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Abstract

Minnesota Power (Applicant) submitted an application to the Minnesota Public Utilities Commission for a high voltage transmission line (HVTL) Route Permit to construct approximately 3.0 miles of new 115 kV transmission line in St. Louis County south of the city of Eveleth, Minnesota.

The Applicant submitted its HVTL route permit application to the Commission on January 16, 2015. The route permit application was accepted as complete by the Commission on March 17, 2015. The docket number for the HVTL Route Permit proceedings is E015/TL-14-977.

Under the Power Plant Siting Act (Minn. Stat. 216E), a route permit from the Commission is required to construct a high voltage transmission line (HVTL). Department of Commerce, Energy Environmental Review and Analysis (EERA) staff is responsible for conducting the environmental review for route permit applications submitted to the Commission (Minn. Rules 7850). Accordingly, EERA staff has prepared this environmental assessment (EA) for the MP 16 Line Relocation project. This EA addresses the issues required in Minnesota Rule 7850.3700, subpart 4, and those identified in the Department's scoping decision of May 19, 2015.

Persons interested in this project can place their names on the project mailing list by registering online at: http://mn.gov/commmerce/energyfacilities/Docket.html?Id=34059 or by contacting Bill Storm, Energy Environmental Review and Analysis, 85 7th Place East, Suite 500, St. Paul, Minnesota 55101, phone: (651) 539-1844, e-mail: bill.storm@state.mn.us. Documents of interest can be found at the above website and on the eDockets system: https://www.edockets.state.mn.us/EFiling/search.jsp (enter the year "14" and the number "977").

Following release of this environmental assessment, a public hearing will be held in the project area. The hearing will be presided over by an administrative law judge from the Office of Administrative Hearings. Upon completion of the environmental review and hearing process, the record compiled on the route permit application will be presented to the Commission for a final decision. A decision on a route permit for the MP 16 Line Relocation project is anticipated in December 2015.

Acronyms, Abbreviations and Definitions

ALJ	Administrative Law Judge
Commission	Minnesota Public Utilities Commission
dBA	A-weighted sound level recorded in units of decibels
DOC	Department of Commerce
EA	Environmental Assessment
EERA	Department of Commerce Energy Environmental Review and Analysis
EMF	electromagnetic field
FEMA	Federal Emergency Management Agency
FHA	Federal Housing Administration
HVTL	high voltage transmission line
kV	kilovolt
MDH	Minnesota Department of Health
mG	milligauss
mg/L	milligrams per liter – equivalent to parts per million (ppm)
MnDNR	Minnesota Department of Natural Resources
MnDOT	Minnesota Department of Transportation
MP	Minnesota Power
MPCA	Minnesota Pollution Control Agency
MSIWG	Minnesota State Interagency Working Group
NAC	noise area classification
NESC	National Electrical Safety Code
NIEHS	National Institute of Environmental Health Sciences
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
NWI	National Wetland Inventory
PUC	Minnesota Public Utilities Commission
PWI	Public Waters Inventory
RAPID	U.S. EMF Research and Public Information Dissemination
ROW	Right-of-Way
SHPO	State Historic Preservation Office
SWPPP	Stormwater Pollution Prevention Plan
USCOE	United States Corp of Engineers
USFWS	United States Fish and Wildlife Service
WHO	World Health Organization

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1.0 Introduction

Minnesota Power (Applicant) has made an application to the Minnesota Public Utilities Commission (Commission) for a high voltage transmission line (HVTL) Route Permit for the construction of a new 115 kV transmission line in the St. Louis County pursuant to Minnesota Statutes Section 216E and Minnesota Rules Chapter 7850.

The Department of Commerce Energy Environmental Review and Analysis (EERA) staff is tasked with conducting environmental review on applications for route permits. The intent of the environmental review process is to inform the public, the applicant, and decision-makers about potential impacts and possible mitigations measures for the proposed project.

This environmental assessment (EA) addresses the issues noted in Minnesota Rule 7850.3700, subpart 4, and those identified in the Department's scoping decision for this project (**Appendix A**), and is organized as follows:

Section 1.0	**Introduction**	The introduction provides an overview of this document and of the proposed project.
Section 2.0	**Regulatory Framework**	Section 2.0 describes the regulatory framework associated with the project, including certificate of need criteria, route permit requirements, and the alternative permitting process.
Section 3.0	**Proposed Project**	Section 3.0 describes the project as proposed by Minnesota Power, including rights-of-way, structures, and conductors.
Section 4.0	**Other Routes**	Section 4.0 describes routes considered and rejected, and any alternative routes or route segments that were developed through the EA scoping process.
Section 5.0	**Potential Impacts and Mitigation Measures**	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 potential adverse impacts.
Section 6.0	**Potential Impacts Comparison of Alternatives Routes**	Section 6.0 compares the potential impacts of the proposed route and the alternative routes to human and natural environments and identifies measures that could be implemented to avoid, minimize, or mitigate potential adverse impacts.

Section 7.0	**Unavoidable Impacts**	Section 7.0 describes the unavoidable impacts, and the irreversible and/or irretrievable commitment of resources resulting from the project.
Section 8.0	**Relative Merits Analysis**	Section 8.0 analyzes the merits of each routing alternative to those factors described in Minnesota Rule 7850.4100.

1.1 Project Description

The proposed project covers a total of approximately 3.0 miles (**Figure 1**) of new 115 kV HVTL and rights-of-way (ROW), and the removal of approximately 3.0 miles of existing HVTL (current 16 Line) that runs through the future expansion of United Taconite's tailings basin.

1.2 Project Location

The project is located in St Louis County, south of Fayal Township and approximately four miles east of McDavitt Township.

Table 1 below summarizes the proposed project location.

Table 1. Project Location

Township	Range	Section	County
56N	17W	16	St. Louis
56N	17W	17	St. Louis
56N	17W	20	St. Louis
56N	17W	21	St. Louis
56N	17W	28	St. Louis
56N	17W	29	St. Louis

1.3 Project Purpose

United Taconite has requested that Minnesota Power remove an existing 115 kV HVTL to accommodate United Taconite's plans to expand its tailings basin to southeast. The project (i.e., installation of 3.0 miles of HVTL) is needed to allow this existing line to be removed without degrading the area's high voltage transmission system.

In order to accommodate the future expansion, Minnesota Power will remove the portion of existing transmission line located in Sections 17, 20, and 29 of Township 56 North, Range 17 West. The area to be temporarily disturbed will be limited to within the existing MP right-of-way. After that portion of the line is removed, the area will be available for expansion of the tailings basin.

1.4 Sources of Information

Much of the information used in this Environmental Assessment is derived from documents prepared by Minnesota Power, including the HVTL Route Permit Application, January 16, 2015. Discussion of Electromagnetic Field (EMF) issues came primarily from the white paper developed by the Interagency Task Force led by the Minnesota Health Department, the National Institute for Environmental Health, and the World Health Organization. Additional information comes from earlier DOC environmental review documents in similar dockets, other state agencies, such as the Department of Natural Resources, and additional research. Firsthand information was gathered by site visits along the proposed line.

Environmental review is guided by the understanding that for a given proposed project and each alternative there shall be a thorough but succinct discussion of potentially significant adverse or beneficial effects generated, be they direct, indirect, or cumulative. Data and analyses shall be commensurate with the importance of the impact and the relevance of the information to a reasoned choice among alternatives and to the consideration of the need for mitigation measures; the environmental reviewer shall consider the relationship between the cost of data and analyses and the relevance and importance of the information in determining the level of detail of information to be prepared for the environmental review document. Less important material may be summarized, consolidated, or simply referenced.

For the MP 16 Line Relocation project issues of potential subsurface soil conditions and constructability, and there impact on route selection were raised during the application review and acceptance portion of the process. The need to gather further information (i.e., field data) was evaluated. For a more detailed discussion of this topic see **Appendix B**.

2.0 Regulatory Framework

Persons seeking to construct and operate a high voltage transmission line in Minnesota must seek permission(s) to do so from the Minnesota Public Utilities Commission (Commission).

2.1 Certificate of Need

No person may construct a large energy facility in Minnesota without a certificate of need from the Commission (Minn. Stat. 216B.243). A transmission line is a large energy facility if it (1) has a capacity of 200 kV or more and is greater than 1,500 feet in length, or (2) has a capacity of 100 kV or more with more than 10 miles of its length in Minnesota, or (3) has a capacity of 100 kV or more and crosses a state line (Minn. Stat. 216B.2421).

For the Minnesota Power 16 Line relocation project a Certificate of Need is not required because the project is not classified as a large energy facility under Minnesota Statutes Sections 216B.243 and 216B.2421, subdivision 2(3). While the project is a HVTL with a capacity of 100 kV or more, it is not more than 10 miles long in Minnesota and it does not cross a state line.

Therefore, the project is exempt from the Certificate of Need requirements.

2.2 Route Permit

Minnesota Statutes Section 216E.03, subd. 2, provides that no person may construct a HVTL without a route permit from the Commission. An HVTL is defined as a transmission line of 100 kV or more and greater than 1,500 feet in length in Minnesota Statutes Section 216E.01, subd. 4. The proposed transmission lines are HVTLs and therefore a route permit is required prior to construction.

The Applicant submitted the HVTL route permit application for the proposed MP 16 Line relocation pursuant to the provisions of the Alternative Permitting Process outlined in Minnesota Rules 7849.2900. The alternative permitting process includes environmental review and public hearings, and typically takes six months.

A copy of the HVTL route permit application, along with other relevant documents, can be reviewed at the Energy Facility Permitting web page at:

http://mn.gov/commerce/energyfacilities/Docket.html?Id=34059

The EERA staff is responsible for evaluating the HVTL route permit application and administering the environmental review process. The Commission is responsible for selecting the transmission lines routes and issuing the HVTL route permit.

Environmental Review

Environmental review under the alternative permitting process includes public information/scoping meetings and the preparation of an environmental review document, the Environmental Assessment (EA) (Minn. R. 7850.3700). The environmental assessment is a written document that describes the human and environmental impacts of the transmission line project (and selected alternative routes) and methods to mitigate such impacts.

The Deputy Commissioner of the Department of Commerce (Commissioner) determines the scope of the EA. The EA must be completed and made available prior to the public hearing.

2.3 Scoping Process

On February 27, 2015, Commission staff sent notice of the place, date and times of the Public Information and Scoping meeting to those persons on the General List maintained by the Commission, the agency technical representatives list and the project contact list.[1]

Additionally, mailed notices were sent to those persons on Minnesota Power's property owners list and to the local units of government. Notice of the public meeting was also published in the local newspapers.[2]

On Monday, March 23, 2015, Commission staff and EERA staff jointly held a public information/scoping meeting at the Eveleth City Hall in Eveleth. The purpose of the meeting was to provide information to the public about the proposed project, to answer questions, and to allow the public an opportunity to suggest alternatives and impacts (i.e., scope) that should be considered during preparation of the environmental review document.

One person attended the public information and scoping meeting; no individuals took the opportunity to speak on the record. A court reporter was present to document oral statements.

Since only one member of the public (a Ms. Julie Marinucci from the consulting firm Short, Elliott, Hendrickson) attended the meeting, an informal question and answer period was held in lieu of a formal presentation. A variety of topics were discussed during this conversation, including project description, environmental review and schedule.

Written comments were due no later than Friday, April 3, 2015.

Three written comments were received: two from state agencies (Department of Natural Resources and Department of Transportation) and one from the Applicant.

The Department of Natural Resources (MnDNR) in its comment letter acknowledged that the MnDNR had previously reviewed a request from the Applicant regarding state listed species.

[1] Notice of Public Information/Scoping Meeting, eDocket No. 20153-107733-01
[2] Notice of Public Information/Scoping Meeting (Newspaper and Landowner List). eDocket No. 21052-107515-01

The MnDNR's response to that request was that the proposed project would not be likely to negatively affect any know rare features.[3]

The Department of Transportation (MnDOT) in its letter recognized that it appears that the project area does not directly abut any state trunk highway; however, the agency did request that it be made aware of any changes to the proposed HVTL that may bring the project area close enough to occupy a portion of current MnDOT rights-of-way (ROW). Additionally, MnDOT requested that it be informed if the transportation and/or storage of structures have the potential to affect any MnDOT ROW.[4]

The Applicant took this opportunity to clarify an alignment question that was raised during deliberations at the Commission's meeting on application completeness; that is, why the proposed route did not follow a straighter line between the portions of the existing 16 Line. The Applicant explained in its letter that the area between the existing 16 Line and the proposed route is comprised of wetland and peat soils. Along the proposed route, the project's heavy angle structures are located in mineral soils. If the project's heavy angle structures were installed in wetland and peat soils rather than the mineral soils found along the proposed route, foundation costs as well as maintenance would increase. Additionally, the proposed route for the project follows existing linear infrastructure, specifically an existing railroad grade in sections 16, 17 and 21 T56N, R17W.[5]

No alternative routes were put forth during the EA scoping comment period.

Commission's Consideration of Alternatives

Under Minn. Rules, part 7850.3700, subp. 3, the scope of the environmental assessment must be determined by the Department within 10 days after close of the public comment period (March 21, 2013, in this case). However, Minn. Stat. § 216E.04, subd. 5, anticipates Commission input into the identification of routes, in addition to the applicant's proposed route, for inclusion in the environmental review of a project. Since the rule's 10-day timeline for determining the scope of the environmental assessment after the close of the public comment period constrains the Commission's ability to provide input, the Commission varied the 10-day timeline. The Commission extended the 10-day timeline to 40 days (which would be May 13, 2015), subject to the Executive Secretary's authority to seek additional time from the Commission.

In its briefing paper dated April 22, 2015 (eDocket No. 20154-109540-01), PUC staff recommended the inclusion of two additional alternatives (AR2 & AR3) to the proposed route for evaluation in the environmental assessment, stating that "all things being equal, the most direct route between two points should be the first route alternative[s] considered."

On April 30, 2015, the Commission at its regularly scheduled meeting considered what action, if any, the Commission should take in regards to the alternatives put forth during the scoping

[3] DNR Comment Letter, April 1, 2015. eDocket No. 20154-108834-01
[4] MnDOT Comment Letter, April 2, 2015. eDocket No. 20154-108882-01
[5] Minnesota Power Comment Letter, April 27, 2015. eDocket No. 20154-109708-01

process. The Commission elected to add the two alternative routes, AR2 and AR3, put forth by PUC staff for evaluation in the environmental assessment.[6]

Scoping Decision

After consideration of the comments, the Deputy Commissioner issued his Scoping Decision on May 19, 2015. A copy of this order is attached in the Appendix A. The items and issues bought forth during the scoping process, along with the typical HVTL routing impacts, were incorporated into the Scoping Decision.

2.4 Public Hearing

The Commission is required by Minn. Rule 7849.5710 subp 1, and Minn. Rule 7850.3800 subp 1, to hold a public hearing once the EA has been completed. It is anticipated that this hearing will be held in late October 2015, in the project area; the hearing will be conducted by an Administrative Law Judge (ALJ).

The hearing will be noticed separately and details can be found online at http://mn.gov/commerce/energyfacilities/Docket.html?Id=34059 Interested persons may comment on the EA at the public hearing. Persons may testify at the hearing without being first sworn under oath. The ALJ will ensure that the record created at the hearing is preserved and will provide the Commission with a report setting forth findings, conclusions, and recommendations on the merits of the proposed transmission line project applying the routing criteria set forth in statute and rule.

Comments received on the Environmental Assessment become part of the record in the proceeding, but EERA staff is not required to revise or supplement the EA document. A final decision on the route permit will be made by the Commission at an open meeting following the public hearing and filing of the ALJ's report.

2.5 Final Decision

Minnesota Statutes, section 216E.03, subdivision 7 identifies considerations that the Commission must take into account when designating transmission line routes, including minimizing environmental impacts, and minimizing conflicts with human settlement and other land uses. Minnesota Rules, part 7850.4100 lists 13 factors for the Commission to consider when making a decision on a Route Permit:

- A. Effects on human settlement, including, but not limited to, displacement, noise, aesthetics, cultural values, recreation and public services;
- B. Effects on public health and safety;
- C. Effects on land-based economies, including, but not limited to, agriculture, forestry, tourism and mining;
- D. Effects on archaeological and historic resources;

[6] Commission Order, Alternative Routes. May 14, 2015. eDocket No. 20155-110416-01

- E. Effects on the natural environment, including effects on air and water quality resources and flora and fauna;
- F. Effects on rare and unique natural resources;
- G. Application of design options that maximize energy efficiencies, mitigate adverse environmental effects, and could accommodate expansion of transmission or generating capacity;
- H. Use or paralleling of existing ROW, survey lines, natural divisions lines and agricultural field boundaries;
- I. Use of existing large electric power generating plant sites;
- J. Use of existing transportation, pipeline and electrical transmission systems or ROWs;
- K. Electrical systems reliability;
- L. Costs of constructing, operating and maintaining the facility which are dependent on design and route;
- M. Adverse human and natural environmental effects which cannot be avoided; and
- N. Irreversible and irretrievable commitments of resources.

