

## 7.5 Twin Cities Zone

The following table provides a list of transmission needs identified in the Twin Cities Zone and the map following the table shows the location of each item in the table. Each item is discussed in more detail in the sections following the map.

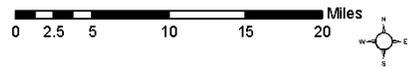
### Twin Cities Zone

Tracking Number	Description	Projected In-Service Year	Need Driver	Section No.
2003-TC-N1	Aldrich to St. Louis Park	Phase 1 Completed March 2006 Phase 2 by 2018	Overloads during contingencies	7.5.2
2003-TC-N2	Eden-Prairie – Minnetonka Area	69 kV line reconductor and substation upgrade completed in 2007. Rebuild line to 115 kV in 2011 timeframe	Overloads from transmission outages and load growth	7.5.3
2003-TC-N3	Carver County – Waconia Area	2008	Load growth	7.5.4
2003-TC-N4	Chisago – Apple River	2010	Overloads and low voltages	7.5.5
2003-TC-N5	High Bridge – Rogers Lake 115 kV line (Need) King, High Bridge and Riverside Generation interconnection substations	2008	Generation outlet	7.5.6
2003-TC-N8	Long Lake – Oakdale – Tanners Lake-Woodbury 115 kV line	Completed & 2009	Thermal overloads from transmission outages	7.5.7
2003-TC-N9	Rush City-Forest Lake – Blaine	2008	Low voltage and line overloads	7.5.8
2003-TC-N10	Twin Cities 345/115 kV Transformer Capacity	To be Determined	Approaching emergency loading levels	7.5.9
2003-TC-N12	Elk River – Ramsey – Bunker Lake Area (Enterprise Park)	2009	Low voltage and line overloads	7.5.10
2003-TC-N13	Minnesota-Wisconsin Stability Interface	To be Determined	Regional constraint	7.5.11
2005-TC-N3	Champlin – Champlin Tap – Crooked Lake	2008	Overloads during transmission outages contingencies	7.5.12
2005-TC-N6	Yankee Doodle 115 kV substation conversion	2007 & To be Determined	Load growth	7.5.13
2005-TC-N7	Twin Cities Fault Current Issue	To be Determined	Load growth	7.5.14
2005-TC-N8	Minnesota River Generation substation interconnection	2008	Generation outlet	7.5.15
2005-TC-N12	Dakota County Generation	To be Determined	Load serving; transmission infrastructure investments needed to meet growth in demand for electricity in Minnesota and the region	7.5.16

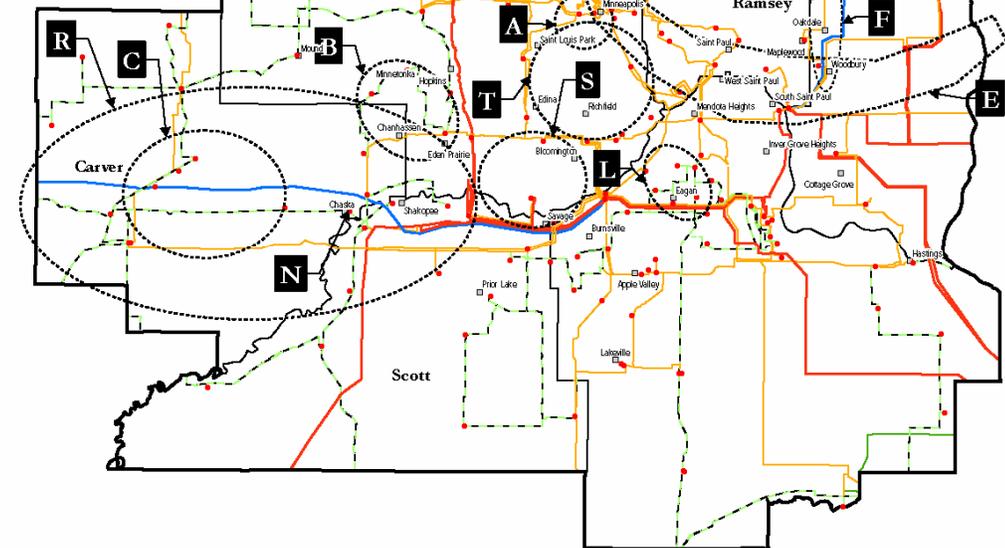
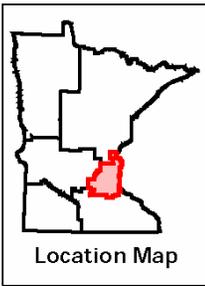
2005-CX-2 2005-CX-3	CapX 2020 Projects Brookings – Twin Cities 345 kV Twin Cities – LaCrosse 345 kV	2014		7.5.17
2007-TC-N1	Outer Metro 115 kV Development	To be Determined	Load serving infrastructure investments needed to meet growth in area demand	7.5.18
2007-TC-N2	Hyland Lake – Dean Lake Line Reconductor	2008	Load serving infrastructure investments needed to meet growth in area demand	7.5.19
2007-TC-N3	South Minneapolis Load-Serving	2010	Load serving; infrastructure investments needed to meet growth in area demand	7.5.20
2007-TC-N4	Arsenal Development and Load-Serving	To be Determined	Load serving infrastructure investments needed to meet growth in area demand	7.5.21

Map ID	Tracking Number	Description
A	2003-TC-N1	Aldrich to St. Louis Park
B	2003-TC-N2	Eden Prairie-Minnetonka Area
C	2003-TC-N3	Carver County-Waconia Area
D	2003-TC-N4	Chisago-Apple River
E	2003-TC-N5	High Bridge - Rogers Lake 115 kV line (Need King, High Bridge and Riverside Generation interconnection substations)
F	2003-TC-N8	Long Lake-Oakdale-Tanners Lake-Woodbury 115 kV line
G	2003-TC-N9	Rush City-Forest Lake-Blaine
H	2003-TC-N10	Twin Cities 345/115 kV Transformer Capacity
I	2003-TC-N12	Elk River - Ramsey - Bunker Lake Area (Enterprise Park)
J	2003-TC-N13	Minnesota-Wisconsin Stability Interface
K	2005-TC-N3	Champlin - Champlin Tap - Crooked Lake
L	2005-TC-N6	Yankee Doodle 115 kV substation conversion
M	2005-TC-N7	Twin Cities Fault Current Issue
N	2005-TC-N8	Minnesota River Generation substation interconnection
O	2005-TC-N12	Dakota County generation
P	2005-CX-2	CapX 2020 Vision Plan Brookings - Twin Cities 345 kV
Q	2005-CX-3	CapX 2020 Vision Plan Prairie Island - LaCrosse 345 kV
R	2007-TC-N1	Outer Metro 115 kV Development
S	2007-TC-N2	Hyland Lake - Dean Lake Line Reconductor
T	2007-TC-N3	South Minneapolis Load-Serving
U	2007-TC-N4	Arsenal Development and Load-Serving

## Minnesota Transmission >69kV Twin Cities Planning Zone



Legend	
●	Transmission Substation
□	Cities
---	Project Location
—	161kV AC
—	230kV AC
—	345kV AC
—	69kV AC
—	115kV AC
—	138kV AC
—	500kV AC
—	250kV DC
—	400kV DC



Grey shading denotes project not located on map because it encompasses too large an area.

### 7.5.1 Completed Projects

Some inadequacies in the Twin Cities Zone that were identified in the 2005 Biennial Report were alleviated through the construction and completion of specific projects over the last two years. Information about each of the completed projects is summarized briefly in the table below, and those matters will be removed from the list of inadequacies that are discussed in the 2007 Report. More detailed information about these projects and inadequacies can be found in the 2005 Report and in the PUC Docket for the matter if the project fell within the jurisdiction of the Public Utilities Commission, in which case the Docket Number is shown below. Also, additional information is available by contacting the designated person for the utility that was responsible for constructing the project.

Tracking Number	Utility	Description	PUC Docket	Date Completed
2003-TC-N6	Xcel Energy	Second circuit was added to existing 115 kV line between Red Rock and Rogers Lake in Dakota County	Permitted locally	2005
2003-TC-N7	GRE	New 115 kV line in Farmington area in Dakota County	Permitted by EQB	December 2006
2003-TC-N11	GRE	New 115 kV line between Plymouth and Maple Grove	TR-05-14	2006
2005-TC-N1	Xcel Energy	115 kV line between Inver Hills and Koch Refinery was reconductored and the substation was expanded and new transformers installed		Reconductoring completed in late 2006. Substation work completed mid-2007
2005-TC-N2	Xcel Energy	Structures replaced along Prairie Island – Red Rock 345 kV circuit	Minor Alteration	29 Structures replaced in 2005. 30 replaced by mid-2007.
2005-TC-N4	Xcel Energy	New combustion turbine at Blue Lake near Shakopee	CN-04-76	2005
2005-TC-N5	Xcel Energy	Eden Prairie – Edina 115 kV rebuilt to double circuit, double bundled higher capacity conductor		Mid-2007
2005-TC-N9	Xcel Energy Wright Hennepin Cooperative Electric Association	New Oakwood Substation built between Otsego and Albertville		2005
2005-TC-N10	Xcel Energy	Upgrade Goose Lake – Kohlman Lake 115 kV line		2006
2005-TC-N11	Xcel Energy	New distribution substation was added in West Hastings		Mid-2007

## 7.5.2 Aldrich to St. Louis Park

**Tracking Number.** 2003-TC-N1

**Utility.** Xcel Energy

**Inadequacy.** The Aldrich – St. Louis Park 115 kV line is subject to overload if another line in the area were to be out of service.

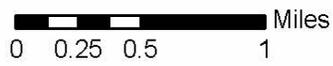
**Alternatives.** Two alternatives were identified – both alternatives involve the reconductoring of a 3.7 mile long portion of the Aldrich line to a higher capacity. Alternative 1 called for upgrading the line to an intermediate level in 2006 (310 MVA) and to a higher level by 2018 (348 MVA). Alternative 2 called for rebuilding the line to a higher level in 2006 (348 MVA). The alternatives differ in that Alternative 1 defers rebuilding of the line until more capacity is required.

A map of the area is shown on the following page.

**Analysis.** The need to upgrade the Aldrich/St. Louis Park line is documented in the Report of Study of Aldrich-St. Louis Park 115kV and Edina-Eden Prairie 115kV Transmission Line Upgrades (2005). The Aldrich/St. Louis Park line has been shown to overload when other system elements are out of service.

**Schedule.** Xcel Energy completed an upgrade of the line to a 310 MVA rating in March 2006. Approval from the Public Utilities Commission was not required to upgrade the line. The second phase of the plan – reconductoring the line to a higher capacity – will be further investigated when system planning studies demonstrate a need.

# Minnesota Transmission >69 kV Twin Cities Planning Zone 03-TC-N1: Aldrich - St. Louis Park 115 kV



WEST RIVER ROAD

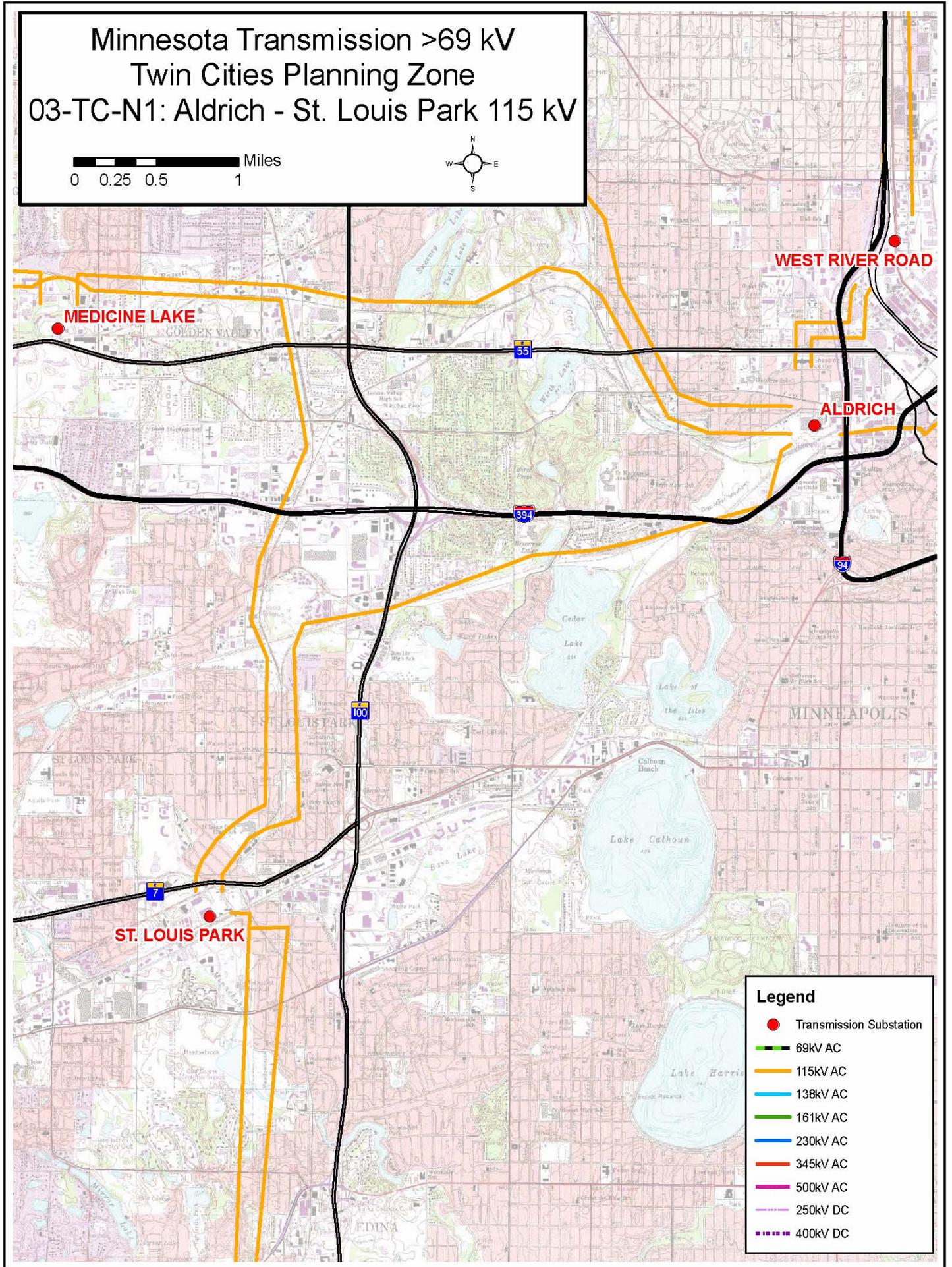
MEDICINE LAKE

ALDRICH

ST. LOUIS PARK

### Legend

- Transmission Substation
- 69kV AC
- 115kV AC
- 138kV AC
- 161kV AC
- 230kV AC
- 345kV AC
- 500kV AC
- 250kV DC
- 400kV DC



