St Lawrence

Regional Infrastructure Plan

March 7, 2022

[This page is intentionally left blank]

Prepared and supported by:

Company
Hydro One Networks Inc. (Transmission)
Independent Electricity System Operator (IESO)
Cooperative Hydro Embrun Inc.
Hydro One Networks Inc. (Distribution)
Rideau St Lawrence Distribution Inc.

DISCLAIMER

This Regional Infrastructure Plan ("RIP") report was prepared for the purpose of developing an electricity infrastructure plan to address all near and mid-term needs identified in previous planning phases and any additional needs identified based on new and/or updated information provided by the RIP Technical Working Group ("TWG"). The preferred solution(s) that have been identified in this report may be reevaluated based on the findings of further analysis. The load forecast and results reported in this RIP report are based on the information provided and assumptions made by the participants of the Regional Planning Technical Working Group.

The Technical Working Group participants, their respective affiliated organizations, and Hydro One Networks Inc. (collectively, "the Authors") make no representations or warranties (express, implied, statutory or otherwise) as to the RIP report or its contents, including, without limitation, the accuracy or completeness of the information therein and shall not, under any circumstances whatsoever, be liable to each other, or to any third party for whom the RIP report was prepared ("the Intended Third Parties"), or to any other third party reading or receiving the RIP report ("the Other Third Parties"), for any direct, indirect or consequential loss or damages or for any punitive, incidental or special damages or any loss of profit, loss of contract, loss of opportunity or loss of goodwill resulting from or in any way related to the reliance on, acceptance or use of the RIP report or its contents by any person or entity, including, but not limited to, the aforementioned persons and entities.

EXECUTIVE SUMMARY

THIS REGIONAL INFRASTRUCTURE PLAN ("RIP") WAS PREPARED BY HYDRO ONE WITH SUPPORT FROM THE TECHNICAL WORKING GROUP IN ACCORDANCE WITH THE ONTARIO TRANSMISSION SYSTEM CODE REQUIREMENTS. IT IDENTIFIES INVESTMENTS IN TRANSMISSION FACILITIES, DISTRIBUTION FACILITIES, OR BOTH, THAT SHOULD BE DEVELOPED AND IMPLEMENTED TO MEET THE ELECTRICITY INFRASTRUCTURE NEEDS WITHIN THE ST. LAWRENCE REGION.

The participants of the Regional Infrastructure Plan ("RIP") Technical Working Group included members from the following organizations:

- Cooperative Hydro Embrun Inc.
- Hydro One Networks Inc. (Distribution)
- Hydro One Networks Inc. (Transmission)
- Independent Electricity System Operator ("IESO")
- Rideau St Lawrence Distribution Inc.

The first cycle of RP process was completed in April 2016 with the publication of the Needs Assessment ("NA") Report. As no further regional coordination or planning was required, the NA recommended that the needs be addressed between relevant Local Distribution Companies (LDCs) and Hydro One and other parties as required.

In accordance with the Regional Planning process, the Regional Planning cycle should be triggered at least every five years. In light of the timing of the needs identified in the previous NA report as well as new asset replacement/refurbishment needs identified in the St. Lawrence Region, the 2nd Regional Planning cycle for the St. Lawrence region was triggered in Q3 2021 beginning with the NA phase. This NA report was completed in Sept. 2021 and did not identify any needs requiring further coordinated regional planning.

This RIP is the final phase of the second cycle of the St. Lawrence regional planning process, and is developed based on the information and recommendations in the previous NA report.

The major infrastructure investment recommended for the St. Lawrence Region over the near and mid-term planning horizon is provided in the Table 1 below, along with a description of the investment, its planned in-service date, and budgetary estimate for planning purposes.

Table 1. Recommended Plans in St Lawrence Region over the Next 10 Years

Stations / Lines Project	Investment	Planned I/S Date	Cost[1] ($M)
L22H	Replacement of conductor, shieldwire, insulator and tower work	2026	64

[1] These costs are budgetary estimates for planning purposes unless otherwise specified.

The St. Lawrence TWG recommends that:

- Hydro One and relevant LDC(s) continue with the implementation of infrastructure investments listed in Table 1 above;
- As no other needs have been identified in the region, the TWG will assess the St. Lawrence region during the next regional planning cycle.