The EA addresses each of these factors by evaluating the potential impacts to individual components or "elements" of each factor. For example, effects on human settlement (the first factor in Minnesota Rules, part 7850.4100) are assessed by evaluating potential impacts to 12 different components or "elements" of human settlement including displacement, noise, property values, air quality, electronic interference, transportation and public services, environmental justice, socioeconomics, aesthetics, land use compatibility, cultural values, and recreation and tourism. Similarly, effects on the natural environment (the fifth factor in Minnesota Rules, part 7850.4100) from the proposed project are assessed by evaluating potential impacts to three distinct components or "elements" of natural environment including, water resources, vegetation, and wildlife. For each element, a number of "indicators"—data sources that provide an indication of potential impacts—are analyzed. For example, proximity to residences is used as one "indicator" of potential aesthetic impacts that residents may experience. Similarly, the evaluation of the water resources element of the natural environment relies on data about the acres and type of wetlands impacted by a proposed route. The acres of wetland impact are used as one "indicator" of potential impacts on water resources.

Route permits contain conditions specifying construction and system operation standards (see a sample Route Permit in **Appendix C**).

The commission must make specific findings that it has considered locating a route for a high-voltage transmission line on an existing high-voltage transmission route and the use of parallel existing highway right-of-way and, to the extent those are not used for the route, the commission must state the reasons.

At the time the commission makes a final decision on the permit application, the commission shall determine whether the EA and the record created at the public hearing address the issues identified in the scoping decision.

The commission shall make a final decision on a site permit or a route permit application within 60 days after receipt of the record from the hearing examiner. A final decision must be made within six months after the commission's determination that an application is complete. The commission may extend this time limit for up to three months for just cause or upon agreement of the applicant.

If issued a HVTL route permit by the Commission, Minnesota Power may exercise the power of eminent domain to acquire the land necessary for the project pursuant to Minnesota Statute 216E.12 and Minnesota Statute 117.

2.6 Other Permits

The Public Utilities Commission HVTL route permit is the only State permit required for routing of high voltage transmission lines, but other permits may be required for certain construction activities, such as river crossings. **Table 2** includes a list of potential permits that may be required for Minnesota Power Energy to complete this project.

Table 2. Potential Required Permits

Jurisdiction and Permit	Requirement
Federal	
USCOE, Clean Water Act, Section 404 Permit	Required if dredging and filling activities will occur within jurisdictional wetlands. If the proposed activities are not eligible for coverage under the General Permit or Letter of Permission, an Individual Permit will be obtained from the USCOE.
State	
MPUC, Route Permit	Required for any high voltage transmission line.
MnDNR, License to Cross Public Waters	Required if any work is necessary in public waters.
MnDOT, Utility Permit	Required if placing utilities on or across a Minnesota trunk highway right-of-way.
MPCA, NPDES/SDS General Stormwater Permit for Construction Activity	Required under the NPDES/SDS General Stormwater Permit for Construction Activity where construction activities will cause more than one acre of ground disturbance.
MPCA, Section 401 Water Quality Certification	If the USCOE authorizes the Project under its GP/LOP permitting program as expected, the MPCA waives its Section 401 Water Quality Certification authority.
Local	
Moving Permit (Hauling)	Required whenever legal dimensions and/or axle weights are exceeded per county regulations.
Oversize/Overweight Vehicle Permit	Required on all county highways. May be required to move over-width loads on county, township, or city roads.
Railroad Crossing Permit	Required if crossing a railroad.

Once the Commission issues a Route Permit, local zoning, building and land use regulations and rules are preempted per Minn. Statute 216E.10, subd 1. However, the Applicant is still required to obtain relevant permissions, such as road crossing permits.

2.7 Applicable Codes

The transmission line, regardless of route location, must meet all requirements of the National Electrical Safety Code (NESC) for High Voltage Transmission Lines. These standards are designed to protect human health and the environment. They also ensure that the transmission line and all associated structures are built from high quality materials that will withstand the operational stresses placed upon them over the expected lifespan of the equipment provided normal routine operational and maintenance is performed.

Utilities must comply with the most recent edition of the National Electric Safety Code, as published by the Institute of Electrical and Electronics Engineers, Inc., and approved by the American National Standards Institute, when constructing new facilities or reinvesting capital in existing facilities. See Minn. Statute 326B.35 and Minn. Rule 7826.0300 subp 1.

The NESC is a voluntary utility developed set of standards intended to ensure that the public is protected. The NESC covers electric supply stations and overhead and underground electric supply and communication lines, and is applicable only to systems and equipment operated by utilities or similar systems on industrial premises. For more information, go to standards.ieee.org/faqs/NESCFAQ.html#q1. The Rural Utilities Service provides leadership and capital to "upgrade, expand, maintain, and replace America's vast rural electric infrastructure." For more information, go to http://www.usda.gov/rus/electric/index.htm.

2.8 Issues Outside the Scope of the EA

The following issues will not be considered or evaluated in the EA:

- No build alternative.
- Issues related to project need, size, type, or timing.
- Any route alternative(s) not specifically identified in the scoping decision.
- The impacts of specific energy sources, such as carbon outputs from coal-generated facilities.
- The manner in which landowners are paid for transmission rights-of-way easements.

3.0 Proposed Project

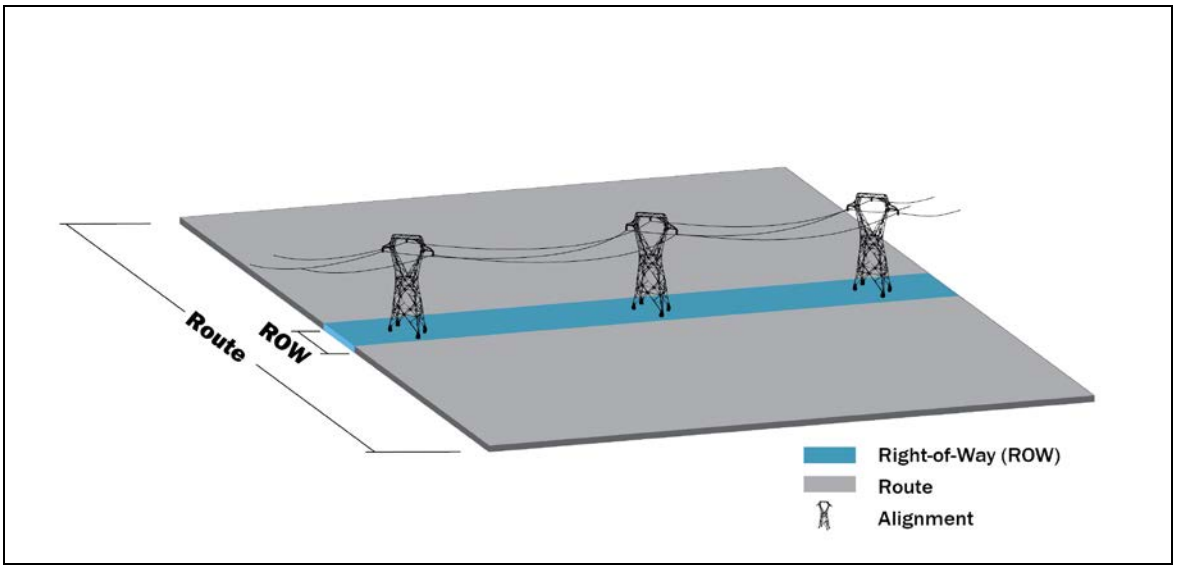
Minnesota Power proposes to construct an approximately 3.0-mile-long, 115 kV HVTL in St. Louis County. The project is located in St Louis County, south of Fayal Township and approximately four miles east of McDavitt Township.

In addition, three miles of existing transmission line will be taken out of service and removed. United Taconite requested that Minnesota Power remove the existing 115 kV HVTL (portion of the 16 Line) to accommodate United Taconite's plans to expand its tailings basin located south of Fayal Township. The proposed HVTL would connect to Minnesota Power's existing 16 Line on the east side of United Taconite's existing tailings basin and proceed southeast, parallel to an existing railroad grade for approximately 1.25 miles. The line would then proceed southwest for approximately 1.75 miles where it would connect to the existing 16 Line.[7]

Figure 2 illustrates the proposed HVTL replacement project on an aerial photograph.

3.1 Right-of-Way Requirements

When the Commission issues a Route Permit, the Commission approves a route, a route width, and an anticipated alignment within that route.



The transmission line must be constructed within the HVTL Route Permit's designated route and along the anticipated alignment unless subsequent permissions are requested and approved by the Commission.

[7] RPA at p 9

The applicable regulations allow the Applicant to request a route that is wider than the actual ROW needed for the transmission line. A "right-of-way" is defined in the regulations as "the land interest required within a route for the construction, maintenance, and operation of a high voltage transmission line."

A "route" is defined as "the location of a high voltage transmission line between two end points. A route may have a variable width of up to 1.25 miles within which a ROW for a high voltage transmission line can be located."

The Applicant has requested a route width of 500 feet and a right-of-way (ROW) width of 100 feet.[8]

Right-of-Way Acquisition

This project will require approximately 3.0 miles of new right-of-way. The evaluation and acquisition process would include title examination, initial owner contacts, survey work, document preparation and purchase. Most of the time, utilities are able to work with the landowners to address their concerns and an agreement is reached for the utilities' purchase of land rights.

In some instances, a negotiated settlement cannot be reached and the landowner may choose to have an independent third party determine the value of the rights taken. Such valuation is made through the utility's exercise of the right of eminent domain pursuant to Minn. Statute 117.

3.2 Technical Description

The proposed project would use H-Frame and Pole Angle structure types as appropriate.

All structures will meet or exceed clearance and strength requirements given in the 2012 edition of the National Electrical Safety Code (NESC). Illustrations of the proposed structure types are shown below. The specifications of these structures are included in **Table 3**.

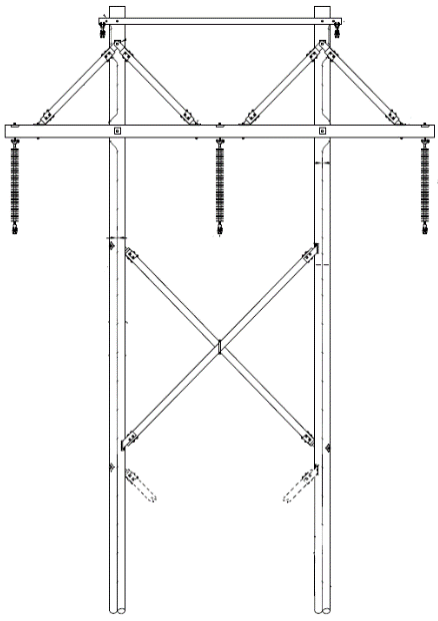
The proposed HVTL would be equipped with protective devices (circuit breakers and relays located in the substation where the transmission lines terminate) to safeguard the public if an accident occurs, such as a structure or conductor falling to the ground. The protective equipment would de-energize the transmission line should such an event occur. The facilities will be posted with signage to warn the public about the risk of coming into contact with the energized equipment. With implementation of safeguards and protective measures, the proposed project is not anticipated to result in adverse or significant impacts on public health and safety.

[8] RPA at p11

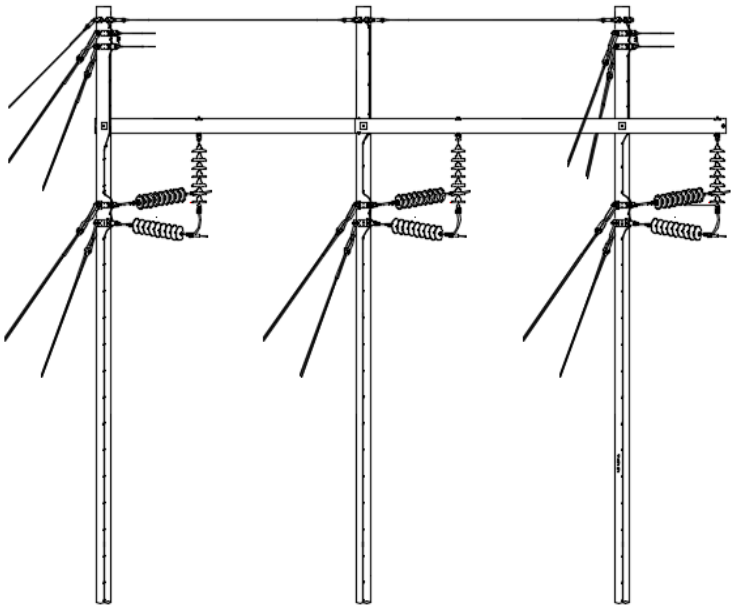
Table 3. Summary of Transmission Structures

Line Type	Structure Type	Structure Material	Typical ROW Width (feet)	Approximate Structure Height (feet)	Structure Base Diameter (inches)	Foundation Diameter (feet)	Span Between Structures (feet)
Single Circuit 115 kV	Angle Structures	Wood	100	Ranges from 60-75	Ranges from 16-32	Wood: direct embed	NA
Single Circuit 115 kV	H-Frame	Wood	100	Ranges from 60-75	Ranges from 16-32	Wood: direct embed	Ranges from 600-7 00

The structures will typically range in height from 60 to 75 feet, depending on the structure type and the terrain. The structures would be placed approximately 500 to 800 feet apart. The angle structures would be equipped with guy wires for support.



Typical H-Frame Structure



Typical Three Pole Angle Structure

3.3 Project Construction and Maintenance

Minnesota Power's proposed 3.0 miles of 115 kV HVTL will be constructed with H-Frame direct embedded wood structures. Monopole angle structures will also be used that will utilize suspension insulators and may require guying.

After land rights have been secured, landowners will be notified prior to the start of the construction phase of the project, including an update on the project schedule and other related construction activities.

The first phase of construction activities will involve survey staking of the transmission line centerline and/or pole locations, followed by removal of trees and other vegetation from the ROW. As a general practice, low-growing brush or tree species are allowable at the outer limits of the easement area. Taller tree species that endanger the safe and reliable operation of the transmission facility will be removed. In developed areas and to the extent practical, existing low growing vegetation that will not pose a threat to the transmission facility or impede construction may remain in the easement area, as agreed to during easement negotiations.

The NESC states that "vegetation that may damage ungrounded supply conductors should be pruned or removed." Trees beyond the easement area that are in danger of falling into the energized transmission line (danger trees) will be removed or trimmed to eliminate the hazard, based on the terms in the easement that is acquired. Danger trees generally are those that are dead, weak or leaning towards the energized conductors. In special circumstances, tree trimming agreements may be possible to minimize tree removal based on negotiations with individual landowners.

All biomass materials resulting from the clearing operations will be chipped on site and spread on the ROW, stacked in the ROW for use by the property owner, or removed and disposed of as agreed to with the property owner during easement negotiations.

The final survey staking of pole locations may again occur after the vegetation has been removed and just prior to the structure installation.

The second phase of construction will involve structure installation and stringing of conductor wire. During this phase, underground utilities are identified through the required One-Call process to minimize conflicts with the existing utilities along the routes.

If temporary removal or relocation of fences is necessary, installation of temporary or permanent gates would be coordinated with the landowner. During the construction process, it may be necessary for the property owner to remove or relocate equipment and livestock from the ROW.

Transmission line structures are generally designed for installation at existing grades. Therefore, structure sites will not be graded or leveled unless it is necessary to provide a reasonably level area for construction access and activities. If vehicle or installation equipment cannot safely

access or perform construction operations properly near the structure, minor grading of the immediate terrain may be necessary.

The Applicant will employ industry-specific best management practices (BMPs). BMPs address ROW clearance, erecting transmission line structures and stringing transmission lines. BMPs for each specific project are based on the proposed schedules for activities, prohibitions, maintenance guidelines, inspection procedures and other practices. In some cases these activities, such as schedules, are modified to incorporate BMP construction that will assist in minimizing impacts for sensitive environments. Any contractors involved in construction of the transmission line will be advised of these BMP requirements.[9]

The new structures are installed directly in the ground, by augering or excavating a hole typically 7 to 10 feet deep and 2 to 3 feet in diameter for each pole. Any excess soil from the excavation will be spread and leveled near the structure or removed from the site, if requested by the property owner or regulatory agency.

The new structures will then be set and the holes back-filled with the excavated material, native soil, or crushed rock. In poor soil conditions, a galvanized steel culvert is sometimes installed vertically with the structure set inside. The Applicant does not anticipate the use of concrete foundations, but if it were to be required, the size of the hole for concrete foundations depends largely on soil type. Based on the known soil types in northeastern Minnesota, it is anticipated that the average structure depth of a typical 65 foot long pole would be approximately 8.5 feet deep. Drilled pier foundations may vary from 4 to 8 feet in diameter. Concrete trucks are normally used to bring the concrete in from a local concrete batch plant.

After a number of new structures have been erected, the Applicant will begin to install the new static wire by establishing stringing setup areas within the ROW. Conductor stringing operations require brief access to each structure to secure the conductor wire to the insulators or to install shield wire clamps once final sag is established. Temporary guard or clearance structures are installed, as needed, over existing distribution or communication lines, streets, roads, highways, railways or other obstructions after any necessary notifications are made or permits obtained. This ensures that conductors will not obstruct traffic or contact existing energized conductors or other cables and also protects the conductors from possible damage.

