1.0 Introduction

Northern States Power Company, a Minnesota corporation (Xcel Energy or Applicant), submits this application for a Route Permit (Application) to construct the Minnesota portion of the Hampton to Rochester to La Crosse 345-kilovolt (kV) Transmission Project (Project, or Hampton–Rochester–La Crosse 345 kV Project). Xcel Energy is making this Application on behalf of itself and the other anticipated co-owners of the Project, including Dairyland Power Cooperative (Dairyland), Rochester Public Utilities (RPU), Southern Minnesota Municipal Power Agency (SMMPA), and WPPI Energy. These co-owners are jointly referred to as the Utilities.

The Project is designed to address three needs: to improve community reliability of the transmission system in Rochester, Winona, La Crosse, and the surrounding areas; to improve the regional reliability of the transmission system; and to increase generation outlet capacity. The Project consists of the following components, shown in Figures 1.0-1 and 1.0-2:

- A proposed 345 kV transmission line between the Hampton Substation near Hampton, Minnesota (southeast of the Twin Cities) and a substation location to be determined in the area of La Crosse, Wisconsin. The proposed 345 kV transmission line would be constructed in two distinct geographic sections in Minnesota that are addressed in this Application:
    - A section between the Hampton Substation and a proposed North Rochester Substation to be located between Pine Island and Zumbrota, Minnesota; referred to as the Hampton-North Rochester 345 kV Section.
    - A section between the proposed North Rochester Substation and the proposed Mississippi River crossing near Alma, Wisconsin; referred to as the North Rochester-Mississippi River 345 kV Section.
- A proposed 161 kV transmission line between the proposed North Rochester Substation and the existing Northern Hills Substation in northwest Rochester, Minnesota.
- Construction of the proposed North Rochester Substation, improvements to the Hampton and Northern Hills substations, and construction of a new substation and/or modifications at a substation location to be determined in the area of La Crosse, Wisconsin.
- The Wisconsin portion of the Project will be permitted in a separate proceeding before the Public Service Commission of Wisconsin (PSCW).

1.1 Applicant

Xcel Energy is a Minnesota corporation headquartered in Minneapolis, Minnesota. Xcel Energy is a wholly owned subsidiary of Xcel Energy Inc., a utility holding company with its headquarters in Minneapolis. Xcel Energy provides electricity services to approximately 1.2 million customers and natural gas services to 425,000 residential, commercial, and industrial customers in the state of Minnesota. Xcel Energy also provides electricity service to approximately 246,000 customers and natural gas services to 102,000 customers in the state of Wisconsin.

CapX2020 is a joint initiative of 11 transmission-owning utilities in Minnesota, Wisconsin, and the surrounding region whose goal is to study, develop, permit, and construct transmission infrastructure needed to implement long-term and cost-effective solutions for customers to meet the growth in electricity demand expected between 2009 and 2020. The 11 utilities participating in the CapX2020 Transmission Expansion Initiative include Xcel Energy, Dairyland, Great River Energy, Central Minnesota Municipal Power Agency, Minnesota Power, Minnkota Power Cooperative, Missouri River Energy Services, Otter Tail Power Company, RPU, SMMPA, and WPPI Energy. The Project is one of four transmission projects proposed by the CapX2020 Utilities, collectively referred to as the Group 1 projects. The three other Group 1 projects, which are being permitted separately, are identified below:

- Monticello–St. Cloud 345 kV Project and the Fargo–St. Cloud 345 kV Project – jointly, a 345 kV transmission line from Fargo, North Dakota, to Monticello, Minnesota;
- Brookings County–Hampton 345 kV Project (Brookings Project), a 345 kV transmission line between Brookings County, South Dakota, and Hampton, Minnesota; and
- Bemidji–Grand Rapids 230 kV Project, a 230 kV transmission line from Bemidji to Grand Rapids, Minnesota.

1.2 Project Ownership

A Project Development Agreement (PDA) was executed in March 2007 for each of the Group 1 projects. Each PDA identifies a lead utility or a Development Manager that is responsible for obtaining major permits and developing and implementing a project if construction is authorized. Xcel Energy is identified as the Development Manager for this Project to manage the permitting process, engineering, procurement, and construction of all of the Project facilities in accordance with the PDA executed by Xcel Energy, Dairyland, RPU, SMMPA, and WPPI Energy (Appendix A). Other utilities may assist Xcel Energy in some of the duties outlined above. Xcel Energy reports progress to the Project's Management Committee, which consists of one representative from each project's participating utilities.

The ownership of the proposed facilities will be determined pursuant to the PDA. Toward the end of the development phase, when critical permits and approvals have been obtained, the participating utilities will have the opportunity to decide whether to take an ownership stake in the Project. At that time, each CapX2020 participant has the option to: (1) take ownership up to a designated level, (2) take some lesser percentage to minimize capital expenditures, or (3) "opt out" of ownership entirely. Ownership decisions will occur toward the end of the development phase, as state, federal, and other approvals and consents are realized. The current Project development percentages (and potential/non-binding ownership percentages) are identified in Table 1.1-1.

Table 1.1-1:
Current Project Development Percentages

Utility	Applicable Project Development Percentage
Dairyland Power Cooperative	11
Rochester Public Utilities	9
Southern Minnesota Municipal Power Agency	13
WPPI Energy	3
Xcel Energy	64
Total	100

If a participant does not elect to invest in the Project, other participants, including third parties, may take on that investment percentage share by following the procedures provided in the Project PDA.

Agreements pertaining to the construction, ownership, operation, and maintenance of the Project are being negotiated and participants will continue to refine the commercial arrangements as the regulatory process proceeds.

1.3 Permittee

The permittee for the Project is Northern States Power Company, a Minnesota corporation, on behalf of itself and the anticipated other co-owners: Dairyland, RPU, SMMPA, and WPPI Energy. Contact information for the Permittee is shown below:

Contact Tom Hillstrom
Supervisor, Siting and Land Rights

Address Xcel Energy
414 Nicollet Mall-MP8A
Minneapolis, MN 55401

Phone 1-800-238-7968

Email lacrosseinfo@capx2020.com

1.4 Certificate of Need Issued

Minn. Stat. § 216B.243 dictates that a Certificate of Need (CON) is required for a “large energy facility” as that term is defined in Minn. Stat. § 216B.2421. A large energy facility includes “any high-voltage transmission line with a capacity of 200 kV or more and greater than 1,500 feet in length,” Minn. Stat. §

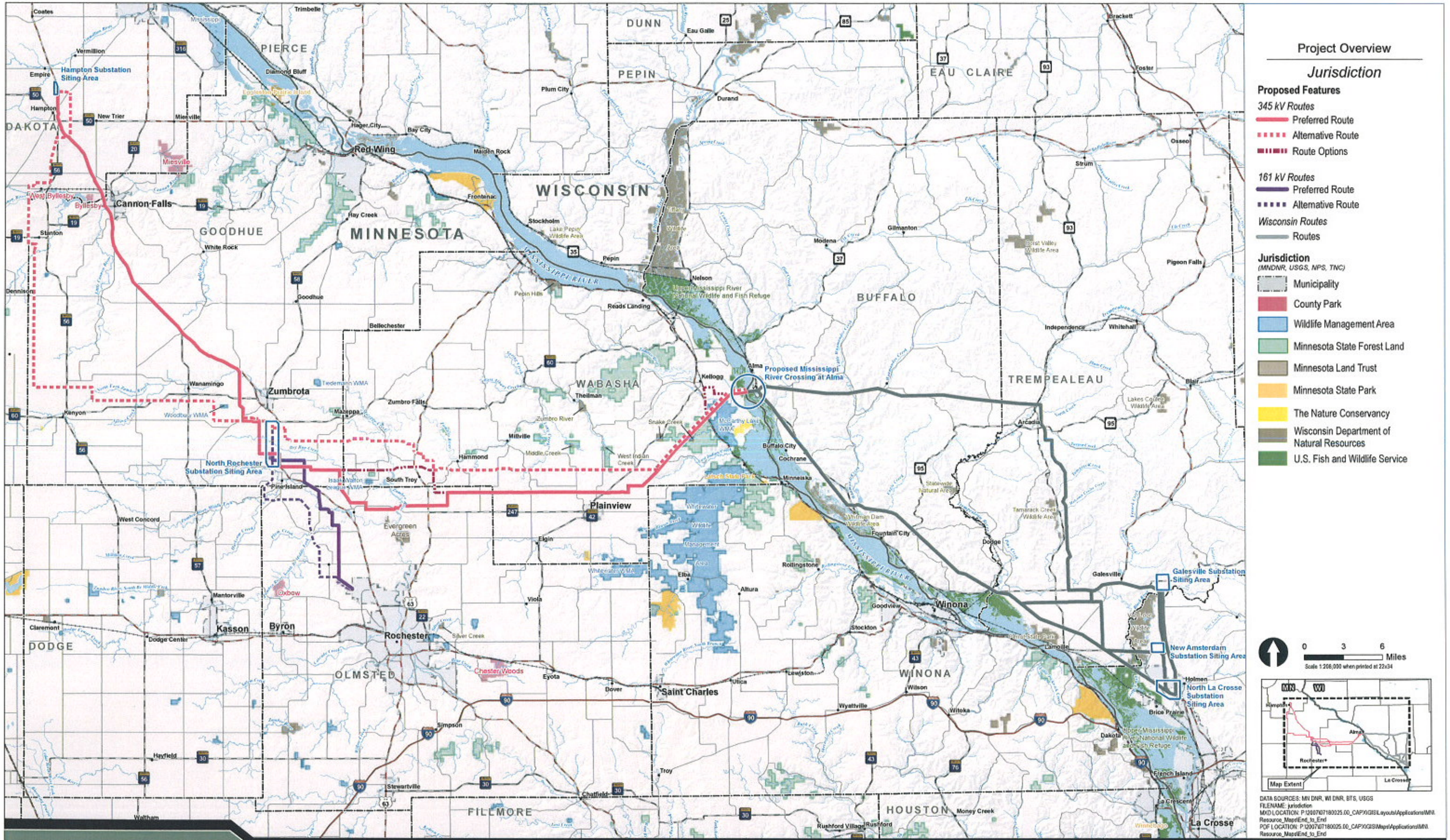
216B.2421, subd. 2(2). On May 22, 2009, the Minnesota Public Utilities Commission (Commission) granted CONs for three 345 kV transmission line projects in Minnesota. Order Granting Certificates of Need with Conditions, *In the Matter of the Application of Great River Energy, Northern States Power Company (d/b/a Xcel Energy) and others for Certificates of Need for the Cap X 345 kV Transmission Projects*, Docket No. ET-2, E-002, et al./CN-06-1115, May 22, 2009, as modified (August 10, 2009) (CON Order) (Appendix B).

The CON Order approved the need for the Hampton–Rochester–La Crosse 345 kV transmission line, the North Rochester-Northern Hills 161 kV transmission line, and a 161 kV transmission line from the proposed North Rochester Substation to the Chester Substation. The 161 kV line from the North Rochester Substation to the Chester Substation is not part of this Route Permit Application. Routing for that system element will be permitted separately. The in-service date for this line is 2015. Commission proceedings, Findings of Fact, and the order granting the CON can be found in Appendix B.

The Commission found that the three identified 345 kV projects are needed to address three needs; to improve regional reliability of the transmission system, to improve community reliability of the transmission system in specified communities, and to increase generation outlet. The Commission specifically determined that both the Rochester and Winona/La Crosse areas are facing electric reliability issues due to increasing growth in the demand for power and that, without transmission system improvements, these communities and the surrounding rural areas are at risk for loss of service under certain critical contingencies. The Commission concluded that the proposed 345 kV and 161 kV transmission lines are needed to maintain community reliability, to improve regional reliability, and to provide generation outlet capacity in southeastern Minnesota. Further, the Commission Order requires the 345 kV transmission lines be constructed on poles capable of carrying a second 345 kV circuit in the future.

1.5 Route Permit Required

The Power Plant Siting Act (PPSA) provides that no person may construct a high-voltage transmission line without a Route Permit from the Commission (Minn. Stat. § 216E.03, subd. 2). The definition of a high-voltage transmission line under the PPSA is broader than the definition of a high-voltage transmission line under the CON statutes. Under the PPSA, a high-voltage transmission line includes a transmission line of 100 kV or more and greater than 1,500 feet in length (Minn. Stat. § 216E.01, subd. 4). The proposed 345 kV and 161 kV transmission lines are high-voltage transmission lines; therefore, a Route Permit is required prior to construction.



CapX2020

Hampton • Rochester • La Crosse 345 kV Transmission Project

Jurisdiction Project Overview
MN Route Permit Application

1.0-1: Project Overview

CapX2020

Hampton • Rochester • La Crosse 345 kV Transmission Project

Utilities Project Overview
MN Route Permit Application

2.0 Project Information

2.1 Project Proposal

The Applicant is proposing to construct the following new facilities in Minnesota and Wisconsin as part of the Project:

- A new double-circuit capable 345 kV transmission line from the Hampton Substation[3] near Hampton, Minnesota (southeast of the Twin Cities), to a proposed North Rochester Substation between Zumbrota and Pine Island, Minnesota, to the La Crosse area. The 345 kV transmission lines would be constructed primarily with single-pole, self-weathering steel structures. The structures would be "double-circuit capable", which means that a second 345 kV circuit could be placed on the poles if warranted. The height of the structures would range from 130 to 175 feet, and spans between structures are expected to range from 700 to 1,000 feet depending on site-specific considerations. The typical right-of-way (ROW) for the 345 kV transmission line would be 150 feet in width. There may be limited circumstances where specialty structures would be used that are taller and require additional ROW. One of the areas that may require taller structures and/or a wider ROW is at the Mississippi River crossing.
- A new 161 kV transmission line between the proposed North Rochester Substation, located between Zumbrota and Pine Island, Minnesota, and the existing Northern Hills Substation, located in northwest Rochester, Minnesota. The 161 kV transmission line would be constructed with steel single-pole structures. The height of the structures would range from 70 to 105 feet and spans are expected to range from 400 to 700 feet. The ROW for the 161 kV facilities would be 80 feet in width.

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3 The Hampton Substation is being permitted and constructed as part of the CapX2020 Brookings County–Hampton 345 kV Project , and will include a graded and fenced area of approximately 4 acres. A Route Permit for the Brookings Project was filed on December 29, 2008 (*In the Matter of the Route Permit Application for a 345 kV Transmission Line from Brookings County, South Dakota to Hampton, Minnesota*, Docket No. ET2/TL-08-1474). Each project independently triggers the need for the Hampton Substation. The first 345 kV line to connect to Hampton will require construction of a substation with three 345 kV breakers, associated line terminal equipment and controls. The second 345 kV line to connect requires the addition of a single 345 kV breaker, associated line terminal and controls. The Brookings – Hampton Project is presumed to be the first to connect to the Hampton Substation, and therefore, all costs for the Hampton Substation are represented in the Brookings County Hampton Route Permit Application. If the Hampton – Rochester – La Crosse project schedule advances ahead of the Brookings Project, the La Crosse Project will be responsible for construction. Under the most likely scenario, the entire substation would be constructed in one operation to avoid the additional costs associated with remobilization of construction forces.

- Construction of and modification to associated facilities[4] including:
  - Construction of a new North Rochester Substation in the area between Zumbrota and Pine Island.
  - Modifications to the Hampton Substation. Equipment at the Hampton Substation to accommodate connection of the proposed 345 kV transmission line is being provided and permitted by the CapX2020 Brookings Project.
  - Improvements at the existing Northern Hills Substation to accommodate the Northern Hills–North Rochester 161 kV transmission line. These improvements would include an expansion of the existing graded yard by approximately 30 feet and the addition of 161 kV equipment, including one circuit breaker, associated line termination switches and associated controls.
  - Construction of a new substation in the area of La Crosse, Wisconsin (likely near Holmen or Galesville), and/or modification of the existing North La Crosse Substation.

For the purpose of this Application, the Minnesota portion of the proposed 345 kV transmission line is discussed in two distinct Project sections, which are based on geography: the Hampton–North Rochester 345 kV section, and the North Rochester–Mississippi River 345 kV section. These Project sections are shown on Figure 2.1-1. Details of the Hampton-North Rochester 345 kV section are described in Chapter 7.0 and the details of the of the North Rochester-Mississippi River 345 kV section are described in Chapter 8.0. The potential impacts associated with the 161 kV transmission line are analyzed in Chapter 9.0. Chapter 10.0 of this Application provides an analysis of the proposed North Rochester Substation and the expansion of the existing Northern Hills Substation.

For the purposes of this Application, a “route” is defined as the location of a transmission line between two end points. Minnesota rules and statutes require under the Full Permitting Process that an Applicant propose at least two routes and to state a preference for one of the routes in a Route Permit for a high-voltage transmission line (Minn. Stat. § 216E.03, subd. 3; Minn. R. 7850.1900, Subp. 2(C)). The Applicant developed one Preferred 345 kV Route and one Alternative 345 kV Route for the proposed 345 kV transmission line. The Applicant also identified two shorter Route Options for the proposed 345 kV line, one at the Zumbro River crossing and one by McCarthy Lake Wildlife Management Area, for the Commission’s consideration. For the 161 kV transmission line, Xcel Energy also developed one Preferred 161 kV Route and one Alternative 161 kV Route. These routes, along with the proposed Mississippi River crossing at Alma, are all identified in Figure 2.1-1. All routes would follow existing ROW and property lines where possible, and are described in more detail in Chapters 5.0 and 6.0.

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4 The associated facilities are the same for any combination of Preferred or Alternative Routes (Figure 1.0-2). Substations and system connections are described in detail in Chapter 3.2. Potential environmental impacts anticipated with associated facilities are discussed in Chapter 9.

2.2 Project Location

The Minnesota portion of the Project is located in Dakota, Goodhue, Olmsted, and Wabasha counties. Figure 1.0-1 shows a general overview of the Project location, and Figure 1.0-2 shows existing transmission lines in the Project area.

In compliance with the requirement of Minn. Stat. § 216E.03, subd. 3a, the Applicant notified local government units (LGUs), by letters dated September 12, 2008, which stated that Xcel Energy intended to apply for a Route Permit for the Project from the Commission. An exemplar letter and affidavit of mailing, and list of the LGUs that were sent the letter is included in Appendices C-2 and C-3.

Counties and townships potentially affected by the Project are listed in Table 2.2-1.

Table 2.2-1:
Affected Counties and Townships

County	Civil Township	Town and Range	Sections
Dakota	Vermillion	T114N, R18W	32, 33, 34
	Hampton	T113N, R18W	3, 4, 5, 8, 9, 10, 15, 16, 17, 20, 21, 22, 27, 28, 29, 32, 35
	Sciota	T112N, R19W	1, 12, 13, 24, 25
	Randolph	T112N, R18W	1, 2, 5, 6, 7,12, 18
Rice	Northfield	T112N, R19W	36
Goodhue	Stanton	T112N, R18W	13, 18, 19, 30, 31
	Cannon Falls	T112N, R17W	18, 19, 30, 31
	Warsaw	T111N, R18W	6, 7, 18, 19, 30, 31
	Leon	T111N, R17W	5, 6, 8, 17, 16, 21, 22, 26, 27, 35, 36
	Holden	T110N, R18W	6, 7, 18, 19, 25, 26, 27, 28, 29, 30, 35, 36
	Wanamingo	T110N, R17W	31, 32, 33, 34, 35, 36
	Minneda	T110N, R16W	6, 7, 8, 15, 16, 17, 22, 23, 26, 27, 31, 32, 33, 34
	Roscoe	T109N, R 16W	1, 2, 3, 4, 5, 8, 9, 10, 11, 12,13, 24, 36
	Pine Island	T109N, R15W	6, 7, 8,13, 14, 15, 16,17, 18, 19, 20, 21, 22, 25, 26, 27, 28, 29, 30, 31, 32, 33,34, 36
Olmsted	New Haven	T108 N, R 15W	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 15, 22, 23, 24, 25, 26, 27, 35, 36
	Oronoco	T108N, R14W	6, 7, 8, 9, 10, 11, 12, 18, 19, 30, 31
	Farmington	T108N, R13W	1, 2, 3, 4, 5, 7, 8, 9,
	Kalmar	T107 N, R15W	1, 2, 11, 12
	Cascade	T107N, R14W	6, 7, 8, 17, 18

Table 2.2-1:
Affected Counties and Townships

County	Civil Township	Town and Range	Sections
Wabasha	Mazeppa	T109N, R14W	15, 16, 17, 18, 27, 28, 29, 30
	Zumbro	T109N, R14W	13, 14, 15, 24, 25, 26, 27
	Zumbro	T109N, R13W	19, 20, 25, 26, 27, 28, 29, 30, 31, 32
	Oakwood	T109N, R12W	25, 26, 27, 28, 29, 30
	Elgin	T108N, R12W	1, 2, 3, 4, 5, 6
	Plainview	T108N, R11W	1, 2, 3, 4, 5, 6
	Highland	T109N, R11W	25, 26, 27, 28, 29, 30, 34, 35, 36
	Watopa	T109N, R10W	1, 2, 3, 9, 10, 11, 15, 16, 17, 19, 20, 21, 29, 30, 31
	Greenfield	T110N, R10W	25, 26, 27, 34, 35, 36
	Greenfield	T110N, R9W	29, 30, 31, 32

2.3 Route Width and Alignments

2.3.1 Route Width

The PPSA, Minn. Stat. § 216E, directs the Commission to locate transmission lines in a manner that "minimize[s] adverse human and environmental impact while ensuring continuing electric power system reliability and integrity and ensuring that electric energy needs are met and fulfilled in an orderly and timely fashion" (Minn. Stat. § 216E.02, subd. 1). The PPSA further authorizes the Commission to meet its siting responsibility by designating a "route" for a new transmission line when it issues a Route Permit. The route may have "a variable width of up to 1.25 miles," within which the ROW for the facilities can be located (Minn. Stat. § 216E.01, subd. 8). At the same time, a "route" designation cannot be so wide that it is unclear where the intended general alignment of the transmission line is meant to be located.

The purpose of the route permitting process is not to establish exact structure locations for a transmission line, but rather to establish a route that best balances competing land use, human settlement, and environmental interests. Once a route is selected by the Commission, the utility would prepare preliminary engineering plans and contact landowners to gather additional detailed information about the circumstances of their property. Only after considering all inputs would the utility establish an exact centerline and pole placement. A "route" designation by the Commission should be wide enough to provide flexibility for the utility to work with landowners to adjust final design. Once the utility establishes an alignment and structure placement, construction drawings would be provided to the Commission to confirm that the utility's plans are consistent with the Route Permit.

The Preferred Route for the Project's 345 kV transmission line is 1,000 feet wide for the majority of its length, but has been widened in certain locations along U.S. Highway 52 (US-52) to provide for consideration of routing other than directly adjacent to the highway ROW. First, the route has been widened in locations where the Minnesota Department of Transportation (Mn/DOT) is considering building new highway infrastructure such as interchanges. The Applicant identified potential new interchanges through coordination with Mn/DOT and by review of Mn/DOT planning documents, including the *Highway 52 Interregional Corridor Management Plan* (Mn/DOT 2002, Appendix D). Second, the route has been widened north of Cannon Falls and east of the highway for approximately 1 mile where Farmland Natural Areas Program (FNAP) easements exist adjacent to the preferred side of the highway. FNAP easements are conservation easements granted in favor of Dakota County and the U.S. Department of Agriculture (USDA) and generally prohibit the placement of transmission poles within the easement. The Applicant is working with Dakota County to identify an appropriate alignment. A list of specific locations where the route is greater than 1,000 feet wide is provided in Chapter 6.2.1.1.

The Preferred and Alternative 161 kV Routes for the proposed North Rochester–Northern Hills 161 kV transmission line are both approximately 1,000 feet wide and begin at the proposed North Rochester Substation siting area and terminate at the existing Northern Hills Substation. A detailed description of the Preferred and Alternative 161 kV Routes is provided in Chapter 6.3.1 and 6.3.2.

2.3.2 Alignments

In developing the proposed routes, the Applicant analyzed the statutory and rule factors set forth in the PPSA (Minn. Stat. § 216E, and Minn. R. ch. 7850). The routes studied were 1,000-foot corridors deemed compatible for transmission line routing. As route options were identified, the Applicant refined its routing study and calculated impacts based on various potential alignments within the 1,000-foot routes.

2.3.3 Minnesota Non-Proliferation Policy

The PPSA directs the Commission to locate transmission lines in a manner that "minimize[s] adverse human and environmental impact while ensuring continuing electric power system reliability and integrity and ensuring that electric energy needs are met and fulfilled in an orderly and timely fashion" (Minn. Stat. § 216E.02, subd.1). In furtherance of this objective, the PPSA and the Commission's implementing routing rules call upon the Commission to consider the utilization of existing railroad and highway ROWs, including interstate ROWs, as well as any existing transmission corridors in selecting transmission line routes (*People for Environmental Enlightenment & Responsibility [PEER], Inc. v. Minnesota Environmental Quality Council, 266 N.W.2d 858 (Minn. 1978*)).

This policy of non-proliferation creates a preference for placing new power lines near existing infrastructure corridors to minimize the proliferation of new corridors. See *PEER, 266 N.W.2d 868*, which holds that a routing authority must "choose a pre-existing route unless there are extremely strong reasons not to do so." In accordance with this policy, the Commission must evaluate "potential routes that will use or parallel existing railroad and highway ROWs" (Minn. Stat. § 216E.03, subd. 7(b); *accord* Minn. R. 7850.4100 (requiring consideration of "use or paralleling of existing ROWs")).

2.3.4 Minnesota Routing Process, Role of Other State Agencies

The PPSA requires all state agencies authorized to issue permits for the construction of a high-voltage transmission line to participate in routing proceedings and to identify whether the site or route being considered for designation or permit and other design matters under consideration for approval would be in compliance with such agencies' standards, rules, or policies (Minn. Stat. § 216E.10, subd. 3(a)). This statutory provision implements an important public policy of ensuring that permitting concerns are addressed in a timely fashion and that stakeholders, including landowners, have a single forum in which they may question or comment on proposals and issues. Bringing all state permitting authorities into a single forum also minimizes the potential for conflicting or inconsistent outcomes, because once the Commission issues a Route Permit, that permit is binding on other state agencies: "To assure the paramount and controlling effect of the provisions herein over other state agencies…the issuance of a site permit or route permit…shall be the sole site or route approval required to be obtained by the utility" (Minn. Stat. § 216E.10, subd. 1).

2.4 Project Schedule

Construction for the Project, if approved, is expected to begin in the third quarter of 2011. The Applicant anticipates a second quarter 2015 in-service date for the proposed 345 kV transmission line and a fourth quarter 2012 in-service date for the proposed 161 kV transmission line. An expected permitting and construction schedule summary, with anticipated end dates, follows:

Minnesota Certificate of Need.....Completed May 22, 2009
Minnesota Route Permit.....Spring 2011
Wisconsin Certificate of Public Convenience and Necessity ..... Summer 2011
Federal Environmental Impact Statement[5].....Spring 2011
Pre-Construction Activities..... First Quarter 2011 to Third Quarter 2011
Construction .....Fourth Quarter 2011 to Second Quarter 2015
Project Completion..... Second Quarter 2015

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

2.5 Project Costs

The Project will cost $229 million to $253 million (in 2009 dollars), depending on the route selected, as summarized in Tables 2.5-1, 2.5-2, and 2.5-3.

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5 The Project will require development of an Environmental Impact Statement in compliance with the National Environmental Policy Act (NEPA). The NEPA process and other Project permitting requirements are discussed in Chapter 11.

Table 2.5-1:
Estimated Construction Costs, 345 kV Transmission Line

345 kV Route Section	Total Cost Preferred Route (millions)	Total Cost Alternative Route (millions)
Hampton–North Rochester	$88	$101
North Rochester -Mississippi River	$106	$101
END-TO-END ROUTE	$194	$202

Table 2.5-2:
Estimated Construction Costs[a], 161 kV Transmission Line

	Total Cost Preferred Route (millions)	Total Cost Alternative Route – North Substation (millions)
161 kV Route Section	$16	$17

[a] Transmission line costs include materials, engineering, survey, and ROW costs.

