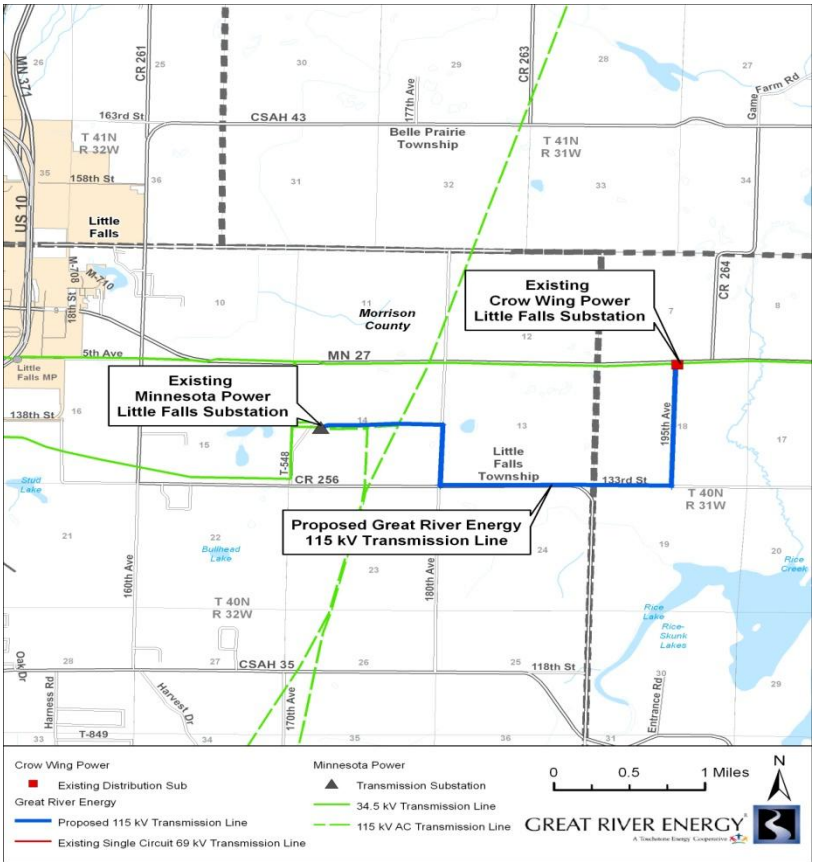
MINNESOTA DEPARTMENT OF COMMERCE ENERGY FACILITY PERMITTING

ENVIRONMENTAL ASSESSMENT

LITTLE FALLS 115 KV TRANSMISSION PROJECT

MPUC Docket No. ET-2, E015/TL-11-318



January 2012

MINNESOTA DEPARTMENT OF COMMERCE

RESPONSIBLE GOVERNMENT UNIT

Minnesota Department of Commerce Division of Energy Resources 85 7th Place East, Suite 500 St. Paul, Minnesota 55101-2198	Suzanne Steinhauer State Permit Manager (651) 296-2888 Suzanne.steinhauer@state.mn.us

PROJECT OWNER

Great River Energy 12300 Elm Creek Blvd. Maple Grove, Minnesota 55369	Marsha Parlow Transmission Permitting Analyst (763) 445-5215 mparlow@grenergy.com
Minnesota Power 30 West Superior Street Duluth, MN 55802	Dan McCourtney Environmental Compliance Specialist II (218)355-3515 dmccourtney@allete.com

ABSTRACT

Pursuant to the provisions of Minnesota Statutes, chapter 216E, Great River Energy and Minnesota Power (Applicants) filed a high-voltage transmission line route permit application with the Minnesota Public Utilities Commission (Commission) on June 16, 2011, for a proposed 115 kilovolt (kV) transmission line and modifications to the existing transmission lines and substations.

The Project, as proposed by the Applicants, would provide an additional power delivery source to rural areas east of Little Falls. As proposed by Applicants, the Project totals approximately 3.8 miles of transmission line and includes the following components:

- Construction of approximately 3.8 miles of new overhead 115 kV transmission line between Minnesota Power's Little Falls Substation and Crow Wing Power's Little Falls Substation.
- Modifications to the Minnesota Power Little Falls Substation to accommodate new 115 kV sources.
- Expansion and modification of Crow Wing Power's Little Falls Substation.

The Project is located east of Little Falls in Little Falls Township of Morrison County. The Applicants request a route width of 300 feet, within which a right-of-way of 100 to 120 feet would be located. GRE proposes using a combination of single pole and H-frame structures with a height of approximately 60 to 85 feet and spans of approximately 300 to 400 feet between poles for the majority of the route length.

The Applicants anticipate beginning construction in mid-2012, with an in-service date of November 2012. The Project is expected to cost approximately $2.8 million dollars.

Minnesota Department of Commerce Energy Facilities Permitting (EFP) is tasked with conducting environmental review of the applications for transmission line route permits. The intent of this environmental assessment document and the environmental review process is to inform the public, the applicant, and decision-makers of the potential impacts from the proposed project and possible mitigations for those impacts.

Persons interested in these matters can register their names on the project contact list at http://energyfacilities.puc.state.mn.us/Docket.html?Id=32098 or by contacting: Suzanne Steinhauer, Energy Facility Permitting, 85 7th Place East, Suite 500, St. Paul, Minnesota, 55101, phone: (651)-296-2888, email: suzanne.steinhauer@state.mn.us.

Documents related to this project can be found at the above website or also by going to: https://www.edockets.state.mn.us/EFiling/search.jsp and entering "11" for Year and "318" for Number, under search criteria.

Acronyms, Abbreviations and Definitions

ACSR	Aluminum Conductor Steel Reinforced
BMP	best management practice
BPA	Bonneville Power Association
Commission	Minnesota Public Utilities Commission
CWP	Crow Wing Power
dB	decibels
dB(A)	A-weighted sound level recorded in units of decibels
EFP	Department of Commerce Energy Facilities Permitting
ELF	Extra Low Frequency
EPRI	Electric Power Research Institute
EMF	electromagnetic field
EPA	United States Environmental Protection Agency
FEMA	Federal Emergency Management Agency
GPS	Global Positioning System
GRE	Great River Energy
HVTL	high voltage transmission line
Hz	Hertz
kV	kilovolt
kV/M	Kilovolt per meter
MDH	Minnesota Department of Health
mG	milligauss
Mn DNR	Minnesota Department of Natural Resources
Mn DOT	Minnesota Department of Transportation
MPCA	Minnesota Pollution Control Agency
MW	Mega Watt
NAC	noise area classification
NERC	North American Electric Reliability Council
NESC	National Electrical Safety Code
NEV	Neutral-to-Earth Voltage
NIEHS	National Institute of Environmental Health Sciences
NPDES	National Pollutant Discharge Elimination System
NWI	National Wetland Inventory
ppm	parts per million
ROW	Right-of-Way
SHPO	State Historic Preservation Office
SWPPP	Stormwater Pollution Prevention Plan
UHF	Ultra High Frequency
USACE	United States Corp of Engineers
USFWS	United States Fish and Wildlife Service
WHO	World Health Organization

TABLE OF CONTENTS

Contents

Acronyms, Abbreviations and Definitions iii
1 INTRODUCTION 1
2 REGULATORY FRAMEWORK 3
2.1 Certificate of Need 3
2.2 Alternative Permitting Process 3
2.3 Route Permit Application 3
2.4 Public Information and Scoping Meeting 3
2.5 Environmental Assessment 4
3 PROPOSED PROJECT 5
3.1 Purpose and Need 5
3.2 Route Development 6
3.3 Project Location 6
3.4 Route Description 6
3.5 Route Width 8
3.6 Right-of-Way 8
3.7 Conductors 8
3.8 Structures 8
3.9 Associated Facilities and Substations 10
3.10 Cost 10
4 FACILITY CONSTRUCTION 12
4.1 Utility Right-of-Way Easement Acquisition 12
4.2 Transmission Line Structures 13
4.3 Conductors 15
4.4 Minnesota Power Little Falls Substation 15
4.5 CWP Little Falls Substation 15
4.6 Relocation of Distribution Facilities 16
4.7 Clean-up and Restoration 16
4.8 Maintenance Procedures 17
5 POTENTIAL IMPACTS & MITIGATION MEASURES 18
5.1 Environmental Setting 18
5.2 Socioeconomic 18
5.3 Human Settlement 19
Proximity to Homes and Businesses and Displacement 19
Property Values 20
Aesthetics 21
5.4 Noise 21
Construction Noise 23
Conductor Noise 23
Substation Noise 24
5.5 Public Health and Safety 24
Equipment Failure and Unauthorized Access to Transmission Equipment 25
Electric and Magnetic Fields 25
Stray Voltage 33
Induced Voltage/Contact Voltage 34

Implantable Devices 34
5.6 Air Quality 35
Ozone and Nitrogen Oxides 35
Construction/Fugitive Dust 36
5.7 Transportation and Utilities 36
Transportation 36
Utilities 37
5.8 Zoning and Compatibility 37
5.9 Recreation 38
5.10 Land Based Economies 38
Agriculture 38
Forestry, Tourism, and Mining Resources 39
5.11 Geology & Soils 40
5.12 Water Resources 41
Groundwater 41
Surface Water 42
5.13 Wetlands and Floodplains 43
5.14 Flora 44
5.15 Fauna 45
5.16 Rare and Unique Species and Habitat 45
5.17 Archaeological & Historic Resources 46
5.18 Interference 47
Radio Interference 47
Television 47
Internet and Cellular Phones 48
GPS-Based Navigation Systems 48
6 PERMITS & APPROVALS 49
7 ROUTING FACTORS 50
8 REFERENCES 52

Tables

Table 1: Transmission Structure Specifications 9
Table 2: Estimated Project Costs 11
Table 3: 2010 Population Characteristics 18
Table 4: Common Noise Sources and Average Sound Levels 22
Table 5: Noise Area Classifications 23
Table 6: Calculated Transmission Line Audible Noise Levels (3.28 feet above ground) 24
Table 7: Summary of Electric and Magnetic Field Properties 26
Table 8: Typical Electric Fields (kV/m) from Common Home and Business Appliances 26
Table 9: State Established Electric and Magnetic Field Standards and Guidelines 27
Table 10: Electric and Magnetic Field Guidelines from Internationally Organizations 28
Table 11: Calculated Electric Fields (kV/m) for Proposed Little Falls 115 kV Transmission Line 29
Table 12: Typical Magnetic Fields (mG) of Common Appliances 30

Table 13: Calculated Magnetic Fields (mG) for Proposed Little Falls 115 kV Transmission Line 32
Table 14: Summary of Potential Permits and Approvals 49
Table 15: Routing Factors 50

Figures

Figure 1: General Vicinity Map 7
Figure 2: Proposed Structure Types 10

APPENDICES

Appendix A: Scoping Decision

Appendix B: Maps

Appendix C: Preliminary Substation Plans

Appendix D: Route Permit Example

1 INTRODUCTION

Great River Energy (GRE) and Minnesota Power (collectively, Applicants) have made application to the Minnesota Public Utilities Commission (Commission) for a route permit under the alternative permitting process of the Power Plant Siting Act (Minnesota Statute 216E). The route permit application is for construction of approximately 3.8 miles of new overhead 115 kV transmission lines, modifications to Minnesota Power's Little Falls Substation and expansion and modification of the existing 34.5 kV Little Falls Substation owned by Crow Wing Power (CWP) to accommodate the new 115 kV source.

The Project, as proposed by the Applicants, would provide an additional power delivery source to rural areas east of Little Falls. As proposed by Applicants, the Project totals approximately 3.8 miles of transmission line and includes the following components:

- GRE would construct approximately 3.8 miles of new overhead 115 kV transmission line between Minnesota Power's Little Falls Substation and CWP's Little Falls Substation.

- Modifications to the Minnesota Power Little Falls Substation to accommodate the new 115 kV source.

- Expansion and modification of CWP's Little Falls Substation to accommodate the new 115 kV source.

The Project is located east of Little Falls in Little Falls Township of Morrison County. The Applicants request a route width of 300 feet, within which a right-of-way (ROW) of 100 to 120 feet would be located. GRE proposes to construct the project using a combination of single pole and H-frame structures with a height of approximately 60 to 85 feet and spans of approximately 300 to 400 feet between poles.

The Applicants anticipate beginning construction in mid-2012, with an in-service date of November, 2012. The Project is expected to cost approximately $2.6 million dollars.

Energy Facility Permitting (EFP) staff is tasked with conducting environmental review of applications for high-voltage transmission line route permits. The intent of the environmental review process is to inform the public, the Applicants, and decision-makers about potential impacts and possible mitigation measures for a proposed high-voltage transmission line project.

This environmental assessment (EA) covers the environmental review requirements in accordance with the Scoping Decision Document for this EA, and as outlined in Minnesota Rules 7850, for the proposed project and route permit application as follows:

Section 1.0 - Introduction

Section 2.0 – Describes the regulatory framework associated with the project, which includes information on the certificate of need criteria, route permit requirements, and the alternative permitting processes.

Section 3.0 – Provides a detailed description of the Project.

Section 4.0 – Describes the methods used when constructing the transmission line along with clean-up and restoration, maintenance procedures, and utility rights-of-way acquisition.

Section 5.0 – Details the potential impacts of the proposed project to human and natural environments and identifies measures that could be implemented to avoid, minimize or mitigate any potential adverse impacts.

Section 6.0 – Lists additional permits that may be required for the proposed project.

Section 7.0 – Summarizes the major routing factors analyzed in this EA.

Section 8.0 – References

Much of the information used in this EA is derived from documents prepared by Applicants. These include the *Route Permit Application for the Little Falls Project*, June 16, 2011, along with the emails and requests for information. Discussion of electromagnetic field issues came primarily from the white paper developed by the Interagency Task Force led by the Minnesota department of Health (MDH), the National Institute for Environmental Health Sciences (NIEHS), and the World Health Organization (WHO). Additional information comes from earlier EFP environmental review documents in similar dockets, other state and federal agencies such as the Minnesota Department of Natural Resources (MnDNR) and the Minnesota Pollution Control Agency (MPCA) and the United States Fish and Wildlife Service (USFWS). Section 8.0 provides a listing of additional references used in the preparation of this EA.

2 REGULATORY FRAMEWORK

In Minnesota, no person may construct a high-voltage transmission line without a route permit from the Public Utilities Commission under Minnesota Statute 216E.03, subdivision 2. A high-voltage transmission line is defined as a conductor of electric energy and associated facilities designed for and capable of operation at a nominal voltage of 100 kV or more and is greater than 1,500 feet in length. Associated facilities of the transmission line include buildings, equipment, and other physical structures that are necessary to the operation of a high-voltage transmission line.

2.1 Certificate of Need

Pursuant to Minnesota Statute 216B.243, subdivision 2, "No large energy facility shall be sited or constructed in Minnesota without the issuance of a certificate of need by the Commission." In the case of a high-voltage transmission line, a large energy facility is defined as, (1) any high-voltage transmission line with a capacity of 200 kV or more and greater than 1,500 feet in length, and (2) any high-voltage transmission line with a capacity of 100 kV or more with more than ten miles of its length in Minnesota or that crosses a state line.

The Project, a 115 kV transmission line with a total length of approximately 3.8 miles, does not qualify as a large energy facility and a certificate of need is not required.

2.2 Alternative Permitting Process

The proposed project is eligible for consideration under the alternative permitting process (Minnesota Rule 7850.2800) of the Power Plant Siting Act (Minnesota Statute 216E.04). The alternative permitting process is shorter than the full permitting procedures and does not require the applicant to propose alternative sites or routes to the preferred site or route, but does require the applicant to disclose rejected route alternatives and an explanation of why they were rejected.

2.3 Route Permit Application

The Applicants filed a route permit application with the Commission for the Project on June 16, 2011. The Commission accepted the application as complete in an order issued on August 8, 2011. Under the alternative permitting process, the Commission has six months to issue a route permit from the date a route permit application is deemed complete. The Commission may extend this time limit for up to three months for just cause or upon agreement of the applicant.

2.4 Public Information and Scoping Meeting

EFP staff held a public information and environmental assessment scoping meeting on September 7, 2011, at the Little Falls Township Hall near Little Falls, Minnesota, as required by Minnesota Rule 7850.3500. The meeting provided members of the public an opportunity to learn about the proposed project and the state's high-voltage transmission line route permitting process, review the Applicants' route permit application, ask questions, provide comments, and identify potential impacts and route alternatives to be considered in the scope of the environmental assessment.