Environmentally sensitive areas (e.g., wetlands) may require special construction techniques, which may vary according to conditions at the time of construction. During construction, impacts on wetland areas will be minimized by Minnesota Power to the extent possible. Additionally, Minnesota Power will use construction practices that help prevent soil erosion and will take measures to ensure that equipment fueling and lubricating will occur at a distance from waterways.

[9] RPA at p16

The principal operating and maintenance costs for transmission facilities are the costs of inspections and vegetation management. Inspection costs include 1 to 2 annual helicopter inspections, annual fixed wing patrol inspection, ground line inspections every 8 years, and pole climbing inspections as necessary. For wood structure HVTLs with voltages ranging from 115 kV through 230 kV, experience shows that the scheduled maintenance cost is approximately $585 per mile per year; pole climbing inspections are budgeted and scheduled as necessary.

Vegetation management is performed on a 7-year cycle at an approximate average annual cost of $480 per mile. Annual operating and maintenance costs for HVTLs in Minnesota and the surrounding states vary. Actual line-specific maintenance costs depend on the setting, the amount of vegetation management necessary, storm damage occurrences, structure types, materials used, and the age of the line.

Vegetation Removal and Management

The purpose of vegetation removal and management is to keep transmission facilities clear of tall growing trees, brush, and other vegetation that could grow close to the conductors, and to allow for construction vehicle access to and between structures.

BMPs attempt to limit ground disturbance during construction wherever possible. However, disturbance will occur during the normal course of work, which can take several weeks in any one location. As construction is completed, Minnesota Power will restore disturbed areas to their original condition to the maximum extent practicable. Right-of-way agents will attempt to contact each property owner after construction is completed to assess if any remaining damage has occurred as a result of the project. If damage has occurred to the property, Minnesota Power will fairly reimburse the landowner for the damages sustained that are not repaired or restored by Minnesota Power or its representatives.

In some cases, Minnesota Power may engage an outside contractor to restore the damaged property as nearly as possible to its original condition. Portions of vegetation that are disturbed or removed during construction of HVTLs will naturally reestablish to pre-disturbance conditions. Resilient species of common grasses and shrubs typically reestablish with few problems after disturbance. Areas with significant soil compaction and disturbance from construction activities along the proposed HVTL may require assistance in reestablishing the vegetation stratum and controlling soil erosion. Commonly used methods to control soil erosion and assist in reestablishing vegetation include re-seeding and mulching, erosion control blankets, silt fence installation, and minimizing soil disturbance during construction.

To avoid adversely impacting reptile and bird species, Minnesota Power will not use plastic mesh erosion control materials and will adhere to the MnDNR's wildlife friendly erosion control guidance.[10]

[10] RPA at p19

These erosion control and vegetation establishment practices are regularly used in construction projects and will be incorporated in the Applicant's construction plans. These construction techniques typically minimize long-term impacts that may result from the project. The Minnesota Noxious Weed Law (Minnesota Statutes Section 18.75-18.91) defines a noxious weed as an annual, biennial, or perennial plant that the Commissioner of Agriculture designates to be injurious to the public health, the environment, public roads, crops, livestock, or other property.

The Minnesota Department of Agriculture's Noxious & Invasive Weed Program assists local governments and landowners with resources for managing noxious and invasive weeds throughout Minnesota. Minnesota Power will attempt to limit the spread of noxious and invasive weeds by cleaning construction equipment before it enters the construction work area and using only invasive-free mulches, topsoil, and seed mixes. Permanent vegetation will be established in areas disturbed within the construction work area except in actively cultivated areas and standing water wetlands. Seed used will be purchased on a "Pure Live Seed" basis for seeding revegetation areas. The seed tags on the seed sacks will also certify that the seed is "Noxious Weed Free."[11]

Minnesota Power may use both herbicides and/or mechanical methods to control the spread of noxious weeds. Minnesota Power will only use herbicides approved by the U.S. Environmental Protection Agency and the State of Minnesota Department of Agriculture. These herbicides are to be applied by commercial pesticide applicators that are licensed by the Minnesota Department of Agriculture. If during post-construction monitoring of the restored right-of-way a higher density and cover of noxious weeds on the right-of-way is noted when compared to adjacent off right-of-way areas, Minnesota Power will obtain landowner permission and work to mitigate noxious weed concerns.

3.4 Project Implementation

The Applicant anticipates a first quarter 2016 in-service date. Construction would be expected to begin in the winter of 2015 (**Table 4**).

Table 4. Estimated Project Schedule

Project Task	Date
File Route Permit Application (Application) with the Commission	1st Quarter 2015
Route Permit Review Process Complete	3rd Quarter 2015
Begin Transmission Line Construction	4th Quarter 2015
In-Service Date	1st Quarter 2016

[11] RPA at p19

This schedule is based on information known as of the date of the application filing and upon planning assumptions that balance the timing of implementation with the availability of crews, material and other practical considerations. This schedule may be subject to adjustment and revision as further information is developed.

Project Costs

The Applicants have estimated that the installation of the new transmission line and removal of the existing transmission line would cost approximately $4.7 million (**Table 5**), depending on final route selection and mitigation.

Table 5. Estimated Project Costs

Project Item	Cost
Construction of 115 kV Transmission Line Facilities	$ 4,300,000
Removal of Existing 115 kV Line Facilities	$ 400,000
Total Project Cost	$ 4,700,000

4.0 Other Routes and Route Segments

In developing its proposed route, Minnesota Power rejected consideration of an alternative HVTL route due to the small geographical area involved and perceived engineering constraints.

The process for individuals to request that specific alternative routes, alternative route segments, and/or alignment modifications be included in the scope of the environmental review document was discussed at the public information and EA Scoping meeting.

No alternative routes, alternative route segments, and/or alignment modifications were put forth during the EA scoping period.

In the PUC staff's briefing paper on what action the Commission should take regarding route alternatives to be evaluated in the environmental assessment, PUC staff recommended the inclusion of two additional alternatives (AR2 & AR3) for evaluation in the environmental assessment.[12]

Further, PUC staff requested a more complete evaluation (characterization/classification) of the surficial and subsurface soil types and estimated costs of construction for all alternatives (see Appendix C).

On April 30, 2015, the Commission elected to add the two alternative routes, AR2 and AR3, put forth by PUC staff for evaluation in the environmental assessment.

This environmental assessment addresses the human and environmental impacts associated with the proposed transmission line and alternative routes AR-2 and AR-3 (as depicted in **Figure 3**).

Alternative Routes - Description

The proposed Project is located south of Fayal Township and approximately four miles east of McDavitt Township in St. Louis County, Minnesota. All three routes (the Proposed, AR-2 and AR-3) share a common connection point to the existing MP 16 Line, a point on the east side of United Taconite's existing tailings basin (**Figure 4**).

Route alternative AR-2 proceeds southeast from this common point, parallel to an existing railroad grade for approximately 0.65 miles. The line would then proceed south for approximately 1.10 miles and then it would proceed west for approximately 0.60 miles where it would again connect to the existing MP 16 Line.

Route alternative AR-3 proceeds southeast from this common point, parallel to an existing railroad grade for approximately 0.65 miles. The line would then proceed south for approximately 1.30 miles and then it would proceed southwest for approximately 0.75 miles where it would connect to the existing MP 16 Line.

[12] Commission Staff Briefing Paper, April 22, 2015 (eDocket No. 20154-109540-01)

Irrespective of which route is selected, the same existing three-mile section of 115 kV transmission line would be taken out of service and removed.

The route width used for all routes would be 500-feet and the ROW width would be 100 feet, to allow for adequate flexibility in developing a final alignment.

The same structure (H-Frame and Monopole Angle) configuration options are anticipated to be utilized regardless of route selection. The transmission line for all routes would be designed to meet or exceed relevant local and state codes including the National Electric Safety Code (NESC) and Minnesota Power standards. Appropriate standards will be met for construction and installation, and applicable safety procedures will be followed during and after installation.

Certain aspects of this project, such as ROW acquisition, construction procedures, operation and maintenance, vegetation management, and schedule, are not specific to the route selected. These characteristics are covered in Chapter 3 of the EA and are detailed in the RPA.

5.0 Potential Impacts of the Proposed Route

The construction of a transmission line involves both short and long-term impacts. Some impacts may be avoidable; some may be unavoidable but can be mitigated; others may be unavoidable and unable to be mitigated. In general, impacts can be avoided and mitigated by prudent routing – i.e., by placing the transmission line away from human and environmental resources – and by design and construction measures.

Short-term impacts of the project are anticipated to be similar to those of a construction project – noise, dust, soil disturbance and compaction, clearing of vegetation. The project would require the use of equipment to clear land, place structures, and string conductors. The impacts of this equipment use are anticipated to be fairly independent of the route selected for the project. They would occur wherever the project is located; thus, they are not mitigated by prudent routing. However, these impacts can be mitigated by construction measures, for example using best management practices to control soil erosion and minimizing the removal of vegetation.

Long-term impacts can exist for the life of the project and may include aesthetic impacts, health impacts, economic impacts, land use restrictions and impacts to flora and fauna. Long-term impacts are generally not well mitigated by construction measures – these impacts do not flow from how the project is constructed but rather where it is placed and its operational characteristics over time. Long-term impacts can be mitigated by prudent routing and design measures. Thus, long-term impacts can be avoided or mitigated, to a greater or lesser extent, based on the route, alignment, and pole placements for the project.

Through the HVTL route permit the Commission can require route permit applicants to use specific techniques to mitigate impacts or require certain mitigation thresholds or standards to be met through permit conditions.

This section discusses the resources, potential impacts, and mitigation measures associated with the proposed MP 16 Line Relocation project. Section 6 of this EA discusses and compares the potential impacts and mitigation measures associated with the two alternative routes.

Potential Impacts and Regions of Influence

Potential impacts to human and environmental resources are analyzed in this EA within specific spatial bounds or regions of influence (ROI). The ROI for each resource is the geographic area within which the project may exert some influence; it is used in this EA as the basis for assessing the potential impacts to each resource as a result of the project. Regions of influence may vary from project to project given the differences in the setting (i.e., natural and/or built environments) and will vary between the resources being analyzed (from the Human Settlement factor to the Archaeological/Historic Resources factor). The ROI for resources analyzed in this EA are summarized in **Table 6**.

The ROI for most human and environmental resources is the transmission line ROW. Resources within the ROW could be impacted by the construction and operation of the project. For

example, soils could be compacted; trees could be removed. Other resources may be impacted at a greater distance from the project. In this EA, the following ROI was used for these resources:

- **Fifteen hundred feet.** A distance of 1,500 ft. from the anticipated alignment for the project was used as the ROI for analyzing potential Human Settlement (aesthetic and property value) impacts. Impacts may extend outside of a transmission line ROW, but are anticipated to diminish relatively quickly such that potential impacts outside of this distance would be minimal.

- **Right-of-way**. The ROW width (in this case 100 feet) or 50 feet either side of the anticipated alignment for the project was used as the ROI for analyzing potential impact to those resources which potentially could be directly impacted. These include: Human Settlement (Displacement), Land-Based Economies (Agriculture, Forestry, and Mining), Public Health and Safety (Electric and Magnetic Fields, and Implantable Medical Devices), and Natural Environment (Water Resources, Soils, Flora, Fauna).

- **Route Width**. The route width (in this case 500 feet) or 250 feet either side of the anticipated alignment for the project was used as the ROI for analyzing potential impact to those resources which potentially could be indirectly impacted, or whose impact may be felt outside of the Applicant's easement. These include: Human Settlement (Noise, Electronic Interference, and Zoning and Land Use Compatibility), and Public Health and Safety (Stray Voltage and Induced Voltage).

- **One mile.** A distance of up to one mile from the project was used as the ROI for analyzing potential impacts to Archaeological and Historic resources and to Rare and Unique Species.

  Direct impacts to archaeological and historic resources are anticipated to occur, if at all, within the ROW. However, indirect impacts may extend beyond the ROW. For example, a historic resource may be impacted by a transmission line near, but not directly next to, the resource. Direct impacts to rare habitats are anticipated to occur, if they occur, within the ROW. However, indirect impacts to rare and unique species may extend beyond the ROW, particularly for wildlife species. Wildlife may move throughout a project area and may be impacted by limitations on their movement and their ability to access cover, food, and water.

- **Project area.** The project area, defined generally as the county through which the project passes, was used as the ROI for analyzing potential impacts to Human Settlement (Cultural Values, Socioeconomics, Public Utilities, Airports, and Emergency Services), Land-Based Economies (Tourism and Recreation), and Public Health and Safety (Air Quality). These are resources for which impacts may extend throughout communities in the project area.

Table 6. Regions of Influence for Human and Environmental Resources

Type of Resource	Specific Resource / Potential Impact to Resource	Region of Influence (ROI)
Human Settlements	Displacement	Right-of-Way
	Aesthetics, Properties Values	1,500 feet
	Noise, Electronic Interference, Zoning and Land Use Compatibility	Route Width
	Socioeconomics, Cultural Values, Public Utilities, Airports, Emergency Services	Project Area
Public Health and Safety	Stray Voltage, Induced Voltage	Route Width
	Electric and Magnetic Fields, Implantable Medical Devices	Right-of-way
	Air Quality	Project Area
Land-Based Economies	Agriculture, Forestry, Mining	Right-of-Way
	Tourism and Recreation	Project Area
Archaeological and Historic Resources	---	One Mile
Natural Environment	Water Resources, Soils, Flora, Fauna	Right-of-Way[13]
Rare and Unique Species	---	One Mile

[13] Avian species can move easily throughout the project area and are susceptible to collision with transmission line conductors. Thus, impacts to avian species will be considered and discussed with a ROI larger than the right-of-way.

5.1 Description of Environmental Setting

The Minnesota Department of Natural Resources (MnDNR) and the U.S. Forest Service have developed an Ecological Classification System (ECS) for ecological mapping and landscape classification. There are eight levels of ECS units in the United States. Map units for six of these levels occur in Minnesota: Provinces, Sections, Subsections, Land Type Associations, Land Types, and Land Type Phases.

The project is located in St. Louis County, Minnesota, south of the cities of Eveleth and Leonidas; this area lies within the *Laurentian Mixed Forest Province* under the ECS. This classification extends from northern Minnesota, Wisconsin, and Michigan, southern Ontario, and the less mountainous portions of New England.

In Minnesota, this Province covers a little more than 23 million acres (9.3 million hectare) of the northeastern part of the state and is characterized by broad areas of conifer forest, mixed hardwood and conifer forests, and conifer bogs and swamps. The landscape ranges from rugged lake-dotted terrain with thin glacial deposits over bedrock, to hummocky or undulating plains with deep glacial drift, to large, flat, poorly drained peatlands.

Based on U.S. Geological Survey topographic maps, the project will be located in an area whose topography has been significantly altered by mining activities.

The project lies within the ECS *Tamarack Lowlands Subsection* of the Northern Minnesota Drift and Lake Plains Section, near the transition between the St. Louis Moraines and Toimi Uplands Subsections. The Tamarack Lowlands Subsection is characterized by level to gently rolling topography. The largest landform is a lake plain. Around the edges of the old glacial lake is a till plain (Aurora Till Plain) formed in Superior lobe sediments. There is also a small piece of end moraine north of Sandy Lake that is related to the St. Louis moraines. The most common forest communities include lowland hardwoods and conifers. Additionally, northern hardwood and aspen-birch forests were common on the other portions of this region. Presently, much of the land is in public ownership. Forestry and tourism, along with some agriculture are the most common land uses.

This Section has high relief, reflecting the rugged topography of the underlying bedrock. The upland vegetation is remarkably uniform relative to that of other sections in the Laurentian Mixed Forest Province, consisting mostly of fire-dependent forests and woodlands. Forests with red and white pine were widespread in the past, mixed with aspen, paper birch, spruce, and balsam fir; much of the pine was cut in the late 1800s and early 1900s, leaving forests dominated mostly by aspen and paper birch. Jack pine forests are present on droughty ridges and bedrock exposures, as well as on local sandy outwash deposits.

The underlying geology and topography near Eveleth and Leonidas have been altered over time as a result of mining operations. Further, the surface topography and natural drainage ways have been impacted by the man-made development of public infrastructure (e.g., buildings, roads).

The northern forest habitats and associated wetlands of this Section support bald eagles, Canada lynx, spruce grouse, American bitterns, bobolinks, Connecticut warblers, gray jays, northern goshawks, ospreys, trumpeter swans, and northern brook lampreys.

5.2 Socioeconomic

According to the 2012 Census data, St. Louis County is 93.0 percent Caucasian; minority groups in the area constitute a very small percentage of the total population, averaging 7 percent in the county and between 2 and 5.5 percent in cities near the project.[14]

Approximately 24 to 30 workers will be required by Minnesota Power for transmission line construction over an approximately 5 month time period.

The proposed route does not contain disproportionately high minority populations or low-income populations. Population and economic characteristics based on the 2012 U.S. Census are presented in **Table 7.**

There will be short-term impacts to community services as a result of construction activity and an influx of contractor employees during construction of the various segments of the project. Both utility personnel and contractors will be used for construction activities. The communities near the project should experience short-term positive economic impacts through the use of the hotels, restaurants and other services by the various workers.