Table 2.5-3:
Minnesota Substation Modification and Construction Cost Estimate[b]

Substation	Status	Total Cost (millions)
Hampton	The Hampton Substation is being permitted and constructed under the Brookings County - Hampton Project	$0
North Rochester	New Substation	$22
Northern Hills	Modified Existing Substation	$2

[b] Substation costs include materials, engineering, survey, and ROW costs.

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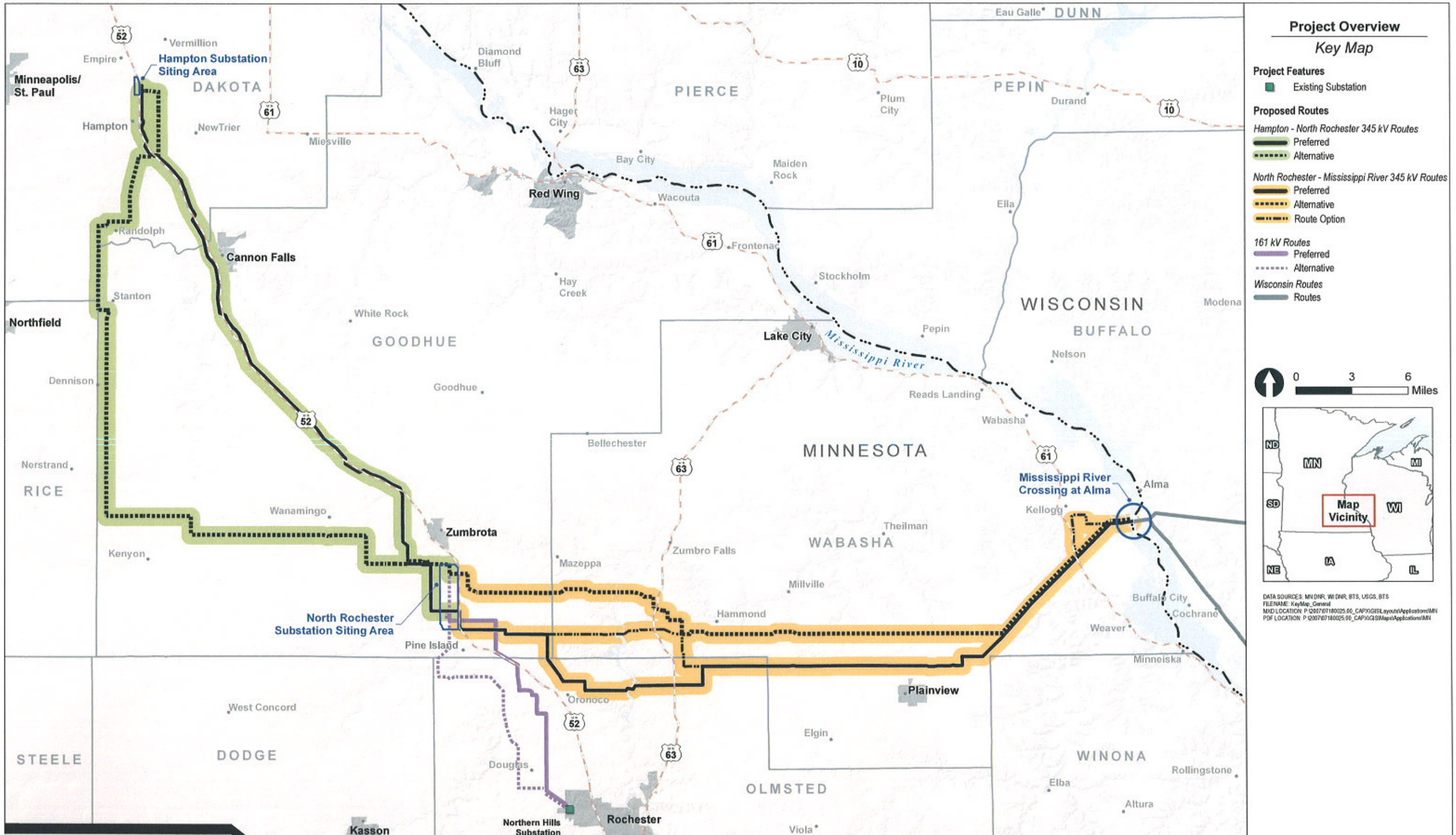

CapX2020

Hampton • Rochester • La Crosse 345 kV Transmission Project

Xcel Energy • Dairyland Power Cooperative • Rochester Public Utilities • WPPI Energy • Southern Minnesota Municipal Power Agency

Key Map Project Overview
MN Route Permit Application

3.0 Engineering, Design, Construction, and Operational Characteristics

This chapter describes the structure design and operational characteristics of the proposed transmission line and substation facilities, including noise and electric and magnetic fields (EMF). Information regarding the Applicant's acquisition procedures for obtaining the required ROW for the proposed facilities also is provided.

3.1 Transmission Structure Engineering, Design and Right-of-Way Requirements

The design of transmission lines is founded on engineering principles applying well-established industry practices to location-specific sites. The design must consider the engineering objectives, topography, land use, and other environmental factors. It is typical for design of the transmission line to vary along the length of the line to meet site-specific or segment-specific needs. Transmission lines also are part of wider, regional, electric power delivery networks. As such, they need to be integrated and compatible with the larger interconnected electrical network. To accomplish consistency and efficiency goals, the CapX2020 utilities developed CapX2020-specific design criteria that will be applied to this Project. The Project would maximize energy efficiencies by reducing system losses and minimize adverse environmental effects through structure placement and design. Project structures and substation locations would be designed to accommodate a future second 345 kV circuit on the 345 kV poles and at substation locations.

A high-voltage transmission circuit consists of three phases, each at the end of a separate insulator string, all physically supported by structures. Each phase consists of one or more electrical conductors, which are metal cables consisting of multiple strands of steel and aluminum wire wound together. When more than one conductor is used to make up a phase, the term "bundled" conductors is used. Shield wires are strung above the electrical phases to prevent damage from lightning strikes. The shield cable also can include fiber optic cable, which provides a communication path between substations for transmission line protection equipment.

The Applicant will design the 345 kV transmission line to have a minimum ground clearance of 34 feet. The 161 kV line will be designed with a minimum 26-foot ground clearance.

Transmission line structures can be designed to carry a single circuit or multiple circuits using several different types of structures. Structures typically used for transmission lines include single-shaft tubular steel pole structures, and multi-pole tubular specialty structures. The width of the linear ROW depends primarily upon structure design, span length and the electrical safety requirements associated with the voltage of the line. Table 3.1-1 provides a summary of structure designs currently anticipated for the Project. Additional details are provided in the text below.

Table 3.1-1:
Structure Design Summary

Line Type (Design Configuration)	Initial Configuration	Structure Type	Structure Material	ROW Width (feet)[c]	Structure Height (feet)[c]	Structure Base Diameter (inches)[c]	Foundation Diameter (feet)[c]	Span Between Structures (feet)[c]
345 kV/345 kV Double-Circuit	345 kV circuit operational	Single Pole Davit Arm	Steel	150	130–175	36–48 (tangent structures) 48–72 (angle structures)	6–12	700–1,000
	345 kV circuit operational/ 161 kV circuit operational	Single Pole Davit Arm	Steel	150	130–175	36–48 (tangent structures) 48–72 (angle structures)	6–12	700–1,000
345 kV/345 kV Double-Circuit w/69 kV Underbuild	345 kV circuit and 69 kV underbuild circuit operational	Single Pole Davit Arm	Steel	150	135-185	40–52 (tangent structures) 48–84 (angle structures	6-12	500-1,000
161 kV Single Circuit	161 kV circuit operational	Single Pole Davit Arm	Steel	80	70-105	24–36 (tangent structures) 32–64 (angle structures)	4-9	400-700

[c] Typical range for specified line type.

3.1.1 Hampton–Rochester–La Crosse 345 kV Transmission Line

For the Project's proposed 345 kV line, the Applicant proposes primarily to use single-pole, self-weathering steel, double-circuit capable structures. Self-weathering steel alloys were developed to eliminate the need for painting and are commonly used by the Applicant and throughout the industry. The steel alloy develops a stable, rust-like appearance (dark reddish-brown color) when exposed to the weather for several years. The wetting and drying cycles cause rust to form a protective layer on its surface, preventing further rusting. The layer develops and regenerates continuously when subjected to the influence of the weather.

These single-pole steel structures would range from 130 to 175 feet in height. Spans could range from 600 to 1,000 feet, but would typically be 700 to 1,000 feet. In some areas, only one circuit would be strung and the other side of the pole would be available for adding a second circuit in the future, when conditions warrant. In other areas, the unused side of the 345/345 kV structure would be used to carry a lower voltage line on the second set of arms until a second 345 kV circuit is needed. Tubular steel pole structures are typically placed on large pier foundations of cast-in-place, reinforced concrete.

Two 954 Aluminum Conductor Steel Supported (ACSS) conductors will be used per phase. One or two shield wires will be used to protect the conductors from lightning strikes. One of these shield wires will incorporate fiber optic to facilitate relay control communications between substations and between substations, utility offices such as control centers. Fiber optics will be used only for utility purposes.

Figure 3.1-1 depicts a representative double-circuit 345 kV single pole structure.

The Mississippi River presents unique considerations that will require the use of multiple-circuit, specialty structures. A portion of this crossing is on Upper Mississippi River Wildlife Refuge lands managed by the USFWS. A Special Use Permit will be required to cross the Refuge and the Applicant will work closely with the USFWS to identify the most appropriate structure design.

An existing double-circuit transmission line crosses the Mississippi River and Refuge at the Project's proposed crossing location. The existing line crosses approximately 0.5 mile of Refuge lands and includes two structures on Refuge property. The line is constructed on a 180-foot-wide permitted ROW. An area approximately 125 feet wide and 1,900 feet long is maintained cleared of trees. The two main river crossing structures are 180 feet tall.

Figure 3.1-1: Representative 345 kV Double-Circuit Single-Pole Structure (Self-Weathering)

Several possible designs for the proposed river crossing are described in detail in Appendix E. The design options demonstrate tradeoffs between structure height and easement width while maintaining only three structures on Refuge lands.

- Option A: A design that stays within the existing 125-foot tree clearing results in main channel crossing structures of 275 feet in height. The Federal Aviation Administration (FAA) requires lighting of poles exceeding 200 feet above ground level, and may also require poles to be painted alternating red and white.
- Option B: The shortest possible pole design keeps the main channel crossing structures less than 200 feet. This avoids FAA lighting requirements and keeps all the conductors in one plane, but requires a 280-foot cleared ROW.
- Options C and D: A combination of options A and B keeps main channel crossing structures of less than 200 feet while using narrower structures elsewhere to minimize the need for additional ROW and tree clearing on Refuge lands.

The Applicant also evaluated underground construction of two 345 kV circuits at the Mississippi River Crossing but believes it is not a prudent alternative. Underground construction requires a wide ROW and adds approximately $90 million to the Project cost to underground a 1.3-mile length, has environmental impacts of its own and does not eliminate the existing overhead transmission line. On balance, the Applicants conclude there are not benefits that justify a $90 million additional expenditure. More information regarding the underground assessment, including environmental impacts, can be found in Appendix E.

The Applicant also is proposing multiple-circuit structures in two other areas: on the Preferred Route for the Hampton–North Rochester 345 kV section along US-52 between Cannon Falls and Zumbrota, and on the Preferred Route for the North Rochester–Mississippi River 345 kV section near Plainview. The proposed triple-circuit structures would hold one 345 kV circuit, provide a location for a future 345 kV circuit, and carry an existing 69 kV circuit (underbuild). These structures would range in height from 135 to 185 feet and have spans of approximately 500 to 1,000 feet. The triple-circuit structures may require an additional pole mid-span to support the 69 kV circuit.

Figure 3.1-2 illustrates a representative double-circuit 345/345 kV structure with 69 kV underbuild.

The Project may also require the use of specialty structures including H-frame and other types of multiple pole structures in certain circumstances to solve site-specific construction issues or address environmental constraints. For example, H-frame structures are sometimes required in areas with poor soil conditions; near environmentally sensitive areas, including areas with significant bird activity; river crossings; or other areas requiring long spans. H-frame structures consist of two steel poles with cross bracing. Two-pole structures may also be required when the alignment turns at a 45- to 90-degree angle to reduce foundation size and aid constructability.

The foundations are proposed to be poured concrete and would typically be 6 to 12 feet in diameter. In sensitive environmental areas, an alternative design may be used to minimize impacts. For example, a lower-impact vibratory caisson may be used in wetland areas to limit ground disturbance.

The typical ROW width required for a 345 kV transmission line is 150 feet, except in special circumstances such as crossing the Refuge. Across the Refuge, the ROW may be wider to accommodate certain structure designs that may be required by the USFWS. The Applicant would locate the structures as close to property lines and roads as practical. An illustration of the 345/345 kV double-circuit single-pole structure and associated ROW is shown in Figure 3.1-3.

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

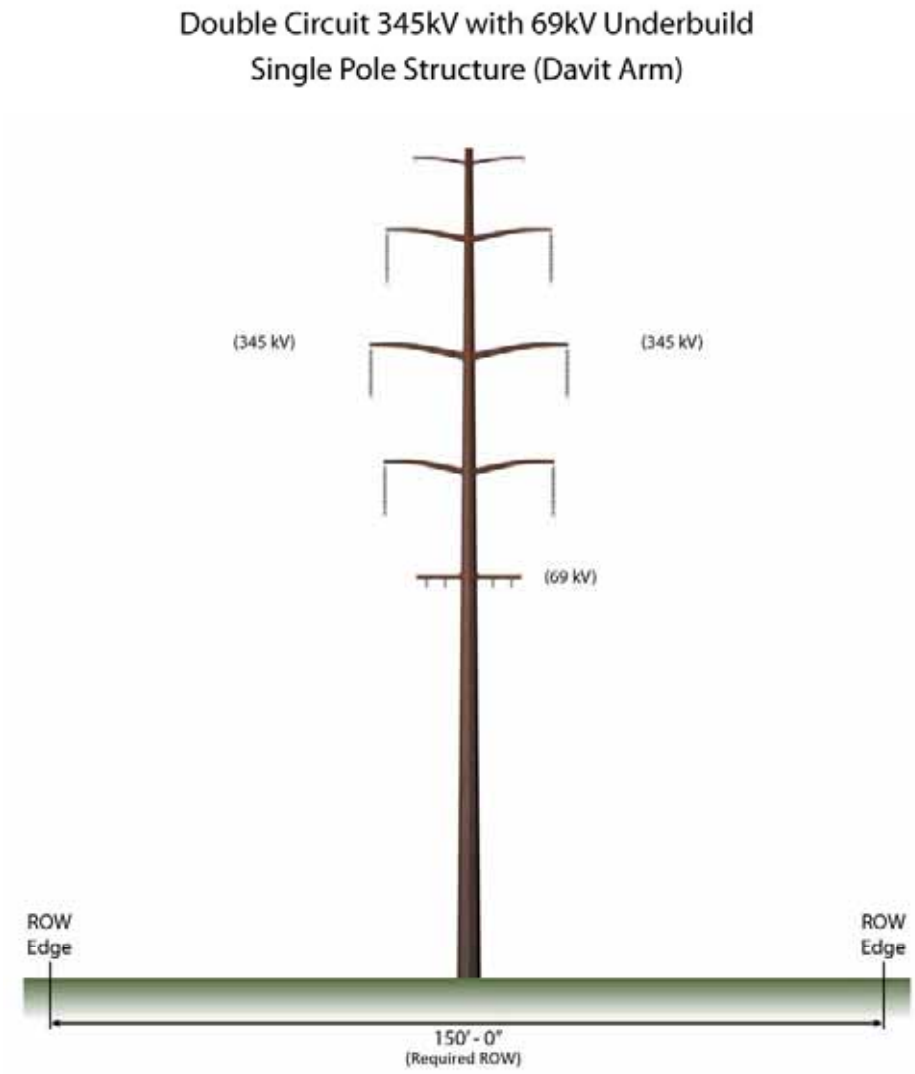

Figure 3.1-2: Representative Double-Circuit 345/345 kV Structure with 69 kV Underbuild

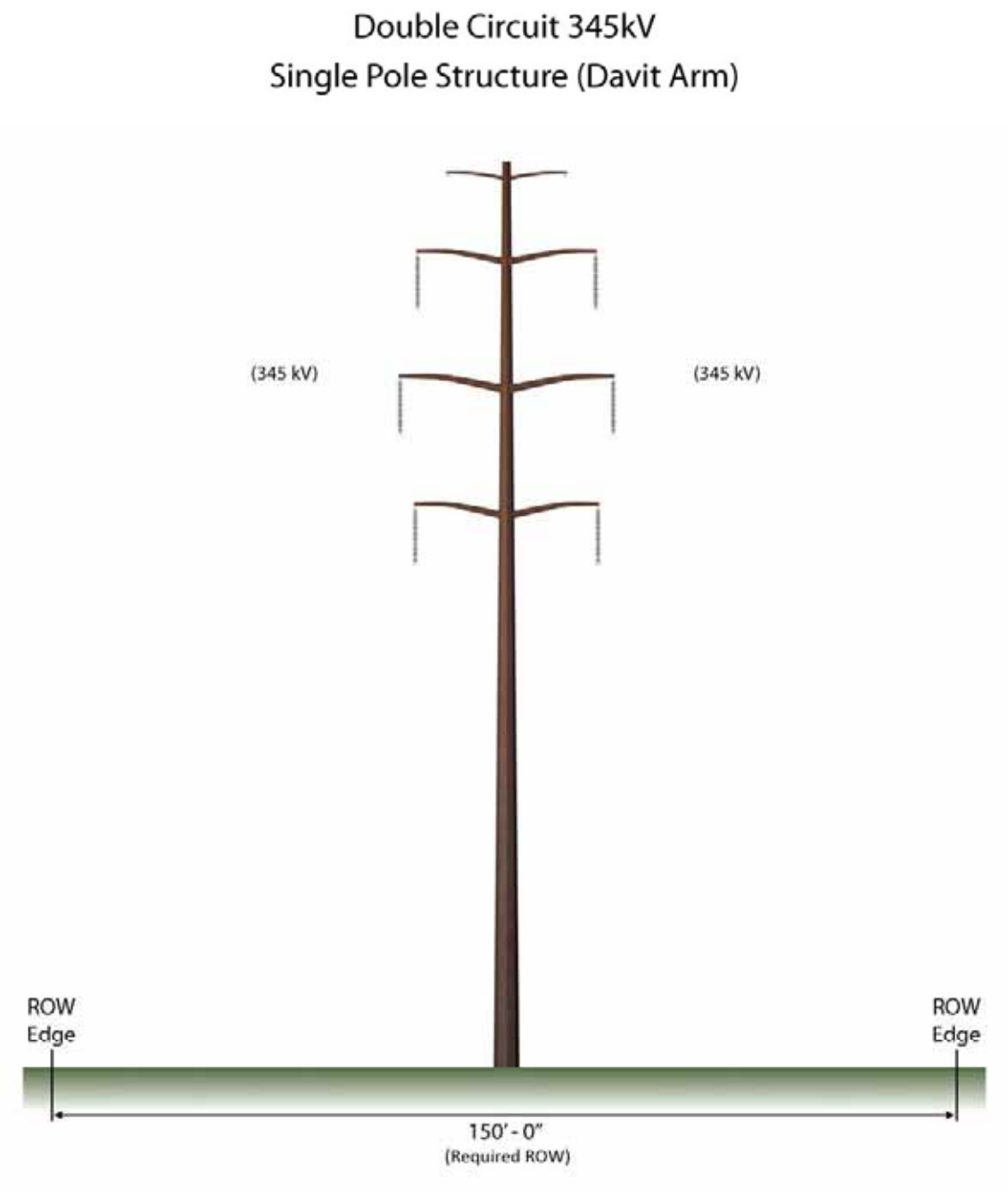

Figure 3.1-3: Representative Double-Circuit 345 kV Single-Pole Structure (Davit Arm)

The arms on the pole would be approximately 85 feet aboveground, depending on span length, and extend approximately 18 feet from the center of the pole. In each instance of ROW sharing, the Applicant would acquire the necessary approvals from the ROW owner (e.g., railroad company for railways), or the agency overseeing use of a particular ROW (e.g., Mn/DOT for state trunk highways, including U.S. highways and interstates).

3.1.2 Northern Hills–North Rochester 161 kV Transmission Line

The Applicant proposes to use single-pole, self-weathering steel, single-circuit structures for the North Rochester–Northern Hills 161 kV transmission line. These structures are typically 70 to 105 feet tall and would be spaced approximately 400 to 700 feet apart. Each phase of the 161 kV transmission line would consist of a single conductor using 795 ACSS cable or a conductor of comparable capacity. One or two shield wires will be used to protect the conductors from lightning strikes. One of these shield wires will incorporate fiber optic to facilitate relay control communications between substations and between substations, utility offices such as control centers. Fiber optics will be used only for utility purposes.

The typical ROW required for the 161 kV transmission line is 80 feet, with less required from private landowners, depending on the amount of sharing possible with existing ROWs.

An illustration of a typical single-circuit 161 kV structure with ROW is shown in Figure 3.1-4.

The proposed transmission lines would be designed to meet or surpass all applicable local and state codes, National Electric Safety Code (NESC), North American Electric Reliability Corporation (NERC) requirements, and the Applicant's standards. Appropriate standards would be adhered to for construction and installation and all applicable safety procedures would be followed during and after installation.

3.2 Substation Design

3.2.1 Hampton Substation (to be constructed as part of Brookings County-Hampton 345 kV Project)

The proposed Project would require modifications to the Hampton Substation near Hampton, Minnesota, to accommodate connection of the proposed 345 kV transmission line. Construction of the Hampton Substation is proposed as part of the Brookings County-Hampton Project, Commission Docket No. ET/LTI-08-1474. The CapX2020 Utilities will require approximately 4 acres of fenced area for construction of the substation; however, they will acquire approximately 40 acres to provide adequate buffer and to allow for transmission line to connect to the substation. The CapX2020 Utilities have identified two substation siting areas; Hampton Substation North and Hampton Substation South. The routes proposed in this Application all terminate in the Hampton Substation siting area. Both the Preferred and Alternative Routes can access either substation siting area. For routes to the Hampton Substation North site, the Preferred and Alternative Routes share less than 0.5 mile of common route along US-52.

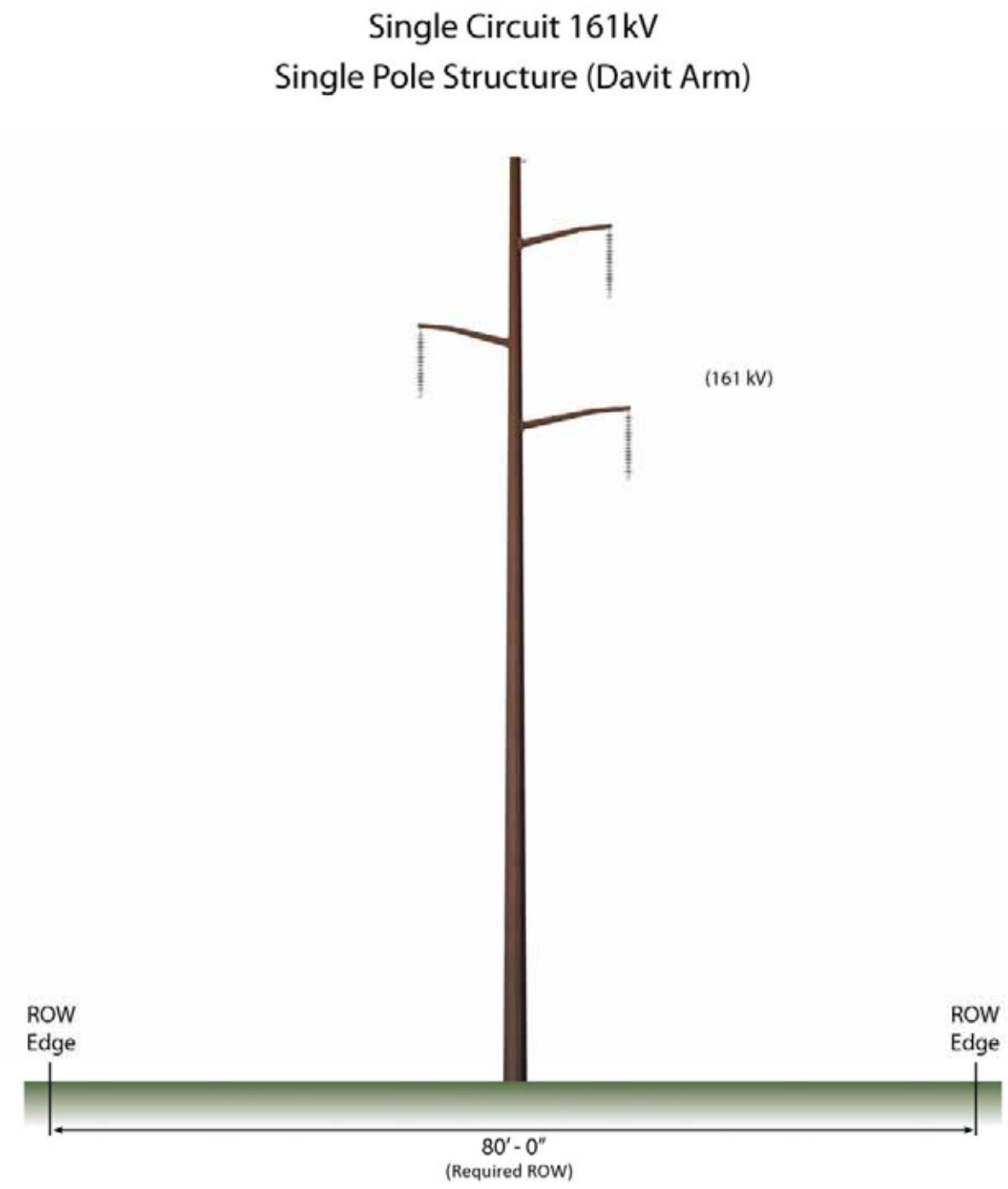

Figure 3.1-4: Representative Single-Circuit 161 kV Single-Pole Structure (Davit Arm)

To accommodate connection of the 345 kV transmission line associated with this Project, equipment at Hampton Substation would include one circuit breaker, two switches and associated bus, and additional relaying in the control building. No additional grading or expansion of the substation footprint would be required.

The modifications that would be required at the Hampton Substation for the proposed Project are shown in Appendix F.

3.2.2 North Rochester Substation

The Project would include construction of a new North Rochester Substation located in the area between Zumbrota and Pine Island, Minnesota. Approximately 8 acres of fenced area will be required for the substation construction; however, the CapX2020 Utilities will acquire approximately 40 acres to provide adequate buffer and to allow for transmission lines to connect to the substation. The new substation would include six 345 kV circuit breakers, a 345 kV/161 kV transformer, three 161 kV circuit breakers, a control house and associated line termination structures, switches, buswork, controls, and associated equipment. The substation siting area for the proposed North Rochester Substation would accommodate the Preferred or the Alternative Routes.

Detailed plans for the proposed North Rochester Substation would be dependent on the final route selection and final substation site location. The North Rochester Substation siting area is shown on Figures 1.0-1 and 1.0-2. Appendix F shows preliminary plans for the North Rochester Substation.

3.2.3 Northern Hills Substation

The Project would require an approximately 0.5 acre expansion of the graded and fenced area of the Northern Hills Substation to accommodate the new 161 kV transmission line and related equipment (Appendix F). No additional property would be required to construct the expansion. Improvements would include an expansion of the existing graded area by approximately 30 feet and the addition of 161 kV equipment, including one circuit breaker and associated line termination switches and controls. Construction would include the associated line switches, foundations, steel structures, and control panels.

The substations and system connections are shown in Appendix F.

