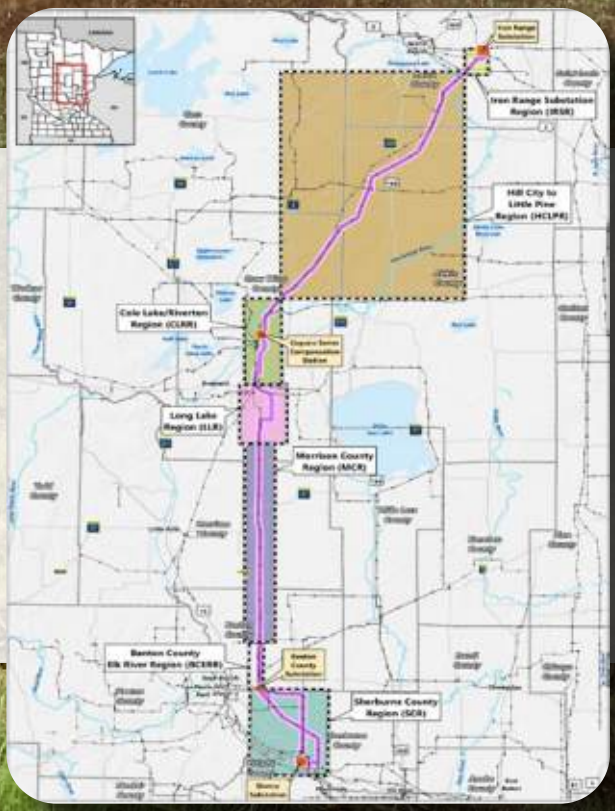
COMMERCE DEPARTMENT

Northland Reliability Project Environmental Assessment

The Human and Environmental Impacts of Addressing Electrical Grid Reliability Concerns in North Central Minnesota



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Abstract

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Minnesota Power and Great River Energy (Applicants) propose to construct approximately 180 miles of double-circuit 345 kilovolt (kV) transmission line from the Iron Range Substation near Grand Rapids, Minnesota to the Sherco and Big Oaks Substations near Becker Minnesota (Northland Reliability Project or project). The project includes equipment additions and reconfigurations within several substations as well as a new Cuyuna Series Compensation Station near Riverton, Minnesota.

The Northland Reliability Project requires two separate approvals from the Minnesota Public Utilities Commission (Commission)—a certificate of need (CN) and a route permit. The applicants submitted a joint CN and route permit application to the Commission in August 2023. The Commission subsequently authorized joint hearings and combined environmental review for the CN and route permit. The Commission requested that Department of Commerce (Department) Energy Environmental Review and Analysis (EERA) staff prepare an environmental assessment (EA) for the project.

This EA addresses the issues and mitigation measures identified in the Department's scoping decision of March 22, 2024. It evaluates the project's potential for human and environmental impacts and possible measures, including route alternatives, to mitigate these impacts. Additionally, this EA discusses system alternatives (i.e., alternatives other than a double-circuit 345 kV transmission line) that may meet the stated need for the project.

Public hearings for the project will be held in the project area and are anticipated to occur the week of July 22, 2024. Notice of the hearings will be issued separately. An administrative law judge (ALJ) from the Minnesota Office of Administrative Hearings will preside over the hearings. Upon completion of the hearings, the ALJ will submit a report to the Commission including recommendations to the Commission regarding the applicants' CN and route permit application. Commission decisions on a CN and route permit are expected in November 2024.

Additional materials related to this project and its permitting proceedings are available on the Department's website: http://mn.gov/commerce/energyfacilities and on the state of Minnesota's eDockets

system: https://www.edockets.state.mn.us/EFiling/search.jsp (enter the year “22” and the number “415” or “416”).

Persons interested in receiving future project notices and updates can place their names on the project mailing list by emailing docketing.puc@state.mn.us or calling 651-201-2246 and providing the docket number (22-415 or 22-416), their name, email address, and mailing address. Please indicate how you would like to receive notices—by email or U.S. mail.

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Acronyms

AC	alternating current
ACSR	aluminum conductor steel reinforced
ACSS	aluminum conductor steel supported
AIMP	agricultural impact mitigation plan
ALJ	administrative law judge
AMA	Aquatic Management Area
Applicants	Minnesota Power and Great River Energy
AQI	Air Quality Index
AUAR	Alternative Urban Area-Wide Review
BEC	Boswell Energy Center
BGEPA	Bald and Golden Eagle Protection Act
BMP(s)	Best Management Practice(s)
BWSR	Board of Water and Soil Resources
CAA	Clean Air Act
CN	certificate of need
CO	carbon monoxide
CO_2	carbon dioxide
Commission	Minnesota Public Utilities Commission
CREAT	Climate Resilience Evaluation and Awareness Tool
CREP	Conservation Reserve Enhancement Program
CWA	Clean Water Act
dBA	decibel scale
DC	direct-current
SBS	Department of Natural Resources Sites of Biodiversity Significance
DNR	Department of Natural Resources
EA	environmental assessment
ECS	Ecological Classification System
EERA	Energy Environmental Review and Analysis
EJC	environmental justice concerns
EMI	electromagnetic interference
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FEMA	Federal Emergency Management Agency
FSA	Farm Service Agency
GBCA	Grassland Bird Conservation Areas
GHGs	Greenhouse gases
GIS	geographic information system
GPS	global position systems
GRE	Great River Energy
HVDC	High-voltage direct current
ICDs	implantable cardioverter defibrillators
IPaC	Information for Planning and Consultation
kV	kilovolt
kV/m	kV per meter
LGUs	local units of government

LRTP	Long-Range Transmission Plan
MDA	Minnesota Department of Agriculture
MEPA	Minnesota Environmental Policy Act
mG	milliGauss
MIAC	Minnesota Indian Affairs Council
MISO	Midcontinent Independent System Operator
MnDOT	Minnesota Department of Transportation
MPCA	Minnesota Pollution Control Agency
MWI	Minnesota Well Index
N_2O	nitrous oxide
NAAQS	National Ambient Air Quality Standards
NERC	North American Electric Reliability Corporation
NESC	National Electrical Safety Code
NHIS	Natural Heritage Inventory System
NHPA	National Historic Preservation Act
NLCD	National Land Cover Database
NO_2	nitrogen dioxide
NOMN	northern Minnesota
NPDES	National Pollutant Discharge Elimination System
SDS	Sanitary Disposal System
NRCS	Natural Resource Conservation Service
NRHP	National Register of Historic Places
O_3	ozone
OAH	Office of Administrative Hearings
OSA	Office of the State Archaeologist
PM_{10}	particulate matter less than 10 microns
$PM_{2.5}$	particulate matter less than 2.5 microns
PWI	public waters inventory
RCP	Representative Concentration Pathway
RICE	reciprocating internal combustion engine
ROI	Region of Influence
ROW	right-of-way
SBS	Sites of Biodiversity Significance
ScPDSI	Self-Calibrated Palmer Drought Severity Index
SDS	State Disposal System
SF_6	sulfur hexafluoride
SFIA	Sustainable Forest Incentive Act
SHPO	State Historic Preservation Office
SO_2	sulfur dioxide
SSURGO	Soil Survey Geographic
SWPPP	Stormwater Pollution Prevention Plan
SWPPP	Stormwater Pollution Prevention Plan
TMDL	total maximum daily load
TWh	Terawatt hours
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
VOR	very high-frequency omni-directional range
WCA	Wetland Conservation Act
WMA(s)	Wildlife Management Area(s)

Summary

This environmental assessment (EA) has been prepared for the Northland Reliability Project (the project), a 345 kV double-circuit transmission line proposed by Minnesota Power and Great River Energy (GRE) (applicants). It evaluates the potential human and environmental impacts of the project and possible mitigation measures, including routing alternatives. Additionally, it evaluates alternatives to the project itself.

