APPLICATION FOR A CERTIFICATE OF NEED AND ROUTE PERMIT FOR THE MANKATO – MISSISSIPPI RIVER TRANSMISSION PROJECT

MPUC Docket Nos. E002/CN-22-532
E002/TL-23-157

April 2, 2024

Submitted by
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1. EXECUTIVE SUMMARY

1.1 Introduction

Northern States Power Company, doing business as Xcel Energy (Xcel Energy or Applicant), requests a Certificate of Need and Route Permit from the Minnesota Public Utilities Commission (Commission) for the Mankato – Mississippi River Transmission Project (the Project). The Project consists of a new, approximately 130 mile 345 kilovolt (kV) transmission line between the Wilmarth Substation in Mankato, Minnesota and the Mississippi River and a new, approximately 20 mile 161 kV transmission line between the North Rochester Substation near Pine Island, Minnesota and an existing transmission line northeast of Rochester, Minnesota. Because of the different characteristics of portions of the overall Project, it has been divided into four segments:

- Segment 1 Wilmarth to West Faribault—a new 345 kV transmission line between the existing Wilmarth Substation and a point near the West Faribault Substation.
- Segment 2 West Faribault to North Rochester—a new 345 kV transmission line between a point near the existing West Faribault Substation and the existing North Rochester Substation.
- Segment 3 North Rochester to Mississippi River—a new 345 kV transmission line between the existing North Rochester Substation and the Mississippi River. This segment involves converting about 27 miles of existing 161/345 kV transmission line to 345/345 kV operation[1] and installing about 16 miles of new 345 kV circuit on existing 345/345 double-circuit structures.[2]

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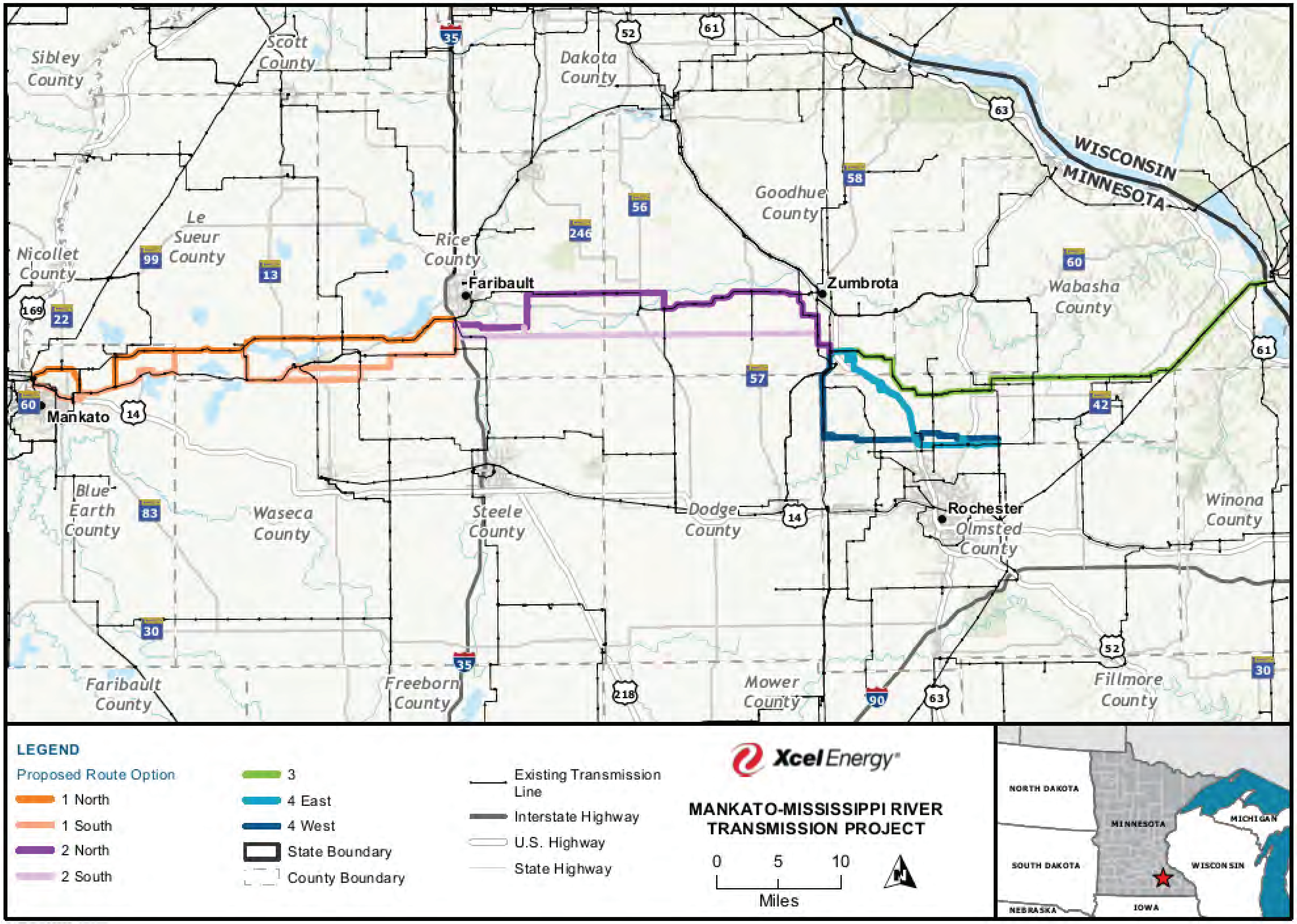
[1] As part of the route permit for the CapX2020 Hampton – Rochester – La Crosse 345 kV Transmission Project, the Commission authorized Xcel Energy to construct this segment with 345/345 kV double-circuit structures with 345 kV conductors on both sides but to energize this segment at 345/161 kV initially until there is a need for a second 345 kV circuit. *See* Docket No. E002/TL-09-1448. The existing 161 kV transmission line on this portion of Segment 3 is a portion of the existing North Rochester – Chester 161 kV transmission line.

[2] The existing 161 kV transmission line on this portion of Segment 3 is Dairyland Power Cooperative's Q-3 line that will need to be relocated to accommodate the new 345 kV circuit on these existing double-circuit structures. Dairyland is separately filing a certificate of need and route permit application for relocation of this 161 kV transmission line. *See* Docket Nos. CN-23-504 and TL-23-388.

- Segment 4 North Rochester to Chester—relocation of a portion of a 161 kV transmission line which is needed because a portion of the new 345 kV line in Segment 3 would displace the 161 kV line where it is currently double-circuited with an existing 345 kV line.

Collectively, the four segments described above comprise the proposed Project. The proposed Project may traverse Blue Earth, Le Sueur, Waseca, Rice, Dodge, Olmsted, Goodhue, Winona, and Wabasha counties in Minnesota. The proposed Project is shown on **Map 1-1**.

Map 1-1
Project Overview



It is anticipated that portions of the Project will either be individually or jointly owned by Xcel Energy, Dairyland Power Cooperative (Dairyland), Southern Minnesota Municipal Power Agency (Southern Minnesota), and the City of Rochester, Minnesota, acting through its Public Utility Board (City of Rochester) (collectively, Joint Utilities).

The Project was studied, reviewed, and approved as part of the Long-Range Transmission Planning (LRTP) Tranche 1 Portfolio by the Midcontinent Independent System Operator, Inc.'s (MISO) Board of Directors in July 2022 as part of its 2021 Transmission Expansion Plan (MTEP21) report.[3] The Joint Utilities filed with the Commission a notice of intent to construct, own, and maintain the Project on October 10, 2022.

The LRTP Tranche 1 Portfolio will provide significant benefits to the Midwest subregion of the MISO footprint by facilitating more reliable, safe, and affordable energy delivery. The Project, designated as a portion of LRTP4[4] in MTEP21, is a key part of the LRTP Tranche 1 Portfolio. The transmission system in southern Minnesota is the nexus between significant renewable resources in Minnesota and the Dakotas and the regional load center of the Twin Cities and load centers to the east in Wisconsin. The amount of renewable energy generation on the electric system is increasing as aging traditional generation resources retire and are replaced with renewable resources. This Project will provide additional transmission capacity that is needed to reliably deliver this renewable energy to customers. This Project will relieve overloads on existing transmission facilities and will also reduce congestion on the transmission system resulting in lower energy costs.

Xcel Energy submits this combined Certificate of Need and Route Permit Application (Application) for the Project pursuant to Minn. Stat. § 216B.243, Minn. Stat. Ch. 216E, and Minn. Rule Ch. 7849. To facilitate review of this Application, completeness checklists are included as **Appendix A** (Certificate of Need Completeness Checklist) and **Appendix B** (Route Permit Completeness Checklist), which provides a roadmap

[3] A copy of MISO's MTEP21 Report Addendum is provided as **Appendix G-1**.

[4] This Project is the Minnesota portion of LRTP4. The overall LRTP4 project involves the construction of a 345 kV transmission line from the existing Wilmarth Substation in Mankato, Minnesota to the existing Tremval Substation located in west central Wisconsin near the town of Blair. The Wisconsin portion of LRTP4 will be permitted in a separate proceeding before the Public Service Commission of Wisconsin (PSCW).

identifying where in this Application information required by Minnesota statutes and rules can be found.

1.2 Project Need and Purpose

The electric system is currently undergoing significant changes. The generation resource mix is changing as more new renewable and variable energy, such as wind and solar, is added to the system and aging coal-fired generation plants are retired. During this energy transition, the system may also need to rely on other types of generation resources such as combined cycle generation. This Project, along with the other LRTP Tranche 1 projects, are needed to provide reliable, resilient, and cost-effective delivery of energy as the generation resource mix continues to evolve over the coming years.

Specifically, this Project, along with the other LRTP projects in Wisconsin,[5] are needed to address loading and congestion issues on the existing 345 kV system across southern Minnesota toward Wisconsin.

During periods when there is high renewable generation output in southwestern Minnesota and northwestern Iowa, there are overloads on several 345 kV transmission lines and substation transformers in southern Minnesota. This Project provides additional transmission capacity to relieve these overloads. This Project also strengthens existing generation outlet towards load centers in Wisconsin and areas to the south. Additional benefits of the Project include reduced congestion, reduced thermal loading, and improved transfer voltage stability.

Additional information on the need for the Project is provided in Chapter 4. Applicant and MISO considered several alternatives to the Project, including different transmission solutions, such as upgrading other existing transmission facilities and transmission lines with different endpoints. A complete discussion of the alternatives to the Project that were evaluated by MISO and Applicant is provided in Chapter 5.

[5] These projects, both located in Wisconsin, are Tremval – Eau Claire – Jump River (LRTP5) and Tremval – Rocky Run – Columbia (LRTP6).

1.3 Proposed Routes

This Application is submitted under the full route permitting process set forth by Minnesota law, specifically, Minn. Stat. § 216E.03 and Minn. Rules 7850.1700 to 7850.2700 and 7850.4000 to 7850.4400. The applicable statutes and rules require, in addition to other information, that an applicant provide at least two proposed routes in its Route Permit application, and neither of the proposed routes may be designated as a preferred route and all must be designated as alternatives.[6] A "route" is defined in Minnesota statutes as "the location of a high voltage transmission line between two end points . . . [with] a variable width of up to 1.25 miles."[7]

Based on the location of the Project and the differences in routing opportunities in different geographic locations, the Project is divided into four segments: Segments 1, 2 and 3 making up the 345 kV portion and Segment 4 the 161 kV portion. Each of the segments are described below:

- Segment 1 - Wilmarth to West Faribault—a new 345 kV transmission line between the existing Wilmarth Substation and a point near the West Faribault Substation. Route alternatives include options to double-circuit with existing 115 kV and 69 kV transmission lines as well as some smaller greenfield segments. Overall length would be approximately 48-54 miles of new transmission.

- Segment 2 - West Faribault to North Rochester—a new 345 kV transmission line between a point near the existing West Faribault Substation and the existing North Rochester Substation. Alternatives include options to double-circuit portions with existing 69 kV and 345 kV transmission and a greenfield alignment between 34-42 miles in total length.

- Segment 3 - North Rochester to Mississippi River—a new 345 kV transmission line between the existing North Rochester Substation and the Mississippi River. This segment involves converting an existing 161/345 kV transmission line to

[6] Minn. Stat. § 216E.03, subd. 3; Minn. R. 7850.1900, subp. 2(C).

[7] Minn. Stat. § 216E.01, subd. 8; *see also* Minn. R. 7850.1000, subp. 16.

345/345 kV operation or installing a new 345 kV circuit on existing double-circuit structures. This segment was previously permitted by the Commission as part of the CapX2020 Hampton – Rochester – La Crosse 345 kV Transmission Project (Hampton – La Crosse Project) in 2012.[8] As part of the Hampton – La Crosse Project, the Commission authorized Xcel Energy to construct this segment with 345/345 kV double-circuit structures. An alternative route is not included for Segment 3 because route alternatives to this segment were evaluated during the Hampton – La Crosse Project route permit proceeding.

- Segment 4 - North Rochester to Chester—relocation of a portion of a 161 kV transmission line which is needed because a portion of the new 345 kV line in Segment 3 would displace the 161 kV line where it is currently double-circuited with an existing 345 kV line.

1.4 Potential Environmental Impacts

Xcel Energy analyzed the potential environmental impacts of the Project and identified measures that can be implemented to avoid, minimize, or mitigate these impacts. Chapter 7 of this Application provides a general description of the environmental setting, land use and human settlement, land-based economies, archeological and historical resources, hydrological features, vegetation and wildlife, and rare and unique natural resources that are known to occur or may potentially occur in the Project Study Area. Chapter 7 also identifies potential impacts to existing resources and identifies measures that can be implemented to avoid, minimize, or mitigate impacts. As discussed in Chapter 7, Xcel Energy has not identified any potential environmental impacts that would preclude construction of the Project.

1.5 Public Input and Involvement

Before construction can begin on the Project, the Commission must determine whether the Project is needed in a Certificate of Need proceeding. If the Commission determines the Project is needed, it will then determine where the Project should be built through Route Permit proceedings. In this case, and as described in more detail below, Applicant

[8] *In the Matter of Xcel Energy's Application for a Route Permit for the CapX2020 Hampton – Rochester – La Crosse High Voltage Transmission Line*, ORDER ISSUING ROUTE PERMIT AS AMENDED, Docket No. E002/TL-09-1448 (May 30, 2012).

is requesting joint Certificate of Need and Route Permit proceedings as part of this Application.

The Certificate of Need process is governed by Minnesota law, including Minnesota Statutes Section 216B.243, and Minnesota Rules Chapters 7829 and 7849—specifically, Rules 7849.0010 to 7849.0400 and 7849.1000 to 7849.2100. The routing of the Project is governed by Minnesota law, including Minnesota Statutes Chapter 216E and Minnesota Rules Chapter 7850.

The Commission will not make determinations on whether to grant a Certificate of Need or Route Permit until it has completed a thorough process that encourages public involvement and analyzes the impacts of the Project. This will include opportunities for public input and comment on the Project.

Thus far, Applicant has employed various engagement methods to provide information about the Project to the public and federal, state, and local agencies, Tribal Nation representatives, and non-government organizations. These engagement methods included public open houses, informational mailings, and the creation of a Project website (https://mmrtproject.com), which itself contains an interactive Project map and other Project information. Additional information regarding the public outreach efforts conducted prior to the filing of this Application is provided in Chapter 8.

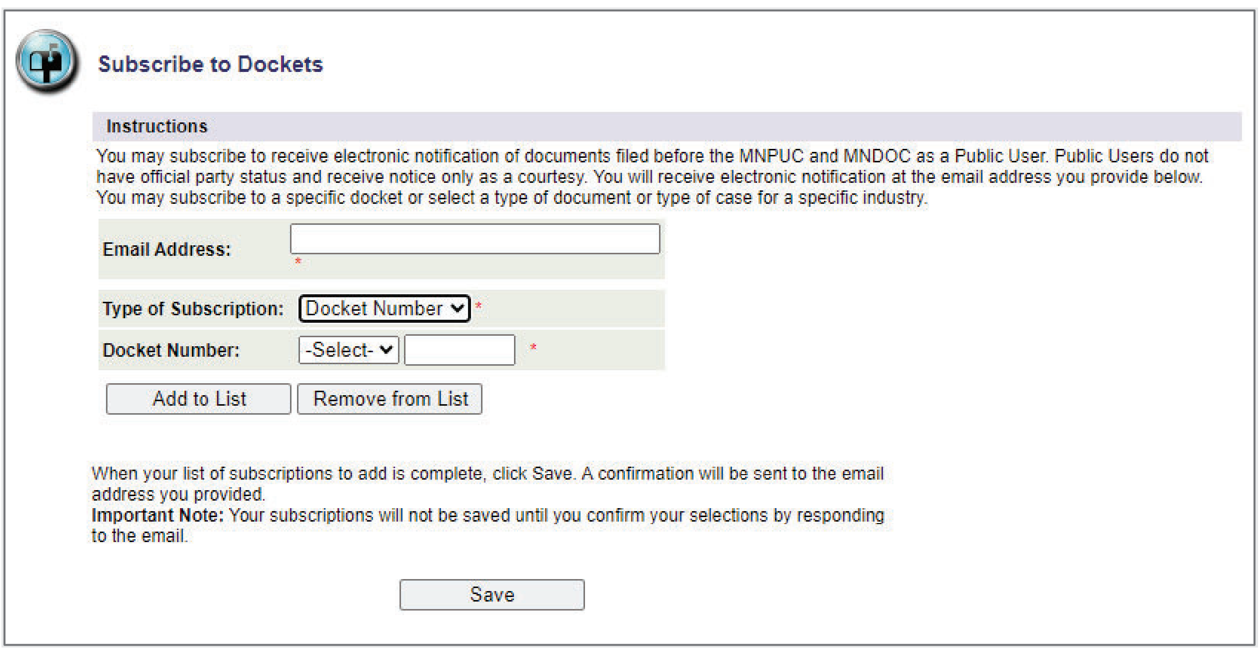
The public can review this Application and submit comments on the Project to the Commission. A copy of the Application is available at the Commission's website: https://mn.gov/puc/. On the Commission's homepage, click on the eDockets link in the menu at the top of the page, and then enter the docket number "22-532" (Certificate of Need) or "23-157" (Route Permit) in the "Docket Lookup" section. A copy of the Application is also available on the Project websites: https://mmrtproject.com. This Application will also be available at the following locations for the public to review:

- Blue Earth County Library, 100 E. Main Street, Mankato, MN 56001
- Buckham Memorial Library, 11 Division Street E., Faribault, MN 55021
- Zumbrota Public Library, 100 West Avenue, Zumbrota, MN 55992
- Rochester Public Library, 101 2nd St. SE, Rochester, MN 55904

- Plainview Public Library, 345 1st Avenue NW, Plainview, MN 55964

Persons interested in receiving notices and other filings about the Application can subscribe to the Project's Certificate of Need and Route Permit dockets by visiting the Commission's website: https://mn.gov/puc/edockets/. Scroll down to the section titled How to Use eDockets, click on the "Subscribe" button, as shown in **Figure 1-1** below, enter your email address and select "Docket Number" from the Type of Subscriptions dropdown box, then for the Certificate of Need docket select "22" from the first Docket number drop down box and enter "532" in the second box before clicking on the "Add to List" button. For the Route Permit docket select "23" from the first Docket number drop down box and enter "157" in the second box before clicking on the "Add to List" button. You must then click the "Save" button at the bottom of the page to confirm your subscription to the docket.

Figure 1-1
Subscribing to the Project Dockets



If you would like to have your name added to the Project mailing list, send an email to eservice.admin@state.mn.us or call (651) 201-2246. If you send an email or leave a phone message, please include: (1) how you would like to receive mail (regular mail or email); and, (2) the docket number(s) (CN-22-532 (Certificate of Need) or TL-23-157 (Route Permit)), your name, and your complete mailing address or email address.

If you have questions about the state regulatory process, you may contact the Minnesota state regulatory staff listed below:

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Website: www.mn.gov/commerce

1.6 Certificate of Need Requirements

The Commission has adopted rules for the consideration of applications for Certificates of Need at Minn. R. Ch. 7849. On October 17, 2023, Xcel Energy filed an Exemption Request under Minn. R. 7849.0200, subp. 6, requesting that Xcel Energy be exempt from certain filing requirements under Minn. R. Ch. 7849. The Commission approved the Petition in an order dated December 12, 2023 ("Exemption Order"). This Application contains the information required under Minn. R. Ch. 7849, as modified by the Commission in its Exemption Order. A copy of the Commission's Exemption Order is provided in **Appendix E**. A Certificate of Need completeness checklist is provided in **Appendix A** with cross references indicating where the information required by Minnesota statute and rules can be found in this Application.

1.7 Route Permit Requirements

This Application is submitted under the full permitting process. The Commission has adopted rules for the consideration of Route Permit applications in Minn. R. Ch. 7850. A Route Permit completeness checklist is provided in **Appendix B** with cross references indicating where the information required by Minnesota statutes and rules can be found in this Application.

1.8 Project Schedule and Cost

Xcel Energy anticipates starting Project construction in 2026. The Project is scheduled to be in service by 2030.[9] Xcel Energy is currently evaluating whether portions of the Project can be placed into service before 2030 and will provide any updates during the proceeding. The estimated cost for the Project is between $524.7 million and $577.2 million. Additional details regarding the schedule and cost for the Project are provided in Chapter 2.

1.9 Project Ownership and Permittee

Segments of the Project will either be individually or jointly owned by Xcel Energy, Dairyland, Southern Minnesota, and the City of Rochester. As the Project Manager, Xcel Energy will be responsible for the construction of the proposed transmission facilities, and as such, Xcel Energy is the sole Applicant for the Certificate of Need and Route Permit for the Project. Xcel Energy therefore requests that it be the sole permittee of any Certificate of Need and Route Permit issued for the Project as part of this proceeding.

Xcel Energy is a Minnesota corporation headquartered in Minneapolis, Minnesota, that is engaged in the business of generating, transmitting, distributing, and selling electric power and energy and related services in the states of Minnesota, North Dakota, and South Dakota. In Minnesota, Xcel Energy provides electric service to 1.5 million customers. Xcel Energy is a wholly-owned utility operating company subsidiary of Xcel Energy Inc. and operates its transmission and generation system as a single integrated system with its sister company, Northern States Power Company, a Wisconsin corporation, known together as the NSP Companies. The NSP Companies are vertically integrated transmission-owning members of MISO. Together, the NSP Companies have over 46,000 conductor miles of transmission lines and approximately 550 transmission and distribution substations.

Dairyland is a Wisconsin based Generation and Transmission Electric Cooperative headquartered in La Crosse, Wisconsin that provides wholesale power requirements

[9] In MTEP21, MISO listed an expected in-service date of June 1, 2028 for LRTP4.

and other services for twenty-four member distribution cooperatives and twenty-seven municipal utilities across Wisconsin, Minnesota, Iowa, and Illinois. In turn, these cooperatives and municipals deliver electricity to approximately 700,000 end-use consumers. Dairyland is a founding regional member of Touchstone Energy Cooperatives, a national network of cooperatives created in 1998 to engage cooperative members and strengthen rural communities.

Southern Minnesota is a municipal corporation and political subdivision of the State of Minnesota, headquartered in Rochester, Minnesota. Southern Minnesota generates and transmits wholesale electricity to its seventeen non-profit, municipally-owned member utilities in Minnesota.

The City of Rochester is a municipally-owned utility headquartered in Rochester, Minnesota. The City of Rochester provides electric service to the greater Rochester Area, serving approximately 59,570 electric customers.

1.10 Applicant's Request and Contact Information

Minn. Stat. § 216B.243, subd. 4 and Minn. Rule 7849.1900, subp. 4 permit the Commission to hold joint proceedings for the Certificate of Need and Route Permit in circumstances where a joint hearing is feasible, more efficient, and may further the public interest. In addition, Minn. Rule 7849.1900, subp. 2 permits DOC-EERA to elect to prepare an EIS in lieu of the environmental report required under Minn. Rule 7849.1200 in certain circumstances.

Xcel Energy respectfully requests that the Commission find this Application complete, and requests that DOC-EERA prepare an EIS, and order a joint regulatory review process for the Certificate of Need and Route Permit. A joint proceeding will further the public interest by allowing issues associated with the Certificate of Need and the Route Permit for the Project to be fully examined in a single proceeding.

Xcel Energy also respectfully requests that, upon completion of its review, the Commission approve a Certificate of Need and a Route Permit for the Project. The Commission has established criteria in Minn. R. 7849.0120 to apply in determining whether a Certificate of Need should be granted for a proposed high-voltage transmission line. Applicant has demonstrated in this Application that the Project meets all the requirements to obtain a Certificate of Need. The Project will provide additional transmission capacity that is needed to mitigate current capacity issues and to improve electric system reliability throughout the region as more renewable energy resources are added to the system. The Project will also support the State's goals to conserve resources, minimize environmental and human settlement impacts and land use conflicts by considering the use of existing corridors to the extent feasible, and ensure the State's electric energy security through the construction of efficient, cost-effective transmission infrastructure.

This Application also demonstrates that issuance of a Route Permit for construction of the Project effectively considers and satisfactorily addresses the factors set forth in Minn. Stat. § 216E.03, subd. 7, and Minn. R. 7850.4100. The Project will support the State's goals to conserve resources and minimize environmental and human settlement impacts and land use conflicts.

All correspondence relating to this Application should be directed to:

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2. PROPOSED PROJECT

2.1 Project Description

The proposed Project includes the construction of a new approximately 130 mile 345 kV transmission line between the Wilmarth substation in Mankato, Minnesota and the Mississippi River near Kellogg, Minnesota. This Project is the Minnesota portion of LRTP4. The overall LRTP4 project involves the construction of a 345 kV transmission line from the existing Wilmarth Substation in Mankato, Minnesota to the existing Tremval Substation located in west central Wisconsin near the town of Blair.[10] The LRTP4 project also includes construction of an approximately 20-mile 161 kV transmission line. The 161 kV part of the Project is a relocation of a portion of the existing North Rochester – Chester 161 kV line.[11] A new location for the 161 kV line is needed because the new 345 kV line in Segment 3 will be displacing a portion of the North Rochester – Chester 161 kV line from its current location on double-circuit structures. The Project also includes upgrades at the Wilmarth, North Rochester, and Eastwood substations.

2.2 Proposed Routes

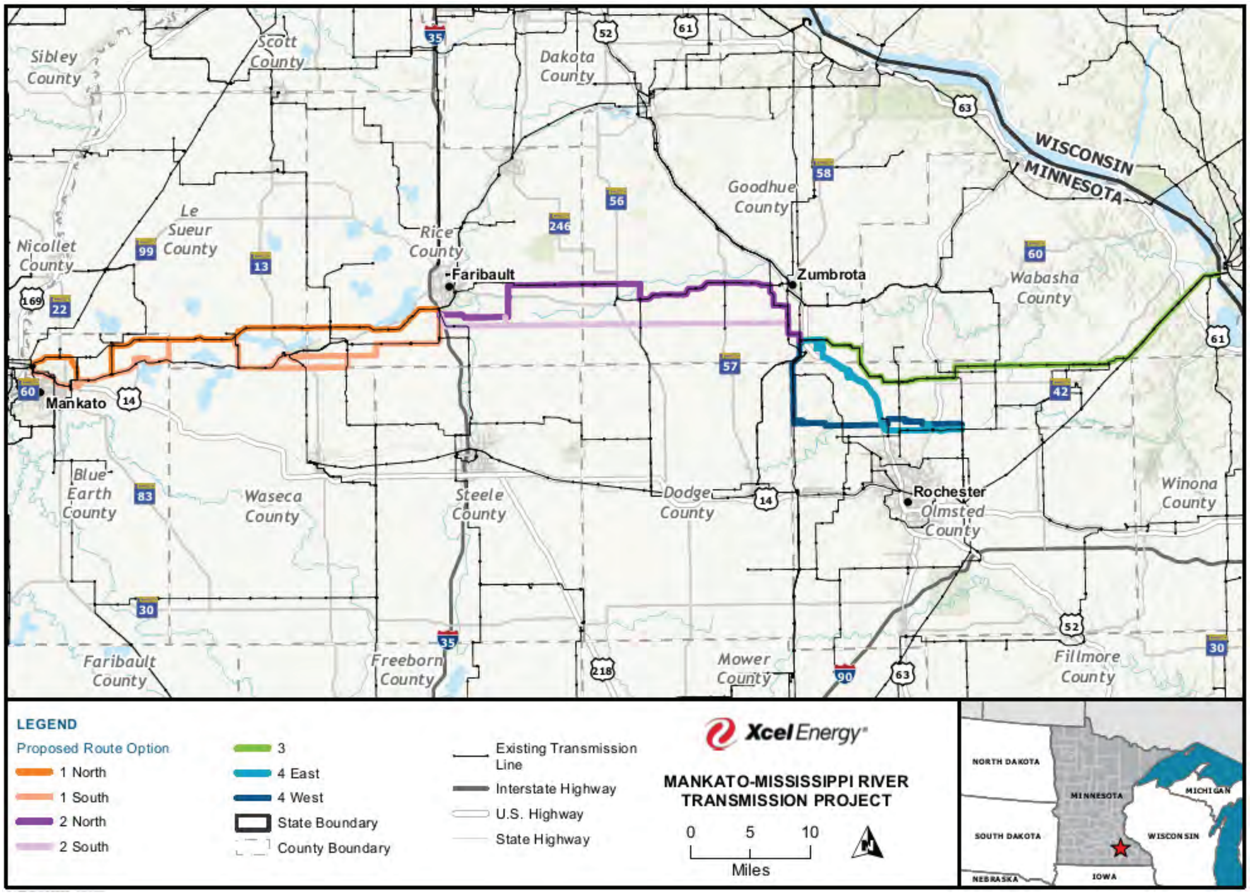
Based on the location of the Project and the differences in routing opportunities between endpoints, the Project is divided into four segments. Segments 1, 2 and 3 making up the 345 kV portion, and Segment 4 the 161 kV portion.

An overview map of the Project is shown in **Map 2-1**.

[10] The Wisconsin portion of LRTP4 will be permitted in a separate proceeding before the PSCW.

[11] A route permit for the North Rochester – Chester 161 kV transmission line was issued by the Commission on September 12, 2012. *In the Matter of the Route Permit Application for the North Rochester to Chester 161 kV Transmission Line Project in Goodhue, Olmstead, and Wabasha Counties*, ORDER, Docket No. E002/TL-11-800 (Sept. 12, 2012).

Map 2-1
Project Overview Map



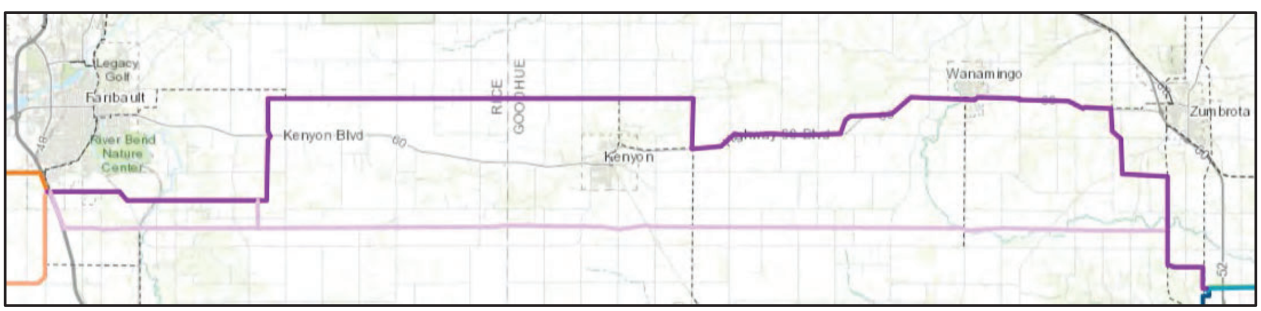
A general description of proposed routes by segment is provided below. More detailed descriptions of routes are included in Chapter 6.

- Segment 1 Wilmarth to West Faribault—a new 345 kV transmission line between the existing Wilmarth Substation and a point near the West Faribault Substation.
  - Alternatives include a north route primarily double-circuited with an existing 115 kV transmission line, and a south route double-circuited with 69 kV and 115 kV transmission lines as well as some smaller greenfield segments. The overall length would be approximately 48-54 miles.

Map 2-2
Segment 1 Overview

- Segment 2 West Faribault to North Rochester—a new 345 kV transmission line between a point near the existing West Faribault Substation and the existing North Rochester Substation.
  - Alternatives include a north route that would be partially double-circuited with existing 69 kV and 345 kV transmission lines and a south route which would be primarily constructed in a new corridor, with a smaller portion at the east end double-circuited with an existing 345 kV line. The total length for Segment 2 would be approximately 34 to 42 miles.

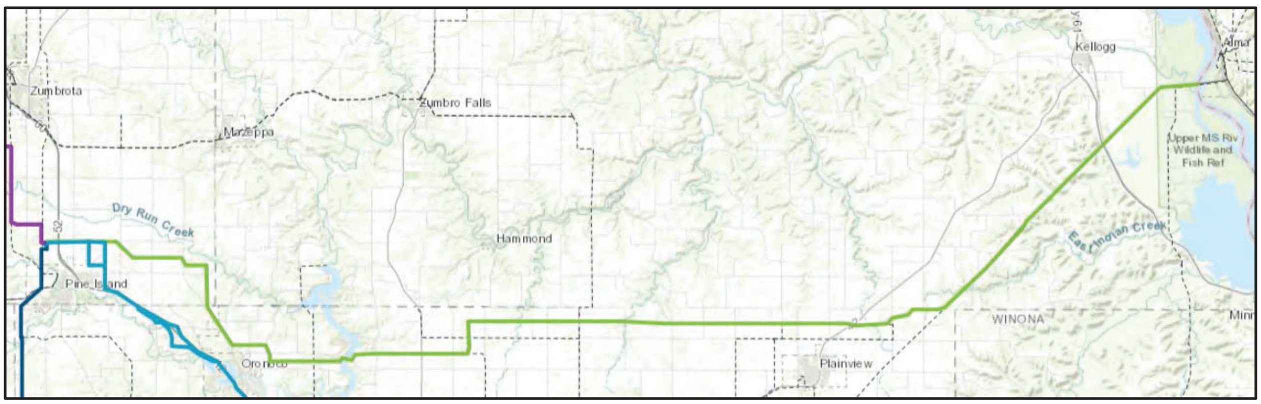
Map 2-3
Segment 2 Overview



- Segment 3 North Rochester to Mississippi River—a new 345 kV transmission line between the existing North Rochester Substation and the Mississippi River. This segment involves converting an existing 161/345 kV transmission line to 345/345 kV operation and adding a new 345 kV circuit to existing double-circuit structures. This segment was permitted by the Commission as part of the CapX2020 Hampton – La Crosse Project in 2012.[12]

- Segment 3 includes a single proposed route for the new 345 kV transmission line between the North Rochester Substation and the Mississippi River because alternatives to this segment were already considered during the CapX2020 Hampton – La Crosse Project route permit proceeding.[13] Segment 3 is approximately 43 miles in length.

Map 2-4
Segment 3 Overview



- Segment 4 North Rochester to Chester—removal and relocation of a portion of a 161 kV transmission line which is needed because a portion of the new 345 kV line in Segment 3 would displace the 161 kV line is currently double-circuited with an existing 345 kV line.[14]
  - Proposed alternatives include an east route that follows existing transmission corridors and Highway 52 for most of its length, and a

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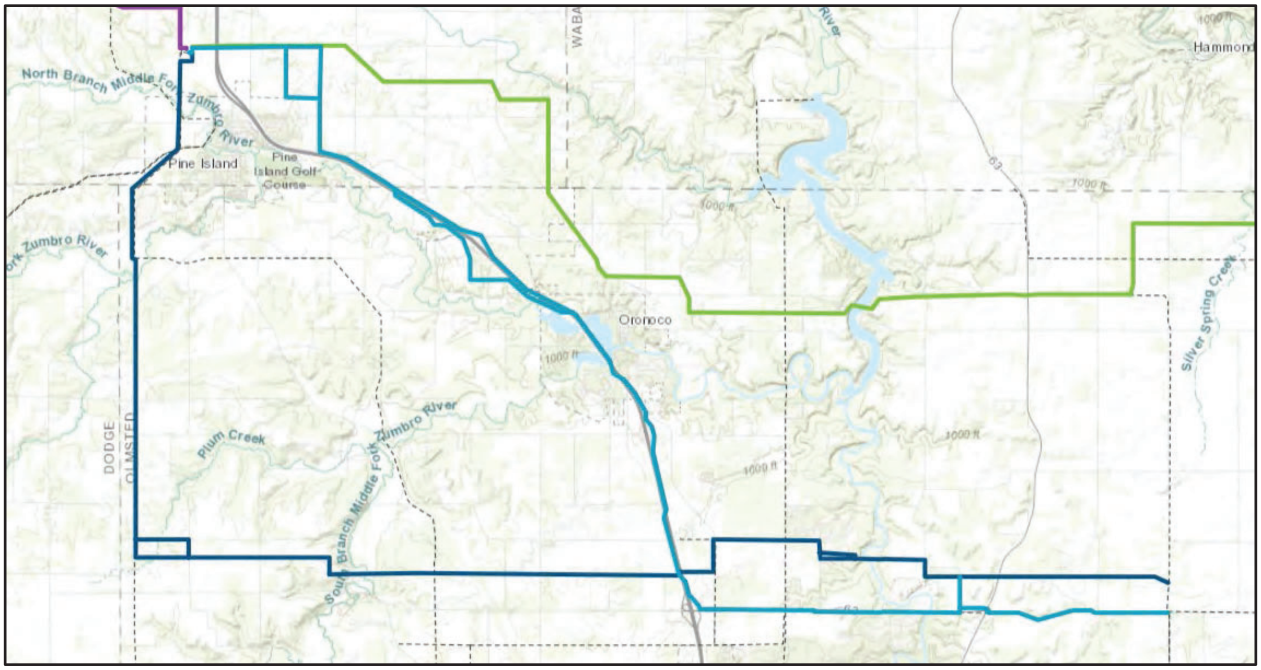
[12] *In the Matter of Xcel Energy's Application for a Route Permit for the CapX2020 Hampton – Rochester – La Crosse High Voltage Transmission Line*, ORDER ISSUING ROUTE PERMIT AS AMENDED, Docket No. E002/TL-09-1448 (May 30, 2012).

[13] *See In the Matter of Xcel Energy's Application for a Route Permit for the CapX 2020 Hampton – Rochester – La Crosse High Voltage Transmission Line*, Docket No. E002/TL-09-1448, ORDER ISSUING ROUTE PERMIT AS AMENDED (May 30, 2012).

[14] *In the Matter of the Route Permit Application by Northern States Power Company for the North Rochester to Chester 161 kV Transmission Line Project in Goodhue, Olmstead and Wabasha Counties, Minnesota*, Docket No. E002/TL-11-800, COMMENTS AND RECOMMENDATIONS OF THE DEPARTMENT OF COMMERCE at 2 (June 29, 2012) ("The project involves a 13 to 19-mile east-west segment in which the Applicant proposes to place the Chester Line on the same poles as the Hampton – Rochester – La Crosse 345 kV Transmission Project.")

west route that follows a combination of roads, property lines and existing transmission lines. The length would be approximately 20 to 24 miles.

Map 2-5
Segment 4 Overview



2.3 Route Width

The route width is the area in which the Commission authorizes a permittee to place the proposed transmission line facilities. The route may have "a variable width of up to 1.25 miles," within which the right-of-way for the facilities can be located (Minn. Stat. § 216E.01, subd. 8). The right-of-way is the specific area that is required for the easement for the transmission line. By requesting a route width that is wider than the right-of-way, Xcel Energy will have some flexibility to make alignment adjustments during final design to work with landowners, avoid sensitive natural resources, and to manage construction constraints as practical.

For this Project, Xcel Energy proposes a typical route width of 1,000 feet along most proposed alignments (500 feet to either side of proposed centerlines), with wider areas around Project substations, locations with routing constraints and where route options come together.

2.4 Transmission Line Rights-of-Way

The 345 kV portion of this Project typically requires a 150-foot wide right-of-way. For the 161 kV portions of the Project, a 100-foot wide right-of-way is typically required.

When the transmission line parallels existing infrastructure right-of-way (e.g., existing transmission lines, roads, railroads or other utilities), the new right-of-way required may be reduced. Xcel Energy's typical practice when paralleling existing road right-of-way is to place the poles on adjacent private property, near the right-of-way. With this pole placement, the transmission line shares the existing infrastructure right-of-way, thereby reducing the size of the easement required from the private landowner(s). For example, if the required right-of-way is 150 feet, and the transmission pole is placed 5 feet off an existing road right-of-way, only an 80-foot right-of-way easement would be required from the landowner. The additional 70 feet of required right-of-way would be shared with the road right-of-way.

2.5 Transmission Structure Design

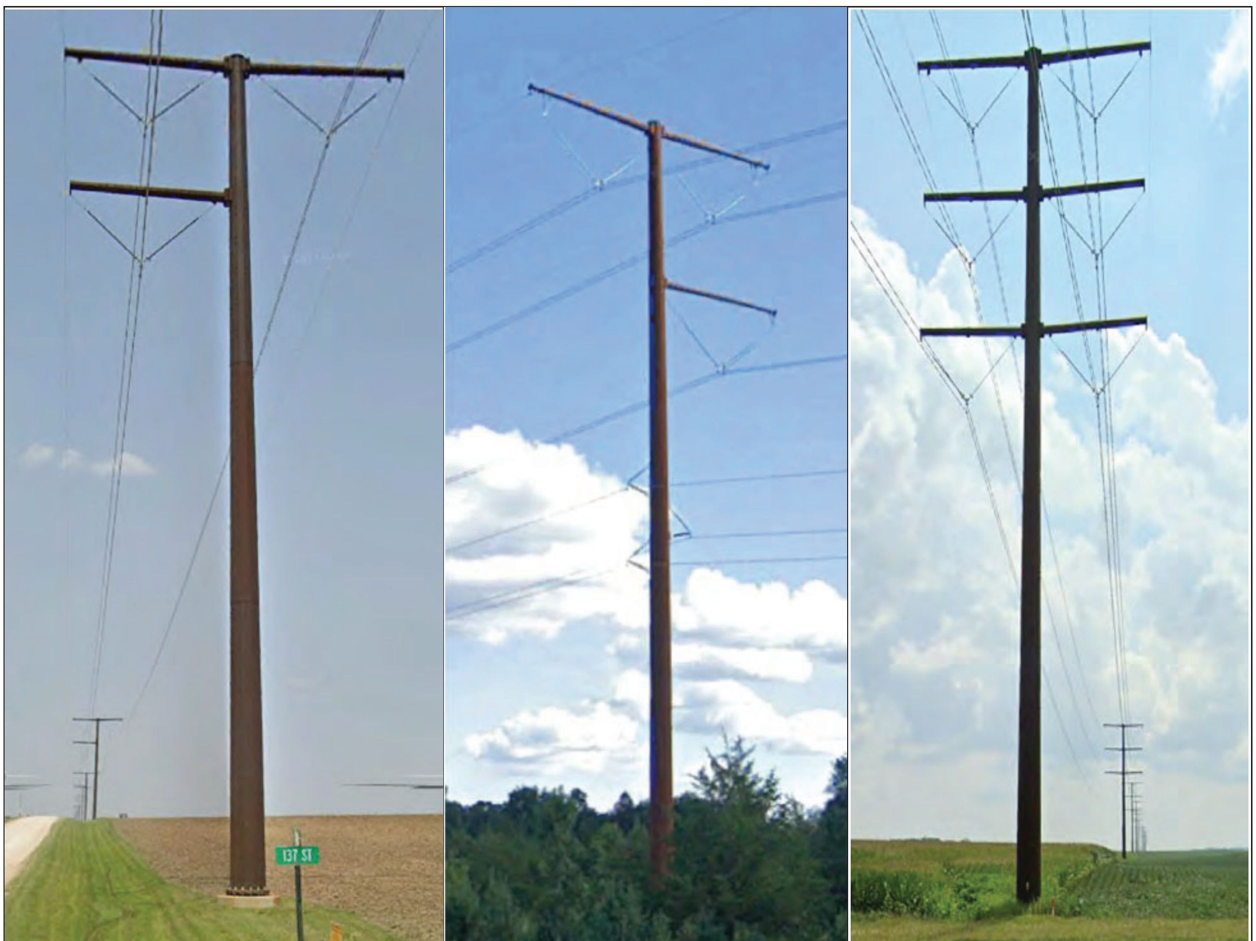
A high-voltage transmission line consists of three phases (conductors), each at the end of a separate insulator string, and all physically supported by poles called structures. Conductors are metal cables consisting of multiple strands of steel and aluminum wire wound together. A single-circuit line contains three conductors, while a double-circuit line contains two sets of three, or six total conductors. At the top of each structure there are also shield wires strung above the electrical phases to prevent damage from lightning strikes. These cables are typically less than one inch in diameter. The shield wire can also include fiber optic cable which provides a communication path between substations for transmission line protection equipment.

2.5.1 345 kV Transmission Line

For the 345 kV transmission line Xcel Energy proposes to primarily use single-pole steel structures. For portions of the Project that will be co-located with existing 115 kV or 345 kV transmission lines, the 115 kV and 345 kV circuits will be double-circuited in a configuration similar to that shown in **Figure 2-1** below. For portions where the new 345 kV will be co-located with existing 69 kV transmission lines, Xcel Energy will underbuild these existing transmission lines with the new 345 kV line (see **Figure 2-1** below). For the remaining portions of the 345 kV transmission line, Xcel Energy will use single-circuit structures. Both the single-circuit and double-circuit structures are typically 85 to 175 feet tall and would be spaced approximately 1,000 feet apart.

Technical diagrams of the proposed structure types shown in **Figure 2-1** below are provided in **Appendix H**.

Figure 2-1
Typical 345 kV Structures



345 kV Steel Single-Circuit Monopole Structure	**345 kV with 69 kV Underbuild Steel Single-Circuit Monopole Structure**	**345 kV/345 kV or 345 kV/115 kV Steel Double-Circuit Monopole Structure**

Table 2-1 summarizes the characteristics of typical 345 kV transmission structures. The structure size may change based on site conditions.

Table 2-1
345 kV Line Typical Structure Design Summary

Line Type	Structure Type	Structure Material	Typical Right-of-way Width (feet)	Typical Structure Height (feet)	Foundation Diameter (feet)	Average Span Between Structures (feet)
345 kV Single-Circuit	Monopole w/ Davit Arms	Galvanized or Self-Weathering Steel	150	85-175	7-12	1,000
345 kV with 69 kV Underbuild	Monopole w/ Davit Arms	Galvanized or Self-Weathering Steel	150	85-175	7-12	1,000
345/345 kV or 345/115 kV Double-Circuit	Monopole w/ Davit Arms	Galvanized or Self-Weathering Steel	150	85-175	7-12	1,000

2.5.2 161 kV Transmission Line

Xcel Energy proposes to use single-pole, self-weathering steel structures for the North Rochester to Chester 161 kV transmission line. In some locations, the 161 kV line will be single-circuit, and in other locations the 161 kV line will be double-circuited with 69 kV transmission lines on double-circuit structures. Both the single-circuit and double-circuit structures are typically 75 to 140 feet tall and would be spaced approximately 350 to 700 feet apart. **Figure 2-2** shows typical single-circuit and double-circuit 161 kV transmission structures. Technical diagrams of these proposed structure types are provided in **Appendix H**.

Figure 2-2
Typical 161 kV Structures

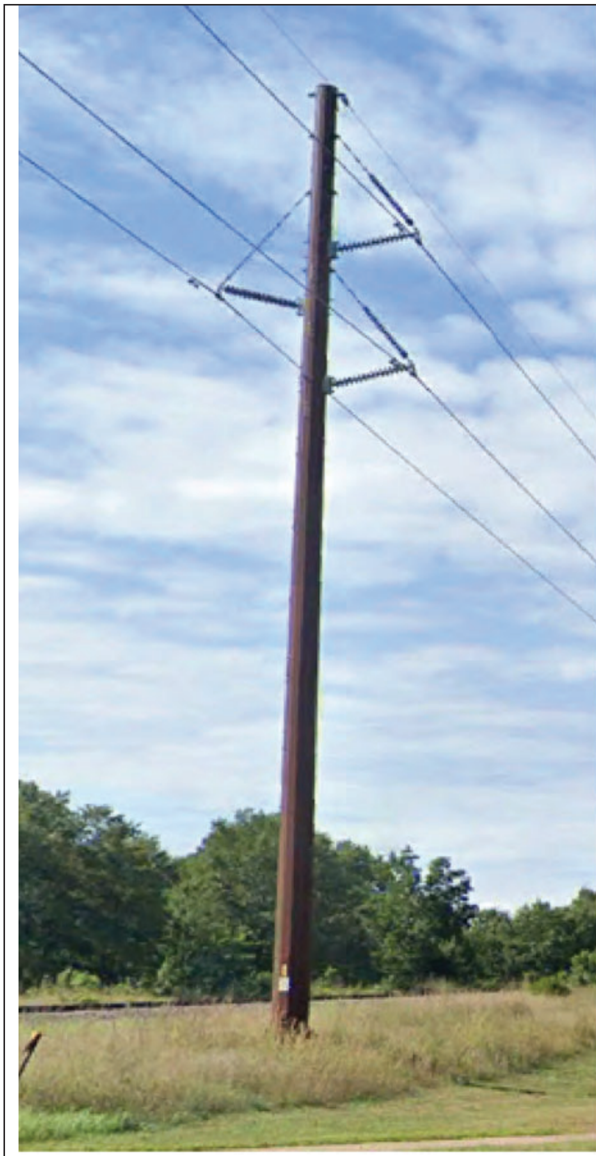
	
161 kV Steel Single-Circuit Monopole Structure	**161/69 kV Steel Double-Circuit Monopole Structure**

Table 2-2 summarizes the characteristics of typical 161 kV transmission structures. The structure size may change based on site conditions.

Table 2-2
161 kV Line Typical Structure Design Summary

Line Type	Structure Type	Structure Material	Typical Right-of-way Width (feet)	Typical Structure Height (feet)	Foundation Diameter (feet)	Average Span Between Structures (feet)
161 Single-Circuit	Monopole w/ Davit Arms	Galvanized or Self-Weathering Steel	100	75-140	6-8	350-700
161/69 Double-Circuit	Monopole w/ Davit Arms	Galvanized or Self-Weathering Steel	100	75-140	6-8	350-700

2.5.3 Conductors

Xcel Energy proposes to use a double bundled 2x636 kcmil 26/7 Twisted Pair ACSR "Grosbeak" conductor for the new 345 kV transmission line. New double bundled 954 kcmil ACSS/TW 20/7 "Cardinal" conductor will be installed as the second circuit on the existing structures between the North Rochester Substation and the Mississippi River to match the wire type of the existing circuit.

The 161 kV portion of the Project will use a single 2x397.5 kcmil 26/7 Twisted Pair ZTACSR "Ibis" to match the wire type of the rest of the existing 161 kV transmission line. Rebuilt sections of 115 kV and 69 kV transmission lines will utilize 2x336 kcmil 26/7 Twisted Pair ACSR "Linnet" conductor in a double bundle and single wire configuration, respectively.

The proposed transmission line will be designed to meet or surpass relevant local and state codes including National Electric Safety Code (NESC) and Xcel Energy's standards. Applicable standards will be met for construction and installation, and applicable safety procedures will be followed during design, construction, and after installation.

2.6 Associated Facilities

The Project will include modifications to the existing Wilmarth and North Rochester substations in Minnesota. Depending on the route selected, the Project may also include modifications to the Eastwood Substation.

2.6.1 Wilmarth Substation

The existing Wilmarth Substation, owned by Xcel Energy, is the western endpoint of the Project and is located in Segment 1. This substation is located on the northern edge of the City of Mankato, adjacent to Xcel Energy's refuse derived fuel plant, just east of the Minnesota River.

New substation equipment necessary to accommodate the proposed 345 kV transmission line will be installed at the Wilmarth Substation. An approximately 0.8 acre expansion of the current fenced area and pad on the northeast corner of the substation will be required to accommodate this new substation equipment.

2.6.2 Eastwood Substation

Depending on the route selected the Project may also involve construction of approximately 500 feet of new 69 kV transmission line to connect an existing 69 kV line at the Eastwood Substation, which is located in Segment 1. New substation equipment will also be installed within the substation fence of the Eastwood Substation to accommodate the interconnection of this 69 kV line. This would be necessary if the south route alternative (Option 1 South) is selected in Segment 1, which would involve re-terminating the 69 kV line at Eastwood and removing the segment of that line that runs between the Wilmarth and Eastwood Substations.

2.6.3 North Rochester Substation

The existing North Rochester Substation is located near Pine Island, Minnesota at the endpoints of Segment 3 and Segment 4. New substation equipment necessary to accommodate the proposed 345 kV transmission lines will be installed at the North Rochester Substation. No expansion of the current fenced area will be required to accommodate this new substation equipment.

2.7 Design Options to Accommodate Future Expansion

The Project is designed to meet current and projected future needs of the local and regional transmission grid. One of the ways that the Project has been designed to accommodate future expansion is by routing the new 345 kV transmission line near the West Faribault Substation. This will allow for the potential for a 345 kV connection into the West Faribault Substation in the future as needed to support greater renewable generation in this area. Increasing wind generation levels in southwestern Minnesota and northern Iowa have resulted in increased levels of power flowing from west to east across southern Minnesota. As that transfer of energy increases, the need for system support on lower voltage transmission systems has also increased. This is especially true in the area of the transmission system near Faribault and Owatonna, Minnesota. In operations of the power grid today, system support services in that area are provided by relatively local thermal generators. As Minnesota advances towards 100% clean energy by 2040, these local generators will not be able to provide the needed support as they do today. While new clean energy resources in the area may be able to provide some of the needed energy, better connections to the backbone 345 kV transmission system in that area provide the most robust and cost-effective solution. By routing the new 345 kV transmission line as close as possible to the existing lower voltage transmission system near Faribault, there is the ability to make this connection to the backbone transmission system in the future while also minimizing additional impacts to the surrounding area.

The North Rochester Substation was initially constructed as part of the Hampton – Rochester – La Crosse Project and was designed with sufficient space to accommodate additional transmission line connections in the future (including the Project).[15]

2.8 Project Schedule

Table 2-3 provides the permitting and construction schedule currently anticipated for the Project. This schedule is based on information known as of the date of filing and may be subject to change as further information develops or if there are delays in

[15] *In the Matter of Xcel Energy's Application for a Route Permit for the CapX2020 Hampton – Rochester – La Crosse High Voltage Transmission Line*, ROUTE PERMIT APPLICATION at 3-11, Docket No. E002/TL-09-1448 (January 19, 2010).

obtaining the necessary federal, state, or local approvals that are required prior to construction. Xcel Energy is currently evaluating whether portions of the Project can be placed in service before 2030 and will provide any schedule updates during the proceeding.

Table 2-3
Anticipated Project Schedule

Activity	Estimated Dates
Minnesota Certificate of Need and Route Permit for Eastern Segment Issued	Third Quarter 2025
Land Acquisition Begins	Fourth Quarter 2025
Survey and Transmission Line Design Begins	Third Quarter 2024
Other Federal, State, and Local Permits Issued	Third/Fourth Quarter 2025
Start Right-of-Way Clearing	Third Quarter 2026
Start Project Construction	Fourth Quarter 2026
Project In-Service	First Quarter 2030[16]

2.9 Project Costs

2.9.1 Estimated Construction Costs

There are several main components of the cost of constructing a new transmission project. This includes:

- transmission line structures and materials
- transmission line construction and restoration
- transmission line and substation permitting and design
- transmission line right-of-way acquisition
- substation materials, substation land acquisition, and construction

Each of these components also may include a risk reserve.

[16] In MTEP21, MISO listed an expected in-service date of June 1, 2028 for LRTP4.

Table 2-4 below provides total Project costs. These costs include all transmission line costs (including materials, associated construction, permitting and design costs, and risk reserves), substation modification costs (including materials, construction, permitting and design costs, and risk reserve), Allowance for Funds Used During Construction (AFUDC), and right-of-way costs.

To prepare a cost estimate for the transmission line portions of the Project, Xcel Energy relied in part upon the actual costs incurred for constructing prior similar transmission projects. Xcel Energy then updated this data based on current market conditions and included a risk reserve. The cost estimates are based on potential transmission line alignments. The introduction of additional corner structures or special structures for river or wetland crossings will increase the Project costs. Right-of-way cost estimates for the transmission line and substations were based on acquiring a 150-foot right-of-way for the transmission line. Xcel Energy considered actual costs from prior project acquisitions and approximated the length of the line to estimate the overall land acquisition costs.

To estimate substation construction costs, Xcel Energy identified the necessary components for each substation. Xcel Energy then estimated land, material, construction, design, and permitting costs based on cost estimates for these items from prior substation improvement projects.

To calculate an appropriate risk reserve, Xcel Energy identified potential risks that could result in additional costs. These risks could include, for example: unexpected weather conditions, environmental sensitivities resulting in the need for mitigation measures, poor soil conditions in areas where no soil data was obtained, transmission line outage constraints, potential shallow bedrock, river crossings, labor shortages, and market fluctuations in material pricing and availability, and labor costs. Xcel Energy then developed an appropriate reserve amount for each of these risks and applied them to each of the cost categories.

Table 2-4 below provides both a low and high range of total Project costs.

Table 2-4
Construction Cost Estimates

Project Components	Low Capital Expenditures ($Millions)	High Capital Expenditures ($Millions)
Mankato – Mississippi River 345 kV Transmission Line	$446.7	$484.8
Wilmarth Substation Modifications	$8.6	$9.1
North Rochester Substation Modifications	$10.5	$11.5
North Rochester to Chester 161 kV Transmission Line	$58.9	$63.2
Eastwood Substation Modifications	$0	$8.7
Total Project Costs*	**$524.7**	**$577.2**
**There may be differences between the sum of the individual component amounts and Total Project Costs due to rounding*		

Xcel Energy notes that **Table 2-4** includes cost estimates escalated to nominal dollars to reflect expected final cost at completion for each component of the Project. These cost estimates could increase over time for any number of reasons such as, but not limited to escalation, inflation and commodity pricing, especially for these types of large-scale 345 kV transmission projects that have multi-year schedules.

2.9.2 MISO's Estimated Project Costs

As part of developing the LRTP Tranche 1 Portfolio, MISO developed cost estimates for each of the 18 transmission projects. MISO's cost estimate for LRTP4, the Minnesota and Wisconsin portions, was $689 million (2022$). Xcel Energy determined, based on Appendix A of MTEP21, that MISO's estimate of Xcel Energy's portion of LRTP4 in Minnesota was approximately $457.4 million in nominal dollars. Xcel Energy's cost estimate for the Project is higher than MISO's cost estimate for several reasons. First, MISO's cost estimates did not take into account the routes proposed by Xcel Energy in this Application. While these routes were developed in accordance with the applicable Minnesota routing statutes and rules and seek to minimize human and environmental impacts, these routes are assumed to be longer in length than the routes used by MISO for their cost estimates. Second, the MISO cost estimate did not account for the full scope of the substation work required for this Project. Specifically, the MISO cost estimate did not include possible modifications to the Eastwood Substation. In addition, it appears that the MISO cost estimate for the modifications to the Wilmarth and North Rochester substations did not account for the full scope of work needed to expand the capacity of these substations to accommodate the new 345 kV transmission line. Third, MISO's cost estimates assumed a June 1, 2028 in service date for the Project while the cost estimates prepared by Xcel Energy assume a 2030 in service date. Finally, commodity prices in general (material and labor) have also increased since the MISO cost estimate was developed.

2.9.3 Effect on Rates

Minn. R. 7849.0270, subp. 2(E) requires an applicant for a Certificate of Need to provide the annual revenue requirement to recover the costs of the proposed Project. Xcel Energy requested an exemption from this rule requirement and instead committed to providing an explanation of how the costs for the LRTP Tranche 1 Portfolio of projects will be shared across the MISO footprint. MISO's allocation of costs for the LRTP Tranche 1 Portfolio is discussed below. Minn. R. 7849.0260, subp. C(5), requires an applicant to provide an estimate of the Project's effect on rates system wide and in Minnesota. To fulfill this requirement, Xcel Energy is also providing the annual revenue requirement impact for the capital costs of the Project for a 20-year period for Xcel Energy starting with the Project's in-service date of June 1, 2030. This analysis is provided in **Appendix J** and discussed further in Section 2.9.3.2 below.

2.9.3.1 Cost Allocation under MISO Tariff

The Project is part of the MISO LRTP Tranche 1 Portfolio, which has been determined by MISO to meet the criteria for being designated a Multi-Value Project (MVP) under the MISO tariff. As a result, the Project, along with the rest of the LRTP Tranche 1 Portfolio, qualifies for regional cost allocation. MISO has determined that the LRTP Tranche 1 Portfolio will be allocated to transmission customers in the MISO Midwest subregion,[17] where these projects are located and provide benefits. The allocation of the Project's costs to transmission customers is governed by Schedule 26-A, Multi-Value Project Usage Rate, in MISO's tariff. The annual revenue requirement for the Project is determined by the formula rate in Attachment MM-MVP Charge in the MISO tariff. Withdrawing Transmission Owners in the MISO Midwest subregion pay the annual revenue requirement through Schedule 26-A charges assessed based on actual monthly energy consumption by customers. Minnesota customers' allocated share of the annual revenue requirement is determined by the percent of total MISO energy used by Minnesota utilities, which is estimated at approximately 15 to 20 percent based on MISO's posted 2021 energy withdrawal data. MISO provided an estimate of these MVP usage charges by pricing zone in Appendix A-4 of MTEP21.[18]

2.9.3.2 Xcel Energy Revenue Requirement

Appendix J provides revenue requirement calculations for the NSP system (both Northern States Power Company, a Minnesota corporation (NSPM), and Northern States Power Company, a Wisconsin corporation (NSPW)), and are then adjusted to a Minnesota jurisdictional basis for NSPM. These revenue requirement calculations do not account for any future operation and maintenance costs for the Project or fuel impacts. These revenue requirement calculations also assume that the Project is individually or jointly owned with the other co-owners as discussed in Section 1.6. The revenue requirement for other Minnesota utilities will be different than those provided for Xcel Energy in **Appendix J**.

2.9.3.3 Inflation Reduction Act Funding

The Commission's September 12, 2023 *Order Setting Requirements Related to Inflation Reduction Act* in E,G999/CI-22-624 at point 1 states:

> The utilities shall maximize the benefits of the Inflation Reduction Act in future resource acquisitions and requests for proposals in the planning

[17] The MISO Midwest Subregion includes MISO transmission customers in Minnesota, Montana, North Dakota, South Dakota, Iowa, Wisconsin, Missouri, Illinois, Indiana, Michigan, and Kentucky. MISO South Subregion transmission customers are excluded in the allocation and recovery of Project costs.

[18] MISO LRTP Tranche 1 MTEP21 Appendix A-4 Schedule 26A *available at* https://cdn.misoenergy.org/LRTP Tranche 1 Appendix A-4 Schedule 26A Indcative625788.xlsx.

> phase, petitions for cost recovery through riders and rate cases, resource plans, gas resource plans, integrated distribution plans, and Natural Gas Innovation Act innovation plans. In such filings, utilities shall discuss how they plan to capture and maximize the benefits from the Act, and how the Act has impacted planning assumptions including (but not limited to) the predicted cost of assets and projects and the adoption rates of electric vehicles, distributed energy resources, and other electrification measures. Reporting shall continue until 2032.

While a Certificate of Need proceeding is not a resource acquisition proceeding, Xcel Energy has evaluated the Inflation Reduction Act for applicability to activities to be undertaken in the planning, procurement, and construction of this Project in an effort to reduce the rate impact of this Project. However, at this time, Xcel Energy has not identified any opportunities under the Inflation Reduction Act to reduce the cost of the Project for customers.

3. ELECTRIC SYSTEM AND CHANGING GENERATION PORTFOLIO OVERVIEW

3.1 Electric System Overview

When a customer turns on a light switch, a circuit is completed that connects the light with the wires that serve the customer's building. The building wires are connected to a transformer that connects to a distribution line outside of the building. The distribution lines, in turn, are connected to substations and then through larger transformers that connect to transmission lines that comprise the bulk power system. The bulk power system is comprised of large power transformers and high voltage transmission lines and can carry large amounts of electric power and energy (generally referred to herein as electricity) from electric generating facilities to meet the demand for electricity at any given moment.

Electricity is produced at both large and small generating facilities. Electricity can be generated using a variety of sources or fuels, including solar, wind, and hydro; internal and external combustion of biomass, biofuels, natural gas, and coal; and heat and steam created through nuclear fission. Electric energy is generated at a specific voltage and frequency. For it to be useful, electricity must be transmitted from the generation source to substations with transformers and then to consumers at acceptable voltages. Unlike other consumables where excess product can be easily and economically stored for future use, electricity must largely be generated simultaneously with its consumption. This means that generators connected to the bulk power system must instantaneously adjust their electric output to respond to changes in customer demand. However, energy storage technologies, including battery energy storage systems (BESS), are advancing and could help reduce the need for generators to adjust instantaneously with customer demand.

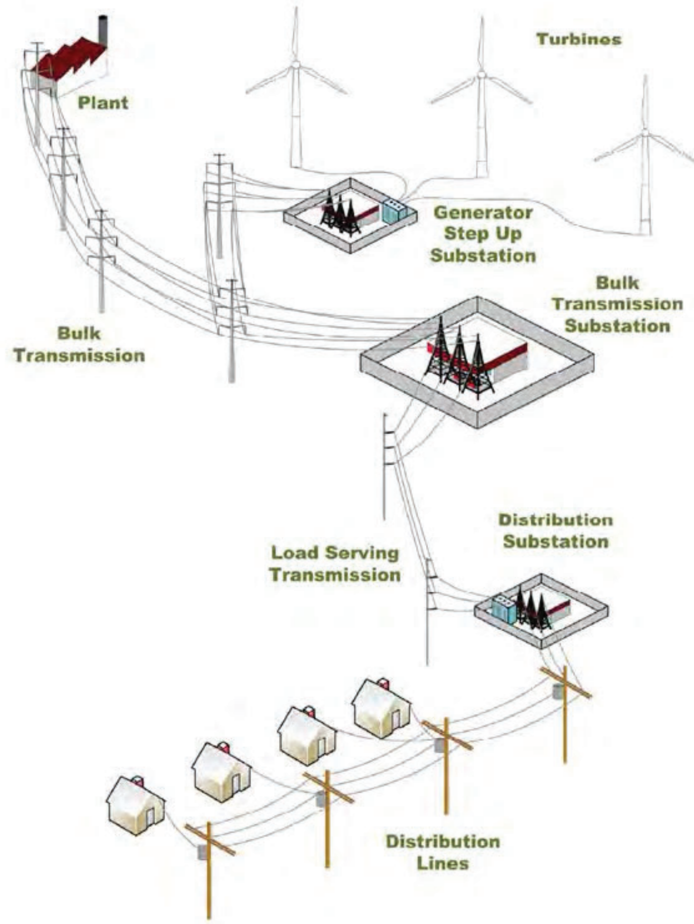
Typically, the voltage of electricity generated in a power plant is increased (stepped-up) by transformers installed close to the generating plant. The electricity is then transported over high voltage transmission lines, often at voltages in excess of one hundred thousand volts (*e.g.*, 115 kV, 230 kV, and 345 kV).[19] Voltage is stepped-up on

[19] One kV equals 1,000 Volts.

high voltage transmission lines because it is more efficient to move electricity over longer distances at higher voltages, as the system experiences less electrical loss at higher voltages. Once the electricity reaches a location where it will be consumed, the transmission voltage (*e.g.*, 115 kV and higher) is reduced (stepped-down) by substation transformers to a lower voltage at a load serving transmission system that is more appropriate to connect to a distribution substation. The electricity is further transformed at distribution substations and is distributed at "primary" distribution voltages (*e.g.*, 13.8 kV, 12.5 kV) within communities, which then delivers power for individual customer use to the end location by stepping-down further to, most commonly, 240 Volts or 120 Volts.

A diagram showing the transfer of electricity from a generator to a consumer is shown below in **Figure 3-1**. Note that this figure is an artistic portrayal of the electric system and is not an actual representation of all electric system components.

Figure 3-1
Electrical System



3.2 Transmission System Overview

The transmission system is made up of high-voltage transmission lines that can efficiently carry electricity long distances. The transmission system delivers power to distribution substations that serve distribution systems that meet customer needs in specific locations. The transmission system is designed to be an integrated system that can withstand the outage of a single transmission line without a major disruption to the overall power supply to consumers.

3.2.1 High Voltage Transmission Lines

Transmission lines throughout this region are primarily made up of conductors that complete a three-phase circuit and are usually accompanied by a shield wire that provides protection from lightning strikes. These conductors consist of several strands of wire grouped together, usually made from copper or aluminum and steel, and most commonly held up by poles or towers that are made from wood or steel.

High voltage transmission lines carry electricity from the generation source to distribution systems where the power is consumed. The rate at which electricity moves through a conductor is the current and is measured in Amperes (Amps). The force that moves the electricity through the conductor is the voltage (V). Voltage is measured in terms of Volts (or kV for 1,000 Volts). The conductors that carry the current have resistance that can hinder their ability to allow current to flow freely. This resistance is measured in the unit Ohms. The conductors used by utilities on the high voltage transmission system conduct electricity with relatively little resistance.

3.2.2 Substations

Substations are a part of the system that contain high-voltage electric equipment to monitor, regulate, and distribute electrical energy. Generally, substations allow transmission lines to connect with one another, or allow power to be transformed from a higher transmission voltage to a lower transmission voltage or from a lower transmission voltage to a distribution voltage.

Substation property dimensions depend on the ultimate design that is planned for the specific substation and physical characteristics of the site, such as shape, elevation, above and below ground geographical characteristics, and proximity of the site to transmission lines. Substation sites must be large enough to accommodate both the ultimate fenced area and the required surrounding areas. The required surrounding areas include applicable setbacks, stormwater ponds, wetlands, grading, access roads, and new transmission line rights-of-way. Depending on the timing of future load growth and electrical system needs, the configuration of a substation may change over time, resulting in multiple construction stages over an extended period of years.

3.3 The Changing Energy Landscape

Over the course of the past 20 years, the generation mix in Minnesota and surrounding states has dramatically shifted from relying primarily on coal and nuclear generation resources to a more diverse generation mix that includes increasing amounts of renewable energy, including wind and solar generation. These changes in the generation portfolio in Minnesota and the surrounding states require additions and changes to the high voltage transmission system in the region to ensure that the added generation can be efficiently and economically delivered to load centers.

The following sections discuss the federal and state policies on renewable energy, the growth in wind and solar energy in Minnesota and the Upper Midwest, and the likely continued expansion of wind and solar energy in Minnesota and the Upper Midwest.

3.3.1 Federal Renewable Energy and Transmission Policies

Current federal energy policy promotes the expansion of renewable energy and the high voltage transmission that will be necessary to interconnect that energy to the bulk power system. For example, the Inflation Reduction Act of 2022 (IRA) puts the United States on a path to approximately 40% emissions reduction by 2040 by supporting, among other things, continued development of domestic renewable energy. More specifically, the IRA extends the production tax credit (PTC) and investment tax credit (ITC) for renewable energy facilities through 2024, after which time the technology-neutral Clean Energy PTC and ITC begin in 2025.

Similarly, federal policy recognizes that additional high voltage transmission infrastructure will be critical to expanding renewable energy and maintaining a resilient and reliable bulk power system. The Infrastructure Investment and Jobs Act of 2021 reflects a significant investment in transmission to facilitate the expansion of renewable energy, including the Department of Energy's (DOE) "Building a Better Grid" Initiative. DOE explained: "[T]he number of generation and storage projects proposed for interconnection to the bulk-power system is growing, interconnection queue wait times are increasing and the percentage of projects reaching completion appears to be declining, particularly for wind and solar resources. Needed investments in transmission infrastructure include increasing the capacity of existing lines, using advanced technologies to minimize transmission losses and maximize the value of existing lines, and building new long-distance, high-voltage transmission lines."[20]

3.3.2 State of Minnesota Renewable Energy Policies

State energy policies have grown and evolved over the years. Minnesota's original Renewable Energy Objective, adopted in 2001, directed all electric utilities in the state to "make a good faith effort" to obtain one percent of their Minnesota retail energy sales from renewable energy resources in 2005, increasing to seven percent by 2010. In 2007, the Renewable Energy Objective was revised to require all utilities (except Xcel Energy) to generate 25% of their retail sales from renewable energy resources by 2025, with Xcel Energy required to generate 30% by 2020.[21]

Minnesota had previously set a goal to reduce statewide greenhouse gas emissions across all sectors producing those emissions to a level at least 30 percent below 2005 levels by 2025 and to a level at least 80 percent below 2005 levels by 2050.[22] Similarly, Minnesota has recognized a "vital interest in providing for … the development and use of renewable energy resources wherever possible."[23] In February 2023, Governor Tim Walz signed the "100 Percent by 2040" legislation into law, which, at a high level, directs electric utilities to transition to meeting the needs of Minnesota retail customers with 100% carbon-free electricity by the end of 2040.[24] Additional sources of emission-free electric energy—like wind and solar—will be necessary to meet these goals.

3.3.3 Overview of Growth of Renewable Generation in Minnesota

In 2005, about 65% of electricity generated in Minnesota came from coal and natural gas. By 2022, renewable energy provided the largest share of electricity generation statewide. Various factors that will continue to drive further expansion of renewable

[20] *See* Department of Energy Notice of Intent Building a Better Grid Initiative to Upgrade and Expand the Nation's Electric Transmission Grid to Support Resilience, Reliability, and Decarbonization, at 4 (Jan. 11, 2022), available at https://www.energy.gov/sites/default/files/2022-01/Transmission%20NOI%20final%20for%20web_1.pdf

[21] Minn. Stat. § 216B.1691, subds. 2 and 2a.

[22] Minn. Stat. § 216H.02, subd. 1.

[23] Minn. Stat. § 216C.05, subd. 1.

[24] Minn. Stat. § 216B.1691, subd. 2g.

generation include the evolving federal and state renewable energy policies discussed above, the favorable wind conditions and solar suitability in Minnesota and neighboring states, and continued technological advancements resulting in improved economics of renewable generation.

The continuing growth of renewable energy generation in Minnesota is evident in utility resource planning processes. For example, the Commission approved Xcel Energy's most recent Integrated Resource Plan (IRP) (2019 Plan) that is expected to reduce carbon dioxide emissions more than 85 percent from 2025 levels and deliver at least 80 percent of customers' electricity from carbon-free energy sources by 2030. Under the plan, which includes retirement of all of Xcel Energy's remaining Upper Midwest coal plants by the end of 2030 and extension of operations at Xcel Energy's Monticello Nuclear Generating Plant to 2040, Xcel Energy will add 2,150 MW of wind and 2,500 MW of solar by 2032, with another 1,100 MW of wind and solar capacity beyond 2032. On February 1, 2024, Xcel Energy filed its 2024-2040 Upper Midwest IRP (2024 Plan).[25] The Company's proposed 2024 Plan builds off the Company's Commission-approved 2019 Plan and includes adding more than 10,000 MW of renewable resources and over 2,100 MWs of energy storage by 2040.

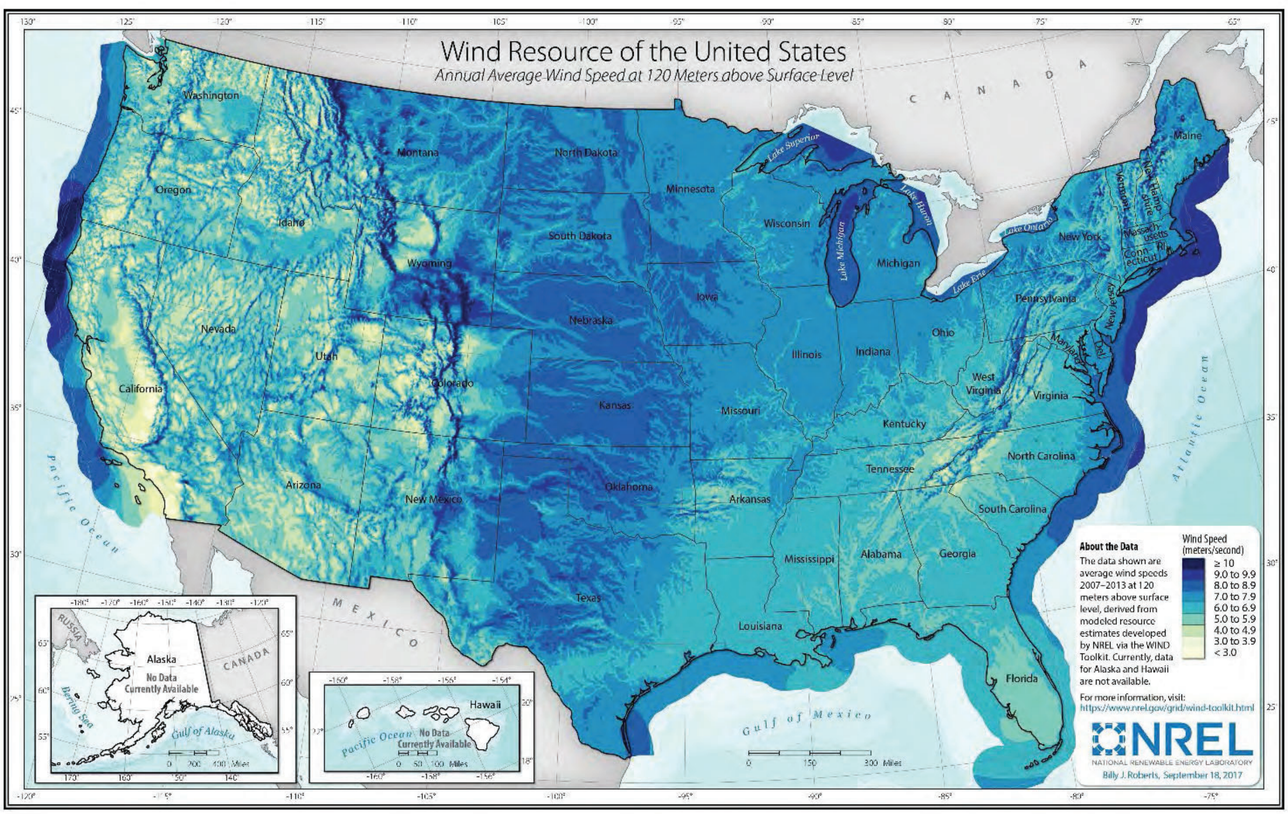
While both of these IRPs call for a continuing expansion of renewable energy generation, there is currently not enough transmission capacity on the high voltage transmission system to accommodate all the renewable energy projects that wish to interconnect. Further, congestion on the high voltage transmission system has been increasing in the past several years due to the increased amount of new generation being added without sufficient additional transmission capacity. This Project will play a key role in providing additional transmission capacity, mitigating current capacity issues, and improving electric system reliability throughout the region as more renewable energy resources are added to the high voltage transmission system in and around the region.

[25] *See* Docket No. E002/RP-24-67.

3.3.3.1 Midwest's Favorable Conditions for Renewable Generation

The Midwest region has favorable conditions for renewable energy generation. Southwestern and southern parts of Minnesota as well as most of Iowa, North Dakota, and South Dakota have strong wind resources. As shown in **Map 3-1** below, these areas have higher than average wind speed as compared to the rest of the country and, as a result, wind turbines in these areas yield more energy than wind turbines in areas with lower average wind speeds.

Map 3-1
U.S. Annual Average Wind Speed at 120 Meters[26]



[26] *See* NREL, *Wind Resource Maps and Data*, available at https://www.nrel.gov/gis/wind-resource-maps.html.

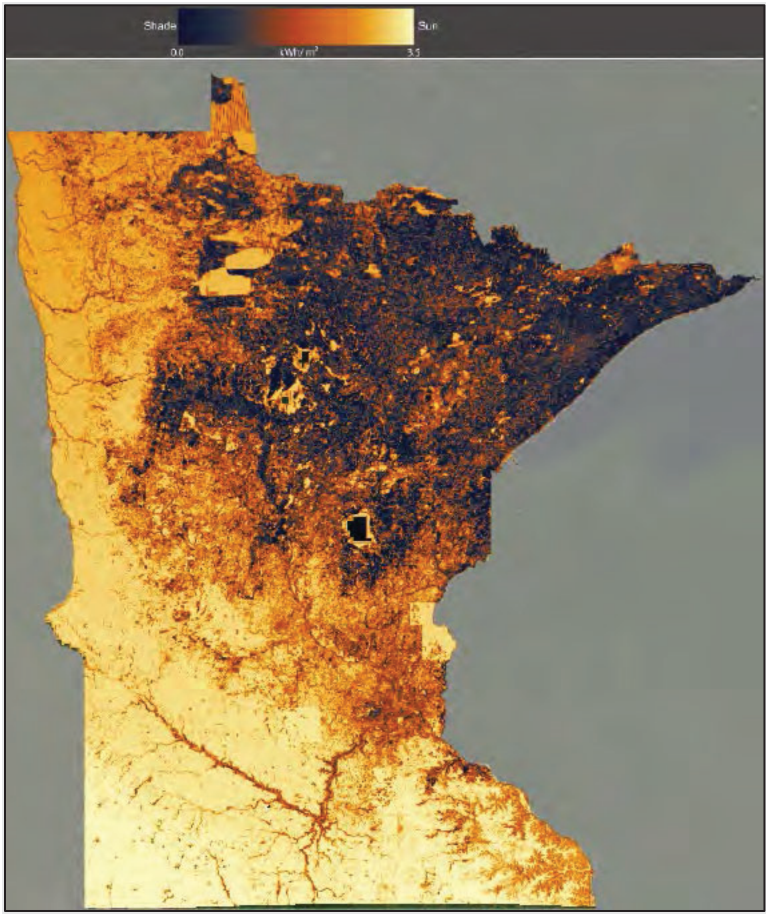
The majority of Minnesota's installed wind capacity is located in southwest Minnesota. In addition, there are wind facilities located throughout Iowa as well as in eastern South Dakota and in North Dakota.[27] The favorable wind conditions in these regions will continue to drive additional development of wind generation in this area.

