APPLICATION TO THE MINNESOTA PUBLIC UTILITIES COMMISSION FOR A CERTIFICATE OF NEED FOR THE UPGRADE OF THE SOUTHWEST TWIN CITIES (SWTC) CHASKA AREA 69 KILOVOLT TRANSMISSION LINE TO 115 KILOVOLT CAPACITY

PUC Docket No. E002/CN-11-826

May 15, 2012

Submitted by
Northern States Power Company, a Minnesota corporation, and
Great River Energy, a Minnesota cooperative corporation

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EXECUTIVE SUMMARY

Two approvals must be received from the Minnesota Public Utilities Commission before a high voltage transmission line can be built within this state: a Certificate of Need and a Route Permit. A Certificate of Need proceeding examines whether a facility is needed and a Route Permit proceeding determines where the facility should be located. This document is Northern States Power Company and Great River Energy's application for one of these approvals, a Certificate of Need, to construct 115 kilovolt transmission facilities. The purpose of this Executive Summary is to summarize the contents of this Certificate of Need application. We will summarize each of the chapters of the application, define key terms in the chapters, and identify the key points of each chapter.

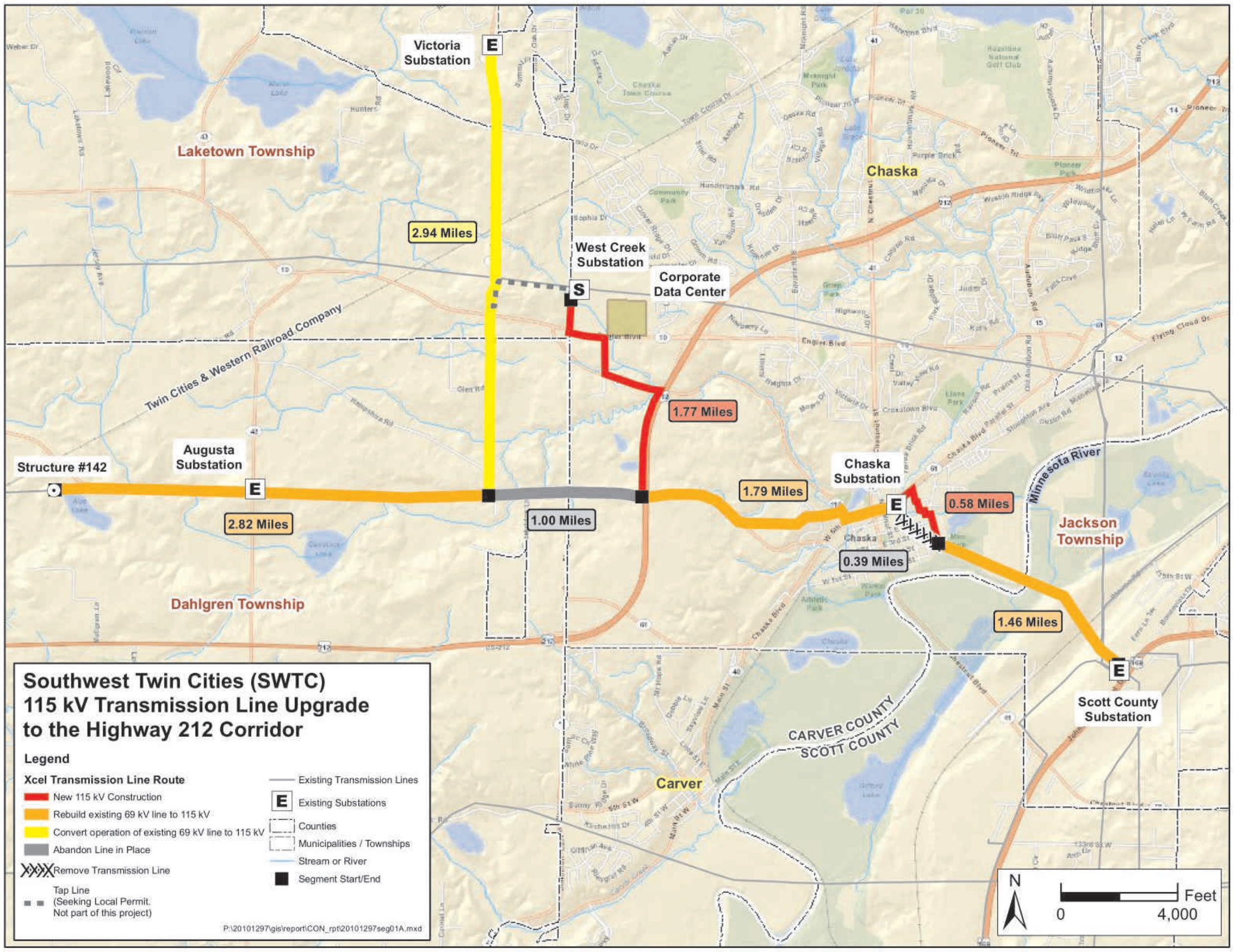
NEED:

The southwest region of the Twin Cities has recently experienced growth and development, including a new data center in the City of Chaska. We have evaluated different ways to provide electrical service to the new data center in the City of Chaska and additional transmission support in the area. We believe that the 115 kilovolt transmission facilities proposed in this Application are necessary to serve the electrical needs of this area.

PROJECT:

To meet this need, we propose to construct approximately 8.5 miles of new 115 kilovolt single circuit transmission line facilities and to change the operating voltage of 2.9 miles of an existing 69 kilovolt line to 115 kilovolts. All of the proposed work will occur near the cities of Chaska and Carver, through Laketown, Dahlgren, and Jackson townships. **Figure 1** shows the Project. The tan lines show where we are proposing to change the existing 69 kilovolt line into a 115 kilovolt line. By "change" we mean that, in most all cases, we will remove the poles and wires that are there and replace them with new and larger poles and wires. The red lines show where we will be constructing new 115 kilovolt transmission facilities. In these locations, this will mean we need to obtain new right-of-way to construct new poles and wires. The yellow line shows the existing Great River Energy 69 kilovolt transmission line. This line was constructed using structures capable of accommodating a 115 kilovolt line but is not currently capable of operating at 115 kilovolt due to the 69 kilovolt switch structure located at the intersection of County Road 140 and Guernsey Avenue. This 2.9 mile line will be converted to operate at 115 kilovolt when the existing 69 kilovolt switch is retired and the line is re-terminated at that intersection. The black lines show where the existing 69 kilovolt line will no longer be in operation. For the few blocks shown in the City of Chaska, the poles and wires will actually be removed since we are essentially moving the line to a new location (as shown by the red line there). For the section along County Road 140 between Highway 212 and Guernsey Avenue, the existing line will be left in place, but it will not normally carry electricity. This is being done to keep the line available for use if a need arises in the future. Finally, the dotted grey line shows a 115 kV line that Xcel Energy is in the process of obtaining a local permit from the City of Chaska to construct. This 115 kV line is not part of the Project but will connect Great River Energy's line to the new West Creek Substation. Xcel Energy expects issuance of this local permit in late May/early June 2012.

Figure 1
Chaska Area 115 Kilovolt Transmission Line Project



For the portions of the Project that require new 115 kilovolt structures, we propose to use primarily single pole steel horizontal post or braced post structures. These structures are typically placed approximately 300 to 400 feet apart and are approximately 60 to 90 feet tall. In instances where the rebuilt line has to span over water or wetlands, two pole H-frame or Y-Frame steel structures may be used. The H-frame or Y-Frame structures will be approximately 60 to 105 feet tall with spans of approximately 600 to 1400 feet. The right-of-way required will be dependent on the ultimate route selected. In the route permit proceeding, we will propose to locate 6.1 miles of the 115 kilovolt facilities within the existing 50-foot right-of-way of the existing 69 kilovolt line. For the 2.4 miles of new 115 kilovolt facilities, we propose a new 75-foot-wide right-of-way.

With the submission of this Certificate of Need Application in May, 2012 we estimate that the processing and approval of the application (along with the Route Permit Application) will be complete about a year from now in the spring of 2013. With these necessary permits in hand, we expect that construction of the Project will commence soon after permits are obtained with an in-service date of spring 2014. The Project is estimated to cost approximately $18.2 million.

If you have questions regarding details of the Project, please contact one of the following representatives:

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Chapter Summaries

Our analysis of the need, alternatives evaluated, and potential environmental impacts are detailed in the six chapters of this Application. Each chapter is dedicated to a specific subject area and is summarized below:

Chapter 1. Project Introduction and Overview: The first chapter of this document summarizes the proposed Project. Here we provide the expected schedule for the Project, provide costs to construct the facilities proposed, describe the transmission structures that will be used, and explain the right-of-way requirements for the Project. The chapter also describes how the Project complies with the statutory and rule requirements for issuance of a Certificate of Need.

Key Terms:

- **Kilovolt** – A kilovolt is equal to one thousand volts.
- **Emergency Rating** – An "emergency rating" is the operation level at which a transformer can still operate for short periods when under stress situations, such as an outage elsewhere on the system.
- **Low Voltage** – Low voltage occurs on the transmission system where an outage or other system fluctuation causes the voltage on a line to drop. This can also occur on distribution systems.
- **Megawatt** – A megawatt is equal to one million watts.
- **Structures** – Towers or poles that support transmission lines.
- **Transmission** – An interconnected group of lines and equipment for transporting electric energy in bulk on a high voltage power line between power sources (*e.g.*, power plants) and major substations where the voltage is "stepped down" for distribution to customers. Transmission is considered to end where the line connects to a distribution station.

Key Points: We propose to construct 8.5 miles of new 115 kilovolt single circuit transmission line facilities and to change the operating voltage of 2.9 miles of an existing 69 kilovolt line to 115 kilovolts. We expect that construction of the Project will commence soon after permits are obtained with an in-service date of spring 2014. The Project is estimated to cost approximately $18.2 million.

Chapter 2. Need: In Chapter 2, we explain why we are proposing the Project. This is referred to as "the need" for the Project. We cover how the transmission facilities currently provide electric service to our customers and what happens if part of the transmission system is out of service.

Key Terms:

- **Capacity** – The load-carrying ability, expressed in megawatts, of generation, transmission, or other electrical equipment.
- **Contingency** – An outage of a transmission line, generator or other piece of equipment, which affects the flow of power on the transmission network and impacts other network elements.

- **Load** – All the devices that consume electricity and make up the total demand for power at any given moment or the total power drawn from the system.
- **Outage** – The unavailability of electrical equipment, possibly as a result of planned for maintenance or unplanned (forced) problems caused by weather or equipment failures.
- **Overloads** – Occur when power flowing through wires or equipment is more than they can carry without incurring damage.
- **Reliability** – The degree of performance of the elements of the bulk electric system that results in electricity being delivered to customers within accepted standards and in the amount desired. It is the ability to deliver uninterrupted electricity to customers on demand and to withstand sudden disturbances such as short circuits or loss of system components.
- **Substation** – A facility that monitors and controls electrical power flows, uses high voltage circuit breakers to protect power lines and transforms voltage levels to meet the needs of end users.
- **Transformers** – Devices that change voltage levels.
- **Voltage** – A type of 'pressure' that drives electrical charges through a circuit. Higher voltage lines generally carry power longer distances.

Key Points: The Project is needed so that the transmission system can reliably meet the growing demand for electric power in the southwestern Twin Cities area. In particular, the Project is needed to serve a new data center in the City of Chaska that will increase demand in the area by 20 megawatts when it is fully operational.

Chapter 3. Alternatives Analysis: In Chapter 3, we explain our analysis of different ways that we have considered to fix the need identified in the previous chapter. This includes other transmission improvements that we have looked at as well as options that don't require new or improved transmission facilities. These are referred to as the "non-transmission alternatives."

Key Terms:

- **Demand-side management** – Actions that influence the quantity or patterns of use of energy consumed by end users, such as actions targeting reduction of peak demand during periods when energy supply systems are constrained.
- **Distributed generation** – Small-scale generation located close to homes, farms and businesses where the power is needed, using traditional as well as renewable sources, like wind and biomass.
- **Generation** – The act of converting various forms of energy input (thermal, mechanical, chemical and/or nuclear energy) into electric power. The amount of electric energy produced is usually expressed in kilowatt hours or megawatt hours.
- **Renewable resource** – A power source that is renewed by nature, such as solar, wind, hydroelectric, geothermal, biomass, or similar sources of energy.

Key Points: We looked at an alternative 115 kilovolt transmission configuration for the Project. We also considered a "no build" alternative that made use of demand-side management solutions and using generation as an alternative to building new or improved transmission facilities. In addition, we analyzed alternative transmission designs such as underground transmission lines and Direct Current lines to serve the need. In the end, we concluded that the proposed Project best serves the needs identified in Chapter 2.

Chapter 4. Transmission Line Routing and Substations: Chapter 4 describes the proposed transmission line and substation improvements for the alternative selected for the Project. The actual route will be determined through the Route Permit proceeding and a separate Route Permit application will be submitted to the Minnesota Public Utilities Commission. This chapter is intended to describe what the Applicants have identified as the alternative best-suited to meet the local area needs, as discussed in Chapter 3.

Key Terms:

- **MV-VTT** – Great River Energy's transmission line between County Road 140 and the Victoria Substation is designated as the "Minnesota Valley to Victoria

Substation Tap", abbreviated as "MV-VTT". Minnesota Valley is Great River Energy's member cooperative in the area of the Project.

- **Span** – A design term used to describe the situation where, during design, engineers have identified an area where they are able to design the line so that poles are placed on either side, and not within, a physical or environmental feature.
- **Termination** – The location where a transmission or distribution line ends in a substation. The termination is typically a transformer, but can also be a breaker.
- **Electrical Equipment Enclosure** – A building within the substation that contains equipment necessary to operate the substation.

Key Points: Although this chapter describes a route for the Project in detail, this is only the route that Applicants prefer to meet the needs of the Project. The final route for the Project will be determined by the Minnesota Public Utilities Commission in the Route Permit proceeding (Docket No. E002/TL-12-401).

Chapter 5. Transmission Line Operating Characteristics: Chapter 5 provides information regarding the operating characteristics of the proposed 115 kilovolt transmission lines and associated substations. This includes information regarding electric and magnetic fields, noise, ozone and nitrogen oxide emissions, and radio and television interference.

Key Terms:

- **Conductor** – A wire made up of multiple aluminum strands supported by a steel core that together carry electricity. A bundled conductor is two or more conductors connected together to increase the capacity of a transmission line.
- **Corona** – Corona is caused when there is some imperfection on a conductor such as a sharp edge, a protrusion on hardware, a scratch on the conductor, or if moisture collects on the line. This causes breakdown or ionization of air within a few centimeters or less immediately surrounding conductors and can produce ozone and oxides of nitrogen in the air and surrounding conductor.

- **Electric and magnetic fields** – Invisible lines of force that surround any electrical appliance or wire that is conducting electricity. The balance of scientific evidence indicates that exposure to electric and magnetic fields does not negatively impact health.
- **Extremely Low Frequency** – This term is used to identify electric and magnetic fields within the range of 3 to 300 hertz. Transmission lines operate at 60 hertz.
- **Ozone** – Ozone is a very reactive form of oxygen molecules and combines readily with other elements and compounds in the atmosphere. Because of its reactivity, ozone is relatively short-lived.

Key Points: The proposed transmission lines and substations will be designed to meet or exceed all relevant safety codes. The noise generated by transmission lines is not expected to exceed background noise levels and will be well below the state noise standards. Electric and magnetic fields exists wherever electricity is produced or used, and surrounds any electrical appliance or wire that is conducting electricity. The potential health effects from electric and magnetic fields have been studied for more than 30 years by government and scientific institutions all over the world. The balance of scientific evidence indicates that exposure to electric and magnetic fields do not cause disease.

> "In addition, virtually all of the laboratory evidence and the mechanistic evidence fail to support a relationship between low-level [extremely low frequency] magnetic fields and changes in biological function or disease status"
>
> \- World Health Organization

> "Most researchers concluded that there is insufficient evidence to prove an association between magnetic fields and health effects;"
>
> \- Minnesota Interagency Working Group

> "The magnetic fields produced by electricity are weak and do not have enough energy to break chemical bonds or to cause mutations in DNA. . . . In addition, whole animal studies investigating long-term exposure to

> [extremely low frequency] magnetic fields have shown no connection between exposure and cancer of any kind."
>
> \- Public Service Commission of Wisconsin

Chapter 6. Transmission Line Construction and Maintenance: Chapter 6 is a basic primer regarding the steps we will take to build the proposed facilities after we have obtained all regulatory and other required approvals. We describe the sequence of activities that occur during the construction of a transmission line and substation and some of the mitigation measures that can be taken to mitigate potential impacts during construction. This chapter also identifies the activities associated with the operation and maintenance of a transmission line once it is constructed.

Key Terms:

- **Best Management Construction Practices** – standard construction and mitigation practices developed from experience with past projects.
- **Easement** – An easement is a permanent right authorizing a person or party to use the land or property of another for a particular purpose. In this case, this means acquiring certain rights to build, operate and maintain a transmission line. Landowners are paid a fair price for the easement and can continue to use the land for many purposes, although some restrictions are included in the agreement.
- **Right-of-Way** – A right-of-way is the land area legally acquired for a specific purpose, such as for the placement of transmission facilities and for maintenance.

Key Points: The construction of a transmission line typically involves four key activities: (1) detailed engineering, design, and regulatory approvals; (2) right-of-way evaluation and acquisition; (3) construction; and (4) right-of-way restoration. Construction of the Project will follow standard construction and mitigation practices developed from experience with past projects.

Chapter 7. Environmental Information: Chapter 7 provides a general overview of the environmental features and land uses in the Project Area.

Key Terms:

- **Considered Eligible Finding ("CEF")** – Cultural Resource sites that have been identified as eligible for listing on the National Register by both state and federal agencies, but not yet nominated or listed are identified as Considered Eligible Findings and are afforded comparable protection to listed sites for evaluation purposes.
- **Cultural Resources** – Cultural Resources are historic or archaeological sites containing unique or significant features relating to the cultural history the region. These resources are considered non-renewable.
- **Floodplain** – A floodplain is flat or nearly flat land adjacent to a stream or river that experiences occasional or periodic flooding. The floodplain includes the floodway which consists of the stream channel and adjacent areas that carry flood flows, and the flood fringe which are areas covered by the flood but do not carry a strong current.
- **Geomorphology** – Geomorphology is a science that deals with the relief features of the earth and seeks a genetic interpretation of them.
- **Mitigative Measures:** These terms refer to actions taken by Applicants to lessen environmental or other impacts resulting from the construction, operation, or maintenance of the proposed Project.
- **Physiography** – Physiography is a branch of geography that deals with the exterior features and changes of the earth.
- **Project Area** – This term refers to the area of environmental review which extends three miles in all directions from the proposed Project.
- **Public waters** – Public waters are designated as such to indicate which lakes, wetlands, and watercourses over which the Minnesota Department of Natural Resources (MnDNR) Waters has regulatory jurisdiction. The statutory definition of public waters includes public waters and public waters wetlands (Minnesota Statute 103G.005, Subd. 15).
- **Wetland** – Wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water.

Key Points: Based on our review, there are no environmental issues that would preclude construction of the proposed facilities. Applicants will take mitigative measures to minimize the environmental impacts of siting, constructing, and operating the Project.

1 PROJECT INTRODUCTION AND OVERVIEW

Chapter 1. Project Introduction and Overview: The first chapter of this document summarizes the proposed Project. Here we provide the expected schedule for the Project, provide costs to construct the facilities proposed, describe the transmission structures that will be used, and explain the right-of-way requirements for the Project. The chapter also describes how the Project complies with the statutory and rule requirements for issuance of a Certificate of Need.

Key Terms:

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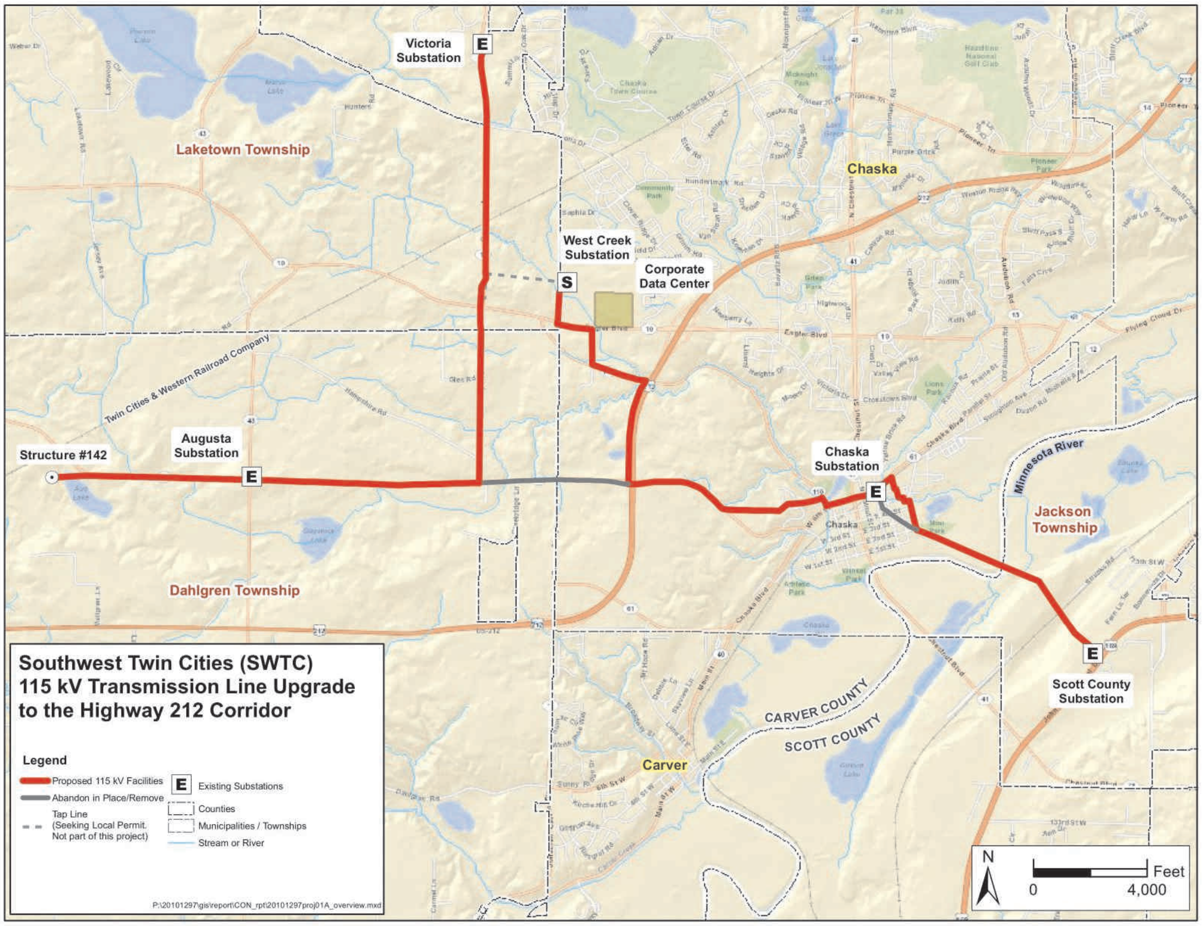
Key Points: *We propose to construct 8.5 miles of new 115 kilovolt single circuit transmission line facilities and to change the operating voltage of 2.9 miles of an existing 69 kilovolt line to 115 kilovolts. We expect that construction of the Project will commence soon after permits are obtained with an in-service date of spring 2014. The Project is estimated to cost approximately $18.2 million.*

Applicants, Northern States Power Company, doing business as Xcel Energy, and Great River Energy, a Minnesota cooperative corporation, submit this Application for a Certificate of Need to the Minnesota Public Utilities Commission. This Application seeks a Certificate of Need to construct 8.5 miles of new 115 kilovolt single circuit transmission line facilities and to change the operating voltage of 2.9 miles of an existing 69 kilovolt line to 115 kilovolts ("Project"). All of the proposed work will occur in Carver and Scott counties, near the cities of Chaska and Carver, through Laketown, Dahlgren, and Jackson townships. The Project will also include modifications at certain associated facilities, including the existing Augusta, Victoria, West Creek, Chaska, and Scott County substations. This Application is submitted pursuant to Minnesota Statutes Section 216B.243 and Minnesota Rules 7849.0020 – 7849.0400. A checklist showing the locations of information required by the Minnesota Statutes and Rules for a Certificate of Need Application is included in **Appendix A**. An overview of the proposed Project is provided in **Figure 2** below.

Figure 2
Chaska Area Project Overview



1.1 Need Overview

The proposed Project is needed so that the transmission system can reliably meet the growing demand for electric power in and near the City of Chaska. The need for the proposed Project was identified in the *Southwest Twin Cities Load Serving Study Review (Highway 212 Corridor 115 kV Conversion)* dated August 8, 2011 (also referred to as the "Study") prepared by Xcel Energy Services Inc. The Study was conducted to address the growing demand for electric power in the southwest Twin Cities area due, in part, to the proposed construction of a new 190,000 square-foot data center in Chaska,[1]

[1] UnitedHealth plans 2nd Twin Cities data center, Minneapolis | St. Paul Business Journal, http://www.bizjournals.com/twincities/stories/2010/03/22/story1.html?page=all (March 21, 2010).

Minnesota that will add 20 megawatts of additional load to the area when it is fully operational.

Xcel Energy is currently in the process of removing an existing 69 kilovolt transmission line between the cities of Glencoe and Waconia and replacing it with a new 115 kilovolt transmission line. Xcel Energy received a Certificate of Need and a Route Permit for this Glencoe to Waconia rebuild in November 2011 (Docket Nos. E002/CN-09-1390 and E002/TL-10-249). As part of the Glencoe to Waconia rebuild project, the 69 kilovolt line west of the Augusta Substation is being removed and replaced with a 115 kilovolt line that will be operated at 69 kilovolt capacity. Xcel Energy determined that this line west of the Augusta Substation was capable of meeting the anticipated demand for electric power in the Study area until 2018. Due to the addition of a data center in Chaska, that is expected to increase the demand for electric power by more than 30% when it is fully operational, additional 115 kilovolt transmission facilities are needed by 2013 to meet this increased electric load demand in the area. Additionally, the City of Chaska has indicated that there is a possibility of an additional data center of the same or similar size may be developed in the same area in the future.

The Study, attached as **Appendix B**, was prepared to identify the reliability problems that will arise on the current transmission system when the electrical demand increases by 30% over the current area load (20 megawatts) in the City of Chaska as a result of the new data center. The large electrical demand addition will result in the Scott County Substation transformers exceeding their emergency rating when certain transmission lines are out-of-service. Operating substation transformers above their emergency rating has the potential to shorten the lifespan of these transformers and increases the risk of a transformer failure. Absent construction of the Project, when the 69 kilovolt line from the Scott County Substation to Chaska Substation is out of service, transmission line overloads in the area of the Project are anticipated and possible low voltage conditions may occur. Overloading of the transmission system can result in outages for residential, retail, commercial, and industrial customers. Outages can be extremely costly and inconvenient. Low voltage conditions, if experienced, can damage customer equipment such as process controls, motor drive controls, electronics, and automated machines.

The Project will provide the necessary transmission system upgrades to reduce the anticipated strain on the existing Scott County Substation transformers that serve the cities of Chaska, Augusta, and Victoria. Additionally, the Study indicated that the Project will eliminate some of the transmission line overloads experienced when the Scott County to Chaska 69 kilovolt line is out of service and possible low voltage conditions on the existing 69 kilovolt system west of the Augusta Substation.

1.2 Cost, Timing & Ownership

Depending on the route of the line and potential need for additional right-of-way, Applicants estimate the overall cost of the proposed improvements will fall within a range of $13 to $27 million. Cost estimates for Project segments are provided in **Table 1**, below. This range of costs accounts for considerations related to labor, materials, and varying construction conditions. Construction of the upgrades is expected to begin soon after permits are obtained with an in-service date of spring 2014.

Table 1
Project Costs

Project	Cost in Million $
Substation Upgrades	$ 10.9
Transmission Line Upgrades	$ 7.3
Total Cost Estimate	**$ 18.2**

The 2014 Minnesota jurisdiction revenue requirement for the Project is $18.2 million or a cost per kilowatt hour of $0.000064. See **Appendix C** for detailed cost analysis of the Company's Minnesota revenue requirement

Xcel Energy would construct, own, and operate:

- The upgraded and new 115 kilovolt single circuit transmission lines and associated facilities between existing Structure #142 on Xcel Energy Line

#0740 west of Aue Lake in Carver County and its existing Scott County Substation;

- The new 115 kilovolt single circuit transmission line from the intersection of Highway 212 and County Road 140 to the future West Creek Substation[2] owned and operated by the City of Chaska; and
- The 69 kilovolt single circuit transmission line along County Road 140 between Guernsey Avenue and Highway 212, that will be abandoned in place.