3.2.4 La Crosse Area End Point Substation

The Project would terminate at a new 345/161 kV substation to be located in the vicinity of La Crosse, Wisconsin. Termination options include the existing North La Crosse Substation, or a new substation near Holmen or Galesville, Wisconsin. The exact location of this substation would be determined in the Wisconsin Certificate of Public Convenience and Necessity (CPCN) proceedings administered by the PSCW.

3.3 Design Options to Accommodate Future Expansion

The Applicant's double-circuit-compatible configuration for the 345 kV line would allow for expansion within the existing ROW. A second 345 kV circuit could be added to structures if future conditions warrant without any need to expand the ROW.

Similarly, the new North Rochester Substation is being designed with sufficient space to accommodate additional transmission line connections in the future.

3.4 Right-of-Way and Land Acquisition, Construction, Restoration and Maintenance Procedures

3.4.1 Right-of-Way and Land Acquisition

3.4.1.1 Transmission Line Right-of-Way Acquisition

The transmission ROW acquisition process begins early in the detailed design process. For transmission lines, utilities typically acquire easement rights to accommodate the facilities. The evaluation and acquisition process includes title examination, initial owner contacts, survey work, document preparation and purchase. Each of these activities, particularly as applied to easements for transmission line facilities, is described in more detail below.

The first step in the ROW process is to identify all persons and entities that may have a legal interest in the real estate upon which the facilities will be built. To compile this list, a ROW agent or other persons engaged by the Applicant would complete a public records search of all land involved in the Project. A title report for each parcel would be prepared to document the legal description and the owner(s) of record for the property, and to gather information regarding easements, liens, restrictions, encumbrances and other conditions of record.

The next step is evaluation of the specific parcel. After owners are identified, and typically after a Route Permit is issued, a ROW representative would contact each property owner or the property owner's representative. The ROW agent would describe the need for the transmission facilities, how the specific Project may affect each parcel, and would seek information from the landowner about any specific construction concerns. The ROW agent may also request the owner's permission for survey crews to enter the property to conduct preliminary survey work. Permission may also be requested to take soil borings to assess soil conditions and determine appropriate foundation design. Surveys would be conducted to locate ROW corridors, natural and manmade features and associated elevations used during detailed engineering of the transmission line. The soils analysis would be performed by an experienced geotechnical testing laboratory.

During the evaluation process, the ROW agent would discuss with the landowner where the structure(s) would be located on the property as well as the boundaries of easement area required for safe operation of the line. In some instances, the proposed transmission line's location would be staked (i.e., the survey

crew would identify the proposed location of each structure or pole on the ground with a surveyor's stake).

The ROW agent would then negotiate with the property owner(s) to determine the amount of just compensation for the rights to build, operate, and maintain the transmission facilities within the easement area and reasonable access to the easement area. The agent also would provide maps of the transmission line route or site and the landowner's parcel and offer compensation for the transmission line easement. In the event that a complicated appraisal problem arises, an appraisal would be completed by the utility's representative to determine the value of the land rights being acquired. The landowner would be allowed a reasonable amount of time to consider the offer and to present any material that the owner believes is relevant to determining the property's value.

In nearly all cases, utilities are able to work with the landowners to address their concerns, and an agreement can be reached for the utility to purchase the land rights. The ROW agent would prepare all of the documents required to complete each transaction. Required documents may include easement, purchase agreement, or contract for deed.

In rare instances, if a negotiated settlement cannot be reached, the landowner may choose to have an independent third party determine the value of the land acquisition. Such valuation would be made through the utility's exercise of the right of eminent domain pursuant to Minn. Stat. § 117. The process of exercising the right of eminent domain is called condemnation.

In the event of a condemnation for a high-voltage transmission line, the utility would provide the landowner with a copy of each appraisal it has obtained for the property interests to be acquired. To start the condemnation process, a utility files a petition in the district court where the property is located and serves that petition on all owners of the property. If the court approves the petition, the court then appoints a three-person condemnation "commission." The three people appointed must be knowledgeable of applicable real estate issues. Once appointed, the commissioners schedule a viewing of the property over and across which the transmission line easement is to be located. Next, the commissioners schedule a valuation hearing where the utility and landowners can testify as to the fair market value of the easement or fee. The commission then makes an award as to the value of the property and files it with the court. The commission also can award up to $3,000 in appraisal fees (Minn. Stat. § 117.189). Each party has 40 days from the award filing to appeal to district court for a jury trial. In the event of an appeal, the jury would hear land value evidence and render a verdict. At any point in this process, the case can be dismissed if the parties reach a settlement.

Once ROW is acquired and prior to construction, the ROW agent would again contact the owner of each parcel to discuss the construction schedule and requirements. To ensure safe construction of the transmission line, special consideration may be needed for fences, crops, or livestock. For instance, fences may need to be moved or temporary or permanent gates may need to be installed and livestock may need to be moved. In each case, the ROW agent would coordinate these processes with the landowner, who would be compensated for damages including crop losses.

3.4.1.2 Substation Land Acquisition

When acquiring property for new substations or substation expansions, the Applicant would typically follow the same general steps as outlined above for the acquisition of ROW for transmission lines. The exception is that the Applicant would not acquire an easement, but would obtain the fee interest in the land for substations. The Applicant would generally seek to acquire a parcel of sufficient size to construct the fenced area of the substation and to provide a buffer between the substation and neighboring properties, as well as room for expansion.

As the regulatory review process proceeds, the Applicant's representatives would consult with the owners of the parcels suitable for substations to discuss the Project in detail prior to conducting any necessary surveys and soils investigation. The Applicant also would develop more site-specific designs. Contacts with the owners of affected properties would continue and the negotiation and acquisition phase would begin. Where possible, the Applicant would seek to obtain necessary property rights through voluntary sale.

During the acquisition phase, individual property owners would be advised of construction schedules, needed access to the site, and any vegetation clearing that would be required for the Project. The site would be cleared of the amount of vegetation necessary to construct, operate, and maintain the proposed substation. Also, any vegetation that is in the way of construction equipment may have to be removed.

Soil analysis at the substation site would be required to assist with the substation's final design. The Applicant would inform landowners at the initial survey consultation that these borings would occur. An independent geotechnical testing company would take and analyze these borings.

3.4.2 Construction Procedures

Construction of a transmission line follows the sequence of surveying the centerline, determining construction access, installing foundations, assembling and erecting the structures, installing shield wires and conductors, installing ground rods, and cleanup and site reclamation. Various phases of construction occur at different locations throughout the construction process and in some cases at the same time at different locations. Typical transmission line construction activities are depicted in Figure 3.4-1.

Figure 3.4-1: Typical Transmission Line Construction Activities

The actual construction typically follows standard construction and mitigation practices developed from experience with past projects and incorporated into the Agricultural Impacts Mitigation Plan (AIMP) approved by the Minnesota Department of Agriculture (MDA) (Appendix G). These best practices address ROW clearance, staging, erecting transmission line structures, and stringing transmission lines. Construction and mitigation practices to minimize Project impacts would be developed based on the proposed schedule for activities, permit requirements, prohibitions, maintenance guidelines, inspection procedures, terrain, established agricultural mitigation plans, and other practices. In some cases, activities such as schedules would be modified to minimize impacts to sensitive environments.

Construction would begin after federal, state, and local approvals are obtained; property and ROW are acquired; soil conditions are established; and final design is completed. The precise timing of construction takes into account various requirements that may be in place due to permit conditions, electrical system loading issues, and available workforce.

3.4.3 Transmission Line Construction

Typical construction equipment that would be used on the Project consists of tree removal equipment, mowers, cranes, backhoes, digger-derrick line trucks, track-mounted drill rigs, dump trucks, front-end loaders, bucket trucks, bulldozers, flatbed tractor-trailers, flatbed trucks, pickup trucks, concrete trucks, and various trailers. Many types of excavation equipment are set on wheel- or track-driven vehicles. Poles would be transported on tractor-trailers.

Staging areas are usually established for the Project. Staging involves delivering the equipment and materials necessary to construct the new transmission line facilities. The materials would be stored at staging areas until they are needed. Temporary lay-down areas may be required for additional space for storage during construction. These areas would be selected for their location, access, security and ability to efficiently and safely warehouse supplies and would be chosen to minimize excavation and grading. The temporary lay-down areas and any staging areas outside of the transmission line ROW would be obtained from affected landowners through rental agreements.

Access to the transmission line ROW corridor would typically be made directly from existing roads or trails that run parallel or perpendicular to the transmission line ROW. In some situations, private field roads or trails would be used. Permission from the property owner is obtained prior to accessing the transmission line corridor. Where necessary to accommodate the heavy equipment used in construction, including cranes, concrete trucks, and hole-drilling equipment, existing access roads may be upgraded or new access may be constructed. New access may also be constructed when no current access is available or the existing access is inadequate to cross roadway ditches.

When it is time to install the poles, they would be moved from the staging areas and delivered to the staked location. The structures would typically be placed within the ROW until set. Insulators and other hardware would be attached while the pole is on the ground. The pole would then be lifted, placed, and secured using a crane.

In general, structures would have drilled pier concrete foundations (see Figure 3.4-2) that may vary from 6 to 12 feet in diameter and 25 or more feet deep, depending on soil conditions. After the concrete foundation is set, the pole is bolted to the foundation. Concrete trucks are required to bring in the concrete from a local concrete batch plant.

Figure 3.4-2: Concrete Pier Foundation with Anchor Bolts

Transmission line structures are generally designed for installation at existing grades. Typically, structure sites with 10 percent or less slope are not graded or leveled. Sites with more than a 10 percent slope have working areas graded level, or fill is brought in to construct working pads. If the landowner permits, it is preferred to leave the leveled areas and working pads in place for use in future maintenance activities. If permission is not obtained, the site would be graded back to its original condition as much as possible. Excess soil from foundation holes would be offered to the landowner for disposal on the structure site or other location on the property within reasonable proximity to the construction site. If on-site disposal is not permitted, it would be completely removed from the site.

Construction mats may be placed in wet or soft soil locations and in narrow ditches to minimize disturbance. These mats also can provide access to sensitive areas during times when the ground is not frozen to minimize impacts at the site. Figure 3.4-3 shows an example of construction mats.

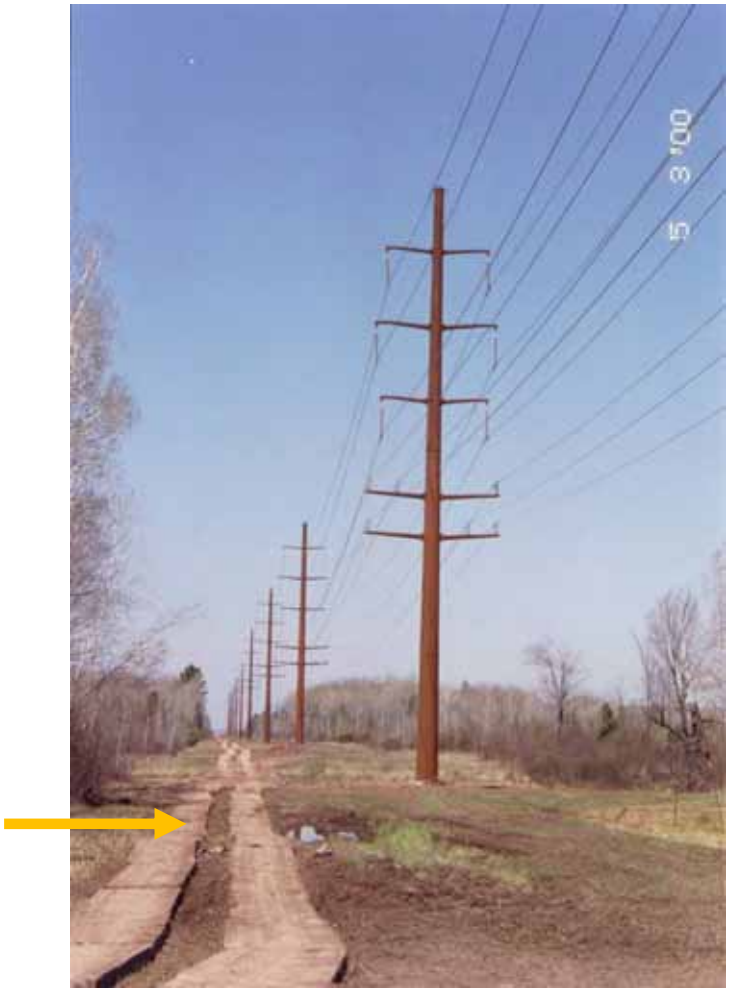

Figure 3.4-3: Construction Mats

Once foundations are in place, conductors are installed by establishing stringing setup areas within the ROW or on temporary construction areas outside of the ROW. These stringing setup areas are usually located every 2 miles along a project route. Conductor stringing operations also require brief access to each structure to secure the conductor wire to the insulator hardware and the shield wire to clamps once final sag is established. Where the transmission line crosses streets, roads, highways, or other energized conductors or obstructions, temporary guard or clearance poles may be installed. This ensures that conductors do not obstruct traffic or contact existing energized conductors or other cables during stringing operations; also it protects the conductors from damage. Figure 3.4-4 shows a single-circuit steel 115 kV structure midway through the stringing process.

Figure 3.4-4: Midway Point in the Stringing Process

Environmentally sensitive areas and wetland areas may also require special construction techniques in some circumstances. During construction, the most effective way to minimize impacts to wet areas is to span all streams and rivers. In addition, construction equipment would not be allowed to cross waterways except under special circumstances, and only after discussion with appropriate resource agencies. Where waterways must be crossed to pull in the new conductors and shield wires, workers may walk across, use boats, or drive equipment across ice in the winter. These construction practices help prevent soil erosion. Equipment fueling and lubricating would occur at a distance from waterways. Additional mitigative measures relating to wetlands are contained in Chapter 7.5.2, Water Resources.

3.4.4 Restoration Procedures

During transmission line construction and in areas outside the fenced area of the existing and proposed substations, crews would attempt to limit ground disturbance wherever possible. However, areas would be disturbed during the normal course of work, which can last several weeks in any one location. As construction on each parcel is completed, disturbed areas would be restored to their original condition to the maximum extent practicable. The ROW agent would contact each property owner after construction is completed to see if any damage has occurred as a result of the Project. If damage has occurred to crops, fences or the property, repairs are made, or the landowner is fairly reimbursed.

Damaged property is restored as nearly as possible to its original condition. Areas where vegetation is disturbed or removed during construction would be allowed to naturally reestablish to pre-disturbance conditions. Resilient species of common grasses and shrubs typically reestablish with few problems after disturbance. Areas with significant soil compaction and disturbance from construction activities may require assistance to reestablish vegetation and control soil erosion. Commonly used methods to accomplish this include, but are not limited to, prompt reseeding of disturbed areas, erosion control blankets, silt fences, and weekly inspection of construction sites for compliance.

These erosion control and vegetation establishment practices are regularly used in construction projects to minimize long-term impacts, and are referenced in construction permit plans.

3.5 Maintenance Procedures

3.5.1 Transmission Lines

Transmission lines are designed to operate for decades and require only moderate maintenance, particularly in the first few years of operation. The estimated service life of a transmission line is estimated for accounting purposes at approximately 40 years. However, from a practical perspective, high-voltage transmission lines are seldom completely retired. Transmission infrastructure has very few mechanical elements and is built to withstand weather extremes that are typical of the local climate. With the exception of severe weather conditions such as tornadoes and ice, 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 also are infrequent. As a result, the average annual availability of transmission infrastructure is very high, in excess of 99 percent.

The principal operating and maintenance cost for transmission facilities is the cost of inspections, usually done monthly by air. Annual operating and maintenance cost for transmission lines in Minnesota and the surrounding states vary. For voltages from 115 kV through 345 kV, the Applicant's experience indicates that costs are approximately $300 to $500 per mile. Actual line-specific maintenance costs depend on the setting, the amount of vegetation management necessary, storm damage occurrences, structure types, materials used, and the age of the line.

3.5.2 Substations

Similar to transmission lines, substations also are designed to operate for decades and require only moderate maintenance, particularly in the first few years of operation. The principal operating and maintenance cost for substation facilities is the cost of routine inspections.

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

be maintained. The substation equipment that would be installed as part of the Project includes state-of-the-art circuit breakers designed to minimize the risk of sulfur hexafluoride (SF6) release. SF6, used as an insulator in breakers, is considered a greenhouse gas by the Environmental Protection Agency (EPA). Current technologies require less SF6 at lower pressures than older technologies, resulting in a more secure system. Except in the case of equipment failure, newer breakers contain and maintain SF6 levels and do not sustain the releases associated with older circuit breakers.

3.6 Electric and Magnetic Fields

EMF is associated with all electrical devices. For the lower frequencies associated with transmission lines, EMF should be separated into electric fields and magnetic fields. EMF arises from the flow of electricity and is dependent on the voltage and current carried by a transmission line. Electric fields are measured in kilovolts per meter (kV/m) and magnetic fields are measured in milliGauss (mG). The intensity of the electric field is proportional to the voltage of the transmission line, while 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).

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 1 meter above the ground. For example, see *In the Matter of the Xcel Energy and Dairyland Power Cooperative Application for a Route Permit and a Certificate of Need for the Chisago County to Apple River 115/161 kV HVTL Project*, Commission Docket Nos. E002,ET3/CN-04-1176, E002,ET3/TL-06-1677, Order Granting Certificate of Need, Granting Route Permit, and Deferring Action on a Portion of Route Permit Application Pending Further Negotiations and Further Filings, Route Permit at 7 (Feb. 20, 2008). The standard was designed to prevent serious hazards from shocks when touching large objects parked under alternating current (AC) transmission lines of 500 kV or greater. The maximum electric field associated with the Applicant's proposal, measured at 1 meter aboveground, is calculated to be 3.76 kV/m.

Considerable research has been completed over the past three decades to determine if exposure to power-frequency (60 hertz) magnetic fields causes biological responses and health effects. Epidemiological and toxicological studies have shown no statistically significant association or weak associations between EMF exposure and health risks. Public health professionals also have investigated the possible impact of exposure to magnetic field upon human health for the past several decades. While the general consensus is that electric fields pose no human risk, the question of whether exposure to magnetic fields can cause biological responses or health effects continues to be debated.

In 1999, the National Institute of Environmental Health Sciences (NIEHS) issued its final report on "Health Effects from Exposure to Power-Line Frequency Electric and Magnetic Fields," in response to the Energy Policy Act of 1992. NIEHS concluded that the scientific evidence linking magnetic field exposures with health risks is weak, a finding that does not warrant aggressive regulatory concern. However, because of the weak scientific evidence that supports some association between magnetic fields and health effects and the common exposure to electricity in the United States, passive regulatory action, such as providing public education on reducing exposures, is warranted.

In 2007, the World Health Organization (WHO) concluded a review of the health implications of electromagnetic fields. In this report, the organization stated:

> Uncertainties in the hazard assessment [of epidemiological studies] include the role that control selection bias and exposure misclassification might have on the observed relationship between magnetic fields and childhood leukemia. In addition, virtually all of the laboratory evidence and the mechanistic evidence fail to support a relationship between low-level Extremely Low Frequency (ELF) magnetic fields and changes in biological function or disease status. Thus, on balance, the evidence is not strong enough to be considered causal, but sufficiently strong to remain a concern.

Environmental Health Criteria Volume N°238 on Extremely Low Frequency Fields, p. 12, WHO (2007).

In addition, regarding disease outcomes, aside from childhood leukemia, the organization stated:

> A number of other diseases have been investigated for possible association with ELF magnetic field exposure. These include cancers in children and adults, depression, suicide, reproductive dysfunction, developmental disorders, immunological modifications and neurological disease. The scientific evidence supporting a linkage between ELF magnetic fields and any of these diseases is much weaker than for childhood leukemia and in some cases (for example, for cardiovascular disease or breast cancer) the evidence is sufficient to give confidence that magnetic fields do not cause the disease.

Ibid. p.12.

Furthermore, in its “Summary and Recommendations for Further Study” the organization emphasized:

> The limit values in (magnetic fields) exposure guidelines (not) are reduced to some arbitrary level in the name of precaution. Such practice undermines the scientific foundation on which the limits are based and is likely to be an expensive and not necessarily effective way of providing protection.

Ibid., p. 12.

The organization concluded:

> Given both the weakness of the evidence for a link between exposure to ELF magnetic fields and childhood leukemia, and the limited impact on public health if there is a link, the benefits of exposure reduction on health are unclear. Thus, the costs of precautionary measures should be very low.

Ibid., p. 13.

Wisconsin, Minnesota and California have all conducted literature reviews or research to examine this issue. In 2002, Minnesota formed an Interagency 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. Its findings were published in September 2002, findings and were summarized:

> Research on the health effects of EMF has been carried out since the 1970s. Epidemiological studies have mixed results—some have shown no statistically significant association between exposure to EMF and health effects, some have shown a weak association. More recently, laboratory studies have failed to show such an association, or to establish a biological mechanism for how magnetic fields may cause cancer. A number of scientific panels convened by national and international health agencies and the United States Congress have reviewed the research carried out to date. Most researchers concluded that there is insufficient evidence to prove an association between EMF and health effects; however, many of them also concluded that there is insufficient evidence to prove that EMF exposure is safe.

White Paper on Electric and Magnetic Field (EMF) Policy and Mitigation Options (Minnesota Department of Health, 2002), p. 1.

Based on the working group and WHO findings, the Commission has repeatedly found that "there is insufficient evidence to demonstrate a causal relationship between EMF exposure and any adverse human health effects." (*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*, Commission Docket No. E-002/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 p. 7-8 (Aug. 29, 2008); *See also*, *In the Matter of the Application for a HVTL Route Permit for the Tower Transmission Line Project*, Commission Docket No. ET-2, ET015/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 p. 23 (Aug. 1, 2007)).

The OES also has analyzed the potential impacts of EMF on human health and safety and concluded that there is insufficient evidence to show a link between EMF and health effects:

> A number of national and international health agencies (the Minnesota Department of Health, the World Health Organization, and the National Institute of Environmental Health Sciences) have generally concluded in their research that there is insufficient evidence to prove a connection between EMF exposure and health effects. Research has not been able to establish a cause and effect relationship between exposure to magnetic fields and human disease, nor a plausible biological mechanism by which exposure to EMF could cause disease.

(In the Matter of the Application for a Route Permit for the Yankee Substation to Brookings County Substation 115 kV High-voltage Transmission Line Project, Commission Docket No. E002/TL-07-1626, Environmental Assessment, p. 10 (May 30, 2008).)

The PSCW has periodically reviewed the science on EMF since 1989 and has held hearings to consider the topic of EMF and human health effects. The most recent hearings on EMF were in July 1998. In January 2008 and August 2009, the PSCW published a fact sheet regarding EMF, which noted:

> Many scientists believe the potential for health risks for exposure to EMF is very small. This is supported, in part, by weak epidemiological evidence and the lack of a plausible biological mechanism that explains how exposure to EMF could cause disease. The magnetic fields produced by electricity are weak and do not have enough energy to break chemical bonds or to cause mutations in DNA. Without a mechanism, scientists have no idea what kind of exposure, if any, might be harmful. In addition, whole animal studies investigating long-term exposure to power frequency EMF have shown no connection between exposure and cancer of any kind.

(*EMF-Electric & Magnetic Fields*, PSCW. January 2008, August 2009. http://psc.wi.gov/thelibrary/publications/electric/Electric12.pdf.

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

3.6.1 Electric Fields

The electric field from a transmission line can couple with a conductive object, such as a vehicle or a metal fence, which is in close proximity to the transmission line. High-voltage transmission lines can induce a voltage on objects and therefore make it possible for current to flow as the object is discharged. The voltage buildup is dependent on many factors, including the weather; object shape, size, orientation, capacitance; object-to-ground resistance; and location along the ROW. If these objects are insulated or semi-insulated from the ground and a person touches them, a small current will pass through the person's body to the ground. This might be accompanied by a spark discharge and mild shock, similar to what can occur when a person walks across a carpet and touches a grounded object or another person.

The main concern with induced voltage on an object is the discharge through the person to ground if a person were to touch the object. The best method to avoid these discharges is not to park equipment directly under the transmission line. Another option is to drop a chain that is attached to the equipment onto the ground (or lower the head of a combine to the ground) prior to dismounting if parked near a transmission line and pulling the chain (or head) up after getting into the equipment. It is important to note that use of a chain attached to farm machinery to eliminate spark discharges is not necessary for safety reasons and therefore should only be considered if the discharge is considered annoying to the operator and the vehicle must be parked under the transmission line.

To ensure that any discharge does not reach unsafe levels, the NESC requires that any discharge be less than 5 milliamperes (mA). Based on the Applicant's 115 kV, 161 kV, 230 kV, and 345 kV transmission line operating experience, the discharge from any large mobile object - such as a bus, truck, or farm

machinery - parked under or adjacent to the transmission line will unlikely reach levels considered an annoyance and are less than the 5-mA NESC limit. The Applicant also would ensure that any fixed object, such as a fence or other large permanent conductive object in close proximity to or parallel to the transmission line, would be grounded so any discharge would be less than the 5-mA NESC limit.

Similarly, the Commission's standard of maximum electric field limit of 8 kV/m measured at 1 meter aboveground was designed to prevent serious hazard from shocks when touching large objects placed under AC transmission lines of 500 kV or greater. The proposed facilities would comply with the NESC and Commission standards.

Table 3.6-1 provides electric fields at the maximum operating voltage for the type of transmission line facilities proposed. Electric fields were calculated using ENVIRO, a software program licensed by the Electric Power Research Institute, Inc. (EPRI). The calculated electric field assumed the maximum operating voltage of 362 kV, which is 105 percent of the nominal voltage for the transmission line. For any specific design, the set height of phase conductors aboveground has a marked influence on the maximum electric field. The phasing arrangement is of particular importance for the maximum field for a double-circuit configuration.

Other potential impacts of electric fields include interference with the operation of pacemakers and implantable cardioverters/defibrillators. Interference with implanted cardiac devices can occur if the electric field intensity is high enough to induce sufficient body currents to cause interaction.

Modern bipolar devices are much less susceptible to interactions with electric fields. Medtronic and Guidant, pacemakers and implantable cardioverters/defibrillators manufacturers, have indicated that electric fields less than 6 kV/m are unlikely to cause interactions affecting operation of most of their devices.

Older unipolar designs are more susceptible to electric field interference. Research completed by Toivoen et al. (1991) indicated that the earliest evidence of interference was in electric fields ranging from 1.2 to1.7 kV/m. For older style unipolar designs, the electric field for some proposed structure types does exceed levels that Toivoen et al. have indicated may produce interference. However, a recent paper (Scholten et al. 2005) concludes that the risk of interference inhibition of unipolar cardiac pacemakers from high-voltage power lines in everyday life is small. In the unlikely event a pacemaker is impacted, the effect is typically a temporary asynchronous pacing (commonly referred to as reversion mode or fixed-rate pacing). The pacemaker returns to its normal operation when the person moves away from the source of the interference.

Table 3.6-1:
Calculated Electric Fields (kV/m) for Proposed Transmission Line Designs (3.28 Feet Aboveground)

Structure Type	Nominal Voltage	Distance to Proposed Centerline in Feet										
		-300	-200	-100	-75	-50	0	50	75	100	200	300
Single-Pole, Davit Arm, 345/345 kV Double-Circuit with one 345 kV Circuit In Service	362 kV	0.04	0.08	0.11	0.05	0.22	3.76	1.58	0.40	0.18	0.12	0.06
Single-Pole, Davit Arm, 345/345 kV Double-Circuit with one 345 kV active and one 345 kV operated at 161 kV	362–169 kV	0.01	0.02	0.09	0.20	0.56	2.62	1.50	0.41	0.16	0.08	0.04
Single-Pole Davit Arm 345/345 kV with 69 kV Underbuild with one 345 kV circuit and 69 kV Circuit in service	362/362/72 kV	0.04	0.06	0.03	0.10	0.43	0.92	1.1	0.40	0.10	0.09	0.06
Single-Pole Davit Arm 161 kV Single-Circuit	169 kV	0.02	0.04	0.21	0.39	0.8	1.64	0.76	0.32	0.18	0.04	0.02

3.6.2 Magnetic Fields

Table 3.6-2 at the end of this chapter provides calculated magnetic fields for each structure and conductor configuration proposed for the Project. Magnetic fields were calculated for each section of the Project and at two system conditions: the expected summer peak and average current flows projected for the planned in-service of the final component (2015) and 10 years following (2025) under normal system intact conditions. The magnetic field values are calculated at a point directly under the transmission line and where the conductor is closest to the ground. The same method is used to calculate the magnetic field at varying distances from the center line of the structure. The magnetic field profile data show that magnetic field levels decrease rapidly as the distance from the centerline increases (proportional to the inverse square of the distance from the source).