### 7.5.3 Eden Prairie – Minnetonka Area

**Tracking Number.** 2003-TC-N2

**Utility.** Xcel Energy

**Inadequacy.** The Eden Prairie – Minnetonka Area is bordered by Minnetonka Boulevard on the north, the Minnesota River on the south, and Highway 169 on the east. The western boundary includes Lake Minnetonka and the area extending south from the west end of the lake. The area includes the cities of Chanhassen, Chaska, Eden Prairie, Hopkins, southern Minnetonka, and the smaller, south Lake Minnetonka communities of Deephaven, Excelsior, Greenwood, Shorewood, Tonka Bay and Victoria.

A contingency situation, *i.e.*, the loss of the Scott County – Chaska 69 kV line, could have caused overloading of the transformers at the Westgate substation. Loss of both Eden Prairie – Westgate 115 kV lines may cause low bus voltages in the area by 2008.

A map of the area is shown on the following page.

**Alternatives.** In the 2005 Report, Xcel Energy described two alternatives for addressing this situation, both involving the upgrade of existing transmission lines and substations. Xcel Energy elected to implement Alternative 2, which called for the Westgate – Deephaven – Excelsior – Scott County 69 kV line (15 miles) to be reconducted to 107 MVA capacity, although the line is limited to 84 MVA by substation equipment. Additional rebuilds to 115 kV capacity will incur in the future.

**Analysis.** Xcel Energy elected to pursue the second alternative because it allowed the utility to postpone some costs for another five years or more, until the loads at Deephaven and Excelsior require the rebuild, and to continue to evaluate the best course of action.

Distributed generation was not considered a viable alternative because the other alternatives can be implemented quickly and without requiring new right-of-way or additional land. Also, distributed generation is a less desirable resolution in this situation due to the uncertainty of the generation being on line when a transmission failure occurs. Further, any generation facilities that were installed would also need to be fairly large to match the deliverability capability of the transmission alternatives.

**Schedule.** The 69 kV reconductor on the transmission line was upgraded and placed in service in the fall of 2006 and the substation upgrades were completed in spring 2007. The following schedule is anticipated for additional upgrades:

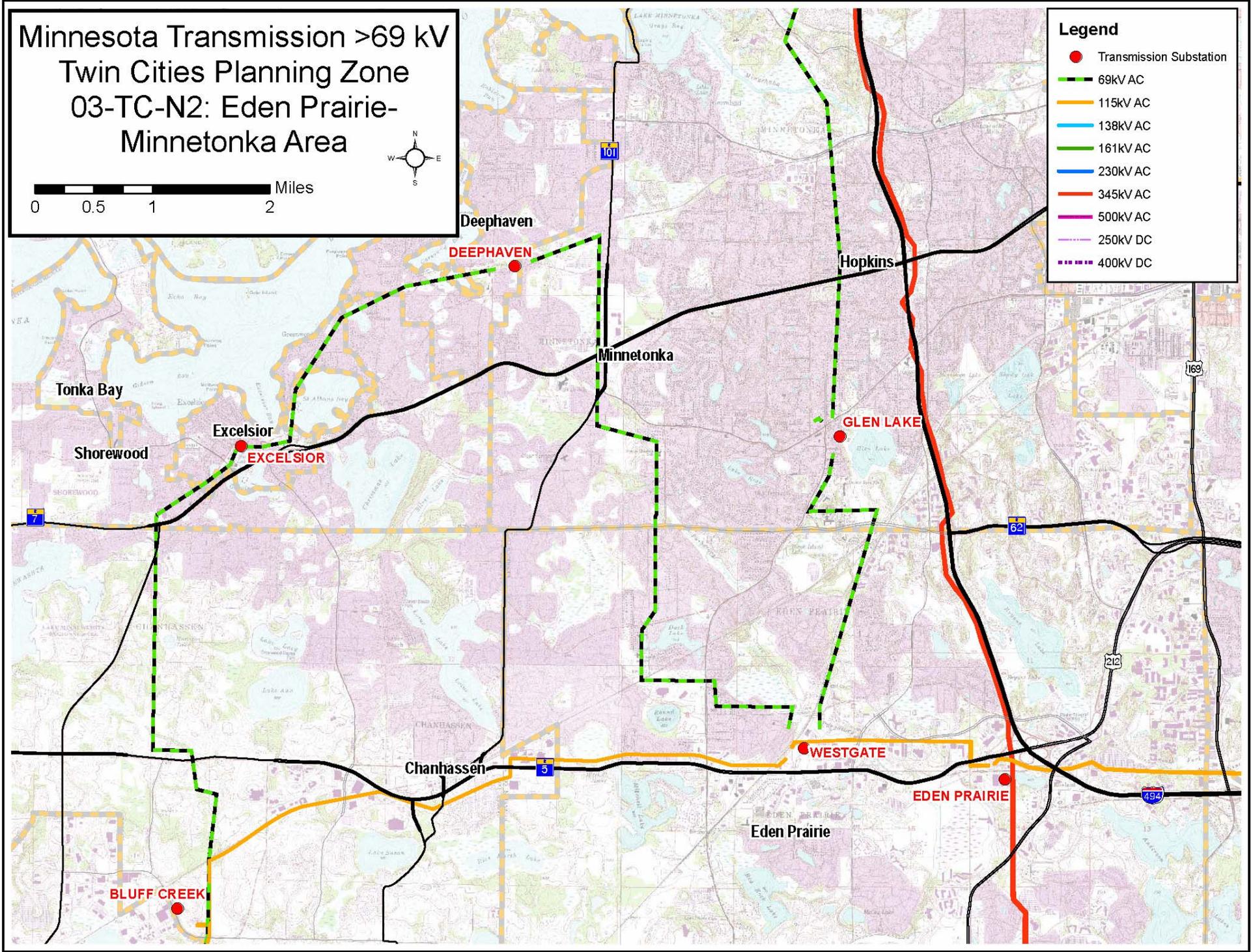
- Install a 115 kV capacitor at Westgate in 2008.
- Rebuild 15 miles of the Westgate-Deephaven-Excelsior-Scott County 69 kV line to 115 kV using 795 SSAC conductor to yield 310 MVA in 2012-2015.
- Upgrade Westgate-Eden Prairie 115 kV #1 and #2 to 600MVA in 2012-2015.

Minnesota Transmission >69 kV  
Twin Cities Planning Zone  
03-TC-N2: Eden Prairie-  
Minnetonka Area



**Legend**

- Transmission Substation
- 69kV AC
- 115kV AC
- 138kV AC
- 161kV AC
- 230kV AC
- 345kV AC
- 500kV AC
- 250kV DC
- 400kV DC



### 7.5.4 Carver County - Waconia Area

**Tracking Number.** 2003-TC-N3

**Utility.** Xcel Energy and Great River Energy

**Inadequacy.** The Carver County – Waconia Area (often called a sub-area) is bounded by Delano on the northeast, the Carver County substation on the southeast, Glencoe on the southwest, and Lester Prairie on the northwest. It includes the cities of Glencoe, Waconia, Watertown, Young America, and several smaller communities. Rapid load growth could develop in this area, as has been observed in other similarly situated communities on the fringe of the Twin Cities metropolitan area.

The Carver County – Waconia area load is served from 69 kV transmission lines that are supplied by three 115/69 kV transformers, one at the St. Bonifacius substation and two at the Carver County substation. The Glencoe Municipal Utility, GRE, and Xcel Energy all have distribution substations on the 69 kV transmission lines in this area.

A significant number of overload situations could occur today at summer peak demand under contingency conditions, like the loss of certain 69 kV or 115 kV lines or the loss of any one of a number of transformers, and the overloads will only be worse as the peak continues to grow.

A map of the area is shown on the following page.

**Alternatives.** Three alternatives were identified in 2003 and described in the 2005 Report and considered before Alternative 1 was selected for implementation. Alternative 1, referred to as the McLeod – Glencoe Option, consists of the following improvements divided into two phases and spread out over a several year period:

Phase I:

- Build 9.9 miles of new 115 kV line from McLeod-Glencoe (completed)
- Install a capacitor bank at West Waconia (completed)

Phase II:

- Rebuild 6.9 miles of the Young America Tap-Glencoe Tap 69 kV to 115 kV in 2010 timeframe.
- Rebuild 1 mile of the Carver County-Young America 69 kV line in 2008-2010 period.
- Install a second capacitor bank at West Waconia in 2010.
- Install a capacitor at Watertown in 2010.

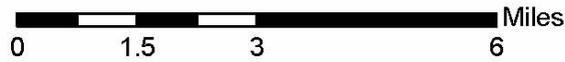
**Analysis.** Since the steps in Phase II have a reasonable amount of time until they are needed, they are being restudied to ensure their applicability. If the steps are determined to be the optimal, long-range plan, then they will be implemented as necessary. Specifically, planning

engineers will be investigating the extension of the 115 kV line from Glencoe to the east and whether it should be built to the Carver County Substation or the Glencoe Substation.

GRE will continue to explore the possibility of installing distributed generation in the area, although it is expected that multiple generation sites would be required to address the situation and these could require transmission infrastructure to be built to deliver to the load.

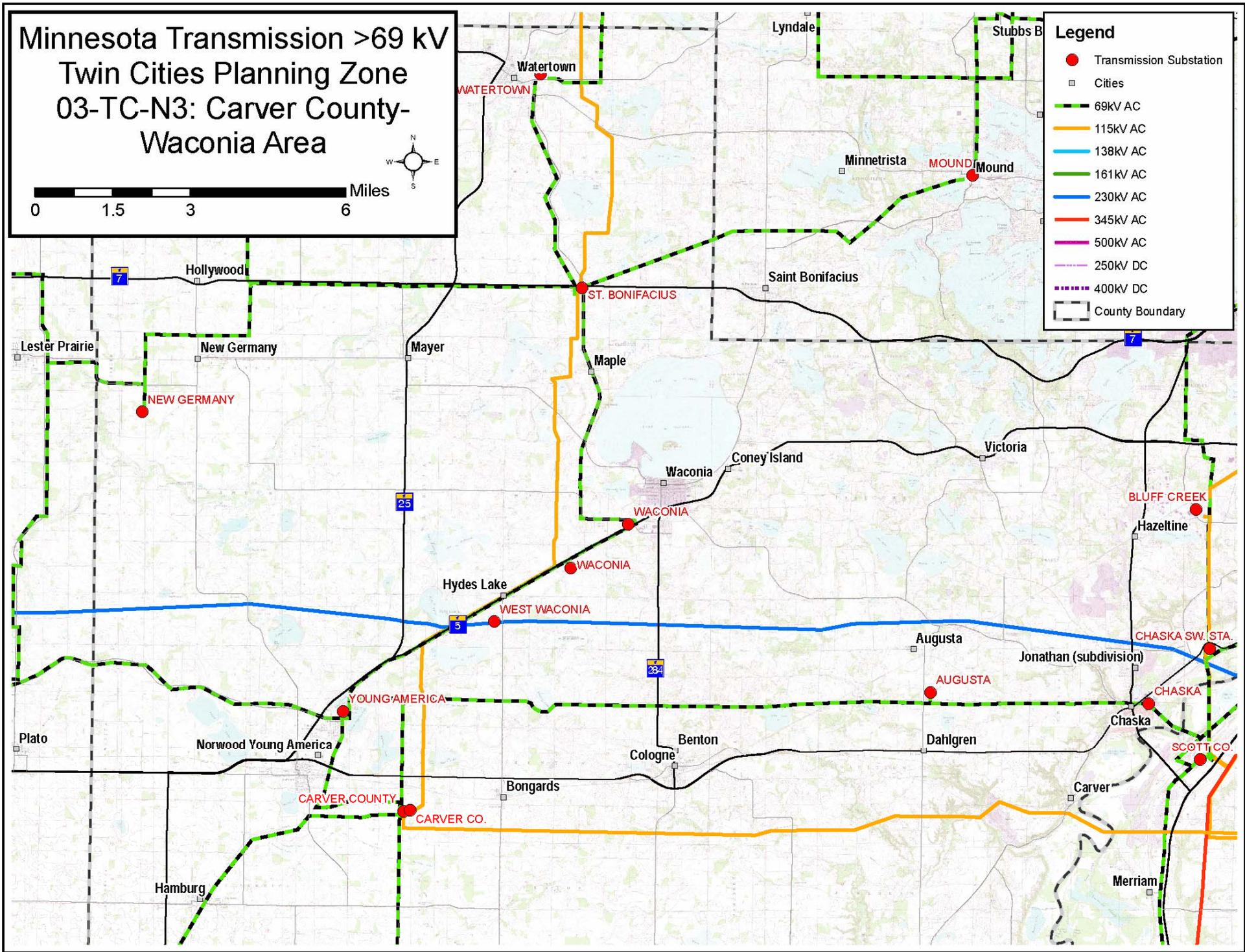
***Schedule.*** The steps under Phase I have been completed. Phase II will be implemented as necessary, with the estimated timeframes shown above.