A court reporter was present at the public meeting and transcribed questions asked and comments made by the public, as well as responses from EFP staff, GRE and Minnesota Power. Approximately seven members of the public attended the meeting.

A public comment period, ending on September 23, 2011, also provided the public an opportunity to submit comments on issues and alternative routes and alignments for consideration in the scope of the EA. Four comment letters were received by the close of the comment period. None of the letters proposed alternative routes or route segments (Minnesota Department of Commerce, 2011b). After consideration of the public comments the deputy commissioner of the Department of Commerce issued the scope of the EA on October 7, 2011. The EA scoping decision document is included in **Appendix A**.

2.5 Environmental Assessment

An EA must be prepared for all high-voltage transmission projects being reviewed under the alternative permitting process. The procedures EFP staff must follow in preparing the EA are described in Minnesota Rule 7850.3700. The EA contains information on the human and environmental impacts of the proposed project as identified in the scoping decision document. It also addresses methods to mitigate such impacts for all routes considered. The EA is the only state environmental review document required to be prepared for this project.

Upon completion of the EA, continuing procedural steps include: providing notice on the availability of the EA, scheduling and providing notice of a public hearing in the area where the project is located, and bringing the matter to the Commission for a final decision. An example of a route permit issued by the Commission for a high-voltage transmission line is provided in **Appendix D**.

Copies of the route permit application and other documents relevant to the process are available for viewing and downloading on the Commission website at: http://energyfacilities.puc.state.mn.us/Docket.html?Id=32098 or the eDockets website at: https://www.edockets.state.mn.us/EFiling/search.jsp, enter "11" for Year and "318" for Number, under search criteria.

3 PROPOSED PROJECT

The Applicants propose to construct approximately 3.8 miles of 115 kV overhead transmission line, modify Minnesota Power's Little Falls Substation and expand and modify CWP's Little Falls Substation. The Project can be broken into the following components:

- GRE will construct approximately 3.8 miles of new overhead 115 kV transmission line between Minnesota Power's Little Falls Substation and CWP's Little Falls Substation. (Figure B-2, Appendix B). Approximately 3.0 miles of the proposed route will follow county and township roads. Along roads, the transmission line poles would be approximately two to five feet outside road ROW. GRE may remove, upgrade and attach portions of the 2.54 miles of existing CWP overhead and underground 12.5 kV distribution line along 133rd Street and 195th Avenue that share the same side of the road as the proposed transmission line. Where both underground and overhead distribution lines share the same right of way, there is a possibility those lines will be double circuited underneath the proposed transmission line

- The Minnesota Power Little Falls Substation will be modified to accommodate the new 115 kV transmission line (**Figure C-1**). All modifications would be within the existing fenced area of the substation.

- The CWP Little Falls Substation will be expanded and modified to accommodate GRE's new transmission line (**Figure C-2**). CWP will obtain any necessary local approval required beyond this proposed Route Permit.

3.1 Purpose and Need

The Project is being proposed to address low voltage and equipment overload concerns that threaten to jeopardize reliable electrical service to electric consumers in the rural areas east of U.S. Highway 10 and Minnesota State Highway 371 served by CWP, including the cities of Pierz, Genola, Lastrup, and Buckman. The largely rural east side of Little Falls is presently served from the 34.5 kV system sourced from the Minnesota Power-owned Little Falls, Blanchard and Platte River 115/34.5 kV substations. These sources are tied together with over 50 miles of 34.5 kV sub-transmission lines that serve the local area substations.

Applicants have studied project needs in the area for some time and believe that the 34.5 kV system that serves the area cannot maintain acceptable voltages when energized solely from the Blanchard and Platte River substations as system demand grows. If voltage cannot be maintained within acceptable limits, electrical appliances and lighting will not perform as expected and could potentially be damaged. Additionally, overloaded equipment is susceptible to failure, which could lead to long-term outages if switching cannot be performed to restore service.

To address this deficiency, Applicants propose to upgrade CWP's Little Falls Substation from its existing 34.5 kV operating voltage to 115 kV. The Project is identified in Great River Energy's 2008 Long Range Plan (GRE, 2008, pages C13-C15).

3.2 Route Development

After identifying the need for the Project, the Applicants' siting team analyzed the Project area using various geographic data (e.g., aerial photos, topographic maps, public water inventory maps, etc.) and input from local government representatives and the public. Applicants identified preliminary route options were then identified based on opportunities to:

- Parallel roads to help decrease the amount of ROW required for the transmission line.
- Reduce impacts to the reliability of existing transmission systems during construction.
- Share ROW with existing transmission and distribution lines by underbuilding where practical.
- Minimize the length of the transmission line to reduce the impact area and costs for the Project.

The routes were further refined by avoiding, to the extent possible and applicable, areas where a transmission line could create significant impacts such as:

- Existing residential structures near the proposed route options.
- Areas where horizontal clearances are limited because of trees or nearby structures.
- Environmentally sensitive sites, such as wetlands, archaeologically significant sites, areas with threatened or endangered species/species of special concern, areas of significant biological or cultural significance and state and federal lands.
- "Severing" parcels rather than following property or field division lines. (GRE, Minnesota Power, 2011a, page 4-2)

3.3 Project Location

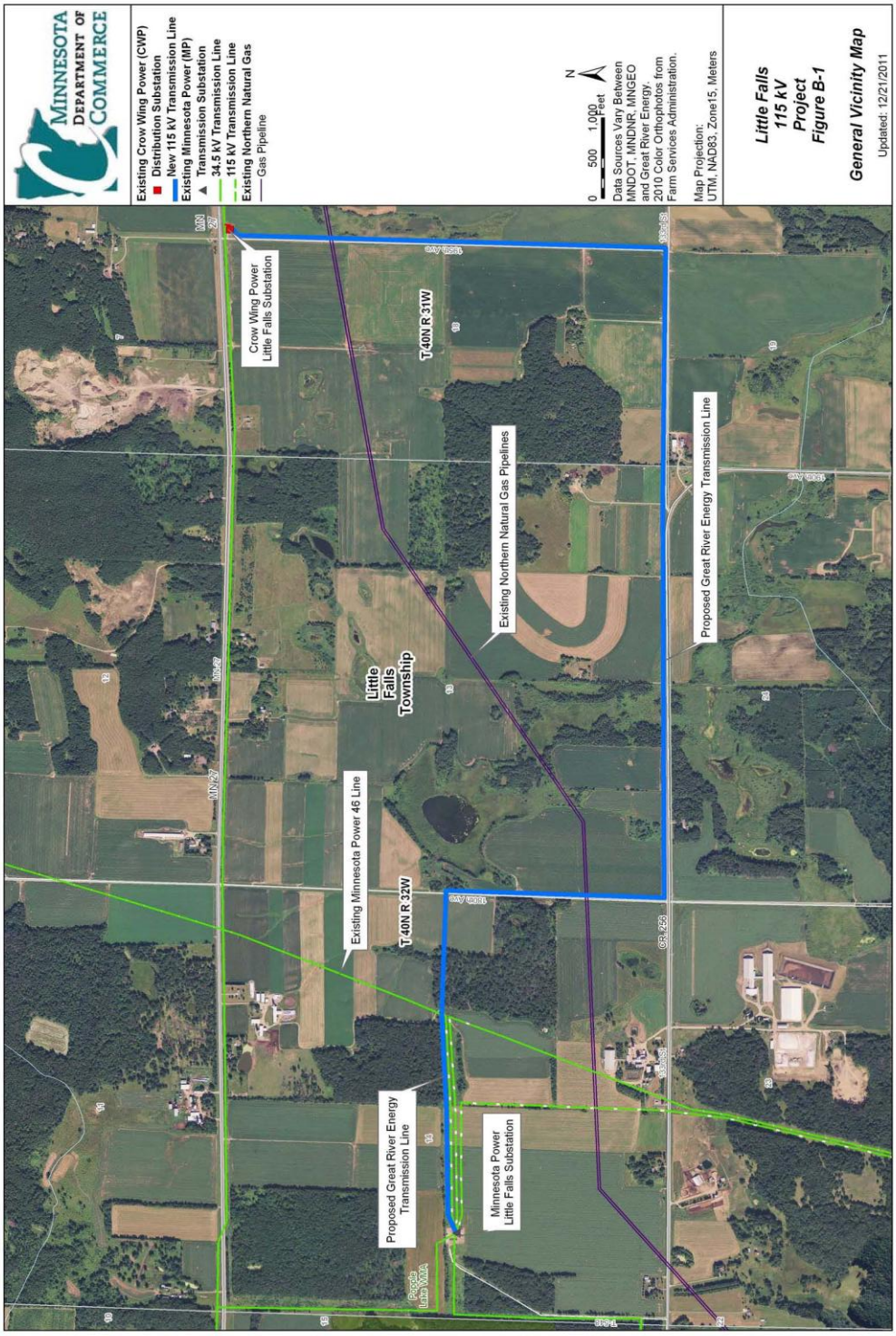
The proposed Little Falls 115 kV Project is located east of Little Falls in Little Falls Township, Section 18, T40N, R30W and Sections 13 and 14, T40N, R31W, Morrison County, Minnesota (**Figure 1**).

3.4 Route Description

A general overview map of the route and is shown in **Figure 1**; more detailed maps are sown in **Appendix B**.

The Proposed Route for which the Applicants are requesting a permit from the Commission exits the east side of the Minnesota Power Little Falls Substation and continues east approximately 0.8 mile cross country, south 0.5 mile along 180th Avenue, east approximately 1.5 miles along County Road 256/133rd Street, and north approximately 1.0 mile along 195th Avenue to the CWP Little Falls Substation as shown in **Figures B-1 to B-8**.

Figure 1: General Vicinity Map



3.5 Route Width

The Applicants have requested a 300 foot route width for the entire length of the proposed transmission line route, 150 feet either side of the proposed center line. (GRE, Minnesota Power 2011a, page 4-2).

3.6 Right-of-Way

As indicated in the route permit application, the GRE portion of the Project would generally require a ROW of up to 100 to 120 feet (50 feet on either side of centerline for single pole structures and 60 feet each side of a centerline for specialty structures such as braced-post or H-frame structures).

Where the Project parallels a roadway, the Applicants anticipate placing poles approximately 2 to 5 feet outside of road ROW, overlapping approximately 45 to 48 feet of anticipated right-of-way with road or railroad right-of-way.

When the transmission line would be located on private property in areas such as open fields or scattered forest land, an easement for the entire ROW (up to 120 feet) would be acquired from the affected landowner(s).

Approximately 3.0 miles, or 79 percent, of the proposed Route would follow county road ROW and approximately 0.8 miles would run cross country on new ROW.

3.7 Conductors

High-voltage transmission line circuits generally consist of three phases, each at the end of a separate insulator, and physically supported by structures or poles. A phase consists of one or more conductors (single, double, or bundled). A typical conductor is a cable consisting of aluminum wires stranded around a core of steel wires. Shield wires are strung above the phases to prevent damage from potential lightning strikes. The shield wire may also include a fiber optic cable that allows for substation protection equipment to communicate with other substation terminals on the line.

The phases for this project would be constructed with three single aluminum conductor steel reinforced (ACSR) which each consist of a single conductor comprised of seven steel core strands surrounded by 26 outer aluminum strands. GRE would use 795,000 circular mil conductor with a diameter of approximately 1.1 inches. The ground to conductor height depends on overall topography and man-made obstacles and will meet or exceed the minimum clearance requirements of the National Electric Safety Code (NESC). To protect from lightning strikes one shield wire would be used on single pole structures and two wires would be used on H-frame structures. Ultimately, the transmission line would be three-phase, 60 hertz (Hz), alternating current line.

3.8 Structures

GRE and Minnesota Power propose to use a combination of up to four different structure types (**Table 1**). Single pole wood structures with horizontal post insulators will be the primary structure used for the Project. In areas where design requires longer spans between structures H-frame or braced post design will be utilized to accommodate the increased loadings. Angles in the line will require guying (the use of anchors and support cables) or specialty structures. Where guying is not practicable, direct embedded laminated wood poles or steel poles on drilled pier concrete foundations will be utilized.

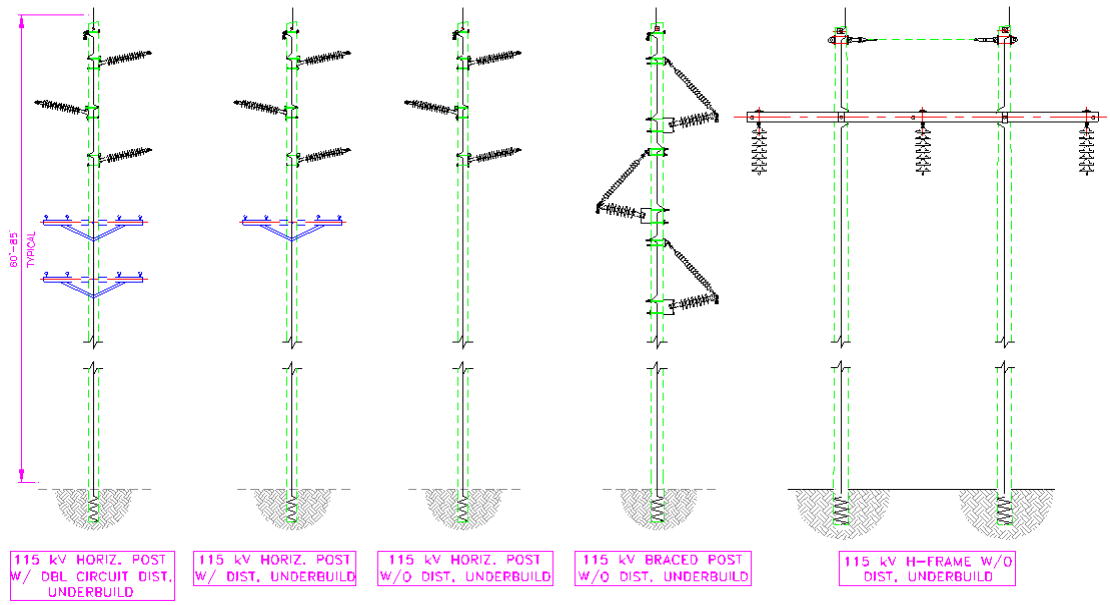
Structures, pole heights and spans will vary depending upon topography and environmental constraints (such as highway crossings, stream crossings, and required angle structures). The proposed ROW easement width is 50 to 60 feet on each side of the transmission centerline.

Table 1: Transmission Structure Specifications

Line Type	Structure Type	Structure Material	Location	Estimated Foundation Diameter (feet)	Structure Base Diameter (inches)	Structure Height (feet)	Span Between Structures (feet)
115 kV Single-Circuit	Single Pole Horizontal Post - Delta Configuration	Wood	Possible along 180th Avenue	3-4	20	60 - 85	300 – 400
115 kV Single-Circuit	Single Pole Braced Post - Delta Configuration	Wood	Possible from Minnesota Power's Little Falls Sub & along 180th Avenue	3-4	20	60 -85	400 – 600
115 kV Single-Circuit with Distribution Underbuild	Single Pole Horizontal Post - Delta Configuration with Distribution Underbuild	Wood	Possible along 133rd Street and 195th Avenue	3 - 4	20	70 - 85	250 - 300
115 kV Single-Circuit	H-Frame	Wood	Possible from Minnesota Power's Little Falls Sub to 180th Avenue	3 – 4 (each pole)	20 (each post)	60 - 80	300 – 400

Source: GRE, Minnesota Power, 2011a, pages 5-1 and 5-2; GRE personal communication December 9, 2011.

Figure 2: Proposed Structure Types



3.9 Associated Facilities and Substations

The Project would upgrade both the Minnesota Power Little Falls Substation and the CWP Little Falls Substation. At the Minnesota Power Little Falls Substation, one bay and breaker and associated equipment would be installed to accommodate connection of an additional 115 kV transmission line. All improvements at the Minnesota Power Little Falls Substation would be done within the existing fenceline.

At the CWP Little Falls Substation, one 115 to 12.5 kV transformer would be installed to accommodate the 115 kV transmission line termination. The CWP Little Falls Substation would be expanded by approximately 0.1 acres, moving the fenceline approximately 50 feet to the south.