This EA is not a decision-making document but rather a guide for decision-makers. The EA is intended to facilitate informed decisions by state agencies, particularly with respect to the goals of the Minnesota Environmental Policy Act (MEPA) — "to create and maintain conditions under which human beings and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of the state's people" (Minn. Statute 116D.02).

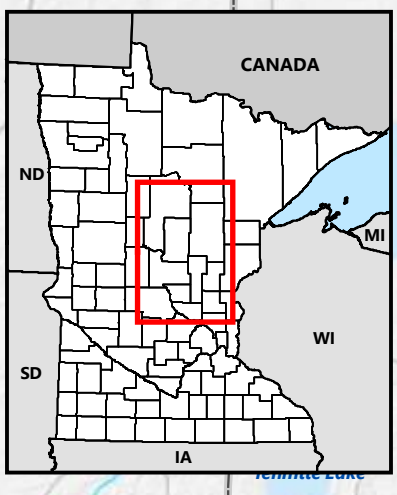
The Perceived Problem: Electrical Grid Reliability Concerns with the Shift to Renewable Energy

Over the past decades, the generation of electricity in Minnesota has evolved away from fossil-fueled baseload generating plants to renewable generating resources (e.g., wind and solar power). In 2011, over half of the electricity generated in Minnesota came from coal-fired electric power plants. In 2021, these plants produced only 27 percent of the electricity in Minnesota, while renewable generating resources provided 29 percent (reference (1)). This change in electrical generation has implications for the electrical transmission grid, among them, the grid may no longer connect generation resources in a manner that ensures reliable electrical service throughout the state.

Studies conducted by the applicants, along with the Midcontinent Independent System Operator (MISO), indicate that the electrical grid in north-central Minnesota will soon be unstable and unreliable if the transmission grid is not upgraded. Additionally, the grid in this area of the state will soon lose the voltage support provided by the Boswell Energy Center (BEC), a coal-fired generating plant in Cohasset, Minnesota. Unit 3 at the plant will cease operation by 2029; Unit 4 at the plant will cease operation by 2035. With these changes and without upgrades to the existing transmission grid, electrical service in north-central Minnesota would be unreliable; voltages at residences and businesses could be unstable.

A Possible Solution: The Northland Reliability Project

MISO and the applicants studied a number of possible solutions to this problem. After several years of study, MISO determined that a double-circuit 345 kV from the Iron Range substation near Grand Rapids, Minnesota, to the Sherco and Big Oaks substations in central Minnesota was the best solution. This solution – the Northland Reliability Project – most cost-effectively resolved the impending reliability issues in north-central Minnesota. MISO approved the project in the first phase (or "tranche") of its Long-Range Transmission Plan (LRTP) Tranche 1 Portfolio (reference (2)). MISO then assigned the development and construction of the Northland Reliability Project to the applicants. In August 2023, the applicants applied to the Minnesota Public Utilities Commission (Commission for a certificate of need (CN) and a route permit for the project (Map S-1).



Iron Range Substation

Cuyuna Series Compensation Station

Benton County Substation

Sherco Substation

Mud Lake
Grand Rapids
Pokegama Lake
Leech Lake
Itasca County
Saint Louis County
Boy Lake
Cass County
Woman Lake
St. Louis River
Sandy Lake Reservoir
Upper/Lower Whitefish
Mississippi River
Aitkin County
Crow Wing County
Wadena County
Pelican Lake
Carlton County
Rice Lake
Gull Lake
North Long Lake
Brainerd
Snake River
Mille Lacs Lake
Long Prairie River
Todd County
Mille Lacs County
Little Falls
Morrison County
Kanabec County
Pine County
Benton County
Isanti County
Chisago County
Sartell
Sauk Rapids
Waite Park
Saint Cloud
Cambridge
Sauk River
Stearns County
Sherburne County
Crow River
Meeker County
Monticello
Elk River
Anoka County
East Bethel
Rum River
St. Croix River

2 169 200 84 6 371 64 210 47 27 10 61 8

Applicants' Proposed Route
Route Alternative
Alignment Alternative
Existing Transmission Line
Benton County Substation
Iron Range Substation
Sherco Substation
Cuyuna Series Compensation Station

0 5 10 15
Miles

Map S-1

PROJECT OVERVIEW MAP
Northland Reliability Project

The State of Minnesota's Role

Though MISO is charged with operating the electrical transmission grid in the Upper Midwest, and though it may propose projects, it is ultimately the state of Minnesota that determines whether specific transmission lines are needed by the state and, if so, where they should be located. This authority is vested in the Commission. Thus, even though a project may be proposed and approved by MISO, it is the Commission that determines whether and where the project is built.

For the Northland Reliability Project, the Commission must make two decisions: (1) whether the proposed project is needed or whether some other project would be more appropriate for the state of Minnesota; for example, a project of a different type or size, and (2) if the proposed project is needed, where it should be located.

To help the Commission with its decision-making and to ensure a fair and thorough airing of the issues, the state of Minnesota has set out a process for the Commission to follow in making its decisions. This process requires (1) the development of an EA and (2) public hearings before an administrative law judge (Minn. Statutes 216B and 216E). The goal of the EA is to describe the potential human and environmental impacts of the project ("the facts"); the goal of the hearings is to advocate, question, and debate what the Commission should decide about the project ("what the facts mean"). The entire record developed in this process, including all public input and testimony, is considered by the Commission when it makes its decisions on the applicants' CN and route permit applications.

Commission Decision Criteria

The Commission makes its decisions on the applicants' CN and route permit applications through criteria set out in Minnesota statutes and rules. Per Minn. Rule 7849.0120, in order to grant a CN, the Commission must find that:

A. The probable result of denial would be an adverse effect on 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. 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.

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.

For a route permit, the Commission is charged with selecting transmission line routes that minimize adverse human and environmental impacts while ensuring continuing electric power system reliability and integrity. Per Minn. Rule 7850.4100, the Commission must consider 14 factors when making a route permit decision:

A. Effects on human settlement, including, but not limited to, displacement, noise, aesthetics, cultural values, recreation and public services.

B. Effects on public health and safety.

C. Effects on land-based economies, including, but not limited to, agriculture, forestry, tourism, and mining.

D. Effects on archaeological and historic resources.

E. Effects on the natural environment, including effects on air and water quality resources and flora and fauna.

F. Effects on rare and unique natural resources.

G. Application of design options that maximize energy efficiencies, mitigate adverse environmental effects, and could accommodate expansion of transmission or generating capacity.