Great River Energy would continue to own and operate:

- The existing 2.9-mile 69 kilovolt MV-VTT line proposed to be converted to 115 kilovolt located between the intersection of County Road 140 with Guernsey Avenue and its Victoria Substation.

Ownership of substations would not change from the current ownership. *See* **Section 4.1.3**. If a Certificate of Need is being sought to meet long term needs, in excess of 80 megawatts, of a utility that is not to be an owner of the project, certain additional information is required. (Minnesota Rule 7849.0220, Subp. 3). The Project is intended to keep the transmission system reliable and is not designed to meet the long term needs of a particular utility that is not an owner.

1.3 Environmental Summary

The Project area contains both urban and rural land uses, as well as natural resource, cultural resource, and recreation areas. Applicants have not identified any environmental factors that would preclude construction of the Project. Impacts can be mitigated by utilizing existing right-of-ways and through best management construction practices. A detailed environmental analysis is provided in **Chapter 7**.

As part of the Certificate of Need process, the Minnesota Department of Commerce, Energy Facility Permitting Staff will also conduct an environmental assessment independent of the information provided in this Application. A Route Permit application will be filed after the Certificate of Need application is filed. Accordingly,

[2] The City of Chaska is currently constructing the distribution side of the West Creek Substation. The West Creek Substation will also include a transmission side which will be constructed as part of this Project.

members of the public will have several opportunities to participate in both the State Certificate of Need and Route Permit processes.

1.4 Certificate of Need Criteria

Minnesota rules and statutes specify the criteria the Commission should apply in determining whether to grant a Certificate of Need. Minnesota Statute Section 216B.243 and Minnesota Rule 7849.0120.

Minnesota Rule 7849.0120 provides that a Certificate of Need is to be granted by the Commission to an applicant on a determination that:

(A) The probable result of denial would be an adverse effect upon the future adequacy, reliability, or efficiency of energy supply to the applicant, to the applicant's customers, or to the people of Minnesota and neighboring states;

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

(C) By a preponderance of the evidence of the record, the proposed facility, or a suitable modification of the facility, will provide benefits to society in a manner compatible with protecting the natural and socioeconomic environments, including human health; and

(D) The record does not demonstrate that the design, construction, or operation of the proposed facility, or a suitable modification of the facility, will fail to comply with relevant policies, rules, and regulations of other state and federal agencies and local governments.

Applicants' proposal satisfies these four criteria as discussed below.

Denial of the Project would have an adverse effect upon the future adequacy, reliability, or efficiency of energy supply to the Applicants' customers

- Denial of a Certificate of Need for the Project would result in adverse effects upon present and future adequacy, reliability, and efficiency of energy supply because of low voltage conditions and overloading in the area. Low voltage conditions, if experienced, can damage customer equipment such as process controls, motor drive controls, electronics, and automated machines. Overloading of the transmission system can result in outages for residential, retail, commercial, and industrial customers. Outages can be extremely costly and inconvenient. *See* **Section 3.9**.

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

- The Study considered costs, system losses, technical performance, and other factors. The proposed transmission upgrades, including the size, type, and timing, were identified in the Study as the best performing option among alternatives reviewed. In addition to the alternatives examined in the Study, in preparation of this Application, Applicants also examined other generation, transmission, and conservation alternatives. *See* **Chapter 3**.

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

- The proposed Project will provide electric reliability and allow additional electric load and development in the Project area.
- As proposed, the Project upgrades will utilize existing rights-of-way to the maximum extent possible. This will reduce the impact to the natural and socioeconomic environments. *See* **Chapters 6 and 7**.

The proposed transmission lines will comply with relevant policies, rules, and regulations of other state and federal agencies and local governments

- Applicants will secure all necessary permits and authorizations prior to commencing construction of the Project. *See* **Chapter 7**.

- The Project will comport with State of Minnesota policies of providing safe and reliable electric service to all customers. *See* **Chapter 5**.

1.5 Socioeconomic Considerations

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

1.5.1 Socially Beneficial Uses of Facility Output

The purpose of the Project is to ensure transmission system reliability in the greater southwest area of the Twin Cities. Present low voltage and overloading conditions, as well as worsening conditions in the future, will arise if the Project is not constructed. Low voltage conditions can damage electronic equipment resulting in significant economic costs to commercial and manufacturing companies. Overloading conditions can result in costly outages and inconvenience to customers.

1.5.2 Promotional Activities

Neither Xcel Energy nor Great River Energy have conducted any promotional activities or events that have triggered the need for the Project. The Project is needed due to continued and anticipated growth in this region of the Twin Cities. Additionally, the construction of a new data center that increases the load in the City of Chaska necessitates the Project. The Project is required to ensure transmission system reliability and to allow for future growth and development in the area.

1.5.3 Effect in Inducing Future Development

The Project is not necessarily intended to induce future development. It may allow future economic development that otherwise would not be possible if the transmission system upgrades are not implemented. The transmission system upgrades are being proposed based on existing conditions and forecasted increases in demand that will continue to cause worsening electrical conditions. The transmission system upgrades will ensure system reliability for Applicants' customers and will also accommodate approximately 50 megawatts of additional load growth in the area before further upgrades are required. Assuming a 2% growth rate beyond 2015, the proposed upgrades would last until 2028. This is in addition to the 20 megawatt data center load.

1.6 Request for Joint Proceeding

Applicants will also be filing an application for a Route Permit for this Project and believe that it would be efficient to combine the hearings in the Certificate of Need and Route Permit proceedings and requests that they be held jointly. *See* Minn. Stat. § 216B.243, subd. 4; Minn. Stat. § 216E.03, subd. 6.

2 NEED

<u>Chapter 2. Need:</u> In Chapter 2, we explain why we are proposing the Project. This is referred to as "the need" for the Project. We cover how the transmission facilities currently provide electric service to our customers and what happens if part of the transmission system is out of service.

Key Terms:

- **Capacity** – *The load-carrying ability, expressed in megawatts, of generation, transmission, or other electrical equipment.*
- **Contingency** – *An outage of a transmission line, generator or other piece of equipment, which affects the flow of power on the transmission network and impacts other network elements.*
- **Load** – *All the devices that consume electricity and make up the total demand for power at any given moment or the total power drawn from the system.*
- **Outage** – *The unavailability of electrical equipment, possibly as a result of planned for maintenance or unplanned (forced) problems caused by weather or equipment failures.*
- **Overloads** – *Occur when power flowing through wires or equipment is more than they can carry without incurring damage.*
- **Reliability** – *The degree of performance of the elements of the bulk electric system that results in electricity being delivered to customers within accepted standards and in the amount desired. It is the ability to deliver uninterrupted electricity to customers on demand and to withstand sudden disturbances such as short circuits or loss of system components.*
- **Substation** – *A facility that monitors and controls electrical power flows, uses high voltage circuit breakers to protect power lines and transforms voltage levels to meet the needs of end users.*
- **Transformers** – *Devices that change voltage levels.*
- **Voltage** – *A type of 'pressure' that drives electrical charges through a circuit. Higher voltage lines generally carry power longer distances.*

Key Points: *The Project is needed so that the transmission system can reliably meet the growing demand for electric power in the southwestern Twin Cities area. In particular, the Project is needed to serve a new data center in the City of Chaska that will increase demand in the area by 20 megawatts when it is fully operational.*

2.1 Electrical System Overview

Electricity transmission is simply the movement of electrons within a conductor (the wire). High voltage transmission facilities provide a necessary link between the production of electricity at power generation plants and its use by consumers.

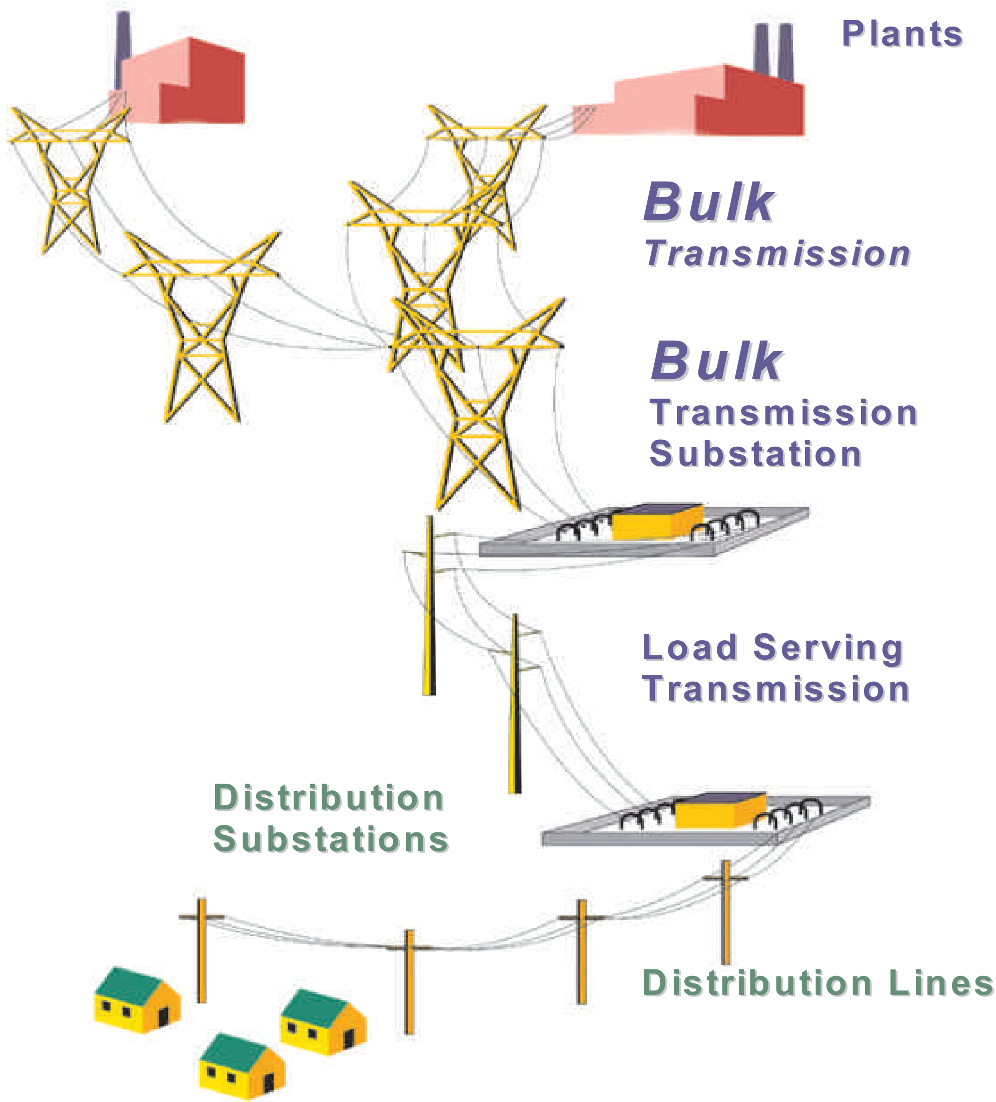
Generating plants (coal, gas, wind, solar, hydro, etc.) are connected to larger transmission lines that facilitate bulk-power transportation. The electricity generated at these plants is introduced to the transmission system via the transmission lines. These transmission lines connect to substations that contain transformers that transform the electricity from a higher voltage to a lower, distribution, voltage. Sometimes, the transmission voltage is transformed at transformers in several substations before reaching distribution voltage (*i.e.*, from 345 kilovolts to 115 kilovolts at one substation, then from 115 kilovolts to 69 kilovolts at another substation, and finally from 69 kilovolts to a distribution voltage of 34.5 kilovolts or less). Distribution lines then exit these substations and transfer the electricity to other transformers that further decrease the voltage for consumption. Service lines then connect these final transformers to buildings. By turning on a light switch or using some other electronic appliance, a circuit is completed that connects the light bulb with the wires that serve the building.

Electricity is produced at both large and small generating plants. Electricity can be generated using a variety of sources or fuels, including solar, wind, and hydro; internal and external combustion of biomass, biofuels, natural gas, and coal; and heat and steam created through nuclear fission. Regardless of the fuel used, electricity is produced by converting the fuel's energy into electric energy through the use of a generator that converts mechanical energy into electric energy. Electric energy is generated at a specific voltage and frequency. For it to be useful, electricity must be transmitted from the generation source to consumers. Unlike other products or services, electricity must be generated instantaneously with its consumption, so generators connected to the system must adjust their electric output to respond to changes in customer demand. The transmission system must also be able respond to the changes in both generation and consumption.

Typically, the voltage of electricity that is generated in a power plant is increased (stepped-up) by transformers installed close to the generating plant. The electricity is then transported (sometimes great distances) over transmission lines, often at voltages in excess of one hundred thousand volts (*e.g.*, 115 kilovolt, 230 kilovolt, 345 kilovolt). The reason for stepping up the voltage is that it is more efficient to move electricity over longer distances at higher voltages because the system experiences fewer electrical losses. Once the electricity reaches the locality where it will be consumed, the voltage is reduced (stepped-down) to a voltage appropriate for distribution to end-use customers (*e.g.,* 69 kilovolt) by transformers at a distribution substation facility. The electricity is then further transformed and distributed at distribution "primary" voltages (*e.g.*, 12.5 kilovolt) within communities by distribution lines and then transformed again near the end-user's premises to the necessary "secondary" voltage for individual use (*e.g.*, 220 volt, 110 volt).

A schematic showing the transfer of electricity from generator to consumer is shown below in **Figure 3**.

Figure 3
Electrical System



2.2 Description of Overloads and Low Voltage Conditions

An overload condition exists when a transmission line, transformer, or other piece of equipment is subjected to loadings that exceed its applicable rating. Transmission lines and transformers may have continuous ("normal") and short-term ("emergency") ratings. For transmission lines, nominal seasonal ratings are computed for Summer and Winter conditions.

Determination of line ratings involves consideration of the increased conductor sag that occurs at higher current loadings, and the potential for irreversible metallurgical damage to the conductor. Transformer ratings are based on heat dissipation capability and consideration of insulation degradation that is accelerated at the higher internal temperatures resulting from high loadings.

To avoid transmission system damage, each transmission owner adheres to certain loading criteria standards to avoid operation of transmission facilities at excessively high temperatures. "Normal" ratings are established that are available for continuous operation of the facilities, with sometimes higher "emergency" ratings allowing higher flows for a shorter duration of time. For example, a utility may operate a transmission transformer at the emergency rating level for a few minutes to complete transmission circuit breaker switching operations to manage a temporary overload condition rather than shedding load. Designing and operating the system according to prudent loading practices ensures that the transmission system will be operated safely and reliably.

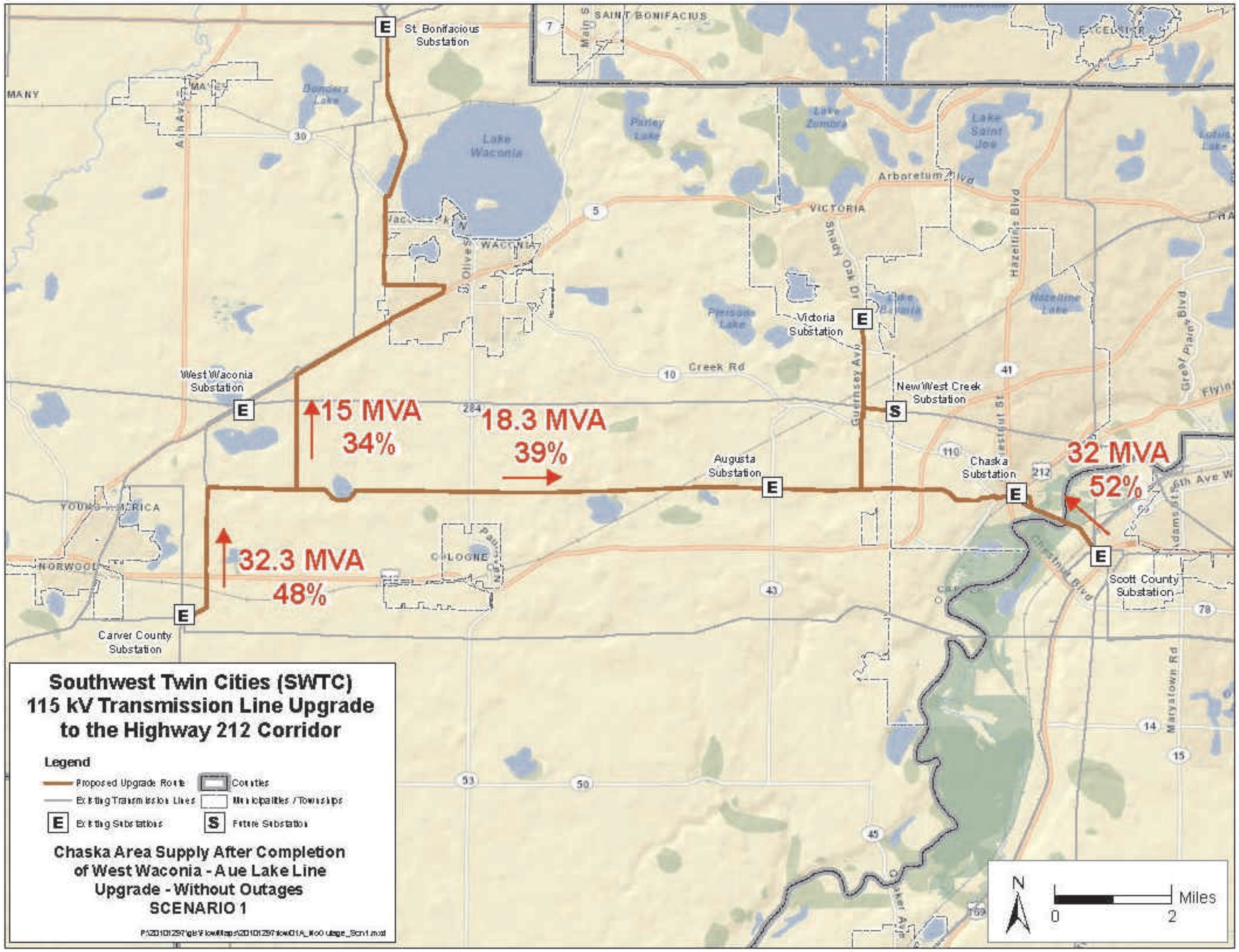
A low voltage condition is a situation that can occur in parts of the transmission system that are heavily loaded or that have high motor loads. A low voltage condition is similar to a clothesline that is pulled taut when nothing is hanging on it but that tends to sag when more and more clothes (*i.e.*, loads or motors) are attached. Low voltage conditions are a problem because, depending on the duration, equipment such as electronic power supplies could also malfunction or fail when service voltage drops below certain levels, damaging customer equipment such as process controls, motor drive controls, and automated machines.

2.3 Chaska Area Reliability Risks

The Chaska area, a summer peaking area, is served by a single transmission line from the Scott County Substation. This single transmission line from the Scott County Substation delivers power to three Chaska area substations, the Chaska Substation, the Victoria Substation, and the Augusta Substation. **Figure 4** is a graphical depiction of the general power flows on the transmission lines in the Chaska area when all facilities are operational (system intact). **Figure 4** assumes that several projects currently under construction are completed including, the West Waconia – Aue Lake

69 kV transmission line upgrade, the construction of Xcel Energy's new distribution substation, the Dahlgren Substation, and the distribution portion of the City of Chaska's new West Creek Substation.

Figure 4
All Facilities Operational



The Project is needed to address overload and low voltage conditions in the Chaska area between the Scott County, Carver County, and St. Bonifacius substations. Applicants used the MRO 2009 series 2015 summer peak model to identify existing transmission system deficiencies that result in transmission system overloads that need to be addressed immediately. The 2015 summer peak model included the 20 MW load addition from the new data center in Chaska and the completion of construction of the Dahlgren Substation.[3] Applicants' analysis of 2015 model also indicates that, without the proposed transmission upgrades, overloading and low voltage conditions will worsen as the Chaska area experiences continued growth and development.

To analyze the transmission system deficiencies in the Study area, the Study examined three possible scenarios described below. Under these three scenarios, when certain transmission lines or substation transformers are out of service, the Study identified other transmission lines and substation transformers that experienced overload and/or low voltage conditions based on 2015 peak summer load forecasts, as illustrated in **Table 2** and **Table 3** below.

Table 2 lists all of the overload conditions identified in the Study, under all three scenarios, at times when certain transmission lines or substation transformers are out of service. The column on the far right of **Table 2** provides the Study's criteria for identifying overloads for a particular facility. For overloads, any transmission line facility that experiences loads greater than 100% and those approaching 100% were noted and documented in the Study. For substation transformers, any transformer experiencing loads greater than 115% was noted and documented in the Study. The facilities listed in italic text indicate that these facilities violate these criteria.

[3] The Dahlgren Substation was permitted locally in April 2012 by Carver County.

Table 2
Overload Conditions Identified in the Study Under All Three Scenarios

FACILITY OUT OF SERVICE	AFFECTED FACILITY	LINE RATING	MVA FLOW	% OVERLOAD	CRITERIA FOR SYSTEM PERFORMANCE
Loss of Scott County – Chaska 69 kV Line	*Carver County tap – Augusta line*	*47*	*56.9*	*121%*	*110%*
Loss of St. Bonifacius Transformer (Scenario 2)	*Carver County – Carver County Tap 69 kV line*	*68*	*81.5*	*120%*	*100%*
Loss of Carver County Tap –Carver County 69 kV line (Scenario 2)	*St. Bonifacius Transformer*	*70*	*106*	*151%*	*Less than 125%*
	St. Bonifacius – Waconia 69 kV Line	*48*	*72*	*150%*	*110%*
Loss of Scott County Transformer No. 1 (Scenario 3)	*Scott County Transformer No. 2*	*70*	*79.2*	*134%*	*Less than 115%*

Table 3 lists all of the low voltage conditions identified in the Study, under all three scenarios, at times when certain transmission lines are out of service. Low voltage conditions less than 92%, or approaching that benchmark, are noted and documented. The deficiencies marked in italic text indicate violations of these criteria.

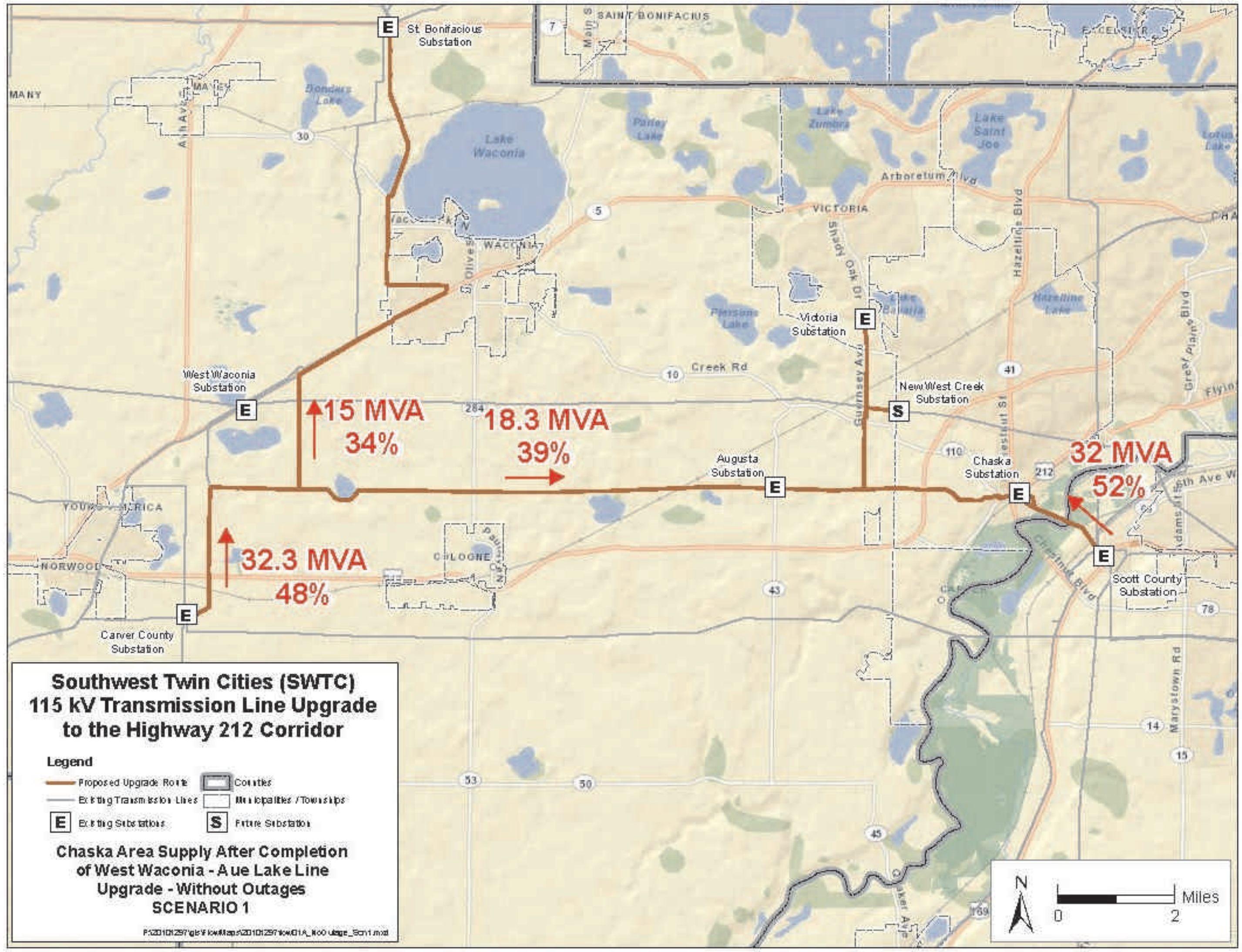
Table 3
Low Voltage Conditions Identified in the Study Under All Three Scenarios

FACILITY OUT OF SERVICE	AFFECTED FACILITY	%LOW VOLTAGE	CRITERIA FOR SYSTEM PERFORMANCE
Loss of Carver County Tap –Carver County 69 kV line (Scenario 3)	*Voltage at West Creek Substation*	*87%*	*92-105%*
	Voltage at West Creek Substation	*87%*	*92-105%*
	Voltage at West Creek Substation	*88%*	*92-105%*

The three scenarios that were used in the Study to identify the overloads and low voltage conditions listed in **Table 2** and **Table 3** are described below.

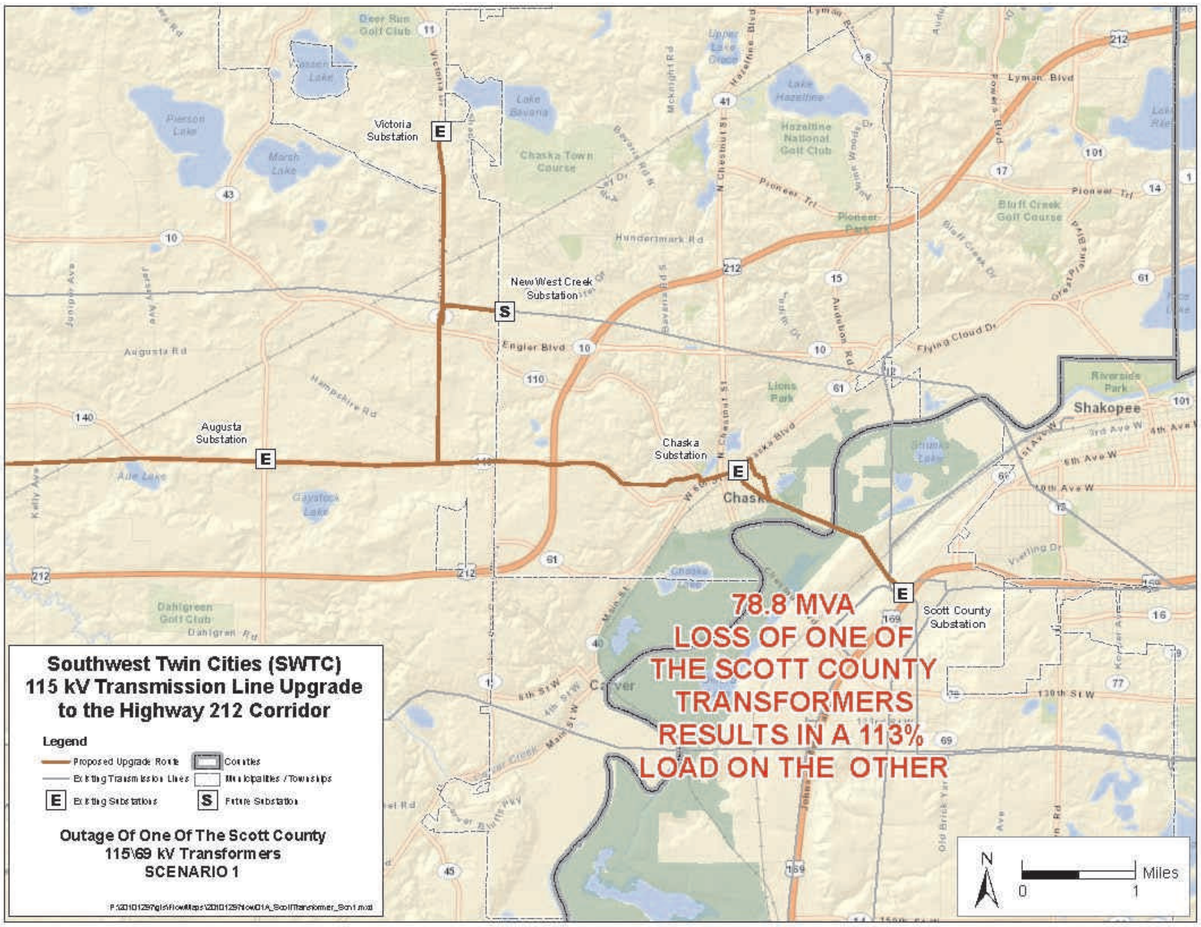
Scenario 1: The first scenario assumed that all of the 69 kilovolt transmission lines between Carver County, Scott County, and St. Bonifacius substations are closed. This means that the electrical path between the substations is continuous. **Figure 5** shows the system during normal operation, without any outages. The loads at the Waconia, Augusta, Victoria, and Chaska substations are assumed to be served from all three substations.