In addition to substation improvements the Project may move existing distribution facilities along 133rd Street and 195th Avenue.

3.10 Cost

Construction costs for High Voltage Transmission Lines depend on a number of variables including structures, land acquisition costs and permit requirements. The Applicants have broken down estimated Project costs into three categories, summarized in **Table 2**:

Pre- and Post-Construction Costs: Pre-construction costs include permitting costs, natural resource and cultural resource surveys, easement and land acquisition and ROW clearing. Post-construction costs include restoration and re-vegetation of disturbed soils after construction is completed.

Construction Costs: Transmission line costs would vary depending on the structure type, the height and diameter and composition of the structures, the number of structures per mile, labor and

hardware costs. The Applicants estimate that installation of H-frame and single-pole structures would cost approximately $340,000 per mile, while single pole with underbuild structures would cost approximately $430,000 per mile. Using underbuild structures is more expensive due to additional costs incurred by removal of the existing distribution facilities and reattaching the conductors to new poles and the shorter spans that require more poles per mile.

Substation Costs: Construction costs also include modifications to the Minnesota Power Little Falls Substation and the CWP Little Falls Substation.

Table 2: Estimated Project Costs

Route	Great River Energy	Minnesota Power	Crow Wing Power	Total Component Cost
Pre- and Post- construction Costs	$ 329,000	N/A	N/A	$ 329,000
Construction Cost – 115 kV Transmission Line	$ 1,316,000		N/A	$ 1,316,000
Substation Modification Cost	N/A	$ 311,000	$ 600,000	$ 911,000
Total Project Cost	$ 1,645,000	$ 311,000	$ 600,000	$ 2,556,000

Source: GRE and Minnesota Power, 2011a, table 3-1

The Applicants indicate that operating and maintenance costs associated with the substations would be minimal and consist mainly of weed control. Inspections of substations and other equipment are generally performed on monthly basis depending on the type of equipment (GRE personal communication, December 13, 2011).

Transmission line inspections are typically performed by airplane or helicopter on a monthly basis. The estimated annual cost of ROW maintenance is between $500 and $750 per mile of transmission line, with an average cost of approximately $600 per mile for 115 kV transmission lines (GRE and Minnesota Power, 2011a, GRE personal communication, December 13, 2011).

4 FACILITY CONSTRUCTION

Project construction would begin after the appropriate federal, state, and local permits and approvals are issued. Applicants would need to acquire property rights-of-way, complete soil investigations, and develop the final detailed design. The precise timing of construction would take into account the required permits and their conditions, system loading issues, existing transmission line outage restrictions, construction constraints, weather, road restrictions, mitigation or impact minimization, and availability of work force and materials. Details regarding Applicant's construction practices are provided in Section 5.0 of the *Route Permit Application*.

As indicated in the route permit application, Applicants design and construct transmission lines following construction and mitigation methods based on past experiences and in compliance with permit conditions, industry standards, and environmental factors. These practices address right-of-way clearance, staging, erecting transmission structures, and stringing transmission lines. Practices to mitigate potential construction impacts are established based on permit requirements, construction schedules, geology and topography, maintenance guidelines, inspection procedures, and encountering of sensitive environments or species and are discussed in Section 5 of this document.

Applicants state that the proposed transmission lines would be designed to meet NESC and the Institute of Electrical and Electronics Engineers standards. This includes standards relating to clearances to ground, clearance to crossing utilities, clearance to buildings, clearances over roadways, and right-of-way widths.

4.1 Utility Right-of-Way Easement Acquisition

Should the Commission select a route and issue a route permit, the Applicants easement acquisition process would begin early in the detailed design phase. The Commission is not involved in the easement acquisition process.

GRE would acquire easements sufficient to construct and operate the transmission line along the 3.8 miles of the Project to the CWP Little Falls Substation. Where the transmission line would require new right-of-way, the easement acquisition process begins early in the detailed design phase. Utilities typically acquire easement rights, not fee title from landowners to accommodate transmission lines. The easement acquisition process can typically be broken down into the following steps:

Title examination. Following identification of a route in a route permit, GRE will perform a public records search of the land involved in the project to identify all persons and entities that may have a legal interest in the real estate upon which the Project will be built. A title report is then developed for each parcel to determine the owner(s) of record of the property, and to gather information regarding easements, liens, restrictions, encumbrances, and other conditions of record.

Initial contact. A right-of-way representative contacts each property owner or the property owner's representative along the route identified in the route permit to discuss the Project and how it may impact each parcel and also seeks information about any construction concerns specific to the landowner.

Initial transmission line survey. GRE will provide notification to property owners along the permitted route requesting permission for survey crews to conduct preliminary survey work on the

property. The survey is performed to establish the right-of-way boundaries, locate natural and man-made features along and within the right-of-way, establish the transmission centerline and determine elevations for use during detailed design. Permission may also be requested at this time to obtain soil samples to assess soil conditions and to determine appropriate foundation design.

During the initial survey the survey crew, with permission of the property owner, may place surveyor's stakes to mark the tentative or anticipated structure locations, thereby allowing the landowner to see where the structures may be located on the property. The right-of-way boundary may also be delineated showing the area that is required for safe operation of the transmission line.

Easement acquisition. GRE collects land value data and based on the impact of the easement or purchase to the market value of each parcel develops a fair market value offer. The offer of compensation is based on the specific attributes of each property, the amount of easement area, design of the transmission line, and other factors.

The right-of-way agent will then contact the property owner(s) to present the easement offer and discuss the amount of just compensation for the rights to construct, operate, access, and maintain the transmission facilities within the easement area. The landowner is then allowed time to consider the offer and to present any additional material that the property owner believes is relevant to determining the property's value. Almost any aspect of the easement is negotiable (Minnesota Department of Commerce, 2011c)

Eminent domain. If a negotiated settlement cannot be reached, it may be necessary for GRE to file for eminent domain, pursuant to Minnesota Statute Chapter 117. In the eminent domain process, a judicial proceeding would commence to determine the scope of the applicant's easement and an independent commission would determine the value of the easement taken. Under Minnesota Statute 117.036, subdivision 2(a), GRE, as the acquiring authority, must obtain at least one appraisal for the property proposed to be acquired if it intends to use eminent domain proceedings to acquire a right-of-way. If the landowner desires a second opinion on the fair market value of the property, the landowner may have an appraisal made and receive reimbursement from the applicant per Minnesota Statute 117.036 subdivision 2(b).

Pre-construction owner contact. Prior to construction, the right-of-way agent would contact the owner of each parcel along the route to discuss the construction schedule and any additional requirements not discussed during the time of the easement acquisition. To ensure safe construction and operation, special consideration may be needed for fences, crops, or livestock. In each case the right-of-way agent assists in coordinating the process.

4.2 Transmission Line Structures

Construction of the transmission line would require the acquisition and preparation of rights-of-way for the transmission line, establishment of work and staging areas, installation of new structures, installation of safety structures at road and other utility crossings. Depending upon final design, portions of existing overhead and underground electric distribution facilities may also be removed and relocated to the new transmission structures.

Construction equipment typically used on a transmission project would include tree removal equipment, mowers, cranes, backhoes, digger-derrick line trucks, track-mounted drill rigs, dump

trucks, front end loaders, bucket trucks, bulldozers, flatbed tractor-trailers, flatbed trucks, pickup trucks, concrete trucks and various trailers.

Transmission line structures are generally designed for installation at existing grades. Applicants anticipate that the proposed 115 kV transmission lines will be constructed at grade and will not require grading along the line. However, along areas with more than 10 percent slope, working areas may have to be graded level or fill would be brought in to create working pads.

Typically existing roads or trails that run parallel or perpendicular to the proposed route are used to access the actual transmission line right-of-way. Where use of private field roads or trails is necessary, permission from the property owner would be obtained by Applicants prior to access. In some cases, new access roads or temporary lay down areas may be required due to problematic structure locations, when no current access is available, or existing access is inadequate for the heavy equipment used in construction. Should these areas fall outside the right-of-way, temporary easements would be arranged with the affected landowner. These temporary easements are not typically part of the route permit issued by the Commission for high-voltage transmission lines.

Staging areas are often established for a project to provide a location to deliver and store materials required for construction. Applicants anticipate that the substation sites will provide adequate space for staging (GRE personal communication, December 13, 2011). If needed, additional temporary staging areas outside the transmission line right-of-way sites will be obtained through rental agreements.

Transmission line structures are typically delivered to their staked location or to a designated staging area depending on delivery and contractor availability. If the poles are delivered to a staked site, they are placed along the right-of-way out of the clear zone of any adjacent highways or designed pathways and marked for visibility.

Tangent structures, structure in a straight line with both its adjacent structures, are generally direct embedded. Applicants anticipate that tangent structures would be wood, though laminated wood or steel direct embedded poles may be required in special circumstances where wood poles do not provide enough support. Direct embedding would generally require an excavation of a three to four foot diameter hole of 10 to 12 feet in depth, depending on soil conditions and other factors (GRE personal communication, December 8, 2011). The poles are typically framed with insulators and hardware on the ground and then lifted and placed in the hole via a bucket truck or a crane, depending on the weight of the structure. The poles would be backfilled with native soils or crushed rock depending on soil and design conditions. In lowland areas, a galvanized steel culvert may be also inserted for pole stability due to poor soil capacity. Any excess soil would be thin spread or removed from the site as required.

Angle structures are more substantial than tangent structures and are used where the route requires more support, such as where the route turns or crosses the road. Applicants anticipate use of guy wires for angle structures on the Project; excavation for medium angle structures would 15 to 20 feet deep . In some instances self-supporting steel structures may be set on drilled pier concrete foundations to support the higher stress. The drilled pier would typically have a diameter of four to eight feet and typically require an excavation depth of approximately 15 - 30 feet, depending on soil conditions and design requirements. The excavation is filled with concrete and a concrete foundation is set, the pole or structure is then bolted to the foundation.

Special construction techniques to minimize impacts to environmentally sensitive areas, such as wetlands, are discussed in Section 5.0 of this document.

4.3 Conductors

Once the structures have been erected, conductors and shield wires are installed by establishing stringing setup areas within the right-of-way. Stringing operations require brief access to each structure to secure the conductors wire to the insulators or the shield wire to shield wire clamps once final sag is established. These stringing setup areas are typically located every two miles along the project right-of-way. The wires are pulled with a rope lead that connects to every structure through a dolly attached at the insulator/clamp location.

Temporary guard or clearance poles are installed at crossings to provide adequate clearance over other utilities, streets, roads, highways, railroads, or other obstructions. Necessary notifications are made or permit requirements are followed, to mitigate any concerns with traffic flow or operations of other utilities.

4.4 Minnesota Power Little Falls Substation

No additional land would need to be acquired or rights-of-way obtained for the proposed substation work. A schematic of the substation highlighting the area where new equipment would be installed is shown in **Figure C-1**.

No additional grading would be needed for the substation. Concrete foundations would be placed to support the substation equipment and gravel laid throughout the fenced area. Substation components would be delivered on tractor-trailer trucks and installed on their foundations.

Transmission facilities at the Minnesota Power Little Falls Substation will consist of:

- A new 115 kV breaker.
- Disconnect switches.
- Station class surge arresters.

A Stormwater Pollution Prevention Plan (SWPPP) and National Pollutant Discharge Elimination System (NPDES) construction stormwater permit from the MPCA will not be needed for the Minnesota Power Little Falls Substation.

4.5 CWP Little Falls Substation

CWP currently owns the 34.5 kV Little Falls Distribution Substation, sited on a 1.7 acre parcel located at the southeast corner of the intersection of Minnesota Highway 27 and 195th Avenue. The substation would be expanded approximately 50 feet to the south to accommodate the new 115 kV source. Additional land would need to be acquired or rights-of-way obtained for the proposed substation work. A schematic of the substation showing the expansion area is shown in **Figure C-2**.

CWP will have minimal grading on the site, for the substation and re-aligned access road to ensure both a stable base for the substation equipment and proper drainage and runoff control (GRE, personal communication, December 22, 2011). Following grading a perimeter fence would be installed to contain the substation equipment. After installation of the fence, concrete foundations

would be placed to support the substation equipment and gravel laid throughout the fenced area. After the surface area is prepared, substation components would be delivered on tractor-trailer trucks and installed on their foundations.

Transmission facilities at the expanded CWP Little Falls Substation will consist of:

- A new 115-12.5 kV transformer.
- Two way 115 kV transmission line switch with an interrupting device.
- 115 kV High side terminal structure.
- Circuit switcher protection device.

If required, CWP or GRE will prepare the required SWPPP and obtain a NPDES/State Disposal System (SDS) construction stormwater permit from the MPCA. Erosion control methods, described in Section 5.11 will be utilized to minimize runoff during substation construction.

Upon completion of construction activities, GRE or CWP would restore the site. Post-construction reclamation activities include the removing and disposing of debris, dismantling all temporary facilities (including staging areas), employing appropriate erosion control measures, and reseeding areas disturbed by construction activities with vegetation similar to that which was removed.

4.6 Relocation of Distribution Facilities

In locations where overhead or underground electric distribution lines will be relocated to the new 115 kV transmission structures, existing distribution facilities would be removed.

GRE would remove above and below ground sections of overhead distribution structures in the planned removal area. Sections of underground distribution would be excavated and all underground facilities would be removed. Holes, ruts and other areas disturbed by the removal work would be backfilled with soil and seeded to re-establish vegetation.

4.7 Clean-up and Restoration

Construction areas would be disturbed during the normal course of work, which can take several weeks in any one location. As construction on each parcel is completed, disturbed areas would be restored to their original condition. Practices to mitigate potential construction impacts would follow permit requirements and be based on construction schedules, geology and topography, maintenance guidelines, inspection procedures, and presence of sensitive environments or species.

Upon completion of construction, disturbed areas would be restored to their original condition to the maximum extent practicable. If damage has occurred to fences or drain tiles, Applicants would reimburse the landowner(s) for the damages sustained (GRE and Minnesota Power, 2011a). Applicants may employ an outside contractor to restore the damaged property to as near its original condition as is possible. Areas with significant soil compaction and disturbance from construction activities along the proposed transmission line route may require assistance in re-establishing the vegetation stratum and controlling soil erosion. Construction and post-construction reclamation activities would include but are not limited to removing and disposing of debris (including personal liter); dismantling staging areas; restoring temporary workspaces, access roads, abandoned right-of-way and other public or private lands affected by construction of the transmission line; employing

erosion control, such as silt fences, hay bales, seed blankets, or hydro seeding; and hand-planting disturbed areas with native vegetation.

Landowners would be contacted by an Applicant representative at the close of construction activities to determine whether any damage has occurred as a result of the project. Areas damaged during construction activities will be restored to their pre-construction condition to the extent possible or Applicants will reimburse the landowner for damages sustained that are not repaired. Upon completion of construction cleanup and restoration of damaged areas, landowners would notify Applicants of any outstanding construction damage that has not been remedied.

HVTL Route Permits issued by the Commission require the permittee to notify the Commission in writing 60 days after completion of all restoration activities and also require the permittee to compensate landowners for any yard/landscape, soil compaction, drain tile, or other property damages that may occur during construction.

4.8 Maintenance Procedures

Transmission infrastructure has few mechanical elements and is designed and constructed to withstand weather events that are normally encountered. Although infrequent, transmission lines are taken out of service by protective relay equipment when a fault is sensed on the system or for scheduled maintenance outages.

Routine maintenance and inspections are performed over the life of the facility to ensure its continued integrity. GRE performs monthly aerial inspections of the transmission (GRE, personal communication, December 13, 2011). Periodic access to the transmission line rights-of-way and substations would be required to perform on-ground inspections and conduct routine maintenance or repairs. Inspections would be limited to the acquired right-of-way and areas where obstructions or terrain require access off the easement.

The transmission line rights-of-way are managed to remove vegetation that has the potential to interfere with the operation and maintenance of the line. GRE would conduct vegetation surveys and remove undesired vegetation that may interfere with the operation of the transmission line. Typical vegetation maintenance for a 115 kV transmission line is on a three to seven year cycle dependent on vegetation growth and weather events. Vegetation management generally includes a combination of mechanical, hand clearing, and herbicide application to remove or control the growth of vegetation in or impinging upon the right-of-way.

Herbicide application would be applied following U.S. Environmental Protection Agency (EPA) and state agency regulations and is applied by licensed applicators.