Because the magnetic field produced by the transmission line is dependent on the current flowing on its conductors, the actual magnetic field when the Project is in service is typically less than that shown in the table. This is because the calculations in the figures represent the magnetic field with current flow at expected normal system peak conditions. Actual magnetic field is lower because current flow on the transmission line would vary throughout the day and would almost always be less than peak levels during most hours of the year.

3.7 Stray Voltage

Stray voltage is a condition that can occur on the electric service entrances to structures from distribution lines—not transmission lines. More precisely, stray voltage can exist when there is a small (1- to 2-volt) voltage difference between the neutral wire of the service entrance and grounded objects in buildings such as barns and milking parlors.

Transmission lines do not, by themselves, create stray voltage because they do not connect to businesses or residences. However, transmission lines can induce stray voltage on a distribution circuit that is parallel to and immediately under the transmission line. If stray voltage issues arise as a result of the transmission lines proposed in this Application, the Applicant will take appropriate measures to address those issues on a case-by-case basis. Such measures may include avoiding routes that contain distribution lines, placing the transmission line across the road from distribution lines, burying distribution lines, crossing perpendicular to distribution lines, or other measures which reduce the possibility of inducing a voltage on the distribution neutral.

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

Insulated electric fences used in livestock operations can pick up an induced charge from transmission lines. Usually, the induced charge drains off when the charger unit is connected to the fence. When the charger is disconnected, either for maintenance or when the fence is being built, nuisance shocks may result. Potential shocks can be prevented by using the following methods:

(1) One or more of the fence insulators can be shorted out to ground with a wire when the charger is disconnected; or

(2) An electric filter can be installed that grounds out charges induced from a power line while still allowing the charger to be effective.

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

There is a potential for vehicles parked under high-voltage transmission lines to build up an electric charge. However, such buildup is a rare event because vehicles are generally effectively grounded through tires. Modern tires provide an electrical path to the ground because carbon black, a good electricity conductor, 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, vehicles and farm equipment do not normally build up charge unless they have unusually old tires or are parked on dry rock, plastic or other surfaces that insulate them from the ground. If buildup does occur, the vehicle can be grounded by attaching a grounding strap that is long enough to touch the earth.

Another issue that arises when operating vehicles near power lines is whether vehicles can be safely refueled. The possibility of fuel ignition under a power line is remote. Nevertheless, the Applicant does not recommend refueling vehicles directly under or within 100 feet of a transmission line 200 kV or greater.

Buildings are permitted near transmission lines, but are generally prohibited within the ROW itself because a structure under a transmission line may interfere with safe operation. For example, a fire in a building located in the ROW could damage a transmission line. As a result, NESC guidelines establish clear zones for transmission facilities. Metal buildings may have unique issues. For example, metal buildings near transmission lines of 200 kV or greater must be properly grounded. Landowners who have questions about a new or existing metal structure can contact the Applicant for further information about proper grounding requirements.

Table 3.6-2:
Calculated Magnetic Fields (mG) for Proposed 345 kV Transmission Line Designs (3.28 Feet Aboveground)

Structure Type	Geographical Segment	System Condition	Current (amps)	-300	-200	-100	-75	-50	0	50	75	100	200	300
Single- Pole Davit Arm 345/345 kV Double-Circuit with one Circuit In Service	Preferred Route: Hampton to Cannon Falls; Non-US-52 segments Zumbrota area to North Rochester	2015 Peak	140 A	0.38	0.79	2.35	3.41	5.24	13.58	9.64	5.88	3.77	1.04	0.46
		2015 Average	112 A	0.30	0.63	1.88	2.73	4.19	10.87	7.71	4.71	3.01	0.83	0.37
	Alternate Route: Hampton to North Rochester	2025 Peak	132 A	0.36	0.74	2.22	3.22	4.94	12.81	9.09	5.55	3.55	0.98	0.43
		2025 Average	106 A	0.29	0.60	1.78	2.58	3.97	10.29	7.30	4.45	2.85	0.79	0.35
Single-Pole Davit Arm 345/345 kV with 69 kV Underbuild with 1 Active 345 kV Circuit	Preferred Route: US-52 segments Cannon Falls to Zumbrota area	2015 Peak	140/325	0.74	1.65	6.20	10.42	20.73	70.89	8.50	3.77	2.51	1.01	0.52
		2015 Average	112/260	0.59	1.32	4.96	8.33	16.58	56.71	6.80	3.02	2.01	0.81	0.41
		2025 Peak	132/328	0.73	1.62	6.14	10.36	20.71	71.85	8.89	3.92	2.54	0.99	0.50
		2025 Average	106/262	0.58	1.30	4.91	8.28	16.55	57.37	7.09	3.12	2.03	0.79	0.40
Single-Pole Davit Arm 345/345 kV Double-Circuit with one Circuit in Service	N. Rochester to Alma	2015 Peak	403 A	1.12	2.33	6.97	10.11	15.54	40.27	28.58	17.44	11.17	3.09	1.35
		2015 Average	322 A	0.87	1.81	5.41	7.85	12.06	31.24	22.17	13.53	8.67	2.40	1.05
		2025 Peak	415 A	1.12	2.33	6.97	10.11	15.54	40.27	28.58	17.44	11.17	3.09	1.35
		2025 Average	332 A	0.90	1.87	5.57	8.09	12.43	32.21	22.86	13.95	8.94	2.47	1.08

Table 3.6-2:
Calculated Magnetic Fields (mG) for Proposed 345 kV Transmission Line Designs (3.28 Feet Aboveground)

Structure Type	Geographical Segment	System Condition	Current (amps)	-300	-200	-100	-75	-50	0	50	75	100	200	300
Single-Pole Davit Arm 161 kV Single-Circuit	N. Rochester to Northern Hills	2015 Peak	95 A	0.20	0.43	1.50	2.42	4.39	14.29	5.41	2.79	1.65	0.42	0.18
		2015 Average	76 A	0.16	0.34	1.20	1.94	3.51	11.43	4.33	2.23	1.32	0.33	0.14
		2015 Peak	96 A	0.20	0.43	1.52	2.45	4.43	14.44	5.47	2.82	1.66	0.42	0.18
		2015 Average	77 A	0.16	0.34	1.22	1.96	3.56	11.58	4.38	2.26	1.33	0.34	0.15

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4.0 Route Selection Process

Minnesota requires utilities to apply for at least two routes for a proposed transmission line and to designate one as preferred. The Applicant determined the Preferred and Alternative Routes described in this Application after two years of careful study and significant public involvement and comment. Through this process, broad Project corridors were narrowed to the Preferred and Alternative Routes for both the 345 kV and the 161 kV transmission lines. The process included work with multiple stakeholder groups and public meetings, field investigation, and data collection and analysis. The total number of route segments studied exceeded 500 in Minnesota and 100 different segments in Wisconsin.

4.1 Summary of Route Selection Process and Guiding Factors

Figure 4.1-1 outlines the route selection process, which can be described as a “funneling” of information. With each step, the geographic scope or extent of study was narrowed to focus on more specific routing opportunities, and the analysis of potential opportunities and sensitivities became more detailed and comprehensive.

Several criteria were analyzed to determine routes that would minimize overall impacts. These criteria include, but are not limited to:

- Giving priority to Minnesota’s policy of non-proliferation, which creates a preference for placing new transmission lines near existing linear infrastructure such as existing transmission lines, roads and railroads to minimize the proliferation of new corridors;
- Minimizing proximity to homes;
- Minimizing impacts to agriculture, forestry, tourism, mining, and other land-based economies;
- Minimizing impacts to the natural environment, including wildlife, flora and fauna, and rare and unique natural resources;
- Maximizing use or paralleling survey lines, natural division lines, and agricultural field boundaries; and
- Using designs that maintain electrical system reliability.

Data regarding these criteria were collected from stakeholders, databases and field observations. The criteria and data collection efforts are described in the following sections.

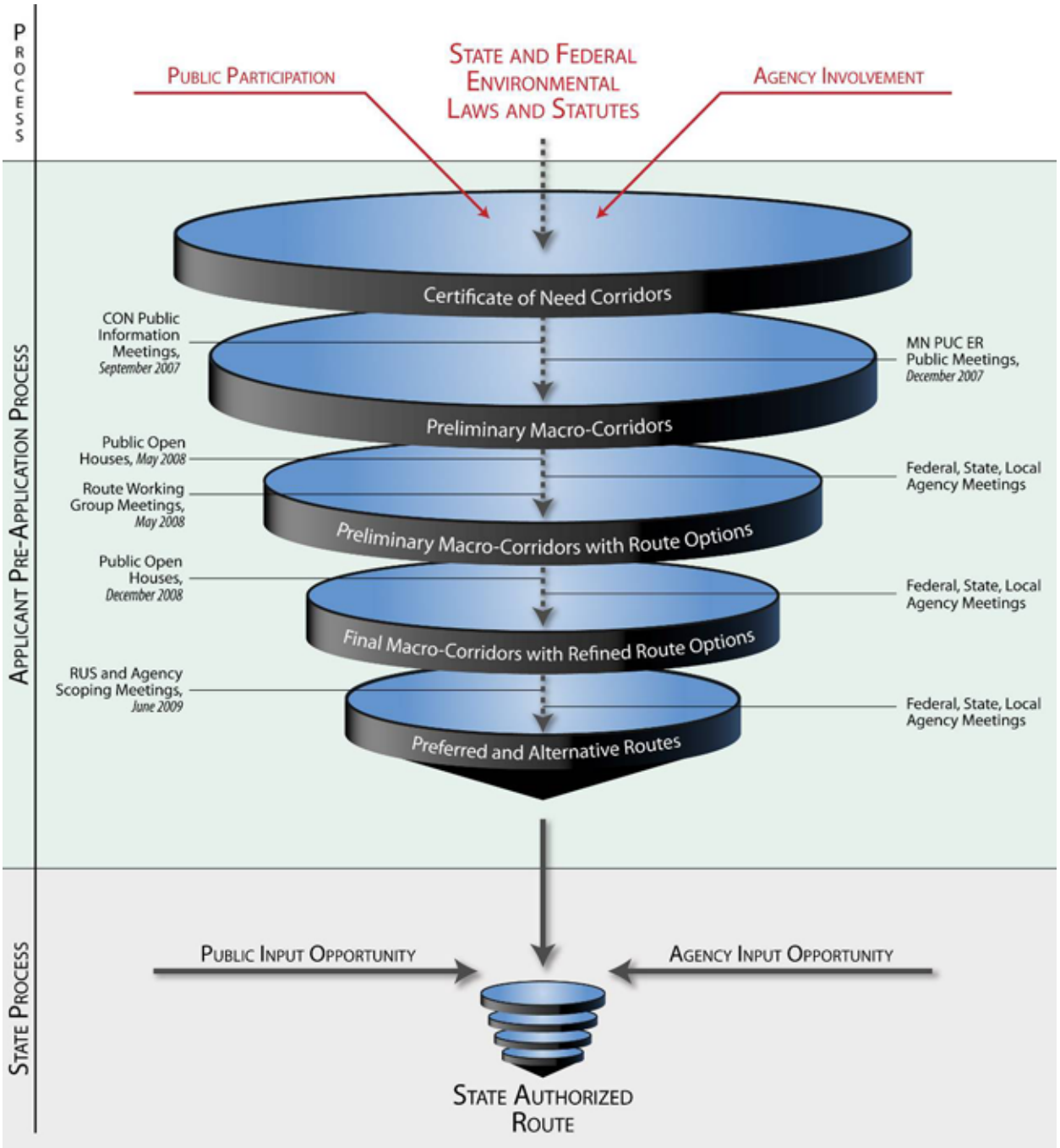

Figure 4.1-1: Route Selection Process

4.1.1 Regulatory Guidance

The Applicant considered all applicable requirements and guidance from Minnesota and Wisconsin for the entire Project across both states, as provided below.

4.1.1.1 Minnesota Routing Guidelines

Chapter 2.3.3 described Minnesota's policy of non-proliferation, which creates a preference for placing new power lines near existing infrastructure. Route development and selection were guided by this policy of non-proliferation, and by further state criteria set forth in Minn. R. 7850.4100 and Minn. Stat. § 216E.03, subd. 7(b). The rule criteria are:

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

B. Effects on public health and safety;

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

D. Effects on archaeological and historic resources;

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

F. Effects on rare and unique natural resources;

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

H. Use or paralleling of existing ROWs, 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 system reliability;

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

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

N. Irreversible and irretrievable commitment of resources.

All of these factors are included in the statutory criteria listed in Minn. Stat. § 216E.03, Subd. 7(b). There also are two additional factors included in Minn. Stat. § 216E.03, Subd. 7(b)(7), evaluation of route alternatives, and (12), consideration of issues raised by other agencies and local entities.

4.1.1.2 Wisconsin Routing Process

Wisc. Stat. § 1.12(6) states that, to the greatest extent feasible, the following corridors should be used in routing a high-voltage transmission line in the following order of priority: (1) existing utility corridors, (2) highway and railroad corridors, (3) recreational trails, to the extent the facilities can be constructed underground and that the facilities do not significantly impact environmentally sensitive areas, and (4) new corridors. Wisconsin law further provides that existing ROWs should be used "to the extent practicable and that the routing minimizes environmental impacts in a manner that is consistent with achieving reasonable electric rates" (Wisc. Stat. §196.491 (3r)).

4.1.2 Transmission Line Reliability and Considerations in Routing

When developing potential routes for the Project, the Applicant analyzed the potential to collocate portions of the transmission line on the same structures as existing electric facilities (sometimes referred to as double circuiting), as well as routing the 345 kV and 161 kV lines parallel to existing facilities. The Applicant concluded that collocating the new 345 kV facilities with existing facilities on common structures was appropriate where the existing transmission line could be strung on the empty side of the double-circuit structure and at the Mississippi River crossing, where triple-circuit structures will be required. In addition, the Applicant concluded that an existing 69 kV transmission line located along US-52 could be collocated with the proposed 345 kV line.

In evaluating the appropriateness of such multiple circuit structures, the Applicant applied reliability criteria established by NERC, which defines minimum transmission system performance requirements that must be met for different system conditions and, defines different types of system events. NERC groups them into four different categories:

- Category A: All facilities in service (no contingencies);
- Category B: Event resulting in loss of a single element;
- Category C: Event(s) resulting in the loss of two or more (multiple) elements; and
- Category D: Extreme event resulting in two or more (multiple) elements removed or cascading out of service.

For each of the different categories of contingencies, each reliability region is allowed to expand on the NERC requirements to make them more stringent. This 345 kV transmission line Project is in the reliability region Midwest Reliability Organization (MRO). The NERC Category C (contingency C5) includes the loss of "any two circuits of a multiple circuit towerline" with an exclusion for multiple circuit towers used over short distances in accordance with regional exemption criteria. If the transmission line in the MRO region is operated at a voltage of 100 kV or higher and if the overall distance that transmission lines are double-circuited is greater than 1 mile, then it falls under the NERC Category C contingency definition.

NERC reliability standards require utilities to plan a transmission system to be able to survive all Category C contingencies without system performance violations. Double-circuit construction has been found to be acceptable if the power system can reliably withstand simultaneous failure of both circuits on a common

structure. Double-circuit construction could be appropriate in some situations where the two circuits serve different functions, connect different substations, split away and proceed in different directions, or where high capacity (but not redundancy) is required.

Common tower outages for double-circuit transmission lines could be caused by:

- Electrical failure of transmission line insulation due to lightning strike;
- Mechanical failure of one or more structures;
- Broken shield wire falling into power conductors;
- Wind-blown debris causing conductor-conductor short circuits;
- Insulator contamination due to road salt, soot, or agricultural chemicals;
- Wind, sleet, and ice conditions;
- Contact with aircraft or construction equipment (crane, dump truck); or
- Protective relaying malfunction ("sympathetic tripping" due to fault on an adjacent circuit).

These common tower failure mechanisms have all occurred on the transmission system within the northern MRO region on double-circuit transmission lines.

Double-circuiting is not acceptable in situations where simultaneous failure of both circuits will jeopardize reliability because of the substantial risk that both transmission lines will be out of service simultaneously. For example, if storm damage caused a double-circuit structure to fail, it can be expected that an outage will occur on both circuits. Thus, if under the relevant reliability rules it were determined that simultaneous outage will jeopardize service, double-circuiting will not be allowed.

This Project is proposed to be constructed with double-circuit-capable structures with the capability to add a second 345 kV circuit at a later date. The Applicant has concluded that the new 345 kV circuit can be collocated with an existing Dairyland Q-3 161 kV transmission line (Dairyland Q-3 line) without limiting system capability. The 161 kV line can be moved at a later date when a second 345 kV circuit is needed.

The Applicant also considered triple-circuiting the new double-circuit structures with existing transmission facilities across the Mississippi River. Such triple circuits pose additional maintenance concerns, because performing electrical work around multiple energized circuits adds a layer of complexity and safety issues. Depending on the circumstances, it may be necessary to de-energize the lines when performing maintenance. Any outage to the circuits will require analysis to ensure adequate system reliability. Because of these reliability and safety concerns, utilities typically limited these configurations to short distances where triple-circuit construction is necessary to minimize potential for impacts and amount of new ROW required. The Applicant concluded that, because of the environmental considerations and the limited ROW available for new facilities, triple-circuit structures would be appropriate to cross the Mississippi River. The river-crossing segments will be designed to minimize outage risks and to reduce maintenance requirements. This is accomplished by using special structures and attaching components designed and constructed on either side of long spans across bodies of water. These special structures

are usually larger than typical structures to allow for wider conductor spacing, which helps reduce outages. The components used to connect the conductors to the structures are specified to handle the higher stresses involved with longer spans.

4.1.3 Data Collection and Analysis

Each step in the route selection process included data collection and analysis. The Applicant reviewed data collected at each phase to analyze corridors and routes at an increasingly detailed scale. The Applicant collected and reviewed digital, hard-copy, and internet-based data in the Project area from a variety of state, federal, and local agencies, including those listed below:

- Bureau of Transportation Services
- Federal Communications Commission (FCC)
- Federal Emergency Management Agency (FEMA)
- Minnesota Department of Transportation (Mn/DOT)
- Minnesota Department of Natural Resources (MDNR)
- Minnesota Land Management Information Center
- Minnesota Land Trust
- Minnesota Public Utilities Commission (Commission)
- National Register of Historic Places (NRHP)
- The Nature Conservancy
- Public Service Commission of Wisconsin (PSCW)
- U.S. Census Bureau
- U.S. Geological Survey (USGS)
- Wisconsin Department of Natural Resources (WDNR)
- Wisconsin Department of Transportation (WisDOT)

Data collected included information related to the natural environment (such as water, geology and soils, vegetation, and wildlife habitat), and the human environment (such as land use, infrastructure, and listed cultural resources).The Applicant also collected data on economic indicators, electrical reliability factors, engineering feasibility, cost, and comments from various stakeholders, including individuals and agencies. The data were compiled and/or georeferenced in a Geographic Information Systems (GIS) database that was used throughout the routing process.

4.1.4 Stakeholder Involvement

The route development and selection process was driven by an extensive public participation and agency coordination effort. To maximize opportunities for stakeholder involvement and to provide for transparency in the routing process, each step identified in Figure 4.1-1 included at least one stakeholder (public and agency) involvement component, which consisted of collecting and incorporating input from the public, government agencies and other interested parties. More than 25,000 addresses in the Project area received regular mailings that informed landowners and managers of the Project status, described opportunities to be involved in the routing process, provided information sources, and explained how to submit comments to the Applicant or agencies. Additionally, more than two years of public participation has been conducted and included 24 separate public information meetings, open houses and public scoping meetings. These meetings had approximately 1,126 people in total attendance as documented through sign-in sheets, with more in attendance who did not sign in. A total of 676 public comment forms were received as a result of both the open houses and scoping meetings. All public comment forms were reviewed by the Utilities. As comments were addressed, some additional data collection was necessary.

Public comments were a key component in the routing process. The input was used to refine corridors and route options, resulting in the Preferred and Alternative Routes proposed in this Application. Supplementary details on public outreach are included in Chapter 12 and a summary of the public meetings and comments collected are provided in Appendix C-5.

4.2 Substation Site Selection

Identifying a siting area for the proposed North Rochester Substation was an important step in the routing process so that potential routes entering and exiting the siting area could be identified. The Applicant selected a broad siting area within which to consider locations for the proposed North Rochester Substation (identified on Figures 1.0-1 and 1.0-2). The identification of the proposed North Rochester Substation siting area was based largely on the following considerations:

- Proximity to the existing Prairie Island-Byron 345 kV transmission line that would be interconnected with the proposed North Rochester Substation;
- Proximity to load center within the greater Rochester area;
- Ability to minimize length required for the 345 kV transmission line to the Mississippi River, and length required for the 161 kV transmission line to the Northern Hills Substation;
- Availability of land within the general area, up to 40 acres in size, that could accommodate the proposed North Rochester Substation and potential future interconnections;
- Availability of site access; and
- Site suitability from a constructability perspective, the potential for minimizing environmental impacts, and proximity to compatible land uses.

Following a desktop assessment and review through field and aerial reconnaissance, it was determined that the North Rochester Substation siting area best meets these considerations for locating a new

substation north of Rochester. The Applicant has identified a preferred siting area and an alternative siting area within the larger North Rochester Substation siting area to accommodate the Preferred and Alternative Routes. These areas are discussed in detail in Chapter 10.1.

4.3 Routing Process Chronology and Methodology

Each of the routing process steps identified in Figure 4.1-1 is summarized below, with a description of the chronological process of corridor and route refinement. Methodology, data analysis, and stakeholder involvement components are described for each step in the process.

4.3.1 Certificate of Need Notice Corridors

The CON notice corridors were established in 2007 at the beginning of the Minnesota CON process (Figure 4.3-1). Based on the Project's required Hampton, Rochester, and La Crosse interconnections, the Applicant established broad CON corridors, which included four potential crossing sites at the Mississippi River. Three potential crossing sites were located along existing high-voltage transmission lines, including; a 161/69 kV double-circuit transmission line near Alma, Wisconsin; a 69 kV transmission line built to 161 kV specifications near Winona, Minnesota; and a 69 kV transmission line between La Crescent, Minnesota and La Crosse, Wisconsin. A fourth crossing option was identified near Trempealeau, at a narrow point in the Mississippi River where several islands were thought to be able to support transmission line structures. This crossing option was eliminated from further consideration because it did not follow an existing high-voltage transmission line corridor (refer to Chapter 5.2, Mississippi River Crossing Analysis).

In September 2007, the Applicant held a series of open houses in the Project area to introduce and describe the proposed Project, communicate the purpose and need, identify potential opportunities and constraints, obtain input, and prepare a mailing list. In December 2007, the OES Energy Permitting Staff responsible for preparing an Environmental Report for CON proceedings (Minn. R. 7849.7010-7110), hosted three scoping meetings in the Project area. The purpose of the meetings was to inform the public of the CON process and collect comments on the purpose and need and potential environmental issues associated with the Project. OES completed its CON Environmental Report on March 31, 2008; it is available online (https://www.edockets.state.mn.us/EFiling/ShowFile.do?DocNumber=5046228). Although the CON proceedings were a Minnesota state process, the Applicant also sent meeting notices to Wisconsin landowners, inviting them to provide comments.

Concurrent with public and agency involvement, the Applicant added and updated GIS data from public sources and agencies. The ongoing data collection component of the routing process was important to identify resources and features as accurately and completely as possible.

Following the CON Environmental Report scoping meetings, the Applicant reviewed public and agency comments, and based on those comments and additional data collection and field investigation conducted to date, refined the CON corridors to preliminary macro-corridors. Corridors were expanded where additional opportunities were identified, or where additional area was needed to assess a wider

array of alternatives. These expanded areas included the Minnesota Highway 56 (MN-56) and Minnesota Highway 60 (MN-60) corridors between Hampton and Pine Island, Minnesota; a northern Zumbro River crossing area between Pine Island and Alma, Wisconsin; and other smaller corridor expansions. In Wisconsin, additional corridors were identified east of the 161 kV transmission line between Alma and La Crosse near Galesville to evaluate alternatives for a Black River crossing. In Minnesota, other areas in the CON corridors were eliminated, including along the Prairie Island-Byron 345 kV transmission line corridor between Prairie Island and Zumbrota. This corridor was removed because geographic separation of the new 345 kV transmission line from this existing 345 kV line is needed to maximize regional reliability benefits. Bluff areas between Winona and La Crescent, Minnesota were removed to exclude Great River Bluffs State Park and other recreation and natural resources in that area. Also in Minnesota, the area south of Kenyon and west of the Pine Island-Byron 345 kV transmission line was removed because the area for the proposed North Rochester Substation was narrowed to the stretch between Zumbrota and Pine Island. These changes are reflected in Figure 4.3-2.

4.3.2 Preliminary Macro-Corridors

Preliminary macro-corridors were refined from the CON corridors as shown in Figure 4.3-2. The preliminary macro-corridors were presented to the public and agencies for comment during routing work group meetings and open houses in March and May of 2008. First, the Applicant held routing work group meetings in March and May of 2008 to provide stakeholders early opportunities to contribute to data collection and initial routing efforts prior to entering into a formal permitting process, as well as to gather comments from landowners, government representatives, and other interested parties about the preliminary macro-corridors. Second, five public open houses were held in May 2008 to collect public comments on the preliminary macro-corridors.

After the May 2008 public open houses, the Applicant conducted further data analysis to identify opportunities and sensitivities within preliminary macro-corridor boundaries as well as route options throughout the Project area. The Applicant then revised the macro-corridors before the next round of public involvement. The following describes the opportunities and sensitivities analysis, the identification of route options, and refinement of preliminary macro-corridors.

4.3.2.1 Identification of Opportunities and Sensitivities

Key factors in identifying preliminary macro-corridors, and route options within the preliminary macro-corridors, include:

- Minimizing environmental and land use impacts by maximizing opportunities to use existing transmission and transportation ROWs, and property, field, and survey lines;
- Minimizing impacts to human settlement, namely proximity to residences;
- Minimizing impacts to environmental and sensitive resources;
- Minimizing the transmission line length to reduce impact area and Project costs; and
- Complying with all laws, policies, and guidelines regarding wetlands, floodplains, historic properties, and other resources.

Routing Opportunities

Existing transmission and transportation corridors, property lines, field lines, and section lines were considered potential opportunities for routing the proposed transmission lines within the identified macro-corridors. Collocating with existing transmission and transportation corridors was given greater priority than other possible corridors in compliance with Wisconsin and Minnesota policies. Existing ROWs also were given priority because easements, access roads, and disturbance often already existed in these locations. As a result, using existing ROWs typically results in less incremental environmental disturbance, and less intrusive maintenance access. Property, field, fence, and section lines were considered in macro-corridor development in compliance with the Minnesota rules. It is common practice to follow property, field, fence, and section lines when routing new transmission lines to minimize impacts on land use, specifically on residences and agricultural operations.

Transmission Corridors

Minnesota requires permitting authorities to consider existing electrical transmission ROWs when issuing a Route Permit for a high-voltage transmission line (Minn. R. 7850.4100(J)), *PEER, 266 N.W.2d 868*. Wisconsin regulations require that existing transmission corridors be given top priority for a new transmission line. Wis. Stat. § 1.12(6)(a). The Rural Utilities Service (RUS), the lead federal agency for the Project regarding compliance with the National Environmental Policy Act (NEPA), indicates in Bulletin 1794A-603 that the use of existing ROWs or double-circuiting of existing electric transmission lines should be considered when developing macro-corridors (RUS 2002).

