



Hydro One Networks Inc.
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LOCAL PLANNING REPORT

**WILSON TS AND THORNTON TS STATION
CAPACITY MITIGATION**

**Region: GTA East
Sub-Region: Oshawa-Clarington**

**Revision: Final
Date: May 15, 2015**

Prepared by: Oshawa-Clarington Sub-Region Local Planning Study Team



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Disclaimer

This Local Planning Report was prepared for the purpose of developing wires-only options and recommending a preferred solution(s) to address the local needs identified in the [Needs Assessment \(NA\) report](#) for the GTA East 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

REGION	GTA East Region (the “Region”) – Oshawa-Clarington Sub-Region		
LEAD	Hydro One Networks Inc. (“Hydro One”)		
START DATE	October 7, 2014	END DATE	May 15, 2015
1. INTRODUCTION			
<p>The purpose of this Local Planning (LP) report is to develop wires-only options and recommend a preferred solution that will address the local needs identified in the Needs Assessment (NA) report for the GTA Region. The development of the LP report is in accordance with the regional planning process as set out in the Ontario Energy Board’s (OEB) Transmission System Code (TSC) and Distribution System Code (DSC) requirements and the “Planning Process Working Group (PPWG) Report to the Board”.</p> <p>For needs that were identified as requiring further regional planning and coordination, the IESO undertook a Scoping Assessment (SA) to determine whether an IESO-led Integrated Regional Resource Planning (IRRP) process, or the transmitter-led Regional Infrastructure Plan (RIP) process (wires solution), or both were required. Currently, an IRRP is underway to address the following needs: Cherrywood TS T7/T8 station capacity and SC restriction, Whitby TS T1/T2 (27.6 kV Supply) station capacity, and load restoration for the loss of two elements.</p>			
2. LOCAL NEEDS ADDRESSED IN THIS REPORT			
<p>The Local needs addressed in this report include the following:</p> <ul style="list-style-type: none"> • Wilson TS T1/T2 Station Capacity • Wilson TS T3/T4 Station Capacity • Thornton TS T3/T4 Station Capacity • Thornton TS Feeder Capability Utilization 			
3. OPTIONS CONSIDERED			
<p>Prior to the new regional planning process coming into effect, planning activities and interim temporary solution discussions were already underway in the Region to address immediate specific station capacity needs. To address the Wilson TS and Thornton TS station capacity needs, the study team agreed to proceed with the preferred solution identified as follows:</p> <ul style="list-style-type: none"> • Add a new 230/44 kV DESN, (previously called “Enfield TS”), at the Oshawa Area Junction site with supply from the two 230 kV Clarington TS busses. <p>The study team also evaluated options for different transformer sizes and initial number of feeder breaker positions for the proposed new TS.</p> <p>See Section 3 for further detail.</p>			
4. PREFERRED SOLUTION			
<p>Based on the load forecast provided by the LDCs, the study team agreed and recommends that the preferred solution is to build a new TS at the Clarington TS site located at Oshawa Area Junction. This will include 2 x 75/125 MVA, 230/44 kV transformers with 6 x 44kV feeder breaker positions (space to be provided for future 2 x 44 kV feeder positions and static capacitor banks).</p> <p>See Section 4 for further detail.</p>			
5. NEXT STEPS			
The next steps are summarized in Table 2.			

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1 INTRODUCTION

The Needs Assessment (NA) for the GTA East Region (“Region”) was triggered in response to the Ontario Energy Board’s (OEB) Regional Infrastructure Planning process approved in August 2013. Prior to the new regional planning process coming into effect, planning activities were already underway in the Region to address some specific station capacity needs. This Region was subsequently expedited at the request of the affected Local Distribution Companies (LDC) and reprioritized from Group 2 to Group 1. The NA for the GTA East Region was prepared jointly by the study team, including LDCs, Independent Electric System Operator (IESO), Ontario Power Authority (merged with IESO as of January 2015 and herein referred to as 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 GTA East Region over the next ten years (2014 to 2023) and recommended whether they should be further assessed through the transmitter-led Local Planning (LP) process or the IESO-led Scoping Assessment (SA) process.