In addition, areas in the Midwest region are suitable for solar generation facilities. For example, in Minnesota the highest solar irradiance is located in the southwestern portion of the state where limited tree cover and expansive non-forested lands result in ample sun exposure at ground level.[28] A Minnesota map with solar suitability is shown in **Map 3-2**.

[27] *See* USGS, *The U.S. Wind Turbine Database*, available at https://eerscmap.usgs.gov/uswtdb/.

[28] *See* e.g., University of Minnesota, *Minnesota Solar Suitability Analysis*, available at https://solar.maps.umn.edu/index.php.

Map 3-2
Minnesota Solar Suitability Map



The southwestern portion of the state described above with the highest solar irradiance can be characterized as lightly populated rural areas with an abundance of agricultural and farmland.

The suitability for wind and solar generation combined with vast areas of land capable of accommodating new wind turbines or solar arrays makes this portion of the state ideal for future wind and solar generation. However, this generation needs to be transported from these resource rich areas in lightly populated rural areas to load centers in more populated areas, which requires a more robust transmission system than what exists today.

The existing 230 kV transmission system in eastern North Dakota and South Dakota plays a key role in transporting and delivering energy to customers in Minnesota, but the existing 230 kV system is currently at its capacity. The Project is a key component of the LRTP Tranche 1 Portfolio by providing a new 345 kV transmission line, which is designed to provide additional transmission capacity to mitigate current capacity issues on the existing 230 kV transmission system and to improve electric system reliability as more renewable energy resources are added throughout the region.

3.3.3.2 MISO Interconnection Queue

While there is tremendous potential for future expansion of renewable generation in the region, it is currently challenging to interconnect new renewable resources onto the high voltage transmission system due in large part to significant constraints in the region. MISO's generator interconnection process is designed to allow generators non-discriminatory access to the electric transmission system and to ensure system reliability is maintained during certain operating conditions. MISO currently has one study cycle per year in which new generator requests are grouped into a common study group. MISO is currently running several interconnection studies for subsequent queue cycles in parallel in an attempt to address the backlog currently present in their generator interconnection process. Once a developer submits an application for a new generation project into MISO's Generator Interconnection Queue, their request enters MISO's queue on a first-ready, first-served basis. Once a developer gains preliminary information through either a feasibility study or the System Planning and Analysis (SPA) phase, the developer typically proceeds to the Definitive Planning Process (DPP) phase during which time MISO undertakes more detailed generation interconnection studies for their specific generation project(s).

In 2022, there were a record 956 interconnection requests during the application period, representing approximately 171 GW of new generation across the MISO footprint, with the vast majority of new generation requests comprised of wind and solar projects. By comparison, queue applications in the 2021 application period included 487 interconnection requests totaling 77 GW. **Table 3-1** below shows the nameplate capacity of the interconnection requests entering the DPP phase in the MISO footprint and the MISO West region, which primarily includes Minnesota, North Dakota and South Dakota.

Table 3-1
MISO DPP Cycle 22 Projects by Category

MISO DPP Cycle 22 (956 Projects)						
Fuel	Solar	Wind	Storage	Hybrid	Natural Gas	Other
GW	83.7	13.9	32.3	34.3	5	1.6
MISO DPP Cycle 22 West (136 Projects)						
Fuel	Solar	Wind	Storage	Hybrid	Natural Gas	Other
GW	6.8	8.2	6.5	2.2	1.7	0

The number of interconnection requests received for the 2022 DPP cycle exceeded the previous all-time high of interconnection requests in a single DPP cycle for the third year in a row. The volume of requests reflects an acceleration of the resource transition in the Midwest to include a larger percentage of renewables, a trend that was studied extensively in MISO's Renewable Integration Impact Assessment (RIIA).[29] Given the substantial volume of generation capacity currently in MISO's interconnection queue requesting study and interconnection approval, it is evident that the resource mix in the MISO region will include more renewables in the future.

The existing high voltage transmission system does not have sufficient capacity to interconnect new generation projects without substantial upgrades. Thus, the generation interconnection studies continue to indicate there will be costly upgrades assigned to new generators requesting to interconnect. For example, in the MISO West 2021 DPP cycle, the approximately 66 generation projects with a combined nameplate rating of 10534.4 MW were assigned approximately $1.6 billion in transmission upgrades (including Affected System Upgrades), if all of these generation projects were to interconnect to the transmission system.[30] This level of expense for transmission

[29] The full RIIA report is available at: https://www.misoenergy.org/planning/policy-studies/Renewable-integration-impact-assessment/.

[30] A copy of the MISO DPP 2021 West Area Phase 1 Study (Aug. 30, 2023) is available at: https://cdn.misoenergy.org/GI-DPP-2021-West_Phase-1_SIS-Study-Results_FINAL_20230905%20-%20PUBLIC630260.pdf.

system upgrade requirements can sometimes render new generation projects uneconomic, forcing the developer to withdraw its new generation project from MISO's generator interconnection queue. This withdrawal then causes MISO to perform additional studies of the remaining projects in that same DPP cycle (and subsequent DPP cycles) to determine how the withdrawal of a generation project impacts the cost of transmission upgrades for the remaining generation projects in the same DPP cycle (and the subsequent DPP cycles).

3.3.3.3 Congestion Issues

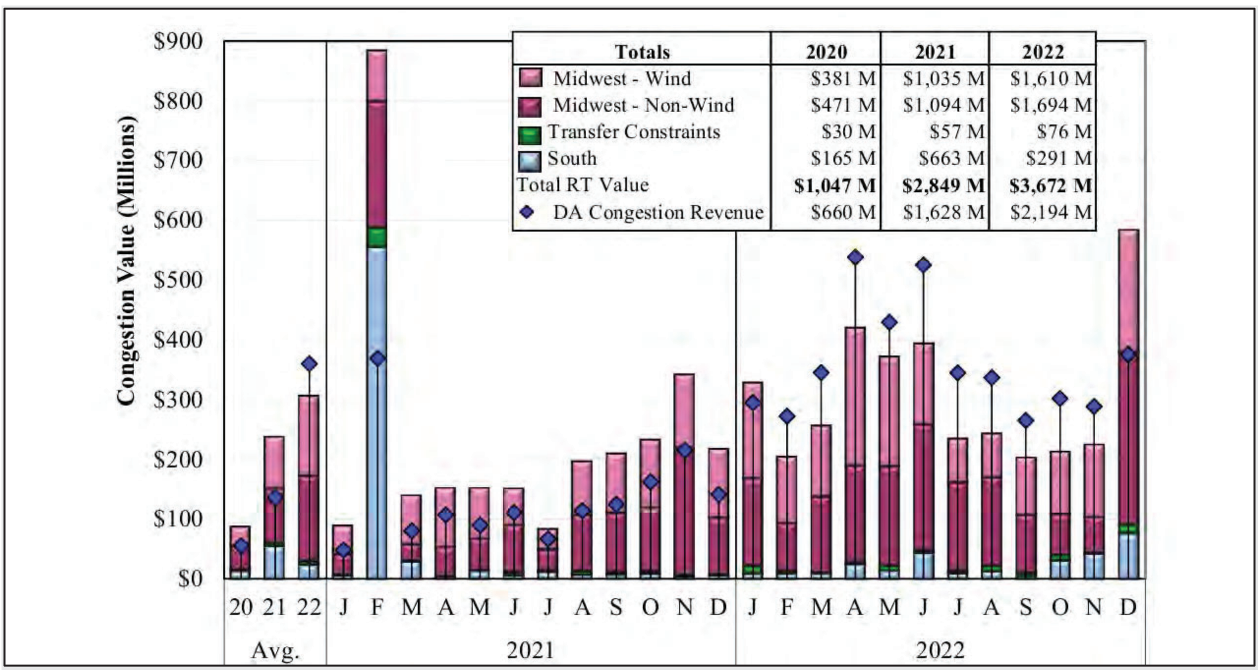
Transmission congestion costs arise on the MISO network when a higher-cost generation resource is dispatched in place of a lower-cost one to avoid a reliability issue, such as overloading a transmission facility. Congestion costs are reflected in MISO's location-specific energy prices, which represent the marginal costs of serving load at each location on the transmission system. The energy price at each location is comprised of the marginal energy costs, network congestion costs, and losses.

Congestion on the transmission system has been increasing in the past several years due to the increased amount of new generation being added to the transmission system without an equivalent amount of new transmission capacity. One issue contributing to increased congestion costs is how MISO is dispatching existing and prior-queued generation projects when they add new generation projects to the models during their interconnection studies. In short, MISO is dispatching the new generation to 100% nameplate rating while existing and prior-queued generation located nearby is dispatched down to offset the new generation. This study assumption has resulted in significant amounts of new generation being added to the system without adding enough new transmission capacity to accommodate the full amount of new generation being added on the transmission system plus the existing and prior-queued generation on the transmission system. This study assumption leads to congestion on the transmission system because there is not adequate transmission capacity to accommodate all of the generation on the transmission system.

Congestion leads to higher energy costs for Minnesota customers because more expensive generation must be dispatched when congestion occurs on the high-voltage transmission system. **Figure 3-2** below shows the monthly real-time congestion value over the past two years across the MISO footprint. Based on trends since 2020, the cost of real-time congestion continued to rise significantly in 2022 to total $3.7 billion across the MISO footprint. This increase in congestion was driven by increasing wind output without the addition of sufficient transmission capacity. Extreme weather events, like Winter Storm Elliot, also contributed to higher congestion costs during 2021.

Figure 3-2[31]

Monthly Congestion Values from 2020-2022 across MISO Footprint



The Project will play a key role in providing additional transmission capacity to reduce the severity of these current congestion issues.

3.3.3.4 Summary

The evolving energy landscape and ongoing changes to Minnesota's generation portfolio will require increasing the capacity of the existing high voltage transmission

[31] *2022 State of the Market Report for the MISO Electricity Markets* at 57, Independent Market Monitor for MISO (June 15, 2023) available at: https://www.potomaceconomics.com/wp-content/uploads/2023/06/2022-MISO-SOM_Report_Body-Final.pdf.

system in the region to ensure that existing generation and new generation projects can be efficiently and economically delivered to load centers. The next chapter discusses MISO's LRTP study that considered the changing energy landscape, reflecting upon the insights gained from MISO's Renewable Integration Impact Assessment that ultimately culminated in the identification of the Project as part of MISO's LRTP Tranche 1 Portfolio.

4. NEED ANALYSIS

4.1 Summary of Need Analysis

This Project is a key component of MISO's LRTP Tranche 1 Portfolio of 18 transmission projects. Overall, the LRTP Tranche 1 Portfolio is needed to address thermal and voltage reliability issues across the MISO transmission system to ensure that it can continue to reliably deliver energy to customers as aging coal-fired generators are retired and replaced with renewable resources. In addition to providing more reliable and resilient energy delivery, the LRTP Tranche 1 Portfolio will also provide congestion and fuel savings, avoid resource and transmission investment, improve transfer capability, avoid the risk of load shedding, and enable a reduction in carbon-dioxide (CO_2 or carbon) emissions by supporting a higher penetration of renewable resources. Overall, MISO concluded that the entire LRTP Tranche 1 Portfolio is expected to provide $23.2 billion in net economic savings over the first 20 years of service or more than two times the cost of the portfolio ($10.3 billion).

While the LRTP Tranche 1 Portfolio was developed as a collection of 18 projects that are designed to work together, each project was also individually studied and justified by MISO as a portfolio. As discussed, this Project is the Minnesota portion of the LRTP4 project. This Project, along with LRTP5 and LRTP6, is needed to provide transmission outlets for renewable energy in Minnesota and North and South Dakota. Southern Minnesota is a nexus between the significant renewable generation resources in Minnesota and North and South Dakota, the regional load center of the Twin Cities and load centers further east in Wisconsin. As discussed in Chapter 3, the electric system is undergoing a transition as aging fossil-fueled baseload generation is retired and new renewable generation is being added to the system. As more renewable generation is put on the system, there is a need for additional transmission capacity to deliver this renewable energy to load centers. This Project, along with LRTP5 and LRTP6, provide this additional capacity and relieve transmission constraints in the Twin Cities metro area that is due to the transfer of renewable energy toward and past the Twin Cities. These projects also strengthen existing generation outlet towards load centers in Wisconsin and areas to the south. Additionally, benefits include reduced congestion, reduced thermal loading, and improved transfer voltage stability.

As part of its analysis in MTEP21, MISO concluded that this Project relieves 39 transmission elements with excessive thermal loading when one transmission element is out of service (N-1 contingency) and relieves 96 transmission elements with excessive loading when one or more transmission elements are out of service (N-1-1 contingency).

In addition to meeting system reliability needs, the Project will also provide economic benefits to help offset its costs. Xcel Energy conducted additional economic analysis of the Project and determined that the Project will provide up to $2.1 billion in economic savings across the MISO footprint over the first 20 years that the Project is in service and up to $3.8 billion in economic savings across the MISO footprint over the first 40 years. These economic savings will help offset the capital cost of the Project.

Xcel Energy also analyzed the carbon reduction benefits of the Project. MISO's analysis demonstrated the implementation of the LRTP Tranche 1 Portfolio is estimated to reduce carbon emissions by 399 million metric tons over the first 20 years and 677 million metric tons over the first 40 years of LRTP Tranche 1 project life.[32] Xcel Energy estimated that this Project will reduce carbon emissions by 197.9 million metric tons over the first 20 years that the Project is in service and by 295.5 million metric tons over the first 40 years that the Project is in service. These values were calculated using the PROMOD MTEP 21 LRTP Reference Model.

This Project has been extensively studied by both MISO and Xcel Energy and this chapter summarizes this study work.

4.2 MISO's Analysis of Need for the Project

The Project is part of MISO's LRTP Tranche 1 Portfolio, a portfolio of 18 regionally beneficial transmission projects identified by MISO and approved by the MISO Board of Directors in July 2022. This section provides background on MISO's role in planning the regional transmission grid, the reliability implications of the Midwest's changing generation fleet, and MISO's LRTP study process. This section also includes a detailed discussion of MISO's analysis and justification of the LRTP Tranche 1 Portfolio,

[32] **Appendix G-1** at 79 (MTEP21 Report Addendum).

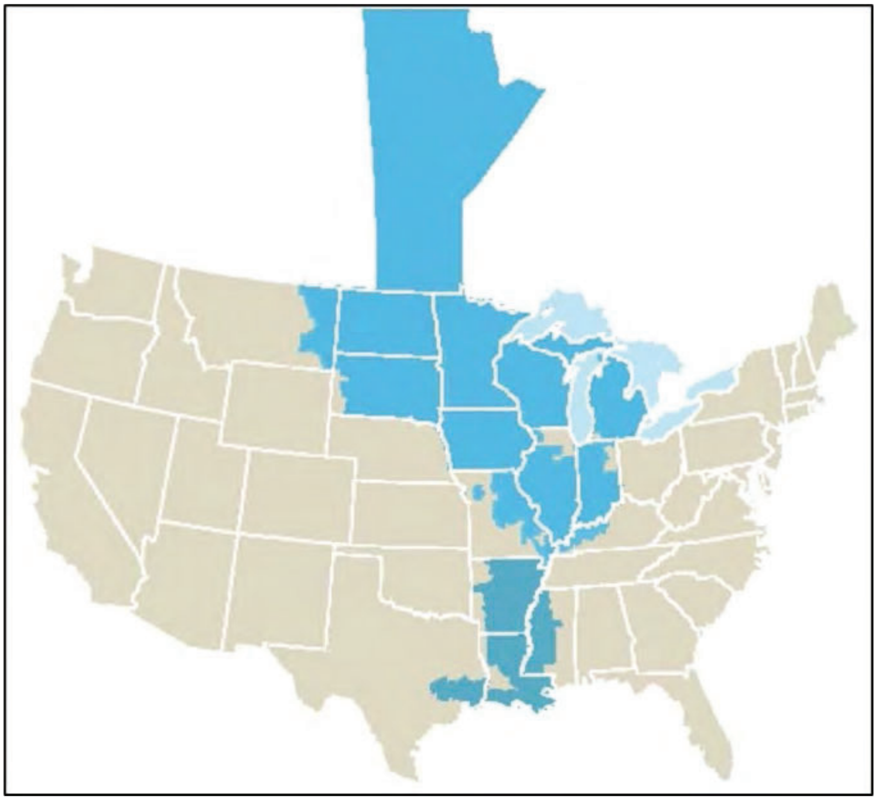
including its specific evaluation of the Project. Additional details on MISO's analysis and justification for the Project can be found in **Appendix G-1** which is MISO's MTEP21 Report Addendum that discusses the need for the LRTP Tranche 1 Portfolio and how MISO analyzed and evaluated these transmission projects.

4.2.1 MISO Overview

MISO is an independent not-for-profit regional transmission organization (RTO) which operates the transmission system and energy market in parts of 15 states and the Canadian province of Manitoba. As an RTO, MISO is responsible for planning and operating the transmission system within its footprint in a reliable manner. MISO also provides operational oversight and control, market operations, and oversees planning of the transmission systems of its member Transmission Owners (TOs). MISO has 57 TO members, including Xcel Energy, with more than 68,000 miles of transmission lines under MISO's functional control.[33] MISO members also include 135 non-TOs such as independent power producers and exempt wholesale generators, municipals, cooperatives, transmission dependent electric utilities, and power marketers and brokers. A map of MISO's geographic footprint is provided in **Map 4-1** below.

[33] Information from MISO fact sheet as of March 2023 available at: https://www.misoenergy.org/about/media-center/corporate-fact-sheet/.

Map 4-1
MISO's Reliability Footprint



4.2.2 MISO's Transmission Planning Process

MISO has a responsibility, established by the Federal Energy Regulatory Commission (FERC), to study the transmission system within its footprint to identify necessary transmission projects to address reliability issues. This study includes the development of the MISO MTEP in collaboration with TOs and other stakeholders. The MTEP is developed each year in an 18-month overlapping cycle of model building, stakeholder input, reliability analysis, economic analysis, resource assessments, and drafting of the MTEP report. MISO adheres to the planning principles outlined in FERC Order Nos. 890 and 1000 in developing the MTEP. These FERC Orders require an open and transparent regional transmission planning process and include the requirement to plan for public policy objectives and for coordinated inter-regional planning and cost allocation. Each MTEP cycle, MISO undergoes a rigorous, open, and transparent stakeholder process that offers numerous opportunities for advice and input from a diverse stakeholder community, which includes utilities, state regulators, and public interest organizations including environmental and consumer groups.

4.2.3 MISO Energy Landscape Transformation

Like Minnesota, the MISO footprint is experiencing a fundamental change in the energy industry landscape – including shifts in generation resources, consumer demand for low-carbon resources, and decentralization of generation. MISO predicts as much industry change in the next five years as happened in the past 35 years. In 2001, generation across MISO was largely provided by coal generation and some natural gas, and customer demand was the largest source of day-to-day operating variation. In 2022, coal generation shrunk to approximately one-third of MISO's annual energy production and annual energy from wind and solar generation rose to 17 percent. Since 2001, over 40 GW of renewable resources have been installed across MISO.

Driven by a combination of state and federal policy, including Minnesota's carbon free by 2040 legislation,[34] customer preferences, economics, and utility goals, the retirement of legacy fossil fuel generators and the replacement with largely geographically dispersed wind and solar units is expected to continue and accelerate across the MISO footprint over the foreseeable future.

As an additional indicator of the regional energy transformation, in 2022 the MISO Generator Interconnection Queue set another record with 956 requests representing approximately 171 GW of new generation across the MISO footprint – 164 GW (or 96%) of which were renewable or storage from new generators – wanting to be built and to interconnect to the MISO transmission grid.[35] Of this 171 GW of new generation, approximately 8 GW is requested to interconnect to the transmission system in Minnesota. By November 2023, the MISO Generator Interconnection Queue had grown to 1,317 requests representing approximately 228.05 GW of new generation across the MISO footprint.[36] The capacity associated with these new generation requests is significantly more than MISO's peak demand. Historically only a fraction of

[34] Minn. Stat. § 216B.1691, subd. 2g.

[35] https://www.misoenergy.org/meet-miso/media-center/2022/misos-generator-interconnection-queue-cycle-set-new-record/.

[36] https://cdn.misoenergy.org/GIQ%20Web%20Overview272899.pdf.

queued generation comes to fruition; however, additional generation interconnection requests are also made each year.

4.2.4 MISO Futures Development and Transmission Planning

As transmission grid expansions are long-term decisions, forecasts of the future generation mix and energy usage are necessary to plan the grid. As part of each MTEP cycle, MISO and its stakeholders engage in a robust process to develop a range of forward-looking scenarios, or Futures, which forecast multiple paths and timelines for states and utilities to meet their energy goals. The Futures are designed to "bookend" the potential range of future economic and policy outcomes, ensuring that the actual future is within the range of the Futures. These Futures, which envision system conditions 20 years into the future, are then used to assess and identify transmission needed to deliver the necessary energy reliably and efficiently from generation resources to customers.

In MTEP21, MISO developed three Futures. These three Futures incorporate varying assumptions about utility and state goals, retirements, distributed energy resources (DER) adoption, and electrification, among other factors. All of the MTEP21 Futures assume changes announced through September 2020 in utility Integrated Resource Plans (IRPs) (resource plans for upwards of 10-15 years into the future) are included in the MTEP21 Futures. A summary of the key assumptions for each MTEP21 Future is shown in **Figure 4-1** and **Figure 4-2**.

Figure 4-1
MTEP21 Futures Generation Assumptions[37]

[37] **Appendix E-3** at 3 (MISO Futures Report).

Figure 4-2
MTEP21 Futures Assumptions[38]

Future I	Future 2	Future 3
• The footprint develops in line with 100% of utility IRPs and 85% of utility announcements, state mandates, goals, or preferences • Emissions decline as an outcome of utility plans • Load growth consistent with current loads	• Companies/states meet their goals, mandates and announcements • Changing federal and state policies support footprint-wide carbon emissions reduction of 60% by 2040 • Energy increases 30% footprint-wide by 2040 driven by electrification	• Changing federal and state policies support footprint-wide carbon emissions reduction of 80% by 2040 • Increased electrification drives a footprint-wide 50% increase in energy by 2040

The magnitude of change considered in these three MTEP21 Futures is transformational. Future 1 alone, the "least transformational" of the MTEP21 Futures because it assumes only 85 percent of state decarbonization goals as of 2020 are met, anticipates 121 GW of resource additions[39] – roughly a 30 percent MISO-wide renewable penetration.

Given that Future 1 is the "least transformational" – in other words, the most conservative – of the MTEP21 Futures, MISO based its Long-Range Transmission Plan analyses for the LRTP Tranche 1 Portfolio on Future 1. This is because any benefits of transmission lines that are demonstrated under the Future 1 assumptions can be assumed to increase under Future 2 and Future 3, which both assume higher levels of decarbonization and renewable penetration, and higher load growth driven by increased electrification.

To understand the implications of the increased renewable penetrations, in 2021 MISO released a study called the Renewable Integration Impact Assessment (RIIA).[40] The RIIA found that up to 30 percent renewable penetration is manageable with incremental transmission; however, managing the system beyond 30 percent of system-wide

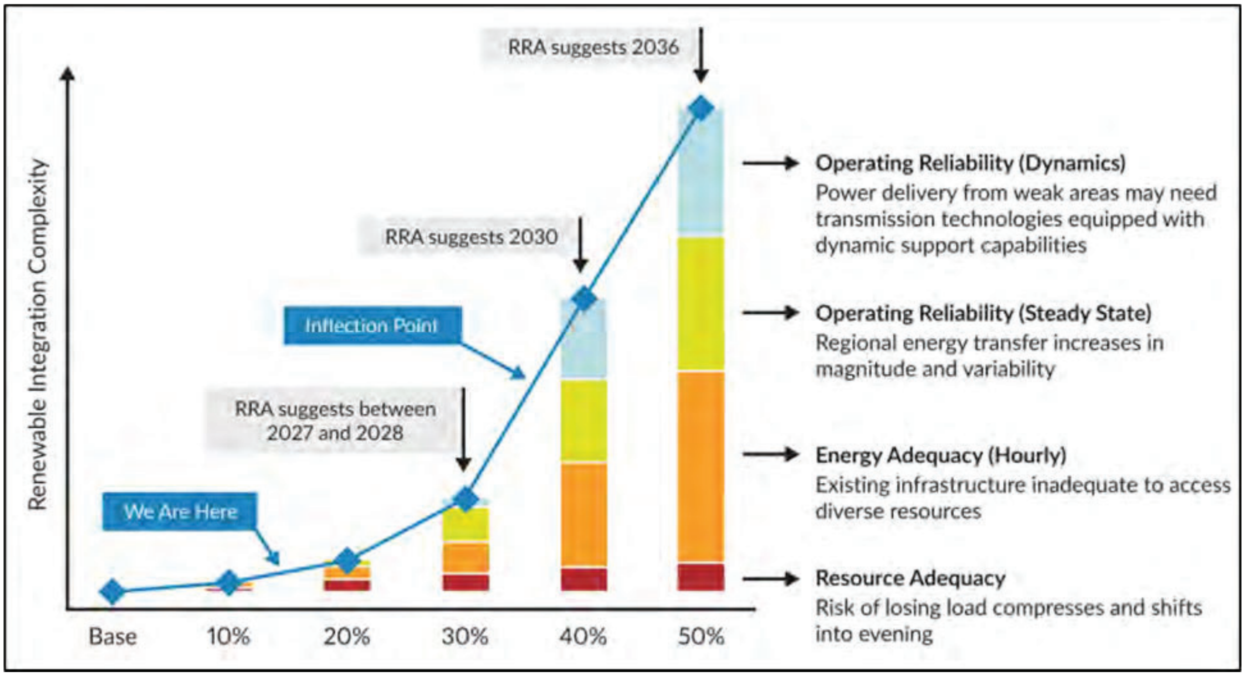
[38] **Appendix G-1** at 26 (MTEP21 Report Addendum).

[39] For reference MISO's total system market capacity as of March 2023 is 190 GW.

[40] The full RIIA report is available at: https://www.misoenergy.org/planning/policy-studies/Renewable-integration-impact-assessment/.

renewable penetration will require transformational change in planning, markets, and operations, as shown in **Figure 4-3**.

Figure 4-3
Reliability Implications of Increasing Renewable Penetrations[41]



In 2022, MISO achieved a 19 percent renewable (wind, solar, and hydro) penetration throughout its footprint with many areas of MISO already experiencing more than 40 percent of its energy being generated from renewables.[42] While incremental transmission expansion has and continues to occur, the increased challenge to efficiently maintain reliability is evident in the increased congestion levels[43] and more frequent use of MISO emergency operating procedures.[44]

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[41] MISO, 2022 Regional Resource Assessment ("RRA"), available at: https://www.misoenergy.org/planning/policy-studies/RRA/#t=10&p=0&s=FileName&sd=desc.

[42] MISO Corporate Fact Sheet – March 2023.

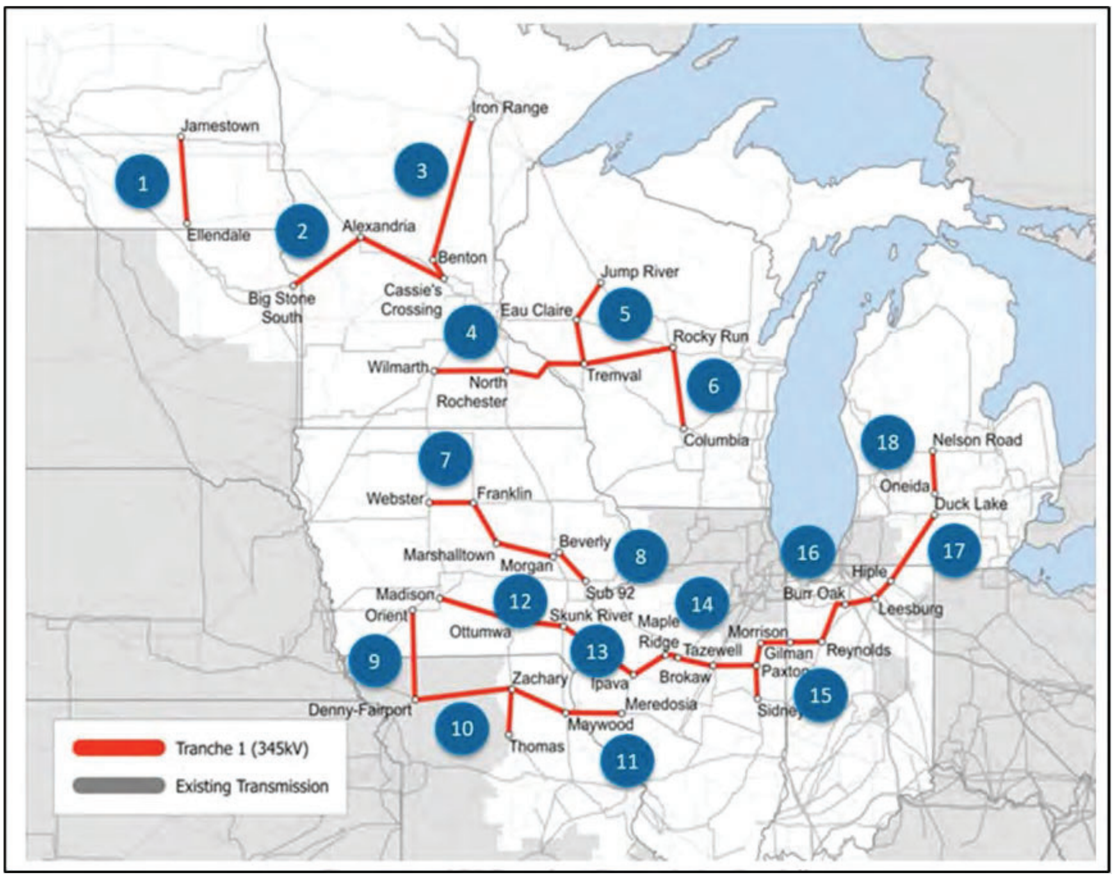
[43] Congestion trends are available via MISO's "Yearly Historical Real-Time Constraints" market reports at: https://www.misoenergy.org/markets-and-operations/real-time--market-data/market-reports/.

[44] From 2014 to 2016 MISO did not make a single emergency declaration. Since 2016, 41 emergency declarations have been required.

4.2.5 LRTP Tranche 1 Portfolio

The Project is one part of a broader regional solution to maintain reliability in the most cost-effective manner. In July 2022, MISO approved the first phase or "tranche" of the LRTP. The MISO LRTP Tranche 1 Portfolio consists of 18 transmission projects, including the Project, identified in **Map 4-2** as project number two. The MISO LRTP Tranche 1 Portfolio includes approximately 2,000 miles of new and upgraded high voltage transmission equaling approximately $10 billion in investment, to enhance connectivity and maintain reliability for the Midwest by 2030 and beyond.

Map 4-2
MISO LRTP Tranche 1 Portfolio



The LRTP Tranche 1 Portfolio is needed to:

- Address reliability violations as defined by the North American Electric Reliability Corporation (NERC) at over 300 different sites across the

Midwest. In addition, increase transfer capability across the MISO Midwest subregion to allow reliability to be maintained for all hours under varying dispatch patterns driven by differences in weather conditions.

- Provide $23.2 billion to $52.2 billion in net economic savings over the first twenty to forty years (respectively) of the LRTP Tranche 1 Portfolio being in-service, which results in a benefit to cost ratio range of 2.6 to 3.8. This means MISO estimates the economic savings provided by the LRTP Tranche 1 Portfolio will more than pay for the costs of the portfolio over the first 20 years of service.
- Enable the reliable interconnection of approximately 43,431 MW of new, primarily renewable, generation capacity across the MISO Midwest subregion, 8,339 MW of which is in Minnesota and the surrounding region.

In the identification of the LRTP Tranche 1 Portfolio MISO considered multiple alternatives both to each of the eighteen individual projects and to the aggregate portfolio. The LRTP Tranche 1 Portfolio was developed through a robust, open, and transparent stakeholder process. The LRTP Tranche 1 Portfolio is the culmination of over 200 stakeholder meetings between 2020 and 2022. The average attendance at each of these stakeholder meetings was between 200 – 300 people.[45] A copy of MISO's MTEP21 Report Addendum can be found in **Appendix G-1**.

4.2.5.1 LRTP Tranche 1 Portfolio Reliability Need

MISO identified that the MISO LRTP Tranche 1 Portfolio is needed to prevent numerous thermal and voltage reliability issues – summarized in **Table 4-1** below. The MISO LRTP Tranche 1 Portfolio is needed to ensure the MISO transmission grid can continue to reliably deliver energy from future generation resources to load under a range of projected system conditions associated with the Future 1 scenario in the 10-year and 20-year time horizon.

[45] **Appendix G-1** at 9 (MTEP21 Report Addendum).

Table 4-1
LRTP Tranche 1 Portfolio Reliability Need Summary

LRTP Project ID(s)[46]	Summary of Reliability Need
LRTP 1 & 2	Relieves 40 elements with excessive thermal loading for N-1 contingencies and 70 elements with excessive loading for N-1-1 contingencies
LRTP 3	Relieves 15 elements with excessive thermal loading for N-1 contingencies and 25 elements with excessive loading for N-1-1 contingencies
LRTP 4, 5, and 6 **Proposed Project: MN portion of LRTP4**	Relieves 39 elements with N-1 heavy loading and severe overloads in MN and WI and 96 elements for N-1-1 contingencies
LRTP 7 and 8	Relieves 21 elements with N-1 heavy thermal loading and severe overloads in Iowa and 34 elements for N-1-1 contingencies
LRTP 9, 10, and 11	Mitigates heavy loading and severe overloads on 19 elements for N-1 and N-1-1 contingencies
LRTP 12 through 18	Addresses 600 thermal reliability violations at 77 different sites.

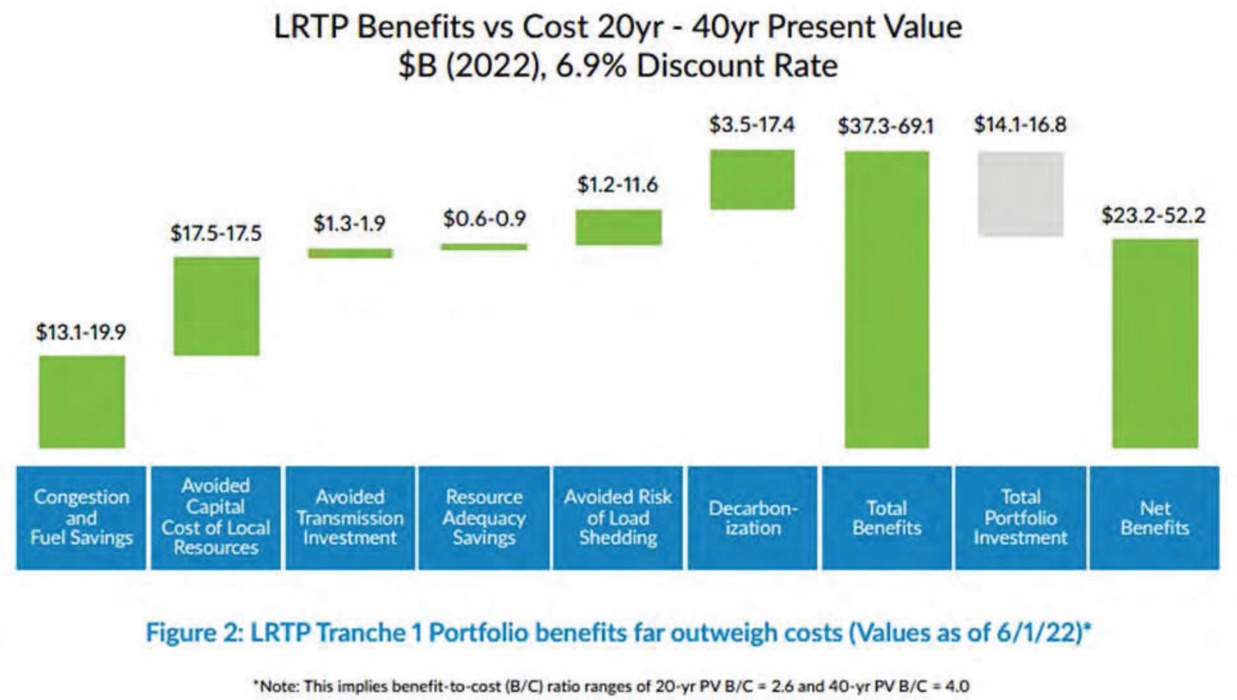
4.2.5.2 LRTP Tranche 1 Portfolio Economic Need

While the LRTP Tranche 1 Portfolio was designed by MISO to primarily address reliability issues, MISO also optimized it to provide economic benefits to help offset the capital costs of the portfolio. As shown in **Figure 4-4**, MISO projects that the MISO LRTP Tranche 1 Portfolio will provide $23.2 billion to $52.2 billion in net economic savings over the first 20 to 40 years (respectively) of the portfolio being in-service – a benefit to cost ratio range of 2.6 to 3.8.[47] This means MISO projects the LRTP Tranche 1 Portfolio will more than pay for itself in less than twenty years of service. MISO used six different metrics to calculate the projected economic savings of the portfolio: (1) congestion and fuel savings, (2) avoided capital cost of local resource investment, (3) avoided transmission investment, (4) resource adequacy savings, (5) avoided risk of load shedding, and (6) reduced carbon emissions. Additional details on the definition and valuation of each of MISO's six benefit metrics can be found in **Appendix G-1**.

[46] LRTP Tranche 1 Project IDs reference **Map 4-2**.

[47] The 2.6 to 3.8 benefit to cost ratio is for the entire MISO Midwest subregion. MISO projects that Minnesota and the surrounding region ("MISO Cost Allocation Zone 1") will realize a 2.8 to 4.0 benefit to cost ratio – slightly better than the broader MISO Midwest subregion.

Figure 4-4
LRTP Tranche 1 Economic Benefits[48]



4.2.5.3 LRTP Tranche 1 Portfolio Enabled Generation

MISO's analysis shows the LRTP Tranche 1 Portfolio accommodates the reliable interconnection of approximately 43,431 MW of new generation needed to serve the forecasted customer demand and replace energy currently provided by retiring fossil-fuel generation with newer lower carbon emitting generation resources – primarily renewable generation.[49] Of the capacity enabled by the LRTP Tranche 1 Portfolio, 8,339 MW is in Minnesota and the surrounding region (MISO Local Resource Zone 1 or LRZ1). The generation enabled by the LRTP Tranche 1 Portfolio is expected to reduce carbon-dioxide emissions by upwards of 20 million metric tons annually across the MISO footprint or 399 million metric tons over the first 20 years of the LRTP Tranche 1 Portfolio being in-service and 677 million metric tons over the first 40 years

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[48] **Appendix G-1** at 4 (MTEP21 Report Addendum).

[49] **Appendix G-1** at 66 (MTEP21 Report Addendum).

of service.[50] Using the Minnesota Public Utilities Commission's valuation of carbon-dioxide emission reduction of $12.55/metric ton[51] the LRTP Tranche 1 Portfolio is expected result in $3.5 billion to $4.8 billion in carbon reduction benefits across the MISO footprint over the first 20 years that the LRTP Tranche 1 Portfolio is in service.[52]

4.2.5.4 LRTP Tranche 1 Portfolio Transfer Capability

MISO found that the LRTP Tranche 1 Portfolio is needed to increase the transfer capability across the MISO footprint. As the generation fleet transitions to more wind and solar generation resources whose output is dependent on weather conditions, the ability to transfer energy across the MISO system is critical to serving demand when wind or solar are not available in a particular area. As weather patterns regularly change, the MISO Tranche 1 Portfolio provides flexibility to transfer more energy where it is needed and when. In addition, the increased transfer capability provided by the LRTP Tranche 1 Portfolio enables more geographic diversity which allows grid operators to better manage generation dispatch volatility and uncertainty.

4.2.5.5 LRTP Tranche 1 Portfolio Other Qualitative Benefits

The LRTP Tranche 1 Portfolio also provides multiple other qualitative benefits. MISO expects the addition of the Tranche 1 Portfolio to increase the operational flexibility to better allow timely outage scheduling to maintain the reliability of the system and to reduce the economic impacts due to congestion caused by outages.[53] The operational flexibility also helps reduce the economic impacts of natural gas fuel price changes by providing access to a broader pool of generation resources.

The LRTP Tranche 1 Portfolio also gives more flexibility to better support diverse policy needs. The proactive long-range approach to planning of regional transmission provides regulators greater confidence in achieving their policy goals by reducing

[50] **Appendix G-1** at 79 (MTEP21 Report Addendum).

[51] **Appendix G-1** at 79 (MTEP21 Report Addendum). The Commission recently updated its cost of future carbon-dioxide regulation for 2023-2024 in Docket No. E999/CI-07-1199 but a written order is currently pending.

[52] **Appendix G-1** at 80 (MTEP21 Report Addendum).

[53] **Appendix G-2** at 48 (LRTP Tranche 1 Portfolio Detailed Business Case).

uncertainty around the future resource expansion plans. Elimination of much of the high transmission cost barriers allows resource planners to assume less risk in making resource investment decisions.

4.2.6 MISO's Summary of Need for the Project

The MISO LRTP Tranche 1 Portfolio was developed as a portfolio of projects designed to work together; however, each of the 18 projects in the MISO LRTP Tranche 1 Portfolio was also individually justified by MISO based on regional and local needs. MISO identified that the Project is a critical component of the LRTP Tranche 1 Portfolio and also the most effective option to maintain regional reliability in southern Minnesota. MISO summarized the need for LRTP4, along with LRTP5 (Tremval – Eau Claire – Jump River) and LRTP6 (Tremval – Rocky Run – Columbia) (collectively, the Minnesota – Wisconsin projects) as follows:

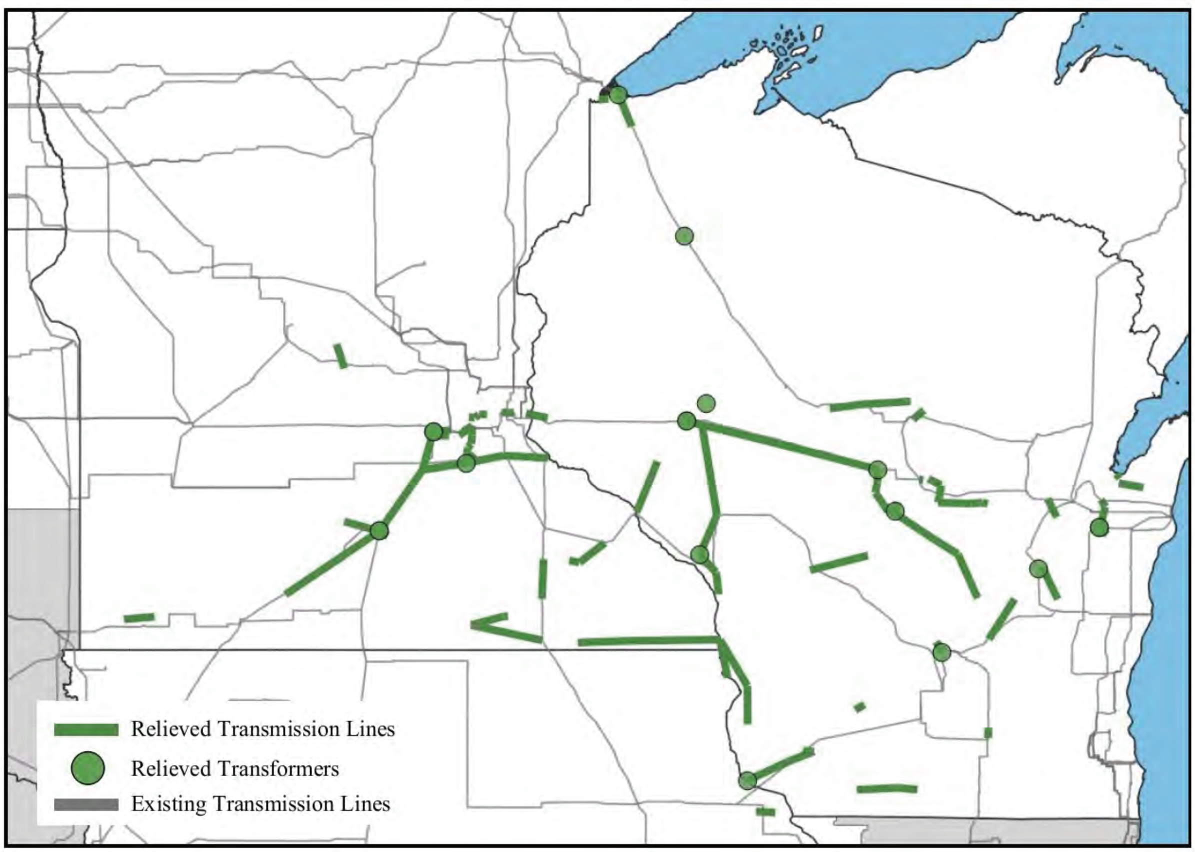
> The transmission system in southern Minnesota is a nexus between significant wind and renewable resources in Minnesota and North and South Dakota, the regional load center of the Twin Cities, and transmission outlets to the East and South. In a future with significant renewable energy growth, MISO sees strong flows West to East across Minnesota to Wisconsin and a need for outlet for those renewables in times of high availability to deliver that energy to load centers in MISO. The Minnesota to Wisconsin projects relieve constraints in the Twin Cities metro area due to high renewable flow towards and past the Twin Cities load center. The projects also reinforce the outlet towards load centers in Wisconsin, providing relief of congestion as well as easing both thermal loading and transfer voltage stability.[54]

MISO's analysis identified that the Minnesota – Wisconsin projects address a number of overload issues identified in southern Minnesota and Wisconsin as shown in **Map 4-3** below. The solid green lines in **Map 4-3** depict the transmission lines that no longer have overloads and the circles depict transformers that no longer have overloads following construction of the Minnesota – Wisconsin projects. Notably, MISO

[54] **Appendix G-1** at 44 (MTEP21 Report Addendum).

concluded that the Wilmarth to North Rochester portion of LRTP4 parallels a number of 345 kV transmission lines across southern Minnesota that are heavily loaded at times when there is high generation transfers from southwestern Minnesota and northwestern Iowa.[55] By constructing a new 345 kV transmission line between the Wilmarth and North Rochester substations, LRTP4 relieves overloads on 345 kV transmission lines and 345/115 kV transformers in this area including the Wilmarth – Shea's Lake – Helena – Chub Lake 345 kV transmission line and the 345/115 kV transformers at the Wilmarth and Scott County substations.[56]

Map 4-3
Reliability Issues Addressed by the Minnesota – Wisconsin projects[57]



[55] **Appendix G-1** at 45-46 (MTEP21 Report Addendum).

[56] **Appendix G-1** at 46 (MTEP21 Report Addendum).

[57] **Appendix G-1** at 45 (MTEP21 Report Addendum).

As shown in **Table 4-2** below, MISO determined that the Minnesota – Wisconsin projects relieved 39 overloads under N-1 contingencies[58] and 96 overloads under N-1-1 contingencies.[59]

Table 4-2
Summary of Elements Relieved by the Minnesota – Wisconsin projects in Future 1[60]

	N-1 (P1, P2, P4, P5, P7)		N-1-1 (P3, P6)	
	Count Elements	Max % Loading Pre-Project	Count Elements	Max % Loading Pre-Project
All	39	95-132%	96	95-151%
345 kV Lines	6	98-119%	9	97-120%
345/xx kV Transformers	9	97-132%	12	95-132%

In its analysis of the Minnesota – Wisconsin projects, MISO considered one alternative to the entire LRTP4 project:[61]

- **Alternative 1:** A new Wilmarth – North Rochester – Tremval – Eau Claire – Jump River 345 kV transmission line, a rebuild of the existing Adams – North Rochester 345 kV transmission line to a double-circuit 345/345 kV transmission line, and a new Colby – Adams 345 kV transmission line;

MISO also analyzed two alternatives to the Wilmarth – North Rochester portion of LRTP4 (i.e., Segments 1 and 2):

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[58] An N-1 contingency is an event that involves the loss of a single generator or transmission component. An N-1-1 contingency is an event that involves the initial loss of a single generator or transmission component, followed by system adjustments, and then another loss of a single generator or transmission component.

[59] MISO considered a constraint relieved if its worse pre-project loading was greater than 95% of its monitored Emergency rating, its worst pre-project loading was less than 100% of its monitored Emergency rating, and the worst loading decreased by greater than 5% following the addition of the project.

[60] **Appendix G-1** at 45 (MTEP21 Report Addendum).

[61] MISO also examined alternatives that were specific to the Wisconsin portion of these projects. MISO's analysis related to these Wisconsin alternatives is provided in **Appendix G-1** at 49-50 (MTEP21 Report Addendum).

- **Alternative 2a:** A new Huntley – Pleasant Valley 345 kV transmission line, a rebuild of Pleasant Valley – North Rochester 345 kV transmission line to a double circuit 345/345 kV transmission line; and
- **Alternative 2b:** A new Colby – Adams 345 kV transmission line.

MISO analyzed one alternative to the North Rochester to Tremval portion of LRTP4 (Segments 3 and 4 and Wisconsin portion of LRTP to Tremval Substation):

- **Alternative 3:** A new Adams – Genoa – Hill Valley 345 kV transmission line.

MISO compared the performance of these alternatives to the noted portions of LRTP4 and concluded that these portions of LRTP4 performed better than these alternatives. A summary of MISO's conclusions related to each alternative is provided in **Table 4-3** below. A more detailed discussion of each of these alternatives is provided in Chapter 5.

Table 4-3
Summary of MISO's Alternatives Conclusion[62]

MISO Alternative	MISO's Conclusion
Alternative 1: A new Wilmarth – North Rochester – Tremval – Eau Claire – Jump River 345 kV transmission line, a rebuild of the existing Adams – North Rochester 345 kV transmission line to a double-circuit 345/345 kV transmission line, and a new Colby – Adams 345 kV transmission line;	"MISO found that the Wilmarth – North Rochester segment was important for resolving Twin Cities area loading, and that the river crossing from North Rochester to Tremval and then Tremval to elsewhere in Northern Wisconsin was effective at both relieving loading across Western Wisconsin and boosting the effectiveness of Wilmarth – North Rochester by providing an outlet and a shorter electrical path towards load centers. The double circuit from North Rochester to Adams directly relieved loading on parallel facilities. Colby – Adams relieved some loading associated with a large amount of future generation sited at Adams, but the effects were very localized."[63]

[62] **Appendix G-1** at 49-50 (MTEP21 Report Addendum).

[63] **Appendix G-1** at 49 (MTEP21 Report Addendum).

MISO Alternative	MISO's Conclusion
Alternative 2a: A new Huntley – Pleasant Valley 345 kV transmission line, a rebuild of Pleasant Valley – North Rochester 345 kV transmission line to a double circuit 345/345 kV transmission line	"MISO reviewed the performance of Huntley – Pleasant Valley and Colby – Adams as alternatives to the Wilmarth – North Rochester line . . . Huntley – Pleasant Valley, when combined with a double circuit rebuild between Pleasant Valley and North Rochester, resolved many but not all of the same 345 kV and 345 stepdown transformer overloads as Wilmarth – North Rochester. It also showed higher adjusted production cost savings when included in PROMOD simulations. However, the difference in production cost savings was less than the difference in increased cost of Huntley-Pleasant Valley to North Rochester. MISO sees Huntley – Pleasant Valley as a valuable project that may be helpful in reinforcing this region in future cycles of the LRTP study."[64]
Alternative 2b: A new Colby – Adams 345 kV transmission line	"Colby – Adams by itself is not effective at reducing the West to East loading across Southern Twin Cities 345 kV facilities and shows little reliability value on its own."[65]
Alternative 3: A new Adams – Genoa – Hill Valley 345 kV transmission line	"MISO initially viewed this project as an alternative to North Rochester – Tremval – Jump River – Eau Claire. However, analysis showed these paths address different sets of reliability concerns, with the Adams – Genoa – Hill Valley project better addressing constraints across northeast Iowa and southern Wisconsin. When tied into Hill Valley, once the Hickory Creek – Hill Valley line is in service, this would effectively form an additional path parallel to Adams – Hazleton 345 kV, and relieve flows being pushed south across eastern Iowa. MISO is prioritizing a northern path (North Rochester – Tremval) in order to address the voltage stability interface and tie into load centers. For that reason, MISO does not propose pursuing Adams – Genoa Hill

[64] **Appendix G-1** at 49 (MTEP21 Report Addendum).

[65] **Appendix G-1** at 49 (MTEP21 Report Addendum).

MISO Alternative	MISO's Conclusion
	Valley at this time, but MISO understands the project's value, especially when paired with Huntley – Pleasant Valley, to potentially reinforcing the region in future cycles of the LRTP study."[66]

Based on its evaluation, MISO determined that the Project was an important component of the overall LRTP Tranche 1 Portfolio to ensure a reliable, resilient, and cost-effective transmission system as the generation mix within the MISO footprint continues to evolve to include more renewables. The Project, along with the entire LRTP Tranche 1 Portfolio, was approved by the MISO Board of Directors in July 2022.

4.3 Xcel Energy's Analysis of Need for the Project

In addition to MISO's need analysis, Xcel Energy further examined system reliability improvements related to the Project and conducted additional economic analyses. These analyses, described in the following sections, focused on the Project under a variety of modeling assumptions to further illustrate the incremental benefits of the Project.

4.3.1 Xcel Energy's Reliability Need Analysis

As discussed in Section 4.2.6, MISO's reliability analysis concluded that construction of the Minnesota – Wisconsin projects addresses overload issues along several transmission lines and at several transformers by providing additional capacity to relieve the currently constrained transmission system in southern Minnesota.

In addition to the reliability analysis conducted by MISO, the Applicant further examined system reliability improvements yielded by the Project based on the most current assumptions on transmission topology and generation retirements and additions contained in MISO's most current transmission system model (MTEP22). As demonstrated in the following sections, the Applicant's analysis further confirms

[66] **Appendix G-1** at 49 (MTEP21 Report Addendum).

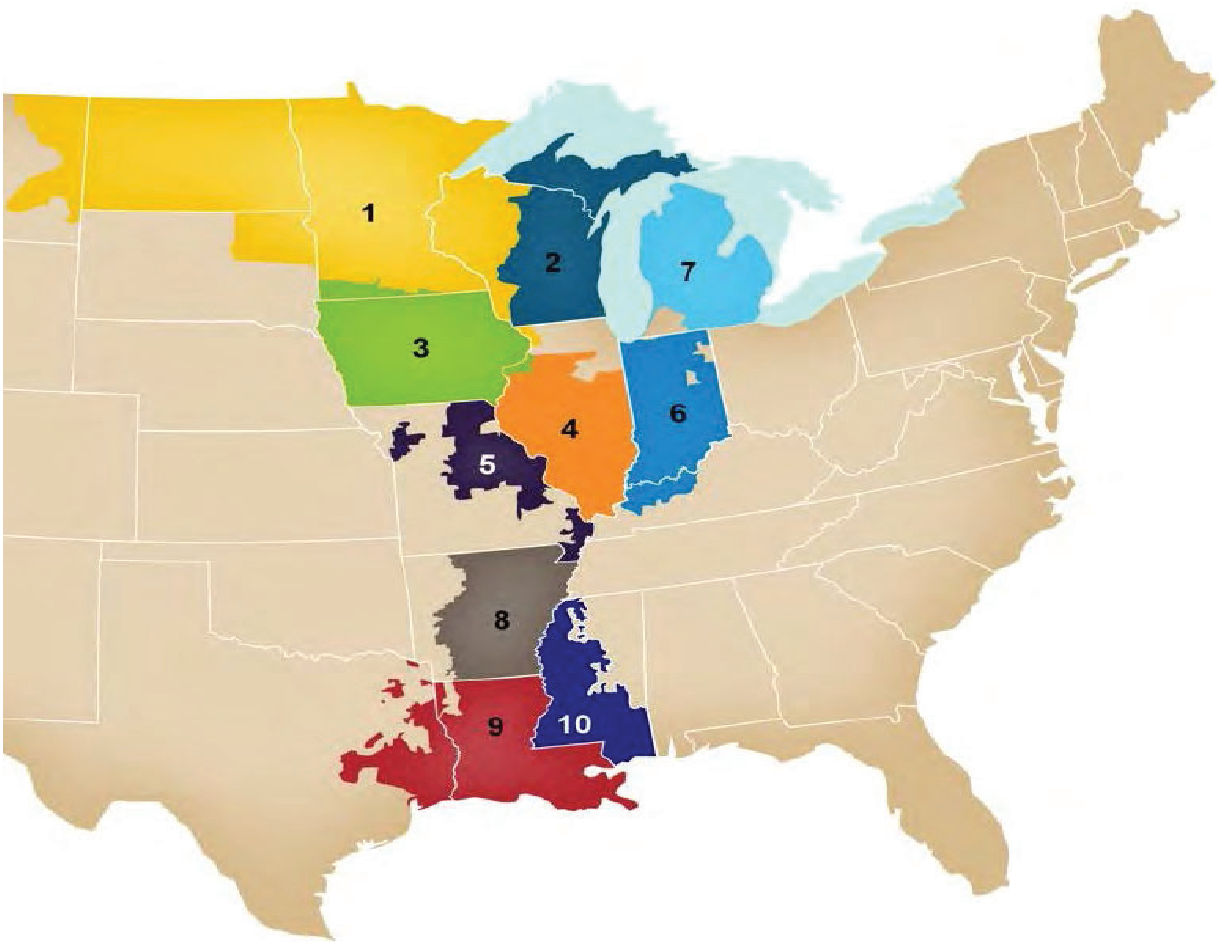
MISO's reliability analysis that the Project is needed to uphold reliability in southern Minnesota.

Xcel Energy conducted two separate analyses:

- First, Xcel Energy conducted an analysis based on the most current MISO transmission system model (MTEP22) assuming no additional generation is added to the system. This analysis looked at the year 2027, which was the most readily available MTEP model that is nearest to the Project's MISO approved in-service date (June 1, 2028), to show improvements to system reliability related to the Project. The MISO MTEP22 model reflects the current transmission system, which includes limited additional transmission facilities in-service compared to the MTEP21 model used for the LRTP Tranche 1 Portfolio analysis.
- Second, Xcel Energy conducted an analysis based on the MTEP21 Future 1 (at year 20) to show improvements to system reliability related to the Project in the future when additional generation is online.

For both analyses, Xcel Energy studied reliability in the MISO Local Resource Zone 1 (LRZ1) area and portions of Local Resource Zone 2 (LRZ2) to include the service territories for Wisconsin Energy Corporation and Wisconsin Public Service Corporation. A map showing both LRZ1 and LRZ2 is provided below.

Map 4-4
MISO Local Resource Zones



The analyses looked at transmission system performance using Summer Shoulder – High Wind models, which represent the most stressed conditions for this portion of the transmission system. The Project is designed to alleviate constraints on the existing 345 kV transmission systems in Minnesota. This system is particularly stressed under Summer Shoulder load conditions, generally defined as 70 to 80 percent of Peak Summer load, combined with high wind conditions. When there is high wind generation available without peak demand to consume that energy, considerable stress is placed on certain elements of the transmission system.

Reliability analyses studied all NERC contingency categories (P1-P7) and looked at facility overloads under a variety of transmission system modeling assumptions, including the following:

- Base Model – assuming no additional transmission projects are constructed (i.e., the current base transmission system remains in place);
- Only LRTP4 – assuming the Project is constructed, but no other LRTP Tranche 1 projects are constructed;
- All LRTP Tranche 1 projects except LRTP4 – assuming construction of all LRTP Tranche 1 projects except the Project; and
- LRTP Tranche 1 – assuming construction of all LRTP Tranche 1 projects.

While LRTP Tranche 1 is a portfolio of 18 individual projects designed to work together to provide benefits, the Applicant's reliability analyses provides an alternative way to look at the reliability improvements resulting from the Project. The results of the reliability studies are provided in the following sections and illustrate which overloads are remedied with implementation of the Project.

4.3.1.1 MTEP22 2027 – Reliability Results

The Applicant conducted an analysis for the LRZ1 and portions of LRTP4 based on the MISO MTEP22 transmission system model assuming no additional generation is added to the system. This analysis looked at the year 2027, which is nearest to MISO's approved in-service date for LRTP4, to show improvements to system reliability related to the construction of the LRTP4.

The results of this analysis are provided in **Table 4-4** below. The table lists the "Overloaded Facilities" and provides the number of different contingencies that cause thermal issues on the facility listed for each transmission model studied. The table also includes the "Fixed By LRTP4" column showing the number of thermal issues that are resolved with implementation of LRTP4.

The number of thermal issues resolved by the Project reflects issues resolved in both the "Base Model" and the "Tranche 1 Without LRTP4" model. A thermal overload was considered to be resolved by the Project if it showed up in the "Base Model" but not the "Only LRTP4" model. Similarly, a thermal overload was considered resolved by the Project if it showed up in the "Tranche 1 Without LRTP4" model but not the "All Tranche 1" model.

Table 4-4
Reliability Results
MTEP22 2027 Summer Shoulder – High Wind

Totals			MTEP Shoulder High Wind Overload Count		
Overloaded Facilities	**Area**	**Contingency Type**	**Base Model**	**Only LRTP 4**	**Fixed by LRTP 4**
Wilmarth - Sheas 345 kV Ckt 1	MN South	N-1, N-1-1	3205	0	3205
Blue Lake - Scott Co 345 kV Ckt 1	MN South	N-1, N-1-1	6412	42	6370
Helena - Scott Co 345 kV Ckt 1	MN South	N-1, N-1-1	3656	44	3612
Helena - Sheas Lake 345 kV Ckt 1	MN South	N-1, N-1-1	232	0	232
Helena - Chub Lake 345 kV Ckt 1	MN South	N-1, N-1-1	3131	0	3131
N Rochester - Byron 345 kV Ckt 1	MN South	N-1, N-1-1	419	0	419

Totals			MTEP Shoulder High Wind Overload Count		
Overloaded Facilities	**Area**	**Contingency Type**	**Tranche 1 Without LRTP 4**	**All Tranche 1**	**Fixed by LRTP 4**
Wilmarth - Sheas 345 kV Ckt 1	MN South	N-1, N-1-1	3	0	3
Blue Lake - Scott Co 345 kV Ckt 1	MN South	N-1, N-1-1	3205	0	3205
Helena - Scott Co 345 kV Ckt 1	MN South	N-1, N-1-1	3216	0	3216
Helena - Sheas Lake 345 kV Ckt 1	MN South	N-1, N-1-1	3	0	3
Helena - Chub Lake 345 kV Ckt 1	MN South	N-1, N-1-1	3	0	3
N Rochester - Byron 345 kV Ckt 1	MN South	N-1, N-1-1	346	0	346

As shown in the last column of **Table 4-4**, LRTP 4 as a standalone project has major reliability benefits on the 345 kV system in southern Minnesota. For example, the 345 kV system from Wilmarth – Sheas Lake – Helena – Scott County – Blue Lake and from North Rochester – Byron has a large number of thermal issues that are mitigated by the construction of LRTP4.

4.3.1.2 MTEP21 Future 1 Year 20 – Reliability Results

Xcel Energy conducted an analysis for the LRZ1 and portions of LRZ2 area based on the MISO MTEP21 Future 1 (at year 20) to show improvements to system reliability related to the construction of the Project in the future when additional generation is online. This analysis shows the impact that the Project has under a high wind model with the added generation that the LRTP Tranche 1 Portfolio will enable.

The results of this analysis are provided in **Table 4-5** below. The table lists the overloaded facilities and provides the number of different contingencies that cause thermal issues on the overloaded facility for each transmission model studied. The table also includes the "Fixed By LRTP4" column showing the number of thermal issues that are resolved by the Project.

The number of thermal issues resolved by the Project reflects issues resolved in both the "Base Model" and the "Tranche 1 Without LRTP4" model. A thermal overload was considered to be resolved by the Project if it showed up in the "Base Model" but not the "Only LRTP4" model. Similarly, a thermal overload was considered resolved by the Project if it showed up in the "Tranche 1 Without LRTP4" model but not the "All Tranche 1" model.

Table 4-5
Reliability Results
MTEP21 Future 1 Year 20, Summer Shoulder – High Wind

Totals			MTEP Shoulder High Wind Overload Count		
Overloaded Facilities	**Area**	**Contingency Type**	**Base Model**	**Only LRTP 4**	**Fixed by LRTP 4**
Wilmarth - Sheas Lake 345 kV Ckt 1	MN South	N-1, N-1-1	4643	0	4643
Blue Lake - Scott Co 345 kV Ckt 1	MN South	N-1, N-1-1	2646	0	2646
North Rochester - Byron 345 kV Ckt 1	MN South	N-1, N-1-1	923	839	84
Helena - Sheas Lake 345 kV Ckt 1	MN South	N-1, N-1-1	4590	0	4590
Wabaco - Alma 161 kV Ckt 1	MN South/WI	N-1	74	2	72

Totals			MTEP Shoulder High Wind Overload Count		
Overloaded Facilities	**Area**	**Contingency Type**	**Tranche 1 Without LRTP 4**	**All Tranche 1**	**Fixed by LRTP 4**
Wilmarth - Sheas Lake 345 kV Ckt 1	MN South	N-1, N-1-1	5	0	5
Blue Lake - Scott Co 345 kV Ckt 1	MN South	N-1, N-1-1	0	0	0
North Rochester - Byron 345 kV Ckt 1	MN South	N-1, N-1-1	7689	5295	2394
Helena - Sheas Lake 345 kV Ckt 1	MN South	N-1, N-1-1	4	0	4
Wabaco - Alma 161 kV Ckt 1	MN South/WI	N-1	9	2	7

The major reliability benefits of the Project can be seen on the 345 kV system in southern Minnesota. For example, the 345 kV system from Wilmarth – Sheas Lake –

Helena – Chub Lake and Blue Lake – Scott County – North Rochester has a large number of thermal issues mitigated with the addition of the Project.

4.3.2 Xcel Energy's Economic Need Analysis

As discussed in Section 4.2.5.2, the entire LRTP Tranche 1 Portfolio is expected to provide economic savings that are more than two times the cost of these transmission projects. As discussed below, the Project alone is projected to provide up to $2.1 billion in economic savings across the MISO footprint over the first 20 years that the Project is in service and up to $3.8 billion in economic savings across the MISO footprint over the first 40 years that the Project is in service. These economic savings will help offset the capital cost of the Project.

Xcel Energy conducted economic analyses using PROMOD software, short for PROduction MODeling (PROMOD), which is used to support economic transmission planning. The PROMOD software simulates the electric market on an hourly constrained-dispatch basis using models containing generation unit locations and operating characteristics, transmission grid topology, and market system operations. The PROMOD software can calculate the future cost of producing electricity, market congestion, and energy losses based on these assumptions.

The economic analysis was performed in a manner consistent with MISO's analysis of the entire LRTP Tranche 1 Portfolio but focused on identifying the economic benefits specifically for the Project. Xcel Energy conducted two economic analyses, each comparing PROMOD results under various scenarios to show the incremental benefit of Project to the entire MISO footprint and LRZ1.

The first analysis evaluated the adjusted production cost (APC) savings[67] benefit of the Project to the MISO footprint and LRZ1. The second analysis evaluated the carbon reduction benefits of the Project for the MISO footprint and LRZ1 under two different cost of carbon assumptions. Each of these three analyses is described in detail in the separate subsections below.

[67] APC savings are utilized to measure the economic benefits of proposed transmission projects. These savings are calculated as the difference in total production costs of energy for a generation fleet adjusted for import costs and export revenues with and without the proposed transmission project.

Xcel Energy's analyses used various models and assumptions to provide a robust assessment of the benefits of the Project under different potential scenarios. A summary of these three models and assumptions are as follows:

- *MISO's MTEP21 Future 1 model.* This model reflects assumed generation additions and retirements shown in **Figure 4-1**, based on the assumptions described in Section 4.2.4 above.
- *MISO's MTEP Future 1 with the addition of Xcel Energy's Upper Midwest Integrated Resource Plan (IRP) generation model.* This model includes additional generation based on Xcel Energy's 2020-2034 Upper Midwest IRP that was approved by the Minnesota Public Utilities Commission in April 2022,[68] after MISO completed the development of its Future scenarios for MTEP21. Under Xcel Energy's approved Upper Midwest IRP, which includes retirement of all Xcel Energy's remaining Upper Midwest coal plants by the end of 2030 and extension of operations at Xcel Energy's Monticello Nuclear Generating Plant to 2040, Xcel Energy will add 2,150 MW of wind and 2,500 MW of solar by 2032, with another 1,100 MW of wind and solar capacity beyond 2032. A comparison of the resource additions assumed by MISO's MTEP21 Future 1 and Xcel Energy's Upper Midwest IRP is provided below in **Table 4-6** and **Table 4-7**.

Table 4-6
Generation Additions in MISO's MTEP21 Future 1

MISO MTEP21 Future 1 Types of Generation Additions by Year (MW)					
	2025	**2030**	**2035**	**2040**	**Total**
Combined-Cycle (CC)	749.7	1,725	-	90	2,565
Combustion Turbine (CT)	-	1,725	2,568		4,293
Wind	233.7*	198*	724.45*	828.32*	-
Solar	1,442	1,213	2,914	374	5,943
					13,257

repower

[68] *In the Matter of the 2020-2034 Upper Midwest Integrated Resource Plan of Northern States Power Company d/b/a/ Xcel Energy*, Docket No. E002-19-368, Order Approving Plan with Modifications and Establishing Requirements for Future Filings (Apr. 15, 2022).

Table 4-7
Generation Additions in Xcel Energy's Approved Upper Midwest IRP

Xcel Energy's Upper Midwest IRP Types of Generation Additions by Year (MW)					
	2025	**2030**	**2035**	**2040**	**Total**
Standalone Storage	-	200	50	850	1,100
Wind	-	1,350	1,900	1,650	4,900
Solar	1,300	1,250	600	1,300	4,450
Firm Peaking	60	1,381	1,496	374	3,311
CC	-	-	-	-	-
Sherco CC	-	-	-	-	-
Demand Response (DR)	382	77	111	15	720
Energy Efficiency (EE)	781	743	493	(585)	1,433
Distributed Solar	440	75	74	72	662
					16,575

- *MISO's MTEP21 Future 2.* This model reflects assumed generation additions and retirements shown in **Figure 4-1**, based on the assumptions described in Section 4.2.4 above.

4.3.2.1 Adjusted Production Cost Savings of the Project

Xcel Energy used the PROMOD software to calculate the APC savings benefit of the Project using the MTEP21 Future 1, MTEP21 Future 1 with generation additions from Xcel Energy's approved Upper Midwest IRP, and Future 2 models. **Table 4-8** through **Table 4-10** below show the APC savings benefit, on a present value basis over 20 years and 40 years of the Project using these models. As shown in these tables, the APC savings benefit of the Project to the MISO footprint is up to $2.1 billion over the first 20 years of the Project being in-service.

In addition, the Future 1 and Future 2 models likely understate the Project's APC savings benefit because these futures do not include the generation enabled by the other LRTP Tranche 1 transmission projects. Rather, the Future 1 and Future 2 models are based on the generation additions and retirements announced in utility Integrated Resource Plans at the time the MISO MTEP21 Futures were developed in the first quarter of 2021. As a result, once the entire LRTP Tranche 1 Portfolio is constructed, the APC savings benefit of the Project will likely increase as greater amounts of lower cost renewable generation will be enabled across the entire MISO footprint.

In addition, the APC savings benefit shown in **Table 4-8** below, which is Future 1 with the generation additions from Xcel Energy's Upper Midwest IRP included, is likely a more accurate representation of the future generation mix than Future 1 which was developed before Xcel Energy's Upper Midwest IRP was approved by the Commission. Notably, the APC savings benefit under this Future is the highest among the three Future scenarios evaluated by Xcel Energy.

Table 4-8
APC Savings Benefits of LRTP4 under MTEP21 Future 1 Model

Timeline	APC Benefits	MISO	LRZ1
20 Year Present Value	APC Benefits ($Millions)	$281.3	$163.2
40 Year Present Value	APC Benefits ($Millions)	$364.3	$219.3

Table 4-9
APC Savings Benefits of LRTP4 under MTEP21 Future 1 Model With Xcel Energy's Upper Midwest IRP Generation Added

Timeline	APC Benefit	MISO	LRZ1
20 Year Present Value	APC Benefits ($Millions)	$ 2,104.2	$ 1,451.9
40 Year Present Value	APC Benefits ($Millions)	$ 3,755.8	$ 2,635.0

Table 4-10
APC Benefits of LRTP4 under MTEP21 Future 2 Model

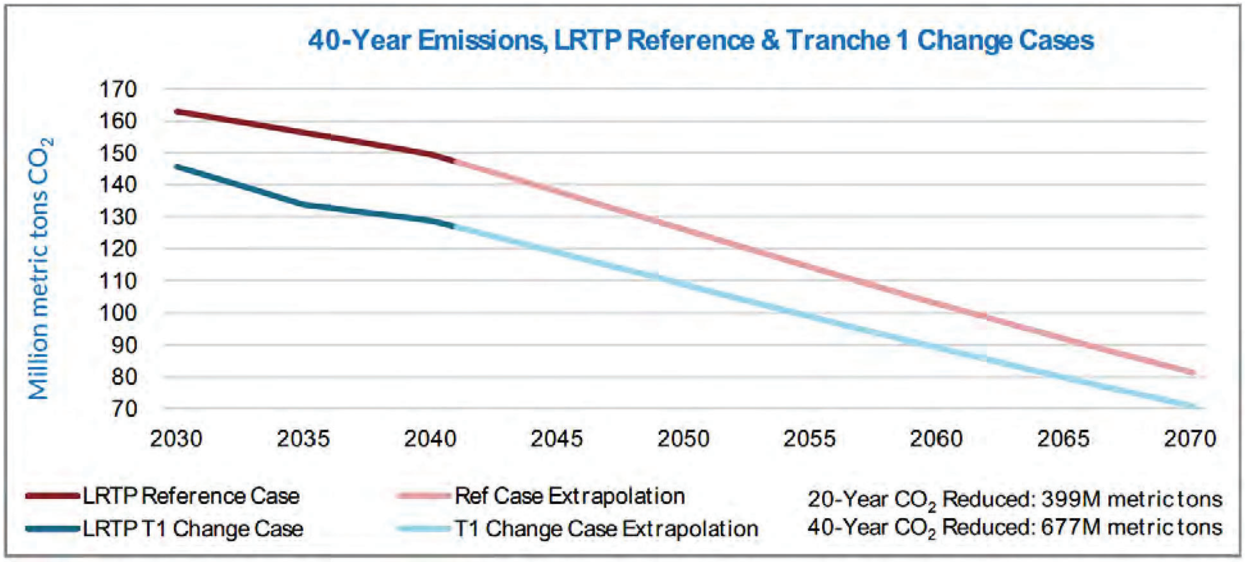
Timeline	APC Benefits	MISO	LRZ1
20 Year Present Value	APC Benefits ($Millions)	$ 504.1	$ 246.6
40 Year Present Value	APC Benefits ($Millions)	$ 859.2	$ 539.2

4.3.3 Xcel Energy's Carbon Reduction Analysis

As discussed above in Section 4.2, one of the benefits of the LRTP Tranche 1 Portfolio is a reduction in carbon emissions across the MISO footprint. MISO's PROMOD analysis demonstrated the implementation of the LRTP Tranche 1 Portfolio is estimated to reduce carbon emissions by 399 million metric tons over the first 20 years of the LRTP Tranche 1 Portfolio being in-service and 677 million metric tons over the first 40 years of LRTP Tranche 1 projects being in-service (**Figure 4-5**).[69]

[69] **Appendix G-1** at 79 (MTEP21 Report Addendum).

Figure 4-5
40-Year CO_2 Emissions Reductions under LRTP Reference and Tranche 1 Change Cases[70]



MISO also calculated the economic benefit of the carbon reduction or decarbonization enabled by LRTP Tranche 1 Portfolio. MISO conducted research to develop a price range to express the value of decarbonization. MISO chose sources within the U.S., at state and federal levels, both within and outside of the MISO footprint. MISO took two steps to standardize price terms. First, as applicable, MISO converted source price data to dollars per metric ton, using a conversion factor of one U.S. (short) ton = 0.9071847 metric tons. Second, MISO converted prices from nominal dollar-years of origin into 2022 dollars using the Consumer Price Index Inflation Calculator. A range of CO_2 emission prices were identified to estimate a benefit value, and are summarized below:

- The Regional Greenhouse Gas Initiative (RGGI) Q4 2021 Auction average (mean) price of $12.47/short ton yielded $13.75/metric ton; $13.87 in 2022 dollars.

[70] **Appendix G-1** at 79 (MTEP21 Report Addendum).

- The California and Quebec (CA-QC) Cap-and-Trade Program Q4 2021 Auction settlement price of $28.26/metric ton is $28.59 in 2022 dollars.
- The Federal price is the average of two price data inputs: the 45Q Tax Credit and the Social Cost of Carbon. The 45Q Tax Credit follows a prescribed price schedule starting with $31.77/metric ton in 2020, increasing to $50 by 2026, and inflation-adjusted afterwards by 2.5% annually. This interpolation yields a 2022 value of $37.85. The Social Cost of Carbon (SCC) follows a similar schedule, but in 2020 dollars. Converting the SCC schedule in 2020 dollars from $51/metric ton (2020) yields $55.58 and $85 (2050) yields $92.64 for those price-years, in 2022 dollars. The SCC's 2022 value in 2022 dollars is $57.76. Beyond 2050, annual inflation of 2.5% is applied. To produce the Federal price, the annual values of 45Q and SCC through 2069 are averaged, beginning in 2022 at $47.80/metric ton in 2022 dollars.

MISO then calculated the decarbonization benefits of the LRTP Tranche 1 Portfolio using the following methods:

- From the Congestion and Fuel Cost Savings analysis, calculate the difference in CO_2 emissions between the LRTP Reference case and LRTP Change case.
- Convert the reduced emissions to metric tons.
- Use range of carbon prices to produce yearly values at 2.5% inflation as applicable.
- Multiply yearly values by annual reduced emissions and discount rates to produce discounted annual benefits.
- Sum discounted annual benefits to yield net present values for 20- and 40-year emission reduction benefits.

This resulted in MISO's decarbonization benefit values as shown in **Table 4-11**.

Table 4-11
MISO's Analysis of LRTP Tranche 1 Decarbonization Benefits[71]

	MN PUC	RGGI Q4 2021	CA-QC Q4 2021	Federal
2022$/metric ton	$12.55	$13.87	$28.59	$47.80
20-Year Benefit (2022$, M):	$3,473	$3,839	$7,913	$13,438
40-Year Benefit (2022$, M):	$4,548	$5,026	$10,361	$17,364

Xcel Energy also evaluated the carbon reduction benefits of the Project using PROMOD. Xcel Energy's analysis estimated that the Project will reduce CO_2 emissions within MISO by 2.42 to 5.25 million metric tons over the first 20 years that the Project is in service and by 0.56 to 8.26 million metric tons over the first 40 years that the Project is in service.

While there is no cost of carbon that is applicable to the entire MISO footprint currently, Xcel Energy used two different carbon costs to determine a range of potential carbon reduction benefits of the Project. Xcel Energy used the same lower and upper bookend prices used by MISO, i.e., the Minnesota Public Utilities Commission approved CO_2 costs of $12.55/metric tons ($2022) and a federal cost of carbon of $47.80/metric ton ($2022).[72]

The next series of tables show the carbon reduction benefits of the Project to the MISO footprint and LRZ1 under the MISO MTEP21 Future 1, the MTEP21 Future 1 with the generation additions from Xcel Energy's Upper Midwest IRP included, and the MTEP21 Future 2 models.

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[71] **Appendix G-1** at 80 (MTEP21 Report Addendum).

[72] The federal price is the average of two price data inputs: the 45Q Tax Credit and the Social Cost of Carbon. This is the same federal price used by MISO in MTEP21 and is discussed in **Appendix G-1** at 80 (MTEP21 Report Addendum).

Table 4-12
Carbon Reduction PV Benefits of LRTP4 under MTEP21 Future 1 Model

MISO	MN PUC	Federal
2022 $/metric ton	*$12.6*	*$47.8*
20-Year Benefit ($Millions)	$30.4	$115.7
40-Year Benefit ($Millions)	$7.0	$24.