Data on existing transmission lines and substations in Minnesota were collected from the Minnesota Land Management Information Center (2007). Data on existing transmission lines and substations in Wisconsin were collected from the PSCW (2001). These datasets were combined to create GIS layers that were verified and corrected using aerial photography as well as on-site verification.

Transportation Corridors

Minnesota requires that state permitting authorities consider existing transportation systems or existing ROWs in siting new high-voltage transmission lines (Minn. R. 7850.4100(J)). Existing transportation corridors, such as roads, bridges, and railroads, may facilitate construction of the transmission line through ROW access. Wisconsin mandates that highway and railroad corridors be given secondary priority, after existing transmission corridors (Wis. Stat. §1.12 (6)(b)).

Data on highways, roads, and railroads were obtained from the Bureau of Transportation Statistics (BTS 2003). Interstate 90 is located in the southern part of the Project area, and connects Rochester, Minnesota, to La Crosse, Wisconsin. There are several U.S. highways and state highways, as well as other major roadways in the study area that represented opportunities for routing the transmission line.

Property, Field, Fence, and Survey Lines

The Commission must consider use or paralleling of survey lines, natural division lines, and agricultural field boundaries when issuing a Route Permit (Minn. R. 7850.4100 (H); Minn. Stat. § 216E.03, Subd. 7(b(9)).

Property lines are established lines of ownership by survey, defined by deed or possession. Field lines separate field plots, and may follow a constructed fence. Survey lines are surveyed land subdivision lines, used by governments in mapping and surveying, and may include section lines, county boundaries, and municipal boundaries. Following any of these lines generally minimizes impacts on agricultural operations and residences. The Applicant used aerial photographs, public records, field verification, and landowner input to identify property lines, field lines, and survey lines with potential to minimize impact to structures (which may include residences and farm buildings), and agricultural fields (including irrigation pivots).

In studying property lines, the Applicant paid close attention to ownership on both sides of the property line and whether there was an actual field division on the property line. In general, if the ownership is the same on both sides of the line or if there was no apparent field division, the property line was not favored.

Routing Sensitivities

"Sensitivities" are areas or resources that should be closely considered with regard to routing, construction, or additional licensing/permitting procedures. Identifying a feature as being sensitive does not require or imply it must be avoided.

Routing sensitivities in the Project area include lands and resources regulated by federal laws or agencies, such as public airports, historic sites, wetlands, floodplains, navigable waters, and other federally regulated lands, resources, or biological species of special status. Minnesota statutes and regulations govern the placement of transmission lines in proximity to sensitive environmental features or landscapes, including wetlands, rivers, Minnesota Wild and Scenic Rivers, recreation areas, scientific and natural areas, trout streams, forested MDNR lands, other public lands, and public waters (Minn. R. ch. 6135; Minn. R. ch. 7850). Minnesota law prohibits transmission line routing through state or national wilderness areas and prohibits transmission line routing through state or national parks or state scientific and natural areas "unless the transmission line would not materially damage or impair the purpose for which the area was designated and no feasible and prudent alternative exists" (Minn. R. 7850.4300). To comply with these regulations, efforts were made to avoid these and other sensitive and prohibited areas or concentrations of such areas during macro-corridor development. Additional sensitivities screened by the Applicant in the preliminary macro-corridor phase include dense residential areas, recreation areas, agricultural operations that may be affected by transmission line siting (such as pivot irrigation systems), and others identified by the public or agencies.

4.3.2.2 Route Option Identification

Data and information associated with the opportunities and sensitivities were collected and incorporated into GIS, and a geospatial database was developed. Potential route options were identified using information from the database, stakeholder comments, and field verification. The Applicant attempted to identify potential route options that followed linear features, minimized impact to residences, and avoided known environmental and cultural resources or conflicting land uses. Multiple route options between substations and river crossings were identified to create options where routing may be more difficult (for example, near residential areas or in proximity to sensitive environmental resources).

4.3.3 Preliminary Macro-Corridors with Route Options

The preliminary macro-corridors and all identified route options (Figure 4.3-3) were presented to the public and agencies for comment during December 2008 public open houses. Participants were provided specific siting and routing suggestions directly on maps that were incorporated into the Project database for analysis.

4.3.3.1 Route Refinement Process

After further public open houses in December 2008, route options were narrowed through detailed comparative analysis of route segments. Routes are comprised of discrete “segments” located primarily along existing linear features or parcel lines, which were named with letter/number combinations depending on their geographic location. More than 500 route segments were identified and analyzed for the Minnesota portion of the Project.

A GIS-based routing matrix was used to compare quantitative data on route segments and segment combinations. The GIS-based routing matrix for all proposed routes is included in Appendix H. Data analyzed in the matrix included opportunities, sensitivities, and other routing criteria based on the factors listed in Minn. R. 7850.4100 (refer to Chapter 4.1.1.1). Additional data related to environmental or engineering criteria were included as appropriate. Public comments also were incorporated into the GIS database. The Applicant also conducted extensive field evaluations to verify GIS data, identify important features of the human and natural environment not evident using aerial photography, evaluate potential visual impacts, and collect preliminary survey information about biological resources. Preliminary engineering assessments also were performed in difficult routing areas to ensure that routes retained for further analysis were feasible.

The Applicant used all qualitative information collected, and quantitative data compared in the matrix to systematically compare and further refine route options. Cumulative advantages and disadvantages associated with each segment or segment combination, including the strength of opportunity from a ROW sharing perspective, were assessed. If two segments or segment combinations were considered comparable based on these considerations, the segments were compared based on impacts to residences, costs (estimated by length or the number of estimated angle structures), and the extent to which the segment or segment combination avoided sensitive resources. The segment or segment combination having a greater associated occurrence of existing residential use, greater estimated cost, or greater impact on sensitive resources was removed from further consideration. Appendix I contains a description of all segments that were considered but eliminated from route development; Appendix J shows segments considered but eliminated. The remaining segments or segment combinations were carried forward as potential route options. New segments or segment combinations also were added where appropriate.

4.3.3.2 Preliminary Macro-Corridor Refinement

After route options were narrowed, preliminary macro-corridors were refined. Refinements are shown in Figure 4.3-4. Areas in the preliminary macro-corridor were eliminated where no feasible routes were

identified. Macro-corridor areas eliminated included areas east and west of the Hampton Substation, between Cannon Falls and the MN-56 corridor, west of Douglas, between the Chester Substation and Plainview along the 161 kV Dairyland Q-3 transmission line, and in the bluffs west of the Mississippi River between La Crescent and Winona. Additions to the macro-corridor were mostly located in Wisconsin along existing 161 kV and 69 kV transmission corridors east of the Mississippi River valley. In Minnesota, relatively smaller areas were added to the macro-corridors southeast of Pine Island and west of the La Crescent crossing of the Mississippi River.

4.3.4 Final Macro-Corridors with Refined Route Options

The final macro-corridors for the Project along with refined route options were presented to stakeholders during public and agency federal scoping meetings held by the RUS (to comply with NEPA) in June 2009. Dairyland Power Cooperative, one of the Utilities intends to request financial assistance from the RUS, an agency which administers the USDA Rural Utilities Programs, for its anticipated 11 percent ownership interest in the Project. RUS has determined that its funding of Dairyland's ownership interest would be a federal action and therefore subject to NEPA, 42 USC § 4321, review. See 7 CFR §1794.3. The final macro-corridors presented at scoping meetings contained a set of refined route options (Figure 4.3-5). Detailed comments on potential route options were gathered from the public and interested agencies during the scoping process. All comments were documented for further evaluation, including any new routes developed through past coordination with the public and agencies.

4.3.5 Preferred and Alternative Route Selection

The Applicant selected the Preferred and Alternative Routes from the refined route set using input from the public and agencies, the GIS matrix and the comparative analysis process described in Chapter 4.3.3.1. Final route selection was based on the factors identified in the state routing criteria and considered the varying values placed on these resources as evidenced by the diverse and sometimes conflicting opinions heard during the stakeholder involvement process. GIS matrix data for the Preferred and Alternative Routes by route section can be found in Appendix H.

At this final stage of the route development process for the 345 kV line, the Applicant had developed equally refined routes to each of the three potential Mississippi River crossings. The Applicant identified Alma as the preferred location for crossing the Mississippi River based several factors on an analysis of the entire routes leading to each crossing location; a thorough analysis of the potential impacts to the Mississippi River's natural, recreational, and historic environment; and by review of the routing criteria to each approach from the alternative routes that lead up to the river crossings in both Minnesota and Wisconsin. An overview of the Applicant's river crossing analysis is presented in Chapter 5.2. Appendix I provides information on all segments considered but eliminated that were associated with the selection of Alma as the preferred river crossing.

Route options associated with the La Crescent and Winona crossings were developed and analyzed using the same methods as the proposed routes; however, these routes are not being proposed in this Application. Appendix K provides an overview of potential impacts associated with two route options identified to the La Crescent crossing, and one route option identified to the Winona crossing.

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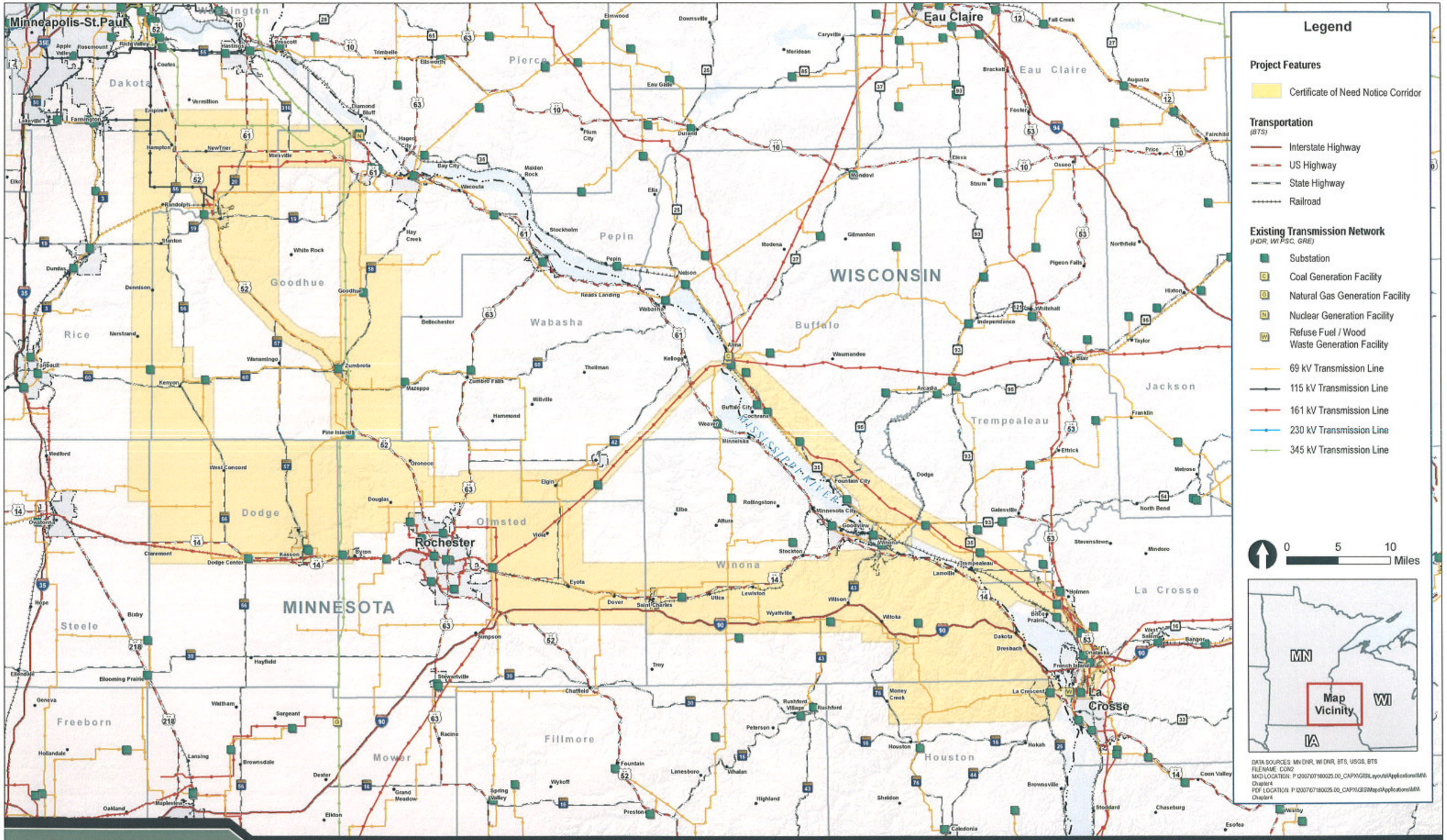

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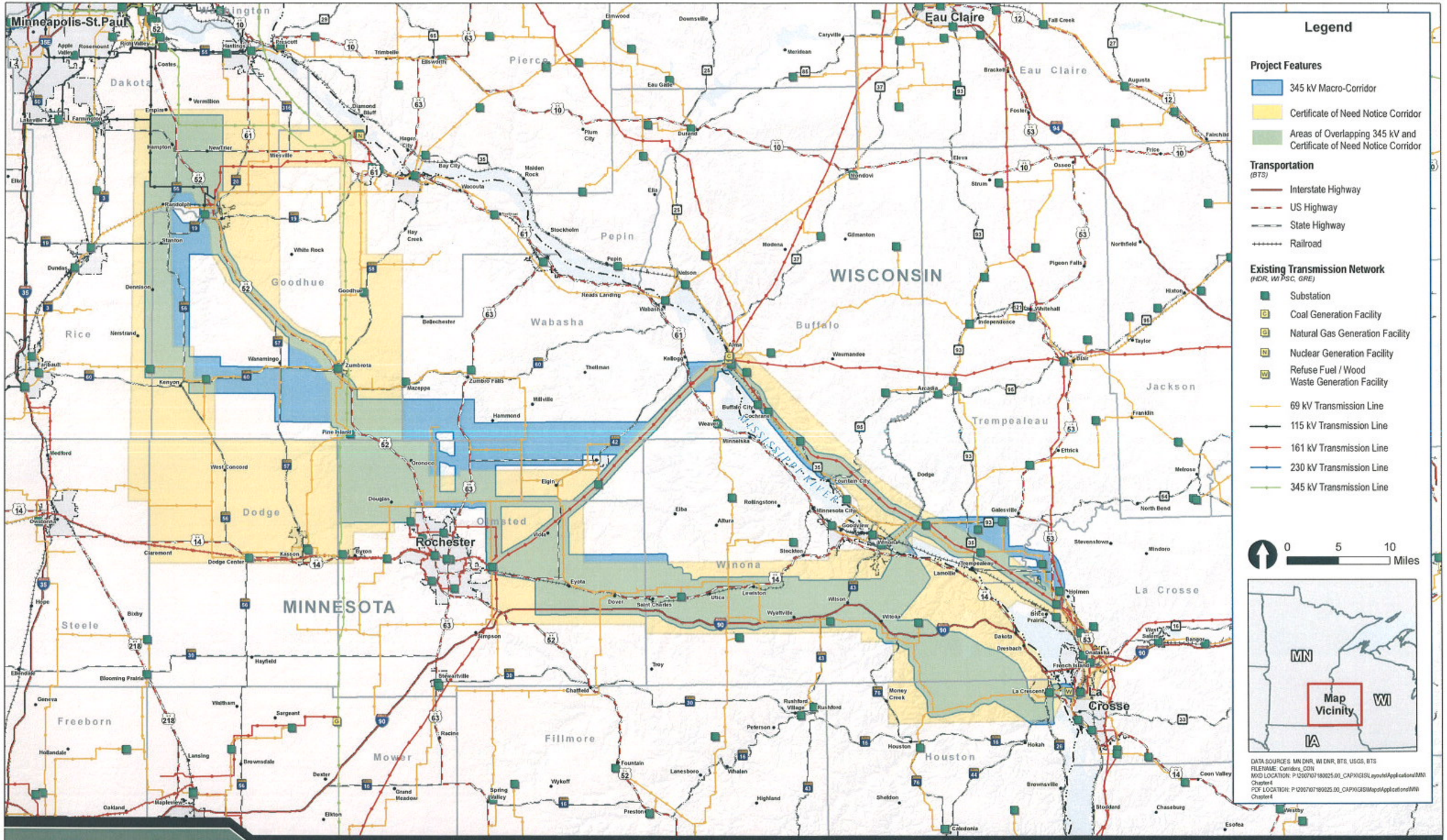
4.3-1: CON Corridors



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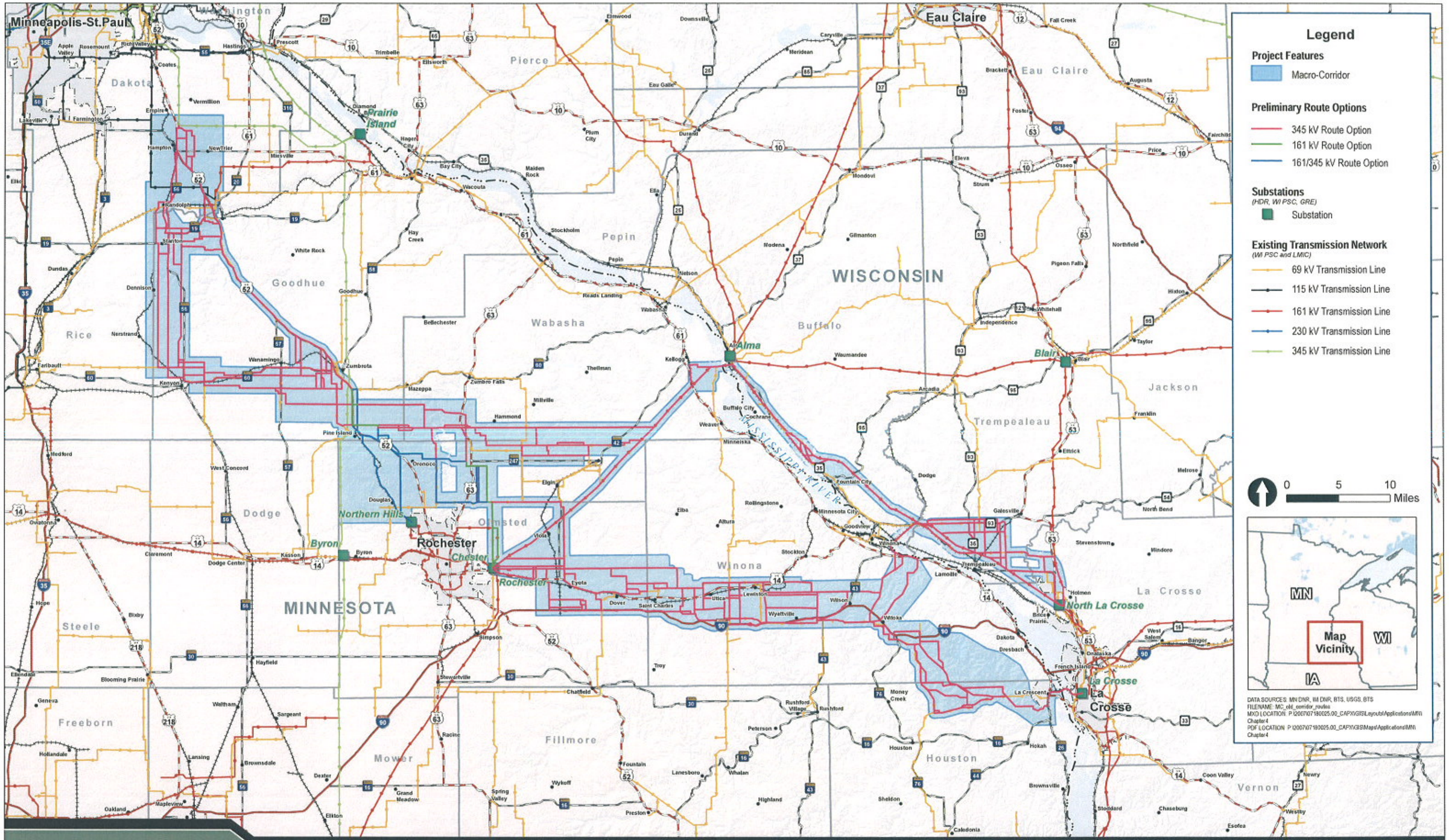
MN Route Permit Application

4.3-2: Preliminary Macro-Corridors with CON Corridors



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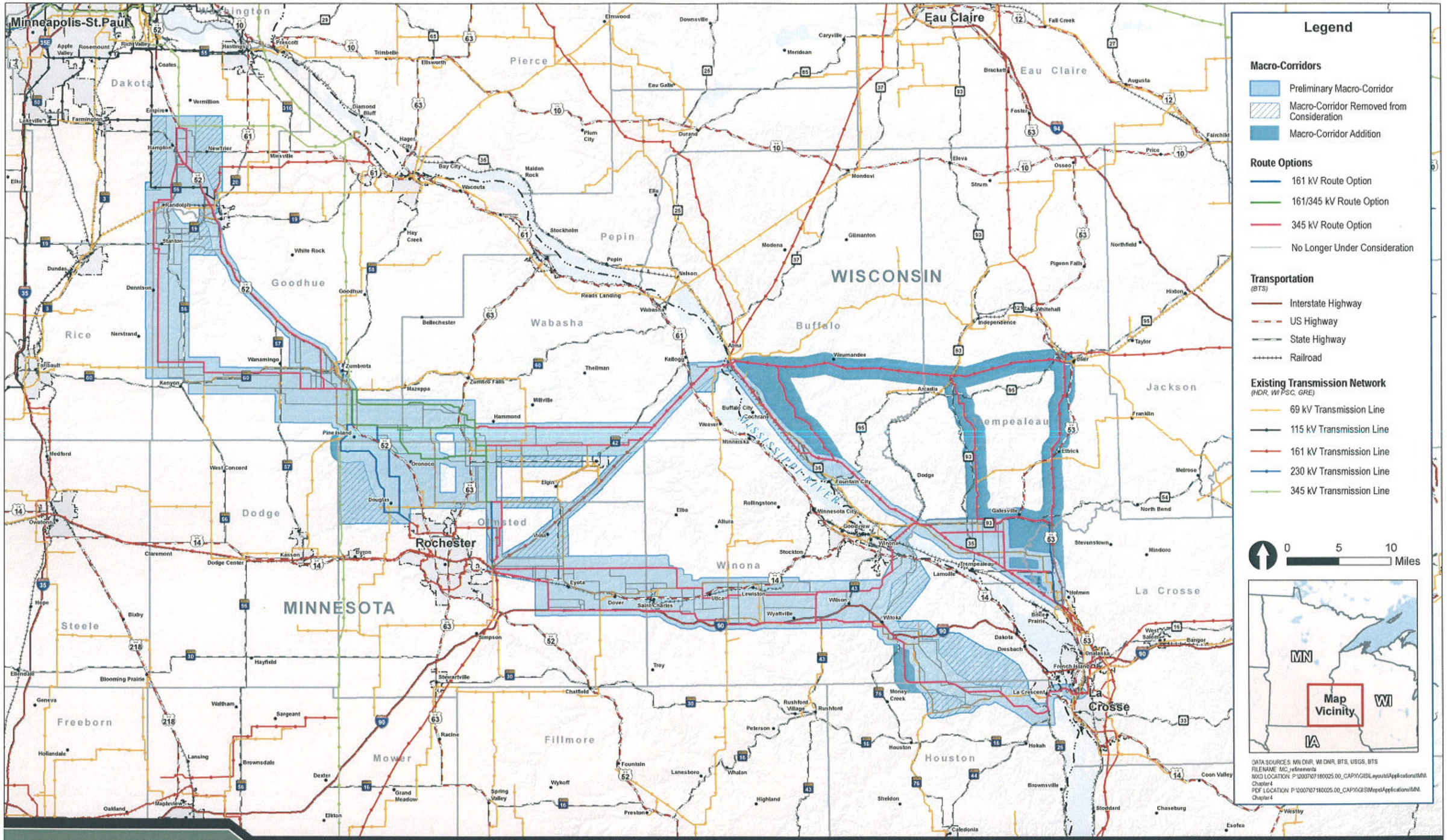
4.3-3: Preliminary Macro-Corridors and All Route Options



CapX2020

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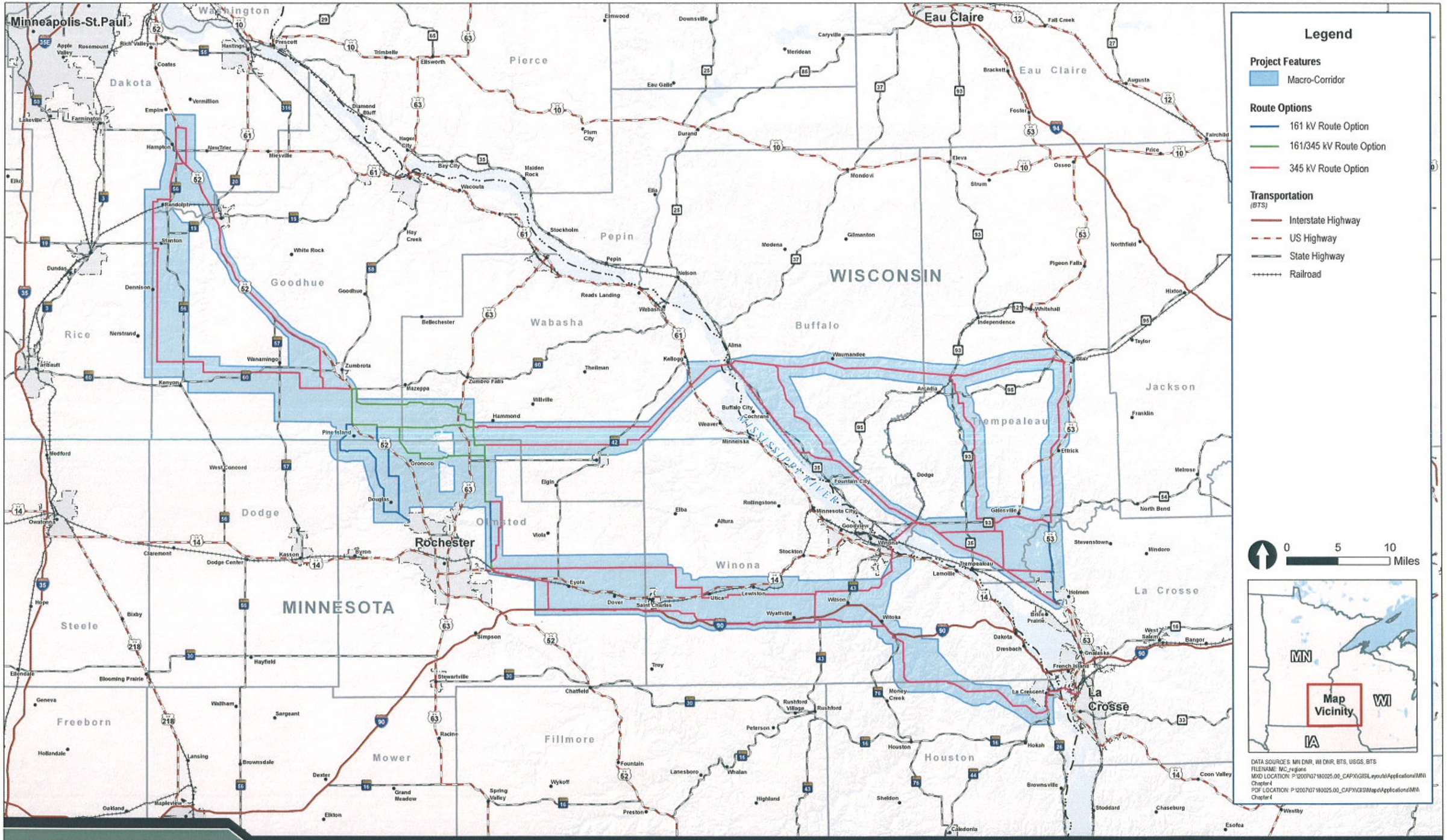
4.3-4: Refined Macro-Corridors with Route Refinement Options



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4.3-5: Final Macro-Corridors with Route Refinement Options

5.0 Rationale for the Selection of Preferred Routes, 345 kV Line and 161 kV Line

As described in Chapter 4.3.5, the Applicant has identified a Preferred Route and an Alternative Route for both the 345 kV and 161 kV transmission lines proposed in this Application. This chapter details the Applicant's rationale for selecting the Preferred 345 kV and 161 kV Routes.