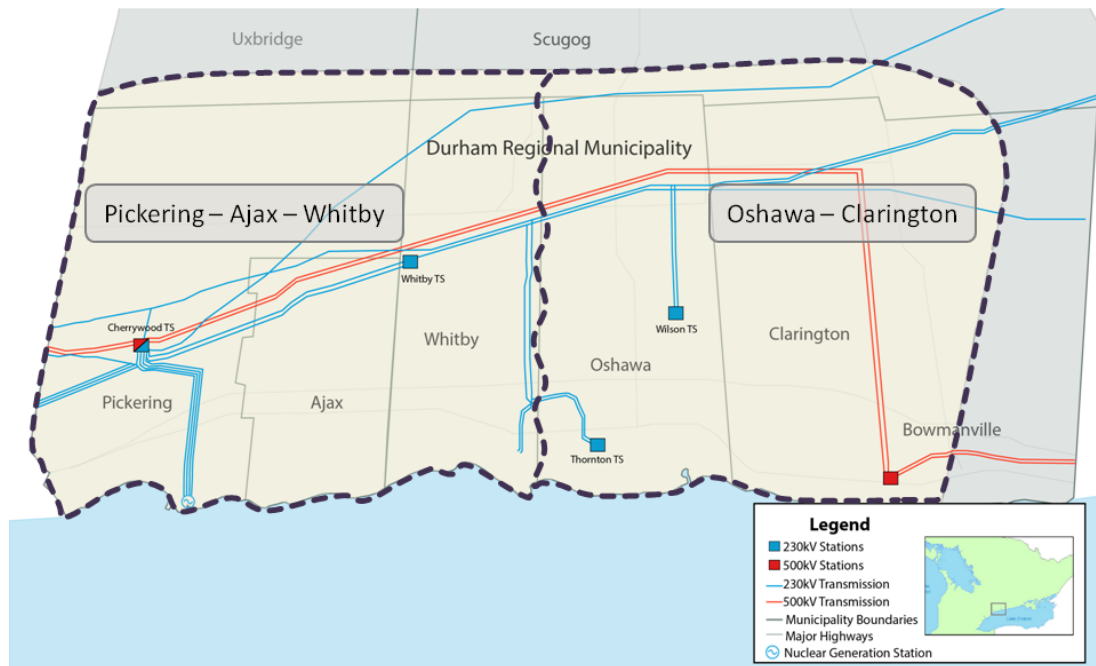
This report was prepared by the GTA East Region LP study team (Table 1) and led by the transmitter, Hydro One Networks Inc. (“HONI”). The report captures the results of the assessment based on information provided by LDCs and HONI.

Table 1: Study Team Participants for GTA East Region

No.	Company
1.	Hydro One Networks Inc. (Lead Transmitter)
4.	Veridian Connections Inc. (“Veridian”)
5.	Oshawa Power and Utilities Corporation Networks Inc. (“OPUCN”)
6.	Whitby Hydro Electric Corporation (“Whitby Hydro”)
7.	Hydro One Networks Inc. (Distribution)

1.1 Oshawa-Clarington Sub-Region Description and Connection Configuration

The GTA East Region comprises the municipalities of Pickering, Ajax, Whitby, Oshawa and parts of Clarington, and other parts of the Durham area. For the purposes of this Local Planning report, the region can be divided into two sub-regions: Pickering-Ajax-Whitby and Oshawa-Clarington. This Local Planning report covers the sub-region of Oshawa-Clarington, which includes the area served by Thornton TS and Wilson TS. The GTA East Region and its approximate sub-region boundaries are shown in Figure 1.



Source: IESO

Figure 1: GTA East Region and Approximate Sub-Region Boundaries

Four 230kV circuits (B23C, M29C, H24C, and H26C) emanating east from Cherrywood TS provide local supply to the Oshawa-Clarington sub-region. Wilson TS is supplied by B23C and M29C and Thornton TS is supplied by H24C and H26C.