Substations require a certain amount of maintenance to keep them functioning in accordance with accepted operating parameters and NESC and NERC requirements. Transformers, circuit breakers, batteries, protective relays, and other equipment need to be serviced periodically in accordance with the manufacturer's recommendation. The site itself must be secure, kept free of vegetation, and proper drainage must be maintained.

5 POTENTIAL IMPACTS & MITIGATION MEASURES

The construction of a transmission facility involves both short- and long-term impacts. An impact is a change to the pre-construction environment as a direct or indirect result of the proposed action and may be positive or negative. Direct impacts are caused by the action and occur at the same time and place. Indirect impacts are caused by the action and occur later in time, but are still reasonably foreseeable.

This section describes the potential impacts on resources and the possible mitigation measures intended to avoid, minimize, or mitigate impacts caused by the construction and future operation and maintenance of the proposed transmission facility.

5.1 Environmental Setting

The Project is located in the southwest portion of the Mille Lacs Upland Ecological Subsection of the Laurentian Mixed Forest Province of the Ecological Classification System developed by MnDNR and the United States Forest Service. The Ecological Classification System was developed to identify, describe, and map progressively smaller areas of land with increasingly uniform ecological features. The Mille Lacs Upland subsection is characterized by gently rolling till plains and drumlin fields. The original vegetation consisted of a mosaic of hardwood and conifer forest types (MnDNR, 2011a). The Project is located in a portion of the subsection characterized by agricultural land use, and land use in the area immediately surrounding the Project is predominately cultivated agricultural fields along with pockets of forest, grassland, pastureland, and rural residential uses.

5.2 Socioeconomic

A review of the 2010 U.S. Census data shows both Morrison County and Little Falls Township to have a lower minority population and lower median income than Minnesota as a whole. Population and economic characteristics from the 2010 U.S. Census are shown in **Table 3**.

Table 3: 2010 Population Characteristics

Category	Minnesota	Morrison County	City of Little Falls	Little Falls Township
2000 Population	4,919,492	31,712	7,719	1,624
2010 Population	5,303,925	33,198	8,343	1,682
Percent Change 2000-2010	7.8	4.7	8.1	3.6
White Persons, non Hispanic or Latino, 2010 Population (percent)	83.1	96.9	95.2	98.1
Median Household Income* (average over 2001-2009)	$55,621	$44,908	$36,619	63,750
Percent Below Poverty Level (average 2005 - 2009)	10.9	13.7	26.6	6.3
Land Area (sq. miles)	79,627	1,125	7	34.7
Population Density (person/sq. mile)	66.6	29.5	1,153	48.5

*Median Household income is for 2009 for Minnesota and Morrison County, and an average from 2005-2009 for Little Falls

Source: U.S, Census Bureau, 2011

Applicants anticipate that construction of the transmission line would require approximately 15 to 20 workers during a period of less than one year. It is not expected that additional permanent jobs will be created by the Project (GRE and Minnesota Power, 2011a).

Construction of the Project should also result in small, short-term positive economic impacts in the form of increased spending for lodging, meals and other consumer goods and services, as well as purchase of some construction material. Short-term economic benefits from increased economic activity during the construction phase are most likely to be felt in Morrison County and particularly in Little Falls.

No disproportionate impacts on minority or low-income populations are anticipated.

Long-term socioeconomic effects from the Project would include an increase to the county's tax revenues as a result of the value of construction and the increased value of utility property resulting from the Project. In addition to the relatively small increase to county tax revenues, estimated at $55,796 in 2012, the Project would improve the overall transmission stability and ensure voltage stability (GRE and Minnesota Power, 2011a).

Mitigation Measures

The socio-economic impacts from the Project are likely to be mostly positive, no additional mitigation measures are proposed.

5.3 Human Settlement

Transmission lines have the potential to produce impacts to human settlement resulting from possible displacement of homes or businesses, aesthetics, and potential impacts to property values. Regulators and utilities try to select routes that avoid residences as much as possible to minimize impacts to residents and businesses. Specifically, Minnesota Statute 216E.02, subd. 1 provides that, "… the commission shall locate transmission lines in a manner that minimize adverse human and environmental impact while insuring continuing electric power system reliability and integrity and insuring that electric energy needs are met and fulfilled in an orderly and timely fashion."

Proximity to Homes and Businesses and Displacement

Transmission line facilities require certain clearances from buildings for safe operation of the transmission line. The required clearances are defined in the NESC. Depending upon the location along the route, Applicants would acquire a transmission ROW of 52 to 120 feet for the Project. The amount of ROW needed in portions where the route parallels local and county roads would be narrower because a portion of the required ROW would overlap road ROW; on cross-country portions of the Project the full transmission ROW would be acquired.

Displacement can occur when a structure is located within the proposed ROW for a new transmission line facility.

The route would parallel existing road rights-of-way for a significant portion, approximately three miles of the total 3.8 mile length. The nearest home to the route is approximately 110 feet from the center line of the Project, and the nearest home to the CWP Little Falls Substation is 1,485 feet (GRE and Minnesota Power, 2011a; GRE personal communication, December 9, 2011).

Based on a review of aerial photographs and a site visit, the routing and construction of the transmission line and associated facilities will not require the displacement of any homes or businesses.

Property Values

One of the first concerns of many residents near existing or proposed transmission lines is how that proximity to the line could affect the value of their property. Research on this issue does not identify a clear cause and effect relationship between the two. Instead, the presence of a transmission line becomes one of several factors that interact to affect the value of a particular property.

Because of the large number of factors that influence the value of a specific property, it is very difficult, if not impossible, to predict the effect that a specific transmission facility would have on a specific property. The Public Service Commission of Wisconsin addressed the issue of changes in property value associated with high-voltage transmission lines in their Final Environmental Impact Statement on the Arrowhead – Weston Electric Transmission Line Project (Public Service Commission of Wisconsin, 2000). Their analysis of the relationship between property values and transmission lines looked at approximately 30 papers, articles and court cases covering the period from 1987 through 1999.

The Wisconsin analysis identified two types of property value impacts that property owners may experience: (1) potential economic impact associated with the amount paid by a utility for a right-of-way easement, and (2) potential economic impact regarding the future marketability of the property.

The Arrowhead – Weston Electric Transmission Line Project Final EIS provides the following six general observations from the studies it evaluated.

- The potential reduction in sale price for single family homes may range from 0 to 14 percent.
- Adverse effects on the sale price of smaller properties could be greater than effects on the sale price of larger properties.
- Other amenities, such as proximity to schools or jobs, lot size, square footage of a house and neighborhood characteristics, tend to have a much greater effect on sale price than the presence of a power line.
- The adverse effects appear to diminish over time.
- Effects on sale price are most often observed for property crossed by or immediately adjacent to a power line, but effects have also been observed for properties farther away from the line.
- The value of agricultural property is likely to decrease if the power line poles are placed in an area that inhibits farm operations.

Aesthetics

The Project crosses a mixture of cultivated fields, wooded areas, grassland and pastureland, and scattered rural homesteads. There are two existing 115 kV transmission lines near the Project with H-frame structures of 50 to 70 feet in height. There are also overhead single pole distribution lines with structures of approximately 39 feet in height in the Project area (GRE and Minnesota Power, 2011a).

The Project would introduce several changes to the existing landscape: an expanded CWP Little Falls Substation, new equipment within Minnesota Power's Little Falls Substation, and 3.8 miles of 115 kV transmission line. The Project may also re-locate existing underground and overhead distribution lines on the new 115 kV structures along 133rd Street and 195th Avenue.

The Project would consist of single-circuit 115 kV structures. As proposed, Applicants would install primarily single-pole wood structures with horizontal post insulators with heights of 60 to 85 feet. In some areas, such as where a longer span is preferred, wood H-frame structures would be used. Applicants anticipate that all transmission structures would be wood. Structures are show in **Figure 2**. The installation of the transmission line would require tree clearing within the 100 to 120 foot right-of-way. Estimates of tree clearing are provided in **Section 5.14**.

The fenced area of the CWP Little Falls Substation would be expanded by approximately 5,000 square feet. Equipment installed at the substation would be approximately 40 feet or less in height, with the exception of a dead-end structure of approximately 60 feet and a static pole of up to 100 feet (GRE personal communication, December 22, 2011).

The Project would be visible to residents in the Project area as well as those travelling along county and township roads.

Neither substation would be lighted. During emergencies, mobile lights would be brought in to facilitate the safety of personnel if work occurs in low light or after sunset; routine maintenance work is typically scheduled during daytime hours (GRE personal communication, December 22, 2012). Transmission structures are not lit.

Mitigation Measures

The primary mitigation strategy to minimize impacts to homes and businesses is avoidance through routing.

The use of a property for a transmission facility transfers ownership of one of the bundle of property rights from the property owner to the easement holder. This loss of a portion of the potential use of the property requires compensation of the property owner for the use of the property. Any potential impacts of property values would typically be mitigated through negotiation in an easement agreement between the applicants and the landowner.

5.4 Noise

Potential noise associated with the proposed project includes sources associated with construction and long-term operation of the proposed project. Noise is measured in units of decibels (dB), or sound pressure level. The sound pressure level for purposes of human hearing is measured with the A-weighted decibel scale or dB(A). In general terms, a noise level change of 3 dB(A) is imperceptible to human hearing, a 5 dB(A) change is clearly noticeable, and a 10 dB(A) change is

perceived as a doubling of noticeable sound. Cumulative noise increases occur on a logarithmic scale. Estimates of some common sources of noise are presented in **Table 4**.

Table 4: Common Noise Sources and Average Sound Levels

Noise Source	Sound Pressure Level (dBA)
Jet Engine (at 25 meters)	140
Jet Aircraft (at 100 meters)	130
Rock and Roll Concert	120
Pneumatic Chipper	110
Jointer/Planer	100
Chainsaw	90
Heavy Truck Traffic	80
Business Office	70
Conversational Speech	60
Library	50
Bedroom	40
Secluded Woods	30
Whisper	20

Source: Minnesota Pollution Control Agency, 2008

Noise standards in Minnesota have been established and are defined in Minnesota Rule 7030 and regulated by the MPCA. The Noise Control Requirement states that noise contributors shall comply with the Noise Area Classifications (NAC) established in Minnesota Rules part 7030.0040, which are shown in **Table 5**. The NAC is based on land use activity at the location of the receiver. For example, household units are defined under NAC (1), bus passenger terminals are defined under NAC (2), and transportation right-of-way is defined under NAC (3). NAC (1) also includes other noise-sensitive areas such as medical and other health services, religious services, educational services and camping areas.

Table 5: Noise Area Classifications

NAC	Day (7 a.m. – 10 p.m.)		Night (10 p.m. – 7 a.m.)	
	L_{50}	L_{10}	L_{50}	L_{10}
1	60	65	50	55
2	65	70	65	70
3	75	80	75	80

Notes: Minnesota Rules part 7030 uses the decibel A-weighting network and applies statistical sound levels (L-Level Descriptors) to account for changes in sound levels over a period time as shown. The L_{10} is defined as the noise level exceeded 10 percent of the time, or for six minutes in an hour. The L_{50} is the noise level exceeded 50 percent of the time, or for thirty minutes in an hour.

The Project would result in short-term noise from the construction phase of the Project as well as noise from the conductors and substation once the Project is in operation.

Construction Noise

Noise from general construction noise are expected to occur during daytime hours as the result of heavy equipment operation and increased vehicle traffic associated with the transport of equipment and construction personnel to and from the work area.

Conductor Noise

Transmission conductors can produce noise under certain conditions. The level of noise depends on conductor conditions, voltage level, and weather conditions. In foggy, damp, or rainy weather, transmission lines can create a crackling sound due to the small amount of electricity ionizing the moist air near the conductors, or corona discharge. In practice, noise levels produced by 115 kV transmission lines are generally less than outdoor background levels and, therefore, are not usually audible.

The worst-case scenario is when the conductor is exposed to heavy rain conditions (one inch per hour). However, during heavy rain the background noise level of the rain is typically greater than the noise from the transmission line. As a result, people do not normally hear noise from a transmission line during heavy rain. Sound emanating from conductors would typically be noticed during light rain, dense fog, snow, and other times when there is moisture in the air; transmission lines would produce audible noise approximately equal to household background levels.

Applicants calculated the estimated audible noise that may be produced from the proposed transmission line using the Bonneville Power Administration (BPA) Corona and Field Effects Program, version 3. The anticipated noise levels derived from the modeling are presented in **Table 6**.

Table 6: Calculated Transmission Line Audible Noise Levels (3.28 feet above ground)

Location	L_5	L_{50}
Edge of Right-of-Way	17.7 dBA	14.2 dBA
Directly Under Line	18.8 dBA	15.3 dBA

Source: GRE and Minnesota Power (2011), Table 8-3.

Substation Noise

Noise associated with substations includes the operation of transformers and switchgear. The transformers produce a constant low-frequency humming noise while the switchgear produces an impulsive or short duration noise during infrequent activation of the circuit breakers. Because the switchgear operation is infrequent, noise generated from the switchgear is considered to be temporary in nature and would not excel the MPCA noise limits.

The Project would install one 115 to 12.5 kV transformer at the CWP Little Falls Substation. No transformers would be installed at the Minnesota Power Little Falls Substation. For the type of transformer anticipated for installation at the CWP Little Falls Substation, noise levels measured at one meter from the transformer are 66 to 70 dBA, depending upon whether cooling fans are running. The nearest home to the CWP Little Falls Substation is approximately 1,485 feet north of the substation. Based on the noise modeling, expected noise from the substation at this home would be approximately 16 dBA (GRE and Minnesota Power, 2011a).

Mitigation Measures

HVTL route permits require compliance with state noise standards established by the MPCA.
The Project will be designed and constructed to comply with state noise standards established by MPCA during operation of the transmission line and substation.

Construction activities would also need to comply with MPCA noise standards. Construction work would generally be limited to daytime hours, between 7 a.m. and 10 p.m on weekdays. Occasionally there may be construction outside of these hours or on a weekend if it becomes necessary to work around customer schedules or line outages. Heavy equipment would be equipped with sound attenuation devices such as mufflers to minimize noise levels.

5.5 Public Health and Safety

Generally human health and safety issues related to transmission projects can be grouped into issues associated with construction and those associated with the operation and maintenance of the Project.

As with any construction project involving heavy equipment and high-voltage electrical facilities, there are safety issues during construction. Potential health and safety impacts would be injuries related to worker falls, falling equipment and electrocution.

Potential health and safety impacts associated with the operation phase of the proposed Projects include: electrocution or injury from equipment failure, injuries associated with unauthorized access to energized transmission equipment, health impacts from electric or magnetic fields associated with operation of the Projects, and stray voltage.

Equipment Failure and Unauthorized Access to Transmission Equipment

Electric transmission lines and their associated facilities carry electricity at a very high voltage. This high voltage is transformed at distribution substations down to the voltage that is used by most customers at their homes.

Under certain conditions high voltage transmission lines or high voltage substation equipment may fail. These failures are most commonly a result of extreme weather or electric circuit overloading. If equipment fails, injury or death may occur as a result.

Unauthorized access to transmission equipment by persons who are not trained to work with high voltage equipment can result in serious injury or death.

Electric and Magnetic Fields

Wherever there is electricity there are electric and magnetic fields (EMF). Electric and magnetic fields are not only created by high-voltage transmission and distribution lines, but also by home appliances, electronics, cell phones, wireless networks, fluorescent lights, and wiring configurations in homes, businesses, and schools. As a result, we are all exposed on a daily basis to a complex mix of electric and magnetic fields at many different frequencies (WHO, 2002).

Electric and magnetic fields are invisible just like radio, television, and cellular phone signals, all of which are part of the electromagnetic spectrum. The frequency of transmission line EMF in the United States is 60 hertz and falls in the extremely low frequency (ELF) range of the electromagnetic spectrum (any frequency below 300 hertz). By comparison, cellular phone communications operate at frequencies almost one billion times higher than EMF resulting from electric power (Long Island Power Authority, 2005).

Natural and human-made electric and magnetic fields are, in fact, present everywhere in our environment. The Earth's natural static background electric field is approximately 120 to 150 volts per meter (V/m). Natural electric fields are also produced by the local build-up of electric charges in the atmosphere that are associated with thunderstorms. The Earth itself has a magnetic field that ranges from approximately 300 to 700 milligauss (mG), the field is a steady-state or static (zero hertz) magnetic field, but has similar characteristics to the magnetic fields emanating from human-made sources.