Figure 5
Scenario 1: All Facilities Operational



In this scenario, the loss of one of the Scott County transformers will result in overloading the other transformer to 113% of its normal rating. **Figure 6** below shows the transmission system under Scenario 1 if one of the Scott County Substation transformers is out of service.

Figure 6
Scenario 1: Outage of Scott County Substation Transformer No. 1 or No. 2



Also, based on the assumptions in Scenario 1, the loss of Scott County – Chaska 69 kilovolt line would result in overloading the 1-mile section of the Carver County tap-Augusta 69 kilovolt line, which is not rebuilt as part of the Glencoe to Waconia 115 kilovolt rebuild project (Docket No. E002/CN-09-1390), west of the Augusta Substation. **Figure 7** shows how the system operates if the Scott County-Chaska 69 kilovolt line were out of service.

Figure 7
Scenario 1: Outage of Scott County – Chaska Line

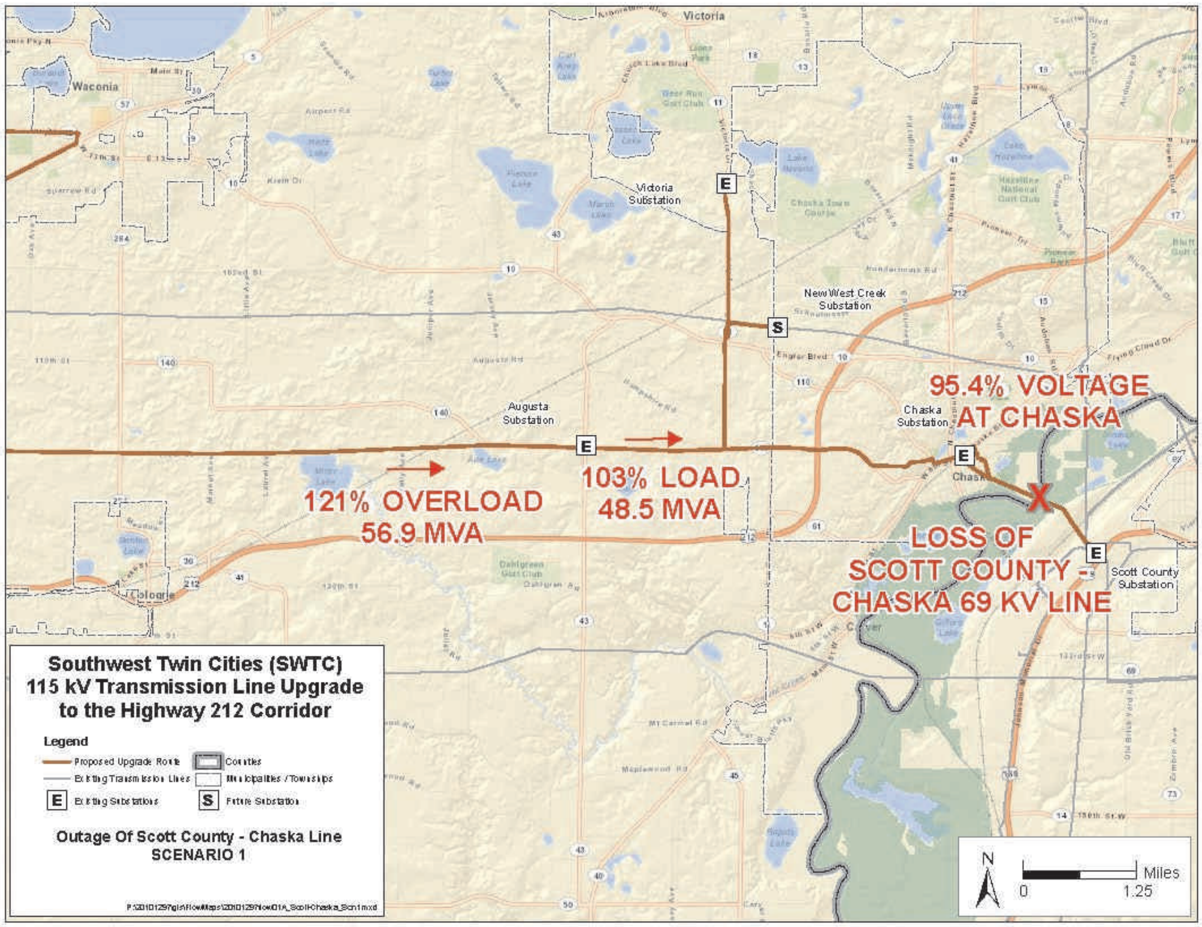


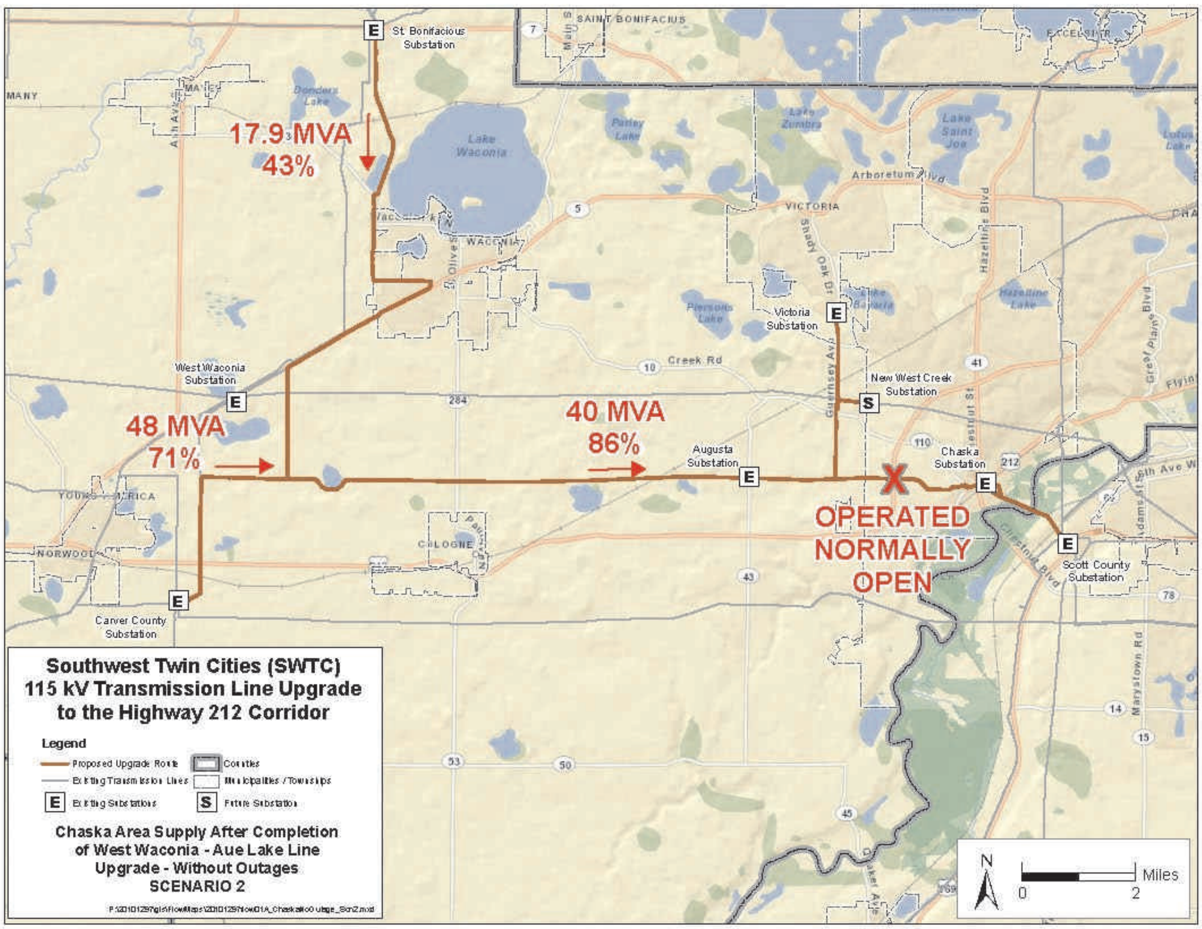
Table 4 below provides a list of the overload conditions identified (in italics) under this first scenario.

Table 4
Scenario 1: Overloads Identified

FACILITY OUT OF SERVICE	AFFECTED FACILITY	RATING	MVA FLOW	%OVERLOAD	CRITERIA FOR SYSTEM PERFORMANCE
Loss of one of the Scott County Transformer	2nd Scott County Transformer	70	78.8	113%	Less than 115%
Loss of Scott County – Chaska 69 kV line	Augusta – MV-VTT 69 kV line	47	48.5	103%	Less than 110%
	Carver County tap – Augusta line	*47*	*56.9*	*121%*	*92%-105%*

Scenario 2: This second scenario involves operating the 69 kilovolt line between the Chaska substation and Victoria tap open. The line is operated normally open to reduce the exposure of loads to faults on any single section of line. Also, in some cases, operating the lines normally open might help alleviate transmission line overloads. This second scenario was studied to demonstrate that opening the lines will not help mitigate the problems in Study Area. **Figure 8** shows the system, under normal operating conditions, with no transmission outages.

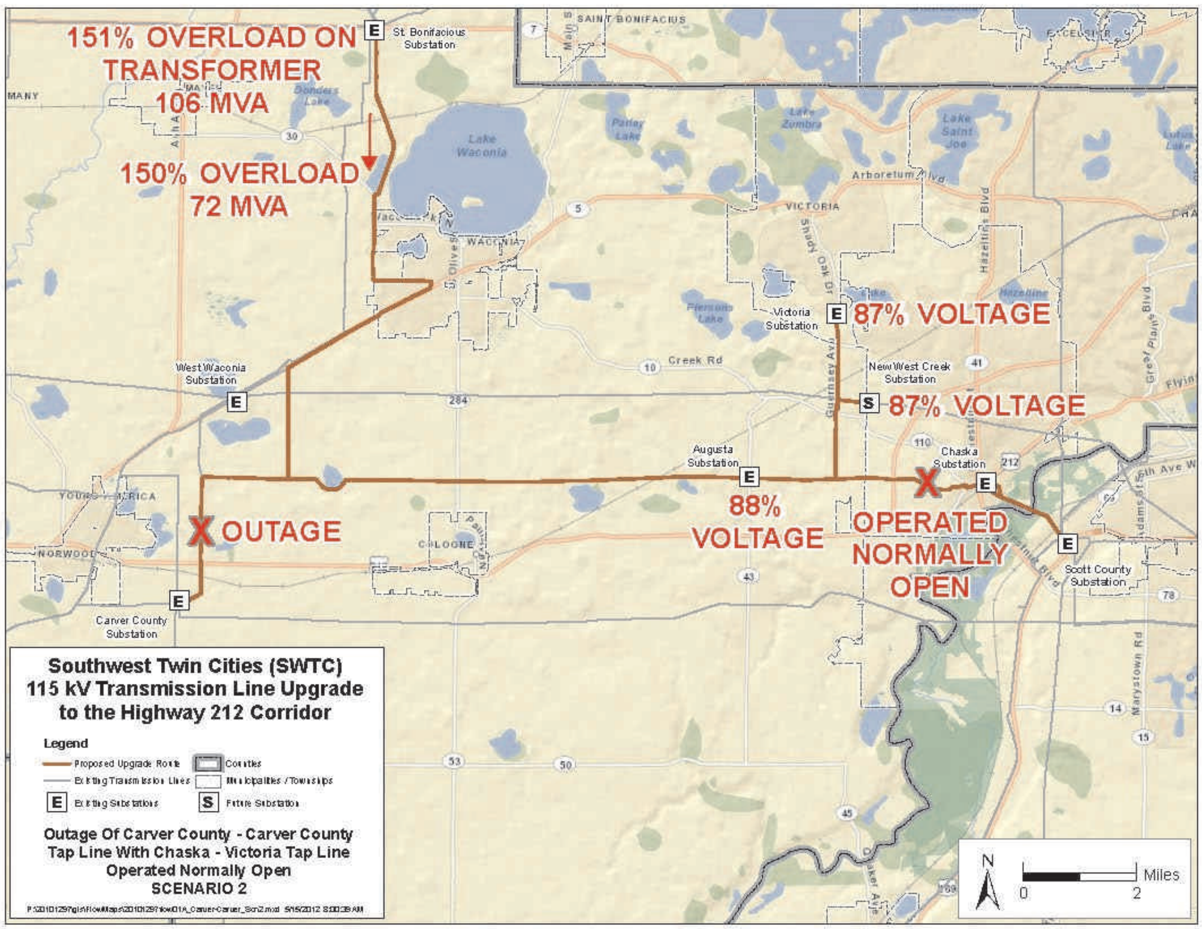
Figure 8
Scenario 2: All Facilities Operational



In this configuration, the loss of the Carver County –Carver County 69 kilovolt tap line would result in overloading the St. Bonifacius transformer and the St. Bonifacius

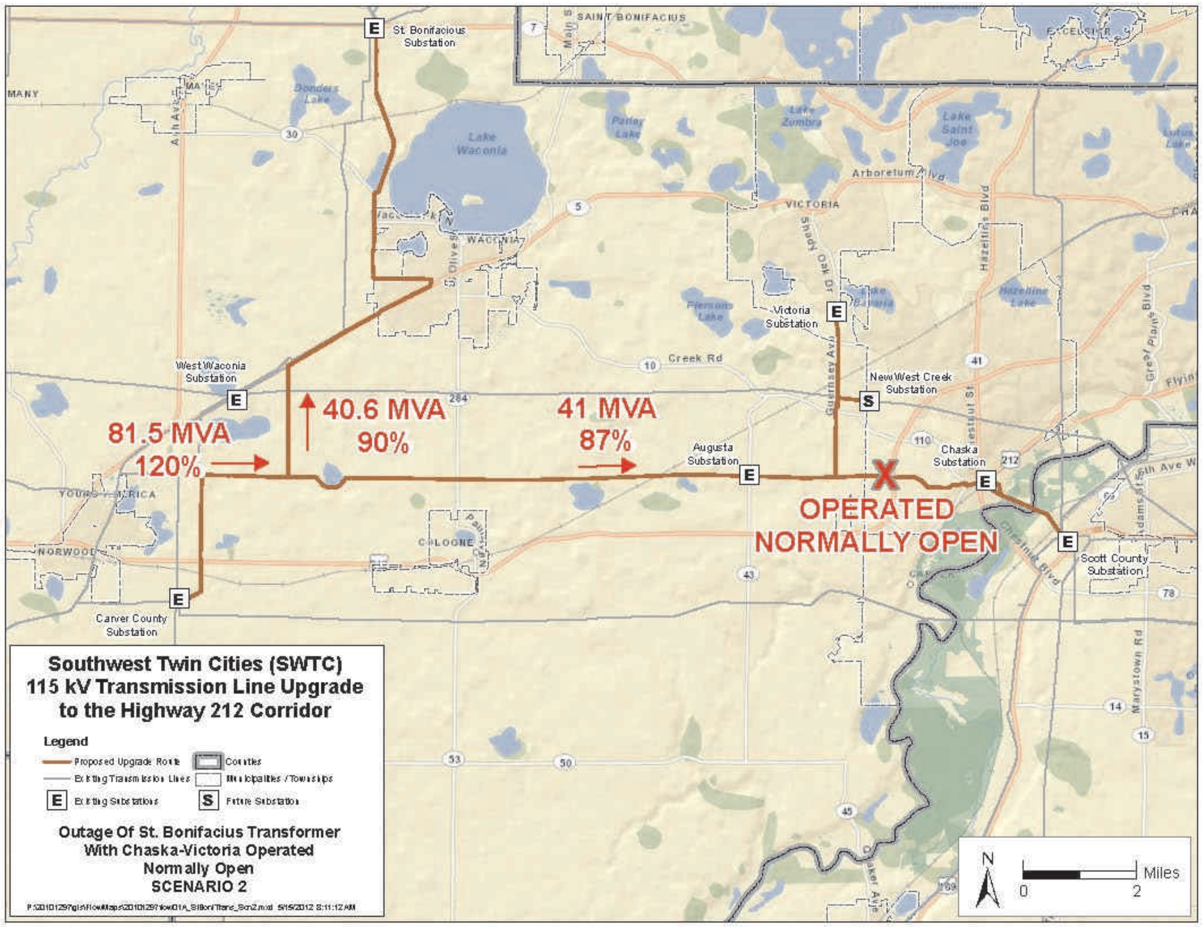
– Waconia 69 kilovolt line. This outage would also result in severe low voltages at West Creek, Victoria, and Augusta substations. **Figure 9** depicts the transmission system with the Carver County – Carver County 69 kilovolt tap line out of service.

Figure 9
Scenario 2: Outage of Carver County – Carver County Tap 69 Kilovolt Line



Also, in this configuration, the loss of St. Bonifacius transformer would result in overloading the Carver County – Carver County tap line to 120%. **Figure 10** depicts the transmission system condition with the outage of St. Bonifacius transformer.

Figure 10
Scenario 2: Outage of St. Bonifacius Transformer



In the second scenario, loss of the Scott County –Chaska 69 kilovolt transmission line would result in overloading the Carver County tap – Augusta line to 121%. **Table 5** below provides a list of the overload conditions identified (in italics) under this second scenario. **Table 6** below provides a list of the low voltage conditions identified (in italics) under this second scenario.

Table 5
Scenario 2: Overloads Identified

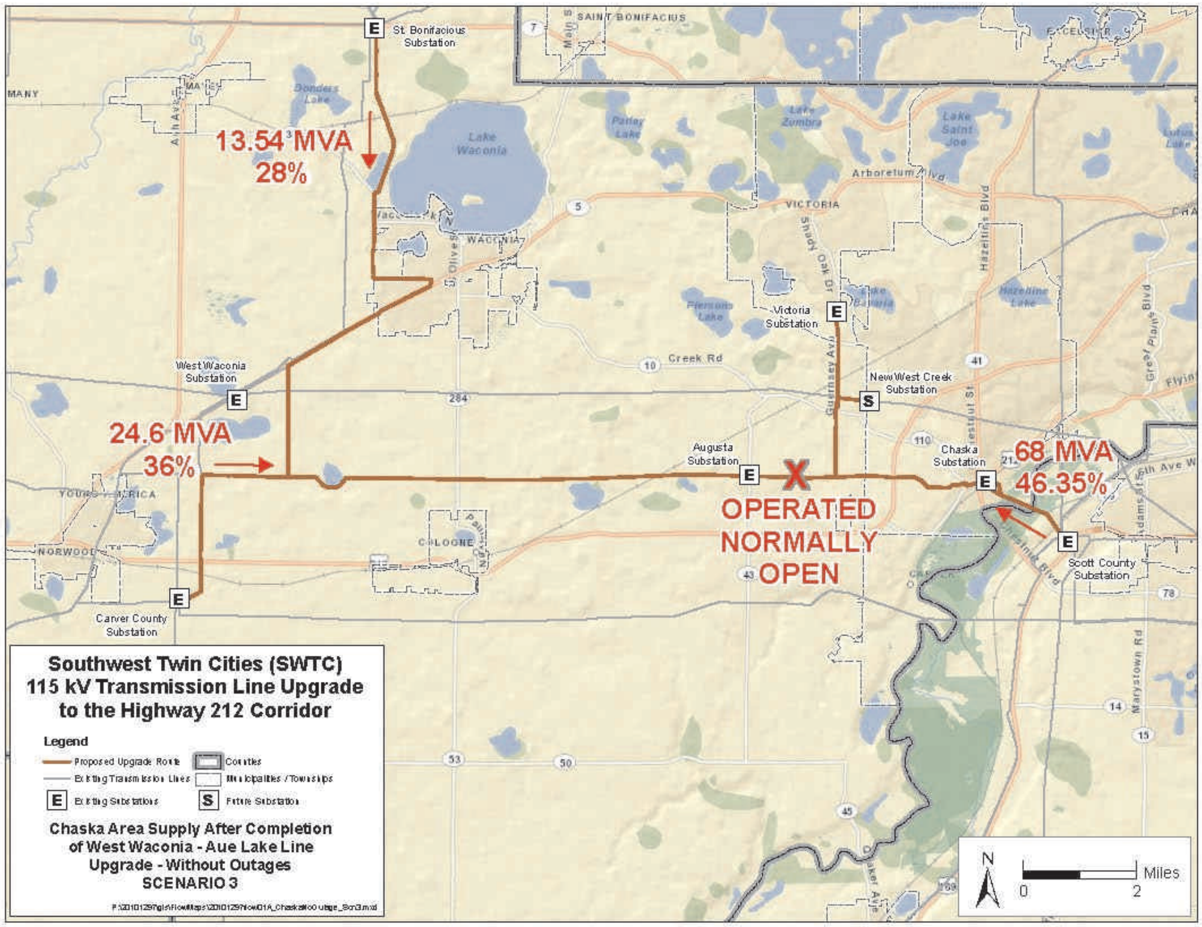
FACILITY OUT OF SERVICE	AFFECTED FACILITY	RATING	MVA FLOW	%OVERLOAD	CRITERIA FOR SYSTEM PERFORMANCE
Loss of St. Bonifacius transformer	*Carver County – Carver County tap 69 kV line*	*68*	*81.5*	*120%*	*100% (GRE)*
Loss of Scott County – Chaska 69 kV line	Augusta – MV-VTT 69 kV line	47	48.5	103%	Less than 110%
	Carver County tap – Augusta line	*47*	*56.9*	*121%*	*100% (GRE)*
Loss of Carver County tap – Carver County 69 kV line	*St. Bonifacius transformer*	*70*	*106*	*151%*	*Less than 125%*
	St. Bonifacius – Waconia 69 kV line	*48*	*72*	*150%*	*110%*
	NSP Waconia – GRE Waconia 69 kV line	48		100%	110%
	GRE Waconia – Carver County tap 69 kV line	45		101%	110%
	Carver County tap – Augusta 69 kV line	47		97%	110%

Table 6
Scenario 2: Low Voltages Identified

FACILITY OUT OF SERVICE	AFFECTED FACILITY	%LOW VOLTAGE	CRITERIA FOR SYSTEM PERFORMANCE
Loss of Carver County tap – Carver County 69 kV line	*Voltage at West Creek*	*87%*	*92%-105%*
	Voltage at Victoria	*87%*	*92%-105%*
	Voltage at Augusta	*88%*	*92%-105%*

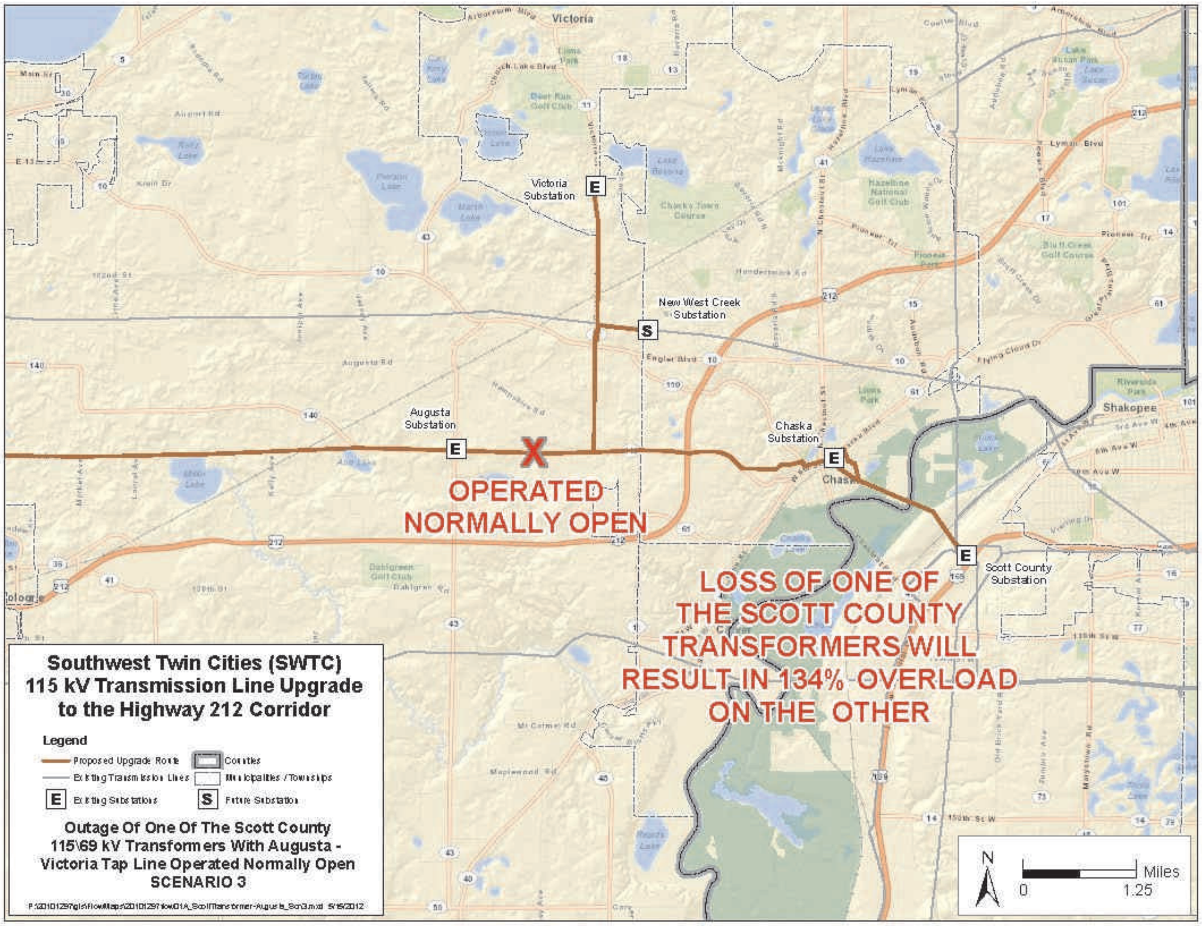
Scenario 3: In this final scenario, the 69 kilovolt line between the Victoria tap and Augusta substation is assumed to be operated normally open. This means the Chaska, Victoria, and West Creek substations would be served from the Scott County Substation and the Augusta Substation would be served from the Carver County and St. Bonifacius substation. **Figure 11** shows the system, under normal operating conditions, with no transmission lines out of service.

Figure 11
Scenario 3: All Facilities Operational



In this third scenario, the loss of one of the Scott County transformers will result in overloading the other transformer above its emergency rating. The Scott County Substation currently serves parts of the city of Shakopee and several other cities including New Prague and parts of Chaska. **Figure 12** depicts the system with the loss of either of the two transformer of the Scott County Substation.

Figure 12
Scenario 3: Outage of Scott County Substation Transformer No. 1 or No. 2



Also in this third scenario, loss of the Scott County – Chaska 69 kV line would result in the Carver County tap – Augusta line to overload to 121%. **Table 7** below provides a list of the facility overload conditions identified (in italics) under this third scenario.

Table 7
Scenario 3: Overloads Identified

FACILITY OUT OF SERVICE	AFFECTED FACILITY	RATING	MVA FLOW	%OVERLOAD	CRITERIA FOR SYSTEM PERFORMANCE
Loss of one of the Scott County 115/69 kV transformer	*2nd Scott County transformer*	*70*	*79.2*	*134%*	*Less than 115%*
Loss of Scott County – Chaska 69 kV line	Augusta – MV-VTT 69 kV line	47	48.5	103%	110%
	Carver County tap – Augusta line	*47*	*56.9*	*121%*	*110%*
Loss of Carver County – Carver County tap 69 kV line	St. Bonifacius transformer	70	106	101%	Less than 125%

2.4 Growth and Development in Chaska Area

The Chaska area has realized significant growth during the past ten years and is projected to continue to grow at a significant rate over the next decade. In 2000, the city of Chaska had 17,499 residents and that grew to 23,770 residents by 2010 according to U.S. Census data. The Metropolitan Council has forecasted that the population of the city of Chaska will grow from a population base of 17,603 in 2000 to 35,700 in 2030. The Metropolitan Council has forecasted the larger Carver County population base of 70,000 in 2000 to grow to 198,500 by 2030.