# Minnesota Transmission >69 kV Twin Cities Planning Zone 03-TC-N3: Carver County- Waconia Area



**Legend**

- Transmission Substation
- Cities
- 69kV AC
- 115kV AC
- 138kV AC
- 161kV AC
- 230kV AC
- 345kV AC
- 500kV AC
- 250kV DC
- 400kV DC
- ▭ County Boundary



### 7.5.5 Chisago – Apple River

**Tracking Number.** 2003-TC-N4

**Utility.** Xcel Energy and Dairyland Power Cooperative

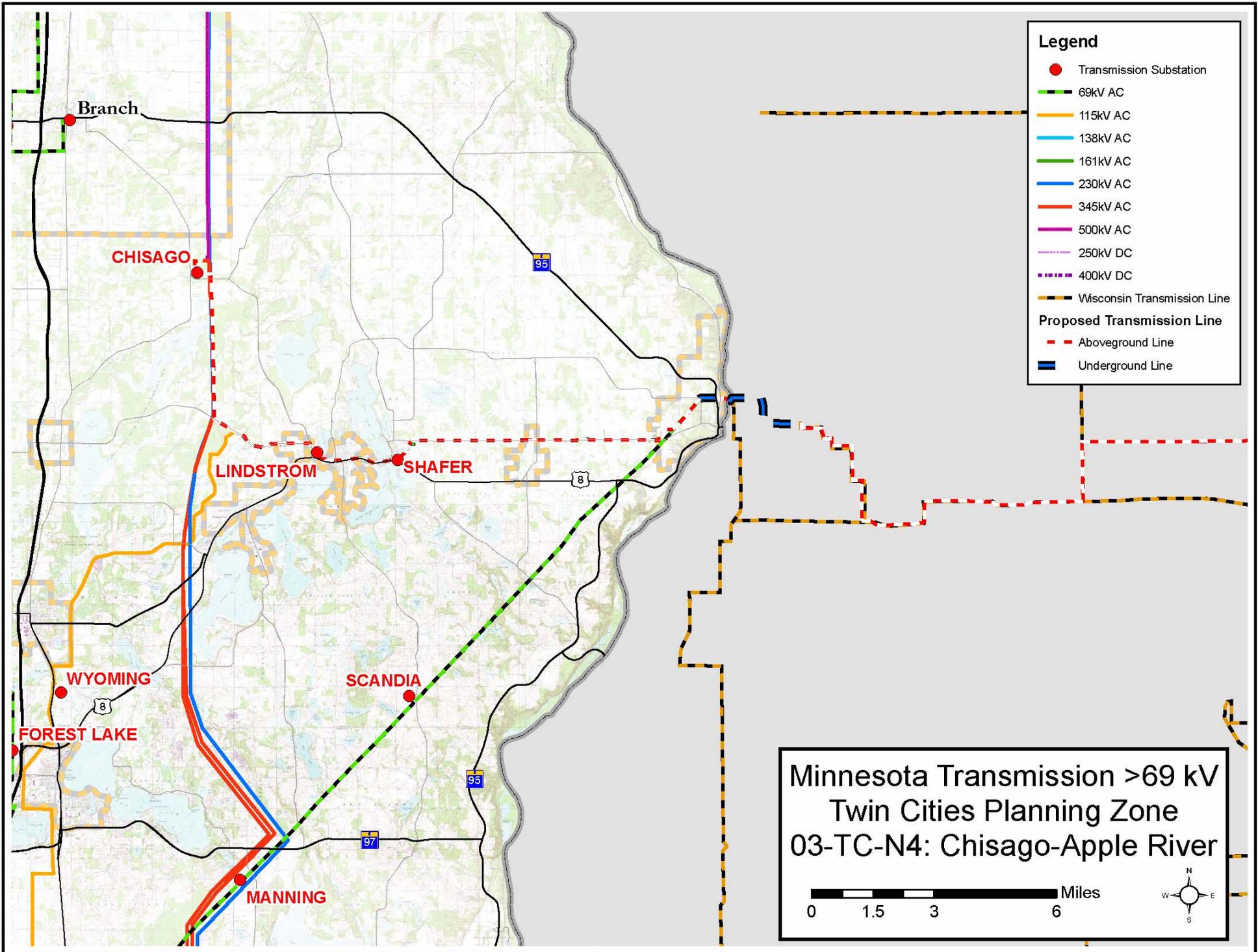
**Inadequacy.** The Chisago County – Apple River area includes Chisago County and parts of northwestern Wisconsin. The area is served by a 69 kV line running between Arden Hills and St. Croix Falls, by a 69 kV tap from the Chisago County substation to Scandia, and by the Apple River – St. Croix Falls 69 kV line from the east. Demand in the Chisago County area has increased over the past few years and is expected to continue to grow in the future. The present system cannot serve the existing demand with the loss of the Apple River – St. Croix Falls 69 kV. The loss of the Apple River – St. Croix Falls 69 kV line during times of peak loading can result in low voltage at several substations in western Wisconsin, overloading of surviving lines, and even loss of power for certain areas.

A map of the area is shown on the following page.

**Alternatives.** Four alternatives were identified in the Chisago Electric Reliability Project – East Central Minnesota and Northwestern Wisconsin Transmission Load Serving Analysis conducted in 2003. The preferred option is a rebuild of the existing 69 kV line between the Chisago County substation and the new Lawrence Creek substation to 115 kV and to 161 kV (with the majority of the section of line being a 161/69 kV double circuit) from Lawrence Creek to Apple River. This option was identified as Alternative 1 in the 2005 Report.

**Schedule.** Xcel Energy and Dairyland Power Cooperative applied to the Public Utilities Commission for a Certificate of Need and Route Permit in November 2006 for the new line between the Chisago County substation and the Wisconsin border. The Wisconsin Public Service Commission has already approved a 161 kV line on the Wisconsin side, from the Border Substation in St. Croix Falls to the Apple River substation. Energization of the entire circuit is expected in 2010.

**PUC Docket Number.** TL-06-1677 (Route Permit)



### **7.5.6 High Bridge – Rogers Lake 115 kV Line King, High Bridge and Riverside Generation Interconnection Substations**

**Tracking Number.** 2003-TC-N5

**Utility.** Xcel Energy

**Inadequacy.** As part of the Metropolitan Emissions Reduction Project (MERP), Xcel Energy proposed substantial changes at three Twin Cities power plants – the Allen S. King plant in Bayport will have new pollution control equipment installed and an additional 20 MW of output; the Riverside plant in north Minneapolis will be converted from coal to natural gas and have 125 MW of additional capacity; and the High Bridge plant in St. Paul will be replaced with a natural gas facility with a capacity increase of 311 MW.

The Midwest Independent System Operator (MISO) conducted generation interconnection studies to determine the transmission requirements for this additional generation. MISO determined that the King generation increase, which went into service in June 2007, does not overload any transmission facilities. However, MISO found that the increased capacities at the Riverside plant and the new High Bridge plant would overload the 115 kV transmission line leading from the High Bridge plant to the Rogers Lake substation in Mendota Heights.

A map of the area is shown on the following page.

**Alternatives.** Two alternatives were described in the 2005 Report: (1) Upgrade the 115 kV line between High Bridge and Rogers Lake to a higher rating, and (2) Build a new 115 kV line between the Dayton’s Bluff substation in St. Paul to the Red Rock substation in Newport.

**Analysis.** The first alternative – upgrade the line to Rogers Lake – was selected as the preferred alternative. Xcel Energy advised the Public Utilities Commission in September 2005 that it intended to upgrade the line.

**Schedule.** The upgrade of the High Bridge/Rogers Lake line will be completed in mid-2008.

**PUC Docket Numbers.** TL-05-1448 (rebuild the line)  
M-02-633 (MERP project)



### 7.5.7 Long Lake-Oakdale-Tanners Lake-Woodbury 115 kV Line

**Tracking Number.** 2003-TC-N8

**Utility.** Xcel Energy

**Inadequacy.** There is a 115 kV line located in the suburbs just east of St. Paul that runs from the Long Lake substation on the north to the Oakdale substation to the Tanners Lake substation to the Woodbury substation on the south. The loss of a separate 115 kV line from the Baytown substation feeding the Long Lake substation results in a significant overload of the line between Tanners Lake and Woodbury, and the loss of a 115 kV line from the Red Rock substation feeding the Woodbury substation causes an overload of the segments between Tanners Lake and Long Lake.

A map of the area is shown on the following page.

**Alternatives.** There are two possible alternatives: (1) Upgrade the conductors to handle a higher capacity, and (2) Install a second 115 kV line in the area.

**Analysis.** Xcel Energy decided an upgrade was preferable to construction of a new line because an upgrade was less expensive and did not require additional right-of-way. The upgrade could also be completed more expeditiously. Xcel Energy decided to upgrade the lines in two phases, first upgrading the Oakdale-Tanners Lake segment and then the Woodbury-Tanner Lake segment. This approach was acceptable from a technical standpoint and allowed the utility to spread the work and the costs out over a two year-period.

**Schedule.** The Oakdale – Tanners Lake 115 kV line upgrade was completed in mid 2007. The 2.5 mile Woodbury – Tanners Lake section of the 115 kV line is scheduled to be upgraded to higher capacity by mid-2009.



### 7.5.8 Rush City – Forest Lake-Blaine

**Tracking Number.** 2003-TC-N9

**Utility.** Great River Energy

**Inadequacy.** This area is served by two 230/69 kV sources, one from Rush City and one from Blaine. The loss of either one of these lines results in low voltages and overload problems in the area between Rush City and Blaine. By 2010, given the anticipated load growth, transformers at either end would overload if the other transformer were out of service.