Table 7. Population and Economic Profile, 2012

Location	Population	Minority Population (Percent)	Caucasian Population (Percent)	Median Household Income	Percentage of Individuals Below Poverty Level
State of Minnesota	5,344,861	13.1	86.9	57,243	10.6
St. Louis County	200,255	7.0	93.0	44,941	15.1
Gilbert	1,799	1.4	98.6	45,292	13.2

[14] http://quickfacts.census.gov/qfd/states/27/27137.html

Eveleth	3,718	5.5	94.5	30,239	18.2
Leonidas	55	2.0	98.0	19,167	14.3

Source: RPA and http://www.city-data.com/

It is not expected that additional permanent jobs will be created by the project. The construction activities will provide a seasonal influx of economic activity into the communities during the construction phase, and materials such as concrete may be purchased from local vendors. Long-term beneficial impacts from the project include increased local tax base resulting from the incremental increase in revenues from utility property taxes and extended mining activities.

Potential Impacts

Socioeconomic impacts resulting from the project will be primarily positive with an influx of wages and expenditures made at local businesses during the construction of the project, increased tax revenue and increased opportunities for business development.

Short-term impacts to existing socioeconomic resources would be relatively minor. The project construction would not cause permanent impacts to leading industries within the project area.

The relatively short-term nature of the project construction and the number of workers who would be hired from outside of the project area should result in short-term positive economic impacts in the form of increased spending on lodging, meals and other consumer goods and services. It is not anticipated that the project would create new permanent jobs during construction, but would create temporary jobs that would provide a short-term influx of income to the area.

If local contractors are used for portions of the construction, total wages and salaries paid to contractors and workers in St. Louis County would contribute to the total personal income of the region. Additional personal income would be generated for residents in the county and the state by circulation and recirculation of dollars paid out by the applicant as business expenditures and state and local taxes. Expenditures made for equipment, energy, fuel, operating supplies and other products and services would benefit businesses in the counties and the state. Indirect impact may occur through the increased capability of the applicant to supply energy to commercial and industrial users, which would contribute to the economic growth of the region.

There is no indication that any minority or low-income population is concentrated in any one area of the project, or that the transmission line would cross through an area occupied primarily by any minority group.

Long-term beneficial impacts to the county's tax base, as a result of the construction and operation of the transmission line, would be the incremental increase in revenue from utility property taxes which is based on the value of the project. The continued availability of reliable

power in the area would have a positive effect on local businesses and the quality of service provided to the general public.

Property Values

Large electric generation facilities have the potential to impact property values. Because property values are influenced by a complex interaction between factors specific to each individual piece of real estate as well as local and national market conditions, the effect of one particular project on the value of one particular property is difficult to determine.

One of the first concerns of many residents near existing or proposed transmission lines is how the 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. Rather, the presence of a transmission line becomes one of several factors that interact to affect the value of a particular property.

In the Final Environmental Impact Statement (EIS) on the Arrowhead-Weston Electric Transmission Line Project, the Wisconsin Public Service Commission addressed the issue of property value changes associated with high voltage transmission lines[15]. This document looked at approximately 30 papers, articles and court cases covering the period from 1987 through 1999.

> *In general there are two types of property value impacts that can be experienced by property owners affected by a new transmission line. The first is a potential economic impact associated with the amount paid by a utility for a right-of-way (ROW) easement. The second is the potential economic impact involving the future marketability of the property.*
>
> *However, substantial differences may exist between people's perceptions about how they would behave and their actual behavior when confronted with the purchase of property supporting a power line.*
>
> *The presence of a power line may not affect some individual's perceptions of a property's value at all. These people tend to view power lines as necessary infrastructure on the landscape, similar to roads, water towers and antenna. They generally do not notice the lines nor do they have strong feelings about them.*

The Final EIS provides six general observations from the studies it evaluated. These are:

- The potential reduction in sale price for single family homes may range from 0 to 14 percent.

[15] Final Environmental Impact Statement , Arrowhead –Weston Electric Transmission Line Project, Volume I, Public Service Commission of Wisconsin Docket 05-CE-113, October 2000, pg 212-215

- 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.

Later, the Final EIS stated, "In coastal states, such as California and Florida, the decrease in property values can be quite dramatic; in states within the Midwest (Minnesota, Wisconsin and the Upper Peninsula of Michigan), the average decrease appears to be between 4 and 7 percent."

Finally, the EIS succinctly summarizes the dilemma in its closing paragraph which stated, "It is very difficult to make predictions about how a specific transmission line will affect the value of specific properties."

Based on the research that has been ongoing since at least the 1950s, several generalizations about the effect of transmission lines on property values can be made:[16]

- Studies have found a potential reduction of sale price for single-family homes of between 0 to 14 percent. Studies conducted in the upper Midwest (Minnesota, Wisconsin, and the Upper Peninsula of Michigan) have shown an average decrease of 4 to 7 percent.
- Although proximity to a transmission line does not appear to affect appreciation of a property, it can sometimes result in increased selling time.
- Property characteristics such as the neighborhood, proximity to schools, lot size, square footage of the house, and other amenities, tend to exert a greater effect on sales place than the presence of a power line.
- High-value properties are more likely than lower-value properties to experience a reduction in sales price.
- The sales price of smaller properties could be more adversely affected than for larger properties.
- For upgrade projects, the level of opposition may affect the size and duration of any reduction in sales price.
- Adverse effects on property prices tend to be greatest immediately after a new transmission line is built and diminish over time.

[16] Final Environmental Impact Statement , Arrowhead –Weston Electric Transmission Line Project, Volume I, Public Service Commission of Wisconsin Docket 05-CE-113, October 2000, pg 212-215

- The sales price for properties crossed by or immediately adjacent to a transmission line appear to be more adversely affected than prices for homes that are not adjacent to the transmission line right-of-way or are greater than 200 feet from the transmission line right-of-way.
- Mitigation measures such as setback distance, landscaping and integration of the right-of-way into the neighborhood, and visual and noise shielding have been shown to reduce or eliminate the impact of transmission structures on sales price.
- Impacts to the value of agricultural property can be reduced by placing structures to minimize disruption to farm operations.[17]

Interviews with residents along existing transmission lines show that a high proportion of residents were aware of the lines at the time they purchased their home and between one-half and three-fourths expressed concerns about the lines. The concerns were related to health effects, aesthetics, and effects on property values. Despite the concerns expressed, 67 to 80 percent of survey respondents with negative feelings about transmission lines reported that their decision to purchase the property and the price they offered to pay was not affected by the lines.[18]

Although results of the studies have not been able to provide a basis for accurately predicting the effect of a particular transmission line on a particular property, researchers have attributed the effects of HVTLs on property values to an interaction between five factors:[19]

- Proximity to the transmission towers and lines
- The view of the towers and lines
- Size and type of HVTL structures
- Appearance of easement landscaping
- Surrounding topography

Federal Housing Administration Regulations

The Federal Housing Administration (FHA) provides mortgage insurance on home loans made by FHA-approved lenders throughout the United States. In order to qualify for FHA mortgage insurance, a property must go through an appraisal and property condition assessment performed by an FHA-qualified appraiser. FHA qualified underwriters and appraisers are responsible for adhering to current the policies contained in the FHA's *Homeownership Center (HOC) Reference Guide.* With respect to overhead HVTLs, FHA guidance requires appraisers to review properties under consideration for FHA loans for presence of utility easements. The US Department of Housing and Economic Development provides the following guidance:

[17] Adapted from Wisconsin Public Service Commission, June 2001. *Environmental Impacts of Transmission Lines.* http://psc.wi.gov/thelibrary/publications/electric/electric10.pdf, p. 17.
[18] Chalmers, James A. and Frank A. Voorvaart. "High-Voltage Transmission Lines: Proximity, Visibility, and Encumbrance Effects." *The Appraisal Journal.* Summer, 2009. http://www.analysisgroup.com/uploadedFiles/Publishing/Articles/2009_HVTLs_and_Property_Values.pdf
[19] Pitts, Jennifer M. and Thomas O. Jackson. 2007. "Power Lines and Property Values Revisited." *The Appraisal Journal. Fall, 2007.*

- *The appraiser must indicate whether the dwelling or related property improvements is located within the easement serving a high-voltage transmission line, radio/TV transmission tower, cell phone tower, microwave relay dish or tower, or satellite dish (radio, TV cable, etc).*
- *If the dwelling or related property improvement is located within such an easement, the DE Underwriter must obtain a letter from the owner or operator of the tower indicating that the dwelling and its related property improvements are not located within the tower's (engineered) fall distance in order to waive this requirement.*
- *If the dwelling and related property improvements are located outside the easement, the property is considered eligible and no further action is necessary. The appraiser, however, is instructed to note and comment on the effect on marketability resulting from the proximity to such site hazards and nuisances*.[20]

Mitigative Measures

Socioeconomic impacts resulting from construction activities associated with the project would be primarily positive with an influx of wages and expenditures made at local businesses during the project construction. Mitigative measures are not necessary.

In the matter of property values (for those properties receiving an easement) potential impact would typically be a negotiated settlement in an easement agreement between the Applicant and the landowner.

Locating the line away from homes to the extent possible and using line design and landscaping to minimize visual intrusions from the line can be used to minimize impacts to property values from the transmission line.

The presence of an HVTL easement on a property does not preclude qualification for FHA mortgage insurance, although the location of an easement on the property does require further documentation than would be required on properties without such easements.

5.3 Displacement

The Applicant does not anticipate that any existing structures along the proposed alignment would fail to meet the NESC safety codes; the proposed project will not require displacement of residences or commercial businesses.

Construction of the proposed HVTL is primarily located in open wetland areas and wetlands adjacent to railroad tracks. A small portion of the proposed HVTL route (1.6 acres) crosses an area zoned residential. **Table 8** summarizes the number of residences located within the proposed ROW and within 1,500 feet of the proposed route.

[20] U.S. Department of Housing and Urban Development. *Is a Property eligible for FHA if there are overhead or high voltage power lines nearby?* http://portalapps.hud.gov/FHAFAQ/controllerServlet?method=showPopup&faqId=1-6KT-2009

Table 8. Proximity to Residential and Non-residential Buildings

Structure Type	Proposed Route	Number of Structures within Various Distances	
		Within ROW	Within 1,500 feet of Proposed Route
Residence	115 kV Route	0	0
Commercial Structure	115 kV Route	0	0

The nearest structure to the Proposed Route is a dwelling located approximately 1,950 feet from the Proposed Route (**Figure 5**).

Potential Impacts

Displacement of residential homes or businesses is not anticipated. Additionally, there are no residential or commercial facilities within the proposed route or anticipated ROW that could be impacted by the FHA issues discussed above (i.e., "fall zone" of a structure).

Mitigative Measures

Since no relocations would occur, no mitigative measures are required.

HVTL permits issued by the Commission anticipate that the right-of-way will generally conform to the anticipated alignment described in the permit, unless changes are requested by individual landowners or unforeseen conditions are encountered. Any alignment modifications within the designated route shall be located so as to have comparable overall impacts relative to the factors in Minn. Rules, part 7850.4100, as does the alignment identified in the HVTL permit, and shall be specifically identified and documented in and approved as part of the plan and profile review required by said permit.

5.4 Anticipated Noise Impacts

Noise is measured in units of decibels (dB) on a logarithmic scale. The A weighted decibel (dBA) scale corresponds to the sensitivity range for human hearing. For example, a noise level change of 3 dBA is barely perceptible to average human hearing while a 5 dBA change in noise level is noticeable. Two sources of noise would be associated with the completed Project: conductors and substations.

Land use activities associated with residential, commercial, and industrial land are grouped together into Noise Area Classifications (NAC). Residences, which are typically considered

sensitive to noise, are classified as NAC 1. Each NAC is assigned both daytime (7 a.m. to 10 p.m.) and nighttime (10 p.m. to 7 a.m.) noise limits for land use activities within the NAC. Table 8 shows the Minnesota Pollution Control Agency (MPCA) daytime and nighttime limits in dBA for each NAC (**Table 9**). The limits are expressed as a range of permissible dBA within a 1-hour period; L50 is the dBA that may be exceeded 50 percent of the time within an hour, while L10 is the dBA that may be exceeded 10 percent of the time within 1 hour.

Typical noise sensitive receptors along the route would include residences, churches, and schools; however, most of the land use along the route is rural agricultural land. Current average noise levels in these areas are typically in the 30 to 40 dBA range and are considered acceptable for residential land use activities. Ambient noise in rural areas is commonly made up of rustling vegetation and infrequent vehicle pass-bys. Higher ambient noise levels, typically 50 to 60 dBA, would be expected near roadways, urban areas and commercial and industrial properties in the project area. Conductor and substation noise would comply with state noise standards.

Noise concerns for this project may be associated with both the construction and operation of the energy transmission system. Construction noise is expected to occur during daytime hours as the result of heavy equipment operation and increased vehicle traffic associated with the transport of construction personnel to and from the work area. Any exceedences of the MPCA daytime noise limits would be temporary in nature and no exceedences of the MPCA nighttime noise limits are expected for this project.

Table 9. MPCA Daytime and Nighttime Noise Limits

Noise Area Classification	Daytime		Nightime	
	L50	L10	L50	L10
1	60	65	50	55
2	65	70	65	70
3	75	80	75	80

Operational noise would be associated with the transmission conductors and transformers at substations that may produce audible noise under certain operational conditions. The level of noise depends on conductor conditions, voltage level and weather conditions. Noise emission from a transmission line occurs during heavy rain and wet conductor conditions. In foggy, damp or rainy weather conditions, transmission lines can create a subtle crackling sound due to the small amount of electricity ionizing the moist air near the wires. During heavy rain, the general background noise level is usually greater than the noise from a transmission line and few people are in close proximity to the transmission line in these conditions. For these reasons, audible noise is not noticeable during heavy rain. During light rain, dense fog, snow and other times when there is moisture in the air, the proposed transmission lines may produce audible noise higher than rural background levels. During dry weather, audible noise from transmission lines is an imperceptible, sporadic crackling sound.

The nearest receptor to the proposed project is a dwelling located approximately 2,200 feet from the anticipated alignment. Noise levels produced by a 115 kV transmission line are generally less than outdoor background levels and are therefore not usually audible.

The EPRI "Transmission Line Reference Book, 345kV and Above", Chapter 6, provides empirically-derived formula for predicting audible noise from overhead transmission lines. Computer software produced by the Bonneville Power Administration (BPA) is also frequently used to predict the level of audible noise from power transmission lines that is associated with corona discharge. Audible noise is predicted for dry and wet conditions, with wet conditions representing a worst case. These procedures are considered to be reliable and represent International best practice.

Computer modeling performed by Applicant using the BPA 1977 software under the worst case wet conditions scenario indicated that the audible L5 and L50 noise levels (discussed above) measured at the edge of the right-of-way would be at 18.89 (H-frame) and 15.39 (H-frame) dBA, respectively, well below the MPCA nighttime L50 limit of 50 dBA for Noise Area Classification 1.

These findings are shown in **Table 10**.

Table 10. Predicted Audible Noise from HVTL

Structure Type	Noise L5 (Edge of ROW) (Decibels A- weighted)	Noise L50 (Edge of ROW) (Decibels A-weighted)
115kV H-Frame	18.89	15.39

Potential Impacts

Noise levels produced by 115 kV transmission lines are usually not audible and have not been demonstrated to approach even the most stringent state standards. Additionally, the majority of the project is located adjacent to railways, and mining activity; sounds from these sources would overpower any project-related noise emissions. Noise impacts from the project are not anticipated.

Mitigative Measures

The Applicant has stated that in an effort to mitigate noise levels associated with construction activities, work would 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 the company is required to work around customer schedules, line outages, or has been significantly impacted due to other factors. Heavy equipment would also be equipped with sound attenuation devices such as mufflers to minimize the daytime noise levels.

No mitigation measures are required for the operational phase of the line as operational noise levels are not predicted to exceed the state noise limits.

5.5 Radio and Television Interference

Corona on transmission line conductors can generate electromagnetic noise at frequencies at which radio and television signals are transmitted. This noise can cause interference (primarily with AM radio stations and the video portion of TV signals) with the reception of these signals depending on the frequency and strength of the radio and television signal. However, this interference is often due to weak broadcast signals or poor receiving equipment.

The most significant factor with respect to radio and television interference is not the magnitude of the transmission line induced noise, but how the transmission line induced noise compares with the strength of the broadcast signal. Very few radio noise problems have resulted from existing 115 kV transmission lines, as broadcast signal strength within a radio station's primary coverage area is great enough that adequate signal to noise ratios are maintained.

If radio interference from transmission line corona does occur with AM radio stations presently providing good reception, satisfactory reception can be obtained by appropriate modification of (or addition to) the receiving antenna system.

Interference with FM broadcast station reception is generally not a problem because:

- corona generated radio frequency noise currents decrease in magnitude with increasing frequency and are quite small in the FM broadcast band (88-108 megahertz (MHz)), and
- the excellent interference rejection properties inherent in FM radio systems make them virtually immune to amplitude type disturbances.