Chapter 5.1 describes the Applicant's rationale for selecting the Preferred Route for the 345 kV transmission line. The Preferred 345 kV Route follows existing infrastructure corridors or property divisions for the majority of the route (including the Dairyland Q-3 161 kV transmission line[6]) through the blufflands west of the Mississippi River, and thus would minimize impacts to other sensitive resources.

Chapter 5.2 discusses the Applicant's selection of the Preferred 161 kV Route. The primary factors supporting the selection of the Preferred 161 kV Route were length and the degree of corridor sharing: the Preferred 161 kV Route is shorter (15.4 miles versus 17.9 miles) and utilizes existing infrastructure corridors for a greater length (92 percent versus 84 percent) when compared to the Alternative 161 kV Route.

5.1 Hampton – La Crosse 345 kV Transmission Line – Overview

An important consideration for the 345 kV transmission line was the location of the Mississippi River crossing. The Applicant and the other anticipated owners of the Project spent more than 2 years evaluating potential river crossings and concluded that a crossing at Alma, where Dairyland's Alma Generating Plant and existing transmission lines are located, is the most feasible alternative. The analysis included a review of routes in both Minnesota and Wisconsin near the Mississippi River and a detailed examination of potential impacts to the Upper Mississippi River Wildlife and Fish Refuge and the Trempealeau National Wildlife Refuge, both owned and managed by the USFWS. The key factors that support this conclusion are:

(1) The Alma crossing best implements Minnesota and Wisconsin policies of non-proliferation;

(2) The USFWS prefers the Alma crossing over the other river crossings analyzed;

(3) The Alma crossing and associated routes minimize the length of the transmission line traversing the Mississippi River floodplain, Refuge property, and open water/wetlands; and

(4) The Alma crossing has the widest existing permitted ROW, providing flexibility to work with USFWS to identify structures that will minimize bird and aesthetic impacts while meeting engineering requirements.

6 The Dairyland Q-3 161 kV line extends from the Rochester to Alma Substations.

The absence of a feasible substation site to interconnect at the La Crescent crossing also factored into the selection of Alma as the preferred river crossing. These factors are detailed in the river crossing analysis contained in Chapter 5.1.1.[7]

5.1.1 Mississippi River Crossing Analysis

The Mississippi River is recognized as a valuable resource with designated habitat areas and many recreational opportunities. There are two designated wildlife refuges along the Mississippi River in the Project area managed by the USFWS. The larger refuge is the Upper Mississippi River National Fish and Wildlife Refuge which provides both recreational opportunities and habitat protection. The Refuge provides habitat for fish, mammals, amphibians, reptiles and in particular, a large percentage of migratory birds that use the Mississippi Flyway. Trempealeau National Wildlife Refuge is smaller and located east of Winona, Minnesota. Any crossing of either refuge would require a Special Use Permit from USFWS.

The following summarizes the process by which the alternative locations for crossing the Mississippi River were identified, the analysis performed by the Applicant on the river crossing options, and the reasons the Applicant selected the Alma crossing as the preferred location.

5.1.1.1 Identification of Alternatives

Due to the width of the Mississippi River, existing settlements, natural areas, and the topography of the surrounding blufflands, feasible crossing locations are limited. Early in the route development process for the 345 kV transmission line, the Applicant and other participating utilities sought to identify existing disturbed corridors for potential river crossings to minimize new impacts to the river and Refuge property. The Applicant reviewed various crossing locations and identified four potential crossing areas, shown in Figure 5.1-1:

- Alma, Wisconsin, referred to as the Alma crossing;
- Winona, Minnesota, referred to as the Winona crossing;
- La Crescent, Minnesota, referred to as the La Crescent crossing; and
- Trempealeau, Wisconsin, referred to as the Trempealeau crossing.

[7] The Applicant notes that this chapter is not intended to inventory all of the impacts identified and factors analyzed. Rather, it aims to describe those discerning factors that led to the determination that the new facilities should be constructed at the Alma crossing.

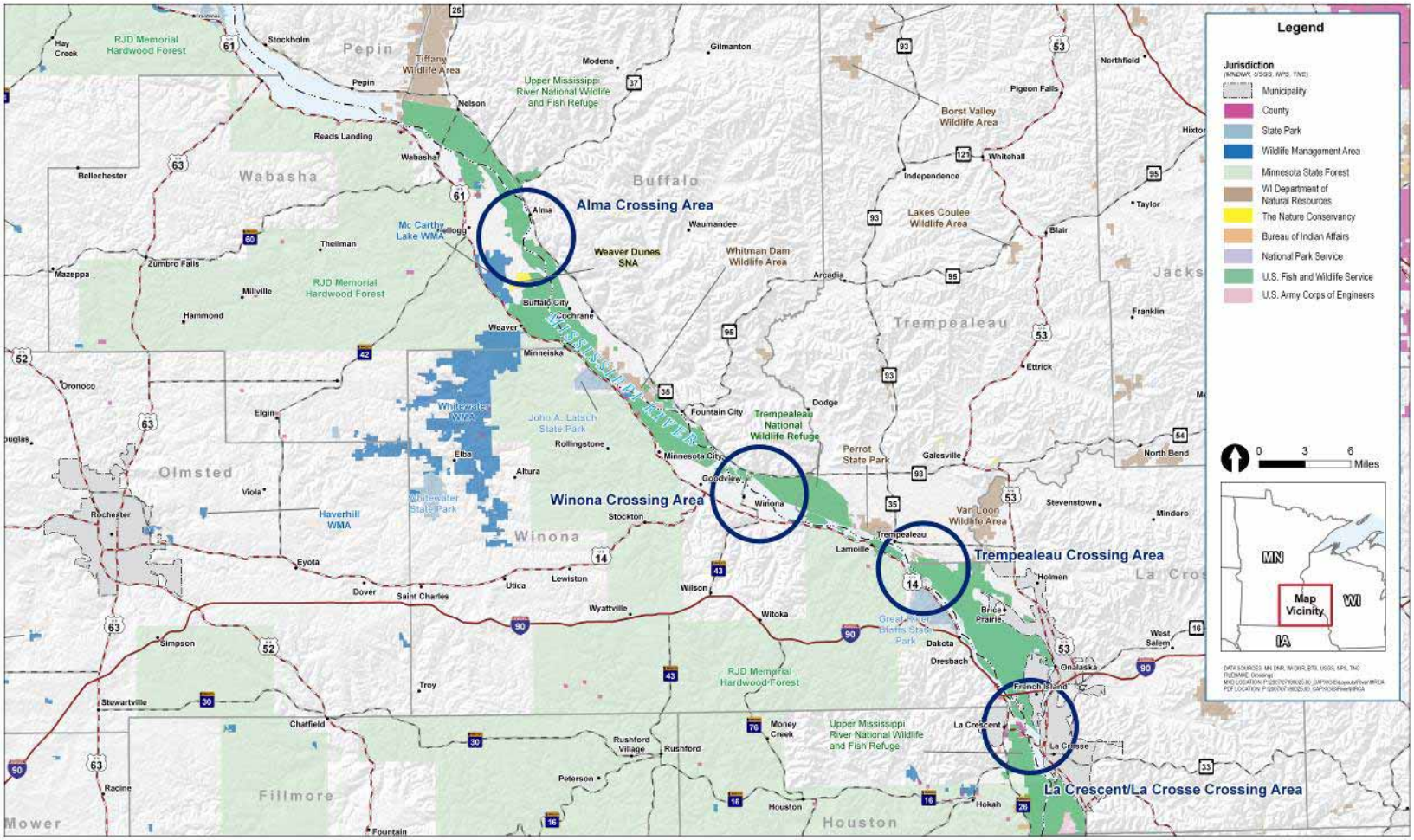


Figure 5.1-1: Mississippi River Crossings

The crossings at Alma, Winona, and La Crescent have existing transmission lines and all three crossings were evaluated assuming that the new 345 kV line would be collocated with existing facilities. The Trempealeau Crossing does not have an existing transmission line or road, but Lock and Dam No. 6 is located in this area and the crossing would have occurred at a narrow section of the river containing several islands that could support transmission line structures.

Early in the evaluation process, the Applicant determined that the Trempealeau crossing should be eliminated because it would require establishing a new transmission line crossing and because three options with existing transmission lines had been identified. Another reason the Trempealeau crossing was eliminated was because a field review identified more residences along the Mississippi River on the Wisconsin side of the Trempealeau crossing than originally expected. In addition, the USFWS advised that it was unlikely a Special Use Permit could be issued because USFWS regulations would not allow new utility corridors when other existing transmission line corridors that are feasible alternatives exist. Accordingly, the remainder of the river crossing analysis discussion focuses on the Alma, Winona, and La Crescent crossings.

5.1.1.2 Detailed Description of Potential Crossings

Alma Crossing

The intersection of the existing Dairyland Q-3 161 kV transmission line and U.S. Highway 61 (US-61) marks the western boundary of the Alma crossing area in Minnesota. The Wisconsin boundary of the Alma crossing is the intersection of the existing Dairyland Q-1 161 kV transmission line (Dairyland Q-1 line) and Wisconsin State Highway 35 (WI-35). A map of the Alma crossing area is shown in Figure 5.1-2, and a photograph of the Alma crossing area is shown in Figure 5.1-3. Appendix E contains additional photographs of the Alma crossing area.

On the Minnesota side of the Alma crossing, the 345 kV transmission line would follow the existing Dairyland Q-3 line corridor that traverses the blufflands west of the Mississippi River (part of the geologic formation known as the “Driftless Area”), and several state and federal lands including the Snake Creek Management Area, McCarthy Lake Wildlife Management Area (WMA), and the Richard J. Dorer Memorial Hardwood State Forest (RJD State Forest). These resources are discussed in detail in Chapter 8.

At the Mississippi River, the Dairyland Q-3 line is collocated with the Alma-Harmony 69 kV transmission line. The USFWS authorized ROW is 180 feet for these facilities. The width of the river floodplain crossed by the transmission facilities is approximately 1.4 miles. The crossing enters Refuge property at an abrupt transition from agricultural land to wooded floodplain wetland. This floodplain extends approximately 1,300 feet to the Zumbro River channel. The Zumbro River occupies a 350-foot channel that is separated from the main Mississippi River by a 500-foot-wide wooded floodplain peninsula. The Mississippi River channel is approximately 1,400 feet wide at the Alma crossing.

Figure 5.1-2: Alma Crossing

Figure 5.1-3: Alma Crossing Photo

On the east side of the Mississippi River channel, the wooded floodplain continues for approximately 2,200 feet with a narrow wooded island separating the main channel from a smaller channel and then wooded floodplain punctuated with backwaters continues to a railroad turnaround associated with Dairyland's Alma Generating Station. The plant stacks are 700 feet tall, and five 161 kV lines tie into the Alma Substation at the site.

The Alma crossing affords several routing alternatives to three potential La Crosse area substation interconnections, including the existing North La Crosse Substation or a new substation near Holmen or Galesville, Wisconsin. The route could follow the Dairyland Q-1 line corridor immediately south to the La Crosse area, or the route could follow an existing 161 kV transmission line corridor in an easterly direction toward Arcadia before connecting southwards via a 69 kV corridor. These Wisconsin route options are shown on Figures 1.0-1 and 1.0-2.

Winona Crossing

The Winona crossing area begins at the intersection of Winona County Highway 5 and Pleasant Valley Road on the Minnesota side of the Mississippi River. On the Wisconsin side, the Winona crossing area is defined by the intersection of WI-35 and the Buffalo/Trempealeau county line. The Winona crossing area is shown on Figure 5.1-4. Appendix E contains photographs of the Winona crossing area.

The Winona area is served by three transmission lines that cross the Mississippi River from Wisconsin, and there are no transmission line corridors to the west of the city. There are no linear features (such as roadways) through the bluffs west of the Mississippi River that are feasible for siting a new 345 kV transmission line. Approximately 10 miles of new corridor would need to be created through the Driftless Area of Minnesota to reach the river at the Winona crossing.

On the Mississippi River at the southern end of Winona, the new 345 kV facilities could be collocated with an existing 161 kV transmission line that is currently operated at 69 kV. The 161 kV line was rebuilt in 2006 under a new Special Use Permit issued by USFWS on a permitted ROW of 100 feet. The width of the river floodplain is approximately 3.2 miles. The Winona crossing traverses the 2,600-foot-wide main channel where it encounters a narrow series of islands a railroad track and approximately 2.5 miles of backwater wetland complex.

On the Wisconsin side, the 345 kV line would be collocated with the 161 kV transmission line (Q1 line Alma-La Crosse-Genoa) that crosses Refuge property. The 345 kV line could then connect with the Dairyland Q-1 line in a southeasterly direction and terminate at the North La Crosse Substation, or follow mostly property lines to a new substation in the Holmen or Galesville area.

La Crescent Crossing

The La Crescent crossing area begins where the proposed transmission line intersects with Minnesota Highway 16 (MN-16), south of La Crescent, Minnesota. In Wisconsin, the eastern boundary of the crossing area is the City of La Crosse. The La Crescent river crossing is shown on Figure 5.1-5. Appendix E contains photographs of the La Crescent crossing area.

Figure 5.1-4: Winona Crossing

Figure 5.1-5: La Crescent River Crossing

In the City of La Crescent, the 345 kV line would be collocated with a 69 kV transmission line that follows a railroad through a commercial/industrial area and then an abandoned roadway through approximately 1 mile of wooded floodplain.

There are no feasible transmission line corridors to the west of the city or other linear features through the blufflands to the Mississippi River that would facilitate routing of a 345 kV transmission line. Approximately 15 miles of new transmission corridor would need to be established through the Driftless Area in Minnesota to reach the Mississippi River at the La Crescent crossing.

At the river, the 345 kV line follows the 69 kV line through the Refuge property and cross the 1,100-foot-wide main channel. The USFWS permitted ROW width for the 69 kV transmission line is 100 feet. After crossing a narrow island, another 750-foot-wide channel is present before approximately 0.7 mile of floodplain forest with several backwater channels is crossed to reach the French Island power plant. East of the power plant, a 750-foot-wide channel of the Black River would be crossed to a narrow strip of forested wetlands, then to the industrial area northwest of La Crosse.

If a crossing at La Crescent had been selected, either an expansion of the existing La Crosse Substation would be required (an expansion was determined to be not feasible due to wetland permitting constraints); a new substation would need to be constructed in an industrial area northwest of La Crosse requiring displacement of an existing business; or a new substation would need to be constructed east of the La Crosse Substation, which would require routing the 345 kV line through the La Crosse Marsh wetland.

5.1.1.3 Analysis of River Crossing Options

To evaluate the river crossings, the Applicant reviewed GIS mapping resources, conducted on-site investigations, consulted with agencies, including USFWS, and gathered stakeholder input through individual and public meetings. The Applicant compared the potential routes at the approach areas for both Minnesota and Wisconsin at each crossing by applying Minnesota and Wisconsin routing guidelines and requirements. On the Minnesota side, the approach area consists of the blufflands that border the Mississippi River. On the Wisconsin side, the geographic area is similarly comprised of a rugged, hilly region dissected by rivers and streams, rocky outcroppings, and numerous small caves abutting the Mississippi River. All three crossings would affect USFWS-managed lands. In addition, impacts to wetlands were reviewed.

Through this evaluation, the Alma crossing emerged as the preferred crossing location. The factors that support this conclusion are described below.

Non-Proliferation

Minnesota routing criteria includes a policy of non-proliferation, described in Chapter 2.3.3. Similarly, Wisconsin law provides that when siting new transmission lines, priority must be given to existing utility corridors (Wis. Stat. § 1.12(6(a), discussed in detail in Chapter 4.1.1.2).

The Alma crossing best implements these non-proliferation policies because opportunities exist for sharing ROW with existing transmission line facilities on both sides of the Mississippi River and through Refuge property. The Alma route is the only one of the three crossings that follows an existing transmission line corridor through the blufflands in Minnesota. The Alma crossing then follows the 161/69 kV line corridor through the Upper Mississippi Wildlife and Fish Refuge. On the Wisconsin side, opportunities exist to follow existing transmission lines to the south to La Crosse (Dairyland Q-1 line), or to the east along a 161 kV corridor to Arcadia, and then south along an existing 69 kV line into the Galesville area. For the Alma Crossing, no new corridor would need to be created near or across the Mississippi River.

In contrast, the Winona and La Crescent crossings would both require creation of a new transmission corridor in Minnesota through the blufflands. These areas are marked by irregular land use patterns and property boundaries that result from the rugged terrain. The new corridor would be approximately 10 miles long for the Winona crossing and 15 miles long for the La Crescent crossing. There are no existing linear features in these areas that present feasible routing opportunities for the proposed 345 kV transmission lines.

Floodplain and USFWS Concerns

The Upper Mississippi River Wildlife and Fish Refuge is a migratory bird corridor. The flyway follows the Mississippi River and is one of four primary bird migration routes in North America.

Potential impacts to Refuge property include additional clearing that may be required through forested areas, potential bird impacts, aesthetic impacts, wetland impacts and temporary construction impacts. The length of the crossing and the height of structures are important considerations related to potential bird impacts. These impacts can be minimized by using the narrowest river and floodplain crossing area. The Alma crossing is located where the fewest miles of floodplain (1.4 miles) would be crossed. The La Crescent crossing would require crossing 2 miles of the floodplain. The Winona crossing would require the greatest distance to cross the floodplain, at 3.25 miles.

Throughout the route development process, the Applicant has sought input from USFWS regarding the crossings being considered. The USFWS is responsible for issuing a Special Use Permit for construction of a transmission line across Refuge property.

In a February 19, 2008, letter USFWS stated that the, “Alma crossing may pose the least environmental impact.” USFWS noted that no new ROW may be required on Refuge property and that it “is also least likely to impact migratory birds since it is some distance from known bird concentration points.” The USFWS also stated that neither the Winona nor the Trempealeau crossings should be considered. “[E]ach would likely involve new rights-of-way across portions of national wildlife refuges, and such rights-of-way would likely not be approved since Service policy and regulations do not allow new uses that fragment habitat on refuges.” With respect to the La Crescent crossing, USFWS stated it was the “second choice,” but that the option presents concerns “due to its proximity to an active eagle nest and great blue heron colony approximately 0.3 mile north (Wisconsin side) and an important heron and egret feeding area adjacent to the line (Minnesota side)” (USFWS 2008).

Engineering Challenges and Visual Impacts

As noted above, the Winona and La Crescent crossings would require development of a new transmission corridor to accommodate the new 345 kV transmission line through the blufflands west of the Mississippi River. There are no linear features in this area that present feasible routing opportunities; therefore, the new corridor would need to traverse cross-country to reach the Mississippi River. These new corridors also would present significant engineering challenges due to topography and limited access for construction vehicles and equipment.

Crossing the Mississippi River channel and floodplain also poses a unique engineering challenge because the river has a minimum clearance of approximately 90 feet that must be maintained for navigational purposes. Backchannels, wetlands and islands also are present at the crossings. The channel would require a long span. These factors may necessitate structures at the river crossing that are taller than the typical height of 150 feet. FAA regulations require structures exceeding 200 feet in height to have lights and/or be painted red and white to increase structure visibility. Structure heights of less than 200 feet are generally desired because lights on tall structures are known to have the potential to increase bird impacts, and painted structures would have higher aesthetic impacts.

The ability to build structures less than 200 feet tall is most constrained at the Winona and La Crescent crossings where the existing permitted ROWs are only 100 feet. If the transmission line were constructed within a 100-foot ROW, the structures would exceed 200 feet to accommodate the two 345 kV circuits and the existing transmission line. In contrast, at Alma, the permitted ROW is 180 feet, providing additional flexibility to work with the USFWS to develop appropriate structures to meet engineering requirements and minimize impacts to birds and aesthetic values. Configuration of the river crossing structures will be subject to approval throughout the federal EIS process and the USFWS Special Use Permit.

Substation Location Concerns

Another factor in the analysis was the need to terminate the line at an existing or new substation in the La Crosse area. The Alma and Winona crossings are better because they provide flexibility in substation siting. The Applicant has identified three potential substation sites that could be used with either the Alma or Winona crossings: at or near the existing North La Crosse Substation, a new substation near Galesville, or a new substation near Holmen. All three substation siting areas in Wisconsin are shown on Figures 1.0-1 and 1.0-2.

For the La Crescent crossing, the existing La Crosse Substation is not a reasonable alternative because the necessary expansion of the substation footprint is not likely to be permitted. The La Crosse Substation is located adjacent to a high-value wetland complex known locally as the La Crosse Marsh. To accommodate the new 345 kV transmission facilities, approximately 5 acres of wetlands would be filled, which would require permits from the U.S. Army Corps of Engineers (USACE) and the WDNR. The WDNR has identified the wetlands complex as an Area of Special Natural Resource Interest (ASNRI). In a May 29, 2009 letter, the WDNR advised that “expansion of the La Crosse Substation would likely result in significant adverse impacts to the function and values of these wetlands” (WDNR 2009). The WDNR

also stated that as a result, it "highly recommends that Xcel Energy remove the La Crosse Marsh substation expansion and accompanying line route from further consideration" Id.

Mississippi River Floodplain Wetlands

Another key factor in the analysis of the river crossings was potential impact on the forested floodplain wetlands of the Mississippi River. The Applicant sought to minimize impacts to the river and its floodplain wetlands to reduce avian impacts and impacts to environmentally sensitive areas.

All three of the potential river crossing locations would pass through Mississippi River floodplain wetlands. The Alma crossing route would require the fewest structures in floodplain wetlands due to the shortest distance (1.4 miles) crossing the floodplain. The Winona crossing location crosses the most floodplain of any of the three river crossings (3.25 miles).

The floodplain crossing at the La Crescent crossing is approximately 2.3 miles wide but the route to La Crescent from the south also would require structures to be placed in the floodplain for an additional 0.75 mile. The total route in the Mississippi floodplain is approximately 3 miles for the La Crescent crossing.

The potential expansion of the North La Crosse substation also would impact as much as 5 acres of the La Crosse Marsh wetland and/or could require crossing the Marsh with a transmission line to other potential substation sites.

5.1.1.4 Summary of Rationale Supporting Alma Crossing

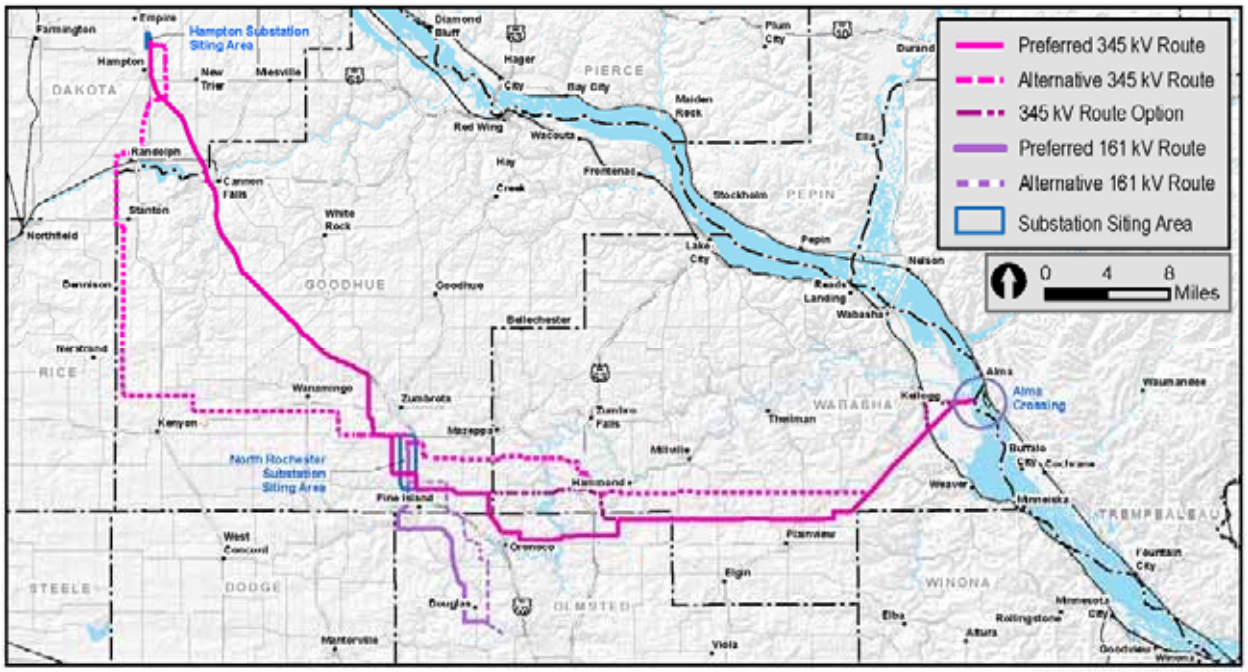
Based on a thorough analysis, the Applicant determined that Alma is the most feasible option for crossing the Mississippi River. This Application, therefore, presents route alternatives for the 345 kV transmission line between the Hampton Substation and the Alma Crossing. The routes identified to the Winona and La Crescent crossings are described in detail in Appendix K. Table 5.1-1 summarizes the key factors supporting these conclusions.

5.1.2 Analysis of Routes for 345 kV Transmission Line

Once the preferred Mississippi River crossing was chosen, the Applicant was able to narrow potential routes to a specific geographic location and select the Preferred and Alternative Routes. Figure 5.1-6 shows the two 345 kV sections, and the location of the North Rochester–Northern Hills 161 kV line.

Table 5.1-1:
Summary of Rationale Supporting Alma Crossing

Factor	Alma	Winona	La Crescent
Use of Existing Corridors, Minnesota	No new corridor required	10 miles of new corridor required	15 miles new corridor required
Use of Existing Corridors, Wisconsin	Two feasible route options that follow existing transmission lines	Two feasible route options. One follows an existing transmission line and one follows property boundaries and roads.	Route options may not be feasible due to potentially unpermittable wetland impacts and/or displacement of businesses
Length in Floodplain	1.4 miles	3.25 miles	2 miles
Permitted ROW in Refuge	180 feet	100 feet	100 feet
USFWS Opinion	Preferred	Opposed	Alternative with additional permitting constraints
Engineering Considerations	Narrowest river crossing Route follows existing transmission corridor through blufflands Wider ROW through refuge property allows flexibility to design lower structures to mitigate potential impacts to birds and aesthetics	Widest river crossing, requiring multiple poles to be located in Mississippi River backwaters New corridor required in blufflands, limited access Narrow ROW through refuge property results in tall structures causing potential impacts to birds and aesthetics	New corridor required in blufflands, limited access Narrow ROW through refuge property results in tall structures causing potential impacts to birds and aesthetics
Feasible Substation Locations	Three potential substation sites	Three potential substation sites	La Crosse Substation not feasible; other alternatives require business displacement or an upgraded line in the La Crosse Marsh



Project Overview Map

Figure 5.1-6: Project Overview Map

When developing the Preferred Route for the 345 kV transmission line between the Hampton Substation and the Mississippi River, the Applicant analyzed two distinct geographic areas. The first area is between the Hampton Substation siting area and the North Rochester Substation siting area (Hampton–North Rochester 345 kV section). The second area is between the North Rochester siting area and the Alma Crossing (North Rochester–Mississippi River 345 kV section). This latter section includes a geographic subsection where the proposed 345 kV transmission line must cross the Zumbro River. The conclusions reached regarding the Preferred Route through analysis in each of these geographic areas were combined to create the overall Preferred Route for the 345 kV transmission line.

