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Toronto, Ontario  
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**LOCAL PLANNING REPORT**

**Q4N THERMAL OVERLOAD**

**Region: Niagara**

**Revision: Final**  
**Date: November 11<sup>th</sup> 2016**

Prepared by: Niagara Region Study Team



CANADIAN NIAGARA POWER INC.  
A FORTIS ONTARIO Company



niagara peninsula energy inc.



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Niagara Peninsula Energy Inc.
Niagara on the Lake Hydro Inc.
Welland Hydro Electric System Corp.

## Disclaimer

This Local Planning Report was prepared for the purpose of developing wires options and recommending a preferred solution(s) to address the local needs identified in the [Needs Assessment \(NA\) report](#) for the Niagara Region that do not require further coordinated regional planning. The preferred solution(s) that have been identified through this Local Planning Report may be reevaluated based on the findings of further analysis. The load forecast and results reported in this Local Planning Report are based on the information and assumptions provided by study team participants.

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## LOCAL PLANNING EXECUTIVE SUMMARY

<b>REGION</b>	Niagara Region (“Region”)		
<b>LEAD</b>	Hydro One Networks Inc. (“Hydro One”)		
<b>START DATE</b>	16 May 2016	<b>END DATE</b>	1 November 2016
<b>1. INTRODUCTION</b>			
<p>The purpose of this Local Planning (“LP”) report is to develop and recommend a preferred wires solution that will address the local needs identified in the <a href="#">Needs Assessment (NA) report</a> for the Niagara Region. The development of the LP report is in accordance with the regional planning process as set out in the Planning Process Working Group (“PPWG”) Report to the Ontario Energy Board’s (“OEB”) and mandated by the Transmission System Code (“TSC”) and Distribution System Code (“DSC”).</p>			
<b>2. LOCAL NEEDS REVIEWED IN THIS REPORT</b>			
<p>This report reviewed the potential thermal rating violation for the Beck SS #1 x Portal Junction section of the 115kV Q4N circuit (egress out from Sir Adam Beck GS #1).</p>			
<b>3. OPTIONS CONSIDERED</b>			
<p>The following options were considered:</p> <ul style="list-style-type: none"> <li>• Option 1: Status Quo</li> <li>• Option 2: Uprate Circuit Section</li> </ul>			
<b>4. PREFERRED SOLUTIONS</b>			
<p>Option 2 is the preferred option. The uprating of limiting section of the circuit is included in Hydro One’s Sustainment plan.</p>			
<b>5. RECOMMENDATIONS</b>			
<p>It is recommended that the circuit section upgrade proceed with current with an expected in-service date of December 2019.</p>			

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## 1 Introduction

The Needs Assessment (NA) for the Niagara Region (“Region”) was triggered in response to the Ontario Energy Board’s (OEB) Regional Infrastructure Planning process approved in August 2013. The NA for the Niagara Region was prepared jointly by the study team, including LDCs, Independent Electric System Operator (IESO) and Hydro One. The NA report can be found on Hydro One’s Regional Planning website. The study team identified needs that are emerging in the Region over the next ten years (2015 to 2024) and recommended that they should be further assessed through the transmitter-led Local Planning (LP) process.

As part of the NA report for the Niagara Region, it identified that under high generation scenarios at Sir Adam Beck GS #1, the loading on the Beck SS #1 x Portal Junction section (egress out from the GS) of 115kV circuit Q4N can exceed circuit ratings in IESO’s System Impact Assessment for the [Sir Adam Beck-1 GS – Conversion of units G1 and G2 to 60 Hz](#)