H. Use or paralleling of existing right-of-way (ROW), survey lines, natural division lines, and agricultural field boundaries.

I. Use of existing large electric power generating plant sites.

J. Use of existing transportation, pipeline, and electrical transmission systems or ROWs.

K. Electrical systems reliability.

L. Costs of constructing, operating, and maintaining the facility which are dependent on design and route.

M. Adverse human and natural environmental effects which cannot be avoided.

N. Irreversible and irretrievable commitments of resources.

Environmental Assessment

The Minnesota Environmental Policy Act requires that environmental review be conducted for major governmental actions with the potential to create significant environmental impacts (Minn. Statute 116D.04). To meet this requirement, the Commission has authorized the preparation of an EA. Department of Commerce (Department), Energy Environmental Review and Analysis (EERA) staff is responsible for preparing the EA on behalf of the Commission.

This EA is intended to facilitate informed decision-making by the Commission and other entities with regulatory authority over the project. It also assists citizens in providing guidance to decision-makers regarding the project. This EA analyzes the potential human and environmental impacts of the project and possible mitigation measures. It also analyzes alternatives to the project itself. The EA does not advocate or state a preference for a specific alternative. Instead, it analyzes and compares alternatives so that citizens, agencies, and governments can work from a common set of facts.

Public Participation

In their CN application, the applicants requested that the Commission approve a double-circuit 345 kV transmission line from the existing Iron Range Substation to a new Cuyuna Series Compensation Substation, to the existing Benton County Substation, finally connecting to the Sherco and Big Oaks Substations. In their route permit application, the applicants proposed a route for the project and discussed routing alternatives that were considered but not proposed by the applicants.

In preparing this EA, EERA staff solicited public comments on these applications. EERA staff solicited comments on (1) the human and environmental impacts that should be evaluated in the EA, (2) possible mitigation measures to study, including route alternatives, and (3) alternatives to the project itself that should be studied. This process of soliciting comments on the contents of the EA is known as “scoping.” EERA staff solicited comments through public meetings in October 2023 and through a comment period that ended on November 21, 2023. Based on the public comments received and after review by the Commission, the Department issued the scoping decision for this EA on March 22, 2024.

Public comments received during the scoping process increased the number of routing alternatives for the project. There is one route, 25 route alternatives, and 15 alignment alternatives that could be used for the project (Map S-1). The Commission could select and permit any of these alternatives or a combination of these alternatives.

Environmental Assessment Analysis and Routing Alternatives

The applicants are proposing to construct an approximately 180-mile-long double-circuit 345 kV transmission line between Grand Rapids, St. Cloud, and Becker, Minnesota. To facilitate analysis and discussion of the project, this EA divided the project into seven regions: the Iron Range Substation Region, the Hill City to Little Pine Region, the Cole Lake-Riverton Region, the Long Lake Region, the Morrison County Region, the Benton County Elk River Region, and the Sherburne County Region. The regions begin in the north, with the Iron Range Substation Region, and extend southward, ending with the Sherburn County Region. The regions were developed to facilitate analysis, as proposed route and alignment alternatives tended to be clustered in the same geographic areas along the route. A summary of the route and alignment alternatives located in each region is provided in Table S-1.

Table S-1 Summary of Route and Alignment Alternatives Analyzed in the EA

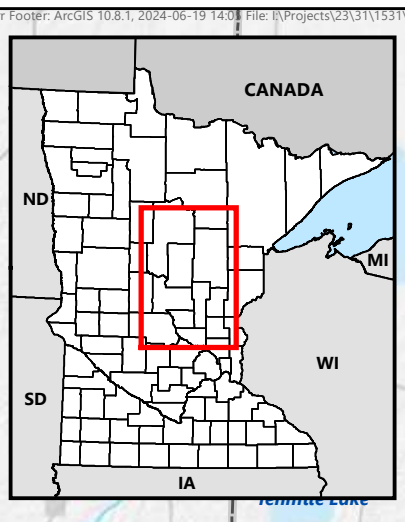
Region	Route Alternatives	Alignment Alternatives
Iron Range Substation	A1, A2, A3, A4	AA15
Hill City to Little Pine	B, C	AA1, AA2, AA16
Cole Lake-Riverton	D3, E1, E2, E3, E4, E5, F, G	AA3, AA4, AA6, AA7, AA8, AA9, AA10
Long Lake	H1, H2, H3, H4, H5, H6, H7, K	AA12, AA13, AA14, AA17
Morrison County	None	None
Benton County Elk River	J1, J2, J3	None
Sherburne County	None	None

Following the region-by-region analysis of each route and alignment alternative, four full route options (i.e., end-to-end routes from the Iron Range Substation to the Sherco and Big Oaks Substations) were identified and compared (Map S-2). These full route options are not meant to represent the only project routing possibilities. Rather, they are offered as examples of full-route options that could be assembled for the project, illustrating how various routing alternatives could be selected to build a full project route.

The full route options identified here were compiled by selecting routing alternatives or alignment alternatives within each region that could be feasibly connected to one another to create a full transmission line route between the existing Iron Range Substation, a new Cuyuna Series Compensation Substation, the existing Benton County Substation, the existing Sherco Substation, and the new Big Oaks Substation. Analyzing these four full route options against each other provides the opportunity to understand what impacts might look like if one of these full routes, or a similar route, were chosen for the project. The four full route options identified for analysis include:

- **The applicants' proposed route**. This is the route proposed by the applicants in their CN and route permit application.
- **The applicants' proposed route with modifications**. This route includes modifications proposed by the applicants in response to public comments and includes routing alternatives that would further consolidate the proposed new double-circuit 345 kV transmission line with existing transmission lines, particularly in the Cole Lake-Riverton Region. This route includes alignment alternatives AA3, AA9, and route alternative E1.
- **Example Route Option 1**. This route includes portions of the applicants' proposed route, including some modifications proposed by the applicants and routing alternatives proposed during the EA scoping comment period. This route includes route alternatives B, E1, H1 and alignment alternatives AA3 and AA16.
- **Example Route Option 2**. Similar to Route 1, this route includes portions of the applicants' proposed route, including some modifications proposed by the applicants and routing alternatives proposed during the EA scoping comment period. This route includes route alternatives A2, B, C, E1, H1, and J1 and alignment alternatives AA3 and AA16.

The summary of potential impacts that follow is limited to the four full route options that are identified above and analyzed in Chapter 7. Details of the potential human and environmental impacts of routing alternatives in specific regions of the project are discussed in Chapters 5 and 6.



