APPLICATION TO THE MINNESOTA PUBLIC UTILITIES COMMISSION FOR A CERTIFICATE OF NEED FOR THE PROPOSED 345 KV BROOKINGS COUNTY – LYON COUNTY AND HELENA – HAMPTON SECOND-CIRCUIT PROJECT

MPUC Docket No. E002/CN-23-200

August 15, 2023

Submitted by

Northern States Power Company

Table of Contents

Table of Contents

Table of Contents

Table of Contents

Table of Contents

List of Tables

List of Tables

List of Figures

List of Figures

Appendices

Defined Terms

Term	Defined
AC	Alternating Current
ACSR	Aluminum Conductor Steel Reinforced
AFUDC	Allowance for Funds Used During Construction
AMA	Aquatic Management Areas
Agreement	Project Participation Agreement
Amps or Amperes	The rate at which electric charge moves through a wire
APC	Adjusted Production Cost
BGEPA	Bald and Golden Eagle Protection Act
BMPs	Best Management Practices
BWSR	Board of Water and Soil Resources
Brookings Second-Circuit Project or Project	The Brookings County – Lyon County and Helena Hampton Second-Circuit Project
CapX2020 Brookings Owners	Central Minnesota Municipal Power Agency, Great River Energy, Xcel Energy, Otter Tail Power Company, and Western Minnesota Municipal Power Agency
Commission or MPUC	Minnesota Public Utilities Commission
Company	Xcel Energy
CSP	Concentrating Solar Power
Curtailment	A reduction in the output of a generator
dB(A)	A-weighted decibel
DC	Direct Current
DOC-EERA	Minnesota Department of Commerce, Energy Environmental Review and Analysis
DOE	U.S. Department of Energy
Eastern Segment	Helena – Hampton portion of the Brookings Transmission Line
ECS	Ecological Classification System
ELF	Extremely Low Frequency
EMF	Electric and Magnetic Fields
ESA	Endangered Species Act
EPA	U. S. Environmental Protection Agency
FAA	Federal Aviation Administration

FEMA	Federal Emergency Management Agency
GBCA	Grassland Bird Conservation Areas
GRE	Great River Energy
IBA	Important Bird Areas
IPaC	USFWS Information for Planning, and Conservation System
IRA	Inflation Reduction Act of 2022
IRP	Integrated Resource Plan
ITC	Investment Tax Credit
Load	All the devices that consume electricity and make up the total demand for power at any given moment or the total power drawn from the system
kV/m	Kilovolt/meter
kV	Kilovolt
kWh	Kilowatt-hour
LRTP	MISO's Long-Range Transmission Planning
MDNR	Minnesota Department of Natural Resources
mG	milliGauss
MISO	Midcontinent Independent System Operator, Inc.
MCBS	Minnesota County Biological Survey
Mono c-Si	Monocrystalline Si modules
MnDOT	Minnesota Department of Transportation
MPCA	Minnesota Pollution Control Agency
MTEP	MISO Transmission Expansion Plan
MVAR	Mega-Volt-Amperes Reactive
MW	Megawatt
NAC	Noise Area Classifications
NESC	National Electric Safety Code
NHIS	MDNR Natural Heritage Inventory System
NRHP	National Register of Historic Places
NWI	National Wetlands Inventory
NWR	National Wildlife Refuges
NO_x	Nitrogen Oxides
NLEB	Northern Long-Eared Bat

NSP	Northern States Power Company, a Minnesota corporation
NSP Companies	Xcel Energy, a Minnesota corporation, and Northern States Power Company, a Wisconsin corporation
NPDES	National Pollution Discharge Elimination System
OSHA	Occupational Safety and Health Administration
Ohms	A measurement of the force that moves the electricity through the wire
OSA	Office of State Archaeologist
OPGW	Optical Ground Wire
Original Brookings Line	Brookings County – Hampton 345 kV transmission line as constructed with a single circuit installed on double-circuit capable structures on the Western and Eastern Segments
PPB	Parts Per Billion
PPM	Parts Per Million
PROMOD	PROduction MODeling
PTC	Production Tax Credit
PV	Photovoltaic
PWI	MDNR Public Waters Inventory
RRWP	Railroad Rights-of-Way Prairies
Renewable Energy	Generation resources that rely on fuel sources that restore themselves over short periods of time and cannot be depleted
RPS	Renewable Portfolio Standards
RIM	Reinvest in Minnesota
SGCN	Species of Greatest Conservation Need
SNA	Scientific and Natural Areas
SHPO	Minnesota State Historic Preservation Office
SWCD	Soil and Water Conservation District
SF6	Sulfur Hexaflouride
Substation	Substations allow transmission lines to connect with one another, or allow power to be transformed between higher and lower voltages
SWPPP	Stormwater Pollution Prevention Plan
TCB	Tricolored bat

USACE	U.S. Army Corps of Engineers
USDA	United State Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
Voltage	A type of "pressure" that drives electrical charges through a circuit. Higher voltage lines generally carry power longer distances
Western Segment	Brookings County – Lyon County portion of the Brookings Transmission Line
WHO	World Health Organization
WIA	Minnesota Walk-In Access
WMA	Wildlife Management Areas
WPA	Waterfowl Production Areas
Xcel Energy	Northern States Power Company, a Minnesota corporation

1. EXECUTIVE SUMMARY

1.1 Introduction

Northern States Power Company, a Minnesota corporation (NSP), doing business as Xcel Energy (Xcel Energy or the Company), requests a Certificate of Need from the Minnesota Public Utilities Commission (Commission) to construct the Minnesota portion of the Brookings County – Lyon County Second-Circuit Project and Helena – Hampton Second-Circuit Project (collectively, the Brookings County – Lyon County Second-Circuit Project and the Helena – Hampton Second-Circuit Project are referred to as the Brookings Second-Circuit Project or Project).

This Project will help reduce energy costs by addressing one of the most electrically congested areas in the region. Currently, low-cost renewable energy generated in North Dakota, South Dakota, and southern Minnesota faces congestion when flowing to load centers, like the Twin Cities. When this congestion occurs, the cost of electricity increases due to congestion charges because electricity must come from higher-cost generators in areas without transmission constraints. These higher costs, resulting from inefficiencies in the wholesale energy market, increase costs for customers. This congestion is projected to worsen over the next 10 years as more renewable energy facilities come online in this area. The Project is needed to help relieve the transmission congestion in the area served by the Project. By relieving congestion, the Project is expected to increase access to low-cost, carbon-free, renewable generation; provide economic benefits; strengthen the regional grid; support wind generation facilities in Minnesota, North Dakota, and South Dakota; and advance the State's energy policy. Xcel Energy estimates the Project would provide Company-specific benefits of $334.83 million in production-cost savings and other quantifiable economic benefits on a present-value basis over the 63-year book life of the Project, as well as significant progress toward carbon-emission reduction policy objectives.

The Project involves installing a second 345 kilovolt (kV) circuit on double-circuit-capable structures installed when the CapX2020 Brookings County – Hampton 345 kV transmission line was originally constructed (Original Brookings Line). The Original Brookings Line is owned by Central Minnesota Municipal Power Agency, Great River Energy (GRE), NSP, Otter Tail Power Company, and Western Minnesota Municipal Power Agency (collectively, CapX2020 Brookings Owners). The Project will also require reconfiguring certain lines near substations, mostly within existing easements. As part of the Project, the Company will also upgrade the Brookings County, Lyon County, Helena, and Hampton substations with new 345 kV breakers. The Project will also require relay setting changes to the Steep Bank Lake and Hawks Nest Lake substations. Finally, the Project will require the construction of eight new poles near Castle Rock to maintain the transmission line's low profile near an airport after the second circuit is installed.

Xcel Energy submits this Certificate of Need Application (Application) to the Commission pursuant to Minn. Stat. § 216B.243 and Minn. R. ch. 7849. To facilitate review, a completeness checklist is included as **Appendix A**, which identifies where in this Application information required by Minnesota Statutes and Rules can be found.

The Company plans to obtain route approval through a minor alteration to the existing approved route permit for the Original Brookings Line under Minn. R. 7850.4800. The Company will submit an application for approval of a minor alteration to the existing route permit.

1.2 Project History and Planning

1.2.1 Project History

In 2005, Xcel Energy and other Minnesota utilities proposed a plan to develop transmission capacity throughout Minnesota that would be needed by 2020.[1] Dubbed "CapX2020," the plan included a number of transmission projects, including the Original Brookings Line. In 2006, Xcel Energy and GRE (collectively, Original Applicants) filed a Certificate of Need application for the Original Brookings Line, as well as two other transmission projects.[2] Xcel Energy and GRE filed the application on behalf of themselves and the other CapX2020 Brookings Owners.[3] The Original Applicants proposed the Original Brookings Line primarily to enable wind-energy development to continue in the region.[4]

The Original Applicants initially proposed that the Lyon County – Helena portion of the Original Brookings Line include two 345 kV circuits.[5] But the Original Applicants proposed constructing the Brookings County – Lyon County portion (Western Segment) and the Helena – Hampton portion (Eastern Segment) of the Project with a single 345 kV circuit.[6] In rebuttal testimony, however, the Original Applicants proposed "Upsized Alternatives" for all three transmission projects.[7] For the Original Brookings Line, the Upsized Alternative involved constructing the Western and Eastern Segments with a single circuit but with a second set of unused arms, known as "davit arms," that extend perpendicular to the main pole to hold the

[1] *In the Matter of the 2005 Minnesota Biennial Transmission Filing*, Docket No. E-999/TL-05-1739, 2005 Minnesota Biennial Transmission Projects Report, Issue 2005-CX-l (Nov. 2, 2005).
[2] *In the Matter of the Application of Great River Energy and Others for a Certificate of Need for the CapX Brookings, S.D. - Southeast Twin Cities 3 45-kV Transmission Project*, Docket No. ET-2/CN-06-1115, Application to the Minn. Public Utils. Comm'n for Certificates of Need for Three 345 kV Transmission Line Projects (Aug. 16, 2007). The other two transmission projects were the Twin Cities – La Crosse and Twin Cities – Fargo transmission lines.
[3] *Id.* at 1.27.
[4] *Id.* at 2.7.
[5] *Id.* at 1.15.
[6] *Id.* at 2.6-.7
[7] Docket No. CN-06-1115, Rebuttal Testimony of Walter T. Grivna at 11 (June 16, 2008).

conductors. The second set of davit arms and increased strength of the towers meant the structures were capable of holding two circuits, making them "double-circuit capable."[8] The Original Applicants noted the Upsized Alternative would easily accommodate future renewable energy and transmission growth.[9] The Original Applicants explained the Upsized Alternative would limit the amount of new right-of-way needed if additional transmission capacity was later needed by the line.[10]

The Commission approved the Upsized Alternative for the Original Brookings Line. The Commission noted the Upsized Alternative would provide "for decades to come the benefits of increased flexibility and avoided costs associated with building new transmission towers in certain areas."[11] The Commission also explained that, even when transmission constraints do not result in service interruptions and blackouts, "a transmission constraint bars a utility from acquiring electricity from a low-cost but remote resource, requiring the utility to substitute a closer - and higher-cost - resource."[12] "Because the Upsized Alternatives would reduce the cost of adding new transmission in the future," the Commission continued, "they would tend to keep the cost of acquiring electricity lower."[13] In response to comments that the Original Applicants had not justified the need for the added capacity of a second circuit, the Commission explained that, if the day comes when the additional capacity is needed, the utilities would first need to obtain a Certificate of Need. That day has now come as there is an undeniable need to relieve the transmission congestion in this area.

1.2.2 Project Planning

After obtaining a route permit,[14] the CapX2020 Brookings Owners constructed the Original Brookings Line and energized the final segment in 2015.[15] As predicted, over the course of the next eight years, renewable energy development continued at a rapid pace in the region. As a result, congestion has become an increasingly significant issue in southern Minnesota.

The Company developed the Project in direct response to these increases in congestion. The Midcontinent Independent System Operator, Inc. (MISO) is taking action to increase transmission capacity, including through its Long-Range Transmission Planning (LRTP) initiative. The first group of LRTP projects (Tranche 1) includes projects to help reduce

[8] *Id.*
[9] *Id.* at 37-39.
[10] *Id.* at 39.
[11] Docket No. CN-06-1115, Order Granting Certificates of Need with Conditions at 29 (May 22, 2009).
[12] *Id.*
[13] *Id.*
[14] *In the Matter of the Route Permit Application for a 345 kV Transmission Line from Brookings County, South Dakota to Hampton, Minn.*, Docket No. ET-2/TL-08-1474, Order Granting Route Permit (Sept. 14, 2010).
[15] Docket No. ET-2/TL-08-1474, Monthly Status Report and Complaint Report for March 2015 (Apr. 14, 2015).

congestion. These are large-scale projects not expected to be in service until 2028-2030 and are not the only opportunities for addressing issues with the transmission system. The Company looked at its system and considered whether there are any projects that could cost-effectively and quickly be brought online to relieve congestion by providing additional transmission capacity.

With its double-circuit capable structures, the Original Brookings Line quickly emerged as a relatively low-cost, minimal-impact project that could relieve congestion. The Company analyzed the economic benefits of the Project by analyzing "adjusted production cost" (APC). APC refers to the total production costs of the Company's generation fleet, adjusted to account for purchases and sales made in the wholesale energy market. The APC includes transmission costs to transmit the energy to distribution systems. Accordingly, higher transmission congestion charges lead to higher APC. The Company's economic analysis compared estimated APC both with and without the Brookings Second-Circuit Project. These costs savings are referred to as APC savings throughout this Application.

The APC comparison with and without the Project estimated that the Project would result in significant APC savings. The present value of the estimated APC savings over the 63-year[16] life of the Project is $334.83 million for NSP, $833.86 million for MISO as a whole, $58.73 million for Otter Tail Power, and $173.99 million for GRE. If the NSP-only benefits of the Project are used in a cost-benefit analysis, the result is an estimated cost-benefit ratio of 2.53. Using MISO-level benefits, the result is an estimated cost-benefit ratio of 6.31. These anticipated economic benefits are at the center of the Project's need.

Although the primary benefits of the Project are economic, the Company also studied the Project's impact on reliability. The results of the study showed the Project would improve reliability.

Based on the economic benefits and the fact the Project would improve reliability under certain contingencies, the Company submitted the Project to MISO for expedited review. In December 2022, the MISO Board of Directors approved the Project for inclusion in Appendix A of the MISO Transmission Expansion Plan (MTEP).

[16] As explained in more detail in Chapter 4, economic analysis in this Application focuses on the 63-year book life of the Project, rather than the 20 years MISO uses for planning purposes (and the Company used in its pre-Application filings). Because this is a local project, the Company concluded book life was the more appropriate lens through which to assess the economic costs and benefits of the Project.

With MISO approval, the next step is to seek Commission approval. The Western Segment can realistically be brought online in 2024 and the Eastern Segment in 2025, provided all permitting, planning, and development milestones are met.

1.3 Project Description

1.3.1 Project Facilities

The Project involves installing separate second 345 kV circuits on double-circuit-capable structures on the Western Segment and Eastern Segment, which were initially constructed as part of the Original Brookings Line. The second circuit will be installed on the Western and Eastern Segments. The Lyon County – Helena segment was originally constructed with the second circuit installed.

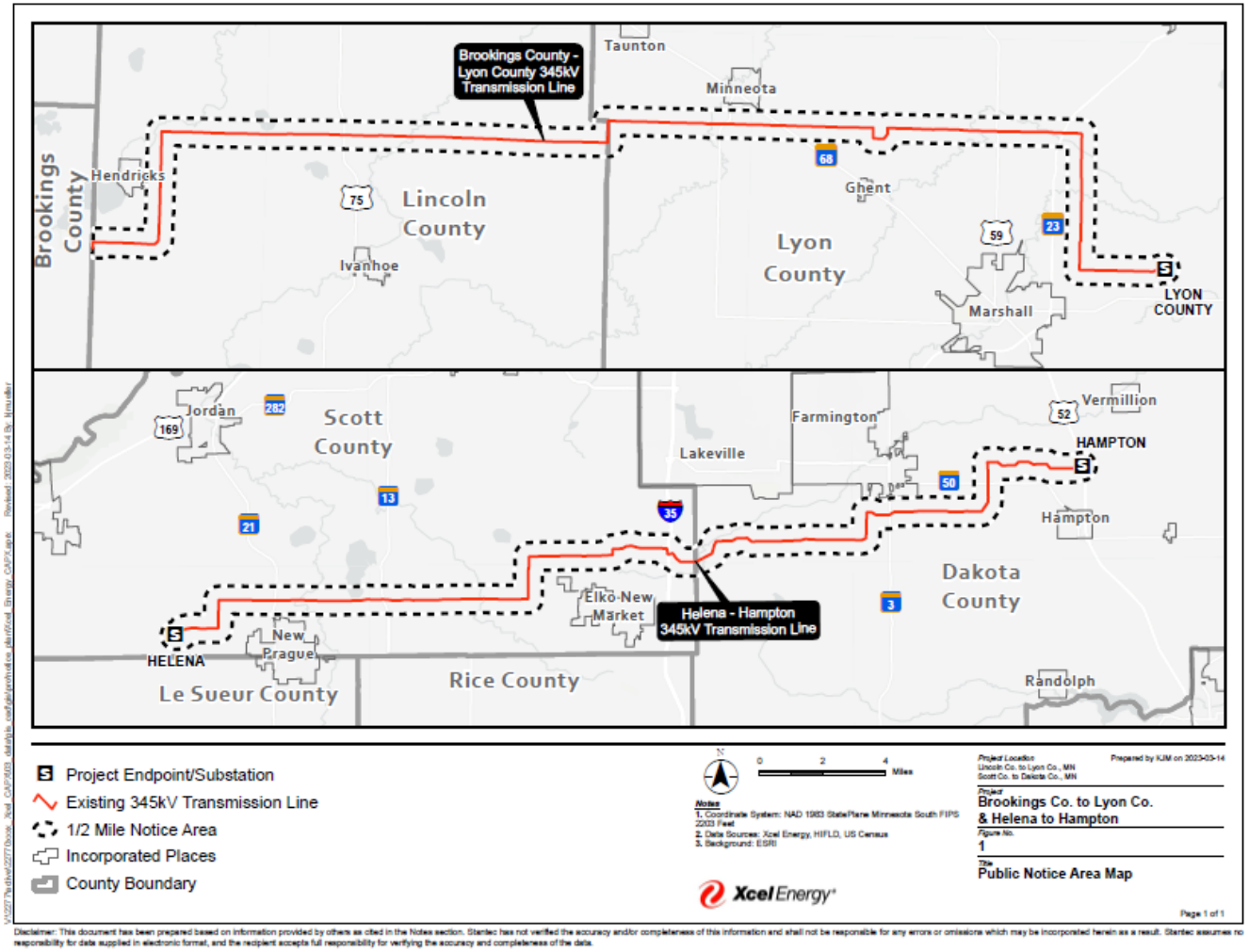
The Western Segment will require reconfiguring an existing line at the Steep Bank Lake Substation to avoid the second circuit crossing the existing transmission line. This reconfiguration will involve adding one structure outside of the Steep Bank Lake Substation but within the existing right-of-way. The Eastern Segment will require rerouting around the Chub Lake Substation. The Company will construct two new dead-end structures on foundations on the south side of the Chub Lake Substation to avoid the second circuit having to go over the top of the Chub Lake Substation. The Company will also install eight new poles in the Eastern Segment to maintain the transmission line's low profile near an airport.

1.3.2 Notice Area and Routing Corridors

The Western and Eastern Segments of the Project will, collectively, be approximately 98.5 miles long. The Western Segment is approximately 59.5 miles, and the Eastern Segment is approximately 39 miles. The Company plans to place the Western Segment in service by September 1, 2024, and the Eastern Segment in service by September 15, 2025.

Figure 1.1 is the map showing the Notice Area for the Project. The Notice Area is being used to notify landowners and other stakeholders about the Project. This Notice Area also represents the Project study area (Project Study Area).

Figure 1.1: Project Study Area



1.4 Project Ownership

Xcel Energy is the sole applicant and currently the sole owner for the Project. Xcel Energy is a Minnesota corporation headquartered in Minneapolis, Minnesota, 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 approximately 1.5 million customers. NSP 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.

The applicable terms of the Brookings Project Owners' Project Participation Agreement (Agreement) specifies that both the Western Segment and the Eastern Segment of the Brookings Second-Circuit Project are separate "Upgrades," under the Agreement. As Upgrades, Xcel Energy has the right to pursue the Project without consent from other CapX2020 Brookings Owners on the Original Brookings Line's Management Committee. However, the other CapX2020 Brookings Owners have the right to participate by investment in each of the Western Segment and the Eastern Segment, respectively, of the Project. Under the Agreement, Xcel Energy must offer, and formally notify the other CapX2020 Brookings Owners of, the option to participate by investment in the Western Segment and the Eastern Segment Upgrades, respectively, of the Project. Xcel Energy plans to send these separate formal notices for the Western Segment in the second half of 2023 and the formal notice for the Eastern Segment in the second half of 2024. Additionally, before energizing the Eastern and Western Segments of the Project, the Owners' Management Committee under the Agreement will determine whether one or both of the Western and Eastern Segments will be incorporated as part of the "Facilities" under the Agreement. If the Management Committee determines that one or both of the Segments will become part of the "Facilities" under the Agreement, the applicable segment will be subject to and governed by the Agreement and certain associated agreements. If any of the other CapX2020 Brookings Owners elect to participate by investment in the Western Segment or the Eastern Segment, the change of ownership will not occur until immediately before the respective segment is energized.

1.5 Need for the Project

Congestion on the transmission system affects the cost of energy, the deliverability of energy, and the efficiency of the market. Transmission lines move large volumes of energy from where

it is generated to where it is needed, like the load center of the Twin Cities. There are limits to the amount of energy that can be transmitted on a particular transmission line at a given point in time. These limits take different forms such as thermal limits, voltage-based transfer limits, and stability-based transfer limits.

With zero congestion, the lowest-priced generators, often wind generators, are first used to meet the energy needs or demands of customers. When there is congestion on the transmission system, however, the lowest-priced energy cannot flow freely across the transmission system. As a result, more expensive generators are ordered to operate or increase output (dispatched) to replace the wind energy that could not be delivered to the end user. Predictably, this "re-dispatch," to avoid overloading transmission facility ratings, increases the price of electricity for both wholesale and retail customers.

By relieving congestion, the Project will allow for greater use of low-cost generation to meet customer demands. The Company modeled the impact of the Project to forecast the amount by which it would reduce overall generation production costs as a result of the shift in the use of generation resources. The present value of those forecasted savings was then compared to the present value of estimated Project costs to determine cost benefit ratios over the 63-year life of the Project. The estimated APC savings resulting from the Project (i.e., the difference between estimated production costs with and without the Project) is $334.83 million for NSP, $833.86 million for MISO as a whole, $58.73 million for Otter Tail Power, and $173.99 million for GRE. If the NSP-only benefits of the Project are used in a cost-benefit analysis, the result is an estimated cost-benefit ratio of 2.53, assuming NSP is assigned the full Project cost, and 3.29 assuming shared ownership and NSP is assigned $78.6 million of the project cost. Using MISO-level benefits, the result is an estimated cost-benefit ratio of 6.31. The economic benefits are the key need the Project addresses.

The Project will also improve the deliverability of wind generation as it will reduce curtailments, allowing a greater amount of this low-cost renewable generation to meet customer demands. Reducing curtailments improves energy delivery, reduces system generation costs, and provides environmental benefits in the form of lower carbon emissions.

Finally, the Project will improve the robustness of the regional backbone transmission system by improving the efficient delivery of energy and enabling the system to better withstand contingencies under multiple future scenarios. A robust transmission system is better positioned to deal with unplanned system outages. A robust regional transmission system is also key to enabling access to a diverse mix of generation resources, which in turn allows customers to access the least expensive power available at any given time.

1.6 Project Costs and Schedule

For purposes of this Application, the Company assumed the Project would be implemented through the installation of a second circuit along the Original Brookings Line. The Company's cost estimate was developed to allow the Commission to evaluate the benefit-to-cost ratio of this design option. Based on this design option, the Company estimates the total cost for the Project, including Allowance for Funds Used During Construction (AFUDC), will be $102.0 million. Additional details regarding the Project costs are provided in **Chapter 2**.

Construction of the Project is anticipated to commence in April 2024. The Western and Eastern Segments are expected to be in service by September 1, 2024, and September 15, 2025, respectively.

1.7 Potential Environmental Impacts

Chapter 7 of this Application provides a discussion of the natural environment and land use features in the area reviewed for the Project Study Area, which is shown in **Figure 1.1** above. The Project Study Area consists primarily of agricultural land, though the density of residences increases closer to the Twin Cities metropolitan area. The Company does not anticipate any homes or businesses will be displaced by the Project. The Company has identified no potential environmental impacts that would preclude or are likely to materially delay construction of the Project.

1.8 Public Input and Involvement

The Company has a long history of working with landowners and in partnership with local communities. Xcel Energy is in the process of implementing its Notice Plan. The Company convened open houses over the course of the past month and plans further public outreach.

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/. Click on the eDockets link near the top right-hand side, and then enter the docket number "23-200" in the "Docket Lookup" section. A copy of the Application is also available on the Project website: www.Brookings2ndCircuit.com.

To subscribe to the Project's Certificate of Need docket and to receive email notifications as information is filed in that docket visit: https://www.edockets.state.mn.us/EFiling and select "Subscribe to Dockets," enter your email address, and select "Docket Number" from the Type of Subscriptions dropdown box, then select "23" from the first Docket number drop down box and enter "200" 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 submit your subscription request. You should receive an email from Efiling.Admin@state.mn.us to the e-mail address you

provided, you must click the link in this email to confirm your subscription to the Project's Certificate of Need docket.

If you would like to have your name added to the Certificate of Need mailing list, send an email to docketing.puc@state.mn.us or call (651) 201-2204 (800-657-3782). 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 (CN-23-200), 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:

Minnesota Public Utilities Commission
Michael Kaluzniak
121 7th Place East, Suite 350
St. Paul, Minnesota 55101
651.201.2257
800.657.3782
Email: mike.kaluzniak@state.mn.us
Website: www.mn.gov/puc/

Minnesota Department of Commerce
Suzanne Steinhauer
85 7th Place East, Suite 280
St. Paul, Minnesota 55101
651.539.1843
800.657.3602
Email: suzanne.steinhauer@state.mn.us
Website: https://apps.commerce.state.mn.us/eera/web/page/home

1.9 Project Meets Certificate of Need Criteria

Minnesota Statutes and Rules specify the criteria the Commission should apply in determining whether to grant a Certificate of Need. Subdivision 3 of Minn. Stat. § 216B.243 identifies the criteria the Commission must evaluate when assessing need. Specifically, Minn. Stat. § 216B.243, subd. 9, provides that in assessing whether to grant a Certificate of Need the Commission must evaluate:

> [t]he benefits of enhanced regional reliability, access, or deliverability to the extent these factors improve the robustness of the transmission system or lower costs for electric consumers in Minnesota.

Xcel Energy identified the Project to relieve congestion on the transmission system in southern Minnesota and to lower wholesale energy costs by improving the access and deliverability of low-cost renewable generation. Construction of the Brookings Second-Circuit Project will also reduce curtailments of renewable generation and enhance the high-voltage transmission system by improving the efficient delivery of energy. This Project will enable the transmission system to be more resilient in the face of unforeseen contingencies.

Minnesota Rule 7849.0120 further provides that the Commission shall grant a Certificate of Need if the Commission determines that:

> (A) The probable result of denial would be an adverse effect upon the future adequacy, reliability, or efficiency of energy supply to the applicant, to the applicant's customers, or to the people of Minnesota and neighboring states;
>
> (B) A more reasonable and prudent alternative to the proposed facility has not been demonstrated by a preponderance of the evidence on the record;
>
> (C) By a preponderance of the evidence on the record, the proposed facility, or a suitable modification of the facility, will provide benefits to society in a manner compatible with protecting the natural and socioeconomic environments, including human health; and
>
> (D) The record does not demonstrate that the design, construction, or operation of the proposed facility, or a suitable modification of the facility, will fail to comply with relevant policies, rules, and regulations of other state and federal agencies and local governments.

The Company's proposal satisfies these four criteria as discussed below.

(A) *Probable result of denial of the Project would have an adverse effect upon the future adequacy, reliability, or efficiency of energy supply to the applicant's customers*

Denial of a Certificate of Need for this Project would result in adverse effects upon the present and future efficiency of energy supply to electric customers and other end users. The Project is designed to improve the efficiency of the regional transmission system under a range of future scenarios by relieving one of the most congested areas in the MISO electric transmission system. Relieving this congestion will improve deliverability and allow customers greater access to low-cost renewable energy and result in lower wholesale energy costs.

(B) *A more reasonable and prudent alternative to the proposed facility has not been demonstrated by a preponderance of the evidence*

A more reasonable and prudent alternative to the Project has not been demonstrated. Permitting for the Original Brookings Line contemplated that installing a second circuit would be necessary. The vast majority of the Project will use existing right-of-way. Most of the towers and davit arms needed to install the second circuit are already in place. In contrast, a new

transmission line elsewhere to provide the same functionality as the Project would require significant ground-disturbing activity at significantly increased cost because it would require the construction of entirely new transmission towers and potential clearing of a new right-of-way.

(C) *The proposed transmission lines will provide benefits to society in a manner compatible with protecting the natural and socioeconomic environments*

The proposed Project will reduce congestion and allow the transmission system to operate more efficiently and more cost-effectively without the need for significant new ground-disturbing activities and with limited environmental impact.

(D) *The proposed transmission line will comply with relevant policies, rules, and regulations of other state and federal agencies and local governments*

Xcel Energy will secure all necessary permits and authorizations before commencing construction on the portions of the Project requiring such approvals.

1.10 Socioeconomic Considerations

Minnesota Rule 7849.0240, subpart 2, requires the applicant for a Certificate of Need to address the socially beneficial uses of the facility output, promotional activities that may have given rise to the demand, and effects of the facility in inducing future development. Following is a discussion of each consideration:

1.10.1 Socially Beneficial Uses of Facility Output

Xcel Energy designed the Project to reduce wholesale energy costs by addressing chronic transmission congestion affecting southern Minnesota. The Project will reduce the current transmission congestion in this area, increase market access to lower cost renewable generation, provide economic benefits in terms of reduced wholesale energy costs, increase the robustness of the regional grid, and support future renewable generation facilities in Minnesota, North Dakota, and South Dakota.

1.10.2 Promotional Activities

Xcel Energy has not conducted any promotional activities or events that have triggered the need for the Project. The Project is needed due to the large amount of renewable generation in Minnesota, North Dakota, and South Dakota coupled with transmission constraints, causing congestion on this part of the transmission system. This congestion is projected to worsen over the next 10 years as more wind facilities come online in this area. Further, the expected coal-generation retirements included in the Company's recently approved Integrated

Resource Plan (IRP),[17] including those north of the Minneapolis/St. Paul area, and other changes required to meet Minnesota's 100% by 2040 law, will further increase the need for power to flow from southwestern Minnesota, North Dakota, and South Dakota to the Twin Cities on the currently congested Original Brookings Line.

1.10.3 Effect in Inducing Future Development

The Project is not expected to induce future development. The Project will reduce significant existing congestion, which is expected to worsen in the absence of the Project from existing and planned generation projects.

1.11 Application Organization

The remaining six chapters of the Application are organized as follows:

- Chapter 2 – Project Description
- Chapter 3 – Electrical System and Changing Generation Portfolio Overview
- Chapter 4 – Need Analysis
- Chapter 5 – Transmission Line Operating Characteristics
- Chapter 6 – Transmission Line Construction and Maintenance
- Chapter 7 – Environmental Information

1.12 Company's Request and Contact Information

For the reasons discussed above and in the remainder of this Application and Appendices, Xcel Energy respectfully requests the Commission find this Application complete and, upon completion of its review, grant a Certificate of Need for the Project. All correspondence relating to this Application should be directed to:

[17] The Commission granted its approval of the IRP in April 2022. IN THE MATTER OF THE 2020-2034 UPPER MIDWEST INTEGRATED RESOURCE PLAN OF NORTHERN STATES POWER COMPANY D/B/A XCEL ENERGY, MPUC Docket No. E-002/RP-19-368, Order Approving Plan with Modifications and Establishing Requirements for Future Filings (Apr. 15, 2022).

Monsherra S. Blank
Director, Regulatory and Strategic Analysis
Xcel Energy
414 Nicollet Mall, 401-7th Floor
Minneapolis, MN 55401
214-422-3672
monsherra.s.blank@xcelenergy.com

Ian Dobson
Xcel Energy
Lead Assistant General Counsel
414 Nicollet Mall, 401-8th Floor
Minneapolis, MN 55401
612-370-3578
ian.m.dobson@xcelenergy.com

Christine Schwartz
Regulatory Administrator
Xcel Energy
414 Nicollet Mall, 401-7th Floor
Minneapolis, MN 55401
regulatory.records@xcelenergy.com

Zeviel Simpser
Dorsey & Whitney LLP
50 South Sixth Street, Suite 1500
Minneapolis, MN 55402
612-492-6129
simpser.zev@dorsey.com

2. Project Description

2.1 Project Components

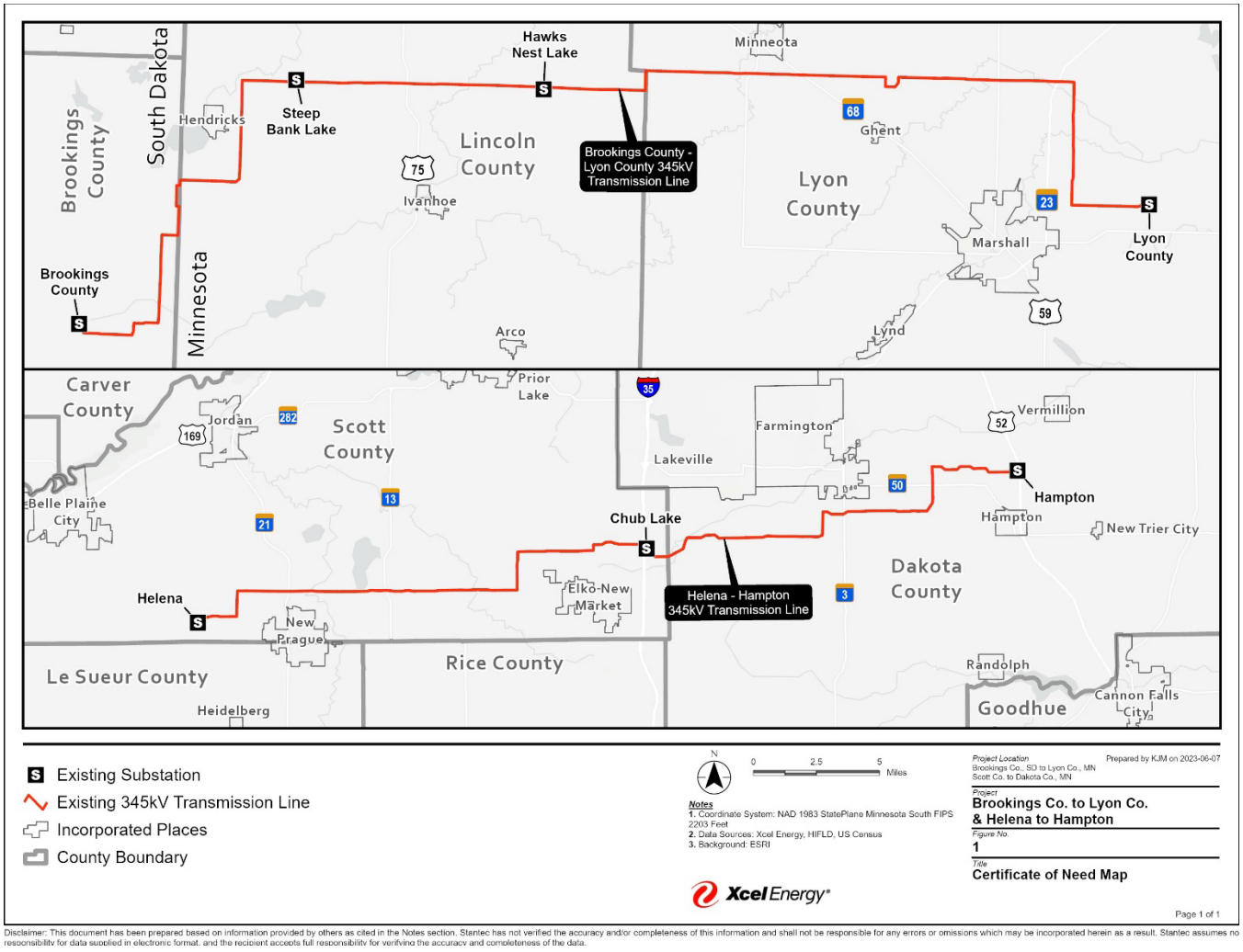
Xcel Energy proposes to install a second circuit on an unused set of davit arms on the Original Brookings Line. These davit arms were installed to make the Original Brookings Line double-circuit capable to accommodate the future installation of a second circuit. The total length of the Project is approximately 98.5 miles (87.9 miles in Minnesota). The Western Segment extends approximately 59.5 miles from the Brookings County Substation near White, South Dakota, to the Lyon County Substation near Milroy, Minnesota. The Western Segment traverses 10.6 miles of Brookings County, South Dakota, 48.9 miles of Lincoln and Lyon counties in Minnesota. The Eastern Segment extends 39 miles from the Helena Substation near New Prague, Minnesota, to the Hampton Substation near Hampton, Minnesota. The Eastern Segment crosses Scott and Dakota counties in Minnesota.