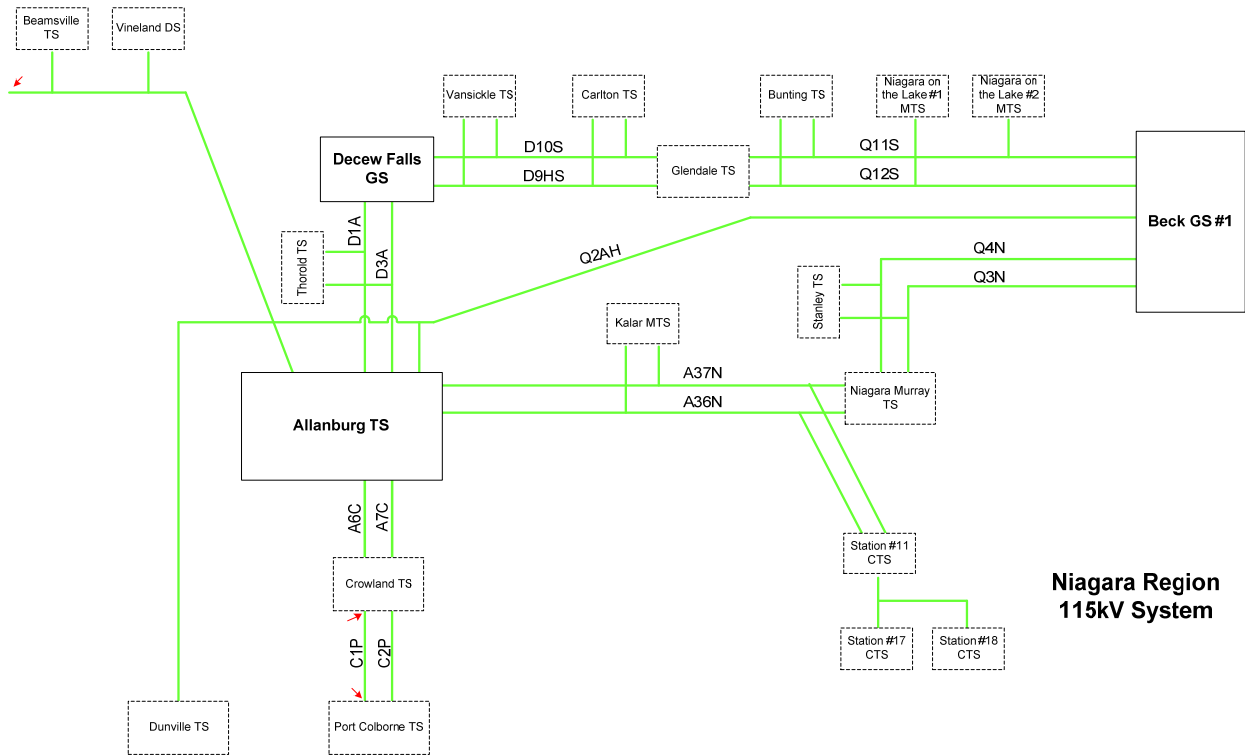
This Local Planning report was prepared by Hydro One Networks Inc. (“HONI”). This report captures the results of the assessment based on information provided by LDCs and HONI.

## 2 Regional Description and Circuit Q4N Description

Sir Adam Beck GS #1 is an 115kV hydroelectric generating station located on the Niagara Escarpment north of Niagara Falls in Queenston. Geographically, it roughly borders Highway 405 and the Canadian-American border via the Niagara River.

Electrical supply from Sir Adam Beck GS #1 is currently provided through eight (8) OPG generators connected to Hydro One’s 115kV solid ‘E’ bus inside the station. Supply to the local 115kV area is delivered via five (5) Hydro One circuits (Q2AH, Q3N, Q4N, Q11S, Q12S) from 115kV ‘E’ bus within the power house. The 115 kV ‘E’ bus serves as a switching station for the Hydro One network as well as a connection facility for OPGI’s generators. The generators, transformers and circuits on the ‘E’ bus are sectionalized via switches.