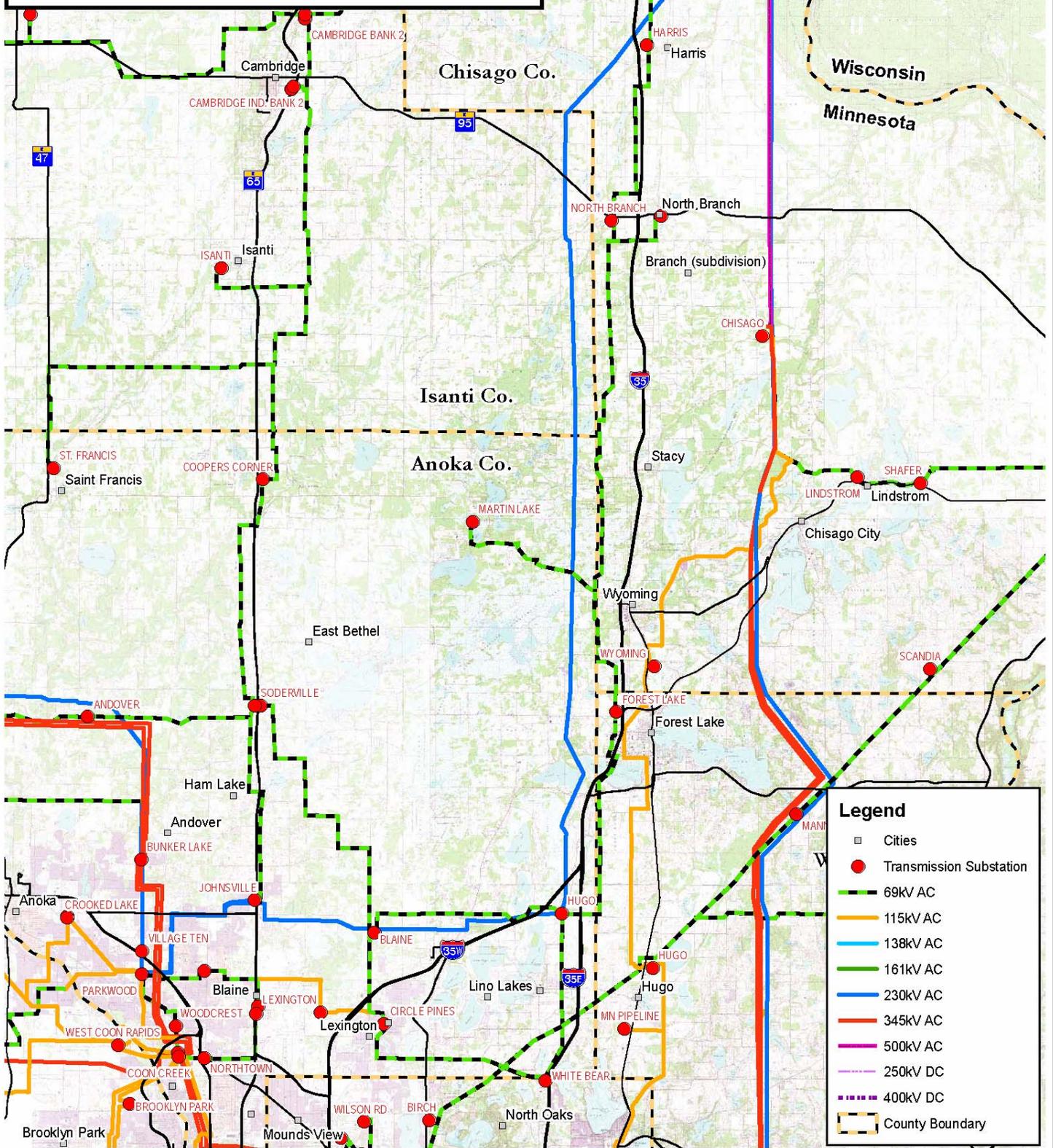
A map of the area is shown on the following page.

**Alternatives.** Three different alternatives were described in the 2005 Biennial Report. GRE has elected to go with construction of a new Linwood 230/69 kV substation.

**Analysis.** Linwood 230/69 kV will maintain voltages, relieve line overloads, and relieve transformer flow at Blaine and Rush City. It establishes a breaker station in the middle of the 69 kV system (at Linwood) that will have a strong 230 kV source. It also provides benefits to the Highway 65 corridor with a proposed 69 kV line to the Athens area, and will enhance the load serving capability that is needed in this corridor.

**Schedule.** The Linwood substation will not require a Certificate of Need as the substation will require a direct tap of the Blaine-Rush City 230 kV line. The tap will be less than 1500 feet long. This substation is expected to be in service by summer 2008.

# Minnesota Transmission >69 kV Twin Cities Planning Zone 03-TC-N9: Rush City-Forest Lake- Blaine



**Legend**

- Cities
- Transmission Substation
- 69kV AC
- 115kV AC
- 138kV AC
- 161kV AC
- 230kV AC
- 345kV AC
- 500kV AC
- 250kV DC
- 400kV DC
- - - County Boundary

### 7.5.9 Twin Cities 345/115 kV Transformer Capacity

**Tracking Number.** 2003-TC-N10

**Utility.** Xcel Energy and Great River Energy

**Inadequacy.** There are nineteen 345/115 kV or 230/115 kV transformers in the Twin Cities area. These transformers serve a majority of the Twin Cities load from remote generation from Xcel Energy's Allen S. King, Monticello, Prairie Island and Sherburne County plants, from Great River Energy's plants in North Dakota, and by hydropower from Manitoba.

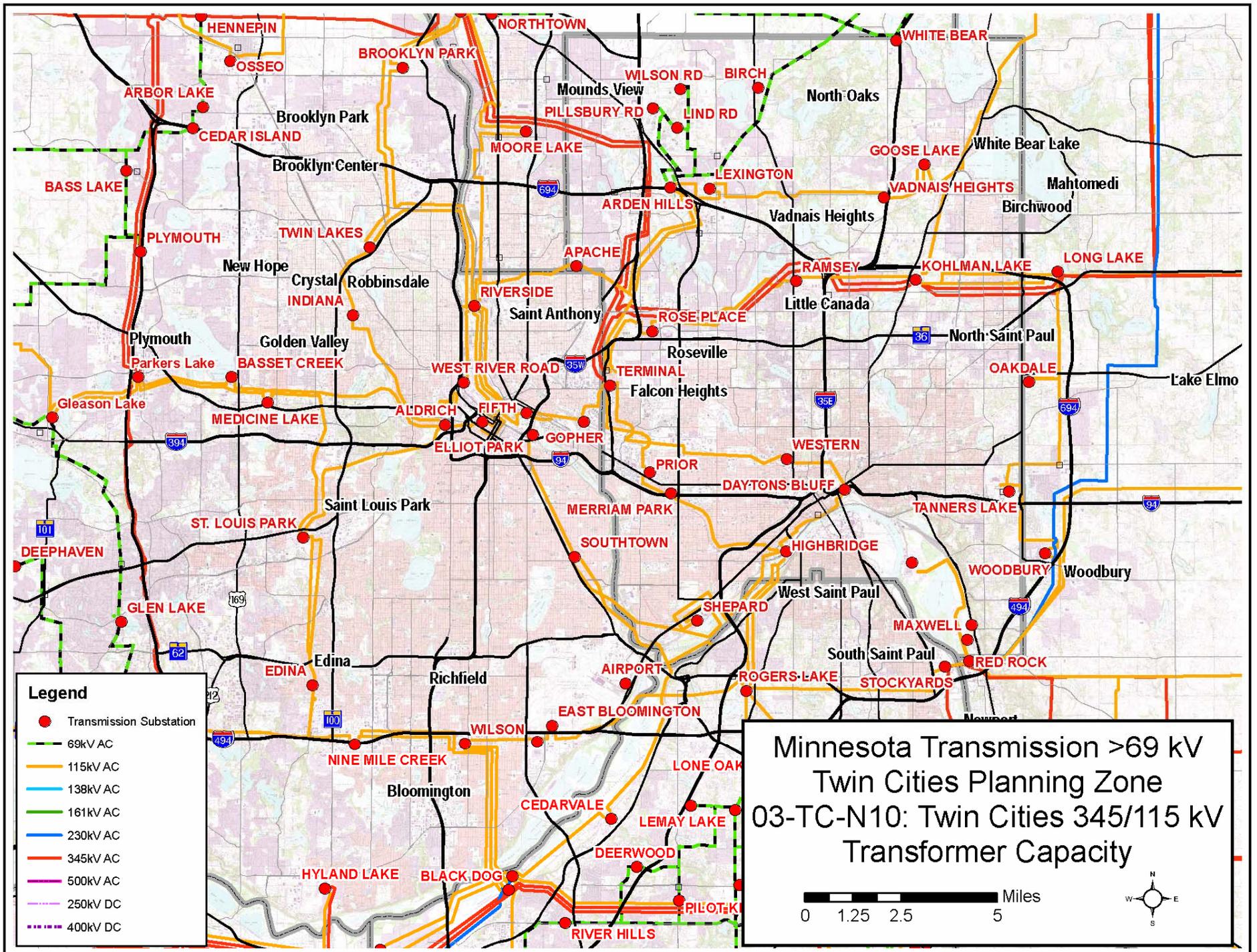
Xcel Energy has made an initial assessment of the loading on these transformers. A number of the transformers are near their emergency loading criteria. However, this is very dependent on Twin City generation schedules.

A map of the area is shown on the following page.

**Alternatives.** The two alternatives are (1) to replace existing transformers with larger capacity units or (2) install additional units at the affected substations.

**Analysis.** This is an ongoing situation that Xcel Energy and Great River Energy continuously monitor.

**Schedule.** The utilities expect that additional transformer capacity may be needed beginning in the 2009-2010 timeframe. The utilities expect that once it is determined that a new transformer is required at a substation, that the replacement can occur within six months. The utilities believe that no Certificate of Need or Route Permit will be required to replace a transformer at a substation. Precise scheduling information will be available when a specific need is foreseen.



### 7.5.10 Elk River – Ramsey – Bunker Lake Area (Enterprise Park)

**Tracking Number.** 2003-TC-N12

**Utility.** Great River Energy

**Inadequacy.** This area is served by two 230/69 kV sources, one from the Elk River substation and one from the Bunker Lake substation. The Enterprise Park substation, between the two sources, is a radial-fed substation, which means it has only one line (source) leading to it. The loss of one of the 230/69 kV sources on either end results in an overload situation on the other 69 kV line. The growth potential in this area is high because of undeveloped land along Highway 10 in Ramsey, and the problem is expected to become worse.

A map of the area is shown on the following page.

**Alternatives.** Three long-term alternatives have been under consideration for several years. As reported in the 2003 and 2005 Reports, the alternatives are:

Alternative 1: A new 115/69 kV source at Enterprise Park.

Alternative 2: Converting the 69 kV system between Elk River and Bunker Lake to 115 kV.

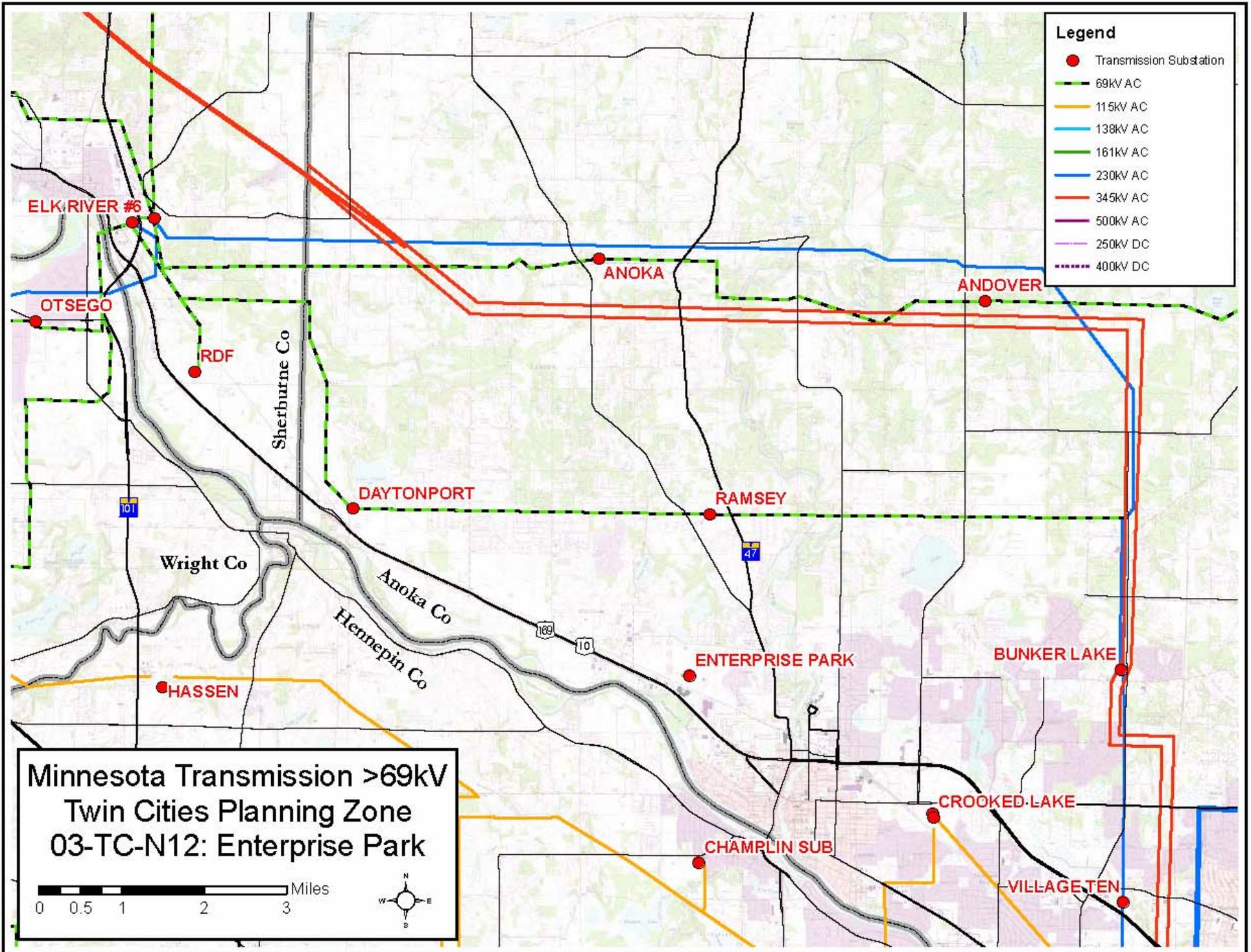
Alternative 3: Rebuild the 69 kV system between Elk River and Bunker Lake.

In addition, a short-term solution is to increase the clearance on the existing 69 kV lines, which would allow additional capacity to be placed on the lines without violating NESC line clearance standards since increased capacity would result in greater line sag.

