



Briggs Road-La Crosse Tap 161 kV Rebuild Study

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1.0 Background and Purpose

Dairyland Power Cooperative's (DPC) Q-1 line is a 161 kV line that was constructed in 1951. The Q-1D connects Xcel Energy's (XEL) Marshland substation to La Crosse Tap where the line continues on to XEL La Crosse and the DPC Genoa substation. In the future the line will terminate at the XEL Briggs Road substation on the north side of La Crosse, Wisconsin.

In April 2013, DPC completed a study recommending the Marshland-Briggs Road 161 kV line section replacement due to age and condition and the fact that the CapX2020 Hampton-Rochester-La Crosse (HRL) 345 kV line routing would not be utilizing the Q-1D right-of-way for a majority of the Marshland-Briggs Road line section. The remaining section of the Q-1D, Briggs Road-La Crosse Tap will need to be replaced due to age and condition and line loading concerns as well. The high voltage projects in the area, HRL and the joint XEL and American Transmission Company (ATC) Badger Coulee 345 kV project will not be utilizing the Briggs Road-La Crosse Tap 161 kV right-of-way, allowing DPC to proceed with plans to replace this 161 kV line.

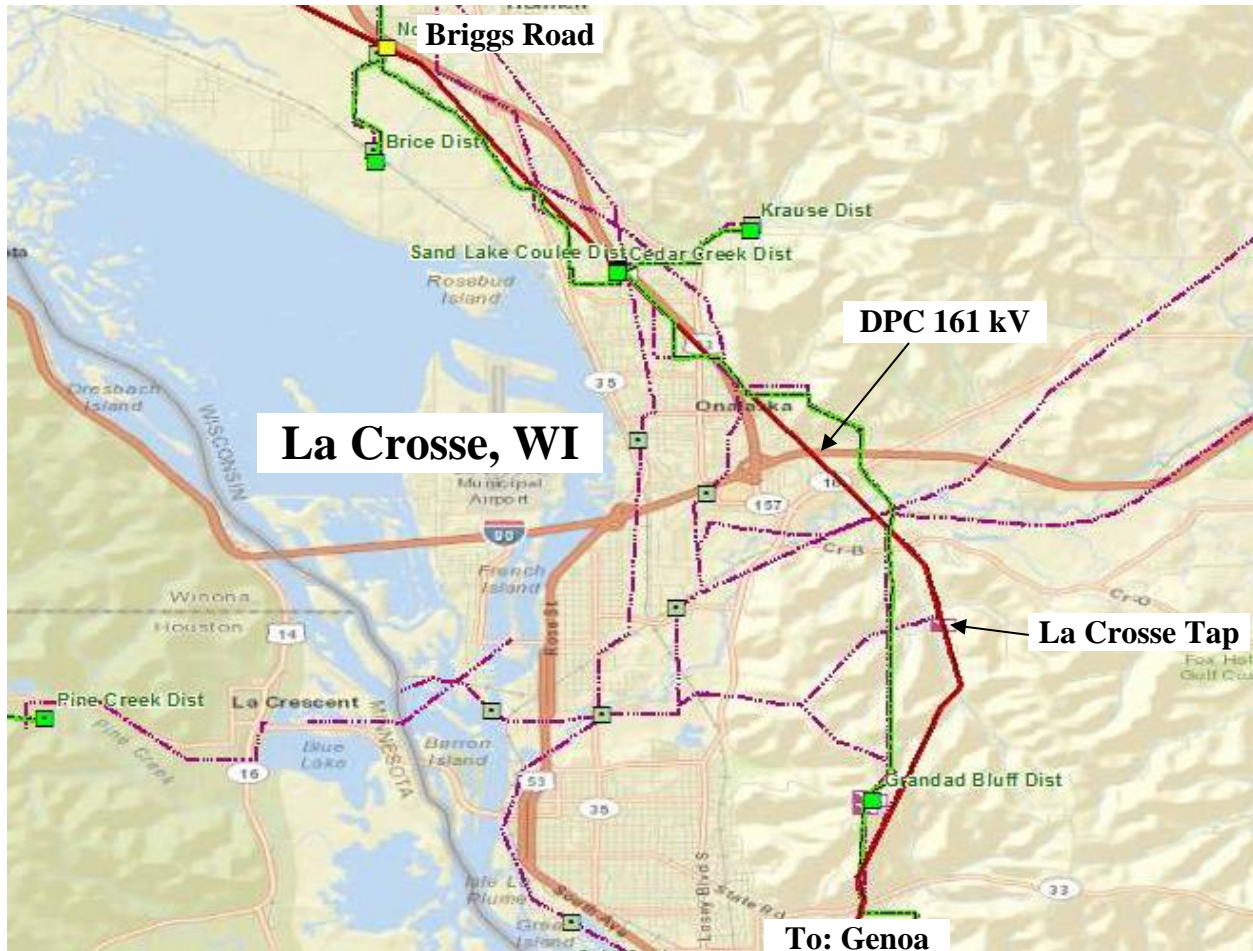


Figure 1 – Briggs Road-La Crosse Tap Area

2.0 Existing Facilities and Reliability History

The existing 161 kV line is summarized in Table 1. The line is 9.1 miles of H-frame wood pole construction with 336 ACSR conductor. There is also a short 0.59 mile section of 795 ACSS conductor in the line due to past changes where the transmission line crosses the Interstate 90 roadway. In 1988, this line was updated from 120 to 212 degree Fahrenheit design temperature primarily by raising cross arms and installing extensions for the static wires. The summer rating for this line is 162 MVA and the winter rating is 211 MVA. Both ratings are the full rating of the existing 336 ACSR conductor. This line has been in service for 62 years and is in poor condition. In recent years there has been an increase in the amount of maintenance required on this transmission line.