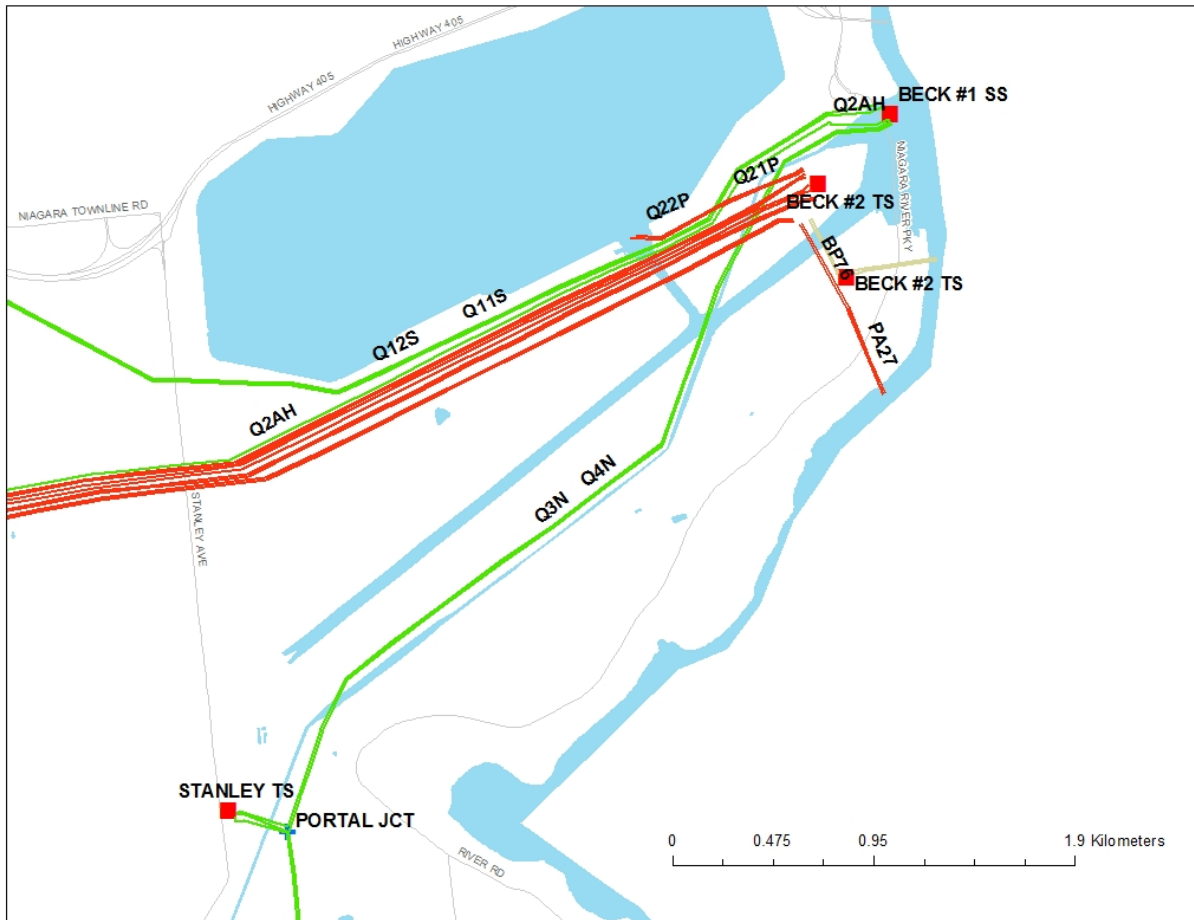
A single line diagram is shown of the 115 kV system originating from the 115kV Sir Adam Beck GS #1 in Figure 1.



*Figure 1: Single Line Diagram – Niagara Region 115kV System*

From the NA report for the Niagara Region, a possible thermal limit issue on a section of the circuit Q4N was identified. Q4N is an approximately 9 km long, 115kV radial circuit from Sir Adam Beck GS #1, supplying Stanley TS and Niagara Murray TS.

The section of Q4N identified in the NA comprises of the section from Sir Adam Beck GS #1 to Portal Junction. This section of circuit is shown in Figure 2.