5.1.2.1 Hampton–North Rochester 345 kV Section

Two routes between the Hampton Substation and the North Rochester Substation siting area are presented in this Application (Figure 5.1-7). The Preferred Route was selected because it is the most direct route, and because it maximizes the use of existing transportation and transmission corridors, which is consistent with Minnesota's policy of non-proliferation discussed in Chapter 2.3.3. The Preferred Route follows US-52, the primary transportation corridor between the Twin Cities and Rochester. In addition, an existing 69 kV transmission line is located next to US-52 between Cannon Falls and Zumbrota. The proposed 345 kV transmission line would be collocated with the existing 69 kV

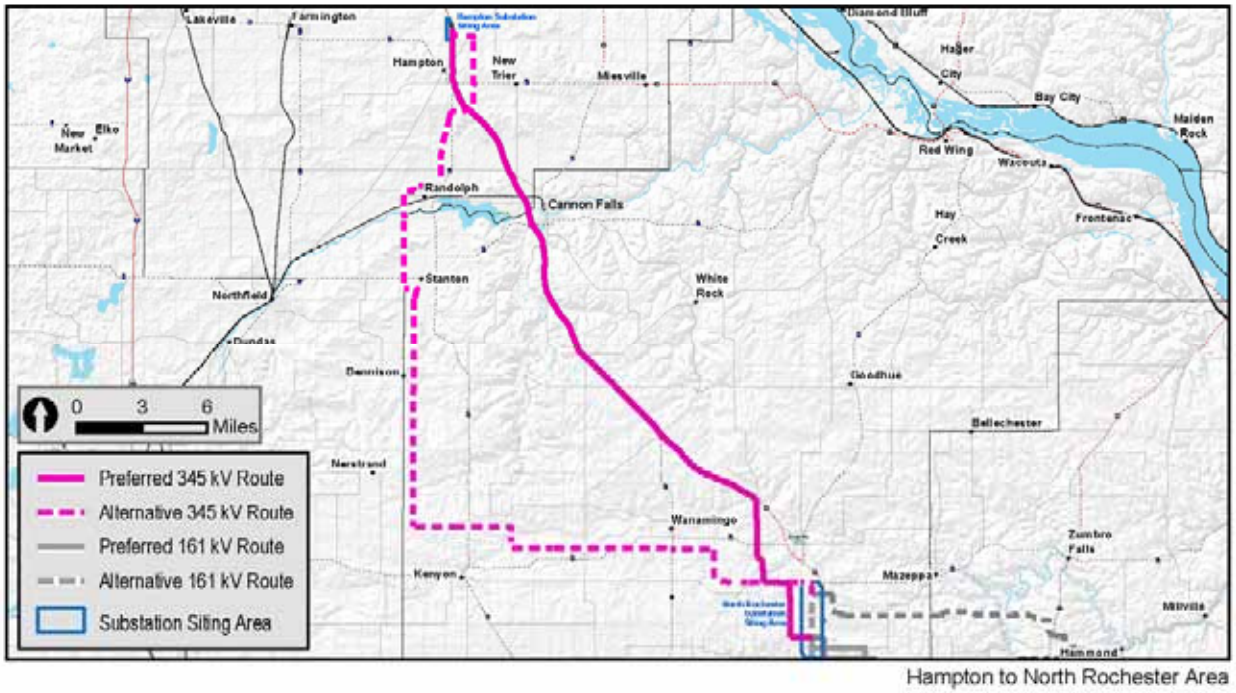


Figure 5.1-7: Hampton – North Rochester 345 kV Section

transmission line where possible for up to 16 miles. The route along US-52 is 10 miles shorter than the Alternative Route. Generally, a shorter route causes fewer impacts to land use and other resources and results in overall lower Project costs.

Placing the new transmission line adjacent to US-52 over the Cannon River would avoid the creation of a new linear corridor across the river. The Preferred Route also would avoid impacts to Lake Byllesby Regional Park by crossing the Cannon River approximately 0.75 mile east of the park boundary. In contrast, the Alternative Route crosses the Cannon River along Lake Byllesby Regional Park's westernmost boundary at a narrow point in the river, where there is no existing linear corridor. In addition, although both routes were carefully developed to avoid direct impacts to known resources such as WMAs and historical sites, there are more of these potentially sensitive areas in proximity to the Alternative Route compared with the Preferred Route.

Selection of the Preferred Route in the Hampton–North Rochester 345 kV section was based upon the route's greater percentage of corridor sharing and shorter distance, especially considering the opportunity to follow a major transportation corridor and collocate with an existing transmission line for the majority of the route's length. Table 5.1-2 summarizes the key factors that support selection of the Preferred Route over the Alternative Route.

Table 5.1-2:
Analysis of Factors, Hampton–North Rochester 345 kV Section

Resource	*Preferred Route*	*Alternative Route*
Route Types		
Percent (miles) following existing transmission line	42% (15.1)	1% (0.7)
Percent (miles) following road or rail but not transmission line	40% (14.6)	7% (3.5)
Percent (miles) following property line but not transmission line, roads or rail	14% (5.0)	69% (32.3)
Percent (miles) not following existing linear feature	4% (1.4)	23% (10.7)
Total length of route (miles)	36.1	47.1
Cannon River Crossing Context/Setting		
Lake Byllesby Regional Park	Offset 0.75 mile east of park boundary	Follows westernmost park boundary
Cannon River	Cross at existing transportation corridor	No existing linear corridor at crossing

5.1.2.2 North Rochester–Mississippi River 345 kV Section

The North Rochester–Mississippi River 345 kV section is approximately 44 miles long (Figure 1.0-1). Two prominent routing challenges in this geographical area include crossing the Zumbro River and traversing the blufflands (also known as the Driftless Area) west of the Mississippi River to reach the Alma Crossing. Analysis of these two areas anchored the routing decisions for the North Rochester–Mississippi River 345 kV section.

Zumbro River Crossing

The Applicant analyzed three Zumbro River crossings within 5 miles of the Zumbro Dam, two of which are collocated with existing structures (a bridge and a dam). Figure 5.1-8 shows the three Zumbro River crossings that were analyzed by the Applicant. The Applicant selected the Preferred Route (White Bridge Road) because it would maximize use of existing linear corridor across the Zumbro River and better avoid sensitive resources.

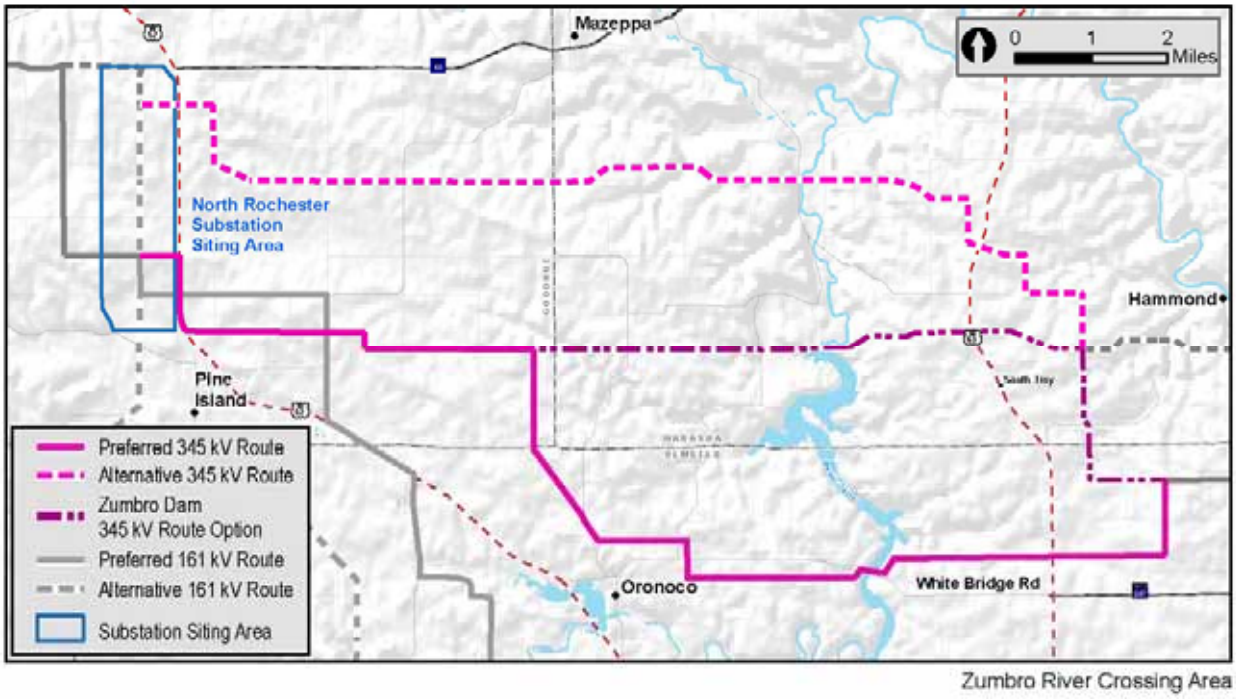


Figure 5.1-8: Zumbro River Crossing

The Preferred Route traverses mostly agricultural lands east and west of the Zumbro River, and crosses the Zumbro River at Olmsted County Road (CR) 12, also known as White Bridge Road. While the Preferred Route would require some additional tree clearing at the Zumbro River, there are no known high quality resources at this location, and the bridge provides an existing corridor that could be used to minimize impacts to the river.

The Alternative Route (North Route) follows a property line across the Zumbro River at a location where there is no existing linear corridor on either side of the river. The crossing at the Alternative Route location would require more clearing of forested areas, and therefore would likely have more impacts to natural resources than the Preferred Route. However, it would require the creation of a new corridor crossing the Zumbro River.

At the Zumbro Dam Route Option there is an existing crossing of the river (Zumbro Dam and Hydroelectric Generation Facility). The Route Option would require new tree clearing on the east bank of the Zumbro River, where the MDNR has identified a forested area of high biodiversity significance. The Route Option would be located in proximity to several recreational resources, including a campground and two summer camps on the east bank of the Zumbro River. The Route Option also would result in the highest number of residences within 300 feet.

Table 5.1-3 summarizes the key factors that support the selection of the Preferred Route over the Alternative Route and the Zumbro Dam Route Option.

Table 5.1-3:
Analysis of Factors, Zumbro River Route [1]

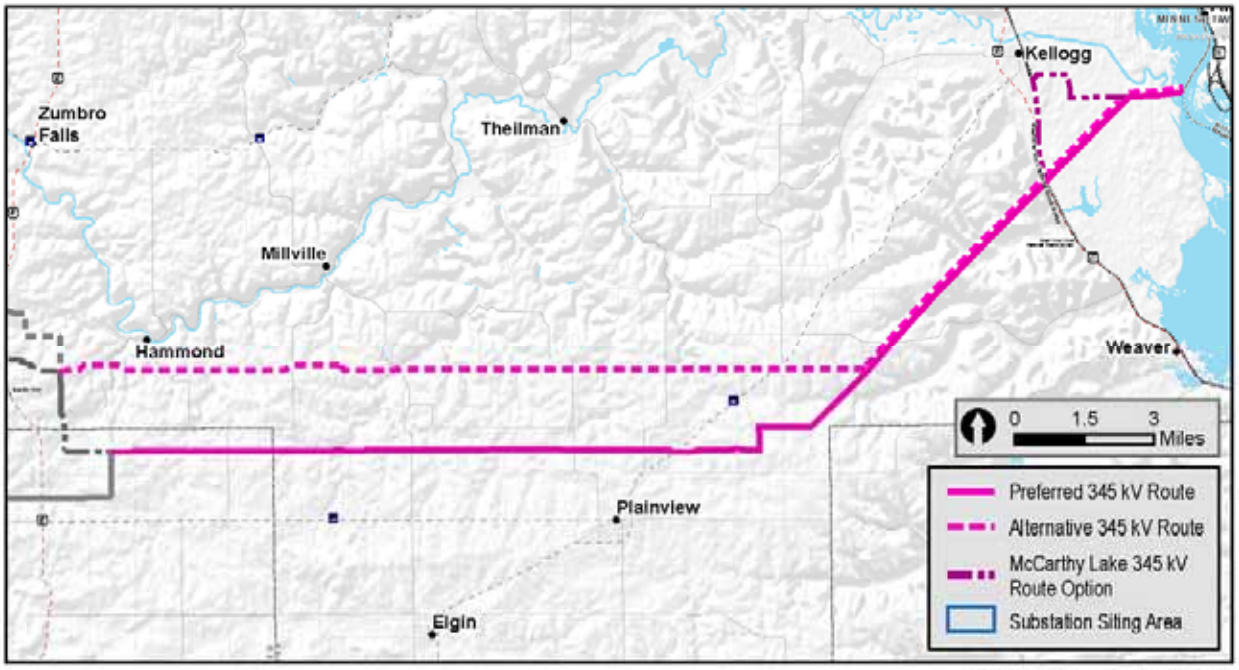
	Preferred Route	Alternative Route	Route Option
Resource	*White Bridge Road*	*North Route*	*Zumbro Dam*
Route Types			
Percent (miles) following existing transmission line	13% (2.6)	6% (1.1)	18% (3.4)
Percent (miles) following road or rail but not transmission line	30% (6.2)	25% (4.5)	22% (4.2)
Percent (miles) following property line but not transmission line, roads or rail	38% (8.0)	45% (8.5)	33% (6.2)
Percent (miles) not following existing linear feature	19% (4.0)	24% (4.5)	27%(5.2)
Total length of route (miles)	20.8	18.6	19.0
Residences			
Within 150 feet	2	0	3
Within 300 feet	5	3	9
Biology			
Length crossing Upland Forest (miles)	1.3	2.2	1.7
Length crossing High biodiversity (miles)	0	0	0.6
Context/Setting			
Existing infrastructure at river	Road	None	Dam
Setting within 1 mile of river	Agricultural in close proximity to road	Woodlands, rural residential	Mixed woodlands and agricultural. Recreational facilities
Affect on woodlands	Route on edge of woodlands	Route divides woodlands	Route divides woodlands

[1] Routes used in this analysis begin at a western common point approximately one-half mile northwest of the North Rochester siting area to an eastern common point near US-63 and Wabasha County Road 11.

Zumbro River to Alma/Blufflands

The three Zumbro River crossing routes converge east of the Zumbro River. Between this point and the Alma crossing, the Applicant identified two routes, the Preferred Route and the Alternative Route (Figure 5.1-8). For approximately 20 miles east of the Zumbro River crossing, the landscape is generally flat agricultural land divided along section lines with occasional forested ravines. In developing routes in this area, the Applicant maximized use of field boundaries and property lines rather than roads because residences tend to be clustered around local roads. The Preferred and Alternative Routes follow the Dairyland Q-3 line for 11 miles and 9 miles, respectively, through the blufflands between Plainview and the Mississippi River.

Both the Preferred and Alternative Routes use the existing Dairyland Q-3 line corridor through the blufflands to the Minnesota border and across the Mississippi River (Figure 5.1-9). The Preferred Route maximizes the use of existing transmission corridors and avoids establishing a new corridor through environmentally sensitive areas, including the RJD State Forest and the McCarthy Lake WMA.



Zumbro River to Alma Area

Figure 5.1-9: Zumbro River to Mississippi River

The Preferred Route was selected because it follows a greater length of transmission lines and property lines and roads when compared with other routes. The Preferred Route follows an existing 69 kV transmission line for approximately 3.5 miles near Plainview, and the Dairyland Q-3 line for 11 miles to the Alma Crossing. Where the Preferred Route does not follow existing infrastructure corridor, it follows a higher percentage of property boundaries and has less impact to forested land than the Alternative Route.

The Alternative Route follows fewer property lines, resulting in more impact to open agricultural fields. The Alternative Route also crosses a higher number of forested ravines that offer wildlife habitat than the Preferred Route. Both the Preferred and Alternative Routes minimize impacts to residences by avoiding roads where houses are concentrated.

The McCarthy Lake Route Option, which is longer and bypasses the McCarthy WMA, is offered for consideration in this area, however the Applicant determined that constructing the proposed line on double circuit structures with the existing transmission through the McCarthy WMA would pose the least impacts.

Table 5.1-4 summarizes the key characteristics of the Preferred and Alternative Routes in the North Rochester–Mississippi River 345 kV section.

Table 5.1-4:
Analysis of Factors, North Rochester–Mississippi River 345 kV Section

Resource	Preferred Route	Alternative Route
Route Types		
Percent (miles) following existing transmission line	32% (14.4)	22% (9.2)
Percent (miles) following road or rail but not transmission line	7% (2.8)	4% (1.6)
Percent (miles) following property line but not transmission line, roads or rail	41% (18.5)	29% (12.4)
Percent (miles) not following existing linear feature	20% (9.0)	45% (18.7)
Total length of route (miles)	44.8	41.9
Context/Setting		
Land Use Impacts	Requires less tree clearing	Requires more tree clearing, therefore more impacts to natural resources

5.1.3 Analysis of Factors for 345 kV Transmission Line, End-to-End

Overall, the Preferred Route (Figure 5.1-5) was selected because it better implements Minnesota's policy of non-proliferation (discussed in Chapter 2.3.3) because it is approximately 10 miles shorter than the Alternative Route and because it minimizes impacts to land use and resources, including agriculture and forested areas. Both Preferred and Alternative 345 kV Routes minimize impacts to residences. The Preferred Route does have more homes within 300 feet. Nevertheless, the Applicant recognized other factors such as following linear features or minimizing impacts to other resources as rationale for selecting the Preferred Route.

Table 5.1-5 summarizes the application of the state routing factors set forth in Minn. R. 7850.4100 for the Preferred and Alternative 345 kV Routes. Potential environmental impacts associated with the Preferred and Alternative Routes are discussed in detail in Chapter 7 (Hampton–North Rochester 345 kV section) and Chapter 8 (North Rochester–Mississippi River 345 kV section). Resulting impacts are dependent upon the route selected by the Commission and the final alignment.

Table 5.1-5:
Rationale for Preferred Route, Preferred 345 kV Route

Resource Category	Preferred Route	Alternative Route
Residences		
Number of Residences 0-75 feet from route centerline	0	0
Number of Residences 75-150 feet from route centerline	10	2
Number of Residences 150-300 feet from route centerline	27	15
Density (residences/linear mile within 300 feet of route centerline)	0.47	0.19
Recreation and Tourism		
McCarthy WMA crossed	0.9 mile	0.9 mile
RJD State Forest crossed	2.1 miles	2.4 miles
Upper Mississippi National Wildlife Refuge lands crossed	0.5 mile	0.5 mile
Effects on Land-Based Economics		
Agriculture		
Permanent Impact	6.0 acres	8.3 acres
Temporary Impact	446 aces	499 acres
Forestry	No impacts to economically important forestry areas are anticipated.	
Mining	No impacts to aggregate mines are anticipated.	
Archaeological and Historic Resources Sites Within 1 mile of Route Centerline		
Archaeological	13	14
Architectural		
National Register of Historic Places (NRHP)	8	1
Architectural	85	99

Table 5.1-5:
Rationale for Preferred Route, Preferred 345 kV Route

Resource Category	Preferred Route	Alternative Route
Natural Environment		
Water Resources		
Permanent Wetlands Impacts	<1 acre	<1 acre
Temporary Wetlands Impacts	7 acres	7 acres
Potential Tree Clearing in Wetlands	5.2 acres	13.1 acres
Stream Crossings	33	37
Permanent Impacts to Floodplains	<1 acre	<1 acre
Flora		
Percent Cropland	659	73
Percent Grassland	24	16
Percent Shrubland	1	1
Percent Forested Land	8	9
Percent Aquatic	1	1
Fauna		
Length of Wildlife Management Areas Crossed	0.91 mile	0.91 mile
Conservation Reserve Program (CRP) Lands Crossed	107	88
Conservation Reserve Enhancement Program (CREP) Lands Crossed	0	0
Length of Important Bird Areas Crossed	1.9 miles	1.9 miles
Length of Grassland Bird Conservation Areas Crossed	1.1 miles	3.9 miles
Length of Upper Mississippi River National Wildlife Refuge Crossed	0.5 mile	0.5 mile
Number of Federal Rare and Unique Species Known to Occur Within 1 mile of Route Centerline		
Threatened	0	1
Endangered	1	1
Candidate	1	1

Table 5.1-5:
Rationale for Preferred Route, Preferred 345 kV Route

Resource Category	Preferred Route	Alternative Route
Number of State Rare and Unique Species Known to Occur Within 1 mile of Route Centerline		
Threatened	18	18
Endangered	5	4
Species of Concern	40	44
DNR Rare Native Communities	1,897	3,233
Length of Outstanding Biodiversity Sites Crossed	0.5 mile	0.7 mile
Length of High Biodiversity Sites Crossed	1.4 miles	0.9 mile
Length of Moderate Biodiversity Sites Crossed	1.2 miles	0.9 mile
Use or Paralleling of existing ROW (transportation, pipeline, and electrical transmission systems) and property lines		
Percent (miles) following existing transmission line	36% (29.5)	12% (10.9)
Percent (miles) following road or rail but not transmission line	22% (17.4)	6% (5.1)
Percent (miles) following property line but not transmission line, roads or rail	29% (23.5)	50% (45.2)
Percent (miles) not following existing linear feature	13% (10.4)	33% (29.5)
Total length of route (miles)	80.9	90.7
Estimated Cost (millions)		
Cost	$194	$202

5.2 Analysis of Routes for 161 kV Transmission Line

The Applicant identified two routes for the 161 kV transmission line between the North Rochester Substation siting area and the Northern Hills Substation (North Rochester–Northern Hills 161 kV transmission line) (Figure 5.2-1). The Preferred 161 kV Route was selected because it follows existing infrastructure corridors (transmission lines or roads) for greater percentage of its length when compared with the Alternative 161 kV Route. This is consistent with the Minnesota policy of non-proliferation. Eighty-nine percent of the Preferred 161 kV Route follows roads, the Douglas Trail, or transmission lines. The narrower easement required for the 161 kV line is considered by the Applicant as generally compatible with road corridors. For the remainder of its length, the Preferred 161 kV Route follows property lines. The Preferred 161 kV Route also is shorter than the Alternative Route. Generally, a shorter route causes fewer impacts to land use and resources and would result in lower overall Project costs.

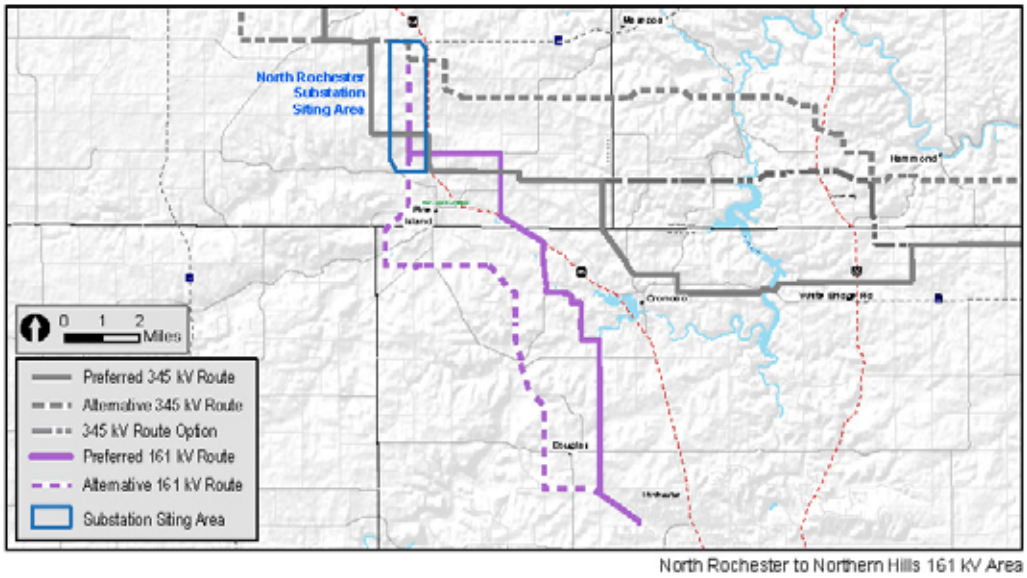


Figure 5.2-1: North Rochester–Northern Hills 161 kV Transmission Line

The Alternative 161 kV Route makes use of existing transmission line corridors and the Douglas Trail. The Alternative 161 kV Route parallels the Prairie Island–Byron 345 kV transmission line for approximately 5.8 miles, but is proposed to parallel the existing transmission line rather creating a double circuit. The segments of the Alternative 161 kV Route that parallel the Douglas Trail may require tree removal along the trail. While the Douglas Trail is an existing linear corridor that is seen as a routing opportunity, the potential impact to forested areas along the trail is a disadvantage for the Alternative 161 kV Route. Residences are located along existing roadways and as a result, when following roadways in an effort to meet Minnesota's non-proliferation requirements, more residents are likely to be impacted.

Table 5.2.1 summarizes key factors in the selection of the Preferred 161 kV Route.

Table 5.2-2 summarizes the application of the routing factors set forth in Minn. R. 7850.4100 for the Preferred and Alternative 161 kV Routes. Environmental data supporting the analysis below is contained in the remaining sections of this Application and appendices. Resulting impacts are dependent upon the route selected by the Commission and the alignment within that route.

Table 5.2-1:
Analysis of Factors, Preferred and Alternative 161 kV Routes

Resource	Preferred 161 kV Route	Alternative 161 kV Route
Route Types		
Percent (miles) following existing transmission line	3% (0.5)	32% (5.8)
Percent (miles) following road or rail but not transmission line	86% (13.3)	45% (8.1)
Percent (miles) following property line but not transmission line, roads or rail	10% (1.6)	12% (2.2)
Percent (miles) not following existing linear feature	1% (0.1)	11% (1.9)
Total length of route (miles)	15.4	18
Context/Setting		
Douglas Trail	1.25 miles	3.5 miles

Table 5.2-2:
Summary Comparison of Impacts for Preferred and Alternative 161 kV Routes

Resource Category	Preferred 161 kV Route	Alternative 161 kV Route
Residences		
Number of Residences 0-40 feet (within ROW) from route centerline	0	0
Number of Residences 0-75 feet from route centerline	0	0
Number of Residences 75-150 feet from route centerline	14	5
Number of Residences 150-300 feet from route centerline	40	28
Density (residences/linear mile within 300 feet of route centerline)	3.5	1.8
Recreation and Tourism		
No impacts to recreation and tourism are anticipated		
Effects on Land-Based Economics		
Agriculture		
Permanent Impact	2.4 acres	2.6 acres
Temporary Impact	139 acres	161 acres

Table 5.2-2:
Summary Comparison of Impacts for Preferred and Alternative 161 kV Routes

Resource Category	Preferred 161 kV Route	Alternative 161 kV Route
Forestry	No impacts to economically important forestry areas are anticipated.	
Mining	No impacts to aggregate mines are anticipated.	
Archaeological and Historic Resources Sites Within 1 mile of Route Centerline		
Archaeological	14	0
Architectural		
National Register of Historic Places (NRHP)	0	3
Architectural	13	11
Natural Environment		
Water Resources		
Permanent Wetlands Impacts	<1 acre	<1 acre
Temporary Wetlands Impacts	2 acres	3 acres
Potential Tree Clearing in Wetlands	1.3 acres	1.9 acres
Stream Crossings	18	18
Permanent Impacts to Floodplains	<1 acre	<1 acre
Flora		
Percent Cropland	76.8	72
Percent Grassland	17	22
Percent Shrubland	<1	<1
Percent Forested Land	3	4
Percent Aquatic	<1	<1
Fauna		
Conservation Reserve Program Lands Crossed	4	2
Conservation Reserve Enhancement Program Lands Crossed	0	0
Length of Important Bird Areas Crossed	0 miles	0 miles
Length of Grassland Bird Conservation Areas Crossed	0 miles	2.6 miles

Table 5.2-2:
Summary Comparison of Impacts for Preferred and Alternative 161 kV Routes

Resource Category	Preferred 161 kV Route	Alternative 161 kV Route
Number of Federal Rare and Unique Species Known to Occur Within 1 mile of Route Centerline		
Threatened	0	0
Endangered	0	0
Candidate	0	0
Number of State Rare and Unique Species Known to Occur Within 1 mile of Route Centerline		
Threatened	6	6
Endangered	0	0
Species of Concern	4	3
DNR Rare Native Communities	35	70
Length of Outstanding Biodiversity Sites Crossed	0	0
Length of High Biodiversity Sites Crossed	0	0.7 mile
Length of Moderate Biodiversity Sites Crossed	0	0
Use or Paralleling of existing ROW (transportation, pipeline, and electrical transmission systems) and property lines		
Percent (miles) following existing transmission line	3% (0.5)	32% (5.8)
Percent (miles) following road or rail but not transmission line	86% (13.3)	45% (8.1)
Percent (miles) following property line but not transmission line, roads or rail	10% (1.6)	12% (2.2)
Percent (miles) not following existing linear feature	1% (0.1)	11% (1.9)
Total length of route (miles)	15.4	18
Estimated Cost (millions)		
Cost	$16	$17

6.0 Description of Project Components

This chapter provides a detailed description of the proposed locations for the Project's components, including associated facilities, the Preferred and Alternative Routes and route options for the proposed 345 kV transmission line, and for the Preferred and Alternative 161 kV Routes. The components are shown in Figures 1.0-1 and 1.0-2. All routes were developed through the route selection process detailed in Chapter 4. Construction and expansion of substations are the same for both the Preferred and Alternative Routes. A detailed description of the geographic location of the substations associated with the Project is found in Chapter 6.1, and a description of engineering components associated with the substations is provided in Chapter 3.2. Environmental information and potential impacts to resources that may occur because of construction or modification of associated facilities is discussed in Chapter 10.