The Original Brookings Line also includes two segments originally constructed with two circuits installed. Those segments connect the Lyon County Substation to the Cedar Mountain Substation, and the Cedar Mountain Substation to the Helena Substation. These segments will not be modified by the Project.

The Western Segment will require reconfiguring an existing line at the Steep Bank Lake Substation to avoid the second circuit crossing the existing transmission line. This reconfiguration will involve adding one additional structure outside of the Steep Bank Lake Substation. The Eastern Segment will require rerouting around the Chub Lake Substation. The Company will construct two new dead-end structures on foundations on the south side of the Chub Lake substation to avoid the second circuit having to go over the top of the Chub Lake Substation. Finally, Xcel Energy will construct eight new poles within the existing right-of-way northwest of Castle Rock, Minnesota. These new poles will allow the transmission line to maintain a horizontal configuration near an airport after the second circuit is installed to comply with Federal Aviation Administration (FAA) requirements.

Figure 2.1 is the map showing the entirety of the Brookings Second-Circuit Project, including the South Dakota portion and all substations.

Figure 2.1: Project Map



Disclaimer: This document has been prepared based on information provided by others as cited in the Notes section. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.

2.1.1 Transmission Line and Structures

The second circuit will be installed on existing single (monopole) steel pole structures on currently unused davit arms along the Original Brookings Line. The second set of davit arms was included when the Original Brookings Line was constructed.

Figure 2.2 are photographs of the existing towers with two sets of davit arms, although only one currently holds a circuit.

Figure 2.2: Existing Structures

Existing double-circuit capable structures with single circuit installed on self-supporting weathering steel poles. Appendix B includes schematic diagrams of the typical pole structure.

The existing single-circuit transmission line carries three phases (conductors), comprising one circuit. The Project involves the installation of another circuit that will carry three additional phases. When complete, the double-circuit transmission line will carry two, three-phase circuits (conductors). The Project's new 345 kV line will utilize bundled (twisted pair) 2x636 thousand circular mills (kcmil)[18] Aluminum Conductor Steel Reinforced (ACSR) or similar performance conductor. The 345 kV twisted pair conductors will have a capacity equal to or greater than 3,000 amps.

This type of twisted-pair conductor is preferred in windy areas like much of the Project Study Area. High winds can cause conductors to vibrate or move (gallop), especially if these windy conditions are accompanied by ice buildup on conductors. If the galloping is significant, it can cause phase-to-phase or phase-to-ground contact and, thereby, cause outages. The design of

[18] A circular mil is 1/1000 of an inch.

two twisted pair conductors in a bundled configuration reduces galloping because it allows the conductor to twist rather than move with the wind.

The Project will also involve the installation of eight new self-supporting single-circuit weathering steel poles northwest of Castle Rock, Minnesota. Eight, two-pole structures were originally constructed near the Airlake Airport to allow conductors to be installed on a horizontal configuration, rather than a vertical configuration. This horizontal configuration allows the Original Brookings Line to maintain a low profile, in compliance with FAA requirements. Two phases of the circuit were installed on one steel pole and one phase was installed on the second steel pole. To maintain the low profile after installation of the second circuit, eight new steel poles will be installed. One of the phases of the second circuit will be installed on the existing steel poles that currently has only a single phase. The two remaining phases of the second circuit will be installed on the new set of steel poles. Once complete, these eight structures, will consist of eight, three-steel-pole structures, with the six conductors laid out horizontally. **Appendix B** contains a schematic diagram showing the three-pole, horizontal configuration.

Table 2.1 summarizes the characteristics of the double-circuit capable transmission line structures.

Table 2.1: Transmission Line Characteristics

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 Double-Circuit & 345 kV Double-Circuit Angle and Dead-end*	Monopole w/ Davit Arms & Two-pole w/Davit Arms Structures*	Weathering Steel	150	130-175	6-13	750-1,100
*Structures 0961-34 to 0961-41 are three-pole structures with davit arms to accommodate horizontal configuration of conductors to comply with FAA requirements.						

Due to recent failures of the existing optical ground wire (OPGW) and to capture the efficiencies of the Company installing a second circuit, the CapX2020 Brookings Owners are exploring replacement of the existing OPGW with an upgraded OPGW to improve lightning protection. This replacement would occur concurrently with the installation of the second circuit. The replacement of the existing OPGW will be treated as separate asset renewal project from the Brookings Second-Circuit Project.

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

The second-circuit davit arms along one 4.2-mile stretch of the Original Brookings Line between the Helena and Chub Lake substations (Cedar Lake Line Facilities) are currently occupied by an existing 115 kV transmission line owned by GRE. The Structure Sharing Agreement between GRE and the other CapX2020 Brookings Owners allows the CapX2020 Brookings Owners to terminate the Structure Sharing Agreement once the second circuit is needed. The CapX2020 Brookings Owners have provided notice of termination to GRE. The Company understands that GRE filed a Route Permit application on June 6, 2023, to construct a replacement line for the Cedar Lake Line Facilities (Commission Docket No. ET2/TL-23-170). That application indicates that GRE anticipates receiving a route permit in the spring of 2024, which would enable energization of the replacement Cedar Lake Line Facilities by the summer of 2025. Under this schedule, the Company anticipates that the Cedar Lake Line Facilities will be removed in the summer of 2025 and the 4.2-mile stretch vacated in time to install the Eastern Segment.

2.1.2 Associated Facilities

The Project will include modifications to the Brookings County, Steep Bank Lake, Hawks Nest Lake, Lyon County, Helena, Chub Lake, and Hampton substations.

2.1.2.1 Steep Bank Lake Substation

The Western Segment will require reconfiguring an existing line at the Steep Bank Lake Substation, northeast of Hendricks, Minnesota, to avoid the second circuit crossing the existing transmission line. This reconfiguration will involve adding one additional structure outside of the Steep Bank Lake Substation.

Due to this reconfiguration, the Company will also need to make changes to the relay settings at both the Steep Bank Lake and Hawks Nest substations.

2.1.2.2 Chub Lake Substation

The Eastern Segment will require routing the second circuit around the Chub Lake Substation, northeast of Elko-New Market. The Company will construct two new dead-end structures on foundations on the south side of the Chub Lake Substation to avoid the second circuit having to go over the top of the Chub Lake Substation. If Xcel Energy can reach agreement with a neighboring landowner on an easement, the Company plans to route the second circuit outside the current right-of-way over the landowner's property. Routing the second circuit outside the existing right-of-way will avoid engineering, design, and constructability issues caused by the steep topography in the existing right-of-way. Although it would present engineering, design, and constructability challenges, if Xcel Energy and the landowner are unable to reach agreement, Xcel Energy will route the second circuit entirely within the existing right-of-way.

2.1.2.3 New Circuit Breakers

As part of the Project, the Company will also upgrade the Brookings County, Lyon County, Helena, and Hampton substations with new 345 kV circuit breakers. The Company will install one new breaker at the Brookings County Substation, four new breakers at the Lyon County Substation, one new breaker at the Helena Substation, and four new breakers at the Hampton Substation. At the Lyon County and Hampton substations, the Company will remove the current ring-bus configuration and construct a breaker-and-a-half configuration. This reconfiguration allows improved operational flexibility and reliability by reducing line outages caused by breaker maintenance or failure.

2.2 Project Costs

Xcel Energy developed a Project cost estimate based on an estimated route length, rerouting costs, and substation upgrade costs. There are several main categories of these cost estimates: (1) engineering, design, permitting, and land rights; (2) material procurement; and (3) construction labor and equipment. Each of these components also includes a risk reserve. AFUDC is listed separately as a footnote in the table below.

To prepare a cost estimate for the transmission line portions of the Project, Xcel Energy relied on the Company's proprietary cost database. The database incorporates historical labor and material costs from similar projects. This database is updated based on current market conditions and contingency factors.

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

On top of the contingency factors included in Xcel Energy's proprietary cost database, to calculate an appropriate risk contingency, Xcel Energy identified potential risks that could result in additional costs. These risks include unexpected weather conditions, poor soil conditions in areas where no soil data was obtained, transmission line outage constraints, river crossings, labor shortages, and market fluctuations in material pricing and labor costs. Xcel Energy then developed an appropriate cost contingency for each of these risks and applied them to each of the three cost categories listed above.

Xcel Energy estimates construction of the Project, including substation construction and all substation equipment, will cost $100.2 million. These costs include all transmission line costs (including materials, associated construction, permitting and design costs, and risk reserve), substation upgrade costs (including materials, construction, permitting and design costs, and risk contingencies). The total capital additions, with AFUDC is noted separately.

Tables 2.2 and **2.3** breakdown the Project cost estimates for each segment, with AFUDC.

Table 2.2: Project Capital Expenditure Estimates Western Segment

Project Components	Cost
Second Circuit*	$42.9 million
Brookings County Substation Upgrade	$4.0 million
Lyon County Substation Upgrade	$11.0 million
Project Total	**$57.8 million**
* includes the cost of reconfiguring the in- and out-tap at the Steep Bank Lake Substation	

Table 2.3: Project Capital Expenditure Estimates Eastern Segment

Project Components	Cost
Second Circuit*	$29.9 million
Helena Substation Upgrade	$3.7 million
Hampton Substation Upgrade	$10.6 million
Project Total	**$44.2 million**
***** includes the cost of the Chub Lake Substation transmission line reroute	

The total capital additions, including AFUDC, is estimated at $102.0 million.

2.3 Rate Impact

As provided in the request for an exemption from Minn. R. 7849.0270, subp. 2(E), the Company is providing information regarding the general rate impact of the Project. To that end, the Company determined the annual revenue requirement impact for the capital costs of

the Project. This analysis, which is set forth in **Appendix C**, provides the results of this calculation for a 20-year period. The Company is providing 20 years of revenue requirement consistent with its general practice as any additional years would be too speculative. Among other things, such a forecast would not account for capital replenishment. As a capital-only analysis, the revenue requirement projections in **Appendix C** do not account for future operation and maintenance expenses for the Project or fuel impacts.

As noted in Section 1.4, the other CapX2020 Brookings Owners have the option to participate in ownership of the respective segments of the Project. The analysis in **Appendix C** provides the forecasted annual revenue requirements for the Company under both a scenario in which the other CapX2020 Brookings Owners choose not to participate, meaning the Company retains full ownership of the Project, and one in which all other CapX2020 Brookings Owners elect to participate. The Company assumes if a CapX2020 Brookings Owner elects to participate in one segment of the Project, it will elect to participate in both segments.

The revenue requirement calculations in **Appendix C** include the NSP system as a whole (both NSP Companies) and are then adjusted to a Minnesota jurisdictional basis for NSP Minnesota. For Year 1,[19] the estimated Minnesota jurisdictional revenue requirement would be approximately $7.2 million under a full Company ownership scenario and $5.6 million assuming all other CapX2020 Brookings Owners elect to participate. In subsequent years over the 20-year period, the estimated nominal revenue requirement would decrease so that by Year 20 it would be $4.2 million under full NSP ownership and $3.3 million under a shared ownership scenario.

The Company provided only a capital rate analysis since it is the only analysis that can be conducted with sufficient accuracy over an extended period. Although the Company has conducted intensive production cost modeling, because that modeling only models production cost impacts, it is nearly impossible to reduce that down to impacts to fuel costs, dispatch costs, or other information necessary to calculate net savings on a retail revenue basis. That said, the Company's benefits analysis remains sound and demonstrates that benefits outweigh costs for this Project.

As discussed further in Chapter 4, to analyze Project benefits, the Company used the PROduction MODeling (PROMOD) computer modeling program to forecast future economic benefits of the Project in the form of APC. The results of this analysis are set forth in **Appendix D**. PROMOD is used by MISO and is commonly accepted throughout the electric-utility industry for use in forecasting the economic impacts of transmission projects. Specifically, PROMOD is used to estimate future estimated electrical production costs, market congestion, and energy losses based on different transmission constraints. Using PROMOD,

[19] Year 1 will be 2026, assuming a January 2026 in-service date.

the Company forecasted APC both with and without the Project, and the difference between the two scenarios provides the expected economic benefit of the Project. As the discussion in Chapter 4 explains in greater detail, and as the results of the forecast in **Appendix D** show, the Project is expected to result in substantial APC savings. Although translating those estimated benefits into net retail savings is not practically feasible, it is reasonable to compare the APC savings with the capital revenue requirements analysis to provide a general understanding of the overall positive economic impact of the Project on customer rates.

If Project ownership is shared among the CapX2020 Brookings Owners, in Year 1 (2026) the total estimated NSP Companies nominal revenue requirement will be $7.6 million, which is less than the estimated annual APC savings to NSP of $8.3 million in Year 1. That is, APC benefits are forecasted to exceed the Project revenue requirement in Year 1—and that is forecasted to be the case for every year thereafter.[20] If only NSP owns the Project, annual savings begin to exceed the NSP annual revenue requirements by Year 6 (2031) and then continue for every year after.

2.4 Project Schedule and Work Force

Table 2.6 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 obtaining the necessary federal, state, or local approvals required prior to construction. Xcel Energy estimates it will engage 60 to 80 workers for Project construction.

[20] Ownership percentages would not directly correlate to the benefits the Project provides to individual owners. That is, 60% ownership of the Project does not necessarily equate to 60% of the benefits. Rather, forecasted annual benefits result from the specific change to the transmission system and how the resulting increased capacity impacts each utility's overall mix of production throughout the year.

Table 2.6: Anticipated Project Schedule

Activity	Estimated Dates
Minnesota Certificate of Need Proceeding	Through Beginning of Second Quarter of 2024
Minnesota Minor Alteration Proceeding	Through First Quarter of 2024 or Beginning of Second Quarter of 2024
Required Federal, State, and Local Permits Obtained	Through Beginning of Second Quarter of 2023
Start Project Construction – Western Segment	April 1, 2024
Western Segment In Service	September 1, 2024
Start Project Construction Eastern Segment	April 1, 2025
Eastern Segment In Service	September 15, 2025

It is critical that the Company is able to begin construction of the Western Segment and Eastern Segment in the early spring of 2024 and 2025, respectively. Only by starting construction early in the construction season can the Company complete construction before times of traditionally high-winds in the fall. Completing construction before the high-wind season will help limit the costs associated with the loss of transmission capacity when the first circuit is taken out of service to accommodate installation of the second circuit. Similarly, having the second circuit in service before the fall will ensure additional transmission capacity is online when needed most.

3. ELECTRICAL SYSTEM AND CHANGING GENERATION PORTFOLIO OVERVIEW

3.1 Electrical System Overview

When a customer turns on a light switch, a circuit is completed to connect the light with the wires that serve the customer's building. The building wires are connected to a transformer and a distribution line outside of the building. The distribution lines, in turn, are connected to substations and through larger transformers to transmission lines, which are connected to the bulk-power system that carries electricity from electric generating facilities.

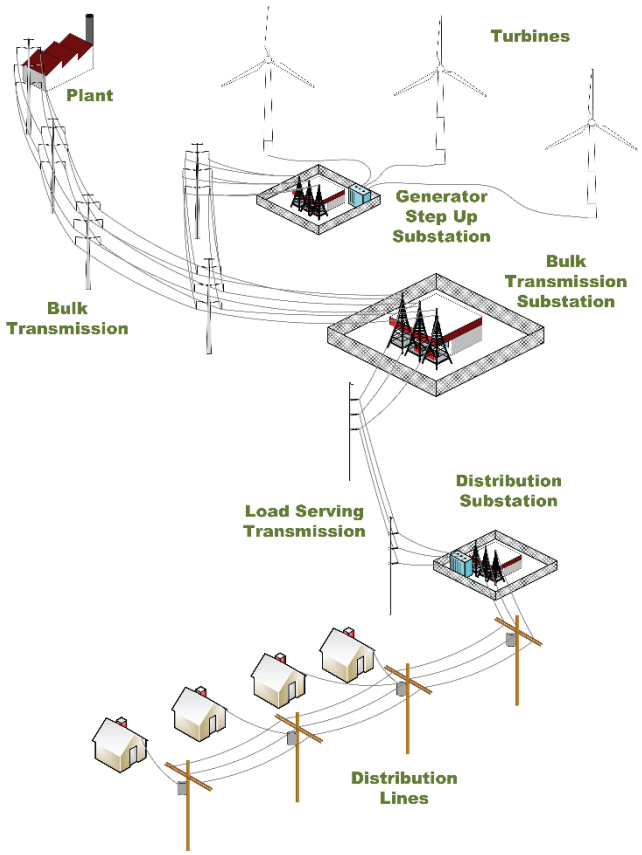
Electricity is produced at both large and small generating facilities. Electricity can be generated using a variety of sources or fuels, including solar, wind, and hydroelectric; internal and external combustion of biomass, biofuels, natural gas, and coal are employed; heat and steam is created through 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 transmission lines and transformers and then to consumers at consistent 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, so generators connected to the system and substations within the system, which are responsible for directing the flow of electric energy, must instantaneously adjust their electric output to respond to changes in 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 transmission lines, often at voltages in excess of 100,000 volts (e.g., 115 kV, 230 kV, 345 kV). One kV equals 1,000 volts. Voltage is stepped-up because moving electricity over longer distances at higher voltages reduces electrical losses on the system; this means more of the energy generated reaches the ultimate customer. As voltage increases, electric current decreases assuming the same amount of power flowing through a transmission line. Due to the relationship between power losses, electrical resistance, and electrical current, reducing current along a transmission line has a much greater impact on reducing power losses than reducing resistance of a power line.

Once the electricity reaches the locality where it will be consumed, the transmission voltage (e.g., 115 kV and higher) is reduced (stepped-down) by transformers at a distribution substation facility to voltages appropriate for distribution to end use customers. The electricity is then further transformed (stepped down) and distributed at distribution "primary" voltages (e.g., 13.8 kV) within communities by the distribution system, which delivers power for individual customer use to the end location where it is stepped-down further to, most commonly, 240 V or 120 V.

A diagram showing the transfer of electricity from generator to consumer is shown below in **Figure 3.1**.

Figure 3.1: Electrical System

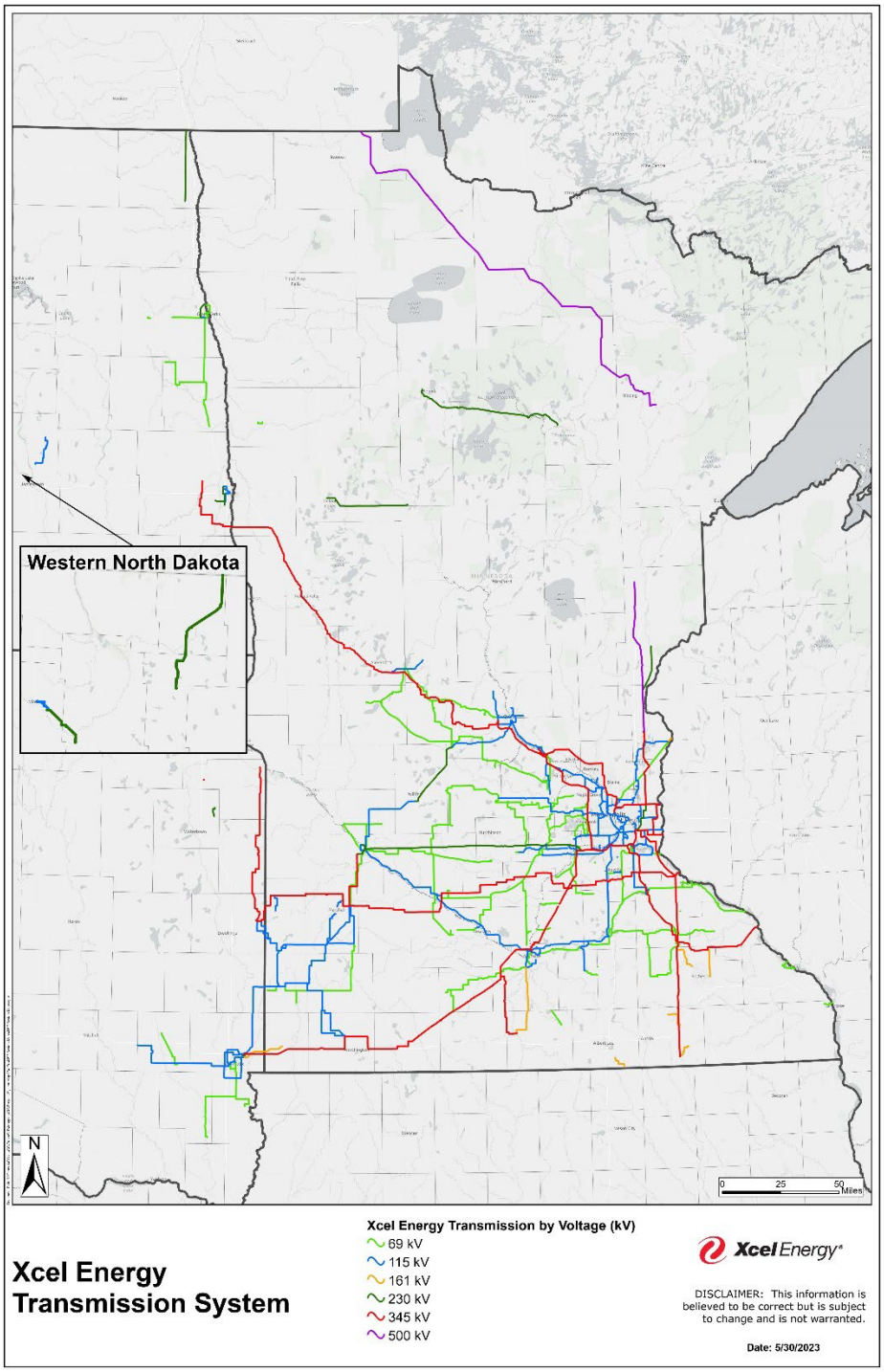


Note **Figure 3.1** is an artistic portrayal of an electrical system and is not an actual representation of all electrical-system components.

3.2 Transmission System Overview

The transmission system is made up of high-voltage transmission lines, which can carry electricity long distances and deliver power to distribution systems to meet customer needs in specific locations, and bulk transformers at 100 kV and above. The transmission system is designed to withstand the outage of a single transmission line without major disruption to the overall power supply. Xcel Energy's transmission system in Minnesota and portions of North Dakota and South Dakota is depicted below in **Figure 3.2**.

Figure 3.2: Xcel Energy's Transmission System in Minnesota, North Dakota, and South Dakota[21]



[21] Portions of the lines depicted above are transmission facilities that Xcel Energy owns with other utilities.

3.2.1 High-Voltage Transmission Lines

Transmission lines are made up of conductors, which complete a three-phase circuit and are usually accompanied by a shield wire that provides protection from lightning strikes. These conductors are groups of wires, usually made from copper or aluminum, and most commonly held up by poles or towers that are made from wood or steel.

Transmission lines carry electricity from the generation source to the area where the power is needed. The rate at which electric charge moves through a wire is called current and is measured in amperes (amps). The force that moves the electricity through the wire is called voltage. Voltage is measured in volts (V) or kilovolts (kV). The wire conducting the current offers resistance to its movement. This resistance is measured in a unit called Ohms. Copper or aluminum wires conduct electricity with relatively little resistance.

3.2.2 Substations

Substations are a part of the electric generation, transmission, and distribution system and contain high-voltage electric equipment to monitor, regulate, and distribute electricity. Generally, substations allow transmission lines to connect with one another, or allow power to be transformed from a higher transmission voltage to a lower voltage for distribution, typically below 69 kV.

Substation configuration depends on the project and anticipated future needs based on the physical characteristics of the site, such as shape, elevation, above and below ground geographical characteristics, and proximity of the site to transmission lines. The configuration of a substation may change over time to accommodate future load growth or electric system needs.

3.3 Changing Generation Portfolio

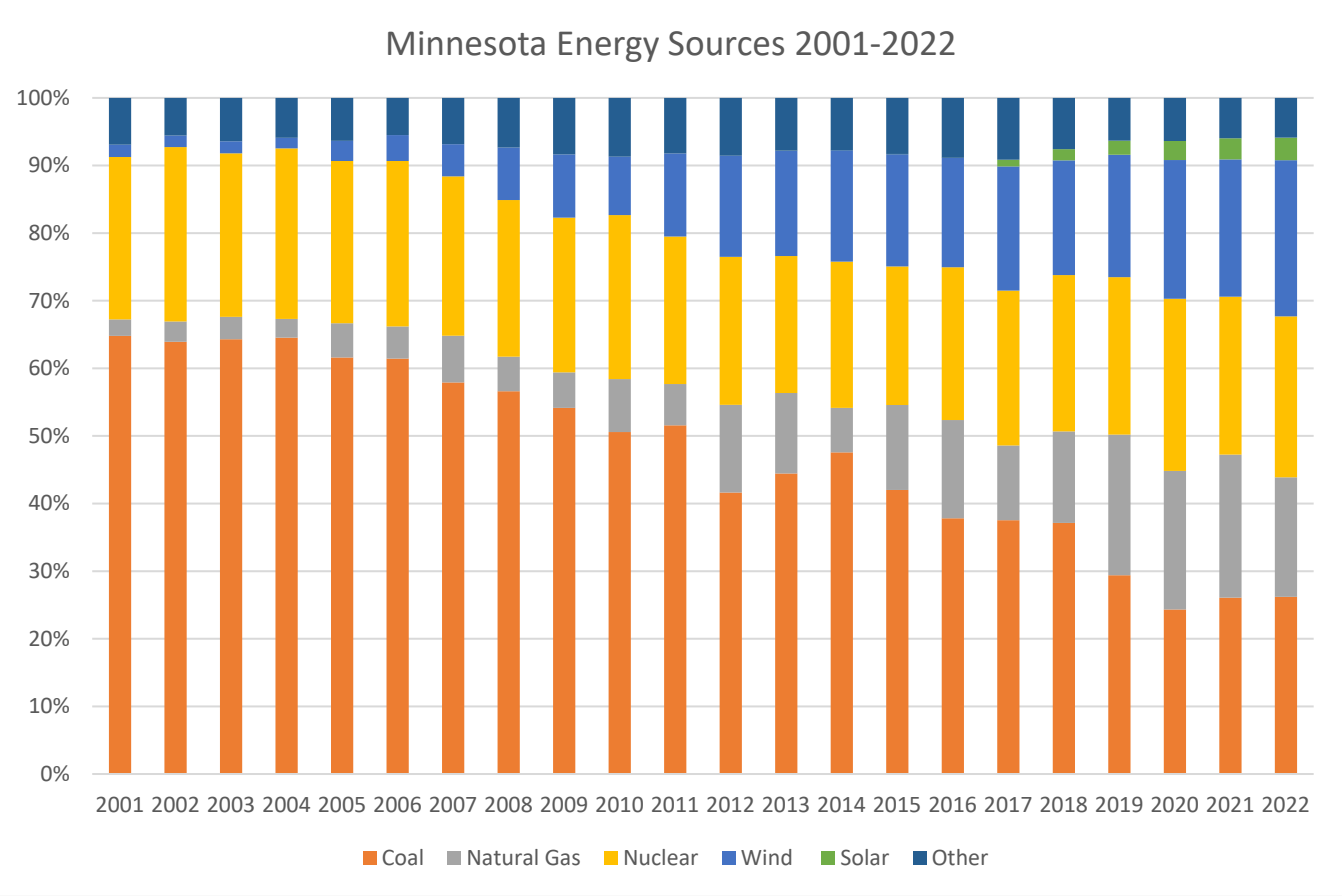
Over the course of the past 25 years, the generation mix in Minnesota and surrounding states has dramatically shifted from relying primarily on coal and nuclear generation resources to a more diverse generation mix that includes increasing amounts of renewable energy, in particular, wind generation. These changes in the generation portfolio in Minnesota require additions and changes to the electrical system in the region to ensure the added generation can be efficiently and economically delivered to load centers.

3.3.1 Overview of Growth in Renewable Generation

In recent decades, Minnesota has experienced a dramatic transformation in its energy production towards more renewable energy resources, including wind and solar generation. As depicted in **Figures 3.3** and **3.4**, wind generation has increased from approximately one

percent of the State's energy sources in 2001[22] to 23% in 2022. At the same time, the State's share of generation from coal-fired resources has dropped from approximately 66% to 26%.

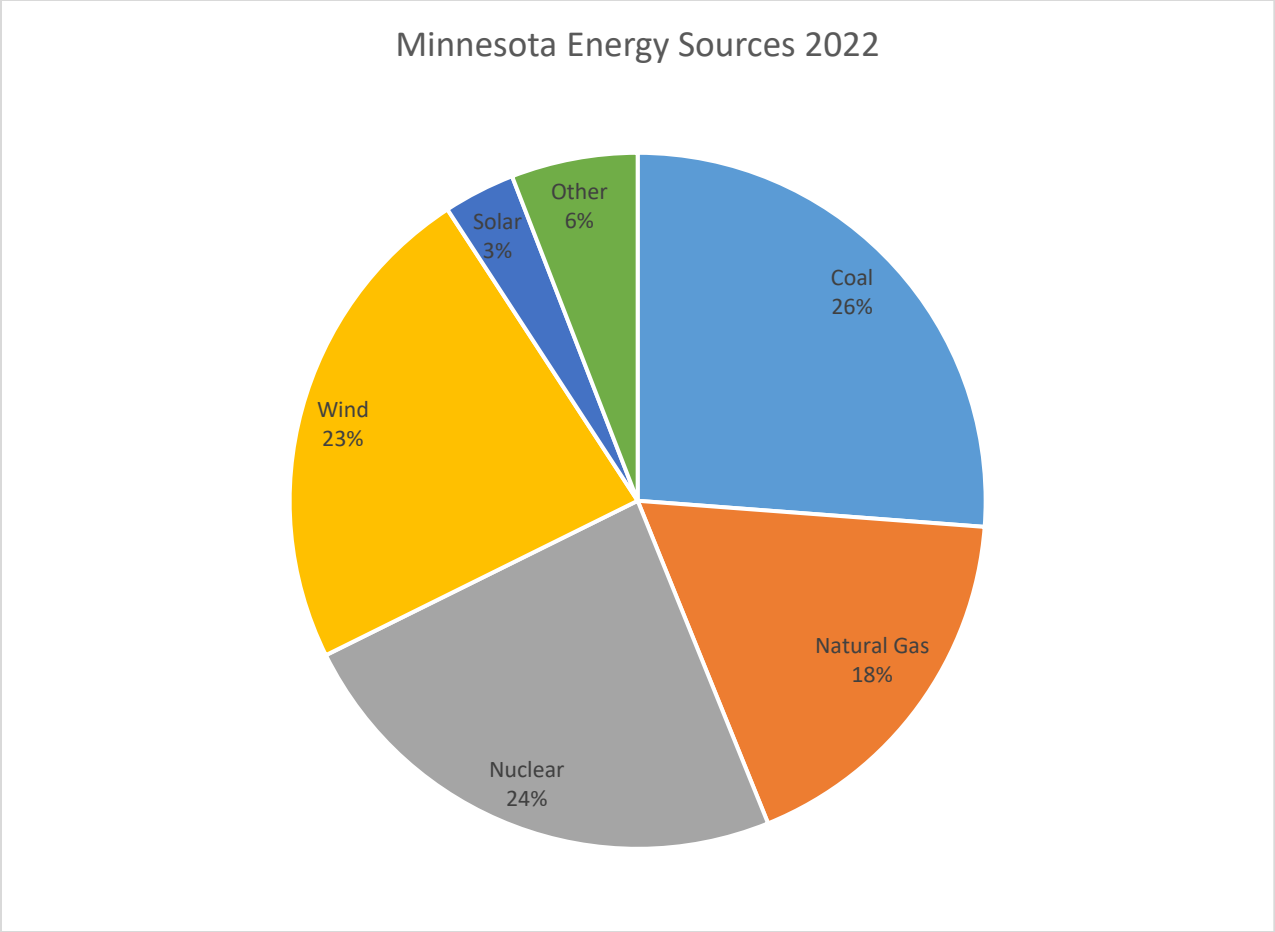
Figure 3.3: Minnesota's Electricity Generation Mix 2001-2021, Percentage of Total MWh[23]



[22] UNIVERSITY OF MINN. ENERGY TRANSITION LAB, *Minn. Clean Energy: Economic Impacts & Policy Drivers* at 5 (Nov. 2016), *available at* http://energytransition.umn.edu/wp-content/uploads/2015/08/ITC-PTC-Report-FINAL-11.14.pdf. *Electricity Data Browser*, U.S. Energy Information Administration, https://www.eia.gov/electricity/data/browser/ (last visited June 1, 2023).

[23] *Id.*

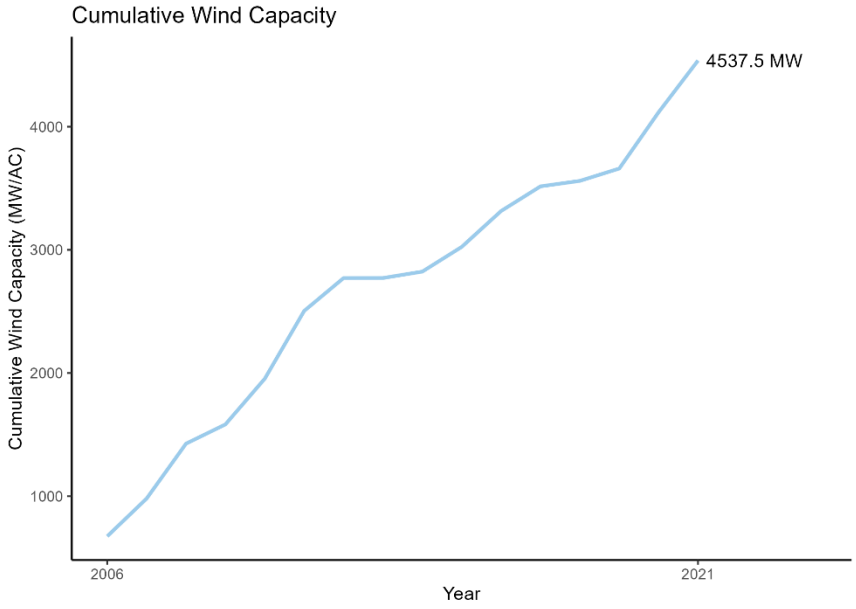
Figure 3.4: Minnesota Electricity Generation in 2022[24]



[24] *Id.*

Figure 3.5 shows the overall increase in Minnesota's wind capacity, in MW, from 2006 to 2021.