A two-way mobile radio located immediately adjacent to and behind a large metallic structure (such as a steel tower) may experience interference because of signal blocking effects. Movement of either mobile unit so that the metallic structure is not immediately between the two units should restore communications. This would generally require a movement of less than 50 feet by the mobile unit adjacent to a metallic tower. Noise in the frequency range of cellular type phones is almost non-existent and the technology used by these devices is superior to that used in two-way mobile radio.

As in the case with AM radio interference, corona-generated noise could cause interference with TV picture reception because the picture is broadcast as an AM signal. The level of interference depends on the TV signal strength for a particular channel (TV audio is an FM signal that is typically not impacted by transmission line radio frequency noise).

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

broadcast station's primary coverage area where good reception is presently obtained, Xcel Energy has stated that it would work with the affected party to correct the problem. Usually any reception problem can be corrected with the addition of an outside antenna.

Mitigative Measures

No interference issues are anticipated with this project, however, should such interferences be identified, the Applicant would be required to resolve the problem as a condition of the HVTL Route Permit.

5.6 Aesthetics

Aesthetic, or visual resources, are generally defined as the natural and built features of a landscape that may be viewed by the public and contribute to the visual quality and character of an area. Aesthetic resources form the overall impression that an observer has of an area or its landscape character.

Distinctive landforms, water bodies, vegetation, and human-made features that contribute to an area's aesthetic qualities are elements that contribute to an area's visual character. Visual quality is generally defined as the visual significance or appeal of a landscape based on cultural values and the land scape's intrinsic physical elements.

Visual sensitivity is a measure of viewer interest and concern for the visual quality of the landscape and potential changes to it. Visual sensitivity is determined based on a combination of viewer sensitivity and viewer exposure. Viewer sensitivity varies for individuals and groups depending on the activities viewers are engaged in, their values and expectations related to the appearance and character of the landscape, and their potential level of concern for changes to the landscape. High viewer sensitivity is typically assigned to viewer groups engaged in: recreational or leisure activities; traveling on scenic routes for pleasure or to or from recreational or scenic areas; experiencing or traveling to or from protected, natural, cultural, or historic areas; or experiencing views from resort areas or their residences.

Low viewer sensitivity is typically assigned to viewer groups engaged in work activities or commuting to or from work. Viewer exposure varies for any particular view location or travel route depending on the number of viewers and the frequency and duration of their views. Viewer exposure would typically be highest for views experienced by high numbers of people, frequently, and for long periods. Other factors, such as viewing angle and viewer position relative to a feature or area, can also be contributing factors to viewer exposure.

Potential Impacts

The existing landscape character provides the context for assessing the effects of changes to the landscape. Major components of landscape character that define the appearance of the landscape include landform, water, vegetation, and human or cultural modifications.

The proposed project area is zoned as industrial, residential, and forest agricultural management (**Figure 6**). The landowners include United Taconite, Canadian National Railroad, State of Minnesota, and one private landowner. There are no residential structures located within the vicinity of the proposed route. The closest dwelling to the proposed route is approximately 1,950 feet to the southeast in a forested area. Given the distance and tree cover, it is anticipated that the aesthetics of the property would not be adversely affected by the proposed transmission line.

Additionally, the existing segment of overhead electric line would be decommissioned and removed, resulting in no net gain or loss in visual encumbrance due to overhead power infrastructure.

Although the transmission line would be visible throughout most of its length, it is not incompatible with its setting among existing transmission lines, transportation corridors and mining development in the area.

Mitigative Measures

No mitigation measures are required.

5.7 Public Health and Safety Including EMF

The project will be designed to comply with local, state, NESC and Minnesota Power standards regarding clearance to ground, clearance to crossing utilities, clearance to buildings, strength of materials and ROW widths. Minnesota Power construction crews and/or contract crews would comply with local, state, NESC and Minnesota Power standards regarding installation of facilities and standard construction practices. Established industry safety procedures would be followed during and after installation of the transmission line. This would include clear signage during all construction activities.

The transmission line must be equipped with protective devices to safeguard the public from the transmission line if an accident occurs and a structure or conductor falls to the ground. The protective devices are breakers and relays located where the transmission line connects to the substation. The protective equipment would de-energize the transmission line, should such an event occur.

Electric and Magnetic Fields

Voltage transmitted through any conductor produces both an electric field and a magnetic field in the area surrounding the wire. The electric field associated with HVTLs extends from the energized conductors to other nearby objects. The magnetic field associated with HVTLs surrounds the conductor. Together, these fields are generally referred to as electromagnetic fields, or EMF. These effects decrease rapidly as the distance from the conductor increases.

Electric Fields

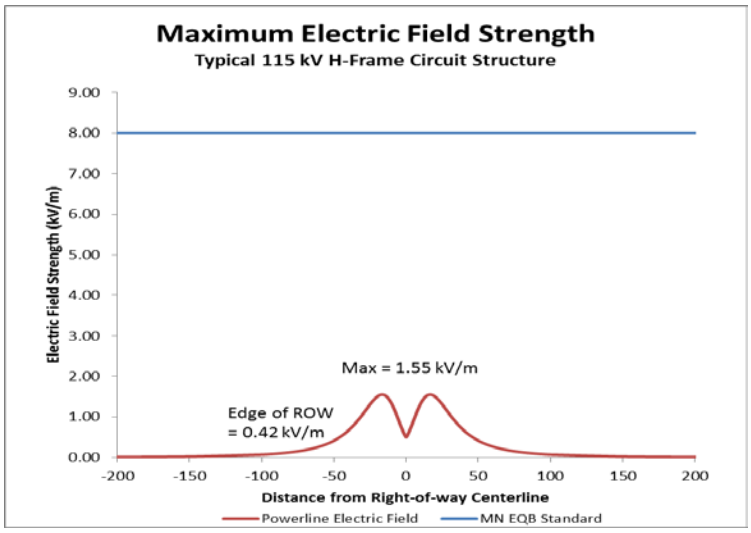
Voltage on any wire (conductor) produces an electric field in the area surrounding the wire. The electric field associated with a high voltage transmission line extends from the energized conductors to other nearby objects such as the ground, towers, vegetation, buildings and vehicles. The electric field from a transmission line gets weaker as one moves away from the transmission line. Nearby trees and building material also greatly reduce the strength of transmission line electric fields.

The intensity of electric fields is associated with the voltage of the transmission line and is measured in kilovolts per meter (kV/M). Transmission line electric fields near ground are designated by the difference in voltage between two points (usually 1 meter). **Table 11** provides the electric fields at maximum conductor voltage for the proposed transmission lines. Maximum conductor voltage is defined as the nominal voltage plus five percent.

Table 11. Calculated Electric Fields (kV/m)

Structure Type	Maximum Operating Voltage (kV)	Distance to Proposed Centerline (feet) of ROW												
		-300	-200	-100	-75	-50	-25	0	25	50	75	100	200	300
115 kV H-Frame	126.5	0.00	0.01	0.07	0.15	0.42	1.31	0.50	1.31	0.42	0.15	0.07	0.01	0.00

Due to the conductor configuration of the single circuit 115 kV H-Frame type structure, the maximum EF for this configuration actually occurs at approximately 16 feet from the centerline of the ROW, as depicted below. The maximum EF was calculated to be 1.55 kV/m at one meter above ground.



There is no federal standard for transmission line electric fields. The Commission, however, has imposed a maximum electric field limit of 8 kV/m measured at one meter above the ground. *In the Matter of the Route Permit Application for a 345 kV Transmission Line from Brookings County, South Dakota to Hampton, Minnesota,* Docket No. ET-2/TL-08-1474, Order Granting Route Permit (*adopting* ALJ Findings of Fact, Conclusions and Recommendation at Finding 194 (April 22, 2010 and amended April 30, 2010)) (September 14, 2010). The standard was designed to prevent serious hazards from shocks when touching large objects parked under AC transmission lines of 500 kV or greater.

Magnetic Fields

Current passing through any conductor, including a wire, produces a magnetic field in the area around the wire. The magnetic field associated with a high voltage transmission line surrounds the conductor and decreases rapidly with increasing distance from the conductor. The magnetic field is expressed in units of magnetic flux density, expressed as milligauss (mG).

Table 12. Calculated Magnetic Flux Density (milligauss)

Structure Type	Current (Amps)	Distance to Proposed Centerline (feet) of ROW												
		-300	-200	-100	-75	-50	-25	0	25	50	75	100	200	300
Magnetic Field Profile at Conductor Thermal Limits														
115 kV H-Frame	461.9	0.64	1.43	5.61	9.73	20.41	56.21	104.90	56.21	20.41	9.73	5.61	1.43	0.64
Magnetic Field Profile at Expected Peak Loading														
115 kV H-Frame	311.3	0.43	0.97	3.78	6.56	13.75	37.88	70.69	37.88	13.75	6.56	3.78	0.97	0.43

The magnetic field profiles around the proposed HVTL for each structure and conductor configuration being considered for the project is shown in **Table 12**. Magnetic fields were calculated at the conductor's thermal limit based on the design of the HVTL. The peak magnetic field values are calculated at a point directly under the HVTL and where the conductor is closest to the ground. The same method is used to calculate the magnetic field at the edge of the right-of-way. The magnetic field profile data show that magnetic field levels decrease rapidly as the distance from the centerline increases.

Because the actual power flow on a transmission line could potentially vary widely throughout the day depending on electric demand, the actual magnetic field level could also vary widely from hour to hour. In any case, the typical loading of the transmission line will be far below the thermal limit of the line, resulting in typical magnetic fields well below those indicated in the table.

It can be noted that magnetic fields are not singularly associated with power lines. Every person has exposure to these fields to a greater or lesser extent throughout each day, whether at home or in schools and offices. The following table (**Table 13**) contains field readings for a number of

selected, commonly encountered items. These reading represent median readings, meaning one might expect to find an equal number of readings above and below these levels.

Table 13. Magnetic Fields (milligauss) From Common Home and Business Appliances

Type	Distance From Source in Feet			
	0.5	1	2	4
Computer Display	14	5	2	-
Fluorescent Lights	40	6	2	-
Hairdryer	300	1	-	-
Vacuum Cleaners	300	60	10	1
Microwave Oven	200	40	10	2
Conventional Electric Blanket	39.4 peak 21.8 average			
Low EMF Electric Blanket	2.7 peak .09 average			

Source: EMF In Your Environment, EPA 1992

Stray Voltage

Stray voltage encompasses two phenomena: Neutral to Earth Voltage and Induced Voltage. In general, stray voltage describes any case of elevated potential, but more precise terminology gives an indication of the source of the voltage.

Neutral to Earth Voltage (NEV) refers to a condition that can occur at the electric service entrances to structures, that is, where distribution lines enter structures. It is the phenomena most commonly referred to as "stray voltage." NEV is an extraneous voltage that appears on metal surfaces in buildings, barns and other structures, which are grounded to earth. NEV can be experienced, for example, by livestock who simultaneously come into contact with two metal objects (e.g., feeders, waterers, stalls). If there is a voltage between these objects, a small current will flow through the livestock. The fact that both objects are grounded to the same place (earth) would seem to prevent any voltage from existing between the objects. However, this is not the case – a number of factors determine whether an object is, in fact, grounded. These include wire

size and length, the quality of connections, the number and resistance of ground rods, and the current being grounded.[21]

Neutral to Earth Voltage can result from damaged, corroded or poorly connected wiring or damaged insulation. Thus, NEV can exist at any business, house or farm which uses electricity, independent of whether there is a transmission line nearby. NEV is largely an issue associated with electrical distribution lines and electrical service at a residence or on a farm. Transmission lines do not create NEV as they do not directly connect to businesses, residences or farms.

NEV can be reduced in three ways: reducing the current flow on the neutral wire entering a home or building, reducing the resistance of the neutral system, or improving the grounding of the neutral system. Making good electrical connections and making sure that these connections have the proper wiring materials for wet and corrosive locations will reduce the resistance of grounded neutral system and thereby reduce NEV levels.

Induced Voltage refers to situations where an electric field extends to a nearby conductive object, thereby "inducing" a voltage on the object. 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 adjacent to the transmission line is the best method of avoiding these shocks.

While transmission lines do not, by themselves, create NEV because they do not connect to businesses or residences, they can induce voltage on a distribution circuit that is parallel and immediately under the transmission line. This induced voltage only occurs in the immediate vicinity of the distribution circuit; it does not travel along the transmission or distribution line. Standard industrial designs can mitigate potential for stray voltage to impact distribution lines.

[21] Stray Voltage, NDSU Extension Publication #108, http://www.ag.ndsu.edu/extension-aben/epq/files/epq108.pdf.

Induced voltage can be reduced or eliminated using cancellation, separation or enhanced grounding. Cancellation can be achieved by configuring the conductors of the transmission line to minimize EMF levels. Separation literally increases the distance between the transmission and distribution lines by physically placing the lines in different locations or by increasing the vertical distance between transmission and distribution lines collocated on the same poles. Enhanced grounding connects counterpoises to the distribution neutral wire and the transmission shield wire.

Potential Impacts

Electric and Magnetic Fields

There are no federal or Minnesota state regulations for the permitted strength of a magnetic field on a transmission line; however both Florida and New York have standards ranging from 150 to 250 mG. **Table 14** summarizes the international and state guidelines for ELF and EMF that current exist.

Table 14. ELF EMF International and State Guidelines

ELF-EMF Guidelines Established by Health & Safety Organizations		
Organization		**Magnetic Field**
American Conference of Governmental and Industrial Hygienists (ACGIH) (Occupational)		10,000 mG (for general worker) 1,000 mG (for workers with cardiac pacemakers)
International Commission on Non-Ionizing Radiation Protection (ICNIRP) (General Public, Continuous Exposure)		833 mG
Non-Ionizing Radiation Committee of the American Industrial Hygiene Association		4,170 mG
Institute of Electrical and Electronics Engineers (IEEE) Standard C95.6 (General Public, Continuous Exposure)		9,040 mG
U.K., National Radiological Protection Board (NRPB)		833 mG
Australian Radiation Protection and Nuclear Safety Agency (ARPANSA)		3,000 mG
State Standards and Guidelines		
State	**Line Voltage**	**Magnetic Field (Edge of ROW)**
Florida	69-230 kV	150 mG
	230-500 kV	200 mG
	>500 mG	250 mG
Massachusetts		85 mG
New York		200 mG

Source: EPRI, 2003; Union of the Electric Industry – EUROELECTRIC, 2003.

The effect of EMF on human health has been the subject of study for over 25 years. Of particular concern is the link between EMF exposure and cancer. Numerous panels of experts have convened to review research data on whether EMF is associated with adverse health effects. The studies have been conducted by the National Institute of Environmental Health Sciences (NIEHS), the USEPA, the World Health Organization (WHO), and the Minnesota State

Interagency Working Group (MSIWG) on EMF issues. Studies regarding EMF exposure and childhood leukemia and other cancer risks have had mixed results. Some organizations have determined that a link between EMF and cancer exists while others have found this link to be weak or nonexistent.

In 1992, Congress initiated U.S. EMF Research and Public Information Dissemination (EMF RAPID). EMF RAPID program studied whether exposure to electric and magnetic fields produced by the generation, transmission, or use of electric power posed a risk to human health. Program conclusions were presented to Congress on May 4, 1999 as follows:

- The scientific evidence suggesting that EMF-EMF exposures pose any health risk is weak.
- Epidemiological studies have serious limitations in their ability to demonstrate a cause and effect relationship whereas laboratory studies, by design, can clearly show that cause and effect are possible. Virtually all of the laboratory evidence in animals and humans and most of the mechanistic work done in cells fail to support a causal relationship between exposure to ELF-EMF at environmental levels and changes in biological function or disease status. The lack of consistent positive findings in animals or mechanistic studies weakens the belief that this association is actually due to ELF-EMFs, but it cannot completely discount the epidemiological findings.
- The NIEHS concludes that ELF-EMF exposure cannot be recognized as entirely safe because of weak scientific evidence that exposure may pose a leukemia hazard. In our opinion, this finding is insufficient to warrant aggressive regulatory concern. However, because virtually everyone in the Unite States uses electricity and therefore is routinely exposed to ELF-EMF, passive regulatory action is warranted such as a continued emphasis on educating both the public and the regulated community on means aimed at reducing exposures. The NIEHS does not believe that other cancers or non-cancer health outcomes provide sufficient evidence of a risk to currently warrant concern (NIEHS, 1999).