Iron Range Substation
Cuyuna Series Compensation Station
Benton County Substation
Sherco Substation

Example Full Routes*
- Applicants' Proposed Route (A)
- Applicants' Proposed Route with Modifications (M)
- Example Route 1 (E1)
- Example Route 2 (E2)

- Benton County Substation
- Iron Range Substation
- Sherco Substation
- Cuyuna Series Compensation Station

* *Routes follow Applicants' Proposed Route (A) except where noted.*

0 5 10 15
Miles

Map S-2

EXAMPLE FULL ROUTES OVERVIEW MAP
Northland Reliability Project

Human and Environmental Impacts of the Project

Project construction and operation will impact human and environmental resources within the designated project area. Some impacts will be short-term and similar to those of any large construction project (e.g., noise, dust, soil disturbance). These impacts are fairly independent of the project route selected and can be mitigated by measures common to most construction projects.

Other impacts will exist for the life of the project and may include aesthetic impacts, impacts on land-based economies such as agriculture, forestry, and recreation and tourism as well as impacts to the natural environment and on rare and unique natural resources. These long-term impacts are generally not well mitigated by construction measures. That is, these impacts do not flow from how the project is constructed but rather through its design and location. Long-term impacts can be mitigated by prudent selection of the route and design for the project.

Many impacts are anticipated to be minimal—in and of themselves or with common mitigation measures—and fairly independent of the route selected for the project. These include:

- Impacts on human settlements (factor A)—noise, property values, electronic interference, cultural values, zoning and land-use compatibility, and public services.
- Impacts on public health and safety (factor B)—electric magnetic fields (EMF), implantable medical devices, stray voltage, induced voltage, and air quality.
- Impacts on rare and unique natural resources (factor F) – federal- and state-protected species.
- Impacts on electric system reliability (factor K).

However, other impacts are anticipated to vary with the route and design of the project. These impacts include:

- Impacts on human settlements (factor A)—aesthetics, displacement, and communities with environmental justice concerns (EJC).
- Impacts on land-based economies (factor C)—agriculture, forestry, mining, and recreation and tourism.
- Impacts on archaeological and historic resources (factor D).
- Impacts on the natural environment (factor E) - water resources, vegetation (flora), and wildlife (fauna).
- Impacts on rare and unique natural resources (factor F) - sensitive ecological resources.
- Use or paralleling of existing rights-of-way (factors H and J).
- Costs that are dependent on design and route (factor L).

Potential human and environmental impacts of the four full route options are summarized in Table S-2 and discussed further here.

Table S-2 Human and Environmental Impacts for the Applicants' Proposed Routes and Example Full Route Options

Resource	Element	Applicants' Proposed Route	Applicants' Proposed Route with Modifications	Example Route Option 1	Example Route Option 2
Length (miles)		182.3	180.5	177.6	179.6
Human Settlement	Residences within 0-75 feet (count)	3	3	2	3
	Residences within 75-250 feet (count)	102	111	109	117
	Residences within 250-500 feet (count)	164	172	194	209
	Residences within 500-1,000 feet (count)	380	377	385	396
Environmental Justice Concerns (EJC)	communities with EJ concerns crossed by the 150-ft ROW (count)	6	5	7	7
Land-Based Economies	Agricultural land in 150-ft ROW (acres)	1,260	1,302	1,298	1,325
Archaeology and Historic Architecture	Archaeological sites and historic architectural resources in 1,000-foot route width (count)	42	43	41	37

Resource	Element	Applicants' Proposed Route	Applicants' Proposed Route with Modifications	Example Route Option 1	Example Route Option 2
Water Resources	NHD stream crossings (count)	151	150	150	134
	PWI stream crossings (count)	82	79	79	59
	Impaired stream crossings (count)	46	46	46	28
	NHD lake crossings (count)	20	15	18	21
	Impaired lake crossings (count)	0	1	1	1
	PWI basin crossings (count)	9	14	16	15
	PWI wetland crossings (count)	10	7	7	6
	Total wetlands in 150-foot ROW (acres)	986	957	968	926
	Forested wetlands in 150-ft ROW (acres)	235	223	233	218
	Wetland crossings greater than 1,000 feet (count)	67	64	65	62
Vegetation	Forested landcover in 150-foot ROW (acres)	590	551	472	476
Wildlife	Wildlife Management Areas in 150-foot ROW (acres)	14	18	5	5
	Grassland Bird Conservation Areas in 150-foot ROW (acres)	1,241	1,241	1,241	1,252
	Shallow Wildlife Lake in 150-foot ROW (acres)	6	6	6	6

Resource	Element	Applicants' Proposed Route	Applicants' Proposed Route with Modifications	Example Route Option 1	Example Route Option 2
Rare and Unique Natural Resources	Sites of Biodiversity in 150-foot ROW (ranked moderate, high, or outstanding; acres)	954	914	743	735
	Native plant communities in 150-foot ROW (acres)	293	275	276	271
	High Conservation Value Forest in 150-foot ROW (acres)	124	124	33	33
	Lake of Biological Significance in 150-foot ROW (acres)	2	5	5	5
	Federal- or state-protected species documented in 150-foot ROW (count)	3	3	3	3
ROW Sharing and Paralleling	Transmission line (miles, percent)	159.3 (87)	166.7 (92)	167.8 (95)	160.0 (89)
	Roadway (miles, percent)	4.0 (2)	4.0 (2)	3.9 (2)	13.3 (7)
	Field, parcel, or section lines (miles, percent)	55.0 (30)	48.1 (27)	44.4 (25)	52.7 (29)
	Total ROW sharing and paralleling (miles, percent)	176.4 (97)	177.0 (98)	174.2 (98)	175.0 (98)
Estimated Cost	Total estimated cost (2022 dollars in millions)	$963	$980	$1,013 to $1,053	$1,035 to $1,075

Human Settlements

Potential project impacts on human settlements are assessed through an evaluation of several elements, including noise, property values, electronic interference, cultural values, zoning and land-use compatibility, and public services. For some of the human settlement elements, project impacts are anticipated to be minimal and independent of the route selected. Analysis of impacts to human settlements focuses on those elements that vary with the route selected – aesthetics, displacement, and communities with EJC.

Aesthetics

Aesthetic impacts differ only slightly among the full route options; impacts can be minimized by placing the transmission line away from residences and by following existing infrastructure and ROW. Proximity of residences to the applicants' proposed routes and full route options are shown in Table S-3 and depicted graphically in Figure S-1, while ROW paralleling and sharing are shown in Table S-4 and depicted graphically in Figure S-2.

Each of the four full routes would have similar aesthetic impacts based on the project's proximity to residences. The applicants' proposed route is near the fewest number of residences; example route option 2 is near the greatest number of residences. Each of the full route options minimizes aesthetic impacts by paralleling and/or sharing existing ROW for between 97 and 98 percent of the route. However, considering the amount of each route that would follow existing transmission lines, example route option 1 likely best minimizes aesthetic impacts because 95 percent of this route follows existing transmission lines.