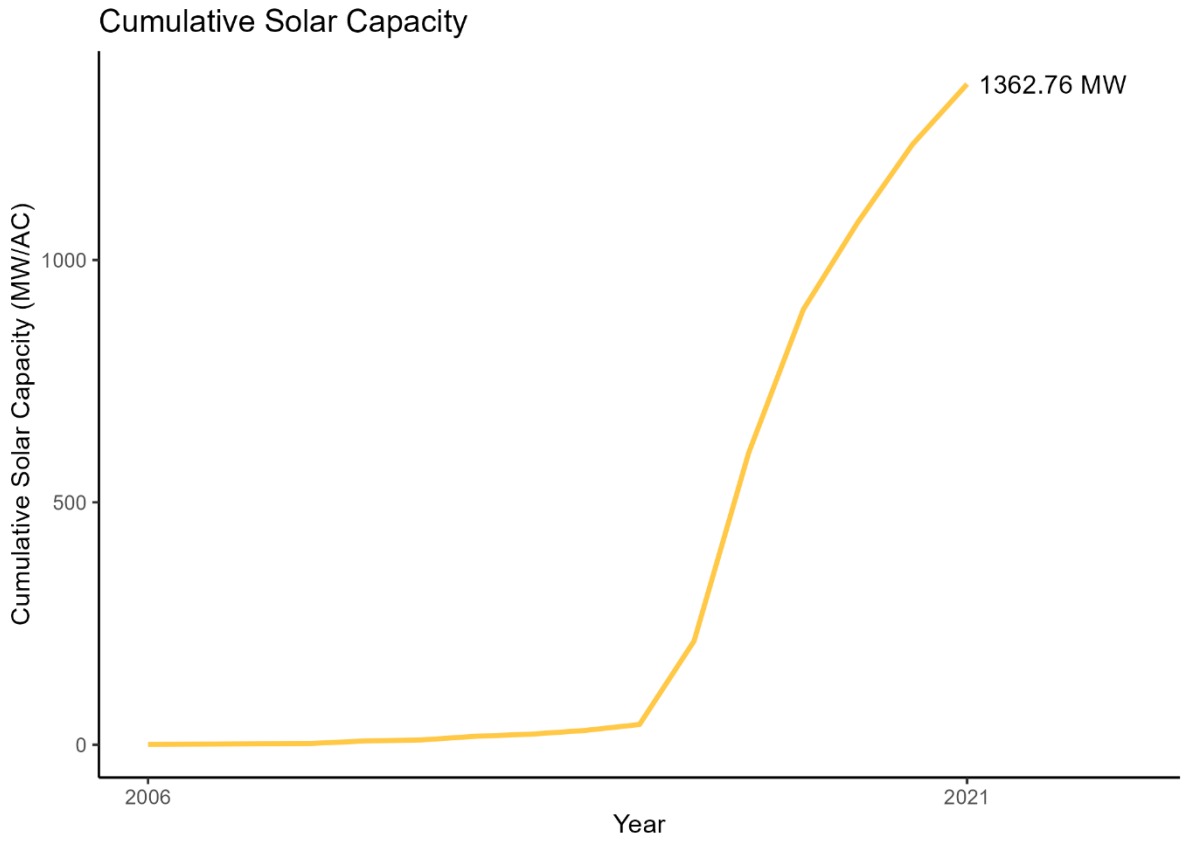
Figure 3.5: Minnesota's Wind Capacity 2006-2021[25]



[25] *Wind Energy Data & Info*, MN Department of Commerce Energy & Utilities, https://mn.gov/commerce/energy/solar-wind/wind-energy-data-info/ (last visited July 11, 2023).

Solar energy has also expanded significantly in Minnesota. Beginning in 2013, Minnesota solar power capacity rapidly expanded from a relatively small amount to 1362.76 MW in 2021, as illustrated by **Figure 3.6**.

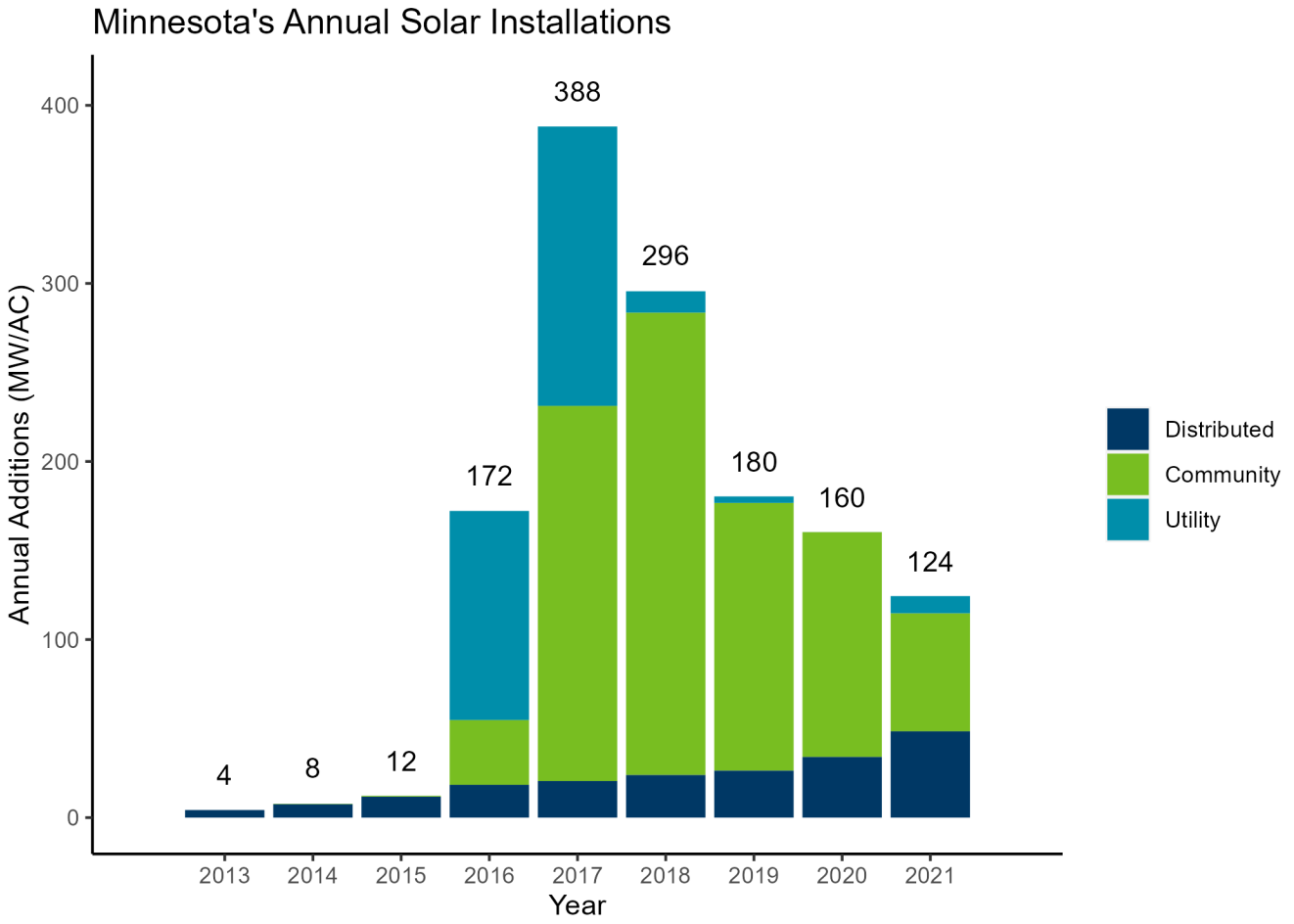
Figure 3.6: Cumulative Solar Capacity in Minnesota[26]



[26] *Solar Energy Data & Info*, MN Commerce Department Energy & Utilities, https://mn.gov/commerce/energy/solar-wind/solar-energy-data-info/ (last visited June 6, 2023).

Although the pace of new solar installations has slowed from its peak of 388 in 2017, the last several years have seen far greater added capacity than before 2016.

Figure 3.7: Annual Solar Installations in Minnesota[27]



3.3.2 Changing Energy Policy

State and federal policies have aided the rapid increase in the percentage of Minnesota's generation coming from renewable sources.

3.3.2.1 Federal Renewable Energy and Transmission Policies

Current federal energy policy promotes the expansion of renewable energy and the transmission that will be necessary to interconnect that energy to the grid. Most recently, the

[27] *See Solar Energy Data & Info*, MN Commerce Department Energy & Utilities, https://mn.gov/commerce/energy/solar-wind/solar-energy-data-info/ (last visited June 6, 2023).

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. 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 take over. The PTC is a per kilowatt-hour (kWh) tax credit for electricity generated by solar and other qualifying technologies for the first 10 years of a system's operation. The ITC is a tax credit that reduces the federal income tax liability for a percentage of the cost of a solar system that is installed during the tax year. The Clean Energy PTC and ITC are functionally similar to the traditional PTC and ITC but are not technology-specific. In other words, they apply to all generation facilities (and energy storage systems under ITC) provided they have an anticipated greenhouse gas emissions rate of zero.

Similarly, federal policy recognizes that, with expanding renewable generation, additional transmission infrastructure will be critical to get this energy to where it is needed, and to maintain a resilient and reliable grid. 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, "[A]s the 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."[28]

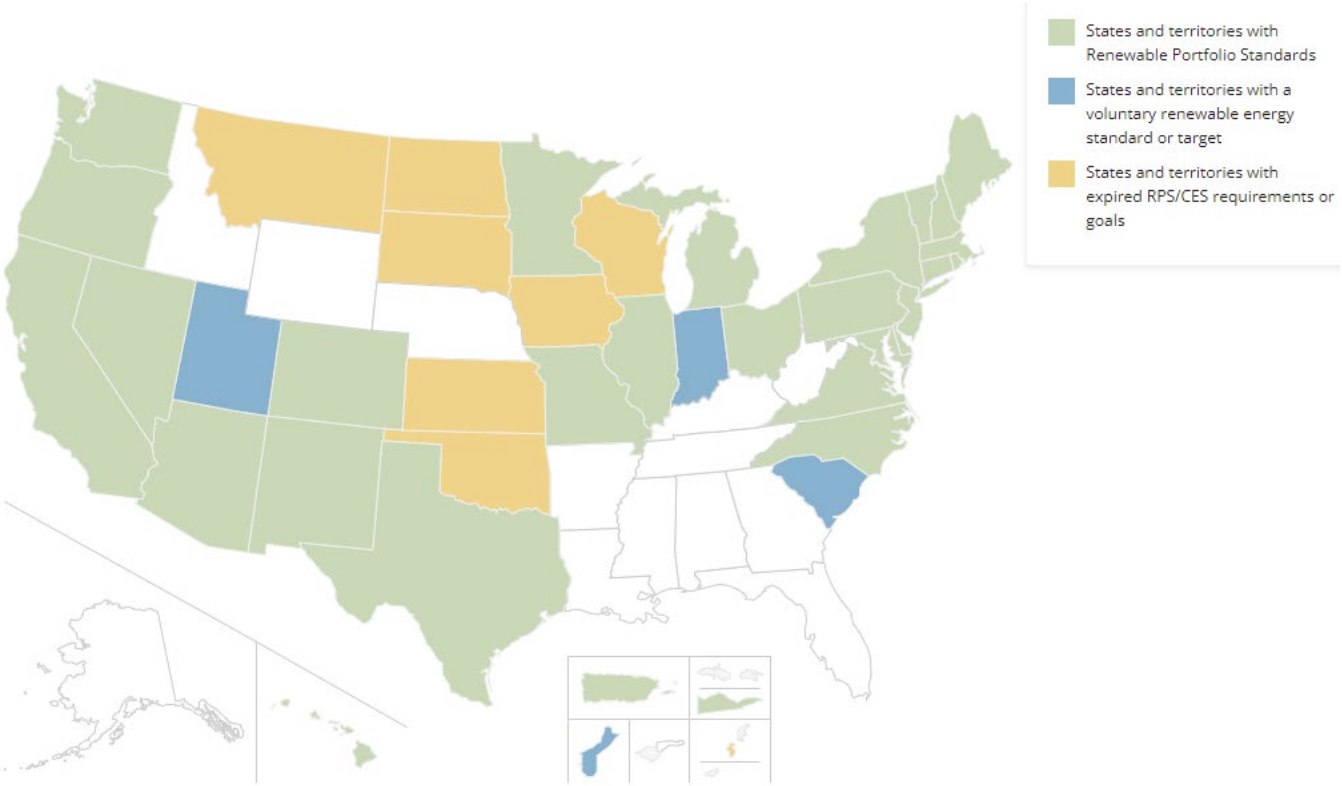
3.3.2.2 State Renewable Energy Policies

In many respects, states have led the way in the energy transformation. Many states now have either established renewable portfolio standards (RPS) or have voluntary renewable energy goals, as shown in **Figure 3.8**.[29]

[28] *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 (last accessed Feb. 23, 2023).

[29] This data is current as of August 13, 2021.

Figure 3.8: States with Renewable Energy Standards or Goals, 2021[30]



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. Minnesota statute also required Xcel Energy to generate 30% of its retail sales from renewable energy by 2020.[31] Xcel Energy met that target.[32]

In 2007, Minnesota set a goal to reduce statewide greenhouse gas emissions across all sectors producing those emissions to a level at least 30% below 2005 levels by 2025 and to a level at least 80% below 2005 levels by 2050.[33] Similarly, Minnesota has recognized a "vital interest in

[30] NAT'L CONFERENCE OF STATE LEGISLATURES, *State Renewable Portfolio Standards and Goals*, (Aug. 13, 2021), *available at* http://www.ncsl.org/research/energy/renewable-portfolio-standards.aspx (last accessed Jun. 5, 2023).
[31] Minn. Stat. § 216B.1691, subds. 2 and 2a.
[32] *See In the Matter of Commission Consideration and Determination of Compliance with Renewable Energy Standards for Year 2020*, MPUC Docket No. E999/PR-21-12, Renewable Energy Certificate Retirement and Solar Energy Standards Reporting for Compliance Year 2020 (June 2, 2021).
[33] Minn. Stat. § 216H.02, subd. 1.

providing for . . . the development and use of renewable energy resources wherever possible."[34] Xcel Energy has been working to meet these goals.

More recently, in February 2023, Governor Tim Walz signed the "100% by 2040" legislation into law. At a high level, 100% by 2040 directs electric utilities to transition to meeting the needs of Minnesota retail customers with 100% carbon-free electricity by the end of 2040. Xcel Energy supported the legislation and is committed to achieving a zero-carbon future as quickly as possible while also ensuring affordability and reliability. Additional sources of emission-free electric energy—like wind and solar—will be necessary to meet these goals.

3.3.2.3 Xcel Energy Goals and Approved Resource Plan

Xcel Energy is a national leader in renewable energy and has steadily expanded its renewable-energy portfolio since 2005. At the end of 2022, Xcel Energy had approximately 1,200 megawatts (MW) of large and distributed-scale solar and over 4,500 MW of wind.

Xcel Energy is committed to delivering carbon-free electricity and is on track to meet Minnesota's 100% by 2040 law targets. In December 2018, Xcel Energy was the first major U.S. energy provider to commit to delivering 100% carbon-free electricity by 2050, with one of the most aggressive interim targets to reduce carbon emissions by more than 80% by 2030 from 2005 levels. Xcel Energy has already reduced carbon emissions by 51%, and the Company's most recent IRP surpasses Xcel Energy's interim target, reducing estimated carbon emissions over 85% by 2030, with even deeper carbon reductions beyond 2030. The Company's recently approved IRP positions Xcel Energy well to reach 100% carbon-free energy faster, meeting Minnesota's ambitious new goals.

Under the plan, Xcel Energy will:

- Add 2,150 MW of wind and 2,550 MW of solar by 2032, with another 1,100 MW of wind and solar capacity beyond 2032;
- Retire all remaining Upper Midwest coal plants by the end of 2030;
- Ensure reliable, affordable energy by extending the generation of carbon-free nuclear energy at Xcel Energy's Monticello Plant an additional 10 years to 2040;
- Build on Xcel Energy's successful energy efficiency programs to help customers save energy and money and work with customers on new demand response

[34] Minn. Stat. § 216C.05, subd. 1.

options to manage electric load; and

- Develop new transmission infrastructure to connect more clean energy to the power grid, taking advantage of existing infrastructure to maintain affordable rates.

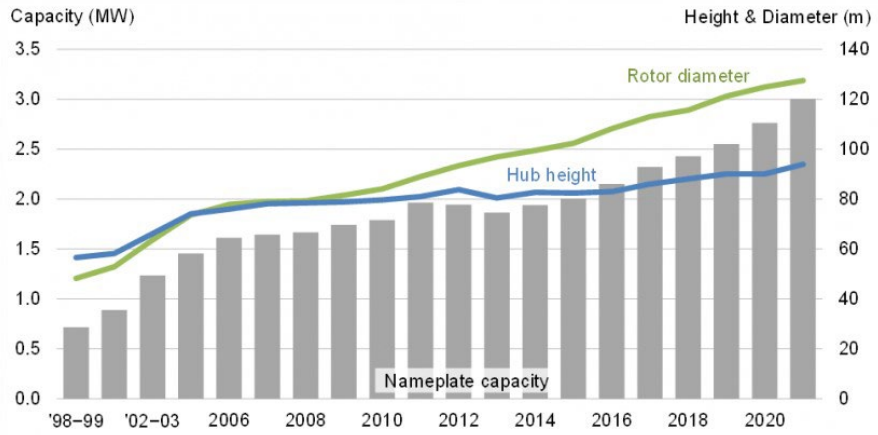
Wind and solar will be integral to Xcel Energy's plan to reduce carbon emissions 85% by 2030 from 2005 levels. Wind and solar will produce more than 50% of Xcel Energy's electricity by 2030 and will help Xcel Energy meet Minnesota's new 100% by 2040 standard.

3.3.3 Technological Advancement and Economics of Renewable Generation

State and federal policies have helped drive advancements in technology and improve cost and performance, which, in turn, has contributed to the increased expansion in renewable generation.

The average electrical output or "nameplate capacity" of newly installed, individual wind turbines in the United States in 2021 was 3 MW—more than four times the average capacity of wind turbines installed from 1998 to 2001. **Figure 3.9** illustrates this trend.[35]

Figure 3.9: Wind Nameplate Capacity 1998-2021[36]



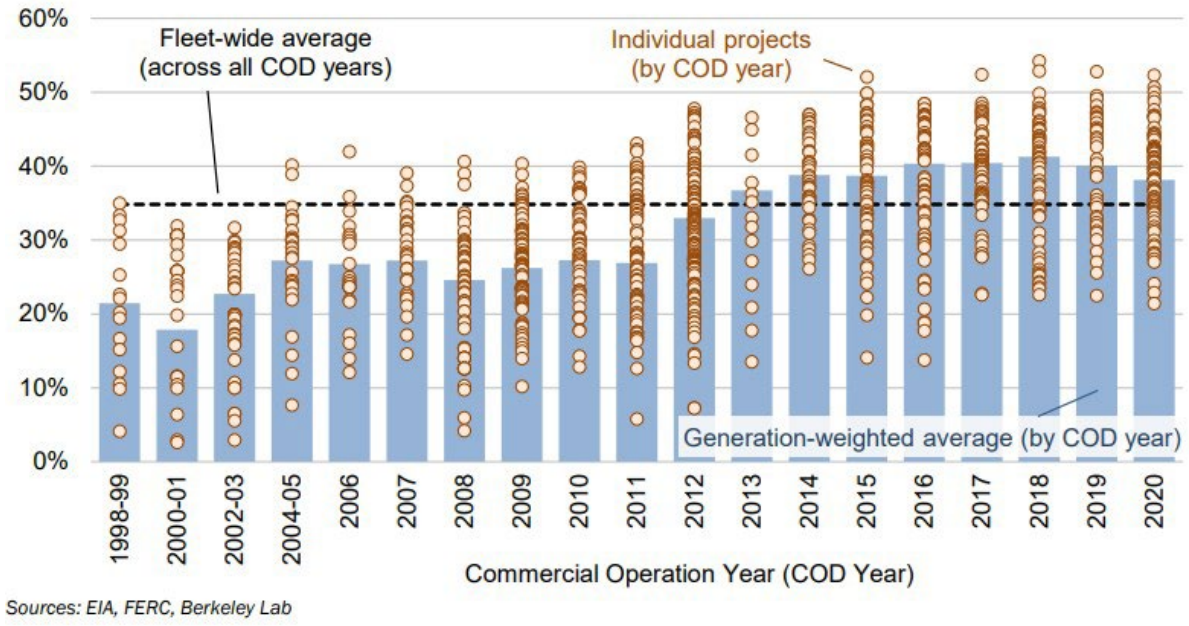
Average turbine hub height, rotor diameter, and nameplate capacity for land-based wind projects from the Land-Based Wind Market Report: 2022 Edition.

Likewise, the capacity factor[37] for wind projects has increased substantially over the past twenty years. The average capacity factor among United States wind projects from 2014 to 2020 was

[35] U.S. DEP'T OF ENERGY – OFFICE OF ENERGY EFFICIENCY & RENEWABLE ENERGY, *Wind Turbines: The Bigger, The Better* (Aug. 16, 2022), *available at* https://www.energy.gov/eere/articles/wind-turbines-bigger-better.
[36] *Id.*
[37] Capacity factor refers to a wind facility's average output compared to the facility's maximum rated output.

39%, compared to an average of 26% among projects built from 2004 to 2011, and 18% among projects built from 1998 to 2001. **Figure 3.10** shows the increase in wind capacity factor between 1998 and 2020 as well as the capacity factor of individual projects.[38]

Figure 3.10: United States Wind Capacity Factors: 1998-2020



Similarly, technological advances in solar energy have reshaped solar power's viability as a source of renewable energy. The unsubsidized, upfront cost of a utility-scale photovoltaic system, for instance, declined more than 80% from 2010 to 2020, primarily due to higher efficiency and lower module cost.[39] In fact, "[a]verage commercial module efficiency has increased by approximately 2% each year since before 2010."[40] For example, studies indicate steadily increasing average efficiency[41] of monocrystalline Si module[42] year over year, as shown by the graphic below:

[38] U.S. DEP'T OF ENERGY – OFFICE OF ENERGY EFFICIENCY & RENEWABLE ENERGY, *Land-Based Wind Market Report: 2022 Edition*, [hereinafter 2022 Wind Power Technologies Market Report] at 33 (August 2022), *accessed at* https://www.energy.gov/sites/default/files/2022-08/land_based_wind_market_report_2202.pdf.

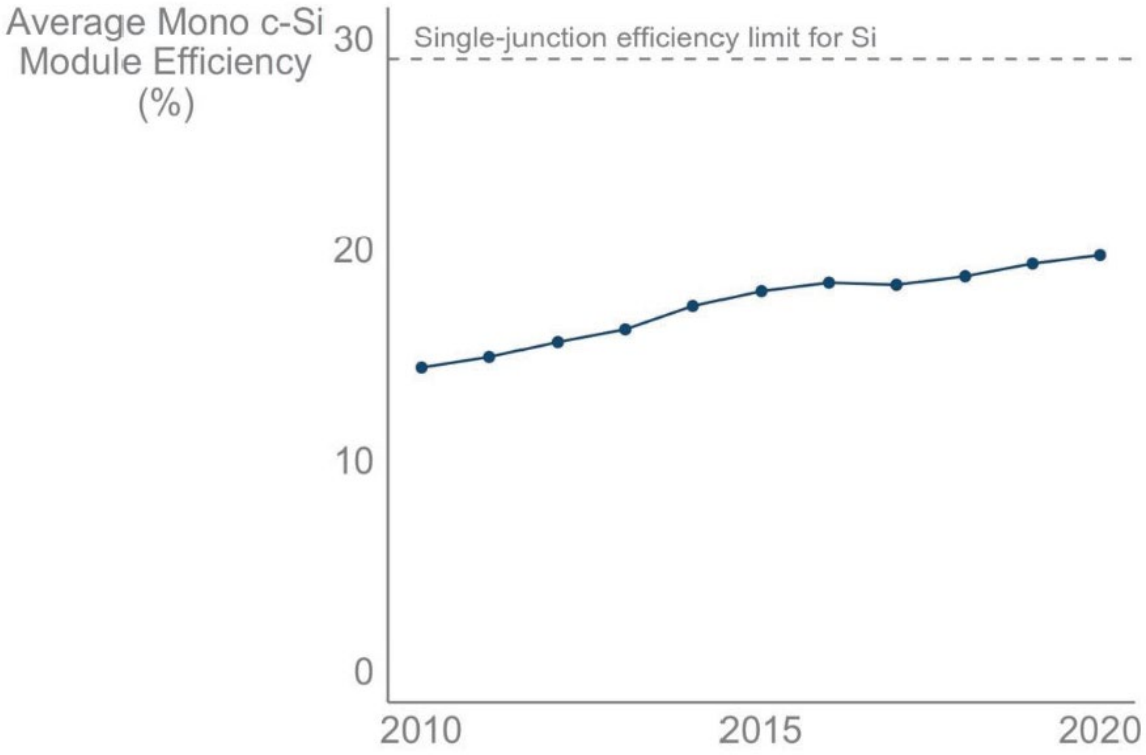
[39] U.S. DEP'T ENERGY, OFF. ENERGY EFFICIENCY & RENEWABLE ENERGY, Solar Futures Study 116 (2021) *available at* https://www.energy.gov/sites/default/files/2021-09/Solar%20Futures%20Study.pdf.

[40] *Id.* at 120.

[41] Efficiency is reported based on the ratio between a PV module's electrical power output and its solar power input.

[42] Monocrystalline Si modules are a type of PV module that comprises approximately 94% of the global PV market. Solar Futures Study at 117.

Figure 3.11: Increases in Si Module Efficiency[43]



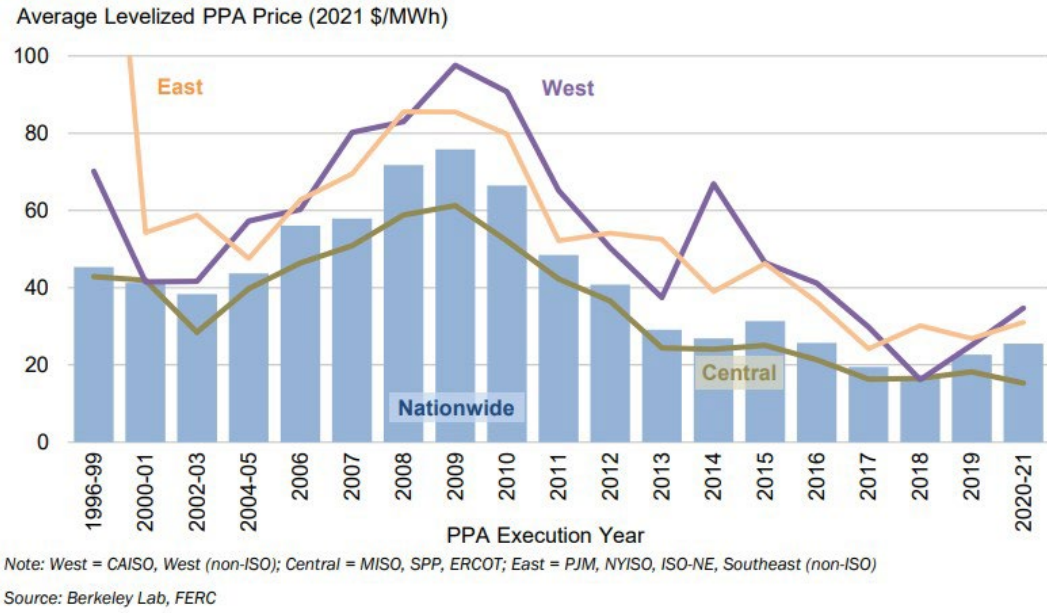
Similarly, improvements in Concentrating Solar Power (CSP) technology[44] and other technological improvements have also played a role in increasing the availability of solar power.[45] Beyond efficiency increases, construction *costs* for solar generation have decreased dramatically in recent years.[46] In fact, global solar power costs have declined by approximately 80% since 2010.[47] For these reasons, it is unsurprising that the U.S. Energy Information

[43] *Id.* at 121.
[44] *Id.* at 129.
[45] *Id.* at 137–39.
[46] U.S. ENERGY INFO. ADMIN, *Average U.S. Construction Costs for Solar Generation Continued to Fall in 2019*, (July 16, 2021), https://www.eia.gov/todayinenergy/detail.php?id=48736.
[47] WORLD ECONOMIC FORUM, *The Price of Solar Power Has Fallen by Over 80% Since 2010. Here's Why* (Nov. 4, 2021), https://www.weforum.org/agenda/2021/11/renewable-energy-cost-fallen/.

Administration predicts solar energy generation will expand from 144.6 billion kWh in 2022 to 239.6 billion kWh in 2024.[48]

As a result of the recent technology improvements, low operational costs, state policies, and availability of federal tax credits, wind and solar have become very economic sources of electricity. Trends show that in 2021, the average levelized power purchase price for wind was about $20 per megawatt-hour (MWh) in the Central region, which covers MISO, the Southwest Power Pool, and the Electric Reliability Council of Texas. This power purchase price reduction represents an over 60% drop from the peak price of over $60 per MWh in 2009, as shown in **Figure 3.12**.[49]

Figure 3.12: Average Levelized PPA Price: 1996-2021[50]



It is expected these favorable economic conditions—where wind and solar are at or among the lowest cost generation sources—will result in construction of additional wind and solar generation in the future, particularly in regions with abundant wind resources, such as southwestern Minnesota, North Dakota, and South Dakota. The types of generation in MISO's generator interconnection queue bear this out.

---

[48] U.S. ENERGY INFO. ADMIN., *U.S. Regional Electricity Generation, Electric Power Sector*, https://www.eia.gov/outlooks/steo/tables/pdf/7dtab.pdf (last visited June 6, 2023).

[49] 2022 Wind Power Technologies Market Report at 48.

[50] *Id.*

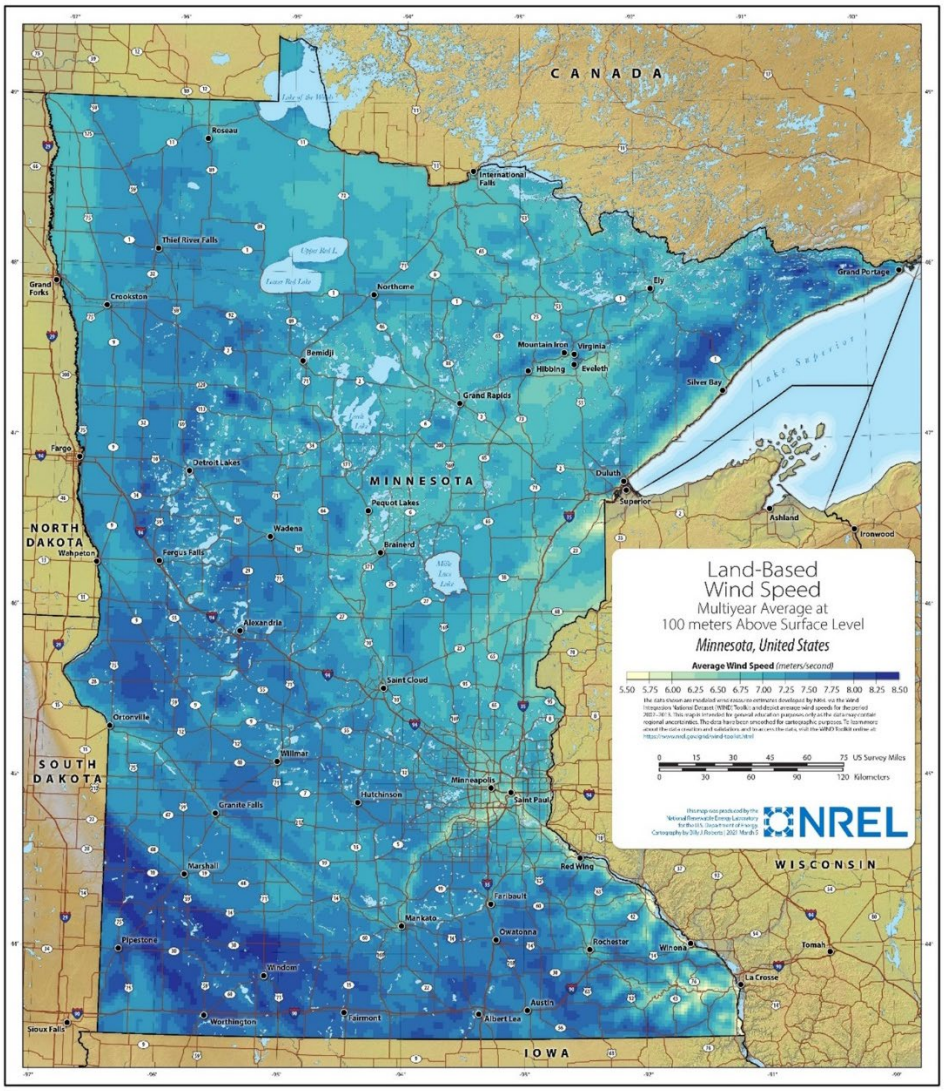
3.3.4 Transmitting Renewable Energy to Where It Is Needed

The increase in renewable energy generation has been accompanied by a decrease in coal generation. Coal generation tends to be located closer to load centers, whereas wind and solar tends to be located where those resources are the most abundant. Consequently, the shift from centrally located coal generation to renewable generation requires additional investments in transmission infrastructure to support the movement of this electric energy from generation areas to load centers. In the Upper Midwest there are abundant wind and solar resources in southwest Minnesota and eastern South Dakota.