Major commercial and retail development is also anticipated in the area. Growth and development will be facilitated by major new road construction in the area, as well. For example, in 2008, construction of the Highway 212 corridor upgrade was completed. Highway 212 runs through the cities of Eden Prairie, Chanhassen, Chaska, Carver, and Dahlgren.

2.5 Actual and Projected Substation Load Data for Chaska Area

To assess the immediacy of the Study area need, planning engineers developed a peak load forecast for the Chaska area's load-serving substations as part of the Study.[4]

[4] The Minnesota Public Utilities Commission granted Applicants an exemption to Minnesota Rules 7849.0270 which requires Applicants to submit "peak demand and annual consumption forecasts for the applicant's service area and

Distribution capacity planning looks at loads on key elements of the system, such as feeders and transformers, on an annual basis. The load readings are gathered from multiple sources and "switching peaks" are removed from the readings to determine each year's peak reading. "Switching peaks" are peak loads observed at a distribution substation when load is transferred from a neighboring substation by switching the distribution feeders. Transmission planning looks at distribution and transmission growth trends and predicts load growth from information from area engineers, new load additions, and economic factors.

For the Study, actual system loads from 2006 to 2011 are provided in (**Table 8**). The loads for Minnesota Valley Electric Co-op and City of Chaska were obtained from Great River Energy and City of Chaska, respectively.

Table 8
Historic Substation Peak Load Data (Megawatts)

Substation	2006	2007	2008	2009	2010	2011
Chaska (NSP)	5.36	6.77	5.16	6.9	7.38	7.38
Chaska	10.4	10.3	9.2	10.5	10.98	11.6
Augusta	13.3	14.4	8.31	5.2	6.2	5.9
West Creek*	0	0	0	0	0	0
Victoria**	0	0**	8.25	8.35	8.63	8.25
Waconia(GRE)	2.1	2.2	2.1	2.1	2.26	2.26
Waconia (NSP)	19.1	15.73	19.7	19.7	16.46	22
Totals	**50.26**	**49.4**	**52.72**	**52.75**	**51.91**	**57.39**

* West Creek Substation would be completed in mid to late 2012, so no substation load data is available for this location
**Although the Victoria Substation was energized in 2007, the load at Victoria Substation is counted at the Augusta Substation.

system . . . " A copy of the Exemption Order is attached as **Appendix E**. In lieu of the system forecasts required by Minnesota Rule 7849.0270, Applicants are submitting peak demand forecasts for the substations within the Study area. Applicants consider this information more informative for the Project because it focuses on electric demand in the region where pending electrical problems were discovered.

Based on the current forecast, the peak load in the Study area is expected to increase by 83% percent between 2012 (51.6 megawatts) and 2020 (94 megawatts) as illustrated in **Table 9** below. Based on the 2015 summer peak model analysis, the system overload conditions on the Scott County – Chaska 69 kilovolt line or either of the transformers at the Scott County Substation appear before 2015.

Table 9
Peak Substation Load Forecast (MWs)

Substation	2012	2013	2014	2015	2016	2017	2018	2019	2020
Chaska (NSP)**	7.3	0	0	0	0	0	0	0	0
Chaska	13	13.5	14.1	14.7	16.21	17.88	19.72	21.79	24
Augusta	5.7	6	7.6	7.9	8.17	8.46	8.76	9.1	9.3
West Creek*	0	20	20	20	20	20	20	20	20
Victoria	9.8	10.2	10.7	11.2	11.57	11.95	12.34	12.8	13.2
Waconia (GRE)	2.2	2.2	2.3	2.3	2.35	2.4	2.45	2.5	2.54
Waconia (NSP)	20.9	21.4	21.8	22.2	22.8	22.46	24.1	24.78	25.28
Totals	**51.6**	**73.3**	**76.5**	**78.3**	**81.1**	**83.15**	**87.37**	**90.97**	**94.32**

**Xcel Energy's load at Chaska would be moved to the new Dahlgren Substation before 2013 peak, therefore will not be impacted by the outages in the Study area.
* West Creek Substation will be completed in late 2012, so no substation load data is available for this location. Also for Study purposes, it is assumed that the expected 20 MW of load would be added starting in 2013, in reality, the load would be ramped up over a few years to the full 20 MW capacity.

3 ALTERNATIVES ANALYSIS

Chapter 3. Alternatives Analysis: *In Chapter 3, we explain our analysis of different ways that we have considered to fix the need identified in the previous chapter. This includes other transmission improvements that we have looked at as well as options that don't require new or improved transmission facilities. These are referred to as the "non-transmission alternatives."*

Key Terms:

- **Demand-side management** – *Actions that influence the quantity or patterns of use of energy consumed by end users, such as actions targeting reduction of peak demand during periods when energy supply systems are constrained.*
- **Distributed generation** – *Small-scale generation located close to homes, farms and businesses where the power is needed, using traditional as well as renewable sources, like wind and biomass.*
- **Generation** – *The act of converting various forms of energy input (thermal, mechanical, chemical and/or nuclear energy) into electric power. The amount of electric energy produced is usually expressed in kilowatt hours or megawatt hours.*
- **Renewable resource** – *A power source that is renewed by nature, such as solar, wind, hydroelectric, geothermal, biomass, or similar sources of energy.*

Key Points: *We looked at an alternative 115 kilovolt transmission configuration for the Project. We also considered a "no build" alternative that made use of demand-side management solutions and using generation as an alternative to building new or improved transmission facilities. In addition, we analyzed alternative transmission designs such as underground transmission lines and Direct Current lines to serve the need. In the end, we concluded that the proposed Project best serves the needs identified in Chapter 2.*

3.1 Southwest Twin Cities Chaska Area Study Methodology

When evaluating system performance, engineers rely on performance criteria established by the industry to ensure reliable performance. In general, the system of interconnected transmission lines and generators must be able to operate without damaging its elements. If a transmission line or transformer or other piece of equipment fails, the remaining system of lines and transformers must be able to operate without damage to remaining equipment or loss of load.

When evaluating the performance of the electric system, engineers use computer simulations of the interconnected system to evaluate performance under a range of scenarios to evaluate the performance of alternative solutions. The computer models consider the capability of each of the transmission elements of the system and simulate the power flows on the system as a result of the predicted power demand levels at each and every distribution substation in the system under study. In this case, the power flow models employed were based on the MRO 2009 series 2015 summer peak model.

The primary strengths of the methodology employed in the Study are its reliance on the latest modeling software and most recent load forecast data available at the time. The methodology incorporated the use of existing rights-of-way to the maximum extent possible and it considered the likely long-term growth in the region. Lastly, the plans presented in the Study not only address current needs, they also provide the framework for future development of 115 kilovolt and 345 kilovolt transmission infrastructure in the Study region.

3.1.1 Modeling Assumptions

Several modeling assumptions were made in the Study to reflect recent plans and corrections. These modeling assumptions are discussed below.

3.1.1.1 Scott County – Chaska 69 Kilovolt Line Assumption

As stated above, three different scenarios of the Scott County – Chaska 69 kilovolt transmission line were evaluated in the Study. In the first scenario, it is assumed that the line between the Scott County and Augusta substations is operated closed, under system intact conditions. This means that the electrical path between the substations is continuous. In the second scenario, it is assumed that the line between Chaska Downtown Substation and Victoria tap is operated normally open, this means that the Chaska downtown Substation would be served from Scott County Substation, and the loads at West Creek, Victoria, and Augusta would be served from the Carver County and St. Bonifacius substations. In the third scenario, the line between the Augusta substation and Victoria Tap is operated normally open, this means that the Chaska, Victoria and West Creek substations would be served from Scott County Substation and Augusta Substation would be served from the Carver County and St. Bonifacius substations.

These three scenarios demonstrate that the current 69 kilovolt transmission system is not sufficient to handle the addition of load from the new data center at the West Creek Substation under any configuration.

3.1.1.2 Related Projects Modeling Assumption

The Glencoe to Waconia 115 kilovolt rebuild project (Docket No. E002/CN-09-1390) (Docket No. E002/CN-09-1390) and the Scott County – Westgate 115 kilovolt upgrade (Docket No. E002/CN-11-332) projects, as proposed to the Minnesota Public Utilities Commission, are included in the models to ensure that only the deficiencies between the Scott County and Augusta substations are identified and addressed by the Study. In addition, the proposed Dahlgren Substation, a distribution substation near the City of Carver, was included in the models. Xcel Energy's load currently served from the Chaska Substation was relocated to this new Dahlgren Substation.

3.1.1.3 West Creek Substation

The model used for the Study assumed the completion of the West Creek Substation located east of the Victoria Substation. It was assumed that the 20 megawatts of data center load would be served from the West Creek Substation.

3.1.2 Selection of End Points

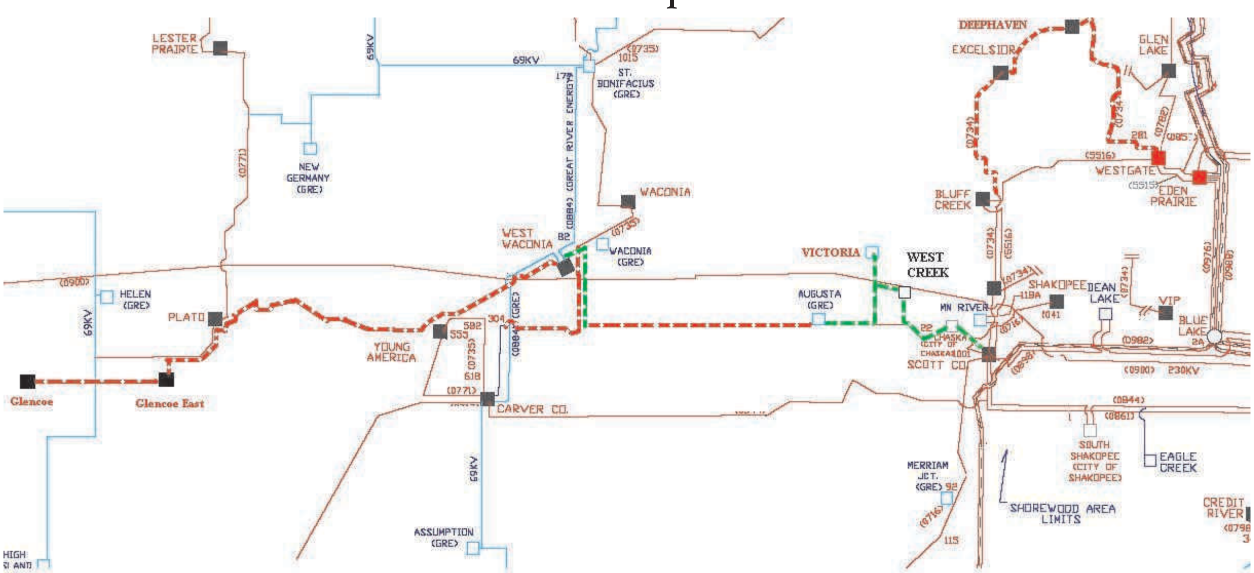
The selection of end points for each of the options was based on the areas requiring transmission upgrades for load serving and voltage benefits. As the load serving need is located in the area bounded by the Augusta, Victoria, Chaska, Scott County, and West Waconia substations, these locations were chosen as end points for one of the options studied. The Carver County and Minnesota River substations were chosen as alternative end points.

3.2 Transmission Alternatives

Two options were analyzed to address pending low voltage conditions and overloads in the Study area. The two options were selected based on the assumption that it would far less costly to utilize the existing transmission system and rights-of-way where possible. Applicants' proposed Project, Option 1, is shown in **Figure 13** below. Option 1:

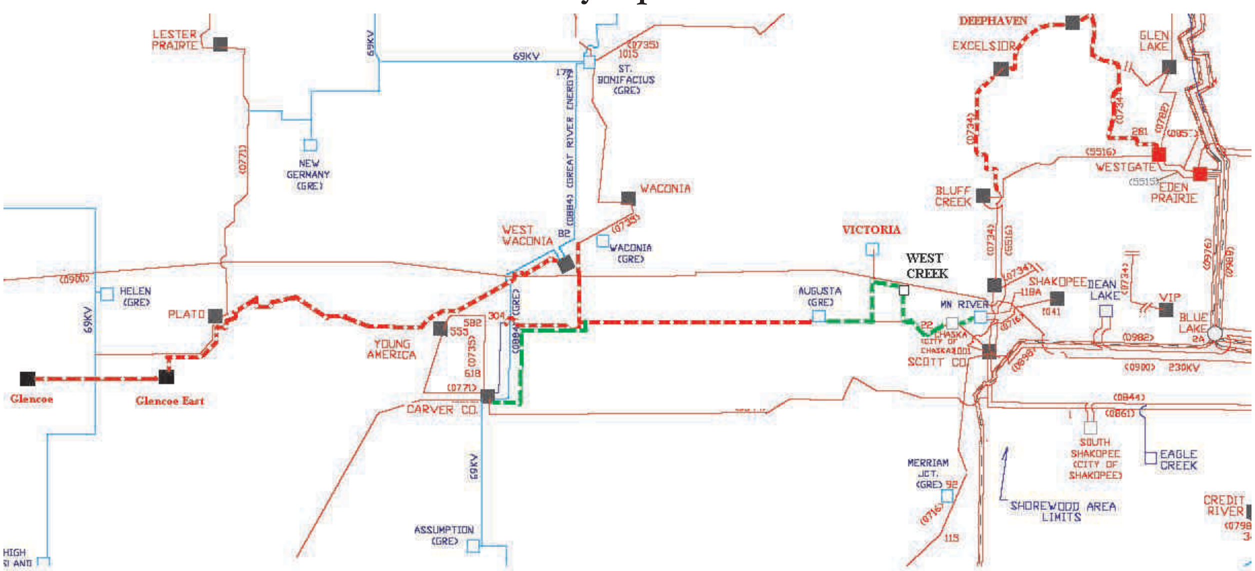
- Converts the existing 69 kilovolt Great River Energy MV-VTT line between the Xcel Energy #0740 line and the Minnesota Valley Electric Cooperative Victoria Substation to 115 kilovolt operation by retiring the existing 69 kV switch with no further physical changes to the remaining existing structures;
- Rebuilds existing Xcel Energy's #0740 69 kilovolt transmission line from an area west of the Augusta Substation to the Scott County Substation;
- Provides for new construction to connect the West Creek Substation directly to line 0740 west of Chaska Downtown Substation;
- Relocates a portion of the existing #0740 line out of the downtown area of Chaska and retires the Chaka Downtown Substation; and
- Modifies the West Waconia, Augusta, Victoria, West Creek, and Scott County substations to allow 115 kilovolt operation of the line.

Figure 13
Preferred Option 1



Option 2, the alternative option, requires construction of more new 115 kilovolt lines outside existing rights-of-way. New 115 kilovolt transmission lines would be required from the Carver County Substation to the Augusta Substation and from the Chaska Substation to the Minnesota River Substation. Additionally, the upgrades, construction, and relocation discussed for Option 1 between the Augusta, Victoria, West Creek, and Chaska substations would be required. Option 2 is shown in **Figure 14**.

Figure 14
Study Option 2



Both options address the low voltage and overload issues that were discovered in the Study area. Both provide approximately 50 megawatts of incremental load growth before new mitigation measures would be needed in the Study area, currently estimated in 2048, assuming a 2 percent load growth rate beyond 2015. Any new large load additions in the Study area, such as data centers and corporate parks, which would add significant load in a short period of time could result in transmission system upgrades being needed sooner than expected.

Option 1, which relies primarily on rebuilt construction and conversion from 69 kilovolt to 115 kilovolt operation, eliminates overload conditions during periods when lines or substations are out of service and provides future growth needs that have been identified by the City of Chaska. Both Option 1 and Option 2 were studied using NERC Category B and C contingencies and no violations were identified. Category B contingencies are events involving the loss of one element of the transmission system such as the loss of one transmission line or one substation transformer. Category C contingencies are events involving loss of more than one element of the transmission system due to failure of protection system or two circuits sharing common structures, etc.[5] Option 2, however, indicated that severe low voltages would occur if the Bluff Creek – Westgate 115 kilovolt line and the Scott County – Minnesota River 115 kilovolt line were simultaneously out of service.

3.2.1 Cost Analysis of Options 1 and 2

In conformity with Minnesota Rule 7849.0260(C), the Study included a planning level cost estimate for the preferred Option 1 in the range of $14 to $27 million. The Study also included a planning level cost estimate for the alternative Option 2 in the range of $17 to $31 million. These ranges assume a 30% accuracy for Option 1 and Option 2.

Table 10 and **Table 11** detail the planning level cost estimates for the two options analyzed in the study. During the early planning stages of a project, including the permitting phase, planners develop project scoping cost estimates that provide a preliminary estimate of projected costs and have an acceptable deviation of plus or

[5] *See* NERC TPL-001, TPL-002, and TPL-003 standards for technical definition of each contingency category.

minus 30 percent. Additionally, the estimates analyzed in the Study include the cost of the West Creek Substation, which is not being permitted as part of this Project.

Table 10

Preferred Option 1 Costs

OPTION 1	COST*
Convert West Waconia – Augusta 69 kV line to 115 kV[6]	$ 2,035,000
Convert Augusta substation to 115 kV	$ 1,500,000
Augusta – West Creek 115 kV line	$ 1,875,000
Convert Victoria substation to 115 kV	$ 1,500,000
West Creek – Chaska 115 kV line	$ 2,630,000
Convert Scott County – Chaska 69 kV line to 115 kV	$ 2,260,000
Convert Chaska substation to 115 kV	$ 2,000,000
New West Creek distribution substation	$ 2,600,000
115 kV line termination at Scott County substation	$ 2,070,000
115 kV line termination at West Waconia substation	$ 1,980,000
Total	**$ 20.45 Million**

Table 11

Alternative Option 2 Costs

OPTION 2	COST*
Convert Carver County – Augusta 115 kV line to 115 kV[7]	$ 4,500,000
Convert Augusta substation to 115 kV	$ 1,500,000
Convert Augusta – West Creek line to 115 kV	$ 1,875,000
Convert Victoria substation to 115 kV	$ 1,500,000
Convert the 69 kV line between (1 miles east of) West Creek and Minnesota River to 115 kV (this would include new right of way)	$ 5,500,000
Convert Chaska substation to 115 kV	$ 2,000,000
New West Creek distribution substation	$ 2,600,000
115 kV line termination at Carver county substation	$ 3,150,000
115 kV line termination at Minnesota River substation	$ 1,000,000
Total	**$ 23.62 Million**

Both options can be expanded in future years to accommodate continued growth in the area.

[6] Only the sections that are not built to 115 kV and the 1.5 mile 69 kV section West of the tap on Augusta – Carver County 69 kV line. It is assumed that the Glencoe – Waconia transmission line upgrade project would build the line from West Waconia to existing Carver County – Augusta line, and only the cross arms, insulators and conductor have to be installed to complete this section.

[7] This would involve building 115/69 kV double circuit tap from the Carver County tap to Carver County substation, in order to terminate the 69 kV line from Waconia into Carver County substation.

3.2.2 Total System Losses by Option

Not all electricity introduced to the transmission system will ultimately be delivered to end-use customers. Due to the resistance of the conductors and transformers, some of the power dissipates as heat energy during operation of the system. Generally speaking, the higher the voltage level of a particular facility, the lower the level of losses for a given amount of power transfer. These transmission losses consist of power ("demand" or "capacity") and energy losses. Every megawatt of system demand loss has a generating capacity cost associated with it, and every megawatt hour of energy losses has a production cost associated with it. By reducing system losses, a more efficient power system results and the cost to deliver power to the consumer is reduced.

Applicants are providing system losses for the control area because it is more informative to analyze system losses in addition to single line losses. A new transmission line will affect losses throughout the control area and will generally reduce losses across the system as a whole, which reduces the amount of power that must be generated. Conversely, focusing on a single line tends to distort its impact because a single, isolated transmission line will always have losses. The amount of power lost on an isolated transmission line is of little value in making a need determination. System losses better inform the determination of whether the proposed transmission line has a positive impact on the system.

As part of the Study of the proposed Project, a system losses analysis was conducted to evaluate Option 1 and Option 2. **Table 12** below provides the system losses for the base case, Option 1 and Option 2. The losses are based on total losses in Xcel Energy and Great River Energy control areas.

Table 12
System Losses – Xcel Energy & Great River Energy

	Base Case (MW)	Option 1 (MW)	Option 2 (MW)
Xcel Energy	253.6	252.0	253.1
Great River Energy	93.3	93.3	93.3
Total	**346.9**	**346.2**	**346.4**

The results indicate that the transmission line losses do not change significantly due to either option, therefore no further analysis was performed to identify the economic benefit of loss reduction.

3.2.3 Rationale for Option 1

Applicants propose Option 1 for several reasons:

- Option 2 does not address the Category C contingency of loss of Scott County – Minnesota River combined with the loss of Westgate – Bluff Creek 115 kV line. Although no new facilities are required to mitigate this, an operating guide may be needed. This would put additional burden on the system operators and therefore is considered undesirable.
- Option 2 requires 3 to 4 miles of new right-of-way for the 115 kilovolt line between Carver County and Augusta. This is not required for Option 1 as the corridor used for Glencoe to Waconia 115 kilovolt rebuild project (Docket No. E002/CN-09-1390) would be utilized to connect Augusta and West Waconia.
- In addition, the Scott County and West Waconia substations are likely to be expanded to have 345/115 kV substations, therefore providing a long-term benefit of better load-serving capability.

3.3 Other Transmission Voltages

Other transmission voltages were not considered for meeting the transmission needs in the Chaska area for the following reasons:

Lower voltage 69 kilovolt lines will not meet the future load growth needs in the area, therefore 69 kilovolt options were not considered.

Higher voltage lines such as adding new 161 kilovolt lines were not considered because new 115/161 kilovolt transformers would be required to connect the 161 kilovolt lines to the existing transmission system, a significantly more expensive option when compared to 115 kilovolt lines (Option 1). Additionally, 230 kilovolt and 345 kilovolt lines are generally used for transferring large amount of power over long distances or providing a "back bone" for 161 kilovolt or 115 kilovolt transmission systems. Therefore 345 kilovolt and 230 kilovolt transmission options are not appropriate to address the load serving needs in the Study area.

3.4 Upgrading Existing Transmission Lines

The Project involves upgrading existing 69 kilovolt transmission lines to 115 kilovolt. The proposed Project upgrades the existing 69 kilovolt line between Structure #142 on Xcel Energy's #0740 line and the Scott County Substation to 115 kilovolt and converts the Great River Energy MV-VTT 69 kilovolt transmission line to 115 kilovolt between the Xcel Energy #0740 line and the Victoria Substation. Where new construction is proposed, it is to allow for the relocation of the existing #0740 line from downtown Chaska and to provide a second 115 kilovolt source to the West Creek Substation from the Chaska Substation.

3.5 Alternative Substation Termination Points for Transmission Line

Alternate termination points of the Carver County and Minnesota River substations were considered as part of the Study. As discussed in Section 3.2.3, the preferred plan would provide certain advantages related to right-of-way usage, ease of system operation, and access to possible future 115 kilovolt sources in the area.

3.6 Additional Alternatives

Applicants also considered several additional alternatives to constructing the proposed facilities. These alternatives included: (1) generation; (2) double-circuiting and upgrading existing facilities; (3) different conductors; (4) Direct Current lines; (5) undergrounding; (6) a "no build" alternative; and (7) demand side management.

These options are discussed below. In the end, Applicants concluded that the proposed Project best meets the identified needs better than any of these alternatives or any combination of these alternatives.

3.6.1 Generation

3.6.1.1 Peaking Generation

In evaluating generation alternatives to the proposed 115 kV transmission project, the Applicants studied the availability of traditional peaking generation sources (e.g., diesel generation) to meet the load serving need and determined that generation is not a reasonable alternative.

Transmission lines have the ability to operate more than 99% of the time. This reliability level is one of the benefits of constructing transmission lines. For comparison purposes, peaking generation cannot be assumed to be available to operate more than 95% of the necessary hours. Consequently, to replicate the 99% reliability found in transmission, redundant generation would need to be installed.

In addition to the extra capital investment that would be required to install redundant generation to serve the same need as transmission, additional costs would have to be taken into account for the higher operations and maintenance of generators when compared to such expenses for transmission. Once constructed, transmission lines require relatively modest ongoing operations and maintenance costs. Peaking generators, by contrast, require much more costs for ongoing operations and maintenance. Generators also generally have a shorter expected service life than transmission facilities (30 years for generators versus 40-plus years for transmission facilities).

3.6.1.2 Distributed Generation

Distributed generation is generally considered to be small generation sources, usually less than 10 megawatts, that are located close to the ultimate users. However, in some cases, generators larger than 10 megawatts are considered to be distributed generation as well. Even if used to serve additional load, transmission facilities would be required to support the distributed generation systems. Distributed generation would not satisfy the needs identified in the Study.

Distributed Generation between Scott County Substation & Augusta Substation

Distributed generation is not considered a viable alternative to the proposed Project. Assuming that the installation cost per kilowatt of generation is $1000, for $20 to 25 million, only about a 20 to 25 megawatts in size generator could be installed to offset approximately an equivalent size load. The transmission alternative provides approximately 50 MW of incremental load-serving capability at the cost of $20 to 25 million. To obtain comparable load-serving capability through distributed generation, small generators would not be sufficient. In addition, the installation cost of such generator would far exceed the cost of proposed project.

Due to the residential nature of the Study area, it would be difficult to site generation in these areas along with gas or oil infrastructure and interconnection facilities required to run the generating plant. Therefore this option was not studied.

Even if distributed generation were studied, any generation alternative would need to replace the reliability provided by adding transmission. Transmission lines have the ability to operate more than 99% of the time. This reliability level is one of the benefits of constructing transmission lines. For comparison purposes, peaking generation cannot be assumed to be available to operate more than 95% of the necessary hours. Consequently, to replicate the 99% reliability found in transmission, redundant generation would need to be installed.

In conclusion, the proposed transmission option is superior when these additional considerations are factored into the distributed generation option.

3.6.1.3 Renewable Energy Generation

Applicants considered the public policy preference for renewable energy generation. The state policy is embodied in two sections of state law. The first renewable energy preference is contained in Minnesota Statutes 216B.243, subdivision 3a. This statute provides:

> **Use of renewable resource.** The commission may not issue a certificate of need under this section for a large energy facility that generates electric power by means of a nonrenewable energy source, or that transmits electric power generated by means of a nonrenewable energy source, unless the applicant for the certificate has demonstrated to the commission's satisfaction that it has explored the possibility of generating power by means of renewable energy sources and has demonstrated that the alternative selected is less expensive (including environmental costs) than power generated by a renewable energy source. For purposes of this subdivision, "renewable energy source" includes hydro, wind, solar, and geothermal energy and the use of trees or other vegetation as fuel.

The second renewable energy preference is found at Minnesota Statutes Section 216B.2422, subdivision 4, which states:

> The Commission shall not approve a new or refurbished nonrenewable energy facility in an integrated resource plan or a certificate of need, pursuant to section 216B.243, nor shall the Commission allow rate recovery pursuant to section 216B.16 for such a nonrenewable energy facility, unless the utility has demonstrated that a renewable energy facility is not in the public interest.

The Minnesota Public Utilities Commission has recognized that the renewable energy preference statutes create unique issues when applied to transmission projects. The Minnesota Public Utilities Commission has found that the preference is not a bar to granting Certificates of Need for transmission facilities where the proposed transmission facility does not immediately interconnect to a new generation source and will not interconnect with a specific generation source. As the proposed transmission lines are not proposed for and will not interconnect any particular generation resource, the renewable energy preference statutes do not establish additional standards that the Applicants must satisfy as part of this Certificate of Need proceeding. *In the Matter of the Application of Otter Tail Power Company for a Certificate of Need for Appleton-Canby 115 kilovolt High Voltage Transmission Line*, order granting certificate of need at p. 9, Docket No. E-017/CN-06-677 (Apr. 18, 2007).

3.6.1.4 Wind Generation

Because of the theoretical possibility that generation could potentially address community reliability needs, Applicants analyzed whether the addition of small and dispersed wind generation projects could eliminate the need for the Project. The analysis concluded that sufficient wind generation cannot be installed to offset the community service reliability deficiencies in the affected area. This is due to the variability of wind and cost.