Briggs Road-La Crosse Tap 161 kV Line			
Facilities	Conductor Size	Miles	Year Installed
Briggs Road-La Crosse Tap	336 ACSR/ 795 ACSS	9.1	1951

Table 1 - Existing Briggs Road-La Crosse Tap

The Q-1D has had some recent history of condition related reliability issues. The ROW is typically not along road ROW, making some pole locations difficult to access during an outage. Several structure failures have occurred on the Marshland-Briggs Road section of line that is of the same vintage as the Briggs Road-La Crosse Tap section. The Marshland-Briggs Road 161 kV line section had structure failures in 2002 and 2012. Table 2 below is a recently reliability history of DPC's Q-1D 161 kV line from Genoa to La Crosse Tap and on to Marshland. When the Briggs Road substation is connected in the fall of 2014 the line will become the Briggs Road-La Crosse Tap-Genoa 161 kV line.

Outages 2009-14	2009	2010	2011	2012	2013	2014*	5 year Average
Marshland-LAC Tap-Genoa Momentary Outages	0	0	1	0	1	3	0.4
Marshland-LAC Tap-Genoa Sustained Outages	0	1	0	0	0	1	0.2

*Note: 2014 Data is through August 3, 2014

Table 2 - Q-1D Reliability History

3.0 Contingency Analysis

The La Crosse area load is primarily served from the north and south due to the geography of the Mississippi River to the west. The two 161 kV lines from the south are Genoa-Coulee and Genoa-La Crosse Tap. From the north are Briggs Road-Mayfair-La Crosse and Briggs Road-La Crosse Tap. DPC's Briggs Road-La Crosse Tap 161 kV line is one of the high voltage lines that will deliver power to the La Crosse area load from the new 345 kV source at Briggs Road that will be constructed as part of the HRL project. The Briggs Road 345/161/69 kV transmission substation will be placed in-service in late 2015. The substation will connect to DPC's

Marshland-La Crosse Tap 161 kV line and XEL’s Tremval-Mayfair 161 kV line. At the 69 kV level, the substation will connect to DPC’s North La Crosse 69 kV switching station.