Figure 3.13, 3.14, and **3.15** show the areas of significant productive wind resources in Minnesota, South Dakota, North Dakota, respectively. Significant installed wind capacity already exists in these areas.[51]

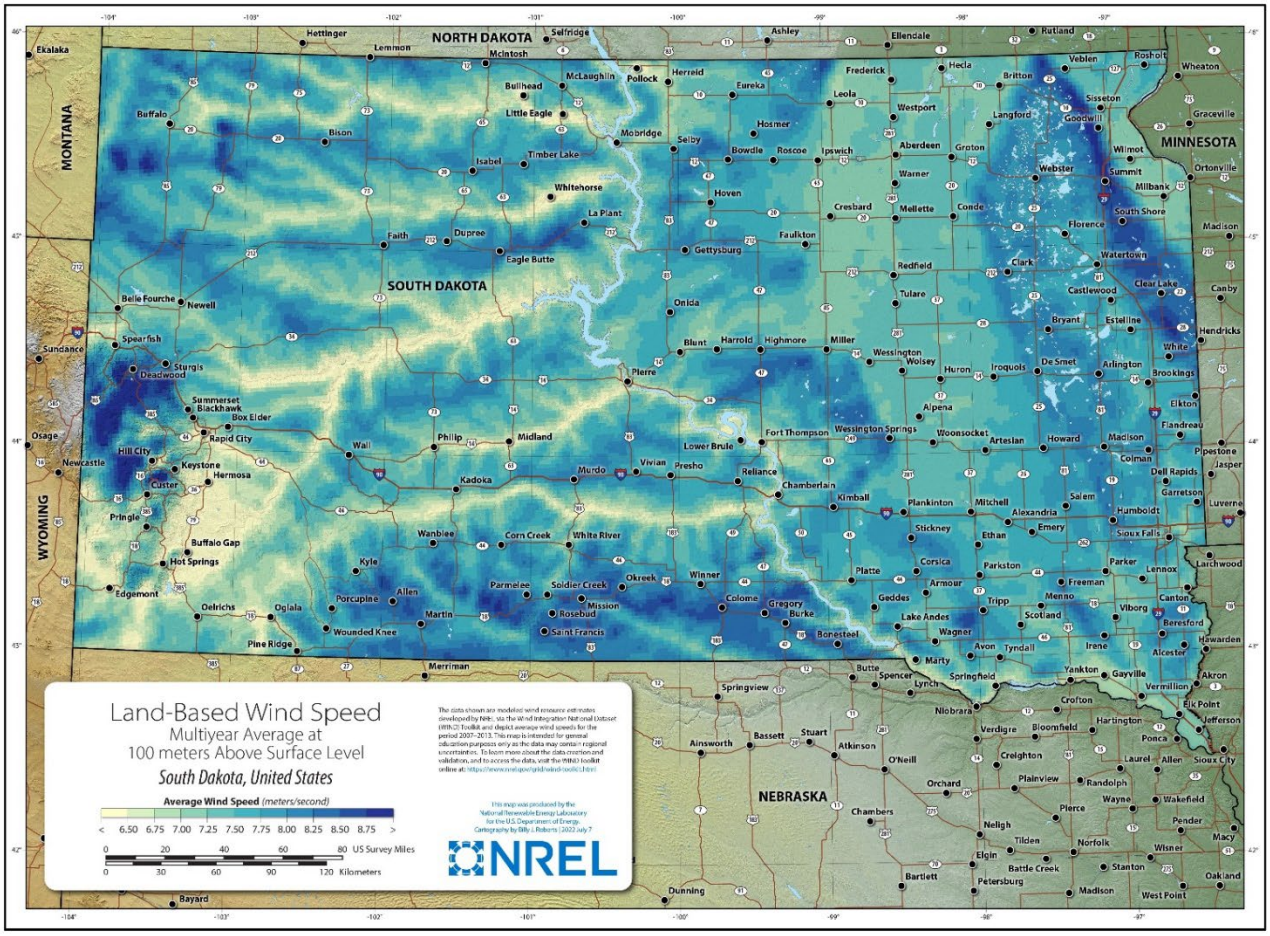
[51] *See* USGS, *The U.S. Wind Turbine Database*, available at https://eerscmap.usgs.gov/uswtdb/ (last accessed Feb. 23, 2023).

Figure 3.13: Minnesota Average Annual Wind Speeds at 100 meters Above Surface Level



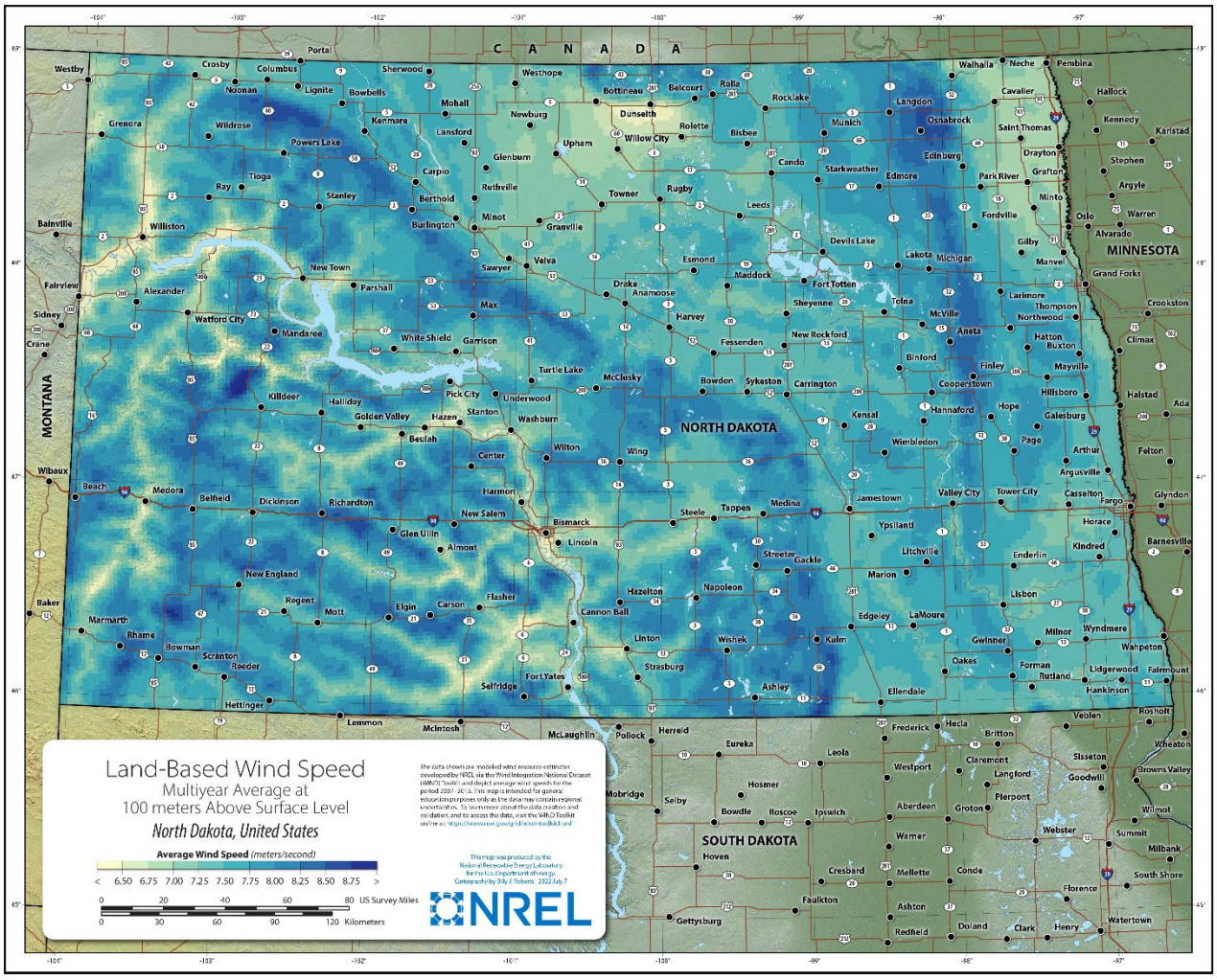
Source: https://www.nrel.gov/gis/wind.html

Figure 3.14: South Dakota Average Annual Wind Speeds at 100 meters Above Surface Level



Source: https://www.nrel.gov/gis/wind.html

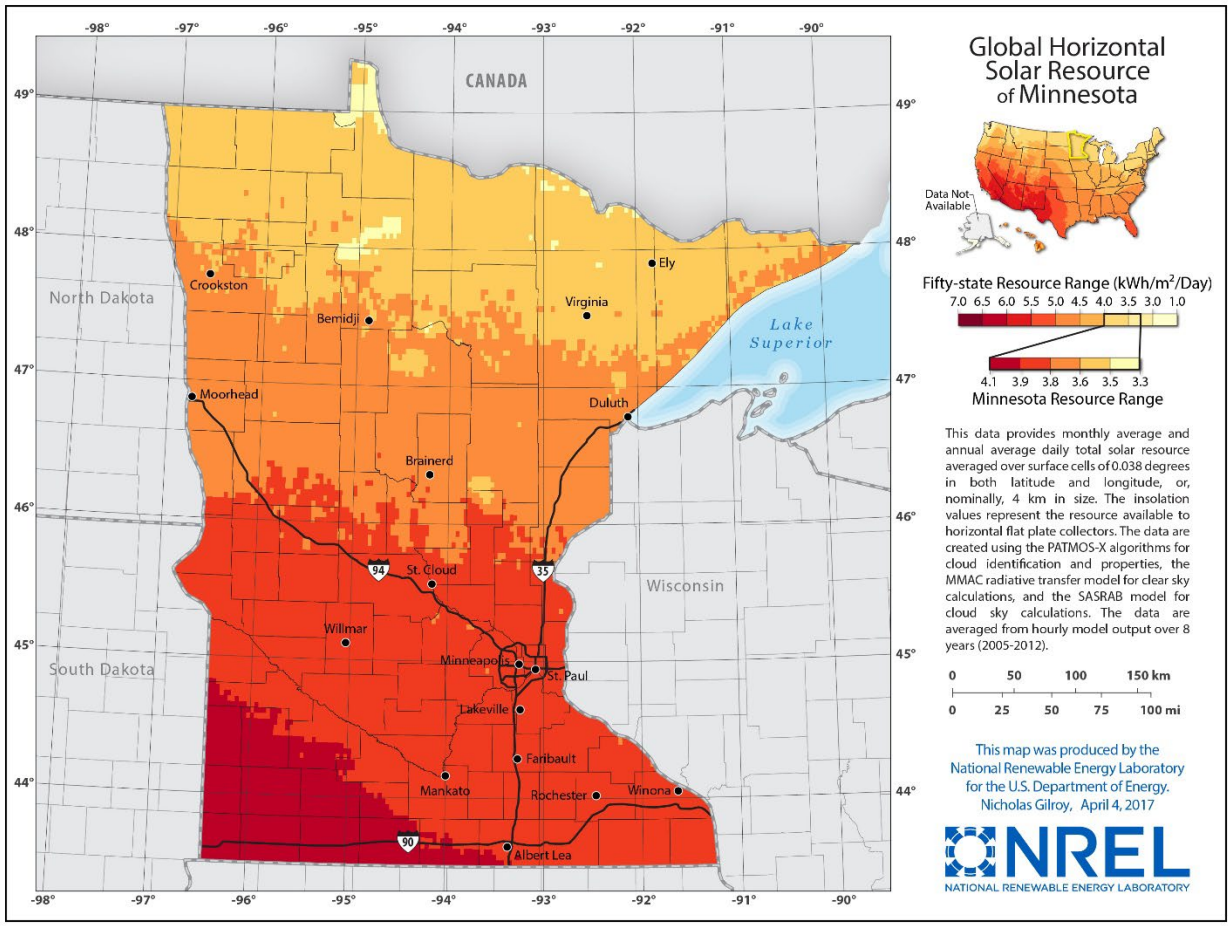
Figure 3.15: North Dakota Average Annual Wind Speeds at 100 meters Above Surface Level



Source: https://www.nrel.gov/gis/wind.html

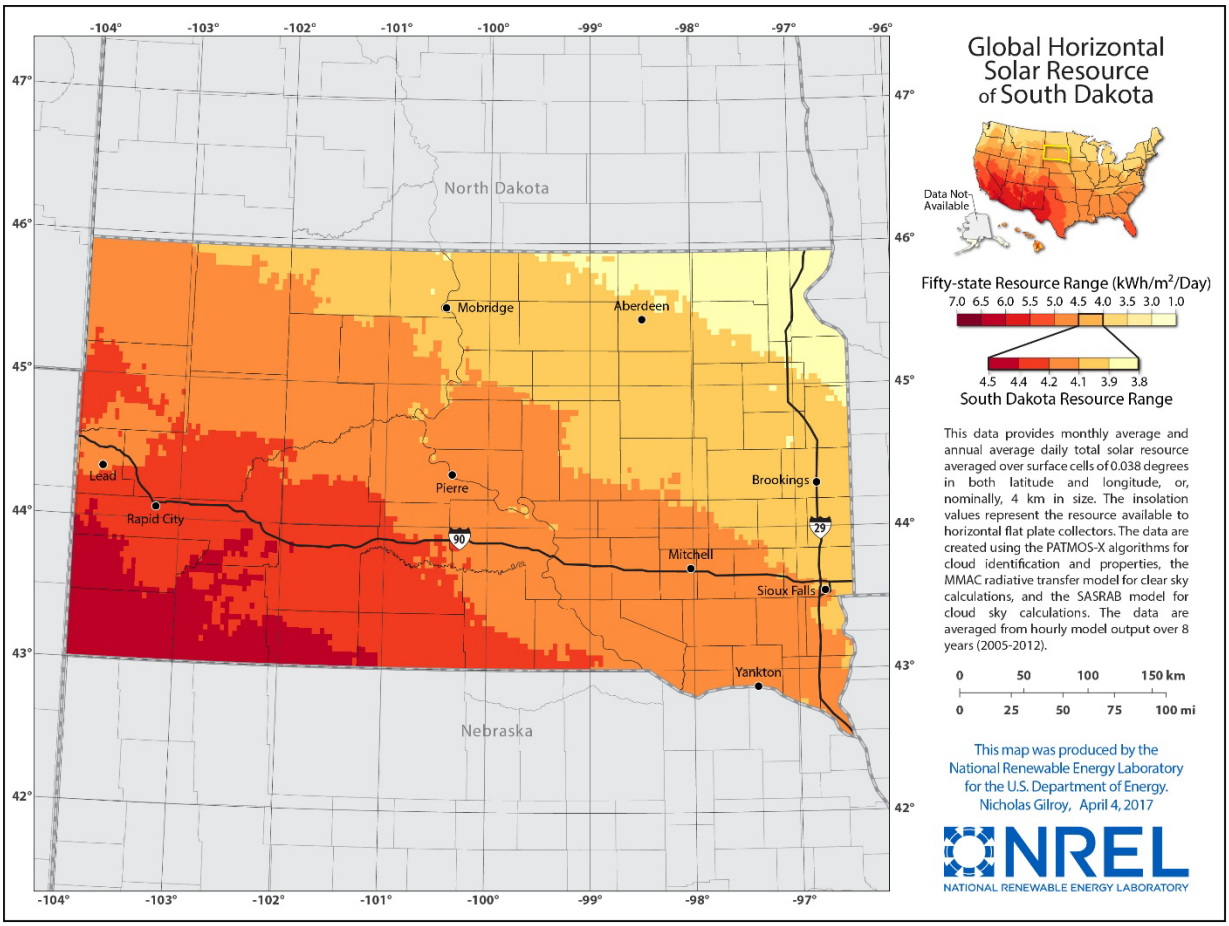
In addition, southwest Minnesota and South Dakota have relatively high solar irradiance, where limited tree cover and expansive non-forested lands result in ample sun exposure at ground level. Solar suitability maps for Minnesota, South Dakota, North Dakota are shown in **Figures 3.16, 3.17,** and **3.18**, respectively.

Figure 3.16: Minnesota Solar Suitability Map



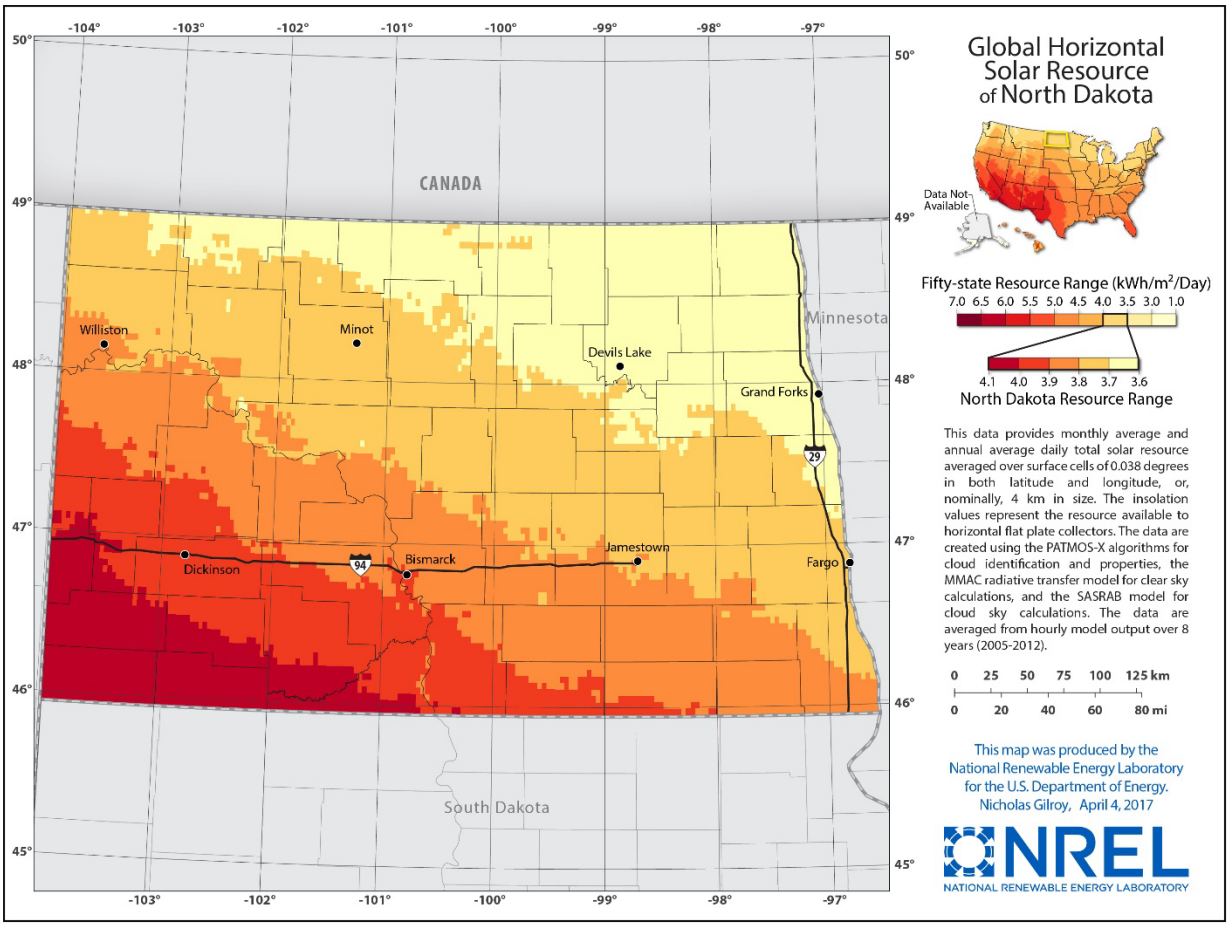
Source: https://www.nrel.gov/gis/solar.html

Figure 3.17: South Dakota Solar Suitability Map



Source: https://www.nrel.gov/gis/solar.html

Figure 3.18: North Dakota Solar Suitability Map



Source: https://www.nrel.gov/gis/solar.html

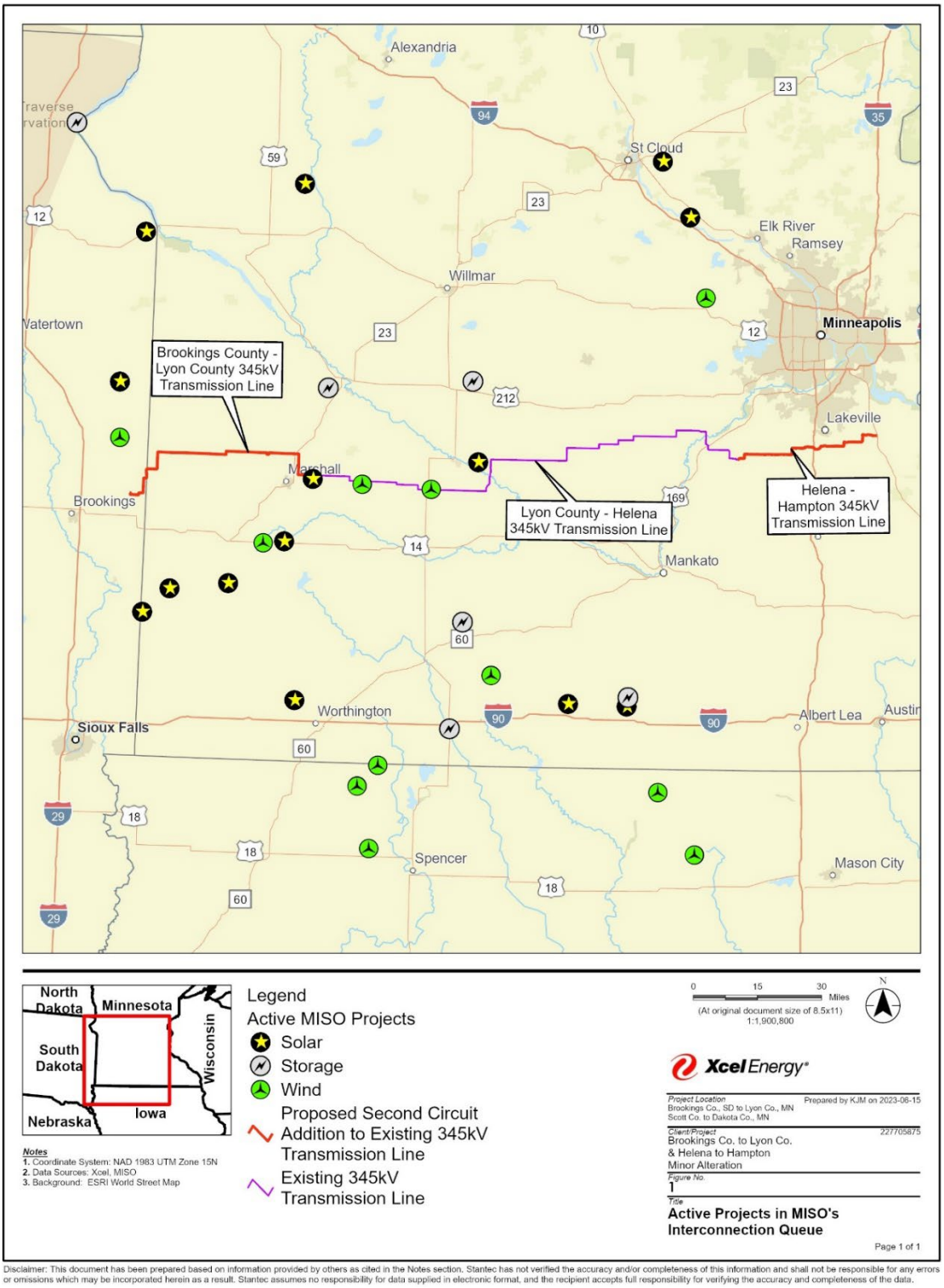
The exceptional wind generation growth in southwestern Minnesota and the surrounding states has put unprecedented pressure on the transmission system to deliver the inexpensive wind power to customers.[52] Specifically, as more wind generation facilities have been constructed along the Minnesota-South Dakota border over the past decade, transmission congestion in this area has increased. Congestion occurs when the amount of energy available to be moved on the transmission system exceeds the limits of the system. These limits are in place to ensure grid reliability.

MISO's current interconnection queue contains a large number of solar, storage, and wind interconnection requests, many of which are located in Minnesota, North Dakota, and South

[52] *See* NAT'L RENEWABLE ENERGY LAB., *2016 State of Wind Development in the United States by Region* (Apr. 2017), *available at* https://www.nrel.gov/docs/fy17osti/67624.pdf.

Dakota. MISO's interconnection queue identifies 1,804 MW of solar, 603 MW of storage or hybrid, and 1,666.47 MW of wind resources interconnecting into the Company's regional system.

Figure 3.19: Wind, Solar, and Battery Energy Storage Projects in MISO Interconnection Queue: Southwestern Minnesota, Eastern South Dakota, and Northern Iowa[53]



As discussed in the following chapter, the Project will reduce congestion to allow renewable resources in Minnesota, North Dakota, and South Dakota to be more efficiently delivered to load centers in the region. Considering the current congestion levels on the transmission system and the over 4 gigawatts of new projects requesting interconnection into the Company's transmission system, this Project will be critical to keeping congestion costs low to ensure these renewable resources continue to be available to meet both customer needs and carbon-reduction goals.

[53] This map is based on the MISO queue as of June 2023. *Accessed at* https://giqueue.misoenergy.org/PublicGiQueueMap/index.html.

4. NEED ANALYSIS

Xcel Energy is proposing the Brookings Second-Circuit Project to reduce congestion. Reducing congestion will lower system costs by allowing for the greater use of low-cost, renewable generation. Currently, there is significant congestion in the MISO electric transmission system. As a result of this congestion, it can be more difficult for low-cost renewable energy from South Dakota, North Dakota, and southern Minnesota to reach areas, like the Twin Cities, with significant load. When congestion occurs, customers pay more for electricity because higher-cost generators from areas without transmission constraints are used to meet customer demand. By adding more transmission capacity, the Project will reduce congestion. Reduced congestion will allow for more transmission of energy from South Dakota, North Dakota, and southern Minnesota. Because low-cost renewable resources make up a large share of this available energy, the Project will result in lower overall costs for customers in the region. In short, the Project is needed because it will reduce costs for customers, and the analysis presented in this chapter demonstrates that need and the economic benefits that will result from the Project.

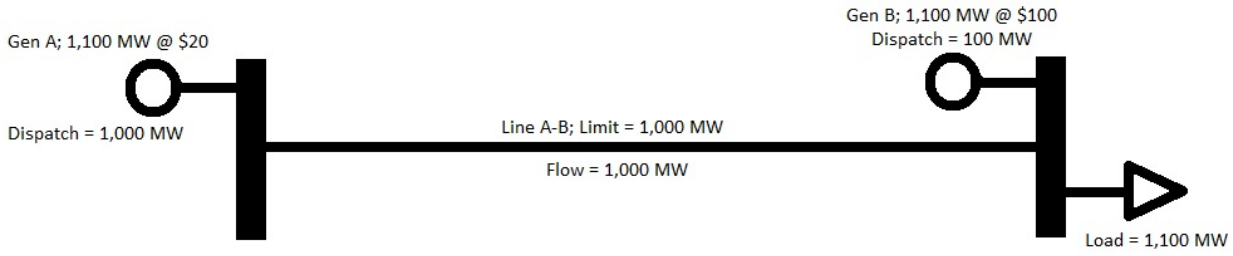
4.1 Congestion Overview

Congestion has become an increasingly serious problem in the MISO territory in recent years. As part of carrying out its responsibility to operate an energy market in an efficient manner, MISO operates day-ahead and real-time energy markets. Congestion can impair the operation of these markets. Limits on the capacity of transmission facilities can prevent MISO from dispatching the most efficient generation resources during all hours of the year, increasing wholesale energy costs.

Currently, there is low-cost energy being produced in South Dakota, North Dakota, and southern Minnesota that is sometimes unable to reach load centers, like the Twin Cities, due to transmission constraints in southern Minnesota and South Dakota that create congestion. More specifically, available energy in the region cannot be provided to load centers because the loading limits on certain transmission facilities limit this additional energy from being delivered along those constrained facilities. As a result, not all available low-cost, wind energy can be delivered, and it must be replaced by more costly substitute energy from other areas without transmission constraints. This curtailment of renewable generation caused by transmission constraints creates inefficiencies in the wholesale energy market, increases costs, and impedes efforts to reduce carbon dioxide emissions.

Figure 4.1 below illustrates ways congestion affects the energy used and pricing in a single moment of time. The illustration assumes an energy need of 1,100 MW that could be supplied by two potential generators, one at a charge of $20 per MW and one at $100 per MW.

Figure 4.1: Congestion Illustration



In this theoretical intact system, Generator A has the generation capacity to serve the entire 1,100 MW needed at $20/MW, but cannot do so because of the 1,000 MW transmission capacity limit on Line A-B. Instead, Generator A's dispatch is limited to 1,000 MW and Generator B will be called on to deliver the remaining 100 MW at $100/MW. If Generator A were able to deliver the entire 1,100 MW it can generate, the energy cost would be $22,000 assuming no energy is lost during transmission. Due to system constraints, the total cost to deliver the 1,100 MW rises to $30,000 because 100 MW cannot be delivered, and more expensive replacement energy is required from Generator B (1,000 MW X $20 for Generator A plus 100 MW X $100 for Generator B). The upshot is the congestion causes the overall cost of energy to increase $8,000 or 36 percent in this simplified example. When there is no congestion, the lowest-cost generator, regardless of fuel source, is the one that serves load. As renewable generation, particularly wind, is often low cost and is also typically located at greater distances from load centers, more efficient market operation can also result in reduced emissions of carbon dioxide.

Congestion has become an increasingly significant factor in MISO, including in MISO Zone 1, which includes the Project Study Area. The analysis of the Project's benefits set forth in the following subsections demonstrate the congestion reduction provided by the Project is forecasted to produce significant savings as a result of more transmission capacity leading to more efficient market operation.

One way to illustrate the increased congestion experienced by the Company is to consider recent and forecasted trends in Xcel Energy's MISO congestion charges. **Table 4.1** below provides 2020-2022 actual figures, the forecasted 2023 amount approved by the Commission, and the Company's forecasted 2024 amount.

Table 4.1: Xcel Energy's MISO Charge Type Year Over Year Comparison ($000s)

2020 Actual	2021 Actual	2022 Actual	2023 Approved	2024 Forecast
PROTECTED DATA BEGINS				
PROTECTED DATA ENDS				

As **Table 4.1** demonstrates, congestion charges have increased significantly since 2020. Although the Company is forecasting a welcome reduction in 2024, the forecasted 2024 amount is still more than four times higher than the amount actually incurred in 2020. The Project is being proposed to reduce overall generation costs by allowing for a shift towards lower-cost, renewable resources. These congestion charges do not directly demonstrate the extent to which congestion has required the use of more expensive generation sources; however, the trends in the charges help illustrate the extent to which congestion has increased recently—a trend that led the Company to identify a need for the Project.

4.2 Method for Analyzing Benefits of Congestion Relief Projects

As discussed above, transmission congestion impairs the delivery of low-cost, renewable generation, resulting in higher generation costs. Accordingly, to analyze the economic impact of potential congestion relief projects, transmission planning engineers run market simulations. The planners can derive estimates of the economic impact of candidate projects by comparing simulated market functioning with and without additions to the transmission system.

To perform these simulations, Xcel Energy uses PROMOD, which is the industry standard market simulation software for economic transmission planning. PROMOD provides a geographically and electrically detailed representation of the topology of the electric power system, including generation resources, transmission resources, and load. This detailed representation allows the model to capture the effect of transmission constraints on the ability to transmit power from generators to load. The model can thus calculate future estimated costs of producing electricity, market congestion, and energy losses based on these assumptions.

The Company typically analyzes the impacts of a project by considering the project's impact on APC, which is the total production costs of a generation fleet including fuel, variable operations and maintenance, startup cost, and emissions, adjusted for energy market sales and purchases. If a project is forecasted to produce APC savings, those are the estimated benefits of the project. The Company then compares those benefits to project costs and other impacts.

PROMOD is used by the Company to provide results for a 20-year period. Within MISO, this 20-year period is typically used in economic transmission planning because 20 years is the time frame during which, when applicable, shared project costs are recovered. However, transmission infrastructure is expected to last in excess of 20 years, and PROMOD results can be extrapolated to arrive at estimated project benefits over longer periods.

PROMOD requires various assumptions regarding future conditions. MISO, in coordination with stakeholders, develops a variety of future scenarios or "Futures" under which to study potential transmission projects. Each Future contains different assumptions as to future demand and energy levels, fuel prices, generation retirements and additions, and potential environmental regulations. These Futures are commonly used within MISO to provide the assumptions needed for PROMOD modeling. These assumptions can be adjusted as appropriate.

4.3 Project Identification and Development

The Company developed the Project in direct response to the recent increases in congestion. MISO is taking action to increase transmission capacity, including through its LRTP initiative. Tranche 1 of LRTP includes projects to help reduce congestion. Those large-scale projects, however, are not expected to be in service until 2028 to 2030 and are not the only opportunities for addressing issues with the transmission system. The Company looked at its system, focused on locations where there is serious congestion, and considered whether there are any projects that could quickly and cost-effectively be brought online to relieve congestion by providing additional transmission capacity. Given the Original Brookings Line was constructed with double-circuit capable structures to accommodate future generation growth, the Project quickly emerged as a potential low-cost, low-impact project that could reduce congestion.

Xcel Energy's analysis utilities PROMOD to confirm the Company's assumptions regarding the likely benefits of the Project. This initial "rough check" evaluated whether the Project would produce worthwhile APC savings. Unfortunately, the initial modeling data and assumptions were lost due to unrelated computer hardware issues. But the overall results were saved. Those results estimated net present values of 20 years of APC savings of $113.3 million for MISO as a whole, $44.3 million for NSP, $83.20 million for Otter Tail Power, and $12.72 million for GRE.

Based on these favorable APC savings, the Company sought MISO approval for the Project. In August of 2022, Xcel Energy submitted a request to MISO for expedited approval of the Project. The Company asked for expedited review so the Project could be considered for approval as part of the 2022 MTEP (MTEP22). With MISO approval in late 2022, the Western Segment can realistically be brought online in 2024 and the Eastern Segment in 2025, provided

other approval, planning, and development milestones are met. The alternative to expedited consideration as part of MTEP22 would have been to submit the project for possible approval in MISO's 2023 MTEP, which could have delayed the Project—and the savings it is projected to provide—a full calendar year. Xcel Energy was not required to submit the preliminary PROMOD modeling as part of the expedited review and approval process.

After review of our submission, including a review of our reliability analysis discussed below and an opportunity for MISO stakeholder input, the Project was recommended for approval by the MISO Board of Directors. In December 2022, the MISO Board of Directors approved the MTEP22 report and Appendix A. The Project is listed in the final, approved Appendix A along with the MTEP22 report and thus has the necessary MISO approval.[54]

4.4 Analysis of Project Benefits

Following MISO approval, the Company decided to perform more rigorous analyses of the potential benefits. Initially, the Company simulated the impact of the Project using Future 1 from MISO's 2021 MTEP (MTEP21). The assumptions included in MISO's MTEP21 Future 1 scenario, including assumptions with regard to load, load growth (including from electrification), energy efficiency, and demand response, are described in the 2021 MISO Futures Report attached as **Appendix E**. **Appendix F** contains a summary of the Company's conservation programs.

Among other things, the Company relied on the MTEP21 Future 1 for peak demand and total demand projections for NSP. Those projections are shown in **Table 4.2**.

Table 4.2: NSP Peak Demand and Total Demand Projections

	2025	2030	2035	2040
Peak Demand (MW)	10,392	11,517	12,005	12,446
Total Demand (GWh)	53,579	57,313	58,498	59,671

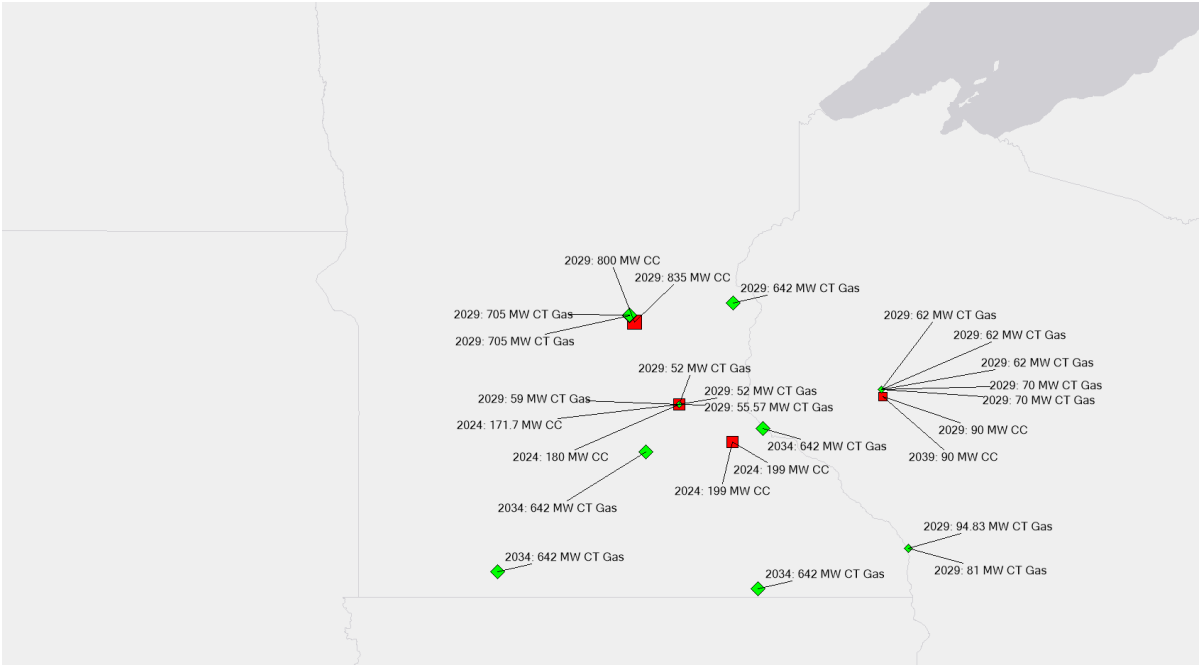
Using those MTEP21 Future 1 assumptions, PROMOD estimated the 20 year present value APC savings from the Project of $75.05 million for MISO, $51.50 million for NSP, $13.43 million for Otter Tail Power, and $7.18 million for GRE. As Xcel Energy considered the matter further, however, the Company determined the assumptions derived from the MTEP21 Future 1 should be modified to more accurately reflect the expected future in the

[54] The Project is listed as Project 23452 in both Appendix A and the main body of the MTEP22 report, which can be accessed at https://www.misoenergy.org/planning/planning/mtep22/.