Wind generation is a "variable" resource that is dependent on the availability of wind to operate. While a wind turbine may have a stated nameplate capacity, its average net operating output may range from 10% to 40% of its nameplate capacity throughout the year. A wind turbine is a "nondispatchable" resource and cannot be relied on to produce power in the same way as a conventional power plant. A traditional power plant (e.g., natural gas, nuclear, hydro, coal) is "dispatchable", meaning it can be relied upon to produce power when power is needed. Power needs to be created and used in equal amounts for each instant of time. Power typically cannot be created one day and used the next without introducing an energy storage system such as batteries to store power until it is needed.

As a result, wind generation is generally relied upon as a source of energy but does not provide the type of capacity that is required to ensure reliable customer service for those times when the wind is not blowing. Wind generation is typically integrated into the transmission system along with dispatchable resources such as natural gas peaking plants and hydro, which are capable of generating power during those hours when customer demand is high but the wind is not blowing.

This operating characteristic creates two separate issues, each of which can be alleviated by transmission. First, the system must be capable of importing power to the affected community during those hours when sufficient wind power is not being generated to satisfy the entire need (i.e., high demand/low wind scenario). Second, the system must be capable of exporting power from the affected community during those hours when more wind energy is being generated than can be used by the local community (i.e., low demand/high wind scenario).

Because the electric system must be designed to meet all customer requirements during all hours of the year, the addition of local wind energy generators will not eliminate the need for additional transmission. To the extent that wind generation projects might be able to meet local community service reliability needs, that ability is limited and therefore the electricity delivery system must still be designed to cover the deficiencies identified. Moreover, additional infrastructure needs to be constructed to export that wind-generated power to the transmission system at times when wind-generated power exceeds community load levels. Therefore, dispersed wind projects are not a reasonable alternative to the proposed transmission alternative for local community service reliability needs.

The alternative is not practical. Given the development of the local area along the Project, small turbines would likely need to be used. The largest turbine that can be installed at a home without major wiring changes is 20 kilowatts. If the assumption is made that wind could provide the needed capacity, 1,000 turbines would need to be installed to create the 20 megawatt capacity that would be needed to provide support to the new data center.

$$\frac{20\ Megawatts}{20\ Kilowatts\,/\,turbine} = 1000\ turbines$$

The costs associated with new turbines are also a relevant consideration. Using turbine costs provided by ReDriven (www.redriven.net)), a manufacturer of wind turbines and towers, the cost for a 20 kW unit is $61,628 ($47,737 for turbine and $13,891 for tower). Without considering shipping and installation, charges that are not included, the cost would be $61.6 million (1,000 * $61,628).

<u>*Solar Generation*</u>

In addition to wind generation as an alternative, Applicants considered distributed solar generation (photovoltaics) as an alternative.

Solar installations generally require significant space and are limited in capacity. For example, Xcel Energy partnered with the City of Minneapolis and Westwood Professional Services to install the largest solar voltaic array in the upper Midwest Region. The 600 kilowatts project, completed in December 2010, includes more than 2,600 panels installed on the roof of the Minneapolis Convention Center. All of the electricity produced annually by the panels is used on-site. The $3 million project received a $2 million grant from the Xcel Energy Renewable Development Fund.

Given the area where the Project is proposed, smaller arrays would likely to be used. For purposes of the analysis for this Application, it was assumed that solar panels will be able to output nameplate rating when demand is needed, that each panel would require 400 sq. ft of space.

Using the above assumptions, the largest array solar that can be placed on a home is approximately 4.6 kilowatts.

$$\frac{20\ Megawatts}{4.6\ Kilowatts / array} = 4{,}348\ arrays$$

The cost of the equipment, excluding shipping and installation, would be approximately $26,000 per array. (http://www.wholesalesolar.com/gridtie.html). The total cost for 20 megawatts would be $113 million. Even if a large area were identified and a project similar to the one discussed above at the Minneapolis Convention Center, the cost to provide 20 megawatts would be approximately $100 million.

Solar system output reaches its maximum output during the noonday period and falls off as the afternoon progresses. Residential load, however, typically reaches its peak later in the day and usually occurs between 4 and 6 p.m. as people return home from work and school for the day. This means that the energy output of the system has peaked prior to the load on the system peaking. This poses significant challenges to efforts to use photovoltaic systems to displace or defer investments in distribution system equipment designed primarily to serve residential customers. In order to do that, either extremely large systems requiring hundreds of acres or unrealistic photovoltaic saturation would be needed to defer investments.

3.6.1.5 C-BED Generation

In evaluating generation as an alternative, Applicants also considered the use of Community-Based Energy Development ("C-BED") generation. C-BED generation, like distributed generation, generally refers to small generation projects. The distinguishing characteristics of a C-BED project are that it is renewable and that it meets certain ownership requirements.[8] As discussed in the Distributed Generation section above (Sections 3.6.2.2), use of generation to meet the load supply needs of the Study area is not economical. This conclusion holds true even if the generation used is C-BED generation.

3.6.2 Double Circuiting Existing Transmission Lines

Double circuiting is the construction of two separate circuits on the same structures to reduce the overall amount of right-of-way required. Double circuiting minimizes the need for new right-of-way and expansion of the overall footprint of the transmission system. In the case of the transmission line between Structure #142 and the Scott County Substation, the Project uses existing rights-of-way for 85% of the route. The Great River Energy MV-VTT transmission line conversion will use existing rights-of-way in its entirety. New construction is only proposed for 1.8 miles between the West Creek and Chaska substations to provide a second source and for 0.6 miles to relocate a short portion of the #0740 line out of downtown Chaska.

[8] The distinguishing feature of a C-BED project is the ownership structure. "C-BED project" means a new renewable energy project that is either a stand-alone project or part of a partnership under subdivision 8:
(1) has no single qualifying owner owning more than 15% of a C-BED wind energy project unless: (i) the C-BED wind energy project consists of only one or two turbines; or (ii) the qualifying owner is a public entity listed under paragraph (b), clause (5), that is not a municipal utility;
(2) demonstrates that at least 51% of the gross revenues from a power purchase agreement over the life of the project will flow to qualifying owners and other local entities; and
(3) has a resolution of support adopted by the county board of each county in which the project is to be located, or in the case of a project located within the boundaries of a reservation, the tribal council for that reservation.
Minn. Stat. § 216B.1612, subd. 2(g) (amended 2007).

Planning engineers examined whether double circuiting was an appropriate solution, in part, to the pending electrical deficiencies in the Study area. Double circuiting is not appropriate in this case because upgrading the existing line as a single circuit is adequate to serve the long-term needs of the Study area.

3.6.3 Direct Current Lines

Applicants further considered the alternative of a direct current ("DC") line in place of the proposed alternating current ("AC") facilities. DC transmission lines normally consist of two current-carrying conductors instead of the three associated with an AC configuration. A DC transmission line's primary intended purpose is to deliver electricity from a distant generation location (several hundred miles away) to a load center. Such lines also do not have the capability to provide community service reliability support to an AC system because there are no intermediate substation connections. Rather, there are converter stations at each end of the line. This characteristic of a DC line makes it unsuitable for the needs sought to be addressed by the proposed transmission line, which is to improve system reliability due to increased demand.

3.6.4 Conductor Choice

Xcel Energy and Great River Energy use several types of conductors for their transmission lines. The standard bare aluminum overhead transmission conductors, Aluminum Conductor Steel Supported ("ACSS") and Aluminum Conductor Steel Reinforced ("ACSR"), offer known reliable power performance, operating at temperatures up to 200ºC and 100ºC, respectively. For each of the 115 kV lines proposed here, ACSR would provide 230 MVA of capacity and ACSS would provide 361 MVA of capacity. ACSS typically costs approximately 10% more than ACSR conductor. A smaller conductor than 795 ACSS will be sufficient for the Project, but the incremental cost of going from a 477 ACSR conductor to 795 ACSS conductor is minimal and at the same time the 795 ACSS conductor provides 217% capacity compared to the smaller 477 ACSR conductor. Therefore 795 ACSS is the choice of conductor for most 115 kV transmission lines.

Two composite conductor alternatives can offer substantial increases in capacity and the ability to span greater distances between poles by use of innovative modern composites, but at a significantly increased cost and lower efficiency. The modern materials and manufacturing process required for these composite conductors result in a material cost that is 300-500% higher compared to standard ACSR and ACSS. Composite conductors also experience higher losses because they are operated at higher temperatures. As a result, this type of conductor is used only in special circumstances, where long spans are required. In the case of this Project, circumstances do not warrant the use of this type of conductor.

3.6.5 Underground Transmission Line

The alternative of placing the proposed transmission line underground was also considered, but ultimately rejected because of cost considerations. Generally, for transmission voltages of 115 kilovolt or greater, overhead construction is the preferred configuration due to costs. Underground transmission lines also have substantially longer construction times and longer repair times than equivalent overhead lines. For example, an overhead 115 kilovolt transmission line constructed with single pole structures spaced 300 to 400 feet apart cost approximately $500,000 - $700,000 per mile. The same facility placed underground could cost up to five to ten times as much.

This cost differential is based on the different design requirements for overhead and underground installations. Overhead transmission lines rely on the dielectric properties of air to provide insulation, thereby preventing the occurrence of short circuits. The properties of the air also efficiently dissipate heat away from the conductor surface.

When a transmission line is placed underground, the conductors must be adequately insulated from the ground and each other, and adequately cooled to prevent equipment failure. Thus, the conductors are wrapped with insulating materials and placed inside oil filled pipes. The oil is circulated through cooling stations every few thousand feet along the line.

Some electric cables have been designed with a specially-formulated plastic covering that does not require circulating oil to dissipate heat. However, the amount of current that can be applied to such conductors is limited.

Because of the significantly-greater expense associated with underground transmission, the use of underground technology is limited to locations where the impacts of overhead construction are completely unacceptable or where physical circumstances allow for no other option. Examples include congested downtown centers where there is no space available between city streets and adjacent buildings for adequate clearance, or airport approaches where an overhead transmission line cannot be constructed for safety reasons. No circumstance warrants underground construction based on Applicants' examination of the environmental and land use setting associated with the proposed Project.

3.7 Rebuilding the Existing 69 Kilovolt Line

Rebuilding the existing 69 kilovolt transmission line would not address the concerns related to service considering the addition of the 20 megawatt data center load in Chaska. In addition to the 69 kilovolt line rebuild, additional upgrades would be needed at Scott County substation and possibly a new 69 kilovolt switching station to reduce exposure of load to faults. These however will not ensure that the transmission system would be sufficient if the load along the Highway 212 Corridor experiences high growth. A system capable of supporting a higher voltage is necessary to ensure system reliability and service to the area in the long term. Due to these reasons, options involving upgrading the 69 kilovolt line to 115 kilovolt were not considered as part of the study.

3.8 Reconductoring

Applicants also examined whether transmission improvements that do not require Certificates of Need, including reconductoring existing transmission lines, could meet the identified needs in the area. Although reconductoring existing lines and upgrading existing 69 kV facilities could mitigate the deficiencies identified, considering the large load growth potential near Chaska area and to improve the reliability of Bulk electric system to meet the TPL-003 standard in the near and long term for NERC Category

C contingencies, without shedding load, it was determined that 115 kilovolt upgrade of existing lines would be the prudent option.

3.9 Conservation and Demand Side Management

No large energy facility can be certified by the Commission for construction unless the applicant can show that "demand for electricity cannot be met more cost effectively through energy conservation and load-management measures." Minn. Stat. § 216B.243, subd. 3. The statutory requirements set forth in sections 216B.243, subdivisions 3 and 3(8) are reflected in Minnesota Rule 7849.0120(A)(2), that requires the Commission to consider "the effects of the applicant's existing or expected conservation programs and state and federal conservation programs." Each electric and gas utility has an annual energy savings goal equivalent to 1.5% of gross annual retail energy sales. Minn. Stat. § 216B.2401.

Applicants present their efforts to reduce energy consumption via demand side management in **Appendix D**. Xcel Energy's proposed 2010-2012 Triennial Plan[9] represents a budget of over $240 million, energy savings of 1,116 gigawatt hours and demand savings of 315 megawatts over the three years. Great River Energy is not required to file a Triennial Plan. However, in 2010, Great River Energy and its member cooperatives invested more than $25 million in the delivery of energy efficiency, conservation and demand side management programs. In 2010 these efforts resulted in over 219 million kilowatt-hours throughout Great River Energy's system.

Although significant reductions in energy consumption have been realized, such efforts are not a feasible alternative to the proposed transmission upgrades because the additional 20 megawatts of load from the new data center will increase load well beyond projected energy reductions realized from the Applicants' conservation and load management programs (collectively, "DSM"). Thus, while DSM is an effective alternative for meeting future needs, it will not be able to address issues related to meeting existing demand at the levels indicated in the Study.

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[9] Docket No. E,G002/CIP-09-198.

Applicants considered whether an increase in customer participation in Applicants' conservation and load management programs (collectively, "DSM") in the Study Area could adequately address the capacity needs identified for that area and determined that these programs could not. Customer conservation is a personal choice. Applicants offer a number of effective energy conservation programs and strongly encourages its customers to participate. Energy conservation is the best way to reduce individual customer load. Applicants provide a broad spectrum of no cost and low cost options to customers to help them reduce their energy usage.

The historical data used in the forecasting includes DSM impacts, so a significant number of additional customers would need to be willing and eligible to participate in the conservation and load management programs to decrease load levels and, even then, any realistic decrease would be insufficient to address the existing transmission deficiencies. Therefore, DSM is not a reasonable alternative to the Project.

3.10 Combination of Generation and Conservation

Based on the generation and no build alternative analysis detailed above, the Company concluded that a combination of generation and DSM could not address the identified needs. Even if a conservation rate of 2 percent of energy sales were achieved, a rate that is above the statutory objective of 1.5 percent, and even if that energy savings translated into the same percentage of demand savings (each percent of energy saved equals a percent of peak demand savings), this would result in meeting only 1.2 megawatts of the need (.02 * 57.9 MW of peak load from 2011). Therefore, load management programs would not provide significant additional relief in meeting the 20 megawatts of additional load that results from the new data center. Generation is not a reasonable alternative to meet this deficit for the reasons set forth above.

3.11 Consequences of Delay and No Facility Alternative

In lieu of the requirements of Minnesota Rules 7849.0300 and 7849.0340 requiring detailed information regarding the consequences of delay and no facility alternative on three levels of demand and energy consumption, the Exemption Order (**Appendix E**) requires Applicants to identify the threshold level of demand that places service at risk and the incremental change in growth.

Based on the results in **Table 13** below, the 2015 year model indicates that the initial overloads in the near term occur on the Scott County Substation transformers #1 and #2 and the 69 kilovolt line between the Scott County Substation and the Chaska Substation. As the load increases in the area, the overloads and low voltages progressively get worse.

Table 13
Consequences of Delay

Outage	Facility	Overload 2013	Overload 2016
Loss of one of the Scott County 115/69 kV transformers	Scott County 115/69 kV transformer	119%	113%[10]
Loss of Scott County – Chaska 69 kV line	Carver County tap – Augusta 69 kV line	92%	121%
	GRE Augusta – Victoria tap	79%	103%

Approximately 78 MW of load would be exposed to faults on the lines between St. Bonifacius, Carver County and Scott County substations, when the lines between the three substations are operated normally closed.

Additional load growth in the area will not be possible after 2015 if the upgrades and new segments of transmission line are not constructed. If growth continues without the Project, load shedding could be required. The voltage and loading problems confronting the Project area demonstrate that a no-facility alternative is not a feasible option. For these reasons, Applicants believe the Project is the best alternative.

Minnesota Rule 7849.0340 further requires Applicants to discuss the impact on existing facilities under a no-facility analysis, specifically their impact on: (1) the amount of land required; (2) induced traffic; (3) fuel requirements; (4) airborne emissions; (5) water appropriation and conservation; (6) discharges to water; (7) reject heat; (8) radioactive releases; (9) solid waste production; (10) audible noise; and (11)

[10] The load on the transformers will drop from 2013 to 2016 as the load at the Excelsior and Deephaven Substation would be upgraded to 115 kV around 2015. However, as the load increases thereafter, the transformer load will continue to rise.

labor requirements (the "Section B Requirements"). There would be little if any impact on existing generation and transmission facilities under a no-facility alternative. The likely consequence of a no-facility scenario would be to shed load. Similarly, the Section B Requirements are not impacted in any significant manner under a no-build scenario. Additionally, since the Section B Requirements will not be significantly impacted, no equipment or measures need be used to mitigate such impacts pursuant to Section C of the Rule.

4 TRANSMISSION LINE ROUTING AND SUBSTATIONS

Chapter 4. Transmission Line Routing and Substations: *Chapter 4 describes the proposed transmission line and substation improvements for the alternative selected for the Project. The actual route will be determined through the Route Permit proceeding and a separate Route Permit application will be submitted to the Minnesota Public Utilities Commission. This chapter is intended to describe what the Applicants have identified as the alternative best-suited to meet the local area needs, as discussed in Chapter 3.*

Key Terms:

- **MV-VTT** – *Great River Energy's transmission line between County Road 140 and the Victoria Substation is designated as the "Minnesota Valley to Victoria Substation Tap", abbreviated as "MV-VTT". Minnesota Valley is Great River Energy's member cooperative in the area of the Project.*
- **Span** – *A design term used to describe the situation where, during design, engineers have identified an area where they are able to design the line so that poles are placed on either side, and not within, a physical or environmental feature.*
- **Termination** – *The location where a transmission or distribution line ends in a substation. The termination is typically a transformer, but can also be a breaker.*
- **Electrical Equipment Enclosure** – *A building within the substation that contains equipment necessary to operate the substation.*

Key Points: *Although this chapter describes a route for the Project in detail, this is only the route that Applicants prefer to meet the needs of the Project. The final route for the Project will be determined by the Minnesota Public Utilities Commission in the Route Permit proceeding (Docket No. E002/TL-12-401).*

4.1 Identification of Project Segments

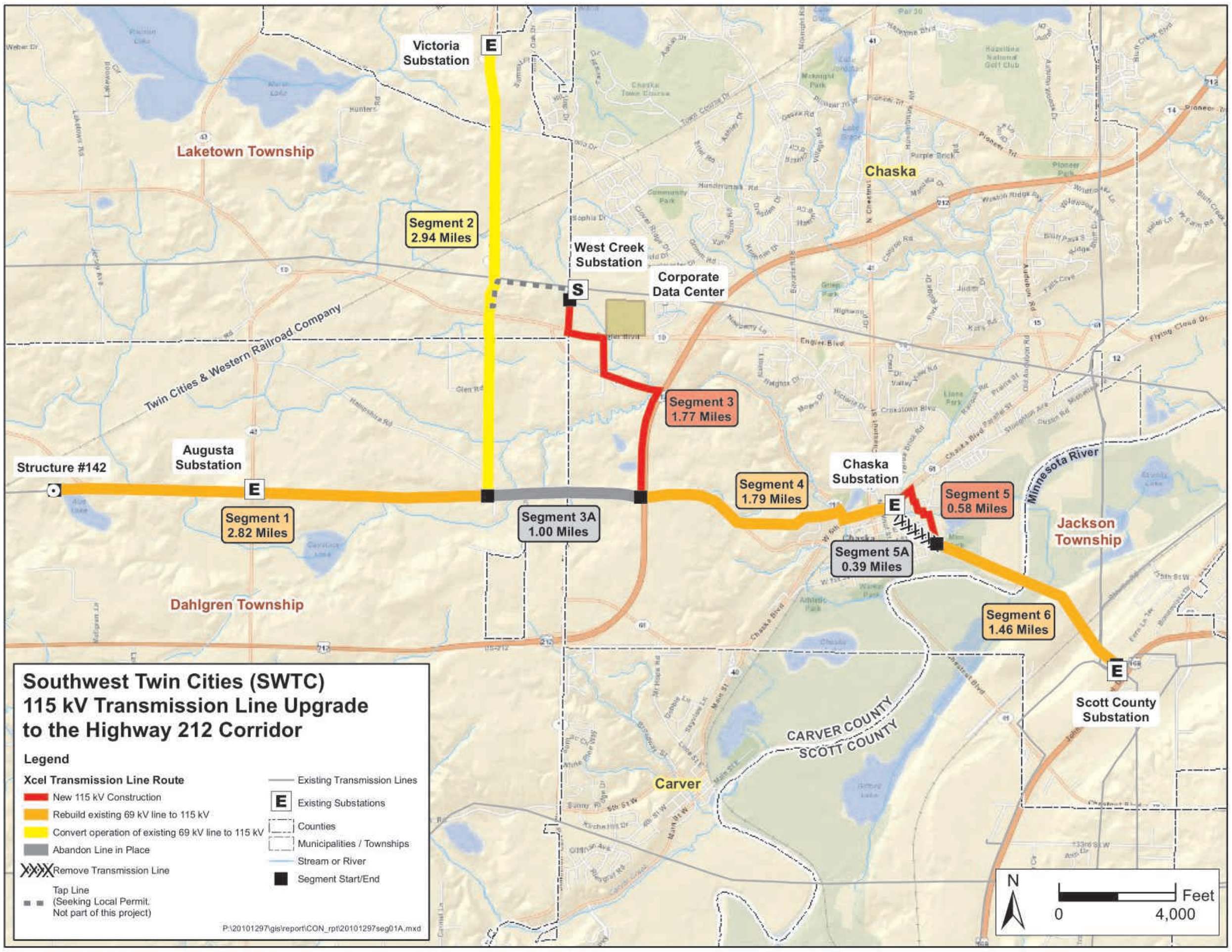
This Certificate of Need Application is focused on documenting the need for new 115 kilovolt transmission facilities in the Chaska area. In the Route Permit proceeding, the exact location of the proposed new 115 kilovolt facilities will be determined. (Docket No. E002/TL-12-401). In that proceeding, Applicants will propose the following:

- Removing approximately 6.1 miles of existing single circuit 69 kilovolt transmission line (Xcel Energy, Line #0740) and replacing it with a new single circuit 115 kilovolt transmission line as follows:
  - Between existing Structure #142 west of Aue Lake to an interconnection with the existing 69 kilovolt MV-VTT transmission line owned by Great River Energy in the southwest quadrant of the intersection of County Road 140 and Guernsey Avenue (2.8 miles) ("**Segment 1**");
  - Along County Road 140 from its intersection with Highway 212 to the existing Chaska Substation located at the northwest quadrant of East 6th Street and North Oak Street (1.8 miles) ("**Segment 4**"); and
  - From existing Structure #12 south of the intersection of East 2nd Street and Beech Street to the existing Xcel Energy Scott County Substation located southeast of Fern Lane Terrace and US Highway 169 (1.5 miles) ("**Segment 6**").
- Changing the voltage of approximately 2.9 miles of an existing 69 kilovolt transmission line (Great River Energy, MV-VTT line) to 115 kilovolt as follows:
  - From the southwest quadrant of the intersection of County Road 140 to Guernsey Avenue north to the existing Great River Energy Victoria Substation ("**Segment 2**").
- Constructing approximately 2.4 miles of new 115 kilovolt single circuit transmission line as follows:
  - Along the west side of Highway 212 from its intersection with County Road 140 extending north to the north side of Creek Road (0.71 miles), then northwesterly to the intersection with Wetzel Lane, then north to the south side of Engler Blvd, then west along the south side of Engler Boulevard (0.7 miles), then north to the West Creek Substation (0.1 miles) (1.8 miles total) ("**Segment 3**"). The West Creek Substation is owned by the City of Chaska and was permitted locally under Minnesota Statutes Section 216E.05 and Minnesota Rule 7850.5300. The

West Creek Substation is under construction at the time of this Application; and
  - From the existing Chaska Substation to the northeast to the south side of the railroad tracks along Chaska Boulevard, then to the south along the east side of Maple Street until crossing East Chaska Creek south of the intersection of East 2nd Street and Beech Street (0.6 miles) ("**Segment 5**").
- Additional existing 69 kilovolt transmission line modifications:
  - Abandon-in-place the existing 69 kilovolt transmission line along the south side of County Road 140 between the intersection of County Road 140 with Guernsey Avenue and the intersection of County Road 140 with Highway 212 (1.0 mile) ("**Segment 3a**"); and
  - Remove the existing 69 kilovolt #0740 line in the City of Chaska from the Chaska Substation along North Oak Street and East 5th Street to the intersection of East 2nd Street with Beech Street (0.4 miles) ("**Segment 5a**").
- Modifications to the Scott County, Chaska, West Creek, Victoria, and Augusta substations.

Xcel Energy is also currently obtaining a local permit under Minnesota Statutes Section 216E.05 and Minnesota Rule 7850.5300 from the city of Chaska to construct a 115 kilovolt transmission line from Great River Energy's MV-VTT line to the new West Creek Substation. Xcel Energy expects issuance of this permit in late May/early June 2012. The Project is depicted in **Figure 15**.

Figure 15
Chaska Area 115 Kilovolt Transmission Line Upgrade – Segment Map



Where transmission lines are proposed to be converted or removed and replaced (Segments 1, 2, 4, and 6), Applicants plan to use the existing 50-foot-wide right-of-way. Use of existing rights-of-way will reduce costs and environmental impacts. In Segments 1, 4, and 6, which collectively measure 6.1 miles, the existing 69 kilovolt single wood pole structures will be removed and a new 115 kilovolt transmission line will be strung on new steel structures within the existing right-of-way. In Segment 2, the existing 69 kilovolt switch located at the intersection of County Road 140 and Guernsey Avenue will be retired and re-terminated to allow for 115 kilovolt operation. The remaining conductors and single pole wood structures of Great River Energy's 2.9-mile long MV-VTT 69 kilovolt line are sufficient to support 115 kilovolt operation, so no additional work will be required along that segment of the line.

For the 2.4 miles of the Project where new construction is required (Segments 3 and 5), Applicants propose to acquire new right-of-way 75 feet wide. Segments 3 and 5 will use steel structures.

Applicants also propose, as part of the Project, to retire and remove approximately 0.4 miles of existing 69 kilovolt transmission line through the City of Chaska from the Chaska Substation along Oak Street to East 5th Street to the intersection of East 2nd Street and Beech Street (Segment 5a). Along Segment 5a, where the current structures support both a 69 kilovolt transmission line and distribution lines, the poles and the transmission and distribution lines would be removed.

In Segment 3a, where Xcel Energy's #0740 transmission line would be abandoned-in-place, the structures will be left in place and the right-of-way would continue to be maintained.

4.2 Transmission Lines – Type, Heights, and Spans

The proposed 115 kilovolt transmission line portions of the Project are proposed to be constructed using single pole steel horizontal post or braced post structures (**Figure 16**), however, Great River Energy's MV-VTT line will retain its existing wood structures (**Figure 18**). With the exception of the 69 kV switch retirement, no other physical changes will be required on the MV-VTT line for this Project. The change from the existing 69 kilovolt wood structures to steel structures along Project Segments 1, 3, 4, 5, and 6 is necessary to support the additional weight of the 115 kilovolt transmission line, additional height for electrical clearance, and for improved reliability. The single pole steel horizontal post or braced post 115 kilovolt structures will be approximately 60 to 90 feet tall with spans of approximately 300 to 400 feet.

In instances where the rebuilt line has to span over water or wetlands, H-frame or Y-Frame steel structures may need to be used. The H-Frame or Y-Frame steel structures will be approximately 60 to 105 feet tall with spans of approximately 600 to 1400 feet within the existing 50-foot wide right-of-way.

The 115 kilovolt lines will be constructed with 795 kcmil Aluminum Conductor Steel Supported ("ACSS") conductor. The average service life of high voltage transmission lines is 50 to 60 years. **Figure 16** depicts typical 115 kilovolt single circuit steel structures proposed to be used for the Project.

Figure 16
Photos of Typical 115 Kilovolt
Single Circuit Structures

Figure 17 illustrates typical dimensions and right-of-way requirements for a single circuit horizontal post and braced post structures.