*Figure 2: Single Line Diagram – Q4N from Beck #1 SS to Portal Junction*

### 3 Local Niagara Need (Q4N)

In the past decade, OPG has been steadily increasing the power output of their generators with station upgrades.

In the IESO SIA for “Sir Adam Beck-1 GS – Conversion of units G1 and G2 to 60 Hz” it was identified that the thermal loading on circuit section Q4N from Beck #1 SS to Portal junction exceeds its continuous rating by 109.6% at total generation output of Sir Adam Beck #1 GS. This study was based on 2018 summer peak demand with high generation dispatch in the 115 kV transmission system in the vicinity with the existing 8 generators and 2 future generators (G1 and G2) at full output. This thermal loading is based on an ambient 35°C temperature condition with 4 km/hr wind speed during daytime.

Reducing the generation output of Sir Adam Beck #1 GS from its maximum capacity of 556 MW to 509 MW reduces the loading on Q4N (Beck #1 SS by Portal Junction) to below its continuous rating.



## 4 Study Result / Options Considered

The conductor on a 64m section of the 115kV circuit Q4N between Sir Adam Beck SS #1 and Portal Jct. is comprised of 605.0 kcmil aluminum, 54/7 ACSR. The continuous rating for this type of conductor at 93°C is 680A. The options considered are outlined below.

### 4.1 Option 1: Status Quo

Status Quo is not an option because there is a risk that for maximum generation dispatch in extreme weather conditions. Under these conditions generation would have to be curtailed to meet line thermal rating requirements and thus causing financial losses to customer.

### 4.2 Option 2: Uprate Conductor Section

Hydro One has plans already in place to replace the existing section of conductor with a 910A continuous rated conductor at 93°C as part of their Beck #1 SS Refurbishment project. This will enable this section of circuit to meet all pre and post contingency thermal limits during max generation and under extreme weather conditions.

## 5 Recommendations

It is recommended that Hydro One continues with their sustainment plans (Option 2) on replacing the section of the 115kV circuit Q4N between Sir Adam Beck SS #1 and Portal Jct. with a larger ampacity conductor (increase of 680A to 910A).

The expected in-service date for this conduction section upgrade is December 2019.

## 6 References

- i) [Planning Process Working Group \(PPWG\) Report to the Board: The Process for Regional Infrastructure Planning in Ontario – May 17, 2013](#)
- ii) [IESO Ontario Resource and Transmission Assessment Criteria \(ORTAC\) – Issue 5.0](#)
- iii) [Needs Assessment Report Niagara Region](#)

**Appendix A: Load Forecast**

Transformer Station Name	Customer Data (MW)	Historical Data (MW)			Near Term Forecast (MW)					Medium Term Forecast (MW)				
		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
<b>Allanburg TS</b>	Net Load Forecast	33.4	35.4	29.6										
<i>Hydro One, NPEI - Embedded</i>	Gross Peak Load				31.1	31.3	31.4	31.6	32.0	32.4	32.6	32.7	32.9	33.1
	Gross Peak Load - DG - CDM				30.8	30.7	30.6	30.4	30.4	30.5	30.5	30.5	30.5	30.5
<b>Beamsville TS</b>	Net Load Forecast	53.6	55.9	49.0										
<i>Hydro One &amp; NPEI, Grimsby Power, NPEI - Embedded</i>	Gross Peak Load				54.9	55.6	56.8	58.0	59.2	59.4	59.6	59.8	60.0	60.2
	Gross Peak Load - DG - CDM				54.1	54.2	55.0	55.5	56.1	55.8	55.6	55.5	55.4	55.3
<b>Bunting TS</b>	Net Load Forecast	58.3	55.9	49.6										
<i>Horizon Utilities</i>	Gross Peak Load				53.1	53.3	53.4	53.5	53.7	53.8	53.9	54.1	54.2	54.3
	Gross Peak Load - DG - CDM				52.5	52.1	51.8	51.4	51.0	50.7	50.5	50.3	50.2	50.1
<b>Carlton TS</b>	Net Load Forecast	100.1	98.3	76.7										
<i>Horizon Utilities</i>	Gross Peak Load				78.4	79.5	79.7	79.9	80.1	80.3	80.5	80.7	80.9	81.1
	Gross Peak Load - DG - CDM				77.6	77.8	77.5	76.8	76.1	75.7	75.4	71.6	71.4	71.2
<b>Crowland TS</b>	Net Load Forecast	89.1	93.6	74.6										
<i>Welland Hydro &amp; Hydro One, CNPI - Embedded</i>	Gross Peak Load				75.2	77.5	78.5	80.0	81.0	82.0	83.0	84.0	85.0	86.0
	Gross Peak Load - DG - CDM				70.4	71.9	72.3	72.9	73.0	73.3	73.8	74.2	74.8	75.3
<b>Dunnville TS</b>	Net Load Forecast	25.3	27.0	24.1										
<i>Hydro One</i>	Gross Peak Load				24.1	24.3	24.4	24.5	24.7	24.9	25.0	25.1	25.2	25.4
	Gross Peak Load - DG - CDM				19.8	19.7	19.6	19.4	19.4	19.3	19.3	19.3	19.3	19.3