Chapter 6.2 describes Preferred and Alternative Routes for the proposed 345 kV transmission line by geographic section. Chapter 6.3 describes the Preferred and Alternative 161 kV Routes.

6.1 Associated Facilities

Following is a detailed description of the North Rochester Substation siting area and the Northern Hills Substation expansion area.

6.1.1 North Rochester Substation

The size and components of the North Rochester Substation are detailed in Chapter 3.2.2. The siting area for the North Rochester Substation was identified using the process described in Chapter 4.2.

The Applicant has identified a 3.5-square-mile siting area for the North Rochester Substation, between Zumbrota and Pine Island (see Chapter 10, Figure 10.1-1). The substation siting area is located in Goodhue County, in Pine Island Township, Sections 7, 18, 19, and the northern quarter of Section 30. A detailed description of the substation siting area is provided in this Chapter. The North Rochester Substation siting area is 1 mile wide (east-west), and is bounded on the west by 180th Avenue, and on the east by US-52. It is 3.5 miles long (north-south). The northern boundary of the substation siting area follows a property line along most of the west side of US-52, and the southern boundary of the substation siting area is north of Pine Island near County 11 Boulevard. The North Rochester Substation must accommodate interconnections with the 345 kV transmission line and the 161 kV transmission line that are components of this Project. The North Rochester Substation also must accommodate interconnections with the existing Prairie Island–Byron 345 kV transmission line.

Within the larger North Rochester Substation siting area, the Applicant has identified a preferred siting area to the south, and an alternative siting area to the north (see Chapter 10, Figure 10.1-1). Both preferred and alternative siting areas meet initial screening requirements, described in Chapter 4.2. The Preferred Route for the Hampton–North Rochester 345 kV section, the North Rochester–Mississippi River 345 kV section, and the Preferred 161 kV Route connects at the preferred siting area. The length of the proposed 161 kV transmission line would be minimized at this substation location.

The Alternative Route for the Hampton–North Rochester 345 kV section, North Rochester–Mississippi River 345 kV section, and the Alternative 161 kV Route connect at the alternative siting area.

The existing Prairie Island–Byron 345 kV line would need to be extended up to 0.5 mile depending on the substation site that is selected.

Chapter 10.1 describes the environmental setting and potential impacts associated with the North Rochester Substation, and identifies where potential impacts of the siting areas differ.

6.1.2 Northern Hills Substation

Planned improvements at the Northern Hills Substation are detailed in Chapter 3.2.3. The existing Northern Hills Substation in Rochester is the endpoint for the North Rochester–Northern Hills 161 kV transmission line. The Northern Hills Substation is operated by RPU, and is located on a 12.5-acre parcel owned by the City of Rochester. The triangular parcel is bounded by the Douglas Trail to the northeast, 50th Avenue on the west, and 55th Street on the south. The substation itself is located on an approximately 1.4-acre graded yard (250 feet by 250 feet). All required improvements would occur within the existing 12.5-acre substation parcel, and no additional acquisition of land is anticipated.

An existing distribution line follows the Douglas Trail for 1 mile to the Northern Hills Substation. This line was built to 161 kV transmission standards in anticipation of a future transmission connection. The Preferred and Alternative 161 kV Routes share an alignment along this distribution line. Two existing 161 kV transmission lines interconnect to the substation from the east and the west.

Chapter 10.2 describes the environmental setting and potential impacts associated with an expansion of the Northern Hills substation in Olmsted County, which would occur within the existing substation property.

6.2 Proposed 345 kV Transmission Line

The Applicant has identified a Preferred Route and an Alternative Route for the proposed 345 kV transmission line. The route segments that compose the Preferred and Alternative 345 kV Routes are listed in Appendix L and are shown on maps in Appendix M. The Preferred Route for the 345 kV transmission line is approximately 81 miles long in Minnesota, and is estimated to cost $194 million (in 2009 dollars): The Alternative Route for the 345 kV transmission line is approximately 91 miles long in Minnesota, and is estimated to cost $202 million (in 2009 dollars).

Detailed analysis of potential environmental impacts associated with the Preferred and Alternative 345 kV Routes are provided in Chapters 7 through 9. The counties, civil townships, and Public Land Survey System (PLSS) township, section, and range for the extent of all routes identified in this Application are identified in Chapter 2.2.

Following is a detailed description of the Preferred and Alternative Routes for the 345 kV transmission line by Project section.

6.2.1 Hampton–North Rochester 345 kV Section

The Hampton–North Rochester 345 kV section begins at the Hampton Substation and ends north of Rochester in the North Rochester Substation siting area. The Applicant identified one Preferred Route and one Alternative Route in this Project section.

6.2.1.1 Preferred Route

The Preferred Route extends from the Hampton Substation to the southern portion of the North Rochester Substation siting area and is located adjacent to US-52 for the majority of the route.

From the Hampton Substation, the Preferred Route follows US-52 for approximately 27 miles between Hampton and a point northwest of Zumbrota. North of Zumbrota, the Preferred Route deviates from US-52 and follows field and property lines for approximately 9 miles to the southern end of the North Rochester Substation siting area.

The Preferred Route passes through the municipal boundaries of Hampton and Cannon Falls, and crosses the Cannon River approximately 0.25 mile west of the Cannon Falls municipal boundary adjacent to the US-52 bridge. The Preferred Route follows a 69 kV transmission line located on the northeastern side of US-52 for approximately 17 miles, between the intersection of highways MN-19 and US-52 in Cannon Falls, and the intersection of US-52/County 7 Boulevard, northwest of Zumbrota. From the US-52/ County 7 Boulevard intersection, the Preferred Route follows property lines wherever possible south and east for approximately 9 miles. The Preferred Route terminates in the southern portion of the North Rochester Substation siting area, located in Goodhue County, south of Zumbrota and north of Pine Island.

Overall, the Preferred Route for this section is approximately 36 miles long. Table 6.2-1 shows the length and percentage of linear corridor followed by the Preferred Route between the Hampton Substation and the North Rochester Substation siting area.

Table 6.2-1:
Preferred Route/Hampton–North Rochester 345 kV Section: Length Paralleling Existing Linear Features

Total length of route	36.1
Percent (length) following existing transmission line	42% (15.1 miles)
Percent (length) following road or rail but not transmission line	40% (14.6 miles)
Percent (length) following property line but not transmission line, roads or rail	14% (5.0 miles)
Percent (length) not following existing linear feature	4% (1.4 miles)

As described above, the Preferred Route from Hampton Substation to North Rochester Substation follows US-52 for approximately 27 miles. A Utility Permit from Mn/DOT is required to place the center of the transmission line closer than 75 feet from the edge of the road ROW (Minn. R. 8810.3300, Subp. 1).

Mn/DOT owns or otherwise controls all state trunk highways, including freeways/interstate highways. In addition to Mn/DOT's rules governing use of trunk highway ROW in Minn. R. 8810.3100—3600 there also is an "Accommodation Policy" that it applies when it issues Utility Permits. The Accommodation Policy acknowledges that it is in the public interest for utility facilities to be accommodated on the ROW of any highway when such use and occupancy, including aerial overhang of the road ROW, does not interfere with the flow of traffic and the safe operation of vehicles, does not otherwise impair the highway or its visual quality, and does not conflict with provisions of federal, state, or local laws or regulations. The Accommodation Policy has been approved by the Federal Highway Administration (FHWA) with the policy detailed in the *Mn/DOT Procedures for Accommodation of Utilities on Highway Right of Way, Mn/DOT Position Statement - Highways No. 6.4*, July 27, 1990, revised November 8, 2005 (Accommodation Policy).

On non-interstate roads where there is only partial control of access, such as the proposed segment along US-52, the controlling rule is Minn. R. 8810.3500. Consistent with the Applicant's understanding of this rule, the Applicant has analyzed a potential alignment along US-52 that is near the ROW (approximately 5 feet). With this alignment, an easement of approximately 80 feet would be required of the adjacent landowner and 70 feet of the transmission line easement would be shared with road ROW.

The Applicant has met with Mn/DOT representatives, as part of the route development process prior to filing the Application, to provide information to Mn/DOT and gather feedback and input on this segment of the Project. At this time it is uncertain what alignment Mn/DOT will permit along or near the US-52 ROW. The Applicant is continuing to meet with agency representatives to provide information and gather its feedback on the permitability of potential route and alignment options. The Applicant also is hopeful that Mn/DOT will participate in the routing proceeding to provide additional information about its permitting requirements so that all stakeholders can evaluate the relevant rules, policies, and impacts.

The Preferred Route is 1,000 feet wide for the majority of its length, but has been widened in certain locations to provide for consideration of route options other than directly adjacent to US-52. The Preferred Route has been widened in locations where Mn/DOT is considering siting new highway infrastructure such as interchanges and where FNAP easements exist adjacent to US-52, as described below. The widened areas are identified on maps located in Appendix M.

- Interchange at Dakota CR-47 near Hampton;
- Potential railroad overpass approximately 0.3 mile north of intersection of 295th Street and US-52;
- Interchange at County 24 Boulevard and industrial area south of Cannon Falls;
- Interchange at County 1 Boulevard;
- Interchange at County 9 Boulevard; and
- Along US-52, approximately 0.7 mile north of intersection of Dakota CR-86 and US-52 (FNAP Easements).

The Applicant will continue to work with Mn/DOT and Dakota County to identify a feasible route in areas where new interchanges are being proposed and in the area where FNAP easements exist.

6.2.1.2 Alternative Route

The Alternative Route for the Hampton–North Rochester 345 kV section is located in Goodhue and Olmsted counties, and follows property lines for the majority of the route. The Alternative Route begins at the Hampton Substation siting area to the east for approximately 0.75 mile, veering slightly south to avoid a cluster of residences along Northfield Boulevard. (The eastern egress preserves routing opportunities west of US-52 for the Brookings Project.) The Alternative Route then follows parcel lines and field lines south for approximately 3.5 miles to US-52, avoiding residences where possible. The Alternative Route follows parcel lines and field lines west for approximately 1 mile prior to crossing US-52 and MN-56.

After crossing MN-56, the Alternative Route continues southwest and follows an abandoned railroad grade and parcel or field lines to avoid residences for approximately 3.5 miles. The Alternative Route then heads west and south for approximately 2.75 miles, avoiding the higher-density residential areas associated with the Town of Randolph, to the Cannon River crossing. The Alternative Route crosses the Cannon River at a narrow point in the river/wetland complex along the Goodhue/Dakota County line. From the Cannon River crossing, the Alternative Route follows the Dakota/Goodhue County line south for approximately 3.8 miles along parcel and field lines to 0.5 mile north of 90th Street, where it shifts 0.5 mile to the east to avoid residences. The Alternative Route then follows parcel and field lines and local roads south past Dennison, for approximately 10.8 miles to a point approximately 0.75 mile northeast of the intersection of 450th Street and Goodhue Avenue.

From this point, the Alternative Route follows parcel and field lines for approximately 4.5 miles east, and 0.5 mile south of 440th Street/Highway 246 Boulevard. The Alternative Route follows 50th Avenue south for 1 mile, and then parcel and field lines east and south for approximately 14 miles, avoiding residences wherever possible. The Preferred and Alternative Routes share approximately 1.25 miles of alignment approaching the North Rochester Substation siting area. The Alternative Route terminates at the northern portion of the North Rochester Substation siting area approximately 0.5 mile west of US-52.

Overall, the Alternative Route in this section is approximately 47 miles long. Table 6.2-2 shows the length and percentage of linear corridor followed by the Alternative Route between the Hampton Substation and the North Rochester Substation siting area.

Table 6.2-2:
Alternative Route/Hampton–North Rochester 345 kV Section: Length Paralleling Existing Linear Features

Total length of route	47.1
Percent (length) following existing transmission line	1% (0.7 mile)
Percent (length) following road or rail but not transmission line	7% (3.5 miles)
Percent (length) following property line but not transmission line, roads or rail	69% (32.3 miles)
Percent (length) not following existing linear feature	23% (10.7 miles)

6.2.1.3 Route Width in Vicinity of North Rochester Substation Siting Area

The routes have been widened in the vicinity of the North Rochester Substation siting area. The substation siting area contains two distinct existing linear features running north to south though the substation siting area, the existing Prairie Island to Byron 345 kV line and US-52. These are possible routing opportunities to connect the Alternative Hampton Route for the Brookings Project, which enters the north end of the substation siting area, to the Preferred Substation Siting Area at the south end.

The wider routing area is approximately 3,600 feet wide east to west and approximately 3.75 miles long north to south. The western boundary is 500 feet west of the Prairie Island to Byron 345 kV line and the eastern boundary is 500 feet east of the centerline of US-52.

6.2.2 North Rochester–Mississippi River 345 kV Section

The North Rochester–Mississippi River 345 kV section begins at the North Rochester Substation siting area and ends at the Mississippi River crossing at Alma. This section has one Preferred Route, one Alternative Route and two route options, the Zumbro Dam Route Option, and the McCarthy Lake Route Option. These route options provide flexibility in areas where routing was especially complex due to terrain, natural resources, or other factors. The Zumbro Dam Route Option provides an option to the Preferred and Alternative Routes for crossing the Zumbro River, and the McCarthy Lake Route Option provides a bypass to the west and north of the McCarthy Lake WMA.

6.2.2.1 Preferred Route

The Preferred Route in the North Rochester–Mississippi River 345 kV section connects with the Preferred Route in the Hampton–North Rochester 345 kV section at the southern end of the North Rochester Substation siting area. The Preferred Route passes through Goodhue, Olmsted, and Wabasha counties.

The Preferred Route begins at the southern end of the North Rochester Substation siting area, crosses US-52, and then parallels US-52 south for approximately 1 mile to a point north of Pine Island. The Preferred Route then primarily follows property lines east for approximately 2.3 miles, then diverts south 0.25 mile to avoid residences, and again primarily follows property lines for 2.25 miles in an easterly direction. The route then follows property lines south for approximately 1.3 miles, and parallels 230th Avenue for 1 mile and 53rd Avenue NW for 0.5 mile in a southeasterly direction. The Preferred Route then follows property lines east for 1.2 miles before crossing to the south side of White Bridge Road for 2.2 miles to the western shoreline of the Zumbro River. The Preferred Route crosses the Zumbro River on the north side of White Bridge Road to avoid residences located southeast of the bridge. East of the Zumbro River, the Preferred Route follows property lines east for approximately 3.8 miles, and for 1 mile north to a point approximately 0.7 mile northwest of the intersection of 125th Street NE and 40th Avenue NE.

From this point, the Preferred Route follows property lines, where possible, easterly for 10 miles through an area dominated by agriculture. Approximately 2 miles northeast of Plainview, the Preferred Route

follows an existing Dairyland 69 kV transmission line for approximately 3.5 miles. The Preferred Route then follows property lines wherever possible for an additional 2 miles northeasterly before joining the Dairyland Q-3 line. The Preferred Route follows the Dairyland Q-3 line for 11 miles.

Overall, the Preferred Route is approximately 43 miles long. Table 6.2-3 lists the length and percentage of linear corridor followed by the Preferred Route in the North Rochester–Mississippi River 345 kV section.

Table 6.2-3:
Preferred Route/North Rochester–Mississippi River 345 kV Section: Length Paralleling Existing Linear Features

Total length of route	44.8
Percent (length) following existing transmission line	33% (14.4 miles)
Percent (length) following road or rail but not transmission line	6% (2.9 miles)
Percent (length) following property line but not transmission line, roads or rail	41% (18.5 miles)
Percent (length) not following existing linear feature	20% (9.0 miles)

6.2.2.2 Alternative Route

The Alternative Route in the North Rochester–Mississippi River 345 kV section connects with the Alternative Route in the Hampton–North Rochester 345 kV section at the North Rochester Substation siting area. The Alternative Route is in Goodhue and Wabasha counties.

The Alternative Route begins at the northern end of the North Rochester Substation siting area. After crossing US-52, approximately 0.5 mile north of 480th Street, the Alternative Route follows 195th Avenue south for approximately 0.75 mile. The Alternative Route then follows property lines wherever possible in an easterly direction for approximately 9 miles, diverting from property lines where necessary to avoid residences. The Alternative Route crosses the Zumbro River along a property line approximately 2.2 miles north of the Zumbro Dam. East of the Zumbro River, the Alternative Route follows property lines wherever possible, east and south, crossing highway US-63, and following 375th Avenue for 0.4 mile. The Alternative Route intersects the Preferred Route along 375th Avenue.

The Alternative Route continues to the east for approximately 17 miles, parallel to the Preferred Route approximately 1.7 miles to the north. In this area, the Alternative Route follows property lines wherever possible, veering from property lines to avoid residences. The Alternative Route follows the same alignment as the Preferred Route along the Dairyland Q-3 line for 9 miles through the blufflands and the Mississippi River floodplain.

Overall, the Alternative Route is approximately 42 miles long. Table 6.2-4 shows the length and percentage of linear corridor followed by the Alternative Route for the North Rochester–Mississippi River 345 kV section.

Table 6.2-4:
Alternative Route/North Rochester–Mississippi River 345 kV Section: Length Paralleling Existing Linear Features

Total length of route	42
Percent (length) following existing transmission line	22% (9.3 miles)
Percent (length) following road or rail but not transmission line	3% (1.6 miles)
Percent (length) following property line but not transmission line, roads or rail	30% (12.4 miles)
Percent (length) not following existing linear feature	45% (18.7 miles)

6.2.2.3 Zumbro Dam Route Option

The Zumbro Dam Route Option was identified as an alternative river crossing because existing infrastructure crosses the river at this location. The route option could be used in combination with either the Preferred Route or the Alternative Route in the North Rochester–Mississippi River 345 kV section.

The Zumbro Dam Route Option connects to the Preferred Route in the North Rochester—Mississippi River 345 kV section (Figure 1.0-1) and is located in Goodhue and Wabasha counties. The Route Option begins approximately 4 miles west of the Zumbro River where it primarily follows property lines. With the Route Option, there is an existing crossing of the river (Zumbro Dam and Hydroelectric Generation Facility). On the east side of the river, the Route Option follows property lines east, veering north to avoid residences, for approximately 2.8 miles to 375th Avenue, which it then follows east for approximately 0.4 mile. From this point, the Zumbro Dam Route Option follows property lines south for 1.75 miles and east for 1 mile before it connects with the Preferred Route on the east side of the Zumbro River.

Table 6.2-5 shows the length and percentage of linear corridor followed by the Zumbro Dam Route Option.

Table 6.2-5:
Zumbro Dam Route Option/North Rochester–Mississippi River 345 kV Section: Length Paralleling Existing Linear Features

Total length of route	10.1
Percent (length) following existing transmission line	8% (0.8 mile)
Percent (length) following road or rail but not transmission line	4% (0.4 mile)
Percent (length) following property line but not transmission line, roads or rail	32% (3.2 miles)
Percent (length) not following existing linear feature	56% (5.7 miles)

6.2.2.4 McCarthy Lake Route Option

The McCarthy Lake Route Option was identified as an alternative to the Preferred 345 kV Route between US-61 and the Mississippi River to bypass the McCarthy Lake WMA and much of the surrounding wetland complex, which has significant natural resource values. The Route Option diverts from the Preferred Route alignment on the east side of US-61 and parallels the Canadian Pacific Railroad north for approximately 2 miles, then follows roads and property lines for approximately 2.25 miles east before its termination approximately 1.2 miles west of the Minnesota state line near the Alma River crossing. The McCarthy Lake Route Option adds approximately 1.8 miles to the Preferred Route.

Table 6.2-6 lists the length and percentage of linear features followed by the McCarthy Lake Route Option.

Table 6.2-6:
McCarthy Lake Route Option/North Rochester–Mississippi River 345 kV Section: Length Paralleling Existing Linear Features

Total length of route	4.7
Percent (length) following existing transmission line	0% (0 mile)
Percent (length) following road or rail but not transmission line	97% (4.6 miles)
Percent (length) following property line but not transmission line, roads or rail	0% (0 mile)
Percent (length) not following existing linear feature	3% (0.1 mile)

6.3 Proposed 161 kV Transmission Line

The Applicant identified Preferred and Alternative 161 kV Routes for the proposed North Rochester–Northern Hills 161 kV transmission line. Both Preferred and Alternative 161 kV Routes are approximately 1,000 feet wide and begin at the proposed North Rochester Substation siting area and terminate at the existing Northern Hills Substation. The Preferred 161 kV Route is approximately 15 miles long and is estimated to cost $16 million (in 2009 dollars): The Alternative 161 kV Route for the proposed 161 kV transmission line is approximately 18 miles long, and is estimated to cost $17 million (in 2009 dollars).

6.3.1 Preferred 161 kV Route

The Preferred 161 kV Route is approximately 1,000 feet wide and originates at the southern end of the North Rochester Substation siting area (Figure 1.0-1). The Preferred 161 kV Route parallels the Xcel Energy existing Prairie Island–Byron 345 kV transmission line for 0.5 mile to the south, begins at the North Rochester Substation siting area and continues east along a property line for 0.5 mile, and crosses US-52. The Preferred 161 kV Route then follows 500th Street for 2 miles, 210th Avenue for 1.7 miles, US-52 for 1.4 miles, and Olmsted CR-31 for 1.3 miles. The Preferred 161 kV Route crosses the Middle Fork Zumbro River along Olmsted CR-31, and follows 117th Street NW for 1.1 miles, and 65th Avenue NW for 1 mile. The Preferred 161 kV Route then follows property lines east for 0.5 mile and south for 0.5 mile

to 60th Avenue NW, which it follows for 3.6 miles to where the route intersects the Douglas Trail. The Preferred 161 kV Route then follows the Douglas Trail for 1.3 miles to the existing Northern Hills Substation, which is located within the City of Rochester's municipal boundary.

Overall, the Preferred 161 kV Route is 15.4 miles. Table 6.3-1 lists the length and percentage of linear corridor followed by the Preferred 161 kV Route.

Table 6.3-1:
Preferred 161 kV Route: Length Paralleling Existing Linear Features

Total length of route	15.4
Percent (length) following existing transmission line	3% (0.5 mile)
Percent (length) following road or rail but not transmission line	86% (13.3 miles)
Percent (length) following property line but not transmission line, roads or rail	10% (1.6 miles)
Percent (length) not following existing linear feature	1% (0.1 mile)

6.3.2 Alternative 161 kV Route

The Alternative 161 kV Route is approximately 1,000 feet wide and originates from the north end of the North Rochester Substation siting area (Figure 1.0-1). The Alternative 161 kV Route parallels the Prairie Island–Byron 345 kV transmission line for 5.8 miles (3 miles within the North Rochester Substation siting area, and 2.75 miles south of the North Rochester Substation siting area). The Alternative 161 kV Route follows the Prairie Island–Byron 345 kV transmission line to the west around Pine Island. The Alternative 161 kV Route diverts east from the Prairie Island–Byron 345 kV transmission line and crosses the Middle Fork Zumbro River south of Trophy Lake Road. The Alternative 161 kV Route follows property lines where possible to the east for approximately 1.25 miles while avoiding residences. The Alternative 161 kV Route follows 125th Street NW eastward for approximately 1.5 miles to the intersection of 125th Street NW and the Douglas Trail. The Alternative 161 kV Route then follows the northeast side of Douglas Trail for 1 mile in a southeasterly direction, diverting from the Douglas Trail to follow property and field lines for approximately 0.7 mile to New Haven Road. The Alternative 161 kV Route then follows New Haven Road for approximately 1 mile before crossing New Haven Road and Olmsted CR-3. The Alternative 161 kV Route continues to follow the Douglas Trail for approximately 1 mile to 75th Avenue (this section also follows CR-3 for 0.8 miles). The Alternative 161 kV Route then follows 75th Avenue for 2.6 miles southeast and south to 65th Street. The Alternative 161 kV Route then follows 65th Street for 1.3 miles to the Douglas Trail, which it follows again on the south side for 1.5 miles into the Northern Hills Substation. The Alternative 161 kV Route shares an alignment with the Preferred 161 kV Route for 1.3 miles between 60th Avenue NW and the Northern Hills Substation. The shared alignment is located along a distribution line built to 161 kV transmission specifications, and passes through an area characterized by growing residential development. The Applicant did not identify a second route in this area, to avoid creating a new linear corridor.

Overall, the Alternative 161 kV Route is 17.9 miles. Table 6.3-2 lists the length and percentage of linear corridor followed by the Alternative 161 kV Route.

Table 6.3-2:
Alternative 161 kV Route: Length Paralleling Existing Linear Features

Total length of route	18.0
Percent (length) following existing transmission line	32% (5.8 miles)
Percent (length) following road or rail but not transmission line	45% (8.1 miles)
Percent (length) following property line but not transmission line, roads or rail	12% (2.2 miles)
Percent (length) not following existing linear feature	11% (1.9 miles)

6.4 Wisconsin Routes

Preliminary routes in Wisconsin were developed in accordance with regulatory guidance identified in Chapter 4.1.1.2. Through the course of the routing process, routes in Wisconsin that connect to the three initial Mississippi River crossing options were identified. Route segments that connected only to the Winona and La Crescent crossings were eliminated from consideration when the Alma crossing was selected as the preferred Mississippi River crossing. All remaining routes in Wisconsin originate at the Alma crossing, and could connect with either the Preferred or Alternative 345 kV Routes in this Application (Figures 1.0-1 and 1.0-2).

In compliance with Wisconsin Statute §1.12(6), priority was given to existing high-voltage transmission corridors, and then transportation corridors, when identifying alternative routes in Wisconsin. Three general alignments for the 345 kV route were identified between the Alma crossing and three potential endpoints including: an expanded substation in north La Crosse, a new substation near Holmen, or a new substation near Galesville identified on Figures 1.0-1 and 1.0-2. All three routes follow existing high-voltage transmission lines for the majority of the route length (Figure 1.0-2). The Applicant also identified route connectors in the southern portion of the Project area that follow existing transmission lines, roads, and some property lines to each of the three substation options.

Routes and substations to be proposed in Wisconsin will be decided pending further consultation with PSCW, WDNR, other Wisconsin state agencies, and interested stakeholders. The final Wisconsin route is between approximately 40 and 60 miles long. Potential impacts to the Upper Mississippi National Fish and Wildlife Refuge, the Van Loon Wildlife Area, land use, residences, and other resources associated with the Mississippi River Valley and the blufflands adjacent to the Mississippi River associated with each route will continue to be important considerations in identifying the proposed routes.

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