Figure 17
Typical Dimensions and Right-of-Way Requirements
for Single Circuit 115 kV Structures

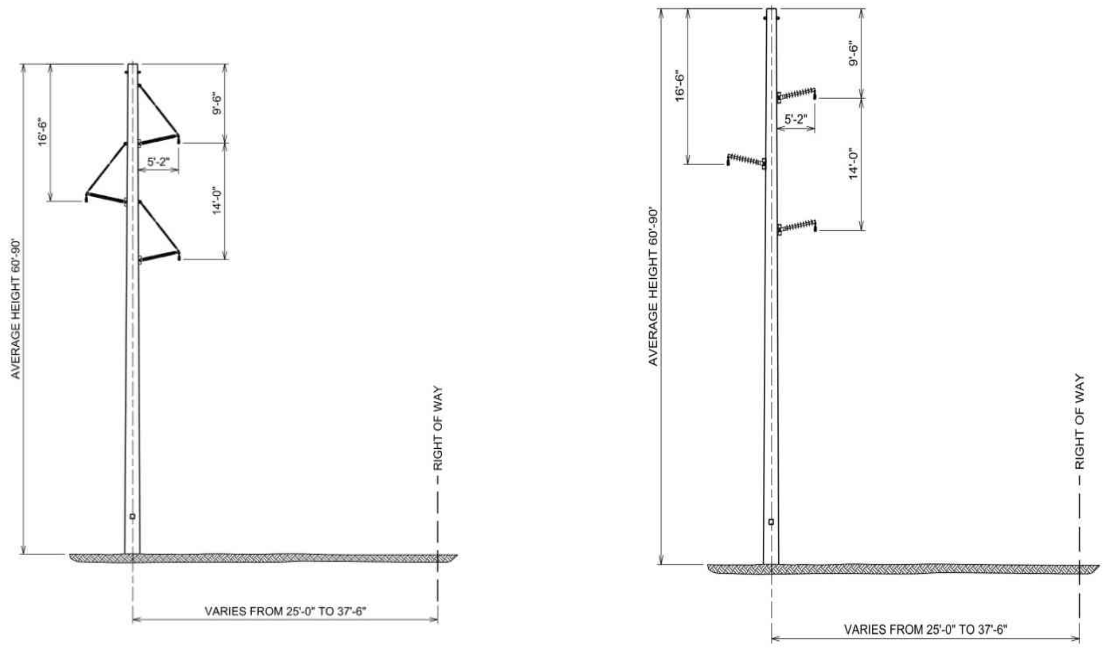


Figure 18 depicts structures similar to those along the existing 2.9-mile Great River Energy MV-VTT line that is proposed to be converted from 69 kilovolt operation to 115 kilovolt operation as part of the Project.

Figure 18
Structures Similar to the Existing MV-VTT Line Transmission Structures

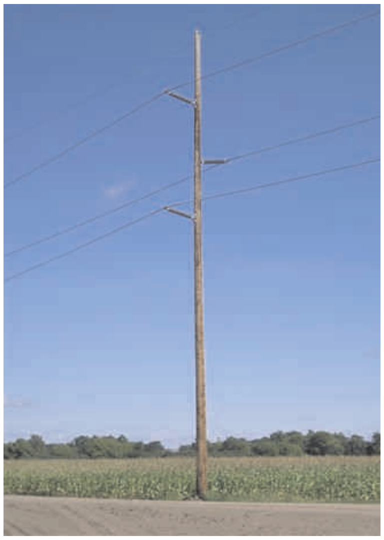



Table 14 summarizes the structure design for the Project.

Table 14
Structure Design Summary

Line Type	Structure Type	Structure Material	Right-of-Way Width (feet)	Structure Height (feet)	Foundation	Foundation Diameter (feet)	Span Between Structures (feet)
115 kV Single Circuit	Single pole, horizontal or braced post insulator	Weathering Steel or Galvanized Steel	75	60-90	Direct embedded for tangents and self-supporting for angle/ dead-end structures	Direct embedded in 4 foot diameter culvert or 5 to 8 foot concrete	300 to 400
115 kV Single Circuit	Two pole, H-Frame or Single pole, Y-Frame	Weathering Steel or Galvanized Steel	75	60-105	Direct Embedded for tangents and self-supporting for angle/dead-end structures	5 to 8 foot concrete	600 to 1,400

4.3 Need for New Right-of-Way

An electric transmission line right-of-way is a strip of land used to construct, operate, maintain and repair transmission line facilities. A transmission line usually is centered in the right-of-way. The right-of-way required will be dependent on the ultimate route selected in the route permit proceeding. In that proceeding, Applicants will propose to remove the existing 69 kilovolt transmission line and replace it with a new 115 kilovolt transmission line within the existing 50 foot right-of-way whenever practical. For new 115 kilovolt transmission line construction, a right-of-way width of up to 75 feet is typically used. When necessary, existing easements may be modified up to a 75-foot width along the rebuild portions (Segments 1, 4, and 6) of the Project. Approximately 2.6 miles of new right-of-way, 75 feet in width will be required for the new construction segments (Segments 3 and 5).

Applicants' preferred route for the Project will require Xcel Energy to acquire 1.0 miles of new right-of-way along Highway 212, 0.7 miles of right-of-way along County State Aid Highway 10, and 0.25 miles across agricultural land north of County State Aid Highway 10 to connect the West Creek Substation to the Chaska Substation. Approximately 0.6 miles of new right-of-way along Chaska Boulevard, Maple Street, and Beech Street within the City of Chaska will be required to construct the 115 kilovolt line that will allow the removal of the existing 69 kilovolt transmission line along North Oak and East 5th streets.

4.4 Substations

4.4.1 Scott County Substation

The Scott County Substation is owned and operated by Xcel Energy. One new 115 kilovolt line termination, including two new 115 kilovolt breakers and associated equipment, such as switches, will be installed.

To accommodate the new 115 kilovolt line termination, a new 115 kilovolt yard will be built. An area approximately 240' x 300' to the west of the existing substation will be graded, grounded, and fenced for the new 115 kilovolt yard. The expansion will be onto property owned by Xcel Energy.

New 115 kilovolt steel box structures will be built, in the new portion of the substation, for the new 115 kilovolt line termination. In order to extend the existing 115 kV in the substation to the new 115 kilovolt yard, strain bus will be brought to the new yard via new transmission type poles.

The existing Electrical Equipment Enclosure ("EEE") cannot accommodate the new installations. Therefore, a new 24' x 40' EEE will be installed in the new 115 kilovolt yard.

4.4.2 Chaska Substation

The Chaska Substation is owned and operated by the City of Chaska and will be retired. No modifications to this substation are proposed as part of this Project.

4.4.3 West Creek Substation

The West Creek Substation is owned and operated by the City of Chaska. Xcel Energy will construct and own the 115 kilovolt side of the substation. The 115 kilovolt installations will include steel structures and 115 kilovolt switches.

4.4.4 Victoria Substation

The Victoria Substation is owned and operated by Minnesota Valley Electric Cooperative. To accommodate the transmission line voltage change from 69 kilovolt to 115 kilovolt, the existing 69-12.47 kilovolt transformer will be replaced with a 115-12-47 kilovolt transformer.

The radial transmission line sourcing the Victoria Substation is owned and operated by Great River Energy. Great River Energy will retire the existing 69 kilovolt switch and re-terminate the line to allow for 115 kilovolt operation. No further changes to the MV-VTT line are needed to serve the converted Victoria Substation.

4.4.5 Augusta Substation

The Augusta Substation is owned and operated by Minnesota Valley Electric Cooperative. The substation is currently "double-ended," meaning it has two 69-12.47 kilovolt transformers. To accommodate the transmission line voltage change from 69 to 115 kilovolt, the existing 69-12.47 kilovolt transformers will be replaced with a single, higher capacity 115-12.47 kilovolt transformer. In addition, the existing 8' x 12' EEE will be replaced with a 15' x 20' EEE and the dead end steel structure inside the substation fence will be retired. Great River Energy's 270 foot radial tap sourcing the Augusta Substation will be re-conductored and re-terminated on Xcel Energy's newly rebuilt 115 kilovolt line. The existing 69 kilovolt tap switch will be retired by Great River Energy.

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5 TRANSMISSION LINE OPERATING CHARACTERISTICS

Chapter 5. Transmission Line Operating Characteristics: Chapter 5 provides information regarding the operating characteristics of the proposed 115 kilovolt transmission lines and associated substations. This includes information regarding electric and magnetic fields, noise, ozone and nitrogen oxide emissions, and radio and television interference.

Key Terms:

- **Conductor** – *A wire made up of multiple aluminum strands supported by a steel core that together carry electricity. A bundled conductor is two or more conductors connected together to increase the capacity of a transmission line.*
- **Electric and magnetic fields** – *Invisible lines of force that surround any electrical appliance or wire that is conducting electricity. The balance of scientific evidence indicates that exposure to electric and magnetic fields does not negatively impact health.*
- **Extremely Low Frequency** – *This term is used to identify electric and magnetic fields within the range of 3 to 300 hertz. Transmission lines operate at 60 hertz.*

Key Points: *The proposed transmission lines and substations will be designed to meet or exceed all relevant safety codes. The noise generated by transmission lines is not expected to exceed background noise levels and will be well below the state noise standards. Electric and magnetic fields exists wherever electricity is produced or used, and surrounds any electrical appliance or wire that is conducting electricity. The potential health effects from electric and magnetic fields have been studied for more than 30 years by government and scientific institutions all over the world. The balance of scientific evidence indicates that exposure to electric and magnetic fields do not cause disease.*

> *"In addition, virtually all of the laboratory evidence and the mechanistic evidence fail to support a relationship between low-level [extremely low frequency] magnetic fields and changes in biological function or disease status"*
>
> *- World Health Organization*

> *"Most researchers concluded that there is insufficient evidence to prove an association between magnetic fields and health effects;"*
>
> *- Minnesota Interagency Working Group*

> *"The magnetic fields produced by electricity are weak and do not have enough energy to break chemical bonds or to cause mutations in DNA. . . . In addition, whole animal studies investigating long-term exposure to [extremely low frequency] magnetic fields have shown no connection between exposure and cancer of any kind."*
>
> *- Public Service Commission of Wisconsin*

Overhead transmission line components typically include: (1) an above ground structure, often referred to as a pole or tower; (2) the wires carrying the electricity, called conductors; (3) insulators that connect the conductors to the structures and provide structural support and electrical insulation; (4) ground rods located below ground and connected to each structure; and (5) grounded shield wires to protect the line from direct lightening strikes. Transmission poles are generally made of either steel or wood. Overhead conductors are typically comprised of aluminum and steel strands.

During operation, transmission lines are, for the most part, passive elements of the environment. Their primary impact is aesthetic, i.e., a man made structure in the landscape. Because of the line's electrical characteristics, some chemical reactions occur around conductors in the air; noise can occur in some circumstances; interference with electromagnetic signals can occur; and electrical and magnetic fields are created around the conductors. All of these operating characteristics are considered as part of the design of a transmission line to prevent any significant impacts to its operation and, generally, to public health and safety, and the overall environment.

5.1 Ozone and Nitrogen Oxide Emissions

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

Currently, both state and federal governments have regulations regarding permissible concentrations of ozone and oxides of nitrogen ("NOx"). The state and national ambient air quality standards for ozone are similarly restrictive. The national standard is 0.075 parts per million "ppm" on an eight hour averaging period. The state standard is 0.08 ppm based upon the fourth highest eight hour daily maximum average in one year. Both averages must be compared to the national and state standards because of the different averaging periods. Calculations done for a 345 kilovolt project showed that the maximum one hour concentration during foul weather (worst case) would be 0.0007 ppm. This is well below both federal and state standards. Lower voltage lines would have correspondingly lower concentrations. Most calculations of the production and concentration of ozone assume high humidity or rain, with no reduction in the amount of ozone due to oxidation or air movement. These calculations would therefore overestimate the amount of ozone that is produced and concentrated at ground level. Studies designed to monitor the production of ozone under transmission lines have generally been unable to detect any increase due to the transmission line facility.

There is not a state or national standard for general NOx. The national standard for nitrogen dioxide ("NO_2"), one of several oxides of nitrogen, is 0.053 ppm on an annual basis and the Minnesota State Air Quality Standard for NO_2 is 0.08 ppm. The operation of the proposed transmission lines would not create any potential for the concentration of these pollutants to exceed the nearby (ambient) air standards.

5.2 Noise

Transmission Line Noise

Transmission conductors produce noise under certain conditions. The level of noise depends on conductor configurations and geometry, voltage level, and weather conditions. Generally, activity-related noise levels during the operation and maintenance of substations and transmission lines is minimal.

Noise emission from a transmission line occurs during certain weather conditions. In foggy, damp, or rainy weather, power lines can create a crackling sound due to the small amount of electricity ionizing the moist air near the wires. During heavy rain, the background noise level of the rain is usually greater than the noise from the transmission line. As a result, people do not normally hear noise from a transmission line during heavy rain. During light rain, dense fog, snow and other times when there is moisture in the air, transmission lines would produce audible noise equal to approximately household background levels. During dry weather, audible noise from transmission lines is barely perceptible. At substations, noise is created primarily by transformers.

Since human hearing is not equally sensitive to all frequencies of sound, the most noticeable frequencies of sound are given more "weight" in most measurement schemes. The A-weighted scale corresponds to the sensitivity range for human hearing. Noise levels capable of being heard by humans are measured in "dBA," which is the A-weighted sound level recorded in units of decibels. A noise level change of 3 dBA is barely perceptible to human hearing. A 5 dBA change in noise level, however, is clearly noticeable. A 10 dBA change in noise level is perceived as a doubling of noise loudness, while a 20 dBA change is considered a dramatic change in loudness. **Table 15** below shows noise levels associated with common, everyday sources.

Table 15
Common Noise Sources and Levels

Sound Pressure Level (dBA)	Noise Source
140	Jet Engine (at 25 meters)
130	Jet Aircraft (at 100 meters)
120	Rock and Roll Concert
110	Pneumatic Chipper
100	Jointer/Planer
90	Chainsaw
80	Heavy Truck Traffic
70	Business Office
60	Conversational Speech
50	Library
40	Bedroom
30	Secluded Woods
20	Whisper

Source: Minnesota Pollution Control Agency (2008).

In Minnesota, statistical sound levels (L-Level Descriptors) are used to evaluate noise levels and identify noise impacts. The standards are expressed as a range of permissible dBA within a one hour period; L_{50} is the dBA that may be exceeded 50 percent of the time within an hour (*i.e.,* 30 minutes), while L_{10} is the dBA that may be exceeded 10 percent of the time within the hour (*i.e.,* 6 minutes).

Land areas, such as picnic areas, churches, or commercial spaces, are assigned to an activity category based on the type of activities or use occurring in the area. Activity categories are then categorized based on their sensitivity to traffic noise. The Noise Area Classification ("NAC") is listed in the Minnesota Pollution Control Agency ("MPCA") noise regulations to distinguish the categories. **Table 16** identifies the MPCA established daytime and nighttime noise standards by NAC

Table 16
Noise Standards by Noise Area Classification (dBA)

Noise Area Classification	Daytime		Nighttime	
	L_{50}	L_{10}	L_{50}	L_{10}
1	60	65	50	55
2	65	70	65	70
3	75	80	75	80

Table 17 provides information of calculated noise data for proposed 115 kilovolt structures for the Project. Noise levels may vary somewhat depending upon actual conditions, which cannot be determined until the final routes have been determined. Transmission line noise would be below the MPCA NAC noise standards.

Table 17
Calculated Audible Noise (db) for Proposed 115 kV Transmission Line Designs (3.28 Feet Above Ground)

Structure Type	**Noise L5** (37.5 Feet From Centerline) **(Decibels a weighted)**	**Noise L50 (37.5 feet From Centerline) (Decibels a weighted)**
Horizontal Post 115kV Steel Pole Single Circuit	22.2	18.7
Braced Post 115kV Steel Pole Single Circuit	21.3	15.6
Y-Frame or H-Frame 115kV Steel Pole Single Circuit	17.9	14.4
Horizontal Post 115kV Steel Pole Single Circuit (Operated at 69kV)	4.6	1.1

<u>Transformer Substation Noise</u>
Transformer "hum" is the dominant noise source at substations. All of the substation modifications required for the Project would comply with the MPCA NAC noise standards.

5.3 Radio and Television Interference

Corona from transmission line conductors can generate electromagnetic "noise" at the same frequencies that radio and television signals are transmitted. This noise can cause interference with the reception of these signals depending on the frequency and strength of the radio and television signal. Tightening loose hardware on the transmission line usually resolves the problem.

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

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

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

A two-way mobile radio located immediately adjacent to and behind a large metallic structure (such as a steel tower) may experience interference because of signal-blocking effects. Movement of either mobile unit so that the metallic structure is not immediately between the two units should restore communications. This would generally require a movement of less than 50 feet by the mobile unit adjacent to a metallic tower.

Television interference is rare but may occur when a large transmission structure is placed between the receiver and a weak distant signal, creating a shadow effect. Loose and/or damaged hardware may also cause television interference. If television or radio interference is caused by, or from, the operation of the proposed facilities in those areas where good reception is presently obtained, Applicants will inspect and repair any loose or damaged hardware in the transmission line, or take other necessary action to restore reception to the present level, including the appropriate modification of receiving antenna systems if deemed necessary.

5.4 Safety

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

The proposed transmission lines will be equipped with protective devices to safeguard the public from the transmission lines if an accident occurs, such as a structure or conductor falling to the ground. The protective devices include breakers and relays located where the line connects to the substation(s). The protective equipment will de-energize the line should such an event occur. Proper signage will be posted warning the public of the risk of coming into contact with the energized equipment.

5.5 Electric and Magnetic Fields

The term electromagnetic fields ("EMF") refer to electric and magnetic fields that are coupled together such as in high frequency radiating fields. For the lower frequencies associated with power lines (referred to as "extremely low frequencies" ("ELF")), EMF should be separated into electric fields ("EFs") and magnetic fields ("MFs"), measured in kilovolts per meter ("kV/m") and milliGauss ("mG"), respectively. These fields are dependent on the voltage of a transmission line (EFs) and current carried by a transmission line (MFs). The intensity of the electric field is proportional to the voltage of the line, and the intensity of the magnetic field is proportional to the current flow through the conductors. Transmission lines operate at a power frequency of 60 hertz (cycles per second).

5.5.1 Electric Fields

There is no federal standard for transmission line electric fields. The Commission, however, has imposed a maximum electric field limit of 8 kV/meter measured at one meter above the ground. *In the Matter of the Route Permit Application for a 345 kV Transmission Line from Brookings County, South Dakota to Hampton, Minnesota,* Docket No. ET-2/TL-08-1474, ORDER GRANTING ROUTE PERMIT (*ADOPTING* ALJ FINDINGS OF FACT, CONCLUSIONS AND RECOMMENDATION) (APR. 22, 2010 AND AMENDED APR. 30, 2010)) at Finding 194 (Sept. 14, 2010). The standard was designed to prevent serious hazards from shocks when touching large objects parked under AC transmission lines of 500 kilovolt or greater. The maximum electric field, measured at one meter above ground, associated with the Project is calculated to be 1.48 kV/m.

The calculated electric fields for the Project are provided in **Table 18**.

Table 18
Calculated Electric Fields (kV/m) for Proposed 115 kV Transmission Line Designs (One meter above ground)

Structure Type	Maximum Operating Voltage (kV)	Distance to Proposed Centerline										
		-300'	-200'	-100'	-50'	-25	0'	25	50'	100'	200'	300'
Horizontal Post 115kV Steel Pole Single Circuit	121	0.01	0.01	0.04	0.15	0.39	1.13	0.51	0.15	0.05	0.01	0.01
Y-Frame and H-Frame 115kV Steel Pole Single Circuit	121	0.00	0.01	0.09	0.52	1.48	0.68	1.48	0.52	0.09	0.01	0.00
Horizontal Post 115kV Steel Pole Single Circuit (Operated at 69kV)	72.5	0.00	0.01	0.03	0.10	0.23	0.66	0.30	0.10	0.03	0.01	0.00
Braced Post 115kV Steel Pole Single Circuit	121	0.01	0.02	0.06	0.19	0.63	1.19	0.49	0.21	0.05	0.01	0.01

5.5.2 Magnetic Fields

There are presently no Minnesota regulations pertaining to MF exposure. Applicants provide information to the public, interested customers, and employees so they can make informed decisions about MFs.

The magnetic field profiles around the proposed transmission lines for each structure and conductor configuration proposed for the Project are shown in **Table 19**. MFs were calculated for each section of the Project under peak and average current flows as projected for the year 2013 under normal (system intact) conditions. The peak MF 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 MF at the edge of the right-of-way. The calculated MFs show that fields decrease rapidly as the distance from the centerline increases (proportional to the inverse square of the distance from source).

The magnetic field produced by the transmission line is dependent on the current flowing on its conductors. Therefore, the actual MFs when the Project is placed in service are typically less than shown in **Table 19**. This is because the table represents the magnetic field with current flow at expected normal peak based on projected regional load growth through 2013. Actual current flow on the line will vary with system conditions, so MFs would be less than peak levels during most hours of the year.

Table 19
Calculated Magnetic Flux Density (mG) for Proposed 115 kV Transmission Line Designs (One meter above ground)

Segment	System Condition	Current (Amps)	Distance to Proposed Centerline										
			-300'	-200'	-100'	-50'	-25	0'	25	50'	100'	200'	300'
Segment 1: West Waconia to Augusta 115kV Single Circuit	Peak	102	0.15	0.29	0.89	2.65	5.92	11.31	6.27	2.55	0.72	0.19	0.09
	Average	61.2	0.09	0.17	0.54	1.59	3.55	6.78	3.76	1.53	0.43	0.11	0.06
Segments 1 & 2: Augusta to MV-VTT 115kV Single Circuit	Peak	86	0.13	0.24	0.75	2.23	5.00	9.53	5.29	2.15	0.61	0.16	0.08
	Average	51.6	0.08	0.14	0.45	1.34	3.00	5.72	3.17	1.29	0.37	0.10	0.05
Segments 3, 4, 5 & 6: West Creek to Scott County 115kV Single Circuit Horizontal Post	Peak	130	0.24	0.53	2.07	7.62	20.22	33.41	20.48	7.80	2.17	0.58	0.27
	Average	78	0.14	0.32	1.24	4.57	12.13	20.04	12.29	4.68	1.30	0.35	0.16
Segments 3, 4, 5 & 6: West Creek to Scott County 115kV Single Circuit Braced Post	Peak	130	0.14	0.28	1.12	3.96	9.63	16.60	8.92	4.10	1.41	0.46	0.25
	Average	78	0.08	0.17	0.67	2.38	5.78	9.96	5.35	2.46	0.85	0.28	0.15

Considerable research has been conducted over the past three decades to determine whether exposure to power-frequency (60 hertz) MFs causes biological responses and health effects. Epidemiological and toxicological studies have shown no statistically significant association or weak associations between ELF-MF exposure and health risks. Public health professionals have also investigated the possible impact of exposure to EMFs upon human health for the past several decades. While the general consensus is that EFs pose no risk to humans, the question of whether exposure to MFs 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. The NIEHS concluded that the scientific evidence linking MF exposure with health risks is weak and that this finding does not warrant aggressive regulatory concern. However, because of the weak scientific evidence that supports some association between MFs and health effects, 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, WHO 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] 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* at p. 12, WHO (2007)).

Also, regarding disease outcomes, aside from childhood leukemia, WHO 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. (*Id.* at p. 12.)

Furthermore, in its "Summary and Recommendations for Further Study" WHO emphasized that:

> The limit values in [ELF-MF] exposure guidelines [should not] be 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. (*Id.* at p. 12).

Although WHO recognized epidemiological studies indicate an association on the range of three to four mG, WHO did not recommend these levels as an exposure limit but instead provided: "The best source of guidance for both exposure levels and the principles of scientific review are international guidelines." *Id.* at pp. 12-13. The international guidelines referred to by WHO are the International Commission on Non-Ionizing Radiation Protection ("ICNIRP") and the Institute of Electrical and Electronic Engineers ("IEEE") exposure limit guidelines to protect against acute effects. *Id.* at p. 12. ICNIRP is a non-governmental organization in formal relations with WHO. *Id.* at p. xii. The ICNIRP-1998 continuous general public exposure guideline is 833 mG and the IEEE continuous general public exposure guideline in 9,040 mG. In addition, WHO determined that "the evidence for a casual relationship [between ELF-MF and childhood leukemia] is limited, therefore exposure limits based on epidemiological evidence is not recommended, but some precautionary measures are warranted." *Id.* at 355-56.

WHO concluded that:

> given the weakness of the evidence for a link between exposure to ELF magnetic fields and childhood leukemia, and the limited impact on public health, the benefits of exposure reduction on health are unclear and thus, the costs of precautionary measures should be very low… Provided that the health, social and economic benefits of electric power are not compromised, implementing very low-cost precautionary procedures to reduce exposure is reasonable and warranted. (*Id.* at p. 372).

In 2010, ICNIRP revised its continuous general public exposure guideline increasing it from 833 mG to 2,000 mG. The WHO has not provided any analysis of the ICNIRP-2010 continuous general public exposure guideline to date.

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

> Research on the health effects of [MF] has been carried out since the 1970s. Epidemiological studies have mixed results – some have shown no statistically significant association between exposure to [MF] and health effects, some have shown a weak association. More recently, laboratory studies have failed to show such an association, or to establish a biological mechanism for how magnetic fields may cause cancer. A number of scientific panels convened by national and international health agencies and the United States Congress have reviewed the

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

The Public Service Commission of Wisconsin ("PSCW") has periodically reviewed the science on MFs since 1989 and held hearings to consider the topic of MF and human health effects. The most recent hearings on MF were held in July 1998. In January 2008, the PSCW published a fact sheet regarding MFs. In this fact sheet the PSCW noted that:

> Many scientists believe the potential for health risks for exposure to [MFs] 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 [MFs] could cause disease. The [MFs] 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 [MF] have shown no connection between exposure and cancer of any kind. (*EMF-Electric & Magnetic Fields*, PSC).

The Minnesota Public Utilities Commission, based on the Working Group and WHO findings, has repeatedly found that "there is insufficient evidence to demonstrate a causal relationship between EMF exposure and any adverse human health effects." *In the Matter of the Application of Xcel Energy for a Route Permit for the Lake Yankton to Marshall Transmission Line Project in Lyon County*, Docket No. 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*, Docket No. ET-2, E015/TL-06-1624, FINDINGS OF

FACT, CONCLUSIONS OF LAW AND ORDER ISSUING A ROUTE PERMIT TO MINNESOTA POWER AND GREAT RIVER ENERGY FOR THE TOWER TRANSMISSION LINE PROJECT AND ASSOCIATED FACILITIES at p. 23 (Aug. 1, 2007)("Currently, there is insufficient evidence to demonstrate a causal relationship between EMF exposure and any adverse human health effects.").

The Commission again confirmed its conclusion regarding health effects and MFs in the Brookings County – Hampton 345 kV Route Permit proceeding ("Brookings Project"). In the Brookings Project Route Permit proceeding, Applicants Great River Energy and Xcel Energy and one of the intervening parties provided expert evidence on the potential impacts of electric and magnetic fields on human health. The ALJ in that proceeding evaluated written submissions and a day-and-half of testimony from these two expert witnesses. The ALJ concluded: "there is no demonstrated impact on human health and safety that is not adequately addressed by the existing State standards for [EF or MF] exposure." *In the Matter of the Route Permit Application by Great River Energy and Xcel Energy for a 345 kV Transmission Line from Brookings County, South Dakota to Hampton, Minnesota*, Docket No. ET-2/TL-08-1474, ALJ FINDINGS OF FACT, CONCLUSIONS AND RECOMMENDATION at Finding 216 (Apr. 22, 2010 and amended Apr. 30, 2010). The Commission adopted this finding on July 15, 2010. *In the Matter of the Route Permit Application by Great River Energy and Xcel Energy for a 345 kV Transmission Line from Brookings County, South Dakota to Hampton, Minnesota*, Docket No. ET-2/TL-08-1474, ORDER GRANTING ROUTE PERMIT (Sept. 14, 2010).

5.6 Stray Voltage

"Stray voltage" is a condition that can occur on the electric service entrances to structures from distribution lines. More precisely, stray voltage is a voltage that exists between the neutral wire of the service entrance and grounded objects in buildings such as barns and milking parlors. Because transmission lines convey power for subsequent distribution and are not connected to non-utility structures, stray voltage is not encountered in such lines.

5.7 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 will drain 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, shocks may result. Potential shocks can be prevented by using a couple of methods, including:

i. one or more of the fence insulators can be shorted out to ground with a wire when the charger is disconnected; or
ii. 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 will be designed to meet or exceed minimum clearance requirements with respect to 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 under high voltage transmission lines to build up an electric charge. If this occurs, the vehicle can be grounded by attaching a grounding strap to the vehicle long enough to touch the earth. Such buildup is a rare event because, generally, vehicles are effectively grounded through tires. Modern tires provide an electrical path to ground because carbon black, a good conductor of electricity, is added when they are produced. Metal parts of farming equipment are frequently in contact with the ground when plowing or engaging in various other activities. Therefore, vehicles will not normally build up a charge unless they have unusually old tires or are parked on dry rock, plastic, or other surfaces that insulate them from the ground.

Buildings are permitted near transmission lines but are generally discouraged within the right-of-way itself because a structure under a line may interfere with safe operation of the transmission facilities. For example, a fire in a building on the right-of-way 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 power lines of 200 kilovolt or greater must be properly grounded. Any person with questions about a new or existing metal structure can contact Great River Energy or Xcel Energy for further information about proper grounding requirements.