In October 1996, a National Research Council Committee of the National Academy of Sciences released a report which corroborated the findings of EMF RAPID. The report concluded:

> *Based on comprehensive evaluation of published studies relating to the effects of power-frequency electric and magnetic fields on cells, tissues, and organisms (including humans), the conclusion of the committee is that the current body of evidence does not show that exposure to these fields presents a human-health hazard.*

Currently the USEPA states the following viewpoint of the associated health effects of EMF on its website (USEPA: Electric and Magnetic Fields (EMF) Radiation form Power Lines, 2009):

> *Much of the research about power lines and potential health effects is inconclusive. Despite more than two decades of research to determine whether elevated EMF exposure, principally due to magnetic fields, is related to an increased risk of childhood*

> *leukemia, there is still no definitive answer. The general scientific consensus is that, thus far, the evidence available is weak and is not sufficient to establish a definitive cause-effect relationship (USEPA, 2009).*

In 2001, the World Health Organization (WHO) International Agency for Research on Cancer classified power-frequency EMF as a "possible carcinogenic to humans." Currently the WHO states the following viewpoint of the associated health effects of EMF on its website (WHO, 2009):

> *Extensive research has been conducted into possible health effects of exposure to many parts of the frequency spectrum. All reviews conducted so far have indicated that exposures below the limits recommended in the INNIRP (1998) EMF guidelines, covering the full frequency range from 0-300 GHz, do not produce any known adverse health effect. However, there are gaps in knowledge still needing to be filled before better health risk assessments can be made (WHO, 2009).*

In September of 2002, the MSIWG on EMF Issues, published "A White Paper on Electric and Magnetic Field (EMF) Policy and Mitigation Options," referred to as the "White Paper." The MSIWG was formed to examine the potential health impacts of EMFs and to provide useful, science-based information to policy makers in Minnesota. Work Group members included representatives from the Department of Commerce, the Department of Health, the Pollution Control Agency, the Public Utilities Commission, and the Environmental Quality Board (MSIWG, 2002). The White Paper concluded the following findings:

- Some epidemiological results do show a weak but consistent association between childhood leukemia and increasing exposure to EMF (see the conclusion of IARC and NIEHS). However, epidemiological studies alone are considered insufficient for concluding that a cause and effect relationship exists, and the association must be supported by data from laboratory studies. Existing laboratory studies have not substantiated this relationship (see NTP, 1999; Takebe et al., 2001), nor have scientists been able to understand the biological mechanism of how EMF could cause adverse effects. In addition, epidemiological studies of various other diseases, in both children and adults, have failed to show any consistent pattern of harm from EMF.
- The Minnesota Department of Health concludes that the current body of evidence is insufficient to establish a cause and effect relationship between EMF and adverse health effects. However, as with many other environmental health issues, the possibility of a health risk from EMF cannot be dismissed. Construction of new generation and transmission facilities to meet increasing electrical needs in the State is likely to increase exposure to EMF and public concern regarding potential adverse health effects.
- Based upon its review, the Work Group believes the most appropriate public health policy is to take a prudent avoidance approach to regulating EMF. Based upon this approach, policy recommendations of the Work Group include:

- Apply low-cost EMF mitigation options in electric infrastructure construction projects;
- Encourage conservation;
- Encourage distributed generation;
- Continue to monitor EMF research;
- Encourage utilities to work with customers on household EMF issues; and
- Provide public education on EMF issues (MSIWG, 2002).

As noted above, research has not been able to establish a cause and effect relationship between exposure to EMFs and adverse health effects. However, a general consensus has been formed to continue research on the health effects of EMFs. At this time, there are no federal standards in the United States to limit EMF exposure.

Continued Research

It is important to note that although expert panels and agencies, such as the ones discussed above, have not yet identified any viable cause and effect relationships between exposure to EMFs and adverse health effects, hypotheses have existed and continue to be researched.

For example, Dr. David O. Carpenter during the recent public hearing proceedings for the proposed 345 kV transmission line from Brookings County, South Dakota, to Hampton, Minnesota, provided pre-filed direct testimony regarding his findings on health effects associated with EMF. Dr. Carpenter is a public health physician and Director of the Institute for Health and the Environment at the University of Albany, SUNY. He researched and wrote a document titled, *Setting Prudent Public Health Policy for Electromagnetic Field Exposures*. Carpenter concludes "there is strong scientific evidence that exposure to magnetic fields from power lines greater than 4 milligauss (mG) is associated with an elevated risk of childhood leukemia" and that some studies have indicated that there is scientific evidence to suggest that exposures above 2 mG could increase leukemia risks. Carpenter goes on to suggest that "lifetime exposure to magnetic fields in excess of 2 mG is associated with an increased risk of neurodegenerative diseases in adults, including Alzheimer's disease and amyotrophic lateral sclerosis (ALS)." Additionally, during his recent testimony on the proposed 345 kV HVTL in response to whether EMF similar to power line exposure can affect biological tissue, he states the following:

> *Any one of these actions [actions that alter cell tissue] might be responsible for the carcinogenic and/or neurodegenerative actions of EMFs. As with many environmental agents, however, assuming that only one mechanism of action exists would be a mistake, particularly where more than one disease is involved. It is more likely that multiple mechanisms of action would contribute to disease.*

EMF as it relates to public health and safety continues to be researched and reviewed.

Stray Voltage

Stray voltage has been raised as a concern on some dairy farms because it can impact operations and milk production. Problems are usually related to the distribution and service lines directly serving the farm or the wiring on a farm. In those instances when transmission lines have been shown to contribute to stray voltage, it was found that the electric distribution system directly serving the farm or the facilities themselves were directly under and parallel to the transmission line. These circumstances are considered in modern day routing/installing of transmission lines and can be readily avoided.

Mitigative Measures

As per the MDH White Paper recommendations concerning "prudent avoidance," utilities routinely use structure designs that minimize magnetic field levels and, where practicable, site facilities in locations affecting the fewest number of people.

5.8 Recreation

The project is located in a region that is known for its outdoor recreation opportunities. The region includes vast areas of forest, lakes, rivers, and streams, making it a destination for outdoor recreation. The area offers opportunities for walleye and northern pike fishing, kayaking, boating, cycling, hiking, hunting, cross country skiing, and snowmobiling.

No known federal, state, or county parks, forests, recreational areas, wildlife refuges, wildlife protection areas, trails, or natural areas are directly impacted by the project. The proposed project is not located in the immediate vicinity of any recognized recreational area; however, Hiekkila and Murphy Lakes are located within one mile to the east of the proposed project as shown in Figure 1. Several properties have shoreline property on these water bodies. These property owners and the general public may use the lakes for a variety of recreational activities; including boating, fishing, and watersports. The proposed project is not anticipated to impact activities on these lakes.

Potential Impacts

Direct impacts on existing recreational opportunities and public services within the project location will be avoided because the proposed route will not cross these areas.

The project is not anticipated to result in adverse or significant impacts on recreation.

Mitigative Measures

Since impacts to recreation are not anticipated, no mitigation is required.

5.9 Land-based Economies

Transmission lines have the potential to impact land-based economies. Transmission lines and poles are a physical presence on the landscape. This presence can prevent or otherwise limit use of the landscape for other purposes. In general, and for safe operation of the line, buildings and tall growing trees are not allowed in transmission line rights-of-way. This limitation can create impacts for commercial businesses and forestry. Additionally, transmission line poles take up space on the ground that could be used for other purposes, e.g., agriculture, mining.

Impacts to land-based economies due to the MP 16 Line Relocation project are, in general, anticipated to be minimal. There are no agricultural or forestry operations in the project area. The proposed route does not impact any managed forests or nurseries. No privately-owned forest production industry would be affected by the project.

Areas identified as prime farmland and as prime farmland if drained (soils that have the potential to be prime farmland but would require hydrologic alteration) do not occur within the proposed HTVL route (**Figure 7**).

No formal tourist areas are present within the proposed route. However, nearby lakes, rivers, parks, and forests provide a variety of outdoor recreational activities for tourists visiting the area.

Impacts to United Taconite mining operations are anticipated to be positive, as the project will remove the existing 115 kV line and allow for the expansion of the tailings basin. As previously mentioned, the project area is bounded by the Mesabi Iron Range, a vast deposit of iron ore and the largest of three major iron ranges in Minnesota. Mining activities play a significant role in the area's economy, accounting for 10 percent of the area's industry (compared to less than 1 percent statewide). The project will remove the existing transmission line that crosses the future tailings basin expansion area, thereby providing United Taconite with additional space to conduct operations and be consistent with future plans for the property.

The new HVTL will be located south and east of the future tailings basin expansion and the proposed route has been selected in consultation with United Taconite.

Impacts to land-based economies can be minimized by prudent routing, i.e., by choosing routes and alignments that avoid such economies. Impacts can be mitigated by the use of designs and structures which are, to the extent possible, compatible with land-based economies.

5.10 Commercial, Industrial, Residential Land Use

The vast majority of the proposed route will cross areas zoned for industrial use and as forest agricultural management; a small portion of the proposed HVTL route (1.6 acres) crosses an area zoned residential (Figure 6). The proposed route does parallel an existing railroad (Canadian National Railroad) for approximately 1.25 miles of its length.

Based on a review of recent aerial photography there are no residences or commercial buildings within 1,000 feet of the proposed route (Table 8).

Potential Impacts

The project will require approximately 3.0 miles of new right-of-way. The Applicant will need to acquire easement rights across certain parcels to accommodate the facilities for the HVTL right-of-way if a route permit is granted.

An easement is an interest in land purchased by a utility, which permits the use of that land for a specific purpose. In this case, Minnesota Power's easement would permit construction, operation and maintenance of an overhead transmission power line. The easement also permits the trimming and removal of trees within the easement to prevent them from touching the line.

The existence of a transmission line easement restricts some possible uses for the property. Acceptable uses within the easement areas include planting crops, pasture, roadways, curbs and gutters. The two most common restrictions would include prohibiting construction of permanent structures or buildings within the easement area and restrictions on planting trees that may grow into the lines; properties with existing structures very close to or within the ROW may have further restrictions placed on them.

The project would be design to meet or exceed the clearance standards provided in NESC Section 232 for a 115 kV transmission line, which require a 9’ 1’’ horizontal distance between the conductor and a building; a 15’ 1’’ vertical distance between the conductor and a roof/balcony accessible by people; and a 20’ 1’’ vertical distance between the conductor and a roadway or parking lot.

Another concern associated with transmission lines includes potential effects on the availability of federal assistance mortgage loan insured by the Federal Housing Administration (FHA) as well as the availability of the Housing and Urban Development (HUD) backed mortgages for development of high density residential and/or mixed use developments. See *Section 5.2 Socioeconomics*, for a detailed discussion on this matter.

Mitigative Measures

Given that the construction of the proposed HVTL is primarily located in open wetland areas and wetlands adjacent to railroad tracks, land use conflicts are not anticipated..

Measures to minimize impacts to existing land uses would be developed through final design; such measures may include placing the conductors on a single side of the support towers, adjustments in final alignment within the proposed route, ROW sharing/overlap with existing infrastructure, and selection of span width and tower placement. Such measures may be specified as a condition of the HVTL Route Permit.

The Applicant stated in the application that it would work with county, city staff and business and residential property owners to ensure that impacts to land use from the construction of the line are minimized and addressed.

5.11 Public Services and Transportation

Public services generally include emergency services provided by government entities, including hospitals, fire departments, and police departments, water supply or wastewater disposal systems, and gas and electricity services, and existing and future transportation corridors and projects.

Minnesota Power will implement proper safeguards during construction and operation to avoid potential impacts public services or to the health and safety of the public. The project will be designed in compliance with local, state, NESC, and Minnesota Power standards for clearance to ground, crossing utilities and buildings, strength of materials, and right-of-way widths.

The Applicant will be responsible for ensuring that construction and contract crews comply with local, state, NESC, and company standards for installation of facilities and standard construction practices. Minnesota Power established and industry safety procedures will also be followed after the transmission line is installed.

This includes proper traffic control, and site security and clear signage during all construction activities.

The proposed HVTL will be equipped with protective devices (circuit breakers and relays located in the substation where the transmission lines terminate) to safeguard the public if an accident occurs, such as a structure or conductor falling to the ground. The protective equipment will de-energize the transmission line should such an event occur. Minnesota Power will post signage to warn the public about the risk of coming into contact with the energized equipment.

The Applicant has stated that it will work within the Minnesota Department of Transportation's (DOT) accommodation policy to position and manage the right-of-way along roadways.[22] MnDOT has adopted a formal policy and procedures for accommodation of utilities on the highway rights-of-way (Utility Accommodation Policy). A copy of MnDOT's policy can be found at:

http://www.dot.state.mn.us/utiIity/files/pdflappendix·b.pdf

Potential Impacts

With implementation of safeguards and protective measures, the project is not anticipated to result in adverse or significant impacts on public services or public health and safety.

[22] RPA at p 37

Construction and operation of the proposed project is not anticipated to impact any public service utilities.

Mitigative Measures

Minimal to no impacts to public services are anticipated to occur as a result of the proposed project; aside from the standard practices stated above no mitigative measures are required.

5.12 Archaeological and Historic Resources

During Minnesota Power's pre-planning phase, the Minnesota State Historic Preservation Office (SHPO) was contacted by the Applicant's representative (Two Pines Resource Group. LLC) and a literature searches were conducted.[23] The purpose of the literature search was to determine if there are any previously recorded cultural resources within the project area (including the proposed route and surrounding 1-mile buffer). A radius of one mile was used in order to determine the types of archaeological and historic resources, both identified and unidentified, that are likely to be found in the area that could be affected by the project.[24]

No archaeological or architecture/historic sites were identified within 1 mile of the project. Additionally, the Two Pines Resource Group concluded that the proposed route had a low potential for containing archaeological resources due to its location in a drained yet still partially inundated tamarack bog.

Potential Impacts

The potential to impact any undiscovered archaeological site is low; also there are no high potential locations for discovery of prehistoric archaeological sites, such as lakes, or perennial rivers or streams in the proposed project location. Similarly, the potential for unknown historic architectural resources to be affected by the proposed construction of the transmission line is low because the historic landscape and surroundings have been compromised due to attempts to drain the area and the dynamic changes resulting from mine activities and its supporting infrastructure.

Mitigative Measures

Avoidance of archaeological and historic architectural properties is the preferred mitigative policy for construction of infrastructure projects.

While not anticipated, there may be impacts to unidentified archaeological properties in previously undisturbed portions of the project. As a standard HVTL Route Permit condition, Minnesota Power would be required to work with SHPO should construction activities encounter such items. The permit condition would also require the Applicant would carry out the appropriate field identification or construction monitoring as deem necessary.

[23] RPA, Appendix F
[24] RPA, Appendix F

5.13 Natural Environment

The consideration of the impacts of a transmission line project on natural environment, including air quality, water resources, and flora and fauna are required as part of the environmental review. The impacts of high voltage transmission projects on the natural environment are a function of the spatial alignment of the grid, the structures and conductors required for various voltages, the extent to which pre-existing corridors are used, and how the transmission line is operated and maintained. The range of potential impacts and their significance depend on the area and the design and construction of individual lines.

Air Quality

There are minimal air quality impacts associated with transmission line construction and operation. The only potential air emissions from a transmission line result from corona. Corona can produce ozone and oxides of nitrogen in the air surrounding the conductor. Corona consists of the breakdown or ionization of air in a few centimeters or less immediately surrounding conductors. For 115/115 kV double-circuit, 115 kV single-circuit and 161 kV single-circuit transmission lines, the conductor gradient surface is usually below the air breakdown level.

Calculations done for a 345 kV project showed that the maximum one hour concentration during foul weather (worst case) would be 0.0007 parts per million (ppm) ozone. This is well below both the federal (0.075 ppm 8 hour) and state standards (0.08 ppm 8 hour) for ozone.

The Henshaw Effect is a theory that fine particulates already present in the air surrounding HVTLs may become ionized from HVTL corona. Ionization of the particulate matter (PM) is believed by Dr. Denis Henshaw, HH Wills Physics Laboratory, University of Bristol, United Kingdom, to increase the deposition of the fine particulates within the lungs. Fine particulates may be comprised of polycyclic aromatic hydrocarbons. The increased deposition may lead to increased lung disease and cancer rates.[25]

Temporary fugitive dust emissions from construction activities may occur. Along the proposed route, clearing vegetation and driving the utility poles may create exposed areas susceptible to wind erosion. In addition, tailpipe emissions may generate exhaust from the construction vehicles.

Fugitive dust is considered particulate matter under air quality regulations. The concentrations of fugitive dust that is fine particulate matter (PM less than 2.5 microns or PM2.5) is generally small, or approximately three percent to ten percent of total particulate matter (USEPA's AP-42, Sections 13.2 and 11.9). Since fine particulate matter has the potential to travel further into the lungs, it is of greater concern than larger particle size ranges.

[25] Corona ions from powerlines and increased exposure to pollutant aerosols A P Fews, D L Henshaw, R J Wilding and P A Keitch, . International Journal of Radiation Biology, Vol. 75. No. 12, 1523 - 1531, 1999.

Potential Impacts

Currently, both state and federal governments have regulations regarding permissible concentrations of ozone and oxides of nitrogen. The national standard is 0.08 ppm on an eight-hour averaging period. The state standard is 0.08 ppm based upon the fourth-highest eight-hour daily maximum average in one year. Calculations using the Bonneville Power Administration (BPA) Corona and Field Effects Program Version 3 (US Department of Energy, BPA Undated) for a standard single-circuit 161 kV project, predicted the maximum concentration of 0.007 ppm near the conductor and 0.0003 ppm at one meter above ground during foul weather or worst-case conditions (rain at 4 inches per hour). During a mist rain (rain at 0.01 inch per hour), the maximum concentrations decreased to 0.0003 ppm near the conductor and 0.0001 ppm at one meter above ground level. For both cases, these calculations of ozone levels are well below the federal and state standards. Studies designed to monitor the production of ozone under transmission lines have generally been unable to detect any increase due to the transmission line facility. Given this, there would be no impacts relating to ozone for the project.