It should be noted that a new 500/230kV autotransformer station in the GTA East Region within the municipality of Clarington (called Clarington TS) is being developed and is expected to be in-service in 2017. The new Clarington TS will provide additional load meeting capability in the Region and will eliminate the overloading of Cherrywood autotransformers that may result after the retirement of the Pickering Nuclear Generating Station (NGS). The new autotransformer station will consist of two 750MVA, 500/230kV autotransformers and a 230kV switchyard. The autotransformers will be supplied from two 500kV circuits that pass next to the proposed site. The 230kV circuits supplying the east GTA will be terminated at Clarington TS. Clarington TS will become the principle supply source for the GTA East Region load. The facilities in the GTA East Region, including the connection to Clarington TS, are depicted in the single line diagram shown in Figure 2.

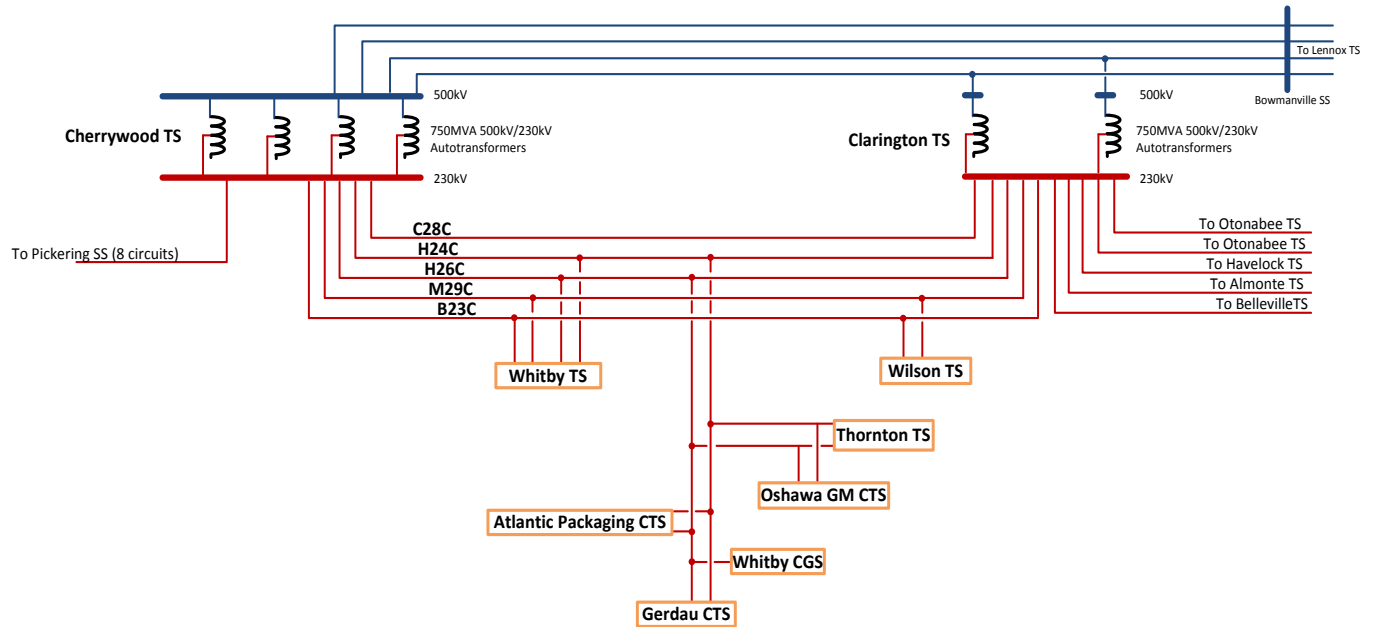


Figure 2: Single Line Diagram – GTA East Region with Clarington TS

2 GTA EAST REGION NEEDS

As an outcome of the NA process, the study team identified several needs in the GTA East Region that require further assessment and planning. The study team recommended that some of the near-term needs required “localized” wires only planning, while others required coordinated regional planning.