LRZ1	MN PUC	Federal
2022 $/metric ton	*$12.6*	*$47.8*
20-Year Benefit ($Millions)	$67.9	$258.4
40-Year Benefit ($Millions)	$76.9	$292.7

Table 4-13
Carbon Reduction PV Benefits of LRTP4 under MTEP21 Future 1 Model With Xcel Energy's Upper Midwest IRP Generation Added

MISO	MN PUC	Federal
2022 $/metric ton	*$12.6*	*$47.8*
20-Year Benefit ($Millions)	$48.5	$184.9
40-Year Benefit ($Millions)	$45.6	$173.8

LRZ1	MN PUC	Federal
2022 $/metric ton	*$12.6*	*$47.8*
20-Year Benefit ($Millions)	$142.0	$540.9
40-Year Benefit ($Millions)	$205.1	$781.3

Table 4-14
Carbon Reduction PV Benefits of the Project under MTEP21 Future 2 Model

MISO	MN PUC	Federal
2022 $/metric ton	*$12.6*	*$47.8*
20-Year Benefit ($Millions)	$65.9	$251.1
40-Year Benefit ($Millions)	$103.7	$395.0

LRZ1	MN PUC	Federal
2022 $/metric ton	*$12.6*	*$47.8*
20-Year Benefit ($Millions)	$52.8	$201.1
40-Year Benefit ($Millions)	$90.2	$343.7

As shown in the tables above, the carbon reduction benefits of the Project to the MISO footprint range from approximately $30.4 million to $251.0 million for the first 20 years the Project is in service. Likewise, the carbon reduction benefits of the Project to LRZ1 range from approximately $52.8 million to $540.9 million for the first 20 years the Project is in service.

4.4 Estimated System Losses

Energy losses on the transmission system can result in increased costs for utilities and ratepayers due to the need to generate enough energy to adequately serve loads while also accounting for the losses incurred during the transmission of this energy. Each new transmission line that is added to the electric system affects the losses of the system. If a new transmission line reduces transmission losses, utilities will not have to generate as much energy to meet customer demands. Thus, if a new transmission line reduces system losses, then the costs to end-use consumers to provide that energy will also be reduced.

Lower voltage lines tend to have higher losses than higher voltage lines. This is because when the voltage of a line is lowered, the current must be increased to achieve similar power flow. This increases losses because of the correlation between the physical requirements of the transmission line conductor and the amount of current flowing on that conductor.

Xcel Energy compared the loss savings achieved by LRTP4 across LRZ1 using the Summer Shoulder - High Wind cases for both the Future 1, Year 20 (F1Y20) and the MTEP22 model sets. The Summer Shoulder - High Wind cases were used to compare line losses because these cases feature the highest losses due to high wind transfers. Line loss data was pulled for transmission lines within the LRZ1 area (Xcel Energy, Minnesota Power, Southern Minnesota Municipal Power Agency, Great River Energy, Otter Tail, Montana-Dakota Utilities, and Dairyland). To determine the amount of line losses, the base model with no changes to today's transmission system was compared to the model with the Project added to see the benefits that LRTP4 alone has on line losses. A similar comparison was made with the full LRTP Tranche 1 model and the Tranche 1 without LRTP4 model. These comparisons were done for both the F1Y20 and MTEP22 model sets and the results are provided in **Table 4-15** below. In conclusion, LRTP4 reduces line losses by an average of 42.73 MW and 182.70 MegaVolt Ampere of reactive power (MVAr) as shown in **Table 4-16**.

Table 4-15
Estimated Line Losses

MTEP22 2027 Shoulder High Wind Line Losses for LRZ1						
Model	**Base Model**	**LRTP 4**	**Delta**	**Tranche 1 without LRTP 4**	**Tranche 1**	**Delta**
MW Losses	1031.8	999.8	32.0	883.4	849.4	34.0
MVAR Losses	9628.6	9513.5	115.1	8882.3	8770.1	112.2

Future 1 Year 20 Shoulder High Wind Line Losses for LRZ1						
Model	**Base Model**	**LRTP 4**	**Delta**	**Tranche 1 without LRTP 4**	**Tranche 1**	**Delta**
MW Losses	1220.5	1159.6	60.9	1071.0	1027.0	44.0
MVAR Losses	10834.4	10490.2	344.2	9941.9	9782.6	159.3

Table 4-16
Average Line Losses

	Average SH Losses
MW Losses	42.73
MVAR Losses	182.70

4.5 Development of Future Renewable Generation Enabled by the Project

The unprecedented level of interconnection requests for renewable generators in MISO has continued since the approval of the LRTP Tranche 1 Portfolio. Moreover, and in accordance with MISO model development practices, the Project has been included in all economic, reliability, and interconnection models that have been developed since the

Project's approval as part of MTEP21. Interconnection of these new generators will be conditioned on the completion of the Project.

Starting with the 2022 DPP cycle, the Project will be considered in-service at the beginning of 2031. The 2021 DPP cycle can utilize the LRTP Tranche 1 Portfolio as mitigation to identified issues, but any cycles before the 2021 DPP cycle would not be able to rely on the Project. Based on the studies conducted to date, up to 198 interconnection requests amounting to over 35,000 MW will be conditioned on, but not necessarily dependent on, the Project. These generators can be subject to quarterly operating studies that can restrict the output. Even if these quarterly studies allow the maximum output of the generators, the MISO real-time and day-ahead market could constrain the output of these units because of system limits that will be addressed by the Project. Once the Project and the other conditional facilities are constructed and put into operation, the quarterly operating studies will no longer be performed for conditional generators.

4.6 MISO Load Forecast Data

The Project is needed to support the reliability of the regional transmission system as it undergoes significant changes to its generation portfolio. In analyzing the need for the LRTP Tranche 1 Portfolio of projects, MISO developed load forecasts to ensure that these projects could meet both current and future demand. MISO's base demand forecast was developed by aggregating each MISO member's forecast. To evaluate a broad range of potential outcomes, MISO created multiple demand and energy forecasts from the base forecast. The load forecasts used in MISO's Futures consider different adoption rates for demand response, energy efficiency, distributed generation, and beneficial electrification. MISO's demand and energy forecasts are developed for each of MISO's ten Local Resource Zones to consider regional differences. MISO's ten Local Resource Zone forecasts are then aggregated to a MISO-wide forecast. The gross peak demand and annual energy forecast for the MISO footprint that were used for the MTEP21 Futures is provided in **Appendix G-3**.[73]

[73] **Appendix G-3** at 21-30 (MISO Futures Report).

4.7 Effect of Promotional Practices

Xcel Energy has not conducted any promotional activities or events that have triggered the need for the Project. As discussed above, the Project is needed to address regional reliability issues across MISO's Midwest subregion.

4.8 Effect of Inducing Future Development

The Project is not necessarily intended to induce future development, but it will support future economic development (for example, additional renewable generation).

4.9 Socially Beneficial Uses of Facility Output

The Project is needed to maintain reliability of the transmission system for Xcel Energy's customers and the MISO Midwest subregion as aging coal-fired generation resources are retired and replaced with renewable generation. As discussed in Sections 4.2.5.3 and 4.3.3, by enabling greater renewable generation, the LRTP Tranche 1 Portfolio will provide societal benefits such as a reduction in carbon emissions. MISO estimated that the LRTP Tranche 1 Portfolio will reduce CO_2 emissions by 399 million metric tons over the first 20 years that these projects are in service and 677 million metric tons over the first 40 years.[74] Using the Minnesota Public Utilities Commission's valuation of carbon-dioxide emission reduction of $12.55/metric ton,[75] the LRTP Tranche 1 Portfolio is expected to result in $5.0 billion in carbon reduction benefits over the first 20 years across the MISO footprint.[76] Using this same cost of carbon ($12.55/metric ton), the Applicant estimates that the carbon reduction benefits of the Project alone to the MISO footprint range from $30.4 million to $65.9 million over the first 20 years. In addition, the Project will relieve transmission congestion, increase market access to lower cost renewable generation, and provide economic benefits in the form of reduced wholesale energy costs.

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[74] **Appendix G-1** at 79 (MTEP21 Report Addendum).

[75] **Appendix G-1** at 79 (MTEP21 Report Addendum).

[76] **Appendix G-1** at 81 (MTEP21 Report Addendum).

5. ALTERNATIVE ANALYSIS

Both MISO and the Applicant analyzed a number of different alternatives considered to solve the need identified in the previous chapter. Minnesota Certificate of Need statutes and rules require analysis of transmission and non-transmission alternatives. This includes examining size alternatives (different transmission line voltages), type alternatives (including different transmission line configurations as well as generation and non-wires alternatives), demand-side management, and a "no build" alternative to solve the identified need. As explained in Chapter 4, as part of its analysis in MTEP21, MISO also evaluated four specific transmission line alternatives, including the proposed Project, for Minnesota and Wisconsin portion of the LRTP Tranche 1 Portfolio. As discussed in more detail below, both MISO's and Xcel Energy's analysis of these alternatives determined that none of these alternatives alone or in combination with other alternatives is a more reasonable and prudent alternative to the proposed Project.

5.1 Size Alternatives

5.1.1 Different Voltages

Xcel Energy evaluated the feasibility of different line voltages (both higher and lower) to relieve current capacity issues and to improve electric system reliability throughout the region as more renewable energy resources are added to the transmission system in and around the region. As additional renewable generation is constructed in the region, the existing congestion problem will only worsen if there is not sufficient capacity available to transmit this generation to load centers such as the Twin Cities. As of June 2023, for the West MISO DPP cycle 22, there is approximately 22,500 MW of renewable generation in the MISO queue that has requested to be placed in-service through 2030.

In examining transmission alternatives to relieve congestion, the capacity of a single transmission line is an important consideration, as the amount of congestion present on the transmission system, in part, is a function of the amount of available transmission capacity on a single transmission line. Generally speaking, the higher the voltage of a transmission line, the higher capacity the line has to carry power, assuming the same current. The correlation between voltage level and the capacity of a transmission line is shown by the following equation:

Three Phase AC Power (MVA, capacity) = Volts (V) x Amperes (I) x √3

The following table provides a general comparison of the capacity of transmission lines operated at different voltages assuming the same current of 3000 Amps.

Table 5-1
Comparison of Capacity by Voltage Level

Voltage Level	Capacity (MVA)
69 kV	358.5
115 kV	597.6
230 kV	1195.1
345 kV	1792.7
Double-Circuit 345/345 kV	3585.4
500 kV	2598.1
765 kV	3975[77]

Given the increasing amounts of renewable generation in Minnesota and the surrounding states, it is important that sufficient transmission capacity be in place to deliver this renewable generation reliably, efficiently, and economically to load centers.

In Minnesota, 345 kV is the current standard high voltage that is utilized to transfer large amounts of power long distances. The 345 kV voltage is the standard because it provides sufficient capacity to accommodate large power transfers, can be easily incorporated into the existing transmission system, and minimizes line losses. Voltages higher than 345 kV are currently less utilized in Minnesota and are reserved for long distance point-to-point power transfers (i.e., moving power from Manitoba's hydro generation facilities into Minnesota). Voltages lower than 345 kV are used primarily for load serving support. Following an evaluation, Xcel Energy concluded that the proposed 345 kV voltage is the appropriate voltage level to address reliability issues,

[77] 765 kV is generally rated higher than a 3,000 amp rating.

relieve congestion, and to efficiently transfer generation currently projected to be developed in Minnesota and surrounding states.

5.1.1.1 Higher Voltage

Higher Voltage Alternative to 345 kV Line

Xcel Energy considered higher voltage 765 kV and 500 kV transmission lines as alternatives to the proposed 345 kV transmission line. There are currently no 765 kV transmission lines in Minnesota and, although there are two 500 kV transmission lines in Minnesota, neither 500 kV line is located in the Project area. As a result, constructing a new 765 kV or 500 kV transmission line would require additional substation transformers to accommodate these higher voltage transmission lines. Specifically, connecting higher voltage lines to the existing electric system, mainly comprised of 345 kV, 161 kV, 115 kV, 69 kV, and 34.5 kV lines in the Project area, would require installation of additional transformers at the existing Wilmarth Substation, the existing North Rochester Substation, and the existing Tremval Substation in Wisconsin.

In addition to the costs of these substation transformers, 765 kV and 500 kV lines are, in general, more costly to construct than 345 kV transmission lines and are meant for long distance power transfer. For comparison, a single-circuit 500 kV line would generally cost approximately $4.1 million per mile and would require, at a minimum, a 500 kV/345 kV transformer at each substation connection at a cost of approximately $20 million per transformer. In contrast, the indicative cost estimate for a double-circuit 345 kV line is approximately $3.5 to $4.5 million per mile.

In addition, portions of Segment 3 of the Project involve converting an existing 161 kV line to 345 kV operation or stringing a new 345 kV circuit on existing double-circuit structures. These existing double-circuit structures were not built to accommodate a 500 kV or 765 kV circuit and would need to be removed and replaced if a 500 kV of 765 kV circuit were to be installed, resulting in significant additional costs and environmental impacts compared to the currently proposed 345 kV Project. A higher voltage line could also be constructed adjacent to these existing structures but would also result in significantly higher costs and impacts as compared to the proposed Project.

A 500 kV or 765 kV transmission line would also require a wider right-of-way than the proposed 345 kV transmission line. A 500 kV or a 765 kV transmission line would require at least 200 feet of right-of-way while a 345 kV transmission line only requires 150 feet of right-of-way. In addition, the typical construction for a 500 kV or 765 kV transmission line would likely be a two-pole structure or a four-legged latticed type structure that would result in greater environmental impacts along the route (two or four foundations per structure as opposed to one foundation for a double-circuit 345 kV structures).

Based on Xcel Energy's analysis, higher voltage transmission lines above 345 kV are not a more reasonable or prudent alternative to the 345 kV portions of the proposed Project.

Higher Voltage Alternative to 161 kV Line

Xcel Energy also considered a higher voltage alternative to Segment 4 of the Project which involves construction of a new single-circuit 161 kV line from North Rochester to Rochester. For this portion of the Project, Xcel Energy considered 345 kV as an alternative to the proposed 161 kV line. Xcel Energy determined that a higher voltage would not provide additional load serving benefits to the Rochester area because the area is currently served by a number of 161 kV transmission lines. These 161 kV lines would not be able to accommodate this higher voltage and could potentially create a new transmission constraint in the Rochester area. Xcel Energy also examined a 230 kV transmission alternative but given that the existing transmission system in this area is primarily 345 kV and 161 kV, integrating a 230 kV line would require a number of system upgrades such as adding additional transformers at the substation endpoints.

5.1.1.2 Lower Voltage

Lower Voltage Alternative to 345 kV Line

Xcel Energy also analyzed lower voltage alternatives to the Project. Transmission line voltages lower than 345 kV include: 230 kV, 161 kV, 138 kV, 115 kV, 69 kV, 41.6 kV, and 34.5 kV. As there are existing 161 kV, 115 kV, 69 kV, and 34.5 kV transmission lines in the Project area, Xcel Energy examined these lower voltages as alternatives to the proposed 345 kV portions of the Project.

The Project is designed to address issues of congestion and overloads in southern Minnesota. The existing transmission system is congested during periods of high renewable generation which results in higher energy prices for Minnesota customers. This is because lower cost renewable energy is unable to reach customers. Because of congestion, higher cost generation resources must be dispatched and renewable generation is curtailed. Given the lower capacity of 161 kV, 115 kV, 69 kV, and 34.5 kV transmission lines, Xcel Energy eliminated these lower voltage alternatives from further study as these voltages would not have sufficient capacity to address the overload and congestion issues on the existing system and would not offer the capacity needed to support future renewable generation. As a result, installing these lower voltage alternatives would require more transmission facilities to be constructed in the future to provide additional capacity to support this future generation.

Another consideration in determining the appropriate voltage for a new transmission line is whether the voltage of the new line is present on the existing system in the Project area. The majority of the transmission system in the Project area is at the 345 kV voltage level such that integrating a new line at the 345 kV voltage fits well into the existing system without requiring the need to construct additional substation facilities. For instance, a lower voltage line would require additional costs to complete substation upgrades to accommodate the introduction of new voltage to the system. The existing Wilmarth and North Rochester substations already have 345 kV infrastructure such that additional transformation is not required. The Wilmarth Substation has existing 115 kV and 69 kV transformers as well but would require a new transformer to accommodate a new 161 kV line. The North Rochester Substation has an existing 161 kV transformer but would require a new transformer to accommodate either a 115 kV or 69 kV line.

Another drawback of lower voltage alternatives is that lower voltage lines tend to have higher losses than higher voltage lines. This is because when the voltage of a line is lowered, the line rating must be increased to achieve similar levels of power transfer. To achieve a comparable line rating on a lower voltage line, larger conductor and thus larger structures, foundations and associated hardware would also be required leading to higher costs.

Based on the analysis summarized above, Xcel Energy determined that lower voltages are not a more reasonable or prudent alternative to the 345 kV portions of the Project.

Lower Voltage Alternative to 161 kV Line

Xcel Energy also considered a lower voltage alternative to Segment 4 of the Project which involves construction of a new single-circuit 161 kV line from North Rochester to Rochester. The 161 kV voltage was selected because it integrates well into the existing 161 kV system that serves the Rochester area. For this portion of the Project, Xcel Energy considered 115 kV and 69 kV as an alternative to the proposed 161 kV line. These lower voltage alternatives were rejected because these voltages would not have sufficient capacity to address the overload and congestion issues on the existing system.

Also, a 161 kV transmission line would integrate well into the existing 161 kV transmission system serving the Rochester area without requiring the need to construct additional substation upgrades. In contrast, a lower voltage 115 kV line would require installation of additional transformers at the North Rochester Substation and a new 69 kV line would require installation of a new transformer at the North Rochester Substation.

5.1.2 Double-Circuiting with Existing Transmission Lines

Double-circuiting is the construction of two separate transmission circuits on the same structures. Placing two transmission circuits on common structures generally reduces right-of-way requirements, which potentially reduces human and environmental impacts. Reliability standards established by NERC require that the transmission system is planned to be able to withstand potential contingencies – including the loss of a common structure. For double-circuiting to be a viable alternative, the system must be able to remain reliable even if both circuits on a double-circuit structure are out at the same time.

Xcel Energy analyzed opportunities to double-circuit the new transmission facilities with existing transmission facilities. Segment 3 of the Project are already proposed to be double-circuited as this segment involves converting an existing 161 kV line that is currently double-circuited with a 345 kV line to 345 kV operation and installing a new 345 kV circuit on existing double-circuit structures.

Xcel Energy examined double-circuiting options for the remaining portions of the 345 kV transmission line. For Segment 1, the route options proposed by Xcel Energy involve double-circuiting with existing 69 kV or 115 kV transmission lines from the Wilmarth Substation to near the West Faribault Substation. Segment 2, Xcel Energy evaluated options to double-circuit with existing transmission line and portions of the routes proposed by the Company are proposed to be double-circuited with existing 69 kV transmission. The Company was not able to double-circuit the entire length of Segment 2 as there are no existing transmission lines that run west/east from near the West Faribault Substation to the North Rochester Substation and avoid populated areas.

For Segment 4, the 161 kV connection between the North Rochester and a tap point on the existing 161 kV transmission line, Xcel Energy evaluated route options to double-circuit the new 161 kV line with existing transmission lines in the Project area. Portions of the Proposed Routes for the 161 kV transmission line are proposed to be double-circuited with existing 69 kV transmission lines in the area and other portions of the Proposed Routes are located adjacent to existing transmission lines. Xcel Energy is currently conducting a reliability analysis to determine whether greater portions of Route Option 4 West can be double-circuited with existing transmission lines in this area. Depending on the results of this reliability analysis, Xcel Energy may propose additional route options during the scoping process that include double-circuiting with existing transmission lines.

5.1.3 Triple-Circuiting with Existing Lines

Triple-circuiting is the construction of three transmission circuits on a common structure. Triple-circuiting is typically used in only limited applications due to reliability, resiliency, cost, maintenance, and safety implications. As noted above, NERC reliability standards require that the transmission system is planned to be able to withstand the loss of a common structure. For a triple-circuit to be a viable alternative, the system must be able to remain reliable even if all three circuits were simultaneously lost. In addition, a triple-circuit design requires larger and more expensive structures compared to a double-circuit or single-circuit design.

Segment 3 of the Project involves converting an existing 161 kV transmission that is currently double-circuited with an existing 345 kV line to 345 kV operation and installing a new 345 kV circuit on existing double-circuit structures. For this Segment of the Project, the Xcel Energy evaluated triple-circuiting to a 345/345/161 kV configuration. Triple-circuiting Segment 3 of the Project would require removal of the existing double-circuit capable structures that were installed between 2013 and 2016 and replacing those structures with new triple-circuit structures. Transmission structures like these generally have useful lives of approximately 60 years, thus replacing these structures that are far from the end of their useful lives would add significant costs to the Project.

In addition, while triple-circuiting a line may be technically feasible, there are reliability and maintenance concerns with this design. With regard to reliability, the system would need to withstand the loss of all three circuits from service at the same time. As discussed in Chapter 4, this Project is designed to provide additional transmission providing congestion relief as well as easing both thermal loading and transfer voltage stability. Loss of all three of these transmission circuits would result in a significant decrease in transmission capacity on the transmission system potentially leading to increased congestion and voltage stability issues. Further, any transmission maintenance activities would require all three lines to be taken out of service to work on a single line reducing the transmission capacity of the system and again, potentially leading to increased congestion and voltage stability issues.

There are also greater impacts associated with triple-circuit structures. Triple-circuit structures are taller than double-circuit structures, would likely require two poles rather than one pole, and would require a wider right-of-way of 175 to 200 feet as compared to the typical 150 foot right-of-way for a single-circuit and double-circuit 345 kV transmission line.

5.2 Type Alternatives

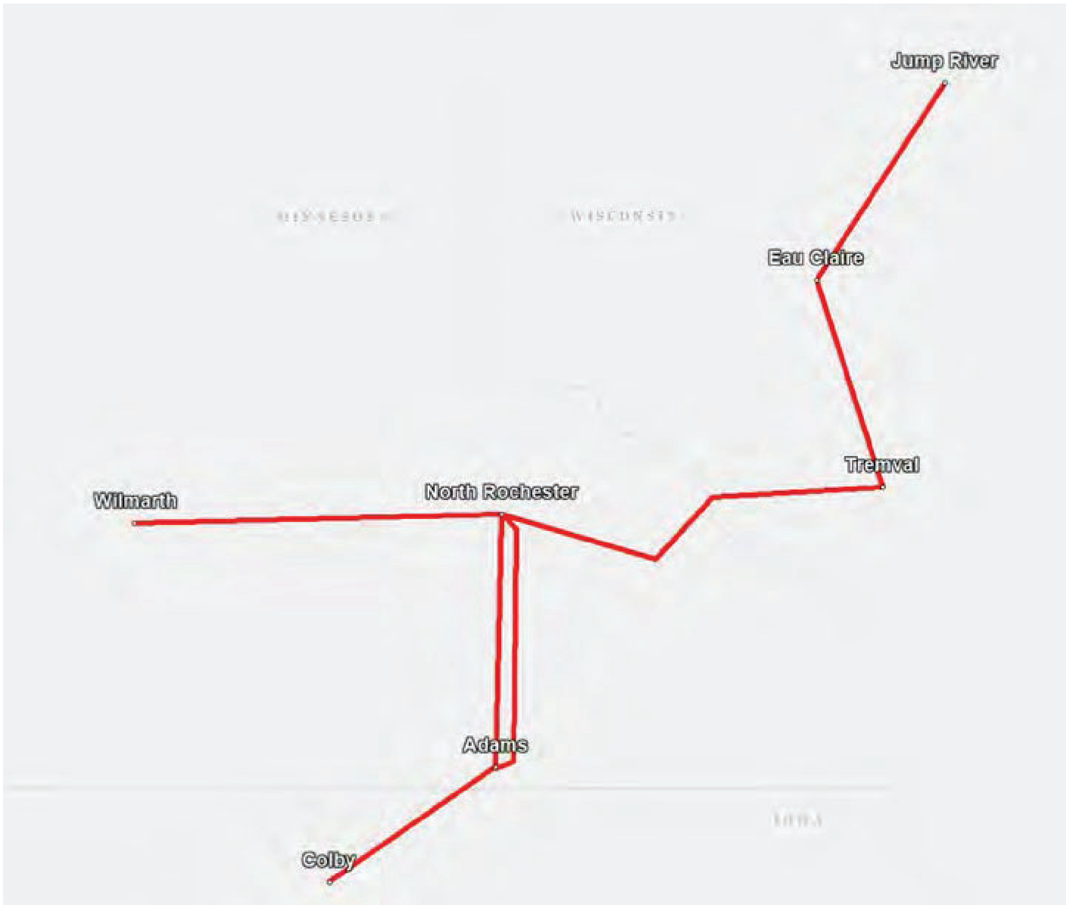
5.2.1 Transmission with Different Terminals/Substations

Both MISO and Xcel Energy evaluated transmission lines with different substation endpoints to meet the identified reliability needs and to relieve the identified congestion. As part of MTEP21, MISO evaluated alternative LRTP Tranche 1 projects on a regional basis. For southern Minnesota and Wisconsin, MISO tested system solutions against its approved projects, comprised of the Wilmarth – North Rochester – Tremval (LRTP4, the Minnesota portion is the subject of this Application), Tremval – Eau Claire – Jump River (LRTP5), and Tremval – Rocky Run – Columbia (LRTP6) (collectively, the Minnesota to Wisconsin projects). These three LRTP projects address issues on the transmission system in southern Minnesota and Wisconsin. The transmission system in southern Minnesota connects renewable resources in Minnesota and North and South Dakota, the Twin Cities, and transmission outlets to the east and south. The Minnesota to Wisconsin projects are needed to relieve constraints in the Twin Cities metro area during times when there is high levels of renewable generation. These projects also provide additional generation outlet towards load centers in Wisconsin, providing congestion relief and easing both thermal loading and transfer voltage stability. MISO evaluated three alternative transmission line configurations to address these same issues. Provided below are the four alternatives MISO considered and a summary of MISO's analysis. Based on this analysis, MISO determined that none of these alternatives is a more reasonable or prudent alternative to the Minnesota to Wisconsin projects.

5.2.1.1 MISO Alternative 1

MISO analyzed one alternative to the entire LRTP4 Project from Wilmarth – North Rochester – Tremval. This alternative was a new Wilmarth – North Rochester – Tremval – Eau Claire – Jump River 345 kV transmission line, a rebuild of the existing Adams – North Rochester 345 kV transmission line to a double-circuit 345/345 kV transmission line, and a new Colby – Adams 345 kV transmission line (Alternative 1). Alternative 1 is depicted in **Map 5-1** below.

Map 5-1
MISO Alternative 1



Alternative 1 differs from LRTP4 Project in that it continues the 345 kV transmission line from Tremval onto Eau Claire and Jump River and includes a rebuild of the existing Adams – North Rochester 345 kV transmission line to a double-circuit 345/345 kV transmission line, and a new Colby – Adams 345 kV transmission line. MISO concluded that the additional connections from Tremval to Northern Wisconsin of Alternative 1 was effective at relieving line loadings across Western Wisconsin and provided generation outlet. MISO also found that the double-circuit 345 kV line from Adams to North Rochester relieved loading on parallel transmission facilities of North Rochester to Briggs Road Substation and Rochester to Wabaco to Alma. However, MISO concluded that the Colby – Adams 345 kV line portion of Alternative 1 was not very effective at relieving transmission loading in southern Minnesota as the effects of the new Colby – Adams 345 kV line were very localized.

5.2.1.2 Alternative 2a

MISO also analyzed two alternatives to the Wilmarth – North Rochester portion of LRTP4 (i.e., Segments 1 and 2). The first alternative was a new Huntley – Pleasant Valley 345 kV transmission line, a rebuild of the existing Pleasant Valley – North Rochester 345 kV transmission line to a double circuit 345/345 kV transmission line (Alternative 2a). Alternative 2a is depicted in **Map 5-2** below.

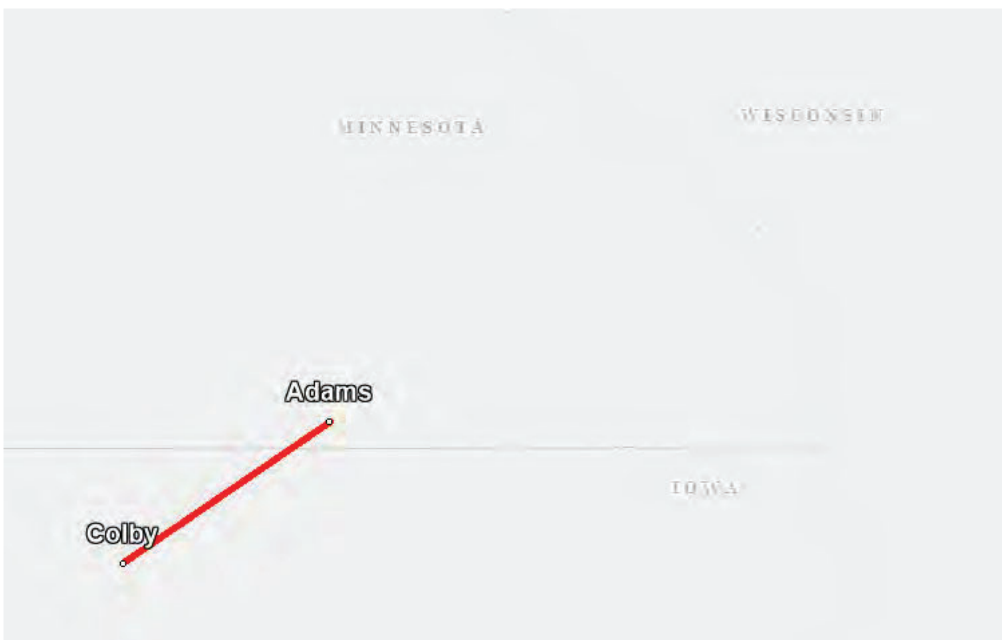
Map 5-2
MISO Alternative 2a

MISO concluded that Alternative 2a resolved many but not all of the same transformer overloads as Segment 1 and Segment 2 of the LRTP4 Project. MISO also found that Alternative 2a had a higher production cost savings but also a higher cost as compared to Segments 1 and 2 of LRTP4. MISO concluded that the difference in production cost savings was less than the difference in cost between Alternative 2a and Segments 1 and 2 of LRTP4 resulting in MISO selecting Segments 1 and 2 rather than Alternative 2a. Given these findings, MISO concluded that Alternative 2a is worth studying in future LRTP study cycles.

5.2.1.3 Alternative 2b

The second alternative that MISO examined to the Wilmarth – North Rochester portion of LRTP4 was a new Colby – Adams 345 kV transmission line. Alternative 2b is depicted in **Map 5-3** below.

Map 5-3
MISO Alternative 2b

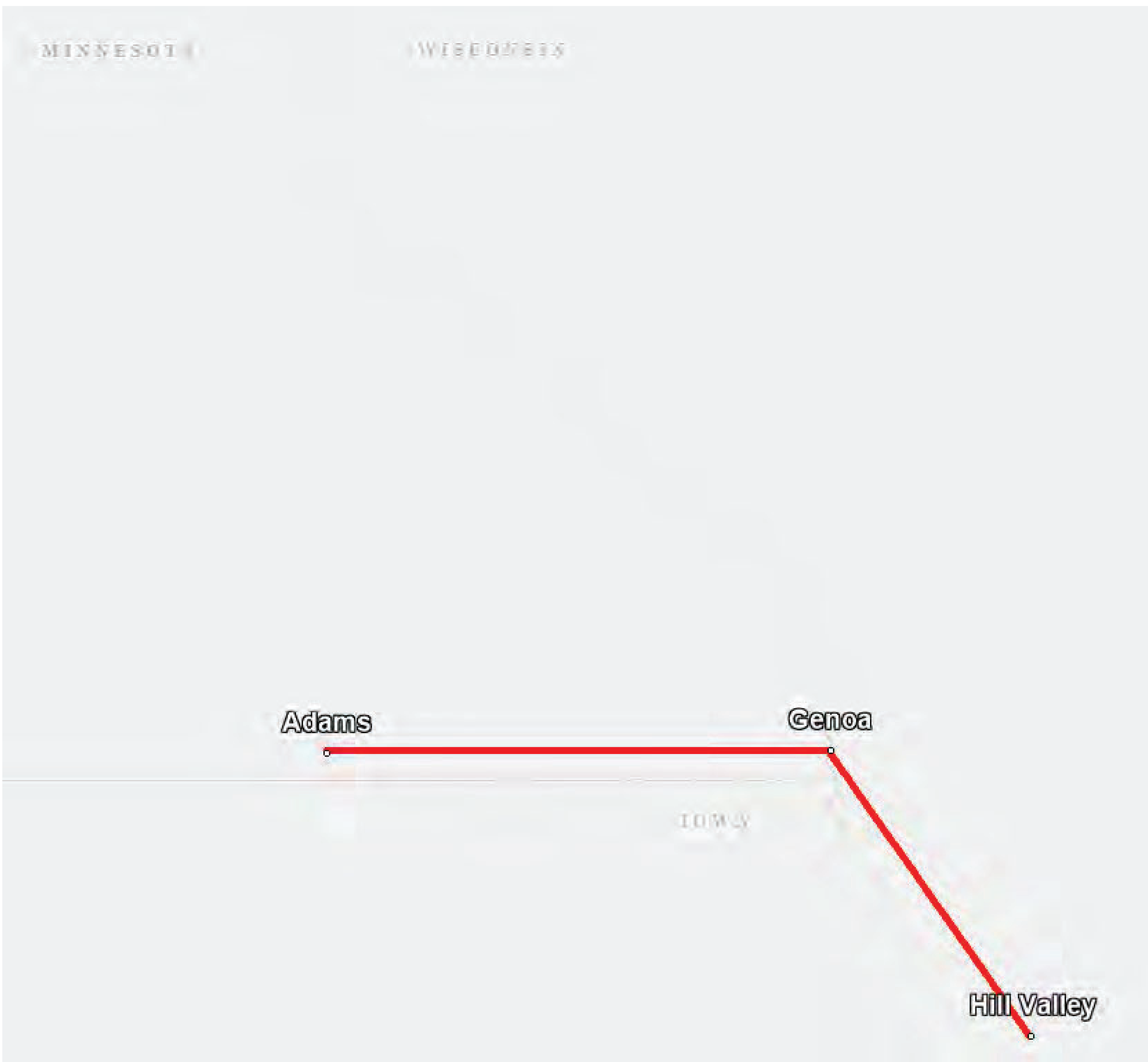


MISO concluded that Alternative 2b by itself was not effective at reducing system loadings on the southern Minnesota 345 kV system and provided little reliability value on its own.

5.2.1.4 Alternative 3

MISO also analyzed an alternative to the North Rochester to Tremval portion of LRTP4 (Segments 3 and 4 and Wisconsin portion of LRTP4 to the Tremval Substation) and LRTP5 (Tremval – Eau Claire – Jump River). This alternative was a new Adams – Genoa – Hill Valley 345 kV transmission line (Alternative 3). Alternative 3 is depicted in **Map 5-4** below.

Map 5-4
MISO Alternative 3



MISO determined that Alternative 3 was not as effective as LRTP4 and LRTP5 at addressing overloads in southern Minnesota and providing ties to load centers to the east and south of the Twin Cities. MISO found that once the new Hickory Creek to Hill Valley 345 kV line (portion of MVP5) was in-serviced that Alternative 3 provided an additional 345 kV path parallel to the existing Adams – Hazelton 345 kV line and was effective at relieving flows south of Minnesota and across eastern Iowa. MISO rejected Alternative 3 in order to prioritize addressing the overloads in southern Minnesota and providing additional 345 kV ties from southern Minnesota to load centers in the east and south.

5.2.2 Upgrading Existing Transmission Lines

Xcel Energy considered upgrading existing transmission facilities as an alternative to the Project. Segments of the Project involve upgrading existing transmission lines. Portions of Segment 3 of the Project involves upgrading an existing 161 kV line to operate at 345 kV thus creating a double-circuit 345/345 kV line.

Existing transmission lines are insufficient to provide the additional transmission capacity needed to resolve the transmission constraints on the system and alleviate congestion on the system. As a result, upgrading existing transmission lines, without also increasing the voltage of these lines, would not meet the identified need. As discussed above, the Applicant did examine co-locating the proposed 345 kV and 161 kV lines with existing transmission lines in developing the Proposed Routes for the Project to minimize potential impacts.

5.2.3 Direct Current Lines

Xcel Energy considered a High Voltage Direct Current (HVDC) line in place of the proposed AC facilities. An HVDC transmission system consists primarily of a converter station, in which the AC voltage of the conventional power grid is converted to HVDC voltage, a transmission line, and another converter station at the other end, where the voltage is converted back into AC.

An HVDC transmission line is generally employed to deliver generation over a considerable distance, more than 300 miles, to a load center. HVDC systems typically do not allow for cost-effective interconnections along the line.

While line losses and conductor costs associated with HVDC lines are generally less than those associated with high voltage AC lines, HVDC lines also require expensive converter stations at each end point of the line to convert power from AC to DC and DC to AC. It should be noted that HVDC converter stations do not eliminate the need for AC substation facilities that would be required after the power is converted back to AC. There are also extended lead times (6 years or more) for HVDC systems.

Converter stations for 500 to 600 kV HVDC lines can range from approximately $400 million to $500 million.[78] Given the substantial additional cost imposed by the required HVDC converter stations, the costs associated with a HVDC design would exceed the benefits and therefore HVDC is not a more prudent or reasonable alternative to the proposed Project.

5.2.4 Underground Transmission Lines

Xcel Energy evaluated underground transmission, both AC and DC, and concluded that an underground design would not be a feasible or reasonable alternative to the proposed overhead design due to the significantly higher cost of undergrounding a line of this length and voltage.

High voltage AC underground cable systems at 345 kV are generally limited in length to approximately 50 miles or less because of its impact on reactive power. While longer installations can be constructed with the addition of shunt reactors along the line, this is an atypical design and practical applications of underground high voltage AC lines for more than 50 miles are cost prohibitive due to the technical requirements for a line of this length. As the proposed Project is approximately 120 miles in length, an underground high voltage AC design was deemed to be cost prohibitive.

High voltage DC cable systems are used for underground lines of approximately 100 miles or more. High voltage DC systems do not have the same reactive power limitations and line losses as high voltage AC underground cable systems. High voltage DC cable systems require converter stations on each end of the line to convert the

[78] MISO's Transmission Cost Estimation Guide for MTEP21 at 39 available at: https://cdn.misoenergy.org/20210209%20PSC%20Item%2006a%20Transmission%20Cost%20Estimation%20Guide%20for%20MTEP21519525.pdf.

voltage from DC to AC and AC to DC. Because of the need for conversion from overhead to underground and conversion of voltage through converter stations, high voltage DC lines do not readily accommodate interconnections at midpoints along the lines.

Both underground AC and DC designs are infeasible due to costs. Indicative estimates for underground high voltage DC over 100 miles are $25 million or more per mile, depending on the ultimate design. As with any high voltage DC option, the costs of two converter stations would be approximately $800 million to $1 billion.

Construction costs for AC underground transmission are anticipated to be similar to underground high voltage DC but would not require converter stations. Specifically, the cost to underground a 345 kV line is approximately $40 to $50 million per mile. This is compared to a cost estimate of $3.5 to $4.5 million per mile for Xcel Energy's overhead 345 kV transmission line designs. Also, all underground cable installations behave electrically different than overhead lines and therefore a study would be required to determine if reactive compensation is required. If reactive compensation is required, this would add several million dollars to the underground costs stated above. Based on this cost analysis, the Xcel Energy determined that the underground design is not a reasonable alternative for the entire Project.

Xcel Energy also evaluated undergrounding a short segment of the 345 kV transmission line south of the Mankato Airport due to protected airspace easements which prohibit above-ground structures. This would involve undergrounding a segment of 345 kV transmission line between 0.5 and 2 miles in length with a transition structure at either end. A shorter length of underground line alleviates the reactive power concerns but Xcel Energy determined that undergrounding for even this short segment was not a reasonable alternative due to the higher construction and maintenance costs and longer outage times. As noted above, underground construction is more costly than overhead construction and would require large transition structures at either end of the underground segment. These transition structures would require fenced yards that would be similar in appearance to a small substation.

An underground transmission line also will require longer outage durations than overhead facilities due to the long lead times for replacement cables and accessories.

There are also only a limited number of qualified professionals that are trained to repair underground facilities. The scarcity of qualified professionals can also increase the outage times if these facilities need to be repaired or replaced. Given the cost and long-term operation and maintenance considerations, Xcel Energy determined that undergrounding this short segment was not a reasonable alternative.

5.2.5 Alternative Conductors

Xcel Energy proposes using a double bundled 2x636 kcmil 26/7 Twisted Pair ACSR "Grosbeak" conductor for the new 345 kV transmission line. New double bundled 954 kcmil ACSS/TW 20/7 "Cardinal" conductor will be installed as the second circuit on the existing structures between the North Rochester Substation and the Mississippi River to match the wire type of the existing circuit.

The 161 kV reroute portion will utilize a single 2x397.5 kcmil 26/7 Twisted Pair ZTACSR "Ibis" to match the wire type of the rest of the existing transmission line. Rebuilt sections of 115 kV and 69 kV transmission lines will utilize 2x336 kcmil 26/7 Twisted Pair ACSR "Linnet" conductor in a double bundle and single wire configuration, respectively.

For the 345 kV circuits, Xcel Energy considered using a double bundled of either 795 kcmil 26/7 ACSS "Drake", twisted pair 2x397.5 kcmil 26/7 ZTACSR "Ibis", or twisted pair 2x636 kcmil 26/7 ACSR "Grosbeak", all of which meet the required ampacity for the Project. Due to the high galloping potential in this area, Xcel Energy decided to use twisted pair. Xcel Energy selected the "Grosbeak" since the larger diameter helps with impedance and noise.

Xcel Energy considered using the same conductor for the 115 kV circuits for consistency however Xcel Energy determined that the increased cost of installing the 2x636 kcmil ACSR wire over the twisted pair 2x336 kcmil 26/7 ACSR "Linnet" wire was not necessary. In addition, the reduced structural loading from the smaller wire would allow Xcel Energy to use braced line posts instead of more expensive davit arms.

For the 69 kV circuit, twisted pair 2x336 kcmil 26/7 ACSR "Linnet" is Xcel Energy's standard twisted pair wire for 69 kV circuits in galloping prone areas. For the second circuit on Segment 3 (North Rochester to the Mississippi River), we considered using twisted pair 2x397.5 kcmil 26/7 ZTACSR "Ibis" but determined that the galloping risk in this area is not as high. We therefore decided to match the new conductor for the 69 kV circuit to the existing conductor.

5.2.6 Generation and Non-Wires Alternatives

5.2.6.1 Generation Alternatives

In evaluating alternatives to the proposed Project, Xcel Energy considered the addition of new generation resources rather than the proposed transmission line facilities to resolve the constraints and congestion that is currently present. Fundamentally, however, adding new generation resources to resolve reliability constraints and congestion is not a reasonable alternative given that generation alternatives will not add transmission capacity. Transmission congestion occurs when there is not enough transmission capacity to support all generation output at a particular time. Thus, regardless of the type of the generation facility evaluated, construction of additional generation facilities is not a feasible and prudent alternative to the Project because such generation would: (1) further exacerbate the congestion already present on the system; (2) result in underutilization of existing generation resources; and (3) likely be more costly than the proposed Project. In addition, the LRTP Tranche 1 Portfolio was designed to address the needs of the MISO Midwest subregion and it is not likely or cost effective that a generation alternative would be able to provide the regional benefits needed in the MISO Midwest subregion.

5.2.6.1.1 Peaking Generation

Xcel Energy considered peaking generation as an alternative to the Project. Peaking generation refers to flexible generation resources – typically natural gas or diesel generators – that can be quickly dispatched to supplement other generation resources. One of the purposes of this Project and the entire LRTP Tranche 1 Portfolio is to enable greater generation deliverability across the MISO Midwest subregion. Construction of additional peaking generation will not create the needed transmission capacity across the MISO Midwest subregion but rather worsen the existing congestion and curtailment issues and increase customer costs.

5.2.6.1.2 Distributed Generation

Xcel Energy considered distributed generation as an alternative to the Project. Distributed generation refers to generation that is located near load centers, is connected to the local distribution system, and is able to run continuously when called upon, most likely on natural gas or other fossil fuels. Renewable distributed generation and battery energy storage were also considered as alternatives and are discussed below. Fossil-fueled distributed generation has the same drawbacks as peaking generation. The Project is needed to provide additional transmission capacity to provide greater generation deliverability across the MISO Midwest subregion. As a result, adding additional distributed generation will not provide this additional transmission capacity and instead will only worsen the existing congestion and curtailment issues on the system. Construction of new distributed generation resources will also result in the underutilization of existing generation resources due to the congestion and curtailment issues.

5.2.6.1.3 Renewable Generation

Xcel Energy considered renewable generation as an alternative to the Project. Renewable generation refers to energy that is produced from the sun or the wind and that is either connected to the transmission system at a single transmission interconnection point or at multiple locations on the transmission and distribution system. As discussed in Chapter 3, Minnesota, North Dakota, and South Dakota have abundant wind resources and, as a result, a number of large-scale wind facilities have already been constructed in these areas. The Project is needed to provide additional transmission capacity to provide greater generation deliverability for these existing renewable generation resources. The addition of new renewable generation resources in lieu of adding transmission capacity would only worsen the existing congestion and curtailment issues on the system and require further build-out of the transmission system.

5.2.6.2 Energy Storage

Xcel Energy considered energy storage as an alternative to the Project. Energy storage refers to the ability to capture energy produced at one point in time for use at a later time. Current energy storage technologies include battery storage systems and pumped hydro facilities. Energy storage was determined to not be a reasonable alternative to the proposed Project because in order to provide the same amount of congestion relief as the proposed Project, an energy storage solution would need to be a large and costly facility. The cost for utility-scale energy storage depends on a variety of factors but the levelized cost of energy storage has been estimated to range from $99/MWh to $253/MWh for an energy storage system with the capability to store 100 MW for up to 4 hours.[79] Using the MTEP21 PROMOD models, the average energy per year on the Wilmarth - North Rochester portion of the Project is 3.2 million MWh. Assuming the life of the transmission line to be 63 years, this results in a levelized cost of energy at $3.40/MWh. By way of comparison, the levelized cost of onshore wind ranges from $24/MWh to $75/MWh for 175 MW facility and the levelized cost of utility-scale solar ranges from $24/MWh to $96/MWh for 150 MW facility.[80]

5.2.6.3 Reactive Power Additions

Xcel Energy considered reactive power additions as an alternative to the Project. Reactive power additions refer to capacitor or reactor banks for voltage control. These devices generally maintain local voltage stability on the system. These devices are not effective at enabling large power transfers across a broad region such as those needed to relieve the existing congestion on the system. As a result, reactive power additions are not a reasonable alternative to the proposed Project. While reactive power additions are not by themselves able to accommodate large scale power transfers, these reactive power additions may be needed for ancillary support.

5.2.6.4 Flow Control Devices

Xcel Energy evaluated flow control devices as an alternative to the Project. Flow control devices refers to devices that divert power flows from constrained areas, but do not provide system stability or additional transmission capacity. Flow control devices are generally used to address more localized overloads where there is already sufficient

[79] Lazard's Levelized Cost of Energy Analysis – Version 16.0 at 35. Available at: https://www.lazard.com/media/2ozoovyg/lazards-lcoeplus-april-2023.pdf.

[80] *Id.* at 37-38.

capacity on the system. As discussed, the primary purpose of this Project is to provide additional transmission capacity across the MISO Midwest subregion. As flow control devices would not provide any additional transmission capacity to support generation outlet, these devices are not a viable alternative to the proposed Project.

5.2.6.5 Conservation and Demand-Side Management

Xcel Energy analyzed conservation and demand-side management as an alternative to the Project. Specifically, Xcel Energy analyzed conservation and demand-side management tools that reduce overall demand as well as tools that reduce peak demand. This included interruptible load programs and energy efficiency programs. Since the need for the Project is driven in part by the need for additional transmission capacity to deliver increasing amounts of renewable generation on the system across the MISO Midwest subregion rather than a localized increase in demand, conservation and demand-side management are not effective alternatives to meet the identified need. Xcel Energy provides information on its conservation and energy efficiency programs in **Appendix I**. **Appendix I** also provides discussion of how conservation and energy efficiency was considered by MISO in its evaluation and approval of the Project.

5.3 Any Reasonable Combination of Alternatives

As the only feasible alternative to meet the identified need is a transmission alternative and the proposed Project is the best performing alternative, there is no reasonable combination of alternatives that would be a more reasonable and prudent alternative to the Project.

5.4 No Build Alternative/Consequences of Delay

Xcel Energy also considered the no build alternative, i.e., no new transmission facilities constructed to meet the identified need. If the Project is not constructed, Minnesota customers will be denied the reliability and economic benefits of this Project.

With regard to economic benefits, this Project relieves existing congestion on the system and provides provide up to $2.1 billion in economic savings across the MISO footprint over the first 20 years that it is in service and up to $3.8 billion in economic savings across the MISO footprint over the first 40 years that it is in service. Relieving the congestion on the transmission system is also important to enabling the state's ability to achieve its goal of 100 percent carbon-free generation by 2040. As discussed in Chapter 3, additional carbon-free generation will need to be added to the system to achieve this 2040 goal. This new generation will require the additional transmission capacity provided by the Project to deliver this power to customers.

As discussed in Chapter 4, MISO found that the Minnesota – Wisconsin projects relieved 39 overloads under N-1 contingencies[81] and 96 overloads under N-1-1 contingencies.[82]

[81] An N-1 contingency is an event that involves the loss of a single generator or transmission component. An N-1-1 contingency is an event that involves the initial loss of a single generator or transmission component, followed by system adjustments, and then another loss of a single generator or transmission component.

[82] MISO considered a constraint relieved if its worse pre-project loading was greater than 95% of its monitored Emergency rating, its worst pre-project loading was less than 100% of its monitored Emergency rating, and the worst loading decreased by greater than 5% following the addition of the project.

6. ROUTE DEVELOPMENT AND PROPOSED ROUTES

The Applicant conducted a route selection process beginning in 2022 and extending through late-2023. This process included consideration of statutory and rule requirements, identification and review of existing transmission lines and linear infrastructure, information gathering and data compilation, public outreach and input (including two rounds of in-person and virtual public meetings in May 2023 and September 2023), meeting with and collecting stakeholder comments, and comparison of route segments and alignments. Considerable public and agency outreach and information gathering was conducted in the Project Study Area. The Applicant also met with tribal government contacts and state and local agencies as part of the outreach program for the Project.

The Applicant developed a GIS database of information gathered from publicly available data resources and from in-field routing review efforts. This data was used to compare the merits of various routing options with a goal of developing routes that minimize impacts to sensitive resources to the extent practicable. Several existing infrastructure corridors were available and reviewed in the Project Study Area. With the exception of Segment 3 (discussed herein), this process resulted in the identification of two routes, five alternative segments, and three connector segments between the Project endpoints presented in this Application. A more detailed description of each step in the route selection process and identified route options is provided below.

6.1 Summary of Route Selection Process and State Routing Criteria

The proposed Project was studied, reviewed, and approved as part of the LRTP Tranche 1 Portfolio by the MISO Board of Directors in July 2022.

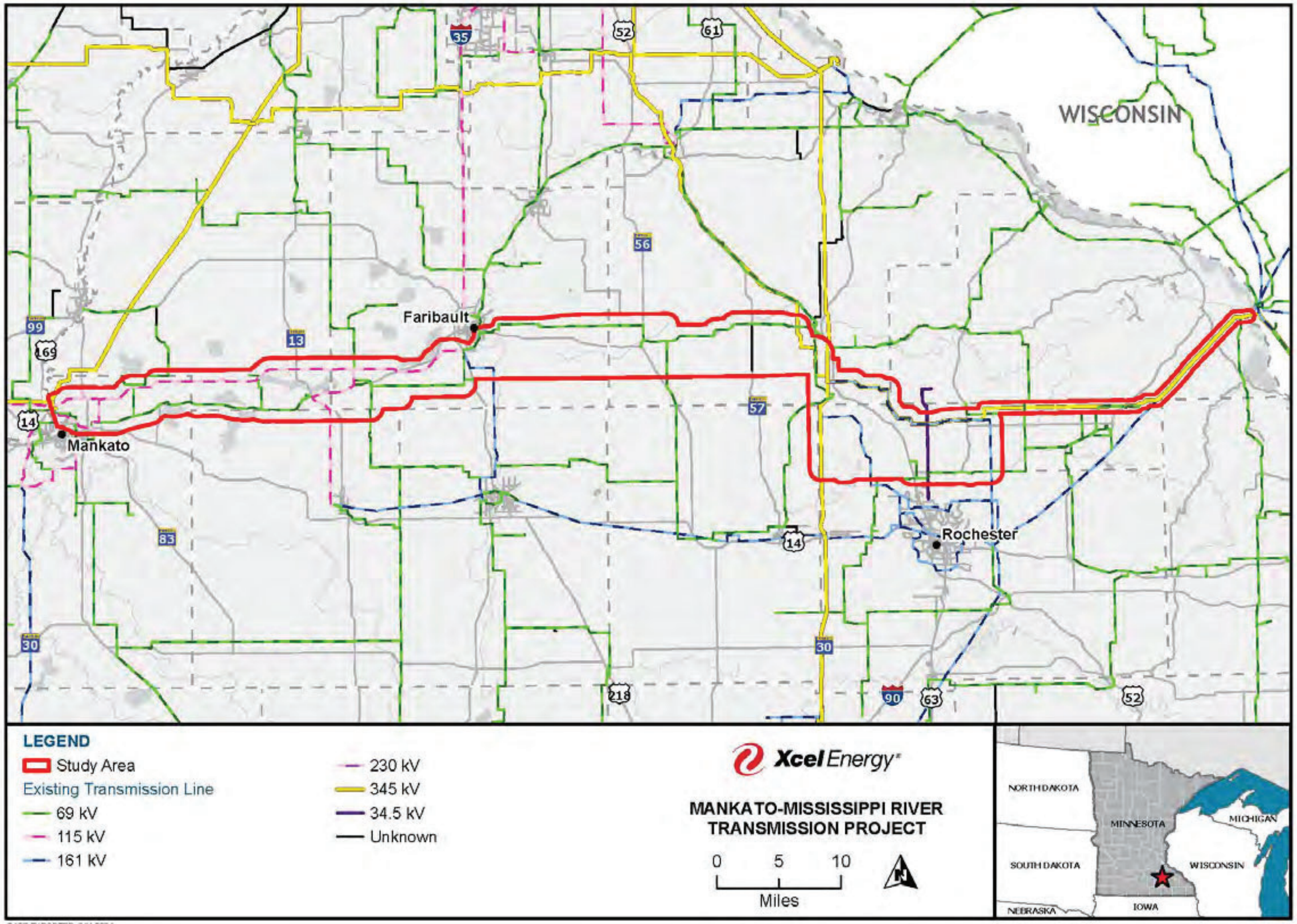
The Joint Owners filed with the Commission a notice of intent to construct, own, and maintain the Project on October 10, 2022. Since that time, on behalf of the Joint Owners, Xcel Energy has undertaken leading the route analysis and identification process described in this Application. Xcel Energy believes that the identification of several routing options within the Project Study Area and the extensive public and agency outreach already conducted will facilitate the Commission's review of this Project.

Xcel Energy developed a Project Study Area between the two Project endpoints (a new 345 kV transmission line between the existing Wilmarth Substation located in Mankato and the Mississippi River, and a new 161 kV transmission line between the North Rochester Substation near Pine Island and an existing transmission line northeast of Rochester) that includes portions of Blue Earth, Le Sueur, Waseca, Rice, Dodge, Olmsted, Goodhue, Winona, and Wabasha counties. The Project Study Area is the same as the Notice Area described in the Notice Plan Petition filing on October 17, 2023.

Xcel Energy applied the criteria set forth in Minn. Stat. § 216E.03, subd. 7, and Minn. R. 7850.4100 in its route development process. These criteria guide the Commission's decision when selecting a route for a high voltage transmission line.

Minn. Stat. § 216E.03, subd. 7(a) provides that the Commission's route permit determinations "must be guided by the state's goals to conserve resources, minimize environmental impacts, minimize human settlement and other land use conflicts, and ensure the state's electric energy security through efficient, cost-effective power supply and electric transmission infrastructure." Subdivision 7(e) of the same section requires the Commission to "make specific filings 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."

Map 6-1
Project Study Area



In addition to the statutory criteria noted above, Minn. Stat. § 216E.03, subd. 7(b), as amended, and Minn. R. 7850.4100 provide factors the Commission will consider in determining whether to issue a route permit for a high voltage transmission line. These factors are:

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;

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 rights-of-way, survey lines, natural division 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 rights-of-way;

K. Electrical system 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;

N. Irreversible and irretrievable commitments of resources;

O. Evaluation of the protection and enhancement of environmental quality and the reliability of state and regional energy supplies;

P. Evaluation of socioeconomic factors; and

Q. Evaluation of employment and economic impacts in the vicinity of the facility site and throughout Minnesota, including the quantity and quality of construction and permanent jobs and their compensation levels.

6.2 Route Development Process

The Applicant gathered information to develop potential routes to construct approximately 120 miles of new 345 kV transmission line and approximately 20 miles of new 161 kV transmission line. The Applicant used a process of identifying, refining, and comparing route options to arrive at the proposed route options and connector segments identified in this Application. The process of gathering this information and developing these potential routes included the following steps:

- Establish boundaries for Project Study Area;
- Identify opportunities and constraints;
- Develop preliminary route alternatives;
- Conduct tribal, local government and agency outreach;
- Conduct initial landowner outreach;
- Review initial route network in the field;
- Hold public open house meetings;
- Review and refine routes based on feedback and analysis, run comparative analysis to remove most impactful routes;
- Conduct a second round of public open house meetings;

- Review, refine routes, run comparative analysis to remove most impactful routes. Optimize route segments and connect for end-to-end routes for this Route Permit Application; and
- Conduct constructability review of end-to-end routes.

As noted in earlier sections of this Application (Sections 1.3 and 2.2) the Project is divided into four overall segments within which various routing opportunities were identified.

6.2.1 Project Study Area

The Project Study Area was designed to include an area large enough that a reasonable number of route options to connect the endpoints for both the 345 kV transmission line and the endpoints for the 161 kV transmission line could be identified without it being so large as to encumber the analysis with excessive data and routing options that did not present reasonable alternatives. It was further tailored to address the proposed conversion of the existing transmission line to operate at 345 kV in Segment 3 (narrowed), as well as rerouting the proposed 161 kV transmission line in Segment 4 (expanded).

The purpose of identifying a Project Study Area was to establish boundaries and limits for the information-gathering process (e.g., identifying environmental and land use resources, routing constraints, and routing opportunities) and the subsequent development of route options for the four segments and associated connector segments of the Project. The Project Study Area was also used as the Project Notice Area for public outreach and developing mailing lists for Project updates and invitations to public open houses.

The Applicant developed the initial Project Study Area boundary by buffering existing transmission lines under routing consideration for Segments 1, 2 and 4 by one mile and by 0.5 mile between the North Rochester Substation and the Mississippi River (Segment 3). The boundary was then manually adjusted in some areas to ensure that preliminary routes which did not follow existing infrastructure were also enclosed. The overall Project Study Area covers approximately 479.2 square miles.

6.2.2 Identifying Routing Opportunities and Constraints

The process of identifying potential routes started by first identifying areas where existing transmission line infrastructure was located and where deviation from such infrastructure and right-of-way would be required. Given the amount of existing transmission lines in the Project Area, routing for the Project focused on taking advantage of these existing corridors to the greatest extent practicable, which limited the overall total number of routes that were analyzed during the routing process.

There are some portions of the Project where the new 345 kV transmission line is proposed to be double circuited on existing structures (i.e., Segment 3 and part of Segment 2) which were permitted and constructed as part of the CapX2020 Hampton – La Crosse Project. These represent significant opportunities, and in those locations additional alternatives are not proposed in this Application because the Commission already evaluated route alternatives in that proceeding.

To minimize impacts on the environment and affected landowners, the Applicant also examined the Project Study Area for routing constraints to avoid where practicable. These routing constraints are listed below, and potential impacts associated with these constraints are discussed in Chapter 7:

- Residences.
- Federally-owned properties: U.S. Fish and Wildlife Service (USFWS) Waterfowl Production Areas (WPAs), Historic Landmarks, or publicly owned properties that were acquired with federal Land and Water Conservation Act funding.
- State-owned properties such as State Parks, Wildlife Management Areas (WMAs), Scientific and Natural Areas (SNAs), or Aquatic Management Areas (AMAs).
- Lakes, Rivers, Wetlands, and Calcareous Fens.
- Public Airports.
- Regional, County, and Municipal Parks: No routes are proposed that cross within the boundaries of these recreation lands.

- Cemeteries, Schools, Hospitals, Public Buildings.
- Conservation easements, such as Conservation Reserve Enhancement Program (CREP) and Reinvest in Minnesota (RIM), administered by the Minnesota Board of Soil and Water Resources (BWSR).
- Tribal-owned properties.
- State Wild and Scenic Rivers.
- Sites of Biodiversity Significance (SOBS), Native Plant Communities (NPCs), native prairie, public water wetlands, and crossings of forested areas where tree clearing would be necessary.

To further minimize impacts on the environment and affected landowners, the Applicant looked for routing opportunities that would share existing rights-of-way or follow existing linear features. Routing opportunities in the Project Study Area included:

- Locations where there was an opportunity to double-circuit with or parallel existing transmission lines.
- Locations where there was an opportunity to parallel a roadway, and potentially share public right-of-way between the transmission line and road, and avoid the constraints listed above.
- Locations where there was an opportunity to place the transmission centerline on a field or property line, where land uses could continue uninterrupted in the transmission line easement.
- Routes that reduce the number of two-pole angle or dead-end structures by following straight lines.

6.2.3 Local Government, Agency, and Tribal Outreach

After the Project Study Area and initial routes were developed, the Applicant contacted state and local agencies (e.g., Minnesota Department of Natural Resources (MnDNR), Minnesota Department of Transportation (MnDOT), and various county and local administrators) to notify them about the Project and request feedback on the preliminary routes. The Applicant also sent outreach letters to every federally recognized tribe in the state of Minnesota, along with several tribes outside of the state who have ancestral interests in the counties the Project Area crosses. The purpose of the outreach to these local agencies and tribes is to collect more input and perspectives regarding route options. More detail regarding outreach efforts is included in Chapter 8.

6.2.4 Site Review of Route Network

After the desktop identification of the initial route network, the Applicant performed an in-field site visit of the Project Study Area. Using data and information gathered from agency responses, county meetings, and the GIS constraints database developed for the Project, the Applicant investigated numerous routes in the field and noted features not evident on aerial photos, reviewed route options for constructability considerations, and observed the context of each route.

6.2.5 Public Open House Meetings

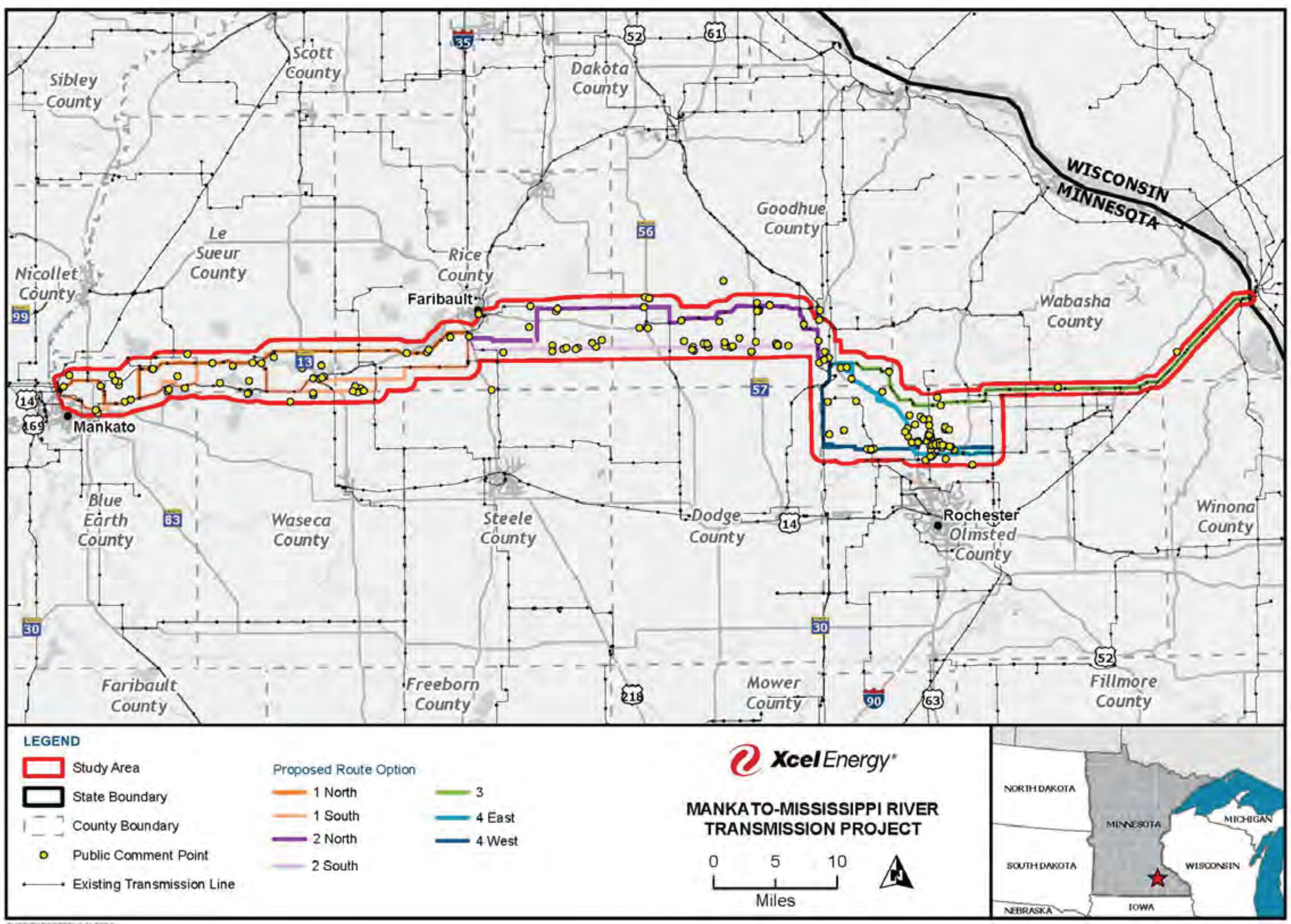
Following the development of the initial routes, and after incorporating route changes based on site review, the Applicant conducted open house meetings for the Project in May 2023. This included six in-person (two meetings per day at three locations) and one live virtual, as well as an on-demand self-guided virtual open house available on the Project website. In-person open houses were held in the cities of Zumbrota, Mankato, and Faribault.

A second round of open house meetings were held in September 2023, including three in-person and one live virtual, as well as an on-demand self-guided virtual open house available on the Project website. In-person open houses were held in the cities of Zumbrota, Mankato, and Faribault. At these open house meetings, the Applicant presented an updated route network with routes slightly modified based on feedback received from public comments, additional field visits, and an ongoing comparative analysis of route segments.

The Applicant provided notices for these open houses via newspaper and direct mail to residents, landowners, public officials, and other potential stakeholders (**Appendix N**). The open house invitation provided information such as a general Project description, a map of the Project Study Area and preliminary route options, the Project website address, and Applicant's contact information to submit questions and comments.

The open house format had stations to display and communicate information about the Project to the attendees. Large-scale poster-sized maps were on display depicting the Routing Study Area and preliminary route options. Meeting attendees were encouraged to leave comments either at the meeting or following the meeting. The Applicant received approximately 145 and 76 comments from the first and second round of public open houses, respectively. The Applicant tallied each comment received and identified categories of common themes that commentors referenced as a concern (see **Appendix N**). **Map 6-2** depicts the location of comments received from each open house if an address was provided.

Map 6-2
Project Comment Locations



These common themes are summarized below and in Section 8.2.5:

- Residential impacts (proximity, property values, aesthetics, etc.).
- Business impacts (proximity, operational disturbances, etc.).
- Agricultural and environmental impacts (farmland disturbance, harvest interruption, etc.).
- Proximity and potential impacts to aviation, quarrying, and landfill operations.
- Use of existing transmission corridors and infrastructure.
- General routing questions and concerns.
- Other Project questions and concerns.

6.3 Route Refinement and Analysis

6.3.1 Comparison of Segments and Routes

Data for the route combinations were quantified for the route evaluation criteria for each of these segment combinations. Additionally, the routing criteria included evaluation categories such as length, co-location with existing linear features, and numbers of occurrences of selected resources or features.

The route screening analysis was used to identify a smaller set of routes upon which to focus the selection process. Additionally, opportunities were identified to connect between these routes to create flexibility in configuring combinations of routes if desired (refer to Section 6.4.5).

The Applicant identified various subsegment combinations (end-to-end routes) for each Route Option and reviewed each in detail (refer to **Appendix L**). This review considered potential human settlement and natural resource impacts as well as compliance with Minnesota routing criteria, regulatory requirements of other agencies for Project permitting (e.g., MnDNR regulations for lake crossings), and engineering and construction considerations (e.g., access, constructability, etc.). During this process, certain subsegments that did not meet Project need or that had greater overall impacts as compared to other options were dropped from further consideration for this Project. These subsegments are shown in **Appendix Q**.

Throughout the route development process, the Applicant added or adjusted route subsegments in response to agency, local government, and landowner comments. Feedback received through consultation with agencies was incorporated into the final Proposed Routes. Information on the consultation feedback is available in Section 8.

6.4 Proposed Routes

As described in Section 1.3, the Project includes four segments which may travel through Blue Earth, Le Sueur, Waseca, Rice, Dodge, Olmstead, Goodhue, Winona, and Wabasha counties in Minnesota. **Table 6-1** and the sections below provide brief descriptions of the end-to-end route options for these segments and **Map 6-3** depicts the Proposed Routes for each segment. Detailed route maps are provided in **Appendix K.**

Map 6-3
Proposed Route Options

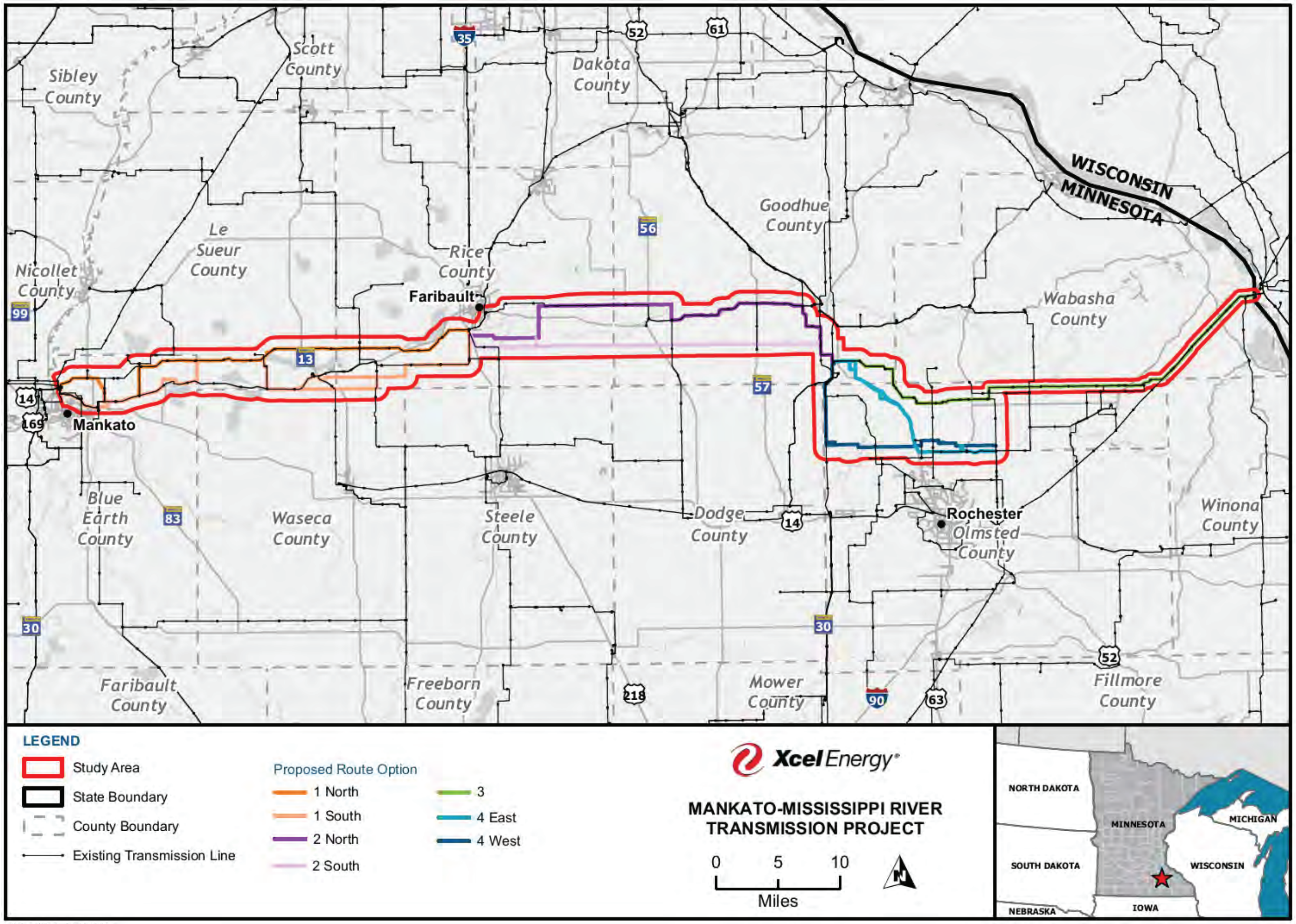


Table 6-1
Project Route Options

Route Option	General Description
Segment 1 – Mankato to Faribault (345 kV)	
1 North	Follows existing Xcel Energy owned 115 kV transmission line between the cities of Mankato and Faribault. Would double-circuit new 345 kV with an existing 115 kV line.
1 South	Follows existing Xcel Energy owned 69 kV and 115 kV lines between the cities Mankato and Faribault. Follows roads and property lines in areas where not following transmission lines. Would double-circuit with existing transmission lines (for approximately 72 percent of the route).
Segment 2 – Faribault to Pine Island (North Rochester substation)(345 kV)	
2 North	Includes a combination of paralleling roads and double-circuited with an existing 69 kV transmission line between the cities of Faribault and Zumbrota. Eastern portion would be double-circuited with existing Hampton to North Rochester 345 kV line.
2 South	Includes a combination of paralleling existing roads and property lines. Smaller portions would be double-circuited with existing 161 kV and 345 kV line on either end.
Segment 3 – North Rochester Substation to Mississippi River (345 kV)	
3	Follows/uses the second circuit position on the existing North Rochester to La Crosse 345 kV transmission line. Segment 3 does not require any new right-of-way.
Segment 4 – North Rochester Substation to Chester Line (161 kV)	
4 East	Follows Highway 52 between Pine Island and Highway 63, then follows Highway 63/75th Street east where it would be double-circuited with an existing 69 kV line.
4 West	Parallels existing 161 kV and 345 kV lines south from Pine Island, then turns and follows a combination of roads and property lines to the east.

In addition to the end-to-end Route Options described, alternative and connector segments are included in this Application. Connectors are included to provide options to shift between identified Proposed Routes. Alternative segments are typically included in locations where landowners requested alternatives to proposed routes, and where the alternatives had approximately comparable, but different, impacts. Alternatives that were submitted by landowners which overall had greater impacts than proposed alignments are discussed in **Appendix Q**. Descriptions of connector and alternative segments are presented in the sections below. A comparison analysis of the Alternative Segment with the corresponding portion of a Route Option can be found in **Appendix R**.

6.4.1 Segment 1

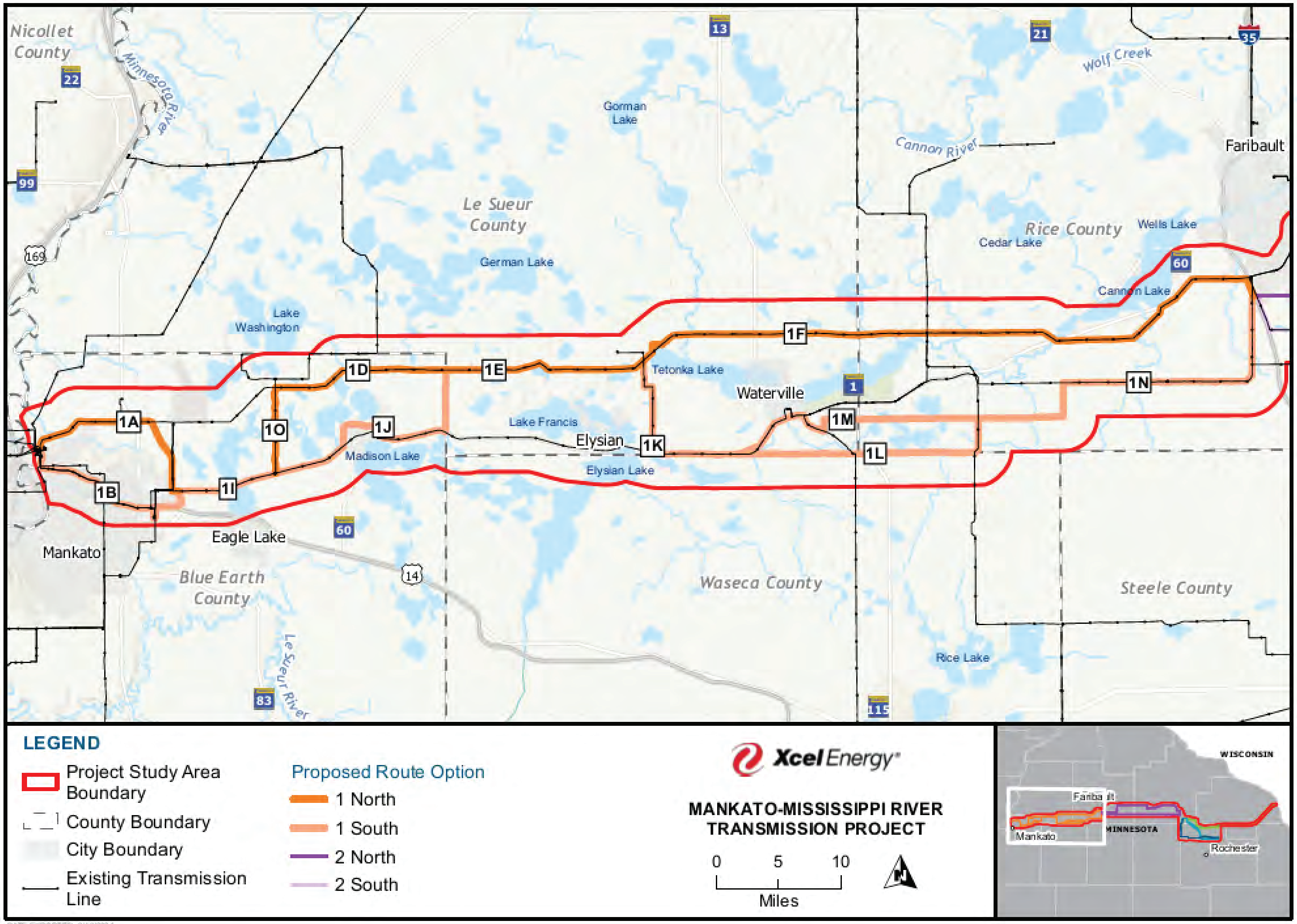
Beginning in the west, Segment 1 runs from the Wilmarth Substation to a point near the West Faribault Substation (building between 48 and 54 miles of 345 kV transmission lines primarily in existing transmission corridors). Two potential routes were identified for Segment 1, Route Option 1 North and Route Option 1 South (**Map 6-4**). Detailed route maps are provided in **Appendix K**.

Table 6-2 below lists the route subsegments that together comprise the end-to-end Proposed Routes for Segment 1. The table also lists the any alternatives or connectors that are being proposed.

Table 6-2
Segment 1 Components

<table>
<tr><th colspan="4">Segment 1 – Wilmarth Substation to West Faribault (345 kV)</th></tr>
<tr><th>Route Option Name (complete end-to-end route)</th><th>Subsegments Included</th><th>Alternative Subsegment/s</th><th>Optional Connector (transition from one Route Option to another)</th></tr>
<tr><td>1 North</td><td>1A, 1I, 1O, 1D, 1E, 1F</td><td>None</td><td rowspan="2">None</td></tr>
<tr><td>1 South</td><td>1B, 1I, 1J, 1E, 1K, 1M, 1N</td><td>1L (in place of 1M)</td></tr>
</table>

Map 6-4
Proposed Routes for Segment 1



6.4.1.1 Route Option 1 North

From the Wilmarth Substation, Route Option 1 North route follows an existing Xcel Energy 115 kV transmission line and a majority of this route would be double-circuited with the 115 kV line. This option heads northeast out of the Wilmarth Substation through a commercial/industrial area, including a crossing of the Summit Avenue Landfill before continuing east through primarily agricultural land. Because the existing 115 kV transmission line runs along the south edge of the Mankato Regional Airport, and the new 345 kV line cannot be constructed near the airport (see Section 5.2.4) the route diverges from the existing transmission line corridor and runs south paralleling the railroad and an existing 115 kV transmission line where it meets and shares a common segment with Option 1 South. The common route segment follows the Sakatah Singing Hills Trail east where it crosses Eagle Lake at its narrowest point and the 345 kV would be double-circuited with an existing 69 kV transmission line in this corridor. East of Eagle Lake, Route Option 1 North diverges from Route Option 1 South running back north to the existing 115 kV transmission line corridor. From that point it would again be double-circuited with the existing 115 kV line for approximately 30.6 miles to Faribault.