Company's portion of MISO. The Company also determined it would be more accurate to forecast Project benefits for the book life of the Project—63 years.

The MTEP21 Futures, including Future 1, used announced state and utility goals and other input assumptions through September 2020 to represent a snapshot in time for purposes of developing MTEP21. As detailed in Section 3.3.2, after Future 1 was developed, there have been significant changes to the goals and inputs assumed at the time this Future was developed. Given the Company's recently approved IRP, Minnesota's 100% by 2040 legislation, Xcel Energy's corporate carbon reduction goals (including our commitment to achieve an entirely carbon-free generation system by 2050), and the state and federal legislative and policy environments, the MISO MTEP21 Future 1 assumptions do not reflect the Company's current generation plans. MTEP21 Future 1 assumes there will be significant additions of gas-powered generation resources in Minnesota and Wisconsin, including in 2029 and the 2030s. The addition of those resources is inconsistent with the Company's IRP. Specifically, MTEP21 Future 1 includes 2,565 MW of additional combined cycle gas-powered generation and 4,293 MW of additional combustion turbine generating capacity by 2040. The multiple additional gas-powered generation resources contained in the MTEP21 Future 1 scenario are depicted in **Figure 4.2**. Interestingly, as can be seen from **Figure 4.2**, many of the gas-powered generation units in the MTEP scenario are forecasted to be sited in Minnesota. In light of the Company's approved IRP, and state and federal policy, it is unlikely significant new gas-powered generation units will be constructed in Minnesota.

Figure 4.2: NSP Fossil Fuel Additions – MTEP21 Future 1 Scenario



Accordingly, the Company decided to run PROMOD by modifying the Future 1 assumptions to better align with the Company's most recent Commission-approved IRP. The Company also adjusted that forecast based on developments that have occurred since the 2022 conclusion of the Company's IRP proceeding. In particular, the Company's IRP future was adjusted to account for the results of our recent procurement process seeking 900 MW of solar generation. That recent RFP resulted in the planned procurements of (1) the 250 MW Sherco Solar 3 project and (2) a PPA for the 100 MW Apple River solar project to be located in Wisconsin. Those two projects and the 460 MW Sherco Solar 1 and 2 projects represent the additional utility-scale solar generation resources the Company expects to come into operation by 2025.

The inputs used in PROMOD were adjusted to not only better align with the quantity of new solar generation expected to be added to the system by 2025 but also to increase the amount of solar expected to be added by 2030. Essentially, the IRP-based inputs to the PROMOD model were adjusted to postpone the addition of some of the utility-scale solar generation.

Although PROMOD is typically used in MISO planning to provide APC savings over a 20-year period, the book life of the Project is approximately 63 years and should provide benefits to customers over that full life. To more accurately reflect the benefits from that full expected book life, the Company extrapolated from PROMOD to derive the present value of 63 years of APC savings. The results of that 63-year analysis are set forth in **Table 4.3**. **Table 4.3** also presents the results of a 20-year analysis and a 40-year analysis, along with the corresponding benefit-cost ratios, which assumes NSP is assigned the full Project cost. The figures reflected in **Table 4.3** were derived from PROMOD after the Company's modifications to the Future 1 assumptions. The Project is projected to provide significant benefits when analyzed over any of those timeframes. The Company used a 6.36% discount rate for this analysis based on its last authorized rate case.

Table 4.3: Estimated APC Savings and Benefit Cost Ratios

Timeline	APC Benefits/Benefit-Cost Ratio	NSP	MISO
20 Year Present Value	APC Benefits ($MM)	$149.00	$322.65
	Benefit-Cost Ratio	1.36	2.94
40 Year Present Value	APC Benefits ($MM)	$272.07	$655.84
	Benefit-Cost Ratio	2.11	5.08
63 Year Present Value	APC Benefits ($MM)	$334.83	$833.86
	Benefit-Cost Ratio	2.53	6.31

In addition to the forecasted APC savings benefits, the Company also used the results of the PROMOD modeling to calculate the forecasted reduction in congestion charges along the Lyon County – Hawks Nest Lake portion of the Original Brookings Line. The Project will have the most significant impact on congestion on this portion of the Original Brookings Line. **Table 4.4** contains the annual nominal congestion-charge amounts with and without the Project through 2044. The Company provides this information for comparative purposes. The benefits of the Project, however, are best evaluated under the more holistic metric of forecasted APC savings.

Table 4.4: Forecasted MISO-Wide Congestion Charges and Savings

Value Type	Year	Nominal Congestion Charge Without Project	Nominal Congestion Charge With Project	Nominal Congestion Charge Savings
Simulated	2025	$39,992,105	$18,731	$39,973,374
Interpolated	2026	$35,105,775	$19,175	$35,086,600
Interpolated	2027	$30,219,444	$19,619	$30,199,825
Interpolated	2028	$25,333,114	$20,063	$25,313,051
Interpolated	2029	$20,446,783	$20,507	$20,426,276
Simulated	2030	$15,560,453	$20,951	$15,539,502
Interpolated	2031	$23,076,989	$17,797	$23,059,192
Interpolated	2032	$30,593,525	$14,643	$30,578,882
Interpolated	2033	$38,110,061	$11,489	$38,098,572
Interpolated	2034	$45,626,598	$8,334	$45,618,264
Simulated	2035	$53,143,134	$5,180	$53,137,954
Interpolated	2036	$55,763,718	$4,144	$55,759,574
Interpolated	2037	$58,384,303	$3,108	$58,381,195
Interpolated	2038	$61,004,887	$2,072	$61,002,815
Interpolated	2039	$63,625,472	$1,036	$63,624,436
Interpolated	2040	$66,246,057	$0	$66,246,057
Interpolated	2041	$63,514,008	$0	$63,514,008
Interpolated	2042	$65,840,899	$0	$65,840,899
Interpolated	2043	$68,167,789	$0	$68,167,789
Interpolated	2044	$70,494,680	$0	$70,494,680

Another benefit of the Project is that the capacity the Project provides will help reduce the cost of outages that will be required during the future construction of LRTP Tranche 1 portfolio projects, specifically future outages that will be necessary on the existing transmission lines between Alexandria and Monticello, and Crandall and Wilmarth. The Company does not yet have detailed schedules that would allow for precise predictions regarding the length and timing of the LRTP construction-related outages. In absence of detailed schedules, the Company used rough assumptions to obtain a sense of the magnitude of benefits the Project could provide in mitigating LRTP-outage impacts. Assuming outages lasting for calendar year 2030, the modeling estimates that, on a MISO-wide basis, the Project will reduce the APC impacts of an outage on the Alexandria to Monticello line by approximately $11-12 million and on the Crandall to Wilmarth line by approximately $15 million.

To be clear, the Project is not being proposed to mitigate the impact of outages caused by LRTP Tranche 1 construction. The Project is aimed at reducing production costs over an extended period, not providing short-term relief from the impacts of construction-related outages. The anticipated mitigation of outage-related losses is an ancillary—but real—benefit. The estimates of the potential amount of such benefits are provided only to give an approximate sense of the magnitude of outage-related benefits.

4.5 Reliability Analyses

In developing the Project and submitting it to MISO for approval, Xcel Energy conducted a study to determine whether the Project would negatively impact the reliability of the transmission system. The type of analysis the Company conducted is sometimes referred to in the industry as a "no harm" analysis.

The results of the study showed no reliability impacts resulting from the Project. Moreover, the analysis indicated the addition of the second 345 kV line along the sections in question improves reliability by reducing or eliminating overloads under certain contingencies. The Project was conceived of and is proposed based on the economic benefits of reducing congestion. Nevertheless, the improved reliability in some scenarios is a welcome additional, albeit secondary, benefit of the Project.

MISO also conducted its own reliability assessment of the MTEP22 portfolio as a whole. As the Project is a part of the overall portfolio, it was necessarily included in that MISO study. The MTEP22 portfolio, including the Project, met all the compliance requirements through MISO's reliability assessment and the MTEP22 portfolio was accepted by MISO's Board of Directors at its meeting in December 2022.

The Project's impact on reliability has thus been considered both on an individual project basis and along with the other MISO transmission projects approved in late 2022, and both studies produced satisfactory results. To summarize, the Project will provide some reliability benefits.

4.6 Transmission and Non-Transmission Alternatives

As required by relevant statutes and rules, the Company considered transmission and non-transmission alternatives. These alternatives fit into the following general categories: (1) size alternative (different voltages or direct current (DC)) scenarios in which a transmission line is constructed as an alternative to the Project; (2) type alternatives, including alternative terminals and substations (a different route), generation alternatives, and underground transmission lines; and (3) the no-build alternative in which neither the Project nor any alternative is constructed. None of the alternatives compare favorably to the Project, including because of the low cost, and low human and environmental impact of installing a second circuit.

4.6.1 New Generation

The identified need is to lower production costs by reducing congestion on the transmission system. In particular, congestion is impacting the ability to deliver energy from renewable resources in southern Minnesota, North Dakota, and South Dakota. New renewable generation resources will not address this need and could contribute to the congestion given the locations where significant wind and solar resources might be sited. In contrast, substantial additional gas-powered generation located close to load centers, including combined cycle units, might reduce congestion, but would be in tension with the Company's IRP and current and emerging state and federal rules and legislation.

4.6.2 Upgrading Existing Transmission Lines or Existing Generating Facilities

The Project as planned involves some upgrades to the existing transmission facilities. Any further upgrades would require a rebuild of existing transmission structures or substation facilities. The Project, which involves double-circuiting of existing transmission towers, is a more economic and quicker method of adding transmission capacity.

4.6.3 Using a Different Voltage or Conductors

The Original Brookings Line was constructed with towers that can hold an additional 345 kV line. Those existing towers cannot hold a new, higher-voltage line. As a result, a higher-voltage alternative would require re-building the transmission infrastructure, with resulting higher costs and an extended schedule. A lower-voltage alternative would not face those cost and schedule problems because the existing towers could be used. But a lower-voltage transmission line would not provide the optimal level of new transmission capacity. A lower-voltage line would also have higher line losses.

The Company studied the Project assuming the use of 345 kV lines and bundled 2x636 kcmil ACSR. This conductor is a large capacity, low impedance conductor and represents a good

baseline conductor for analysis. So long as the final conductor selected for construction has similar impedance characteristics, it will achieve similar system performance.

4.6.4 Construction of Alternative Transmission Line with Different Terminals or Substations.

The Project involves double-circuiting portions of the Original Brookings Line. One obvious alternative that would also reduce congestion would be to construct an entirely new transmission line along a different route connecting to the relevant portions of South Dakota and southern Minnesota. This alternative would cost significantly more than the Project; take longer to construct (thus postponing the congestion-reduction benefits); require the Company to seek approval from MISO for a new project (contributing to the delay associated with this category of alternatives); and have greater impacts on communities, property owners, and the environment. Simply put, the Project is superior to the alternative because it largely takes advantage of the structures and route of the Original Brookings Line thus limiting costs, and environmental and societal impacts.

Given the obvious advantages of double-circuiting along the route of the Original Brookings Line, including the significantly reduced costs, the Company did not design specific alternative lines (and routes) or create estimates of the costs for constructing such potential alternative transmission lines.

4.6.5 Double Circuiting of Existing Transmission Lines or Double Circuiting Project

The Project involves double-circuiting an existing transmission line and, therefore, fits into this category.

4.6.6 Construction of a DC Transmission Line

This alternative would involve the development and construction of a greenfield transmission line, and so it is not a favorable alternative for the reasons discussed above with regard to transmission lines with different terminals or substations. Moreover, high-voltage DC transmission lines are typically employed to deliver generation over long distances, more than 300 miles; they require more lead time for construction and development; they do not typically allow for cost-effective interconnection; and they have high costs. For these reasons, a direct current line would be a particularly poor choice as an alternative to the Project.

4.6.7 Construction of an Underground Transmission Line

Constructing an underground transmission line would cost substantially more than the Project. It would require trenching work and would not re-use the existing transmission towers. High-

voltage AC underground cable systems at 345 kV are generally limited in length to approximately 50 miles because of the rate at which cables consume reactive power. The Project is a superior alternative because it has the cost, schedule, and reduced impact advantages resulting from the double-circuiting of an existing transmission line. Although longer underground installations can be constructed with the addition of shunt reactors (at an added cost) along the line, this is an atypical design and practical applications of underground AC lines for more than 50 miles are technically infeasible.

HVDC cable systems are used for underground lines of 100 miles or more. HVDC systems do not have the same reactive power limitations. Moreover, line losses in HVDC cables are approximately half that of HVAC cables when using comparable conductor. HVDC cable systems require converter stations on each end of the line to convert the 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, HVDC lines only accommodate interconnections at midpoints along the lines by adding costly converter stations.

4.6.8 Construction of Only One Segment of the Project.

The Project involves adding a second circuit along two different segments of the Brookings County – Hampton 345 kV transmission line. Accordingly, one potential alternative is to build one of the two Project segments. But that is not a viable alternative because the Company determined that constructing only one of the two segments would create reliability impacts.

4.6.9 Reasonable Combination of Alternatives

The efficiencies resulting from double-circuiting are substantial and as a result there are no combinations of alternatives that compare favorably to the Project.

4.6.10 No action alternative.

Simply not constructing or developing the Project would avoid project development and construction costs. But the analysis set forth above estimates the Project is expected to produce $334.83 million in NSP benefits, which outweigh construction costs. Also, as discussed in the final chapter, the nature of the Project, which largely involves double-circuiting of existing transmission poles, limits the environmental and societal impacts. For these reasons, the Company concluded the Project is more prudent than the no action alternative.

Finally, Xcel Energy compared NSP system losses with and without the Brookings Second-Circuit Project. As shown in **Table 4.5**, the Project reduces system losses by 6.7 MW and 1.6 MVAR in the shoulder high-wind season. The year 2026 was used since that is the first full year both segments of the Project will be in service. System losses decrease during the shoulder

high-wind season due to the significant congestion benefits of the Project during times of high wind dispatch. The system losses increase during the summer season due to lower wind dispatch and resulting lower congestion relief.

Table 4.5: NSP System Losses

Season	MW	MVAR
2026 Shoulder High Wind Without Project	378.3	3,275.1
2026 Shoulder High Wind With Project	371.6	3,273.5
2026 Shoulder High Wind Change	**-6.7**	**-1.6**
2026 Summer Peak Without Project	205.3	2,315.2
2026 Summer Peak With Project	206.1	2,326.9
2026 Summer Peak Change	**.8**	**11.7**

4.7 Conclusion and Recommendations

The Project is needed because unchecked congestion will increase costs for NSP and our customers. Our modeling of the economic impacts of the Project, prepared using PROMOD, results in estimated APC savings with a present value of $334.83 million for NSP, which is substantially in excess of the estimated costs of the Project. The Project is a prudent addition because it can be brought into operation relatively quickly (as compared to other possible transmission projects), will create cost savings for customers well in excess of estimated costs, will allow for greater use of renewable resources, and will improve reliability.

5. TRANSMISSION LINE OPERATING CHARACTERISTICS

5.1 Transmission Line Operating Characteristics Overview

The major components of an overhead transmission line include: (1) an above-ground structure typically made from wood or steel, often referred to as a pole or tower; (2) the wires attached to the structure and carrying the electricity, called conductors; (3) insulators connecting the conductors to the structures to provide structural support and electrical insulation; (4) shield wires which protect the line from direct lightning strikes; and (5) ground rods located below ground and connected at each structure. For this Project, these elements are already installed. The Project predominantly involves installing a second set of wires on existing towers.

During operation, transmission lines are, for the most part, passive elements of the environment as they are stationary in nature with few, if any, moving parts. Their primary impact is aesthetic, i.e., a man-made structure in the landscape. Due to the physics of electricity, some chemical reactions occur around conductors in the air, noise can occur in some circumstances, interference with electromagnetic signals can occur, and electrical and magnetic fields are created around the conductors. All of these operating characteristics are considered when designing the transmission line to prevent any significant impacts to its operation and to the overall environment.

5.2 Ozone and Nitrogen Oxide Emissions, Sulfur Hexaflouride

Corona consists of the breakdown or ionization of air within a few centimeters of conductors. Usually some imperfection, such as a scratch on the conductor or a water droplet, is necessary to induce corona discharge because transmission lines are designed to be corona free under typical operating conditions. Corona can produce ozone and oxides of nitrogen in the air surrounding the conductor. Ozone also forms in the lower atmosphere from lightning discharges and from reactions between solar ultraviolet radiation and air pollutants, such as hydrocarbons from auto emissions. The natural production rate of ozone is directly proportional to temperature and sunlight, and inversely proportional to humidity. Thus, humidity or moisture, the same factor that increases corona discharges from transmission lines, inhibits the production of ozone. Ozone is a very reactive form of oxygen molecule and combines readily with other elements and compounds in the atmosphere. Because of its reactivity, it is relatively short-lived.

Currently, both state and federal governments have regulations regarding permissible concentrations of ozone and oxides of nitrogen (NO_x). The state and national ambient air quality standards for ozone are similarly restrictive. The national standard is 0.07 parts per million (ppm) on an eight-hour averaging period. The state standard is 0.08 ppm based on the

fourth highest eight-hour daily maximum average in one year. The ozone created by the Project will be below these standards.

The national standard for nitrogen dioxide (NO_2), one of several oxides of nitrogen, is 100 parts per billion (ppb) and the annual standard is 53 ppb. The State of Minnesota is currently in compliance with the national standards for NO_2. The operation of the proposed transmission lines would not create any potential for the concentration of these pollutants to exceed the nearby (ambient) air standards.

Sulfur hexafluoride (SF6) will be used at the substations. Small releases will occur as part of regular breaker operation and maintenance. Xcel Energy will minimize sulfur hexafluoride emissions through operational best management practices (BMPs) and will monitor equipment for leaks. Xcel Energy will comply with Environmental Protection Agency reporting requirements in the event a leak is detected.

5.3 Noise

5.3.1 Transmission Line Noise

Generally, activity-related noise levels during the operation and maintenance of substations and transmission lines are minimal.

Transmission conductors can produce noise under certain conditions. The level of noise depends on conductor conditions, voltage level, and weather conditions. Noise emission from a transmission line occurs during certain weather conditions. In foggy, damp, or rainy weather, power lines can create a crackling sound due to the small amount of electricity ionizing the moist air near the wires. During heavy rain, 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.

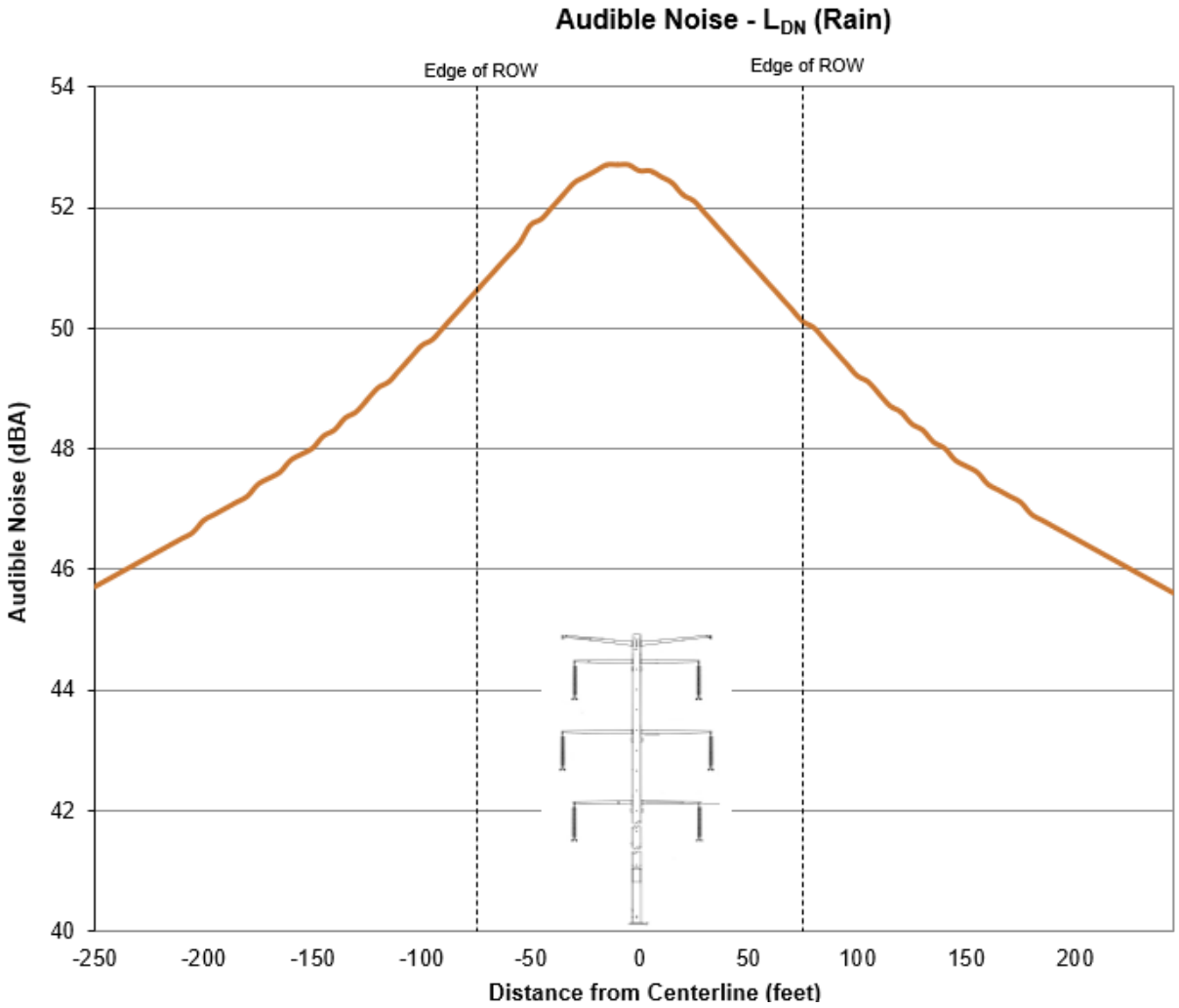
Under Minn. R., ch. 7030, the Minnesota Pollution Control Agency (MPCA) sets forth standards for three noise area classifications (NAC).

- NAC 1 includes residential housing, religious activities, camping and picnicking areas, health services, hotels, educational services.
- NAC 2 includes retail, business and government services, recreational activities, transit passenger terminals.

- NAC 3 includes highway and street right-of-way, utilities, manufacturing, fairgrounds and amusement parks, agricultural and forestry activities.

Xcel Energy anticipates that NAC 3 is likely to apply to the large majority of the Project. NAC 3 has a daytime L_{50} limit of 75 dBA and a nighttime L_{50} limit of 75 dBA. As shown in **Figure 5.1**, the Project will be below Minnesota limits.

Figure 5.1: Noise Chart



The Project is also below the Minnesota limits of NAC 1 daytime L_{50} limit of 60 dBA. Although, at 50.7 dBA at the edge of the right-of-way, the Project is slightly above the NAC 1 nighttime L_{50} limit, there are no sensitive receptors that are classified under the NAC 1 category, including residences, within the right-of-way. The nearest occupied residence is 87 feet from the centerline of the Project. Other than residences, no other sensitive receptors are within close proximity to the Project.

5.3.2 Substation Noise

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 or the operation of an emergency generator. 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 to reduce the distance the sound can travel. Like the transmission lines themselves, Project substations will comply with the MPCA noise standards as set forth in Minn. R. 7030.0040.

5.4 Radio, Television, and GPS Interference

Overhead transmission lines are designed to not cause radio or television interference under typical operating conditions. Corona, as well as spark discharge, from transmission line conductors can generate electromagnetic "noise" at the same frequencies that some radio and analog television signals are transmitted.[55] This noise can cause interference with the reception of these signals depending on the frequency and strength of the radio and television signal. Interference from a spark discharge source can be found and corrected.

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

FM radio receivers usually do not pick up interference from transmission lines because:

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

A two-way mobile radio located immediately adjacent to and behind a large metallic structure (such as a steel tower) may experience interference because of signal-blocking effects.

[55] Full power television stations were required by the DTV Delay Act, Public Law No: 111-4, to cease broadcasting signals by June 12, 2009.

Movement of either mobile unit so that the metallic structure is not immediately between the two units should restore communications. This would generally require a movement of less than 50 feet by the mobile unit adjacent to a metallic tower.

Television interference is rare but may occur when a large transmission structure is aligned very close to the receiver and between the receiver and a weak distant signal, creating a shadow effect. If television or radio interference is caused by or from the operation of the proposed facilities in those areas where good reception is presently obtained, the Company will take necessary action to restore reception to the present level, including the appropriate modification of receiving antenna systems if deemed necessary.

GPS interference is also not anticipated. The Company uses GPS-based survey equipment directly under transmission lines and has not experienced any problems.

5.5 Safety

The Project will be designed in compliance with local, state, and NESC standards regarding clearance to ground, clearance to crossing utilities, clearance to buildings, strength of materials, and right-of-way widths. Appropriate standards will be met for construction and installation, and all applicable safety procedures will be followed during and after installation.

The second circuit will be equipped with protective devices to safeguard the public from the transmission line if an accident occurs, such as a structure or conductor falling to the ground. The protective devices include breakers and relays located where the line connects to the substations. The protective equipment will de-energize the line should such an event occur.

5.6 Electric and Magnetic Fields

"EMF" is an acronym for electric and magnetic fields. For the lower frequencies associated with power lines, EMF should be considered separately – electric fields and magnetic fields, measured in kilovolts/meter (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).

5.6.1 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.[56] The standard was designed to prevent serious hazards from shocks when touching large objects parked under AC transmission lines of 500 kV or greater. **Figure 5.2** provides the electric fields at maximum conductor voltage for the proposed 345 kV transmission line. 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 5.2 kV/m. As shown in **Table 5.1**, the strength of electric fields diminishes rapidly as the distance from the conductor increases. The electric field values at the edge of the transmission line right-of-way are shown in **Table 5.1**.[57]

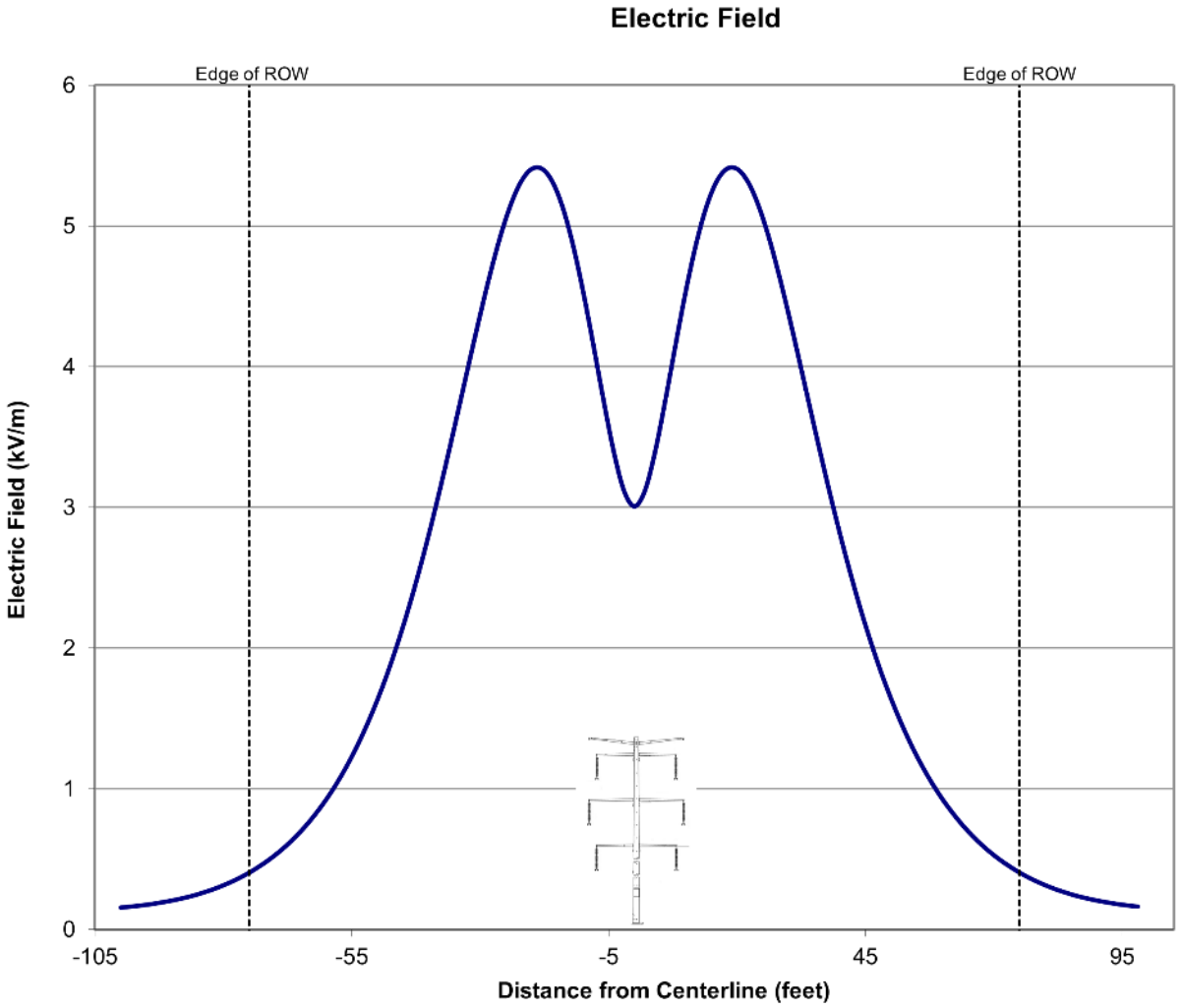
Table 5.1: Electric Field Calculation Summary (kV/m) (Both Segments)

Structure Type	Maximum Conductor Voltage	Maximum Within Right-of-Way	Distance to Proposed Centerline (feet)						
			-75	-50	-25	0	25	50	75
345 kV/345 kV Double-Circuit Monopole	362 kV	5.2	0.4	1.5	4.9	2.8	4.8	1.6	0.4

[56] *In the Matter of the Route Permit Application for a 345 kV Transmission Line from Brookings County, S.D. to Hampton, Minn.,* MPUC 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).

[57] Electric field calculations are not provided for Project substations because Project substations will not be accessible to the public, and electric fields associated with the substations are anticipated to be similar to the 345-kV lines—and thus, well below the Commission's electric field limit.

Figure 5.2: Calculated Electric Fields (kV/m) for Proposed 345 Kilovolt Transmission Line Designs (one meter above ground) (Both Segments)



5.6.2 Magnetic Fields

The projected magnetic fields for different structure and conductor configurations for the Project are provided in **Tables 5.2 and 5.3** and **Figures 5.3 and 5.4**. The reported magnetic field values are the magnetic flux density at a given point in space. Magnetic fields are calculated with the winter emergency loading current of each circuit in review. Values are calculated at the minimum conductor height (near mid-span) at a height of one meter (3.28 feet) above 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.