The next regional planning cycle for the St. Lawrence Region must be triggered within five years, beginning with the NA phase. It is expected that the next NA will start in Q3 2026. However, the next regional planning cycle can be started earlier if required to address any new emerging needs.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1. INTRODUCTION

THIS REPORT PRESENTS THE REGIONAL INFRASTRUCTURE PLAN (“RIP”) TO ADDRESS THE ELECTRICITY NEEDS OF THE ST LAWRENCE REGION BETWEEN 2021 AND 2032.

The report was prepared by Hydro One Networks Inc. (Transmission) (“Hydro One”) on behalf of the Technical Working Group (“TWG”) that consists of Hydro One, Cooperative Hydro Embrun Inc., Hydro One Networks Inc. (Distribution), Rideau St Lawrence Distribution Inc., the Independent Electricity System Operator (“IESO”), in accordance with the new Regional Planning process established by the Ontario Energy Board in 2013.

The St Lawrence region is located in southeastern Ontario bordering the St Lawrence River. The region starts at the Gananoque in the West and extends to the inter-provincial boundary with Quebec in the East. Electrical supply to the Region is provided from four 230 kV and three 115 kV step-down transformer stations. The approximate boundaries of the St Lawrence Region are shown below in Figure 1-1.

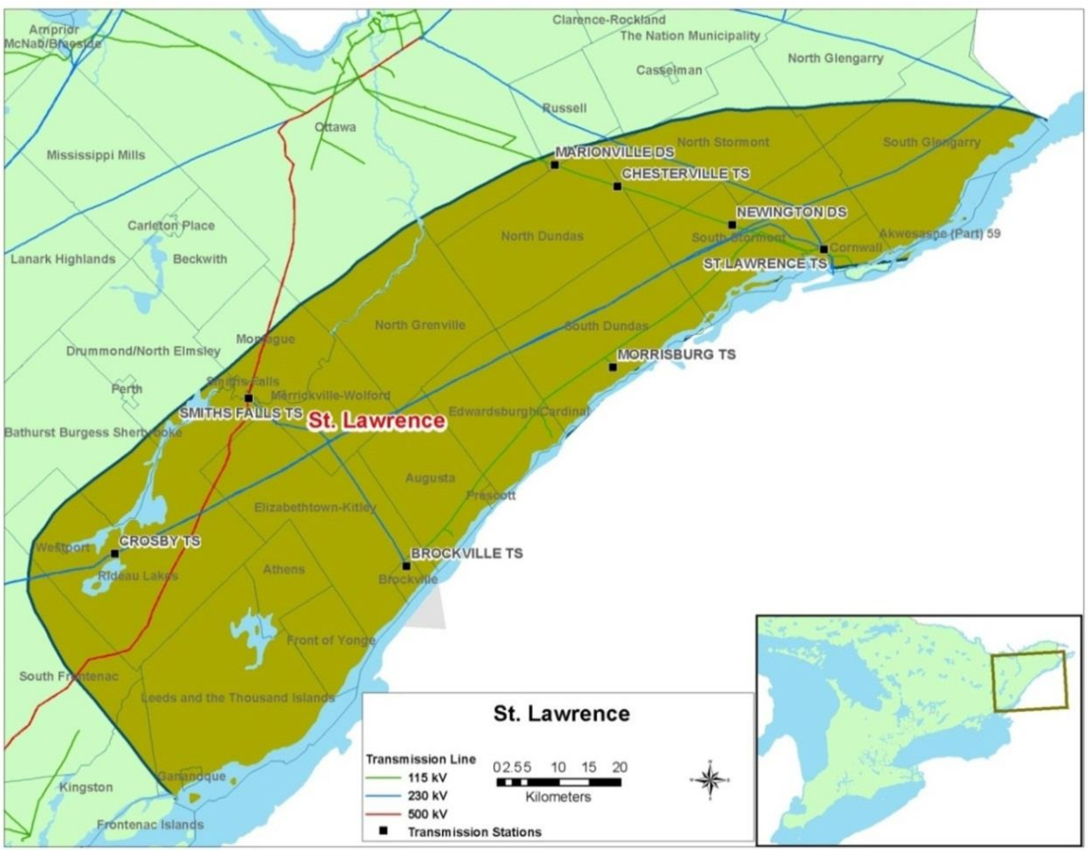

FIGURE 1-1: ST LAWRENCE REGION MAP

1.1. Objectives and Scope

The RIP report examines the needs in the St Lawrence Region. Its objectives are to:

- Provide a comprehensive summary of needs and wires plans to address the needs;
- Assess and develop a wires plan to address these needs; and
- Identify investments in transmission and distribution facilities or both that should be developed and implemented on a coordinated basis to meet the electricity infrastructure needs within the region.