6.4.1.2 Route Option 1 South

This route generally follows existing 115 kV or 69 kV transmission lines and the 345 kV line would be double-circuited with those lines where practicable. From the Wilmarth Substation, Route Option 1 South would use an existing 115 kV/ 69 kV double-circuit line corridor which runs south to Highway 14 then follows the south side of the highway for approximately 4 miles. It would involve rebuilding the existing line and replacing the 69 kV circuit with the new 345 kV line on double-circuit structures with the 115 kV. This option would require installing equipment at the nearby Eastwood Substation to re-terminate the 69 kV line there instead of at the Wilmarth Substation. Option 1 South then crosses to the north side of Highway 14, and then north where it meets and shares a common segment with Option 1 North. The common route segment would be double-circuited with the existing 69 kV line generally following the Sakatah Singing Hills Trail east where it crosses Eagle Lake at its narrowest point. To the east of Eagle Lake, Route Option 1 North turns back to the north and Route Option 1 South continues east double-circuited with the existing 69 kV line. In locations where the existing 69 kV lines would be double-circuited with the new 345 kV line, the alignment is typically shifted slightly from the existing alignment due to the wider right-of-way requirement for 345 kV voltages.

Due to routing constraints from existing residential and commercial development, the Route Option 1 South diverges from the existing transmission line corridor at Madison Lake where it traverses around the city, eventually rejoining the 69 kV corridor east of town and continuing east along Highway 60. At the Blue Earth/Le Sueur County boundary Route Option 1 South turns to the north and then follows another common corridor with Route Option 1 North for approximately 6 miles. This common segment is proposed because the 69 kV line runs through the town of Elysian which is located at a narrow point between two lakes and there is not adequate space for a 345 kV right-of-way through the town. Route Option 1 South turns back to the south at 193rd Avenue, following an existing GRE 69 kV line back to Highway 60 and the existing Xcel Energy 69 kV line.

At Waterville, Route Option 1 South diverges from the existing 69 kV transmission line/Highway 60 corridor, making a slight jog to the south before turning back to the east following existing property lines and roads and crossing agricultural, open, and forested lands.

Approximately 2 miles east of Morristown, Route Option 1 rejoins the existing 69 kV transmission line corridor traveling east and then north for about 8 miles to the endpoint for Segment 1 on the west side of I-35 near Faribault. To minimize impacts on existing farmsteads along this route option, the route includes multiple crossings of roads.

6.4.1.3 Alternative 1L

At Waterville, Option 1 South includes an approximately 8.0-mile alternative, Alternative 1L, which diverges from the existing 69 kV corridor and continues east along existing roads and property lines. Due to the amount of residential development along the roadways, the alternative includes multiple crossings of the road to bring the route further from residences where possible. The alternative then joins an existing transmission line corridor, where it would be double-circuited with the existing line, and travels turns north through agricultural land.

6.4.2 Segment 2

From the end of Segment 1, the Project would connect to the North Rochester Substation (34-42 miles of new 345 kV transmission lines in either a new corridor and/or existing transmission corridors). This segment is referred to as Segment 2.

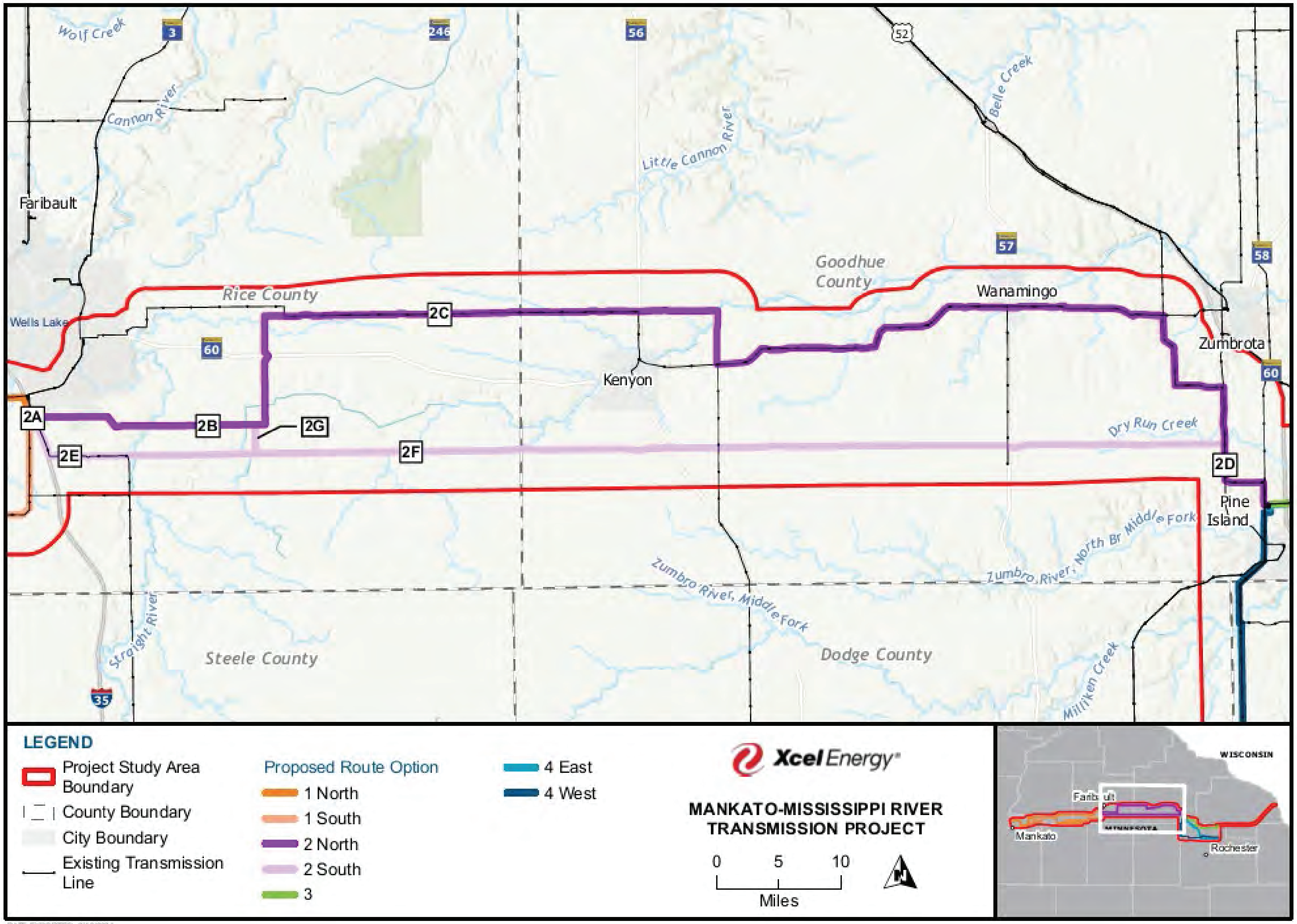
Two potential Route Options were identified for Segment 2, Route Option 2 North (41.2 miles) and Route Option 2 South (33.6 miles) (**Map 6-5**). Portions of Route Option 2 North would be double-circuiting with Xcel Energy's existing 69 kV and 345 kV transmission lines. In locations where the existing 69 kV lines would be double-circuited with the new 345 kV line, the proposed alignment is typically shifted slightly from the existing alignment due to the wider right-of-way requirement for a 345 kV line. For Route Option 2 South, larger portions of the route would require greenfield right-of-way, though there are sections at each end that would be double-circuited with existing 161 kV and 345 kV lines.

Table 6-3 below lists the route segments that together comprise the main end-to-end routes for Segment 2. The table also lists an optional connector that is being proposed.

Table 6-3
Segment 2 Components

Segment 2 – West Faribault to North Rochester Substation (345 kV)			
Route Option Name (complete end-to-end route)	**Subsegments Included**	**Alternative Subsegment/s**	**Optional Connector (transition from one Route Option to another)**
2 North	2A, 2B, 2C, 2D	None	2G (transition from 2 South to 2 North or 2 North to 2 South)
2 South	2A, 2E, 2F, 2D	None	

Map 6-5
Proposed Routes for Segment 2



6.4.2.1 Route Option 2 North

Starting the west side of I-35, Route Option 2 North heads generally east, crossing I-35 and the CP Rail Systems railroad. The route then continues in a general easterly and northerly direction crossing primarily agricultural land. This approximately 9.3-mile portion of the route would not be double-circuited with or parallel to an existing transmission line. After crossing Gates Avenue, Route Option 2 North joins Xcel Energy's existing 69 kV corridor where it continues east through agricultural land. This approximately 9.0-mile portion of the route would be double-circuited with the existing 69 kV line.

Continuing east, the route leaves the existing 69 kV corridor and crosses Highway 56. Route Option 2 North continues generally east and then south through primarily agricultural and open land along roadways and crosses the North Branch Zumbro River. This approximately 3.4-mile portion of the route would not be double-circuited with an existing transmission line and would require a greenfield right-of-way.

After crossing 50th Avenue, the Route Option joins back with the 69 kV corridor and continues in a general easterly direction paralleling Highway 60 and crossing primarily agricultural, residential, and open land. This approximately 12.2-mile portion of the route would be built as a double-circuit 345 kV/69 kV. Approximately 1.4 miles west of Zumbrota, the Route Option leaves the 69 kV corridor and at that point would be double-circuited with the existing Hampton – La Crosse 345 kV line. For this approximately 7.2-mile portion of the route, the new 345 kV line would be placed on the existing double-circuit capable poles. This segment continues in a general southerly direction, the Route Option crosses primarily agricultural land interspersed with open and forested land and ends at the North Rochester Substation.

6.4.2.2 Route Option 2 South

Starting from at a point on the west side of I-35 near Westwood Park, Route Option 2 South follows the same alignment as Route Option 2 North for the first 0.1 mile, crossing I-35 and the CP Rail Systems railroad. The Route Option then joins an existing 161 kV corridor and travels generally south and east through agricultural land. This approximately 3.1-mile portion of the route would be double-circuited with an existing 161 kV line.

Continuing east, Route Option 2 South leaves the existing 161 kV corridor and crosses the Straight River, the Straight River Golf Course, North Fork Zumbro River, and Highway 56. This approximately 27.9-mile portion of the route, crossing primarily agricultural land interspersed with forested land, would not be double-circuited with an existing transmission line and would require a greenfield right-of-way. Route Option 2 South then joins the existing 345 kV corridor and follows the same alignment as Route Option 1 North for the remainder of the route. This approximately 2.6-mile portion of the route would be double-circuited with the existing 345 kV line and ends at the North Rochester Substation.

6.4.2.3 Connector 2G

Segment 2 includes an approximately 0.8-mile-long connector in Rice County, referred to as Connector 2G. The connector travels south for the entire length across agricultural land. The connector would not be double-circuited with an existing transmission line and would therefore require a greenfield right-of-way.

6.4.3 Segment 3

From the North Rochester Substation, the Project would continue on to the Mississippi River where it would cross the river at a point near Kellogg, converting about 27 miles of currently operating 161 kV transmission line to 345 kV and installing about 16 miles of new 345 kV transmission lines on existing transmission structures. The Mississippi River crossing would not require any new construction as it would use an existing 69 kV line which would be converted to 345 kV operation. This segment is referred to as Segment 3.

One 43.4 mile Route Option was identified for Segment 3, known as Route Option 3. This is due to the fact that Segment 3 involves either converting an existing 161 kV to 345 kV operation or stringing an additional 345 kV circuit on existing double-circuit 345/345 kV structures. This segment was previously permitted by the Commission as part of the Hampton – La Crosse Project in 2012.[83] An alternative route is not included for Segment 3 because route alternatives to this segment were evaluated as part of the route permit proceeding for the Hampton – La Crosse Project. The entire length of Route Option 3 is within an existing transmission corridor. No additional right-of-way would be required for this work.

Table 6-4 below describes the route segments that together comprise the end-to-end routes for Segment 3 and **Map 6-6** depicts the Proposed Route. No alternatives or connectors are being proposed as part of Segment 3.

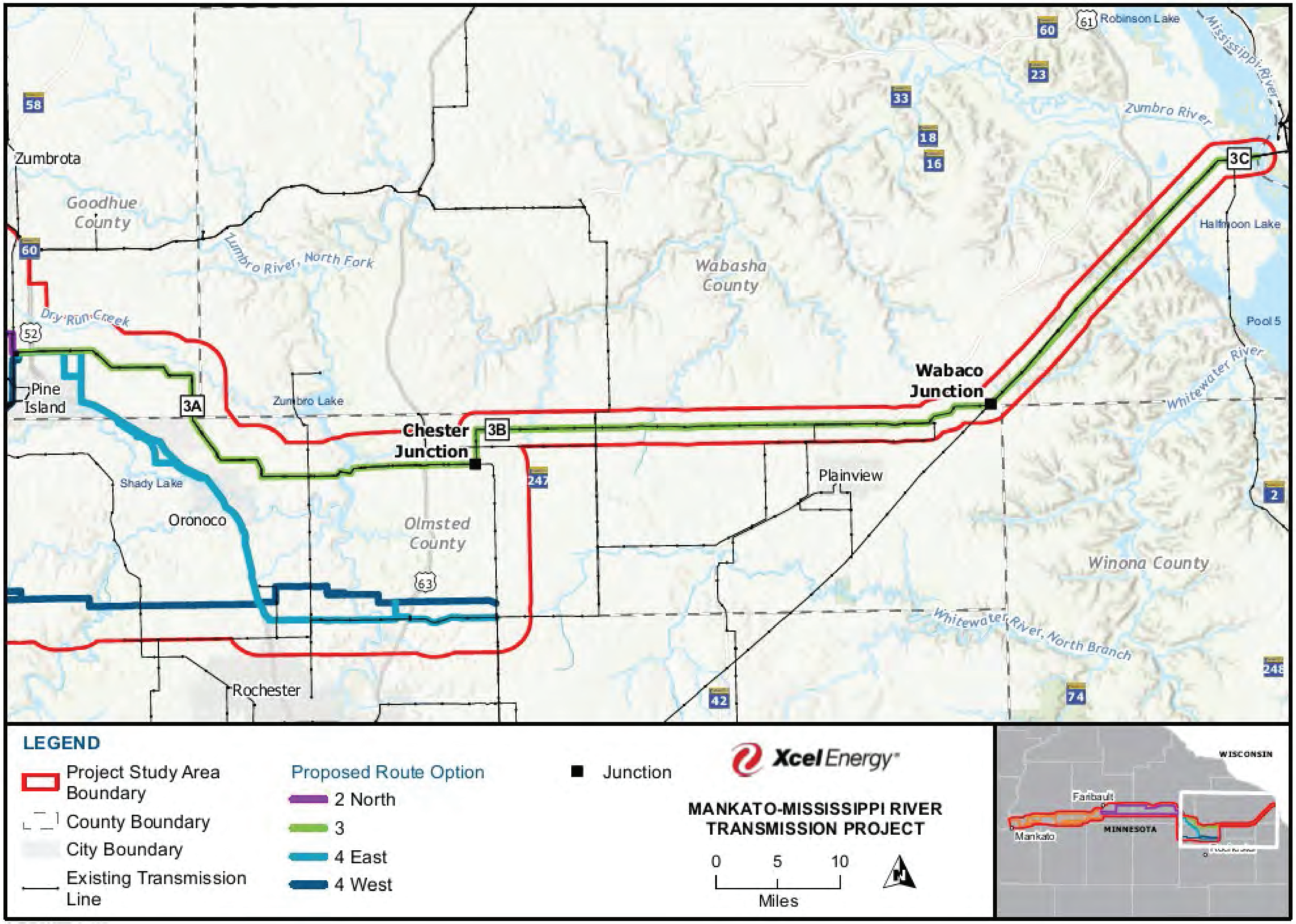
Table 6-4
Segment 3 Components

Segment 3 – North Rochester Substation to Mississippi River (345 kV)			
Route Option Name (complete end-to-end route)	**Subsegment Name (making up the Route Option)**	**Alternative Subsegment Name (replacement subsegment)**	**Connector Subsegment Name (transition from one Route Option to another)**
3	3A, 3B, 3C	None	None

Starting from the North Rochester Substation, Route Option 3 travels in an easterly direction through primarily agricultural land and crossing Zumbro Lake. This approximately 16.1-mile portion of Route Option 3 would only require converting an existing 161 kV circuit to 345 kV operation and no impacts along the route are anticipated. The Route Option then turns north and then east through primarily agricultural land. This approximately 16.3-mile portion of the route would require stringing a new 345 kV circuit on existing double-circuit 345/345 kV structures within the existing transmission line right-of-way. Route Option 3 then travels northeast through primarily forested and agricultural land to the Mississippi River. This final approximately 10.9-mile portion of Route Option 3 would only require converting an existing 161 kV circuit to 345 kV operation and no impacts along the route, including at the Mississippi River crossing, are anticipated.

[83] *In the Matter of Xcel Energy's Application for a Route Permit for the CapX2020 Hampton – Rochester – La Crosse High Voltage Transmission Line*, ORDER ISSUING ROUTE PERMIT AS AMENDED, Docket No. E002/TL-09-1448 (May 30, 2012).

Map 6-6
Proposed Route for Segment 3



6.4.4 Segment 4

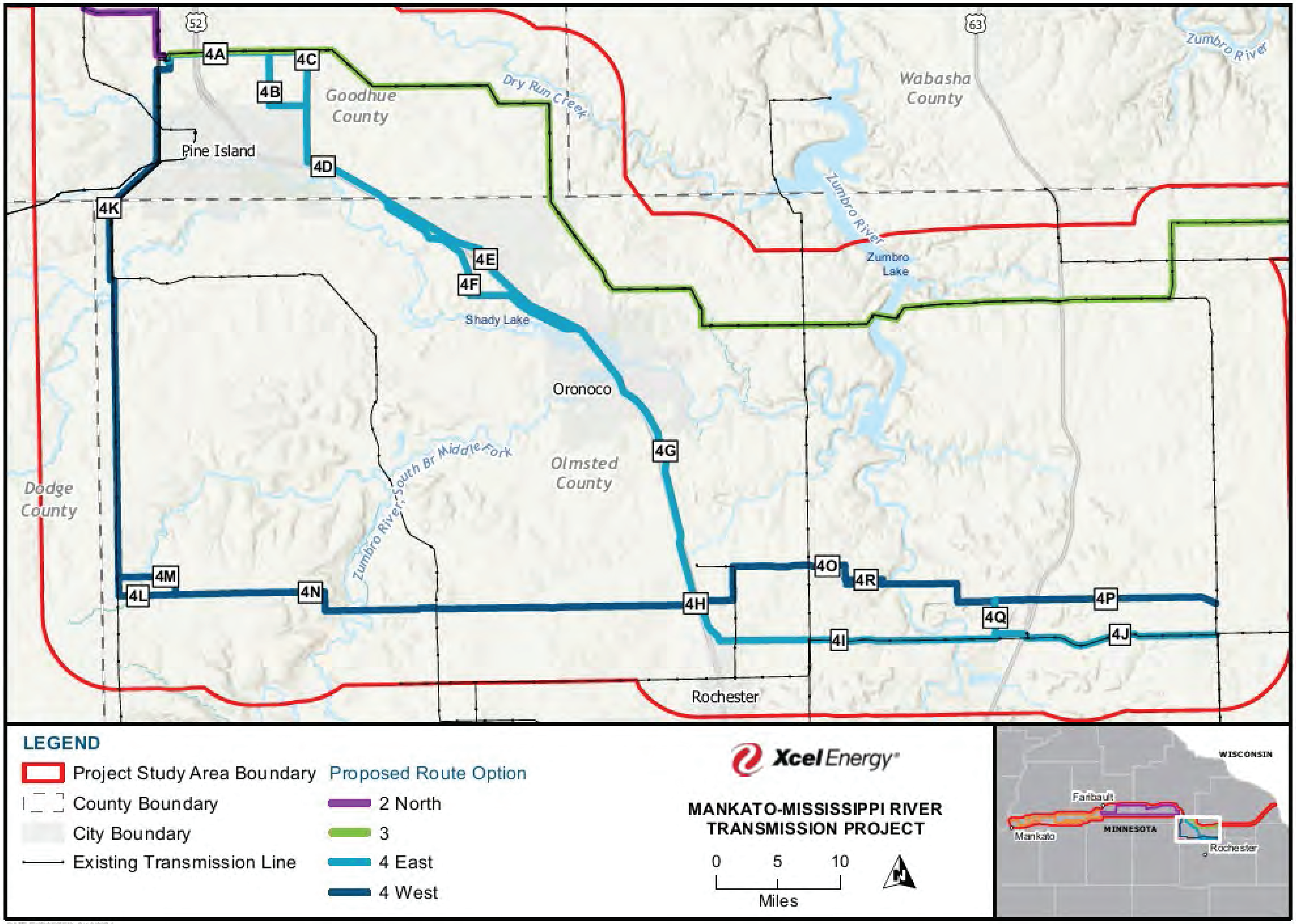
Segment 4 includes the relocation of a portion of the existing North Rochester to Chester 161 kV transmission line. Approximately 16 miles of this line is currently double-circuited with the existing Hampton – La Crosse 345 kV line. Segment 3 of this Project involves converting that portion of the 161 kV line to 345 kV; therefore the 161 kV line will need to be constructed in a new location. Two potential Route Options were identified for Segment 4, Route Option 4 East (19.6 miles) and Route Option 4 West (23.7 miles) (**Map 6-7**). Portions of both routes would parallel existing transmission line rights-of-way; however, both routes also require significant segments where new greenfield right-of-way would be required. Additionally, a portion of Route Option 4 East would be double-circuited with existing 69 kV transmission lines. An opportunity also exists to double-circuit portions of both routes with new or re-routed Dairyland 69 kV lines in the area, and Xcel Energy will continue to work with Dairyland during the route permit process.

Table 6-5 below describes the route segments that together comprise the end-to-end routes for Segment 4. The table also lists the alternatives and connectors that are being proposed. In addition to Connector 4Q, Route Options 4 East and 4 West intersect at Highway 52 and there would be an option to transition between route options at that point.

Table 6-5
Segment 4 Components

Segment 4 – North Rochester Substation to Chester Line (161 kV)			
Route Option Name (complete end-to-end route)	**Subsegments Included**	**Alternative Subsegment/s**	**Optional Connector (transition from one Route Option to another)**
4 East	4A, 4B, 4D, 4F, 4G, 4H, 4I, 4J	4C (in place of 4B), 4E (in place of 4F)	4Q (transition from 4 East to 4 West Route Option, or vis-versa)
4 West	4K, 4L, 4N, 4H, 4O, 4P	4M (in place of 4L), 4R (in place of portion of 4O),	

Map 6-7
Proposed Routes for Segment 4



6.4.4.1 Route Option 4 East

Starting at the North Rochester Substation, Route Option 4 East travels east paralleling Xcel Energy's existing 345 kV transmission line corridor through agricultural land for approximately 1.4 miles. It then leaves the existing transmission corridor and travels generally south through agricultural land. The Route Option then parallels the north and south sides of Highway 52. To minimize impacts on residences (including the Oronoco Mobile Home Park), Route Option 4 East includes multiple crossings of the highway and two bump-outs where the route moves further from the highway. This approximately 11.9-mile portion of the route, crossing primarily agricultural and open land along roadways, is not double-circuited with an existing transmission line and would require new transmission line right-of-way.

The route then turns east through agricultural and low-density residential areas for about 1.2 miles before joining an existing 69 kV line corridor. Continuing east, Route Option 4 East parallels roadways and crosses more developed (residential and commercial/industrial) land. To avoid impacts on existing residences along 75th Street NE near the intersection with Highway 63 North, the route diverges from the existing transmission corridor for about 0.4 mile crossing behind residences and avoiding a direct crossing of a rotary intersection. The Route Option rejoins the existing transmission line corridor and continues east through primarily agricultural and forested land along roadways before terminating at 50th Avenue NE. With the exception of the section that routes around the 75th Street/Highway 63 intersection, this approximately 5.6-mile portion of the route would be double-circuited with the existing 69 kV line.

6.4.4.2 Route Option 4 West

Starting at the North Rochester Substation, Route Option 4 West travels south and parallels existing 161 kV and 345 kV transmission lines through primarily agricultural land interspersed with forested land. This approximately 7.7-mile portion of the route parallels existing lines, however additional right-of-way would be required. The Route Option continues east for the remainder of the route and includes crossings of South Branch Middle Fork Zumbro River, Highway 52, Zumbro River, and Highway 62 before terminating at 50th Avenue NE. This approximately 15.9-mile portion of the route, crossing a combination of agricultural, forested, and open land, would not be double-circuited with an existing transmission line and would require a greenfield right-of-way.

6.4.4.3 Alternative 4C

Route Option 4 East includes an approximately 1.2-mile Alternative 4C, which is provided as an alternative to 4B. This alternative continues east along 500th Street, paralleling an existing transmission line corridor through agricultural land, then turns south, continuing through agricultural land. The entire length of the alternative would not be double-circuited with an existing transmission line and would therefore require a greenfield right-of-way.

6.4.4.4 Alternative 4E

Route Option 4 East includes an approximately 3.1-mile Alternative 4E. This alternative was reviewed and generally follows the existing Highway 52 alignment. As part of Xcel Energy's stakeholder outreach, they met with the Prairie Island Indian Community which has expressed interest in developing newly acquired property on the east side of the highway (see Section 8.1). As part of Xcel Energy's work with the Prairie Island Indian Community, and to give the Commission several options to review in this area, Xcel Energy also identified an option (4F) to parallel the highway on the southwestern side of Highway 52. Xcel Energy also includes this alternative (4E) on the north/east side of Highway 52. The alternative crosses behind businesses and primarily crosses open land adjacent to the Highway 52 corridor. The alternative would not be double-circuited with an existing transmission line and would therefore require a greenfield right-of-way.

6.4.4.5 Alternative 4M

Route Option 4 West includes an approximately 1.0-mile Alternative 4M, which was identified in response landowner comments regarding the alignment of 4L not following existing property lines or other rights-of-way. The alternative parallels roads and crosses primarily agricultural and open land along the roadways. The alternative would not be double-circuited with an existing transmission line and would therefore require a greenfield right-of-way.

6.4.4.6 Alternative 4R

Route Option 4 West includes an approximately 0.6-mile Alternative 4R. Due to landowner comments received regarding a planned development in this area along 4O, Xcel Energy identified an alternative that brings the alignment further north along the property boundary. The alternative veers east and then south through primarily open and forested land. The alternative would not be double-circuited with an existing transmission line and would therefore require a greenfield right-of-way.

6.4.4.7 Connector 4Q

Segment 4 includes an approximately 0.4-mile-long Connector 4Q. The connector travels south paralleling 20th Ave NE crossing agricultural land for the entire length of the route. The connector would not be double-circuited with an existing transmission line and would therefore require a greenfield right-of-way.

7. ENVIRONMENTAL ANALYSIS OF ROUTES

This chapter provides an environmental analysis of the Proposed Routes and, where applicable, the proposed right-of-way and proposed centerline or alignment. To better understand the impact calculations included in this chapter, it is important to define several of the terms that are used throughout this chapter:

- ***Project Study Area*** –The Project Study Area encompasses the area that the Applicant evaluated for potential routes as part of the route development process. The Project Study Area covers an area of approximately 479.2 square miles and is approximately 100 miles long and 12 miles wide at its widest point.

- ***Proposed Routes*** – A route is the area in which the Commission authorizes a permittee to place the proposed transmission line facilities. The Proposed Routes for this Project are typically 1,000 feet wide but there are portions of the Proposed Routes where the route width is wider such as near highway interchanges or where the Proposed Routes are parallel to other Proposed Routes.

- ***Proposed Right-of-Way*** – The right-of-way is the specific area that is required for the easement for the transmission line. The proposed right-of-way is narrower than, and located within, the Proposed Routes. For the 345 kV transmission line, the right-of-way is 150 feet wide (75 feet on each side of the centerline). For the 161 kV transmission line, the right-of-way is 100 feet wide (50 feet on each side of the centerline).

- ***Proposed Centerline or Alignment*** – This is where the Applicant, based on the information available at the time of filing this Application, intends to place the centerline of the transmission line. The proposed centerline for the Proposed Routes can be seen on the maps contained in **Appendix K**.

7.1 Description of Environmental Setting

The state of Minnesota is divided into Ecological Provinces, Sections, and Subsections classifications. Under this classification system, the Proposed Routes are located within the Eastern Broadleaf Forest Province. Segment 1 and the majority of Segment 2 are located in the Minnesota and Northeast Iowa Morainal Section and the majority of Segment 3 and Segment 4 are located in the Paleozoic Plateau Section. These sections are further broken down into subsections. Segment 1 is located within the Big Woods and Oak Savannah subsections. Segment 2 is located within the Oak Savanna and the Rochester Plateau subsections. Segment 3 is within the Rochester Plateau and Blufflands subsection. Segment 4 is primarily located within the Rochester Plateau subsection and part of the Oak Savannah subsection along Route Option 4 East.

7.2 Land Cover and Land Use

The 2021 National Land Cover Database (NLCD) maintained by the U.S. Geological Survey (USGS) was reviewed to identify existing land cover and uses within the Proposed Routes and right-of-way.[84] Land cover and land use across the Proposed Routes are discussed for each segment below. It should be noted that current land use and cover may differ based on the date of the data available. Top livestock operations in the Project area include hog and pig, milk cows, beef cattle, and poultry. A discussion of the existing agricultural economy is presented in Section 7.4.1.

7.2.1 Segment 1

Segment 1 has two Route Options (1 North and 1 South), and one Alternative Segment (1L). The ROW required for the proposed 345 kV transmission line in Segment 1 is 150 feet wide (75 feet on either side of the centerline of the Proposed Routes). The land uses and land cover types for each are described below. In addition to the land cover types crossed by the Proposed Routes, the expansion of the Wilmarth Substation is located within 0.78 acre of developed land, the majority (0.61 acre) of which consists of developed open space.

7.2.1.1 Route Option 1 North

The dominant land cover within the Route Option 1 North is cultivated crops making up approximately 60% of the Proposed Route and 57% of the ROW. Typical crops grown in these agricultural areas include corn for grain, soybeans, hay/haylage, sweet

[84] United States Geological Survey. 2021. National Land Cover Database. Earth Resources Observation and Science Center. Accessed from: https://www.usgs.gov/centers/eros/science/national-land-cover-database.

corn, corn for silage, green peas, and oats for grain. Pasture/hay make up approximately 12% of the Proposed Route and 13% of the ROW.

Developed areas within Route Option 1 North make up approximately 9% of the Proposed Route, and 12% of the ROW. These areas include rural existing roadways, residential lots and agribusiness concentrated around the cities of Mankato, Madison Lake, Elysian, Waterville, and Morristown. Existing transmission corridors within Segment 1 North run from the Wilmarth Substation near Mankato to the West Faribault Substation in Faribault.

Other land cover types greater than 5% include deciduous forest and emergent herbaceous wetlands. See **Table 7-1** for a complete breakdown of land cover acreages and percents of the Proposed Route and ROW for Route Option 1 North.

Table 7-1
Route Option 1 North Land Cover Types

Land Cover Type	Acres within the Proposed Route	Percent of Proposed Route	Acres within ROW (150 ft)	Percent of ROW
Cultivated Crops	3061.90	59.70%	436.19	56.90%
Developed	483.51	9.43%	93.56	12.20%
Pasture/Hay	629.08	12.27%	101.15	13.19%
Deciduous Forest	479.11	9.34%	63.93	8.34%
Emergent Herbaceous Wetlands	315.49	6.15%	54.38	7.09%
Woody Wetlands	52.21	1.02%	4.71	0.61%
Grassland/Herbaceous	24.23	0.47%	3.64	0.47%
Mixed Forest	15.66	0.31%	4.70	0.61%
Open Water	53.84	1.05%	2.20	0.29%
Shrub/Scrub	5.33	0.10%	1.64	0.21%
Barren Land (Rock/Sand/Clay)	7.88	0.15%	0.39	0.05%
Evergreen Forest	0.00	0.00%	0.00	0.00%

7.2.1.2 Route Option 1 South

The dominant land cover within the Route Option 1 South is cultivated crops making up approximately 58% of the Proposed Route and 43% of the ROW. Typical crops grown in these agricultural areas are the same as those described for Route Option 1

North. Pasture/hay make up approximately 12% of the Proposed Route and 10% of the ROW.

Developed areas within Route Option 1 South make up approximately 18% of the Proposed Route and 37% of the ROW. Other land cover types greater than five percent include deciduous forest and emergent herbaceous wetlands. See **Table 7-2** for a complete breakdown of land cover acreages and percents of the Proposed Route and Right-of Way for Route Option 1 South.

Table 7-2
Route Option 1 South Land Cover Types

Land Cover Type	Acres within the Proposed Route	Percent of Proposed Route	Acres within ROW (150 ft)	Percent of ROW
Cultivated Crops	3338.13	57.52%	371.68	42.88%
Developed	1057.03	18.21%	323.12	37.28%
Pasture/Hay	690.77	11.90%	88.27	10.18%
Deciduous Forest	293.60	5.06%	29.49	3.40%
Emergent Herbaceous Wetlands	282.62	4.87%	42.96	4.96%
Woody Wetlands	23.10	0.40%	1.81	0.21%
Grassland/Herbaceous	47.00	0.81%	5.16	0.60%
Mixed Forest	15.25	0.26%	1.58	0.18%
Open Water	39.57	0.68%	1.55	0.18%
Shrub/Scrub	2.66	0.05%	0.00	0.00%
Barren Land (Rock/Sand/Clay)	12.86	0.22%	0.96	0.11%
Evergreen Forest	0.67	0.01%	0.06	0.01%

Route Option 1 South includes an Alternative Segment 1L which could be selected to replace Segment 1M. **Table 7-3** provides a land cover type comparison between the alternative segments.

Table 7-3
Route Option 1 South Alternative Segments Land Cover Types

Land Cover Type	Segments 1L Acres in the Proposed Route	Segments 1L Acres within ROW (150 ft)
Cultivated Crops	583.47	54.92
Developed	113.16	69.64
Pasture/Hay	163.82	13.20
Deciduous Forest	62.77	4.45
Emergent Herbaceous Wetlands	32.76	1.73
Woody Wetlands	7.78	0.69
Grassland/Herbaceous	0.00	0.00
Mixed Forest	0.00	0.00
Open Water	0.00	0.00
Shrub/Scrub	0.00	0.00
Barren Land (Rock/Sand/Clay)	0.00	0.00
Evergreen Forest	0.00	0.00

7.2.2 Segment 2

Segment 2 has two main Route Options (2 North and 2 South), no Alternative Segments, and one Connector Segment. The ROW required for the proposed 345 kV transmission line in Segment 2 is 150 feet wide (75 feet on either side of the centerline of the proposed route). The land uses and land cover types for each are described below.

7.2.2.1 Route Option 2 North

The dominant land cover within the Route Option 2 North is cultivated crops making up approximately 73% of the Proposed Route and 57% of the ROW. Typical crops grown in agricultural areas include corn for grain, soybeans, hay/haylage, corn for silage, green peas, and oats for grain. Pasture/hay make up approximately 8% of the Proposed Route and 8% of the ROW.

Developed areas within Route Option 2 North make up approximately 11% of the Proposed Route, and 27% of the ROW. Developed areas typically include agricultural land and farmsteads with agribusiness development and rural residences concentrated around the cities of Faribault, Kenyon, and Wanamingo.

All other land cover types are individually less than 5% with deciduous forest being the highest with 3% of the Proposed Route and grasslands/herbaceous making up 3% of the ROW. See **Table 7-4** for a complete breakdown of land cover acreages and percents of the Proposed Route and ROW for Route Option 2 North.

Table 7-4
Route Option 2 North Land Cover Types

Land Cover Type	Acres within the Proposed Route	Percent of Proposed Route	Acres within ROW (150 ft)	Percent of ROW
Cultivated Crops	3622.41	72.60%	428.04	57.18%
Developed	537.72	10.78%	200.59	26.80%
Pasture/Hay	382.62	7.67%	60.97	8.15%
Deciduous Forest	145.01	2.91%	14.41	1.93%
Emergent Herbaceous Wetlands	104.15	2.09%	14.46	1.93%
Woody Wetlands	22.12	0.44%	2.48	0.33%
Grassland/Herbaceous	135.11	2.71%	23.35	3.12%
Mixed Forest	26.99	0.54%	2.64	0.35%
Open Water	2.60	0.05%	0.90	0.12%
Shrub/Scrub	0.00	0.00%	0.00	0.00%
Barren Land (Rock/Sand/Clay)	10.15	0.20%	0.75	0.10%
Evergreen Forest	0.00	0.00%	0.00	0.00%

7.2.2.2 Route Option 2 South

The dominant land cover within the Route Option 2 South is cultivated crops making up approximately 81% of the Proposed Route and 76% of the ROW. Typical crops grown in agricultural areas are the same as described for Route Option 2 North. Pasture/hay make up approximately 5% of the Proposed Route and 5% of the ROW.

Developed areas within Route Option 2 South make up approximately 5% of the Proposed Route and 10% of the ROW. Developed areas typically include farmsteads with agribusiness development and rural residences. This Route Option is generally south of concentrated developed areas around the cities of Faribault, Kenyon, and Wanamingo.

All other land cover types are individually less than 4% with emergent herbaceous wetlands being the highest with 3% of the Proposed Route and 4% of the ROW. See **Table 7-5** for a complete breakdown of land cover acreages and percents of the Proposed Route and ROW for Route Option 2 South.

Table 7-5
Route Option 2 South Land Cover Types

Land Cover Type	Acres within the Proposed Route	Percent of Proposed Route	Acres within ROW (150 ft)	Percent of ROW
Cultivated Crops	3331.21	81.29%	467.60	76.26%
Developed	201.73	4.92%	61.83	10.08%
Pasture/Hay	206.11	5.03%	31.21	5.09%
Deciduous Forest	116.83	2.85%	12.40	2.02%
Emergent Herbaceous Wetlands	126.32	3.08%	22.74	3.71%
Woody Wetlands	3.70	0.09%	0.00	0.00%
Grassland/Herbaceous	88.43	2.16%	15.41	2.51%
Mixed Forest	12.02	0.29%	1.05	0.17%
Open Water	3.89	0.09%	0.07	0.01%
Shrub/Scrub	0.00	0.00%	0.00	0.00%
Barren Land (Rock/Sand/Clay)	6.92	0.17%	0.75	0.12%
Evergreen Forest	0.00	0.00%	0.00	0.00%

7.2.2.3 Segment 2 Connector Segment 2G

The Applicant has also proposed a Segment Connector (2G) to allow for transitioning between Route Option 2 North and Route Option 2 South. **Table 7-6** provides a breakdown of the land cover types of Segment Connector 2G.

Table 7-6
Segment 2 Connector (2G) Land Cover Types

Land Cover Type	Acres within the Proposed Route	Acres within ROW (150 ft)
Cultivated Crops	77.45	10.21
Developed	4.93	2.80
Pasture/Hay	5.97	0.41
Deciduous Forest	0.00	0.00
Emergent Herbaceous Wetlands	2.32	0.17

Land Cover Type	Acres within the Proposed Route	Acres within ROW (150 ft)
Woody Wetlands	0.00	0.00
Grassland/Herbaceous	0.00	0.00
Mixed Forest	0.00	0.00
Open Water	0.00	0.00
Shrub/Scrub	0.00	0.00
Barren Land (Rock/Sand/Clay)	0.00	0.00
Evergreen Forest	0.00	0.00

7.2.3 Segment 3

As noted in Section 6.4, Segment 3 consists of only one proposed route, and it does not include other Route Options, Alternative Segments, or Connector Segments. The ROW of the existing line is 150 feet wide and will not be expanded for the Project. The dominant land cover within the Proposed Route in Segment 3 is cultivated crops making up approximately 62% of the Proposed Route and 60% of the ROW. Typical crops grown in agricultural areas include corn for grain, soybeans, hay/haylage, corn for silage, green peas, and oats for grain. Pasture/hay make up approximately 11% of the Proposed Route and 11% of the ROW.

East of US Highway 61, Segment 3 runs through the Upper Mississippi River National Wildlife Refuge and the McCarthy Lake State Wildlife Management Area, which consists of wetlands and backwaters of the Mississippi River, all of which are described in detail in Section 7.6.4 (Water Resources). The available land use and land cover data indicate that deciduous forest makes up 12% of the Proposed Route and 10% of the ROW. However, Segment 3 occurs within an existing ROW cleared of tall-growing vegetation and no longer supports forested land cover types. Any forested land cover types within the ROW in Table 7-7 would have been converted to grassland during construction of the existing transmission line. Therefore, there is no deciduous tree cover type in the ROW.

All other land cover types are individually less than 7% with developed areas and emergent herbaceous wetlands being the highest. Grassland/Herbaceous and Emergent Herbaceous Wetlands land cover are concentrated where the ROW crosses the Zumbrota River and within the backwaters of the Mississippi River at the east end of Segment 3. Developed lands consists of existing roadways and rural residential lots throughout the ROW. See **Table 7-7** for a complete breakdown of land cover for Segment 3.

Table 7-7
Route Option 3 Land Cover Types

Land Cover Type	Acres within the Proposed Route	Percent of Proposed Route	Acres within ROW (150 ft)	Percent of ROW
Cultivated Crops	3267.68	62.14%	475.52	60.28%
Developed	190.98	3.63%	50.87	6.45%
Pasture/Hay	595.91	11.33%	88.97	11.28%
Deciduous Forest	641.67	12.20%	82.12 [a]	10.41% [a]
Emergent Herbaceous Wetlands	181.95	3.46%	31.01	3.93%
Woody Wetlands	93.89	1.79%	10.01 [a]	1.27% [a]
Grassland/Herbaceous	184.92	3.52%	32.93	4.17%
Mixed Forest	43.8	0.83%	8.35 [a]	1.05% [a]
Open Water	37.95	0.72%	6.43	0.82%
Shrub/Scrub	1.27	0.02%	0.97	0.12%
Barren Land (Rock/Sand/Clay)	5.1	0.10%	0.89	0.11%
Evergreen Forest	12.57	0.24%	0.65 [a]	0.08% [a]

[a] Segment 3 occurs within an existing ROW cleared of tall-growing vegetation and no longer supports these forested land cover types.

7.2.4 Segment 4

Segment 4 has two main Route Options (4 East and 4 West), four Alternative Segments, and one Connector Segment. The ROW required for the proposed 161 kV transmission line in Segment 4 is 100 feet wide (50 feet on either side of the centerline of the proposed route). The land uses and land cover types for each are described below.

7.2.4.1 Route Option 4 East

The dominant land cover within the Route Option 4 East is cultivated crops making up approximately 39% of the Proposed Route and 32% of the ROW. Typical crops grown in these agricultural areas include corn for grain, soybeans, hay/haylage, green peas, corn for silage, and sweet corn. Pasture/hay make up approximately 13% of the Proposed Route and 11 % of the ROW.

Developed areas make up 30% of the Proposed Route and 40% of the ROW. These areas consist of concentrated residential and urban development around the cities of Pine Island and Oronoco and northern Rochester as well as rural homesteads. Route Option 4 East parallels portions of US Highways 52 and 63.

Pockets of grassland/herbaceous, woody wetlands, and deciduous forest are located throughout the Proposed Route; however, only deciduous forest and grassland cover types exceed 7% of the land cover. Deciduous forest makes up 5% of the Proposed Route and 2% of the ROW. Grassland/herbaceous land cover is approximately 8% of the Proposed Route and 11% of the ROW. See **Table 7-8** for a complete breakdown of land cover acreages and percents of the Proposed Route and ROW for Route Option 4 East.

Table 7-8
Land Cover Types within Route Option 4 East Proposed Route and ROW

Land Cover Type	Acres within the Proposed Route	Percent of Proposed Route	Acres within ROW (100 ft)	Percent of ROW
Cultivated Crops	974.81	38.64%	76.99	32.38%
Developed	749.66	29.71%	94.52	39.76%
Pasture/Hay	317.3	12.58%	25.40	10.68%
Deciduous Forest	135.61	5.37%	5.65	2.38%
Emergent Herbaceous Wetlands	23.78	0.94%	2.17	0.91%
Woody Wetlands	20.15	0.80%	1.96	0.82%
Grassland/Herbaceous	193.48	7.67%	26.23	11.03%
Mixed Forest	52.19	2.07%	2.58	1.09%
Open Water	4.97	0.20%	0.40	0.17%
Shrub/Scrub	0.00	0.00%	0.00	0.00%
Barren Land (Rock/Sand/Clay)	31.4	1.24%	1.64	0.69%
Evergreen Forest	19.66	0.78%	0.19	0.08%

For Route Option 4 East two Alternative Segments have also been proposed. The Commission may choose to replace Segments 4B with 4C and/or replace 4F with 4E. **Table 7-9** provides a land cover type comparison between the Alternative Segments.

Table 7-9
Route Option 4 East Alternative Segment Land Cover Types

Land Cover Type	Segment 4C Acres in Proposed Route	Segment 4E Acres in Proposed Route	Segment 4C Acres within ROW (100 ft)	Segment 4E Acres within ROW (100 ft)
Cultivated Crops	119.61	85.19	12.86	6.62
Developed	15.95	156.23	2.80	13.25
Pasture/Hay	7.34	81.85	0.41	12.20
Deciduous Forest	0.00	4.46	0.00	0.00
Emergent Herbaceous Wetlands	0.00	2.82	0.17	0.00
Woody Wetlands	0.00	2.07	0.00	0.00
Grassland/Herbaceous	5.13	28.60	0.00	5.32
Mixed Forest	0.00	6.01	0.00	0.33
Open Water	0.00	0.00	0.00	0.00
Shrub/Scrub	0.00	0.00	0.00	0.00
Barren Land (Rock/Sand/Clay)	0.00	4.24	0.00	0.07
Evergreen Forest	0.00	8.89	0.19	0.25

7.2.4.2 Route Option 4 West

The dominant land cover within the Route Option 4 West is cultivated crops which make up approximately 65% of the Proposed Route and 59% of the ROW. Typical crops grown in these agricultural areas are similar to those in Route Option 4 East. Pasture/hay make up approximately 11% of the Proposed Route and 12% of the ROW.

Developed areas make up only 5% of the Proposed Route and 11% of the ROW. These areas consist of concentrated residential and urban development around the cities of Pine Island and northern Rochester as well as rural homesteads. Route Option 4 West crosses the South Fork Zumbro River near a large aggregate mine located north of US Highway 63. Mining operations are described in detail in Section 7.4.4 (Mining).

Pockets of grassland/herbaceous, woody wetlands, and deciduous forest are located throughout the Proposed Route; however, only deciduous forest and grassland/herbaceous cover types exceed 9% of the land cover. See **Table 7-10** for a complete breakdown of land cover acreages and percents of the Proposed Route and ROW for Route Option 4 West.

Table 7-10
Option 4 West Land Cover Types

Land Cover Type	Acres within the Proposed Route	Percent of Proposed Route	Acres within ROW (100 ft)	Percent of ROW
Cultivated Crops	2219.44	64.62%	253.74	59.02%
Developed	175.83	5.12%	45.78	10.65%
Pasture/Hay	382.6	11.14%	52.97	12.32%
Deciduous Forest	327.54	9.54%	45.78	10.65%
Emergent Herbaceous Wetlands	20.71	0.60%	3.48	0.81%
Woody Wetlands	52.65	1.53%	6.63	1.54%
Grassland/Herbaceous	193.53	5.63%	22.65	5.27%
Mixed Forest	21.57	0.63%	2.30	0.54%
Open Water	1.78	0.05%	0.27	0.06%
Shrub/Scrub	0.00	0.00%	0.00	0.00%
Barren Land (Rock/Sand/Clay)	28.7	0.84%	0.47	0.11%
Evergreen Forest	9.83	0.29%	0.14	0.03%

An Alternative Segment has also been proposed for Route Option 4 West. Alternative Segment 4M could replace Segment 4L. **Table 7-11** provides a land cover type comparison between the Alternative Segments.

Table 7-11
Route Option 4 West Alternative Segment Land Cover Types

Land Cover Type	Segments 4M Acres in Proposed Route	Segments 4R Acres in Proposed Route	Segment 4M Acres within ROW (100 ft)	Segments 4R Acres within ROW (100 ft)
Cultivated Crops	92.57	3.03	2.10	0.03
Developed	16.21	1.92	8.78	0.37
Pasture/Hay	15.33	50.63	0.10	5.20
Deciduous Forest	0.00	13.06	0.00	1.12
Emergent Herbaceous Wetlands	2.67	0.00	0.00	0.00
Woody Wetlands	0.33	0.00	0.00	0.00
Grassland/Herbaceous	19.85	1.22	1.11	0.22
Mixed Forest	0.89	0.00	0.00	0.00
Open Water	0.00	0.00	0.00	0.00
Shrub/Scrub	0.00	0.00	0.00	0.00

Land Cover Type	Segments 4M Acres in Proposed Route	Segments 4R Acres in Proposed Route	Segment 4M Acres within ROW (100 ft)	Segments 4R Acres within ROW (100 ft)
Barren Land (Rock/Sand/Clay)	0.00	0.00	0.00	0.00
Evergreen Forest	0.00	0.00	0.00	0.00

7.2.4.3 Segment 4 Segment Connector 4Q

The Applicant has also proposed a segment connector to allow for transitioning between Route Option 4 East and Route Option 4 West. **Table 7-12** provides a breakdown of the land cover types found in the Proposed Route and ROW of Connector Segment 4Q.

Table 7-12
Land Cover Types within Connector Segment 4Q

Land Cover Type	Connector Segment 4Q Acres in Proposed Route	Connector Segment 4Q Acres within ROW (100 ft)
Cultivated Crops	30.53	1.03
Developed	5.53	3.40
Pasture/Hay	11.26	0.00
Deciduous Forest	0.50	0.00
Emergent Herbaceous Wetlands	0.00	0.00
Woody Wetlands	0.00	0.00
Grassland/Herbaceous	2.17	0.92
Mixed Forest	0.51	0.00
Open Water	0.00	0.00
Shrub/Scrub	0.00	0.00
Barren Land (Rock/Sand/Clay)	2.95	0.00
Evergreen Forest	0.00	0.00

7.2.5 Land Cover: Avoidance and Mitigation of Potential Impacts

The Project is not anticipated to significantly alter existing land use or land cover. However, the Project will result in both temporary (during construction of the Project) and permanent minor impacts (due to construction and as part of operation of the facilities post-construction).

Xcel Energy's standard practice is to clear all woody vegetation within the entire width of the right-of-way for construction of new transmission lines and along temporary construction access paths. This includes cases where a new line will be located within an existing right-of-way such as for a line rebuild or double-circuiting a new line with an existing line. There are limited circumstances when this practice is modified provided National Electric Safety Code (NESC) clearance requirements are met. While the removal of woody vegetation (e.g., trees and tall growing shrubs) within the right-of-way is necessary, efforts are made to protect existing compatible low-growing vegetation when practicable in order to minimize construction impacts such as soil erosion, wetland damage, or habitat loss.

Most existing land uses and cover types along the transmission line will experience minimal, short-term impacts during the period of construction. As stated above, vegetation in the right-of-way would be cleared as needed. The forest land cover types would be most affected as all trees would be cleared, and the land cover would be converted permanently to a different cover type. When transmission line construction is complete, Project workspaces will be restored as described in Section 9.3, and land uses which are consistent with the safe and reliable operation of the Project will be allowed to continue as before (e.g., agriculture). The Proposed Routes presented in this Application were designed to predominantly parallel existing infrastructure or land divisions, such as existing transmission lines, roadways, property lines, and agricultural field edges, and to avoid municipalities and other densely populated residential areas. Mitigation measures for impacts to wetland and agricultural land cover within the ROWs are described in detail in Sections 7.4.1 (Agriculture) and 7.6.4.6 (Wetlands).

Minor, permanent impacts to land cover will occur where new transmission structures and foundations are installed and at the expansion of the Wilmarth Substation. The majority of lands crossed by the Project include cultivated crop, pasture/hay, and developed land cover types. The land uses associated with these cover types (e.g., agricultural and grazing) are likely to continue during operation of the Project with only minor permanent impacts from the installation of permanent structures. As described above, conversion of land cover types would occur in forest cover types, including deciduous forest, evergreen forest, mixed forest, and wooded wetlands. Deciduous forest cover would be most affected of the forest cover types based on the percentage of the ROWs in that cover type. Impacts by segment are discussed below.

In Segment 1, Route Option 1 North has roughly 14% more cultivated crops crop land and around 3% more pasture/hay cover type in the ROW compared to Route Option 1 South. Route Option 1 South would impact around 25% more developed land cover types in the ROW than Route Option 1 North. Impacts to other land cover types would be similar across the two route options. Since impacts to cultivated crops and pasture/hay would be minimal, it is expected that those land uses would continue.

In Segment 2, Route Option 2 North has approximately 19% less cultivated crop land cover in the ROW compared to Route Option 2 South. Route Option 2 North has roughly 3% more pasture/hay cover types in the ROW compared to Route Option 2 South. However, Route Option 2 North has roughly 17% more developed areas in the ROW compared to Route Option 2 South. Impacts to other land cover types would be similar across the two route options.

Segment 3 involves only one Proposed Route which consists of an existing transmission corridor and therefore will not have any permanent impacts to land cover. Temporary construction impacts in Segment 3 route would primarily impact cultivated crop cover types with slightly more than 60% of the ROW falling in this land use category. Pasture/hay cover types would be impacted at similar percentages as in the other Segments.

In Segment 4, Route Option 4 West has roughly 26% more cultivated crop land and around 2% more pasture/hay in the ROW compared to Route Option 4 East. Route Option 4 East would impact around 29% more developed land cover than Route Option 4 West. Route Option 4 East would have more of an impact on grassland/herbaceous cover types whereas Route Option 4 West could have higher impacts on deciduous forests. Impacts to grasslands/herbaceous cover types would be temporary as the areas would be restored after construction. Impacts to deciduous forests, roughly 45 acres, would be permanent as the forests would be converted to low-growing vegetation types.

Xcel Energy will implement an agricultural impact mitigation plan (AIMP) and reasonably restore and/or compensate landowners, as appropriate, for damages caused by transmission line construction, and as outlined in the AIMP (See **Appendix U**). Xcel Energy will also implement a vegetation management plan to mitigate impacts and restore lands impacted by construction. (See **Appendix V**).

7.3 Human Settlement

Each of the Proposed Routes had different human settlement impacts. **Table 7-13** below lists municipalities crossed by any of the Proposed Routes. The Wilmarth Substation is located within the City of Mankato, and the North Rochester Substation is located within the Township of Pine Island. Outside of cities, residences are scattered across the landscape at rural homes and farmsteads.

Table 7-13
Municipality Boundaries Crossed by Route Options

Municipality	Type	County	Route Options
Cannon City	Township	Rice	2 North
Cascade	Township	Olmsted	4 East
Cherry Grove	Township	Goodhue	2 North, 2 South
Elgin	Township	Wabasha	3
Elysian	City	Le Sueur	1 South
Elysian	Township	Le Sueur	1 North, 1 South
Faribault	City	Rice	2 North, 2 South
Farmington	Township	Olmsted	3, 4 East, 4 West
Greenfield	Township	Wabasha	3
Haverhill	Township	Olmsted	4 East
Highland	Township	Wabasha	3
Holden	Township	Goodhue	2 North
Iosco	Township	Waseca	1 South
Jamestown	Township	Blue Earth	1 North, 1 South
Kenyon	Township	Goodhue	2 North, 2 South
Le Ray	Township	Blue Earth	1 South
Lime	Township	Blue Earth	1 North
Madison Lake	City	Blue Earth	1 South
Mankato	City	Blue Earth	1 North, 1 South
Mankato	Township	Blue Earth	1 South

Municipality	Type	County	Route Options
Minneola	Township	Goodhue	2 North
Morristown	City	Rice	1 South
Morristown	Township	Rice	1 North, 1 South
New Haven	Township	Olmsted	4 East, 4 West
Oronoco	City	Olmsted	4 East
Oronoco	Township	Olmsted	3, 4 East, 4 West
Pine Island	City	Olmsted	3, 4 East[a], 4 West
Pine Island	Township	Goodhue	3, 4 East, 4 West
Plainview	Township	Wabasha	3
Richland	Township	Rice	2 South
Roscoe	Township	Goodhue	2 North, 2 South, 4 West
Walcott	Township	Rice	2 North, 2 South
Wanamingo	City	Goodhue	2 North
Wanamingo	Township	Goodhue	2 North
Warsaw	Township	Rice	1 North, 1 South, 2 North, 2 South
Waterville	City	Le Sueur	1 South[b]
Waterville	Township	Le Sueur	1 North, 1 South
Watopa	Township	Wabasha	3
Wheeling	Township	Rice	2 North

[a] Municipality is not crossed by Alternative Segment 4C

[b] City is not crossed by Alternative Segment 1L

7.3.1 Proximity to Residences

The Proposed Routes presented in this Application avoid densely populated areas where feasible, and displacement of residential properties is not anticipated if any of the Proposed Routes are selected by the Commission. The proposed Segments consist of multiple Route Options that differ in distance to residential areas (see **Appendix K** for detailed route maps). A summary of the proximity of each Route Option and Alternative Segment to residences is presented below. Distances are based on the proposed centerline of the transmission line. Residences were manually digitized using 2023 National Agricultural Imagery Program (NAIP) aerial photography. Digital points were placed on the center of residences to capture potential route alternatives that may be located on either side of a residence. A full comparison of alternatives is provided in **Appendix R**.

7.3.1.1 Segment 1

Segment 1 has two Route Options and an Alternative Segment.

There are 70 residences within 500 feet of Route Option 1 North. There are no residences within 75 feet.

There are 136 residences within 500 feet of Route Option 1 South. Of these 136 residences two residences are within 75 feet of the proposed centerline. Segment 1 South also has one Alternative, 1L, which provides an alternative to Segment 1M. There are 18 residences within 500 feet of Alternative 1L. The closest residence to that Alternative 1L is approximately 60 feet.

Table 7-14
Segment 1: Proximity of Residences to Proposed Centerline

Residence Proximity (ft.)	1 North	1 South	Alternative 1L
0-75	0	2	1
76-150	3	18	3
151-300	32	55	9
301-500	35	61	5
Total Residences	**70**	**136**	**18**

7.3.1.2 Segment 2

Segment 2 has two Route Options and a Connector Segment. There are no alternative segments in Segment 2.

There are 97 residences within 500 feet of Route Option 2 North. There are no residences within 75 feet and three residences are between approximately 75 feet to 150 feet.

There are 31 residences within 500 feet of Route Option 2 South. Of these 31 residences, none are within 75 feet of the proposed centerline of Route Option 2 South and four residences are between approximately 75 feet to 150 feet away.

There are no residences within 500 feet of Connector Segment 2G.

Table 7-15
Segment 2: Proximity of Residences to Proposed Centerline

Residence Proximity (ft.)	2 North	2 South	Connector 2G
0-75	0	0	0
76-150	3	4	0
151-300	46	10	0
301-500	48	17	0
Total Residences	**97**	**31**	**0**

7.3.1.3 Segment 3

A total of 22 residences are located within 500 feet of Segment 3, none of which are within 75 feet. The closest residence is 136 feet from the proposed centerline. A summary of residential proximity to the proposed centerline of Segment 3 is presented below in **Table 7-16**.

Table 7-16
Segment 3: Proximity of Residences to Proposed Centerline

Residence Proximity (ft.)	Route 3
0-75	0
76-150	1
151-300	9
301-500	12
Total Residences	**22**

7.3.1.4 Segment 4

Segment 4 has two Route Options, four Alternative Segments, and a Connector Segment.

There are 135 residences within 500 feet of the Route Option 4 East, one of which is within 50 feet. This Route Option has two Alternative Segments (4C and 4E). The closest residences to the proposed centerline of these alternative segments are approximately 230 and 190 feet, respectively. Alternative Segment 4C provides an alternative to Segment 4B, and Alternative Segment 4E provides an alternative to 4F. There are 3 residences within 500 feet of Alternative 4C, and 4 residences within 500 feet of Alternative 4E.

There are 46 residences within 500 feet of the proposed centerline for Route Option 4 West, four within 150 feet, and none within 50 feet. This Route Option has two Alternative Segments (4M and 4R). The closest residences to the alternative segments are approximately 110 and 100 feet, respectively. Alternative Segment 4M provides an alternative to Segment 4L, and Alternative Segment 4R provides an alternative to 4O. There are 4 residences within 500 feet of Alternative 4M, and 4 residences within 500 feet of Alternative 4R.

There are no residences are within 500 feet of Connector Segment 4Q.

Table 7-17
Segment 4: Proximity of Residences to Proposed Centerline

Residence Proximity (Ft)	4 East	4 West	Connector 4Q	Alternative 4C	Alternative 4E	Alternative 4M	Alternative 4R
0-50*	1	0	0	0	0	0	0
51-150	9	4	0	0	0	2	2
151-300	40	15	0	1	2	1	1
301-500	85	27	0	2	2	1	1
Total Residences	**135**	**46**	**0**	**3**	**4**	**4**	**4**

* Distance to residences ranges were adjusted for Segment 4 because the right-of-way for a 161 kV line is smaller than for a 345 kV line (typically 100 feet vs. 150 feet).

7.3.1.5 Residences: Avoidance and Mitigation of Potential Impacts

The Project will be double-circuited along existing infrastructure when feasible and will use existing rights-of-way to the extent practicable. The Proposed Routes for the new 161 kV and 345 kV transmission line will not displace any residences. Implementation of transmission line infrastructure could result in visual impacts to residences along the Proposed Route. For a discussion of aesthetic impacts of the proposed transmission line to residential areas, see Section 7.3.4. Xcel Energy may work with landowners to address alignment adjustments and structure placement for the proposed transmission line to the extent practicable. The requested route width provides Xcel Energy flexibility to work with landowners around existing residences, other structures, and businesses, as appropriate.

7.3.2 Public Health and Safety

Public health and safety will be a priority during the construction and operation of the proposed Project. Safety concerns related to construction may include hazards associated with conductor stringing in public areas, movement of heavy equipment across roadways, and land clearing. Potential operational concerns include electrocution, fire, and outages surrounding the service area and associated substations.

Emergency services in the Project Study Area are provided by local emergency service personnel and law enforcement located in nearby communities. Fire departments respond to fires, emergency medical services supply emergency patient transport and medical care, and county and local police and sheriff departments administer law enforcement. For a summary of emergency services provided in the Project Study Area, see Section 7.3.9.1.

7.3.2.1 Electric and Magnetic Fields and Stray Voltage

Electric and magnetic fields (EMF)s are invisible areas of energy associated with use of electrical power. For the lower frequencies associated with power lines (referred to as ELF), EMF should be considered separately – electric fields and magnetic fields, measured in kV/m and milligauss (mG), respectively. Electric fields are dependent on the voltage of a transmission line and magnetic fields are dependent on the current carried by a transmission line. The strength of the electric field is proportional to the voltage of the line, and the intensity of the magnetic field is proportional to the current flow through the conductors. Transmission lines operate at a power frequency of 60 hertz (cycles per second).

A majority of the research conducted on the potential health effects of EMF from power facilities has focused on transmission and distribution lines rather than substations. According to the National Institutes of Environmental Health Sciences (NIEHS- a federal research institute), most of the EMF that comes from a substation is produced by these lines, rather than the equipment at the substation itself. Beyond the substation fence, the EMF produced by the transformers and other substation equipment is typically indistinguishable from background levels. In addition, calculation of EMF for Project substations would require a level of detailed design for the substations that is not yet available. For these reasons, the discussion of electric and magnetic fields below focuses on the Project's proposed transmission lines.

7.3.2.2 Electric Fields

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.[85] The standard was designed to prevent serious hazards from shocks when touching large objects parked under alternating current transmission lines of 500 kV or greater. **Table 7-18** provides the electric fields at maximum conductor voltage for the proposed 345 kV and 161 kV transmission lines. Graphs showing the calculated electric fields for the configurations listed in the table are included in **Appendix S**. Maximum conductor voltage is defined as the nominal voltage plus five percent. The maximum electric field, measured at one meter (3.28 feet) above ground, associated with the Project is calculated to be 6.9 kV/m. As shown in **Table 7-18** the strength of electric fields diminishes rapidly as the distance from the conductor increases. The electric field values of the 345 kV and 161 kV transmission lines, with different structure configurations and parallel circuits, across the right-of-way, at the edge of the transmission line right-of-way, and sample points beyond are shown in **Table 7-18**. Maximum calculated electric field values for each configuration typically occur at a point midway between the distances to centerline listed in the table, therefore the maximum within the right-of-way is typically higher than the values listed at each discreet distance.

[85] *In the Matter of the Route Permit Application for a 345 kV Transmission Line from Brookings County, S.D. to Hampton,* Docket No. ET2/TL-08-1474, ORDER GRANTING ROUTE PERMIT (Sept. 14, 2010) (adopting the Administrative Law Judge's Findings of Fact, Conclusions, and Recommendation at Finding 194).

Table 7-18
Calculated Electric Field for the Operation of Proposed Single/Double Circuit Transmission Line Designs

Structure Type	Circuits Present	Maximum within ROW	Maximum at Edge of ROW	Distance to Proposed ROW Centerline (Feet)														
				-250	-200	-150	-100	-75	-50	-25	0	25	50	75	100	150	200	250
Single Pole, Davit Arm, 345 kV Single Circuit	Wilmarth – North Rochester 345 kV	6.2 kV/m	0.9 kV/m	0.1 kV/m	0.1 kV/m	0.2 kV/m	0.6 kV/m	0.9 kV/m	1.4 kV/m	1.5 kV/m	4.1 kV/m	5.3 kV/m	1.9 kV/m	0.7 kV/m	0.4 kV/m	0.2 kV/m	0.1 kV/m	0.1 kV/m
Single Pole, Davit Arm, 345 kV Single Circuit with 115 kV	Wilmarth – North Rochester 345 kV & Line 832 115 kV	2 kV/m	0.6 kV/m	0.1 kV/m	0.1 kV/m	0.2 kV/m	0.4 kV/m	0.5 kV/m	0.4 kV/m	1 kV/m	1.9 kV/m	1.3 kV/m	1 kV/m	0.6 kV/m	0.3 kV/m	0.2 kV/m	0.1 kV/m	0.1 kV/m
Single Pole, Davit Arm, 345 kV Single Circuit with 69 kV Underbuild	Wilmarth – North Rochester 345 kV & Line 706, 707 or 708 69 kV	1.5 kV/m	0.6 kV/m	0.1 kV/m	0.1 kV/m	0.2 kV/m	0.5 kV/m	0.6 kV/m	0.6 kV/m	0.7 kV/m	1.5 kV/m	1.4 kV/m	1.1 kV/m	0.6 kV/m	0.4 kV/m	0.2 kV/m	0.1 kV/m	0.1 kV/m
Single Pole, Davit Arm, 345 kV Single Circuit / Single Pole, Tangent, 345 kV Single Circuit	Wilmarth – North Rochester 345 kV / Line 964 345 kV	6.4 kV/m	0.9 kV/m	0.1 kV/m	0.1 kV/m	0.2 kV/m	0.5 kV/m	0.9 kV/m	1.4 kV/m	1.6 kV/m	4.2 kV/m	5.4 kV/m	1.9 kV/m	0.7 kV/m	2.7 kV/m	3 kV/m	0.2 kV/m	0.3 kV/m
Single Pole, Tangent/Davit Arm, 345 kV Double Circuit	Wilmarth – North Rochester 345 kV & Line 964 345 kV	5.2 kV/m	0.3 kV/m	0 kV/m	0.1 kV/m	0.1 kV/m	0.1 kV/m	0.3 kV/m	1.5 kV/m	4.7 kV/m	3.2 kV/m	4.5 kV/m	1.4 kV/m	0.3 kV/m	0.1 kV/m	0.1 kV/m	0.1 kV/m	0 kV/m

Structure Type	Circuits Present	Maximum within ROW	Maximum at Edge of ROW	Distance to Proposed ROW Centerline (Feet)														
				-250	-200	-150	-100	-75	-50	-25	0	25	50	75	100	150	200	250
Single Pole, Tangent/Davit Arm, 345 kV Double Circuit with 69 kV Underbuild	Wilmarth – North Rochester 345 kV , Line 964 345 kV & Line 739 69 kV	1.2 kV/m	0.5 kV/m	0 kV/m	0 kV/m	0 kV/m	0.2 kV/m	0.4 kV/m	0.8 kV/m	0.9 kV/m	1.2 kV/m	1.1 kV/m	0.9 kV/m	0.5 kV/m	0.2 kV/m	0.1 kV/m	0.1 kV/m	0.1 kV/m
Single Pole, Davit, 161/69 kV Double Circuit	North Rochester – Chester 161 kV & Peoples Line 69 kV	1.5 kV/m	0 kV/m	0 kV/m	0 kV/m	0 kV/m	0 kV/m	0 kV/m	0.2 kV/m	1 kV/m	1.1 kV/m	0.2 kV/m	0.1 kV/m	0 kV/m	0 kV/m	0 kV/m	0 kV/m	0 kV/m
Single Pole, Tangent, 345 kV Double Circuit	North Rochester – Tremval 345 kV, Line 965 345 kV	6.3 kV/m	0.6 kV/m	0.1 kV/m	0.1 kV/m	0.2 kV/m	0.1 kV/m	0.6 kV/m	2.8 kV/m	6.3 kV/m	3.1 kV/m	6.1 kV/m	2.6 kV/m	0.6 kV/m	0.3 kV/m	0.2 kV/m	0.1 kV/m	0.1 kV/m
Single Pole, Davit, 161 kV Double Circuit with 69 kV Underbuild	North Rochester – River 345 kV, Line 965 345 kV, Peoples Line 69 kV	1.3 kV/m	0.5 kV/m	0 kV/m	0 kV/m	0 kV/m	0.2 kV/m	0.5 kV/m	1 kV/m	1.3 kV/m	1.2 kV/m	0.9 kV/m	0.8 kV/m	0.5 kV/m	0.2 kV/m	0 kV/m	0 kV/m	0 kV/m
Single Pole, Davit, 161 kV Single Circuit / Two Pole H-Frame 345 kV Single Circuit	North Rochester – Chester 161 kV & Line 979 345 kV	6.9 kV/m	2.3 kV/m	0 kV/m	0 kV/m	0 kV/m	0.1 kV/m	0.1 kV/m	0.3 kV/m	1.1 kV/m	1.5 kV/m	1.8 kV/m	2.7 kV/m	5.7 kV/m	5.6 kV/m	5.6 kV/m	2.3 kV/m	0.6 kV/m

Structure Type	Circuits Present	Maximum within ROW	Maximum at Edge of ROW	Distance to Proposed ROW Centerline (Feet)														
				-250	-200	-150	-100	-75	-50	-25	0	25	50	75	100	150	200	250
Single Pole, Davit, 161 kV Single Circuit / Single Pole Tangent 345 kV Double Circuit	North Rochester – Chester 161 kV / Line 965 345 kV, North Rochester – River 345 kV	6.2 kV/m	0.6 kV/m	0 kV/m	0 kV/m	0.1 kV/m	0.1 kV/m	0.2 kV/m	0.4 kV/m	1 kV/m	1.1 kV/m	0.8 kV/m	0.8 kV/m	2.5 kV/m	5.7 kV/m	6.2 kV/m	0.6 kV/m	0.2 kV/m
Single Pole, Davit, 161 kV Single Circuit	North Rochester – Chester 161 kV	2.7 kV/m	0.3 kV/m	0 kV/m	0 kV/m	0.1 kV/m	0.1 kV/m	0.3 kV/m	0.5 kV/m	1.7 kV/m	2.1 kV/m	1.4 kV/m	0.7 kV/m	0.3 kV/m	0.2 kV/m	0.1 kV/m	0 kV/m	0 kV/m

7.3.2.3 Magnetic Fields

The projected magnetic fields for different structure and conductor configurations for the Project are provided in **Table 7-19**. Graphs showing the calculated magnetic fields for the configurations listed in the table are included in **Appendix S**. Because magnetic fields are dependent on the current flowing on the line, magnetic fields were calculated for two different estimated typical system conditions during the Project's first year in service (2030). These two scenarios are: (1) System Peak Energy Demand and (2) System Average Energy Demand. The "System Peak Energy Demand" current flow (estimated loading of 718 MVA from Wilmarth to North Rochester and 692 MVA from North Rochester to Tremval, station beyond the Minnesota border) represents the current flow on the line during the peak hour of system-wide energy demand. The "System Average Energy Demand" current flow (estimated loading of 331 MVA from Wilmarth to North Rochester and 334 MVA from North Rochester to Tremval, station beyond the Minnesota border) represents the current flow on the line during a non-peak time (winter months) when there are high levels of wind generation and the transmission system is intact (i.e., no outages).

The magnetic field values for the two scenarios were calculated at a point where the conductor is closest to the ground. The magnetic field data shows that magnetic field levels decrease rapidly as the distance from the centerline increases (proportional to the inverse square of the distance from source). In addition, since the magnetic field produced by the transmission lines is dependent on the current flow, the actual magnetic fields when the Project is placed in service will vary as the current flow on the line changes throughout the day. Maximum calculated magnetic field values for each configuration typically occur at a point midway between the distances to centerline listed in the table, therefore the maximum within ROW is typically higher than the values listed at each discreet distance.

Table 7-19
Calculated Magnetic Field for the Operation of Proposed Single/Double Circuit Transmission Line Designs

Structure Type	Circuits Present	Maximum within ROW	Maximum at Edge of ROW	Distance to Proposed ROW Centerline (Feet)														
				-250	-200	-150	-100	-75	-50	-25	0	25	50	75	100	150	200	250
Single Pole, Davit Arm, 345 kV Single Circuit (Average Loading)	Wilmarth – North Rochester 345 kV	77 mG	17 mG	2 mG	3 mG	5 mG	10 mG	16 mG	27 mG	47 mG	73 mG	64 mG	33 mG	17 mG	10 mG	5 mG	3 mG	2 mG
Single Pole, Davit Arm, 345 kV Single Circuit (Max Loading)		167 mG	37 mG	4 mG	6 mG	10 mG	22 mG	34 mG	58 mG	102 mG	158 mG	140 mG	71 mG	37 mG	22 mG	11 mG	6 mG	4 mG
Single Pole, Davit Arm, 345 kV Single Circuit with 115 kV (Average Loading)	Wilmarth – North Rochester 345 kV & Line 832 115 kV	65 mG	16 mG	2 mG	3 mG	5 mG	10 mG	16 mG	27 mG	51 mG	57 mG	29 mG	19 mG	13 mG	9 mG	5 mG	3 mG	2 mG
Single Pole, Davit Arm, 345 kV Single Circuit with 115 kV Underbuild (Max Loading)		114 mG	31 mG	4 mG	6 mG	10 mG	21 mG	31 mG	52 mG	93 mG	99 mG	54 mG	37 mG	25 mG	18 mG	9 mG	6 mG	4 mG

Structure Type	Circuits Present	Maximum within ROW	Maximum at Edge of ROW	Distance to Proposed ROW Centerline (Feet)														
				-250	-200	-150	-100	-75	-50	-25	0	25	50	75	100	150	200	250
Single Pole, Davit Arm, 345 kV Single Circuit with 69 kV Underbuild (Average Loading)	Wilmarth – North Rochester 345 kV & Line 708 69 kV	55 mG	15 mG	2 mG	3 mG	5 mG	10 mG	15 mG	24 mG	45 mG	48 mG	25 mG	17 mG	12 mG	8 mG	4 mG	3 mG	2 mG
Single Pole, Davit Arm, 345 kV Single Circuit with 69 kV Underbuild (Max Loading)		96 mG	29 mG	4 mG	6 mG	10 mG	19 mG	29 mG	47 mG	80 mG	82 mG	48 mG	35 mG	24 mG	17 mG	9 mG	5 mG	4 mG
Single Pole, Davit Arm, 345 kV Single Circuit with 69 kV Underbuild (Average Loading)	Wilmarth – North Rochester 345 kV & Line 707 69 kV	27 mG	12 mG	2 mG	3 mG	4 mG	8 mG	12 mG	17 mG	25 mG	25 mG	22 mG	17 mG	12 mG	8 mG	4 mG	3 mG	2 mG
Single Pole, Davit Arm, 345 kV Single Circuit with 69 kV Underbuild (Max Loading)		59 mG	25 mG	4 mG	6 mG	9 mG	18 mG	25 mG	37 mG	54 mG	55 mG	48 mG	37 mG	25 mG	17 mG	9 mG	6 mG	4 mG

Structure Type	Circuits Present	Maximum within ROW	Maximum at Edge of ROW	Distance to Proposed ROW Centerline (Feet)														
				-250	-200	-150	-100	-75	-50	-25	0	25	50	75	100	150	200	250
Single Pole, Davit Arm, 345 kV Single Circuit with 69 kV Underbuild (Average Loading)	Wilmarth – North Rochester 345 kV & Line 706 69 kV	31 mG	12 mG	2 mG	3 mG	4 mG	8 mG	12 mG	18 mG	28 mG	27 mG	20 mG	16 mG	11 mG	8 mG	4 mG	3 mG	2 mG
Single Pole, Davit Arm, 345 kV Single Circuit with 69 kV Underbuild (Max Loading)		62 mG	26 mG	4 mG	6 mG	9 mG	18 mG	26 mG	38 mG	57 mG	56 mG	46 mG	36 mG	25 mG	17 mG	9 mG	5 mG	4 mG
Single Pole, Davit Arm, 345 kV Single Circuit / Single Pole, Tangent, 345 kV Single Circuit (Average Loading)	Wilmarth – North Rochester 345 kV / Line 964 345 kV	78 mG	15 mG	2 mG	3 mG	5 mG	10 mG	15 mG	26 mG	46 mG	72 mG	67 mG	38 mG	26 mG	28 mG	23 mG	7 mG	3 mG
Single Pole, Davit Arm, 345 kV Single Circuit / Single Pole, Tangent, 345 kV Single Circuit (Max Loading)		246 mG	36.6 mG	4 mG	6 mG	10 mG	21 mG	32 mG	54 mG	95 mG	155 mG	164 mG	117 mG	118 mG	175 mG	167 mG	53 mG	25 mG

Structure Type	Circuits Present	Maximum within ROW	Maximum at Edge of ROW	Distance to Proposed ROW Centerline (Feet)														
				-250	-200	-150	-100	-75	-50	-25	0	25	50	75	100	150	200	250
Single Pole, Tangent/Davit Arm, 345 kV Double Circuit (Average Loading)	Wilmarth – North Rochester 345 kV & Line 964 345 kV	74 mG	20 mG	2 mG	3 mG	5 mG	12 mG	20 mG	35 mG	65 mG	68 mG	33 mG	14 mG	7 mG	5 mG	3 mG	2 mG	1 mG
Single Pole, Tangent/Davit Arm, 345 kV Double Circuit (Max Loading)		224 mG	45 mG	1 mG	2 mG	4 mG	10 mG	20 mG	46 mG	123 mG	218 mG	178 mG	87 mG	45 mG	26 mG	11 mG	6 mG	4 mG
Single Pole, Tangent/Davit Arm, 345 kV Double Circuit with 69 kV Underbuild (Average Loading)	Wilmarth – North Rochester 345 kV , Line 964 345 kV & Line 739 69 kV	19 mG	13 mG	2 mG	2 mG	4 mG	6 mG	7 mG	10 mG	13 mG	17 mG	19 mG	17 mG	13 mG	10 mG	5 mG	3 mG	2 mG
Single Pole, Tangent/Davit Arm, 345 kV Double Circuit with 69 kV Underbuild (Max Loading)		59 mG	35 mG	6 mG	10 mG	15 mG	26 mG	35 mG	44 mG	51 mG	57 mG	54 mG	43 mG	32 mG	24 mG	14 mG	9 mG	6 mG

Structure Type	Circuits Present	Maximum within ROW	Maximum at Edge of ROW	Distance to Proposed ROW Centerline (Feet)														
				-250	-200	-150	-100	-75	-50	-25	0	25	50	75	100	150	200	250
Single Pole, Davit, 161/69 kV Double Circuit (Average Loading)	North Rochester – Chester 161 kV & Peoples Line 69 kV	5 mG	1 mG	0 mG	0 mG	0 mG	1 mG	1 mG	2 mG	4 mG	5 mG	2 mG	1 mG	0 mG	0 mG	0 mG	0 mG	0 mG
Single Pole, Davit, 161/69 kV Double Circuit (Max Loading)		21 mG	5 mG	0 mG	1 mG	1 mG	3 mG	5 mG	9 mG	17 mG	20 mG	10 mG	5 mG	3 mG	2 mG	1 mG	1 mG	0 mG
Single Pole, Tangent, 345 kV Double Circuit with 69 kV Underbuild (Average Loading)	North Rochester – River 345 kV, Line 965 345 kV, Peoples Line 69 kV	105 mG	35 mG	3 mG	4 mG	7 mG	15 mG	25 mG	45 mG	82 mG	96 mG	104 mG	65 mG	35 mG	21 mG	9 mG	5 mG	3 mG
Single Pole, Tangent, 345 kV Double Circuit with 69 kV Underbuild (Max Loading)		190 mG	63 mG	5 mG	9 mG	15 mG	32 mG	52 mG	96 mG	168 mG	182 mG	186 mG	116 mG	63 mG	37 mG	17 mG	9 mG	6 mG
Single Pole, Davit, 161 kV Double Circuit with 69 kV Underbuild (Average Loading)	North Rochester – River 345 kV, Line 965 345 kV, Peoples Line 69 kV	23 mG	11 mG	0 mG	1 mG	1 mG	4 mG	6 mG	11 mG	17 mG	21 mG	22 mG	16 mG	11 mG	7 mG	4 mG	2 mG	1 mG

Structure Type	Circuits Present	Maximum within ROW	Maximum at Edge of ROW	Distance to Proposed ROW Centerline (Feet)														
				-250	-200	-150	-100	-75	-50	-25	0	25	50	75	100	150	200	250
Single Pole, Davit, 161 kV Double Circuit with 69 kV Underbuild (Max Loading)		41 mG	18 mG	1 mG	2 mG	3 mG	9 mG	14 mG	23 mG	33 mG	40 mG	38 mG	27 mG	18 mG	11 mG	5 mG	3 mG	2 mG
Single Pole, Davit, 161 kV Single Circuit / Two Pole H-Frame 345 kV Single Circuit (Average Loading)	North Rochester – Chester 161 kV & Line 979 345 kV	150 mG	47 mG	2 mG	2 mG	3 mG	5 mG	6 mG	8 mG	13 mG	22 mG	29 mG	48 mG	97 mG	149 mG	149 mG	47 mG	18 mG
Single Pole, Davit, 161 kV Single Circuit / Two Pole H-Frame 345 kV Single Circuit (Max Loading)		400 mG	127 mG	5 mG	6 mG	8 mG	12 mG	16 mG	22 mG	37 mG	64 mG	80 mG	128 mG	259 mG	398 mG	397 mG	127 mG	49 mG
Single Pole, Davit, 161 kV Single Circuit / Single Pole Tangent 345 kV Double Circuit (Average Loading)	North Rochester – Chester 161 kV / Line 965 345 kV, North Rochester – River 345 kV	111 mG	18 mG	1 mG	1 mG	1 mG	2 mG	2 mG	3 mG	6 mG	13 mG	17 mG	29 mG	58 mG	105 mG	87 mG	18 mG	5 mG

Structure Type	Circuits Present	Maximum within ROW	Maximum at Edge of ROW	Distance to Proposed ROW Centerline (Feet)														
				-250	-200	-150	-100	-75	-50	-25	0	25	50	75	100	150	200	250
Single Pole, Davit, 161 kV Single Circuit / Single Pole Tangent 345 kV Double Circuit (Max Loading)	North Rochester – Chester 161 kV / Line 965 345 kV, North Rochester – River 345 kV	205 mG	41 mG	1 mG	1 mG	1 mG	1 mG	2 mG	5 mG	14 mG	28 mG	33 mG	52 mG	103 mG	189 mG	176 mG	41 mG	13 mG
Single Pole, Davit, 161 kV Single Circuit (Average Loading)	North Rochester – Chester 161 kV	8 mG	1 mG	0 mG	0 mG	0 mG	1 mG	1 mG	2 mG	5 mG	8 mG	4 mG	2 mG	1 mG	1 mG	0 mG	0 mG	0 mG
Single Pole, Davit, 161 kV Single Circuit (Max Loading)	North Rochester – Chester 161 kV	27 mG	3 mG	0 mG	1 mG	1 mG	2 mG	3 mG	7 mG	17 mG	27 mG	15 mG	7 mG	3 mG	2 mG	1 mG	1 mG	0 mG

There are presently no Minnesota regulations pertaining to magnetic field exposure. The Applicant provides information to the public, interested customers, and employees so they can make informed decisions about magnetic fields. Such information includes the availability for measurements to be conducted for customers and employees upon request.