Electric and magnetic fields created by humans include X-rays and magnetic resonance imaging (MRIs) machines, electric and magnetic passenger trains, electric cars, and cellular telephones. The general wiring and appliances located in a typical home can produce an average background magnetic field of 0.5 mG to 4 mG (EPA, 1992).

Electric and magnetic fields arise from the voltage and the flow of electricity (current) through a conductor. 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 electric current. The electric field associated with high-voltage transmission lines "extend" from the energized conductors to other nearby objects whereas the

magnetic field "surrounds" the conductor. Together, these fields are generally referred to electric and magnetic fields or EMF. A summary of electric and magnetic field properties is summarized in **Table 7**.

Table 7: Summary of Electric and Magnetic Field Properties

Electric Fields	Magnetic Fields
Electric fields arise from voltage.	Magnetic fields arise from current flows.
Their strength is measured in kilovolts per meter (kV/m).	Their strength is measured in milligauss (mG) or microtesla (μT).
An electric field can be present even when a device is switched off.	Magnetic fields exist as soon as a device is switched on and current flows.
Field strength decreases with distance from the source.	Field strength decreases with distance from the source.
Most building materials shield electric fields to some extent.	Magnetic fields are not attenuated by most materials.

Source: WHO, 1999

This section of the EA specifically addresses electric and magnetic fields produced through transmission of electric power at 60 Hz or cycles per second.

Electric Fields

Electrical fields are created by voltage. Voltage can be described as the potential difference between two points and will always try to drive an electric current. The voltage on any conductor produces an electric field that extends from the wire in all directions. The intensity of electric fields is associated with the voltage of the transmission line and is measured in kilovolts per meter (kV/m). Some typical electric field strengths measured near common household appliances are presented in **Table 8**.

Table 8: Typical Electric Fields (kV/m) from Common Home and Business Appliances

Source	Electric Field Strength (at a distance of 30 cm)
Iron	0.12
Refrigerator	0.12
Toaster	0.08
Coffee machine	0.06
Vacuum cleaner	0.05

Source: WHO, 1999.

Transmission line electric field levels are typically greatest near the center of the line right-of-way with levels decreasing as one moves away from the central alignment. The electric field associated with a high-voltage transmission line may extend from the energized conductors to other nearby objects such as the ground, towers, vegetation, buildings, and vehicles. These objects are commonly referred to as "screeners." The screening effect associated with these and other objects reduces the strength of transmission line electric fields.

On the whole, scientific evidence indicates that chronic exposure to electric fields at or below levels traditionally established for safety does not cause adverse health effects. Safety concerns related to electric fields are sufficiently addressed by adherence to the Institute of Electrical and Electronics Engineers (IEEE) and NESC standards.

There are currently no federal guidelines on the strength of electrical fields beneath high-voltage transmission lines. However, six states have established their own regulations or guidelines with regard to transmission line electric fields (**Table 9**).

Table 9: State Established Electric and Magnetic Field Standards and Guidelines

State	Electric Field (kV/m)		Magnetic Field (mG)
	Within Right-of-Way	Edge of Right-of-Way	Edge of Right-of-Way
Florida	8[a]	2	150[a] (max load)
	10[b]	---	200[b] (max load)
	---	---	250[c] (max load)
Massachusetts	---	---	85[g]
Minnesota	8	---	---
Montana	7[d]	1[e]	---
New Jersey	---	3	---
New York	11.8	1.6	200 (max load)
	11[f]	---	---
	7[d]	---	---
Oregon	9	---	---

Source: MSH, 2002 and NIEHS, 2002

[a] 69 kV to 230 kV transmission lines
[b] 500 kV transmission lines
[c] 500 kV transmission lines on certain existing ROW
[d] maximum for highway crossing
[e] may be waived by the landowner
[f] maximum for private road crossings
[g] a level above 85 mG is not prohibited, but may trigger a more extensive review of alternatives.

In addition to the state guidelines identified above, there are a number of national and international boards, committees, and commissions that have recommended electric field exposure guidelines or thresholds for 60 hertz high-voltage transmission lines. **Table 10** summarizes the suggested electric field guidelines from a number of these internationally recognized organizations.

Table 10: Electric and Magnetic Field Guidelines from Internationally Organizations

Organization	Electric Field (kV/m)		Magnetic Field (mG)	
	General Public	Occupational	General Public	Occupational
IEEE	5	20	9,040	27,100
ICNIRP	4.2	8.3	830	4,200
ACGIH	---	25	---	10,000/1,000[a]
NRPB	4.2	---	830	4,200
European Union	4.2	---	830	---

Source: IEEE – Institute of Electrical and Electronics Engineers, ICNIRP – International Commission on Non-Ionizing Radiation Protection, ACGIH – American Conference of Industrial Hygienists, NRPB – National Radiological Protection Board

[a] for persons with cardiac pacemakers or other medical electronic devices.

Estimated electrical fields at maximum operating voltage for the proposed project, as provided by the applicant, are presented in **Table 11**. The expected electric fields at 3.28 feet above the ground for the structure type and voltage proposed have been calculated at various distances from the centerline.

Table 11: Calculated Electric Fields (kV/m) for Proposed Little Falls 115 kV Transmission Line

Scenario	Maximum Operating Voltage (kV)	Distance to Proposed Centerline										
		-300'	-200'	-100'	-50'	-25'	0'	25'	50'	100'	200'	300'
Horizontal Post Operation No Distribution Underbuild Average Load	121	0.01	0.02	0.06	0.22	0.47	1.30	0.66	0.20	0.07	0.02	0.01
Horizontal Post Operation No Distribution Underbuild Emergency Load	121	0.01	0.02	0.06	0.22	0.47	1.30	0.66	0.20	0.07	0.02	0.01
Horizontal Post Operation with Single Circuit Distribution Underbuild Average Load	121	0.01	0.02	0.07	0.20	0.27	0.42	0.37	0.17	0.07	0.02	0.01
Horizontal Post Operation with Single Circuit Distribution Underbuild Emergency Load	121	0.01	0.02	0.07	0.20	0.27	0.42	0.37	0.17	0.07	0.02	0.01
Horizontal Post Operation with Double Circuit Distribution Underbuild Average Load	121	0.01	0.02	0.07	0.18	0.20	0.29	0.27	0.15	0.07	0.02	0.01
Horizontal Post Operation with Double Circuit Distribution Underbuild Emergency Load	121	0.01	0.02	0.07	0.18	0.20	0.29	0.27	0.15	0.07	0.02	0.01
H-Frame Operation Average Load	121	0.00	0.01	0.09	0.59	1.74	1.86	1.74	0.59	0.09	0.01	0.00
H-Frame Operation Emergency Load	121	0.00	0.01	0.09	0.59	1.74	1.86	1.74	0.59	0.09	0.01	0.00

Source: GRE and Minnesota Power, 2011a, table 5-1, personal communication December 14, 2011.

* Maximum operating voltage is the nominal voltage plus five percent (i.e. 115 kV + 5.75 = 121 kV).

The closest home to the transmission line is approximately 110 feet. The highest calculated electric field directly under the transmission line is 1.86 kV/m. As indicated by the applicant in the route permit application and subsequent information, the highest calculated electric fields at 50 and 100 feet from transmission centerline would be 0.59 kV/m and 0.09 kV/m, respectively. These electric field strengths are within the range of electric fields generated by other common household and business sources and well below the various state and international organization established guidelines.

The maximum calculated electric field on the entire length of project, directly beneath transmission centerline at 3.28 feet above ground is estimated to be 1.86 kV/m. This maximum calculated electric field is approximately 23 percent of the 8 kV/m guideline historically recommended by the Minnesota Environmental Quality Board and the Commission in other route permit proceedings and, again, well below any of the national and international recognized electric field guidelines as identified in **Tables 9** and **10**.

Magnetic Fields

Electric current passing through a conductor produces a magnetic field in the area surrounding the wire. Similar to electric fields, magnetic fields are strongest near the conductor and diminish with distance. Magnetic fields, however, are not shielded by most common materials and easily pass through them. The magnetic field may also be called magnetic flux density and is measured in units of milligauss (mG) or microtesla (μT).

We encounter magnetic fields from every-day things such as radar and microwave towers, television and computer screens, motors, fluorescent lights, microwave ovens, cell phones, electric blankets, house wiring and hundreds of other common electrical devices.

The general wiring and appliances located in a typical home can produce an average background magnetic field of 0.5 mG to 4 mG (EPA, 1992). A U.S. government study conducted by the EMF Research and Public Information Dissemination Program determined that most people in the United States on average are exposed to magnetic fields of 2 mG or less daily, and varies by individual (NIEHS, 2002). **Table 12** summarizes the average level of magnetic fields of common appliances.

Table 12: Typical Magnetic Fields (mG) of Common Appliances

Source	Distance from Source			
	0.5 foot	1 foot	2 feet	4 feet
Baby Monitor	6	1	-	-
Computer Displays	14	5	2	-
Fluorescent Lights	40	6	2	-
Copy Machines	90	20	7	1
Microwave Ovens	200	4	10	2
Electric Pencil Sharpeners	200	70	20	2
Vacuum Cleaner	300	60	10	1
Can Opener	600	150	20	2
Color Televisions	NA	7	2	-

Source: NIEHS, 2002

The study of cancer in relation to ELF magnetic fields has been a topic of study since the late 1970s. Since that time there have been several epidemiological studies that have explored the possible association of not only cancer risks, including brain tumors, leukemia, and breast cancer, but other potential human maladies including mental health issues. Studies have focused on both occupational exposures for individuals working in electrical industries and public exposures for children and adults living and working around common magnetic field sources (in-home wiring, transmission lines, home and office appliances/equipment). The results of the various studies conducted over the last three decades, specifically those regarding the relationship between EMF

and childhood leukemia and other cancer risks, have been mixed; some have found an association while others have not (National Cancer Institute, 2005).

Where there is association suggested in epidemiological studies, it is usually very near the statistical threshold of significance. When these studies are repeated in a laboratory, the results have not reproduced or identified a biological mechanism to support a link between health impacts and magnetic fields. Researchers continue to look at magnetic fields until more certain conclusions can be reached.

In a 2007 report the World Health Organization (WHO) concluded that, although some studies have noted a weak statistical link between exposure to EMF and incidence of childhood leukemia, laboratory evidence does not support these findings and that a similar link has not been noted with other types of cancer:

> … *epidemiological evidence is weakened by methodological problems, such as potential selection bias. In addition, there are no accepted biophysical mechanisms that would suggest that low-level exposures are involved in cancer development. … Additionally, animal studies have been largely negative. Thus, on balance, the evidence related to childhood leukaemia is not strong enough to be considered causal. … Regarding long-term effects, given the weakness of the evidence for a link between exposure to ELF [extremely low frequency] magnetic fields and childhood leukaemia, the benefits of exposure reduction on health are unclear.* (WHO, 2007)

Although scientists are still debating whether EMF is a hazard to health, at the current time in the United States, there are no federal standards for occupational or residential exposure to magnetic fields. Florida, New York, and Massachusetts are the only three states in the country that have set standards for magnetic field exposure (**Table 9**). These standards were not in response to health-based analysis, but rather on maintaining transmission systems within historic levels.

The International Commission on Non-Ionizing Radiation Protection (ICNIRP) has developed occupational and residential guidelines for EMF exposure (**Table 10**). The exposure guidelines established by the ICNIRP have typically been the guidelines adopted by most countries and organizations. They have also concluded that available data regarding potential long-term effects, such as increased risk of cancer, is insufficient to provide a basis for setting exposure restrictions.

Applicants' estimates of magnetic fields expected at 3.28 feet above ground at both average and emergency load conditions at various distances from the centerline are presented in **Table 13**. Emergency load conditions would occur in rare instances where one transmission line fails and the load normally carried by the line experiencing failure is shifted to another line. The line carrying the additional electrical load is then said to be operating under emergency load conditions.

Table 13: Calculated Magnetic Fields (mG) for Proposed Little Falls 115 kV Transmission Line

Scenario	Maximum Operating Voltage (kV)	Distance to Proposed Centerline										
		-300'	-200'	-100'	-50'	-25'	0'	25'	50'	100'	200'	300'
Horizontal Post Operation No Distribution Underbuild Average Load	121	0.06	0.13	0.46	1.43	3.17	5.96	3.71	1.63	0.50	0.13	0.06
Horizontal Post Operation No Distribution Underbuild Emergency Load	121	1.20	2.64	9.71	30.33	67.09	126.16	78.54	34.45	10.51	2.75	1.23
Horizontal Post Operation with Single Circuit Distribution Underbuild Average Load	121	0.07	0.14	0.48	1.45	3.88	10.58	5.94	2.45	0.70	0.18	0.08
Horizontal Post Operation with Single Circuit Distribution Underbuild Emergency Load	121	1.18	2.54	8.70	23.10	41.97	90.92	65.95	32.65	10.68	2.84	1.27
Horizontal Post Operation with Double Circuit Distribution Underbuild Average Load	121	0.08	0.16	0.58	1.68	3.51	6.48	4.18	1.96	0.65	0.18	0.08
Horizontal Post Operation with Double Circuit Distribution Underbuild Emergency Load	121	1.30	2.82	9.79	26.66	49.68	72.55	52.65	29.11	10.56	2.95	1.34
H-Frame Average Load	121	0.10	0.21	0.84	3.17	8.73	14.00	8.73	3.17	0.84	0.21	0.10
H-Frame Emergency Load	121	2.01	4.51	17.85	67.07	184.77	296.45	184.77	67.07	17.85	4.51	2.01

Source: GRE and Minnesota Power, 2011a, personal communication December 14, 2011

The maximum estimated magnetic field generated by the proposed transmission line under emergency loading conditions would be approximately 297 mG directly under the transmission centerline at 3.28 feet above ground, well below the 830 mG general public magnetic field guideline established by ICNIRP. The right-of-way required for the proposed project is 100 to 120 feet (50-60 feet on each side of centerline); the highest estimated magnetic field at a distance of 50 feet from

the transmission line centerline would be approximately 67 mG under emergency load conditions. At 200 feet from the transmission centerline the magnetic field level under emergency loading conditions drops to a maximum of 4.51 mG, slightly above the average background magnetic field of a typical home of 0.5 mG to 4 mG; under average loading conditions the magnetic field at 200 feet is approximately 0.21 mG, slightly under the average background magnetic field of a typical home.

Based upon current scientific evidence, no adverse effects from electric fields or magnetic fields on health are expected for persons living or working at locations along or near the proposed project.

The Commission has consistently found that there is insufficient evidence to demonstrate a causal relationship between EMF exposure and any adverse human health effects. Below are some references to recent Commission proceedings relating to high-voltage transmission lines and the issue of electric fields and magnetic fields:

> *120. The absence of any demonstrated impact by electric field and magnetic field exposure supports the conclusion that there is no demonstrated impact on human health and safety. No adverse effects from electric fields and magnetic fields on health are expected for persons living or working at locations along or near the proposed Project.* (Minnesota Public Utilities Commission, 2010, Finding 120)

> *40. The issue of electric and magnetic fields was discussed in the environmental assessment. A number of national and international health agencies (The Minnesota Department of Health, The World Health Organization, The National Institute of Environmental Health Sciences) have generally concluded in their research that there is insufficient evidence to prove a connection between electric and magnetic fields exposure and health effects. Research has not been able to establish a cause and effect relationship between exposure to magnetic fields and human disease, nor a plausible biological mechanism by which exposure to electric and magnetic fields could cause disease. No Minnesota regulations have been established pertaining to magnetic fields from high voltage transmission lines.* (Minnesota Public Utilities Commission, 2009, Finding 40)

To assist the public in understanding this issue, electric utilities often provide information to the public, interested customers and employees. The information may references studies and provides data to help explain the relative impact of transmission line exposure to other common EMF exposures, and allow individuals to make informed decisions regarding EMF.