**Analysis.** As explained in the 2005 Report, Alternative 1 is the preferred long-term solution. However, in spring 2007 Great River Energy submitted separate Certificate of Need and Site Permit applications to the Public Utilities Commission for a new 175 MW natural gas and fuel oil-fired peaking plant to be located in Elk River. This generation addition will require a portion of the existing 69 kV line to be rebuilt to higher capacity as indicated in Alternative 3.

**Schedule.** Alternative 1 remains the best least-cost, long-term solution, and is the preferred option. However, GRE will be reviewing its options for this area through its Long Range Plan which is scheduled to be completed in early 2008. The new line is less than ten miles in length so a Certificate of Need from the Commission is not required. The line is not expected to be built until 2009.

**PUC Docket Numbers.** CN-07-678 (Certificate of Need)  
GS-07-715 (Site Permit)



### 7.5.11 Minnesota – Wisconsin Stability Interface

**Tracking Number.** 2003-TC-N13

**Utility.** Several

**Inadequacy.** The Minnesota-Wisconsin Stability Interface (MWSI) is a measure of the power flowing from or through the Twin Cities area to areas south and east. The MWSI is presently a regional constraint that limits the delivery of power in MAPP and MISO. The MWSI has transmission reservations that exceed the capacity of the interface. This constraint limits the implementation of new wholesale transactions and the construction of new generation within Minnesota, even to serve Minnesota load, because parallel path flows (loop flows) often impact this interface.

**Alternatives.** A number of proposals under consideration for various purposes will help to increase the MWSI and thus alleviate the present constraint. These include the 345 kV CapX line from the southeast Twin Cities to Rochester and on to LaCrosse (Tracking No. 2005-CX-3). Other Rochester area lines would provide some expansion as well (Tracking No. 2003-SE-N1). In addition, American Transmission Company (ATC) is nearing completion of a 345 kV line from the Arrowhead Substation in northeast Minnesota to the Gardner Park Substation in east central Wisconsin.

**Analysis.** The MWSI constraint is a factor that all utilities continue to consider as they conduct their studies and determine appropriate transmission infrastructure to construct.

**Schedule.** There is no schedule specifically for the MWSI constraint but other projects affect the ability of the transmission grid to transfer power between the Twin Cities and areas to the south and east. In addition, a working group made up of engineers from Xcel Energy, Minnesota Power, and American Transmission Company is currently conducting a study which will establish a new MWSI limit upon completion of the Arrowhead – Gardner Park 345 kV line.

### 7.5.12 Champlin – Champlin Tap – Crooked Lake

**Tracking Number.** 2005-TC-N3

**Utility.** Xcel Energy

**Inadequacy.** A 115 kV line between Champlin, the Champlin Tap, and Crooked Lake in the Northwest part of the Twin Cities needs to be upgraded due to continued load growth in the vicinity of Champlin and Anoka. Certain contingency situations involving the loss of transmission lines overload the Champlin – Champlin Tap in summer peak conditions.

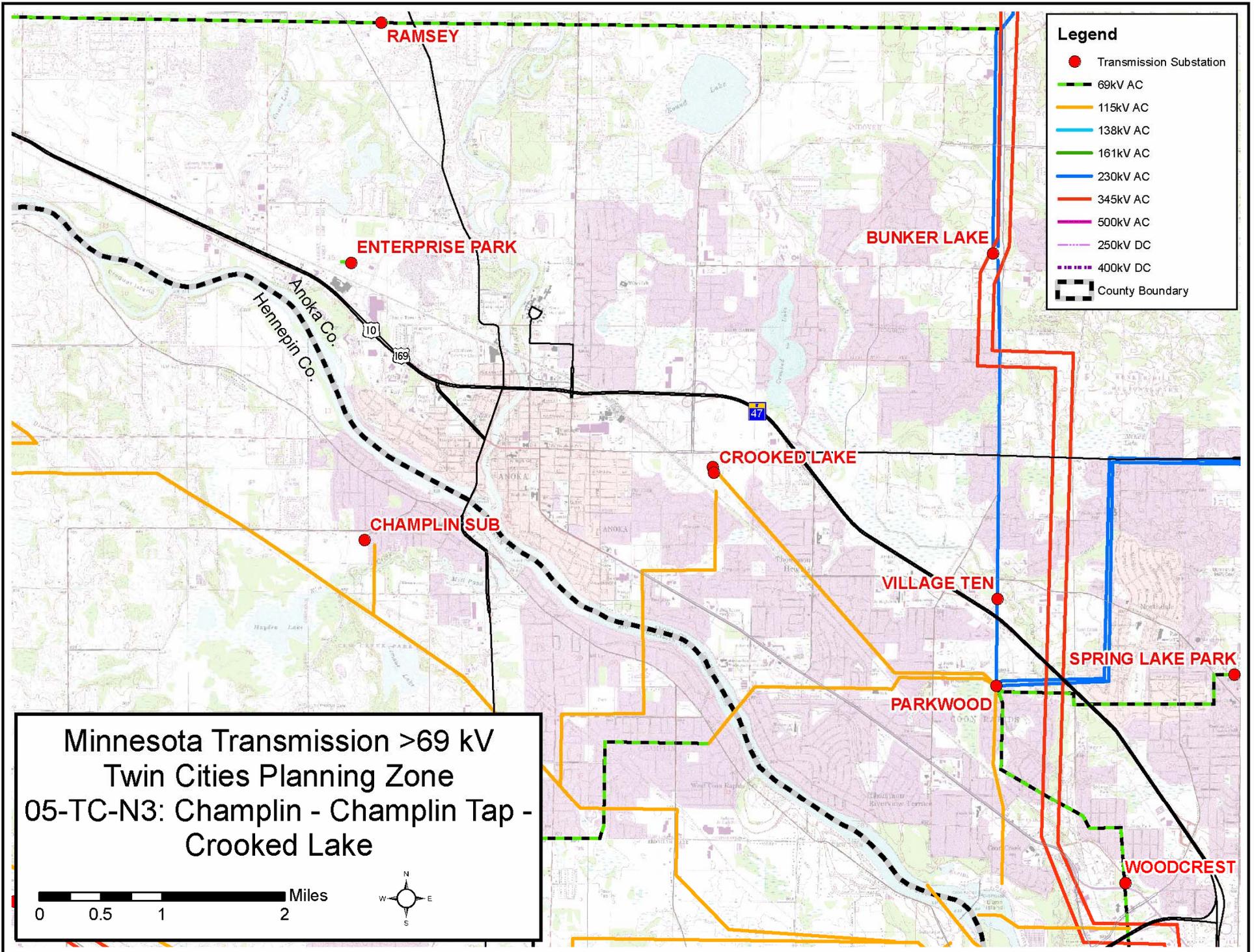
A map of the area is shown on the following page.

**Alternatives.** As described in the 2005 Report, the two possible solutions are (1) to replace the Champlin – Champlin Tap 115kV and the Champlin Tap to Crooked Lake 115kV line with a higher capacity high temperature conductor or (2) to construct a new 115 kV transmission line.

Distributed generation was not considered a viable alternative due to the uncertainty of its being on line when a transmission failure occurs and the requirement for multiple sites. The generation facilities would also need to be fairly large to match the deliverability capability of the transmission alternatives. Also, an upgrade of an existing line has less land use requirements.

**Analysis.** Xcel Energy decided in 2007 to go ahead with the upgrade of the Champlin to Champlin Tap and Champlin Tap to Crooked Lake 115 kV line.

**Schedule.** The upgrades have planned in service dates of June 2008. An operating procedure has already been put in place to quickly restore the Coon Creek 345/115 kV transformer for this condition once the upgrade is complete.



### 7.5.13 Yankee Doodle 115 kV Substation Conversion

**Tracking Number.** 2005-TC-N6

**Utility.** Great River Energy, Xcel Energy, and Dakota Electric Cooperative

**Inadequacy.** The Yankee Doodle substation, located in Eagan, is part of the Dakota Electric Cooperative system. (Dakota Electric is a member of Great River Energy). Because of load growth in the area, Dakota Electric has requested an upgrade of the substation. In addition, this substation no longer has adequate backup for its single transformer. Also, the transformer capacity of Pilot Knob Substation, which serves this 69 kV system, has also reached its limit of expansion.

A map of the area is shown on the following page.

**Alternatives.** As explained in the 2005 Report, the objective here is to convert the Yankee Doodle Substation to a two-transformer 115 kV station with two sources of high capacity 115 kV transmission. This requires a two-step process. First, a 115 kV source must be tapped into Yankee Doodle, and then a second 115 kV source must be connected.

GRE had two options for the first 115 kV source: either (1) a tap from the Lone Oak Substation, or (2) a new 115 kV line from some other substation in the Dakota County area.

There are three possibilities for introducing a second source into Yankee Doodle: (1) a Rogers Lake-Lone Oak-Yankee Doodle-Rogers Lake loop, (2) a line from the Pilot Knob substation, and (3) a line from the Inver Grove substation.

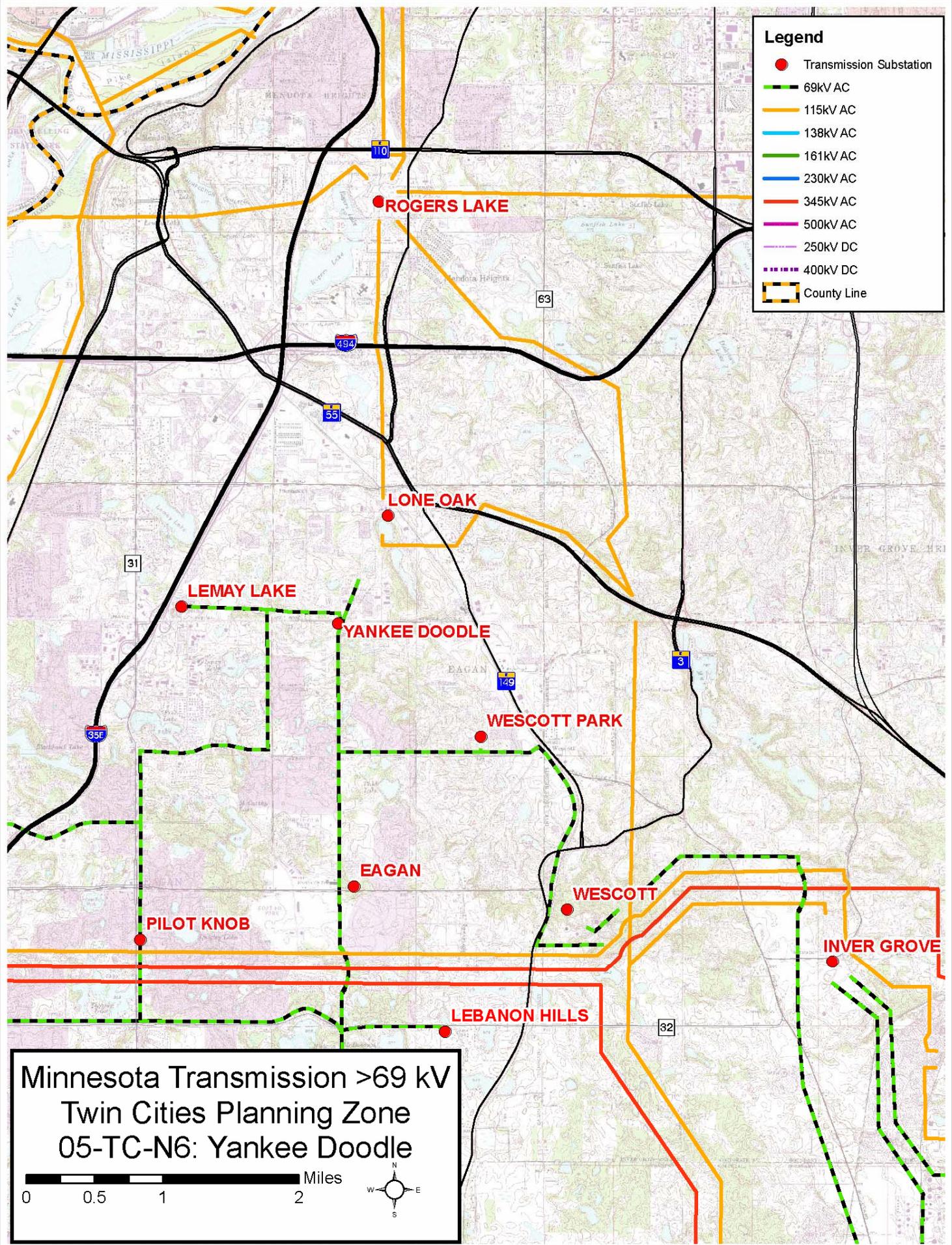
**Analysis.** GRE selected the tap from the Lone Oak Substation as the first step because it uses an existing transmission facility and requires little new transmission work. Building a new 115 kV line from another substation would require more new right-of-way.

It is still necessary to implement the second step and build another source to Yankee Doodle. Pilot Knob is the recommended source for the second 115 kV line to Yankee Doodle, based on cost and expected permitting issues. The Pilot Knob line can be double circuited the entire way whereas the Inver Grove line may require new right-of-way. Planning engineers at Xcel Energy and GRE are currently reviewing the location of the second source.