Considerable research has been conducted since the 1970s to determine whether exposure to power-frequency (60 hertz) magnetic fields causes biological responses and health effects. Public health professionals have also investigated the possible impact of exposure to EMF on human health for the past several decades. While the general consensus is that electric fields pose no risk to humans, the question of whether exposure to magnetic fields can cause biological responses or health effects continues to be debated.

A large body of research has been reviewed by many leading public health agencies such as the U.S. National Cancer Institute, the U.S. National Institute of Environmental Health Sciences, and the World Health Organization (WHO), among others. These reviews do not show that exposure to electric power EMF causes or contributes to adverse health effects.

Wisconsin, Minnesota, and California have all conducted literature reviews or research to examine this issue. In 2002, Minnesota formed an Interagency Working Group (Working Group) to evaluate the body of research and develop policy recommendations to protect the public health from any potential problems resulting from high voltage transmission line EMF effects. The Working Group consisted of staff from various state agencies and published its findings in a White Paper on Electric and Magnetic Field (EMF) Policy and Mitigation Options in September 2002. The report summarized the findings of the Working Group as follows:

> Research on the health effects of EMF has been carried out since the 1970s. Epidemiological studies have mixed results – some have shown no statistically significant association between exposure to EMF and health effects, some have shown a weak association. More recently, laboratory studies have failed to show such an association, or to establish a biological mechanism for how magnetic fields may cause cancer. A number of

> scientific panels convened by national and international health agencies and the United States Congress have reviewed the research carried out to date. Most researchers concluded that there is insufficient evidence to prove an association between EMF and health effects; however, many of them also concluded that there is insufficient evidence to prove that EMF exposure is safe.[86]

The Commission, based on the Working Group and WHO findings, has repeatedly found that "there is insufficient evidence to demonstrate a causal relationship between EMF exposure and any adverse human health effects."[87]

7.3.2.4 Stray Voltage and Induced Voltage

"Stray voltage" is a condition that can potentially occur on a property or on the electric service entrances to structures from distribution lines connected to these structures—not transmission lines as proposed here. The term generally describes a voltage between two objects where no voltage difference should exist. More precisely, stray voltage is a voltage that exists between the neutral wire of either the service entrance or of premise wiring and grounded objects in buildings such as barns and milking parlors. The source of stray voltage is a voltage that is developed on the grounded neutral wiring network of a building and/or the electric power distribution system.

Transmission lines do not, by themselves, create stray voltage because they do not connect directly to businesses or residences. Transmission lines, however, can induce voltage on a distribution circuit that is parallel and immediately under the transmission line. If the proposed transmission lines parallel or cross distribution lines, appropriate mitigation measures can be taken to address any induced voltages. For additional

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[86] THE MINNESOTA STATE INTRAGENCY WORKING GROUP ON EMF ISSUES, *A White Paper on Electric and Magnetic Fields Policy and Mitigation Options* at 1 (Sept. 2002). *Available at:* Microsoft Word - EMF White Paper _final_ - September 2002.doc (mn.gov).

[87] In the Matter of the Application of Xcel Energy for a Route Permit for the Lake Yankton to Marshall Transmission Line Project in Lyon County, Docket No. E002/TL-07-1407, FINDINGS OF FACT, CONCLUSIONS OF LAW AND ORDER ISSUING ROUTE PERMIT TO XCEL ENERGY FOR THE LAKE YANKTON TO MARSHALL TRANSMISSION PROJECT at 7-8 (Aug. 29, 2008); *see also* In the Matter of the Application for a HVTL Route Permit for the Tower Transmission Line Project, Docket No. ET2, E015/TL-06-1624, FINDINGS OF FACT, CONCLUSIONS OF LAW AND ORDER ISSUING ROUTE PERMIT TO MINNESOTA POWER AND GREAT RIVER ENERGY FOR THE TOWER TRANSMISSION LINE PROJECT AND ASSOCIATED FACILITIES at 23 (Aug. 1, 2007) ("Currently, there is insufficient evidence to demonstrate a causal relationship between EMF exposure and any adverse human health effects.").

information regarding stray voltage, please see the Minnesota Stray Voltage Guide that is available online at www.minnesotastrayvoltageguide.com or contact your electric utility provider.

7.3.2.5 Farming Operations, Vehicle Use, and Metal Buildings near Power Lines

The Project will be designed to meet or exceed minimum clearance requirements for electric fencing as specified by the NESC. Nonetheless, insulated electric fences used in livestock operations can be instantly charged with induced voltage from transmission lines. The induced charge may continuously drain to ground when the charger unit is connected to the fence. When the charger is disconnected either for maintenance or when the fence is being built, shocks may result. The local electrical utility can provide site specific information about how to prevent possible shocks when the charger is disconnected.

Farm equipment, passenger vehicles, and trucks may be safely used under and near power lines. The power lines will be designed to meet or exceed minimum clearance requirements with respect to roads, driveways, cultivated fields, and grazing lands as specified by the NESC. Recommended clearances within the NESC are designed to accommodate a relative vehicle height of 14 ft.

Vehicles or any conductive body under high voltage transmission lines will be immediately charged with an electric charge. Without a continuous grounding path, this charge can provide a nuisance shock. Such nuisance shocks are a rare event because generally vehicles are effectively grounded through tires. Modern tires provide an electrical path to ground because carbon black, a good conductor of electricity, is added when they are produced. Metal parts of farming equipment are frequently in contact with the ground when plowing or engaging in various other activities. Therefore, the induced charge on vehicles will normally be continually flowing to ground unless they have unusually old tires or are parked on dry rock, plastic, or other surfaces that insulate them from the ground. The Applicant can provide additional vehicle-specific methods for reducing the risk of nuisance shocks in vehicles.

Buildings are permitted near transmission lines but are generally discouraged within the right-of-way itself because a structure under a line may interfere with the safe operation of the transmission facilities. For example, a fire in a building within the right-of-way could damage a transmission line. The NESC establishes minimum electrical clearance zones from power lines for the safety of the general public and utilities often acquire easement rights that require clear areas in excess of these established zones. Utilities may permit encroachment into that easement for buildings and other activities when they can be deemed safe and still meet the NESC minimum requirements. Metal buildings may have unique issues due to induction concerns. For example, conductive buildings near power lines of 200 kV or greater must be properly grounded. Any person with questions about a new or existing metal structure can contact the Applicant for further information about proper grounding requirements.

7.3.2.6 Public Health: Avoidance and Mitigation of Potential Impacts

Impacts to public health and safety are not anticipated during construction and operation of the proposed Project. Proper safeguards would be implemented for construction and operation of the proposed 161 kV and 345 kV transmission lines. The Project will be designed according to local, state, NESC, and Applicant standards regarding proper facility installation, ground, utility, and building clearances, material quality and strength, rights-of-way width, and operation and maintenance of transmission facilities. Industry safety procedures and standardized construction practices will be used throughout construction of the Project and will include appropriate signage during all construction activities.

The proposed facilities will be equipped with protective devices including high-voltage circuit breakers and relays along transmission lines and at substations. Circuit breaks will de-energize equipment in the event of a short circuit overload, and relays will be used to detect faults, minimize time of outages, and prevent damage to the system. Substation facilities will be fenced, and only trained and authorized personnel will be allowed access to electrified equipment. In the event of an emergency, local emergency services will be contacted. A description of emergency services that will be provided in the Project Area is presented in Section 7.3.8.1.

With the proper safeguards and protective measures described above, impacts related to public health and safety are not anticipated. No additional mitigation is proposed.

7.3.3 Noise

Noise is defined by the MPCA as unwanted sound. Noise can vary in intensity and magnitude across the entire frequency spectrum. Higher to more moderate noise frequencies can typically be heard with greater ease than lower frequencies and are therefore generally given more "weight" for how intensely they can be perceived by the human ear. To account for the differences in how humans respond to sound and the variance in perception for high and low frequencies, an "A-weighted decibel" scale (dBA) is frequently used, which logarithmically approximates relative human perceptions of loudness. An increase of three dBA is considered barely perceptible to the average listener, but an increase of 10 dBA noise levels is perceived as a doubling of loudness, and an increase of 20 dBA is a quadrupling of loudness. Additionally, as dBA rises, human hearing is more likely to be damaged.

When considering cumulative noise impacts, if there is a difference of greater than ten dBA between noise sources, there will be no additive effect and only the louder source will contribute to noise. Therefore, noise levels associated with quiet sources can be barely perceptible compared to ambient noise levels and may not increase existing background noise.

Table 7-20 provides noise levels associated with common, everyday sources, providing context for the noise sources discussed below.

Table 7-20
Noise Levels Associated with Common Sources[88]

Sound Pressure Level (dBA)	Noise Source
140	Air raid siren
120	Rock concert with amplifiers

[88] University of Michigan. 2015. Noise NavigatorTM Sound Level Database with Over 1700 Measurement Values . Indianapolis, IN. *Available at:* noise-navigator-sound-level-hearing-protection-database.pdf (3m.com).

Sound Pressure Level (dBA)	Noise Source
110	Pneumatic chipper (powered by compressed air or hydraulics)
100	Lawn mower, gas-powered
80 - 100	Typical construction
80	Heavy truck traffic
65	Business office
60	Conversational speech
40	Library or bedroom
30	Whisper
20	Secluded woods
10	Range of human hearing

7.3.3.1 Noise Related to Construction

Construction noise typically includes intermittent noise associated with operation of heavy equipment and transport of equipment and personnel to and from construction sites. Noise related to construction is variable depending on equipment type and duration may vary depending on type of construction activity.

7.3.3.2 Noise Related to Transmission Line

Noise levels during operation and maintenance of the proposed transmission lines will generally be minimal. Transmission conductors can create noise through the discharge of electrical energy, called corona, which is audible in the direct vicinity of transmission line conductors under foggy, damp, or humid conditions. This noise is generally described as a low humming or crackling sound. During heavy rain conditions, the background noise level of the rain is usually greater than the noise from the transmission line. As a result, people do not normally hear noise from a transmission line during heavy rain. During light rain, dense fog, snow, and other times when there is moisture in the air, transmission lines will produce audible noise equal to approximately household background levels. During dry weather, audible noise from transmission lines is barely perceptible by humans.

The MPCA has established standards for the regulation of noise levels for residential, commercial, and industrial areas. The audible land use activities associated with residential, commercial, and industrial land have been grouped together into Noise Area Classifications (NACs) under Minnesota Rules 7030.0040 and 7030.0050, shown in **Table 7-21**. Each NAC has been assigned 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. The limits are expressed as a range of permissible dBA within a one-hour period; L_{50} is the dBA that may be exceeded 50 percent (30 minutes) of the time within an hour, while L_{10} is the dBA that may be exceeded 10 percent (six minutes) of the time within an hour.

Table 7-21
MPCA Noise Limits by Noise Area Classification (dBA)

Noise Area Classification (NAC)	Land Use Activities	Daytime		Nighttime	
		L50	L10	L50	L10
1	Household Units (includes farmhouses) Hotels, motels, or other overnight lodging Medical and other health services Correctional institutions Educational services Religious activities	60	65	50	55
2	Railroad, rail, bus passenger, airport, marine terminals Transportation services and arrangements Retail trade, including restaurants and bars Finance, insurance, real estate, governmental (except correctional institutions) services Contract construction services Parks	65	70	65	70
3	Manufacturing Transportation (except passenger terminals) Highway and street right-of-way Communication and utilities Agricultural and related activities Forestry activities and related services (including commercial forest land, timber production, and other related activities)	75	80	75	80

NAC-1 is likely to apply to the Project along transmission lines and substation connections. NAC-1 has a daytime L_{50} limit of 60 decibels and a nighttime L_{50} limit of 50 decibels. As shown in **Table 7-22,** the proposed 161 kV and 345 kV lines will be below Minnesota limits.

Table 7-22
Calculated Audible Noise for the Operation of Proposed Single/Double Circuit Transmission Line Designs

Structure Type	Circuits Present	Noise L_{50} (Edge of Right-of-Way, dBA)*
Single Pole, Davit Arm, 345 kV Single-Circuit	Wilmarth – North Rochester 345 kV	40.9
Single Pole, Davit Arm, 345 kV Single-Circuit with 115 kV	Wilmarth – North Rochester 345 kV & Line 832 115 kV	39.8
Single Pole, Davit Arm, 345 kV Single-Circuit with 69 kV Underbuild	Wilmarth – North Rochester 345 kV & Line 706, 707 or 708 69 kV	39.7
Single Pole, Davit Arm, 345 kV Single-Circuit / Single Pole, Tangent, 345 kV Single-Circuit	Wilmarth – North Rochester 345 kV / Line 964 345 kV	43.6
Single Pole, Tangent/Davit Arm, 345 kV Double-Circuit	Wilmarth – North Rochester 345 kV & Line 964 345 kV	46.8
Single Pole, Tangent/Davit Arm, 345 kV Double-Circuit with 69 kV Underbuild	Wilmarth – North Rochester 345 kV , Line 964 345 kV & Line 739 69 kV	45.7
Single Pole, Davit, 161/69 kV Double-Circuit	North Rochester – Chester 161 kV & Peoples Line 69 kV	26.1
Single Pole, Tangent, 345 kV Double Circuit	North Rochester – Tremval 345 kV, Line 965 345 kV	48.7
Single Pole, Davit, 161 kV Double-Circuit with 69 kV Underbuild	North Rochester – River 345 kV, Line 965 345 kV, Peoples Line 69 kV	48.5
Single Pole, Davit, 161 kV Single Circuit / Two Pole H-Frame 345 kV Single-Circuit	North Rochester – Chester 161 kV & Line 979 345 kV	42.2
Single Pole, Davit, 161 kV Single Circuit / Single Pole Tangent 345 kV Double-Circuit	North Rochester – Chester 161 kV / Line 965 345 kV, North Rochester – River 345 kV	47
Single Pole, Davit, 161 kV Single-Circuit	North Rochester – Chester 161 kV	11.5

* 5 Feet Above Ground

As discussed in Section 7.3.1, depending on the Proposed Route, there are up to 390 residences within 500 feet of the center of the proposed transmission line right-of-way. These residences would be classified under the NAC-1 category meaning there would be a daytime L_{50} limit of 60 dBA and a nighttime L_{50} limit of 50 dBA. Noise generated by the proposed 345 kV and 161 kV transmission lines is not anticipated to exceed 50 dBA. Therefore, it is anticipated that the Project would not exceed the MPCA noise standard.

7.3.3.3 Noise Related to Substations

Substations may also contribute noise. Transformer or shunt reactor "hum" is the dominant noise source at substations if such equipment exists. At substations without transformers or shunt reactors, only infrequent noise sources would exist such as the opening and closing of circuit breakers, the operation of an emergency generator, or unexpected maintenance issues. Typical substation design is such that noise produced by these sources does not reach beyond the substation property, in the rare cases that space is limited such that it cannot be accomplished, noise reduction designs are applied such as sound walls placed around transformers, or shelter belts planted around substations to reduce the distance the sound can travel.

The closest residence to the Wilmarth Substation is approximately 0.5 mile southwest of the substation. The closest residence to the North Rochester Substation is approximately 0.4 mile southeast of the substation. Noise levels associated with existing substation operation of the Wilmarth and North Rochester substations are below the applicable state standards and do not extend beyond substation properties and therefore are not audible from the nearest residences. New substation connections should not substantially increase noise levels. Like the transmission lines themselves, Project substations will comply with the applicable MPCA noise standards as set forth in Minnesota Rules 7030.0040.

7.3.3.4 Noise: Avoidance and Mitigation of Potential Impacts

Construction noise will be limited to daylight hours and will be temporary during implementation of the Project.

The noise modeling for the proposed transmission line indicates that the noise generated by the Project will not exceed the most stringent MPCA noise standards of NAC-1. Therefore, no mitigation is proposed.

7.3.4 Aesthetics

This section describes aesthetics in terms of the current visual landscape in and adjacent to the proposed Project Area, which may be affected by Project construction or new Project features added to the landscape. A landscape's character is largely influenced by topography, vegetation, water resources, and existing development, and infrastructure.

The topography of the landscape in the Project Area is generally level to moderately rolling, with central portions of the Project characterized by rolling loess mantled ridges and bluff lands deeply dissected by river valleys to the east (see Section 7.8). The landscape is primarily agricultural and characterized by fields, rural roads, farms, and homesteads. Rural buildings along the Proposed Routes, both inhabited and uninhabited, are typically buffered by treed areas. Portions of the Project border wetlands and river bluffs, which are characterized by rolling basins or valleys. In riparian zones and along ponds and lakes, vegetative cover (including forested areas) is higher.

Urban zones are scattered near and within the Proposed Routes for the Project. Portions of the Proposed Routes pass through or near multiple municipalities including the cities of Mankato, Eagle Lake, Madison Lake, Kenyon, Pine Island, Wanamingo, Zumbrota, Elysian, Waterville, Oronoco, Rochester, Faribault, and Morristown, characterized by a higher concentration of industrial, municipal, and commercial features, power lines and electrical substations, residential buildings, streets, and sidewalks. Additionally, these areas include parks, trails, and other recreational features that influence the visual character and enjoyment of the general area.

The majority of the Project Study Area contains existing utility infrastructure (see **Map 6-1**), including electric transmission and distribution lines, which visually altered the landscape upon initial establishment. The proposed overhead transmission lines will be permanently visible to observers in the area surrounding the Project. To minimize aesthetic impacts, the Applicant has proposed Route Options that generally follow existing rights-of-way, where practicable. As shown in **Appendix L**, the Proposed

Routes will be double-circuited with existing transmission lines for varying lengths as well as running parallel to existing transmission lines, roadways, and property lines. Below is a summary of the approximate percentage of each proposed Route Option that is proposed to be double-circuited with exiting transmission lines, which would minimize aesthetic impacts to new areas:

- Route Option 1 North – 97 percent
- Route Option 1 South – 72 percent
- Route Option 1 North – 69 percent
- Route Option 2 South – 17 percent
- Route Option 3 – 100 percent
- Route Option 4 East – 26 percent
- Route Option 4 West – 0 percent

The existing transmission structures along Segments 1, 2, and 4 generally range in height from 45 to 70 feet for single-circuit 69 kV lines and 55 to 95 feet for single-circuit 115 kV lines. The double-circuit 115/69 kV line on the south side of Highway 14 (Route Option 1 South) has structure heights ranging from 80-120 feet. The new 345 kV transmission line structures would generally range in height from 85 to 175 feet, with several taller structures (up to approximately 195 feet) necessary where Route Option 1 South crosses Highway 14 and an existing double-circuit 115 kV line north of the Eastwood Substation. A change in visual impacts would result from the installation of new, taller transmission structures; however, in general permanent impacts will be limited in the portions of the Project where transmission structures are already part of the existing visual character. New visual impacts will occur in locations where Route Options are not double-circuited with or parallel to existing transmission lines. Existing structures along Segment 3 range between 70-175 feet and will not change as a result of the Project. See **Figure 2-1** and **Figure 2-2** and **Appendix H** for photographs and technical drawings of proposed transmission structure types.

Tree-clearing will occur in some wooded areas along the proposed Route Options, which will change the land characteristic and affect the visual character of the Project area. Depending on which Route Options are selected by the Commission, between approximately 67 and 158 acres of woodland areas (evergreen forest, deciduous forest, woody wetlands, mixed forest land cover types) will be cleared for new right-of-way for the Project.

Areas of higher scenic value exist in the form of scenic byways, recreation areas, and river crossing by the Proposed Routes.

- Minnesota River Valley Scenic Byway – On the westernmost side of the Project Area, portions of US Highway 169, US Highway 14, and CR 5/3rd Avenue are part of the Minnesota River Valley Scenic Byway. Route Options 1 North and 1 South both cross the Scenic Byway just east of the Wilmarth Sub. Both crossings of the scenic byway would occur in locations where the Route Option would be double-circuited with existing transmission lines and where existing industrial/commercial development exists. As the proposed transmission structures will have a greater height compared to existing structures, the Project would have a slight increase in visual impacts.
- Sakatah Singing Hills State Trail - Route Option 1 North and 1 South both cross the Sakatah Singing Hills State Trail in multiple locations and parallel the trail for approximately 1.4 and 3.7 miles, respectively. In these areas the line would be offset from the trail to minimize tree clearing adjacent to the trail. Along Route Option 1 North all crossings and paralleling occurs in areas where the Project would be double-circuited with existing transmission lines. Along route Option 1 South, three crossings of the trail occur in areas where there is no existing transmission line infrastructure. Visual impacts will be greater at these crossing locations.
- Shoreland - As described **in** Section 7.6.4 the proposed Route Options cross a number of waterways and waterbodies. Tree clearing would occur in some forested areas along shoreland within the proposed right-of-way which will affect the aesthetic nature of the impacted areas. These impacts will be greater for crossings where no existing transmission infrastructure exists.
- Wildlife Management Areas – As described in Section 7.3.8 some proposed Route Options cross or pass near state managed WMAs. Proposed crossings

typically follow existing transmission lines, but additional ROW width/clearing would typically be required. Impacts on aesthetic resources will be greater for crossings where no existing transmission infrastructure exists.

7.3.4.1 Aesthetics: Avoidance and Mitigation of Potential Impacts

The Applicant will mitigate aesthetic impacts by avoiding removal of trees where possible, spanning natural areas when feasible, and by using existing infrastructure and roadway or transmission facility rights-of-way to the maximum practicable extent. The introduction of a new overhead transmission line will create a permanent visual impact in the Project area. By siting the Route Options along existing linear features where practicable, the Applicant has minimized impacts to the viewshed. Visual disturbance of the Project during operation will include regularly scheduled maintenance and clearing of vegetation in the Project right-of-way. As impacts will generally be localized and will diminish over time as residents become used to the visual landscape, no other mitigation is proposed.

7.3.5 Socioeconomics

The area of study for the socioeconomic analysis includes the State of Minnesota, the counties of Blue Earth, Le Sueur, Waseca, Rice, Goodhue, Olmsted, Wabasha, the cities of Mankato, Eagle Lake, Madison Lake, Kenyon, Pine Island, Wanamingo, Zumbrota, Elysian, Waterville, Oronoco, Rochester, Faribault, and Morristown. Socioeconomic factors analyzed include population, income, unemployment rate, and largest employment industries. U.S. Census data was obtained from the 2010 and 2020 census at the state, county, and city levels to characterize the area along the Proposed Routes. These datasets were compared to county and state data, as demonstrated in **Table 7-23**.

Table 7-23
Socioeconomic Characteristics
U.S. Census Bureau 2010[89] and 2020[90] Data

Location	2010 Population	2020 Population	Population Change (%)	2020 Median Household Income	2020 Unemployment Rate	2020 Largest Employment Industries
State of Minnesota	5,241,914	5,707,390	6.83	$73,382	3.80%	Manufacturing, Health Care, Retail
Blue Earth County	62,719	67,368	7.41	$61,058	3.90%	Manufacturing, Health Care, Retail
Mankato City	38,187	42,685	11.78	$52,411	4.50%	No Data
Eagle Lake City	2,423	3,064	26.45	$75,610	5.50%	No Data
Madison Lake City	1,007	1,081	7.35	$42,500	1.70%	No Data
Goodhue County	45,930	46,330	0.87	$69,334	3.60%	Manufacturing, Health Care, Retail
Kenyon City	1,844	1,865	1.14	$60,568	4.30%	No Data
Pine Island City	3,249	3,629	11.7	$72,292	3.80%	No Data
Wanamingo City	1,000	1,117	11.7	$61,094	2.40%	No Data
Zumbrota City	3,181	3,452	8.52	$67,353	0.90%	No Data
Le Sueur County	27,719	28,425	2.55	$75,925	3.30%	Manufacturing, Health Care, Construction
Elysian City	528	703	33.14	$75,417	2.40%	No Data
Waterville City	1,783	1,841	3.25	$58,900	2.70%	No Data
Olmsted County	141,244	156,446	10.76	$80,403	3.40%	Health Care, Manufacturing, Retail
Oronoco City	974	1,517	55.75	$120,625	0.40%	No Data

89 United States Census. 2010. American Community Survey. Available at: 2010 (census.gov).

90 United States Census. 2020. American Community Survey. Available at: 2020 Census Results.

Location	2010 Population	2020 Population	Population Change (%)	2020 Median Household Income	2020 Unemployment Rate	2020 Largest Employment Industries
Rochester City	104,201	117,134	12.41	$76,034	3.90%	No Data
Rice County	63,087	66,549	5.49	$70,600	5.10%	Manufacturing, Health Care, Educational Services
Faribault City	23,034	23,853	3.56	$54,832	6.70%	No Data
Morristown City	1,106	959	-13.29	$58,750	2.90%	No Data
Wabasha County	21,743	21,564	-0.82	$67,906	3.70%	Health Care, Manufacturing, Construction
Waseca County	19,168	18,658	-2.66	$60,450	3.60%	Manufacturing, Health Care, Retail

CDP = Census Defined Place, an unincorporated community

Olmsted County is the most populated county within the Project Study Area, with the population concentrated in the City of Rochester and bordering the southern edge of Segment 4 of the Project.[91] Plans in the City of Rochester are primarily focused on community improvements and expansions in central and northwest Rochester. The Proposed Route does not extend into Rochester city limits, but a Segment 4 Route Option (Route Option 4 East) does border an area zoned as Mixed-Use Single Family in northwest Rochester, which is currently being used for agriculture.[92]

The counties of Blue Earth, Waseca, Rice, Goodhue, Wabasha, the cities of Mankato, Madison Lake, Kenyon, Pine Island, Wanamingo, Zumbrota, Waterville, Faribault, and Morristown have a lower median household income than the state average (**Table 7-23**). Unemployment is higher than the state average in the counties of Blue Earth, Rice and the cities of Mankato, Eagle Lake, Kenyon, Rochester, and Faribault (**Table 7-23**).

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[91] City of Rochester. 2021. Strategic Priorities and Action Plan. Accessed from: Strategic Priorities & Action Plan | Rochester, MN (rochestermn.gov) 32706 (rochestermn.gov).

[92] City of Rochester. 2023. Zoning Updates Experience Builder (arcgis.com).

The largest employment industry within the Project Area is health care followed by manufacturing and retail.

7.3.5.1 Socioeconomics: Avoidance and Mitigation of Potential Impacts

The construction and operation of the Project is expected to have minimal long-term impacts on local (county and municipal) economies due to the relatively short-term time frame of construction (2-3 years). Construction of the Project will last approximately 2-3 years and will employ 50-100 construction workers. The Applicant will pay prevailing wages for applicable construction jobs in the Project area. The Project will support multiple employment sectors (i.e., utilities, construction, manufacturing) and provide employment opportunities during the duration of construction and operation. During construction, local businesses may experience increases in revenue due to increased purchase of goods and services. Local construction crew expenditures will result in a temporary, positive impacts on local economies.

Long-term benefits of the Project include ensuring continued, reliable electric service for communities serviced by the Project and economic benefits through incremental increases in revenues from utility property taxes. Additionally, the Project will support increases in renewable energy production and enhance the capacity for the energy industry (including the Applicant) to accommodate growing communities, which will benefit local economies.

No adverse socioeconomic impacts are anticipated, and therefore, no mitigation measures are proposed.

7.3.6 Environmental Justice

Environmental justice involves the fair treatment and meaningful involvement of people regardless of race, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.[93] An environmental justice analysis is typically conducted through the analysis of socioeconomic indicators to determine areas where adverse environmental and human

[93] Definition, Environmental Justice | US EPA.

health impacts could disproportionately affect low-income or minority (American Indian or Alaskan Native; Asian or Pacific Islander; Black, not of Hispanic origin; or Hispanic) populations. Areas with disproportionately high low-income or minority populations are considered environmental justice areas.

According to Minn. Stat. § 216B.1691, subd. 1(e), an "environmental justice area" is defined as an area in Minnesota that, based on the most recent data published by the U.S. Census Bureau, meets one or more of the following criteria:

> (1) 40 percent or more of the area's total population is nonwhite;
>
> (2) 35 percent or more of households in the area have an income that is at or below 200 percent of the federal poverty level
>
> (3) 40 percent or more of the area's residents over the age of five have limited English proficiency; or
>
> (4) the area is located within Indian country, as defined in United State Code, title 18, section 1151.

The following analysis includes a summary of environmental justice areas with disproportionately high poverty levels, Limited English Populations (LEP), minority populations, and Indian country areas within the Proposed Routes that could be impacted by implementation of the Project. Because the Proposed Routes span urban and rural areas, this analysis includes U.S. Census data from counties, cities, census tracts, and census block groups crossed by the Project.

EJScreen is a spatial tool developed by the EPA that provides high-resolution environmental and demographic information in the U.S. to identify locations that may be candidates for further review (EPA 2023). The EJScreen tool was used to broadly analyze socioeconomic indicators in the 90-100 national percentile along the Proposed Routes including areas with minorities, high unemployment rates, and high LEP populations. EJScreen results were compared to U.S. Census data for a final overview of environmental justice status.

According to the U.S. Census Bureau, the majority of the population along the Proposed Routes identifies as white. Areas crossed by the Proposed Routes generally have a lower percentage of minority populations than the state average, except in the cities of Faribault, Mankato, and Rochester. The total population and percent households below poverty level and the percentage of minorities in 2020 in the state and cities and counties along the Proposed Routes is summarized in **Table 7-24**.

Table 7-24
Environmental Justice Characteristics along the Proposed Routes 2020 5-Year Estimates[94]

Location	Total 2020 Population	2020 Households Below Poverty Level	2020 Percent Minority	2020 Percent LEP Population
State of Minnesota	5,707,390	9.30%	19.20%	2.18%
Blue Earth County	67,368	16.40%	13.25%	1.10%
Mankato	42,685	22.50%	18.26%	1.70%
Eagle Lake	3,064	7.10%	7.69%	0.00%
Madison Lake	1,081	5.50%	4.00%	0.00%
Goodhue County	46,330	8.60%	7.10%	0.60%
Kenyon	1,865	8.90%	10.35%	0.00%
Pine Island	3,629	2.40%	5.62%	0.00%
Wanamingo	1,117	14.30%	4.10%	0.00%
Zumbrota	3,452	10.70%	4.78%	1.90%
Le Sueur County	28,425	8.10%	8.21%	0.80%
Elysian	703	5.10%	2.54%	0.00%
Waterville	1,841	8.00%	4.91%	0.00%
Olmsted County	156,446	8.00%	18.91%	2.30%
Oronoco	1,517	1.00%	3.72%	0.00%
Rochester	117,134	9.50%	23.47%	3.00%
Rice County	66,549	10.10%	19.37%	4.40%
Faribault	23,853	16.30%	31.18%	10.40%
Morristown	959	11.50%	9.38%	0.00%

[94] United States Census. 2020. United States Decennial Census. *Available at*: 2020 Census Results.

Location	Total 2020 Population	2020 Households Below Poverty Level	2020 Percent Minority	2020 Percent LEP Population
Wabasha County	21,564	7.60%	4.51%	0.80%
Waseca County	18,658	8.00%	9.72%	0.80%

A complete summary of minority, low-income populations, and LEPs in counties, cities, census tracts, and census block groups along the Proposed Routes is presented in **Appendix W**.

7.3.6.1 Environmental Justice: Avoidance and Mitigation of Potential Impacts

Using the Minnesota definition of an "environmental justice area," an analysis of counties, cities, census tracts, and census block groups along the Proposed Route revealed one low-income population within the Proposed Route of Route Option 1 South, along Census Tract 1703 and Block Group 1. No other low-income or minority populations were identified within the Proposed Routes. Additionally, the percentage of LEP populations with limited ability to read, speak, write, or understand English is below the Minnesota definition of an environmental justice area within the Proposed Routes. The Proposed Routes do not pass through Indian country, as defined in 18 U.S. Code § 1151.

Environmental impacts from all resource areas assessed in this Application were evaluated. As described in Sections 7.3.5, 7.3.8, and 7.6.1 of this Application, the Project is not anticipated to result in adverse impacts to socioeconomics, recreation, air quality, or climate. As a result, the Project is not anticipated to have disproportionately high and adverse impacts on environmental justice areas, and no additional mitigation is proposed.

7.3.7 Cultural Values

Cultural values are based on core principles and beliefs that form the foundation for community unity. The Project Study Area spans multiple counties including (roughly from west to east) Blue Earth, Le Sueur, Waseca, Rice, Goodhue, Dodge, Olmsted, Wabasha, and Winona. The region was historically Dakota land; the first European explorers were French traders, soldiers, and missionaries. Other historic settlers of the Project Study Area primarily included Norwegian, Swedish, British, Welsh, Irish, Polish, and Czech peoples.[95]

The Project Study Area crosses lands ceded by the Dakota in various treaties. The first land to be ceded, largely comprised of Wabasha County at the eastern end of Segment 3, was purchased by the U.S. government in 1830 and called the "Half Breed Tract on Lake Pepin" or Wabasha Reservation. This area was "neutral ground" set aside for mixed blood Dakota peoples.[96] In 1851, treaties were signed with the Dakota at Traverse des Sioux and Mendota. Eastern bands of the Dakota were coerced into signing away all their remaining lands in Minnesota and Iowa, comprising 35 million acres. These treaties covered all the remaining land within the Project Study Area. In 1854, the area previously set aside in 1830 for the "Half Breed Tract on Lake Pepin" was desired by European settlers as prime farmland. Since the U.S. government did not acknowledge mixed Native American-European individuals, the government instead bought all land from the mixed settlers to sell or trade to full-blooded European settlers (MNHS n.d.). Today, only the Prairie Island Indian Community owns property crossed by the Project Study Area. Specifically, they own lands southeast of Pine Island adjacent to Highway 52. These parcels are crossed or abutted by Route Option 3 and Alternative Segments 4E and 4F. One wild rice lake recorded in the Project Study Area—Hands Marsh—is still used by indigenous peoples today. This lake is located in Rice County, southwest of Morristown.

The counties crossed by the Project Study Area are largely defined by the riverine landscape feeding plentiful lakes, large tracts of lush woods, and rolling farmland. The area's fertile land was what initially drove European settlement throughout the region, and agriculture continues to be the major industry. This cultural value is still celebrated today at each of the counties' annual county fairs.

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[95] Holmquist, June Drenning. 1981. They Chose Minnesota: A Survey of the State's Ethnic Groups. Chicago: Minnesota Historical Society Press.

[96] MNHS. n.d. Minnesota Treaty Interactive. Accessed on August 25, 2023. Procured from: https://www.usdakotawar.org/history/treaties/minnesota-treaty-interactive.

One state park is within the Project Study Area: Sakatah Lake State Park in Waterville, Rice County. Established in 1963, this state park comprises nearly 800 acres of wooded land just south of Upper and Lower Sakatah Lakes. County parks within the Project Study Area include Duck Lake Park and Lake George Park in Blue Earth County, Ray's Lake Park in Le Sueur County, Falls Creek Park and Shager Park in Rice County, the developing Nielsen Memorial Preserve in Goodhue County, and Lake Zumbro Park in Olmsted County.

Major municipalities within the Project Study Area include Mankato and Faribault. Faribault includes a designated historic district in Minnesota, second only to St. Paul, containing commercial buildings erected in the mid to late 1800s and early 1900s. Building owners make great efforts to keep these historic structures in good condition while maintaining the historic feel of downtown Faribault.[97]

In the 1860s, during the early years of historic downtown Faribault, the city was known as the "Athens of the West" due to its growing number of institutions giving the city a strong reputation as a center for the arts, education, and religion. Many of these institutions, including schools founded by Bishop Henry Whipple, the State Academies for the Deaf and Blind, the Buckham Memorial Library, and the Cathedral of Our Merciful Savior are still in operation. The city continues to support a developing arts and culture community through the Paradise Theater for the Arts, the Fesler-Lampert Performing Arts Series at Shattuck-Saint Mary's School, the City's Concerts in the Park program, and multiple private art galleries and music venues (City of Faribault 2020).

Faribault and the surrounding area in Rice County maintain a sense of community through various local events like Heritage Days, the Blue Collar Music and Arts Festival, Pet Parade, the aforementioned Concerts in the Park, the Fall Festival, Faribault Car Cruise Nights, the Faribault Flannel Formal, and the Faribault International Festival (City of Faribault 2020).

The city of Mankato was originally founded in 1852 and named after the Dakota phrase "mahkato" or "blue earth", which describes the blue-gray clayey soil common to the

[97] City of Faribault. 2020. Journey to 2040 Comprehensive Plan Update. Accessed on September 19, 2023. Procured from: https://www.ci.faribault.mn.us/DocumentCenter/View/6577/CompPlan-Full.

area. In the early 1900s, Mankato become a bustling center for the performing arts and recreation, hosting a renowned Opera House, multiple sports (i.e., bicycling, baseball, curling, trapshooting, and others), a horse racetrack, and the Sibley Park Zoo.[98] Mankato supports its collective history and art with museums such as the Blue Earth County Historical Society, Children's Museum of Southern Minnesota, and Historic R.D. Hubbard House.[99]

Mankato and the surrounding area in Blue Earth County maintain a sense of community through various local events like Mankato Craft Beer Expo, CityArt Walking Sculpture Tour, Bookin' on Belgrade, Blues on Belgrade, Bells on Belgrade, Kiwanis Holiday Lights, Ribfest, and the Mahkato Annual Traditional Pow-Wow.[100]

7.3.7.1 Cultural Values: Avoidance and Mitigation of Potential Impacts

Construction, operation, and maintenance of the Project is not expected to conflict with the cultural values within the Project Study Area. The area is generally rural in nature with small historic municipal pockets and an agriculture-based economy. This character is anticipated to remain after construction. No aspects of the culture of the area are anticipated to be significantly impacted or changed as a result of the construction and operation of the Project.

7.3.8 Recreation

There are several recreational areas crossed or bordered by the Proposed Routes for the Project including multiple rivers, state hiking and snowmobile trails, and a state forest. Additionally, five Wildlife Management Areas (WMAs), one Aquatic Management Area (AMA), multiple state water trails, a Girl Scout camp, a golf course, and an archery club are present. Common recreational activities that occur in these

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[98] Harren, H. 2017. A Brief History of Mankato Township. Blue Earth County Historical Society. Accessed on January 23, 2024. Procured from: https://blueearthcountyhistory.com/2017/03/28/a-brief-history-of-mankato-township/.

[99] City of Mankato. 2024b. Events and Festivals. Accessed January 23, 2023. Procured from: https://greatermankato.com/stay-enjoy/events-festivals/.

[100] *Id.*

locations include hiking, hunting, fishing, boating, snowmobiling, birdwatching, golfing, and archery.

WMAs are public areas managed by the MnDNR intended for the protection and production of wildlife species and their habitat. WMAs may be used by residents and tourists for hunting, fishing, trapping, and wildlife viewing. AMAs are lake, river, and stream management areas intended for the preservation of water resources and the engagement in compatible outdoor recreational activities such as fishing, hunting, and wildlife viewing.

Many lakes, rivers, and streams are spanned or bordered by the Project. Multiple rivers spanned by the Project along Route Options 1 North, 2 North, 2 South, 3, 4 East, and 4 West contain state water trails such as the Zumbro River State Trail, Cannon River Water Trail, and the Straight River Water Trail often used for canoeing or boating. Lakes and rivers are also used for recreational activities such as fishing and swimming. A full list of lakes and rivers present within the Project Study Area is presented in Section 7.6.2.3.

The Project will cross multiple unpaved snowmobile trails including the Tiger Bear 1 Trail, Zumbrowatha Trail, Snake Creek Unit Trail, Faribo-Snow-Go Trail, and Goodhue County trails which wind throughout multiple routes. Snowmobile trails are used frequently for recreational activities during the winter.

Other nearby recreational areas include nearby municipal or state parks, such as the Sakatah Lake State Park, which are not crossed by the Proposed Routes. There are no Scientific and Natural Areas (SNAs) crossed by the Proposed Routes. A description of recreational features unique to individual Segments and Route Options is presented below.

7.3.8.1 Segment 1

Segment 1 has two Route Options (1 North and 1 South), one Alternative Segment (1L), and no Connector Segments.

The Sakatah Singing Hills State Trail is crossed in multiple locations by Route Options 1 North and 1 South. This trail, developed on an abandoned railroad grade, is frequently used by the public for biking, running, walking, and cross-county skiing. The recreational features unique to each Segment 1 Route Option and Alternative Segment are described below.

7.3.8.1.1 Route Option 1 North

Multiple WMAs are crossed by Route Option 1 North including Dove Lake WMA, Earl Swain WMA, and Cannon River WMA: Thomas West Unit. Each of these is described below.

- Dove Lake WMA is located 1.5 miles northwest of Elysian along County Highway 16. This 258.16-acre WMA is crossed by an existing transmission line right-of-way. Dove Lake WMA features a primitive trail and a restored oak savanna complex that provides habitat to upland wildlife species.
- Earl Swain WMA is located 2 miles north of Elysian along County Highway 11 and is crossed along the north end by an existing transmission line right-of-way. This 105.2-acre WMA contains marshland and restored oak savanna habitat that benefits upland and wetland wildlife species.
- Cannon River WMA: Thomas West Unit, 118.52 acres in size, is crossed by existing transmission line right-of-way. This WMA is managed for native wildlife that require upland brush and riparian habitats. Three recreational trails, the Sakatah Singing Hills State Trail, the Cannon River Canoeing Route, and the Faribo-Sno-Go snowmobile trail, run through this WMA and are crossed by the Route Option 1 North.

Tetonka Lake AMA is bordered by an existing transmission line right-of-way along Route Option 1 North of the Project. The Sakatah Singing Hills State Trail is a 38.6-mile paved trail crossed in three locations by Route Option 1 North. Additionally, a Girl Scouts camp is present within a forested area east of Fish Lake (DOWLKNUM 40005100) and south of Route Option 1 North.

7.3.8.1.2 Route Option 1 South

Gilfillan Lake WMA is located 1.5 miles west of Madison Lake along County Highway 26 and is crossed along the southern end by an existing transmission line right-of-way and Route Option 1 South. This WMA features 558.6 acres of wetland, lowland forest, and lake habitat. Route Option 1 South would also cross Dove Lake and Earl Swain WMAs (described above).

The Sakatah Singing Hills State Trail is a 38.6-mile paved trail crossed four times by Route Option 1 South. The Mankato Golf Club is bordered by Route Option 1 South of the Project in Mankato.

7.3.8.1.3 Alternative Segment 1L

No recreation areas are crossed by Alternative Segment 1L.

7.3.8.2 Segment 2

Segment 2 has two Route Options (2 North and 2 South) and a Connector Segment (2G), but no Alternative Segments. The recreational features are described below.

Faribault WMA is located approximately 1 mile south of Faribault and is crossed by Route Options 2 North and 2 South. This WMA, 521.75 acres in size, is primarily comprised of grassland habitat and managed for upland game species. Waterfowl and other wetland wildlife associated with the Straight River and small waterbodies within the WMA are also present in the unit.

The recreational features unique to each Segment 2 Route Options and the Connector Segment are described below.

7.3.8.2.1 Route Option 2 North

There are no recreational features unique to Route Option 2 North, other than those indicated above and in common with Route Option 2 South.

7.3.8.2.2 Route Option 2 South

There is one private recreational facility in Faribault crossed by Route Option 2 South, the Straight River Golf Course.

7.3.8.2.3 Connector Segment 2G

There are no recreational features unique to Connector Segment 2G.

7.3.8.3 Segment 3

Segment 3 consists of only one proposed Route Option (3), and it does not include other Route Options, Alternative Segments, or Connector Segments.

One State Forest, the Richard J. Dorer (RJD) Memorial Hardwood State Forest, is crossed by Route Option 3. This 1,016,227-acre state forest contains forests, rivers, streams, and bluffs of the Great River Road and features numerous opportunities for recreation including a day-use area, ten campgrounds, class 1 and 2 ATV trails, horseback riding areas, ski trails, and hiking trails. Additionally, multiple areas of the state forest are open to hunting, fishing, wildlife viewing, mountain biking, and canoeing.

McCarthy Lake WMA is crossed by Route Option 3. This large, 3,129.36-acre WMA contains lowland hardwood, grassland, and wetland habitat. Six parking lots and numerous hunting, trapping, and fishing opportunities exist at this unit.

7.3.8.4 Segment 4

Segment 4 has two Route Options (4 East and 4 West), four Alternative Segments, and a Connector Segment (4Q). The recreational features unique to each Segment 4 Route Option, Alternative Segment, and Connector Segment are described below.

7.3.8.4.1 Route Option 4 East

There are no recreational features which are unique to Route Option 4 East.

7.3.8.4.2 Route Option 4 West

The Douglas State Trail is a 12.5-mile paved trail crossed once by Route Option 4 West. This trail is developed on an abandoned railroad grade and is frequently used by the public for biking, running, walking, and cross-county skiing. The Rochester Archery Club is located 0.2 miles south of the centerline of Route Option 4 West.

7.3.8.4.3 Segment 4 Alternative and Connector Segments

There are no recreational features which are unique to the Alternative and Connector Segments associated with Segment 4.

7.3.8.5 Recreation: Avoidance and Mitigation of Potential Impacts

Impacts to recreation along Segments and associated Route Options would differ depending on type and number of recreational facilities crossed. All Route Options would cross state water trails and snowmobile trails, which wind throughout the Project Study Area.

For Segment 1, Route Option 1 North primarily follows an existing transmission line right-of-way. Any impacts to recreation at public or private facilities would be limited and primarily involve temporary disturbance during Project construction. Route Option 1 South crosses the Sakatah Singing Hills State Trail more times than Option 1 North, which would result in a greater amount of temporary impacts to the trail during Project construction. Although Route Option 1 South includes a greater amount of new right-of-way, temporary impacts to WMAs, AMAs and private facilities would be similar along both Segment 1 Route Options.

Along Segment 2, Route Option 2 South would cross one WMA along an existing transmission line corridor and could result in temporary disturbance of recreational uses during construction, but would not result in any permanent changes in use. Route Option 2 South also crosses a private golf course, which would be a permanent impact. Use of Connector Segment 2G could be used to avoid those facilities by transitioning from Route Option 2 North to 2 South at that point.

Segment 3 would not result in any new impacts to recreation.

Along Segment 4, Route Option 4 East would not cross any recreational facilities, and 4 West would cross one State Trail and border one private facility (archery club). Any impacts to these recreational facilities would be temporary during construction.

Construction of the Project will not permanently disturb recreational activities. Construction will involve tree and land clearing, use of heavy equipment, loud noises, and lighting that may disturb wildlife, habitat, natural areas, and user enjoyment in the Proposed Route and associated construction and laydown areas. Short-term closures may occur where rights-of-way span or border trails, which could impact pedestrians, bikers, and ATV users. Moderate disturbance to hunters, anglers, wildlife observers, golfers, archers, and trail users may occur during construction of the Project, depending on the timing of activities. This disturbance may impact the enjoyment of recreational areas surrounding WMAs, conservation areas, golf courses, and parks. Disturbance will be minimal, localized to construction areas, and temporary during the duration of Project construction. Appropriate signage will be placed along recreational areas to warn trail users of ongoing construction. The Applicant will coordinate with local governments, the MnDNR, and USFWS to ensure construction of the Project will not significantly impact nearby natural resources that could influence recreation.

Use of heavy equipment and land clearing will increase noise and dust in the vicinity of construction areas, which may negatively impact enjoyment of recreational areas. These impacts will be temporary, and dust will be mitigated through appropriate implementation of BMPs such as dust abatement through watering during Project construction.

Construction of transmission lines spanning lakes, rivers and streams may temporarily influence enjoyment of waterways, but all lakes and rivers will be spanned. A full description of impacts and mitigation surrounding lakes, rivers, and streams is presented in Section 7.6.2.3.

Impacts to private recreational facilities will be avoided or mitigated through landowner agreements where feasible.

Impacts from operations would include the visual presence of the structures, and conductors and any noise generated by the transmission line or substations. These impacts would be permanent.

With the above measures and agency coordination implemented, no other mitigation is proposed.

7.3.9 Public Services

The Project Study Area crosses multiple municipalities where public services including law enforcement, fire services, medical services (ambulances, hospitals), water and wastewater services, school districts, utilities, and other public services are provided.

7.3.9.1 Police, Fire, and Ambulance Services

Police, fire, and ambulance services are provided by emergency response and law enforcement in nearby cities and counties. Sheriff's offices and municipal police departments provide local law enforcement to the counties of Blue Earth, Le Sueur, Waseca, Rice, Goodhue, Olmsted, Wabasha and their respective cities of Mankato, Eagle Lake, Madison Lake, Kenyon, Pine Island, Wanamingo, Zumbrota, Elysian, Waterville, Oronoco, Rochester, Faribault, and Morristown. Most law enforcement in the Project Study Area is centered around urban settings where higher human populations and crime are typically concentrated.

Fire departments would provide emergency fire response services to the Project. Fire services are provided by city and community fire departments in the Project Study Area. Mankato, Pine Island, Waterville, Zumbrota, Rochester, Faribault, Morristown, and Wanamingo have paid fire departments that serve surrounding cities and townships. Eagle Lake, Oronoco, Kenyon, Elysian, and Madison Lake have volunteer fire departments.

Ambulance districts would provide emergency medical response services to the Project. Ambulance services in the Project Study Area include the North Memorial Ambulance Service in Faribault and Kenyon. Combined fire and ambulance services are provided by the Elysian Fire Department, the Pine Island Fire Department, the Waterville Fire Department, and the Oronoco Volunteer Fire Department. The Mayo Medair Ambulance Service in Mankato provides emergency helicopter transport for patients in areas surrounding the Mankato Regional Airport. Emergency medical response is also available from local hospitals listed in Section 7.3.9.2.

7.3.9.2 Hospitals

There are five hospitals and clinics that offer emergency services within the cities and townships intersected by the Project. Details regarding the clinic and hospital distance from the Proposed Route are presented in **Table 7-25**.

Table 7-25
Hospitals and Clinics Within the Project Study Area

Hospital Name	City	Approximate Distance from Proposed Route (ft)	Heliport ID (if applicable)
District One Hospital	Faribault	9,815	MN59
Mayo Clinic Health System - Madison East Health Center	Mankato	3,634	N/A
Olmsted Medical Center - Pine Island	Pine Island	1,482	N/A
Olmsted Medical Center - Wanamingo	Wanamingo	2,214	N/A
Mayo Clinic Health System	Waterville	2,872	N/A

The District One Hospital, located in Faribault, has an associated heliport (Heliport ID MN59) that may be used for emergency medical services in the Project Area. Safety risks associated with the heliport and its proximity to the Project are described in Section 7.3.11.3 and Section 7.3.11.4.3.

7.3.9.3 Water and Wastewater Services

Water and wastewater services provide clean drinking water and access to sewage treatment, which are critical to maintaining public health. Municipal water and wastewater services are provided to residences and businesses within cities and townships in the Project Study Area. In rural areas, residents typically use private septic systems and wells. As the majority of the Proposed Routes cross rural areas beyond the boundaries of cities and townships, most residences in the Project Study Area have private septic systems. The counties of Blue Earth, Le Sueur, Waseca, Rice, Goodhue, Olmsted, and Wabasha have septic programs that conduct inspection services, issue permits, and oversee installation and maintenance of private septic systems and wells in the Project Study Area.

7.3.9.4 School Districts

There are 13 school districts crossed by the Proposed Routes including:

- Byron Public School District,
- Cleveland Public School District,
- Faribault Public School District,
- Kenyon-Wanamingo School District,
- Mankato Public School District
- Medford Public School District,
- Pine Island Public School District,
- Plainview-Elgin-Millville Community Schools,
- Rochester Public School District,
- Wabasha-Kellogg Public School District,
- Waseca Public School District,
- Waterville Elysian-Morristown Public School District, and
- Zumbrota-Mazeppa School District.

7.3.9.5 Utilities

Existing electric utilities in the Project Study Area are provided by Xcel Energy, Kenyon Municipal Utilities, People's Energy Cooperative, Rochester Public Utilities, and Southern Minnesota Municipal Power Agency.

Two utility pipelines are crossed by the Proposed Routes. A hydrocarbon pipeline owned by Enterprise Products, running north to south, and a hydrocarbon pipeline owned by Kinder Morgan, running northwest to southeast. Both pipelines are crossed by Routes 1 North and 1 South.

7.3.9.6 Other Public Services

Other public services in the Project Study Area include public works and utility design offices and public facilities. Public works and utility departments design and maintain public infrastructure including sanitary sewer and water mains, sidewalks, streets, public parks and trails, and public landscaping. Public facilities include libraries, parks, public swimming pools, and ice rinks within incorporated areas.

7.3.9.7 Public Services: Avoidance and Mitigation of Potential Impacts

Impacts to law enforcement, fire services, medical services, water and wastewater services, school districts, utilities, and other public services are not expected to occur during construction and operation of the Project. The Applicant will coordinate with local emergency services to ensure that emergency access to areas near construction activities is maintained.

Construction and operation of the proposed transmission line may pose a risk to workers through incidents resulting from the operation of heavy equipment, falls, and equipment-use related injuries. The Applicant will ensure workers follow all safety standards to the maximum extent practicable. In the event an incident does occur, local emergency services will be contacted, which should be available in all areas of the proposed Project.

Damage to utility pipelines or water lines are not expected to occur during ground-disturbing activities, as transmission lines will be designed to span the existing right-of-way of underground utilities. The Applicant will notify Gopher State One-Call of all proposed excavations to ensure that underground utilities will not be impacted throughout construction. If a pipeline or water line must be spanned during construction of the Project, the Applicant will use soil preserving BMPs such as construction matting over underground utilities when using heavy equipment.

The Applicant will contact utility providers, businesses, or residents near the construction area to notify of potential impacts and prevent damage to public utilities.

Overall, public services are not anticipated to be impacted by construction and operation of the Project. Because no impacts to public services are anticipated, no mitigation is proposed.

7.3.10 Radio, Television, Cell Phone, and GPS

Operation of transmission lines can interfere with technology that produces AM radio frequency signals including radio stations, televisions, cellular phones, and Global Positioning System (GPS) devices. Interference to these sources is caused by the production of corona from electrical conductors along transmission lines and near substations. This corona generates weak broadband radio signals that may cause poor reception to devices near lines. The following paragraphs provide a summary of devices that may be impacted by operation of the Project.

7.3.10.1.1 Radio

Amplitude modulation (AM) and frequency modulation (FM) radio broadcasting stations that operate or can be heard within the Project Study Area include (but are not limited to):

- Kato Hits KATO, (93.1 FM Mankato),
- KXLP (94.1 FM Mankato)
- HOT 96.7 KDOG (96.7 FM Mankato)
- KTOE (98.7 FM and 1420 AM Mankato)
- Minnesota 100 KXAC (100.5 FM Mankato)
- The Fan KFSP (103.1 FM and 1230 AM Mankato)
- North Star Country KRRW (105.9 FM Mankato)
- Minnesota Public Radio KLSE (90.7 FM Rochester)
- KFAN Sports Radio (1270 AM Rochester)
- The Ticket KOLM (1520 AM Rochester)
- Laser KRCH (101.7 FM Rochester)

- KDHL (920 AM Faribault)
- Power 96 KQCL (95.9 FM Faribault)

7.3.10.1.2 Television

There are over 80 television channels broadcast in the Project Study Area. These channels are received in cities including Mankato, Eagle Lake, Madison Lake, Elysian, Waterville, Faribault, Kenyon, Wanamingo, Zumbrota, Pine Island, Oronoco, Rochester, Plainview, and Kellogg, Minnesota. Television broadcasts are received from local stations within the Project Study Area, the Twin Cities Metro area, and other cities in Minnesota and neighboring states.

7.3.10.1.3 Cellular Phone

There are 54 registered cellular phone towers located within the Project Study Area. Cellular phone service providers that operate in the vicinity of the Project include Spectrum, Mint Mobile, Sprint, Cricket, Verizon Wireless, AT&T, and T-Mobile which offer service in the area and have stores located in Mankato, Rochester, Faribault, and Zumbrota.

7.3.10.1.4 Global Positioning System

GPS technology uses satellites to provide precise location information across the surface of the earth, functioning independently of internet or telephone operation. GPS applications are used by a range of industries and public sectors including agriculture, aviation, defense, education, Global Information System (GIS) services, and public recreation. GPS technology is likely used throughout the Project Study Area.

7.3.10.1.5 Radio, TV, Cell Phone and GPS Signals: Avoidance and Mitigation of Potential Impacts

No impacts on radio, television, cellular phones, or GPS units are expected from the construction or operation of the Project.

Corona and electrical spark discharge (gap discharge) from transmission line conductors can generate noise at the same frequency that some AM radio signals are transmitted and can therefore result in some noise interference. AM radio interference generally occurs directly below transmission lines and will dissipate rapidly with increased distance from the transmission line right-of-way. If transmission line operation results in radio interference to AM radio stations, modification of the receiving antenna system can restore reception. Signals for FM radio are generally high enough to not be influenced by corona or gap discharge.

Television broadcast frequencies (digital and satellite) are typically not impacted by operation of transmission lines, as signals are high enough to not be influenced by corona-generated interference. In particular, digital and satellite television transmissions are not affected by corona-generated noise because they are dependent on packets of binary information or transmitted in the Ku band of radio frequencies (12,000 to 18,000 MHz), respectively. Digital and satellite transmissions are more likely to be affected by multi-path reflections (shadowing) generated by nearby transmission structures. In addition, line-of-sight interference from transmission line structures can affect satellite television transmissions. The use of shielded coaxial cable for cable television transmittals generally makes them insusceptible to interference from electromagnetic noise. Interference to digital and satellite signals as a result of the Project is not anticipated. If interference to these signals were to occur from multi-path reflections or line-of-sight interference, such interference can be mitigated by use of an outdoor antenna to improve digital signals or by moving the affected satellite antenna to a slightly different location.

Cellular phone signals use an ultra-high frequency, generally around 900 MHz, which is significantly higher than the range of electromagnetic noise generated by transmission line conductors. GPS signals operate at a higher frequency as well, within the range of 1,225 to 1,575 MHz. Because both cellular phone signals and GPS operate at frequencies outside the range of electromagnetic noise generated by transmission line conductors, the risk of interference is negligible.

7.3.11 Transportation

The Project Study Area includes multiple roadways, railroads, airports, and airstrips. The description of these features and a discussion of potential impacts from construction and operation of the Project is presented below.

7.3.11.1 Roadways

The Proposed Routes for the Project, cross 273 roads, including 97 interstate highways, state, county roads, and county state aid highways, and 176 roads owned and operated at the township or municipal level. Roads are depicted on the detailed route maps (**Appendix K**).

A review of the Minnesota 2023-2026 State Transportation Improvement Program[101] (MNDOT 2022), Faribault Comprehensive Plan[102] (City of Faribault 2020), City of Mankato Community Investment Plan[103] (City of Mankato 2022), and various websites for cities and counties spanned by the Proposed Routes indicates there are no roadway improvement projects planned along road sections crossed or bordered by the Project.

A description of roadways crossed or paralleled by each Segment and Route Option and Alternative Segment is presented below.

7.3.11.1.1 Segment 1

A total of four trunk highways are crossed and/or paralleled by the Segment 1 Route Options and Alternative Segments. Route Option 1 North and Route Option 1 South would cross MN Highway 22, 13, and 60, which would result in similar impacts. Route Option 1 South also crosses US Highway 14 in two locations. The right-of-way for Route Option 1 North would parallel MN Highway 60, and the Proposed Route for Route Option 1 South would parallel US Highway 14 and MN Highway 13. Crossings

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[101] Minnesota Department of Transportation. 2022. State of Minnesota 2023-2026. State Transportation Improvement Program (STIP). Accessed from: State Transportation Improvement Program - MnDOT.

[102] City of Faribault. 2020. Journey to 2040: Comprehensive Plan. Accessed from: Comprehensive Plan | Faribault, MN.

[103] City of Mankato. 2022. City of Mankato Community Investment Plan: Fiscal Years 2023 - 2027. Accessed from: untitled (mankatomn.gov).

are listed below in **Table 7-26**. There are no trunk highways crossed by Connector Segment 1O.

Table 7-26
Trunk Highway Crossings along Proposed Route Options along Segment 1

Highway	Crossing Location (Route Option)	Number of Crossings	Approximate Distance Paralleled (miles)
MN Hwy 60	1 North	1	0.3
	1 South	8	5.8
	Alternative 1L	7	4.1
MN Hwy 22	1 North	1	N/A
	1 South	1	N/A
	Alternative 1L	1	N/A
MN Hwy 13	1 North	1	N/A
	1 South	1	0.8
MN Hwy 14	1 South	2	3.9

7.3.11.1.2 Segment 2

A total of four trunk highways are crossed and/or paralleled by the Segment 2 Route Options. Route Option 2 North would cross MN Highway 60, and both Route Options 2 North and 2 South would cross MN Highway 56, 57, and I-25. Crossings and paralleled right-of-way for MN Highway 60 would be substantial for Route Option 2 North compared to other route options, with this route option crossing MN Highway 60 a total of 15 times and paralleling existing roadway right-of-way for 11 miles. Crossings are listed below in **Table 7-27**. There are no trunk highways crossed by Connector Segment 2G.

Table 7-27
Trunk Highway Crossings along Proposed Route Options along Segment 2

Highway	Crossing Location (Route Option)	Number of Crossings	Approximate Distance Paralleled (miles)
MN Hwy 60	2 North	15	11
MN Hwy 57	2 North	1	N/A
	2 South	1	N/A
MN Hwy 56	2 North	1	N/A
	2 South	1	N/A
I-35	2 North	1	N/A
	2 South	1	N/A

7.3.11.1.3 Segment 3

A total of four trunk highways are crossed by the Segment 3. The Proposed Route would cross US Highway 63, 61, 52, and 42. Segment 3 does not parallel any existing roadway rights-of-way. Only one of these crossings, of MN Hwy 42, will require installation of new facilities on Segment 3 Crossings are listed below in **Table 7-28**.

Table 7-28
Trunk Highway Crossings along Proposed Route Options along Segment 3

Highway	Crossing Location (Route Option)	Number of Crossings	Approximate Distance Paralleled (miles)
US Hwy 63	3	1	N/A
US Hwy 61	3	1	N/A
US Hwy 52	3	1	N/A
MN Hwy 42	3	1	N/A

7.3.11.1.4 Segment 4

A total of two trunk highways are crossed and/or paralleled by the Segment 4 Route Options. Route Option 4 East would cross US Highway 52, and both Route Options 4

East and 4 West would cross US Highway 52. The right-of-way for Route Option 4 East would parallel US Highway 52 and 63. Crossings and paralleled right-of-way for MN Highway 52 would be substantial for Route Option 4 East compared to other route options, with this route option crossing MN Highway 52 a total of 6 times and paralleling existing roadway right-of-way for 6.8 miles. Crossings are listed below in **Table 7-29**. There are no trunk highways crossed by Connector Segment 4Q.

Table 7-29
Trunk Highway Crossings along Proposed Route Options along Segment 4

Highway	Crossing Location (Route Option)	Number of Crossings	Approximate Distance Paralleled (miles)
US Hwy 63	4 East	2	3.3
	4 West	1	N/A
US Hwy 52	4 East	6	6.4
	Alternative 4E	4	7.5
	4 West	1	N/A

7.3.11.1.5 Annual Average Daily Traffic

Annual Average Daily Traffic rates were averaged over the most recent year for trunk highways crossed by, or running parallel to, the Proposed Routes (**Table 7-30**). With the exception of US Highway 14, US Highway 52, MN Highway 22, and MN Highway 60, average daily traffic volumes for trunk highways are generally low along the Project. Annual Average Daily Traffic rates are highest on MN Highway 22 as measured near Mankato. Rates are lowest along MN Highway 56 and MN Highway 57 near Kenyon and Wanamingo.

Table 7-30
Annual Average Daily Traffic on Trunk Highways Crossed by or Co-located with the Proposed Routes

Highway	AADT	Traffic Count Year	County
US Hwy 63	3,501	2022	Olmsted
US Hwy 61	2,812	2022	Wabasha
US Hwy 52	11,962	2022	Goodhue, Olmsted
MN Hwy 60	12,369	2022	Blue Earth, Le Sueur, Rice, Goodhue
MN Hwy 57	819	2019	Goodhue
MN Hwy 56	810	2022	Goodhue
MN Hwy 42	2,814	2022	Wabasha
MN Hwy 22	29,670	2022	Blue Earth
MN Hwy 13	1,364	2022	Le Sueur, Waseca
I-35	2,302	2022	Rice

MNDOT 2023

7.3.11.2 Railroads

The Proposed Routes cross six active rail line subdivisions at ten locations. Railroads are depicted on the detailed route maps (**Appendix K**). A description of railroads and associated rail lines crossed by individual Segments and Route Options is presented below.

7.3.11.2.1 Segment 1

There are two rail lines crossed by Segment 1, the Dakota, Minnesota, and Eastern (DME) Railroad of the Tracy Subdivision and the Union Pacific (UP) Railroad of the Mankato Subdivision. There are no rail lines crossed by Alternative Segment 1L. A description of rail lines crossed by the Proposed Route along Segment 1 Route Options is presented below in **Table 7-31**.

Table 7-31
Rail Lines Crossed by the Segment 1 Route Options

Railroad Operator	Subdivision	Location	Crossing Location (Route Option)
DME	Tracy	Waseca - East Mankato	1 North
DME	Tracy	Waseca - East Mankato	1 South
UP	Mankato	Old Quarry Spur	1 North
UP	Mankato	Chestnut St - St James	1 North
UP	Mankato	North Mankato Yard	1 South
UP	Mankato	St. Paul - St. James	1 South

7.3.11.2.2 Segment 2

There are two rail lines crossed by Segment 2, the DME Railroad of the Owatonna Subdivision and the UP Railroad of the Albert Lea Subdivision. There are no rail lines crossed by Connector Segment 2G. A description of rail lines crossed by the Segment 2 Route Options is presented below in **Table 7-32**.

Table 7-32
Rail Lines Crossed by the Segment 2
Route Options

Railroad Operator	Subdivision	Location	Crossing Location (Route Option)
DME	Owatonna	Owatonna - Comus	2 North
UP	Albert Lea	Comus - State Line	2 North
UP	Albert Lea	Comus - State Line	2 South

7.3.11.2.3 Segment 3

There is one rail line crossed by Segment 3, the Soo Line Railroad (SOO) of the River Subdivision, which spans between Hastings and St. Croix, Minnesota.

7.3.11.2.4 Segment 4

There are no rail lines crossed by the Project along the Segment 4 Route Options.

7.3.11.3 Airports and Airstrips

Operation of transmission facilities can pose safety concerns near airports and airstrips. Airports, as defined by the state and the Federal Aviation Administration (FAA), are areas of land or water that are used or intended to be used for the landing and takeoff of aircraft, and includes the surrounding area used or intended to be used for airport buildings and facilities (14 C.F.R. Part 1, § 1.1 and Minn. R. 8800.0100, subp. 3). As aircraft takeoff and land at airports, transmission lines can pose hazards or affect maneuverability of aircraft if the structures encroach into the airspace. Federal Aviation Regulation (FAR) Part 77 and Minn. R. 8800.1200 establish guidelines on heights for any structures that could endanger aircraft, which includes structures exceeding 200 ft above ground level (AGL) or the airport elevation (whichever is greater). These guidelines impose stricter regulations for structures within a maximum distance of 20,000 ft (3.78 miles) of a public use or military airport.

A complete description and copy of the FAA and Minnesota Airport Zoning Standards can be found at 14 CFR Part 77 and Minn. Rules 8800.1100. Additionally, all structures 200 feet AGL must be marked and lighted in accordance with FAA Advisory Circular 70/7460-1K, Obstruction Marking and Lighting.

Aerial crop dusting, which involves spraying fertilizers, herbicides, and pesticides from specialized aircraft, is an important part of agricultural activities in Minnesota, and may occur along various fields within the Project Study Area during construction and operation of the proposed Project. Aircraft used in aerial application may use airstrips in and surrounding the Project.

A description of airports and airstrips within approximately 20,000 feet (3.78 miles) of the right-of-way for individual Segments and Route Options is presented below.

7.3.11.3.1 Segment 1

There are two public airports, the Mankato Regional Airport and the Faribault Municipal Airport, which are located within 20,000 feet (3.78 miles) of Route Option 1 North.

Airstrips associated with the Mankato Regional Airport are located 4,561 feet (0.86 miles) northeast of Route Option 1 North and 12,374 feet (2.34) miles north of Route Option 1 South. The Mankato Regional Airport is located at an elevation of 1,021 feet Above Sea Level (ASL) and is located along existing underground transmission line infrastructure. This airport has a designated fire station, two airstrips (6,000 x 100 ft, 4,000 x 75 ft), and 15 large hangars that accommodate small single engine recreational aircraft, medical helicopters, and corporate jet aircraft. Full emergency response services are provided by the city of Mankato.

The Faribault Municipal Airport property is located approximately 19,536 feet (3.70 miles) from Route Option 1 North. Airstrips associated with the Faribault Municipal Airport are located 20,064 feet (3.80) miles north of Route Option 1 North of the Project. The Faribault Municipal Airport is at an elevation of 1,051 ft ASL at its lowest and 1,060 ft ASL at its highest. This airport has two airstrips (4,257 x 75 ft, 2,300 x 175 ft), 37 private hangars, and 25 city-owned T-hangers that accommodate single-engine planes, multi-engine planes, helicopters, and gliders. There is no on-site fire station.

The FAA sent a letter on May 8, 2023, warning of potential impacts to Mankato Regional Airport and Faribault Municipal Airport operations from the proposed Project.

Comments expressing concern for the proximity of a hot air balloon facility, located 0.4 miles south of Elysian, with regards to new structures along an existing transmission line right-of-way were submitted during the May 2023 open houses, when route alternatives included an option through Elysian. The hot air balloon facility is located approximately 14,678 feet (2.78 miles) from Route Option 1 North and 11,933 feet (2.26) miles from Route Option 1 South.

7.3.11.3.2 Segment 2

There is one heliport (Heliport ID MN59) at the District One Hospital in Faribault, located about 9,821 feet (1.86 miles) from Route Option 2 North and 15,048 feet (2.85 miles) from Route Option 2 South.

7.3.11.3.3 Segment 3

There are no airports or airstrips within 3.78 miles of Segment 3 (Route Option 3).

7.3.11.3.4 Segment 4

There is one private airstrip located approximately 1,584 feet (0.30 miles) east of an existing transmission line right-of-way along Route Option 4 West.

7.3.11.4 Transportation: Avoidance and Mitigation of Potential Impacts

Impacts to roadways, railroads, and airports are anticipated to be temporary during construction of the proposed Project, and to be minor to moderate depending on the form of transportation and location. A summary of impacts and mitigation is presented below.

7.3.11.4.1 Roadways

Roadway impacts along the proposed Route Options would differ depending on number of crossings and miles of paralleled roadway rights-of-way.

Project construction could impact roadways and result in temporary closures, lane closures, traffic delays, and increased traffic volumes due to the presence and movement of personal and construction vehicles by Project construction employees. Lane closures and traffic management may pose safety concerns to workers and the public as active traffic and workers move throughout the construction space. Lane closures could range from minutes to hours depending on the width of the right-of-way and extent of the construction activity. Additionally, construction along roadways can increase dust as grading occurs, which can obscure road lines or vision. Concerns related to construction along roadways or trails would be temporary, and localized to areas where active construction is underway. Additionally, the Applicant will attempt to avoid or limit roadway closures to the maximum extent practicable and will use conductor safety guides over roads or utilize helicopters for stringing activities where possible.

Where road interruptions must occur, impacts to safety during construction will be mitigated by limiting construction traffic to the Project right-of-way and existing access points to the maximum extent feasible. Temporary closures in rural areas, which make up most of the Proposed Route, should not significantly impact transportation as rural areas typically have low traffic levels and normal traffic flows can be rerouted. Dust along grading areas near roadways or trails will be managed and reduced through proper use of BMPs (e.g., soil matting, wetting) which will reduce the potential for dust. Where roads must be used for construction access, the Applicant will utilize appropriate safety measures such as use of safety signage, installation of temporary barrier structures, and employing spotters during clearing or stringing activities.

Once construction along or crossing (a) roadway is completed, the Applicant will confirm that road(s) used for purposes of access during construction are returned to either the condition they were in or better before right-of-way clearing began, and road(s) will be reopened to allow normal traffic flow. The Applicant will meet with MnDOT, county highway departments township road supervisors, and/or city road personnel to address any issues that occur during roadway construction.

The Applicant will apply for utility permits for work within roadway rights-of-way under Minnesota Rules 8810.3100-8810.3600 and applicable county and city ordinances for roads crossed or bordered by the Project. The Applicant will work with MnDOT and local municipalities to ensure the proposed alignment meets utility guidelines, will not interfere with routine roadway maintenance, and will not adversely impact conditions of existing roadway rights-of-way.

7.3.11.4.2 Railroads

Railroad impacts along the proposed Route Options would differ depending on the number of railroad crossings. Along the proposed Route Options, there are two crossings along 1 North, three crossings along 1 South, two crossings along 2 North, one crossing along 2 South, and one crossing along Segment 3 (Route Option 3).

Stringing HVTL lines and maintenance of structures can create delays and safety concerns near railroads as trains are temporarily rerouted or crossings are postponed. Additionally, co-locating transmission lines along existing railroads can widen the environmental impacts of existing corridors.

Permanent impacts to railroads are not anticipated during Project operation. Temporary, short-term impacts to railroads may occur as proposed lines span railroads along Routes 1 North, 1 South, 2 North, 2 South, and 3. The Applicant will obtain all necessary railroad crossing permits from SOO, UP, and DME and will work subject to train schedules during conductor stringing to avoid train delays.

Safety measures will be implemented during active construction around railroads. Construction workers will maintain regular contact with railroad personnel as electrical constructor stringing occurs over spanned rail lines to ensure appropriate safety standards are maintained throughout construction and operation. Additionally, appropriate signage, barriers around construction zones, and flaggers at roads and railroad crossings will be maintained during active construction to protect the public.

With the above safety measures implemented, no other mitigation is proposed.

7.3.11.4.3 Airports and Airstrips

Structure heights within 3.78 miles of Mankato Regional Airport airstrips and the private airstrip would be kept below 200 feet AGL. While not proposed at this time, if it is determined to be necessary to construct any structures with a height greater than 200 feet AGL those structures would be marked and lighted in accordance with FAA Advisory Circular 70/7460-1K, Obstruction Marking and Lighting. The Applicant will coordinate with the FAA and MNDOT to address any Project-related concerns for aviation activities as the Project progresses, if necessary.

The nearest Faribault Municipal Airport airstrip is located approximately 3.80 miles from Route Option 1 North. As the right-of-way is located beyond the distance where structures may be considered general obstructions under Minnesota Rule 8800.1200 and FAA Part 77, the Project will not be considered a general obstruction to Faribault Municipal Airport operations. However, as the proposed structures will be located within 3.78 miles of airport property, the Applicant will confirm impacts with the FAA before final construction if Route Option 1 North is selected.

Structures can be considered an obstruction to a public heliport if they are located within 4,000 feet of a heliport under Minnesota Rule 8800.1200, subp. 6. The one heliport within the Project Area, located at the District One Hospital in Faribault, is 9,815 feet from the Project along Route Option 2 North. As the right-of-way is beyond the distance where structures may be considered general obstructions, the Project will not be considered an obstruction to District One Hospital helicopter operations.

Route Option 1 South is located approximately 1.5 miles from the hot air balloon facility in Elysian and is not anticipated to impact this facility.

7.4 Land-Based Economics

This section describes the land-based economies at a county level and summarizes the potential impacts the Project would have on land-based economies. Construction and operation of the Project has the potential to affect these economies in Blue Earth, Le Sueur, Rice, Waseca, Goodhue, Olmstead, and Wabasha counties through physical, long-term presence, which could prevent or otherwise limit use of the land for other purposes. The following subsections present an overview of agricultural, forestry, tourism, and mining operations in the vicinity of the Proposed Routes and discusses how the Project may affect these economies and what measures the Applicant will implement to mitigate Project effects.

7.4.1 Agriculture

The USDA assesses agricultural economy statistics at a county wide level, therefore, impacts to agricultural economies were assessed by counties crossed by the Project.[104] In 2017, the average farm size in the counties crossed by the Project was 282 acres,

[104] United States Department of Agriculture. 2017. Census of Agriculture: 2017 State and County Profiles - Minnesota. Retrieved from: https://www.nass.usda.gov/Publications/AgCensus/2017/Online_Resources/County_Profiles/Minnesota/. Accessed November 18, 2023.

which is smaller than the 371-acre average for all of Minnesota farms. Livestock sales account for a larger percentage of total market value of agricultural products compared to crop sales in Blue Earth, Rice, Waseca, Goodhue, and Wabasha counties. In Le Sueur and Olmstead counties, crop sales account for the majority of total market value of agricultural products compared to livestock sales. See **Table 7-33** below.

Table 7-33
2017 Agricultural Statistics of Counties Crossed by the Proposed Routes

Location	Number of Farms	Average Farm Size (acres)	Total Land in Farm Operation (acres)	Crop Sales	Livestock Sales
Minnesota	**68,822**	**371**	**25.5 million**	**$10 billion (55%)**	**$8 billion (45%)**
Blue Earth	983	389	382,730	$202,637 (42%)	$280,861 (58%)
Le Sueur	937	266	249,463	$116,103 (64%)	$65,254 (36%)
Rice	1,242	182	226,255	$101,687 (50%)	$103,295 (50%)
Waseca	729	339	247,045	$132,628 (48%)	$142,412 (52%)
Goodhue	1,461	263	384,651	$174,108 (50%)	174,481 (50%)
Olmstead	1,139	251	285,944	$121,634 (57%)	$92,781 (43%)
Wabasha	809	285	230,800	$80,167 (43%)	$106,142 (57%)
			Total County Sales	$928,964	$965,226

7.4.1.1 Agriculture: Avoidance and Mitigation of Potential Impacts

Temporary construction impacts on agricultural land could include soil compaction and rutting, accelerated soil erosion, crop disturbance, disruption to normal farming activities, and introduction of noxious weeds. Construction would occur throughout the year, with many structures being constructed outside of growing and harvest seasons. During winter, impacts are not anticipated to affect agricultural activities as crop fields are unplanted and the ground is frozen.