The RIP reviewed factors such as the load forecast, major high voltage transmission equipment requiring replacement over the near and mid-term horizon, transmission and distribution system capability along with any updates to local plans, conservation and demand management ("CDM") forecasts, renewable and non-renewable generation development, and other electricity system and local drivers that may impact the need and alternatives under consideration.

The scope of this RIP is as follows:

- A consolidated report of the relevant wires plans to address near and medium-term needs identified in previous planning phases; and,
- Discussion of any other major transmission infrastructure investment plans over the planning horizon.

1.2. Structure

The rest of the report is organized as follows:

- Section 2 provides an overview of the regional planning process.
- Section 3 describes the regional characteristics.
- Section 4 describes the transmission work completed over the last ten years.
- Section 5 describes the load forecast and study assumptions used in this assessment.
- Section 6 describes the adequacy of the transmission facilities in the region over the study period.
- Section 7 discusses the needs and provides the alternatives and preferred solutions.
- Section 8 provides the conclusion and next steps.

2. REGIONAL PLANNING PROCESS

2.1. Overview

Planning for the electricity system in Ontario is done at three levels: bulk system planning, regional system planning, and distribution system planning. These levels differ in the facilities that are considered and the scope of impact on the electricity system. Planning at the bulk system level typically looks at issues that impact the system on a provincial level, while planning at the regional and distribution levels looks at issues on a more regional or localized level.

Regional planning looks at supply and reliability issues at a regional or local area level. Therefore, it largely considers the 115 kV and 230 kV portions of the power system that supply various parts of the province.

2.2. Regional Planning Process

A structured regional planning process was established by the Ontario Energy Board ("OEB") in 2013 through amendments to the Transmission System Code ("TSC") and Distribution System Code ("DSC"). The process consists of four phases: the Needs Assessment[1] ("NA"), the Scoping Assessment ("SA"), the Integrated Regional Resource Plan ("IRRP"), and the Regional Infrastructure Plan ("RIP").

The following describes the process in general, considering all four phases of the study.

The regional planning process begins with the NA phase, which is led by the transmitter to determine if there are regional needs. The NA phase identifies the needs and the TWG determines whether further regional coordination is necessary to address them. If no further regional coordination is required, further planning is undertaken by the transmitter and the impacted local distribution company ("LDC") or customer and develops a Local Plan ("LP") to address them.

In situations where identified needs require coordination at the regional or sub-regional levels, the IESO initiates the SA phase. During this phase, the IESO, in collaboration with the transmitter and impacted LDCs, reviews the information collected as part of the NA phase, along with additional information on potential non-wires alternatives, and makes a decision on the most appropriate regional planning approach. The approach is either a RIP, which is led by the transmitter, or an IRRP, which is led by the IESO. If more than one sub-region was identified in the NA phase, it is possible that a different approach could be taken for different sub-regions.

The IRRP phase will generally assess infrastructure (wires) versus resource (non-wires alternatives) options at a higher or more macro level, but sufficient to permit a comparison of options. If the IRRP phase identifies that infrastructure options may be most appropriate to meet a need, the RIP phase will conduct detailed planning to identify and assess the specific wires alternatives and recommend a preferred wires solution. Similarly, resource options that the IRRP

[1] Also referred to as Needs Screening

identifies as best suited to meet a need are then further planned in greater detail by the IESO. The IRRP phase also includes IESO led stakeholder engagement with municipalities, Indigenous communities, business sectors and other interested stakeholders in the region.

The RIP phase is the fourth and final phase of the regional planning process and involves discussion of previously identified needs and plans, identification of any new needs that may have emerged since the start of the planning cycle, and development of a wires plan to address the needs where a wires solution would be the best overall approach. This phase is led and coordinated by the transmitter and the deliverable is a comprehensive report of a wires plan for the region. Once completed, this report is also referenced in transmitter's rate filing submissions and as part of LDC rate applications with a planning status letter provided by the transmitter.