**Schedule.** Construction of the first connection from the Lone Oak substation and conversion of the Yankee Doodle Substation were completed in mid-2007. The work was permitted by the City of Eagan. The second step – another line to Yankee Doodle – is expected to be placed in service in mid-2009.

**Legend**

- Transmission Substation
- 69kV AC
- 115kV AC
- 138kV AC
- 161kV AC
- 230kV AC
- 345kV AC
- 500kV AC
- 250kV DC
- 400kV DC
- ▭ County Line



Minnesota Transmission >69 kV  
 Twin Cities Planning Zone  
 05-TC-N6: Yankee Doodle

0 0.5 1 2 Miles

### 7.5.14 Twin Cities Fault Current Issue

**Tracking Number.** 2005-TC-N7

**Utility.** Xcel Energy and Great River Energy

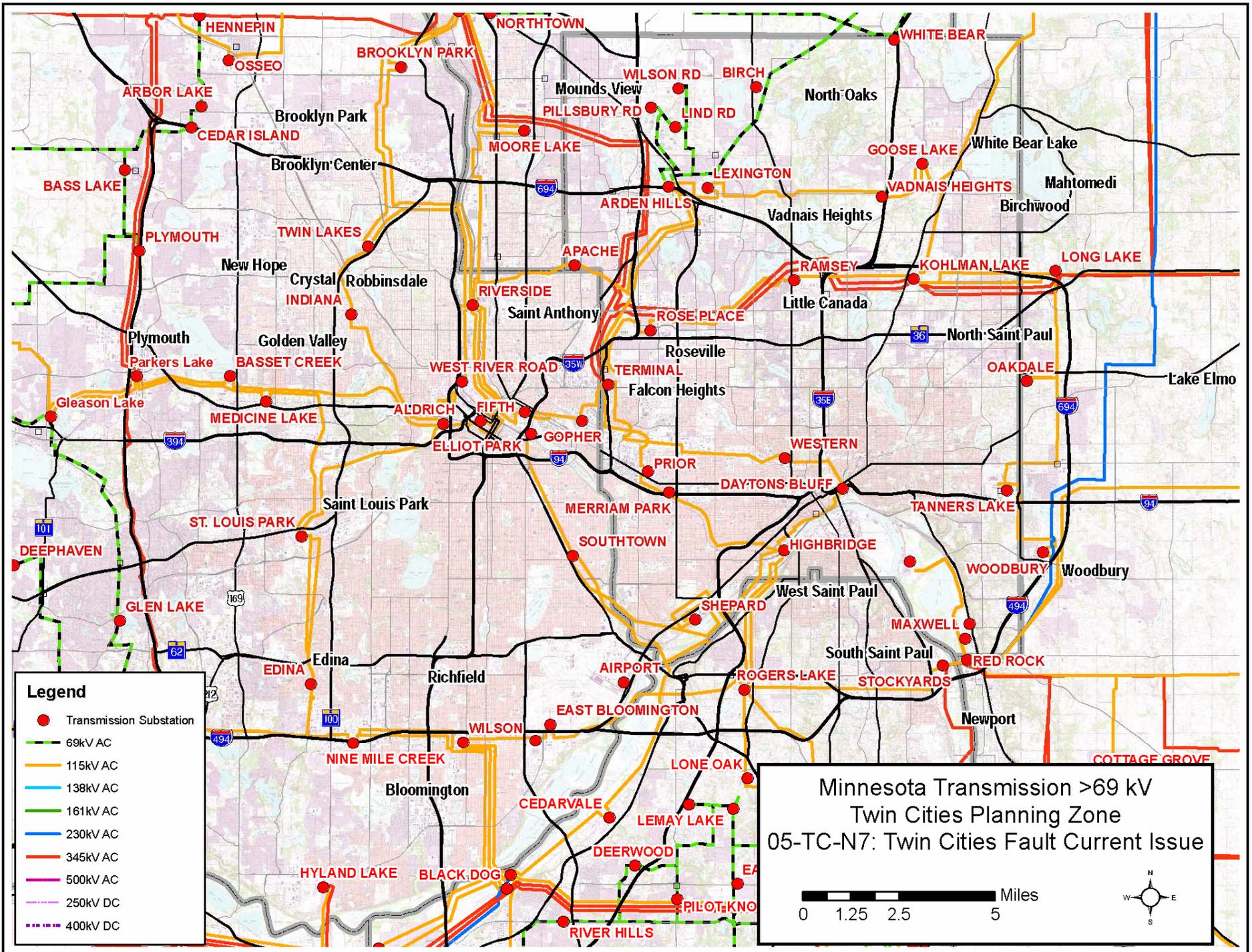
**Inadequacy.** General fault current levels on the system in the Twin Cities are increasing as transmission lines and generation are added to the transmission system. The grounding capability in the inner Twin Cities substations may be exceeded as loads continue to increase. At present there is no immediate need to address this concern. As transmission and generation facilities are added to the transmission grid, planning engineers will continue to monitor the fault currents that will result. When a potential problem is detected, a specific study will be launched to address the need.

A map of the area is shown on the following page.

**Alternatives.** Sectionalizing the system may be needed to decrease the fault current levels, but no alternatives have been identified or evaluated.

**Analysis.** These issues have not yet been evaluated at this early stage of the planning process. Until possible solutions are identified, it is not possible to determine the possible environmental impacts.

**Schedule.** The date for the planning study will be determined when a specific need is identified.



### **7.5.15 Minnesota River Generation Substation Interconnection**

**Tracking Number.** 2005-TC-N8

**Utility.** Minnesota Municipal Power Agency and the City of Chaska

**Inadequacy.** The Minnesota River Generating Station, located approximately 30 miles southeast of downtown Minneapolis, is owned by the City of Chaska, which is not a member of MISO. The plant has an existing capacity of 50 MW, and the City is proposing to install a second gas fired combustion turbine facility with a capacity of approximately 49 MW. The City will require an interconnection to the transmission system for the second unit.

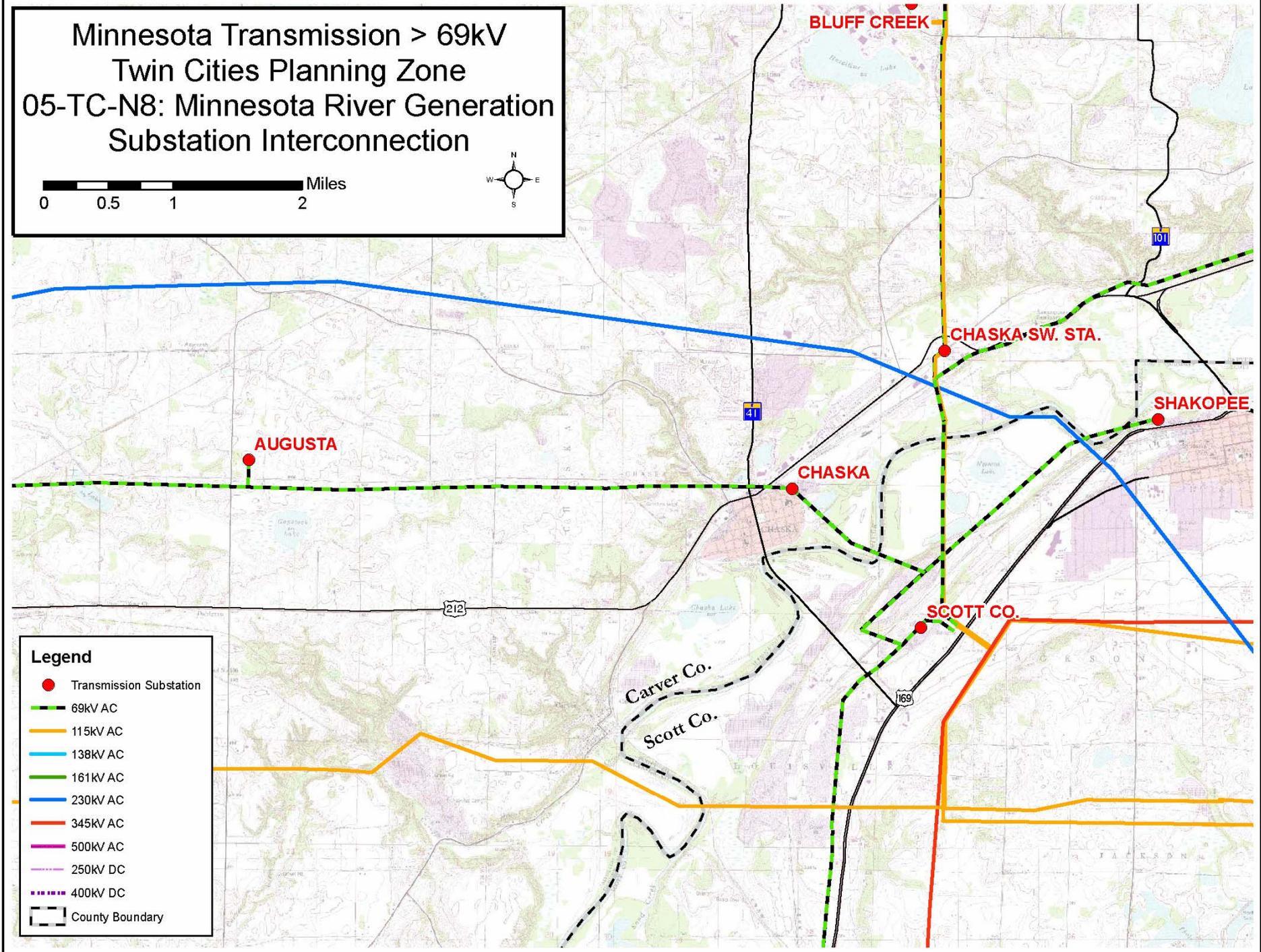
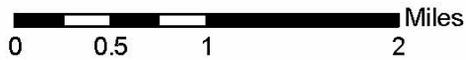
A map of the area is shown on the following page.

**Alternatives.** The new plant can be connected to the existing 115 kV Minnesota River substation without any system upgrades.

**Analysis.** The Environmental Quality Board prepared an Environmental Assessment Worksheet on the proposed power plant. All the work for this generation interconnection will be taking place within the substation owned by the City of Chaska. No work is required on the part of any neighboring utilities (Xcel Energy or GRE).

**Schedule.** The plant has a scheduled in service date of mid-2008.

Minnesota Transmission > 69kV  
 Twin Cities Planning Zone  
 05-TC-N8: Minnesota River Generation  
 Substation Interconnection



**Legend**

- Transmission Substation
- 69kV AC
- 115kV AC
- 138kV AC
- 161kV AC
- 230kV AC
- 345kV AC
- 500kV AC
- 250kV DC
- 400kV DC
- County Boundary

### 7.5.16 Dakota County Generation

**Tracking Number.** 2005-TC-N12

**Utility.** Great River Energy and Xcel Energy

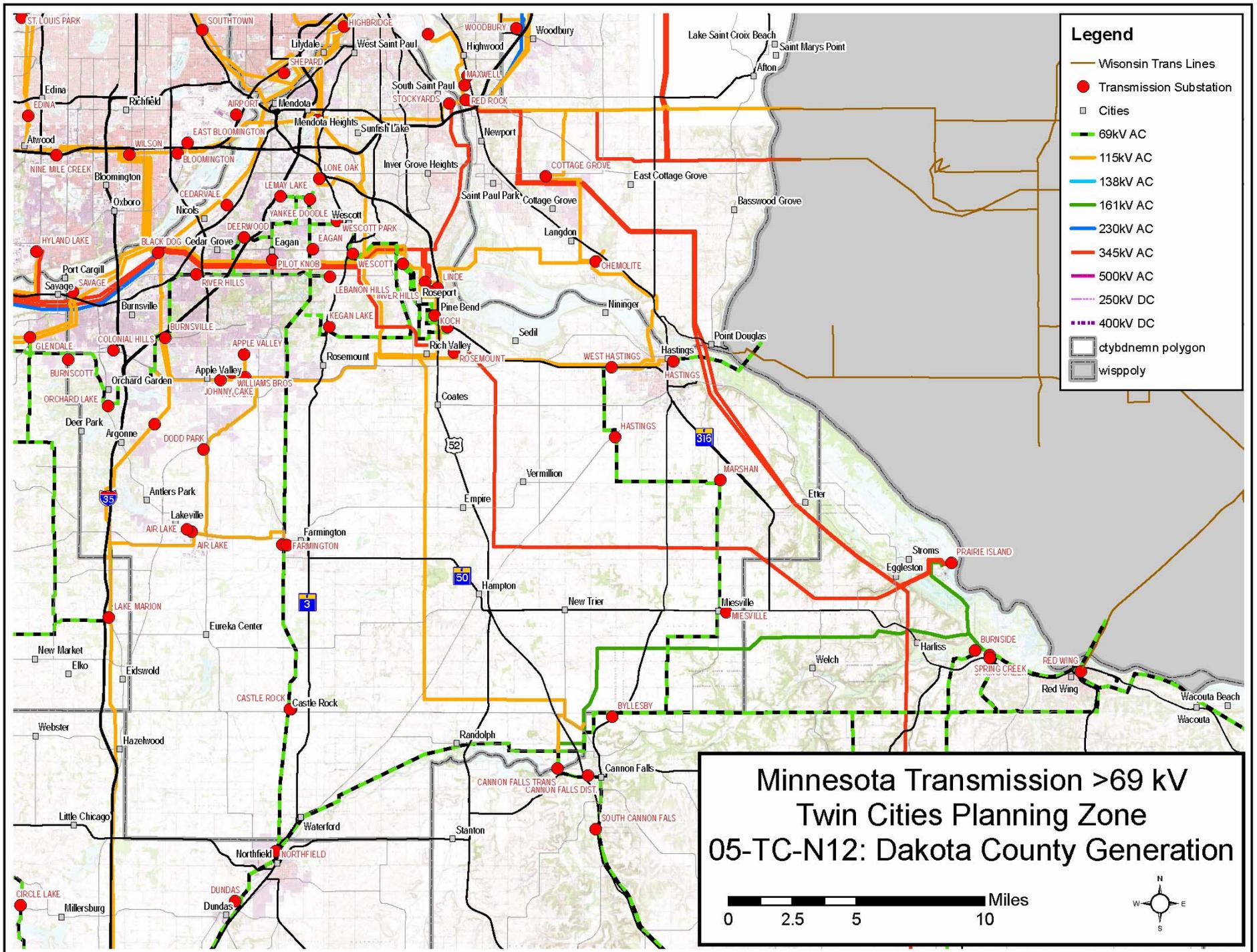
**Inadequacy.** MISO has a request in its Generation Interconnection Queue for a new generation facility in Dakota County that would consist of two-200 MW generators.