The Applicant will implement measures to reduce compaction, soil erosion, and sedimentation and will compensate producers for crop or livestock loss or damage. Post-construction restoration efforts will include restoration of any temporary access modifications and deep plowing to remove compaction. Both crop and livestock activities will be able to continue around Project structures and facilities after construction.

Xcel Energy will implement an agricultural impact mitigation plan (AIMP) and reasonably restore and/or compensate landowners, as appropriate, for damages caused by Xcel Energy as a result of transmission line construction, and as outlined in the AIMP (See **Appendix U**). Xcel Energy will work with landowners to determine whether to restore land and/or compensate landowners after discussions with them. Xcel Energy will also implement a vegetation management plan to reduce impacts agriculture, as appropriate. (See **Appendix V**). As a result of mitigation as described in the referenced plans, impacts are not likely to be significant.

7.4.2 Forestry

As discussed in Section 7.2 Land Cover and Land Use, forested land does not make up a significant percentage of the Proposed Routes. There are no commercial forest operations identified within the Proposed Routes.

7.4.2.1 Forestry: Avoidance and Mitigation of Potential Impacts

Since there are no known commercial forestry operations in the vicinity of the Proposed Routes, there are no anticipated impacts to commercial forestry operations from the construction and operation of the Project. Impacts on forested areas within the Proposed Routes would be reduced by minimizing the tree clearing to the extent feasible; however, tall-growing vegetation within the ROW would be cleared. Xcel Energy will work with landowners to come to an agreement of any timber removed from private lands, as appropriate. (See **Appendix V**).

7.4.3 Tourism

Tourism in the vicinity of the Proposed Routes center around outdoor recreational activities described in Section 7.3.8 (Recreation) as well as leisure and hospitality industries such as local restaurants and resorts. The 2020 Minnesota Department of

Revenue's (MDR) Tourism's Economic Impact Fact Sheet[105] listed Olmsted County and Blue Earth County as having the highest gross sales in the leisure and hospitality industries out of the counties crossed by the Proposed Routes (see below, **Table 7-34**).

Table 7-34
Tourism in 2020 by County

County	Gross Sales	State Sales	Private Sector Employment (Number of Employees)
Olmsted	$384,571,776	$24,938,825	7,685
Blue Earth	$158,741,583	$10,132,949	3,618
Goodhue	$84,785,859	$4,940,172	1,670
Le Sueur	$27,605,179	$1,629,370	452
Rice	$102,478,485	$5,935,397	1,869
Wabasha	$24,284,370	$1,510,318	511
Waseca	$17,203,056	$1,118,268	385

Source: Minnesota Department of Revenue (2020)

7.4.3.1 Tourism: Avoidance and Mitigation of Potential Impacts

The Proposed Routes are in proximity or cross over recreational resources discussed in Section 7.3.7 (Recreation) but will not permanently interfere with the use of the recreational areas, therefore no mitigation is proposed. Signage and temporary closures may be necessary during construction, such as when vehicles are crossing a trail or wire stringing occurs across a trail causing temporary impacts. The Applicant will attempt to avoid or limit trail closures to the maximum extent practicable.

7.4.4 Mining

Mining operations are prevalent in the vicinity of the Project and consist of aggregate mining operations and bedrock quarries owned either by individuals, private companies, or MNDOT. Aggregate operations are primarily sand and gravel mined for local use

[105] Minnesota Department of Revenue. 2020. Tourism's Economic Impact on Minnesota: 2020 Tourism Facts by County. Retrieved from: 22_FactSheet_tcm1135-518462.pdf (mn.gov). Accessed December 28, 2023.

such as making concrete for highways, roads, bridges, and buildings, and bedrock quarries are primarily mined for limestone.

The most recent annual Aggregate Material Tax statistics[106] reported by the MDR for counties crossed by the Proposed Routes are shown in **Table 7-35** below.

Table 7-35
Aggregate Material Production Tax in 2020 by County

County	Aggregate Material Production Tax*
Blue Earth	$0
Le Sueur	$210,894
Rice	$76,899
Waseca	$0
Goodhue	$168,637
Olmstead	$0
Wabasha	$152,942

*Aggregate material includes sand, gravel, crushed rock, limestone, and granite, among others.

A query of aggregate sources from the MnDOT Gravel Pit and Rock Quarry Aggregate Source Map[107] within the Proposed Routes and ROW was conducted for each segment and is summarized below.

7.4.4.1 Segment 1

7.4.4.1.1 Route Option 1 North

One bedrock quarry and one commercial aggregate operation was identified within Segment 1A of Route Option 1 North. The bedrock quarry appears to be inactive, while the commercial aggregate operation appears to be active based on a review of 2021 aerial imagery.[108] This aggregate source is not crossed by the ROW.

[106] Minnesota Department of Revenue. 2020. Aggregate Materials Tax, Aggregate Materials Tax Collection History (by counties). Retrieved from https://www.revenue.state.mn.us/aggregate-materials-tax. Accessed December 5, 2023.

[107] MNDOT. 2023. Aggregate Sources: Viewing with Google Earth™. Gravel Pit and Rock Quarry Aggregate Source Information. Retrieved from https://www.dot.state.mn.us/materials/asis_GE.html. Accessed December 5, 2023.

[108] Google Earth Pro. 2022. https://earth.google.com/.

One active commercial aggregate operation was identified within Segment 1F. The entrance to this aggregate source is crossed by the ROW and is already crossed by the existing transmission line.

7.4.4.1.2 Route Option 1 South

No mining or quarry operations were identified within Route Option 1 South.

7.4.4.2 Segment 2

7.4.4.2.1 Route Option 2 North

One prospective aggregate pit was identified within the Segment 2C. A prospected aggregate pit is a pit that was prospected or leased by MNDOT but does not imply that the source is producing aggregate at the present time. In fact, it may only indicate an aggregate deposit that was leased by MNDOT and was tested. This prospective aggregate pit is not crossed by the ROW.

7.4.4.2.2 Route Option 2 South

No mining or quarry operations were identified within Route Option 2 South.

7.4.4.3 Segment 3

No mining or quarry operations were identified within Segment 3.

7.4.4.4 Segment 4

7.4.4.4.1 Route Option 4 East

One inactive aggregate source was identified within Segment 4G. An inactive aggregate source is either a depleted source or is unavailable for current use. This inactive aggregate source is not crossed by the ROW.

7.4.4.4.2 Route Option 4 West

Milestone Materials Rochester Landscape Supply Center, an active aggregate mining operation, was identified within Segment 4O. While this active aggregate operative is not crossed by the ROW, the ROW is adjacent to the facility. The Applicant has met with the operators of this facility to discuss the route and no impacts on facility operations are anticipated.

7.4.4.5 Mining: Avoidance and Mitigation of Potential Impacts

Impacts to mining from the Project would be both short-term from construction and permanent from project operations. Construction-related access could interfere with mining operations if construction equipment affects mining operations and transportation. However, these impacts would be minor and mitigated through advanced notice and planning. Permanent impacts from the placement of transmission line towers or substations near mining operations could interfere with access to existing mines and could limit the future expansion of the mining operation.

If Segments 1F or 4O are chosen by the Commission, the Applicant will coordinate with the owner of mining operations to ensure Project construction does not interfere with access to or operation of the mining facilities.

7.5 Archaeological and Historic Resources

A Cultural Resources Literature Review was conducted between March of 2023 and December of 2023 using inventory files from the Minnesota State Historic Preservation Office (SHPO) and the Minnesota Office of the State Archeologist (OSA) online portal. The research identified known Precontact archaeological sites, Post-Contact archaeological sites, unrecorded cemeteries, and architecture/history properties previously identified within the Cultural Resources Review Area, which included a one-mile buffer surrounding the furthest extents of the multiple routes initially under consideration to further inform routing and siting for the Project (**Appendix O**). A copy of the Cultural Resources Literature Review along with a completed Request for Project Review form was submitted to the SHPO on February 16, 2024. As of this date there has been no response from SHPO on this request.

In December 2023 and January of 2024, the data were further analyzed based on the Proposed Routes and Rights-of-Way for overall Segments and corresponding Route Options and sub-Segments. This information was used to identify archaeological, architectural, and unrecorded cemetery sites that may be encountered and establish alternative route options to avoid areas of cultural concern.

The four route Segments are located within the Prairie Lakes Archaeological Region (Region 2) and the Southeast Riverine Archaeological Region (Region 3), which cover the areas of southwestern and south-central Minnesota. The Prairie Lakes Archaeological Region is crossed by Segments 1 and 2 and includes the counties of Big Stone, Blue Earth, Brown, Carver, Chippewa, Cottonwood, Faribault, Freeborn, Jackson, Lac Qui Parle, Le Sueur, Lyon, McLeod, Martin, Nicollet, Redwood, Renville, Scott, Sibley, Stevens, Swift, Watonwan, and Yellow Medicine counties and portions of Douglas, Grant, Kandiyohi, Lincoln, Meeker, Nobles, Otter Tail, Pipestone, Pope, Rice, Steele, Traverse, and Waseca counties. The Southeast Riverine Archaeological Region is crossed by Segments 2, 3, and 4 and includes Dodge, Fillmore, Goodhue, Houston, Mower, Olmsted, Wabasha, and Winona counties, and portions of Dakota, Freeborn, Rice, and Waseca counties.

The Prairie Lakes Archaeological Region primarily consisted of tallgrass prairie at the time of European-American settlement, and the region encompasses the entirety of the Minnesota River Valley.[109] Bison was the dominant upland fauna in the region, while elk and white-tailed deer were also present. Woodland period base camps (identified by the presence of cord-marked pottery) are common in the region, occurring primarily on islands or peninsulas on moderate to large-sized lakes. Lithic scatters are also fairly common along the rivers and around the lakes of the region. In the Late Prehistoric period, agricultural village sites are found on intermediate terraces of the Minnesota and Blue Earth rivers. Contact period sites are primarily associated with the Yankton Dakota and Sisseton Dakota (Dakota), and French, English, and American wintering posts. Dakota villages were predominantly located along areas of the Minnesota River. Wintering posts were concentrated along the upper areas of the Minnesota River between 1750-1800 but became established along surrounding interior forested locations during the early 1800s. Within and surrounding sites of Dakota settlement,

[109] Gibbon G.E., Johnson C.M., and E. Hobbs. 2002. Minnesota's Environment and Native American Culture History. Minnesota Department of Transportation. Retrieved from: https://www.dot.state.mn.us/mnmodel/P3FinalReport/chapter3.html#ch343. Accessed December 27, 2023.

the remains of fluted (Clovis, Folsom) and Plano (Browns Valley, Agate Basin, Hell Gate) projectile points are common.

The Southeast Riverine Archaeological Region is characterized by forested areas and extensive rocky outcrops containing occasional primary and secondary lag deposits.[110] Within the region, two major river systems (the Cannon and the Zumbro) extend westward from the Mississippi to the area of the Project. Archaic and Woodland cultural areas are concentrated within areas to the south and east. Generally, few Early Prehistoric components have been recorded in the region and Late Prehistoric period sites are uncommon in the interior. French and Anglo-American trading posts (established by the late 1700s) are generally concentrated to the north of the region and along the Mississippi River.

7.5.1 Previously Recorded Archaeological and Architectural Resources

A detailed literature review of known archaeological sites and historical properties located within the Cultural Resources Review Area (1 mile of the Proposed Route) is presented in **Appendix O**. An analysis of cultural resources located along the proposed Segments and associated Route Options, Alternative Segments, and Connector Segments is presented below and in the Cultural Resources Mapbook in **Appendix O**. Cemetery locations can often only be ascertained to the Section or Quarter Section Public Land Survey System (PLSS) level, and therefore may compose a large area but not make up the area in its entirety.

7.5.1.1 Segment 1

The known archaeological, historic structures, and unrecorded cemeteries within the Proposed Route and Right-of-Way for each route option are described below.

7.5.1.1.1 Route Option 1 North

Within Route Option 1 North, three archaeological resources, seven architectural resources, and one unrecorded historic cemetery overlap the Proposed Route

[110] *Id.*

(**Table 7-36**). All of the archaeological resources, two of the architectural resources, and the unrecorded historic cemetery are also located within the Right-of-Way. One of the architectural resources (XX-RRD-015) has been previously determined eligible for listing in the National Register of Historic Places (NRHP).

Table 7-36
Archaeological, Architectural, and Unrecorded Historic Cemeteries Within Route Option 1 North

Route Option Segment	Site / Inventory Number or Cemetery ID	Name	Resource Type	NRHP Status	Within Right-of-Way
Archaeological Resources					
1I	21BEe	No Name	Indeterminate	Not Evaluated	Yes
1D	21BEbc	Park	Post-Contact ghost town	Not Evaluated	Yes
1F	21LE0008	Lake Tetonka I	Precontact habitation	Not Evaluated	Yes
Architectural Resources					
1A	BE-LIM-003	Farmstead	Farmstead	Not Evaluated	No
1A	BE-LIM-022	Borgmeier Farmstead	Farmstead	Not Evaluated	No
1A	BE-MKT-028	Farmhouse	Residence	Not Evaluated	No
1A	BE-MKT-030	District School No. 55	School	Not Evaluated	Yes
1I	BE-MKT-029	Farmhouse	Residence	Not Evaluated	No
1I	BE-MKT-036	Sakatah Singing Hills State Trail Bridge - Bridge SSH011	Bridge	Not Evaluated	No
1A, 1I, 1F	XX-RRD-015	MN Central/WI, MN & Pacific/Chicago, Rock Island & Pacific/Chicago Great Western & Chicago & North Western Railway	Railroad Corridor	Eligible	Yes
Unrecorded Historic Cemeteries					
1A	19491	Pilgrims Rest Cemetery	Unrecorded Cemetery	N/A	Yes

7.5.1.1.2 Route Option 1 South

Within Route Option 1 South, four archaeological resources, thirteen architectural resources, and eight unrecorded historic cemeteries overlap the Proposed Route (**Table 7-37**). All four archaeological resources, three architectural resources, and all eight unrecorded historic cemeteries are also located within the Right-of-Way. All of the resources have not been previously evaluated to determine their NRHP eligibility, except for two architectural resources (LE-WTC-032 and XX-RRD-015), which have been previously determined Eligible for listing in the NRHP.

Table 7-37
Archaeological, Architectural, and Unrecorded Historic Cemeteries Within Route Option 1 South

Route Option Segment	Site / Inventory Number or Cemetery ID	Name	Resource Type	NRHP Status	Within Right-of-Way
Archaeological Resources					
1I	21BEe	No Name	Indeterminate	Not Evaluated	Yes
1J	21BE0298	Schraml Site	Precontact Isolated Find	Not Evaluated	Yes
1K	21WEg	Okaman	Post-Contact Ghost Town	Not Evaluated	Yes
1M	21LEab	No Name	Contact Period Trading Post	Not Evaluated	Yes
Architectural Resources					
1B	BE-MKC-426	Bridge 07016	Bridge	Not Evaluated	No
1B	BE-MKC-429	Bridge 91386	Bridge	Not Evaluated	No
1B	BE-MKT-018	House	Residence	Not Evaluated	No
1B	BE-MKT-019	House	Residence	Not Evaluated	No
1B	XX-ROD-016	Trunk Highway/U.S. Highway 14 (formerly Trunk Highway 7)	Roadway	Not Evaluated	Yes
1I	BE-MKT-028	Farmhouse	Residence	Not Evaluated	No
1I	BE-MKT-029	Farmhouse	Residence	Not Evaluated	No
1I	BE-MKT-030	District School No. 55	School	Not Evaluated	No

Route Option Segment	Site / Inventory Number or Cemetery ID	Name	Resource Type	NRHP Status	Within Right-of-Way
1I	BE-MKT-036	Sakatah Singing Hills State Trail Bridge - Bridge SSH011	Bridge	Not Evaluated	No
1I, 1J, 1K, 1M	XX-RRD-015	MN Central/WI, MN & Pacific/Chicago, Rock Island & Pacific/Chicago Great Western & Chicago & North Western Railway	Railroad Corridor	Eligible	Yes
1J	BE-JAM-006	Sakatah Singing Hills State Trail Culvert	Culvert	Not Evaluated	No
1J	BE-LER-018	Sakatah Singing Hills State Trail Culvert	Culvert	Not Evaluated	Yes
1M	LE-WTC-032	Sakatah Singing Hills State Trail Bridge - SSH007	Bridge	Eligible	No
Unrecorded Historic Cemeteries					
1B	19491	Pilgrims Rest Cemetery	Unrecorded Cemetery	N/A	Yes
1B	19495	Calvary Cemetery (Old)	Unrecorded Cemetery	N/A	Yes
1B	19456	Rural Grove Cemetery 1/2	Unrecorded Cemetery	N/A	Yes
1J	19489	Calvary Cemetery	Unrecorded Cemetery	N/A	Yes
1M	21717	Sakatah Cemetery 2/2	Unrecorded Cemetery	N/A	Yes
1M	21716	Sakatah Cemetery 1/2	Unrecorded Cemetery	N/A	Yes
1M	21714	Calvary Cemetery 1/2	Unrecorded Cemetery	N/A	Yes
1M	21715	Calvary Cemetery 2/2	Unrecorded Cemetery	N/A	Yes

For Route Option 1 South, an Alternative Segment has been proposed; Segment 1M of Route Option 1 South could be used to replace Alternative Segment 1L. Within

Alternative Segment 1L, no archaeological resources or architectural resources, and one unrecorded historic cemetery overlap the Proposed Route and the Right-of-Way (**Table 7-38**).

Table 7-39 provides a comparison of known cultural resources between the Alternative Segments.

Table 7-38
Archaeological, Architectural, and Unrecorded Historic Cemeteries Within Route Option 1 South Alternative Segment (1L)

Site / Inventory Number or Cemetery ID	Name	Resource Type	NRHP Status	Within Right-of-Way
Unrecorded Historic Cemeteries				
21717	Sakatah Cemetery 2/2	Unrecorded Cemetery	N/A	Yes

Table 7-39
Comparison of Known Cultural Resources Within Route Option 1 South Alternative Segments

Alternative Segments	Archaeological Resources Within Proposed Route / Right-of-Way	Architectural Resources Within Proposed Route/ Right-of-Way	Unrecorded Historic Cemeteries Within Proposed Route / Right-of-Way
1M	1/1	2/1	4/4
1L	0/0	0/0	1/1

7.5.1.2 Segment 2

The known archaeological, historic structures, and unrecorded cemeteries within the Proposed Route and Right-of-Way for each are described below.

7.5.1.2.1 Route Option 2 North

Within Route Option 2 North, four archaeological resources, six architectural resources, and five unrecorded historic cemeteries overlap the Proposed Route (**Table 7-40**). Three archaeological resources, one architectural resource, and all five unrecorded historic cemeteries are also located within the Right-of-Way. One previously NRHP listed architectural resource (RC-WAL-004) has been demolished. The remaining resources have not been previously evaluated to determine their NRHP eligibility.

Table 7-40
Archaeological, Architectural, and Unrecorded Historic Cemeteries Within Route Option 2 North

Route Option Segment	Site / Inventory Number or Cemetery ID	Name	Resource Type	NRHP Status	Within Right-of-Way
Archaeological Resources					
2C	21GDah	Finseth Station	Post-Contact Ghost Town	Not Evaluated	Yes
2C	21GDag	Eldsvald	Post-Contact Ghost Town	Not Evaluated	No
2C	21GDw	Spring Creek	Post-Contact Ghost Town	Not Evaluated	Yes
2C	21GDae	Old Wanamingo	Post-Contact Ghost Town	Not Evaluated	Yes
Architectural Resources					
2B	RC-WAL-004	Dump Road Bridge (Bridge No. L2733) (razed)	Bridge	Delisted	No (non-extant)
2C	GD-CGR-006	Cheese Factory	Food Processing Facility	Not Evaluated	No
2C	GD-CGR-007	Grain Elevator	Grain Elevator	Not Evaluated	No
2C	GD-CGR-008	Feed Mill	Feed Mill	Not Evaluated	No
2C	GD-WMT-038	Farmhouse	Residence	Not Evaluated	No
2C	XX-ROD-022	Trunk Hwy 56	Roadway	Not Evaluated	Yes
Unrecorded Historic Cemeteries					
2C	23737	Methodist Episcopal Church Cemetery	Unrecorded Cemetery	N/A	Yes
2C	20766	Old Hauge Cemetery	Unrecorded Cemetery	N/A	Yes
2C	20723	Unknown-Cemetery	Unrecorded Cemetery	N/A	Yes
2C	20688	Dale Cemetery	Unrecorded Cemetery	N/A	Yes
2D	20716	Catholic Cemetery	Unrecorded Cemetery	N/A	Yes

7.5.1.2.2 Route Option 2 South

Within Route Option 2 South, no archaeological resources, two architectural resources, and two unrecorded historic cemeteries overlap the Proposed Route (**Table 7-41**). All of the resources are also located within the Right-of-Way. None of the resources have been previously evaluated to determine their NRHP eligibility.

Table 7-41
Archaeological, Architectural, and Unrecorded Historic Cemeteries Within Route Option 2 South

Route Option Segment	Site / Inventory Number or Cemetery ID	Name	Resource Type	NRHP Status	Within Right-of-Way
Architectural Resources					
2F	GD-KNT-008	District School No. 87	School	Not Evaluated	Yes
2F	XX-ROD-022	Trunk Hwy 56	Roadway	Not Evaluated	Yes
Unrecorded Historic Cemeteries					
2E	23701	Denison Cemetery	Unrecorded Cemetery	N/A	Yes
2D	20716	Catholic Cemetery	Unrecorded Cemetery	N/A	Yes

7.5.1.2.3 Segment 2 Connector Segment 2G

There are no known archaeological or architectural resources, or unrecorded historic cemeteries, within the Proposed Route or Right-of-Way of Segment Connector 2G.

7.5.1.3 Segment 3

The ROW of the existing line is 150 feet wide (75 feet on either side of the centerline). The known archaeological, historic structures, and unrecorded cemeteries within the Proposed Route and Right-of-Way for each are described below.

Within Route Option 3, four archaeological resources, three architectural resources, and one unrecorded historic cemetery overlap the Proposed Route (**Table 7-42**). Of those, three archaeological resources, one architectural resource, and one unrecorded historic cemetery are also located within the Right-of-Way. All of the resources have not been previously evaluated to determine their NRHP eligibility, except for one archaeological resource (21GD0248) which has been previously Recommended Eligible for listing in the NRHP.

Table 7-42
Archaeological, Architectural, and Unrecorded Historic Cemeteries Within Route Option 3

Route Option Segment	Site / Inventory Number or Cemetery ID	Name	Resource Type	NRHP Status	Within Right-of-Way
Archaeological Resources					
3A	21GD0248	Goodhue Good View	Precontact: Archaic Period Habitation	Recommended Eligible	Yes
3A	21OL0058	Zumbro Lake Ring Site	Fire Ring, Indeterminate Cultural Context	Not Evaluated	No
3C	21WB0084	No Name	Precontact Isolated Find	Not Evaluated	Yes
3C	21WBh	Fitzgerald	Precontact Burial Mound and Artifact Scatter	Not Evaluated	Yes
Architectural Resources					
3A	GD-PIT-030	Farmstead	Farmstead	Not Evaluated	No
3A	OL-ORT-023	Gould Farmstead	Farmstead	Not Evaluated	No
3C	XX-ROD-6/ XX-ROD-11/ WB-ROD-1	U.S./Trunk Highway 61 (formerly State Road/Trunk Highway 1 and 3)	Roadway	Not Evaluated	Yes
Unrecorded Historic Cemeteries					
3A	20716	Catholic Cemetery	Unrecorded Cemetery	N/A	Yes

7.5.1.4 Segment 4

The known archaeological, historic structures, and unrecorded cemeteries within the Proposed Route and Right-of-Way for each are described below.

7.5.1.4.1 Route Option 4 East

Within Route Option 4 East, four archaeological resources, twenty-six architectural resources, and two unrecorded historic cemeteries overlap the Proposed Route

(**Table 7-43**). Of these, two archaeological resources, five architectural resources, and two unrecorded historic cemeteries are also located within the Right-of-Way. All of the resources have not been previously evaluated to determine their NRHP eligibility, except for one architectural resource (OL-ORT-013) which has been previously determined Eligible for listing in the NRHP.

Table 7-43
Archaeological, Architectural, and Unrecorded Historic Cemeteries Within Route Option 4 East

Route Option Segment	Site / Inventory Number or Cemetery ID	Name	Resource Type	NRHP Status	Within Right-of-Way
Archaeological Resources					
4D	21GD0249	O'Brien	Precontact Habitation and Lithic Procurement Site	Not Eligible	Yes
4G	21OL0032	South Branch	Precontact Campsite	Not Evaluated	No
4G	21OL0030	Shady Lake	Precontact Campsite	Not Evaluated	Yes
4G	21OL0029	Davis Site	Precontact: Archaic Period Lithic Scatter	Not Evaluated	No
Architectural Resources					
4A	GD-PIT-030	Farmstead	Farmstead	Not Evaluated	No
4D, 4F	OL-NHT-021	Leuck Farmstead	Farmstead	Not Evaluated	No
4F, 4G	OL-ORT-024	Gray Farmstead	Farmstead	Not Evaluated	No
4F, 4G	OL-ORT-025	Tavern Ell House and Motel Cabin	Motel	Not Evaluated	Yes
4F, 4G	OL-ORT-026	House	Single Dwelling	Not Evaluated	No
4G	OL-ORT-018	House	Single Dwelling	Not Evaluated	Yes
4G	OL-ORT-034	Barn	Barn	Not Evaluated	No
4G	OL-ORT-005	Bridge No. 4939	Bridge (Steel Truss)	Not Evaluated	No
4G	OL-ORT-030	Cabin	Cabin	Not Evaluated	No
4G	OL-ORT-031	Cabin	Cabin	Not Evaluated	No
4G	OL-ORT-020	Hewitt House	Single Dwelling	Not Evaluated	No
4G	OL-ORT-027	Cabin	Cabin	Not Evaluated	No
4G	OL-ORT-022	Love Cabin	Cabin	Not Evaluated	No
4G	OL-ORT-028	Cabin	Cabin	Not Evaluated	Yes
4G	OL-ORT-029	Bishop Cabin	Cabin	Not Evaluated	Yes
4G	OL-ORT-006	Bridge No. 4940	Bridge (Steel Truss)	Not Evaluated	No

Route Option Segment	Site / Inventory Number or Cemetery ID	Name	Resource Type	NRHP Status	Within Right-of-Way
4G	OL-ORT-019	House	Single Dwelling	Not Evaluated	No
4G	OL-ORC-017	House and Barn	Farmstead	Not Evaluated	No
4G	OL-ORC-021	Bascom Farmstead	Single Dwelling	Not Evaluated	No
4G	OL-ORT-013	William-Rucker Farmstead	Farmstead	Eligible	Yes
4G	OL-ORT-014	Rueber Farmstead	Single Dwelling	Not Evaluated	No
4G	OL-ORT-015	Farmstead	Farmstead	Not Evaluated	No
4G	OL-ORT-038	House	Single Dwelling	Not Evaluated	No
4J	OL-FRM-017	Schultz Farmstead	Farmstead	Not Evaluated	No
4J	OL-FRM-018	Dorothy Schultz Barn	Barn	Not Evaluated	No
4J	OL-HVH-003	School	School	Not Evaluated	No
Unrecorded Historic Cemeteries					
4A, 4B, 4C, 4D	20716	Catholic Cemetery	Unrecorded Cemetery	N/A	Yes
4J	22685	Fitch Cemetery	Unrecorded Cemetery	N/A	Yes

Route Option 4 East includes two Alternative Segments. Segment 4B of Route Option 4 East could be replaced with Alternative Segment 4C and Segment 4F could be replaced with Segment 4E. Within Alternative Segment 4C, one archaeological resource, no architectural resources, and one unrecorded historic cemetery overlap the Proposed Route and the Right-of-Way (**Table 7-44**). Within Alternative Segment 4E, no archaeological resources, seven architectural resources, and no unrecorded historic cemeteries overlap the Proposed Route; none of the resources are within the Right-of-Way (**Table 7-44**).

Table 7-45 provides a comparison of known cultural resources between the Alternative Segments.

Table 7-44
Archaeological, Architectural, and Unrecorded Historic Cemeteries Within Route Option 4 East Alternative Segments (4C and 4E)

Alternative Segment	Site / Inventory Number or Cemetery ID	Name	Resource Type	NRHP Status	Within Right-of-Way
Archaeological Resources					
4C	21GD0248	Goodhue Good View	Precontact: Archaic Period Habitation	Recommended Eligible	Yes
Architectural Resources					
4E	OL-NHT-021	Leuck Farmstead	Farmstead	Not Evaluated	No
4E	OL-ORT-024	Gray Farmstead	Farmstead	Not Evaluated	No
4E	OL-ORT-025	Tavern Ell House and Motel Cabin	Motel	Not Evaluated	No
4E	OL-ORT-026	House	Single Dwelling	Not Evaluated	No
4E	OL-ORT-034	Barn	Barn	Not Evaluated	No
4E	OL-ORT-037	House	Single Dwelling	Not Evaluated	No
4E	OL-ORT-018	House	Single Dwelling	Not Evaluated	No
Unrecorded Historic Cemeteries					
4A, 4B, 4C, 4D	20716	Catholic Cemetery	Unrecorded Cemetery	N/A	Yes

Table 7-45
Comparison of Known Cultural Resources Within Route Option 4 East Alternative Segments

Alternative Segments	Archaeological Resources Within Proposed Route / Right-of-Way	Architectural Resources Within Proposed Route / Right-of-Way	Unrecorded Historic Cemeteries Within Proposed Route / Right-of-Way
4B	0/0	0/0	1/1
4C	0/0	1/1	1/1
4F	0/0	4/1	0/0
4E	0/0	7/0	0/0

7.5.1.4.2 Route Option 4 West

Within Route Option 4 West, one archaeological resource, one architectural resource, and three unrecorded historic cemeteries overlap the Proposed Route (**Table 7-46**). All resources that overlap the Proposed Route are also located within the Right-of-Way, except for the one architectural resource (OL-ORT-003). None of the resources have been previously evaluated to determine their NRHP eligibility.

Table 7-46
Archaeological, Architectural, and Unrecorded Historic Cemeteries Within Route Option 4 West

Route Option Segment	Site / Inventory Number or Cemetery ID	Name	Resource Type	NRHP Status	Within Right-of-Way
Archaeological Resources					
4K	21GDs	Pine Island Mill	Post-Contact Mill Site	Not Evaluated	Yes
Architectural Resources					
4O	OL-ORT-003	School	School	Not Evaluated	No
Unrecorded Historic Cemeteries					
4K	20716	Catholic Cemetery	Unrecorded Cemetery	N/A	Yes
4K, 4L, 4M	22692	Othello Cemetery	Unrecorded Cemetery	N/A	Yes
4N	22738	Crofoot Cemetery	Unrecorded Cemetery	N/A	Yes

For Route Option 4 West, two Alternative Segments have been proposed to avoid various resource impacts. Segment 4L could be replaced with Alternative Segment 4M. Within Alternative Segment 4M, no archaeological or architectural resources, and no unrecorded historic cemeteries overlap the Proposed Route and the Right-of-Way. The applicant may also choose to replace a portion of Segment 4O with Alternative Segment 4R. Within Alternative Segment 4R, no archaeological or architectural resources, and no unrecorded historic cemeteries overlap the Proposed Route and the Right-of-Way.

Table 7-47 provides a comparison of known cultural resources between the Alternative Segments.

Table 7-47
Comparison of Known Cultural Resources Within Route Option 4 West Alternative Segments

Alternative Segments	Archaeological Resources Within Proposed Route / Right-of-Way	Architectural Resources Within Proposed Route / Right-of-Way	Unrecorded Historic Cemeteries Within Proposed Route / Right-of-Way
4L	0/0	0/0	0/0
4M	0/0	0/0	0/0
4O (portion)	0/0	1/0	0/0
4R	0/0	0/0	0/0

7.5.1.4.3 Segment 4 Connector Segment 4Q

The applicant has also proposed a Segment Connector (4Q) to allow for transitioning between Route Option 4 East and Route Option 4 West if needed to avoid resource issues. There are no known archaeological or architectural resources, or unrecorded historic cemeteries, within the Proposed Route or Right-of-Way of Segment Connector 4Q.

7.5.2 Archaeological and Historic Resources: Avoidance and Mitigation of Potential Impacts – All Routes

The Applicant carefully considered information regarding the location of known cultural resource sites along Route Options and Segments gathered during a Cultural Resources Literature Search which encompassed all areas within one mile of the Proposed Route (**Appendix O**). Routes were designed to avoid physical impacts to previously identified cultural resources.

Table 7-48 compares the known cultural resources within the Proposed Route and Right-of-Way for each of the Route Options. Based on this comparison, Route Option 1 North has the potential to impact fewer known resources. If Alternative Segment L is selected, the number of known archaeological resources within the Right-of-Way for Route Option 1 South is comparable to Route Option 1 North and the number of architectural resources within the Right-of-Way is the same, but the number of unrecorded historic cemeteries within the Right-of-Way is still more than Route Option

1 North. Route Option 2 South has the potential to impact fewer known cultural resources. Route Option 4 West has the potential to impact fewer known cultural resources. Alternative Segments for Route Option 4 East only slightly change the number of known architectural resources within the Proposed Route and Right-of-Way, but Route Option 4 West still has significantly fewer known cultural resources.

Because most of the transmission line, structures, and Right-of-Way currently exist within Route Option 3, there is less potential to impact the known cultural resources within the Proposed Route and Right-of-Way.

Neither of the Connector Segments (Segments 2 and 4) have known cultural resources within the Proposed Route or Right-of-Way.

Table 7-48
Comparison of Known Cultural Resources Within Route Options

Route Option	Archaeological Resources Within Proposed Route / Right-of-Way	Architectural Resources Within Proposed Route / Right-of-Way	Unrecorded Historic Cemeteries Within Proposed Route / Right-of-Way
Segment 1			
1 North	3/3	9/2	1/1
1 South	4/4	13/3	8/8
1 South with Alternative Segment L	3/3	11/2	5/5
Segment 2			
2 North	4/3	6/1	5/5
2 South	2/2	0/0	2/2
Segment 3			
3	4/3	3/1	1/1
Segment 4			
4 East	4/2	26/5	2/2
4 East with Alternative Segment C	4/2	27/6	2/2
4 East with Alternative Segment E	4/2	29/4	2/2

Route Option	Archaeological Resources Within Proposed Route / Right-of-Way	Architectural Resources Within Proposed Route / Right-of-Way	Unrecorded Historic Cemeteries Within Proposed Route / Right-of-Way
4 East with Alternative Segments C and E	4/2	30/5	2/2
4 West	1/1	1/0	3/3
4 West with Alternative Segment M	1/1	1/0	3/3
4 West with Alternative Segment R	1/1	0/0	3/3

Following final route selection, the Applicant will initiate consultation with SHPO to determine if additional mitigation efforts would be required for sites of concern.

During Project construction, previously undocumented cultural resources including lithic materials, artifact scatter, habitation sites, Native American mounds and earthworks, and other archaeological features may be discovered. Therefore, to avoid impacts to unknown resources, the Applicant will conduct a Phase I Cultural Resource Reconnaissance survey and cooperate with SHPO and engage with Tribes to complete field investigations along the Project Area.

After receiving the proposed final Project route and layout, the Applicant and qualified archaeologists will develop a Cultural Resource Survey Strategy and associated Phase I Cultural Resource Reconnaissance survey that assesses the potential for unknown resources along the Proposed Route. The Cultural Resource Survey Strategy will involve review of archaeological surveys previously completed within the Proposed Route and will evaluate historic plat maps, historic topographic maps, Precontact hydrography models, and land use history to identify previous disturbances. Additionally, research will focus on areas of Tribal cultural interest highlighted during current and future outreach.

The Phase I Cultural Resource Reconnaissance survey strategy will focus on portions of the Proposed Route and Right-of-Way intended for construction and will include locations intended for placement of transmission structures, workspace areas, and associated temporary and permanent access road locations. Reconnaissance survey strategies (pedestrian and/or shovel probing and/or deep testing) for the archaeological resource inventory will depend on surface exposure and the characteristics of the landforms proposed for development. All investigations will be conducted by a professional archaeologist meeting the Secretary of the Interior's Standards for Archaeology as published in Title 36 Code of Federal Regulations Part 6. Final reconnaissance survey strategies will be shared with SHPO and interested Tribes to gather their input on the methodology prior to completing the study.

If cultural resources are identified as a result of the Phase I Cultural Resource Reconnaissance survey, the Applicant will make minor adjustments to the Project design to avoid or span sensitive cultural resources and prevent impacts to known and newly identified archaeological and historic architectural resources during implementation of the Project.

Prior to construction, the Applicant will prepare an Unanticipated Discoveries Plan, which will set guidelines to be used if human remains or archaeological resources are discovered during Project construction. This plan will describe protocol and mitigation measures for unanticipated archaeological and human burial discoveries and will provide relevant contact information for qualified SHPO officials, environmental inspectors, archaeologists, geologists, and county sheriffs.

The Applicant will continue to engage Tribes and state cultural regulatory agencies to share Project information and gather information regarding resource areas to inform the identification of potential routes and to avoid or minimize impact to these resources, if feasible. A summary of tribal consultation efforts is presented in Section 8.1 (Tribal and Agency Outreach).

7.6 Natural Environment

Transmission lines have the potential to impact natural resources through temporary, construction-related impacts and long-term impacts to air quality, geology and groundwater, soils, water resources, flora, and fauna.

7.6.1 Air Quality

7.6.1.1 Criteria Pollutants

Section 109(b) of the Clean Air Act (CAA) requires that the EPA establish National Ambient Air Quality Standards (NAAQS) "requisite to protect" public health and welfare (42 USC 7401 et seq.; 40 CFR Part 50). The CAA identifies two classes of NAAQS: primary standards, which are limits set to protect the public health of the most sensitive populations, such as asthmatics, children and the elderly; and secondary standards which are limits set to protect public welfare, such as protection against visibility impairment or damage to vegetation, wildlife and structures. The EPA has promulgated NAAQS for six criteria pollutants: ozone (O_3), particulate matter (PM_{10}/$PM_{2.5}$), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), and lead (Pb). Individual states implement the CAA through State Implementation Plans.

The EPA and state agencies operate a system of air quality monitoring stations throughout the country. Readings from these stations are compared to the NAAQS as a way to classify the air quality of the area surrounding the monitoring stations. Areas of the country that do not meet the NAAQS are classified as "non-attainment" areas. Regions that were classified as non-attainment and have improved their air quality to meet the NAAQS are considered to be in "maintenance." Areas of the country that are not represented by a monitoring station are considered "unclassifiable." Unclassifiable areas are considered to be in attainment with the NAAQS.

Compliance with the national and state air quality standards in the State of Minnesota is assessed at the county level. The EPA designates all of the counties within the Proposed Routes to be in attainment for all NAAQS.[111]

7.6.1.1.1 Emissions Related to Construction

Construction of the Project will result in intermittent and temporary emissions of criteria pollutants. These emissions generally include dust generated from soil disturbing

[111] EPA. 2024.Minnesota Nonattainment/Maintenance Status for Each County by Year for All Criteria Pollutants. Green Book.. Retrieved from https://www3.epa.gov/airquality/greenbook/anayo_mn.html . Accessed on February 6, 2024.

activities, such as earthmoving and wind erosion associated with right-of-way clearing and construction, combustion emissions from construction machinery engines, and indirect emissions attributable to construction workers commuting to and from work sites during construction. These emissions would be dependent upon weather conditions, the amount of equipment at any specific location, and the period of operation required for construction at that location. Air pollutants from the construction equipment will be limited to the immediate vicinity of the construction area and will be temporary. Therefore, it is not anticipated that construction activities will independently cause or significantly contribute to an emission level that alters the attainment status for any of the NAAQS.

The amount of dust generated would be a function of construction activity, soil type, soil moisture content, wind speed, precipitation, vehicle traffic, vehicle types, and road surface characteristics. Emissions would be greater during dry periods and in areas where fine-textured soils are subject to surface activity. If construction activities generate problematic dust levels, the Applicant may employ construction-related practices to control fugitive dust such as application of water or other commercially available dust control agents on unpaved areas subject to frequent vehicle traffic, reducing the speed of vehicular traffic on unpaved roads, and covering open-bodied haul trucks.

Table 7-49 summarizes the estimated potential emissions of criteria pollutants from construction activities for the Project, including transmission line and substation facility work (see Section 7.6.2 below for information on greenhouse gas (GHG) emissions associated with the Project). Construction emissions are calculated based on typical counts of diesel-fueled construction equipment, expected hours of operation, and estimated vehicle miles traveled. Fugitive dust emissions assume an area of disturbance including a 20 foot buffer (10 feet on either side of the centerline of the Proposed Routes) of the longest route. Supporting emission calculations are provided in **Appendix T**.

Table 7-49
Construction Emissions of Criteria Air Pollutants (tons/year)

Construction Components	NO_x[a]	CO	VOC[a]	SO_2	PM_{10}	$PM_{2.5}$
Year 2026						
Off-Road Engine Emissions	10.92	6.36	0.57	<0.1	0.37	0.37
Fugitive Dust Emissions	NA	NA	NA	NA	35.53	3.86
On Road Emissions	<0.1	0.45	<0.1	<0.1	<0.1	<0.1
Year 2026 Total	10.95	6.80	0.58	<0.1	35.92	4.23
Year 2027						
Off-Road Engine Emissions	49.84	29.02	2.62	<0.1	1.68	1.68
Fugitive Dust Emissions	NA	NA	NA	NA	140.77	14.38
On Road Emissions	<0.1	1.18	<0.1	<0.1	<0.1	<0.1
Year 2027 Total	49.91	30.20	2.63	<0.1	142.52	16.08
Year 2028						
Off-Road Engine Emissions	51.36	29.91	2.70	<0.1	1.73	1.73
Fugitive Dust Emissions	NA	NA	NA	NA	144.98	14.80
On Road Emissions	<0.1	1.56	<0.1	<0.1	<0.1	<0.1
Year 2028 Total	51.45	31.47	2.71	<0.1	146.81	16.56

[a] NO_x = oxides of nitrogen; VOCs = volatile organic compounds

Air emissions from the construction equipment will be limited to the immediate vicinity of the construction area and will be temporary. Therefore, it is not anticipated that construction activities will independently cause or significantly contribute to an emission level that results a violation of NAAQS. At the completion of construction activities, all construction-related air impacts would cease.

7.6.1.1.2 Emissions Related to Operation

During operation of the proposed transmission line and substation facilities, air emissions would be minimal. During operation of the line, air emissions would be minimal. Small amounts of NO_X and ozone are created due to corona from the operation of transmission lines. The production rate of ozone due to corona discharges decreases with humidity and less significantly with temperature. Rain causes an increase in ozone production, but also accelerates the decay of ozone. Ozone production by high voltage transmission lines is not detectable during fair weather above ambient conditions. Ozone production under wet-weather conditions is detectable with special efforts but will result in emissions below the NAAQS and therefore is considered insignificant.

A small amount of ozone is created due to corona from the operation of transmission lines (reference EPRI, 1982). A corona signifies a loss of electricity, so the Applicant has engineered the transmission lines to limit corona. During operation, corona effects will be minimized by using good engineering practices, such as using bundled conductors.

Design of the transmission line also influences ozone production rate. The production rate decreases significantly as the conductor diameter increases and is greatly reduced for bundled conductors over single conductors. Conversely, the production rate of ozone increases with applied voltage. The emission of ozone from the operation of a transmission line of the voltages proposed for the Project is not anticipated to have a significant impact on the environment.

Emissions will be generated during routine inspection and maintenance activities. Xcel Energy will perform an annual aerial inspection of the line. Once every four years, crews will visually inspect the lines from the ground. Additionally, vegetation maintenance will generally occur once every four years. Routine inspection and maintenance activities will not have a significant impact on ambient air quality.

Xcel Energy also analyzed the carbon reduction benefits of the Project. MISO's analysis demonstrated the implementation of the LRTP Tranche 1 Portfolio is estimated to reduce carbon emissions by 399 million metric tons over the first 20 years and 677 million metric tons over the first 40 years of LRTP Tranche 1 project life.[112] Xcel Energy estimated that the Project will reduce carbon emissions by 197.9 million metric

[112] **Appendix G-1** at 79 (MTEP21 Report Addendum).

tons over the first 20 years that the Project is in service and by 295.5 million metric tons over the first 40 years that the Project is in service. Therefore, the overall Project is anticipated to help carbon reduction goals both nationally and those set by the state of Minnesota.

7.6.1.1.3 Air Quality: Avoidance and Mitigation of Potential Impacts

Transmission line and substation projects have the potential to impact air quality through temporary, construction-related and operational impacts. Potential impacts to air quality and associated mitigation measures are discussed collectively here across all Project facilities.

7.6.2 Greenhouse Gas Emissions and Climate Change

Climate change is the alteration of average or "typical" weather, which includes variables like temperature, precipitation, and drought, in a certain location. Some of the most abundant gases in the atmosphere are known as greenhouse gases (GHGs). Anthropogenic climate change is caused by the production of GHGs, gases that exacerbate climate change through increased infrared radiation absorption in the atmosphere. The concentration of GHGs in the atmosphere has a direct relationship to global warming or climate change. GHGs are known to trap heat in Earth's atmosphere by absorbing light energy and emitting a portion of released energy back towards Earth. Trapped heat in the atmosphere creates a warming effect known as the GHG effect, in which the temperatures of Earth's atmosphere rise as more GHGs are added to the atmosphere. This drives further changes to the climate affecting precipitation, flooding, and storms.[113]

The most common and significant contributors to the GHG effect include carbon dioxide (CO_2), followed by methane (CH_4), nitrous oxide (N_2O), and fluorinated gases including hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). The amount of energy absorbed by 1 ton of a GHG over a given

[113] EPA 2024. Climate Change Indicators: Weather and Climate. Retrieved from: https://www.epa.gov/climate-indicators/weather-climate. Accessed February 6, 2024.

period is known as the Global Warming Potential (GWP). The order of common GHGs by GWP from lowest to highest is CO_2, CH_4, N_2O, and fluorinated gases.[114] For ease of comparison, GWPs are calculated relative to the energy absorption of 1 ton of CO_2. Emission of a given GHG is normalized using the GWP; the resultant value is referred to as carbon dioxide equivalent (CO_2e).

In Minnesota, CO_2 makes up 70 percent of GHG emissions.[115] CO_2 is most frequently produced through the combustion of hydrocarbon fuels to operate vehicles and equipment. The Applicant will use construction vehicles and equipment and maintenance vehicles throughout the Project to support transport, construction, equipment operation, maintenance, and repair activities. The Project will produce GHG emissions during earth-moving activities, construction, and restoration activities through the use of cranes, bulldozers, bucket loaders, personal employee vehicles, and other heavy equipment associated with Project construction and maintenance.

During construction and operation of the Project, small amounts of GHGs will be generated. GHG emissions from this Project will be largely from the combustion of fossil fuels such as gasoline and diesel. GHGs associated with fuel combustion are CO_2, CH_4, and N_2O. The largest source of GHG emissions from the Project will be from the temporary combustion of fossil fuels in construction equipment and heavy machinery.

Construction efforts associated with the Project include: modification of the existing Wilmarth Substation, modification of the Eastwood Substation (if Route Option 1 South is selected), modification of the North Rochester Substation, installation of the second 345 kV circuit on a portion of the existing structures in Segment 3, construction of the re-routed 161 kV line (either double circuit, parallel or greenfield construction depending on the route selected) in Segment 4, and construction of the new 345 kV line (either double circuit, parallel or greenfield construction depending on route selected) in Segments 1 and 2. Project construction is estimated to take place over 2-3 years. Construction efforts will involve the use of various mobile combustion sources.

[114] EPA. 2024. Understanding Global Warming Potential. Retrieved from: https://www.epa.gov/ghgemissions/understanding-global-warming-potentials. Accessed February 6, 2024

[115] Minnesota Department of Commerce. 2021b. Greenhouse Gas Emissions Inventory 2005-2018. Available at https://mn.gov/puc-stat/documents/pdf._files/MPCA-DOC%20Greenhouse%20Gas%20Inventory%20Report%20-%202021-1-14.pdf. Accessed February 6, 2024.

Construction emissions will be localized to the construction area and are not anticipated to result in long-term impacts.

To estimate the potential amount of GHG emissions, the Applicant identified the types and numbers of construction equipment that could be used to construct the Project. Supporting emission calculations are provided as **Appendix T**. This assessment is preliminary and based on the best information available to the Applicant as of the date of this Application. Based on this assessment, potential GHG emissions from pre-construction activities (tree clearing, grading where needed, vegetation management, etc.), construction activities (e.g., foundations, structures, conductors, etc.), and restoration are indicated in **Table 7-50**. This table provides preliminary estimates of CO_2, CH_4, N_2O and CO_2e emissions. CO_2 and CH_4 emissions were calculated using factors for diesel combustion from the South Coast Air Quality Management District (SCAQMD).[116] N_2O emissions estimated based on the ratio of grams of N_2O per CO_2 in a gallon of gasoline obtained from Table 2.7 of the 2022 Climate Registry Default Emission Factors.[117] Detailed calculations are in **Appendix T**.

Table 7-50
Preliminary Greenhouse Gas Emissions from Project Construction

Year	Activity	CO_2 (metric tons/year)	CH_4 (metric tons/year)	N_2O (metric tons/year)	CO_2e (metric tons/year)
2026	Equipment	1,124	0.02	0.10	1,153
	Onroad	58	<0.01	<0.01	58
2027	Equipment	5,126	0.09	0.44	5,259
	Onroad	161	0.02	0.01	161
2028	Equipment	5,284	0.09	0.45	5,420
	Onroad	224	<0.01	<0.01	224
Total		11,976	0.23	1.00	12,275

[1] CO_2e calculated by equation A-1 of 40 CFR, Part 98.2, which states the total CO_2e is equal to the GWP for each pollutant multiplied by the potential pollutant emissions. The GWP for CO_2 is 1, CH_4 is 25, and N_2O is 298.

116 SCAQMD. 2023. South Coast Air Quality Management District. Off-Road - Model Mobile Source Emission Factors. Air Quality Analysis Handbook. [Online] Off-road Mobile Source Emission Factors (Scenario 2007-2025.xls [2023 SCAB Fleet Average Emission Factors (Diesel). Retrieved from: https://www.aqmd.gov/home/rules-compliance/ceqa/air-quality-analysis-handbook/off-road-mobile-source-emission-factors. Accessed February 6, 2024.
117 Available at: .

All estimates are quantified as CO_2 equivalents and based on a 2.1 year construction period from 2026 to 2028. Based on this initial assessment the total GHG emissions from construction of the Project would be 12,275 $MTCO_2e$. Over the Project's lifetime, GHG emissions from construction would be insignificant compared to overall regional GHG emissions and, in turn, climate change impacts.

The generation of construction-related GHG emissions would be short term and temporary. Emissions resulting from routine operation and maintenance of the transmission line and substations will largely be from the combustion of gasoline or diesel in maintenance equipment and vehicle use. Routine maintenance is expected to occur on an annual basis and involve the use of diesel fueled, mobile combustion sources. While these emissions are anticipated to be minimal, total annual GHG emissions expected from the routine operation and maintenance of this Project are estimated to be 20.79 tons of CO2e per year. **Table 7-51** provides a preliminary estimate of CO2, CH4, and N2O emissions. Emissions were calculated using factors from SCAQMD and the EPA CCCL.[118]

Table 7-51
Greenhouse Gas Emissions from Operation and Maintenance

Emission Source	CO_2 (metric tpy)	CH_4 (metric tpy)	N_2O (metric tpy)	CO_2e^* (metric tpy)
O&M Activities	20.33	<0.01	<0.01	20.79

* CO_2e calculated by equation A-1 of 40 CFR, Part 98.2, which states the total CO_2e is equal to the GWP for each pollutant multiplied by the potential pollutant emissions. The GWP for CO_2 is 1, CH_4 is 25, and N_2O is 298.

During operations, some negligible operational GHG emissions are anticipated as a result of the use of maintenance vehicles (cars, trucks, helicopters) or substation equipment (SF_6 production). Potential emission of the fluorinated gas, sulfur hexafluoride (SF6), is also associated with this Project. SF6 is a powerful GHG that is used in high-voltage circuit breakers in transmission systems. The emission of SF_6, when it occurs, would originate from substations as releases occur due to cracks in seals in certain substation equipment. The Applicant track SF_6 and would maintain their equipment to minimize unanticipated releases. The use of such a substance is extremely

118 EPA CCCL. 2022. Emission Factors for Greenhouse Gas Inventories.

common due to its stability and effectiveness at insulating electrical equipment. However, SF6 emissions from high-voltage circuit breakers are minimal and not expected routinely since they are largely attributed to faulty equipment and leakage.

7.6.3 Climate Change and Resiliency

Climate change is the change in global or regional climate patterns over time. Potential indicators of climate change include an alteration of average precipitation or temperature over years or decades. Over the past century, Minnesota's climate has been changing. Noticeable effects include warmer periods during winter and at night, increased precipitation, and heavier downpours. Between the years 1895 and 2020, Minnesota's average temperature has increased by 3.0 °F and annual precipitation has increased by 3.4 inches (MNDNR, 2023a). As a result of climate change, the Project Study Area could experience an increased risk of flooding, increased temperatures, high winds, and excessive rainfall. Electric transmission equipment can withstand the anticipated increases in temperature, and changes in weather patterns are accounted for in the Project design.

When analyzing the historical climate data from the MnDNR Minnesota Climate Trends resource, there were upward trends visible within all four analyzed climate variables including average and maximum temperatures, annual precipitation, and the Palmer Drought Severity Index (PDSI) data. These trends are based on the compiled historical data from 1895-2023 for the following southeastern Minnesota counties crossed by the Project: Blue Earth, Dodge, Goodhue, Le Sueur, Olmsted, Rice, Wabasha, Waseca, and Winona.[119]

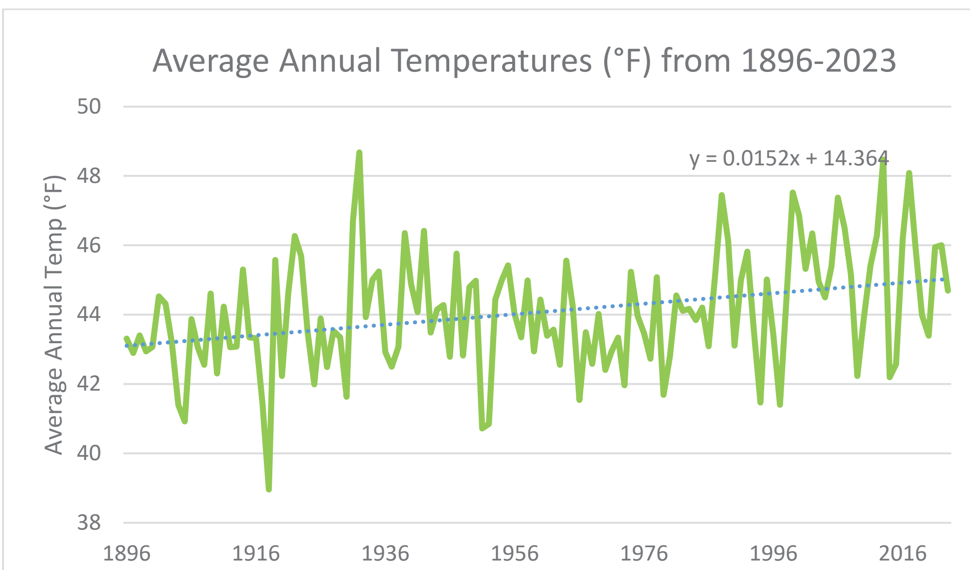
Based on the available data within these Minnesota counties, there have been increases in average temperatures, maximum temperatures, and precipitation depths, all which can be explained or supported by the idea of climate change. With increased GHG emissions from anthropogenic actions such as the burning of fossil fuels for transportation and power generation, the greenhouse gas effect's positive feedback loop continues to be fueled. Implications of this feedback loop include rising temperatures

[119] MNDNR. 2023. Minnesota Climate Trends. Available at https://arcgis.dnr.state.mn.us/ewr/climatetrends/. Accessed **February 6, 2024**.

and increased precipitation and are a very reasonable explanation for the trends observed in the four analyzed climate variables. The following trends were identified:

- Annual average temperatures have displayed an average increase of 0.15F/decade (**Figure 7-1**).
- Maximum temperatures (averaged monthly) have displayed an average increase of .045F/decade (**Figure 7-2**) annually, but a decrease of .14F/decade (**Figure 7-3**) for the months of June through September.
- Annual precipitation has shown an increasing trend of .54 inch/decade (**Figure 7-4**).
- Annual PDSI has displayed an average increase of .27/decade[120] (**Figure 7-5**).

Figure 7-1
Average Annual Temperatures for the Project Study Area



[120] It should be noted that PDSI from the Minnesota Climate Trends resource are displayed monthly to better represent the drought status of an area. By averaging the annual values for every month, it raises the question as to whether this underrepresents the drought severity of a year. This should be kept in mind during the interpretation of the data because each year had PDSI values with ranges of .99 to 10.69 indicating great variation for wetness/dryness levels from month to month and not creating a great picture of the true drought status across the 9 counties on an annual basis.

Figure 7-2
Maximum Temperatures Between June and September in the Project Study Area (based on monthly averages)

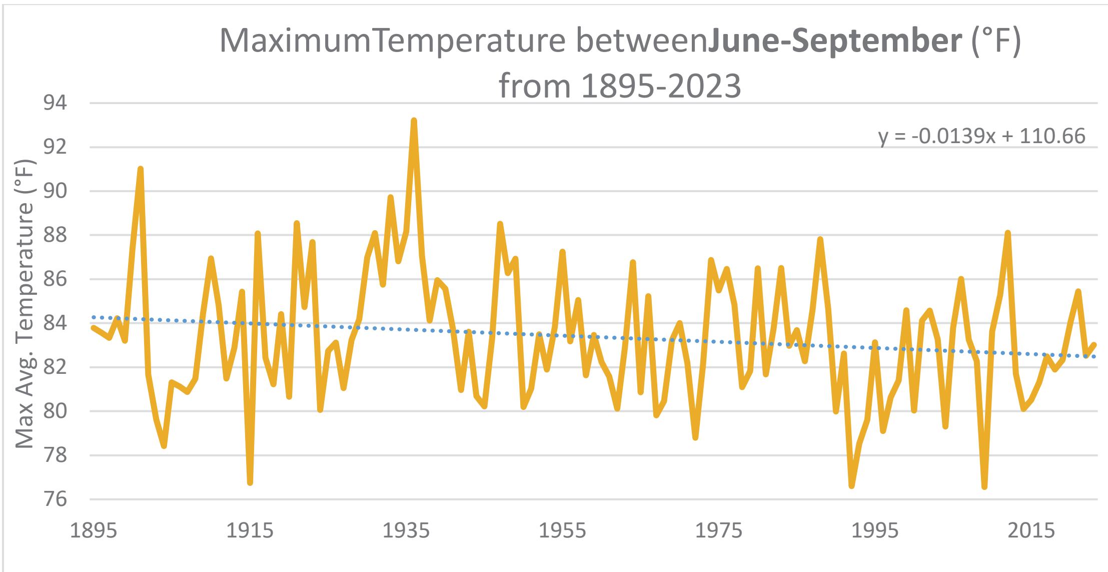


Figure 7-3
Maximum Temperatures Considering All Months in the Project Study Area (based on monthly averages)

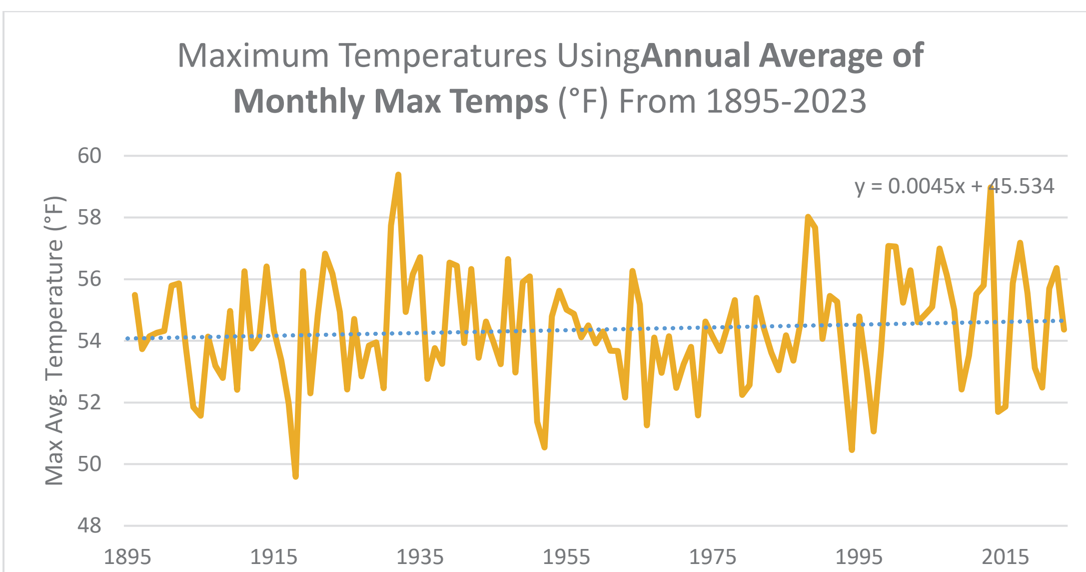


Figure 7-4
Annual Precipitation Depth as Snow Water Equivalent (SWE) in the Project Study Area

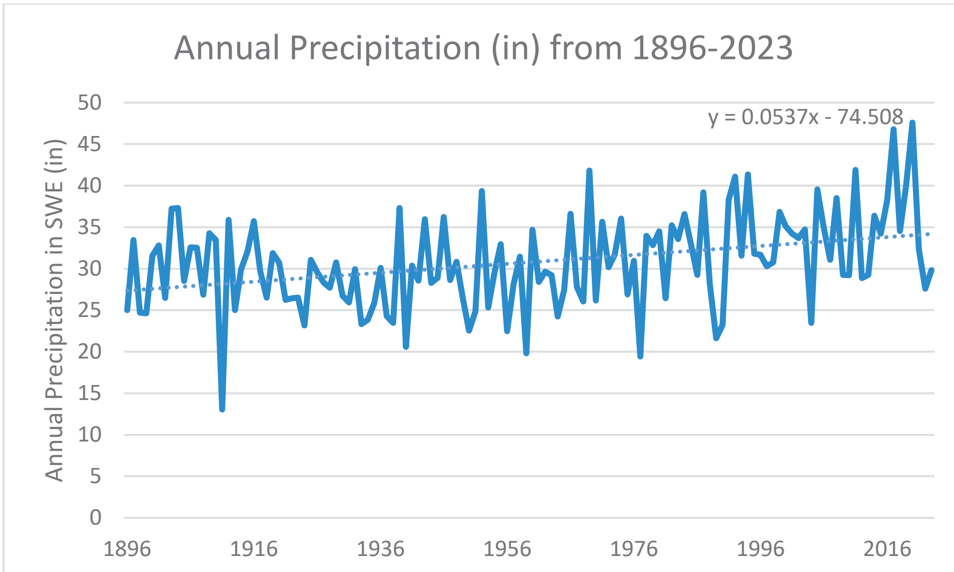
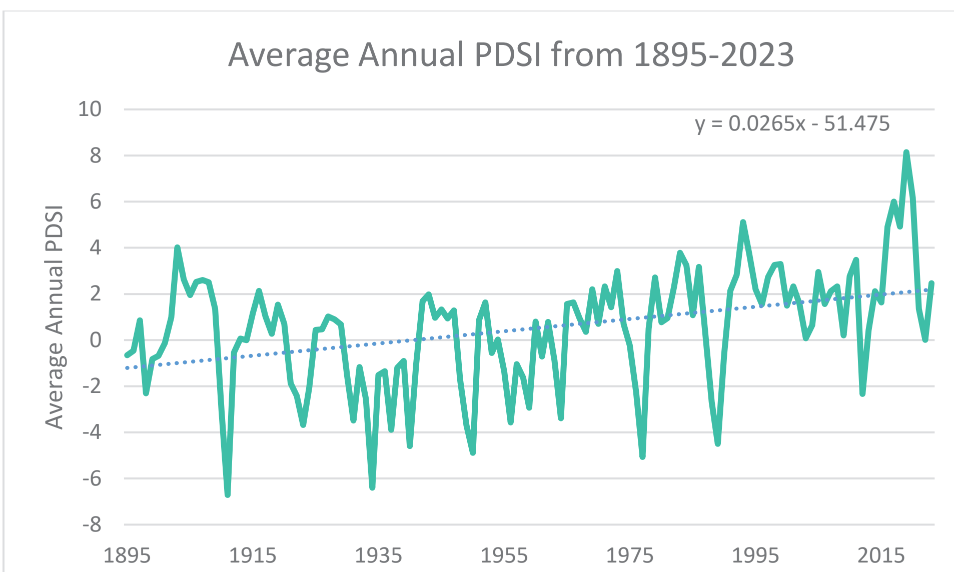


Figure 7-5
Average Annual PDSI in the Project Study Area



The Project will be routed and engineered to be resilient under changing climatic factors including increased average temperatures and changes in precipitation intensities and quantities. Although the warmest months of the year (June-September) have demonstrated a decreasing trend in average high temperatures, the overall trend across all months of the year show an increasing trend indicating greater annual temperatures increase in some months to account for the negative trend observed within the summer months.

High temperatures can affect the sagging of a transmission line conductor and its thermal tolerance. However, the transmission lines would be built to NERC reliability standards to address thermal limitations. Changes in storm timing and intensities may increase landslide potential in areas of steeper terrain and increase the risk of local flooding. Final structure placement will consider the Project ROW slope to avoid areas with steeper terrain and associated risks of erosion and landslides. Upon construction completion, the disturbed area will be restored and revegetated.

Although the precipitation trends indicate increasing SWE depths on an annual average, there may be periods of dry weather and concerns of wildfires which is supported by the increasing trend in the PDSI (i.e., wet winters and dry springs and summers). However, the transmission lines would be maintained following or exceeding NERC reliability standards that address vegetation management, including the increase of noxious weeds that could occur from changed conditions that allow them to spread. Surface water temperatures could increase in locations where the Project requires tree clearing along shorelines increasing sun exposure. This would be exacerbated by increased temperatures. Although the climate trends in the Project Study Area show increases in precipitation, it also shows an increase in drought severity (PDSI).

7.6.4 Water Resources

The following sections briefly describes the existing water resources and potential impacts from the proposed Project and proposed mitigation to reduce impacts, where applicable. Water resources evaluated include watersheds; floodplains; lakes, rivers, streams, and ditches; water quality; groundwater resources; wetlands; calcareous fens; special designated waters and infested waters. See detailed maps (**Appendix K**) for location data of these natural resources.

7.6.4.1 Watersheds

The Proposed Routes cross 5 watersheds, though crossings vary depending on Route Option (1 North, 1 South, 2 North, 2 South, Connector Segment 2G, 3, 4 East, 4 West, Connector Segment 4Q, and Alternative Segments 1L, 4C, 4E, 4M and 4R). **Table 7-52** lists the watersheds crossed by each Segment denoted by the 8-digit Hydrologic Unit Codes (HUC) as assigned by U.S. Geologic Survey (USGS).

Table 7-52
Watersheds Crossed by the Proposed Right-of-Way[121]

Route Option (Crossing Length – Miles)	Watershed Name and 8-digit HUC-8				
	Minnesota River - Mankato	Le Sueur River	Cannon River	Mississippi River - Winona	Zumbro River
	07020007	0702001	07040002	07040003	07040004
Route 1 North	10.93	3.76	33.40	N/A	N/A
Route 1 South	8.92	7.42	37.29	N/A	N/A
Alternative 1L	N/A	N/A	7.95	N/A	N/A
Route 2 North	N/A	N/A	19.91	N/A	31.25
Route 2 South	N/A	N/A	5.66	N/A	25.36
Connector 2G	N/A	N/A	N/A	N/A	0.74
Route 3	N/A	N/A	N/A	11.51	31.85
Route 4 East	N/A	N/A	N/A	0.62	18.98
Route 4 West	N/A	N/A	N/A	0.54	23.04
Alternative 4C	N/A	N/A	N/A	N/A	1.23
Alternative 4E	N/A	N/A	N/A	N/A	3.14
Alternative 4M	N/A	N/A	N/A	N/A	1.00
Alternative 4R	N/A	N/A	N/A	N/A	0.57
Connector Segment 4Q	N/A	N/A	N/A	N/A	0.44

[121] Minnesota Department of Natural Resources. 2023. Ecological and Water Resources: Watersheds. Accessed from: https://www.dnr.state.mn.us/watersheds/index.html.

7.6.4.1.1 Watershed: Avoidance and Mitigation of Potential Impacts

The larger crossing length of a watershed by a Route Option does not necessarily directly correlate to a greater impact on that watershed. Potential impacts on watersheds are tied to the potential impacts of all other water resources described in Section 7.6.2. Avoidance and mitigation measures are described in Section 7.6.2.

7.6.4.2 Floodplains

A floodplain is a low-lying, flat area adjacent to a river or stream that is prone to flooding. A floodplain contains two parts: the floodway, which is the channel of the stream plus any adjacent areas that will allow floodwaters to pass without increasing the water surface elevation by more than one foot, and the flood fringe, which is essentially the remainder of the floodplain extending out to the elevation that contains the remaining standing water during a flood event. The Federal Emergency Management Administration[122] maintains the national flood insurance program, which provides flood insurance and reduces flood damages by restricting floodplain development. The national flood insurance program database contains flood maps, which show how likely any given floodplain is to flood. These maps consist of the 100-year floodplain, which has a 1% chance of flooding each year, and the 500-year floodplain, which has a 0.2% chance of flooding each year.

In Minnesota, floodplains are typically regulated at the county and city level, with enforcement largely depending on local ordinances. The MnDNR is required to review and approve all new and amended floodplain ordinances prior to their adoption to verify that minimum state and federal standards are met as defined under Minn. Stat. § 103A.207 and Minn. Rule 6120.5700. MnDNR also provides regulatory assistance to minimize risk to landowners from potential flood hazards. Construction and operation of utility transmission lines is allowed as a conditional use for floodplain districts.

Portions of the Project are located within FEMA-designated 100-year and 500-year floodplain areas. FEMA-designated 100-year floodplain areas are associated with major

[122] Federal Emergency Management Agency (FEMA) 2023. National Flood Insurance Program. FEMA Flood Map Service Center. Digital Flood Rate Insurance Maps Accessed from: https://msc.fema.gov/portal/home.

rivers along the Proposed Routes such as the Mississippi River. **Table 7-53** and **Table 7-54** provide the total acres of the Proposed Routes and rights-of-way located within FEMA-designated floodplains. Additionally, expansion of the Wilmarth Substation will also be located within portions of both 100-year (0.64 acre) and 500-year floodplains (0.14 acre). Wabasha, Blue Earth, Winona, Dodge, Le Sueur, and Waseca Counties do not utilize FEMA Digital Flood Rate Insurance Maps (DFIRM) or have preliminary versions. Available data was digitized from publicly available county floodplain maps using the MNDNR Lake and Flood Elevations Online (LFEO) viewer.[123]

Table 7-53
FEMA Designated 100- and 500-Year Floodplain Areas Crossed by the Proposed Routes (Acres)

FEMA Floodplain Layer	Route 1 North	Route 1 South	Route 2 North	Route 2 South	Conn. Seg. 2G	Route 3	Route 4 East	Route 4 West	Conn. Seg. 4Q
100-Year Floodplain (Zone A and AE)	213.87	62.96	35.85	51.66	0	375.73	134.50	121.49	0
500-Year Floodplain (Zone X)	4.21	375.73	0	0	0	0	28.20	7.47	0

Source: FEMA, 2023; MNDNR FLEO, 2023

In addition to the floodplains presented in the table above, Route Option 1 South includes one alternative segment. Alternative Segment 1L crosses 3.51 acres of 100-year floodplain and does not cross any areas of 500-year floodplain. Segment 4 includes four alternative segments, two along Route Option 4 East (4C and 4E), and two along Route Option 4 West (4M and 4R). Alternative Segment 4C ROW does not cross any areas of 100-year floodplain or 500-year floodplain. Alternative Segment 4E ROW crosses 1.04 acres of 100-year floodplain and 2.34 acres of 500-year floodplain. Alternative

[123] Minnesota Department of Natural Resources. 2022. Lake and Flood Elevations Online (LFEO) Viewer. Accessed from: https://arcgis.dnr.state.mn.us/ewr/lfeo/lat/44.2018/lng/-92.3483/z/11"Lake & Flood Elevations Online (state.mn.us).

Segments 4M and 4R ROWs does not cross any areas of 100-year floodplain or 500-year floodplain.

Table 7-54
FEMA Designated 100- and 500-Year Floodplain Areas Crossed by the Proposed Right-of-Way (Acres)

FEMA Floodplain Layer	Route 1 North	Route 1 South	Route 2 North	Route 2 South	Conn. Seg. 2G	Route 3	Route 4 East	Route 4 West	Conn. Seg. 4Q
100-Year Floodplain (Zone A and AE)	34.24	8.40	2.59	5.29	0	56.22	11.49	17.42	0
500-Year Floodplain (Zone X)	0.29	0	0	0	0	0	3.60	1.29	0

Source: FEMA, 2023; MNDNR FLEO, 2023

7.6.4.2.1 Floodplains: Avoidance and Mitigation of Potential Impacts

The Project may require transmission line structures to be placed within FEMA designated 100-year or 500-year floodplains. Transmission lines will span floodway and flood fringe areas where possible and would be designed to minimize impacts to the flood storage capacity of floodplains. Where structures cannot span floodplains, temporary impacts to floodways or flood fringes may occur. The placement of transmission line structures in floodplains is not anticipated to alter the flood storage capacity of the floodplain based on the minimal size of individual transmission line structures. The expansion of the Wilmarth Substation will be completed in accordance to state and local floodplain permitting requirements. Contractors will use BMPs including silt fences, inlet protection, and temporary stabilization as applicable during construction to ensure there is minimal damage to floodplains. The Applicant will work with city and county governments during development in the floodplain and will follow all applicable local ordinances throughout Project construction and operation.

7.6.4.3 Lakes, Rivers, Streams, and Ditches

Major rivers in the Project Study Area include the Cannon River, Mississippi River, Straight River, Zumbro River, and various creeks (refer to **Appendix K**).

The Project Study Area also contains several lakes, many of which are greater than 160 acres (an NRCS primary sample unit size). Some of the named lakes in the Project Study Area include Shady Lake, Hands Marsh, North Eagle Lake, Lower Sakatah Lake, South Eagle Lake, Zumbro Lake, Tetonka Lake, and Pool 5 of U.S. Lock and Dam #5. Many of the smaller lakes are designated as a "shallow lake", which by Minnesota Statute is defined as, "a body of water, excluding a stream, that is greater than or equal to 50 acres in size and less than or equal to 15 feet in maximum depth."

Section 404 of the Clean Water Act (CWA) establishes a program to regulate the discharge of dredged or fill material into "Waters of the United States," which encompass all waterways and waterbodies that are permanent and navigable or are relatively permanent bodies of water connected to traditional interstate navigable waters. Navigable waters are designated by the USACE and regulated under Section 10 of the Rivers and Harbors Act of 1899. Under the CWA, no dredged or fill material may be permitted in Waters of the United States if the nation's waters would be significantly degraded or a practicable alternative exists that is less damaging to the aquatic environment. Multiple lakes, river, streams, and ditches in the Project Area are considered Waters of the United States.

In Minnesota, additional MnDNR regulations may apply to lakes, rivers, streams, and ditches designated as Public Water Inventory (PWI) waters,[124] which are basins, watercourses, and wetlands that meet the criteria set forth in Minn. Stat. §103G.005, subd. 15. Projects that have the potential to alter the course, current, or cross section of PWI basin, watercourse, or wetland require a MnDNR Public Waters Work Permit (Minn. Stat. § 103G.245).

[124] Minnesota Department of Natural Resources. 2023. Public Waters Inventory Program. Accessed from: https://www.dnr.state.mn.us/waters/watermgmt_section/pwi/index.html.

The Applicant reviewed the USGS National Hydrography Dataset (NHD)[125] waterbody data, MNDNR watercourse and basin data, MNDNR PWI data, MNDOT basemap lake delineations, and USGS NHD and USGS 7.5-minute quadrangle maps to assess the presence of jurisdictional lakes, river, streams (perennial and intermittent), and ditches along the four segments and associated subsegments. An analysis of waterbody crossings by Route Option is presented in **Table 7-55** (Proposed Routes) and **Table 7-56** (Proposed Rights-of-Way) below.

Table 7-55
Waterbodies and Waterways Crossed by the Proposed Routes

Waterbody Feature	Route 1 North	Route 1 South	Route 2 North	Route 2 South	Conn. Seg. 2G	Route 3	Route 4 East	Route 4 West	Conn. Seg. 4Q
Number of Stream and River Crossings	35	36	58	46	1	91	34	37	0
Number of PWI Stream and River Crossings	8	6	12	5	0	8	5	7	0
Number of PWI Basins	9	11	0	1	0	2	1	0	0
Number of PWI Basins over 1,000 feet Crossed	6	2	0	1	0	1	1	0	0
Number of Shallow Lakes*	7	7	0	0	0	1	1	0	0

***A "Shallow Lake" is defined as "a body of water, excluding streams, that is greater than or equal to 50 acres in size and less than or equal to 15 feet maximum depth" (MN Statutes 103G.005, Subd. 15e)**
Source: Minnesota Department of Natural Resources, Division of Waters, June 10, 2020

Table 7-56
Waterbodies and Waterways Crossed by Proposed Right-of-Way

Waterbody Feature	Route 1 North	Route 1 South	Route 2 North	Route 2 South	Conn. Seg. 2G	Route 3	Route 4 East	Route 4 West	Conn. Seg. 4Q
Number of Stream and River Crossings	29	29	44	36	1	68	22	26	0
Number of PWI Stream and River Crossings	7	6	12	5	0	7	3	5	0

[125] United States Geological Survey. 2023. National Hydrography Dataset. Accessed from: https://www.usgs.gov/national-hydrography/national-hydrography-dataset.

Waterbody Feature	Route 1 North	Route 1 South	Route 2 North	Route 2 South	Conn. Seg. 2G	Route 3	Route 4 East	Route 4 West	Conn. Seg. 4Q
Number of PWI Basins	7	7	0	1	0	2	1	0	0
Number of PWI Basins over 1,000 feet Crossed	0	2	0	1	0	0	1	0	0
Number of Shallow Lakes*	6	5	0	0	0	1	1	0	0

***A "Shallow Lake" is defined as "a body of water, excluding streams, that is greater than or equal to 50 acres in size and less than or equal to 15 feet maximum depth" (MN Statutes 103G.005, Subd. 15e)**
Source: Minnesota Department of Natural Resources, Division of Waters, June 10, 2020

7.6.4.3.1 Route Option 1 North

Proposed Route

Nine PWI lakes are located within the Proposed Route for Route Option 1 North. Seven of them, including Eagle Lake North, Eagle Lake South, Fish Lake, Long Lake, Lower Sakatah Lake, Cannon Lake, and one unnamed lake are designated as shallow lakes. The other two – Mud Lake and Tetonka Lake, are deeper and/or larger lakes. Route 1 North has 35 waterway crossings including 3 rivers, 9 ditches/connector features, 19 intermittent streams and 4 perennial streams (refer to Detailed Maps in Attachment K). Of these, the following are PWI waters: Minnesota River, Cannon River, Mackenzie Creek, Devil Creek, and 4 unnamed streams.

Right-of-Way

Seven PWI lakes are located within the ROW for Route Option 1 North. Of these, six are designated shallow lakes and are crossed by Route Option 1 North within the 150-foot right-of-way, including Long Lake, Mud Lake, Lower Sakatah Lake, Eagle Lake (South), Eagle Lake (North), and an unnamed public water wetland. The other lake, Fish Lake, is a deeper and/or larger lake. Route Option 1 North ROW has 29 waterway crossings including 2 rivers, 4 ditches, 20 intermittent streams and 3 perennial streams (refer to Detailed Maps in Attachment K). Of these, the following are PWI waters: Cannon River, Mackenzie Creek, Devil Creek, two unnamed creeks and two unnamed streams.

7.6.4.3.2 Route 1 South

Proposed Route

Eleven PWI basins are crossed by the Proposed Route for Route 1 South. Seven of them, including North Eagle Lake, South Eagle Lake, Madison Lake, Sprague Lake, Hands Marsh, and two unnamed lakes are designated as shallow lakes. The other four, Fish Lake, Lily Lake and two unnamed lakes, are deeper and or larger lakes. Route 1 South has 36 waterway crossings including 23 intermittent streams, 4 perennial streams, and 9 connector/ditch features. Of these streams, the following are PWI waters: Waterville Creek, Mackenzie Creek, Whitewater Creek, one unnamed stream and two unnamed creeks.