Transformer Station Name	Customer Data (MW)	Historical Data (MW)			Near Term Forecast (MW)					Medium Term Forecast (MW)				
		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
<b>Glendale TS</b>	Net Load Forecast	61.5	59.1	60.1										
<i>Horizon Utilities</i>	Gross Peak Load				66.5	62.5	62.6	62.8	62.9	63.1	63.2	63.4	63.5	63.7
	Gross Peak Load - DG - CDM				65.7	61.0	60.7	60.2	59.7	59.3	59.1	58.9	58.8	58.6
<b>Kalar MTS</b>	Net Load Forecast	39.5	38.6	33.9										
<i>NPEI</i>	Gross Peak Load				39.8	40.0	40.2	40.4	40.6	40.8	41.0	41.2	41.4	41.6
	Gross Peak Load - DG - CDM				39.4	39.2	39.1	38.8	38.6	38.5	38.4	38.4	38.4	38.4
<b>Niagara Murray TS</b>	Net Load Forecast	97.0	101.7	90.2										
<i>Hydro One &amp; NPEI</i>	Gross Peak Load				89.7	90.0	90.4	90.7	91.0	91.4	91.7	92.0	92.4	92.7
	Gross Peak Load - DG - CDM				88.9	88.3	88.0	87.4	86.9	86.5	86.3	86.2	86.1	86.0
<b>Niagara On the Lake #1 MTS</b>	Net Load Forecast	23.8	22.3	22.3										
<i>Niagara On the Lake</i>	Gross Peak Load				24.9	25.3	25.7	26.1	26.5	26.9	27.3	27.7	28.1	28.5
	Gross Peak Load - DG - CDM				24.7	24.8	25.0	25.1	25.2	25.3	25.6	25.8	26.1	26.3
<b>Niagara On the Lake #2 MTS</b>	Net Load Forecast	20.7	22.6	18.3										
<i>Niagara On the Lake</i>	Gross Peak Load				18.9	19.2	19.5	19.8	20.1	20.4	20.7	21.0	21.3	21.7
	Gross Peak Load - DG - CDM				18.8	18.8	19.0	19.0	19.1	19.2	19.4	19.6	19.8	20.0
<b>Niagara West MTS</b>	Net Load Forecast	47.5	43.5	35.7										
<i>Grimsby Power, NPEI Embedded</i>	Gross Peak Load				35.8	35.9	36.1	36.5	36.7	37.0	37.2	37.6	37.8	38.1
	Gross Peak Load - DG - CDM				34.4	34.2	34.0	34.0	33.8	31.2	31.2	31.4	31.4	31.5