A map of the area is shown on the following page.

**Alternatives.** The Interconnection Evaluation Study showed that the most likely interconnection option involved a new 345 kV line. An alternative interconnection option involved a new 115 kV generation substation with a 115 kV transmission line to the Rosemount Substation and several other line rebuilds or upgrades.

**Analysis.** The proposed generation facility is to be located in Dakota County, Minnesota, just south and east of the Xcel Energy Rosemount Substation. The plant site is in Xcel Energy's transmission control area, however the transmission facilities that are in close proximity to the proposed site are owned by GRE and Xcel Energy.

**Schedule.** No developments have occurred over the past two years but the developer is maintaining its position in the queue. The schedule depends on the generator owner.



### 7.5.17 CapX 2020 Projects

**Tracking Number.** 2005-CX-2 (Brookings – Southeast Twin Cities 345 kV)  
2005-CX-3 (Twin Cities – LaCrosse 345 kV)

**Discussion.** The CapX 2020 Projects are discussed in detail in Section 5. One of the three CapX lines is a 345 kV line from Brookings, South Dakota, to the Southeast Twin Cities. Another CapX line located partially in the Twin Cities Zone is a 345 kV line from Brookings, South Dakota, to the Southeast Twin Cities.

### 7.5.18 Outer Metro 115 kV Development (Hennepin, Scott and Carver counties)

**Tracking Number.** 2007-TC-N1

**Utility.** Great River Energy

**Inadequacy.** The study region has been subdivided into three areas:

Area 1 – between the City of Glencoe and West Waconia. Based on the study results, the City of Glencoe would experience low voltages during the loss of its primary 115 kV source from McLeod. The loss of the 115 kV source from the Carver County Substation also results in a number of thermal and voltage problems in the area. Due to the age of the system in the region, the 69 kV lines in this area have been a source of poor reliability in the past.

Area 2 – between West Waconia and Scott County. This area is found to be a high load growth corridor. Minnesota Valley Electric Co-op is building a new distribution substation to meet the load growth in the area. The City of Chaska is proposing to build a new Bio Technology Campus near the City, which is expected to add 25 to 40 MW of new load to the area by 2015.

Area 3 – between Scott County and Westgate. This area is found to experience thermal overloads on the 115 and 69 kV lines between Scott County and Westgate under certain contingencies.

A map showing the area is found on the following page.

**Alternatives.** Two transmission alternatives have been studied as a long-term solution to the inadequacies in the region. Both alternatives consist of the construction of several sections of 115 kV lines.

Alternative 1: This alternative involves three sections of 115 kV lines.

(1) Rebuild the existing 69 kV line to 115 kV capability from City of Glencoe to Biscay Junction to Young America to West Waconia and add a new 115/ 69 kV substation near the City of Glencoe and a new 115 to 69 kV step down transformer at West Waconia.

(2) Build a double circuit 115/69 kV line between West Waconia and Scott County, involving several substations. Several options are available to accomplish this step. A double circuit 115/69 kV line could be built from West Waconia south to Carver County and terminate the existing 69 kV line. A new 115 kV circuit from the West Waconia substation eastward could be constructed by converting the existing 69 kV line through Augusta and then to Scott County. The section of new 115 kV line between Augusta and Scott County could be double circuited with the existing 115 kV line from Carver County to Scott County. An alternative is to convert the entire 69 kV line from August to Victoria tap to Chaska to Scott County.

(3) Convert the 69 kV line connecting Scott County, Excelsior, Deephaven, and Westgate to 115 kV.

Alternative 2: This alternative also involves three sections of 115 kV lines.

(1) Rebuild the existing 69 kV line from City of Glencoe to Biscay Junction to Young America to Carver County to 115 kV. This also involves adding a new 115/69 kV substation at Biscay Junction and a new 115/69 kV transformer at West Waconia.

(2) Convert the existing 69 kV line to 115 kV from Carver County to Augusta to Victoria tap to Minnesota River. For this alternative, it is assumed that the city of Chaska will be served from the 69 kV lines.

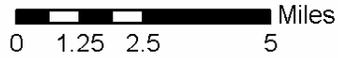
(3) Rebuild the existing 115 kV line from Scott County to Minnesota River to Bluff Creek to a higher capacity and upgrade some of the 69 kV facilities between Scott County and Westgate.

**Analysis.** As the study region is close to the Twin Cities Metropolitan Area, the analysis to date has focused on various transmission options to address the situation in this high-growth area. Initial results show that a 115 kV system should be adequate to address the need for more energy. The economic and environmental analysis and impacts of any new transmission lines are yet to be determined.

Further study is required to determine the details of the 115/69 kV substation near the City of Glencoe and transmission service to the City of Chaska. Also, the options for serving the new Bio Technology Park in Chaska need to be examined in more detail.

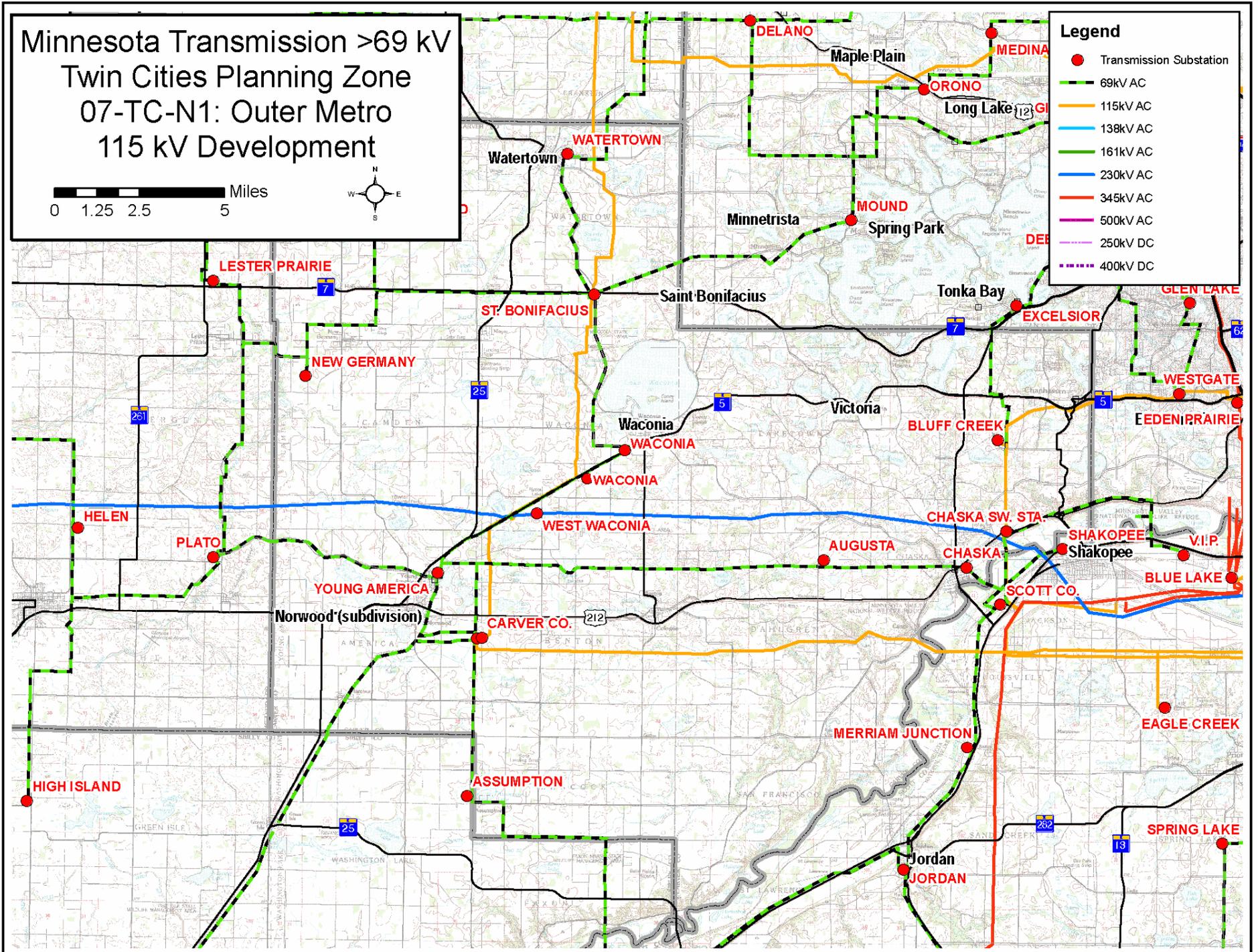
**Schedule.** While the in service date of any new project is still to be determined, planning studies indicate that improvements will be needed in the 2011 or 2012 timeframe.

Minnesota Transmission >69 kV  
 Twin Cities Planning Zone  
 07-TC-N1: Outer Metro  
 115 kV Development



**Legend**

- Transmission Substation
- 69kV AC
- 115kV AC
- 138kV AC
- 161kV AC
- 230kV AC
- 345kV AC
- 500kV AC
- - - 250kV DC
- - - 400kV DC



### 7.5.19 Hyland Lake – Dean Lake line Reconductor

**Tracking Number.** 2007-TC-N2

**Utility.** Great River Energy

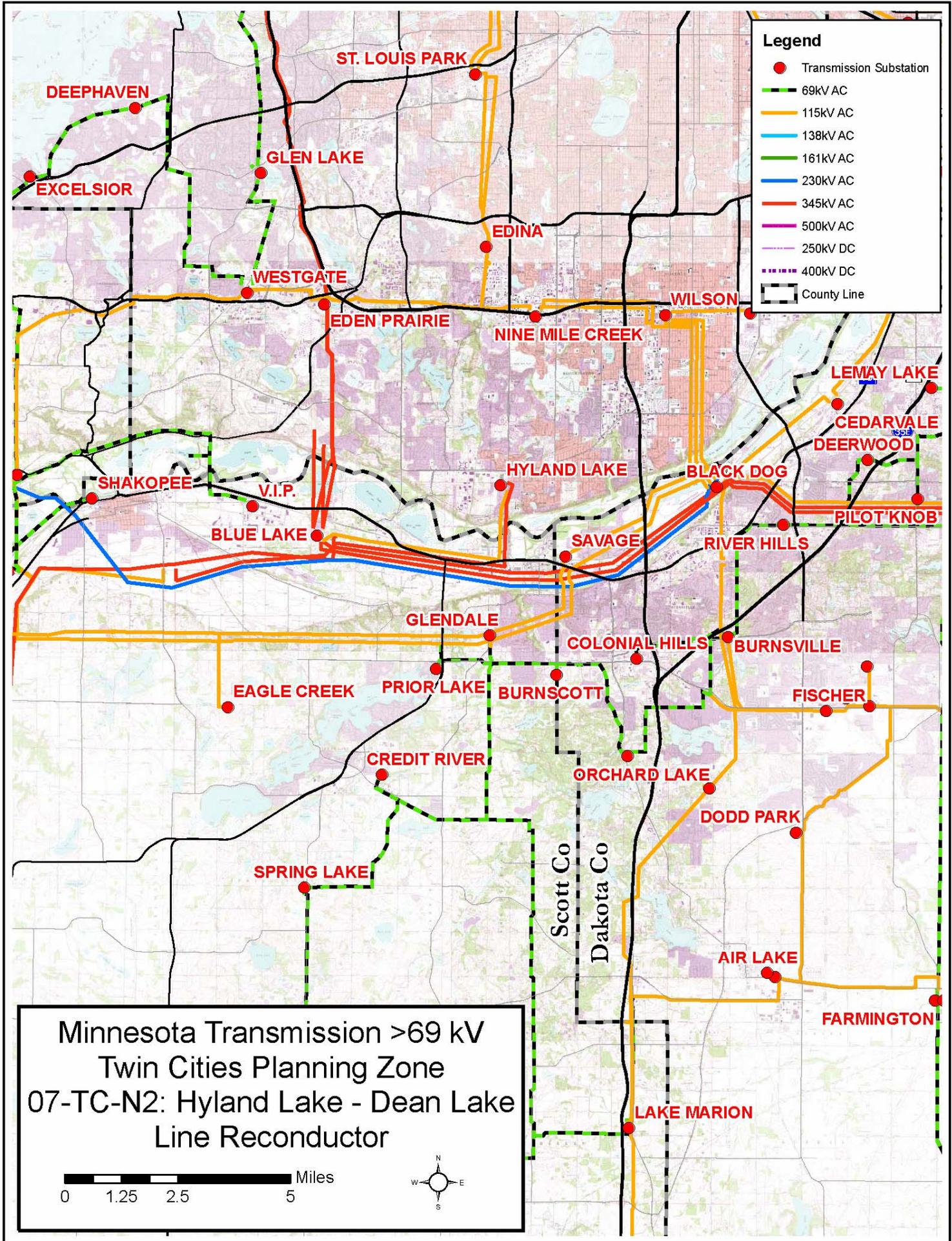
**Inadequacy.** The Hyland Lake – Dean Lake 115 kV line is found to overload for the loss of another line in the region.