To efficiently manage the regional planning process, Hydro One has been undertaking wires planning activities in collaboration with the IESO and/or LDCs for the region as part of and/or in parallel with:

- Planning activities that were already underway in the region prior to the new regional planning process taking effect;
- The NA, SA, and LP phases of regional planning;
- Participating in and conducting wires planning as part of the IRRP for the region or sub-region;
- Working and planning for connection capacity requirements with the LDCs and transmission connected customers.

Figure 2-1 illustrates the various phases of the regional planning process (NA, SA, IRRP, and RIP) and their respective phase trigger, lead, and outcome.

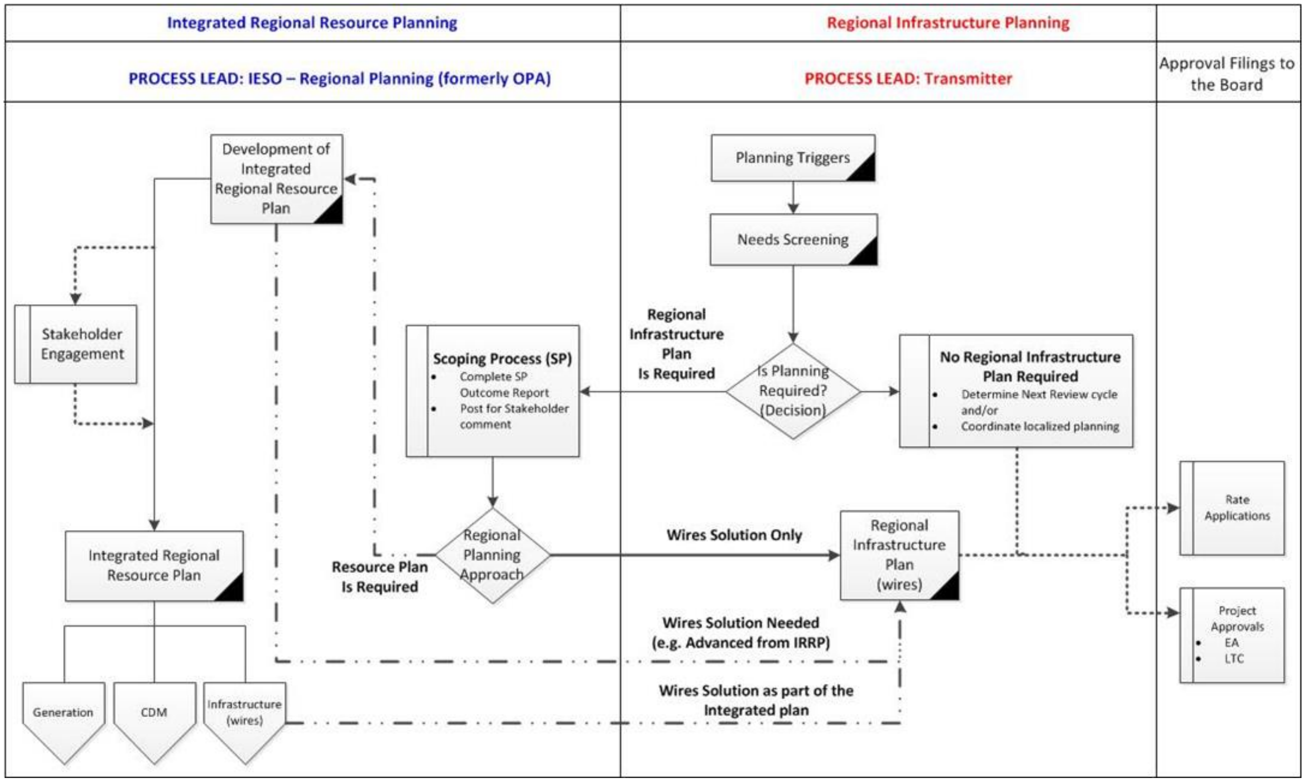

FIGURE 2-1: REGIONAL PLANNING PROCESS FLOWCHART

2.3. RIP Methodology

The Needs Assessment did not identify any needs requiring further coordinated regional planning. As such this RIP report summarizes the information and recommendations in the previous NA report.. The following discusses the RIP process in general.

.