A 2019 Summer Peak case from the 2014 MRO Model Series was used to review potential line loading on the Briggs Road-La Crosse Tap 161 kV line section. The line loading on this line can increase during scenarios when a generation on the south side of La Crosse (Genoa #3 or Lansing #4) is off-line, either forced or for market reasons, in addition to a line outage. The scenario of one of these generators not being online and loss of XEL’s Briggs Road-Mayfair line section was studied. The resulting power flows are summarized in Table 3 below.

Briggs Road-La Crosse Tap Contingency Analysis		
Facility	Contingency	Line Loading
Briggs Road-La Crosse Tap 161	Base Case	27% (44 MVA)
Briggs Road-Mayfair 161		48% (95 MVA)
Briggs Road-La Crosse Tap 161	Genoa #3	68% (111 MVA)
Briggs Road-Mayfair 161		72% (144.6 MVA)
Briggs Road-La Crosse Tap 161	Genoa #3 and Briggs Road-Mayfair-La Crosse 161	115% (189 MVA)
Briggs Road-Mayfair 161		Off-line
Briggs Road-La Crosse Tap 161	Lansing #4	53% (86 MVA)
Briggs Road-Mayfair 161		63% (127 MVA)
Briggs Road-La Crosse Tap 161	Lansing #4 and Briggs Road-Mayfair-La Crosse 161	92% (152 MVA)
Briggs Road-Mayfair 161		Off-line
Briggs Road-La Crosse Tap 161	Lansing #4 and Briggs Road-Mayfair 161	106% (174 MVA)
Briggs Road-Mayfair 161		Off-line

Table 3 - Briggs Road-La Crosse Tap Contingency Analysis

During scenarios where Genoa #3 is off-line and the contingency of XEL’s Briggs Road-Mayfair-La Crosse 161 kV line occurs, DPC’s Briggs Road-La Crosse Tap 161 kV line could overload to 189 MVA, 115% of its summer normal rating. Similarly, although the same scenario with Lansing #4 instead of Genoa #3 does not result in an overload, if XEL were to restore the Mayfair load from their La Crosse substation, Briggs Road-La Crosse Tap would overload to 174 MVA, 106% of its summer normal rating.

4.0 Recommended Plan

The Q-1D line is one of the oldest 161 kV lines on the DPC system. The Badger Coulee 345 kV preliminary line routing has been filed with the State of Wisconsin and will not be utilizing the DPC ROW through the City of Onalaska allowing DPC to proceed with replacement plans for this line. Recent reliability issues on other sections of the Q-1D have supported the claim that this line is in poor condition and is in need of replacement.

Additionally, this line is one of the primary outlets for power in the area once the new Briggs Road 345/161/69 kV substation is placed in-service. The Briggs Road-La Crosse Tap

transmission line could become overloaded when a local generator is off-line and the Briggs Road-Mayfair-La Crosse line is out-of-service. A larger 795 ACSS conductor would mitigate any overload concerns for this line section and increase the existing rating from 162 MVA to 400 MVA in the summer.

DPC should proceed with replacing the Briggs Road-La Crosse Tap 161 kV line on the existing ROW. Section of this line could be double circuited with DPC’s adjacent 69 kV line, the N-222 to consolidate right-of-ways. Once complete, all of the sections of DPC 161 kV line between Alma and Genoa will have been replaced. Replacing Briggs Road-La Crosse Tap with new poles and a larger conductor will address the condition issue and ensure reliable service into the future. The new conductor will also provide enough capacity for future load growth and power flows across the transmission system. The Briggs Road-La Crosse Tap section will keep the Q-1 line number for this section. A one-line of the project is in Appendix A.

For construction timing, DPC is anticipating that construction crews will move to this section once the Briggs Road-Marshland 161 kV line rebuild is complete. Based on the current schedule, this could be in early 2016.