Where local planning was recommended to address the needs, Hydro One, as transmitter, with the impacted LDCs, further undertook planning assessments to develop options and recommend a wires only solution(s). For needs that required further regional planning and coordination, the IESO undertook a Scoping Assessment to determine whether an IESO-led Integrated Regional Resource Planning (IRRP) process, or the transmitter-led Regional Infrastructure Plan (RIP) process (wires solution), or both were required.

2.1 Needs Assessed by IESO led Scoping Assessment – Pickering-Ajax-Whitby Sub-Region

The SA reviewed the following needs and determined that they should be addressed by an IRRP, led by the IESO:

2.1.1 Cherrywood TS (230/44 kV)

- i. Station Capacity T7/T8: Based on the planned conservation and demand management (CDM) targets, the station capacity is adequate to meet the net demand over the study period, except for years 2014 and 2015. The years 2014 and 2015 may have slight overloads until the planned CDM initiatives offset the expected load.
- ii. Short Circuit (SC) Constraint T7/T8: Currently, new distributed generation (DG) is restricted from connecting to Cherrywood TS T7/T8 due to short circuit constraints. Veridian Connections Inc. is supplied by this station and indicated that they have several customers that have expressed interest in connecting DG (over 5MW to date) to Cherrywood TS T7/T8, but have been unable to due to the existing SC restriction. It is worth noting that there is an existing 30 MW landfill gas generation connection at Cherrywood TS T7/T8 contributing to the SC restriction, but has been shut down for the past year.
 - **Action:** As per the study team’s recommendation, the station capacity need and SC restriction at Cherrywood TS T7/T8 is being further assessed by the IRRP study team led by the IESO.

2.1.2 Whitby TS T1/T2 (230/44/27.6 kV)

Station Capacity T1/T2 (27.6 kV): The station capacity is expected to be adequate to meet the net demand up to 2019. The existing stations in the area are not able to supply the entire projected new load. Hydro One and Veridian assessed the station capacity requirements and have discussed plans for a proposed new 230/27.6 kV station called “Seaton TS”.

- **Action:** As per the study team’s recommendation, the station capacity need at Whitby TS T1/T2 (27.6kV supply) is being further assessed by the IRRP study team to assess if CDM/Resource solutions can economically defer the wires investment. Accordingly, the study team will determine and recommend the timing for this new 230/27.6 kV station.

Note that the 230/44 kV supply capacity of Whitby TS T1/T2 and Whitby TS T3/T4 is expected to be adequate during the study period. However, Whitby TS T3/T4 is forecasted to be greater than 90% of the Summer 10-Day LTR from 2015 to the end of the study period. No action is required at this time and the capacity need will be reviewed in the next regional planning cycle.

2.1.3 Load Restoration for the Loss of Two Elements

- i. The IESO Ontario Resource and Transmission Assessment Criteria (ORTAC)

require loads of 150 MW or more to be restored in 4 hours and 250 MW or more in 30 minutes. For the loss of two elements, the load interrupted by configuration in the GTA East Region may exceed 150 MW and 250 MW.

- **Action:** As per the study team’s recommendation, load restoration for the loss of two elements is being further assessed by the IRRP study team.

2.2 Needs Assessed by Hydro One led Local Planning – Oshawa-Clarington Sub-Region

2.2.1 Wilson TS (230/44kV)

- i. Station Capacity T1/T2: Wilson TS T1/T2 DESN1 is forecast to exceed its normal supply capacity in 2017 based on the net demand forecast. Transformation capacity relief is needed.
- ii. Station Capacity T3/T4: Wilson TS T3/T4 DESN2 is forecast to exceed its normal supply capacity in 2015 based on the net demand forecast. Transformation capacity relief is needed. In the past, overloading at this DESN under certain conditions was significant enough that plans were put in place for emergency rotating load shedding, if and when required.

2.2.2 Thornton TS (230/44kV)

- i. Station Capacity T3/T4: Thornton TS T3/T4 is forecast to exceed its normal supply capacity in 2015 based on the net demand forecast. Transformation capacity relief is needed.
- ii. Feeder Capability Utilization: OPUCN indicated during the NA process that their four feeders at Thornton TS will exceed their maximum capability by 2015 based on their gross demand forecast. As a result, the study team recommended that feeder capability utilization at Thornton TS required review by the LDCs to ensure the efficient and cost effective use of available feeder capability.