Table 5.2: Magnetic Field Calculation Summary (mG) (Western Segment)

Structure Type	Maximum Within Right-of-Way	Distance to Proposed Centerline (feet)						
		-75	-50	-25	0	25	50	75
345 kV Single-Circuit Monopole (Pre-Project)	266	83	149	247	222	123	74	46
345 kV/345 kV Double Circuit Monopole (Post Project Daily (60%) Load)	183	47	89	160	166	80	33	16
345 kV / 345 kV Double Circuit Monopole (Post Project Max (100%) Load)	188	39	78	152	183	106	42	17

Table 5.3: Magnetic Field Calculation Summary (mG) (Eastern Segment)

Structure Type	Maximum Within Right-of-Way	Distance to Proposed Centerline (feet)						
		-75	-50	-25	0	25	50	75
345 kV Single-Circuit Monopole (Pre-Project)	209	68	117	199	174	101	58	38
345 kV/345 kV Double Circuit Monopole (Post Project Daily (60%) Load)	179	48	87	162	161	84	32	16
345 kV / 345 kV Double Circuit Monopole (Post Project Max (100%) Load)	183	40	76	156	177	110	40	17

Figure 5.3: Calculated Magnetic Flux density (mG) for Proposed 345/345 Kilovolt Transmission Line Design (one meter above ground) (Western Segment)

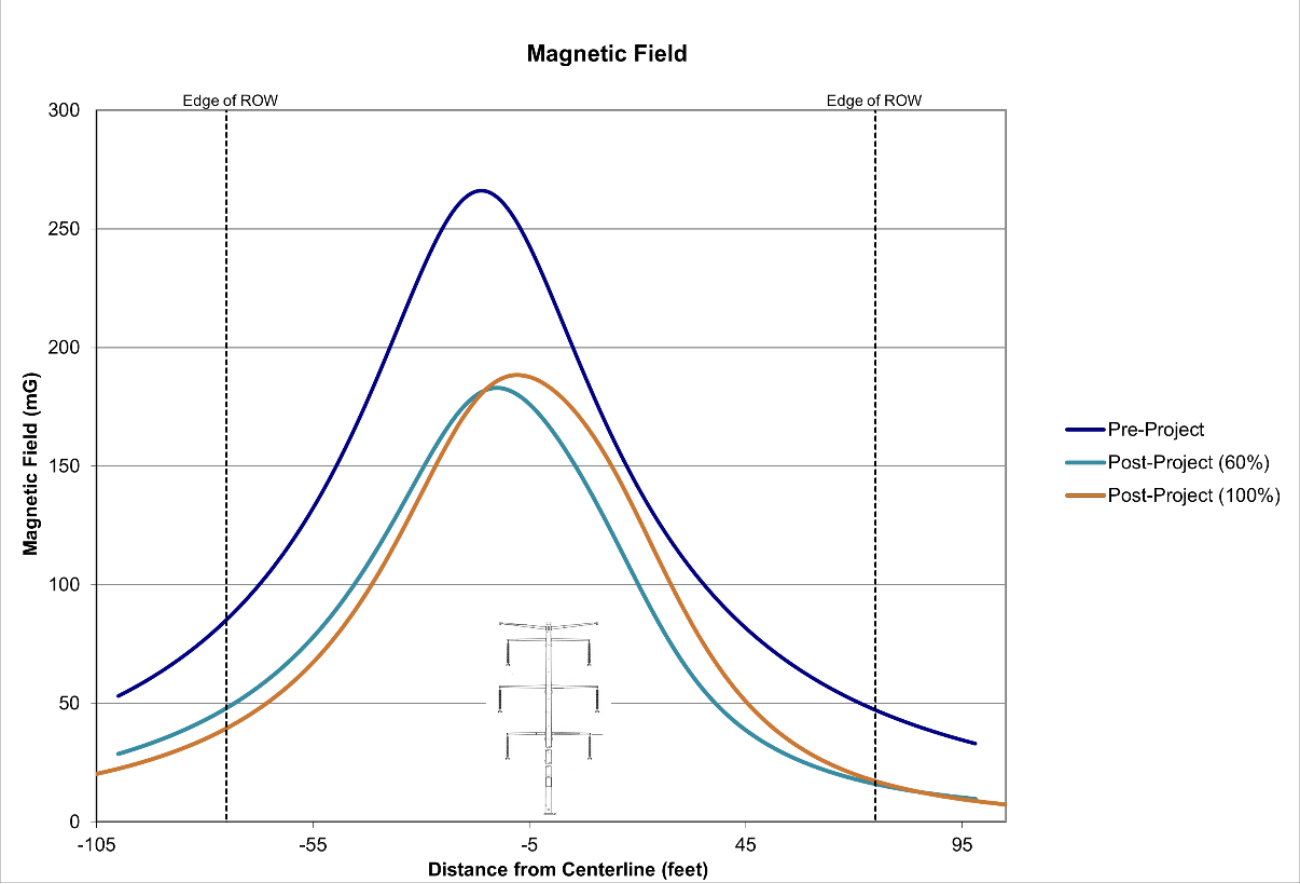
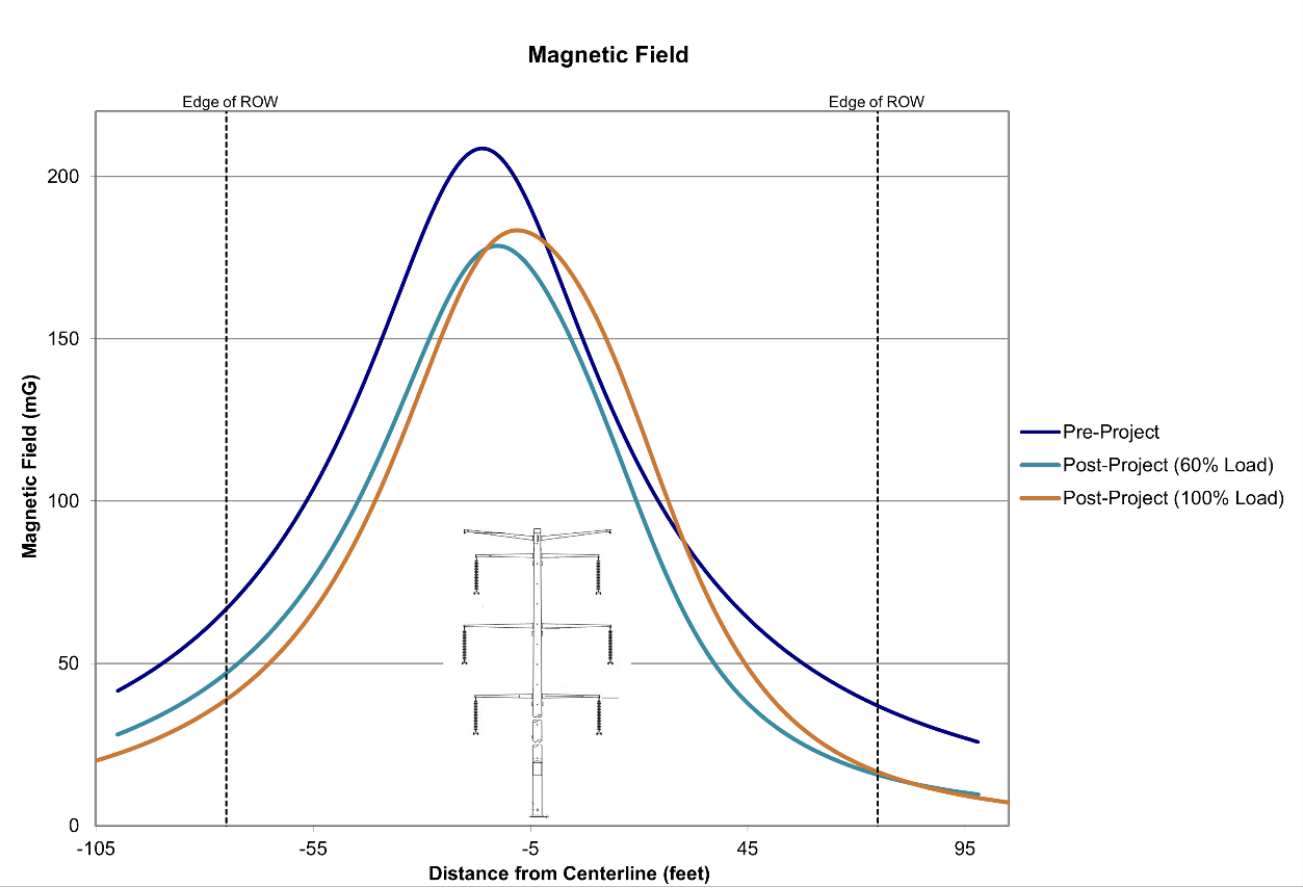


Figure 5.4: Calculated Magnetic Flux density (mG) for Proposed 345/345 Kilovolt Transmission Line Design (one meter above ground) (Eastern Segment)



There are presently no Minnesota regulations pertaining to magnetic field exposure. The Company 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. Although 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.

Since the 1970s, a large amount of scientific research has been conducted on EMF and health. This 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.

For example, in 2016, the U.S. National Cancer Institute summarized the research as follows:

> Numerous epidemiologic studies and comprehensive reviews of the scientific literature have evaluated possible associations between exposure to non-ionizing EMFs and risk of cancer in children (13–15). (Magnetic fields are the component of non-ionizing EMFs that are usually studied in relation to their possible health effects.) Most of the research has focused on leukemia and brain tumors, the two most common cancers in children. Studies have examined associations of these cancers with living near power lines, with magnetic fields in the home, and with exposure of parents to high levels of magnetic fields in the workplace. No consistent evidence for an association between any source of non-ionizing EMF and cancer has been found.[58]

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, (Minnesota Department of Health, 2002). The report summarized the findings of the Working Group as follows:

> Research on the health effects of [MF] has been carried out since the 1970s. Epidemiological studies have mixed results – some have shown no statistically significant association between exposure to [MF] 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

[58] NAT'L CANCER INST., *Electromagnetic Fields and Cancer* (reviewed May 30, 2022), *available at* https://www.cancer.gov/about-cancer/causes-prevention/risk/radiation/electromagnetic-fields-fact-sheet (last accessed Feb. 23, 2023).

> between [MF] and health effects; however, many of them also concluded that there is insufficient evidence to prove that [MF] exposure is safe. (*Id.* at p. 1.)

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."[59]

5.7 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 a transmission line 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 line parallels or crosses distribution lines, appropriate mitigation measures can be taken to address any induced voltages.

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

The power line will meet or exceed minimum clearance requirements with respect to electric fencing as specified by the NESC. Nonetheless, insulated electric fences used in livestock operations can be instantly charged with an 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

[59] *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*, MPUC Docket No. E002/TL-07-1407, Findings of Fact, Conclusions of Law and Order Issuing a 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*, MPUC Docket No. ET2, E015/TL-06-1624, Findings of Fact, Conclusions of Law and Order Issuing a 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.").

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 line will 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 feet.

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. Xcel Energy 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 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 Company for further information about proper grounding requirements.

6. TRANSMISSION LINE CONSTRUCTION AND MAINTENANCE

Since the Project largely involves the installation of a second circuit on existing structures, the construction and maintenance process differs from an entirely new transmission line.

6.1 Engineering Design and Regulatory Approvals

The route and characteristics of the Original Brookings Line has driven the engineering and design work for the Project. Throughout the process, the Company will ensure that all permit conditions are satisfied. Plan and profile documents will be prepared for the new transmission line and associated substation work. These plans will provide detailed descriptions of the facilities, including wire heights above ground, and are reviewed by the Minnesota Department of Commerce Energy Environmental Review and Analysis (DOC-EERA) staff.

6.2 Right-of-Way Acquisition

The Project will be almost entirely confined to the right-of-way acquired when the Original Brookings Line was constructed. Agents for the Company will work with the property owners where the right-of-way exists to address any construction needs, impacts, or restoration issues.

Xcel Energy may acquire a single new long-term easement from a single property owner. This property is located northeast of Elko-New Market, near the Chub Lake Substation. On the south side of the Chub Lake Substation, the Company will construct two new dead-end structures to avoid the second circuit having to go over the top of the Chub Lake Substation. Xcel Energy will attempt to purchase an easement from the neighboring property owner to allow the rerouted transmission line to be constructed outside the existing right-of-way. Routing the second circuit outside the existing right-of-way avoids engineering, design, and constructability challenges associated with the steep topography at this location. An agent will contact the property owner to describe the need for the rerouted transmission line and how the reroute may affect the property. The agent will also seek information from the property owner about any specific construction concerns. To aid in the evaluation of the parcel, the agent may request permission to enter the property to conduct preliminary survey and geotechnical work. With permission of the property owner, the location of the proposed rerouted transmission line may be staked. The agent will discuss the construction schedule and construction requirements with the owner. The agent will collect land value data based on the impact of the easement to the market value of the property. A fair market value offer will be developed.

Although it would present construction and operational challenges, if Xcel Energy and the property owner are unable to reach agreement, Xcel Energy will route the transmission line entirely within the existing right-of-way.

6.3 Construction Procedures

Construction duration for this Project will be approximately 18 months, though there will be a six-month construction pause in the fall and winter of 2024-2025. The Project will employ approximately 60 to 80 construction workers. Construction will be split into two phases.

During the first phase, the Company will install the Western Segment, reconfigure an existing line at the Steep Bank Lake Substation, upgrade the Brookings County and Lyon County substations with new 345 kV breakers, and change relay settings at the Steep Bank Lake and Hawks Nest Lake substations. The first phase will last from April – September 2024.

The second phase will last from April – September 2025. (No significant construction work is anticipated to occur between October 2024 and March 2025.) During the second phase, the Company will install the second circuit for the Eastern Segment, rerouting around the Chub Lake Substation. The Company will also upgrade the Helena and Hampton substations.

Construction will begin after necessary federal, state, local, and other required approvals are obtained. Construction in areas where approvals are not needed or have already been obtained may proceed while approvals for other areas are in process. The precise timing of construction will take into account various requirements of permit conditions, environmental restrictions, availability of outages for existing transmission lines (if required), available workforce, and materials.

Ending construction in the first half of September in 2024 and 2025 will ensure the existing circuit does not need to be out of service during times of traditionally high wind in the fall. Transmission capacity in the area is generally the most congested during these times of high wind. Likewise, putting the new line in service in September of each year will mean the additional transmission capacity will be available when the capacity is most needed.

Construction will follow Xcel Energy's standard construction and mitigation best practices as developed to minimize temporary and permanent impacts to land and the environment. Xcel Energy anticipates construction progressing as follows:

- survey marking of existing right-of-way
- deployment and establishment of staging areas and stringing setup areas;
- conductor stringing; and
- installation of any aerial markers required by state or federal permits.

For the limited areas where new poles are required, construction will also involve:

- right-of-way clearing and access preparation;
- grading or filling if necessary;
- installation of culvert or concrete foundations; and
- installation of poles, insulators, and hardware.

Installing a second conductor is the major component of this Project. Stringing setup areas are typically located at two-mile intervals. These sites are located within the existing right-of-way, when possible, or on temporary construction easements. These operations require brief access to each structure to secure the conductor wire to the insulator hardware and the shield wire to clamps once final conductor sag, compliant with Xcel Energy procedures and minimum code clearances, is established. The majority of the second circuit will be secured to the insulator by helicopter. In areas where helicopter work is infeasible, such as at dead-end structures, a crane will be used.

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 Company will work with the appropriate agencies to identify locations where marking devices will be installed.

Installing the second circuit will require the use of cranes, bucket trucks, flatbed tractor-trailers, flatbed trucks, pickup trucks, helicopters, and various trailers or other hauling equipment.

In the limited places where new structures are needed, construction equipment will also include mowers, backhoes, digger-derrick line trucks, drill rigs, dump trucks, front-end loaders, tree removal equipment, bulldozers, and concrete trucks. Excavation equipment is often set on wheeled or track-driven vehicles. Construction crews will attempt to use equipment, when opportunities are available, that minimizes impacts to lands.

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 the Project will likely include two or more staging areas. Materials are delivered to staging areas and stored until they are needed for the Project.

The Company will take advantage of the existing transmission line easements, roads, or trails that already run along the Original Brookings Line. Where feasible, the Company will limit construction activities to the easement area. In certain circumstances, additional short-term off-easement access may be required. Permission will be obtained from landowners before using short-term off-easement access.

Improvements to existing access or construction of new short-term access may be required to accommodate construction equipment. Field approaches and roads may be constructed or improved. Where applicable, the Company will obtain permits for new access from local road authorities. The Company will also work with appropriate road authorities to ensure proper maintenance of roadways traversed by construction equipment.

Where the Project 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.

The Company does not anticipate needing to complete work in environmentally sensitive areas, especially in light of the fact so few new poles are needed. If work in environmentally sensitive areas is required, however, the Company will implement special 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:

- 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 prevent soil erosion and ensure that fuel and lubricants do not enter waterways or impact environmentally sensitive areas.

- Various 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.

6.4 Restoration and Clean-Up Procedures

Crews will attempt to minimize ground disturbance whenever feasible. The Company expects ground disturbance to be more limited than the typical transmission line construction since few new poles will be required. Nevertheless, 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 MPCA construction permit requirements.

After construction activities have been completed, a 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 Company has started restoration activities. If fences, drain tile, or other property have been damaged, the Company will repair damages or reimburse the landowner to repair the damages.

Farmers will be compensated for crops damaged during construction. The damaged area will be measured, yield determined in consultation with the farmer, and paid at current market rates. The Company will also make a payment for future year crop loss due to soil compaction In addition, farmers will be compensated for their expense to deep rip compacted areas. If an individual does not have access to deep ripping equipment, the Company will provide this service.

Ground-level vegetation disturbed or removed from the right-of-way during construction of the Project will naturally reestablish to pre-construction conditions.

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 Company 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 Company will ensure that township, city, and county roads used for purposes of access during construction will be restored to their prior condition. The Company 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.

6.5 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. Depending on whether the respective Western and Eastern Segments become part of the "Facilities" under the Agreement, either Xcel Energy (if not part of the Facilities) or GRE (if part of the Facilities) will be responsible for the maintenance of this Project. This selected maintenance provider will be responsible for the operation and maintenance of the Project. The maintenance

provider will perform aerial annual inspections of the 345 kV transmission lines and will inspect the lines 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. The maintenance provider will continue to perform necessary vegetation management for the line. Vegetation maintenance generally occurs every four years.

The annual inspections are the principal operating and maintenance cost for transmission facilities. The aerial inspections for the Original Brookings Line cost approximately $75-$100 per mile and the ground inspections cost approximately $200-$400 per mile. Xcel Energy estimates that adding a second circuit would increase these inspection costs by 10%-20%. 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 line for accounting purposes varies among utilities. Xcel Energy uses an approximately 60-year service life for its transmission assets. However, practically speaking, high-voltage transmission lines are seldom completely retired.

6.6 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 system. 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 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 the proposed Project occurs, the maintenance provider will have the necessary infrastructure and crews in place in southern Minnesota to respond quickly and safely to return this line to service.

If there is a storm or emergency outage on the line, the maintenance provider will deploy maintenance "first responders" as quickly as possible to patrol the line and immediately assess the damage. Once the damage has been assessed, the first responders will immediately relay the following information back to the service center:

- Magnitude of damage;

- Isolation requirements for switching;
- Material required for restoration;
- Number of line crew needed; and
- Equipment needed.

Based on the assessment of the first responder, the maintenance provider will develop a plan to restore the Project facilities. The goal of the repair is to place the transmission system back into service as quickly as possible to minimize the impact to the transmission system. Xcel Energy and GRE have the benefit of crews distributed across southern Minnesota that will enable a rapid response to outage events on the transmission line. These crews can typically be mobilized and on site within two hours of an event to begin restoration activities. Xcel Energy and GRE both have experienced engineers that can be called upon to quickly develop an engineering solution to any damaged transmission infrastructure.

Another key element of the emergency and unplanned outage response is having the necessary materials on hand and nearby to replace or repair damaged facilities as quickly as possible. For its part, Xcel Energy maintains nearly 20,000 miles of transmission line and is able to promptly procure, load, and deliver materials during emergency situations. In the event of an unplanned outage of the line, Xcel Energy's primary transmission material emergency stock is stored at its service center located in Maple Grove, Minnesota, that has a critical stock of replacement wires and hardware. In addition, the Maple Grove service center also has a fleet of tractor trailers and drivers on call 24 hours a day that can be utilized to ship these replacement materials to the Project area.

Xcel Energy has won multiple industry awards for its storm and emergency response. In 2020, Xcel Energy received its fifth and sixth major storm response awards in nine years. The 2020 Emergency Recovery Awards recognized Xcel Energy's outstanding efforts to restore service to customers after a Minnesota tornado in August 2020 and Winter Storm Billy in Texas in October 2020. In 2016, the Company received an Emergency Recovery Award for its superior efforts to respond to a three-day blizzard that damaged utility infrastructure in Xcel Energy's Texas and New Mexico service territories. Xcel Energy also won Emergency Recovery Awards in 2013 and 2015 for its response to severe thunderstorms in the Twin Cities and an Assistance Award in 2012 for Xcel Energy's help with the recovery following Superstorm Sandy.

7. ENVIRONMENTAL INFORMATION

The Project has been designed to avoid and minimize environmental impacts, and overall, hanging the second circuit via helicopter will significantly reduce land disturbance and environmental impacts compared to ground installation methods. During construction temporary and minor impacts will be limited to areas of temporary access roads, matting areas, helicopter landing pads, and the installation of 11 new transmission towers, all but one of which will be within existing right-of-way and none will be in environmentally sensitive areas. Permanent impacts are not anticipated for the Project, nor are significant operational impacts.

The Company has avoided impacts to groundwater by minimizing land disturbance. The Company has minimized impacts to surface water features. All surface water impacts will be temporary, occurring only during construction. Pre-construction conditions will be restored following construction. Permanent impacts to wetlands and streams are not expected. Two designated trout streams (South Branch Vermillion River and a tributary) along the Eastern Segment will be crossed during construction, where impacts will be avoided, minimized, and/or mitigated in accordance with agency recommendations.

Vegetation impacts will be temporary and since the Project is largely co-located with road rights-of-way and agricultural fields; impacts to native plant communities, sites of biodiversity significance, calcareous fens, and conservation easements are not expected. The Company will implement best management practices to curb the introduction of noxious weeds within the Project Study Area. Land uses within the Project Study Area are not expected to change as a result of construction and operation of the proposed Project. Permanent impacts will result from the placement of 11 new structures, which are largely sited within the existing right-of-way and are in areas that are not environmentally sensitive.

Impacts to wildlife are expected to be minimal. The Company has routed the Project to minimize wildlife impacts and is continually working with federal and state agencies to determine avoidance and minimization measures, and permitting requirements, if needed.

In terms of demographics, race and ethnicity, environmental justice, recreation, and aesthetics, the increase of transmission output capability and reliability will benefit the surrounding communities on a long-term basis and is not expected to have any negative economic impacts. Indirectly, the increased capability and reliability of the electric system to supply low-cost, renewable energy to commercial and industrial users may contribute to the economic growth of communities and counties along the route. Impacts on agricultural fields and production have been minimized through avoidance and routing the existing transmission lines along field edges and other existing linear infrastructure (e.g., roads and transmission lines). Additional agricultural impacts are expected to be minimal due to the small footprint of the temporary workspaces.

Project impacts resulting from climate change are unlikely (e.g., flooding and temperature increases) as the Project is sited in upland areas and engineered appropriately. The Project will mitigate climate change impacts as the second circuit will allow for the efficient use of existing renewable energy projects and new renewable energy projects to go online. Impacts to cultural resources and architectural history within the Project are not anticipated, and the Company will coordinate with agencies as applicable.

The subsections below detail environmental resources, avoidance and minimization measures implemented by the Company, impacts analyses for each environmental resource, as well as mitigation and permitting efforts implemented by the Company to ensure the Project does not adversely affect the environment, communities, and economic industries within the Project Study Area.

7.1 Project Study Area

The Project Study Area includes portions of Lincoln, Lyon, Scott, and Dakota counties as shown on Figures 1a and 1b. Most of the figures in this Chapter can be found in Appendix G. The Project route and temporary workspace areas includes two distinct segments: the Western Segment proposes to add a second circuit to the portion of an existing 345 kV transmission line between Brookings County, South Dakota, and Lyon County, Minnesota, and the Eastern Segment proposes to add a second circuit to the portion of an existing 345 kV transmission line between the Helena Substation, west of New Prague, Minnesota, and the Hampton Substation, north of Hampton, Minnesota.

The Western Segment of the Project will require reconfiguring an existing line at the Steep Bank Lake Substation, near Hendricks, Minnesota, to avoid the second circuit crossing the existing transmission line. This reconfiguration will involve adding one additional structure outside of the Steep Bank Lake Substation but within the existing right-of-way. The Eastern Segment of the Project will require routing the Project around the Chub Lake Substation, northeast of Elko New Market, which requires the construction of two new dead-end structures on foundations on the south side of the Chub Lake Substation to avoid the second circuit having to go over the top of the Chub Lake Substation. Finally, the Project will require the construction of eight new poles near Castle Rock to maintain the transmission line's low profile near an airport after the second circuit is installed.

Landscape topography crossed by the Project route between the South Dakota border and the Lyon County Substation along the Western Segment, as well as Eastern Segment, is a mixture of agriculture, farmsteads, fallow fields, large open vistas, and gently rolling hillside topography. The Project Study Area is primarily located in sparsely populated rural areas of southwestern and eastern Minnesota, where the landscape is mostly flat to rolling agricultural lands and can be classified as rural open space. The settlements in much of the Project Study

Area are rural residences and farm buildings (inhabited and uninhabited) scattered along rural country roads. These structures are focal points in the open space character of the landscape crossed by the Project. A number of farmsteads date back to the late 19th and early 20th centuries, along with more modern farm buildings and residences that represent the different eras of Minnesota farm architecture. Scattered areas of forest and tree cover occur throughout the Project Study Area, primarily along the Eastern Segment of the Project.

7.2 Physiographic Regions

The Minnesota Department of Natural Resources (MDNR) and the U.S. Forest Service developed an Ecological Classification System (ECS) for ecological mapping and landscape classification in Minnesota that is used to identify, describe, and map progressively smaller areas of land with increasingly uniform ecological features (MDNR, 2023a). Minnesota is split into ecological provinces defined by major climate zones, vegetation, and biomes; sections within provinces defined by origin of glacial deposit, elevation, vegetation and regional climate; and subsections within sections defined by glacial deposition processes, surface bedrock formations, local climate, topography and vegetation. The Western Segment of the Project Study Area is in the North Central Glaciated Plains Section of the Prairie Parkland Province while the Eastern Segment of the Project Study Area is in the Minnesota and NE Iowa Morainal and Paleozoic Plateau Sections of the Eastern Broadleaf Forest Province.

Ecological land classification sections are further broken down into subsections. Within the North Central Glaciated Plains Section, the Western Segment is in the Minnesota River Prairie and Couteau Moraines subsections. Within the Minnesota and NE Iowa Morainal Section the Eastern Segment overlaps the Oak Savanna and Big Woods subsections, and within the Paleozoic Plateau section is within the Rochester Plateau subsection. Figures 2a and 2b depict the ECS subsections in relation to the Project Study Area segments.

7.2.1 Minnesota River Prairie Subsection

The eastern portion of the Western Segment is within the Minnesota River Prairie subsection. This subsection is characterized by a gently rolling ground moraine (MDNR, 2023). The Minnesota River bisects the subsection. Topography is level to gently rolling with the steepest areas along the Minnesota River and the Big Stone Moraine. Glacial drift generally ranges between 100 and 400 feet throughout this subsection. Soils are generally well-to-moderately well-drained loams formed in gray calcareous till of the Des Moines lobe. Streams and small rivers drain into the Minnesota River or the Upper Iowa River. There are 150 lakes greater than 160 acres in size throughout this subsection, though many are shallow. Historically, wetlands were common within this subsection; however, most have been drained to establish usable cropland. Prior to European settlement, vegetation in this subsection was dominated by tallgrass prairie interspersed by areas of wet prairie and deciduous forest along the margins

of the waterways. Current land use in the subsection is dominated by agricultural activity and remnants of tallgrass prairie are rarely found (MDNR 2023a).

7.2.2 Coteau Moraines Subsection

The western half of the Western Segment is within the Coteau Moraines subsection. This subsection is characterized by thick deposits (600-800 feet) of pre-Wisconsin age glacial till (MDNR, 2023a). Two distinct landforms comprise this subsection: the middle Couteau and the outer Couteau. Landforms in the middle Couteau are rolling moraine ridges, while landforms in the outer Couteau are a series of terminal and end moraines separated by ground moraines that range from gently undulating to steeply rolling and hilly. A high elevation point in this subsection is Buffalo Ridge (1,995 feet above sea level), which is located in central Pipestone County. Soils are loamy and well-drained with thick dark surface horizons. The Couteau Moraines subsection primarily drains into the Minnesota River system or southeast into Iowa. The middle Couteau has few lakes while the outer Couteau has a poorly developed drainage network comprised primarily of glacial till where a greater number of wetlands and lakes have formed. Prior to European settlement, vegetation in this subsection was almost entirely tallgrass prairie, currently land in this subsection is used for agricultural production and remnants of pre-settlement vegetation (i.e., tallgrass prairie) are rare (MDNR 2023a).

7.2.3 Rochester Plateau Subsection

The far eastern portion of the Eastern Segment is within the Rochester Plateau subsection. This subsection is characterized by an old plateau covered by loess, pre-Wisconsin age glacial till, and gently rolling glacial till plain partially covered by loess. Topography ranges from mostly bedrock controlled in the east and underlying glacial till to the west with sinkholes being common the southwestern portion. Depth of drift over bedrock varies from 10 to 200 feet depending on landscape position. Bedrock exposures of Ordovician dolomite, limestone, sandstone, Cambrian sandstone, shale, and dolomite are common. Soil properties are influenced by Cambrian siltstones, sandstones, and shales. Coldwater trout streams are common in the eastern portion while overall lakes are rare within in the subsection. Major rivers include the Root, Whitewater, Zumbro, and Cannon. Prior to European settlement, tallgrass prairie and bur oak (*Quercus macrocarpa*) savanna were common vegetation communities. Currently land use is dominated by agriculture (90% row crop and pastureland collectively) (MDNR 2023a).

7.2.4 Oak Savanna Subsection

Most of the eastern portion of the Eastern Segment is within the Oak Savanna subsection. This subsection is characterized by a rolling plain of loess-mantled ridges over sandstone and carbonate bedrock and till. Topography is gently rolling with small steep stagnation moraines in the southwest portion. Glacial drift is usually less than 100 feet thick but up to 200 feet.

Soils common to this subsection consist of wet and well-drained soils developed under prairie vegetation and wet and well-drained soils developed under forest vegetation. The few lakes in this subsection are found in the moraines of the western edge. Prior to European settlement, bur oak savanna was the dominant vegetation community. Currently, most of the land is dominated by agricultural uses with urban development increasing along the northern boundary (MDNR 2023a).

7.2.5 Big Woods Subsection

The western half of the Eastern Segment is within the Big Woods subsection. This subsection is characterized by a large block of deciduous forest. Prior to European settlement, basswood (*Tilia americana*), sugar maple (*Acer saccharum*) and American elm (*Ulmus americana*) were common (MDNR, 2023a). Currently most of the land in this subsection is used for agricultural production, including row crop agriculture and pastureland (collectively about 84%). Areas not used for agricultural production generally consist of upland forest and wetlands. Topography is gently to moderately rolling, with thick deposits of gray limey glacial till. The dominant landform is a loamy mantled end moraine with circular, level-topped hills that dominate the landscape, and broad level areas between the hills that contain closed depressions with lakes and peat bogs. More than 100 lakes greater than 160 acres in size are present within this subsection. Soils are predominantly loamy and range from loam to clay loam formed by the calcareous glacial till of the Des Moines lobe, with depth to bedrock ranging between 100 and 400 feet. Major rivers within this subsection are the Minnesota River, which bisects the Big Woods subsection, the Crow River and its tributaries, and the Mississippi River, which forms part of the eastern boundary (MDNR 2023a).

7.3 Hydrologic Features

The Project Study Area is within the Lower Mississippi River Basin and the Minnesota River Basin (MDNR 2023b). Within the Project Study Area, there are five major watersheds in these basins. The Western Segment lies within the Lac qui Parle River, Minnesota River-Yellow Medicine River, and Redwood River major watersheds. The Eastern Segment lies within the Mississippi-Lake Pepin and Lower Minnesota River major watersheds. Figures 3a and 3b depict the major watersheds in the Project Study Area for the Western and Eastern Segments, respectively.

Two watershed management organizations are within the Eastern Segment of the Project Study Area. The Scott Watershed Management Organization is located within the Lower Minnesota River Watershed in Scott County and the Vermillion River Watershed Joint Powers Organization is located within the Mississippi River – Lake Pepin Watershed in Scott and Dakota Counties.

7.3.1 Groundwater

Groundwater in the state of Minnesota is divided into six aquifer provinces based on glacial geology and bedrock (MDNR 2023c). The Project Study Area crosses five of the six provinces. The Western Segment is within the Western and Arrowhead/Shallow Bedrock Groundwater Provinces. The Eastern Segment is within the South-Central, East Central, and Karst Groundwater Provinces. The Western Province contains limited bedrock aquifers. Aquifers across the Arrowhead/Shallow Bedrock are limited. Sediment is thin or absent and mostly underlain by crystalline bedrock that has limited groundwater availability. The South-Central and Western Provinces are defined by fine grained glacial sediment with limited surficial and buried sand aquifers. The South-Central Province contains good availability of bedrock aquifers. The Karst Province contains moderate surficial sands aquifers and productive bedrock aquifers.

7.3.2 Surface Water

7.3.2.1 Public Waters

The MDNR Public Waters Inventory (PWI) was reviewed to identify public wetlands, waters, and watercourses within the Project Study Area and temporary workspaces (MDNR 2020; Figures 4a and 4b). The Western Segment crosses 11 public waters watercourses at 13 locations including the North Branch, South Branch, and main channel of the Yellow Medicine River, Three Mile Creek, and the Redwood River. The Project Study Area in this segment does not cross any Minnesota public water basins. The Company has designed the Project to avoid PWI impacts so that no PWI watercourses or basins are within the Project's temporary workspaces of the Western Segment.

The Eastern Segment crosses 12 public waters watercourses at 14 locations including Raven Stream, East Branch Raven Stream, Sand Creek, Porter Creek, Vermillion River, and the South Branch Vermillion River. The South Branch Vermillion River and a tributary are designated trout streams at the crossing locations. The Company has worked to avoid and minimize impacts to PWI watercourses and basins; within the Project's temporary workspace, two intermittent public water streams will be crossed. One intermittent PWI watercourse is a designated trout stream tributary to the South Branch Vermillion River. The other intermittent PWI watercourse is an unnamed tributary to Bradshaw Lake.

The Company consulted with the MDNR in June of 2023 to develop appropriate trout stream avoidance, minimization, and mitigation measures for the South Branch Vermillion River and its tributary including best management practices and erosion and sediment control. No new clearing will occur outside of the current right-of-way. No earthwork will occur near the streams, no new structures will be installed near the streams. And, in general, no in-water work will occur. Consequently, adverse impacts to South Branch Vermillion River are not

anticipated. Additionally, a MDNR Public Waters Work Permit may be required for the Project for areas affecting PWIs. If these are deemed necessary, the Company will obtain necessary permits and approvals prior to construction.

7.3.2.2 Wetlands

The United States Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI; USFWS undated-a) was reviewed to assess the presence of potential wetlands within the Project's temporary workspaces within (Figures 5a and 5b). Many of the wetlands found along the Project Study Area are associated with streams and rivers. Within the Western Segment, a total of 0.13 acre of palustrine emergent NWI wetlands may be impacted by temporary workspace. Within the Eastern Segment a total of 2.79 acres of palustrine emergent, palustrine forested, palustrine scrub-shrub, and riverine wetlands will be crossed by temporary workspace. **Table 7.1** provides the acres of NWI identified wetlands by classification within the Project's temporary workspaces.

Impacts to wetlands are expected to be temporary resulting from temporary use of timber matting at the workspaces during construction and will be returned to pre-construction conditions without loss of hydrological function. Appropriate permits and/or approvals from the U.S. Army Corps of Engineers (USACE), MDNR, and Minnesota Pollution Control Agency will be obtained prior to the start of construction. Where a USACE Nationwide Permit will be the likely vehicle. If there are any impacts identified to Waters of the United States, the Company will conduct wetland delineations during the growing season of 2023 to collect boundaries of wetlands and waterbodies within the temporary workspaces of the Project, to accurately quantify impact acreages, further the design to minimize impacts, to determine regulatory jurisdiction, and to ensure the requisite regulatory approvals and/or permits are obtained for the Project.

Table 7.1: Wetland Acreage by Cowardin Classification within Temporary Workspaces

Wetland Acreage by NWI Classification within Temporary Workspaces		
Segment	**Cowardin Classification**	**Wetland (acres)**
Western	PEM/Palustrine Emergent	0.13
Eastern	PEM/Palustrine Emergent	1.95
Eastern	PFO/Palustrine Forested	0.74
Eastern	R2UB/Riverine	0.01
Eastern	PSS/Palustrine Scrub Shrub	0.08
TOTAL		**2.92**

Source: USFWS undated -a, Cowardin et al 1979.

7.3.2.3 Floodplains

The Federal Emergency Management Agency (FEMA) designates areas likely to experience flooding during various rainfall events. FEMA 100-year and 500-year floodplains along with regulated floodways were reviewed to determine the presence of floodplains and floodways within temporary workspaces. Impacts to floodplains and floodways are expected to be temporary and minimal.

Within the Western Segment, a total of 0.42 acres of 100-year floodplain will be temporarily impacted by temporary workspaces in Lyon County. This floodplain is associated with the South Branch Yellow Medicine River (Figure 4a). There will be no impacts to 500-year floodplains or regulated floodways within the Western Segment.

Within the Eastern Segment, a total of 0.27 acres of 500-year floodplain and 0.54 acres of 100-year floodplain will be temporarily impacted by temporary workspaces. Of the temporarily impacted 100-year floodplain, 0.09 acres are also floodway. These floodplains are associated with the Vermillion River, South Branch Vermillion River, an Unnamed Stream and Sand Creek (Figure 4b).

7.3.2.4 Karst

Southeastern Minnesota is a region comprised of porous limestone rich in karst features, such as caves, sinkholes, and hollows with rolling hills and bluffs. Karst landscapes are directly connected to groundwater aquifers through infiltration. Karst features are mapped by the MDNR. While portions of the Eastern Segment are located within an area with suitable geology for karst formation (Weary and Doctor 2014), the MDNR has not identified karst features within the Project Study Area and the closest karst feature is over 2.5 miles from the

Project Study Area. (MDNR 2022). In addition, due to the limited excavation involved in the Project, no impacts to karst features are expected if any would be encountered.