Table S-3 Proximity of Residences to Applicants' Proposed Routes and Example Full Route Options

Residences, Distance from Anticipated Alignment	Applicants' Proposed Route	Applicants' Proposed Route with Modifications	Example Route Option 1	Example Route Option 2
Residences within 0-75 feet	3	3	2	3
Residences within 75-250 feet	102	111	109	117
Residences within 250-500 feet	164	172	194	209
Residences within 500-1,000 feet	380	377	385	396
Total Residences within 1,000 feet	649	662	690	725

Figure S-1 Proximity of Residences to the Applicants' Proposed Routes and Example Full Route Options

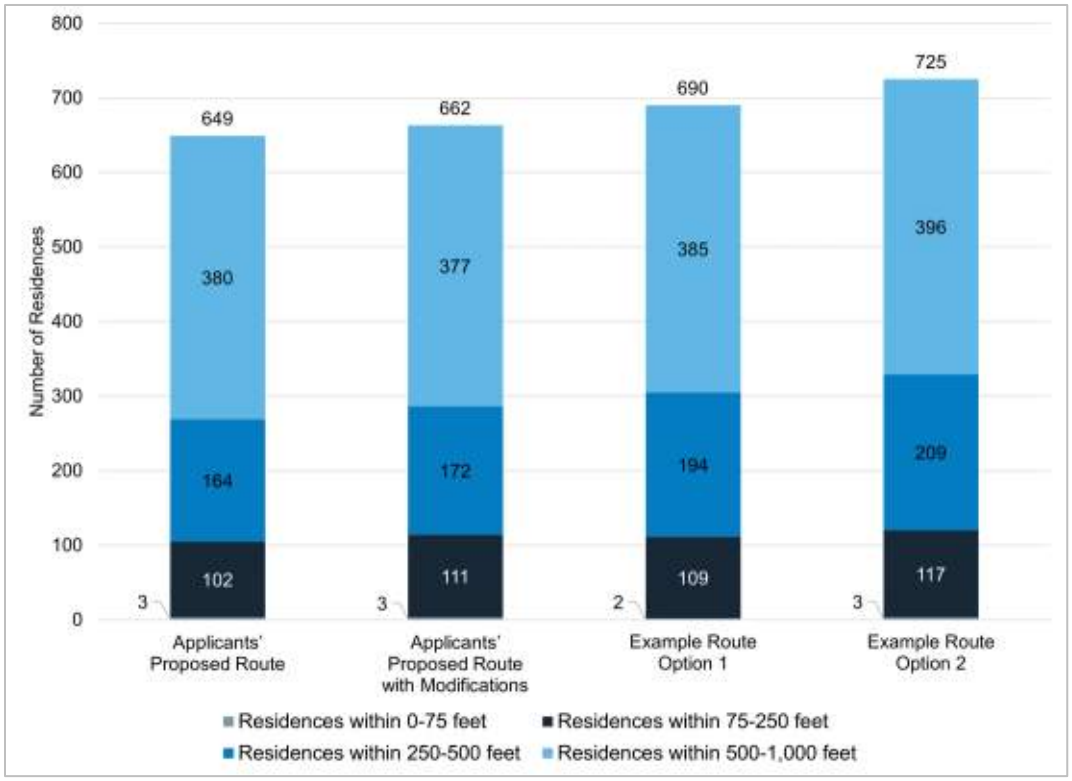
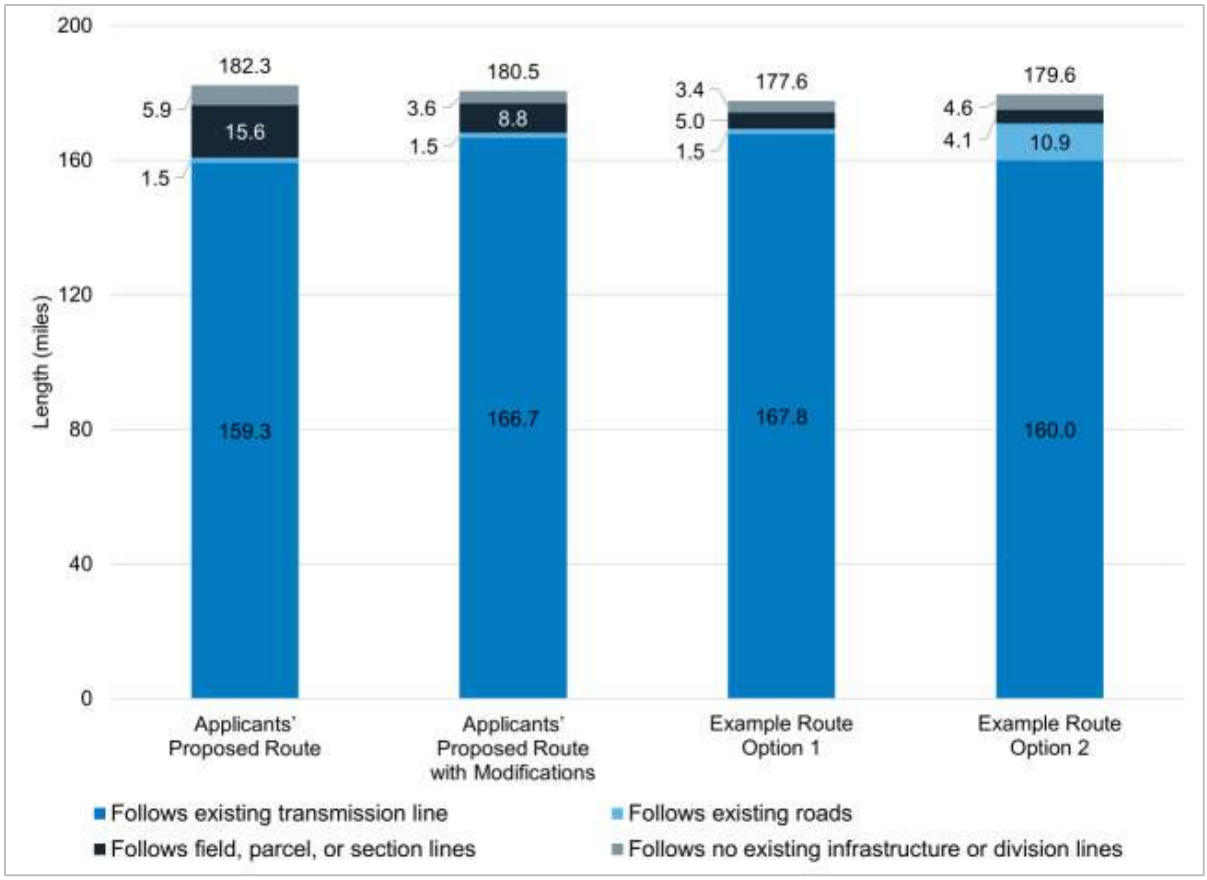


Table S-4 ROW Paralleling and Sharing of Applicants' Proposed Routes and Example Full Route Options

Infrastructure	Applicants' Proposed Route miles (percent)	Applicants' Proposed Route with Modifications miles (percent)	Example Route Option 1 miles (percent)	Example Route Option 2 miles (percent)
Follows Existing Railroad	1.0 (1)	1.0 (1)	1.0 (1)	1.0 (1)
Follows Existing Roads	4.0 (2)	4.0 (2)	3.9 (2)	13.3 (7)
Follows Existing Transmission Line	159.3 (87)	166.7 (92)	167.8 (95)	160.0 (89)
Total – Follows Transmission Line, Road, or Railroad	160.8 (88)	168.2 (93)	169.2 (95)	170.9 (95)
Follows Field, Parcel, or Section Lines	55.0 (30.2)	48.1 (26.6)	44.4 (25)	52.7 (29)
Total – ROW Paralleling and Sharing	176.4 (97)	177.0 (98)	174.2 (98)	175.0 (98)
Total Length of Route Alternative	182.3	180.5	177.6	179.6

Portions may share or parallel more than one type of infrastructure ROW or division/boundary line; therefore, the sum may be greater than 100 percent.