3 OPTIONS CONSIDERED

This section describes the options considered to address the local needs described in section 2.2.

3.1 Wilson TS and Thornton TS Station Capacity Needs [refer to sections 2.2.1 (i), (ii) and 2.2.2 (i)]

Prior to the new regional planning process coming into effect, planning activities were already underway in the Region to address specific station capacity needs. Prior to 2010, Hydro One and impacted LDCs were in discussions and developing plans for a proposed new 230/44 kV DESN station that would provide transformation capacity relief to Wilson TS. The proposed station would accommodate the anticipated load growth at the time in Oshawa and Clarington and improve reliability of electricity supply to customers in these areas. As part of the planning process, different options were evaluated and a Class Environmental Assessment for Minor Transmission Facilities (“Class EA”) was undertaken. It was determined that the preferred site for the new DESN (called “Enfield TS”) would be Oshawa Area Junction. The anticipated load was not materializing to support construction at the time and as a result this plan was put on hold.

Following this and in the past few years, load growth has emerged again in the region. To help manage OPUCN’s and Whitby Hydro’s load growth and respect 10-Day LTRs at Wilson TS T1/T2 and Whitby TS T3/T4 (during summer peak load conditions), load transfers to Thornton TS were required and the associated distribution investments were made by impacted LDCs. At the time, OPUCN planned to utilize available feeder capability of Hydro One Distribution’s (HOD) feeders at Thornton TS where Whitby Hydro is embedded. However, Whitby Hydro was also later required to transfer load from Whitby TS T3/T4 to Thornton TS in order to respect the 10-Day LTR at Whitby TS T3/T4. Currently, the most recent load forecast from LDCs show significant load growth at Thornton TS in the near term, particularly to supply the anticipated load of Metrolinx. Based on the load transfer and updated load forecast for Thornton TS, available feeder capability of HOD’s feeders has reduced and consequently OPUCN has limited their load transfer to Thornton TS (see section 3.3 on Thornton TS T3/T4 Feeder Capability Utilization).

As per the current load forecast provided by the study team, transformation capacity relief is needed for both Wilson TS and Thornton TS. To accommodate the load growth of OPUCN and HOD at Wilson TS and Thornton TS, the study team agreed to proceed with the preferred solution identified previously, Enfield TS, with the exception that the current plan supplies the proposed new DESN from Clarington TS as follows:

- Build a new 230/44 kV DESN (name to be determined) at the Clarington TS site located at Oshawa Area Junction, with supply from the two 230 kV Clarington TS busses.

The study team re-emphasized some of the benefits to the preferred option which include:

- Land already acquired at Oshawa Area Junction, where the new TS is proposed to be sited (on a location on the west side of the Clarington TS property). Any location much further east or west to Oshawa Area Junction would adversely affect one or the other LDCs by having to construct longer distribution feeders.

- EA approval previously obtained for building a new TS on Hydro One lands at the Clarington TS site.

The study team also recognized and agreed that, where possible, distribution load transfers to help balance the forecasted load at Wilson TS and Thornton TS would be required in the interim prior to the proposed TS coming into service. However, this would be temporary and unsustainable solution.

3.2 Feasibility Study Results and Budgetary Cost Estimates for Proposed TS

The study team recommended that the following transformer options for the proposed new TS be compared:

- a) 2 x 50/83 MVA, 230/44 kV transformers with 6 x 44kV feeder breaker positions
- b) 2 x 75/125 MVA, 230/44 kV transformers with 6 x 44kV feeder breaker positions (space to be provided for future 2 x 44 kV feeder positions)
- c) 2 x 75/125 MVA, 230/44 kV transformers with 8 x 44kV feeder breaker positions

The preliminary cost estimates for the above options are: \$19 million, \$23 million, and \$27 million for options (a), (b), and (c) respectively (note that this cost does not include the cost for capacitor banks, which may be required if identified in the System Impact Assessment by the IESO).