There would be limited emissions from vehicles and other construction equipment and fugitive dust from ROW clearing during construction of the transmission line and substation. Temporary air quality impacts caused by the construction-related emissions are expected to occur during this phase of activity. The magnitude of the construction emissions is influenced heavily by weather conditions and the specific construction activity occurring. 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 National Radiological Protection Board (NRPB) has a statutory responsibility for advising the governmental departments of the United Kingdom on standards of protection for exposure to electric and magnetic fields and radiations in the natural and working environments. The NRPB established an advisory group to review work on biological effects of non-ionizing radiation relevant to human health and to advise on research priorities. The advisory group reviewed the possible effects of corona ions or electric fields on intakes of radioactive particles or other airborne pollutants and made recommendations of future research.[26]

The advisory group concluded that the potential impact of corona ions on health (Henshaw Effect) would depend on the extent to which they increase the dose of relevant pollutants to target tissues in the body and that it was not possible to estimate the impact precisely because of uncertainties involving the extent to which corona increase the charge on particles, the exact impact of charging on particle deposition in the respiratory system, and dose-response health outcomes.[27]

[26] Particle Deposition in the Vicinity of Power Lines and Possible Effects on Health, National Radiological Protection Board, vol 15, No. 1, 2004. Oxfordshire, UK. (http://www.hpa.org.uk/webc/HPAwebFile/HPAweb_C/1194947415038)
[27] Ibid

Further, the study continues, that it seems unlikely that corona ions would have more than a small effect on the long-term health risks associated with particulate air pollutants, even in the individuals who are most vulnerable. In public health terms, the proportionate impact would be even lower because only a small fraction of the general population live or work close to sources of corona ions.[28]

The advisory group's recommendations were that the possible implications for health of the mechanisms associated with this issue did not provide a strong case for further research in this area.[29]

Mitigative Measures

As a standard HVTL Permit condition, construction activities must follow best management practices (BMPs) to control air emissions (fugitive dust). Petroleum based dust suppressants may not be used. Construction vehicles with excess tailpipe emissions would not be operated until repairs to the vehicle could be made. The disturbed area for each route would be minimized.

There would be no significant impacts to air quality; therefore, no mitigation beyond BMPs would be necessary.

Water Quality - Surface Water and Wetlands

Public waters are wetlands, water basins and watercourses of significant recreational or natural resource value in Minnesota, as defined in Minnesota Statutes Section 103G.005; the DNR has regulatory jurisdiction over these waters

The MnDNR Public Waters Inventory (PWI) identifies lakes, wetlands, and watercourses over which the MnDNR has regulatory jurisdiction. Minnesota law (Minnesota Statutes Section 84.415 administered through Minnesota Rules Chapter 6135) requires that a license be obtained from the MnDNR Division of Lands & Minerals for the passage of any utility over, under, or across any state land or public waters.

Hydrologic features within the vicinity of the proposed project include large wetland complexes ringed by numerous water basins (**Figure 8**). There are no water basins classified as PWI water bodies within the anticipated ROW. There are no designated floodplains within the proposed route.

Wetlands are important resources for flood abatement, wildlife habitat, and water quality. Wetlands that are hydrologically connected to the nation's navigable rivers are protected federally under Section 404 of the Clean Water Act. In Minnesota, wetlands are also protected under the Wetland Conservation Act. The USFWS produced maps of wetlands based on aerial

[28] Particle Deposition in the Vicinity of Power Lines and Possible Effects on Health, National Radiological Protection Board, vol 15, No. 1, 2004. Oxfordshire, UK. (http://www.hpa.org.uk/webc/HPAwebFile/HPAweb_C/1194947415038)
[29] Ibid

photographs and Natural Resources Conservation Service soil surveys starting in the 1970s; these wetlands are known as the National Wetland Inventory (NWI).

Wetlands that were identified through the NWI system as being located within the requested route width are listed in **Table 15** and shown in Figure 8. Review of the available soils data in the project area indicates that the soils along the existing 16 line segment, which runs through the a large wetland complex, are composed of the Lobo, Waskish and Rifie Series; these soils are characterized by poorly drained organic materials which can range to depths of 20 feet.

Soils along Minnesota Powers' proposed route, the relocation site of the 16 Line, are composed of the Greenwood Series, and the Graycalm-Biwabik and Ellsburg-Baden Complexes. While these soils are also organic in nature, their depths are significantly shallower (**Figure 9**).

Based on NWI data approximately 157.5 acres of Forested/Shrub Wetland have been mapped within the proposed route; this represents approximately 94 percent of the route. Approximately 33.3 acres of Forested/Shrub Wetland have been mapped within the anticipated ROW; this represents approximately 95 percent of the ROW.

The anticipated alignment would require wetland crossings ranging in length from 250 feet to 1.7 miles. Because the maximum span length for this HVTL is 650 feet (+/- 150 feet for H-frame structures; Table 3), it is not possible to span the wetland crossings. Due to the concentration of wetlands in the proposed project area it is anticipated that all (current estimate 24) poles will be placed within wetlands.

Table 15. Wetlands Identified within the Proposed Route/ROW

NWI Wetland Type	Wetland (acres)	
	ROW	Route
Forested/Shrub	33.3	157.5
Total acres	**33.3**	**157.5**

Potential Impacts

During construction, there is the possibility of sediment reaching surface waters and wetlands as the ground is disturbed by excavation, grading and construction traffic. As a standard HVTL Permit condition, the Applicant would be required to employ erosion control best management practices (BMPs); as well as, adherence to the terms and conditions of the National Pollutant Discharge Elimination System (NPDES) permits and Stormwater Pollution Prevention Plan (SWPPP).

Clearing forested wetlands can expose the wetland to invasive and shrubby plants, thus removing habitat for species in the forest interior.

After construction, maintenance and operation activities for the transmission line facilities are not expected to have an adverse impact on surface water quality.

The wetlands crossed by the proposed route are subject to jurisdiction of the US Army Corp of Engineers (USCOE) under Section 404 of the Clean Water Act and current guidance regarding the jurisdictional status of isolated wetlands. Once the route is finalized and permitting requirements determined, Minnesota Power will submit the Minnesota Local/State/Federal Application Form (Joint Application Form) for water/wetland projects to the USCOE's Two Harbors District, MnDNR, and St. Louis County. Application materials will include information necessary for the USCOE to make its jurisdictional determination for impacted wetlands. Minnesota Power anticipates the project will be authorized under the USCOE's RGP-003-MN or LOP-05-MN permitting program.

According to the Clean Water Act, Section 401 water quality certification is required for activities that may result in a discharge to waters of the United States. On non-tribal lands in Minnesota, the MPCA administers Section 401 water quality certification. If the USCOE authorizes the project under its GP/LOP permitting program as expected, the MPCA waives its Section 401 Water Quality Certification authority.

No impacts to groundwater in the project area are anticipated.

Mitigative Measures

BMPs include maintaining sound water and soil conservation practices during construction and operation of the project to protect topsoil and adjacent water resources and minimize soil erosion. Practices can include containing excavated material, protecting exposed soil and stabilizing restored soil. Minnesota Power, through adherence to BMPs, would avoid major disturbance of individual wetlands and drainage systems during construction. This would be done by spanning wetlands and drainage systems where possible. When it is not possible to span the wetland, Minnesota Power will draw on several options during construction to minimize impacts:

- When possible, construction would be scheduled during frozen ground conditions.
- Crews would attempt to access the wetland with the least amount of physical impact to the wetland (e.g., shortest route).
- The structures would be assembled on upland areas before they are brought to the site for installation.
- When construction during winter is not possible, plastic mats would be used where wetlands would be impacted.

The transmission line rebuild may require waters and wetlands permits, letters of no jurisdiction, or exemptions from the USCOE, MnDNR Division of Waters, and St. Louis County. Wetland

and surface water impacts, through adherence to BMPs, will be avoided and minimized to the extent practicable. After coordination and application submission, authorization from the USCOE would likely fall under a Letter of Permission (LOP-05-MN) or the utility line discharge provision of a Regional General Permit (RGP-3-MN).

The MnDNR Division of Waters requires a Public Waters Work Permit for any alteration of the course, current, or cross-section below the ordinary high water level of a Public Water or Watercourse. No such alterations are anticipated.

Flora

The project is located within the Laurentian Mixed Forest Province, which, in Minnesota, is characterized by broad areas of conifer forest, mixed hardwood and conifer forests, and conifer bogs and swamps.

St. Louis County is comprised primarily (over 50 percent) of forest land; the remaining land uses include approximately 23 percent bog/marsh/fen, 9 percent surface water, 0.7 percent urban/industrial, and less than 0.1 percent cultivated (St. Louis County Comprehensive Water Management Plan). Common tree and plant species in central St. Louis County include, but is not limited to, various species of firs, pines, maples, birch, willow, basswood, ash, juneberry, sedge, honeysuckle, pondweed, goldenrod, aster, and rush.

Based on U.S. Geological Survey Land Use, Land Class data (2012) specific to the project, the proposed corridor will cross primarily lowland black spruce and lowland shrub wetlands (**Figure 10, Table 16**).

Table 16. Land Use/Land Cover within the Anticipated ROW

Land Cover Type	Acres	Percent
Aquatic	0.75	2.15
Lowland Shrub	11.02	31.58
Marsh	1.86	5.32
Tamarack	4.89	13.99
Lowland Black Spruce	15.00	42.96
Aspen/White Birch	0.55	1.57
Pine	0.60	1.72
Grassland	0.25	0.71
Total	**34.91**	**100**

Potential Impacts

A transmission line ROW can fragment a larger forest block into smaller tracts. Fragmentation makes interior forest species more vulnerable to predators, parasites, competition from edge species, and catastrophic events. The continued fragmentation of a forest can cause a permanent

reduction in species diversity and suitable habitat. This loss of forested habitat increases the number of common (edge) plants and animals that can encroach into what were the forest interiors. This encroachment can have impacts on the number, health, and survival of interior forest species, including some of which may be rare. Examples of edge species that can encroach into forest interiors via transmission ROWs include raccoons, cowbirds, crows, deer, and box elder trees. Interior forest species include songbirds, wolves, and hemlock trees.

The opening of the forest floor to sunlight through tree clearing of the ROW can further encourage these aggressive, invasive species to proliferate. Their spread can alter the ecology of a forest as they out-compete native species for sunlight and nutrients, further reducing suitable habitat and food sources for local wildlife.

Construction vehicles may inadvertently bring into forest interiors invasive and/or non-native plant species. Transmission line construction causes disturbance of ROW soils and vegetation through the movement of people and vehicles along the ROW, access roads, and laydown areas. These activities can contribute to the spread of invasive species. Parts of plants, seeds, and root stocks can contaminate construction equipment and essentially "seed" invasive species wherever the vehicle travels. Invasive species' infestations can also occur during periodic transmission ROW maintenance activities especially if these activities include mowing and clearing of vegetation. Once introduced, invasive species will likely spread and impact adjacent properties with the appropriate habitat.

Examples of problematic invasive species are buckthorn, honeysuckle, and garlic mustard. Invasive species, once introduced, have few local natural controls on their reproduction and easily spread.

Temporary impacts may occur due to activities associated with pole construction, including minor vegetative clearing for excavation, leveling and heavy equipment traffic. Vegetative clearing would include felling trees along the proposed ROW and temporarily trimming or removing any shrubs or tall grass.

Mitigative Measures

BMPs for control of invasive species include marking and avoidance of invasives, timing construction activities during periods that would minimize their spread, proper cleaning of equipment and proper disposal of woody material removed from the ROW.

Because construction measures may not be completely effective in controlling the introduction and spread of invasives, post-construction activities are required. Sensitive areas such as wetlands and high quality forests and prairies should be surveyed for invasive species following restoration of the construction site. If new infestations are discovered, then measures should be taken to control the infestation. Each exotic or invasive species requires its own protocol for control or elimination.

Techniques to control exotic/invasive species include the use of pesticides, biological agents, hand pulling, controlled burning, and cutting or mowing. The HVTL Route Permit could include, as a standard condition and deliverable, the development of an invasive species control plan; the Applicant would be required to consult the DNR to determine the best methods for control of invasive species.

To minimize forest fragmentation, ROWs that avoid major forest blocks should be selected to the extent practicable.

Fauna

The grasslands, wetlands, and woodlands in the area provide habitat for a variety of wildlife. Wildlife and other organisms that inhabit the project area include small mammals such as mice, voles, and ground squirrels; large mammals such as white-tailed deer; waterfowl and other water birds like pelicans and egrets, songbirds, raptors, upland game birds; and reptiles/amphibians such as frogs, salamanders, snakes, and turtles.

The Anchor Lake MnDNR Wildlife Management Area (WMA) is located approximately 0.75 miles east of the proposed route (Figure 5). While the proposed route crosses a variety of habitat for fauna that are commonly found in Northeast Minnesota, no USFWS Waterfowl Production Areas (WPA) are located within the vicinity of the proposed route.

Potential Impacts

Wildlife that resides within the construction zone will be temporarily displaced to adjacent habitats during the construction process. It is anticipated that fish and mollusks that inhabit the local watercourses will not be affected by transmission line rebuild or new lines.

Because much of the route/alignment is located within and adjacent to a developed and commercial/industrial area, the fauna generally present within the area are adapted to high levels of anthropogenic disturbance. Therefore, it is unlikely that the construction, operation, and maintenance of the project would have a permanent effect on fauna present in the area. Wildlife that inhabits trees that may be removed for the HVTL will likely be displaced. Comparable habitat is near the route, and it is likely that these organisms would only be displaced a short distance. The majority of construction will be limited to upland areas and, therefore, it is anticipated that any potential impacts on fish and mollusks that inhabit the local waterbodies will be limited to the removal phase of the existing line (i.e., de-construction) where there would be short term disturbance.

Birds have the potential to collide with all elevated structures, including power lines. Avian collisions with transmission lines can occur in proximity to agricultural fields that serve as feeding areas, wetlands and water features, and along riparian corridors that may be used during migration.

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 a conductor and a grounding device. Utility transmission and distribution line design standards provide adequate spacing to eliminate the risk of raptor electrocution and will minimize potential avian impacts of the proposed project.

Plastic erosion control netting is frequently used for erosion control during construction and landscape projects and can negatively impact terrestrial and aquatic wildlife populations as well as snag in maintenance machinery, resulting in costly repairs and delays. Wildlife entanglement in, and death from, plastic netting and other man-made plastic materials has been documented in birds, fish, mammals, and reptiles.[30]

Mitigative Measures

Minnesota Power has stated that it would construct the transmission line according to the Avian Power Line Interaction Committee (APLIC) recommended safety design standards regarding avian collisions and avian electrocution with HVTLs. In addition, the Applicant would work with the MnDNR and the USFWS to identify any areas that may require marking transmission line shield wires and/or using alternative structures to reduce the likelihood of avian collisions.[31]

Avoiding the use of photodegradable erosion-control materials where possible and the use of biodegradable materials (typically made from natural fibers), preferably those that will biodegrade under a variety of conditions, can minimize the impact to wildlife. The HVTL Route Permit could include the use of these materials as a standard condition.

With regard to other wildlife species, it is anticipated that any habitat displacement resulting from the proposed project will be temporary. Therefore, no wildlife mitigation measures are proposed.

5.14 Rare and Unique Natural Resources

Construction and maintenance of transmission lines might destroy individual plants and animals or might alter their habitat so that it becomes unsuitable for them. For example, trees used by rare birds for nesting might be cut down or soil erosion may degrade rivers and wetlands that provide required habitat.

In some limited cases, transmission line ROWs can be managed to provide habitat for endangered/threatened resources. An example includes osprey nesting platforms built on top of transmission poles.

[30] http://files.dnr.state.mn.us/eco/nongame/wildlife-friendly-erosion-control.pdf
[31] RPA at p44

Endangered species are species whose continued existence is in jeopardy. Threatened species are likely to become endangered. Species of special concern have some problems related to their abundance or distribution, although more study is required.

The MnDNR Division of Ecological and Water Resources manages the Natural Heritage Information System (NHIS) which provides information on Minnesota's rare plants, animals, native plant communities, and other rare features. The NHIS is continually updated as new information becomes available, and is the most complete source of data on Minnesota's rare or otherwise significant species, native plant communities, and other natural features. Its purpose is to foster better understanding and conservation of these features.

However, some areas of the state have not been surveyed extensively or recently, so the NHIS database cannot be relied upon as a sole information source for rare species.

The MnDNR NHIS database was queried by the Applicant to obtain the locations of rare and unique natural resources within the project area. The results of this search are shown on Figure 5. The review of the NHIS database identified northern goshawk (Accipiter gentilis; state special concern) nests comprising one territory as well as one bald eagle (Haliaeetus leucocephalus) nest within one mile of the proposed project.