Stray Voltage

Stray voltage is an extraneous voltage that appears on grounded surfaces in buildings, barns and other structures, including utility distribution systems. Sources of stray voltage include a variety of on-farm wiring and grounding problems and off-farm problems related to connections on the electric distribution system. Sometimes a small voltage can develop at these grounding points and flow through the earth. This voltage is called a neutral-to-earth voltage (NEV). More precisely, stray voltage is a small voltage that is measured between two points that animals such as livestock can simultaneously come into contact with. When an animal simultaneously contacts these points a small current will flow through the animal (Fick and Surbrook, n.d.). These NEV currents may contribute to an excess of acceptable current in a livestock contact area on an adjoining farm. As such, stray voltage has primarily been raised as a concern on dairy farms because it may impact operations and milk production. Stray voltages are low-level voltages and should be distinguished from shocks felt by humans. Stray voltages are not lethal.

Stray voltage is by and large an issue associated with electrical distribution lines. Transmission lines do not create stray voltage as they do not directly connect to businesses, residences, or farms.

Stray voltage sources can be reduced in three fundamental ways: reduce the current flow on the neutral system; reduce the resistance of the neutral system; or improve the grounding of the neutral system. Making good electrical connections and making sure that these connections are maintained by the proper choice of wiring materials for wet and corrosive locations will reduce the resistance of the grounded neutral system and thereby reduce NEV levels.

Induced Voltage/Contact Voltage

The electric field from a transmission line in some instances can reach a nearby conductive object, such as a vehicle or a metal fence, which is in close proximity to the transmission line. This may induce a voltage on the object, which is dependent on many factors, including the weather conditions, object shape, size, orientation, capacitance and location along the right-of-way. If these objects are insulated or semi-insulated from the ground and a person touches them, a small current would pass through the person's body to the ground. This touch may 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.

The major concern with induced voltage is the current that flows through a person to the ground when touching the object, not the level of the induced voltage. Most shocks from induced current are considered more of a nuisance than a danger, but to ensure the safety of persons in the proximity of high-voltage transmission lines, the NESC requires that any discharge be less than 5 milliAmperes. In addition, the Commission's electric field limit of 8 kV/m was designed to prevent serious hazard from shocks due to induced voltage under high-voltage transmission lines. Proper grounding of metal objects under and/or adjacent to the transmission line is the best method of avoiding these shocks.

The power lines will be designed to meet or exceed minimum clearance requirements over roads, driveways, cultivated fields, and grazing lands specified by the NESC. Recommended clearances within the NESC are designed to accommodate a relative vehicle height of 14 feet.

Implantable Devices

Implantable medical devices such as pacemakers, defibrillators, neurostimulators, and insulin pumps may be subject to interference from strong electric and magnetic fields. Most of the research on electromagnetic interference and medical devices is related to pacemakers. According to a 2004 Electric Power Research Institute (EPRI) report, implantable cardiac devices are much more sensitive to electric fields than to magnetic fields. In the report, the earliest interference from magnetic fields in pacemakers was observed at 1,000 mG, far greater than the magnetic fields associated with high-voltage transmission lines (EPRI, 2004). Therefore, the focus of research has been on electric field impacts.

Electric fields may interfere with an implanted cardiac device's ability to sense normal electrical activity in the heart if the electric field intensity is high enough to induce body currents strong enough to cause interaction. 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 returns to its normal operation when the person moves away from the source of the interference.

Medtronic and Guidant, manufacturers of pacemakers and implantable cardioverter/ defibrillators, have indicated that electric fields below 6 kV/m are unlikely to cause interactions affecting operation of modern bipolar devices (Department of Commerce, 2009). Older unipolar designs, however, are more susceptible to interference from electric fields with research suggesting that the earliest evidence of interference occurred in electric fields ranging from 1.2 to 1.7 kV/m (Toivonen et al, 1991). Maximum electric fields predicted for this project are estimated at 1.86 kV/m directly under the transmission line and 0.59 kV/m at the edge of the ROW. The risk of interference inhibition of unipolar cardiac pacemakers from high-voltage power lines in everyday life is small (Scholten et al, 2004).

There would be no anticipated permanent impacts on implantable medical devices as a result of the proposed project.

5.6 Air Quality

Air quality emissions directly related to high-voltage transmission lines are negligible amounts of ozone and oxides of nitrogen caused by the corona effect. The other potential air quality issues are associated with construction activities, such as fugitive dust and exhaust emissions from construction equipment.

Ozone and Nitrogen Oxides

Corona discharge is energy loss that physically creates very small amounts of sound, radio noise, heat, and chemical reactions of the air near a conductor, and is a phenomenon associated with all transmission lines. Under certain conditions, the localized electric field near an energized conductor can become strong enough to produce a tiny electric discharge that can ionize air close to the conductors. Several factors contribute to corona discharge, including conductor voltage, shape and diameter, and surface irregularities that can affect a conductor's electrical surface gradient such as scratches, nicks, dust, or water drops. In the case of air quality, this partial discharge of electrical energy can produce very tiny amounts of ozone and nitrogen oxide with ozone being the primary oxidant.

Ozone also forms naturally in the Earth's lower atmosphere from lightning discharges and from reactions between solar ultraviolet radiation and air pollutants such as hydrocarbons from auto emissions. Typical rural ambient levels are around 10 to 30 parts per billion (ppb) at night with peaks of 100 ppb and higher (EPRI, 1982). In urban areas, concentrations greater than 100 ppb are common.

The natural production rate of ozone is directly proportional to temperature and sunlight and inversely proportional to humidity. Therefore, humidity, the same factor that increases corona discharges from transmission lines, inhibits the production of ozone. Ozone is a very reactive form of oxygen and combines readily with other elements and compounds in the atmosphere. Because of its high reactivity, ozone is relatively short-lived. The state and federal government both have regulations regarding permissible concentrations of ozone and oxides of nitrogen: Minnesota sets an ozone limit of 0.08 parts per million (ppm) as the highest eight hour average (Minnesota Rule, part 7009.0800), and the federal limit is 0.075 ppm as the fourth-highest eight hour daily maximum average (40 CFR, Part 50).

Calculations according to the BPA Corona and Field Effects Program Version 3 for a standard single-circuit 115 kV project predicted a maximum concentration of 0.006 ppm near the conductor and 0.002 ppm at one meter above ground during foul weather or worst case conditions with rain at one inch per hour. During a mist (rain at 0.01 inch per hour) the maximum concentrations decreased to 0.0002 ppm near the conductor and 0.0001 ppm at one meter above ground level. (United States Department of Energy, BPA). For both cases, the ozone levels are below federal standards. Studies designed to monitor the production of ozone under transmission lines have been unable to detect any increase attributable to the transmission line facility.

Construction/Fugitive Dust

There would be limited emissions from vehicles and other construction equipment and fugitive dust from right-of-way clearing during construction of the Project. Temporary air quality impacts are expected to occur during this phase of activity. The magnitude of emissions is influenced heavily by weather conditions and the specific construction activity taking place. Exhaust emissions from primarily diesel equipment would vary according to the phase of construction but would be minimal and temporary. Adverse impacts to the surrounding environment would be minimal because of the short and intermittent nature of the emission and dust-producing construction phases. The Project is not anticipated to result in any permanent impacts on air quality.

Mitigation Measures

As a standard HVTL Permit condition, permittees are required to follow standard erosion control measures outlined in MPCA guidance and best management practices (BMPs). These BMPs also identify mitigation measures to reduce the potential for fugitive dust.

As there are no significant impacts to air quality anticipated, no mitigation beyond these BMPs are proposed.

5.7 Transportation and Utilities

Applicants anticipate overlapping Project ROW with existing highway ROWs for most of the route, approximately three miles of the total 3.8 mile length. The Project would cross a natural gas pipeline at two points along the route. The Project may relocate electric distribution facilities to the new transmission structures. The Project would enhance the reliability of the electric transmission grid. Potential interference with communication sources is discussed in Section 5.18.

Transportation

The Project area is served by township and county roads. The Project would parallel township and county roads (180th Avenue, County Road 256, 133rd Street and 195th Avenue) for approximately 79 percent of the Project length. The CWP Little Falls Substation is located on the southeast corner of the intersection of Minnesota Highway 27 and 195th Avenue.

Delivery of Project components, such as poles and conductors, may have temporary impacts along county roads. Construction crews may use portions of the road shoulder while poles are installed and conductors are strung. During construction temporary guard or clearance poles would be installed at crossings to ensure adequate clearance over other utilities, streets, roads, highways, or other manmade infrastructure.

Depending upon final design Applicants may seek to either move or add an additional access point to the CWP Little Falls Substation further south along 195th Avenue.

There are no railroads in the Project area. The nearest airport is the Little Falls/Morrison County – Lindbergh Field Airport, a public airport serving mostly general aviation, located approximately two miles southwest of the Project. It is not anticipated that the Project would impact air traffic (GRE and Minnesota Power, 2011a).

Utilities

CWP provides electrical service to the Project area. The Project will not change electric service, but will increase reliability of the electric transmission grid. CWP maintains both overhead and underground electric distribution lines along County Road 256/133rd Street and 195th Avenue. The Project may relocate the electric distribution facilities to the new transmission structures.

The Project will cross two parallel eight-inch Northern Natural Gas pipelines at two points along its route; approximately 1,000 feet north of County Road 256/133rd Street and again approximately 1,000 feet south of the CWP Little Falls Substation. When a high-voltage alternating current transmission line is located adjacent to a pipeline ROW, the pipeline may be subject to electric and magnetic induction if there are flaws in the pipeline coating. This induction has the potential to cause corrosion in the pipeline.

The Applicants will not install water or wastewater facilities at either substation.

Mitigation Measures

Applicants will notify MnDOT, County, and township road authorities to inform them of construction plans and ensure that all necessary permits are obtained and traffic impacts are minimized. During construction Applicants will install temporary guard or clearance poles are installed at road crossings to ensure adequate clearance is maintained over other utilities, roads, or highways. Applicants will use traffic safety signage and flaggers as necessary during construction activities to minimize traffic disruption and ensure public safety. Guard structures, such as temporary wood poles with a cross arm or line trucks with booms, can be used to protect traffic lanes (GRE and Minnesota Power, 2011a).

Any change in access to the CWP Little Falls Substation would require approval from Morrison County.

GRE will perform tests to identify any potential corrosion issues to the pipeline that may occur as a result of the Project. Based on the results of the tests, GRE will work with Northern Natural Gas to identify appropriate mitigation measures to ensure that the pipeline is properly grounded.

5.8 Zoning and Compatibility

The Project is located in an area designated as Agricultural (AG) by Morrison County Zoning Ordinance. The Project would be exempt from a Conditional Use Permit under the county zoning ordinance (Darrin Welle, Morrison County Assistant Zoning Administrator, personal communication, December 23, 2011).

Mitigation Measures
As discussed in Section 5.10, the Project would result in some loss of agricultural land. No additional impacts to land use or zoning are anticipated, and no additional mitigation is proposed.

5.9 Recreation

The Platte River Trail System is approximately one mile south of the Route, and the Soo Line ATV trail is approximately three miles south of the route.

The Popple Lake Wildlife Management Area (WMA) is located approximately 1,500 feet west of the Minnesota Power Little Falls Substation. The Popple Lake WMA comprises approximately 223 acres and is primarily a wetland area with cattails, low land grass and brush, with some oak woods along its edges. There is no public access to the WMA, access is available by contacting Minnesota Power to request access to the WMA through the substation property. MnDNR has identified management objectives focused on maintaining and improving the habitat for a diversity of native plants and wildlife. The WMA provides opportunities for hunting, trapping, hiking, snow shoeing and wildlife viewing and photography. The WMA also provides opportunities for hiking and cross-country skiing, although trails are not maintained within the WMA.

The Project would not directly impact recreational resources. At a distance of one to three miles, visual impacts to the recreational uses along the identified trails would be minimal. There would be no direct impacts to the use of the Popple Lake WMA; impacts to wildlife are discussed in Section 5.15.

Mitigation Measures
Because no direct impacts to recreational resources are anticipated, no mitigation measures are proposed.

5.10 Land Based Economies

Land use and land cover in the project area consist primarily of agricultural and rural residential uses coupled with undeveloped wetland and woodland.

Agriculture
The U.S. Department of Agriculture, 2007 Census of Agriculture indicates that approximately 431,346 acres or 60 percent of land, in Morrison County is considered farmland. The vast majority of Morrison County agricultural production, approximately 89 percent is in livestock sales. The County is ranked number 2 in Minnesota in the value of livestock, poultry and their products, and is the largest producer of broiler chickens, the third largest producer of cattle, and the fifth largest producer of laying chickens. Top crops (in acreage) are forage, corn for grain, corn for silage, soybeans and oats. The market value of crop sales increased 29 percent between 2002 and 2007, although the number of farms and land dedicated to farming has decreased 5 percent during that same period (USDA, 2007 and Minnesota Department of Agriculture, 2011).

Approximately 92 percent of the route crosses areas of cultivated agricultural land; the land proposed for the CWP Little Falls Substation expansion is currently planted in alfalfa. Approximately 5 percent of the route crosses pasture, hay and grassland (GRE and Minnesota Power, 2011a, page 8-13).

The Project would result in permanent and temporary impacts to agricultural land. Permanent impacts will occur where structures are placed, resulting in loss of approximately 30 square feet around each structure placement. Approximately 1900 square feet, or 0.04 acres, along the route would be permanently impacted by transmission structures and an additional impact of approximately 0.1 acres from the expansion of the CWP Little Falls Substation.

Temporary impacts, such as soil compaction, disruption of agricultural practices, and crop damage within the right of way are likely to occur during construction. Construction of the new transmission structures and removal of existing distribution structures will require repeated access to install foundations, structures and conductors. Impacts would originate from the various construction vehicles required to install the transmission line and structures, and may result in rutting and compaction of soil and farm fields. Applicants anticipate that the majority of construction activity will occur within the easements acquired for the route. If needed, a temporary storage area outside of the easement area would be leased for the duration of construction to provide for storage of material and equipment.

Forestry, Tourism, and Mining Resources

There are no federal, state, or locally designated forests or commercial logging operations located within the Project location. Although there are forested areas along both routes, there is no forest production in the Project location. No impacts to forestry are anticipated from the Project. Vegetation clearing is discussed in Section 5.14.

There are several recreational areas in the Little Falls area offering opportunities for golfing, fishing, camping canoeing, hiking, biking, birding, cross-country skiing, snowmobiling, and hunting. The Project would not directly impact any of these resources. Impacts to recreational uses are discussed in Section 5.9.

According to information on aggregate resources maintained by MnDOT, two active aggregate pits are located across Minnesota Highway 27, northwest of the CWP Little Falls Substation.(MnDOT, 2003 and 2011). The Project would not impede access to or otherwise impact these resources.

Mitigation Measures

Because no impacts to forestry, tourism, or mining resources are anticipated, no mitigation measures are proposed.

The Project will produce temporary and permanent impacts to agricultural uses. In their application, the Applicants have described several mitigation measures they will employ to minimize impacts to agriculture:

- Approximately 79 percent of the transmission line route would be located adjacent to existing utility, road, and highway rights-of-way. Applicants propose to locate the alignment approximately 5 to 10 feet inside private property in these areas, minimizing impacts to agricultural land.
- Right-of-way easements would be purchased through negotiations with each landowner affected by the Project.

- Applicants will work with landowners in determining pole locations and structure types to minimize impact to agricultural land.
- Areas disturbed during construction will be repaired and restored to pre-construction contours to ensure that all surfaces drain naturally.
- Applicants will compensate landowners for crop damage and soil compaction that may occur during construction. Following completion of construction and right-of-way restoration, payment would be made for full value of crop damages or other property damage that occurs during construction or maintenance.
- Movement of crews and equipment will be limited to the right-of-way to the extent possible. If movement outside of the right-or-way is necessary during construction.
- Following completion of construction deep ruts hazardous to farming operations will be repaired when weather and ground conditions permit. Such ruts would be leveled, filled and graded, or otherwise eliminate in a manner agreeable to the landowner. In hay meadows, alfalfa fields, pastures and cultivated agricultural lands, compacted soils will be loosened and ruts will be leveled by scarifying, harrowing, disking, or by other approved methods. If the landowner prefers, compensation will be provided as an alternative.
- Applicants will identify the location of ditches, tile drains, terraces, roads and other agricultural features through surveys and discussion with landowners. Once these locations are known, features will be marked so that they will be avoided during construction. If damage does occur, it will be repaired as nearly as practical to its original condition or the landowner will be compensated if they prefer.
- To the extent possible, construction will be scheduled during periods when agricultural activities will be minimally affected.
- Fences, gates and similar improvements that are removed or damaged during construction will be promptly repaired or replaced.