As per the preliminary estimates, option (a) is not materially less than option (b). If a longer term 25-year forecast is considered for the proposed new station, it will require upgrading the 50/83 MVA transformers (which have an assumed Summer 10-Day LTR of 113 MVA) to 75/125 MVA transformers around 2025 based on the current load forecast. The study team agreed that the typical cost to replace 50/83 MVA transformers with 75/125 MVA transformers would not be cost effective as compared to installing 75/125 MVA transformers initially.

3.3 Thornton TS T3/T4 Feeder Capability Utilization [refer to section 2.2.2 (ii)]

Thornton TS T3/T4 is a 230/44 kV DESN which supplies OPUCN and HOD. This station consists of eight feeders, four of which are owned by OPUCN and the remaining four by HOD. HOD's four feeders solely supply Whitby Hydro's load (embedded customer of HOD).

OPUCN indicated that their four feeders at Thornton TS will exceed their maximum capability for normal operations by 2015 based on their gross demand forecast. HOD's feeders, however, will be adequate to meet Whitby Hydro's gross demand forecast and will also have available

feeder capability remaining on their four feeders up to 2023.

The study team considered the following options to address OPUCN’s need for additional feeder capability:

- A. OPUCN, HOD, and Whitby Hydro to carry out a distribution planning assessment and develop an implementation plan to manage effective and efficient utilization of feeder capability at Thornton TS under both normal and emergency conditions.
- B. Add additional feeder breaker positions at Thornton TS.

Option B was rejected for the following reason:

- The station already consists of eight feeders and TS capacity cannot accommodate any additional feeder breaker positions.

Note: Consistent with the Transmission System Code (TSC) and OEB’s regional planning objectives to ensure cost effective and efficient wires expansion without duplication of facility investments, existing feeder capability should be efficiently utilized before investing in new feeders. It should also be noted that as per the TSC transmission facility capacity, if available, cannot be reserved for connecting customers.

4 PREFERRED SOLUTION

4.1 Wilson TS and Thornton TS Station Capacity Needs [refer to section 3.1]

Given the forecasted load growth in the Oshawa-Clarington sub-region, the study team determined that the preferred solution to address this need would be to proceed with option (b): 2 x 75/125 MVA, 230/44 kV transformers with 6 x 44kV feeder breaker positions initially (space to be provided for future 2 x 44 kV feeder positions). This will ensure reliable supply capability for OPUCN and HOD for the medium-to-long term and is a cost effective solution.

The proposed station will be located at the Oshawa Area Junction property (on the right of way of the Bowmanville x Cherrywood transmission line corridor) that HONI owns in the municipality of Clarington. This property is also the site of the new 500/230 kV autotransformer station called “Clarington TS” that will be supplied from 500kV circuits, B540C and B543C. EA approval was previously obtained for building a new TS at the Oshawa Area Junction site on a location on the west side of the property. The new TS will be supplied from the two 230 kV Clarington TS busses. It will consist of 2 x 75/125MVA, 230/44kV transformers with 6 x 44kV feeder breaker positions. Space will be provided for future 2 x 44 kV feeder positions and static

capacitor banks.

The proposed in-service date for the new TS will be aligned with the Clarington TS in-service date, currently scheduled for 2017/18.