Figure S-2 ROW Sharing and Paralleling - Applicants' Proposed Routes and Example Full Route Options



Displacement

Residences or other buildings are typically not allowed within the transmission line ROW for electrical safety code and maintenance reasons. Any residences or other buildings located within a proposed ROW are, therefore, generally relocated or displaced.

The applicants' proposed route, proposed route with modifications, and example route option 2 may each result in the potential displacement of three residences, while example route option 1 may result in the potential displacement of two residences. In addition, each of these full routes could result in the potential displacement of several non-residential buildings (i.e., storage sheds, agricultural outbuildings, etc.) located within the 150-foot ROW (Table S-5).

Table S-5 Proximity of Residences and Non-Residences to Applicants' Proposed Routes and Example Full Route Options

Residences and Non-Residences, Distance from Anticipated Alignment	Applicants' Proposed Route	Applicants' Proposed Route with Modifications	Example Route Option 1	Example Route Option 2
Residences within 0-75 feet	3	3	2	3
Non-Residences within 0-75 feet	14	13	11	14
Total Residences and Non-Residences within 75 feet	17	16	13	17

Non-residential buildings within the 150-foot ROW may or may not be displaced as a result of the project. Though buildings are generally not allowed within the ROW of a transmission line, there are instances where the activities taking place in these buildings are compatible with the safe operation of the line (e.g., storage, animal production, etc.). For all residences and buildings in the ROW, the applicants would need to conduct a site-specific analysis to determine if the residence or building would be displaced.

Environmental Justice

Utility infrastructure can adversely impact low-income, minority, or tribal populations (communities with EJCs). Each of the full route options would cross several communities with EJCs (Table S-2). However, no adverse or permanent impacts to the identified communities with EJCs are anticipated. While each of the full routes included in this analysis intersect EJC communities, they are not anticipated to experience disproportionately adverse impacts as a result of the project, particularly because the transmission line will parallel and/or share existing ROW for the majority of these full route options (97 to 98 percent).

Land-Based Economies

Potential impacts to land-based economies are assessed through several elements. It addresses those elements of land-based economies that vary with the route selected – agricultural, forestry, mining, and recreation and tourism resources.

Agriculture

Impacts to agricultural land in the 150-foot ROW of the full route options would be relatively similar (Table S-2). The applicants' proposed route has the least amount of agricultural land within the ROW, totaling 1,260 acres (38 percent) (Table S-2). In contrast, example route option 2 has the most agricultural land within the ROW, with 1,325 acres (41 percent), representing a difference of approximately 65 acres (Table S-2).

Forestry

Impacts to designated forestry resources in the 150-foot ROW of the full route options would be relatively similar (Table S-2). Forestry land within the ROW of these options ranges between 472 acres (example route option 1) to 590 acres (applicants' proposed route).

There are designated forestry resources in the form of Minnesota Department of Natural Resources (DNR) state forest, Minnesota School Trust Land, and Forest for the Future land within the ROW of the full route options (Table S-6). The ROW of example route option 2 contains the fewest designated forestry resources (328 acres), while the applicants' proposed route with modifications contains the most (427 acres).

Table S-6 Designated Forestry Resources Within the 150-foot ROW of Applicants' Proposed Routes and Example Full Route Options

Forestry Acreage	Applicants' Proposed Route	Applicants' Proposed Route with Modifications	Example Route Option 1	Example Route Option 2
Acres of DNR state forest within 150-foot ROW	258	264	206	188
Acres of Minnesota School Trust Land[1] within 150-foot ROW	137	144	123	104
Acres of Forests for the Future[2] land within 150-foot ROW	19	19	32	36
Total Acreage	414	427	361	328

Data Sources: references (3); (4)
1 Minnesota School Trust Lands are DNR-administered lands that are set aside to provide a continual source of funding for public education (reference (4).
2 Minnesota's Forests for the Future Program is a conservation program administered by the DNR to encourage the protection of privately-owned forest lands through conservation easements or land purchases (reference (5)).

New transmission line construction through forested lands would be required for all full route options; however, example route option 1 minimizes forestry impacts most effectively by having the least amount of forested lands in its ROW. Example route option 1 also shares the most ROW with existing roadway and transmission line infrastructure (97 percent) (Table S-2). In areas of ROW paralleling and sharing, impacts to forestry resource lands have already occurred. Placement of transmission infrastructure in these locations may increase areas of forestry impact but would not introduce new impacts to an otherwise undisturbed forested setting.

Mining

Potential effects on mining operations are likely to occur if the construction or operation of a transmission line prevents access to and recovery of resources. The construction of a transmission line could limit the ability to mine these resources depending on the proximity of the resources to the project route selected.

There are no mining resources in the vicinity of the applicants' proposed route or the applicants' proposed route with modifications. Example route options 1 and 2 each have the same two aggregate mines located in their ROW, though both routes would follow an existing transmission line ROW through one of these aggregate mines, minimizing the introduction of new impacts.

Recreation and Tourism

Recreation and tourism opportunities in the project vicinity primarily consist of scenic byways, state forests, Wildlife Management Areas (WMAs), off-road vehicle trails, snowmobile trails, and water trails. Each full route option contains recreation and tourism opportunities. Compared to example route options 1 and 2, the applicants' proposed route and applicants' proposed route with modifications have the

following additional recreational resources in their rights-of-way: two scenic byways, two state forests, two WMAs, eight off-road vehicle trails, one snowmobile trail, and one water trail (Table S-7).

Table S-7 Recreational Resources Crossed by the 150-foot ROW of Applicants' Proposed Routes and Example Full Route Options

Route	Applicants' Proposed Route	Applicants' Proposed Route with Modifications	Example Route Option 1	Example Route Option 2
Scenic byways crossings (count)	4	4	2	2
State forest crossings (count)	6	6	4	4
WMA crossings (count)	2	2	0	0
Off-road vehicle trail crossings (count)	13	13	5	5
Snowmobile trail crossings (count)	8	8	7	7
Water trail crossings (count)	2	2	1	1

Example route options 1 and 2, as well as the applicants' proposed route with modifications, would each cross through a portion of the Cuyuna Country State Recreation Area. However, example route options 1 and 2 would cross this recreation area within existing transmission line ROW in an area of double-circuiting. An additional 80 feet of ROW from within the Cuyuna Country State Recreation Area would be needed to accommodate the double-circuiting and placement of the route through this area. As a result, only minor impacts to the Cuyuna Country State Recreation Area are anticipated. The applicants' proposed route with modifications would cross this recreation area parallel to existing road ROW at the far eastern edge of the recreation area and outside of the area used for recreation.