The Fish and Wildlife Service (USFWS) website was reviewed by the Applicant for a list of species covered under the Endangered Species Act (ESA) that may be present within St. Louis County. According to the website, the following federally listed species are known to occur within the county: piping plover (*Charadrius melodus*), Grey Wolf (Canis lupus; federally threatened), the rufa red knot (Calidris canutus rufa; federally threatened), the northern long-eared bat (Myotis septentrionalis; federally threatened), and Canada lynx (*Lynx canadensis*).

The Great Lakes population of piping plover is federally listed as endangered and Critical Habitat is designated in St. Louis County. Great Lakes piping plovers use open, sandy beaches, barrier islands, and sand spits formed along the Great Lakes' perimeters (FWS, 2012b). They do not inhabit lakeshore areas where high bluffs formed by severe erosion have replaced beach habitat. They prefer sparsely vegetated open sand, gravel, or cobble for nesting sites and forage along the rack line where invertebrates are most readily available (FWS, 2012c). The proposed project is not located within designated Critical Habitat nor does the appropriate habitat occur within the proposed route.

The Canada lynx is federally listed as threatened and Critical Habitat is designated in St. Louis County. Lynx live in dense forests with boreal features across northern Minnesota in areas that receive deep snow and have high-density populations of snowshoe hares, the principal prey of lynx (FWS, 2012d). Although the proposed route is not located within designated Critical Habitat, the general project area could be populated with Canada lynx at the time of construction based on distribution in the state.

The northern long-eared bat is a medium-sized bat about 3 to 3.7 inches in length, with a wingspan of 9 to 10 inches. Its fur color can be medium to dark brown on the back and tawny to pale-brown on the underside. As its name suggests, this bat is distinguished by its long ears.

Potential Impacts

It is anticipated that the proposed project will have no effect on the piping plover or its habitat.

It is anticipated that the project impacts on the Canada lynx and Grey Wolf would be minor and temporary. Noise and/or physical disturbance would prompt these species to temporarily vacate the area for a short period of time, returning to the area shortly after cessation of activities. Lynx and Grey Wolf movement may be temporarily impeded and individuals may be displaced, but the impacts on these populations would likely be minimal if not negligible.

No rufa red knot are expected to be found in the project vicinity, as the species only utilizes shore line areas during migration through this county. While there are no known northern long-eared bat (NLEB) hibernacula in close proximity to any of the proposed routes, suitable habitat for the NLEB is potentially present near the proposed route.

Infrastructure projects such as the development of HVTL routes can cause the loss, degradation, and fragmentation of natural habitats in which the NLEB resides. These types of impacts have the potential to adversely affect the northern long-eared bat. Projects proposed in areas where suitable habitat occurs and the northern long-eared bat is known or assumed to be present require project proponents to determine if potential adverse effects to the NLEB are likely to occur and, if so, how they can avoid, minimize, and/or mitigate for those adverse effects.

Mitigative Measures

The environmental review process is designed to identify rare species and unique natural resources that may be presence within the proposed route to avoid encroachment and effects on these items to the greatest extent practicable. Once a final route has been determined, biological (flora and/or fauna) surveys along select portions of the anticipated alignment may be required as a permit condition if resources agencies deem it necessary.

Restricting ROW construction activities to avoid the NLEB's active season (April 1st through September 30th) may be a sufficient mitigation strategy to avoid the necessity of conducting a species specific biological survey and potential requirement of an Incidental Take Permit for this species. As a special condition of the route permit, tree clearing may be prohibited from April 1st through September 30th.

6.0 Potential Impacts Comparison of Alternative Routes

Because the proposed route and the alternative routes (AR-2 and AR-3) are sited virtually, and to a certain extent literally "on top of each other" the potential impacts are similar, with the primary distinctions between the routes being associated with the following factors:

- Human Settlement-Aesthetics, Land Use Compatibility, and Property Values;
- Use or Paralleling of Existing ROWs; and
- Cost of Construction.

Human Settlement

Alternative route AR-2 avoids crossing a private ownership parcel (PIN 690-0010-04630) of land (**Figure 11**) that the proposed route and alternative route AR-3 would impact. This parcel is 40 acres, is currently undeveloped, and is zoned as Forest Agricultural Management. The property is approximately evenly divided between Forested/Shrub Wetland and Lowland Deciduous forest cover.

If this private parcel were to be developed and depending on the siting and nature of the development, the presence of the HVTL may have a perceived aesthetic impact. The potential aesthetic impact, if any, would be influenced by the same considerations as discussed in Section 5.6 *Aesthetics* of this document.

Although the transmission line would be visible throughout most of its length, it is not incompatible with the parcel's zoning classification of Forest Agricultural Management, or the setting among existing transmission lines, transportation corridors and mining development that occur in this area.

Route alternatives AR-2 and AR-3 have the potential to interfere with any additional future expansion of the mine tailings basin, while the proposed route moves the 16 Line outside any foreseeable additional expansion of the United Taconite tailings basin.

As stated in Section 5.2 *Socioeconomic-Property Values*, due to the fact that property values are guided by various considerations specific to each separate piece of real estate, as well as, market conditions the effect of one specific transmission line project on a given parcel is difficult to determine. The potential impact relating to property values on this parcel is anticipated to be in line with those impacts discussed in that section.

Micro siting of the alignment during final design (i.e., placing the ROW along the western most boundary of the requested route width) may avoid or minimize the above potential impacts to this private parcel along the proposed route and alternative AR-3. Section 3.1 of the sample HVTL Route Permit (Appendix C) details the requirements for modification of the anticipated alignment.

Use or Paralleling of Existing ROWs
The proposed route parallels existing infrastructure (CN railroad) for approximately twice the distance as the two alternative routes.

Cost of Construction
It is the anticipated type and depth of the subsurface soils along the routing options, and the associated construction costs that differentiate the potential routes relative to the cost of construction.

EERA requested from the Applicant comparative cost estimates for construction of each route option; these costs are presented in **Table 17**.

Based on available information, Minnesota Power believes that the proposed route will avoid the necessity of requiring substantial backfill to support the structures by siting the line along the ridgelines/uplands surrounding the large wetland complex. The cost differential shown in table 18 reflects the need of backfill material if the route were to be sited through the large wetland complex.

Table 17 Cost Estimates Construction

	Proposed Route	Alternative 2	Alternative 3
Material Cost	$269,712.09	$606,681.97	$370,729.18
Construction Matting Cost	$1,365,280.00	$1,792,960.00	$1,983,040.00
Removal Matting Cost	$2,000,600.00	$1,620,440.00	$2,000,600.00
Construction Cost	$1,063,757.29	$1,075,385.65	$1,176,678.21
Total Cost	$4,699,349.38	$5,095,467.62	$5,531,047.39
Total Cost Difference	$0.00	$396,118.24	$831,698.01
*Structure Foundations Constructed with Mine Tailings			

	Proposed Route	Alternative 2	Alternative 3
Material Cost	$269,712.09	$744,292.87	$400,869.59
Construction Matting Cost	$1,365,280.00	$1,792,960.00	$1,983,040.00
Removal Matting Cost	$2,000,600.00	$1,620,440.00	$2,000,600.00
Construction Cost	$1,063,757.29	$1,075,385.65	$1,176,678.21
Total Cost	$4,699,349.38	$5,233,078.52	$5,561,187.80
Total Cost Difference	$0.00	$533,729.14	$861,838.42
*Structure Foundations Constructed with Select Granular Fill			

There are no other potential human or environmental impacts in which one routing option would minimize or mitigate impacts over another routing option.

A comparison of the potential human and environmental impacts of the routing options is presented in **Figure 12**.

7.0 Unavoidable Impacts

During construction of the proposed HVTL, there would be temporary unavoidable adverse impacts on the existing flora and fauna, soil, and traffic in those locations where construction would occur adjacent to an existing roadway. Some of these impacts may occur, on a lesser scale, during maintenance of the transmission line. Longer-term, non-temporary adverse impacts related to construction and maintenance of the proposal transmission line include loss of forested areas, including forested wetlands, within the ROW; visual impacts; impacts to migratory birds from collisions with the lines; and potential impacts to property values.

In addition, there are few commitments of resources associated with this project that are irreversible and irretrievable, but those that do exist are primarily related to construction. Irreversible and irretrievable resource commitments are related to the use of nonrenewable resources and the effects that the use of these resources have on future generations. Irreversible effects primarily result from the use or destruction of a specific resource that cannot be replaced within a reasonable time frame. Irretrievable resource commitments involve the loss in value of an affected resource that cannot be restored as a result of the action.

The proposed HVTL will require the commitment of land (a ROW of 3.0 miles in length and 100 feet wide) and while it is possible that the structures and conductors could be removed, and the ROW returned to the natural landscape, this is unlikely to happen in the foreseeable future.

The proposed HVTL may result in the loss of some forests and forested wetlands. While these are not irreplaceable, replacing them will take a significant amount of time. The ROW for certain land uses will be lost. In most cases, this ROW can continue to be used for many purposes; however, some other areas, such as forested areas, areas with minable resources, or areas that could have been used for other construction, will be converted during the lifetime of the project.

Construction resources that would be used include aggregate resources, concrete, steel, and hydrocarbon fuel. These resources would be used to construct the project. During construction, vehicles would be traveling to and from the site utilizing hydrocarbon fuels. However, once built, the proposed HVTL will not consume raw materials.

8.0 Relative Merits Analysis

An analysis of the relative merits utilizes the routing factors of Minnesota Rule 7850.4100 (A through N) and factor elements to analyze the relative merits of the various routing options. The relative merit factors reviewed for the MP 16 Line Relocation project included the following nine specific routing factors of Minnesota Rules, part 7850.4100:

- A. Effects on human settlement, including, but not limited to, displacement, noise, aesthetics, cultural values, recreation, and public services;
- B. Effects on public health and safety;
- C. Effects on land-based economies, including, but not limited to, agriculture, forestry, tourism, and mining;
- D. Effects on archaeological and historic resources;
- E. Effects on the natural environment, including effects on air and water quality resources and flora and fauna;
- F. Effects on rare and unique natural resources;
- H. Use or paralleling of existing ROW, survey lines, natural divisions lines, and agricultural field boundaries;
- J. Use of existing transportation, pipeline, and electrical transmission systems or ROWs;
- L. Costs of constructing, operating, and maintaining the facility which are dependent on design and route.

The discussion in this section uses text and a graphic to describe the relative merits of specific routing options (**Table 18**). For routing factors where impacts are anticipated to vary with routing options, the graphic represents these anticipated impacts and compares them across these options. For routing factors that express the State of Minnesota's interest in the efficient use of resources (for example, the use of existing rights-of-way), the graphic represents the consistency of routing options with these interests and compares them one to the other.

For purposes of discussion here, and with respect to routing factor G, it is assumed that all of the routing options are equal with regard to maximizing energy efficiencies and accommodating expansion of transmission capacity. With respect to environmental impacts, the examination of

such impacts suggested by routing factor G is included in the discussion of other routing factors and elements that more specifically address an environmental impact (e.g., effects on the natural environment, routing factor E). Thus, factor G is not discussed further here.

Routing factor I, the use of large electric generating plant sites, is not relevant to this project and is not discussed here.

Routing factor K, relating to electrical system reliability, is not relevant since the MP 16 Line is a relocation project and neither routing option will result in a change to the system's reliability.

Routing factors M and N, the unavoidable and irreversible impacts of the project, are discussed in Section 7.0 *Unavoidable Impacts*.

Table 18 Guide to Relative Merits of Routing Options

Anticipated Impact or Consistency with Routing Factor	Color / Shape
Impacts are anticipated to be minimal with the application of BMPs and general route permit conditions (Commission's generic route permit template) – OR – routing option is very consistent with routing factor.	
Impacts are anticipated to be minimal to moderate with the application of BMPs and general route permit conditions (Commission's generic route permit template); impacts may require special conditions or selection of a specific routing option to mitigate – OR – routing option is consistent with routing factor but less so than other options in this area.	
Impacts are anticipated to be moderate and unable to be mitigated – OR – routing/siting option is not consistent with routing factor or consistent only in part.	

As indicated in Section 6.0 *Potential Impacts Comparison of Alternative Routes*, outside of the Factors Human Settlement (Aesthetics, Land Use Compatibility, and Property Values), the Use or Paralleling of Existing ROWs, and the Cost of Construction, there are no other potential human or environmental impacts in which one routing option would minimize or mitigate impacts over another routing option.

Table 19 provides an overview of the relative merits analysis for the proposed and alternative routes.

Table 19 Relative Merits Table: MP 16 Line Relocation Project Options

Routing Factor	Element/Indicator	Proposed Route	AR-2	AR-3	Comments
Human Settlement	Aesthetics/ Proximity to residences (Count within 0-1,500 from the anticipated alignment)	●	●	●	There are no residential structures located within the proposed project area. The closest dwelling to each of the routes is at least 1950 feet away in a forested area. Therefore, the aesthetics resources of this area would not be adversely affected by any of the routes.
	Land Use Compatibility/ Summary - land use type data and land ownership data	●	▲	▲	Each of the routes is within areas zoned as either industrial, residential, or forest agricultural management. The transmission line is not incompatible with the private parcel's zoning classification of Forest Agricultural Management, or the setting among existing transmission lines, transportation corridors and mining development that occur in this area. AR-2 and AR-3 have the potential to interfere with future expansions of the mine tailings basin.
	Property Values/ Proximity to residences and land ownership data	▲	●	▲	Alternative route AR-2 avoids crossing a private ownership parcel (PIN 690-0010-04630) of land (Figure 11) that the proposed route and alternative route AR-3 would impact. This parcel is 40 acres and is currently undeveloped. Micro-siting of the alignment within the proposed route and AR-3

					may avoid/minimize the impacts to this private parcel.
Paralleling of Existing ROWs	NA/ Proximity to high voltage transmission lines, roads, rail, and trails (percent of total length)				The proposed HVTL would parallel an existing railroad grade for approximately 1.25 miles. AR-2 and AR-3 would parallel an existing railroad grade for approximately 0.65 miles.
Cost of Construction	NA/ Total construction cost[1]				

(1) If the maximum cost of the alternative is up to 20% more than the Applicant-proposed route = yellow, if the maximum cost of the alternative is more than 20% above the cost of the Applicant-proposed route - it is red.

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Figures

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Appendix A – Scoping Decision

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Appendix B – Data Collection

In the Alternative Routing Process, applicants are not required to provide any routes for review other than their proposed, preferred route. However, alternatives are often brought forward during the scoping processes by concerned citizens or local governments. In this case, while no route alternatives were developed through the public scoping process, the Commission did adopt two alternatives (AR-2 and AR-3) bought forth by PUC staff, which were carried forward into the Scoping Decision for further consideration. Descriptions of these alternatives are presented in Section 4.

The PUC staff briefing paper on the issue of alternative routes also recommended that additional information (i.e., geotechnical soil boring and soil and wetland classification) and cost data be gathered in preparation of the EA to assist the Administrative Law Judge and the Commission in its evaluation of the routing alternatives.[32]

EERA requested cost estimates from the Applicant for the field work (See below) associated with this recommendation.

The level of "deck-top" resource data (aerial photographs, U.S. Geological Survey Topographical Maps, National Wetlands Inventory (NWI) soil data, U.S. Fish and Wildlife Service's Wetland Inventory Mapper, and U.S. Department of Agriculture NRCS data base) available today allows the reviewer access to much information, that while not eliminating the need for the collection of field data in the final design/pre-construction phase of a project, it can greatly reduce the need (and scope) of this work.

The surface and subsurface conditions (soils and wetlands) within the proposed and alternative routes for the 16 Line replacement project is one such instance. Considering the cost of the field work required to "ground-proof" this information and the fact that the routes are virtually, and to a certain extent literally "on top of each other", EERA determined that the level of information available is adequate for a comparison of the three route options.

Cost Estimates Geotechnical Investigation

	Soil Boring Cost	Matting Access	Matting Access Cost	Total
Proposed Route	$0.00	NA	$0.00	**NA**
AR-2	$8,000.00	1.7 miles	$404,000.00	**$412,000.00**
AR-3	$3,000.00	1.3 miles	$309,000.00	**$315,000.00**

[32] PUC staff Briefing Paper, April 22, 2015. eDocket 20154-109540-01

Cost Estimates Wetland Delineation

Task	Subtask	Proposed Route, AR-2 and AR-3
Pre-field	Define Study Area w/ Client	$250.00
	Desktop GIS Analysis & QC Check	$1,140.00
	Figure & GIS Data Management	$300.00
	Study Area Discussion/Revisions	$920.00
Field Survey	Resources Coordination	$380.00
	General Safety Coordination	$1,300.00
	Kick-off Meeting w/ Client	$1,300.00
	Field Maps, GPS Data Analysis	$1,100.00
	Field Work	$5,888.40
	Field Data Handling/Processing	$1,100.00
	Client Updates	$500.00
Reporting	Data Review & Analysis	$1,600.00
	Narrative/Tables/Photos/Datasheets	$4,050.00
	Figures & GIS Data Management	$2,400.00
	Peer Review/Edits	$920.00
	Publishing	$350.00
	Review Results w/ Client	$960.00
	Distribute to Agencies	$730.00
Total		**$25,188.40**

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Appendix C – Sample Route Permit

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