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6 TRANSMISSION LINE CONSTRUCTION AND MAINTENANCE

Chapter 6. Transmission Line Construction and Maintenance: *Chapter 6 is a basic primer regarding the steps we will take to build the proposed facilities after we have obtained all regulatory and other required approvals. We describe the sequence of activities that occur during the construction of a transmission line and substation and some of the mitigation measures that can be taken to mitigate potential impacts during construction. This chapter also identifies the activities associated with the operation and maintenance of a transmission line once it is constructed.*

Key Terms:

- **Best Management Construction Practices** – *standard construction and mitigation practices developed from experience with past projects.*
- **Easement** – *An easement is a permanent right authorizing a person or party to use the land or property of another for a particular purpose. In this case, this means acquiring certain rights to build, operate and maintain a transmission line. Landowners are paid a fair price for the easement and can continue to use the land for many purposes, although some restrictions are included in the agreement.*
- **Right-of-Way** – *A right-of-way is the land area legally acquired for a specific purpose, such as for the placement of transmission facilities and for maintenance.*

Key Points: *The construction of a transmission line typically involves four key activities: (1) detailed engineering, design, and regulatory approvals; (2) right-of-way evaluation and acquisition; (3) construction; and (4) right-of-way restoration. Construction of the Project will follow standard construction and mitigation practices developed from experience with past projects.*

The construction of a transmission line typically involves four key activities: (1) detailed engineering, design, and regulatory approvals; (2) right-of-way evaluation and acquisition; (3) construction; and (4) right-of-way restoration.

6.1 Engineering Design and Regulatory Approvals

Detailed transmission line and substation engineering design work generally begins after a route permit is obtained. The design of a transmission line is refined as more site-specific information is gathered for properties along the approved route.

Throughout the process, utilities work with landowners to design facilities to minimize impacts and ensure that all permit conditions are satisfied.

Plan and profile documents are also prepared for each new high voltage transmission line and associated substation work. These plans provide a detailed descriptions of the facilities, including pole placement, and are approved by the Department of Commerce staff or local authorities, as appropriate.

6.2 Right-of-Way Evaluation and Acquisition

Early in the detailed design process, the right-of-way acquisition process begins. For transmission lines, utilities typically acquire easement rights across the parcels to accommodate the facilities. For substations, utilities typically purchase land outright and buy enough land to accommodate the facilities and to provide a buffer area around the facilities. In both circumstances, the evaluation and acquisition process includes title examination, initial owner contacts, survey work, document preparation and purchase. Each of these activities, particularly as it applies to easements for transmission line facilities, is described below.

Where the Project is expected to use existing rights-of-way , the right-of-way agent will evaluate all existing easements. If the terms of the existing easement are sufficient and no new right-of-way is needed, the right-of-way agent will continue to work with the landowner to address any construction needs, impacts, or restoration issues. To the extent the existing easement needs to be expanded, the right-of-way agent will work with landowners to expand existing easements.

For those segments of the Project where new right-of-way will be necessary, the acquisition process begins early in the detailed design phase. The first step in the right-of-way 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 right-of-way agent or other persons engaged by the utility will complete a public records search of all land involved in the project. A title report is then developed for each parcel to determine the legal description of the property and the owner(s) of record of the property, and to gather information regarding easements, liens, restriction, encumbrances and other conditions of record.

After owners are identified, a right-of-way representative contacts each property owner or the property owner's representative. The right-of-way agent describes the need for the transmission facilities and how the Project may affect each parcel. The right-of-way agent also seeks information from the landowner about any specific construction concerns.

The next step in the acquisition process is evaluation of the specific parcel. For this work, the right-of-way agent may request permission from the owner for survey crews to enter the property to conduct preliminary survey work. Permission may also be requested to take soil borings to assess the soil conditions and determine appropriate foundation design. Surveys are conducted to locate the right-of-way corridors, natural features, man-made features and associated elevations for use during the detailed engineering of the line. The soil analysis is performed by an experienced geotechnical testing laboratory.

During the evaluation process, the location of the proposed transmission line or substation facility may be staked with permission of the property owner. This means that the survey crew locates each structure or pole on the ground and places a surveyor's stake to mark the structures or substation facility's anticipated location. By doing this, the right-of-way agent can show the landowner where the structure(s) will be located on the property. The right-of-way agent may also delineate the boundaries of the easement area required for safe operation of the line.

Prior to the acquisition of easements or fee purchase of property, land value data will be collected. Based on the impact of the easement or purchase to the market value of each parcel, a fair market value offer will be developed. The right-of-way agent then contacts the property owner(s) to present the offer for the easement and discuss 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 will also provide maps of the line route or site, and maps showing the landowner's parcel. The landowner is 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. This step is often performed prior to full evaluation in the form of an "option to purchase" contract and can be very helpful in obtaining permission for completion of all necessary evaluations.

In nearly all cases, utility companies are able to work with the landowners to address their concerns and an agreement is reached for the utility's purchase of land rights. The right-of-way agent prepares all of the documents required to complete each transaction. Some of the documents that may be required include: easement; purchase agreement; contract; and deed.

In rare instances, a negotiated settlement cannot be reached and the landowner chooses to have an independent third party determine the value of the rights taken. Such valuation is made through the utility's exercise of the right of eminent domain pursuant to Minnesota Statutes Chapter 117. The process of exercising the right of eminent domain is called condemnation.

Before commencing a condemnation proceeding, the right-of-way agent must obtain at least one appraisal for the property proposed to be acquired and a copy of that appraisal must be provided to the property owner. Minn. Stat. § 117.036, subd. 2(a). The property owner may also obtain another property appraisal and the company must reimburse the property owner for the cost of the appraisal according to the limits set forth in Minnesota Statute § 117.036, subdivision 2(b). The property owner may be reimbursed for reasonable appraisal costs up to $1,500 for single-family and two-family residential properties, $1,500 for property with a value of $10,000 or less, and $5,000 for other types of properties.

To start the formal 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 grants the Petition, the court then appoints a three-person condemnation commission that will determine the compensation for the easement. The three people 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 commission schedules 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 acquired and files it with the court. Each party has 40 days from the filing of the award to appeal to the district court for a jury trial. In the event of an appeal, the jury hears land value evidence and renders a verdict. At any point in this process, the case can be dismissed if the parties reach a settlement.

As part of the right-of-way acquisition process, the right-of-way agent will discuss the construction schedule and construction requirements with the owner of each parcel. To ensure safe construction of the line, special consideration may be needed for fences, crops or livestock. For instance, fences may need to be moved, temporary or permanent gates may need to be installed; crops may need to be harvested early; and livestock may need to be moved. In each case the right-of-way agent and construction personnel coordinate these processes with the landowner.

6.3 Transmission Line Construction

Construction will begin after all federal, state, and local approvals are obtained, property and rights-of-way are acquired, soil conditions are determined and the design is completed. The precise timing of construction will take into account various requirements that may be in place due to permit conditions, system loading issues, available workforce and materials.

The actual construction will follow standard construction and mitigation practices that have been developed from experience with past projects. These best practices address right-of-way clearance, staging, erecting transmission line structures and stringing transmission lines. Construction and mitigation practices to minimize impacts will be developed based on the proposed schedule for activities, permit requirements, prohibitions, maintenance guidelines, inspection procedures, terrain and other practices. In certain cases some activities, such as schedules, are modified to minimize impacts to sensitive environments.

Typical construction equipment used on transmission projects includes: 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 are transported on tractor-trailers.

Steel poles are proposed to be used for the structures for the Project. Steel pole tangent structures are proposed to be directly embedded into the ground if soil conditions warrant. Rock-filled culvert foundations may be required in areas with poor soils. This method typically involves digging a hole for each pole, filling it partially with crushed rock and then setting the pole on top of the rock base. The area around the pole is then backfilled with crushed rock and/or soil. Culvert foundations involve auguring a hole for each pole, installing a galvanized steel culvert, filling the annular space outside the culvert with hole spoils, filling the culvert partially with crushed rock and then setting the pole on top of the rock base. The annular space between the pole and culvert is filled with crushed rock.

Long span, angle and dead end structures along the route will require concrete foundations. In those cases, holes will need to be drilled in preparation for the concrete foundations. Drilled pier foundations may vary from five to eight feet in diameter and 20 to 30 feet deep, depending on soil conditions. Steel reinforcing bars and anchor bolts are installed in the drilled holes prior to concrete placement. Concrete trucks are required to bring the concrete in from a local concrete batch plant. Steel pole structures are hauled unassembled on pole trailers to the staked location and placed within the right-of-way until the pole sections are assembled and the arms attached. Insulators and other hardware are attached while the steel pole is on the ground. The pole is then lifted, placed, and secured on the foundation using a crane.

Construction staging areas are usually established for transmission projects. Staging involves delivering the equipment and materials necessary to construct the new transmission line facilities. Construction of the Project will likely include one or two staging areas. Structures are delivered to staging areas and materials are stored until they are needed for the Project. The materials are then sorted and loaded onto structure trailers for delivery to the staked location.

In some cases, additional space (temporary lay down areas) may be required. These areas will be selected for their location, access, security and ability to efficiently and safely warehouse supplies. The areas are chosen to minimize excavation and grading. The temporary lay down areas outside of the transmission line right-of-way will be secured from affected landowners through rental agreements.

Typically, access to the transmission line right-of-way corridor is made directly from existing roads or trails that run parallel or perpendicular to the transmission line right-of-way. In some situations, private field roads or trails are used. Where easements exist, the Company notifies the property owner that it will access the easement area. Where necessary to accommodate the heavy equipment used in construction, including cranes, concrete trucks and foundation drilling equipment, existing access roads may be upgraded or new roads may be constructed. New access roads may also be constructed where no current access is available or the existing access is inadequate to cross roadway ditches.

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 will be to span wetlands, streams, and rivers. In addition, the Company will not allow construction equipment to be driven across waterways except under special circumstances and only after discussion with the appropriate resource agency. 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 and ensure that equipment fueling and lubricating will occur at a distance from waterways.

Impacts to wetlands will be minimized through construction practices. Construction crews will maintain sound water and soil conservation practices during construction and operation of the facilities to protect topsoil and adjacent water resources and to minimize soil erosion. Practices may include: containing excavated material, protecting exposed soil and stabilizing restored soil. Crews will avoid major disturbance of individual wetlands and drainage systems during construction. This will be accomplished by strategically locating new access roads and spanning wetlands and drainage systems where possible.

When it is not feasible to span the wetland, construction crews will consider the following options during construction to minimize impacts:

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

6.4 Right-of-Way Restoration and Clean Up

During construction, crews will attempt to limit ground disturbance wherever possible. However, areas are typically disturbed during the normal course of work, which can take several weeks in any one location. As construction on each parcel is completed, disturbed areas will be restored to their original condition to the maximum extent practicable. The right-of-way agent contacts each property owner after construction is completed to determine whether any damage has occurred as a result of the Project.

If damage has occurred to crops, fences or the property, the Company will fairly reimburse the landowner for the damages sustained. In some cases, the Company may engage an outside contractor to restore the damaged property to as near as possible to its original condition. Portions of vegetation that are disturbed or removed during construction of transmission lines will naturally reestablish to pre-disturbance conditions. Resilient species of common grasses and shrubs typically reestablish with few problems after disturbance. Areas with significant soil compaction and disturbance from construction activities along the proposed transmission line corridor will require assistance in reestablishing vegetation and controlling soil erosion.

Commonly used methods to control soil erosion and assist in reestablishing vegetation include, but are not limited to:

- Erosion control blankets with embedded seeds;
- Silt fences;
- Hay bales;
- Hydro seeding; and
- Planting individual seeds or seedlings of native species.

These erosion control and vegetation establishment practices are regularly used in construction projects and are referenced in the construction storm water permit plans. Long-term impacts are also minimized by utilizing these construction techniques.

6.5 Maintenance Practices

Transmission lines and substations are designed to operate for decades and require only moderate maintenance, particularly in the first few years of operation.

The estimated service life of the proposed transmission line for accounting purposes is approximately 50 years. However, practically speaking, high voltage transmission lines are seldom completely retired. Transmission infrastructure has very few mechanical elements and is built to withstand weather extremes that are normally encountered. With the exception of severe weather such as tornadoes and heavy ice storms, transmission lines rarely fail.

Transmission lines are automatically taken out of service by the operation of protective relaying equipment when a fault is sensed on the system. Such interruptions are usually only momentary. Scheduled maintenance outages are also infrequent. As a result, the average annual availability of transmission infrastructure is very high, in excess of 99 percent.

The principal operating and maintenance cost for transmission facilities is the cost of inspections, which is usually done monthly by air. Annual operating and maintenance costs for transmission lines in Minnesota and surrounding states vary. However, past experience shows that costs are approximately $300 to $500 per mile for voltages from 69 kilovolt through 345 kilovolt. 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.

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

7 ENVIRONMENTAL INFORMATION

Chapter 7. Environmental Information: *Chapter 7 provides a general overview of the environmental features and land uses in the Project Area.*

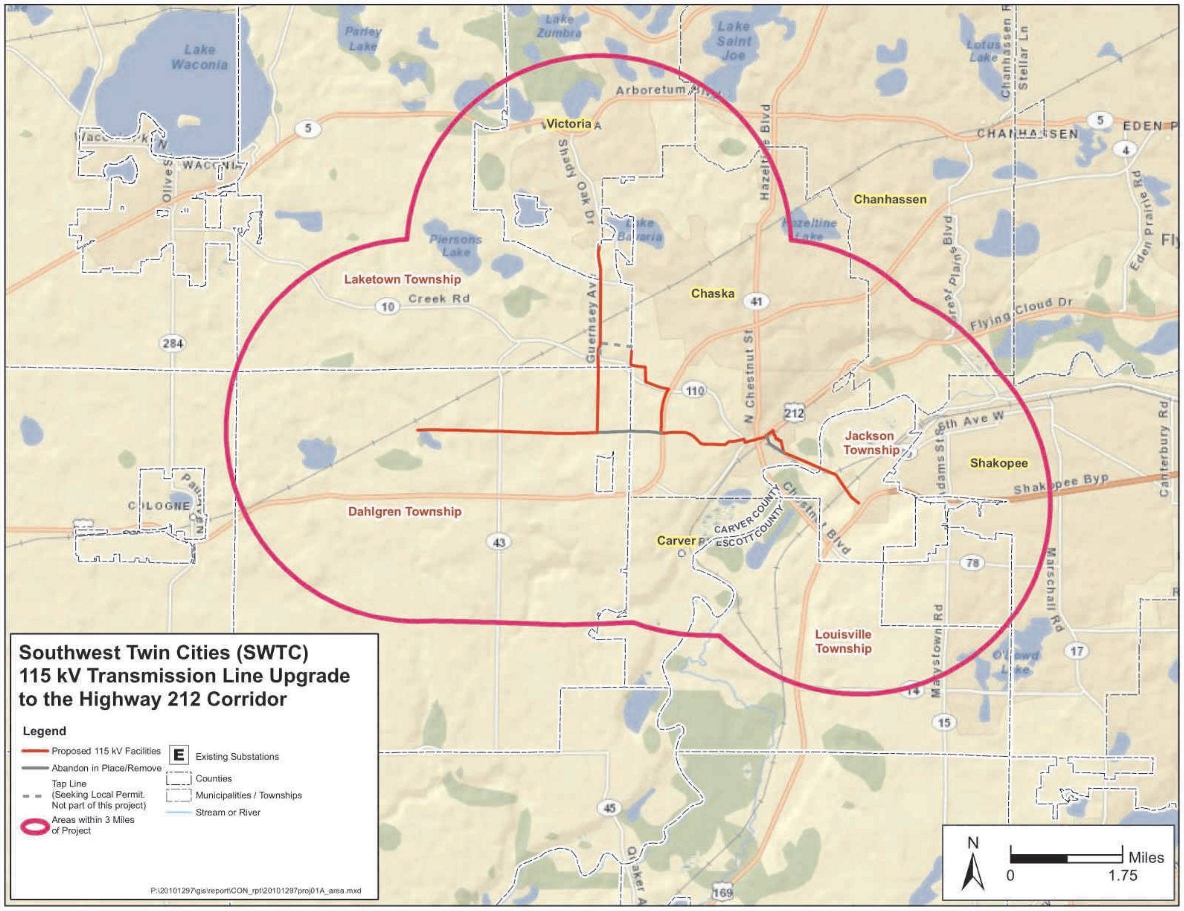
Key Terms:

- ***Considered Eligible Finding ("CEF")*** – *Cultural Resource sites that have been identified as eligible for listing on the National Register by both state and federal agencies, but not yet nominated or listed are identified as Considered Eligible Findings and are afforded comparable protection to listed sites for evaluation purposes.*
- ***Cultural Resources*** – *Cultural Resources are historic or archaeological sites containing unique or significant features relating to the cultural history the region. These resources are considered non-renewable.*
- ***Floodplain*** – *A floodplain is flat or nearly flat land adjacent to a stream or river that experiences occasional or periodic flooding. The floodplain includes the floodway which consists of the stream channel and adjacent areas that carry flood flows, and the flood fringe which are areas covered by the flood but do not carry a strong current.*
- ***Geomorphology*** – *Geomorphology is a science that deals with the relief features of the earth and seeks a genetic interpretation of them.*
- ***Mitigative Measures:*** *These terms refer to actions taken by Applicants to lessen environmental or other impacts resulting from the construction, operation, or maintenance of the proposed Project.*
- ***Physiography*** – *Physiography is a branch of geography that deals with the exterior features and changes of the earth.*
- ***Project Area*** – *This term refers to the area of environmental review which extends three miles in all directions from the proposed Project.*
- ***Public waters*** – *Public waters are designated as such to indicate which lakes, wetlands, and watercourses over which the Minnesota Department of Natural Resources (MnDNR) Waters has regulatory jurisdiction. The statutory definition of public waters includes public waters and public waters wetlands (Minnesota Statute 103G.005, Subd. 15).*
- ***Wetland*** – *Wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water.*

Key Points: *Based on our review, there are no environmental issues that would preclude construction of the proposed facilities. Applicants will take mitigative measures to minimize the environmental impacts of siting, constructing, and operating the Project.*

This section provides a description of the environmental setting, potential impacts and mitigative measures Xcel Energy has proposed, where appropriate, to minimize the impacts of siting, constructing and operating the Project. If the transmission line was removed in the future, the land could be restored to its prior condition and/or put to a different use. The majority of the measures proposed are part of the standard construction process at Xcel Energy. Unless otherwise identified in the following text, the cost of the mitigative measures proposed is considered nominal. For the purpose of this Section, the "Project Area" refers to an area that extends a distance of three miles from the proposed route unless otherwise specified. The "Project" refers to the proposed location of the line itself. The six-mile wide Project Area totals approximately 55,000 acres. A map of the Project Area is shown below as **Figure 19**.

Figure 19
Project Area



7.1 Description of Environmental Setting

The Project is located in Carver and Scott Counties, in and near the City of Chaska. The western end of the Project Area is located in Dahlgren Township, Carver County, west of Aue Lake at existing structure #142. From there, the Project extends north along the existing Great River Energy MV-VTT line through Laketown Township, and east through the City of Chaska. The Project route continues across the Minnesota River into Jackson Township, Scott County to the eastern terminus of the Project at the Scott County Substation.

7.2 Geomorphology and Physiography

Geologic and topographic information from the MnDNR and the United States Geological Survey ("USGS") was analyzed to determine the existing conditions within the Project Area. Carver and Scott County are part of a geologic structure called the Hollandale Embayment, which formed as a result of erosion, sedimentation, and the rise and fall of ancient seas. These actions resulted in a sedimentary deposition of rock over 1,000 feet deep over older sedimentary and igneous rocks.

The uppermost layer in the system is the glacial drift, which covers Carver and Scott Counties at depths from 100 to over 500 feet. Advances and declines of glaciers over one million years deposited the drift which consists of two types of sediment: till and outwash.

Till is unconsolidated material consisting of varying portions of clay, silt, sand, gravel, and boulders. In some areas of Carver and Scott County, very heavy deposits of clay occur but commonly include sand and gravel lenses. Outwash is sand and gravel material which has been deposited by a stream or river. Areas closer to the Minnesota River show large amounts of outwash deposited from the ancient glacial River Warren.

The Project Area is located within the Minnesota and Northeast Iowa Morainal Section (222M), a section within the biogeographic province known as the Eastern Broadleaf Forest Province under the Ecological Classification System ("ECS") developed by the Minnesota Department of Natural Resources ("MnDNR") and the United States Forest Service ("USFS") (MNDNR, 2010). The Project Area is further located within the Big Woods subsection of the Minnesota and Northeast Iowa Morainal Section, and through the Minnesota River Valley. The dominant landscape features in the general area are described as level topped hills bounded by smooth side slopes per the ECS. There are broad level areas between these hills that contain lakes and wetlands, with the area's drainage controlled by the level of these lakes. The topography of this ECS subsection is gently to moderately rolling. The topography of the Project Area, however, is relatively level and ranges from 950 feet above mean sea level in elevation in the west to 720 feet above mean sea level as the transmission line route travels to the east and crosses the Minnesota River.

Segments 1 through 5 of the project are significantly disturbed by human activity. Agriculture, development, and settlement have changed the original landscape in much of these areas. Portions of Segment 6, through the Minnesota River Valley, retain significant attributes of its original pre-settlement condition.

Each segment of the Project crosses or passes near water features. Segment 1 is near Aue Lake and wetlands; Segments 2, 3 4 and 5 pass over Chaska Creek, its tributaries, wetlands, and Fireman's Clayhole; and Segment 6 crosses the Minnesota River.

7.3 Land Use and Human Settlement

7.3.1 Commercial, Industrial, Residential Land Use

Land use within the proposed transmission line Segments 1 through 3 of the Project area are primarily agricultural and undeveloped open-space. In Segment 4, significant increases in suburban residential development have occurred within recent years. The eastern portion of Segment 4 and all of Segment 5 remain largely unchanged for decades as developed urban residential and commercial areas of the City of Chaska, which is the largest city in Carver County with a population of 23,770 (2010 Census). Segment 6 through the Minnesota River valley is primarily undeveloped with the exception of the some private land parcels in Scott County where agriculture and mining have occurred.

7.3.2 Displacement

No displacement of residential homes or businesses will occur as a result of this Project. The NESC and Xcel Energy's standards require certain clearances between transmission line facilities and buildings for safe operation of the proposed transmission line. Xcel Energy will acquire a right-of-way for the transmission line that is sufficient to maintain these clearances.

The Project will be designed in compliance with local, state, NESC, Xcel Energy and Great River Energy standards regarding clearance to ground, clearance to crossing utilities, clearance to buildings, strength of materials, and right-of-way widths. Construction crews and/or contract crews will comply with local, state, NESC, Xcel Energy, and Great River Energy standards regarding installation of facilities and standard construction practices. Established Company and industry safety procedures will be followed during and after installation of the transmission lines. This will include clear signage during all construction activities.

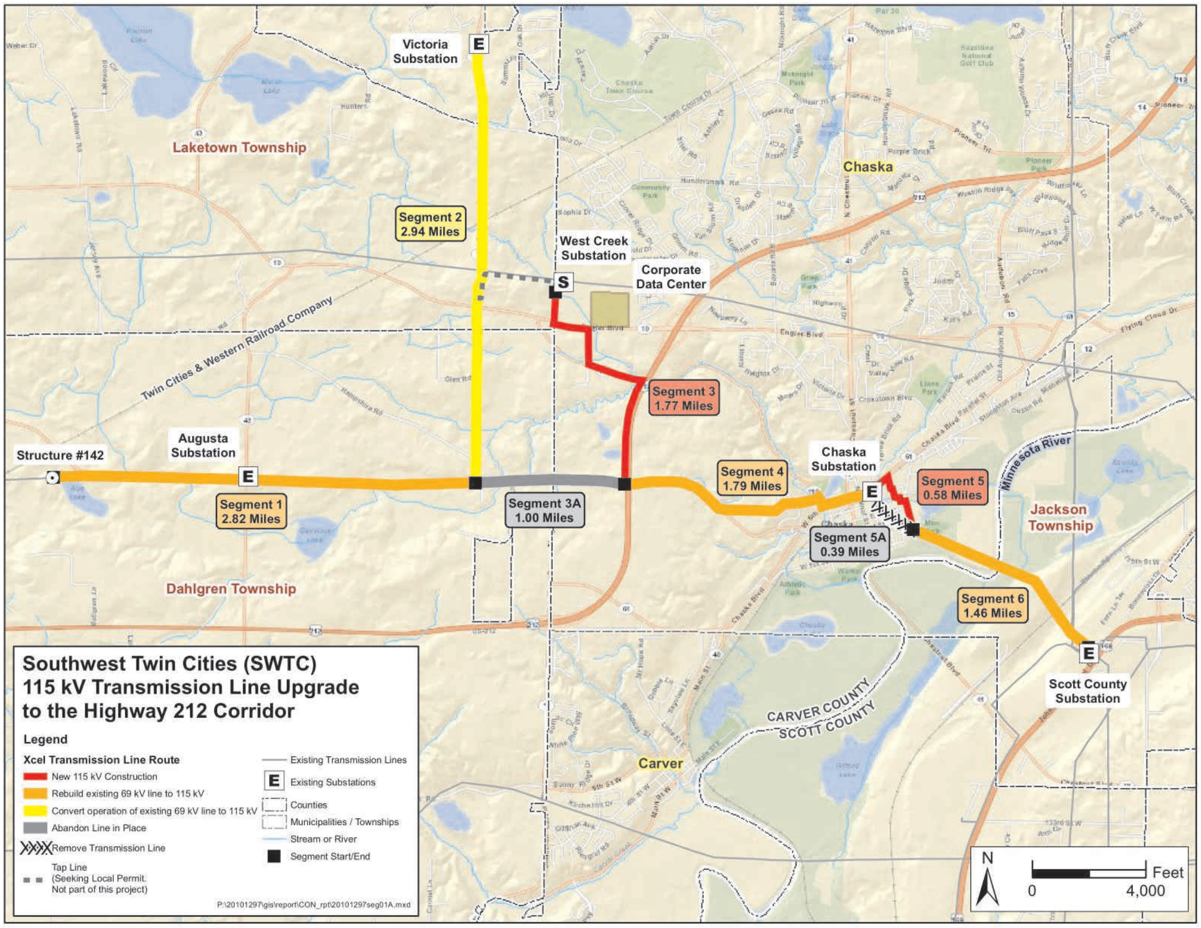
7.3.3 Aesthetics

The proposed Project route will mainly follow existing 69 kV transmission line routes for **Segments 1, 2, 4 and 6** and therefore, the Project will not result in a significant change to the visual and aesthetic character of the area. In Project areas involving rebuilding the existing line (**Segments 1, 4, and 6),** existing poles will be removed and replaced in generally the same location. In **Segment 2** the Project will involve a conversion which will not result in a significant change to visual and aesthetic character of the area.

In Project areas involving new construction **(Segments 3 and 5)**, the transmission line will be a new feature visible along the route. The structures will be about 60 to 105 feet tall and will have an average span of 325 feet. A maximum span of 400 feet will be used between the structures which will still keep the conductor within the right-of-way under blowout conditions. The usual right-of-way required for these types of structures is 75 feet wide. The existing transmission line structures vary in height between 50 to 90 feet. By comparison, the proposed transmission line structures will generally be slightly taller, ranging from 60 to 105 feet in height. The overall spacing of the poles will be comparable to the current layout, which varies greatly by engineering and land use constraints.

A map of the Project segments is **Figure 20**.

Figure 20
Segment Map



The finish of the proposed poles will be galvanized or self-weathering steel. The existing transmission line structures in this area are wood poles, and some of the existing poles are of H-frame construction. The proposed steel poles will give the new transmission line a somewhat cleaner and more modern appearance.

Like the existing 69 kV transmission line, the new single circuit transmission line will be visible to area residents. Outside of the City of Chaska, the majority of the landscape in the Project Area is undeveloped and agricultural. The visual effect will depend largely on the perceptions of the observers. The visual contrast added by the transmission structures and lines may be perceived as a visual disruption or as points of visual interest. The transmission lines that already exist in the Project Area will limit the extent to which the new line is viewed as a disruption in the area's scenic integrity.

7.4 Socioeconomic

According to 2010 US Census data, Carver County had a population consisting of 92.8 percent Caucasian, and Scott County had a population consisting of 77 percent Caucasian. In the Project Area, minority groups constitute a range of 1.6% to 34.22% of the total population.

Per capita incomes within the townships in the Project Area are slightly lower when compared to Carver and Scott counties on a whole. The proposed route does not contain disproportionately high minority populations or low-income populations.

Population and economic characteristics based on the 2010 U.S. Census are presented in **Table 20** below.