Since transmission line construction and operation generally has minimal permanent and temporary impacts to trails and introduction of new impacts would be minimized to the extent possible by ROW sharing and paralleling, recreation and tourism impacts as a result of the project are expected to be minimal. This said, example route options 1 and 2 are the most likely to minimize the project's impacts on recreation and tourism in the area.

Archaeological and Historic Resources

Between 37 and 43 archaeological and historic architectural resources are located within the 1,000-foot route width of the full route options (Table S-2). These resources are further classified in Table S-8. Most of these cultural resources have been previously determined to be ineligible for the National Register of Historic Places (NRHP) and therefore no additional work related to these cultural resources would be required for the project to proceed, regardless of which route is selected. However, the project has the potential to adversely affect those cultural resources that have not been evaluated for the NRHP, or which are listed on or have been determined eligible for listing on the NRHP (i.e., significant cultural resources).

Table S-8 Summary of Archaeological and Historic Architectural Resources within the 1,000-foot Route Width of Applicants' Proposed Route and Example Full Route Options

	Applicants' Proposed Route	Applicants' Proposed Route with Modifications	Example Route Option 1	Example Route Option 2
Count of NRHP-listed or -eligible Resources	5	5	6	6
Count of Unevaluated Cultural Resources	19	19	16	15
Count of Resources Previously Determined Not Eligible for NRHP	18	19	19	16

While the overall counts of cultural resource types are similar across all full route options, example route options 1 and 2 have less impact on archaeological and historic architectural resources. This is due to their use of existing infrastructure in proximity to significant cultural resources.

Of the significant cultural resources located within the route width of the applicants' proposed route and the applicants' proposed route with modifications, three NRHP-listed/-eligible historic architectural resources (XX-RRD-NPR007/ XX-RRD-NPR021, and CW-XXX-00001) have the potential for project impacts. Resource XX-RRD-NPR007/ XX-RRD-NPR021 consists of a duplicate recording of railroad ROW between the Lake Superior and Mississippi (LS&M)/ St. Paul and Duluth (StP & D) main line at Carlton and ND State Line at Moorhead, and resource CW-XXX-00001 consists of the Cuyuna Iron Range Historic Mining Landscape District. The applicants' proposed route would cross each of these resources in a brand-new location, which may alter these resource's setting, feeling, appearance, and/or association. Where example route options 1 and 2 cross these resources, the crossing occurs where an existing transmission line is present. Due to paralleling an existing transmission line, example route options 1 and 2 do not have the potential to introduce new impacts to the resources' setting, feeling, appearance, and/or association.

SH-BK-00012 (listed in the NRHP) and XX-RRD-00001 (eligible for the NRHP) would not be adversely affected by the project regardless of the route selected because these resources are located in an area that consists of double-circuiting on an existing transmission line. As a result, no new impacts to these cultural resources are anticipated because no new ROW would be acquired, nor would new visual or other impacts be introduced as a result of the project because the transmission line in proximity to these resources is existing.

Archaeological sites that are not evaluated or are listed in or eligible for the NRHP may also be impacted by the project if any of these sites are present within the footprint of ground disturbance. Ground disturbing activities have the potential to impact these resources if they cannot be avoided by the project. The primary means to minimize impacts to archaeological and historic architectural resources is prudent routing or structure placement – (i.e., avoiding known archaeological and historic resources). If they cannot be avoided, impacts to these resources could be mitigated by measures developed in consultation with State Historic Preservation Office (SHPO) prior to construction.

Natural Environment

Potential impacts to the natural environment are assessed by looking at several specific elements. For some of the elements of the natural environment, project impacts are anticipated to be minimal and

independent of the route selected and therefore are not discussed in the following sections. This section addresses those elements that do vary with the route selected – water resources, vegetation, and wildlife.

Water Resources

Impacts to floodplains and groundwater are anticipated to be minimal and independent of the route selected for the project. This discussion addresses watercourses and waterbodies, and wetlands.

Watercourses and Waterbodies

Each of the full route options would cross streams and waterbodies, as summarized in Table S-2. Example route option 2 minimizes stream crossings, including NHD streams, impaired streams, and public waters inventory (PWI) streams. However, the difference in stream crossings between example route option 2 and the other three full route options stems from the J1 route alternative in the Benton County Elk River region (which is part of example route option 2) being located in a new transmission line ROW west of the Elk River, while the other three full routes would use the applicants' equivalent to parallel an existing transmission line ROW while crossing the Elk River multiple times.

The applicants' equivalent in the Benton County Elk River region would cross the Elk River 26 times; this count is high due to the meandering nature of the Elk River. Waterbody crossings would be relatively comparable across each of the full route options. However, the applicants' proposed route with modifications would have fewer NHD lake crossings than the other three routes. The applicants' proposed route would have fewer PWI basin crossings but more PWI wetland crossings than the other three routes.

Wetlands

Wetlands within the rights-of-way of the full route options consist of emergent wetlands, forested wetlands, and shrub-dominated wetlands. The applicants' proposed route has the most acres of wetland (986 acres) and forested wetland (235 acres) within its 150-foot ROW, while example route option 2 has the least acres of wetland (926 acres) and forested wetland (218 acres) (Table S-2). Although wetlands would be spanned to the extent possible, each of the full route options would cross between 62 (example route option 2) and 67 (applicants' proposed route) wetland areas wider than 1,000 feet, which may require one or more structures to be placed in a wetland (Table S-2).

Vegetation

Each of the full route options would impact forested vegetation within their 150-foot ROW. Impacts to forested vegetation would be minimized with example route option 1 (472 acres) and example route option 2 (476 acres; Table S-2). The applicants' proposed route would impact 590 acres of forested vegetation in its ROW, while the applicants' proposed route with modifications would impact 551 acres of forested vegetation in its ROW (Table S-2). Each of the full route options would minimize impacts associated with forest fragmentation by following existing transmission line and/or road rights-of-way for the majority of their length (Table S-2).

Wildlife

Impacts to wildlife habitat would be relatively comparable for the full route options in that they would all cross WMAs, Grassland Bird Conservation Areas (GBCA), and a DNR-identified shallow wildlife lake. The

applicants' proposed route and the applicants' proposed route with modifications would cross the edge of the Birchdale and Moose Willow WMAs, while example route options 1 and 2 would only cross solely the edge of the Birchdale WMA. Example route option 2 would cross slightly more acres of GBCA than the other routes (Table S-2). Each of the full route options would minimize impacts associated with habitat fragmentation by following existing transmission line and/or road rights-of-way for the majority of their length (Table S-2).

Rare and Unique Natural Resources

Based on data reviewed from the Natural Heritage Inventory System (NHIS) database, there are no differences among the full route options with respect to documented federal- or state-protected species. Each of the full route options have one documented federally protected species (the northern long eared bat) and the same 15 state protected species documented within 1 mile of them. In addition, three of the 15 state protected species, including the loggerhead shrike, Blanding's turtle, and rock sandwort, have also been documented within the 150-foot ROW of each full route option. Potential impacts to these species can be mitigated by incorporating species-specific Best Management Practices (BMPs).