Briggs Road-La Crosse Tap Recommended Plan				
Facilities	Conductor Size	Miles	Year Installed	Cost
Briggs Road-La Crosse Tap	795 ACSS	8.8	2016	\$11,908,000

Table 4 – Briggs Road-La Crosse Tap Recommended Plan

Appendix A – One-Line Drawing of Briggs Road-La Crosse Tap Line
Rebuild, Q-1

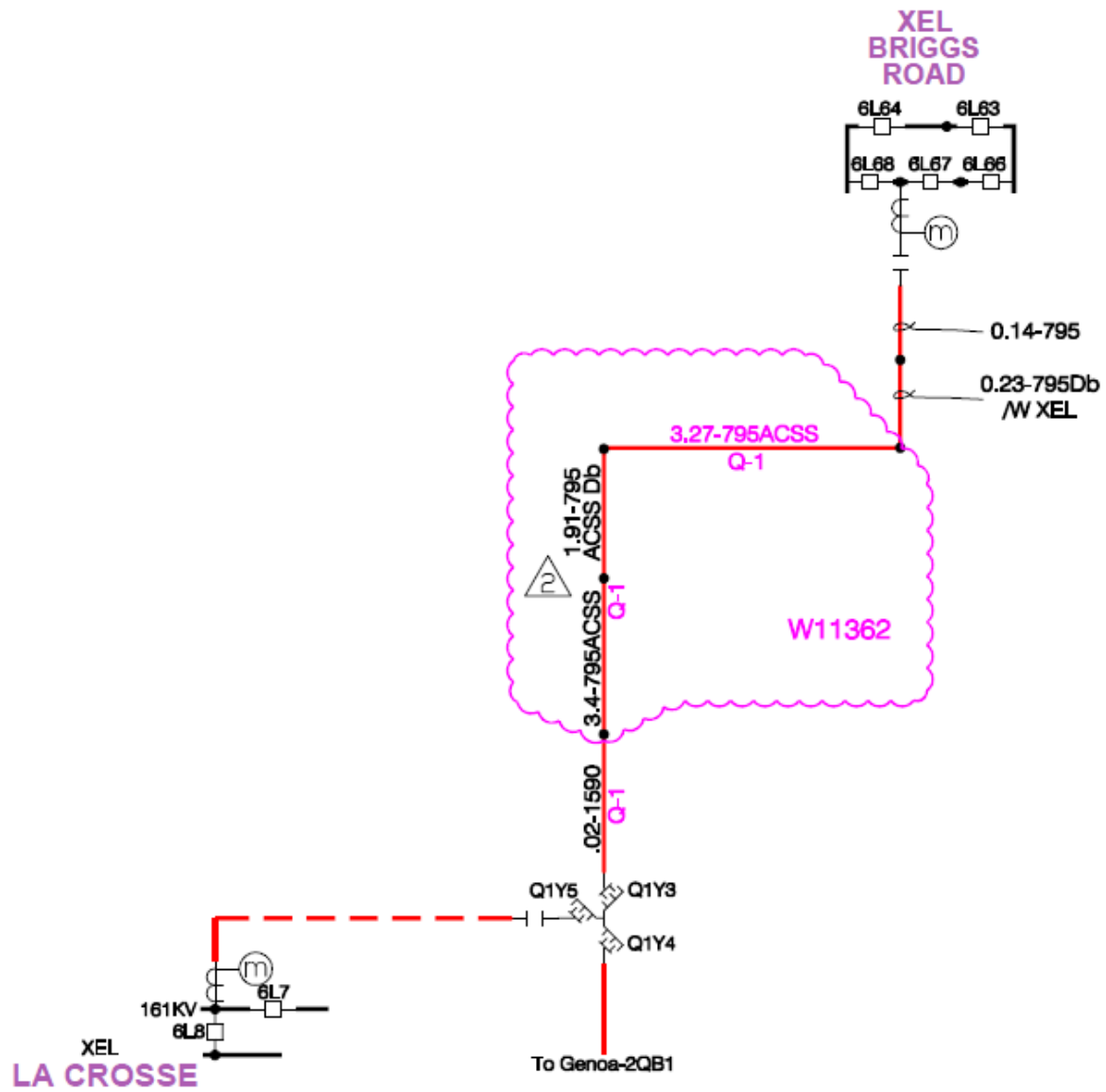


Figure 2 - Briggs Road-La Crosse Tap Project One-line