7.4 Natural Vegetation and Associated Wildlife

7.4.1 Vegetation and Wildlife

As discussed in the physiography section of this Chapter, the Western Segment of the Project Study Area is in the North Central Glaciated Plains Section of the Prairie Parkland Province ECS and further broken down into the Minnesota River Prairie and Couteau Moraines subsections (Figure 2a). The Eastern Segment of the Project Study Area is in the Minnesota and NE Iowa Morainal and Paleozoic Plateau Sections of the Eastern Broadleaf Forest Province ECS, and further categorized into the Oak Savannah, Big Woods, and Rochester Plateau subsections (Figure 2b)

Pre-settlement vegetation in the Minnesota River Prairie subsection consisted primarily of tallgrass prairie and wetland communities. Most of the land in this subsection, 91%, is currently used for agricultural production, including row crops and pastureland. Wildlife Species of Greatest Conservation Need (SGCN) found in this subsection includes bald eagles, prairie chickens (*Tympanuchus cupido*), marbled godwits (*Limosa fedoa*), upland sandpipers (*Bartramia longicauda*), Richardson's ground squirrels (*Urocitellus richardsonii*), regal fritillaries, Swainson's hawks, Forster's terns (*Sterna forsteri*), dickcissels, paddlefish (*Polyodon spathula*), gophersnakes, western hognose snakes (*Heterodon nasicus*), foxsnakes, and mucket (*Actinonaias carinata*) and elktoe (*Alasmidonta marginata*) mussels. This subsection is important for nesting prairie ducks and is a migratory corridor in the Mississippi Flyway. Habitat loss and degradation are the biggest factors influencing the decline of SGCN in this subsection (MDNR 2006).

The Coteau Moraines subsection was historically dominated by tallgrass prairie. Most of the land in this subsection, 95%, is currently used for agricultural production, including row crops and pastureland. Wildlife SGCN found in this subsection includes American bitterns (*Botaurus lentiginosus*), Franklin's gulls (*Leucophaeus pipixcan*), northern harriers, short-eared owls (*Asio flammeus),* and Forster's terns. Habitat loss and degradation are the biggest factors influencing the decline of SGCN in this subsection (MDNR 2006).

The Oak Savanna subsection consisted primarily of bur oak savanna communities, with areas of tallgrass prairie and maple-basswood forest also common. Currently, 92% of the land is dedicated to agricultural production, including row crops and pasture. Wildlife SGCN found in this subsection includes Swainson's hawks (*Buteo swainsoni*), red-headed woodpeckers (*Melanerpes erythrocephalus*), regal fritillaries (*Speyeria idalia*), bobolinks (*Dolichonyx oryzivorus*), sandhill cranes (*Grus canadensis*), wood turtles (*Glyptemys insculpta*), Blanding's turtles (*Emydoidea blandingii*), trumpeter swans (*Cygnus buccinator*), northern harriers (*Circus hudsonius*), dickcissels (*Spiza americana*), Ozark minnows (*Notropis nubilus*), and redfin (*Lythrurus umbratilis*) shiners.

Habitat loss and degradation are the biggest factors influencing the decline of SGCN in this subsection (MDNR 2006).

The Big Woods subsection previously consisted of oak woodlands and maple-basswood forests. Red oak (*Quercus rubra*), sugar maple, and American elm were the most common tree species. Currently, 74% of the land in this subsection is currently used for agricultural production, including row crops and pastureland. Wildlife SGCN found in this subsection includes red-shouldered hawks (*Buteo lineatus*), warblers, Blanding's turtles (*Emydoidea blandingii*), red-headed woodpeckers, turtles, ospreys (*Pandion haliaetus*), black terns (*Chlidonias niger*), milk snakes (*Lampropeltis trangulum*), western foxsnakes, gophersnakes (*Pituophis catenifer sayi*), and racers (*Coluber constrictor*). Habitat loss and degradation are the biggest factors influencing the decline of SGCN in this subsection (MDNR 2006).

Pre-settlement vegetation in the Rochester Plateau consisted primarily of tallgrass prairie and bur oak savanna communities. Currently approximately 90% of the land is used for agricultural production, including row crops and pasture. Wildlife SGCN found in this subsection includes timber rattlesnakes (*Crotalus horridus*), western foxsnakes (*Elaphe vulpina*), Blanding's turtles (*Emydoidea blandingii*), wood turtles (*Glyptemys insculpta*), peregrine falcons (*Falco peregrinus*), American brook lampreys (*Lampetra appendix*) and ellipse mussels (*Venustaconcha ellipsiformis*). Habitat loss and degradation are the biggest factors influencing the decline of SGCN in this subsection (MDNR 2006).

Game species populations are managed by the MDNR and are an important part of Minnesota recreation and rural economies. Ring-necked pheasant (*Phasianus colchicus*) populations are near or above their 10-year average, while mourning dove (*Zenaida macroura*) populations are below their 10-year average. Whitetail deer (*Odocoileus virginianus*) populations are greater than their 10-year average, as are the populations of cottontail rabbits (*Sylvilagus floridanus*) and gray partridge (*Perdix perdix*). Jackrabbits (*Lepus townsendii*) remain well below their long-term average (Lyons 2022). Fishing takes place on many lakes and rivers near the Project. Trout streams, designated and managed by the MDNR, have high water quality and are stocked with trout.

There is potential for the displacement of wildlife and loss of habitat from construction of the Project. Wildlife could be impacted in the short term within the immediate area of construction. The distance that animals may be displaced will depend on the species. Additionally, these animals will be typical of those found in agricultural and urban settings and should not incur population level effects due to the temporary nature of Project construction. Habitat fragmentation could be caused by the transmission line bisecting habitats; however, because the proposed Project involves primarily adding lines to existing structures with construction of only 11 new structures and the existing transmission line follows existing features such as roads, transmission lines, or field lines, very few new corridors will be created

as a result of this Project; fragmentation is unlikely. Within most of the Project Study Area, the construction area was disturbed during initial construction and additional impacts to wildlife are expected to be minimal.

Temporary impacts to fauna will take place most intensively at the new structure locations (requiring one acre per span of transmission line) where borings will take place and spoils will be stored at temporary workspaces. Temporary workspaces will also temporarily impact fauna within the Project Study Area. Grading could occur at the staging areas if they are not located in previously disturbed sites. Clearing for access roads will be limited as much as possible and will be, at maximum, 20 feet wide. Tree clearing is not anticipated for the Project, but if needed, will be limited to only those trees necessary to permit the passage of equipment. Such clearing will temporarily fragment habitat. Temporary access roads will be removed following completion of construction and the area restored to original condition.

Temporary vegetation impacts will occur during construction of the Project. Temporary construction impacts may lead to the introduction of noxious weeds. The proposed design and mitigation measures described below will effectively avoid and minimize impacts such that the Project will not significantly change the Project's impacts on vegetation resources. The Company will use BMPs to limit the spread of invasive species through maintenance equipment and vehicles through:

- Cleaning equipment prior to starting construction;
- Early detection of invasive species;
- Limiting traffic through weed-infested areas, if possible;
- If unable to avoid weed infested areas, cleaning mowers and bladed equipment before moving to other sections of the Project Study Area; and
- Seeding with native seed mixes.

7.4.2 Sensitive or Managed Wildlife Habitats

No National Park Service Wilderness Areas, National Wild and Scenic Rivers, or National Forests are located within the Project Study Area.

Designated habitat or conservation areas include managed lands such as U.S. Fish and Wildlife Service (USFWS) Waterfowl Production Areas (WPAs), National Wildlife Refuges (NWRs), and various conservation easements. While agricultural land uses are an important component of wildlife resources in the Project Study Area, land managed to promote wildlife habitat can provide for higher species diversity and larger populations than surrounding intensively used

landscapes. No USFWS WPAs, NWRs, or conservation easements are within the Project Study Area or its temporary workspace.

Wildlife Management Areas (WMAs) and Scientific and Natural Areas (SNAs) in Minnesota are managed by the MDNR to promote wildlife and game species. Aquatic Management Areas (AMAs) protect aquatic wildlife and fish species by conserving lakes, rivers, and the surrounding land areas. The MDNR Shallow Lakes Program manages many PWIs less than 15 feet deep for wildlife resources including waterfowl. No WMAs, SNAs, AMAs, or shallow lakes are intersected by the Project Study Area or its temporary workspace.

Organizations have identified other areas or habitats that are important for wildlife species, although these lands are usually privately owned. Important Bird Areas (IBAs) are developed by BirdLife International and the Audubon Society and designate high-quality bird habitat. Similarly, Grassland Bird Conservation Areas (GBCAs) have been developed by the USFWS to identify areas of unbroken grassland where migratory bird species make their summer homes.

Figure 6a depicts the managed lands and recreation areas within the Western Segment and Figure 6b within the Eastern Segment. A distance of one mile was used because studies have shown that transmission line impacts to avian species are negligible at distances greater than one mile from wildlife habitat (APLIC 1994).

The primary method of mitigation for sensitive or managed wildlife habitat is avoidance. Because native habitat and managed wildlife areas were previously spanned during initial construction of the Project, impacts to these species' habitat will be insignificant. Similarly, because transmission line routing avoids direct impacts to lakes and rivers, and little additional structure construction will occur, impacts to fisheries will be minor.

7.4.3 Federally Listed Species

The USFWS Information for Planning and Conservation (IPaC) database was reviewed in May 2023 to obtain a list of federally listed species, candidate species, or designated critical habitat that may occur within or near the Project Study Area. The IPaC results identify two endangered species, one proposed endangered species, three threatened species, and one candidate species as potentially being present in the vicinity of the Project Study Area (**Table 7.2**; USFWS 2023). The IPaC also noted that one species has designated critical habitat within the Western Segment, but additional research using the USGS Protected Areas Database of the United States (PADUS; USGS 2022) also noted designated critical habitat for a second species (Figures 7a and 7b).

Table 7.2: Federally Listed Species Potentially Present in the Project Study Area

Species Name	Common Name	Federal Status	Section of Occurrence
Myotis septentrionalis	Northern long-eared bat	Endangered	Western and Eastern Segments
Perimyotis subflavus	Tricolored bat	Proposed Endangered	Western and Eastern Segments
Danaus plexippus	Monarch butterfly	Candidate	Western and Eastern Segments
Bombus affinis	Rusty patched bumble bee	Endangered	Eastern Segment
Hesperia dacotae	Dakota skipper	Critical Habitat	Western Segment
Calidris canutus rufa	Red knot	Threatened	Western Segment
Lampsilis higginsii	Higgins eye	Threatened	Eastern Segment
Lespedeza leptostachya	Prairie bush clover	Threatened	Eastern Segment

In June 2023, the Company began consultations with the USFWS to gather input on federal species, preliminary effect determinations, as well as early avoidance, minimization, and mitigation measures to be considered during routing and construction. The Company intends to avoid adverse impacts to the extent practicable and will continue to work with the USFWS to avoid and minimize effects to federally listed species. Mitigation is not anticipated at this point as avoidance and minimization are preferred and are expected to be feasible.

7.4.3.1 Northern Long-eared Bat

The northern long-eared bat (NLEB; *Myotis septentrionalis*) is listed as federally endangered by the USFWS. NLEB is a medium-sized bat of the Vespertilionidae family. Approximately 3.0-3.7 inches in length with a wingspan of 9-10 inches, the species derives its name from oversized ears relative to other members of the genus *Myotis* (USFWS 2023a).

In Minnesota, the species is most likely to be found to winter in natural caves, sand mines, and iron mines. Summer roosting and foraging grounds include forested habitats especially near water sources (MDNR 2018). A review of the MDNR Natural Heritage Inventory System (NHIS) licensed data did not indicate NLEB species occurrences within one mile of the Project Study Area. The Project Study Area is primarily agricultural lands with only small, forested habitats; however, these small, forested habitats could contain potential bat habitat.

The Company has designed the Project to avoid the need for tree clearing; however, consultations with the USFWS triggered a may affect, not likely to adversely affect determination for NLEB. The USFWS agreed that consultations are complete and the Company can proceed with work.

7.4.3.2 Tricolored Bat

The tricolored bat (TCB; *Perimyotis subflavus*) is listed as a federally proposed endangered species in Minnesota. TCB is a small bat also of the Vespertilionidae family. The species is so named because the coat appears dark at the base, lighter in the middle, and dark at the tip.

On September 14, 2022, the USFWS published a proposed rule to the Federal Register proposing to list the tricolored bat as an endangered species under the Endangered Species Act (ESA). Proposed species are not protected under the ESA; however, minimization measures implemented for the NLEB will also be protective of TCBs.

During spring, summer, and fall, tricolored bats roost among live and dead leaf clusters of live or recently dead deciduous hardwood trees. During the winter, they will hibernate in caves, mines, and tunnels. Maternity colonies have not been identified in Minnesota (MDNR 2023d). A review of the MDNR NHIS licensed data did not indicate TBC species occurrences within or near the Project Study Area. The Project Study Area is primarily agricultural lands with only small, forested habitats; however, these small, forested habitats could contain potential bat habitat.

The Company has designed the Project to avoid the need for tree clearing; however, they will consult with the USFWS to develop necessary avoidance and minimization measures for this species if necessary and will comply with any applicable USFWS requirements, as needed. As such, the Project will have ***no effect*** on TCB.

7.4.3.3 Monarch Butterfly

The monarch butterfly (*Danaus plexippus*) is a federal candidate species. Monarchs are a large butterfly with an approximate 3–4.5-inch wingspan and characterized by bright orange wings with black veins and white spots. The species is common throughout Minnesota during summer months. Monarchs can be found in habitats where milkweed (*Asclepias* spp.) and native plants are common (MDNR 2023e). Habitat may include roadside ditch areas, open areas, wet areas, and urban gardens. The Project Study Area is primarily agricultural lands with only a small portion of herbaceous habitat. A review of the MDNR's Native Prairie database identified one native prairie crossed by the existing Western Segment and multiple native prairie fragments near the Western Segment. There are no native prairies identified by the MDNR within the Eastern Segment. The likelihood of monarch butterfly occurrence within the Project Study Area is low to medium.

In December 2020, the USFWS determined that listing the species under the ESA was "warranted but precluded at this time by higher priority listing actions." The species is now a candidate for listing; however, candidate species are not protected under the ESA (USFWS 2020). If species status changes, the Company will review Project activities for potential

impacts on the species, develop appropriate avoidance and minimization measures, Consultations with the USFWS have indicated the Project will have no effect on this species.

7.4.3.4 Prairie Bush-Clover

The prairie bush-clover (*Lespedeza leptostchya*) is a federally listed threatened plant species. Prairie bush-clover prefers bedrock outcrop or mesic to dry prairie slopes. The majority of populations can be found in remnant or isolated prairie habitat in Minnesota (MDNR 2020). The Project Study Area is primarily agricultural lands with only a small portion of herbaceous habitat, and the landscape surrounding the Project Study Area is also dominated by agricultural lands. The species is typically found in undisturbed prairie remnants but is also tolerant of disturbed sites.

A review of the MDNR's Native Prairie database identified one native prairie crossed by the existing Western Segment and multiple adjacent native prairie fragments. This review did not yield native prairies identified within one mile of the Eastern Segment of the Project Study Area. Impacts to native prairies are not anticipated as the Company will be minimizing ground disturbance, and consultations with the USFWS yielded a no effect determination for both segments.

7.4.3.5 Rusty Patched Bumble Bee

The rusty patched bumble bee (*Bombus affinis*) is a federally endangered species. The USFWS (2018) adapted a habitat connectivity model to identify the zones around current (2007-2017) records. The model is annually updated with recent sightings and produces discrete zones where there is a potential for the species to be present. The zones are referred to as High Potential Zones or Low Potential Zones. High Potential Zones contain extant sites and the surrounding area and are considered to have greatest potential for species presence. Low Potential Zones include Primary Dispersal Zones, which models the maximum dispersal potential of the species from sites with recent records surrounding High Potential Zones, which assumes the presence of species where suitable habitat is present; and Uncertain Zones, which contain the maximum dispersal potential from historic records of the species observed between 2000 and 2006. The Project Study Area within the Eastern Segment includes an area identified as a High Potential Zone for rusty patched bumble bee (Figure 7b). The High Potential Zone crossed by the Project is primarily agricultural lands and hay land, with small areas of herbaceous habitat adjacent to streams. Trees were cleared from the Project Study Area during construction of the existing transmission line and the landscape surrounding the High Potential Zone is also dominated by agricultural lands. A review of the MDNR NHIS licensed data indicated one species occurrence observation within a one-mile buffer of the Project Study Area within the Eastern Segment, but not within the Project's temporary

workspace. No High Potential Zones or Low Potential Zones are located near the Western Segment.

The Company has formally consulted with the USFWS on this species. The consultations yielded a no effect determination given the limited and temporary nature of disturbance associated with the Project, and by working with the USFWS to develop necessary avoidance and minimization measures for this species.

7.4.3.6 Higgins eye

Higgins eye (*Lampsilis higginsii*) is a federally listed threatened mussel species. Higgins eye occurs only in the Mississippi River and lower portions of some of its large tributaries (MDNR 2023f). The Project Study Area does not cross the Mississippi River or any lower portions of large tributaries, therefore habitat for this species is not present within the Project Study Area. Additionally, the Company will not be conducting construction in water, therefore there will be ***no effect*** to this species.

7.4.3.7 Red knot

The red knot (*Calidris canutus rufa*) is a federally threatened bird species. Red knots are generally found in coastal marine and estuarine habitats but may use inland saline lakes as stopover habitat in the Northern Great Plains. There is little information regarding red knots use of inland freshwater habitats during migration (USFWS 2023b). The only saline lake in the region is approximately 30 miles north of the Project Study Area at the South Dakota / Minnesota border and therefore the likelihood of red knot occurrence within the Project Study Area is unlikely. As such, the Project will have ***no effect*** to this species.

7.4.3.8 Bald Eagles

Bald eagles (*Haliaeetus leucocephalus*) are protected by both the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act (BGEPA). The 1940 BGEPA (16 U.S.C. § 668-668C) specifically prohibits the taking or possession of, and commerce in, bald and golden eagles (*Aquila chrysaetos*), either alive or dead, or any part, nest, or egg of these eagles. Taking includes disturbances to eagles that cause or are likely to cause injury, decrease in productivity, and nest abandonment by interfering with breeding, feeding, or sheltering.

In Minnesota, the bald eagle nesting season is generally January through early July. Bald eagles are primarily found near rivers, lakes, and other waterbodies in remote and, more recently, within metropolitan areas. Nests are large, 6-8 feet across, and commonly found in tall trees. Human disturbance near nests may cause eagles to abandon their nests and young (MDNR 2023g).

During a Project route review conducted on April 19, 2023, an active eagle nest was observed within approximately 225 feet of the Eastern Segment. Since the nest is within the 600-foot buffer that is federally recognized by the USFWS (USFWS undated-b), the Company is consulting with the USFWS and MDNR on how to avoid and minimize impacts to the nest. During initial consultations, the MDNR indicated that implementing timing restrictions would be preferred for avoidance (e.g., constructing outside of their nesting season). Overall, the USFWS agreed with this approach, but also suggested further coordination with the USFWS Migratory Bird Permit Office. At minimum, the Company will continue to work with the USFWS and MDNR, conduct construction outside of the nesting season (January to July), and employ ornithological monitors prior to, during, and following construction to ensure they return to the nest. The Company will follow agency recommendations and conditions and will apply for applicable USFWS nest disturbance permits as needed.

7.4.4 State-Listed Species

The Minnesota NHIS database was reviewed for state-listed threatened and endangered species that may occur within the Project Study Area. All MDNR NHIS data reviews were conducted under license number 2022-023 via the Company's environmental consultant, Stantec Consulting Services Inc. **Table 7.3** lists the state-listed threatened and endangered species with the Project Study Area and a one-mile buffer.

Table 7.3: State-Listed Species Potentially Present Within One Mile Buffer of Project Study Area

Common Name	*Scientific Name*	Status[a]	
		State	Federal
Western Segment			
Mammals			
Prairie Vole	*Microtus ochrogaster*	SC	-
Northern Grasshopper Mouse	*Onychomys leucogaster*	SC	-
Richardson's Ground Squirrel	*Urocitellus richardsonii*	SC	-
Birds			
Henslow's Sparrow	*Ammodramus henslowii*	END	-
Loggerhead Shrike	*Lanius ludovicianus*	END	-
Mollusks			
Creek Heelsplitter	*Lanius ludovicianus*	SC	-
Reptiles and Amphibians			
Great Plains Toad	*Anaxyrus cognatus*	SC	-
Insects			
Regal Fritillary	*Argynnis idalia*	SC	-
Plants			
Sea Naiad	*Najas marina*	SC	-
Slender Milk-vetch	*Astragalus flexuousus var. flexuousus*	SC	-
Western White Prairie-clover	*Dalea candida var. oligophylla*	SC	-
Eastern Segment			
Birds			
Loggerhead Shrike	*Lanius ludovicianus*	END	-
Reptiles and Amphibians			
Blanding's turtle	*Emydoidea blandingii*	THR	-
Insects			
Rusty-patched Bumble Bee	*Bombus affinis*	Watchlist	END
Plants			
American Ginseng	*Panax quinquefolius*	SC	-
Big Tick Trefoil	*Desmodium cuspidatum var. longifolium*	THR	-
Butternut	*Juglans cinerea*	END	-
[a] END = Endangered, THR = Threatened, SC = Special Concern			

The Company began consultations with the MDNR to address state-listed species relative to the Project in June 2023 and is undergoing the formal NHIS review by the MDNR. Overall,

impacts to state-listed species are not anticipated at this stage due to the limited and temporary nature of impacts, and the Company's avoidance, minimization, and early coordination efforts with the agencies. During initial consultations, the MDNR indicated that tree and shrub clearing is the largest factor to consider for federally listed bats and state-listed bird species (e.g., loggerhead shrike [*Lanius ludovicianus*]), and that clearing outside of nesting seasons (April to June; per communication on June 22, 2023) will be critical to avoiding impacts to those species. Based on the current Project design, tree and shrub clearing is not expected, and the Company will continue to consult with the MDNR on construction recommendations.

The Company submitted the formal NHIS review in late June 2023 and will continue to consult and coordinate with the MDNR to effectively avoid and minimize impacts to state-listed species.

7.4.4.1 Native Plant Communities and Sites of Biodiversity Significance

Minnesota County Biological Survey (MCBS) sites and lakes of biodiversity significance and rare native habitats and communities data were reviewed to determine if there were areas with medium, high, or outstanding biodiversity significance in the Project Study Area. Areas with medium diversity significance are those containing significant occurrences of rare species and/or moderately disturbed native plant communities and landscape with a strong potential for recovery. Areas with high biodiversity significance contain sites with very good quality occurrences of the rarest plant communities and/or important functional landscapes. Areas with outstanding biodiversity significance contain the best occurrence of the rarest species; the most outstanding example of the rarest native plant communities; and/or the largest, most intact functional landscapes present in Minnesota. One site of moderate biodiversity significance (Southern Dry Prairie) is crossed by the Western Segment but is not intersected by the Project's temporary workspace. No other sites of biodiversity significance are crossed by the Project Study Area. See Figures 7a and 7b.

No lakes of biodiversity significance are crossed by the Project Study Area or its temporary workspaces. No calcareous fens are crossed by the Project Study Area or its temporary workspace (MDNR 2023h). While minor changes to the workspace may occur as the Project evolves, impacts to these native plant communities, sites of biodiversity significance, and calcareous fens are not expected. The Company will continually work with the MDNR to avoid, minimize, and implement best management practices to prevent adverse impacts to these sensitive resources.

7.4.4.2 Native Prairie

As a result of settlement and farming in the 1800s, most of the historical prairie has been converted to agriculture. The dominant plant species grown in the agricultural areas are corn (*Zea mays*) and soybeans (*Glycine max*); in the grazed areas, dominant vegetation includes

introduced grasses, such as smooth brome (*Bromus inermis*) and reed canary grass (*Phalaris arundinacea*). Similarly, woodland trees were often removed, and land was converted to agriculture.

In Minnesota, the MDNR has Railroad Rights-of-Way Prairies (RRWPs; MDNR 2017). A review of this inventory identified no RRWPs within the Project Study Area or its temporary workspaces. A review of the MDNR's Native Prairie database identified one native prairie crossed by the Western Segment but is not intersected by the Project's temporary workspaces. There are no native prairies identified by the MDNR within the Eastern Segment. Project activities will not impact sensitive native prairie resources.

7.5 Conservation Easements

Conservation easements are lands that have been sold or leased by the landowner to a federal, state, county, or non-profit agency, who will in turn apply specific development or activity restrictions designed to protect and conserve natural resources. Long-term and permanent federal and state agricultural land conservation easement programs such as Conservation Reserve Program, Conservation Reserve Enhancement Program, Board of Water and Soil Resources (BWSR) Reinvest in Minnesota (RIM), and Minnesota Walk-In Access (WIA) easements provide valuable grassland habitat for many bird and terrestrial species and act as riparian buffers to improve water quality for wildlife and humans (MDNR 2023i). For this discussion, all permanent land conservation programs will be considered in one category.

One RIM easement is intersected within the Western Segment and temporary workspace for matting and an access road. This work will be temporary, and the Company will work with the MDNR to minimize impacts to the area. The identified easement is a RIM wetland restoration easement and is also coupled with MDNR WIA, where these easements are designed to permanently protect, restore, and manage important natural resources on private lands. RIM easements are coordinated by BWSR but implemented by the local Soil and Water Conservation District (SWCD) (BWSR 2019). Approximately 0.06 acres will be temporarily impacted by temporary workspaces. The Company will consult with BWSR and Lincoln County SWCD to develop appropriate avoidance and minimization measures as applicable.

7.6 Topography and Land-use Types within the Temporary Workspaces

The landscape topography crossed by the Project is a mixture of agriculture, farmsteads, fallow fields, large open vistas, and gently rolling hillside topography. The Project is primarily located in sparsely populated rural areas of southwestern and eastern Minnesota, where the landscape is mostly flat to rolling agricultural lands and can be classified as rural open space. Based on review of the U.S. Geological Survey (USGS) National Land Cover Database, the predominant land use category throughout the Western Segment is cultivated crops followed by developed land, and the predominant land use category throughout the Eastern Segment is cultivated

crops followed by hay/pasture (Dewitz 2021). **Table 7.4** presents the acres of each land-use category within the Project's temporary workspace organized by Project segment and Figures 8a and 8b illustrate the land cover over the Project Study Area of the Western Segment and the Eastern Segment, respectively.

Table 7.4: Land Use within the Project's Temporary Workspace

Land Use Category	Acres	Percent of Temporary Workspace
Western Segment		
Cultivated Crops	18.3	83.1
Developed	3.3	15.1
Hay/Pasture	0.3	1.2
Emergent Herbaceous Wetlands	<0.1	0.3
Herbaceous Land	<0.1	0.2
Barren Land	<0.1	0.1
Total	**22**	**100**
Eastern Segment		
Cultivated Crops	30.3	70.1
Hay/Pasture	5.9	13.6
Developed	4.4	10.3
Emergent Herbaceous Wetlands	1.3	3
Deciduous/Mixed Forest	0.9	2.1
Herbaceous Land	0.2	0.5
Woody Wetlands	0.2	0.4
Open Water	<0.1	<0.1
Total	**43.3**	**100**
Source: Dewitz 2021		

The existing transmission line has already been designed to minimize impacts on existing land uses such as cultivated cropland, forested land, or wetlands by locating the transmission line along road rights-of-way, section lines, or property lines and spacing structures in a manner that avoids sensitive areas while still maintaining safety and design standards.

Land uses within the Project Study Area are not expected to change as a result of construction and operation of the proposed Project. Permanent impacts will result from the placement of 11 new structures. These structures will avoid open farm fields or heavily forested areas where possible. During construction there will be temporary impacts to agricultural land, including

soil compaction and likely some crop damage within the Project Study Area. The Company will purchase right-of-way easements for private property crossed pursuant to state and federal land acquisition requirements, which will be documented as part of the property record. The Company anticipates needing an additional easement from only one landowner. The Company will work with landowners to minimize impacts to farming operations along workspaces. Landowners will be compensated in the event of any crop damage or soil compaction during construction, and where new transmission lines cross property.

7.7 Human Settlement

Human settlement within the Project Study Area includes municipalities, farmsteads, utility infrastructure, roadways, and commercial and industrial areas. The settlements in much of the Project Study Area are rural residences and farm buildings (inhabited and uninhabited) scattered along rural country roads. These structures are focal points in the open space character of the landscape crossed by the Project Study Area. A number of farmsteads date back to the late 19th and early 20th centuries, along with more modern farm buildings and residences that represent the different eras of Minnesota farm architecture.

NESC and Xcel Energy standards require minimum clearances between transmission line facilities and buildings to ensure safe operation of transmission line facilities. The Project will be designed in compliance with state, NESC, and Xcel Energy standards for clearance to ground, crossing other utilities, clearance from buildings, strength of materials, vegetation, and other obstructions. Furthermore, the Company will comply with Xcel Energy's construction standards, which include requirements of NESC and Occupational Safety and Health Administration (OSHA). Adherence to NESC, Xcel Energy, and OSHA standards will limit the effects of the Project on areas of human settlement and related infrastructure.

The primary method of mitigation for minimizing effects on human settlements and related infrastructure is to route transmission lines away from municipalities and residential areas. The route for the Original Brookings Line was designed to minimize effects of transmission lines by routing adjacent to existing utility corridors and roadways, which help minimize impact.

The Company will work with tribal, state, county, and local stakeholders to identify areas of concern and work collaboratively to minimize effects on areas of human settlement and related infrastructure.

7.7.1 Demographics and Socioeconomics

Demographic information for the Project Study Area is based on the U.S. Census Bureau 2020 Census: American Community Survey 5-year Estimates Data Profiles, available on Explore Census Data and QuickFacts websites. U.S. Census information is available at the state and county levels.

The Project Study Area encompasses portions of four counties with populations that vary in size from 439,882 persons in Dakota County to 5,640 persons in Lincoln County (U.S. Census Bureau 2020 and 2023) (see **Table 7.5**). Scott and Dakota counties are within the seven-county Twin Cities metro area and, as such, generally have larger populations and are more densely populated than counties in the southwestern portion of the Project Study Area, which are more rural in nature.

Table 7.5 presents demographic and socioeconomic information from the U.S. Census Bureau for the State of Minnesota and each county within the Project Study Area and **Table 7.6** presents information about the racial and ethnic groups in these areas.

Table 7.5: Demographic Information in the Project Study Area

County	Population Census April 1, 2020[a]	Percent Population Change [a,b]	Population per Square Mile – 2020[a]	Per Capita Income in Last 12 Months (2020 U.S.$)[a]	Unemployment Rate (%)[c]	Persons in Poverty (%)[c]	Top 3 Industries [cd]
Minnesota	**5,706,494**	**7.1**	**71.7**	**$38,881**	**2.6**	**9.3**	**E, M, R**
Scott	150,928	13.9	410	$43,890	2.3	5.8	E, M, P
Dakota	439,882	9.4	749	$42,588	2.5	5.3	E, P, R
Lincoln	5,640	-4.3	10.5	$30,178	1.8	8.7	E, Ag, R/M
Lyon	25,269	-2.3	35.4	$30,706	2.1	8.8	E, R, M

[a]U.S. Census Bureau 2023.

[b]Percent population change is based on Population Census April 1, 2020, as compared to Population Census April 1, 2010.

[c]U.S. Census Bureau 2020 ACS 5-Year estimates.

[d]U.S. Census Bureau 2020. Industries are defined under the 2012 North American Industry Classification System and abbreviated as follows: Ag = Agriculture, Forestry, Fishing, and Hunting, and Mining; C = Construction; E = Educational, Health and Social Services; M = Manufacturing; P = Professional, Scientific, and Management, and Administrative and Waste Management Services; and R = Retail Trade.

Table 7.6: Race and Ethnicity of the Population in the Project Study Area

County	White Alone, not Hispanic or Latino (%)	Black or African American Alone (%)	American Indian and Alaska Native Alone (%)	Asian Alone (%)	Native Hawaiian and other Pacific Islander Alone (%)	Hispanic or Latino (%)	Total Minority (%)[a]
Minnesota	**78.1**	**7.4**	**1.4**	**5.4**	**0.1**	**5.8**	**21.9**
Scott	78.2	6.3	1.1	6.8	0.1	5.8	21.8
Dakota	75.6	8.3	0.7	5.5	0.1	7.8	24.4
Lincoln	94.7	0.4	0.5	0.8	0.1	2.6	5.3
Lyon	82.2	3.4	0.9	5.3	0.1	7.7	17.8

[a] Total minority percentage equals the total population minus the percentage of white alone, not Hispanic or Latino.

Source: U.S. Census Bureau, 2023

In general, increasing the transmission output capability and reliability will benefit the surrounding communities on a long-term basis. The Project is not expected to have any negative economic impacts. Indirectly, the increased capability and reliability of the electric system to supply low-cost, renewable energy to commercial and industrial users may contribute to the economic growth of communities and counties along the route and to future generation and renewable energy development. The construction, operation, and maintenance of the transmission line is not anticipated to negatively impact the socioeconomic resources along the route.

Short-term positive economic gains will result from activities associated with construction. Local businesses may see positive economic gains in the form of spending, lodging, meals, and other consumer goods and services. It is not anticipated that the Project will create new permanent jobs, but construction activities will provide a seasonal influx of additional dollars into the communities during the construction phase of the Project.

7.7.2 Environmental Justice

The U.S. Environmental Protection Agency (EPA) defines environmental justice (EJ) as the "fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income in the development, implementation, and enforcement of environmental laws, regulations, and policies." (EPA 2022). Fair treatment means that no group of people should bear a disproportionate share of the negative environmental consequences resulting from industrial, governmental, and commercial operations or policies. Meaningful involvement means:

- People have an appropriate opportunity to participate in decisions about a proposed activity that will affect their environment and/or health,
- The public's contributions can influence the regulatory agency's decision,
- Community concerns will be considered in the decision-making process, and
- Decision makers will seek out and facilitate the involvement of those potentially affected.

EPA developed a mapping and screening tool, EJScreen, that can be used as an initial step to gather information regarding minority and/or low-income populations; potential environmental quality issues; environmental and demographic indicators; and other important factors (EPA 2023). EPA recommends that screening tools like EJScreen be used for a "screening-level" look and a useful first step in understanding or highlighting locations that may require further review.

The MPCA website Understanding Environmental Justice provides tools to help identify EJ communities throughout the state and provide guidance for integrating EJ principles such as fair treatment and meaningful involvement of EJ communities (MPCA 2022). The MPCA uses data on income, poverty levels, and race from the U.S. Census Bureau to identify areas of EJ concern at the census tract level. Areas of EJ concern are defined by the MPCA to include an area where at least one of the following criteria are met:

- The number of persons of color is greater than 50%, or
- More than 40% of the households have a household income of less than 185% of the federal poverty level.

Federally recognized Indian Tribes and reservation areas are also defined by MPCA as areas of EJ concern. The MPCA has created an interactive map that shows identified areas of EJ concern throughout the state (MPCA, n.d.[c]).

A review of the MPCA's EJ mapping tool identified an area in which more than 40% of households have a household income of less than 185 percent of the federal poverty level near the City of Marshall in Lyon County, Minnesota. No other potential EJ areas were identified within the Project Study Area. At the time this document was prepared, the EJScreen tool was not available as the EPA is in the process of releasing an updated version of the tool. An analysis of EJScreen and U.S. Census data will be completed during development of the Commission Minor Alteration permit application.

7.7.3 Recreation

Recreational opportunities within the Project Study Area include snowmobiling, biking, hiking, canoeing, boating, fishing, camping, swimming, hunting and nature observation. Publicly available information on federal, state, and local recreation lands was reviewed to identify properties within the temporary workspaces that may be impacted by the Project. Recreation lands were reviewed during initial routing and construction and thus impacts to these lands will be minimal.