5.11 Geology & Soils

The topography of Morrison County is the result of glacial deposition. The area is characterized by nearly level to moderate topography with elevations ranging from approximately 1,117 to 1,220 feet above mean sea level. The Mille Lacs Uplands Subsection consists primarily of Superior lobe ground moraine, and includes the Brainerd-Pierz and Automba Drumlin Fields. The depressions between drumlin ridges contain peatlands with shallow organic material. Glacial drift ranges from 100 to 300 feet in depth over bedrock consisting of Middle to Late Archean and Early Proterozoic gneiss, amphibolite, undifferentiated granite, and metamorphosed mafic. Brown and red till forms the parent material (GRE and Minnesota Power, 2011a).

A review of soil survey information from the Natural Resource Conservation Service of the United States Department of Agriculture shows soils in the Project area tend to be sandy loams or loamy sands.

As excavation for foundations for both the substation and transmission structures would be approximately 10 to 30 feet, no geologic impacts are anticipated from the Project.

Temporary short-term disturbance of soils would result from site clearing and excavation activities at the substation site and structure locations, pulling and tensioning sites, setup areas and during transport of crews, machinery, materials and equipment over access routes (primarily along transmission right-of-way).

Construction activities can increase erosion by removing vegetation, disturbing soil and exposing sediment to the elements. The eroded soil can quickly become a sedimentation problem when wind and rain carry the soil off the construction site and sediment is deposited in surface waters unless stabilized. The use of construction vehicles can also compact the soil.

Mitigation Measures

Typical conditions of a high-voltage transmission line route permit require the applicant to utilize erosion control techniques throughout the duration of the project to achieve vegetation establishment and, ultimately, final stabilization. HVTL permits also typically require that contours be graded so that all surfaces drain naturally, blend with the natural terrain, and are left in a condition that will facilitate re-vegetation, provide for proper drainage, and prevent erosion. All areas disturbed during construction of the facilities must be returned to their pre-construction condition.

HVTL permits typically require Permittees to consult with MnDOT and MnDNR to select site characteristic seed certified to be free of noxious weeds.

Applicants have stated that soils will be re-vegetated as soon as possible to minimize erosion or some other method used during construction to prevent soil erosion. Mulch will be used in areas that need immediate cover.

If over an acre of soil will be disturbed during the construction of the Project, the Applicants and CWP will obtain a NPDES construction stormwater permit from the MPCA and will prepare a SWPPP. Erosion control methods and BMPs will be utilized to minimize runoff during construction.

When construction takes place outside of frozen ground conditions, as anticipated in the Project schedule, construction mats can reduce the potential for soil compaction.

5.12 Water Resources

Potential impacts to both groundwater and surface water resources from transmission projects are generally related to the construction phase.

Groundwater

The project area lies within the Central Province that is generally described as containing buried sand aquifers in thick sandy and clayey glacial drifts that are generally over 100 feet in depth overlying Precambrian and Cretaceous bedrock. Sand and gravel aquifers are common in this province, the deeper fractured bedrock is rarely used as an aquifer (MnDNR, 2011).

Groundwater information specific to the project area was obtained using information from the MnDNR Waters Division and the MDH Minnesota County Well Index. A review of well construction records in the vicinity of the Project shows wells are dug to a depth of between 70 and 125 feet (MDH, 2007).

Potential groundwater impacts from overhead transmission lines are typically associated with the construction phase of the project and may result from structure placement or sedimentation release into shallow aquifers from equipment vibration. Transmission structures will require excavation of approximately 10 to 30 feet, depending on structure types and soil conditions. As such, the placement of the transmission structures would not have an impact on the groundwater supply or domestic wells in the area of the project.

The Project would not install any wells.

Surface Water

The proposed project area is located in the Mississippi River (Sartell) Watershed of the Upper Mississippi River Basin. The watershed is also known locally as the Platte-Spunk River Watershed. The Upper Mississippi River Basin is approximately 20,100 square miles in size and stretches from the Headwaters of the Mississippi to the metro area. Drainage typically flows south towards the Mississippi River, the largest river in the watershed (MPCA, 2010).

Based on a review of publicly available information, the Project does not cross any Public Waters lakes, rivers, streams, ditches or riparian areas. Popple Lake is located approximately 1,000 feet west of Minnesota Power's Little Falls Substation. The Project will not cross any rivers or streams. Rice Creek runs approximately one-half to one mile west of the segment of the route along 195th Avenue between 133rd street and the CWP Little Falls Substation. The Platte River, which has been identified as impaired as a result of biological assessment, is approximately one mile south of the Project at its nearest point (MPCA, 2011).

Land that forms the transition from aquatic to terrestrial ecosystems along streams, lakes, and open water wetlands are known as riparian areas. The MnDNR shoreland standards define riparian areas as the land that is within 300 feet of a public waters watercourse and within 1,000 feet of the ordinary high water level of a public water, lake, pond or flowage. The Project does not cross any areas identified as shoreland overlay districts by Morrison County.

During construction, there is the potential for sediment to reach surface waters due to ground disturbances vegetation clearing, excavation, grading, and construction traffic. During the operation of the Project, there is potential for runoff from the substation site to impact surface waters.

Applicants do not anticipate grading around the pole sites. Some grading in the expansion area of the CWP Little Falls substation may be required.

The Project is not expected to alter existing water drainage patterns or floodplain elevations due to the relatively small areas of excavation per structure and the span between structures.

Mitigation Measures

Because no impacts to groundwater are anticipated from the Project, no mitigation measures are proposed.

HVTL permits issued by the Commission typically require that structures be located to span watercourses, wetlands and floodplains to the extent practicable. Upon completion of construction in a specific area route permit conditions require that contours be graded so that all surfaces drain

naturally, blend with the natural terrain, and are left in a condition that will facilitate re-vegetation, provide for proper drainage, and prevent erosion. All areas disturbed during construction of the facilities must be returned to their pre-construction condition.

The HVTL permit also requires permittees to adhere to the terms and conditions of the NPDES permit and SWPP prepared for the Project in cases where one is prepared. All construction projects disturbing one acre or more are required to apply for a construction stormwater permit through the MPCA. The Project would disturb approximately 0.1 acres at the CWP Little Falls Substation site.

HVTL permits require permittees to follow standard erosion control measures outlined in MPCA guidance and employ erosion BMPs, regardless of whether a NPDES permit is required.

In the route permit application, Applicants have committed to maintaining sound water and soil conservation practices during construction and operation of the Project to protect topsoil and adjacent water resources. Practices may include:

- Containment of stockpiled material away from stream banks and lake shorelines;
- Stockpiling and re-spreading topsoil;
- Reseeding and re-vegetating disturbed areas; and
- Implementing BMPs for erosion and sediment controls.

In addition to erosion control measures, fueling and lubricating far construction equipment away from waterways would ensure that fuel and lubricants do not enter waterways.

5.13 Wetlands and Floodplains

Wetlands provide direct benefits to the environment and vary according to the type or class of wetland and the season. Wetlands serve as floodwater detentions, provide nutrient assimilation and sediment entrapment (water quality), and provide wildlife habitat. Wetlands are either protected federally under Section 404 of the Clean Water Act or by the State of Minnesota under the Wetland Conservation Act.

The National Wetland Inventory (NWI) developed by the United States Fish and Wildlife Service (USFWS) shows a large wetland complex south of 133rd street extending into the Rice-Skunk WMA and crossing the Project at several points along 133rd street (**Figure B-10**). The NWI is based on aerial photographs and soil survey information and has not been field verified for the Project. Nevertheless, the NWI does provide a good start to identify potential wetland areas. The MnDNR Public Water Inventory (PWI) shows one wetland in Section 13, approximately 500 feet from the proposed route.

Applicants anticipate that wetlands along the route can be spanned; no permanent impacts to wetlands from the substation sites are anticipated. During the construction phase of the Project, there is the potential for temporary impacts to wetlands as a result of ground disturbance related to grading, construction traffic, substation construction, and placement of the transmission line structures. Although minimal grading of areas around pole locations is expected, the CWP Little Falls Substation site will be graded.

The Project is not located within any floodplains mapped by the Federal Emergency Management Agency (FEMA, 2011) and would not impact to the function of any floodplains.

Mitigation Measures

Applicants intend to avoid pole placement in wetlands to the extent possible by spanning wetlands along the route. During the initial design Applicants will locate poles outside of wetland areas shown on NWI maps. If soil surveys information at pole locations indicates wetland soils, Applicants will attempt to adjust pole locations to span wetlands to the extent possible.

Although scheduling construction during frozen ground conditions in wetlands to the extent possible is preferred, the proposed Project schedule makes that unlikely. Impacts to wetlands from ground disturbance can be minimized by following standard erosion control measures identified in the MPCA *Stormwater BMP Manual* and discussed in Section 5.12.

In its route permit application, Applicants have proposed the following mitigation measures:

- No staging or stringing set up areas will be placed within or adjacent to wetlands or water resources, as practicable.
- Spanning wetlands to the greatest extent possible;
- Assembling structures on upland areas before they are brought to the site for installation;
- Construction crews will attempt to access the wetland with the least amount of physical impact to the wetland (i.e., shortest route) and will access poles near or in wetlands from roadways whenever possible to minimize travel through wetland areas;
- When construction during winter is not possible, construction mats (wooden mats or a composite mat system) would be used to protect wetland vegetation (GRE and Minnesota Power, 2011a).

Additional mitigation measures could include:

- Avoid crossing wetlands with construction equipment to the extent possible;
- Restoration of wetland vegetation as soon as possible following construction.

If a Regional General Permit under Section 404 of the Clean Water Act is required from the United States Army Corps of Engineers (USACE), Applicants will restore wetlands as required by the USACE and comply with the requirements of the Wetland Conservation Act.

5.14 Flora

The proposed project is located in the southwest portion of the Mille Lacs Upland Ecological Subsection of the Laurentian Mixed Forest Province. At the time of European settlement, vegetation consisted of a mix of forest types. The southern portion of this subsection was dominated by maple-basswood forests while the rest of the subsection was a mix of conifer, hardwood and mixed conifer-hardwood forests. Peatland areas were inhabited by sedge-fen, black spruce-sphagnum (MnDNR, 2011a). The vegetation along the route is currently dominated by agricultural uses including cultivated fields, pockets of upland deciduous forest, shrubby grasslands, grasslands and wetlands.

The Project would directly impact vegetation would by removing approximately 3.6 acres of trees to prepare the ROW (GRE personal communication, January 4, 2012). No impacts to identified native plant communities or sensitive plant species are anticipated.

Mitigation Measures
The primary mitigation strategy to minimize impacts to vegetation is minimizing the extent of tree clearing. By overlapping road ROW for approximately 79 percent of the route, the proposed route minimizing the need for tree clearing.

5.15 Fauna

Wildlife within the Project area consists primarily of deer, small mammals, waterfowl, raptors, and perching birds. These species are typical of the land use in the Project area. Threatened and endangered species are discusses in Section 5.16.

Wildlife could temporarily be displaced and small amounts of habitat could be lost from the project area during construction. Because similar habitats are found adjacent to both routes evaluated, it is likely that these species will only be displaced a short distance and would not incur population level effects due to construction of the transmission line.

The primary potential impact presented to fauna by transmission lines is the potential injury and death of migratory birds such as raptors, waterfowl, and other large bird species. The electrocution of large birds, such as raptors, is more commonly associated with small distribution lines than large transmission lines. Electrocution occurs when birds with large wingspans come in contact with two conductors or with a conductor and a grounding device. The Applicants' transmission line design standards and adherence to current industry standards outlined in the *Avian Powerline Action Committee Report* (APPLIC, 2006) would provide for adequate spacing to eliminate the risk of raptor electrocution. As such, electrocution is not a concern related to the project.

Avian collisions are also a recognized possibility with the construction and placement of a new transmission line. The species of birds more commonly involved in collisions are large-bodied and have long wing spans such as swans, geese, ducks, herons, pelicans, and cranes. Collision frequency may increase when a new transmission line is located between agricultural fields that serve as feeding areas, wetlands, or open water, which serve as resting areas.

Mitigation Measures
The USFWS and MnDNR both recommend installation of bird flight diverters along the transmission line (GRE and Minnesota Power, 2011a). In most cases, the shield wire of an overhead transmission line is the most difficult part of the structure for birds to see. To minimize the potential for avian collision, Applicants propose installing Swan Flight Diverters, pre-formed spiral shaped devices made of polyvinyl chloride that are wrapped around the shield wire in several locations along the route as shown in **Figure B-13**.

5.16 Rare and Unique Species and Habitat

The MnDNR's Natural Heritage and Nongame Research Program and the USFWS were consulted to determine the presence of any federal- and state-listed endangered, threatened, and special concern species in addition to any rare and unique native plant communities or Minnesota County Biological Survey sites within or near the proposed project area (GRE and Minnesota Power, 2011a).

As of January 7, 2011, there are no federally-listed or proposed species and/or designated or proposed critical habitat within the action area of the Project.

The Project is adjacent to the authorized boundary for the Crane Meadows National Wildlife Refuge for approximately one-half mile, and is within one-half mile of refuge-owned lands. (GRE and Minnesota Power, 2011a). The USFWS has designated approximately 13, 450 acres within the larger Rice-Skunk Lakes wetland complex for eventual acquisition. Approximately 2,000 acres in scattered parcels within this acquisition area are currently under USFWS ownership; the USFWS continues to pursue additional land acquisitions from willing sellers. Crane Meadows National Wildlife Refuge is considered to be an important bird area for waterfowl, greater sandhill cranes (USFWS, 2011). The whooping crane is an occasional visitor to the refuge during migration and is currently listed as a "nonessential, experimental population" and protected under certain provisions of the Endangered Species Act. The primary concern with the Project in relation to the Crane Meadows National Wildlife Refuge would be the potential for avian collisions, as discussed in Section 5.15.

As of January 26, 2011, no rare flora features have been identified the route. Blandings Turtles, a state-listed threatened species, have been reported in the Project Area.

Mitigation Measures

As discussed in Section 5.15, installation of Bird Flight Diverters can minimize potential for avian collisions with transmission lines. Both MnDNR and USFWS recommend that Bird Flight Diverters be installed on shield wire. Applicants propose to install Bird Flight Diverters along portions of 133rd Street and 195th Avenue, as shown in **Figure B-13**.

The Project will not dredge or convert any wetlands used as habitat by the Blanding's Turtle. Applicants propose to leave turtles undisturbed unless they are in imminent danger, in which case they will be removed by hand. Erosion controls, as discussed in Section 5.12, will be used during construction to minimize potential for erosion and sedimentation. Terrain will be graded to maintain natural contour to the extent possible.

HVTL permits issued in area where Blanding's Turtle is known to occur typically contain a condition requiring permittees to follow MnDNR's measures and recommendations for avoiding and minimizing impacts to Blanding's Turtle populations. These measures include:

- Providing contractors with a flyer with illustrations of the turtle and a summary of recommendations for avoiding and minimizing impacts.
- Establishing silt fencing to keep turtles out of construction areas and removing the fencing after the area has been revegetated.
- Turtles in imminent danger should be moved, by hand, out of harm's way. Turtles not in direct harm's way should be left undisturbed.

5.17 Archaeological & Historic Resources

No known archaeological or historic resources have been identified along the proposed route. Applicants commissioned a background research and literature review to better understand the existing archaeological and historic resources that may be affected by the Project (GRE and Minnesota Power, 2011a). The report did not identify any archaeological site or documented standing structure within a one-mile buffer of the proposed route. The Minnesota State Historic Preservation Office (SHPO) reviewed the report and other available information and concluded that

no known or suspected archaeological properties in the area will be affected by the project (Minnesota SHPO, 2011)

Even though no known archaeological resources have been identified, impacts to as yet undiscovered archaeological resources could result from damage to surface and subsurface soils resulting from construction activities along the route.

Mitigation Measures

Avoidance of archaeological and historic architectural properties is the preferred mitigation measure. The Project avoids historic architectural properties and known archaeological properties.

In the event of an unanticipated discovery of cultural resources during Project construction, HVTL permits require permittees to stop construction activities and consult with a professional archaeologist and the SHPO to determine the proper course of action. If a cultural resource or feature is determined to be potentially eligible for listing on the National Register of Historic Places, it will be avoided or mitigated before construction can resume (GRE and Minnesota Power, 2011a).