Transformer Station Name	Customer Data (MW)	Historical Data (MW)			Near Term Forecast (MW)					Medium Term Forecast (MW)				
		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
<b>Stanley TS</b>	Net Load Forecast	59.8	58.9	52.4										
<i>NPEI</i>	Gross Peak Load				52.7	52.9	53.1	53.3	53.5	53.7	53.9	54.1	54.3	54.5
	Gross Peak Load - DG - CDM				52.1	51.7	51.5	51.1	50.8	50.5	50.4	50.3	50.3	50.2
<b>Station 17 TS</b>	Net Load Forecast		16.1	16.6										
<i>CNP</i>	Gross Peak Load				16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6
	Gross Peak Load - DG - CDM				16.4	16.2	16.1	15.9	15.8	15.6	15.5	15.5	15.4	15.3
<b>Station 18 TS</b>	Net Load Forecast		32.3	35.2										
<i>CNP</i>	Gross Peak Load				35.2	37.7	40.2	40.2	40.2	40.2	40.2	40.2	40.2	40.2
	Gross Peak Load - DG - CDM				34.8	36.9	39.1	38.6	38.2	37.9	37.7	37.4	37.3	37.1
<b>Port Colborne TS</b>	Net Load Forecast		40.2	35.7										
<i>CNP</i>	Gross Peak Load				30.8	30.8	30.8	30.8	30.8	30.8	30.8	30.8	30.8	30.8
	Gross Peak Load - DG - CDM				30.3	30.0	29.8	29.4	29.1	28.9	28.7	28.5	28.4	28.2
<b>Thorold TS</b>	Net Load Forecast	20.1	21.3	18.4										
<i>Hydro One</i>	Gross Peak Load				21.3	21.5	21.6	21.7	22.0	22.2	22.4	22.5	22.6	22.7
	Gross Peak Load - DG - CDM				21.1	21.1	20.9	20.8	20.9	20.9	20.9	20.9	20.9	20.9
<b>Vansickle TS</b>	Net Load Forecast	46.3	53.3	43.7										
<i>Horizon Utilities</i>	Gross Peak Load				44.1	44.5	44.6	44.8	44.9	45.0	45.1	45.2	45.3	45.4
	Gross Peak Load - DG - CDM				43.7	43.6	43.4	43.0	42.7	42.4	42.2	42.1	42.0	41.9
<b>Vineland DS</b>	Net Load Forecast	17.4	17.0	17.0										
<i>Hydro One, NPEI - Embedded</i>	Gross Peak Load				21.9	22.3	22.4	22.7	23.1	23.5	23.8	24.0	24.3	24.5
	Gross Peak Load - DG - CDM				21.7	21.8	21.8	21.8	22.0	22.2	22.3	22.4	22.5	22.6

**Appendix B: Acronyms**

BES	Bulk Electric System
BPS	Bulk Power System
CDM	Conservation and Demand Management
CIA	Customer Impact Assessment
CGS	Customer Generating Station
CTS	Customer Transformer Station
DESN	Dual Element Spot Network
DG	Distributed Generation
DSC	Distribution System Code
GS	Generating Station
GTA	Greater Toronto Area
IESO	Independent Electricity System Operator
IRRP	Integrated Regional Resource Planning
kV	Kilovolt
LDC	Local Distribution Company
LTE	Long Term Emergency
LTR	Limited Time Rating
LV	Low-voltage
MW	Megawatt
MVA	Mega Volt-Ampere
NA	Needs Assessment
NERC	North American Electric Reliability Corporation
NGS	Nuclear Generating Station
NPCC	Northeast Power Coordinating Council Inc.
OEB	Ontario Energy Board
OPA	Ontario Power Authority
ORTAC	Ontario Resource and Transmission Assessment Criteria
PF	Power Factor
PPWG	Planning Process Working Group
RIP	Regional Infrastructure Planning
SIA	System Impact Assessment
SS	Switching Station
TS	Transformer Station
TSC	Transmission System Code
ULTC	Under Load Tap Changer