One MDNR WIA site is located within temporary workspaces of the Western Segment in Lincoln County. WIA sites are administered by the MDNR and allow public access to private lands. Recreation opportunities on these properties are limited to hunting during legal hunting seasons from September 1st to May 31st each year.

Routing design to avoid recreation activities has already occurred during the construction of the Original Brookings Line. The Company will work with the federal, state, county, and local agencies to develop appropriate mitigation measures to minimize impacts on public recreational use, if warranted, for construction of the additional structures and stringing of new lines. Mitigation measures could include avoiding construction during seasons of peak use, signage, and ensuring public access to recreation areas is not restricted.

7.7.4 Aesthetics

The visual character and setting of the majority of the Project Study Area includes largely level agricultural fields with narrow swaths of trees, roads, and water features (i.e., wetlands, lakes, and rivers). Visual and aesthetic resources within the Project Study Area were identified during permitting of the Original Brookings Line through discussions with state and local agency officials, review of city and county comprehensive land use plans and other local and regional plans, public comments, and through a review of high-resolution aerial photography and field observation during the permitting process for the Original Brookings Line. Generally, visual and aesthetic resources within the area include historical residential or commercial structures, parklands, open space areas, water features, scenic overlooks, and densely forested areas.

Public roadways and utility corridors, including overhead transmission lines, already exist throughout the Project Study Area (Figures 1a and 1b). Overhead transmission lines are visible from a variety of potential viewpoints within the Project Study Area, including private residences, highways, county and township roads and recreation areas.

7.7.5 Agricultural Production

The agricultural production industry is a significant part of the economy throughout Minnesota. Information from the United State Department of Agriculture's (USDA) 2017

Census of Agriculture for each of the counties in the Project Study Area is provided in **Table 7.7**. For a listing of counties within each ECS, refer to **Section 7.2** and **Table 7.1**.

In the Project Study Area, the role agricultural production plays in local economies varies by county. Lincoln and Lyon counties in southwest Minnesota are dominated by agricultural activities. Scott and Dakota counties are part of the seven-county metro area, and large portions of former farmland located near the Twin Cities metropolitan area has been developed. As shown in **Table 7.7**, the Eastern Segment is predominantly located in agricultural land, either cultivated crops or hay and pastureland.

Variations in crops by acreage and livestock by farms do not vary significantly between counties in the Project Study Area. Corn is the primary row crop by acreage in all four of the counties in the Project Study Area, along with soybeans and forage. Cattle is the primary livestock by farms in most of the Project Study Area along with hogs and pigs, sheep and lambs, and poultry.

Table 7.7: Agricultural Statistics for the Project Study Area

County	Land in Farms (acres)	Top 3 Crops by Acreage	Top 3 Livestock Inventories by Farms
Lincoln	297,836 (87% of county)	Corn, soybeans, forage	Cattle, hogs and pigs, poultry
Lyon	395,132 (87% of county)	Corn, soybeans, forage	Cattle, hogs and pigs, sheep and lambs
Scott	115,504 (49% of county)	Corn, soybeans, forage	Cattle, poultry, sheep and lambs
Dakota	227,081 (60% of county)	Corn, soybeans, forage	Cattle, hogs and pigs, poultry

Source: USDA 2017

Designated "prime farmland" exists throughout the Project Study Area. Federal regulations define prime farmland as "land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber and oilseed crops and is available for these uses." 7 C.F.R. § 657.5 (a) (1).

Impacts on agricultural fields and production have already been minimized through avoidance and routing the Original Brookings Line along field edges and other existing linear infrastructure (e.g., roads, transmission lines). Additional impacts are expected to be minimal due to the small footprint of the temporary workspaces. The Company will maintain landowner access to agricultural fields, storage areas, structures, and other agricultural facilities during construction to the extent practicable. If irrigation systems or drain tile are present, the Company will work with landowners to avoid these systems. Crop production on some

portion of agricultural lands may be temporarily interrupted for one growing season while transmission line facilities are constructed. The Company will compensate landowners for impacts on crops resulting from the construction, operation, and maintenance of the Project including compaction that might result from these activities.

7.7.6 Forestry Production

Commercial forestry operations are not common in these areas of Minnesota due to the lack of forested areas. Forested areas in the Project Study Area typically consist of narrow swaths of trees along the margins of waterbodies, farmsteads, along the boundaries of agricultural fields, or in state parks or forest and other federal, state, or locally designated and managed lands (see Figure 7). According to the MDNR Forestry Division Fiscal Year 2024 Stand Examinations (MDNR 2023j), no townships within the Project are being considered for potential timber sales. There are no economically important forestry resources within the Project.

7.7.7 Mineral Extraction

The Company reviewed publicly available information from the Minnesota Department of Transportation (MnDOT) Aggregate Source Information System and the USGS Mineral Resources Data System to identify mineral mining operations in the Project Study Area (MnDOT 2023b; USGS n.d.). The primary mining resources in the area are sand and gravel. There are a few active and inactive aggregate operations identified near the Project Study Area. There are no mining operations within the Project Study Area. The Original Brookings Line was originally constructed to avoid direct impacts to existing and future (if known) mining operations whenever feasible.

7.8 Public Services and Transportation

The Project Study Area encompasses a mostly rural area. In rural areas, residents often rely on privately owned septic systems and wells, although some residents may have access to rural water distribution facilities.

Existing road infrastructure within the Project Study Area is a mix of federal, state, and county highways, and township roads. Interstate 35 travels north-south through the Eastern Segment of the Project Study Area. Other major roadways crossing the Eastern Segment include State Highways 21, 13, and 3. Major roadways crossing the Western Segment include U.S. Highways 75 and 59 and State Highways 271, 68, and 23. There are four railroads that cross the Project Study Area. One Burlington Northern Santa Fe Railroad line crosses the Western Segment. Two Canadian Pacific and one Union Pacific Railroad lines cross the Eastern Segment.

Existing electric transmission lines exist throughout the Project Study Area, as depicted on Figure 1a and 1b. This Project will minimize impacts by adding a second 345 kV circuit to existing structures with the construction of 11 new structures. During construction, power to the existing circuit will need to be halted temporarily during work. Work is being planned in the low-wind summer months (expected 2024 to 2025) to minimize congestion costs being passed to Xcel Energy customers.

Oil and gas transmission and distribution pipelines cross the existing transmission corridor (PHMSA 2023). If the proposed workspaces are near or cross a pipeline, appropriate engineering standards will be incorporated into Project design, and any required crossing permissions or agreements will be obtained.

In general, impacts on public services and transportation have been avoided through routing design including paralleling existing utility corridors and other linear infrastructure. However, during Project construction roadway closures or diversions may be necessary to accommodate construction equipment and public safety. If road closures cannot be avoided, the Company will work with the federal, state, and county agencies to develop appropriate mitigation measures to minimize impacts on public services and transportation. Mitigation measures could include avoiding construction during hours of peak use, detours, signage, and ensuring access to public service infrastructure is not restricted. The Company is actively coordinating with MnDOT to ensure safety and reliability of roads during construction.

There are no public or private airports within the Project Study Area (MnDOT 2023a); however, the Airlake Airport is located approximately 1.6 miles north of the Eastern Segment. Airport impacts were addressed during initial construction of the Original Brookings Line. Eight, two-pole structures were originally constructed near the Airlake Airport to allow conductors to be installed on a horizontal configuration, rather than a vertical configuration. This horizontal configuration allows the Original Brookings Line to maintain a low profile, in compliance with FAA requirements. Two phases of the circuit were installed on one steel pole and one phase was installed on the second steel pole. To maintain the low profile after installation of the second circuit, eight new steel poles will be installed. One of the phases of the second circuit will be installed on the existing steel poles that currently has only a single phase. The two remaining phases of the second circuit will be installed on the new set of steel poles. Once complete, the transmission line in this area, will consist of eight, three steel-pole structures, with the six phases laid out horizontally. The Project will comply with other rules that establish safety zones for airports as required.

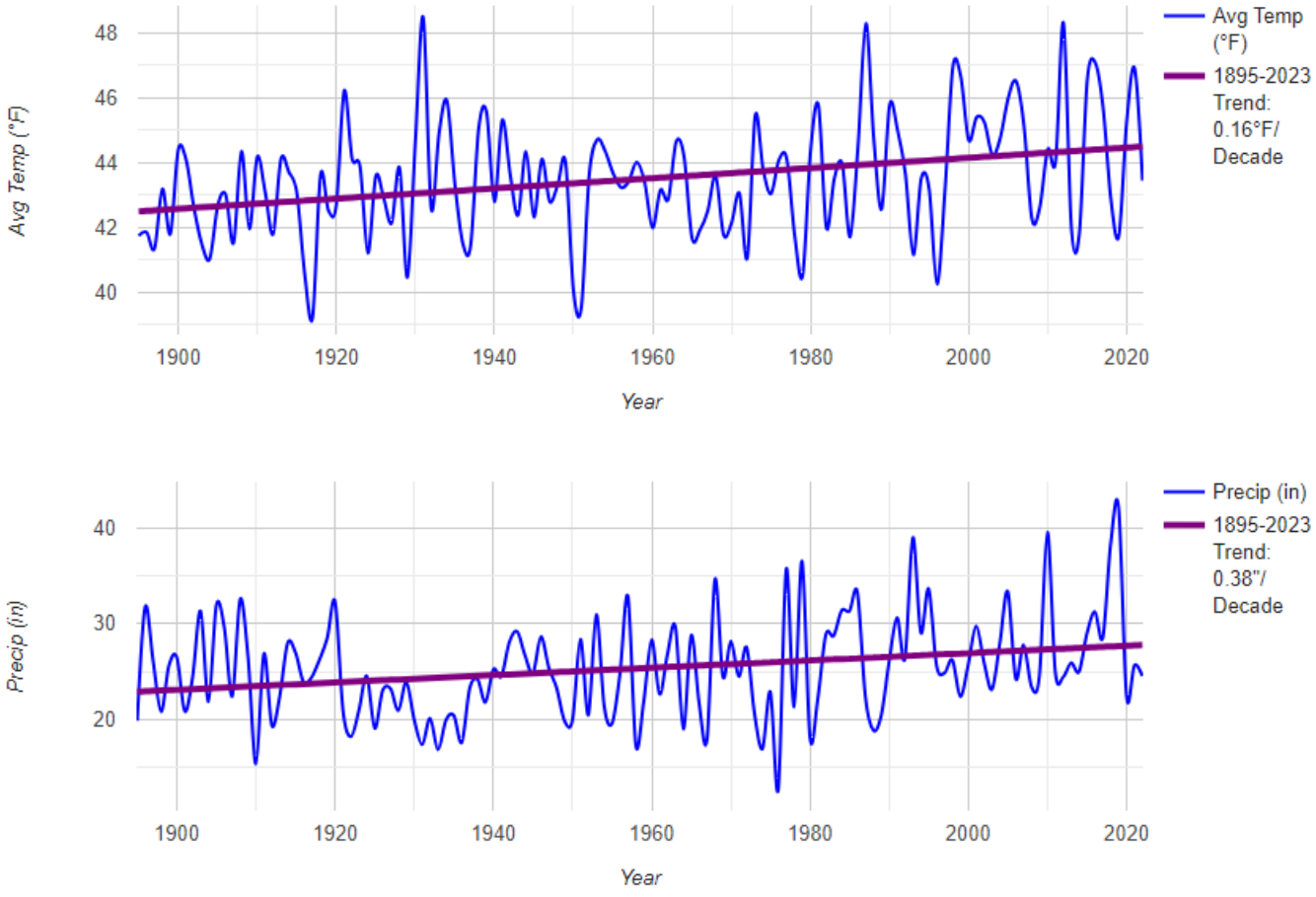
7.9 Climate Change

In general, Minnesota is anticipated to experience an increase in temperature, precipitation, and more frequent extreme precipitation events resulting from climate change. In Minnesota,

annual average temperatures have risen three degrees Fahrenheit over the past century with the highest average temperature increases having occurred during the winter. Since 1895, temperatures during the winter have increased at a rate two to three times higher than during the summer. In particular, winter warming rates have risen more sharply in recent decades. Current climate warming trends, most notably during the winter, are anticipated to continue.

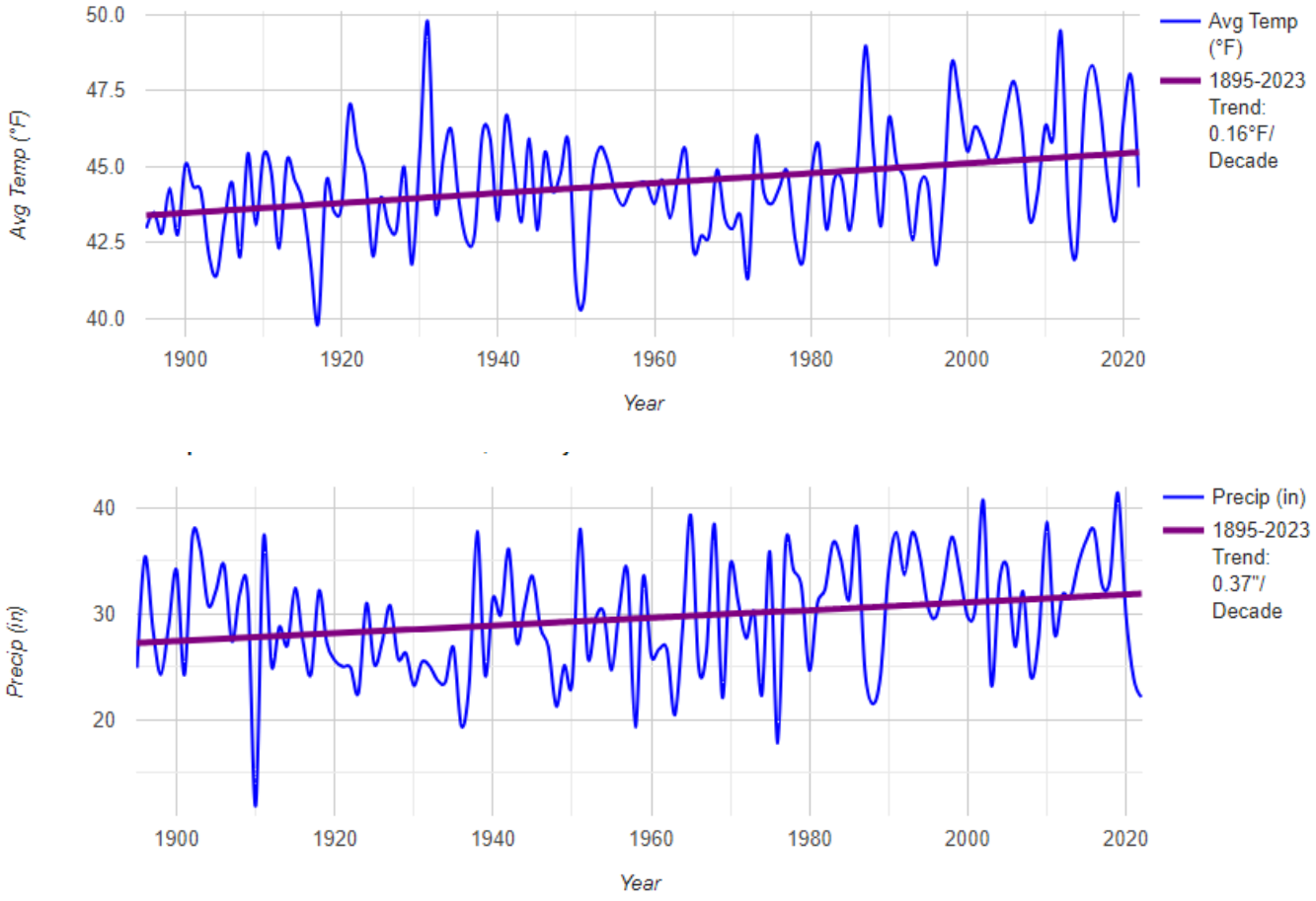
Climate trends for Lincoln and Lyon Counties (Western Segment) and Scott and Dakota Counties (Eastern Segment) parallel the overall statewide trends of Minnesota's climate is becoming warmer and wetter. **Figure 7.1** and **7.2** below illustrate historical average annual temperature and precipitation trends from 1895 to 2023 (MDNR 2023k). The average temperature near the Project has risen by 0.16 degrees per decade. The average annual precipitation has risen by 0.38 inches per decade along the Western Segment and 0.37 inches per decade along the Eastern Segment has risen by.

Figure 7.1: Lincoln and Lyon Counties (Western Segment) Precipitation and Temperature Trends from 1895 – 2023



Source: MDNR 2023k

Figure 7.2: Scott and Dakota Counties (Eastern Segment) Precipitation and Temperature Trends from 1895 – 2023



Source: MDNR 2023k

Climate change impacts to the Project's reliability or function are not expected, as minor changes in precipitation and temperature trends have been accounted for in the engineering design and siting. For example, transmission towers are located in uplands, the towers are engineered to withstand storms, and fill has been added to substations. The Project will also curb carbon emissions by allowing existing and new renewable energy projects to go online from the additional voltage the second circuit provides.

7.10 Electric and Magnetic Fields

To assess the potential change in EMF for the Brookings Second-Circuit Project compared to the Original Brookings Line, the estimated magnitudes of the EMF from the 2008 analysis were compared to recent EMF results for the Project (POWER Engineers, Inc., 2023). The results of the two studies are shown in **Table 7.8**.

Table 7.8. EMF Comparison

Segment	Maximum within Right-of-Way			
	Electric Field Magnitude (kV/m)		Magnetic Field Magnitude (milligauss)	
	2008	2023	2008	2023
Western Segment	3.7	5.2	94.0	183.0
Eastern Segment	3.7	5.2	114.4	179.0

Comparing the results of the two studies shows that the maximum magnitude of EMF within right-of-way is expected to increase due to the Project but remain below the 8 kV/m limit for electric field and 9,040 mG exposure reference level for magnetic field. EMF generated by transmission lines decrease with distance and will be lower than the values in the table above at the edge of right-of-way and locations beyond right-of-way limits.

Changes to human or environmental impacts from EMF due to the addition of the second circuit as part of the Project are not expected because EMF levels are expected to remain within applicable limits. See Section 5.6 for additional detail.

7.11 Archaeological and Historical Resources

Previously identified archaeological sites (e.g., pre-contact artifact assemblages, burial mounds, and earthworks) are present in the Project Study Area, primarily along the margins of rivers (e.g., Mississippi and Minnesota Rivers) and other surface waters. The Project Study Area also contains historic architectural resources, the majority of which are located within municipalities (e.g., churches, grain elevators, banks, railroads) though some rural farmsteads and bridges are also considered historic architectural resources. Some of the archaeological sites and historic architectural resources are listed or considered eligible for listing in the National Register of Historic Places (NRHP), while other sites have yet to be evaluated.

After temporary workspaces are identified for the Project, the Company will complete a Phase 1a literature review to characterize the prehistoric and historic context along identified route options and to identify previously recorded archaeological sites and historic architectural resources that need to be avoided due to their listing in or eligibility for listing in the NRHP.

Effects to historic properties will be avoided by using the existing tower locations, hanging the second circuit via helicopter, minimizing workspace, and minimizing ground disturbance. However, the Western Segment will require reconfiguring an existing line at the Steep Bank Lake Substation, near Hendricks, Minnesota, where one additional structure will be added. The Eastern Segment will also require rerouting around the Chub Lake Substation, northeast of Elko New Market. Finally, the Project will require the construction of eight new poles near Castle Rock to maintain the transmission line's low profile near an airport after the second

circuit is installed. For these reasons, a small amount of ground disturbance is anticipated during the installation of transmission towers (less than one acre). The viewshed impacts for historic properties for most of the Project are assumed to be minimal as the Project will be using existing infrastructure to run the second circuit.

The Company has reviewed Minnesota State Historic Preservation Office (SHPO), Office of State Archaeologist (OSA), and NRHP databases to gather baseline data on cultural and archaeological resources within the Project Study Area and its temporary workspaces. A total of 31 archaeological sites, 13 cemeteries/burials and one NRHP listed site occur within the one-mile Project Study Area. Three of the archaeological sites and no NRHP sites or cemeteries occur within the Temporary Workspace areas. Two of these are Alpha sites and do not have a well-defined location. Within the Project Study Area, 29 archaeological sites and one NRHP site will be avoided by the Company by hanging the second circuit via helicopter methods. The initial review did not include a full review of possible known historic structures that are not listed on the NRHP. A full list of known historic structures will be included in the Phase 1a literature review.

If impacts to any recorded site cannot be avoided by the Project, that recorded site will require formal significance evaluation to determine if it meets the eligibility requirements of the NRHP. If found significant, mitigation strategies will be undertaken to reduce impacts. This mitigation could include identifying the site in detail prior to construction, limiting construction access and activities as much as possible, and having an archaeologist present during construction to monitor work and to gather any artifacts found. If properties are listed in the NRHP, or if they are considered eligible for listing, they may be afforded protection under federal and state regulations. The Company will provide notice to affected landowners, applicable agencies, tribes, and elected officials throughout the Commission permitting process. The Company will work with the appropriate state, federal, and tribal agencies during the routing process to avoid known cultural resources to the extent practicable, though impacts are not anticipated based on the limited ground disturbance required for the installation of 11 new towers.

In June 2023, the Company reviewed online OSA and NRHP records to identify known archaeological resources within the centerline of the Project Study Area. Sixteen archaeological resources were previously recorded within the Western Segment (**Table 7.9**). These archaeological sites represent locations of Pre-contact habitation and tool manufacture and use, and Post-contact Euro-American farmsteads. The sites have not been evaluated for listing on the NRHP.

Table 7.9: Cultural Sites Within One-Mile Project Study Area of the Western Segment

Site Number	Site Name	Site Type	NRHP Eligibility	Location Relative to Project
21LY0032	Boerboom	Isolated Find	Unevaluated	One-mile Buffer
21LN0076	Unnamed	Lithic Scatter	Unevaluated	One-mile Buffer
21LN0079	Unnamed	Lithic Scatter	Unevaluated	One-mile Buffer
21LN0083	Unnamed	Isolated Find	Unevaluated	One-mile Buffer
21LN0087	Unnamed	Isolated Find	Unevaluated	One-mile Buffer
21LN0090	Unnamed	Isolated Find	Unevaluated	One-mile Buffer
21LN0091	Unnamed	Isolated Find	Unevaluated	One-mile Buffer
21LN0093	Unnamed	Isolated Find	Unevaluated	One-mile Buffer
21LN0094	Unnamed	Lithic Scatter	Unevaluated	One-mile Buffer
21LN0112	Unnamed	Isolated Find	Unevaluated	One-mile Buffer
21LN0113	Unnamed	Euro-American Farmstead	Not Eligible	One-mile Buffer
21LN0114	Bednarek	Lithic Scatter	Unevaluated	One-mile Buffer
21LN0115	Unnamed	Lithic Scatter	Unevaluated	One-mile Buffer
21LN0116	Unnamed	Isolated Find	Unevaluated	One-mile Buffer
21LN0117	Unnamed	Isolated Find	Not Eligible	One-mile Buffer
21LN0118	Unnamed	Euro-American Farmstead	Not Eligible	One-mile Buffer
21759	Cavalry Cemetery	Cemetery/Burial	N/A	One-mile Buffer
21781	Jenson Cemetery	Cemetery/Burial	N/A	One-mile Buffer
21785	Norwegian Lutheran Church and Cemetery	Cemetery/Burial	N/A	One-mile Buffer
21795	St. Paul's Cemetery	Cemetery/Burial	N/A	One-mile Buffer
21796	St. Clotilde Cemetery	Cemetery/Burial	N/A	One-mile Buffer
21807	Hope Cemetery	Cemetery/Burial	N/A	One-mile Buffer
21813	St. Edward's Cemetery	Cemetery/Burial	N/A	One-mile Buffer

One site (21LN76) was identified within 30m (98.4ft) of the Project Study Area, but the Company will avoid ground disturbance in or near the site. No other known sites within one mile of the Western Segment will be impacted by the Project or its temporary workspace.

Twelve archaeological sites were previously identified within the Eastern Segment section centerline (**Table 7.10**) where these archaeological sites represent locations of Pre-contact habitation and tool use and manufacturing, and historically documented towns or structural

features, and have not been evaluated for listing on the NRHP. One NRHP listed historic structure was identified within the Project Study Area: Kajer, Wencl Farmstead (80002166) is located west of Elko New Market and approximately 630m (2066.9ft) west of the centerline.

Table 7.10: Cultural Sites Within One-Mile Project Study Area of Eastern Segment

Site Number	Site Name	Type	NRHP Eligibility	Location
21SCc	Benedict	Ghost Town	Unevaluated	One-mile Buffer
21SCs	Raven Stream	Ghost Town	Unevaluated	One-mile Buffer
21SC100	Unnamed	Isolated Find	Unevaluated	One-mile Buffer
21SCn	Plum Creek	Ghost Town	Unevaluated	Temporary Workspace
21DKat	Benjamin Caskey Homestead	Homestead	Unevaluated	Temporary Workspace
21DK107	Unnamed	Lithic Scatter	Unevaluated	One-mile Buffer
21DK144	Eureka School No. 96	Schoolhouse	Unevaluated	One-mile Buffer
21DKk	Unnamed	Pre-contact Scatter	Unevaluated	One-mile Buffer
21DK75	Empey	Historic, Corn Crib	Unevaluated	Temporary Workspace
21DK94	Unnamed	Historic Scatter	Unevaluated	One-mile Buffer
21DKm	Auburn	Ghost Town	Unevaluated	One-mile Buffer
21DKg	Vermillion Mill	Mill	Unevaluated	One-mile Buffer
21DK127	Unnamed	Isolated Find	Unevaluated	One-mile Buffer
21DK122	Unnamed	Lithic Scatter	Unevaluated	One-mile Buffer
21DK123	Unnamed	Lithic Scatter	Unevaluated	One-mile Buffer
80002166	Kajer, Wencl Farmstead	Historic Structure	Listed	One-mile Buffer
20178	Emmanuel Cemetery	Cemetery/Burial	N/A	One-mile Buffer
20239	St John's Cemetery	Cemetery/Burial	N/A	One-mile Buffer
20248	Cadwell Burials	Cemetery/Burial	N/A	One-mile Buffer
24008	West Christiana Cemetery	Cemetery/Burial	N/A	One-mile Buffer
24029	St Benedict's Church & Cemetery	Cemetery/Burial	N/A	One-mile Buffer

Five sites (21DK0075 (Empey), 21DK94, 21DKat, 21SCn, and 21SC100) were within 30m (98.4ft) of the Project Study Area. The Project planning and engineering effort worked to avoid two of the sites, meaning one archaeological site (21DK0075) and two alpha sites (21Dkat, and 21SCn) were located within the Project's temporary workspaces. For temporary workspace that have potential to cause ground disturbance and cannot be relocated to avoid the sites, the Company will consult with SHPO to gather existing condition, site management recommendations, and efforts, if known, to avoid, minimize, or treat impacts related to construction and maintenance of the Project. No other known sites within one mile of the Eastern Segment centerline will be impacted by construction or maintenance of the Project.

7.12 Other Permits and Approvals

In addition to a Certificate of Need, a Minor Alteration to the existing route permit from the Commission will be required. The Company may also need to obtain other local, state, and federal approvals. **Table. 7.11** lists additional permits and approvals that may be required for the Project. Typical municipal permit categories are listed, but specific permits may vary from city to city and are limited. Once the Commission issues a Minor Alteration to the existing route permit, local zoning, building, and land use regulations and rules are preempted per Minn. Stats. § 216E.10, subd. 1.

Table 7.11: Potential Permits/Compliance Requirements

Permit	Jurisdiction
Local Approvals	
Road Crossing/Right-of-Way Permits	County, Township, City
Lands Permits	County, Township, City
Utility Permits	County, Township, City
Oversize / Overweight Permits	County, Township, City
Driveway/Access Permits	County, Township, City
Local/State/Federal Application for Water/Wetland Projects (under WCA)	BWSR
State Approvals	
Certificate of Need	MPUC
Minor Alteration	MPUC
Threatened & Endangered Species Consultation	MDNR
License to Cross Public Waters	MDNR – Lands and Minerals
Construction Dewatering Permit	MDNR
Utility Permit	MnDOT
Driveway/Access Permits	MnDOT
Oversize/Overweight Permits	MnDOT
Wetland Conservation Act Exemption Concurrence	BWSR
Section 401 Water Quality Certification	MPCA
National Pollutant Discharge Elimination System Permit	MPCA
Cultural Resources Review	Minnesota State Historic Preservation Office
Federal Approvals	
Section 7 Consultation	USFWS
Section 10 Permit	USACE
Section 404 Permit	USACE
Notice of Proposed Construction (7460-1)	FAA
Notice of Actual Construction or Alteration	FAA
Farmland Protection Policy Act/Farmland Conversion Impact Rating	USDA/NRCS

7.13 References

Avian Power Line Interaction Committee (APLIC). 1994. Migrating Bird Collisions with Power Lines: the State of the Art in 1994. Edison Electric Institute. Washington, D.C.

BWSR. 2019. Reinvest in Minnesota Overview. Available at Reinvest in Minnesota Overview | MN Board of Water, Soil Resources (state.mn.us). Accessed June 2023.

Cowardin, L. M., V. Carter, F. C. Golet, E. T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. U. S. Department of the Interior, Fish and Wildlife Service, Washington, D.C. 131pp.

Dewitz, J. (2021). National Land Cover Database (NLCD) 2019 Products [Data set]. U.S. Geological Survey. https://doi.org/10.5066/P9KZCM54.

MDNR. 2006. Tomorrow's Habitat for the Wild and Rare: An Action Plan for Minnesota Wildlife, Comprehensive Wildlife Conservation Strategy. Division of Ecological Services, Minnesota Department of Natural Resources.

MDNR. 2017. MCBS Railroad Rights-of-Way Prairies. Available online at MCBS Railroad Rights-of-Way Prairies - Resources - Minnesota Geospatial Commons (mn.gov). Accessed June 2023.

MDNR. 2018. Northern Long-eared Bat Rare Species Guide. Available online at Myotis septentrionalis : Northern Long-eared Bat | Rare Species Guide | Minnesota DNR (state.mn.us). Accessed June 2023.

MDNR. 2020. Public Waters Basin and Watercourse Delineations. Available online at Public Waters (PW) Basin and Watercourse Delineations - Resources - Minnesota Geospatial Commons (mn.gov). Accessed June 2023.

MDNR. 2022. Karst Feature Inventory Points. Available online at Karst Feature Inventory Points - Resources - Minnesota Geospatial Commons (mn.gov). Accessed June 2023.

MDNR. 2023a. Ecological Classification System. Available online at Ecological Classification System | Minnesota DNR (state.mn.us). Accessed June 2023.

MDNR. 2023b. Minnesota's Watershed Basins. Minnesota's watershed basins | Minnesota DNR (state.mn.us). Accessed June 2023.

MDNR. 2023c. Minnesota groundwater provinces 2021. Available online at Minnesota groundwater provinces 2021 | Minnesota DNR (state.mn.us). Accessed June 2023.

MDNR. 2023d. Tricolored Bat Rare Species Guide. Available online at Perimyotis subflavus : Tricolored Bat | Rare Species Guide | Minnesota DNR (state.mn.us). Accessed June 2023.

MDNR. 2023e. Monarch Butterfly. Available online at Monarch Butterfly | Minnesota DNR (state.mn.us). Accessed June 2023.

MDNR. 2023f. Higgins Eye Rare Species Guide. Available online at Lampsilis higginsii : Higgins Eye | Rare Species Guide | Minnesota DNR (state.mn.us). Accessed June 2023.

MDNR. 2023g. Bald Eagles in Summer. Available online at Bald eagles in summer | Minnesota DNR (state.mn.us). Accessed June 2023.

MDNR. 2023h. Calcareous Fens – Source Feature Points. Available online at Calcareous Fens - Source Feature Points - Resources - Minnesota Geospatial Commons (mn.gov). Accessed June 2023.

MDNR. 2023i. Walk-In Access (WIA) Program. Available online at Walk-In Access (WIA) Program | Minnesota DNR (state.mn.us). Accessed June 2023.

MDNR. 2023j. Fiscal Year 2024 Stand Examinations. Available online at Annual Stand Exam List | Minnesota DNR (state.mn.us). Accessed June 2023.

MDNR. 2023k. Climate Trends. Available online at: https://www.dnr.state.mn.us/climate/climate_change_info/climate-trends.html. Accessed June 2023.

MnDOT. 2023a. Minnesota AirportFinder App. Available online at Aviation: Minnesota Department of Transportation (state.mn.us). Accessed June 2023.

MnDOT. 2023b. Aggregate Source Information System. Available online at https://www.dot.state.mn.us/materials/aggsource.html. Accessed June 2023.

MPCA. Understanding Environmental Justice. Publication date June 29, 2022. https://mpca.maps.arcgis.com/apps/MapSeries/index.html?appid=f5bf57c8dac24404b7f8ef1717f57d00. Accessed June 2023.

Pipeline and Hazardous Materials Safety Administration (PHMSA). 2023. National Pipeline Mapping System: Public Map Viewer. Available online at General Public Portal Page (dot.gov). Accessed June 2023.

USFWS. Undated-a. National Wetlands Inventory. Available online at: https://www.fws.gov/program/national-wetlands-inventory. Accessed June 2023.

USFWS. Undated-b. Do I need a permit for my activity around a bald eagle nest? How close is too close? Available online at: https://www.fws.gov/story/do-i-need-eagle-take-permit. Accessed June 2023.

USFWS. 2018. Habitat Connectivity Model for the Rusty Patched Bumble Bee (*Bombus affinis*). Available online at High Potential Zone Model for Rusty Patched Bumble Bee | FWS.gov. Accessed June 2023

USFWS. 2020. Endangered and Threatened Wildlife and Plants; 12-Month Finding for the Monarch Butterfly. 85 Federal Register 81813 (December 17, 2020). Available online at 2020-27523.pdf (govinfo.gov). Accessed June 2023.

USFWS. 2023a. Northern Long-eared Bat. Available online at Northern Long-eared Bat (Myotis septentrionalis) | U.S. Fish & Wildlife Service (fws.gov). Accessed June 2023.

USFWS. 2023b. Rufa Red Knot. Available online at Rufa Red Knot (Calidris canutus rufa) | U.S. Fish & Wildlife Service (fws.gov). Accessed June 2023.

U.S. Census Bureau. 2020. 2020 American Community Survey 5-year Estimates Data profiles. Available online at: Census Bureau Tables. Accessed June 2023.

U. S. Census Bureau. 2023. QuickFacts. Available online at: U.S. Census Bureau QuickFacts: United States. Accessed June 2023.

U.S. Department of Agriculture. 2017. 2017 Census of Agriculture, Chapter 2, Table 1, County Summary Highlights. Available online at: USDA/NASS Census of Agriculture Chapter 2, Table 1. Accessed June 2023.

USEPA. 2022. Learn About Environmental Justice. https://www.epa.gov/environmentaljustice/learn-about-environmental-justice. Accessed June 2023.

USEPA. 2023. Purposes and Uses of EJSCREEN. https://www.epa.gov/ejscreen/purposes-and-uses-ejscreen. Accessed June 2023.

USGS. n.d. Mineral Resources Data System. Available online at: https://mrdata.usgs.gov/mrds/. Accessed June 2023.

USGS. 2022. PAD-US Data Overview. Available online at: https://www.usgs.gov/programs/gap-analysis-project/science/pad-us-data-overview. Accessed June 2023.

Weary, D.J., and Doctor, D.H., 2014, Karst in the United States: A digital map compilation and database: U.S. Geological Survey Open-File Report 2014–1156, 23 p., https://dx.doi.org/10.3133/ofr20141156. ISSN 2331-1258. Accessed June 2023.