Right-of-Way

Seven PWI basins, are crossed by the Route 1 South ROW. Of these, five are designated shallow lakes. The other two lakes, Fish Lake and one of the unnamed basins, are deeper and/or larger lakes. Route 1 South has 29 waterway crossings including 18 intermittent streams, 4 perennial streams, and 7 connector/ditch features. Of these streams, the following are PWI waters: Waterville Creek, Mackenzie Creek, Whitewater Creek, one unnamed stream and two unnamed creeks.

Alternative Segment 1L

Five streams are crossed by the right-of-way of Alternative Segment 1L. Three of these streams are PWI streams including Whitewater Creek, Waterville Creek, and one unnamed creek. One shallow lake, Pooles Lake, is crossed by the alternative segment right-of-way.

7.6.4.3.3 Route 2 North

Proposed Route

No PWI lakes or shallow lakes are crossed by Route 2 North. Route 2 North has 58 waterway crossings including 3 rivers, 3 ditch/connector features, 49 intermittent streams, and 3 perennial streams. Of these, the following are PWI waters: Dry Run

Creek, Falls Creek, Shingle Creek, Spring Creek, Straight River, Zumbro River (North Fork) – multiple crossings, and five unnamed creeks.

Right-of-Way

No PWI lakes or shallow lakes are crossed by Route 2 North. Route 2 North has 44 waterway crossings including 3 rivers, 1 intermittent ditch, 37 intermittent streams, and 3 perennial streams. Of these, the following are PWI waters: Dry Run Creek, Falls Creek, Shingle Creek, Spring Creek, Straight River, Zumbro River (North Fork) – multiple crossings, and five unnamed creeks.

7.6.4.3.4 Route 2 South

Proposed Route

One PWI lake, an unnamed public water wetland, is crossed by Route 2 South. Route 2 South has 46 waterway crossings including 2 rivers, 2 connector/ditch features, 39 intermittent streams, and 3 perennial streams. Of these, the following are PWI waters: Zumbro River-North Fork, Dry Run Creek, Straight River, and two unnamed creeks.

Right-of-Way

One PWI lake, an unnamed public water wetland, is crossed by Route 2 South. Route 2 South has 36 waterway crossings including 2 rivers, 2 connector/ditch features, 30 intermittent streams, and 2 perennial streams. Of these, the following are PWI waters: Zumbro River-North Fork, Dry Run Creek, Straight River, and two unnamed creeks.

Connector Segment 2G

No PWI rivers, lakes or shallow lakes are crossed by the connector route segment. One unnamed intermittent stream crosses the segment.

7.6.4.3.5 Route 3

Proposed Route

Two PWI lakes, Zumbro Lake, and U.S Lock and Dam #5 Pool are crossed by Route 3. U.S. Lock and Dam #5 Pool is designated as a shallow lake. Route 3 has 91 waterway crossings including 3 rivers, 5 connector/ditch features, 78 intermittent streams, and 5 perennial streams. Of these, the following are PWI waters: Silver Spring Creek, Zumbro River, Zumbro River (Middle Fork), Mississippi River, East Indian Creek, Gorman Creek, Snake Creek, and one unnamed creek.

Right-of-Way

Two PWI lakes, Zumbro Lake, and U.S Lock and Dam #5 Pool are crossed by Route 3. U.S. Lock and Dam #5 Pool is designated as a shallow lake. Route 3 has 68 waterway crossings including 2 rivers, 2 connector/ditch features, 60 intermittent streams, and 4 perennial streams. Of these, the following are PWI waters: Silver Spring Creek, Zumbro River, Mississippi River, East Indian Creek, Gorman Creek, Snake Creek, and one unnamed creek.

7.6.4.3.6 Route 4 East

Proposed Route

One PWI lake, Shady Lake, also designated as a shallow lake, is crossed by Route 4 East. Route 4 East has 34 waterway crossings including 1 river, 4 connector/ditch features, 27 intermittent streams, and 2 perennial streams. Of these, the following are PWI waters: Zumbro River-Middle Fork (2 crossings), Zumbro River (2 crossings), and one unnamed creek.

Right-of-Way

One PWI lake, Shady Lake, also designated as a shallow lake, is crossed by Route 4 East. Route 4 East has 22 waterway crossings including 1 river, 2 connector/ditch features, and 19 intermittent streams. Of these, the following are PWI waters: Zumbro River-Middle Fork, Zumbro River, and one unnamed creek.

Alternative Segment 4C and 4E Rights-of-Way

No PWI rivers, lakes or shallow lakes are crossed by the rights-of-way of either alternative segment. No streams cross the alternative segments.

7.6.4.3.7 Route 4 West

Proposed Route - Route 4 West

No PWI lakes are crossed by Route 4 West. Route 4 West has 37 waterway crossings including 4 rivers, 32 intermittent streams, and one perennial stream. Of these, the following are PWI waters: Zumbro River-Middle Fork, Zumbro River-North Branch Middle Fork, Plum Creek, Harkcom Creek, Zumbro River-South Branch Middle Fork, Zumbro River, and one unnamed creek.

Right-of-Way

No PWI lakes are crossed by Route 4 West. Route 4 West has 26 waterway crossings including 4 rivers, and 22 intermittent streams. Of these, the following are PWI waters: Zumbro River-Middle Fork, Zumbro River-North Branch Middle Fork, Zumbro River-South Branch Middle Fork, Zumbro River, and one unnamed creek.

Alternative Segments 4M and 4R Right-of-Way

No PWI rivers, lakes or shallow lakes are crossed by the alternative segments. One unnamed intermittent stream crosses Alternative Segment 4R.

Connector Segment 4Q Right-of-Way

No PWI rivers, lakes or shallow lakes are crossed by the route segment. No streams cross the route segment.

7.6.4.3.8 Lakes, Rivers, Streams, and Ditches: Avoidance and Mitigation of Potential Impacts

The Project will have minor, mostly short-term, effects on surface water resources. The Applicant will design the Project to avoid or minimize impacts to surface water resources to the extent feasible as it will span surface water resources and floodplains where practicable and minimize the number of structures in surface water resources where these resources cannot be spanned. The Applicant will work with the MnDNR to ensure all proper licenses and approvals are obtained for PWI crossings by the

Project. Through the license approval process, the Applicant and the MnDNR will determine the appropriate mitigation measures for PWI crossings.

Indirect impacts to waters within the Study Area could include sedimentation during construction due to ground disturbance by excavation, grading, construction traffic, and dewatering of holes drilled for transmission structures. This could temporarily degrade water quality by causing turbidity. These impacts will be avoided and minimized using appropriate sediment control and construction practices. These practices will be detailed in the NPDES permit[126] and SWPPP that will be completed prior to the start of construction. Additionally, the Applicant will seek Section 401 certification from the MPCA to certify the proposed Project will not violate any MPCA water quality standards. Once the Project is completed, there will be no significant impact on surface water quality because impacts will be minimized and mitigated, disturbed soil will be restored to previous conditions or better, and the amount of land area converted to an impervious surface will be small.

The Applicant will maintain water and soil conservation practices during construction and operation of the Project to protect topsoil and adjacent water resources and minimize soil erosion. Construction will be completed according to NPDES permit requirements and an approved AIMP and VMP.

Watercourses will only be crossed by construction equipment where required to support construction activities. Additionally, the Applicant will obtain crossing permits and consult with the appropriate local state, and or federal agencies, as necessary. Where watercourses must be crossed to string new conductors and shield wires, workers may walk across, use boats, or drive equipment across ice in the winter. These construction practices will help to prevent soil erosion and reduce the likelihood for impacts to water quality from leaking fuels and lubricants.

[126] Environmental Protection Agency. 2023. Minnesota NPDES Permits. Accessed from: https://www.epa.gov/npdes-permits/minnesota-npdes-permits.

An NPDES permit from the MPCA will be obtained by the Applicant for construction of the Project. The Applicant will also develop a SWPPP[127] that complies with MPCA rules and guidelines. All waterways crossed would be maintained for proper drainage through the use of temporary culverts or other temporary crossing devices, according to BMPs and permit requirements. If tree removal is required along waterways, trees would be cut, leaving the root systems intact to retain bank stability. Sediment barriers, if deemed necessary, would be used along waterways and slopes during construction to protect from soil erosion and sedimentation. Additionally, if new access roads for vehicles and equipment are required, access roads would be selected to avoid disturbances to stream banks. No permanent impacts to surface water resources are anticipated.

7.6.4.4 Water Quality

Under CWA Section 303(d), Minnesota is required to establish basic standards for regulating water quality and develop a list of waters for which current regulations are not stringent enough to meet the state water quality standards,[128] specified as "Impaired Waters," and listed in the MPCA Inventory of Impaired Waters. Impairments to water quality are typically caused by an influx of pollutants due to unsustainable agricultural activities, urban runoff, municipal sources, and hydrologic modifications. Under the CWA, Minnesota must develop Total Maximum Daily Loads (TMDLs) for these waters, which includes the maximum concentration of pollutants that can be present in impaired waters and set goals to restore water quality standards. Additionally, under Section 401 of the CWA, the MPCA has the authority to require projects that discharge to jurisdictional waters, to obtain a Water Quality Certification and comply with state and federal water quality regulations.

A NPDES permit is required for projects that could influence surface waters and requires the Applicant to design and maintain effect erosion and sediment controls, stabilize disturbed areas, and prohibit or mitigate dewatering discharge, which would

[127] Minnesota Pollution Control Agency. 2023. Minnesota Stormwater Manual, Stormwater Pollution Prevention Plan (SWPPP). Accessed from: https://stormwater.pca.state.mn.us/index.php?title=Stormwater_pollution_prevention_plan_(SWPPP).

[128] Minnesota Pollution Control Agency. 2023. Water Quality Standards. Accessed from: https://www.pca.state.mn.us/business-with-us/water-quality-standards.

prevent impacts to Impaired Waters. An NPDES permit is required for construction activity disturbing one acre or more of land or for disturbing land under one acre that is part of a common plan of development or sale. Additionally, in accordance with Section 23.1 of MNR100001, construction projects that could impact Impaired Waters must develop a Storm Water Pollution Prevention Plan (SWPPP) for construction activities.

Table 7-57 through **Table 7-59** summarize waterbodies listed by the MPCA Inventory of Impaired Waters and crossed by the route options, including number of crossings and impairments. See detailed maps for waterbody crossings (**Appendix K**).[129]

Table 7-57
Impaired Waterbodies Crossed by Route Option 1 Proposed Routes

Waterbody Name	Impairment	Route 1 North (no. of crossings)		Route 1 South (no. of crossings)	
		Proposed Route	ROW	Proposed Route	ROW
Minnesota River	Fecal coliform, mercury in fish tissue, mercury in water column, turbidity	1	0	0	0
Cannon River	Dissolved oxygen, E. coli, invertebrate biology	2	2	0	0
Waterville Creek	E. coli, fish bioassessment, invert bioassessment	0	0	2	2
MacKenzie Creek	E. coli, invertebrate bioassessments	2	9	1	1
Devil Creek	E. coli, invertebrate bioassessments	1	1	0	0
Unnamed Creek (07040002-702)	Dissolved oxygen, E. coli	1	1	0	0
Unnamed Creek (07040002-705)	E. coli, fish bioassessments	0	0	1	1
Whitewater Creek	E. coli, invertebrate bioassessments	0	0	1	2
Eagle (North) Lake	Nutrients	1	0	1	1
Tetonka Lake	Mercury in fish tissue, nutrients	1	1	0	0
Cannon Lake	Mercury in fish tissue, nutrients	1	0	0	0

[129] Minnesota Pollution Control Agency. 2023. Minnesota's Impaired Waters List. Accessed from: https://www.pca.state.mn.us/air-water-land-climate/minnesotas-impaired-waters-list.

Waterbody Name	Impairment	Route 1 North (no. of crossings)		Route 1 South (no. of crossings)	
		Proposed Route	ROW	Proposed Route	ROW
Lower Sakatah Lake	Mercury in fish tissue, nutrients	1	0	0	0

Source: Minnesota Pollution Control Agency, 2022

As shown in the table above, the ROW for Route Option 1 North crosses 14 impaired waterbodies. In comparison, the ROW for Route Option 1 South crosses 7 impaired waterbodies. Alternative Segments IG and IH and IL do not cross any impaired waterbodies. Connector Segment 1O does not cross any impaired waterbodies.

Table 7-58
Impaired Waterbodies Crossed by Route Option 2 Proposed Routes

Waterbody Name	Impairment	Route 2 North (no. of crossings)		Route 2 South (no. of crossings)	
		Proposed Route	ROW	Proposed Route	ROW
Straight River	Fecal coliform, invertebrate biology, turbidity	1	1	1	0
Shingle Creek	Invertebrate bioassessments	1	1	0	0
Unnamed Creek (07040004-579)	Invertebrate bioassessments	1	1	0	0
Zumbro River, North Fork	E. coli, Invertebrate bioassessments, turbidity	1	1	0	0

Source: Minnesota Pollution Control Agency, 2022

As shown in the table above, the ROW for Route Option 2 North crosses 4 impaired waterbodies. In comparison, the ROW for Route Option 2 South does not cross any impaired waterbodies. Connector Segment 2G does not cross any impaired waterbodies.

Route Option 3 includes three crossings of impaired waterbodies, crossed by both the Proposed Route and the ROW. There are the Mississippi River (aluminum, mercury in fish tissue, PCB in fish tissue, sulfate), Zumbro River (fecal coliform, mercury in fish tissue, PCB in fish tissue, turbidity), and Zumbro Lake (Mercury in fish tissue, nutrients).

Table 7-59
Impaired Waterbodies Crossed by Route Option 4 Proposed Routes

Waterbody Name	Impairment	Route 4 East (no. of crossings)		Route 4 West (no. of crossings)	
		Proposed Route	ROW	Proposed Route	ROW
Zumbro River, South Fork	Fecal coliform, invertebrate bioassessments, turbidity	1	1	1	1
Zumbro River, Middle Fork	E. coli	2	1	0	0
Zumbro River, Middle Fork, South Branch	E. coli	1	1	1	1
Zumbro River, Middle Fork	E. coli, Turbidity	0	0	1	1

Source: Minnesota Pollution Control Agency, 2022

In Segment 4, Route Option 4 East crosses 3 impaired waterbodies, with the Proposed Route crossing the Zumbro River, Middle Fork twice. Route Option 4 West also crosses 3 impaired water bodies. Connector Segment 4Q and Alternative Segments 4C, 4E, 4M, and 4R do not cross any impaired waterbodies.

Under the CWA, states have the primary responsibility for establishing, reviewing, and revising water quality standards, which consist of the designated uses of a waterbody, the numerical values or narrative water quality criteria necessary to protect those designated uses, and an antidegradation policy (40 CFR §§ 131.10 - 131.12 and 131.4).

The MPCA is the agency charged with classifying waterbodies in Minnesota. Consistent with the requirements of the CWA, the MPCA has established water quality standards, including the identification of beneficial uses of the state's waters, numeric standards and narrative criteria, and non-degradation protections for high-quality or unique waters. Minnesota advances the CWA's presumption that a waterbody should attain healthy aquatic life and recreation uses and groups the waters of the state into one or more of the following seven designated use classifications per Minn. R. 7050.0140:

- Class 1 waters, domestic consumption
- Class 2 waters, aquatic life and recreation

- Class 3 waters, industrial consumption
- Class 4 waters, agriculture and wildlife
- Class 5 waters, aesthetic enjoyment and navigation
- Class 6 waters, other uses and protection of border waters
- Class 7 waters, limited resource value waters

Section 401 of the CWA grants state agencies the authority to require projects that discharge to jurisdictional waters, to obtain a Water Quality Certification and comply with state and federal water quality regulations. The MPCA is granted the authority to implement Section 401 regulations.

The impaired streams and lakes within the Project are classified in Minn. R. 7050.0470 as a Class 2B(g) (warm water habitat, beneficial uses are aquatic life and recreation) waterbody. As unnamed tributaries and ephemeral drainages, the other waterbodies crossed by the Project are defined by default in Minn. R. 7050.0430 as Class 2B (aquatic warm water community), 3C (industrial consumption), 4A (irrigation), 4B (livestock and wildlife), 5 (aesthetic enjoyment and navigation), and 6 (other uses) waters.

Minnesota designates some surface waters as outstanding resource value waters (ORVWs) because of their exceptional qualities.[130] As specified in Minnesota Rules, wild, scenic, and recreational river segments comprise a part of the definition of ORVWs. The Cannon River was added to Minnesota's Wild & Scenic Rivers Program in 1984; however, the designated stretch does not extend into the Project Study Area.

Several lakes in the vicinity of the Project have been identified as a Lake of Biological Significance. Lakes of Biological Significance are ranked based on unique plant and animal presence. Two lakes ranked as Outstanding within the vicinity of the Project Study Area include Lily Lake and Mississippi River-U.S. Lock and Dam #5 Pool. A lake ranked High included Fish Lake. Three lakes ranked Moderate include Tetonka Lake, Eagle Lake, and Madison Lake. According to the MnDNR, it is important that effective erosion prevention and sediment control practices be implemented and maintained near

[130] Minnesota Pollution Control Agency. 2023. Outstanding Resource Value Waters. Accessed from: https://www.arcgis.com/home/item.html?id=8358fe79d8e14403a28fe3451aa7f48b.

lakes throughout the Project. Indirect impacts such as the introduction or spread of invasive species should also be considered and minimized.

7.6.4.4.1 Water Quality: Avoidance and Mitigation of Potential Impacts

The construction of the Project could impact water quality. Short-term, minor, Project-related water quality impacts may occur during the construction of the Project even though mitigation measures will be implemented to prevent sedimentation. These impacts would result from soils disturbed during construction being washed by stormwater into adjacent waters during rainstorm events. Increased turbidity and localized sedimentation of the stream bottom may occur from the runoff. If any of these events occur, however, these impacts would be temporary and would not significantly alter water quality conditions due to the minimal soil disturbance that is expected to occur in any one location during construction of the Project.

The Applicant will apply for an NPDES permit from the MPCA and will develop a SWPPP that will identify BMPs to be implemented during construction to minimize erosion and sedimentation impacts to impaired surface waters. Erosion and sedimentation abatement measures, for example, would be employed to decrease impacts to the hydrology of the Project Study Area. No fueling or maintenance of vehicles or application of herbicides would occur within 100 feet of streams, ditches, and waterways to protect against introduction of these materials into surface or groundwater systems. Materials such as fuels, lubricants, paints, and solvents required for construction would be stored away from surface water resources according to appropriate regulatory standards. Any spills or leaks would be cleaned up immediately and leaking equipment removed from the area for proper maintenance.

7.6.4.5 Groundwater

Minnesota is divided into six groundwater provinces,[131] which are distinguished by the thickness, lateral extent, permeability, and porosity of the underlying bedrock. Aquifers

[131] Minnesota Department of Natural Resources. 2021. Minnesota Groundwater Provinces 2021. Accessed from: https://www.dnr.state.mn.us/waters/groundwater_section/mapping/provinces.html.

within these provinces include bedrock and unconsolidated sediments such as clay, sand, and gravel that allow for lateral and vertical water movement within and between the component layers of the aquifer. Three groundwater provinces,[132] the East-Central, South-Central and Karst provinces, are a source of water for the Project area (MNDNR 2021). The East-Central province includes the eastern portion of Wabasha County and is characterized by buried sand aquifers and relatively extensive superficial sand plains and is underlain by sedimentary bedrock with good aquifer properties. The South-Central province includes the counties of Blue Earth, Le Sueur, Waseca, Rice, Steele, Dodge, and Goodhue, and is demarcated by thick loam and clay loam glacial sediment overlying thick, extensive sandstone, and carbonate aquifers. The Karst province includes the counties of Rice, Goodhue, Dodge, Olmsted, Wabasha, and a small portion of northern Blue Earth, and is defined by thin glacial sediment overlying thick carbonate and sandstone bedrock prone to conduits, sinkholes, and caves. Karst features within the Proposed Route are described in detail in Section 7.8.2 and depicted on the detailed route maps (**Appendix K**).

The EPA defines a Sole Source Aquifer (SSA)[133] as an aquifer that supplies at least 50% of the drinking water consumed in an area. Localities within the range of these aquifers have limited options for drinking water supplies apart from the SSA,[134] and if the SSA is contaminated, it could create a significant hazard to public health (EPA 2022). No SSAs have been identified within the study area.[135]

Under the Safe Drinking Water Act, Minnesota lists Wellhead Protection Areas (WHPAs) where contaminants have the potential to infiltrate and pollute groundwater sources. WHPAs for public and community water-supply wells are delineated based on existing groundwater flow models or by using calculations based on a projected 10-year water demand, the effective porosity of the associated aquifer, and the length of the

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[132] *Id.*

[133] Environmental Protection Agency. 2023a. Map of Sole Source Aquifer Locations. Accessed from: https://www.epa.gov/dwssa/map-sole-source-aquifer-locations.

[134] Minnesota Department of Health. 2023. Source Water Protection Web Map Viewer. Accessed from: https://www.health.state.mn.us/communities/environment/water/swp/mapviewer.html.

[135] Environmental Protection Agency. 2022. Overview of the Drinking Water Sole Source Aquifer Program. Obtained from https://www.epa.gov/dwssa/overview-drinking-water-sole-source-aquifer-program.

proposed well screen (MDH 2021). A search for WHPAs in the MDH database indicated that the route crosses four WHPAs including Oronoco, Wanamingo, Madison Lake, and Pine Island.

The Minnesota County Well Index (CWI),[136] maintained by the Minnesota Geological Survey (MGS) in cooperation with MDH, provides a complete, up-to-date list of well locations in Minnesota. A search of the 2022 CWI index found 248 wells[137] within the Proposed Routes of the Project, 16 of which are water supply wells located within the Proposed Right-of-Way, identified in **Table 7-60**. An additional 10 water supply wells were identified in the right-of-way of Alternative Segment 1L.

Table 7-60
Water Supply Wells Within Proposed Right-of-Way[138]

Well Name	Well Number	Depth (Drilled)	Route Option
Unnamed	00256061	171	4 East
BEN HERING 2 (DNR 40000)	00213648	445	1 South
BEN HERING 3 (DNT 40004)	00215782	861	1 South
BG-19	00213490	180	Alternative Segment 1L
GOLDBERG EAST W-1	00672703	149	4 West
HAND, VERN MO-34	00213674	445	Alternative Segment 1L
HAND, VERN 1	00213684	1144	Alternative Segment 1L
HAND, VERN 2	00213685	503	Alternative Segment 1L
I-6	00215528	300	Alternative Segment 1L
JIM BOYLE	00213059	150	1 South
JOSEPH DAVISON I-11	00213183	485	Alternative Segment 1L
LOVE, GRAFTON F.	00220903	282	4 East

[136] Minnesota Department of Health. 2023. Minnesota Well Index (MWI). Accessed from: https://www.health.state.mn.us/communities/environment/water/mwi/index.html.

[137] *Id*. Minnesota Geological Survey. 2022. CWI Non-Public Supply Wells FTP Access. Accessed from: https://mgs-gispub.mngs.umn.edu/cwi/mgs-cwi-ftp-access-instructions.pdf.

[138] Minnesota Geological Survey. 2022. CWI Non-Public Supply Wells FTP Access. Accessed from: https://mgs-gispub.mngs.umn.edu/cwi/mgs-cwi-ftp-access-instructions.pdf.

Well Name	Well Number	Depth (Drilled)	Route Option
MAHLON GRUBISH G-3	00212966	1016	Alternative Segment 1L
MAHLON GRUBISH G-4	00212967	857	Alternative Segment 1L
MORRISTOWN 2 MO-2	00213652	140	1 South
MORRISTOWN 3 MO-3	00213653	200	Alternative Segment 1L
MORRISTOWN 9 MO-9	00213658	220	1 South
R & D DEVELOPMENT	00601271	347	4 East
RAYGOR, JOEL	00187604	380	4 East
REMUND, KEVIN K.	00529964	202	1 South
RIESS, HERBERT	1000011183	160	4 East
RUCKER, WANDA	1000011200	100	4 East
SCHMIDT, DON	00105462	354	4 East
STRUCK, EMMA	1000011189	150	4 East
WATER TEST HOLE NO. 5	00213554	200	Alternative Segment 1L
WILLIAM SCOTT	1000010624	375	4 East

7.6.4.5.1 Groundwater: Avoidance and Mitigation of Potential Impacts

The construction and operation of the transmission line has the potential to impact groundwater through temporary construction-related impacts and/or long-term impacts, but is not anticipated to adversely impact groundwater resources on any route option, alternative segment, or connector segment. Foundation materials would range from 25 feet to 60 feet deep, and wells in the area range from 100 feet to 1,115 feet deep. As depths of wells will be greater than structure foundations, the Project should not impact groundwater resources. Any impacts to groundwater resources would be localized, short-term, and would not affect any underlying aquifer. The Applicant will conduct geotechnical investigations of the Project area to identify shallow depth to aquifer areas and will continue to work with landowners to identify springs and wells near the proposed Project. If shallow depth aquifer areas are discovered, the Applicant will use specialty structures that require wider, shallower excavation areas to avoid impacts to groundwater resources.

7.6.4.6 Wetlands

Wetlands are unique ecosystems that provide numerous beneficial ecological services that include improving water quality, storing floodwaters, providing wildlife habitat, and controlling shoreline erosion.[139] In the United States, wetlands are protected under Section 404 of CWA, jurisdictionally determined by the United States Army Corps of Engineers (USACE). Wetlands are typically classified using the Cowardin System of Classification, which defines wetlands by a series of traits related to geomorphic setting, water source, and hydrodynamics.[140]

According to the USACE regional wetland designations,[141] the Project is located within the Midwest region. This region is characterized by flat to rolling topography, moderate to abundant rainfall, and fertile soils that support the production of agriculture and livestock.

The Project Study Area contains approximately 32,260 acres of wetlands, comprising of approximately 10 percent of the Study Area.[142] The Proposed Routes include about 2,380 acres of wetlands and the rights-of-way encompass approximately 332 acres of wetlands. Wetlands are depicted on the detailed route maps (**Appendix K**) The majority of the wetlands are classified as shallow open water wetlands, seasonally flooded wetlands, shallow marshes, or wooded swamps (**Table 7-61**).

Table 7-61
National Inventory Wetlands located within the Proposed Routes and ROW

Cowardin Class.[1]	Circular 39 Class.[2]	Wetland Type	Proposed Route	ROW

[139] Environmental Protection Agency. 2023b. Why are Wetlands Important? Accessed from Why are Wetlands Important? | US EPA.

[140] *Id.*

[141] United States Army Corps of Engineers. 2023. Regional Supplements to Corps Delineation Manual. Accessed from: https://www.usace.army.mil/Missions/Civil-Works/Regulatory-Program-and-Permits/reg_supp/.

[142] United States Fish and Wildlife Service. 2023. National Wetlands Inventory. Accessed from: https://www.fws.gov/program/national-wetlands-inventory.

PEMA, PUS, PFOA	1-PEM	Seasonally Flooded Wetlands	830.97	135.61
PEMB, PSSB	2-PEM	Wet Meadows (including Calcareous Fens)	105.71	11.13
PEMC and F, PSSH, PUBA and C	3-PUM	Shallow Marshes	503.85	78.37
L2ABF, L2EMF and G, L2US, PABF and G, PEMG and H, PUBB and F	4-PUB	Deep Marshes	52.24	6.91
L1; L2ABG and H; L2EMA, B, and H; L2RS; L2UB; PABH; PUBG and H	5-PUB	Shallow Open Water	132.33	7.96
PSSA, C, F, and G; PSS1, 5, and 6B	6-PSS	Shrub Swamp	191.46	26.87
PFO1, 5, and 6B; PFOC and F	7-PFO	Wooded Swamp	355.90	41.21
PF02, 4, and 7B; PSS2, 3, 4, and 7B	8-PFO	Bogs	0.00	0.00
	NA	Riverine	205.39	30.28
TOTAL			2,377.32	332.13

Source: Minnesota Department of Natural Resources, 2023

7.6.4.6.1 Segment 1

As shown in **Table 7-62** below, the Proposed Route of Route Option 1 North crosses 705.21 total acres of wetland and Proposed Route of Route Option 1 South crosses 645.04 total acres of wetland. The Route Option 1 North ROW crosses 110.98 total acres of wetland and Route Option 1 South ROW crosses 92.72 total acres of wetland. The majority of wetlands crossed by Route Option 1 North and Route Option 1 South are emergent. Alternative Segment 1L ROW crosses 6.62 total acres of wetland (0.55 acres riverine, 3.70 acres Type 1, 1.63 acres Type 3, 0.22 acres Type 4, 0.50 acres Type 7). In addition to the wetlands crossed by the Proposed Routes, the expansion of the Wilmarth Substation is located within 0.53 acre of emergent wetlands.

Table 7-62
National Inventory Wetlands Crossed by Route Option 1 Proposed Routes

Circular 39 Class.[2]	Wetland Type	Route 1 North (acres)		Route 1 South (acres)	
		Proposed Route	ROW	Proposed Route	ROW
1-PEM	Seasonally Flooded Wetlands	253.51	46.82	283.20	42.60
2-PEM	Wet Meadows (including Calcareous Fens)	9.78	2.31	9.10	2.00
3-PEM	Shallow Marshes	212.00	35.38	166.36	24.03
4-PUB	Deep Marshes	16.38	3.62	16.38	0.58
5-PUB	Shallow Open Water	62.92	3.10	38.24	0.83
6-PSS	Shrub Swamp	44.68	5.84	36.43	6.13

Circular 39 Class.[2]	Wetland Type	Route 1 North (acres)		Route 1 South (acres)	
		Proposed Route	ROW	Proposed Route	ROW
7-PFO	Wooded Swamp	80.22	9.13	78.68	11.33
8-PFO	Bogs	NA	NA	NA	NA
NA	Riverine	25.68	4.74	16.62	4.36
Total Acres		705.21	110.98	645.04	92.72

Source: Minnesota Department of Natural Resources, 2023

7.6.4.6.2 Segment 2

As shown in **Table 7-63** below, the Proposed Route of Route Option 2 North crosses 252.54 acres of wetland and Proposed Route of Route Option 2 South crosses 220.91 acres of wetland. The Route Option 2 North ROW crosses 35.25 acres of wetland and Route Option 2 South ROW crosses 38.06 acres of wetland. The majority of wetlands crossed by Route Option 2 North and Route Option 2 South are emergent. Connector Segment 2G ROW crosses 1.23 acres of wetland (0.83 acres Type 1, 0.36 acres Type 3, and 0.03 acres riverine).

Table 7-63
National Inventory Wetlands Crossed by Route Option 2 Proposed Routes

Circular 39 Class.[2]	Wetland Type	Route 2 North (acres)		Route 2 South (acres)	
		Proposed Route	ROW	Proposed Route	ROW
1-PEM	Seasonally Flooded Wetlands	161.33	21.62	91.09	16.06
2-PEM	Wet Meadows (including Calcareous Fens)	NA	2.31	NA	NA
3-PEM	Shallow Marshes	14.53	0.21	48.75	6.64
4-PUB	Deep Marshes	2.94	0.21	4.29	NA
5-PUB	Shallow Open Water	2.39	0.27	0.17	NA
6-PSS	Shrub Swamp	10.75	3.02	34.76	10.34
7-PFO	Wooded Swamp	25.70	3.06	17.56	2.41
8-PFO	Bogs	NA	NA	NA	NA
NA	Riverine	34.88	4.75	24.27	2.59
Total Acres		252.54	35.25	220.91	38.06

Source: Minnesota Department of Natural Resources, 2023

7.6.4.6.3 Segment 3

As shown in **Table 7-64** below, the Proposed Route for Route 3 crosses 418.57 acres of wetland whereas the ROW crosses 62.76 acres. The majority of wetlands crossed by Route 3 are emergent. Segment 3 occurs within an existing ROW cleared of tall-growing vegetation and no longer supports forested land cover types. Any PFO wetlands listed within the ROW in Table 7-64 would have been converted to PEM wetlands during construction of the existing transmission line.

Table 7-64
National Inventory Wetlands Crossed by Route Option 3 Proposed Route

Circular 39 Class.[2]	Wetland Type	Route 3 (acres)	
		Proposed Route	ROW
1-PEM	Seasonally Flooded Wetlands	54.82	11.44
2-PEM	Wet Meadows (including Calcareous Fens)	13.38	0.84
3-PEM	Shallow Marshes	100.67	20.95
4-PUB	Deep Marshes	8.04	1.48
5-PUB	Shallow Open Water	16.42	2.78
6-PSS	Shrub Swamp	79.11	6.38
7-PFO	Wooded Swamp	88.53	9.91[a]
8-PFO	Bogs	NA	NA
NA	Riverine	57.57	8.96
Total Acres		418.57	62.76

[a] PFO wetlands are not supported within the existing cleared ROW for Route 3.

7.6.4.6.4 Segment 4

As shown in **Table 7-65** below, the Proposed Route for Route Option 4 East crosses 123.39 acres of wetland, and the Proposed Route for Route Option 4 West crosses 184.32 acres of wetland. The ROW of Route Option 4 East crosses 9.97 acres of wetland, and the Route Option 4 West ROW crosses 18.89 acres of wetland. The majority of wetlands crossed by both routes are emergent.

The Alternative Segment 4C ROW crosses 0.05 acres of riverine wetland, Alternative Segment 4E ROW crosses 0.14 acres of riverine wetland, Alternative Segment 4M

ROW crosses 1.54 acres of wetland (0.02 acres riverine wetland, 0.13 acres of Type 1, 1.15 acres Type 2, and 0.23 acres of Type 7), Alternative Segment 4R ROW crosses 0.47 acres of Type 2 wetland, and Connector Segment 4Q ROW crosses 0 acres of wetland.

Table 7-65
National Inventory Wetlands Crossed by Route Option 4 Proposed Routes

Circular 39 Class.[2]	Wetland Type	Route 4 East (acres)		Route 4 West (acres)	
		Proposed Route	ROW	Proposed Route	ROW
1-PEM	Seasonally Flooded Wetlands	12.75	1.53	17.19	1.51
2-PEM	Wet Meadows (including Calcareous Fens)	16.99	1.58	57.10	3.84
3-PEM	Shallow Marshes	17.12	1.76	3.28	0.25
4-PUB	Deep Marshes	17.12	1,78	0.62	NA
5-PUB	Shallow Open Water	3.12	0.77	0.40	NA
6-PSS	Shrub Swamp	3.03	1.81	6.36	1.46
7-PFO	Wooded Swamp	15.76	0.09	74.43	9.07
8-PFO	Bogs	NA	NA	NA	NA
NA	Riverine	20.15	0.61	24.91	2.73
Total Acres		123.39	9.97	184.32	18.89

Source: Minnesota Department of Natural Resources, 2023

7.6.4.6.5 Wetlands: Avoidance and Mitigation of Potential Impacts

Temporary impacts to wetlands may occur if they need to be crossed during construction of the transmission line. No staging or pulling and stringing sites will be placed within or adjacent to water resources, to the extent feasible. The Applicant will avoid major disturbance of individual wetlands and drainage systems during construction to the extent feasible. This will be done by spanning wetlands and drainage systems, where possible. Construction of the expansion of the Wilmarth Substation will permanently impact approximately 0.53 acre of emergent wetlands. The Applicant will consult with the applicable state and federal agencies to obtain wetland permits for the Project.

The Applicant will follow standard erosion control measures identified in the MPCA's Stormwater Best Management Practices Manual, such as using silt fencing to minimize impacts to adjacent water resources. In addition, construction will be completed according to NPDES permit requirements and an approved AIMP and VMP.

If impacts to wetlands occur, they will be minimized through construction practices. Construction crews will maintain water and soil conservation practices during construction and operation of the facilities to protect topsoil and adjacent water resources and minimize soil erosion. Practices may include containing excavated material, protecting exposed soil, and stabilizing restored soil.

Crews will avoid major disturbance of individual wetlands and drainage systems during construction. This will be accomplished by strategically locating new access roads and spanning wetlands and drainage systems where possible. When it is not feasible to span the wetland, construction crews will rely on several options during construction to minimize impacts:

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

7.6.4.7 Calcareous Fens

Calcareous fens are a rare, unique type of wetland that contain a substrate of non-acidic peat and are steadily fed with alkaline and oxygen-poor groundwater. Calcareous fens are fragile and highly susceptible to disturbance through construction activities and disruptions to water supply. Calcareous fens are found in western Minnesota and along limestone-dominated karst topography in the southeast. According to the MNDNR's Identification List of Known Calcareous Fens, there are six known calcareous fens located within 5 miles of the Proposed Routes. One calcareous fen is located on the western side of the Project area (Lime 30 [Fen ID: 38219]) approximately 0.7 mile from the Wilmarth Substation. The remaining five calcareous fens are on the eastern side of the Project area, one of which (McCarthy Lake [Fen ID: 31975]) is located within 160 ft of the Segment 3 Proposed Route. Four calcareous fens, Haverhill 19 (Fen ID: 46597), Holden 1 West (Fen ID: 13336), Kasota 7 (Fen ID: 45805), and Wanamingo 22 (Fen ID: 29012) are mapped within 5 miles of the Segment 3 Proposed Route.[143]

7.6.4.7.1 Calcareous Fens: Avoidance and Mitigation of Potential Impacts

No calcareous fens are crossed by the Proposed Routes. The closest calcareous fen is McCarthy Lake (Fen ID: 31975) which is approximately 160 feet from the edge of the Route Option 3 Proposed Route and 500 feet from the edge of the right-of-way. No additional deep excavation or other subsurface disturbance that might affect groundwater flow to the McCarthy Lake calcareous fen is necessary within Route Option 3. No impacts on calcareous fens are anticipated as part of the Project.

7.6.4.8 Special Designated Watercourses

The Wild and Scenic Rivers Act of 1968 (16 U.S.C. 1271-1287) is a federal law that was enacted to preserve rivers with outstanding ecological, cultural, and recreational values. Wild and Scenic Rivers are designated as wild, scenic, or recreational river areas. Wild river areas include primitive rivers free of impoundments and inaccessible except by trail, scenic river areas include primitive rivers free of impoundments but accessible by road or railroad, and recreational rivers include recreationally important rivers that may have been developed in the past. Designated rivers are administered with the goal of protecting and preserving values that were the cause of the original designation. Protection of Wild and Scenic Rivers is achieved through regulations and programs of federal, state, local, and tribal governments, and voluntary stewardship.

[143] Minnesota Department of Natural Resources. 2023. Calcareous Fens. Accessed from: https://files.dnr.state.mn.us/natural_resources/water/wetlands/calcareous_fen_fact_sheet.pdf.

The MNDNR also applies protections to streams that have quality trout habitat. These streams, called trout streams, require more stringent levels of permitting for those seeking to acquire permits for in-stream work.

Three Wild and Scenic Recreational River segments, Minnesota River, Cannon River, and Mississippi River, are mapped within the Project Study Area. Thirty-three MNDNR trout streams[144] occur in the Project Study Area, all of which are crossed by Route Option 3, and are listed below in **Table 7-66**.

Table 7-66
MNDNR Trout Streams in Project Study Area

Label	Route Segment	Designated Trout Stream Type
Unnamed Creek (M-032.5-009)	3	Tributary
Unnamed Creek (M-032-029)	3	Tributary
Unnamed Creek (M-032-025)	3	Tributary
Unnamed Creek (M-032-031)	3	Stream
Unnamed Creek (M-032-015)	3	Tributary
Unnamed Creek (M-032.5-005)	3	Tributary
Unnamed Creek (M-032.5-008)	3	Tributary
Unnamed Creek (M-032-022)	3	Tributary
Unnamed Creek (M-032.5-007)	3	Tributary
Unnamed Creek (M-032-015-005)	3	Tributary
Unnamed Creek (M-032-031-001)	3	Tributary
Unnamed Creek (M-032.5-002)	3	Tributary
Unnamed Creek (M-032-015-004)	3	Tributary
Unnamed Creek (M-032.5-006)	3	Tributary
Unnamed Creek (M-032.5-004.4)	3	Tributary
Unnamed Creek (M-032.5-005.3)	3	Tributary
Snake Creek (M-032.5)	3	Tributary
Unnamed Creek (M-032.5-004.5)	3	Tributary
Unnamed Creek (M-032-020)	3	Tributary
Unnamed Creek (M-032.5-002-001)	3	Tributary
Unnamed Creek (M-032-016)	3	Tributary

[144] Minnesota Department of Natural Resources. 2023. Trout Fishing Streams and Lakes. Accessed from: https://www.dnr.state.mn.us/fishing/trout/map.html.

Label	Route Segment	Designated Trout Stream Type
Snake Creek (M-032.5)	3	Stream
Unnamed Creek (M-032.5-004.6)	3	Tributary
Unnamed Creek (M-032.5-004.95)	3	Tributary
Unnamed Creek (M-032-030)	3	Tributary
East Indian Creek (M-032)	3	Tributary
East Indian Creek (M-032)	3	Stream
Unnamed Creek (M-032.5-005.5)	3	Tributary
Unnamed Creek (M-032-015-003)	3	Tributary
Unnamed Creek (M-032.5-004.7)	3	Tributary
Unnamed Creek (M-032-031)	3	Tributary
Unnamed Creek (M-032-027)	3	Tributary
Unnamed Creek (M-032-028)	3	Tributary

Source: Minnesota Department of Natural Resources, updated May 14, 2020

No additional impacts to special designated waters have been identified within the other Route Options, alternative route segments, or connector segments.

7.6.4.8.1 Special Designated Watercourses: Avoidance and Mitigation of Potential Impacts

All waterbodies will be spanned during construction. Watercourses will only be crossed by construction equipment where required to support construction activities and the Applicant will obtain crossing permits and consult with the appropriate local state, and or federal agencies, as necessary.

7.6.4.9 Infested Waters

Infested waters are lakes, rivers, ponds, or wetlands that contain aquatic invasive species, regulated under Minnesota Rules, Chapter 6216.[145] The MNDNR will add a watercourse to the infested waters list if it contains an aquatic invasive species that could spread to other waters or if the watercourse is connected to a body of water where

[145] Minnesota Department of Natural Resources. 2023. Infested Waters List. Accessed from: https://www.dnr.state.mn.us/invasives/ais/infested.html.

invasive species are present. A watercourse is listed as an infested water if it contains invasive plants, animals, or diseases including:

- Zebra mussel (Dreissena polymorpha),
- White perch (Morone americana),
- Common carp (Cyprinus carpio),
- Chinese mystery snail (Cipangopaludina chinensis),
- Starry stonewort (Nitellopsis obtuse),
- Eurasian watermilfoil (Myriophyllum spicatum),
- Brittle naiad (Najas minor),
- Viral Hemorrhagic Septicemia Virus (VHSV),
- Spring Viremia of Carp (SVC), or
- Other species listed by the MNDNR.

Activities within Infested Waters are regulated to prevent the spread of aquatic invasive species. The current Infested Waters list was updated on August 4, 2023, by the MNDNR. **Table 7-67** through **Table 7-68** summarize waterbodies classified as Infested Waters listed and crossed by the route options, including number of crossings and infested species. See detailed route maps for waterbody crossings (**Appendix K**).

Table 7-67
Infested Waterbodies Crossed by Route Option 1 Proposed Routes

Waterbody Name	Infested Species and Designation Date	Route 1 North (no. of crossings)		Route 1 South (no. of crossings)	
		Proposed Route	ROW	Proposed Route	ROW
Cannon Lake	flowering rush / 2007	1	0	0	0
Cannon River from Wells Lower Sakatah to the confluence with the Straight River	flowering rush / 2007	1	1	0	0
Eagle Lake (includes North and South Eagle)	Eurasian watermilfoil / 2015	1	1	1	1

Waterbody Name	Infested Species and Designation Date	Route 1 North (no. of crossings)		Route 1 South (no. of crossings)	
		Proposed Route	ROW	Proposed Route	ROW
Sprague Lake	flowering rush / 2014	0	0	1	0
Tetonka Lake	flowering rush / 2009	1	0	0	0
Tetonka Lake	Eurasian watermilfoil/ 2016	1	0	0	0
Minnesota River	Zebra mussel / 2017	1	0	1	0

Source: MN Department of Natural Resources, updated August 4, 2023

As shown in the table above, the ROW for Route Option 1 North crosses 2 infested waters including the Cannon River and Eagle Lake. The ROW for Route Option 1 South ROW crosses the infested Eagle Lake.

No infested waterbodies are crossed by either Route Option 2 North or Route Option 2 South.

Table 7-68
Infested Waterbodies Crossed by Route Option 3 Proposed Routes

Waterbody Name	Infested Species and Designation Date	Route 3 (no. of crossings)	
		Proposed Route	ROW
Zumbro Lake	Zebra mussel / 2000	1	1
Zumbro River downstream of Zumbro, including 500 feet upstream into its tributaries	Zebra mussel / 2000	3	3
Mississippi River, Pool 5	grass carp / 2015	1	1
Mississippi River, Pool 5	Eurasian watermilfoil / 1995	1	1
Mississippi River, Pool 5	bighead carp / 2012	1	1
Mississippi River, Pool 5	silver carp / 2012	1	1
Mississippi River, Pool 5, including 500 feet upstream into its tributaries	zebra mussel / 1995	1	1
Mississippi River, Pool 5	bighead carp / 2012	1	1
Mississippi River, Pool 5	Eurasian watermilfoil / 1995	1	1
Mississippi River, Pool 5	grass carp / 2015	1	1
Mississippi River, Pool 5	silver carp / 2012	1	1
Mississippi River, Pool 5, including 500 feet upstream into its tributaries	zebra mussel / 1995	1	1
Mississippi River - U.S. Lock & Dam #5 Pool (main channel)	faucet snail / 2016	1	1

Waterbody Name	Infested Species and Designation Date	Route 3 (no. of crossings)	
		Proposed Route	ROW
Mississippi River - U.S. Lock & Dam #5 Pool (main channel)	flowering rush / 2020	1	1

Source: MN Department of Natural Resources, updated August 4, 2023

As shown in the table above, the Proposed Route and ROW for Route Option 3 cross various infested waters including Zumbro Lake, Zumbro River, and multiple crossings of Mississippi River U.S. Lock and Dam Pool #5.

No infested waterbodies are crossed by either Route Option 4 East or Route Option 4 West.

7.6.4.9.1 Infested Waters: Avoidance and Mitigation of Potential Impacts

All waterbodies will be spanned during construction. Watercourses will only be crossed by construction equipment where required to support construction activities and the Applicant will obtain crossing permits and consult with the appropriate local state, and or federal agencies, as necessary. See Section 7.6.2.3.8 for additional avoidance and mitigation measures for waterbody crossings. No additional impacts to infested waters have been identified within the alternative route segments or connector segments.

7.6.5 Flora

The Project Study Area is located within the Eastern Broadleaf Forest Province, which is a forested vegetation province that serves as an ecotone between semi-arid prairie of the southwest and semi-humid conifer-deciduous forests of the northwest.[146] Within this province, the Project crosses four ecological subsections including the Big Woods, Oak Savanna, Rochester Plateau, and Blufflands subsections.

The Project crosses the Big Woods subsection in Blue Earth, Le Sueur, and Rice counties. Prior to European contact (1650-1837) and into the early Post-Contact Period

[146] Minnesota Department of Natural Resources. 2023a. Ecological Classification System. Division of Ecological Services, Minnesota Department of Natural Resources. Accessed from: https://www.dnr.state.mn.us/ecs/index.html.

(beginning 1837), this area was characterized by American elm (*Ulmus americana*), sugar maple (*Acer saccharum)*, and northern red oak (*Quercus rubra*).[147] Present day vegetation is dominated by pasture and agricultural land, which make up 74% of the subsection, with the remaining vegetation including interrupted forested areas and scattered wetlands.

The Project crosses the Oak Savanna subsection in Rice, Waseca, and Goodhue counties. Prior to European contact and into the early Post-Contact Period, vegetation was defined by bur oak (*Quercus macrocarpa*) savanna throughout the majority of the subsection, with tallgrass prairie concentrated in the center of the subsection and maple-basswood (*Acer* spp., *Tilia americana*) forest located in steep ravines and along streams.[148] Present day vegetation in this subsection is primarily agricultural, with row crop and pasture making up 92% of modern land use.

The Project crosses the Rochester Plateau subsection in Olmsted, Goodhue, and Wabasha counties. Prior to European contact and into the early Post-Contact Period, these areas were vegetated primarily by bur oak savanna and tallgrass species including big bluestem (*Andropogon gerardi*), little bluestem (*Schizachyrium scoparium*), switchgrass (*Panicum virgatum*), and Indiangrass (*Sorghastrum nutans*).[149] Present day vegetation land cover in this subsection is heavily farmed and dominated by 90% pasture and row crops.

The Project crosses a small area of the Blufflands subsection in Wabasha County. This subsection is characterized by complex landforms including loess-capped plateaus with deeply dissected river valleys that host a range of vegetation types. Prior to European contact and into the early Post-Contact Period, vegetation included tallgrass prairie and bur oak savanna at the tops of ridges, hardwood forests with northern red oak, white oak (*Quercus alba*), shagbark hickory (*Carya ovata*), and basswood along slopes, and floodplain forests dominated by red oak, basswood, and black walnut (*Juglans nigra*)

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[147] Minnesota Department of Natural Resources, 2023. The Big Woods Subsection. Division of Ecological Services, Minnesota Department of Natural Resources. Accessed from: Big Woods Subsection | Minnesota DNR (state.mn.us).

[148] Minnesota Department of Natural Resources, 2023. The Oak Savanna Subsection. Division of Ecological Services, Minnesota Department of Natural Resources. Accessed from: Oak Savanna Subsection | Minnesota DNR (state.mn.us).

[149] Minnesota Department of Natural Resources, 2023. The Rochester Plateau Subsection. Division of Ecological Services, Minnesota Department of Natural Resources. Accessed from: Rochester Plateau Subsection | Minnesota DNR (state.mn.us).

along river valleys.[150] Present day vegetation cover in this subsection is 58% row crop and pasture, and 33% forest. Diverse vegetation and landforms along the eastern portion of this subsection make it important habitat for multiple wildlife species including birds, reptiles, and mollusks.[151]

Agricultural areas within the Project Study Area are dominated by active row crop fields planted with corn, wheat, and other crops (see land use Section 7.2) and are interspersed with forested and grassy wind breaks, scattered woodlots, drainage ditches, and large grassland pastures regularly disturbed by grazing cattle. Suitable habitat for Species in Greatest Conservation Need (SGCN), including special concern, threatened, and endangered plant and animal species, may be present in natural areas surrounding agricultural row crops and within pastures.

7.6.5.1 Flora: Avoidance and Mitigation of Potential Impacts

The acreage of each land cover type crossed by the route options is provided in Section 7.2. Impacts to flora along the Proposed Routes will primarily be associated with right-of-way clearing within rangeland and agricultural areas. Impacts to vegetation within the Proposed Routes will occur where clearing of trees and tall vegetation is required for the construction, maintenance, and safe operation of the transmission line. Impacts to low growing vegetation will be temporary as low growing vegetation will be allowed to grow back following construction. Impacts to tall vegetation within the right-of-way will be permanent as the right-of-way will be mowed and maintained as needed following construction. Permanent removal of vegetation will occur in areas where new structures are proposed. See Section 7.4.1 for a discussion of Impacts and Mitigation to row crops and pasture along the Proposed Routes.

[150] Minnesota Department of Natural Resources, 2023. The Blufflands Subsection. Division of Ecological Services, Minnesota Department of Natural Resources. Accessed from: The Blufflands Subsection | Minnesota DNR (state.mn.us).

[151] Minnesota Department of Natural Resources, 2006. Tomorrow's Habitat for the Wild and Rare: An Action Plan for Minnesota Wildlife, Comprehensive Wildlife Conservation Strategy: The Blufflands. Division of Ecological Services, Minnesota Department of Natural Resources. Accessed from: blufflands.pdf (state.mn.us).

Impacts to flora associated with WMAs, WPAs, AMAs, State Water Trails, county parks, state parks, golf courses, and other recreational areas crossed by the route are discussed in Section 7.3.7.

Construction and maintenance activities have the potential to result in the introduction or spread of noxious weeds. Noxious weeds, which are regulated under Minn. Stat. § 18, can be introduced to new areas through the propagation of material such as roots or seeds transported by contaminated construction equipment. In general, noxious weed species establish more quickly on disturbed soil surfaces than existing native vegetation and have the potential to displace existing vegetation, without proper controls in place. The Applicant will work with the state and counties crossed by the proposed route to identify locations where noxious weeds may be present and will develop appropriate BMPs to minimize impacts during construction.

Other potential impacts to flora include vegetation disturbance along wind breaks, woodlots, fence rows, grassland swales, and other natural areas. Disturbance may include cutting, mowing, and removal of vegetation, crushing of vegetation with construction equipment, and grading soils. Much of this disturbance such as mowing would be temporary and would be related to construction activities as low growing vegetation will be allowed to revegetate after construction. Impacts to trees and tall vegetation would be permanent as tall growing species will not be allowed to revegetate and will be periodically removed as part of maintenance of the transmission line. Disturbance to these areas would be minimized by limiting vehicle traffic to roads and pathways along the proposed right-of-way and within previously disturbed areas to the extent practicable, restricting equipment to narrow paths within the proposed right-of-way, spanning sensitive areas, installing the line as a double-circuit with an existing transmission line, and routing parallel or adjacent to existing rights-of-way. See Sections 9.2 and 9.4 for a discussion of construction methods and maintenance procedures, and Section 7.7 for a discussion of impacts to protected plant species.

7.6.6 Fauna

Wildlife species common to the Project Study Area include those typically found in rangelands, deciduous forest patches, wetlands, and habitat transition zones frequently associated with agricultural, suburban, and urban areas. Homesteads, farmsteads, wind rows, pastures, wind breaks, and waterbodies along the route may provide ideal habitat for a variety of wildlife species well-adapted to areas dominated by agriculture and human settlement. Common species in the Project Study Area are shown in **Table 7-69**.

Table 7-69
Common Wildlife Species Found in the Project Study Area

Common Name	Scientific Name	Habitat
Mammals		
Deer Mouse	*Peromuscus maniculatus*	Open forest, forest fringes, grasslands, farms, suburban and rural communities
White-tailed deer	*Odocoileus virginianus*	Open forest, forest fringes, grasslands, farms, suburban and rural communities
Gray squirrel	*Sciurus carolinensis*	Open forest, forest fringes, grasslands, farms, suburban and rural communities
Coyote	*Canis latrans*	Open forest, forest fringes, grasslands, farms, suburban and rural communities
Red fox	*Vulpes*	Open forest, forest fringes, grasslands, farms, suburban and rural communities
Eastern cottontail	*Sylvilagus floridanus*	Forest fringes, open areas, grasslands, suburban and rural communities
Striped skunk	*Mephitis*	Forest fringes, open areas, grasslands, suburban and rural communities
Northern raccoon	*Procyon lotor*	Forested areas with abundant water sources including ponds, lakes, streams, and rivers
Beaver	*Castor canadensis*	Forested areas with abundant water sources including ponds, lakes, streams, and rivers
Birds		
Wild turkey	*Meleagris gallopavo`*	Open forest, forest fringes, grasslands, farms, suburban and rural communities
Red-tailed hawk	*Buteo jamaicensis*	Open forest, forest fringes, grasslands, farms, suburban and rural communities
American robin	*Turdus migratorius*	Open forest, forest fringes, grasslands, farms, suburban and rural communities
Brown-headed cowbird	*Molothrus ater*	Forest fringes, grassland, farms and pastures, suburban and rural communities
Ring-necked pheasant	*Phasianus colchicus*	Forest fringes, grassland, farms and pastures, suburban and rural communities
Wood duck	*Aix sponsa*	Forested areas with abundant water sources including ponds, lakes, and marshes

Common Name	Scientific Name	Habitat
Common yellowthroat	*Geothlypis trichas*	Wetland edges, wet meadows, marshes, wet areas with dense vegetation, brushy fields
Red-winged blackbird	*Agelaius phoeniceus*	Wetland edges, wet meadows, marshes, wet areas with dense vegetation, brushy fields
Mallard	*Anas platyrhynchos*	Ponds, lakes, streams, and rivers
Fish		
Large-mouth bass	*Micropterus salmoides*	Pond, lakes, reservoirs, and backwaters with abundant littoral vegetation
Bluegill	*Lepomis macrochirus*	Pond, lakes, reservoirs, and backwaters with abundant littoral vegetation
Brown bullhead	*Ameiurus nebulosus*	Ponds, lakes, and slow-moving streams with soft muddy substrates
Reptiles and Amphibians		
American toad	*Anaxyrus americanus*	Forested areas, grasslands, farms, suburban and rural communities, and freshwater ponds and lakes (early development)
Tiger salamander	*Ambystoma tigrinum*	Forested areas, grasslands, farms, suburban and rural communities, and freshwater ponds and lakes (early development)
Northern leopard frog	*Lithobates pipiens*	Wetlands, wet meadows, ponds, lakes, and streams with abundant vegetation
Common garter snake	*Thamnophis sirtalis*	Forested areas, grasslands, farms, suburban and rural communities near water sources
Smooth softshell turtle	*Apalone mutica*	Ponds, lakes, and slow-moving streams with soft, muddy substrates

7.6.6.1 Fauna: Avoidance and Mitigation of Potential Impacts

A constraints analysis was conducted during the routing process to determine potential impacts to sensitive natural resources, including wildlife habitat (refer to Section 7.2). Where possible, the Applicant designed routes to avoid these resources. The acreage of each land cover type crossed by the route segments is provided in Section 7.2.

Wildlife species may be temporarily and permanently displaced during construction of the proposed product due to loss of habitat or disturbance due to noise and use of equipment. Impacts to wildlife will be determined by a number of variables, including the size of the animal, its range and mobility, and its behavioral traits, including tolerance to disturbance, denning/nesting habits and periods of activity. The area of the disturbance and vicinity to the species' activity will also influence the Project's impact on individual species. Larger or more mobile animals such as deer, foxes, and birds will be able to vacate the immediate area of construction and should return upon Project completion. However, small species such as reptiles, amphibians, and small mammals could be more affected by construction because of their inability to vacate a construction area. Nocturnal animals not resting in the Project Width will unlikely be impacted as construction would stop at night. Aquatic species should not be permanently impacted as the Project will span waterbodies and watercourses, and any potential temporary impacts to watercourses and adjacent riparian areas will be returned to preconstruction conditions. The construction, operation, and maintenance of the Project would be designed to minimize potential adverse impacts to wildlife resources.

Potential collisions with the transmission line pose a risk of injury or death to bird species. These impacts often involve waterfowl. Larger birds, especially raptors, are at additional risk of being electrocuted if their large wingspans contact parallel conductors as they land or take off from a tower. The Applicant will coordinate with MNDNR and USFWS to identify any avian flyways crossed by the four route options and to identify areas where the line should be marked to minimize avian interactions. To mitigate impacts on potential bird strikes and electrocutions, the Project will be constructed according to Avian Power Line Interaction Committee (APLIC) recommended guidelines to reduce the potential for avian collisions.

7.7 Rare and Unique Resources

Rare and Unique Resources include plant and animal species listed at the federal or state level as endangered or threatened. Federally-listed endangered or threatened species are species are protected under the Endangered Species Act of 1973, administered by the U.S. Fish and Wildlife Service (USFWS). State-listed endangered and threatened species are protected under MN Statute 84.0895, administered by the Minnesota Department of Natural Resources (MNDNR). Additionally, rare and unique resources include plant and animal species listed as proposed or candidate listings at the federal level, and as special concern at the state level. These species are not legally protected by federal or state laws; however, USFWS and/or MNDNR are typically notified of potential impacts to these species. Bald and Golden Eagles are protected under the Bald and Golden Eagle Protection Act of 1940. Bird species and their nests are, in general, protected by the Migratory Bird Treaty Act of 1918.

In addition to plant and animal species, rare and unique resources include natural resource sites administered by federal or state agencies, including the following:

- Minnesota Biological Survey (MBS)[152] Sites of Biodiversity Significance,[153]
- Native Plant Communities (NPC)[154] and Scientific and Natural Areas (SNA)[155] identified by MNDNR,
- Wildlife Management Areas (WMA),[156] Aquatic Management Areas (AMA)[157] and Waterfowl Production Areas (WPA)[158] identified by USFWS,
- Reinvest in Minnesota (RIM) Wetland Reserve[159] program sites identified by the MN Board of Water & Soil Resources (BWSR)[160]

Important Bird Areas (IBA)[161] are natural resource sites identified by the National Audubon Society. The USFWS also administers the State Wildlife Grant (SWG) Program, developed to protect Species of Greatest Conservation Need (SGCN) in

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152 Minnesota Department of Natural Resources, 2023. Minnesota Biological Survey. Accessed from: https://www.dnr.state.mn.us/eco/mbs/index.html.

153 Minnesota Department of Natural Resources. 2023f. MBS Site Biodiversity Significance Ranks. Accessed from https://www.dnr.state.mn.us/eco/mbs/biodiversity_guidelines.html.

154 Minnesota Department of Natural Resources, 2023. Minnesota's Native Plant Communities. Accessed from: https://www.dnr.state.mn.us/npc/index.html.

155 Minnesota Department of Natural Resources, 2023. Minnesota's Scientific and Natural Areas. Accessed from: https://www.dnr.state.mn.us/snas/index.html.

156 Minnesota Department of Natural Resources. 2023. Wildlife Management Areas. Accessed from https://www.dnr.state.mn.us/wmas/index.html.

157 Minnesota Department of Natural Resources. 2023. Aquatic Management Areas. Accessed from https://www.dnr.state.mn.us/amas/index.html.

158 United States Fish and Wildlife Service. 2023. Wetland Management Districts and Waterfowl Production Areas. Accessed from: https://www.fws.gov/story/waterfowl-production-areas.

159 Minnesota Board of Water and Soil Resources. 2023. Reinvest in Minnesota Overview Accessed from https://bwsr.state.mn.us/reinvest-minnesota-overview.

160 Minnesota Board of Water and Soil Resources. 2023. What are Conservation Easements? Accessed from https://bwsr.state.mn.us/what-are-conservation-easements#:~:text=Landowners%20who%20offer%20the%20state,forbs%2C%20trees%20or%20wetland%20restorations.

161 National Audubon Society. 2013. Important Bird Areas in the US: Whitewater Valleys IBA. Accessed from: netapp.audubon.org/iba/Reports/2907; National Audubon Society. 2013. Important Bird Areas in the US: Upper Mississippi River NWR IBA. Accessed from: netapp.audubon.org/iba/Reports/2778.

Minnesota. A SGCN species[162] is one that is rare or uncommon, and in decline primarily due to habitat degradation. In Minnesota, 346 native wildlife species have been designated as SGCN species. This is approximately 16% of all native wildlife species in Minnesota. There are no comprehensive records of known locations of most of Minnesota's SGCN species. As a result, there are no records of occurrences of most SGCN species in the Project area, and thus no means of assessing the Project's potential impact on SGCN species.

7.7.1 Threatened and Endangered Species

The Applicant requested consultation with MNDNR and USFWS and reviewed data on threatened and endangered species within one mile of the Right-of-Way. On August 25, 2023, the USFWS Information for Planning and Conservation (IPaC) website[163] was used to review federally threatened and endangered species listed under the Endangered Species Act (ESA; 16 USC 1531 et seq.), candidate species, experimental populations, and designated critical habitat that may be impacted by implementation of the Project. Furthermore, the Applicant reviewed an unofficial list of state-listed threatened and endangered, species using the MNDNR NHIS database on the Minnesota Conservation Explorer (MCE) website (**Appendix O**). These reviews do not represent a comprehensive survey but provide an overview of the species that may occur in the vicinity of the Project. In accordance with Minnesota Rules, part 7829.0500 and Minnesota Statutes Chapter 13, state listed species location data is designated as Nonpublic Data-Not For Public Disclosure because it contains natural heritage information. Natural heritage information is nonpublic under Minn. Stat § 84.0872. The Minnesota Department of Natural Resources also restricts its dissemination by license agreement, LA-2023-034 signed by HDR January 9th, 2023. Given the need to include nonpublic information, location data of state listed species has been redacted from public versions of the documents.

[162] United States Department of Agriculture. 2023. State Wildlife Action Plans (SWAP), A national look at Species of Greatest Conservation Need as reported in State Wildlife Action Plans. Accessed from: https://www1.usgs.gov/csas/swap/.

[163] United States Fish and Wildlife Service. 2023. IPaC: Information for Planning and Consultation. Accessed from: https://ipac.ecosphere.fws.gov/.

The USFWS IPaC review determined that eleven species with federal status designations are potentially present within one mile of the ROW of one or more of the Routes and segments. These species, and the Route Options along which they are potentially present, are shown in **Table 7-70**. Only species with federal endangered or threatened status are protected by USFWS under the Endangered Species Act (ESA). Species with candidate or proposed status are under consideration for listing and protection under the ESA, but have not yet been designated by USFWS as endangered or threatened. The "experimental" designation for the whooping crane means that the populations potentially present have been reintroduced outside their current range, but within their historic range. USFWS has not designated critical habitat for any of the species potentially present.

The MNDNR NHIS database query through MCE indicated that there are nineteen species with state designations potentially present within one mile of the ROW of one or more of the Routes and segments. These species, and the Route Options along which they are potentially present, are shown in **Table 7-71**. Under Minnesota Rules 84.0895, Protection of Threatened and Endangered Species, no species designated as state-endangered or state-threatened may be taken without a permit from MNDNR. Species with a special concern designation are not protected under Minnesota Rules.

A more detailed description and life histories of federal and state listed species listed in the tables below is provided in **Appendix O**.

Table 7-70
Federally Threatened and Endangered Species Potentially Present Along Route Options

Species Name (Status)	Route Option													
	1 North	1 South	Alt 1L	2 North	2 South	Con 2G	3	4 East	Alt 4C	Alt 4E	4 West	Alt 4M	Alt 4R	Con 4Q
Northern Long-eared Bat (E)	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Rusty Patch Bumblebee (E)	X	X		X	X		X	X	X	X	X	X	X	X
MN Dwarf Trout Lily (E)	X	X		X	X	X								
Higgins Eye (E)							X							
Sheepnose (E)							X							
Spectaclecase (E)							X							
Prairie Bush-clover (T)				X	X		X	X	X	X	X	X	X	X
Tricolored Bat (PT)	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Salamander Mussel (PT)	X	X												
Monarch Butterfly (C)	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Whooping Crane (Exp)	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Notes: E = Federally Endangered; T = Federally Threatened; C = Federal Candidate Species; PT = Federal Proposed Threatened; Exp = Experimental Population

Table 7-71
State Threatened and Endangered Species Potentially Present Along Route Options

Species Name (Status)	Route Option													
	1 North	1 South	Alt 1L	2 North	2 South	Con 2G	3	4 East	Alt 4C	Alt 4E	4 West	Alt 4M	Alt 4R	Con 4Q
Northern Long-eared Bat (SC)	X			X	X	X	X	X			X	X	X	X
MN Dwarf Trout Lily (E)	X			X	X	X								
Salamander Mussel (E)	X	X												
Loggerhead Shrike (E)	X	X												

Species Name (Status)	Route Option													
	1 North	1 South	Alt 1L	2 North	2 South	Con 2G	3	4 East	Alt 4C	Alt 4E	4 West	Alt 4M	Alt 4R	Con 4Q
Blanding's Turtle (T)	X	X	X								X			
Hair-Like Beak Rush (T)		X												
Tricolored Bat (SC)	X			X	X	X	X	X	X	X	X	X	X	X
Higgins Eye (E)							X							
Sheepnose (E)							X							
Spectaclecase (E)							X							
Prairie Bush-clover (T)				X	X		X	X			X	X	X	X
Ellipse (SC)				X						X				
Fluted Shell (SC)				X	X					X				
Mucket (SC)				X	X									
Spike (SC)				X										
Elktoe (T)								X						
Tuberous Indian-Plantain (T)							X	X		X				
Blanchard's Cricket Frog (E)											X			
Glade Mallow (T)											X			

Notes: E = State Endangered; T = State Threatened; SC = State Special Concern

7.7.2 Natural Resource Sites

7.7.2.1 Segment 1

7.7.2.1.1 Route Option 1 North

The ROW of Route Option 1 North crosses a total of 40.67 acres of MBS Sites of Biodiversity Significance, over eleven sites. The Proposed Route of Route Option 1 North crosses 374.85 acres of MBS Sites of Biodiversity over the same eleven sites, as detailed in **Table 7-72**.

Table 7-72
Minnesota Biological Survey Sites Crossed by Route Option 1 North

Site of Biodiversity Significance	Rank	Existing Power lines Present	Crossing within 150-feet of Centerline		Total Site Acres	Acres Crossed In ROW	Acres Crossed In Route
			Segment	Subsegment or Connector			
Blue Earth 12	Below	Yes	1 North	1A	286.43	5.57	42.56
Jamestown 97	Below	Yes	1 North	1D	289.74	4.71	65.85
Waterville 14	Moderate	Yes	1 North	1F	86.62	1.37	27.27
Townsend Woods	Outstandin g	Yes	1 North	1F	55.79	1.20	15.56
Morristown 17	Moderate	Yes	1 North	1F	87.97	1.84	13.99
Morristown 16	High	Yes	1 North	1F	253.65	7.28	42.60
Morristown 15 North	Below	Yes	1 North	1F	16.04	0.01	9.95
Cannon Lake	High	Yes	1 North	1F	391.19	4.64	35.84
Warsaw 16	Below	Yes	1 North	1F	71.48	5.06	29.22
Fish Lake	High	No	1 North, 1 South	1E, 1K	389.37	8.40	73.62
Lime W 36	High	Yes	1 North	1A	186.89	0.59	18.39

Route Option 1 North ROW crosses or nears a total of 23.41 acres of MNDNR Native Plant Communities (NPC) over fourteen sites. The Route Option 1 North crosses a total of 190.66 acres of NPC sites, as detailed in **Table 7-73**:

Table 7-73
MNDNR NPCs Crossed by Route Option 1 North

NPC Code	Native Plant Community	Existing Power lines Present	Crossing within 150-feet of Centerline		Total Site Acres	Acres Crossed In ROW	Acres Crossed In Route
			Segment	Subsegment			
FDs37b	Pin Oak – Bur Oak Woodland	Yes	1 North	1A	44.68	0.59	12.31
WMn82b	Sedge Meadow	Yes	1 North	1F	10.87	2.68	10.81
WMn82b	Sedge Meadow	Yes	1 North	1F	21.08	0.22	2.85
MHs39	Southern Mesic Maple-Basswood Forest	Yes	1 North	1F	23.19	0.82	9.04
WMn82b	Sedge Meadow	Yes	1 North	1F	30.16	1.02	4.95

NPC Code	Native Plant Community	Existing Power lines Present	Crossing within 150-feet of Centerline		Total Site Acres	Acres Crossed In ROW	Acres Crossed In Route
			Segment	Subsegment			
MHs39c	Sugar Maple Forest (Big Woods)	Yes	1 North	1F	33.31	0.52	6.47
MHs39	Southern Mesic Maple-Basswood Forest	Yes	1 North	1F	42.74	0.14	5.56
MHs39	Southern Mesic Maple-Basswood Forest	Yes	1 North	1F	43.87	1.23	21.70
MHs39c	Sugar Maple Forest (Big Woods)	Yes	1 North	1F	61.14	0.12	8.21
MRn83a	Cattail- Sedge Marsh (Northern)	Yes	1 North	1F	131.82	1.74	22.18
MRn93	Northern Bulrush-Spikerush Marsh	Yes	1 North	1F	172.99	7.16	34.38
MHs39a	Sugar Maple – Basswood - (Bitternut Hickory) Forest	Yes	1 North	1E	12.62	0.37	5.55
MHs39c	Sugar Maple Forest (Big Woods)	Yes	1 North	1E	20.3	1.55	7.89
OPn92a	Graminoid Rich Fen (Basin)	Yes	1 North	1E	28.71	5.25	22.82
UPs23	Southern Mesic Prairie	Yes	1 North	1A	24.70	0.00	2.99
UPs23	Southern Mesic Prairie	Yes	1 North	1A	69.93	0.00	2.09
FDs37	Southern Dry-Mesic Oak (Maple) Woodland	Yes	1 North	1A	47.56	0.00	0.99
MHs39	Southern Mesic Maple-Basswood Forest	No	1 North	1E	39.13	0.00	8.98
MRn93	Northern Bulrush-Spikerush Marsh	No	1 North	1E	5.51	0.00	0.89

Route Option 1 North crosses other natural resources sites only within this Route Option. Route Option 1 North intersects the Dove Lake WMA, Earl Swain WMA, the Gilfillan Lake WMA, and the Cannon River WMA: Thomas West Unit. The Dove Lake WMA is 258.16 acres and located along CSAH 16, the Earl Swain WMA is 105.2 acres and located along CSAH 11, the Gilfillan Lake WMA is 558.61 acres and located along CSAH 26, and the Cannon River WMA: Thomas West Unit is 118.52 acres and located along State Highway 60. Both the Dove Lake WMA and Earl Swain WMA contain upland and wetland forest types, a restored oak savanna component, and an agricultural food plot. The Cannon River WMA: Thomas West Unit is comprised of abundant wetland areas and surrounding upland habitat. Route Option 1 North also crosses the Le Sueur WPA.

Route Option 1 North crosses the Tetonka Lake AMA which is intended for general use (e.g., angling, non-motorized travel, wildlife observation, hunting and trapping allowed).

Route Option 1 North intersects the Townsend Woods SNA. The Townsend Woods SNA features a section of high-quality Big Woods sugar maple remnant forest and an imperiled NPC community. Present-day management is focused on the continued establishment of oak seedlings and common buckthorn (*Rhamnus cathartica*) control.

Additionally, Route Option 1 North crosses one active National Conservation Easement Database (NCED) Conservation Easement (ID 19483), one expired Reinvest in Minnesota (RIM) Conservation Easement (ID 66-28-86-01) classified as Marginal Cropland – Limited, one active RIM (ID-66-02-87-01) classified as Marginal Cropland – Limited, and one active RIM (ID-40-03-12-02) classified as Marginal Cropland.

7.7.2.1.2 Route Option 1 South

The Route Option 1 South ROW crosses a total of 10.71 acres of MBS sites in four locations. The Proposed Route for Route Option 1 South crosses a total of 116.01 acres of MBS sites in eight locations, as detailed in **Table 7-74** below.

Table 7-74
Minnesota Biological Survey Sites Crossed by Route Option 1 South

Site of Biodiversity Significance	Rank	Existing Power lines Present	Crossing within 150-feet of Centerline		Total Site Acres	Acres Crossed In ROW	Acres Crossed In Route
			Segment	Subsegment or Connector			
Tyrone W.1	Moderate	Yes	1 South	1J	53.89	0.99	6.04
Hands Marsh	High	No	1 South	1M	396.05	0.00	13.55
Lily Lake	Moderate	Yes	1 South	1K	4.54	0.00	1.15
Iosco 4	Below	Yes	1 South	1K	36.06	0.00	0.83

Iosco 6	Below	No	1 South	1K	7.82	0.00	0.23
Fish Lake	High	No	1 North, 1 South	1E, 1K	389.37	8.44	73.62
Jamestown 97	High	Yes	1 South	1J	289.74	1.08	11.42
Radio Tower Woods	Below	Yes	1 South	1B	266.46	0.20	9.17

The ROW of Route Option 1 South crosses a total of 7.17 acres in three MNDNR NPCs. Route Option 1 South crosses 64.42 acres of MNDNR NPCS, as detailed in **Table 7-75** below:

Table 7-75
MNDNR NPCs Crossed by Route Option 1 South

NPC Code	Native Plant Community	Existing Power lines Present	Crossing within 150-feet of Centerline		Total Site Acres	Acres Crossed In ROW	Acres Crossed In Route
			Segment	Subsegment			
OPn92a	Graminoid Rich Fen (Basin)	No	1 South	1E	28.71	5.25	22.82
NHs39a	Sugar Maple – Basswood - (Bitternut Hickory) Forest	No	1 South	1E	12.62	0.37	5.55
MHs39c	Sugar Maple Forest (Big Woods)	No	1 South	1E	20.30	1.55	7.89
MRn93a	Bulrush Marsh (Northern)	No	1 South	1E	5.51	0.00	0.89
MHs38c	Red Oak – Sugar Maple – Basswood - (Bitternut Hickory) Forest	No	1 South	1M	13.65	0.00	7.25
LKi54b2	Mud Flat (Inland Lake), Non-Saline Subtype	No	1 South	1K	4.53	0.00	1.15
LKi54b2	Mud Flat (Inland Lake), Non-Saline Subtype	No	1 South	1K	2.74	0.00	0.51
MRn83	Northern mixed Cattail Marsh	No	1 South	1M	326.50	0.00	6.29
MHs39c	Sugar Maple Forest (Big Woods)	No	1 South	1E	39.13	0.00	12.07

Route Option 1 South includes one Alternative Segment (1L). Within Alternative Segment 1L ROW, 0.93 acres of Red Oak – Sugar Maple – Basswood (Bitternut Hickory) (MHs38c), and 0.44 acres of Northern Mixed Cattail Marsh (MRn82) are crossed. Within Alternative 1L, 5.01 acres of Red Oak – Sugar Maple – Basswood (Bitternut Hickory) (MHs38c), and 11.51 acres of Northern Mixed Cattail Marsh (MRn82) are crossed.

Route Option 1 South intersects the Dove Lake WMA and Earl Swain WMA. Furthermore, the Route Option crosses one active NCED Conservation Easement (ID 19483), and two active RIM Permanent Wetland Preserves Program Conservation Easements (ID 66-13-91-01-C, 66-13-91-01-A). No SNAs or AMAs intersect with the Route Option 1 South.

7.7.2.2 Segment 2

Segment 2 has two Route Options (2 North and 2 South) and a Connector Segment (2G). There are a total of seven species with federal designations under the ESA. There are a total of eight species protected under Minnesota statute. See **Table 7-70** and **Table 7-71** above for species associated with Segment 2.

Other Rare & Unique Features present along the routes and route segments, including natural resource sites administered by federal or state agencies, are discussed below for each Route Option and segment.

7.7.2.2.1 Route Option 2 North

Route Option 2 North crosses four MBS sites as detailed in **Table 7-76** below, three of which are cross by the ROW.

Route Option 2 North crosses one MNDNR NPC, a willow dogwood shrub swamp (WMn82a), in subsegment 2C. The total area of the NPC is 19.52 acres, and the area crossed in the ROW is 4.28 acres. Within Route Option 2 North, 15.55 acres of Willow – Dogwood Shrub Swamp (WMn82a), 0.57 acres of Southern Dry-Mesic Oak Forest (MHs37), and 5.41 acres of Red Oak – White Oak Forest (MHs37a) are crossed.

Table 7-76
Minnesota Biological Survey Sites Crossed by Route Option 2 North

Site of Biodiversity Significance	Rank	Existing Power lines Present	Crossing within 150-feet of Centerline		Total Site Acres	Acres Crossed In ROW	Acres Crossed In Route
			Segment	Subsegment or Connector			
Holden 33 Northeast	Moderate	No	2 North	2B	47.11	1.30	9.16
Roscoe 24	Below	Yes	2 North	2C	172.44	0.38	10.57
Spring Creek Lowlands	Moderate	No	2 North	2C	148.70	0.00	0.57
North Fork Zumbro Woods	Outstandin g	Yes	2 North	2C	480.18	4.28	15.55

Route Option 2 North intersects the Faribault WMA. This 521.75-acre WMA, located south of Faribault along CSAH 19, contains a mosaic of habitats including hardwood woodlots, grassland, and food plots. Management is intended to benefit grassland, brushland, and small game populations. No SNAs or AMAs intersect the Proposed Route.

Route Option 2 North intersects two active Riparian Minnesota Conservation Reserve Enhancement Program (MN CREP) II RIM Conservation Easements (ID 66-02-07-01, 66-08-07-01) and one active Marginal Cropland RIM Conservation Easement (ID 25-07-87-01).

7.7.2.2.2 Route Option 2 South

There are no MBS sites or MNDNR NPCs crossed by Route Option 2 South. Within Route Option 2 South, 10.57 acres of ROSCOE 24 are crossed in subsegment 2D. This site already has existing powerlines and has a total site acreage of 172.44 acres.

Segment 2E intersects the Faribault WMA. The route does not intersect any SNAs or AMAs. Segment 2B also intersects one active RIM Conservation Easement (66-04-91-01-B) classified as Wetland Restoration.

7.7.2.2.3 Segment 2 Connector Segment 2G

There are no MBS sites or MNDNR NPCs crossed by Connector Segment G. Connector Segment 2G does not intersect with any WMAs, AMAs, SNAs, or RIM Conservation Easements.

7.7.2.3 Segment 3

There are a total of nine species with federal designations under the ESA. There are a total of seven species protected under Minnesota statute. See **Table 7-70** and **Table 7-71** above for species associated with Segment 3.