Table 20
Population and Economic Characteristics

Location	Population	Minority Population (Percent)	Caucasian Population (Percent)	Per Capita Income	Percentage of Individuals Below Poverty Level (Bureau)
State of Minnesota	5,303,925	14.7	85.3	$29,582	10.6
Carver County	91,042	7.2	92.8	$35,807	4.7
City of Chanhassen	22,952	7.5	92.5	$44,080	2.9
City of Chaska	23770	11.9	88.1	$33,600	7.5
Dahlgren Township	1,331	1.6	98.4	$36,468	4.9
Carver City	3,724	11.5	88.5	$35,381	5.0

Location	Population	Minority Population (Percent)	Caucasian Population (Percent)	Per Capita Income	Percentage of Individuals Below Poverty Level (Bureau)
Laketown Township	2,243	7.0	93.0	$39,218	3.9
Scott County	129,928	13.6	86.4	$33,612	4.7
Jackson Township	1,464	34.22	65.78	$27,372	3.6
Shakopee City	37,076	23.0	77.0	$30,908	6.3

Source: 2010 U.S. Census: General Demographic Characteristics

There will be short-term impacts to community services as a result of construction activity and an influx of contractor employees during construction of the various segments of the Project. Both utility personnel and contractors will be used for construction activities. Socioeconomic impacts resulting from the Project will be primarily positive with an influx of wages and expenditures made at local businesses during the construction of the Project. It is not expected that additional permanent jobs will be created by the Project.

7.4.1 Cultural Values

Cultural values include those perceived community beliefs or attitudes in a given area, which provide a framework for community unity. According to the U.S. Census Bureau, the populations of both counties derive from a diverse ethnic heritage. However, a majority of the reported ethnic backgrounds are of European origin. In Carver County, German and Scandinavian heritage comprises 76% of the total population, with German heritage being the most prevalent with nearly 50%. Scott County has a similar German and Scandinavian ethnic representation at 70%, with German heritage being nearly 45%. The region surrounding the Project Area has cultural values tied to the area's strong German and Scandinavian heritage, and the agricultural and industrial economy. Cultural representation in community events appears to be more closely tied to geographic features (such as the Minnesota River), seasonal events, national holidays, and municipal events than to those based in ethnic heritage. Examples of regional cultural events include the annual River City Days held in July in Chaska, Derby Days held every August and the Happy Birthday America parade held every July in Shakopee.

Construction of the proposed Project is not expected to conflict with the cultural values of the Project Area.

7.4.2 Recreation

The Project Area crosses five municipalities, including from west to east: Dahlgren Township, Laketown Township, and the City of Chaska, all within Carver County, and Jackson Township within Scott County. The Project intersects or abuts five parks including the Schimelpfenig Park, Fireman's Park I and II, Highland Park, and the Minnesota Valley State Recreational Area near the Minnesota River. Numerous parks and bike trails are located within three miles of the Project which provide a range of recreational uses from athletic fields, picnic areas and tennis courts to boat access, fishing, public swimming and nature trails. Several bikeways and recreational trails are within the Project Area including the Minnesota Valley State Trail on the Scott County side of the Minnesota River. The Project is not expected to directly impact any of these recreational resources with the exception of Fireman's Park I. Construction activities associated with the Project near these parks consist of upgrades to existing infrastructure which are already in established, cleared rights-of way, so no additional vegetation removal or use restrictions should occur in the parks as a result of the Project. A new line will be constructed along the west edge of Fireman's Park I. The construction of the new line will require some limited vegetation removal and will result in an aesthetic change for the park; however it is unlikely the Project will change or restrict the uses of the park.

7.4.3 Public Services and Transportation

The City of Chaska provides water, sewer and electrical service to its residents. Outside the city limits, along the transmission route, private wells and septic systems are used. The Project is not expected to directly impact public services to area residents.

According to the Carver County Capital Improvement Plan for 2012 to 2016, future road projects within the six mile-wide Project Area include the County State Aid Highway 13/Trunk Highway 5 Turn Lane and County State Aid Highway 11/Trunk Highway 5 Turn Lane project slated for the 2012 construction year, and corridor construction on County State Aid Highway 18 from the intersection of County State Aid Highway 13 to 0.3 miles west of Trunk Highway 41 for the 2013 construction year. The County State Aid Highway 10 (Engler Blvd.) reconstruction from County State Aid Highway 11 to Trunk Highway 212 and corridor construction of County State Aid Highway 14 from Bavaria Road to Trunk Highway 41 are both slated for the 2016 construction year, but are currently unfunded.

MNDOT and Carver county are in the process of securing permits for the County State Aid Highway 11 road project between County State Aid Highway 61 (Chaska Boulevard) and County State Aid Highway 10 (Engler Boulevard). The project consists of the realignment and reconstruction of an approximately two mile segment of County State Aid Highway 11 to provide a continuous two-lane roadway between County State Aid Highway 61 and County State Aid Highway 10. Between County State Aid Highway 61 and County Road 140, improvements will be made to bring the corridor to current design standards. Between County Road 140 and County State Aid Highway 10, County State Aid Highway 11 will be reconstructed along a new alignment to eliminate two existing intersections along County Road 140.

Ongoing and future road project within the general area are not anticipated to affect the planning or construction of the Project.

7.5 Land-Based Economics

7.5.1 Agriculture

Both Carver and Scott counties have strong economic ties to agricultural production. According to the 2007 United States Department of Agriculture ("USDA") Census of Agriculture, Carver County has 800 individual farms, marking a 2% decrease in total number of farms over the previous five years. Agricultural lands cover 169,397 acres, representing over 70% of all lands in Carver County with an average farm size of 212 acres. Carver County ranks among the top 20 counties (by value of sales) in production of fruits, tree nuts, and berries (ranking 15th statewide); nursery, greenhouse, floriculture, and sod (ranking 10th statewide); and milk and other bovine dairy products (ranking 13th statewide). Nearly $93 million was generated from both crop and livestock sales in 2007.

Scott County also has strong economic dependence on agricultural production. According to the 2007 USDA Census of Agriculture, Scott County has 795 individual farms, marking a 21% decrease in total number of farms over the previous five years. Agricultural lands cover 117,551 acres, representing over 51% of all land in Scott County with an average farm size of 148 acres. Scott County ranks among the top twenty counties (by value of sales) in production of fruits, tree nuts, and berries (ranking 5th statewide); cut Christmas trees and short rotation woody crops (ranking 6th statewide); and horses, ponies, mules, burros, and donkeys (ranking 13th statewide). Over $63 million was generated from both crop and livestock sales in 2007.

Construction activities associated with the Project will temporarily access areas of agricultural land. Construction of new transmission structures and removal of existing structures will require repeated access to structure locations to install foundations, structures and conductors. Equipment used in the construction process includes drill rigs, concrete trucks, backhoes, cranes, boom trucks and assorted small vehicles. Operation of these vehicles on adjoining farm fields can cause rutting and compaction, particularly during springtime and otherwise wet conditions.

Mitigative Measures

Spring-time construction will be avoided where possible. However, if construction during spring-time is necessary, disturbance to farm soil from access to each structure location will be minimized by using the shortest access route. This may require construction of temporary driveways between the roadway and the structure, but would limit traffic on fields between structures. Construction mats may also be used to minimize impacts on the access paths and in construction areas. Xcel Energy construction teams will work with the property owner, right of way agent, and transmission line engineers to minimize the impact on property through use of the owner's knowledge of the property. In addition to payments for easements acquired, Xcel Energy will compensate landowners for any crop damage and soil compaction that occurs as a result of the Project.

7.5.2 Forestry

There are no forested areas along the proposed Project Area where trees are harvested. The primary tree cover in the area is associated with waterways and homesteads. No economically significant forestry resources are located along the proposed transmission line rebuild or new construction routes.

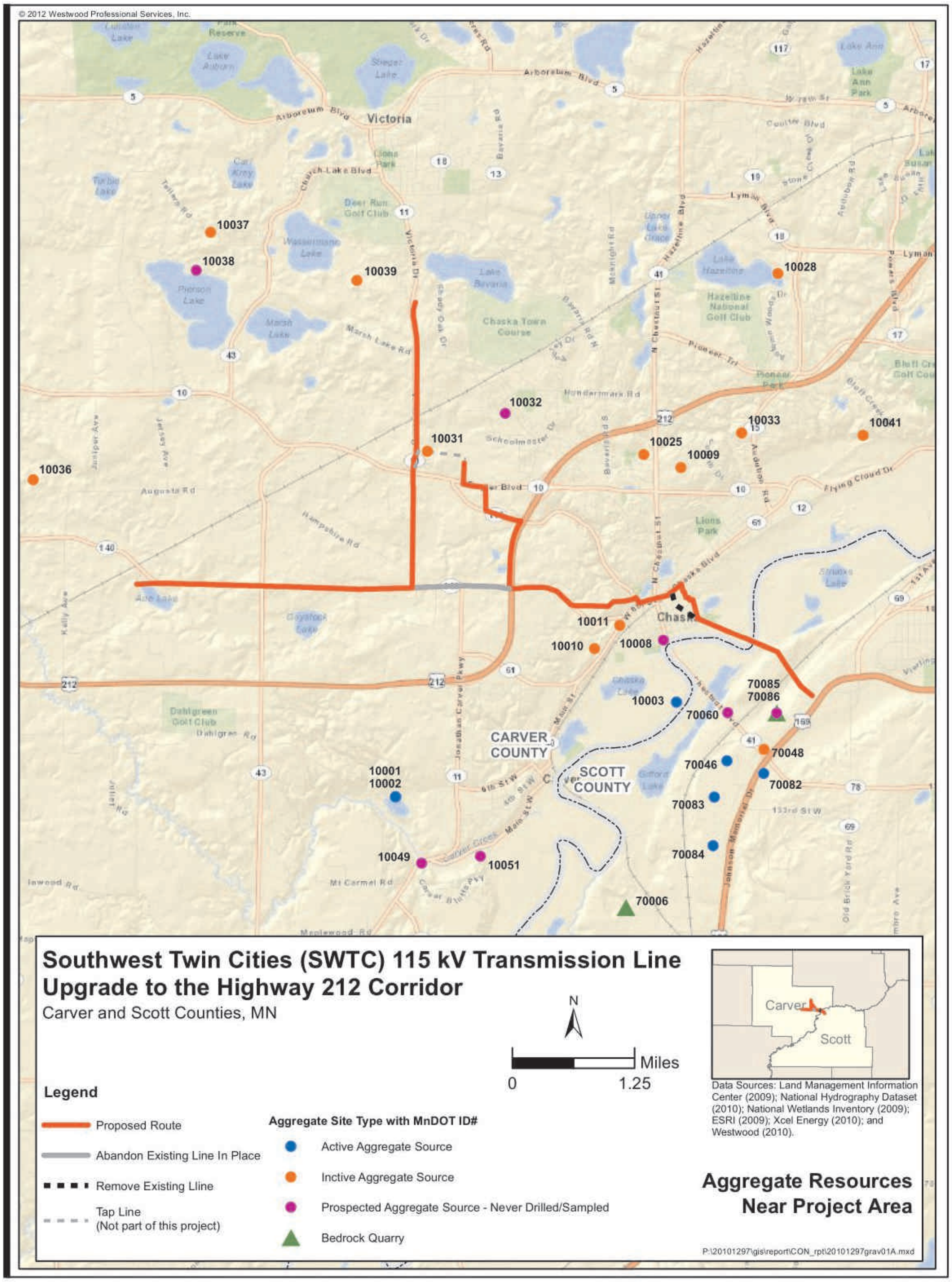
7.5.3 Tourism

Primary tourism activities in the region include camping, fishing, boating, bicycling, and cross country skiing. The Minnesota River Valley offers multiple opportunities for outdoor recreation. Popular tourist attractions located in Scott County include the Minnesota Renaissance Festival, Mystic Lake Casino, and the Valleyfair Amusement Park. No impacts to these tourism resources are anticipated, therefore no mitigative measures are proposed.

7.5.4 Mining

According to MnDOT county pit maps for Carver and Scott counties, there are gravel pits, rock quarries and commercial aggregate sources within the Project Area **Figure 21**.

Figure 21
Aggregate Resources Near Project Area



Of these, the closest is an inactive aggregate source located on the route west of the proposed West Creek Substation. The next closest is a bedrock quarry located approximately 0.35 miles from the eastern terminus of the Project in Scott County. Three active aggregate sources and four inactive sources are located within one mile of the Project. Four inactive gravel pits are within one mile of the Project. Because no active aggregate resources are being utilized in close proximity to the Project, no impacts are anticipated and therefore no mitigative measures are proposed.

7.6 Archaeological and Historical Resources

A review of records at the Minnesota State Historic Preservation Office ("SHPO") and the Minnesota Office of the State Archaeologist ("OSA") was conducted in February 2011 to determine the number and nature of cultural resources in proximity to the project area.

An initial count of cultural resources was looked at within the Project Area. A total of 77 archaeological sites have been previously recorded within the Project Area and 976 historic or architectural resources have been inventoried within township sections which are either fully or partially located within the Project Area.

Additional and more precise information was obtained on cultural resources within a one mile buffer of the Project. A total of 293 previously recorded cultural resource properties are located within one mile of the proposed Project, including 20 archaeological sites and 273 inventoried historic architectural properties.

Of the 20 archaeological sites, nine consist of prehistoric artifact or lithic scatters, two are single artifact finds, five are records based on historical documentation, and four are earthworks (which may or may not contain burials). One of the archaeological sites, Site 21CR0002- an earthwork, has been listed on the National Register of Historic Places (NRHP). Of the 273 historic architectural resources identified in the records review, 32 are listed on the National Register of Historic Places (NRHP) and three are Considered Eligible Findings (CEF) by the SHPO.

Only 43 of the 293 cultural resource properties identified are located within the proposed route width of 200' on rebuild segments and 400' on new segments. Segment 1 has zero cultural resources properties identified within the segment buffer. Segment 2 has four identified cultural resource properties, Segment 3 has one identified cultural resource property, Segment 4 has zero cultural resources properties identified, Segment 5 has thirty-seven identified cultural resource properties within the City of Chaska, and Segment 6 has zero cultural resource properties identified. None of the 43 properties located within the Project Area have been formally evaluated and have not been considered for eligibility for listing on the National Register of Historic Places. None of the historic architectural resources will be directly impacted by construction of the Project. Three of the archaeological sites (21CR0101, 21SC0026, and 21SC0091) are within the proposed route width and could potentially experience direct impacts resulting from the construction of the Project. The proposed construction will primarily constitute the replacement of pre-existing features and new indirect visual impacts will be minimal.

Mitigative Measures

The proposed Project will avoid impacts to identified archaeological and historic architectural resources to the extent possible. Should a specific impact be identified, Applicants will consult with SHPO on whether the resource is eligible for listing in the NRHP. While avoidance would be a preferred action, mitigation for Project-related impacts on NRHP-eligible archaeological and historic resources may include resource investigations and/or additional documentation through data recovery.

7.7 Hydrologic Features

The Project lies entirely within the Minnesota River-Shakopee major hydrologic unit (HU) which is within the Upper Mississippi Drainage Region (Seaber et al, 1987; USDA NRCS, 2003). Wetlands, lakes, and streams intersect the Project Area at several locations, ending by crossing the Minnesota River at its east end.

7.7.1 Water Quality

Groundwater

As a result of glacial activity, all of Carver County and most of Scott County are located where groundwater supply is from predominately sedimentary bedrock sources. The bedrock layers deposited in ancient seas are the primary aquifers for this area. A 1,000-foot-thick layer of inter-bedded aquifers (water-bearing rock units) and aquitards (confining layers) comprise the Twin Cities aquifer basin (Metropolitan Council, 2005). There are several principal aquifers along with the confining layers in the basin.

A "water-table aquifer" contains groundwater unconfined by impermeable beds of clay, silt or rock. An "artesian aquifer" contains water confined by clay or shale or by other relatively impermeable overlying rock strata. These impermeable layers restrict water's vertical movement to and from the aquifer. Water levels in wells that penetrate an artesian aquifer rise above the top of the aquifer. The Project Area has both water table and artesian conditions.

Karst topography is not found within the Project Area, although some known Karst sites are located approximately 7 miles to the east along the Minnesota River. Karst topography developed from mildly acidic groundwater slowly dissolving carbonate bedrock, forming areas of "karst". Karst aquifers are susceptible to groundwater contamination because sinkholes form passageways that funnel the water from the surface into the groundwater system (Alexander, Jr. 1988, "Sinkholes and Sinkhole Probability," University of Minnesota Geological Survey County Atlas Series (C-3)).

Floodplains

The Project Area crosses the 100-year floodplains of Chaska Creek and the Minnesota River, and the 500-year floodplain of the Minnesota River in Carver County according to FEMA Flood Insurance Rate Maps (FEMA, 1992). The 500-year floodplain information is not available for Scott County.

The floodplain crossings of Chaska Creek and its tributaries occur primarily in agricultural land and correspond to existing roadways. The Minnesota River floodplain crossing occurs primarily in residential areas near downtown Chaska, with the remainder of the floodplain crossing parallel to an existing utility as it extends through the undeveloped portion of the Minnesota River forested floodplain.

Wetlands, Waters, and Watercourses

Various large wetland complexes and small isolated wetlands are scattered throughout the Project Area. Many of the wetlands are associated with Aue Lake, Chaska Creek, or the Minnesota River. GIS data from the National Wetlands Inventory ("NWI") was reviewed to assess wetlands present within the Project Area. Note that the NWI has not been field verified and sometimes contains inaccuracies; however, NWI is a tool for initial wetland identification and assessment.

Based on NWI mapping, approximately 16 percent of the area within three miles of the Project is mapped as wetland.

Of the wetlands present within the Project Area, most are classified as Palustrine type wetlands. The other wetland types within the Project Area are Lacustrine, which are associated with lakes, and Riverine, which are associated with Rivers. Of the NWI-mapped wetland within the Project Areas, 80 percent consist of Palustrine type wetlands, approximately 15 percent are Lacustrine type features, and the remainder are Riverine.

The Palustrine System includes all nontidal wetlands dominated by trees, shrubs, emergents, mosses or lichens (**Cowardin** et al. **1979**). Lacustrine wetland systems are found in the shallow protected areas of lakes with water depth in the deepest part of the wetland basin greater than 6.6 feet. The Riverine System includes all wetlands and deepwater habitats contained within a channel. The Riverine System is bounded on the landward side by upland, by the channel bank (including natural and man-made levees), or by wetland dominated by trees, shrubs, persistent emergents, emergent mosses, or lichens. In braided streams, the system is bounded by the banks forming the outer limits of the depression within which the braiding occurs.

The MnDNR Public Waters Inventory (PWI) identifies Public Wetlands, Waters and Watercourses. Notable watercourses in close proximity to the Project include Chaska

Creek, Chaska Creek east, and the Minnesota River. Notable Public Waters in close proximity to the Project include Fireman's Clayhole and Aue Lake. Within the Project Area overall other notable Public Waters and Watercourses include Lake Minnewashta, Tamarack Lake, Steiger, Auburn, Schutz, Wasserman, and Hazeltine lake and Minnehaha Creek, Carver Creek, Assumption Creek and Bluff Creek.

The proposed transmission line rebuild and new line construction will have minor, mostly short term effects on surface water resources. The transmission line rebuild and new line construction may require waters and wetlands permits, letters of no jurisdiction, or exemptions from the USACE, MnDNR Division of Waters, and LGU's that administer WCA.

After coordination and application submission, authorization from the USACE would likely fall under a Letter of Permission (LOP-05-MN) or the utility line discharge provision of a Regional General Permit (RGP-3-MN).

The MnDNR Division of Waters requires a Public Waters Work Permit for any alteration of the course, current, or cross-section below the ordinary high water level of a Public Water or Watercourse. No such alterations are anticipated. Minnesota Statutes Section 84.415 requires a license from the MnDNR Division of Lands and Minerals for the passage of any utility over, under, or across any state land or public waters. Therefore, Applicants will either confirm the applicability of existing licenses for these crossings or obtain new utility crossing licenses prior to construction.

Carver County, the City of Chaska, and Jackson Township are LGU's that administer the WCA in the Project Area. It is possible that the Board of Water and Soil Resources (BWSR) representatives for Carver and Scott Counties will coordinate with the LGU'S so that one entity administers the WCA over the entire project area. As a utilities project, it is likely that wetland impact minimization will allow the Project to be eligible for a WCA de minimis or utilities exemption. If that is not the case, WCA permits will be required.

The MPCA regulates construction activities that may impact storm water under the Clean Water Act. A National Pollutant Discharge Elimination System ("NPDES") permit is required for owners or operators for any construction activity disturbing: 1) one acre or more of soil; 2) less than one acre of soil if that activity is part of a "larger common plan of development or sale" that is greater than one acre; or 3) less than one acre of soil, but the MPCA determines that the activity poses a risk to water resources. In the event that a construction storm water permit and Stormwater Pollution Prevention Plan ("SWPPP") are required for the Project, Applicants will obtain the permit and SWPPP.

Mitigative Measures

Applicants will design the Project to minimize or avoid impacts to surface water resources to the maximum extent practicable. Permanent impacts to these areas will be minimized by maximizing the typical span length across wetlands and watercourses.

Temporary construction impacts will be minimized by employing erosion control measures identified in the MPCA Storm Water Best Management Practices Manual, such as using silt fencing to control sediment runoff to adjacent water resources. Disturbed surface soils will be stabilized at the completion of the construction process to minimize the potential for subsequent effects on surface water quality. Construction operations will be designed and controlled to minimize and prevent material discharge to surface waters. If materials do enter wetlands or public waters, such materials will be promptly removed and properly disposed of to the extent feasible.

7.8 Vegetation and Wildlife

7.8.1 Vegetation

Historically, the Project Area was primarily covered with hardwoods including oak, maple, basswood, elm, and hickory with pockets of brush prairie and wet prairie. The pockets of prairie existed in areas of wet depressions where the soils and water table were not suitable for trees (MnDNR 2009c).

Areas of wetland, grassland and forest are interspersed along the extent of Project Area with concentrations of forested areas at the east end associated with the

Minnesota River. Common species in forested areas include sugar maple, red maple, basswood, American elm, box elder, green ash, bur, red, and white oak, and eastern cottonwood. Native grassland is relatively scarce within the Project Area. Wetlands are present throughout the Project Area and primarily associated with Aue Lake, Chaska Creek and its tributaries, and the Minnesota River. Reed canary grass, cattail, cottonwood, willow, and sedges are the primary species in wetlands. Some native species remain in these wetland systems, however many are dominated by invasive species.

As a result of settlement throughout the 1800's, most of the area's land had been converted to agricultural use, which remains the predominant land use. Approximately 20 percent is developed as residential and commercial land use in and around the City of Chaska near the east end of the Project Area. Many of the species historically found in the Project Area still remain, albeit in limited numbers. Additionally, many species found near water or in floodplains are common in many of the remaining wooded plots as these areas were unsuitable for farming and were not converted to agriculture. **Table 21** summarizes land cover and land use in the Project Area.

Table 21
Land Cover and Land Use in Project Area

Cover Type	Area (acres)	Percent Cover of Project Area
Forest/Shrubland	10,030	18%
Developed/High Intensity	462	<1%
Developed/Medium Intensity	1,968	4%
Developed/Low Intensity	4,439	8%
Developed/Open Space	3,486	6%
Grassland	191	<1%
Herbaceous & Woody Wetlands	2,667	5%
Open Water	2,394	4%
Pasture/Hay/Cropland	29,033	53%
Barren land	282	<1%

Source USDA, NASS Cropland Data Layer (2011)

The proposed transmission line rebuild and new line construction are primarily located in agricultural areas with the exception of Project segments located in the City of Chaska, which is developed with urban land uses.

Mitigative Measures

Transmission line construction impacts to trees and woodlands will be minimized because the transmission line rebuild will follow existing rights-of-way and new construction will occur along existing roadways. Areas where new transmission line construction is planned are primarily agricultural and will require minimal tree removal.

7.8.2 Wildlife

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

Wildlife that resides within the Project Area may be temporarily displaced to adjacent habitats during the construction process. It is anticipated that fish and mollusks that inhabit the local watercourses will not be affected by transmission line rebuild or new line construction because no work will occur within habitat areas that support these species.

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

The electrocution of large birds, such as raptors, is more commonly associated with small distribution lines than large transmission lines. Electrocution occurs when birds with large wingspans come in contact with two conductors or a conductor and a grounding device. Company design standards for transmission and distribution lines provide adequate spacing to minimize the risk of raptor electrocution.

<u>Mitigative Measures</u>
It is anticipated that most wildlife displacement and habitat impacts will be temporary. Consequently, no wildlife population mitigation measures are proposed. Xcel Energy has been working with various state and federal agencies for over 20 years to address avian issues as quickly and efficiently as possible. In 2002, Xcel Energy Operating Companies, including Xcel Energy, entered into a voluntary Memorandum of Understanding ("MOU") with the U.S. Fish and Wildlife Service ("USFWS") to work together to address avian issues throughout its service territories. The MOU sets forth standard reporting methods and the development of Avian Protection Plans ("APP") for each state that Xcel Energy serves. APPs include designs and other measures aimed at preventing avian electrocutions, as described in guidance provided by the Avian Power Line Interaction Committee ("APLIC" 2006) and the guidelines for developing APPs (APLIC and USFWS, 2005). The APP for the Minnesota Territory is complete and retrofit actions for areas with potential avian impacts are underway across the territory. Xcel Energy also addresses avian issues related to transmission projects by working with resource agencies such as the MnDNR and the USFWS to identify areas that may be appropriate for marking transmission line shield wires with bird diverters. Avian issues area also addressed by attempting to avoid areas known as primary migration corridors or migratory resting areas.

7.9 Rare and Unique Natural Resources

A request for a Natural Heritage Database Search and comments regarding rare species and natural communities for the Project Area was submitted to the MnDNR on March 14, 2011.

The following assessment is based on MnDNR response, a review of the Natural Heritage Database licensed to Westwood Professional Services, and other state and federal rare species and natural community information. In an email dated January 27, 2012, the MnDNR confirmed there were no new records within the Project Area and that the letter dated May 4, 2011 is still valid.

The letter from the MnDNR dated May 4, 2011 indicated rare features have been document within one mile of the proposed project. Of particular note was that the Project crosses a Central Region Regionally Significant Ecological Area (RSEA) with an Outstanding ranking. The DNR Central Region (in partnership with the Metropolitan Council for the 7-county metro area) identified ecologically significant areas by conducting a landscape-scale assessment to inform regional scale land use decisions. The Project is within the RSEA when it crosses the Minnesota River.

There are eighty five (85) known occurrences of rare species and sensitive natural communities within three miles of the Project. These occurrences include nine (9) vertebrate species, twenty (20) invertebrate species, twelve (12) native plant communities, thirteen (13) vascular plant species, and one (1) bat concentration. Eleven (11) of the eighty-five records are located within 0.5 miles of the Project Area and include: Rock Pocketbook (2 records), Yellow Sandshell, Shovelnose Sturgeon (2 records), Wartyback, Mucket, Sessile-flowered Cress, and three native plant communities. Thirty-seven of the 85 records are invertebrate species of the freshwater mussel family Unionidae. **Table 22** summarized rare and sensitive species within 0.5 miles of the proposed Project.

Table 22
Rare Species and Sensitive Natural Communities
Within 0.5 Miles of The Project

Common Name	Scientific Name	Type	MN Status [1]	Federal Status	Last Obs.	Proximity (Miles)
Shovelnose Sturgeon	*Scaphirhynchus platorynchus*	Vertebrate Animal	NON		06/05/1987	0.0-0.5
Shovelnose Sturgeon	*Scaphirhynchus platorynchus*	Vertebrate Animal	NON		09/30/1999	0.0-0.5
Rock Pocketbook	*Arcidens confragosus*	Invertebrate Animal	END		Pre-1989	0.0-0.5
Rock Pocketbook	*Arcidens confragosus*	Invertebrate Animal	END		Pre-11/2006	0.0-0.5

Common Name	Scientific Name	Type	MN Status [1]	Federal Status	Last Obs.	Proximity (Miles)
Wartyback	*Quadrula nodulata*	Invertebrate Animal	END		09/20/2000	0.0-0.5
Yellow Sandshell	*Lampsilis teres*	Invertebrate Animal	END		10/09/1989	0.0-0.5
Mucket	*Actinonaias ligamentina*	Invertebrate Animal	THR		Pre-1989	0.0-0.5
Sessile-flowered Cress	*Rorippa sessiliflora*	Vascular Plant	SC		07/1891	0.0-0.5
Northern Poor Fen	Northern Poor Fen Class	Terrestrial Community			07/08/1998	0.0-0.5
Red Oak-Sugar Maple-Basswood	Red Oak-Sugar Maple-Basswood	Terrestrial Community			09/19/1995	0.0-0.5
Native Plant Community, Undet. Class	*Not Applicable*	Community			06/06/1995	0.0-0.5

[1]*SC = State-listed Special Concern; END = Endangered; THR= Threatened (Minnesota DNR 2007)*

Mitigative Measures

The Project and construction process will be designed to avoid encroachment and effects on rare species and unique natural resources to the extent practicable. If rare species or unique natural resources will be affected, Xcel Energy will coordinate with the MnDNR and consider modifying either the construction footprint or the construction practices to minimize impacts.

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