Each of the full route options would intersect several DNR Sites of Biodiversity Significance (SBS), with example route options 1 and 2 intersecting approximately 200 acres less than the applicants' proposed route and the applicants' proposed route with modifications (Table S-2). Each of the full route options would intersect native plant communities, with the applicants' proposed route intersecting slightly more than the other routes (Table S-2). Each of the full route options would also intersect High Conservation Value Forest, with example route options 1 and 2 intersecting approximately 90 fewer acres. All four full route options would intersect Lakes of Biological Significance while paralleling an existing transmission line ROW. The applicants' proposed route would traverse approximately 2 acres of one Lake of Biological Significance, while the other three routes would traverse approximately 5 acres of two Lakes of Biological Significance (Table S-2).

Relative Merits Summary

This discussion and presentation rely on text and a color graphic to describe the relative merits of the full route options (Table S-9). The color graphic and related notes for a specific routing factor or element are not meant to be indicative of the best route for the project but are provided as a relative comparison to be evaluated together with all other routing factors. For example, routes that are "red" for a particular factor or element are not meant to indicate a fatal flaw with a specific full route option. For routing factors where impacts are anticipated to vary with the full route options, the graphic represents the magnitude of anticipated difference between these anticipated impacts and compares them across the four full route options. For routing factors that express the state of Minnesota's interest in the efficient use of resources (e.g., the use and paralleling of existing rights-of-way), the graphic represents the consistency of the full route options with these interests and compares them to one another.

Table S-9 Guide to Relative Merits of the Applicants' Proposed Routes and Example Full Route Options

Anticipated Impacts or Consistency with Routing Factor	Symbol
Minimal: Impacts are anticipated to be minimal with mitigation – OR – route option is very consistent with this routing factor.	
Moderate: Impacts are anticipated to be minimal to moderate with mitigation; special permit conditions may be required for mitigation – OR – route alternative is very consistent with the routing factor, but less so than other route alternatives. Indicates that this route option may not be the least impactful with respect to this routing factor.	
Significant: Impacts are anticipated to be moderate to significant and likely unable to be mitigated – OR – route alternative is not consistent with the routing factor or consistent only in part. Indicates that this route option has notably more impacts with respect to this routing factor than other route options.	

Relative merits of the full route options for all routing factors / elements for which impacts are anticipated to vary among route options are shown and discussed in Table S-10.

Table S-10 Relative Merits of Applicants' Proposed Routes and Example Full Route Options

Routing Factor/Resource	Applicants' Proposed Route	Applicants' Proposed Route with Modifications	Example Route Option 1	Example Route Option 2	Summary
Human Settlement – Aesthetics					Each of the four full routes would have similar aesthetic impacts based on proximity to residences. The applicants' proposed route is near the fewest number of residences; example route option 2 is near the greatest number of residences. Route option 1 uses the most existing transmission line ROW (95 percent), while the applicants' proposed route with modifications is second with 92 percent. Route option 2 and the applicants' proposed route each use less than 90 percent of existing transmission line ROW (89 percent and 87 percent, respectively).
Human Settlement – Displacement					Route option 1 has the fewest residences and non-residences within the 150-foot ROW (2 residences and 11 non-residences). The other three full route options each have 3 residences and between 13 and 14 non-residences within the 150-foot ROW. As such, route option 1 best minimizes displacement.
Human Settlement – Environmental Justice Concerns					The applicants' proposed route with modifications would only cross five EJ communities, where the other route options would cross six to seven EJ communities. However, since these full route examples mostly follow existing transmission line ROW, these EJ communities should not be adversely or disproportionately affected by the project and differences are marginal.
Land-Based Economies – Agriculture					There is only a difference of approximately 65 acres of agricultural land between each of the full route options. Impacts would be similar regardless of the route selected.
Land-Based Economies – Forestry					Route option 1 minimizes forestry impacts by having the least amount of forested lands in its ROW and by sharing the most ROW with existing roadway and transmission line infrastructure (97 percent).

Routing Factor/Resource	Applicants' Proposed Route	Applicants' Proposed Route with Modifications	Example Route Option 1	Example Route Option 2	Summary
Land-Based Economies – Mining					Route options 1 and 2 have two aggregate mines within their rights-of-way; the applicants' proposed route and the applicants' proposed route with modifications do not. Impacts to the aggregate mines likely can be mitigated; thus, differences between the route options are marginal.
Land-Based Economies – Recreation and Tourism					The applicants' proposed route and applicants' proposed route with modifications have the following additional recreational resources in their rights-of-way compared to the route options 1 and 2: two scenic byways, two state forests, two Wildlife Management Areas (WMAs), eight off-road vehicle trails, one snowmobile trail, and one water trail. Example route options 1 and 2 would each require new ROW within the boundaries of the Cuyuna Country State Recreation Area.
Archaeological and Historic Architectural Resources					The applicants' proposed route and the applicants' proposed route with modifications would both cross significant cultural resources in an area of new ROW, where route options 1 and 2 would cross these same resources using existing transmission line ROW. Otherwise, counts of cultural resources are similar across each full route option.
Natural Environment – Watercourses and Waterbodies					Route option 2 would have the least number of stream crossings. However, it should be noted that the difference in stream crossings between route option 2 and the other three route options stems from the J1 route alternative in the Benton County Elk River region (which is part of example route option 2) being located in a new transmission line ROW west of the Elk River. In contrast, the other three full route options would use the applicants' equivalent to parallel an existing transmission line ROW while crossing a meandering section of the Elk River multiple times. The applicants' proposed route would avoid crossing an impaired lake and would have the least number of PWI basin crossings but would have the most PWI wetland crossings.
Natural Environment – Wetlands					The ROW of route option 2 has the least acres of wetland, including forested wetland.

Routing Factor/Resource	Applicants' Proposed Route	Applicants' Proposed Route with Modifications	Example Route Option 1	Example Route Option 2	Summary
Natural Environment – Vegetation					Route options 1 and 2 would have less impact on forested vegetation.
Natural Environment – Wildlife					Route option 1 minimizes impacts to wildlife and associated habitat by avoiding the Moose Lake WMA.
Rare and Unique Natural Resources					Route options 1 and 2 minimize impacts to Sites of Biodiversity Significance and High Conservation Value Forests.
Use or Paralleling of Existing ROW					Total ROW paralleling and sharing is nearly equal across all route options. There is some variation in the paralleling of existing transmission line rights-of-way. Route option 1 uses the most existing transmission line ROW (95 percent), while the applicants' proposed route with modifications is second with 92 percent. Route option 2 and the applicants' proposed route each use less than 90 percent of existing transmission line rights-of-way (89 percent and 87 percent, respectively).
Costs Dependent on Design and Route (2022 dollars in millions)	$963.7	$980.4	$1,013 to $1,053	$1,035 to $1,075	The applicants' proposed route is the least expensive, while example route option 2 is the most expensive. Factors affecting cost include double-circuiting long sections of transmission line in route options 1 and 2 as well as specialty structures that would be required near the Hill City/Quadna Mountain airport.