The ROW of Segment 3 crosses a total of 68.08 acres of MBS sites of Biodiversity Significance over eleven sites. The Proposed Route of Segment 3 crosses 479.80 acres of sites of Biodiversity Significance over twelve sites, as detailed in **Table 7-77**:

Table 7-77
Minnesota Biological Survey Sites Crossed by Segment 3

Site of Biodiversity Significance	Rank	Existing Power lines Present	Crossing within 150-feet of Centerline		Total Site Acres	Acres Crossed In ROW	Acres Crossed In Route
			Segment	Subsegment or Connector			
Oronoco 11	Below	Yes	3	3A	65.19	1.75	14.56
Oronoco 12	Moderate	Yes	3	3A	221.42	7.68	55.64
Farmington 2	Below	No	3	3B	108.69	1.90	17.82
East Indian Creek West	Below	No	3	3C	427.44	5.36	26.39
Watopa 20	Below	No	3	3C	281.94	2.46	16.21
Rattlesnake Ridge	Moderate	No	3	3C	1,094.98	0.00	3.12
Snake Creek Bluffs South	Moderate	No	3	3C	804.95	3.58	23.57
Snake Creek Bluffs North	Below	No	3	3C	694.48	7.25	50.66
Watopa 10	Moderate	No	3	3C	578.72	7.46	70.36
McCarthy Lake	High	No	3	3C	2915.68	15.57	111.88
Finger Lakes	Outstanding	No	3	3C	1,588.20	8.51	60.77
Pine Island 25	Below	Yes	3	3A	114.47	6.56	28.82

There are six MNDNR NPCs crossed by Segment 3 ROW (totaling 15.92 acres crossed), and three additional NPCs crossed by the Proposed Route (totaling 142.32 acres crossed), as detailed in **Table 7-78**:

Table 7-78
MNDNR NPC Sites Crossed by Segment 3

NPC Code	Native Plant Community	Existing Power lines Present	Crossing within 150-feet of Centerline		Total Site Acres	Acres Crossed In ROW	Acres Crossed In Route
			Segment	Subsegment			
FFs68a	Silver Maple - (Virginia Creeper) Floodplain Forest	Yes	3	3C	7.27~~8~~	0.00	3.76
MHs37a	Red Oak - White Oak Forest	No	3	3C	56.4	1.81	13.19
MHa37b	Red Oak - White Oak - (Sugar Maple) Forest	No	3	3C	61.28	1.57	13.21
FFs68a	Silver Male - (Virginia Creeper) Floodplain Forest	No	3	3C	90.24	3.11	18.31
FFs68a	Silver Maple - (Virginia Creeper) Floodplain Forest	Yes	3	3C	92.8	0.00	9.66
FFs59a	Silver Maple - Green Ash - Cottonwood Terrace Forest	Yes	3	3C	395.82	0.43	8.71
WMn82b	Sedge Meadow	No	3	3C	1414.11	6.35	50.71
MHs37a	Red Oak – White Oak Forest	Yes	3	3A	41.09	2.65	24.16
UPs13c	Dry Bedrock Bluff Prairie (Southern)	No	3	3C	1.55	0.00	0.55
FFs68a	Silver Maple - (Virginia Creeper) Floodplain Forest	Yes	3	3C	1.10	0.00	<0.01

The Proposed Route of Segment 3 intersects the McCarthy Lake WMA in Wabasha County. This 3,129.36-acre WMA, located directly east of US Highway 61, contains numerous wetlands associated with the former Zumbro River water channel. Management of this area is intended to maintain the ecological diversity of plant and animal communities in the area and includes regular timber management. The Weaver Dunes SNA is directly adjacent to this WMA unit but is not crossed by the Proposed

Route. The Proposed Route of Segment 3 intersects the Upper Mississippi River National Wildlife and Fish Refuge. No AMAs are intersected by Segment 3.

Segment 3 also crosses the Richard J. Dorer (RJD) Memorial Hardwood State Forest. This state forest includes bluffs of the Great River Road of the Mississippi River and a number of National Wild and Scenic Rivers and state water trails including the Cannon River, Mississippi River, Root River, Whitewater River, and Zumbro River. The state forest also crosses six recreation areas and multiple trails. As discussed in Section 7.3.7. this area is almost entirely hardwood forest.

The Segment 3 Proposed Route crosses four active BWSR RIM Conservation Easements (ID 25-15-91-01-A, 25-08-91-01-A, 25-08-91-01-B, 25-13-90-01, 79-04-86-01) classified as Marginal Cropland – Perpetual and Other – Perpetual.

7.7.2.4 Segment 4

Segment 4 has two Route Options (4 East and 4 West), four alternative segments, and a Connector Segment (4Q). There are a total of six species with federal designations under the ESA potentially present in Segment 4. There are a total of ten species protected under Minnesota statute. See **Table 7-70** and **Table 7-71** above for species associated with Segment 4.

7.7.2.4.1 Route Option 4 East

The federally-listed species potentially present in Route Option 4 East also have state designations, with the exception of the rusty patched bumblebee, monarch butterfly and whooping crane, which are not listed in Minnesota.

The Segment 4 East ROW crosses one MBS site (0.47 acre), and the Proposed Route of Segment 4 East crosses four MBS sites totaling 30.42 acres, as detailed in **Table 7-79**.

Table 7-79
Minnesota Biological Survey Sites Crossed by Segment 4 East and ROW

Site of Biodiversity Significance	Rank	Existing Power lines Present	Crossing within 150-feet of Centerline		Total Site Acres	Acres Crossed In ROW	Acres Crossed In Route
			Segment	Subsegment or Connector			
New Haven 12	Below	No	4 East	4F	165.88	0.47	19.00
Pine Island 32	High	No	4 East	4D	1.33	0.00	1.33
Oronoco 35	Moderate	No	4 East	4I	117.63	0.00	6.84
Cascade 1	Moderate	No	4 East	4I	126.31	0.00	3.25

One MNDNR NPC is within 150 feet of the Route Option 4 centerline. It is a 6.38-acre Southern Mesic Maple-Basswood Forest (MHs39; however, no part of the NPC is crossed by the ROW. Within Route Option 4 East, 1.33 acres of Elm – Ash – Basswood Terrace Forest (FFs59c), 2.94 acres of Red Oak – White Oak Forest (MHs37a), 3.70 acres of Southern Mesic Maple – Basswood Forest (MHs39), and 0.19 acres of Southern Wet-Mesic Hardwood Forest (MHs49) are crossed.

No WMAs, AMAs, SNAs, or RIM Conservation Easements intersect Route Option 4 East.

No MBS sites, NPC, WMA, AMA, SNAs, or RIM Conservation Easements intersect Alternative Segment 4C or 4E.

7.7.2.4.2 Route Option 4 West

The Segment 4 West ROW crosses three MBS sites totaling 6.59 acres, and the Proposed Route of Segment 4 West crosses four MBS sites totaling 77.70 acres, as detailed in **Table 7-80**. No MBS sites are crossed by Alternative Segment 4M.

Table 7-80
Minnesota Biological Survey Sites Crossed by Segment Route Option 4 West

Site of Biodiversity Significance	Rank	Existing Power lines Present	Crossing within 150-feet of Centerline		Total Site Acres	Acres Crossed In ROW	Acres Crossed In Route
			Segment	Subsegment or Connector			
Pine Island 30	High	Yes	4 West	4K	83.69	1.55	20.49
New Haven 35	Below	No	4 West	4N	172.18	1.83	25.47
Oronoco 35	Moderate	No	4 West	4O	151.04	3.21	29.56
New Haven 18	Below	Yes	4 West	4K	114.47	0.00	2.18

Four MNDNR NPCs are within 150 feet of the centerline of Route Option 4 West, and are partially crossed by the ROW, totaling 3.13 acres crossed. Six MBDNR NPCs are within the Proposed Route of Segment 4 West totaling 35.81 acres and detailed in **Table 7-81**. No NPCs are crossed by Alternative Segment 4M.

Table 7-81
MNDNR NPC Sites Crossed by Route Option 4 West

NPC Code	Native Plant Community	Existing Power lines Present	Crossing within 150-feet of Centerline		Total Site Acres	Acres Crossed In ROW	Acres Crossed In Route
			Segment	Subsegment			
FFs59c	Elm - Ash - Basswood Terrace Forest	Yes	4 West	4K	23.00	0.76	13.24
FFs59c	Elm - Ash - Basswood Terrace Forest	No	4 West	4O	12.58	0.11	5.26
MHs37a	Oak - Shagbark Hickory Woodland	No	4 West	4O	25.47	0.67	7.37
FDs38a	Red Oak - White Oak Forest	No	4 West	4O	47.08	1.59	8.62
FFs59c	Elm – Ash – Basswood Terrace Forest	No	4 West	4K	3.07	0.00	0.97
FFs59c	Elm – Ash – Basswood Terrace Forest	No	4 West	4K	35.22	0.00	0.35

Within the ROW of Alternative Segment 4R, 0.3 acres of Red Oak – White Oak Forest (MHs37a) are crossed. Within the Route of Alternative Segment 4 R, 10.98 acres of Red Oak – White Oak Forest (MHs37a) are crossed.

No WMAs, AMAs, SNAs, or RIM Conservation Easements intersect Route Option 4 West.

7.7.2.4.3 Segment 4 Connector Segment 4Q

Connector Segment 4Q does not cross any MBS sites or NPC areas. Connector Segment 4Q does not intersect with any WMAs, AMAs, SNAs, or RIM Conservation Easements.

7.7.2.4.4 Segment 4R

Within the ROW of Alternative Segment 4R, 0.30 acres of MBS Site Oronoco 35 are crossed. Within Alternative Segment 4R, 11.67 acres of Oronoco 35 are crossed.

Within the ROW of Alternative Segment 4R, 0.3 acres of the NPC Red Oak – White Oak Forest (MHs37a) are crossed. Within the Route of Alternative Segment 4 R, 10.98 acres of NPC Red Oak – White Oak Forest (MHs37a) are crossed.

No WMAs, AMAs, SNAs, or RIM Conservation Easements intersect Segment 4R.

7.7.3 Rare and Unique Resources: Avoidance and Mitigation of Potential Impacts

The Applicant has planned routes and structure design to span waterways, basins, and wetlands wherever feasible at natural resource sites, and impacts will be minimized to the maximum extent practicable as described in Section 7.6.2.6 and Section 7.6.2.3. In addition, the Applicant will access or obtain available USFWS and MNDNR rare species databases prior to construction activities to determine locations where the routes and structures are near or adjacent to known locations of listed species. The Applicant will conduct rare species surveys in those areas and similar high-quality habitats preferred by listed species. The Applicant will avoid impacts to federal- and state-listed species to the maximum extent practicable and will coordinate with the appropriate federal and/or state agency in the unlikely event of unavoidable impacts to listed species.

Tree removal will be required in some natural resource sites. As timber management is regularly used as part of management regimes throughout these natural areas, impacts from active tree removal will be minor and consistent with current land maintenance practices. Permanent tree removal and continued maintenance of the Project Right-of-Way within forested areas may permanently change these areas to grassland habitat and therefore contribute to habitat fragmentation as forested areas are intersected. The Applicant will continue to work with the MNDNR to refine route and reduce impacts to natural resource sites.

Several MBS Sites of Biodiversity Significance and NPCs are located within the Route Options and are associated with water basins, various NPCs, and waterways such as the Zumbro and St. Croix rivers. Where possible, the Applicant designed routes to avoid impacts to MBS Sites of Biodiversity Significance and NPCs. Mitigation methods during construction may include seasonal restrictions, fencing of rare features, and vegetation restoration as applicable. Vegetation that is removed during construction outside of the Project Right-of-Way will be allowed to regrow. The Applicant will continue to work with the MNDNR to refine route and reduce impacts to MBS Sites of Biodiversity Significance or NPCs. Overall, impacts to MBS sites or NPCs are anticipated to be minor and mostly temporary throughout the Project Area.

In a letter dated October 26, 2023, the Applicant requested MNDNR review the Project Routes, and met with MDNR staff on October 25, 2023, to discuss potential impacts to rare features. The Applicant worked with MNDNR to incorporate and refine routing to reduce and minimize impacts to MBS sites and NPCs. The Applicant will continue to work with MNDNR to identify and minimize impacts to these sensitive resources.

The Applicant will implement integrated vegetation management plans associated with its existing pollinator initiative, which was created to enhance pollinator habitat; these plans minimize chemical use by avoiding broadcast applications and employ spot treatments for control of invasive species.

7.8 Physiographic Features

Physiographic features crossed by the Proposed Project Route include topography, geology, and soils, and discussed in detail below.

7.8.1 Topography

The Project and associated Segments and Route Options lie within the Central Lowlands Province of the Interior Plains Physiographic Region of the United States. The Central Lowlands Province is the largest physiographic province. It is bounded by areas of higher relief and elevations in the region are 2,000 ft above mean sea level (AMSL) or less. This province is characterized by flat lands with geomorphic remnants of glaciation.[164]

7.8.1.1 Segment 1

7.8.1.1.1 Route Option 1 North

Elevation along Route Option 1 North varies from 840 ft above mean sea level (AMSL) near Mankato to 1080 ft AMSL near Faribault.

7.8.1.1.2 Route Option 1 South

Elevation along Route Option 1 South is similar to Route Option 1, and ranges from around 840 ft AMSL near Mankato and gradually increases to around 1080 ft AMSL near Faribault.

7.8.1.2 Segment 2

7.8.1.2.1 Route Option 2 North

Elevation along Route Option 2 North range from 1080 ft AMSL near Faribault, then plane out to 1200 ft AMSL along County Highway 87, and gradually decreases to around 1194 ft AMSL near Pine Island.

[164] National Park Service. 2017. Physiographic Provinces. Retrieved from: https://www.nps.gov/subjects/geology/physiographic-provinces.htm. Accessed on September 5, 2023.

7.8.1.2.2 Route Option 2 South

Elevations along Segment 2 South range from 1080 ft AMSL near Faribault to 1216 ft AMSL near Kenyon, and 1194 ft AMSL near Pine Island.

7.8.1.3 Segment 3

7.8.1.3.1 Route Option 3

Elevation along Route Option 3 is relatively flat for the majority of the route (around 1100 AMSL) and decreases from 1120 AMSL to around 680 AMSL near Kellogg to the Mississippi River.

7.8.1.4 Segment 4

7.8.1.4.1 Route Option 4 East

Elevations along Route Option 4 East are relatively flat along Highway 52 (around 1100 ft AMSL) and gradually increase to around 1130 ft AMSL along Highway 63 and drop down to 930 ft AMSL at the South Fork Zumbro River crossing.

7.8.1.4.2 Route Option 4 West

Elevations along Route Option 4 West ranges from 1037 ft AMSL near Pine Island, to 950 ft AMSL at the South Branch Middle Fork River crossing and increases to around 1200 ft AMSL at the eastern end out the Route.

7.8.1.5 Topography: Avoidance and Mitigation of Potential Impacts

Construction of the Project will have minimal to no impacts to the topography of the area; therefore, no mitigation is proposed.

7.8.2 Geology

The surficial geology of the Proposed Segments and Route Options consists of sediments deposited by the Des Moines Lobe during the Wisconsinan Episode 10,000 to 75,000 years ago. Des Moines lobe till is gray to brown and is distinguishable by its shale content that originates from North Dakota and Canada. The Bemis moraine encompasses the furthest boundaries of the Des Moines lobe from northeastern South Dakota, through southern Minnesota and into Iowa.[165] The majority of the surficial deposits along the Proposed Project Segments and Route Options are categorized as glacial plain deposits that include fine-grained lake sediment, washed till, sandy loam, loamy sand, sand, gravel, and cobble gravel. Additional deposit types include alluvium and terrace deposits in the vicinity of major rivers (such as the Mississippi River), channel deposits near smaller streams and rivers, drumlins, and moraine deposits.

The Segment and Route Options are underlain by bedrock formed primarily during the Cambrian and Ordovician periods in the Paleozoic Era. Bedrock along Segments 1, 3, and 4 consist of sandstone, siltstone, shale and dolostone. Bedrock along Segment 2 consists of limestone, shale, sandstone and dolostone.[166]

The Karst Feature Inventory, maintained by Minnesota Department of Natural Resources and University of Minnesota, contains reported and verified karst features and was queried to identify karst features within the Proposed Route.[167] Surface karst features include, but are not limited to, sinkholes, caves, stream sinks, and karst springs which primarily occur in Minnesota where 50 feet or less of unconsolidated material overlies carbonate bedrock or sandstone.

No surface karst features were identified within the Proposed Route or ROWs of Segment 1 or 2. As shown in **Table 7-82** below, three sinkholes were identified within the Proposed Route of Segment 3 (Route Option 3), two sinkholes and one spring were identified within the Proposed Route of Route Option 4 East, and one spring, two tile outlets, and three sinkholes were identified within the Proposed Route of Route Option 4 West. Of the features within the Proposed Route, three sinkholes were identified within Route Option 3 right-of-way and one sinkhole was identified within Route

[165] B.A. Lusardi, 1994, Minnesota at a Glance: Quaternary Glacial Geology: Minnesota Geological Survey; revised by E.L. Dengler, May 2017. Accessed on September 6, 2023.

[166] Jirsa, Mark A.; Boerboom, Terrence J.; Chandler, V.W.; Mossler, John H.; Runkel, Anthony C.; Setterholm, Dale R.. (2011). S-21 Geologic Map of Minnesota-Bedrock Geology. Minnesota Geological Survey. Retrieved from the University of Minnesota Digital Conservancy, https://hdl.handle.net/11299/101466.

[167] MDNR. 2023.Karst Feature Inventory Points. Retrieved from https://gisdata.mn.gov/dataset/geos-karst-feature-inventory-pts. Accessed November 30, 2023.

Option 4 West right-of-way. Karst features within the Proposed Routes are depicted on the detailed route maps (**Appendix K**).

Table 7-82
Surface Karst Features within Route Option Proposed Routes and Rights-of-Way

Route Option ID	Karst Feature*	PLSS Location	Distance from Route Centerline (feet)	Within Right-of-Way (Yes/No)
3	Sinkhole	108N, 14W, Section 11	66 feet west, west of Zumbro River	Yes
3	Sinkhole	108N, 14W, Section 11	68 feet east, west of Zumbro River	Yes
3	Sinkhole	108N, 14W, Section 11	10 feet west, west of Zumbro River	Yes
4 East	Sinkhole	107N, 14W, Section 2	60 feet south	No
4 East	Sinkhole	108N, 14W, Section 35	104 feet north	No
4 East	Spring	107N, 13W, Section 4	110 feet south	No
4 West	Spring	108N, 15W, Section 31	241 feet south	No
4 West	Tile Outlet	108N, 15W, Section 32	210 feet north	No
4 West	Tile Outlet	108N, 15W, Section 32	315 feet north	No
4 West	Sinkhole	108N, 15W, Section 33	171 feet north	No
4 West	Sinkhole	108N, 14W, Section 28	20 feet north	Yes
4 West	Sinkhole	108N, 14W, Section 34	158 feet south	No

**Sinkhole* – closed depressions that form by the solution of the underlying soluble bedrock and function as connections between surface and ground waters.
Spring – a focused, natural discharge where water emerges from the ground.
Tile Outlet - structures placed at the ends of drainage tiles that may contain adjustable weirs used to control the minimum elevation at which water leaves the drainage tile.

7.8.2.1 Geology: Avoidance and Mitigation of Potential Impacts

Construction of structure foundations and substation expansions would not alter the geology of the region; therefore, no mitigation is proposed.

The Applicant will conduct geotechnical analyses where appropriate to evaluate whether karst areas are present at structure locations and micrositing and structure foundation design will account for the presence of karst and the potential for dewatering, as needed. Neither a dewatering permit nor water appropriations permit are anticipated to be required during construction. If geotechnical analyses determine that temporary dewatering or water appropriations would be required, the Applicant will coordinate with the MDNR to obtain the necessary permits. The Minnesota Pollution Control Agency's (MPCA) Construction Stormwater Permit contains mitigation measures for stormwater runoff when karst features are known or suspected to be present on site. If geotechnical analyses determine karst features are present where construction will occur, the Applicant will comply with MPCA stormwater requirements and would prohibit infiltration of stormwater runoff within 1,000 feet up-gradient or 100 feet down-gradient of active karst features.

7.8.3 Soils

Soil information for the Proposed Project Segments and Route Options was obtained from the USDA-Natural Resource Conservation Service (NRCS) Soil Survey Geographic (SSURGO) Database.[168] The SSURGO database is a digital version of the original county soil surveys developed by USDA - Natural Resources Conservation Service (NRCS) for use with GIS. It provides the most detailed level of soils information for natural resource planning and management.

The USDA-NRCS SSURGO Database identifies farmland soils based on three categories, which are subject to protection under the Farmland Protection Policy Act (FPPA). These categories include prime farmland, prime farmland when drained, and farmland of statewide importance.

Prime farmland is defined as land that has the best combination of physical and chemical characteristics for producing food, feed, fiber, and oilseed crops, and is also available for these uses (the land could be cropland, pasture, woodland, or other lands). Urbanized land and open water cannot be designated as prime farmland. Prime farmland typically contains few or no rocks, is permeable to water and air, is not excessively erodible or saturated with water for long periods and is not subject to frequent or prolonged flooding during the growing season. Soils that do not meet the

[168] United States Department of Agriculture. 2023. Web Soil Survey. Retrieved from: https://websoilsurvey.nrcs.usda.gov/. Accessed February 2024.

above criteria may be considered prime farmland if the limiting factor is mitigated (e.g., by draining or irrigating; USDA - NRCS, n.d.).

The NRCS also recognizes farmlands of statewide importance, which are defined as lands other than prime farmland that are used for production of specific high-value food and fiber crops (e.g., fruits and vegetables). Farmlands of statewide importance have the special combination of soil quality, location, growing season, and moisture supply needed to economically produce sustained high quality or high yields of specific crops when treated and managed according to acceptable farming methods. Farmland of statewide importance is similar to prime farmland but with minor shortcomings such as greater slopes or less ability to store soil moisture. The methods for defining and listing farmland of statewide importance are determined by the appropriate State agencies, typically in association with local soil conservation districts or other local agencies.

Soil characteristics crossed by the rights-of-way of each Segments' Route Options are presented in **Table 7-83** through **Table 7-86**. Right-of-way was chosen as the impact parameter due to permanent construction impacts only anticipated within the respective rights-of-way.

7.8.3.1 Segment 1

Soil types crossed by the Route Option 1 North and South are generally loamy and silty.

Table 7-83
Summary of Soil Characteristics Along ROW of Route Options 1 North and 1 South and Alternative Segments (Acres)

	1 North Route Option	1 South Route Option	1 South Alternative Segment (1L)
Total Right of Way	766.58	866.76	144.64
Prime Farmland[1]	378.55	566.53	80.72
Farmland of Statewide Importance[2]	187.85	154.14	48.16
Wind Erodible[3]	40.52	24.49	4.43
Water Erodible[4]	66.09	57.03	4.12
Hydric[5]	322.22	375.08	48.20

	1 North Route Option	1 South Route Option	1 South Alternative Segment (1L)
Revegetation Concerns[6]	416.27	330.31	67.30

Note: Soils may have more than one characteristic.
[1] Includes soils that meet the prime farmland or prime farmland if a limiting factor is mitigated.
[2] Includes soils classified as farmland of statewide importance by SSURGO.
[3] Includes soils in wind erodibility group designation of 1 or 2.
[4] Includes soils with a slope greater than 15 percent or soils with a K value of greater than 0.35 and slopes greater than 5 percent.
[5] Includes soils that are classified as hydric by SSURGO.
[6] Includes soils with a non-irrigated land capability classification of 3 or greater.

7.8.3.2 Segment 2

Soil types crossed by the Route Option 2 North and South are generally loamy, silty, and sandy.

Table 7-84
Summary of Soil Characteristics Along ROW of Route Options 2 N and 2 S, Alternative Segments and Connector Segments (Acres)

	2 North Route Option	2 South Route Option	2 North and 2 South Connector Segment (2G)
Total Right of Way	748.56	613.13	13.60
Prime Farmland[1]	589.00	514.10	5.31
Farmland of Statewide Importance[2]	91.08	49.19	1.82
Wind Erodible[3]	39.19	5.12	0.00
Water Erodible[4]	42.56	15.03	0.00
Hydric[5]	156.96	278.97	4.82
Revegetation Concerns[6]	248.48	261.94	8.77

Note: Soils may have more than one characteristic.
[1] Includes soils that meet the prime farmland or prime farmland if a limiting factor is mitigated.
[2] Includes soils classified as farmland of statewide importance by SSURGO.
[3] Includes soils in wind erodibility group designation of 1 or 2.
[4] Includes soils with a slope greater than 15 percent or soils with a K value of greater than 0.35 and slopes greater than 5 percent.
[5] Includes soils that are classified as hydric by SSURGO.
[6] Includes soils with a non-irrigated land capability classification of 3 or greater.

7.8.3.3 Segment 3

Soil types crossed by Route Option 3 are generally silty and loamy.

Table 7-85
Summary of Soil Characteristics Along ROW of Route Option 3, Alternative Segments and Connector Segments (Acres)

	Route Option 3
Total Right of Way	788.82
Prime Farmland[1]	331.97
Farmland of Statewide Importance[2]	233.25
Wind Erodible[3]	47.27
Water Erodible[4]	122.49
Hydric[5]	36.38
Revegetation Concerns[6]	450.33

Note: Soils may have more than one characteristic.
[1] Includes soils that meet the prime farmland or prime farmland if a limiting factor is mitigated.
[2] Includes soils classified as farmland of statewide importance by SSURGO.
[3] Includes soils in wind erodibility group designation of 1 or 2.
[4] Includes soils with a slope greater than 15 percent or soils with a K value of greater than 0.35 and slopes greater than 5 percent.
[5] Includes soils that are classified as hydric by SSURGO.
[6] Includes soils with a non-irrigated land capability classification of 3 or greater.

7.8.3.4 Segment 4

Soil types crossed by the Route Options 4 West and East are generally loamy, sandy and fine silty.

Table 7-86
Summary of Soil Characteristics Along ROW of Route Options 4 E and 4 W, Alternative Segments and Connector Segments (Acres)

	Route Option 4 East	Alternative Segment 4C	Alternative Segment 4E	Route Option 4 West	Alternative Segment 4M	Alternative Segment 4R	Connector Segment 4Q
Total Right of Way	237.75	14.92	38.05	429.91	12.09	6.95	5.35
Prime Farmland[1]	151.72	0.00	5.40	261.30	2.55	0.00	5.35
Farmland of Statewide Importance[2]	45.79	4.23	5.40	106.83	3.19	3.41	0.0
Wind Erodible[3]	3.44	0.00	0.00	3.72	0.00	0.00	0.0
Water Erodible[4]	55.06	4.23	5.40	27.69	0.40	3.41	0.0
Hydric[5]	7.25	0.00	0.00	46.47	0.00	0.00	0.0
Revegetation Concerns[6]	89.01	0.00	0.00	173.77	0.00	0.00	0.0

Note: Soils may have more than one characteristic.
[1] Includes soils that meet the prime farmland or prime farmland if a limiting factor is mitigated.

[2] Includes soils classified as farmland of statewide importance by SSURGO.
[3] Includes soils in wind erodibility group designation of 1 or 2.
[4] Includes soils with a slope greater than 15 percent or soils with a K value of greater than 0.35 and slopes greater than 5 percent.
[5] Includes soils that are classified as hydric by SSURGO.
[6] Includes soils with a non-irrigated land capability classification of 3 or greater.

7.8.3.5 Soils: Avoidance and Mitigation of Potential Impacts

Transmission line and substation projects have the potential to impact soils during the construction (short-term) and operation (permanent) stages of a project. Construction may require some amount of grading to provide a level surface for safe operation of construction equipment. In addition, potential topsoil and subsoil mixing may result from the excavation, stockpiling, and redistribution of soils during installation of transmission line structures and substation components. Localized soil erosion, compaction, and topsoil and subsoil mixing could affect revegetation within temporary work areas. Construction of a substation would result in permanent impacts to soils for that facility's operational lifetime.

Temporary impacts to soils will occur during the construction of the transmission line. During construction, soil compaction and localized soil erosion may occur during clearing and grading of temporary work areas. The Applicant will implement measures to reduce soil compaction and will commit to decompaction of soils during restoration of temporary workspaces, including travel lanes. Impacts to soils along the transmission line would be temporary and minor and would be mitigated through the proper use and installation of BMPs, such as minimizing the number of vehicles trips, use of silt fencing or other effective sediment controls, and segregation of topsoil and subsoil. Construction impacts to soils would be reduced through implementation of the agricultural impact mitigation plan (AIMP) and the vegetation management plan (VMP) (see **Appendices U** and **V**).

Construction work within the substation sites will include site preparation, including grading, and installation of substructures and electrical equipment. Installation of concrete foundations and embedments for equipment will require the use of trenching machines, concrete trucks and pumpers, vibrators, forklifts, boom trucks, and large cranes. The limit of disturbance will be within the footprint of the substations for both the foundation equipment and the concrete delivery trucks. All topsoil from the substation footprints will be removed to a pre-established suitable location for storage. The storage area would be near the site where the soil was removed, accurately located (GPS boundary, soil depth) and graded to facilitate revegetation. Subsoil would be removed, if necessary, to an acceptable pre-established and approved area for storage.

The Applicant will also develop a SWPPP that complies with MPCA rules and guidelines; implementation of the protocols outlined in the SWPPP will minimize the potential for soil erosion during construction of the transmission line and substations. Xcel Energy will implement measures to reduce soil compaction and will commit to decompaction of soils during restoration of temporary workspaces. Landowners will be compensated accordingly for any localized crop damage that may occur through implementation of the AIMP and the VMP (see Appendices U and V).

Modifications to the Wilmarth, Eastwood and North Rochester substations and construction of the proposed transmission lines would result in permanent impacts to soils. Where present, operation of substations would constitute a permanent loss of prime farmland soils. It is important to note that prime farmland soil designation is independent of current land use and soils at the proposed permanent facilities may have already been significantly modified by previous development or may not currently be used for agricultural purposes.

7.9 Unavoidable Impacts

A description of the human and natural environmental effects that are unavoidable if the Project is approved by the Commission is required for a Route Permit application pursuant to Minn. Rule 7850.1900, subp. 3(G). The Project has been developed by the Applicant with a goal to avoid impacts to environmental resources whenever possible. Some impacts to environmental resources are not possible to avoid entirely. However, where impacts cannot be avoided, impacts could be minimized through various mitigation measures.

Sections 7.1 through 7.9 of this Application provide a detailed discussion of the environmental impacts of the proposed Project and the mitigation measures that would be used to minimize such impacts. Environmental impacts that cannot reasonably be avoided but would be minimized through mitigation measures are provided below. The majority of these unavoidable impacts would occur during construction of the Project and would resolve with the completion of construction and restoration of construction areas.

Unavoidable construction related Project impacts that would resolve after construction is complete include:

- Increased traffic on roads that are in the vicinity of the Project and potential short-term traffic delays on public roadways.
- Visual disturbance to nearby residents and recreationalists.
- Noise emitted from vehicles and equipment during construction that will be audible to neighboring landowners and recreationalists.
- Temporary impacts to agricultural operations, such as crop losses and soil compaction and erosion.
- Vegetation clearing that could result in minor amounts of habitat loss.
- Temporary disturbance to and displacement of wildlife, as well as direct impacts to wildlife inadvertently struck or crushed during structure placement or other construction activities.
- Minor air quality impacts due to construction vehicle emissions and fugitive dust.

Unavoidable operation related Project impacts that would last throughout the life of the Project would include the following:

- Changes to existing aesthetics of landscape (from predominantly agricultural to transmission line or substation), which will be visible from local roadways and parcels.
- Physical impacts to land use and change in landcover where the permanent Project structures exist and/or where the right-of-way requires vegetation maintenance (e.g., forested lands).

- Injury or death of avian species that collide with, or are electrocuted by, conductors.
- Continued maintenance of tall-growing vegetation within the right-of-way to comply with NESC requirements.

In addition to the unavoidable temporary and permanent impacts listed above, a minimal commitment of individuals and resources would be required to construct either of the route options in Segments 1, 2 and 4 (only the single existing route is proposed for Segment 3, which would involve minimal construction activities). Some resources would be irreversibly committed to the Project and would be irretrievable, including trees cleared and maintained as such along the right-of-way of the selected route option. Resources committed would be similar for either route options in Segments 1, 2 and 4 due to the same general area being crossed by each of the route options.

8. TRIBAL, FEDERAL AND STATE AGENCY, LOCAL GOVERNMENT, AND PUBLIC INVOLVEMENT

This section describes outreach efforts conducted by the Applicant and discusses pre-application involvement by Tribal, federal, state, and local agencies as well as the public information outreach campaign. In addition to public outreach, the Applicant created a Project website to provide key Project information for the public. The Project website mmrtproject.com launched on May 8, 2023, and is further discussed below.

Throughout the outreach processes, the Applicant provided opportunities for stakeholders and potentially affected landowners to participate in the routing process. This engagement provided the Applicant with valuable insight into landowner, public agency, and Tribal preferences regarding development of Project facilities, including the development of Route Alternatives analyzed for the Project.

Initial outreach letters were sent to Tribal, federal, state, and local agencies May 1, 2023 (see **Appendix M**). A second round of outreach letters were sent to Tribal contacts on September 1, 2023 (**Appendix M**). Letters to local governmental units (LGUs) were sent on October 4, 2023 (see **Appendix F** for the 90-day Pre-application Letter to Local Units of Government and Affidavits of Mailing).

8.1 Tribal and Agency Outreach

As part of pre-application outreach, in May 2023 the Applicant initiated an outreach campaign to Tribal contacts and federal, state and local public agencies through in-person meetings and project notification letters. As needed, the Applicant either met with or continued corresponding with stakeholders who responded to the outreach campaign and associated Project information. Correspondence and meeting notes of outreach efforts are included in **Appendix M** and are briefly summarized below.

The Project introduction letters included a Project overview map showing preliminary routing options. Letters were sent to Tribal, federal, state, county, and local agencies and stakeholders with jurisdiction in the Project Study Area (see **Appendix M**). The letter introduced the Project and requested input and comment on public and natural resources that may be potentially affected by the proposed Project. In the letter, the

Applicant provided preliminary Project details and a potential timeline for major Project milestones. The Applicant also requested input from the federal and state agencies with respect to the resources under their jurisdiction as well as the identification of federal and state permits and/or approvals that may be potentially required for the Project.

8.1.1 Native American Tribal Nations

On May 1, 2023, initial outreach letters were sent to all federally recognized Tribes in Minnesota and Tribes currently located in other states that have ancestral interest in the Minnesota counties crossed by the Project. A second follow up letter was sent to Tribal contacts on October 31, 2023. A list of the Tribes that were notified is included in **Table 8-1** below and an example of the letter and contacts are included in **Appendix M**.

Table 8-1
MMRTP Native American Tribal Nation Correspondence

Tribal Nation
Minnesota Federally Recognized Tribes
Bois Forte Band of Chippewa
Fond du Lac Band of Lake Superior Chippewa
Grand Portage Band of Lake Superior Chippewa
Leech Lake Band of Ojibwe
Lower Sioux Indian Community
Mille Lacs Band of Ojibwe
Minnesota Chippewa Tribe
Minnesota Indian Affairs Council
Prairie Island Indian Community
Red Lake Band of Chippewa Indians
Shakopee Mdewakanton Sioux Community
Upper Sioux Community
White Earth Nation

Tribal Nation
Out of State Tribes
Apache Tribe of Oklahoma
Cheyenne and Arapaho Tribes, Oklahoma
Flandreau Santee Sioux Tribe of South Dakota
Fort Belknap Indian Community of the Fort Belknap Reservation of Montana
Iowa Tribe of Kansas and Nebraska
Menominee Indian Tribe of Wisconsin
Santee Sioux Nation, Nebraska
Sisseton-Wahpeton Oyate of the Lake Traverse Reservation, South Dakota
Spirit Lake Tribe, North Dakota

In May 2023, representatives from the Prairie Island Indian Community (PIIC) contacted Xcel Energy and noted that one of the proposed route options crossed lands that were owned by the Tribe and requested a meeting. On July 17, 2023, Xcel Energy and PIIC had a call to discuss the Project and the potential impacts, and PIIC representatives noted that they are interested in developing the property, which is located on the east side of Highway 52. On November 15, 2023, PIIC sent a letter to Xcel Energy noting their concerns with the alignment of Route Option 4 East. A copy of the letter is included in **Appendix M**. In response to the expressed concerns, and to give the Commission multiple options to review in the area, the Applicant identified an additional alignment option to parallel the highway on the southwestern side of Highway 52.

On December 14, 2023, Xcel Energy had a follow-up call with PIIC and went over the overall scope of the route options in Segment 4, including the added alternative alignment option. Xcel Energy explained that the Applicant cannot identify a preferred route in its Route Permit Application and encouraged the PIIC stay involved to advocate to the Commission for their preferred route.

8.1.2 Federal Agencies

The Applicant sent initial outreach letters in May 2023 to the federal agencies listed in **Table 8-2** below. As needed, the Applicant completed follow up correspondence with the following federal agencies: the U.S. Army Corps of Engineers (USACE), Federal Aviation Administration (FAA), U.S Fish and Wildlife Service (USFWS) regarding the Project. See **Appendix M** for copies of key correspondence with applicable agencies.

Table 8-2
MMRT Federal Agency Correspondence

Federal Agency	Date of Initial Outreach Letter and Correspondence
U.S. Army Corps of Engineers	May 1, 8, and 9, 2023, and August 31, 2023
Federal Aviation Administration	May 1, 9 and 10, 2023
U.S. Department of Agriculture	May 1, 2023, June 22, 2023, and September 6, 2023
U.S. Bureau of Indian Affairs	May 1 and 9, 2023
U.S. Fish and Wildlife Service	May 1, 2023, and September 6 and 8, 2023
U.S. Environmental Protection Agency	May 1, 2023

8.1.2.1 U.S. Army Corps of Engineers

The USACE responded to the Project notification letter on May 8, 2023, and on May 9, 2023 provided contact information for the USACE Project Manager that will evaluate the Applicant's Section 404 permit once a route has been ordered. The Applicant responded to USACE in August 2023 with follow up Project updates and an estimated date of permitting for the Project. The Applicant will continue to coordinate with the USACE Project Manager as the route becomes more defined.

8.1.2.2 Federal Aviation Administration

The FAA responded to the Project notification letter on May 9 and 10, 2023, and directed the Applicant to use the Notice Criteria Tool to determine whether Form 7460-1, Notice of Proposed Construction of Alteration is required for the Project. The FAA also noted two airports in the vicinity of the proposed Project – Mankato (MKT) and Faribault (FBL), and that it would expect a significant number of line poles around the two airports and strategic points that help define the pole configuration going from east to west. The FAA contact indicated he could meet with the Applicant to further review the Project as needed.

8.1.2.3 U.S. Department of Agriculture

An easement program manager of the U.S. Department of Agriculture (USDA) – Natural Resource Conservation Service (NRCS) responded to the Applicant's May 2023 outreach letter that the NRCS would like to review the Proposed Routes to make sure it does not intersect with any of the NRCS easements. The Applicant sent maps of the Proposed Routes to NRCS staff on June 22 and updated routing maps on September 6, 2023. While the Applicant has not received comments yet from NRCS on the Proposed Routes, it will continue to coordinate and consult with the NRCS to identify easements crossed by the Proposed Routes.

8.1.2.4 U.S. Bureau of Indian Affairs

A representative of the U.S. Bureau of Indian Affairs (BIA) responded through the Project website comment tool that the BIA reviewed the map provided in the May 2023 Applicant outreach letter by the Bureau of Land Management (BLM) Surveyor and he found that the Proposed Routes are not close to any tribal lands in the State. The BIA indicated the "closest tribe would be Prairie Island Indian Community." The Applicant will continue to consult with the BIA as needed for the Project.

8.1.2.5 U.S. Fish and Wildlife Service

Along with the initial Project letter the Applicant included a copy of the IPaC (Information for Planning and Consultation) report for the Project Study Area to the U.S. Fish and Wildlife Service (USFWS) in May 2023. In a follow up conversation on September 8, 2023, USFWS staff responded and noted that a new eagle ruling was pending and expected to be final at the end of 2023. The USFWS recommended waiting for this final ruling, which was published on February 12, 2024, to see how it would impact the Project and any required surveys. While waiting on the pending final ruling, the USFWS suggested waiting to discuss other aspects of the Project further until 2024. The Applicant will coordinate with USFWS to schedule this consultation in 2024 to review the final February 2024 ruling and other relevant requirements.

8.1.3 State Agencies

The Applicant corresponded with the state agencies listed in **Table 8-3** below regarding the Project. After initial letters were sent in May 2023, follow-up communications have taken place via emails, virtual meetings and phone calls.

Table 8-3
MMRTP State Agency Correspondence

State Agency	Date(s) of Initial Outreach Letter & Correspondence
Minnesota Association of Soil and Water Conservation	May 1, 2023
Minnesota Board of Water and Soil Resources	May 1, 2023
Minnesota Department of Agriculture	May 1, 2023, and February 5 and 7, 2024
Minnesota Department of Health	May 1, 2023
Minnesota Department of Transportation	May 1, 2023, August 22, 2023, September 13, 2023, and January 30, 2024
Minnesota Department of Transportation: Development Commission	May 1, 2023
Mississippi River Parkway Commission	October 11 and 13, 2023
Minnesota Pollution Control Agency	May 16, 2023, and October 18, 2023
Minnesota Pollution Control Agency: SSTS Policy and Planning Compliance and Enforcement	May 1, 2023
Minnesota State Historic Preservation Office	May 1, 2023, and February 16, 2024
Minnesota Department of Natural Resources	May 1, 2023, July 17, 2023, January 23, 2024

8.1.3.1 Minnesota Department of Natural Resources

The Applicant has had ongoing discussions about the Project with MnDNR over Project details and addressing any initial questions or concerns of the MnDNR.

On July 17, 2023, a call was held between MnDNR, the Applicant, and HDR (see **Appendix M** for meeting notes). The purpose of the call was to go over the preliminary route alternatives for the Project and to discuss natural resource concerns, schedule, and Route Permit Application details at a high level. The MnDNR requested that a formal NHIS request be made through the Minnesota Conservation Explorer (MCE) and included in this application. A copy of the MCE review provided by the MnDNR on January 23, 2024 is included in **Appendix M**. The Applicant is using this data to assess potential Project impacts and mitigation in applicable portions of this application. The Applicant will continue to coordinate and consult with MnDNR through the permitting process for the Project.

8.1.3.2 Minnesota Department of Transportation

The Applicant has had ongoing discussions about the Project with MnDOT about Project details and addressing any initial questions or concerns of MnDOT.

On August 22, 2023, MnDOT had a call with the Applicant and members of HDR (see **Appendix M** for meeting notes). MnDOT went over areas of note along all Proposed Route segments and alternatives. Feedback included locations where roadway construction is upcoming, existing infrastructure MnDOT would prefer to be avoided or would prefer the proposed transmission line would be parallel to, and MnDOT making note that US Highway 61 (near Segment 3) is a scenic byway (Segment 3 would be built along existing transmission line infrastructure and will not be impacting the viewshed).

On September 13, 2023, MnDOT had another call with the Applicant and members of HDR (see **Appendix M** for meeting notes). During this meeting, MnDOT explained the new Early Notification Memo (ENM) process that the department has begun using and requested the Applicant complete the ENM form. Following the call MnDOT sent a formatted ENM form for the Applicant to use for requesting MnDOT review for use in the application. MnDOT also notified the Applicant that contact with the Mississippi River Parkway Commission (MRPC) should be made regarding potential impacts to applicable scenic byways crossed by the Project and obtain comments and recommendations from MRPC; MnDOT provided a contact at MRPC for the Applicant to initiate that consultation (see below).

On January 30, 2024, MnDOT provided its Early Coordination response for the Project and included information concerning meeting summaries, general transmission line routing considerations, and an attachment with detailed MnDOT recommendations and comments concerning resources associated with the Project. ENM correspondence is included in **Appendix M**.

The Applicant will continue to coordinate with MnDOT as the routing process moves forward.

8.1.3.3 Mississippi River Parkway Commission

The Applicant sent an email with Project information and a request for comment letter to Mississippi River Parkway Commission (MRPC) on October 11, 2023. In that communication, the Applicant noted that no new construction would take place on the portion of the Project where it crosses Highway 61 but noted that Dairyland will have a project to construct a new 161 kV line (which is being replaced by the new 345 kV line on the existing poles). MPRC responded on October 13, 2023 indicating it would share the Applicant letter with MPRC members and watch for details on the Dairyland 161 kV transmission reroute project.

8.1.3.4 Minnesota State Historic Preservation Office

The Minnesota SHPO was contacted on March 7, 2023, to request information on known cultural resources within the Project Study Area. The Minnesota SHPO responded on March 10, 2023, with a Microsoft Access database file containing all known records of cultural resources within the Project Study Area. This dataset was incorporated into Section 6.5. On May 1, 2023, the Applicant sent the initial outreach letter to the Minnesota SHPO describing the Project and requesting comments. The Applicant prepared a draft Cultural Resources Literature Review of the Project Study Area and submitted a copy of that to the Minnesota SHPO along with a completed Request for Project Review form on February 16, 2024 (see **Appendix M**). See

Appendix O for the Cultural Resource Mapbook and the Cultural Resources Literature Review.

8.1.3.5 Minnesota Department of Agriculture

In addition to the general Project description and outreach letter the Applicant sent a copy of the draft AIMP to the MDA on February 5, 2024, and MDA provided comments on February 7, 2024, which the Applicant has incorporated into the draft AIMP (see **Appendix M**). A copy of the draft AIMP is included in **Appendix U**.

The Applicant will continue to coordinate with MDA to finalize the AIMP prior to construction of the Project.

8.1.3.6 Minnesota Pollution Control Agency

The Applicant sent an initial outreach letter with Project information and a request for comment to the Minnesota Pollution Control Agency (MPCA) on May 1, 2023. MPCA contacted the Applicant and requested a meeting to discuss the proposed Segment 1 North as the existing line is located across a closed demolition landfill (called the Summit Avenue Demolition Landfill). The Applicant met with MPCA staff on October 18, 2023, to discuss the proximity of the Project to the closed landfill (see **Appendix M**) and concerns of replacing existing transmission structures with new double circuit 345/115 kV structures if this route is selected. Following the meeting, MPCA sent additional information about the extent of the landfill, which the Applicant incorporated into the Project routing map. The Applicant also met with the owner of the landfill site on November 9, 2023. During the meeting activities associated with the demolition landfill, closure of the landfill, and ongoing maintenance and monitoring of the landfill site were discussed. The locations of existing transmission structures were reviewed and observed in a site visit after the meeting. The Applicant will continue to coordinate and consult with both the MPCA and landowner of the closed landfill site regarding replacing the existing 115 kV line with a double circuit 345/115 kV line if this route is selected.

8.1.4 Local Government Units

The Applicant also corresponded with the following Local Government Units (LGUs) regarding the Project. On May 1, 2023, the Applicant sent an initial outreach letter to the LGUs describing the Project and requesting comments (see **Table 8-5** and **Appendix M**). Pursuant to Minn. Stat. § 216E.03, on October 5, 2023, the Applicant also sent LGUs the 90-day notice letter to inform them of the Project and the opportunity to arrange for a pre-application consultation meeting with the Applicant. Details regarding in-person or virtual meetings requested by the LGUs are described below.

Table 8-4
Local Government Units in Project Study Area

Local Government Unit
Counties
Blue Earth County
Dodge County
Goodhue County
Le Sueur County
Olmsted County
Rice County
Wabasha County
Waseca County
Winona County
Cities and Townships
Cannon City Township
Cascade Township
Cherry Grove Township
City of Faribault
Eagle Lake City
Elgin Township
Ellinton Township
Elysian
Elysian Township
Farmington Township
Greater Mankato Growth

Greenfield Township
Haverhill Township
Highland Township
Holden Township
Iosco Township
Jamestown
Janesville
Janesville Township
Kalmar Township
Kasota
Kenyon Township
LeRay Township
Lime Township
Madison Lake City
Mankato
Mankato Township
Mantorville Township
Mazeppa Township
Milton Township
Minneiska Township
Minneola Township
Morristown
Morristown Township
New Haven
Oakwood Township
Oronoco
Oronoco Township
Pine Island
Plainview City
Plainview Township
Richland Township
Rochester
Roscoe Township
Walcott Township
Wanamingo Township
Warsaw Township
Washington Township
Waterville City

Waterville Township
Watopa Township
Wells Township
Wheeling Township
Whitewater Township
Zumbro Township
Zumbrota City
Community and Economic Development Associates (CEDA)
Region 9 Development Commission
Southeast Minnesota Regional Transportation Coordinating Council

Representatives from Lime Township spoke with Project team members at the September open houses and provided written comments regarding the Project (see **Appendix M**). Concerns about airport safety were expressed, given the proximity of some Proposed Routes to Mankato Airport and to the preferred location of the Airport's control tower. Additional concerns were conveyed regarding Project proximity to the Summit Avenue Demolition Landfill and about pollution sensitivity within the Lime Township. The township supervisor also expressed an interest in preserving natural resources in the area, such as calcareous fen, endangered and threatened species, and game refuge areas. The Applicant held a virtual meeting with Lime Township on November 28, 2023 to discuss the concerns raised, provide updates on information the Applicant had learned regarding the airport and landfill, and address any additional questions or concerns.

City of Mankato staff attended the September 2023 public open houses and spoke with the Applicant about the Project. The Applicant also held a virtual meeting with staff on October 25, 2023, to discuss routing options near the Mankato Airport. In that meeting, City of Mankato representatives noted that the City held airspace easements in locations where Proposed Routes were located, and after the meeting provided mapping data and copies of said easements to the Applicant. Based on analysis of the easement terms, evaluation of engineering constraints, and confirmation from the City of Mankato staff that the City did not intend to release any of the easement rights, certain potential route segments south of the airport were eliminated from the Proposed Routes. A discussion of those eliminated segments is included in **Appendix Q**. On February 16, 2024, the

Applicant held a virtual meeting with City to discuss those, and related, changes to the final Proposed Routes.

The Applicant attended a Goodhue County Committee of the Whole meeting on January 16, 2024, to provide a presentation giving Project details and answering questions about the Project. A copy of the agenda with a link to the presentation is included in **Appendix M**.

The Applicant met with and presented to city council members at the City of Oronoco City Council meeting on January 16, 2024. At the meeting, the Applicant shared information about the Project need, the Proposed Routes, how those routes were developed, and answered questions from attendees and collected feedback from council members. City council members expressed concerns related to routing along Highway 52. Members of the Council noted a preference that the new single-circuit 161 kV line be built parallel to the existing Hampton – La Crosse 345 kV transmission line, which is also Segment 3 of this Project. Following the presentation, Cascade Township, Oronoco Township, Pine Island Township, and the City of Oronoco passed resolutions requesting that a route alternative for the new single-circuit 161 kV line be added which would parallel the Hampton – La Crosse 345 kV line from the North Rochester Substation to the Chester Junction. Copies of these resolutions are included in **Appendix M**. The Applicant informed these townships and the City of Oronoco that while this route alternative is not being added to the Proposed Routes at this time, an analysis of this route will be included in the Application. A discussion of this alternative is included in **Appendix Q**.

8.2 Public Outreach

Public outreach for the Project consisted of digital engagement, informational mailings and virtual and in-person open house meetings, as described below.

8.2.1 Website and Digital Engagement

The Applicant established a Project website to provide key Project information for the public. The website contains a description of the Project scope and schedule, explanation of the Project need, static and interactive segment maps, an informational video about transmission infrastructure, and a Project library that includes Frequently Asked Questions, fact sheets, open house meeting boards and recordings and presentations from the virtual open houses (**Appendix N)**. To facilitate public involvement, the website contained links to subscribe to the Project mailing list for email notifications, comment form and comment map, information line telephone number, and a page with past and upcoming events including open houses. The open houses were promoted on Xcel Energy's Facebook account with the most website visits coming from Facebook.

The Project website, mmrtproject.com, launched on May 8, 2023. From May 8 to March 19, 2024, the site had 3,649 users and 10,398 views. 65 percent of users visited the site on a desktop computer, 33 percent from mobile, and 2 percent from a tablet. The top five regional cities of origin for users were Minneapolis, Rochester, Pine Island, Owatonna and Mankato. Most users visited in May and September 2023 corresponding with the open house meeting outreach. The top visited pages were the home page and the project segments page that contained the interactive comment map for the online meeting.

The self-paced virtual open house included the same content presented during the in-person public open houses. It provided an opportunity for viewers to attend at their convenience to learn more about the Project, the routing process and provide input. Information about the self-guided virtual open house was included on outreach materials in addition to being linked from the Project website. This virtual open house was available from May 22 – June 9 and September 5 – 30, 2023. Virtual open house pages included:

- Welcome
- Overview
- Agenda
- Project Team Presenters
- Project Need
- Project Segments
- Segment 1
- Segment 2
- Segment 3
- Segment 4
- Permitting
- Working with Landowners
- Regulatory Process
- Transmission Line Infrastructure
- Typical Construction Process

- Project Description
- Project Benefits
- Project Map
- Project Partners
- Anticipated Schedule
- Routing Process
- Connect with Us
- Questions

Additionally, live virtual meetings were hosted using an interactive format called Broadnet that allowed people to call in and/or view on a personal device and allowed time for viewers to submit questions using prompts.

8.2.2 Mailings and Newsletters

The Applicant sent two mailers to approximately 17,000 recipients in the Project Study Area providing notification of the May 2023 and September 2023 open houses to landowners and agencies. In addition to providing information on dates and locations of the open houses, notifications also included a general Project description, a Project schedule, a map of the Project Study Area, the Project's website address, and Project contact information. Open houses were also promoted on Xcel Energy's social media accounts and advertised in the Faribault Daily News, Kasson Dodge County Independent, Kenyon Leader, Lake Crystal Tribune, Mankato Free Press, Plainview News, Rochester Post Bulletin, Wabasha County Herald, and Waseca County News. See **Appendix N** for Project mailings, social media posts and newspaper advertisements.

8.2.3 Open House Meetings

In May 2023, eight open house meetings were held for the Project, six in-person and one live virtual, as well as an on-demand self-guided virtual open house available on the Project website. A total of 68 people attended the in-person open houses in Goodhue County, 27 people attended the in-person open houses in Rice County, 20 people attended the in-person open houses in Nicollet County, and 3 people logged on to attend the live virtual meetings. Some attendees chose not to sign in and were not included in the attendance totals. During and after the open house meetings, formal and informal comments were collected. A total of 145 comments were submitted: 38 through in-person comment forms, 17 through online comment forms, 28 through in-person mapping stations, 26 through the online comment map, 19 through the Project email and 17 through the Project hotline.

In September 2023, an additional five open house meetings were held for the Project, three in-person and one live virtual, as well as an on-demand self-guided virtual open house available on the Project website. A total of 50 people attended the in-person open house in Zumbrota, 28 people attended the in-person open house in Mankato, 32 people attended the in-person open house in Faribault, and 5 people logged on to attend the live virtual meetings. During and after the open house meetings, formal and informal comments were collected. A total of 76 comments were submitted during this period, with 9 at the in-person open house in Zumbrota, 4 at the in-person open house in Mankato, and 11 at the in-person open house in Faribault.

Table 8-5
Public Open House Summary

Open House Venue	Open House Location	Date of Open House
First Round		
Goodhue County Fairgrounds	Zumbrota, MN	May 23, 2023
Rice County Fairgrounds Cannon River Room	Faribault, MN	May 24, 2023
Country Inn & Suites by Radisson	Mankato, MN	May 25, 2023
Virtual Open House, Live	Online	May 30, 2023
Virtual Open House, Self-Guided	Online	May 22 through June 9, 2023
Second Round		
Goodhue County Fairgrounds	Zumbrota, MN	September 19, 2023
Country Inn & Suites by Radisson	Mankato, MN	September 20, 2023
Rice County Fairgrounds Cannon River Room	Faribault, MN	September 21, 2023
Virtual Open House, Live	Online	September. 26, 2023

Open House Venue	Open House Location	Date of Open House
Virtual Open House, Self-Guided	Online	September. 5 – 30, 2023

8.2.4 Summary of Common Themes from Comments

As detailed in Chapter 6, route selection process for the Project began in 2022 and extended through late-2023. This process included consideration of statutory and rule requirements, identification and review of existing transmission lines and linear infrastructure, information gathering and data compilation, public outreach and input (including two rounds of in-person and virtual public meetings in May 2023 and September 2023), meeting with and collecting stakeholder comments, and comparison of route segments and alignments. Considerable public and agency outreach and information gathering was conducted to inform the proposed Project.

Among other things, development of route alternatives is informed by stakeholder comments and completed pursuant to Minn. R. 7850.3100 (i.e., an applicant must identify rejected route alternatives in the Application with an explanation of the reasons for rejecting them). In addition to the Proposed Routes described in Section 6 of the Application, several other route alternatives were considered and evaluated during route development and refinement which were ultimately not proposed (**Appendix Q**).

Approximately 342 comments have been submitted and reviewed by Project team members. Comments were received through a number of channels including, a Project information hotline, Project email inbox, online comment forms, interactive map comments and at in-person open houses. Comments that were associated with a specific property or address are shown in Map 6-2 in Section 6.2.5. Comments submitted about the Project during and after the open house meetings were centered on the following themes:

- Residential impacts (proximity, property values, aesthetics, etc.)
- Business impacts (proximity, operational disturbances, etc.)

- Agricultural and environmental impacts (farmland disturbance, harvest interruption, etc.)
- Proximity and potential impacts to aviation, quarrying and landfill operations
- Use of existing transmission corridors and infrastructure
- General routing questions and concerns
- Other Project questions and concerns

Comments from stakeholders were reviewed and evaluated to determine if routing changes to the proposed routes might be warranted or further considered. Obtaining routing comments from stakeholders is a necessary and critical component of determining the viability of proposed transmission facility routing and siting. As described in more detail in Chapter 6, the Applicant used stakeholder comments to inform proposed routing and siting opportunities and constraints, modified proposed routing/siting as applicable, and continued to refine the proposed Project in order to avoid, minimize or mitigate potential impacts. Specific route alternatives which were proposed by landowners, but which were not included in the final proposed routes, are shown and discussed in **Appendix Q** (Previously Considered Routes). Further analysis of routing and siting work that assesses stakeholder comments, as applicable, is included in **Appendix L** (Route Comparison Table) and **Appendix R** (Alternative Segments), as well as Tribal, Agency and LGU comments in **Appendix M** (Tribal, Agency and Local Government Correspondence).

9. TRANSMISSION LINE CONSTRUCTION AND MAINTENANCE

9.1 Right-of-Way Acquisition

Early in the detailed design process, typically after the route permit is obtained, the right-of-way acquisition process begins. For transmission lines, utilities typically acquire easement rights across land parcels to accommodate the transmission line. The evaluation and acquisition process includes title examination, initial owner contacts, survey work, document preparation, and acquisition of easement rights.

In areas of the Project that will use existing rights-of-way and the terms of the existing easement are sufficient, the Applicant's right-of-way agents will work with the landowner to address any short-term construction needs, impacts, or restoration.

For portions of the Project where a new or expanded right-of-way will be necessary, the Applicant's right-of-way agents will identify all persons and entities that may have a legal interest in the identified real estate. The Applicant's right-of-way agents contact each property owner to describe the need for the transmission facilities and how the Project may affect each parcel. The Applicant's right-of-way agents also seek information from the property owner about any specific concerns that they may have with the Project.

To aid in the design and routing of the Project, Applicant may request permission to enter the property to conduct preliminary survey and geotechnical work. During this process, the location of the proposed transmission line or substation facility may be staked with permission of the property owner.

The agent will discuss the construction schedule and construction requirements with the property owner. Special consideration may be needed for fences, crops, or livestock. Fences and livestock may need to be moved; temporary or permanent gates may need to be installed; and crops may need to be harvested early. In each case, the right-of-way agent and construction personnel coordinate these processes with the property owner.

Land value data will be collected to assist in determining the fair market value of the easement needed for the land parcels to be crossed by the Project as well as the impact the easement may have on the market value of those parcels. A fair market value offer will be developed that recognizes the impact of the easement to each parcel. Sometimes, a negotiated easement agreement cannot be reached. In those cases, the Applicant may exercise eminent domain pursuant to Minnesota law. The process of exercising the right of eminent domain is called condemnation.

Before commencing a condemnation proceeding, typically, the Applicant must obtain at least one appraisal and provide a copy to the property owner. The property owner may also obtain another property appraisal and the Applicant must reimburse the property owner for the cost of the appraisal according to the requirements and limits set forth in Minn. Stat. §117.036. To start the formal condemnation process, the Applicant file a petition in the district court where the property is located and serves that petition on all owners with an interest in each of the land parcels identified in the petition.

If the district court grants the petition, the court then appoints a three-person condemnation commission that will determine a just compensation amount for the easement. The three people appointed to the condemnation commission must be knowledgeable of applicable real estate matters. The commissioners schedule a viewing of the property and then schedule a valuation hearing where the utilities and property owners offer their evidence, such as testimony by appraisers, as to the fair market value of the property interests required for the Project. The condemnation commission then makes an award as to the value of the property acquired for the easement and that award is filed with the court. Each party has the right to appeal the award to the district court for a jury trial. A jury trial typically occurs in the event of an appeal in which the jury considers the parties' evidence and renders a verdict. At any point in this process, the case can be dismissed if the parties reach a settlement.

There may be instances where a property owner elects to require the Applicant to purchase their entire property rather than acquiring only an easement for the transmission line. The property owner is granted this right under Minn. Stat. § 216E.12, subd. 4, which is sometimes referred to as the "Buy-the-Farm Statute." The Buy-the-Farm Statute applies only to transmission lines that are 200 kV or more; thus, the Buy-the-Farm Statute may apply to parcels crossed by the proposed 345 kV transmission lines.

9.2 Construction Procedures

Construction will begin after necessary federal, state, and local approvals are obtained and property rights are acquired for each respective segment. Construction in areas where new easements are not needed or have already been obtained may proceed while right-of-way acquisition for other areas is still in process. The precise timing of construction will consider various requirements of permit conditions, environmental restrictions, availability of outages for existing transmission lines (if required), available workforce, and materials.

Construction will follow the Applicant's best practices for construction and mitigation to minimize temporary and permanent impacts to land and the environment. Construction typically progresses as follows:

- survey marking of the right-of-way
- right-of-way clearing and access preparation;
- grading or filling if necessary;
- installation of culverts or concrete foundations;
- installation of poles, insulators, and hardware;
- conductor stringing;
- installation of any aerial markers required by state or federal permits; and
- restoration / clean-up.

The Applicant will design the transmission line structures for installations at the existing grades. Where a site slope is required (typically on slopes exceeding 10 percent), working areas may be graded or leveled with fill. If acceptable to the property owner, the Applicant propose to leave the graded/leveled areas after construction to allow access for future maintenance activities. If not acceptable to the property owner, the Applicant will, to the best of its ability, return the grade of the site back to its original condition.

Construction will require the use of many different types of construction equipment including tree removal equipment, mowers, cranes, backhoes, digger-derrick line trucks, drill rigs, dump trucks, front-end loaders, bucket trucks, bulldozers, flatbed tractor-trailers, flatbed trucks, pickup trucks, concrete trucks, helicopters, and various trailers or other hauling equipment. Excavation equipment is often on wheeled or track-driven vehicles. Construction crews will attempt to use equipment, when opportunities are available, that minimizes impacts to land.

Construction staging areas/laydown yards are usually established for transmission projects. Staging involves delivering the equipment and materials necessary to construct the new transmission line facilities. Construction of each segment will likely include two or more staging areas. Structures, conductor, matting, and other materials are delivered to staging areas and stored until they are needed for the Project.

The Applicant will evaluate construction access opportunities by identifying existing transmission line easements, roads, or trails that are near the approved route. When feasible, the Applicant will confine construction activities to the easement area. In certain circumstances, additional off-easement access may be required on a temporary basis. Permission will be obtained from property owners prior to using off-easement access.

Improvements to existing access or construction of new access may be required to accommodate construction equipment. Field approaches and roads may be constructed or improved. Where applicable, the Applicant will obtain permits for new access from local road authorities. The Applicant will also work with appropriate road authorities to ensure proper maintenance of roadways traversed by construction equipment.

After right-of-way clearing and access preparation has been completed, pole and foundation installation will begin. Structures for the Project will require drilled pier concrete foundations.

Drilled pier foundations are typically between eight to ten feet in diameter and are typically 20 to 60 feet deep, depending on soil conditions. An angle or dead-end structure may require a foundation up to 12 feet in diameter. The actual diameter and depth of the hole (and foundation) depend on structure design and soil conditions that are determined during the initial survey and soil testing phases. Concrete is brought to the site by concrete trucks from a local concrete batch plant and filled around a steel rebar support cage and anchor bolts. Once the foundation is cured, the structure is bolted to the foundation.

Structures will be moved from staging areas and delivered to the site of each foundation where they are assembled. Using a crane, the structure is lifted and placed into position. Insulators and other hardware are attached to the structure prior to placing it on the foundation.

Conductor stringing is the last major step of transmission line construction. Stringing setup areas are typically located at two-mile intervals. These sites are located within the right-of-way, when possible, or within temporary construction easements. Conductor stringing often uses helicopters to start the process by pulling a "sock-line" or high strength rope through pulleys attached to the insulators on each structure that is attached to the conductor which are pulled into place and sagged to meet design requirements that are compliant with good utility practice and minimum code clearances. This process requires brief access to each structure to secure the conductor wire to the insulator hardware and to fasten the shield wire on each structure. After conductor installation is complete, conductor marking devices will be installed if required. These marking devices may include bird flight diverters or air navigational markers. The Applicant will work with the appropriate agencies to identify locations where marking devices need to be installed.

Where the transmission line crosses streets, roads, highways, or other energized conductors or obstructions, temporary guard or clearance poles may be installed before conductor stringing. The temporary guard or clearance poles ensure that conductors will not obstruct traffic or contact existing energized conductors or other cables during stringing operations and also protects the conductors from damage if they were to fall during stringing.

Some soil conditions and environmentally sensitive areas will require special construction techniques. The most effective way to minimize impacts to these areas will be to avoid placing poles in the sensitive areas by spanning over wetlands, streams, and rivers. When it is not feasible to avoid traversing sensitive areas, one or more of the following options will be used to minimize impacts, in consultation with the appropriate agencies:

- When possible, construction will be scheduled during frozen ground conditions;
- When construction during winter is not possible and conditions require, construction mats will be used where wetlands and other sensitive areas would be impacted;
- Equipment fueling and other maintenance will occur away from environmentally sensitive and wet areas. These construction practices help ensure that fuel and lubricants do not enter waterways or impact environmentally sensitive areas; and
- Various best management practices (BMPs) will be identified in the Project's Stormwater Pollution Prevention Plan (SWPPP), including the use of silt fences, bio logs, erosion control blankets with embedded seeds, and other sound water and soil conservation practices to protect topsoil and adjacent water resources and to minimize soil erosion.

These techniques are also used to reduce impacts to private property including driveways, yards, and drain tile.

9.3 Restoration and Clean-Up Procedures

Crews will attempt to minimize ground disturbance whenever feasible, but areas will be disturbed during the normal course of work. Once construction is completed in an area, disturbed areas will be restored to their original condition to the maximum extent feasible. Temporary restoration before the completion of construction in some areas along the right-of-way may be required per National Pollution Discharge Elimination System (NPDES) and Minnesota Pollution Control Agency (MPCA) construction permit requirements.

After construction activities have been completed, a utility representative will contact the property owner to discuss any damage that has occurred as a result of the Project. This contact may not occur until after the Applicant have started restoration activities.

If fences, drain tile, or other property have been damaged, the Applicant will repair damages or reimburse the landowner to repair the damages.

Farmers will be compensated for crop losses caused by Project construction. The compensation will be based upon the area(s) affected, the typical yield for the crops lost, and the market rates for those crops. A utility representative will measure the area(s) in which planted crops were damaged or destroyed, or not planted at the Applicant's request. The lost yields will be determined in coordination with the property owner. The market rate will also be determined in coordination with the property owner and local elevator and/or other evidence to determine the appropriate rate of payment. The Applicant will also make a payment for future year crop loss due to soil compaction. In addition, property owners will be compensated for their expense to deep rip compacted areas. If an individual does not have access to deep ripping equipment, Applicant will provide this service or access to such equipment.

Ground-level vegetation disturbed or removed from the right-of-way during construction of the Project will naturally reestablish to pre-construction conditions. Additionally, vegetation that is consistent with substation site operation outside the fenced area will be allowed to reestablish naturally at substation sites. Areas where significant soil compaction or other disturbance from construction activities occur will require additional assistance in reestablishing the vegetation stratum and controlling soil erosion. In these areas, the Applicant will use seed that is noxious weed free to reestablish vegetation.

Another aspect of restoration relates to the roads used to access staging areas or construction sites. After construction activities are complete, the Applicant will ensure that township, city, and county roads used for purposes of access during construction will be restored to their prior condition. The Applicant will meet with township road supervisors, city road personnel, or county highway departments to address any issues that arise during construction with roadways to ensure the roads are adequately restored, if necessary, after construction is complete.

9.4 Maintenance Practices

Transmission lines and substations are designed to operate for decades and require only moderate maintenance, particularly in the first few years of operation. Xcel Energy will perform aerial inspections of the 345 kV and 161 kV transmission line and inspect the line from the ground every four years. Typically, one to two workers are required to perform aerial inspections and three workers are required to perform the ground inspections. Any defects identified during these inspections will be assessed and corrected. Xcel Energy will also perform necessary vegetation management. Vegetation maintenance generally occurs every four years.

Line inspections are the principal operating and maintenance cost for transmission facilities. The aerial inspections cost approximately $75 to $100 per mile and the ground inspections cost approximately $200 to $400 per mile. 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.

The estimated service life of the proposed transmission lines for accounting purposes varies among utilities. Xcel Energy uses an approximately 60-year service life for their transmission assets. However, practically speaking, high voltage transmission lines are seldom completely retired.

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

9.5 Storm and Emergency Response and Restoration

Transmission infrastructure has very few mechanical elements and is built to withstand weather extremes that are normally encountered. With the exception of outages due to severe weather such as tornadoes and heavy ice storms, transmission lines rarely fail. Transmission lines are automatically taken out of service by the operation of protective relaying equipment when a fault is sensed on the line. Such interruptions are usually only momentary. Scheduled maintenance outages are also infrequent. As a result, the average annual availability of transmission infrastructure is very high, in excess of 99%.

However, unplanned outages of transmission facilities can happen for a variety of reasons. Unplanned outages can occur due to mechanical failures or severe weather like heavy ice, wind, and lightning. In the event an unplanned outage of any facility along the proposed Project occurs, Xcel Energy has the necessary infrastructure and crews in place in order to respond quickly and safely to return these facilities to service.

10. REQUIRED PERMITS, APPROVALS, AND CONSULTATIONS

In addition to the Certificate of Need and Route Permit, the Project will also require several regulatory permits, approvals, consultations, and reviews. **Table 10-1** provides a summary of the major permits, approvals, consultations, reviews, and public involvement that may be required for the Project and depend upon final routing, design/engineering and construction. Applicable permits and approvals will be obtained as required prior to the onset of construction of the Project.

Table 10-1

Anticipated Permits, Approvals, Consultations and Reviews

Administering Agency	Permit, Approval, or Consultation	Description
	Federal	
U.S. Army Corps of Engineers (USACE), St. Paul District	Section 404, Clean Water Act (CWA) – Dredge and Fill	The U.S. Army Corps of Engineers (USACE) requires a Section 404 permit for discharges of dredged or fill material into waters of the United States (WOTUS) including wetlands. Per both Minnesota Statute § 103G.2241, subd.3 and 6 and Minnesota Rules 8420.0420, subp.4, it is not required for the Applicant to have a replacement plan for wetland impacts. This is because "new placement or maintenance, repair, enhancement, or replacement of existing utility or utility-type service," does not require a replacement plan for wetlands when the project is authorized by the USACE under Section 404 of the Clean Water Act (CWA).
USACE, St. Paul District	Section 10 Rivers and Harbors Act	Under Section 10 of the Rivers and Harbors Act, the USACE regulates impacts made to navigable WOTUS. The Mississippi River is the only navigable WOTUS adjacent to any proposed route. The Mississippi River crossing was permitted as part of the CapX2020 Hampton – La Crosse 345 kV Project and no work will be required in the Mississippi River as part of the Project.
U.S. Fish and Wildlife Service (USFWS)	Section 7 and Section 9 Consultation	The USFWS is directed to identify potential presence of endangered and threatened species in the Project area and protect them along with their critical habitat under The Endangered Species Act (ESA) of 1973, as amended. Section 9 of the ESA prohibits take of federally listed species; take is defined as "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct" The term "harm" includes significant habitat alteration which

Administering Agency	Permit, Approval, or Consultation	Description
		kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Section 7 of the ESA requires that projects involving federal lands, funding, or authorizations require consultation between the lead federal agency and the USFWS. If the consultation with the USFWS determines that the Project will have adverse impacts on a listed species, a Biological Opinion and Incidental Take Statement will be issued by the USFWS.
U.S. Fish and Wildlife Service (USFWS)	Special Use Permit (for work in waterfowl production areas)	Consultation with the USFWS will determine whether a Special Use Permit will be necessary in areas along the Project that cross waterfowl production areas and/or are in close proximity to waterfowl production areas.
Federal Aviation Administration (FAA)	Part 7460 review	Structures higher than 200 feet above ground level or those that may exceed an imaginary surface extending outward and upward at certain slopes defined in the Code of Federal Regulations Chapter 77.9., shall provide proper notice to the FAA and receive approval before construction. Form 7460-1 shall be submitted to the FAA for notice of construction. Notice must be registered for each individual structure meeting these requirements. Notice shall include information such as the latitude and longitude, structure height, and the elevation at the structure location. Once notice is received, the FAA conducts an aeronautical study for potential airspace impacts and issues. If the FAA determines that the structure will not be a hazard, a Determination of No Hazard (DNH) will be granted for the structure. If the FAA determines the structure will create a significant hazard, a DNH will not be granted, and the structure may need to be moved or altered. If a structure location is changed prior to construction, it is necessary to resubmit Form 7460-1 for that structure. Once construction is complete, Form

Administering Agency	Permit, Approval, or Consultation	Description
		7460-2 will be submitted and will include the structure's as-built information.
Environmental Protection Agency (EPA)	Spill Prevention, Control, and Countermeasure (SPCC) Plan	If construction and/or operation of the Project is anticipated to result in meeting minimum requirements of fuel storage or discharge of oil or other petroleum into WOTUS, a Spill Prevention, Control, and Countermeasure (SPCC) plan will be required. If required, the Applicant will create and adhere to an SPCC that complies with Environmental Protection Agency (EPA) requirements.
U.S. Department of Agriculture (USDA)/ Natural Resources Conservation Service (NRCS)	Farmland Protection Policy Act / Farmland Conversion Impact Rating	If it is determined that the Project is going to cause "unnecessary and irreversible conversion of farmland to nonagricultural uses," a FPPA form (AD-1006 or CPA 106) will be completed and filed with the USDA/NRCS.
Native American Tribes	National Historic Preservation Act (NHPA) (coordination upon request in support of USACE Section 106 consultation to determine impacts on Traditional Cultural Properties)	Section 106 of the National Historic Preservation Act (NHPA) requires Federal agencies to consider the effects of their undertakings on historic properties (properties included in the National Register of Historic Places or the meet the criteria for the National Register). Surveys regarding historic property and/or cultural resources within the Project area or near the Project area may be required. Review surveys and coordination will occur between the USACE and the State Historic Preservation Officer (SHPO), Tribal Historic Preservation Officer (THPO) (if any of the Project is on tribal lands), and/or the Advisory Council on Historic Preservation (ACHP) to determine if mitigation or alternative action is necessary.
	State	
Minnesota Public Utilities Commission	Route Permit and Certificate of Need	Under Minn. Stat. § 216B.243 and § 216B.2421, a Certificate of Need from the Commission is required for this Project. Under Minn. Stat. § 216E.03 and Minnesota Rules 7850.1700 to

Administering Agency	Permit, Approval, or Consultation	Description
		7850.2700 and 7850.4000 to 7850.4400 a Route Permit from the Commission is required for this Project.
MPCA	National Pollutant Discharge Elimination System (NPDES) Stormwater Permit	The Minnesota Pollution Control Agency (MPCA) requires a National Pollutant Discharge Elimination System (NPDES) Permit for stormwater discharges associated with construction activities disturbing more than one acre of land. The Applicant will obtain the NPDES Permit prior to construction. The Applicant will also obtain a Stormwater Pollution Prevention Plan (SWPPP) from a representative with the proper certifications to create a SWPPP in the state of Minnesota. The purpose of the SWPPP will be to minimize discharge and sediment during stormwater events by taking proper precautions to contain soils on the site. The SWPPP will be obtained prior to construction and will be abided by throughout the construction process.
MPCA	Section 401 CWA Water Quality Certification	The Minnesota Pollution Control Agency (MPCA) requires Section 401 water quality certification to obtain a federal permit for any activity potentially resulting in discharge to waters of the U.S. This certification ensures the Project will comply with state water quality standards according to the Clean Water Act (CWA). The Applicant will obtain Section 401 water quality certification as necessary for the Project.
Minnesota Department of Natural Resources (MNDNR)	License to Cross Public Waters or State Lands Public Water Works Permit	A Minnesota Department of Natural Resources (MDNR) Utility License is required for the passage of any utility over, under, or across any public waters or state land. The MDNR Division of Lands and Minerals is responsible for granting approval in the form of a crossing license. In addition to a long-term license fee, there is a one-time crossing fee for each waterbody crossed. Agency review time of the application varies depending on the crossing technique and involves review and approval from several state departments and associated divisions. The

Administering Agency	Permit, Approval, or Consultation	Description
		Applicant will consult with the MDNR and will obtain a license, as applicable.
MNDNR	State Protected Species Consultations	Pursuant to Minnesota's Endangered Species Statute (Minn. Stat. §84.0895), the MnDNR is required to adopt rules designating species meeting the statutory definitions of endangered, threatened, or species of special concern and regulate treatment of these species. After receiving a Route Permit, Applicant will consult with the MnDNR regarding any Project-specific construction considerations related to Minnesota's Endangered Species Statute.
MNDNR	Water Appropriation General Permit 1997-0005 (dewatering)	The General Permit 1997-0005 is administered by the DNR for temporary water appropriations such as (but not limited to): dewatering, watering landscape, dust control, and hydrostatic testing.
MNDNR	State National Heritage Information System (NHIS) Review	The Natural Heritage Information System (NHIS) is a Minnesota data source that provides information on rare plants, animals, native plant communities, and rare features throughout the state. In consultation with the MNDNR, a review of this data source will be conducted to determine potential project related impacts to rare plants, animals, native plant communities, and rare features.
Board of Water and Soil Resources (BWSR)	Conservation Easements, Wetland Conservation Act	The Minnesota Wetland Conservation Act (MWCA) is administered at the local level with oversight from the Board of Water and Soil Resources (BWSR) in accordance with Minnesota Rules, Chapter 8420. After consultation with the BWSR, it will be determined whether a permit will be necessary.

Administering Agency	Permit, Approval, or Consultation	Description
Minnesota State Historic Preservation Office (SHPO)	Section 106 Consultation, NHPA	The Applicant will consult the MN State Historic Preservation Office (SHPO) to determine is there are any features eligible for listing in the National Record of Historic Places are present within the Project area or near the Project area. Coordination with SHPO will be ongoing.
Minnesota Department of Transportation (MNDOT)	Utility Permit on Trunk Highway Right-of-Way (Long Form No. 2525)	The Applicant will consult with MnDOT to determine if a Utility Accommodation Permit (Form 2525) is necessary for any roadways that the Applicant plans to work along. This permit is required for the construction of utility facilities crossing or paralleling existing trunk highway rights-of-way.
MNDOT	Driveway Access	The Applicant will apply for an Access/Driveway Permit (Form 1721) for using driveways and access points to trunk highways crossed or paralleled by the Project during construction. These permits will be obtained after the Applicant has been issued a Route Permit and prior to construction.
MNDOT	Oversize/Overweight Permits	The Applicant will apply for oversize and/or overweight permits for all vehicles using state trunk highways during construction and operation of the Project. These permits are required for vehicle loads of excess height, length, and/or weight, although overlength utility poles may be exempt. Certain over-width and/or overlength loads require escorts, which the Applicant will arrange, as necessary. These permits will be obtained after the Applicant has been issued a Route Permit and prior to construction.
Minnesota Department of Agriculture (MNDOA)	Agricultural Impact Mitigation Plan	The Applicant will consult with the Minnesota Department of Agriculture (MNDOA) to create an Agricultural Impact Mitigation Plan (AMIP) for impacts to agricultural areas as a result of construction and operation of the Project. This plan will describe measures and BMPs used in agricultural land to minimize any negative impacts on cultivated fields and drain tile systems.

Administering Agency	Permit, Approval, or Consultation	Description
	Local	
Soil and Water Conversation Districts	Coordination meetings	
County, City, and/or Township	Overwidth/Overweight Loads Permits, Road Crossing Permits, Driveway/Access Permits, Stormwater Permits, Utility Permit in County Right-of-Way	County permits often required for transmission lines include: a Utility Permit on County right-of-way, an Overwidth/Overweight Load Transportation Permit, and a Driveway/Access Permit. Conversations with representatives in the county are ongoing. The Applicant will not apply for any local permits until after the Commission approves the Certificate of Need and Route Permit.