5.18 Interference

The Corona from transmission line conductors can generate electromagnetic noise at frequencies that may potentially impact electronic communication and similar devices, including radios, televisions, microwave communications, and Global Positioning System (GPS)-based agricultural navigation systems. No impacts to electronic devices are anticipated as a result of the proposed project.

Radio Interference

Corona from transmission line conductors can generate electromagnetic "noise" in the radio frequency range. This noise may cause broadband interference at the same frequencies that many communication and media signals are transmitted. This noise can cause interference with the reception of these signals depending on the frequency and strength of the signal. Loose hardware on the transmission line may also cause interference.

AM radio frequency interference typically occurs immediately under a transmission line and dissipates rapidly to either side. If radio interference from transmission line corona does occur, satisfactory reception from AM radio stations can be restored by appropriate modification of (or addition to) the receiving antenna system.

FM radio receivers usually do not pick up interference from transmission lines because corona-generated radio frequency noise currents decrease in magnitude with increasing frequency and are quite small in the FM broadcast band (88-108 Mega Hertz); and the excellent interference rejection properties inherent in FM radio systems make them virtually immune to amplitude type disturbances.

Television

Both digital and satellite television are expected to have little interference from corona generated noise, but may experience other types of interference.

Compared to analog broadcasts, digital television broadcast frequencies are high enough that any electromagnetic noise currents, if they were to exist at all, would be very small.

An outdoor antenna can be used to solve issues with multipath reflections.

Satellite television is transmitted in the K_u Band of radio frequency and is not very susceptible to corona generated noise.

Line of sight for satellite television users could be obstructed by a transmission line structure. Line of sight can usually be restored by moving the consumer satellite dish to a slightly different location.

Internet and Cellular Phones

Wireless internet and cellular phones use frequencies in the ultra-high frequency (UHF) range. The specific UHF frequency used by a cellular phone would depend on the technology (global system for mobile communications (GSM), 3G, etc.) of the provider. All radio frequencies used for both cellular phones and wireless internet are high enough that the effect of corona generated noise near the line would be negligible, no impacts are anticipated.

GPS-Based Navigation Systems

Corona-generated noise and not the EMF from transmission lines could be a source of interference for GPS systems. Satellite GPS signals are broadcast at 1.57542 GHz (L1 signal) and 1.2276 GHz (L2 signal) and are high enough that they would have minimal interference. Differential correction signal beacons on the nationwide Coast Guard network transmit at frequencies around 283-325 kHz and are susceptible to electrical noise. Interference with correction signals could result in reduced accuracy while operating directly under a high-voltage transmission line.

Impacts to GPS systems are primarily an issue in agricultural areas because of concerns with interference with farm machinery. Transmission line structures placed in agricultural fields would have GPS coordinates that may be added to the farmer's GPS unit coordinates. However, if the GPS unit is not configured to accept new coordinates, the user would have to manually divert around any structure placed in the fields. Specialty antennas can be connected to existing GPS-based systems to increase reception.

6 PERMITS & APPROVALS

Should a route permit be issued for the project, Applicants may be required to apply for the various local, state, and federal permits listed in this section.

Table 14: Summary of Potential Permits and Approvals

Permit Approvals	Jurisdiction
Federal Approvals	
Section 404 Permit, Clean Water Act (Local/State/Federal Application for Water/Wetland Projects, for discharge of fill due to placement of poles in wetlands). Section 106 Review	U.S. Army Corps of Engineers
Part 7460 review	Federal Aviation Administration
Spill Prevention, Control and Countermeasure (SPCC) Plan	EPA
Minnesota State Approvals	
License to Cross Public Waters or State Lands	MnDNR – Lands and Minerals
Utility Permit (Road Crossing Permits to cross or occupy state trunk highway road right of way)	MnDOT
NPDES/SDS Permit (construction)	MPCA
Section 401, Clean Water Act	MPCA
Minnesota Local/Regional Approvals	
Land Permits, including road crossing/right of way permits (may be required to occupy lands such as parklands, watershed districts, and other publicly-owned land)	County, Township
Wetland Permit	County, Watershed District
Road Crossing, Over-width Loads, Driveway/Access Permits	County, Township
Driveway Permit	County, Township
Culvert Extension/Connection	County

7 ROUTING FACTORS

In the Alternative Routing Process, applicants are not required to provide any routes for review other than the route proposed in the Route Permit Application. However, the scoping process allows citizens or local units of government to propose alternatives. In this case, no additional routes or route segments were proposed. Major routing factors are summarized in **Table 15**.

Table 15: Routing Factors

Issue	Proposed Route
Route Length	3.8 miles
Effect on Human Settlement	
Distance from substation to nearest home	110 feet
Distance from substation to nearest home	1,485 feet
Displacement	No impact
Noise	Temporary / No impact
Aesthetics	Viewshed would include new and incrementally taller transmission line structures; expanded substation
Cultural Values	No impact
Recreation	No impact
Transportation	Depending upon final design, may request change of driveway location to CWP Little Falls Substation
Utilities	May re-locate and underbuild existing electric distribution lines
Public Health and Safety	No impact
Effect on Land-Based Economies	
Agriculture	Loss of approximately 0.1 acres
Forestry	No impact
Tourism	No impact
Mining	No impact
Effect on Cultural Resources	
Archaeological Resources	No identified resources
Historic Resources	No identified resources
Effect on Natural Resources	
Air Quality	No impact
Water Quality	No impact
Surface Water Crossings	No crossings
Wetlands	Wetlands likely to be spanned
Floodplains	Located outside floodplain

Issue	Proposed Route
Flora	Approximately 3.6 acres of trees removed
Fauna	Temporary/no impact
Rare and Unique Natural Resources	One State-listed Threatened Species
Sharing of Existing Rights-of-way	
Transportation	3 miles, 79 percent
Electric Transmission	Parallels existing transmission for 0.8 miles, no overlap
Cross Country	0.8 miles, 21percent
Costs	$2.6 million for construction; $300-$500 per mile per year for maintenance

8 REFERENCES

Much of the information contained within this document was provided by the Applicants or the Applicants' representatives in Great River Energy and Minnesota Power's application to the Public Utilities Commission for a route permit, June 16, 2011 (available for viewing at: http://energyfacilities.puc.state.mn.us/Docket.html?Id=32098

Additional information sources include:

Avian Powerline Interaction Committee (APLIC). 2006. *Suggested Practices for Avian Protection on Powerlines: The State of the Art in 2006*. Edison Electric Institute, APLIC, and the California Energy Commission.

Electric Power Research Institute (EPRI). 1982. *Transmission Line Reference Book*. Second Edition

Electric Power Research Institute (EPRI). 2004. *Electromagnetic Interference with Implanted Medical Devices*.

Federal Emergency Management Agency (FEMA) Map Service Center. 2011. Morrison County Flood Zone Maps. http://msc.fema.gov/webapp/ (Accessed December 22, 2011)

Fick, R.J. and T.C. Surbrook. n.d. "A review of stray voltage research: Effects on livestock." Prepared by the Michigan Agricultural Electric Council.

Great River Energy. 2008. *Long Range Transmission Plan*. http://www.greatriverenergy.com/deliveringelectricity/planningforthefuture/doc083180.pdf (accessed December 13, 2011)

Great River Energy. 2011. Letter to Public Utilities Commission. https://www.edockets.state.mn.us/EFiling/edockets/searchDocuments.do?method=showPoup&documentId={2F5B2DA2-A364-4B1E-B715-A31E0C5EF7C0}&documentTitle=201112-69270-01 (accessed December 16, 2011)

Long Island Power Authority. 2005. *Magnetic Fields Around Your Home*, http://www.lipower.org/residential/safety/emf.html , (Accessed November, 21, 2011).

Minnesota Department of Administration, Minnesota State Demographic Center. 2011. http://www.demography.state.mn.us/ (accessed December 19, 2011).

Minnesota Department of Agriculture. 2011. *Morrison County Agricultural Profile*. http://www.mda.state.mn.us/~/media/Files/food/business/countyprofiles/econrpt-morrison.ashx (accessed December 12, 2011)

Minnesota Department of Commerce. 2011a. *Transcript for Public Scoping Meeting Little Falls September 7, 2011*. https://www.edockets.state.mn.us/EFiling/edockets/searchDocuments.do?method=showPoup&documentId={401C40B1-1561-4523-ADB3-D6F49552A8D4}&documentTitle=201110-66937-01 (accessed November 30, 2011)

Minnesota Department of Commerce. 2011b. *Public Scoping Comments Received.* https://www.edockets.state.mn.us/EFiling/edockets/searchDocuments.do?method=showPoup&documentId={E8B4A042-FCCC-4210-BEC3-03A9B291943C}&documentTitle=201110-66934-01 (accessed November 30, 2011)

Minnesota Department of Commerce. 2011c. *Rights-of-Way and Easements for Energy Facility Construction and Operation.* http://energyfacilities.puc.state.mn.us/documents/DOC%20Easements%20Fact%20Sheet,%206.3.11.pdf (accessed October 10, 2011)

Minnesota Department of Commerce. 2009. *Draft Environmental Impact Statement of the Brookings to Hampton 345 kV Transmission Project.* http://energyfacilities.puc.state.mn.us/resource.html?Id=25589 (accessed November 28, 2011)

Minnesota Department of Health (MDH). 2002. The Minnesota State Interagency Working Group on EMF Issues. 2002. *A White Paper on Electric and Magnetic Field (EMF) Policy and Mitigation Options.* http://energyfacilities.puc.state.mn.us/documents/EMF%20White%20Paper%20-%20MN%20Workgroup%20Sep%202002.pdf (accessed November 28, 2011)

Minnesota Department of Health (MDH). 2007. *County Well Index Online.* http://mdh-agua.health.state.mn.us/cwi/cwiViewer.htm (accessed January 3, 2012)

Minnesota Department of Natural Resources (MnDNR). 2011a. *Ecological Classification System- Mille Lacs Upland Ecological Subsection.* http://www.dnr.state.mn.us/ecs/212Kb/index.html (accessed December 13, 2011).

Minnesota Department of Natural Resources (MnDNR). 2011b. *Groundwater Provinces.* http://www.dnr.state.mn.us/groundwater/provinces/index.html (accessed December 19, 2011)

Minnesota Department of Natural Resources (MnDNR).2011c. *PWI Maps Northeastern Minnesota.* http://www.dnr.state.mn.us/waters/watermgmt_section/pwi/maps_ne.html (accessed December 19, 2011)

Minnesota Department of Natural Resources (MnDNR). 2011d. *WMA Detail Report: Popple Lake WMA*, http://www.dnr.state.mn.us/wmas/index.html (accessed December 19, 2011).

Minnesota Department of Transportation (MnDOT). 2003. *Morrison County Pit Map.* http://www.dot.state.mn.us/materials/maps/copitmaps/morrison2.pdf (accessed January 3, 2012).

Minnesota Department of Transportation (MnDOT). 2011. *Aggregate Sources Information Map.* http://www.dot.state.mn.us/materials/asismap.html (accessed January 3, 2012).

Minnesota Pollution Control Agency (MPCA). 2001. *Map of Basins and Watersheds in Minnesota.* http://www.pca.state.mn.us/index.php/view-document.html?gid=14171 (accessed October 11, 2011)

Minnesota Pollution Control Agency (MPCA). 2008. *A Guide to Noise Control in Minnesota, Acoustical Properties, Measurement, Analysis and Regulation.*

Minnesota Pollution Control Agency (MPCA). 2010. *Upper Mississippi River Basin.* http://www.pca.state.mn.us/index.php/water/water-types-and-programs/surface-water/basins-and-watersheds/upper-mississippi-river-basin/upper-mississippi-river-basin.html (accessed October 11, 2011)

Minnesota Pollution Control Agency (MPCA). 2011. *Impaired Waters List.* http://www.pca.state.mn.us/index.php/water/water-types-and-programs/minnesotas-impaired-waters-and-tmdls/assessment-and-listing/303d-list-of-impaired-waters.html#2010-tmdl-list (accessed January 3, 2012)

Minnesota Public Utilities Commission. 2009. *In the Matter of the Application of Xcel Energy for a Route Permit for a 115/69 Kilovolt Transmission Line Rebuild from a Proposed West New Ulm Substation to the Existing Fort Ridgely Substation, Findings of Fact, Conclusions of Law, and Order Issuing a Route Permit to Xcel Energy for the 115/69 Kilovolt Transmission Line Rebuild and Substation (Docket No. E002/TL-08-956).* http://energyfacilities.puc.state.mn.us/documents/19744/08-956%20PUC%20Permit%20ORDER.pdf (accessed November 28, 2011)

Minnesota Public Utilities Commission. 2010. *In the Matter of the Application of Great River Energy for a Route Permit for the Potato Lake 115 kV Transmission Line and Substation in Park Rapids, Minnesota, Findings of Fact, Conclusions of Law, and Order Issuing a Route Permit to Great River Energy for a 115 Kilovolt Transmission Line and Associated Facilities (Docket No. ET2/TL-10-86).* *http://energyfacilities.puc.state.mn.us/documents/26124/PUC_ORDER_111710.pdf (accessed November 28, 2011)*

Morrison County. *Morrison County Land Use Control Ordinance.* http://www.co.morrison.mn.us/vertical/Sites/%7BC8FCCAFF-AECD-45DC-91B1-016A998EB4A8%7D/uploads/Latest_Ordinance.pdf (accessed December 16, 2011)

National Cancer Institute. 2005. *Magnetic Field Exposure and Cancer: Questions and Answers Fact Sheet*, http://www.cancer.gov/cancertopics/factsheet/Risk/magnetic-fields (accessed November 25, 2011)

National Institutes of Health. National Institute of Environmental Health Sciences (NIEHS). 2002. *EMF Electric and Magnetic Fields Associated with the use of Electrical Power.*

Public Service Commission of Wisconsin, *Final Environmental Impact Statement on the Arrowhead – Weston Electric Transmission Line Project, Volume 1, Docket 05-CE-113*. 2000.

Scholten, A., S. Joosten, and J. Silney. 2004. *Unipolar Cardiac Pacemakers in Electromagnetic Fields of High Voltage Overhead lines.* FEMU, University Hospital, Aachen, Germany.

Toivonen, L., J. Valjus, M. Hongisto, and M. Ritta. 1991. The Influence of Elevated 50 Hz Electric and Magnetic Fields on Implanted Cardiac Pacemakers: The Role of the Lead Configuration and Programming of the Sensitivity. Blackwell Publishing Limited. Helsinki, Finland.

United States Census Bureau. 2011. *State, County, and City Quickfacts*: http://quickfacts.census.gov (accessed December 19, 2011)

United States Department of Agriculture. 2007. *2007 Census of Agriculture County Profile: Morrison County, Minnesota* http://www.agcensus.usda.gov/Publications/2007/Online_Highlights/County_Profiles/Minnesota/cp27097.pdf (accessed December 12, 2011)

United States Department of Energy, Bonneville Power Administration. *Corona and Field Effects Program, Version 3.0* (Computer Program), Vancouver, Washington.

United States Environmental Protection Agency. 2008. *Clean Air Act, National Ambient Air Quality Primary Standards (NAAQS)*. http://www.epa.gov/air/criteria.html#5 . (accessed November 23, 2011).

United States Environmental Protection Agency, Office of Radiation And Indoor Air (6603J) (EPA). 1992. *Electric Magnetic Fields In Your Environment*. http://www.web-pub.com/library/brochure/emf.html (accessed November 25, 2011).
United States Fish and Wildlife Service (USFWS). 2011. *Crane Meadows National Wildlife Refuge*. http://www.fws.gov/midwest/CraneMeadows/

World Health Organization (WHO). 1999. "What are Electromagnetic Fields?" *Health and Environment Briefing Pamphlet*, Series 32. http://www.who.int/peh-emf/about/WhatisEMF/en/ (accessed November 23, 2011)

World Health Organization (WHO), Radiation and Environmental Health, Department of Protection of the Human Environment. 2002. *Establishing a Dialogue on Risks from Electromagnetic Fields*. . http://www.who.int/peh-emf/publications/en/emf_final_300dpi_ALL.pdf (accessed November 23, 2011)

World Health Organization (WHO). 2007. *Electromagnetic Fields and Public Health: Exposure to Extremely Low Frequency Fields. Fact Sheet No. 322*. http://www.who.int/mediacentre/factsheets/fs322/en/index.html (accessed November 23, 2011)