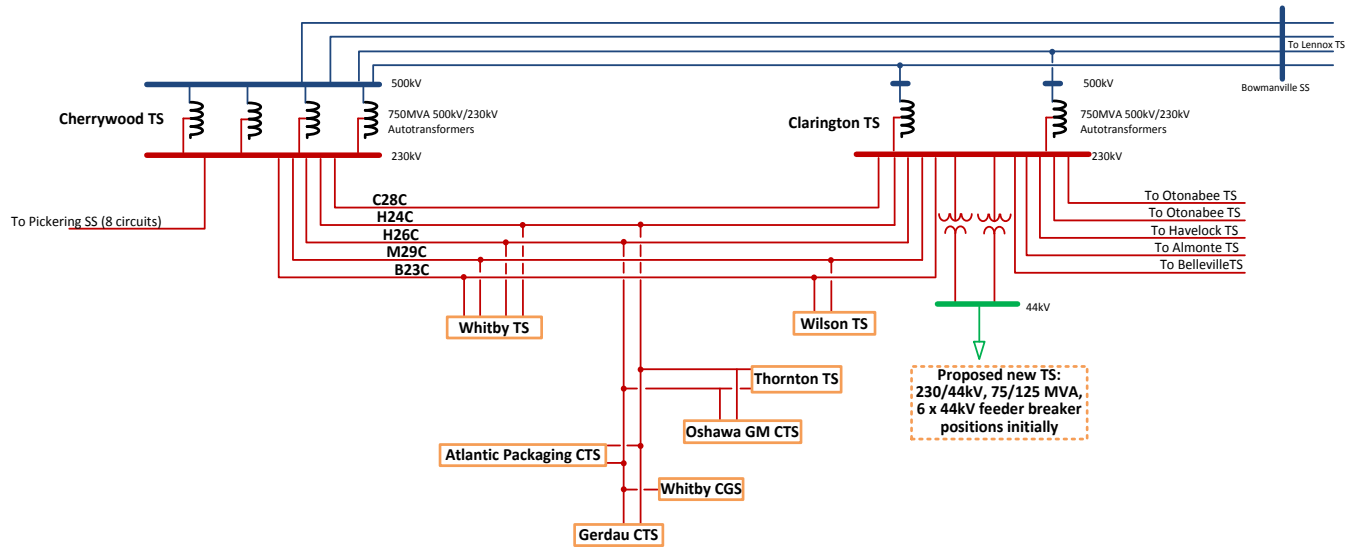


Figure 3: Single Line Diagram – GTA East Region with Proposed New TS

5 NEXT STEPS

A summary of the next steps, actions/solutions and timelines required to address the local needs are as follows:

Table 2: Solutions and Timeframe

Item #	Need	Action / Recommended Solution	Lead Responsibility	Timeframe
1	Wilson TS T1/T2 Station Capacity [Refer to Section 2.2.1 (i)]	<ul style="list-style-type: none"> Proposed new 230/44 kV, 75/125 MVA station. This solution will be executed through Hydro One’s Transmission Load Connection Process. HOD and OPCUN to initiate the process by contacting Hydro One’s Account Executive (AE). LDCs to assess and confirm if load transfers can partially mitigate forecasted overloading and provide timeline to implement required load transfers. 	Affected LDCs and HONI OPUCN, HOD	To be determined (TBD) by LDCs June 2015
2	Wilson TS T3/T4 Station Capacity [Refer to Section 2.2.1 (ii)]	<ul style="list-style-type: none"> Proposed new 230/44 kV, 75/125 MVA station. This solution will be executed through Hydro One’s Transmission Load Connection Process. HOD and OPCUN to initiate the process by contacting Hydro One’s AE. LDCs to assess and confirm if load transfers can partially mitigate forecasted overloading and provide timeline to implement required load transfers. 	Affected LDCs and HONI OPUCN, HOD	TBD by LDCs June 2015

4	<p>Thornton TS T3/T4 Station Capacity</p> <p>[Refer to Section 2.2.2 (i)]</p>	<ul style="list-style-type: none"> Proposed new 230/44 kV, 75/125 MVA station. This solution will be executed through Hydro One’s Transmission Load Connection Process. HOD and OPCUN to initiate the process by contacting Hydro One’s AE. LDCs to assess and confirm if load transfers can partially mitigate forecasted overloading and provide timeline to implement required load transfers. 	<p>Affected LDCs and HONI</p> <p>OPUCN, Whitby Hydro</p>	<p>TBD by LDCs</p> <p>June 2015</p>
7	<p>Thornton TS Feeder Capability Utilization</p> <p>[Refer to Section 2.2.2 (ii)]</p>	<ul style="list-style-type: none"> LDCs distribution planning. 	<p>OPUCN, HOD, and Whitby Hydro</p>	<p>TBD by LDCs</p>

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) [GTA East Region Needs Assessment Report](#)
- iv) [GTA East Region Scoping Assessment Report](#)

7 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