A map of the area is shown on the following page.

**Alternative.** The only available alternative to this inadequacy is to upgrade the line to a higher capacity.

**Analysis.** Analysis has indicated that the loss of double circuit 115 kV line between Westgate and Eden Prairie will result in overloading the Hyland Lake – Dean Lake 115 kV line when Blue Lake units 7 and 8 are running. If not fixed, this overload could limit the output from these generators.

**Schedule.** The upgrade is scheduled to be completed in mid 2008. No Certificate of Need or Route Permit is required for the upgrade.



### 7.5.20 South Minneapolis Load-Serving Study

**Tracking Number.** 2007-TC-N3

**Utility.** Xcel Energy

**Inadequacy.** Loading on Xcel Energy's 12.4 kV distribution system in south Minneapolis has reached levels where numerous single contingencies can lead to overloads elsewhere in the system. Many of the distribution substations served by the south Minneapolis transmission loop have either reached their capacities or will in the near future, as Xcel Energy is forecasting 100 MW of load growth in south Minneapolis over the next ten years due to redevelopment in many areas of the city.

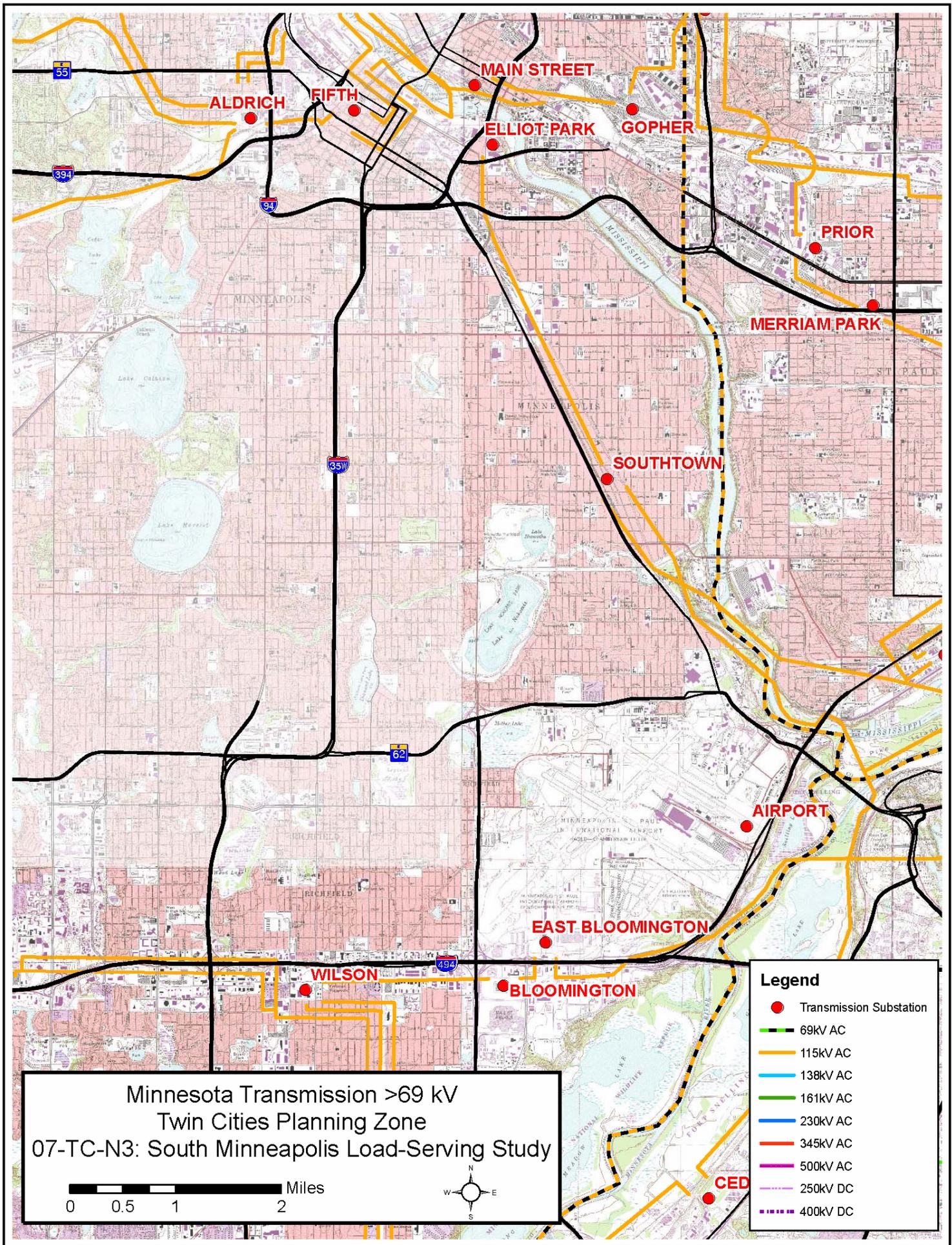
A map of the area is shown on the following page.

**Alternatives.** Initial investigation and scoping discussions have led to the development of three potential alternatives:

- (1) Construct a new 115 kV line from a new Hiawatha Substation along Highway 55 to a new Oakland Substation near Lake Street and I-35W. The line would then continue south to a new Highway 62 Substation near Highway 62 and Nicollet Avenue. The line would continue to its final termination at a new Penn Lake Substation near I-494 and Sheridan Avenue.
- (2) Similar to Option 1, but the final 115 kV line would stretch from Highway 62 Substation to the existing Wilson Substation near I-494 and Wentworth Avenue.
- (3) Construct two smaller 115 kV loops with new 115 kV lines running from Hiawatha to Oakland to Elliot Park and a second loop from Penn Lake to Highway 62 to Wilson.

**Analysis.** A load-serving study examining the alternatives is underway and is expected to be completed in early 2008.

**Schedule.** To address near-term load-serving needs, it is anticipated that the first portions of this development will need to be in service in 2010.



Minnesota Transmission >69 kV  
 Twin Cities Planning Zone  
 07-TC-N3: South Minneapolis Load-Serving Study

0 0.5 1 2 Miles



- Legend**
- Transmission Substation
  - 69kV AC
  - 115kV AC
  - 138kV AC
  - 161kV AC
  - 230kV AC
  - 345kV AC
  - 500kV AC
  - - - 250kV DC
  - · · 400kV DC

## 7.5.21 Arsenal Development and Load-Serving

*Tracking Number* 2007-TC-N4

*Utility.* Xcel Energy

*Inadequacy.* Xcel Energy has received notification from a private developer of an intent to place development on the land formerly occupied by the Twin Cities Ordnance Plant in Arden Hills. Details of this potential development are still coming forward, so the size of the new load is unknown. However, given the operational history and loading on transmission lines in the area, it is anticipated that a development of significant size will require new infrastructure to reliably serve a new load.

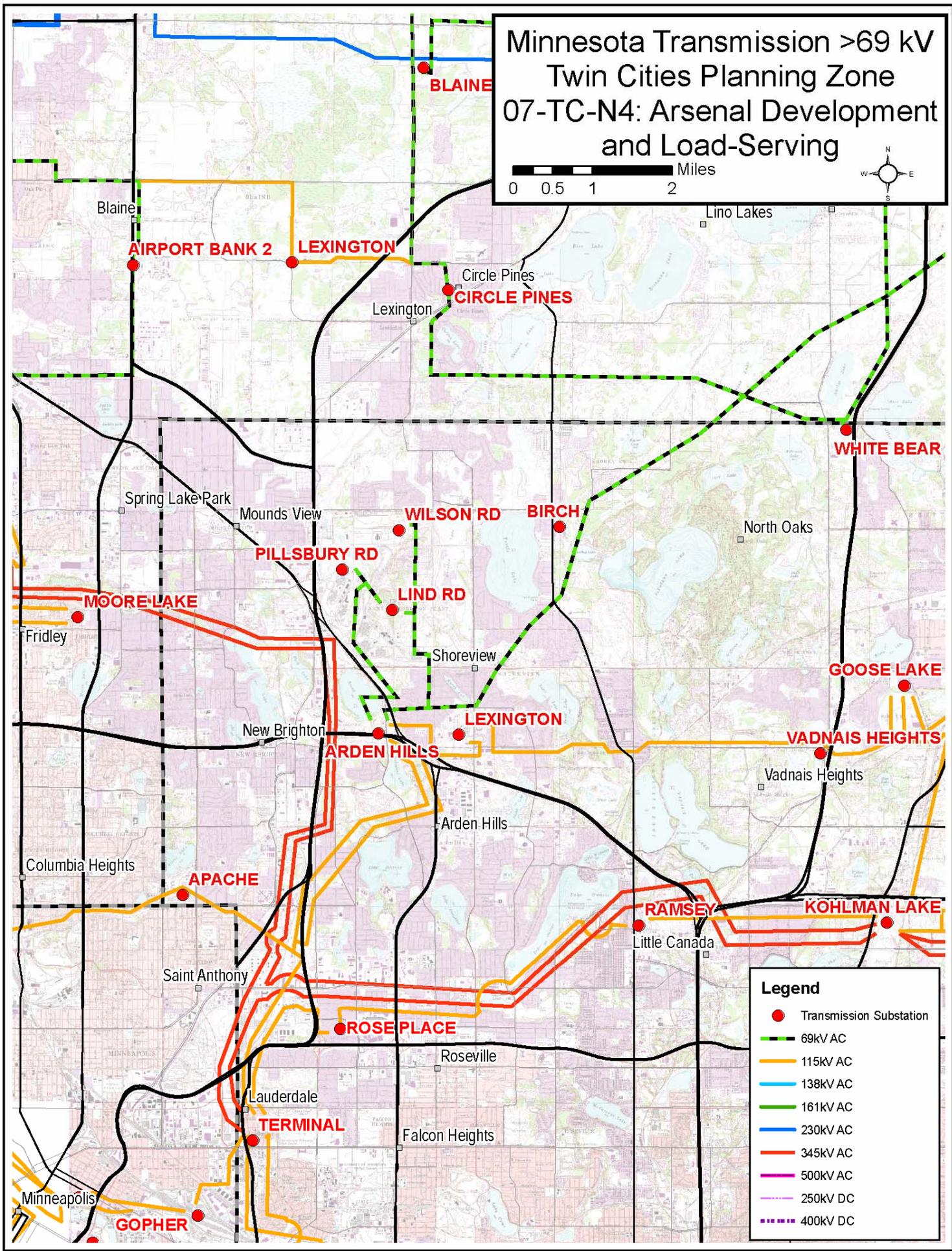
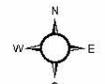
A map of the area is shown on the following page.

*Alternative.* Many details are still unknown, but the scope of transmission work could include the construction of new transmission facilities at or above 115 kV. The potential also exists that a 345/115 kV substation could be necessary.

*Analysis.* As soon as enough details are known, a load-serving study will commence. This load-serving study could begin as soon as late 2007.

*Schedule.* The timeframe is uncertain but the developer has indicated that this development could be in operation in the 2009 to 2013 timeframe.

# Minnesota Transmission >69 kV Twin Cities Planning Zone 07-TC-N4: Arsenal Development and Load-Serving



**Legend**

- Transmission Substation
- 69kV AC
- 115kV AC
- 138kV AC
- 161kV AC
- 230kV AC
- 345kV AC
- 500kV AC
- 250kV DC
- 400kV DC

**AIRPORT BANK 2**

**LEXINGTON**

**BLAINE**

**CIRCLE PINES**

**WHITE BEAR**

**WILSON RD**

**BIRCH**

**PILLSBURY RD**

**LIND RD**

**MOORE LAKE**

**GOOSE LAKE**

**ARDEN HILLS**

**LEXINGTON**

**VADNAIS HEIGHTS**

**APACHE**

**RAMSEY**

**KÖHLMAN LAKE**

**ROSE PLACE**

**TERMINAL**

**GOPHER**