The RIP phase consists of a four step process (see Figure 2-2) as follows:

1) Data Gathering: The first step of the process is the review of planning assessment data collected in the previous phase of the regional planning process. Hydro One collects this information and reviews it with the Technical Working Group to reconfirm or update the information as required. The data collected includes:

    - Net peak demand forecast at the transformer station level. This includes the effect of any distributed generation or conservation and demand management programs.
    - Existing area network and capabilities including any bulk system power flow assumptions.
    - Other data and assumptions as applicable such as asset conditions; load transfer capabilities, and previously committed transmission and distribution system plans.

2) Technical Assessment: The second step is a technical assessment to review the adequacy of the regional system including any previously identified needs. Depending

upon the changes to load forecast or other relevant information, regional technical assessment may or may not be required or be limited to specific issue only. Additional near and mid-term needs may be identified in this phase.

3) Alternative Development: The third step is the development of wires options to address the needs and to come up with a preferred alternative based on an assessment of technical considerations, feasibility, environmental impact and costs.
4) Implementation Plan: The fourth and last step is the development of the implementation plan for the preferred alternative.

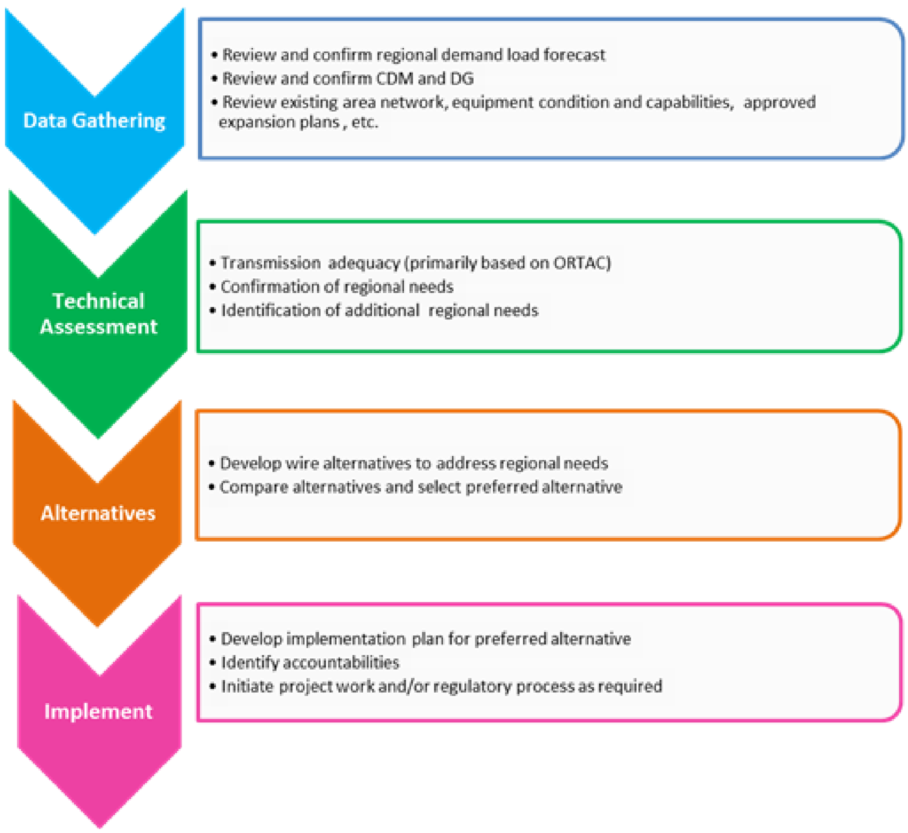

FIGURE 2-2: RIP METHODOLOGY

3. REGIONAL CHARACTERISTICS

THE ST LAWRENCE REGION IS LOCATED IN SOUTHEASTERN ONTARIO BORDERING THE ST LAWRENCE RIVER. THE REGION STARTS AT THE GANANOQUE IN THE WEST AND EXTENDS TO THE INTER-PROVINCIAL BOUNDARY WITH QUEBEC IN THE EAST.

The St Lawrence Region is connected to the Greater Ottawa Region through 230kV circuits L24A and B31L. Circuit B31L also provides an interconnection between the Provinces of Ontario and Quebec. In addition, 115kV circuit L2M also connects St Lawrence to the Greater Ottawa Region, however this connection is normally open and is only used for load transfers between the two areas in case of system need. The Region is also connected to the Peterborough to Kingston Region through 230kV circuits L20H, L21H, and L22H. The existing facilities and interconnection of the Region are summarized below and depicted in the single line diagram shown in Figure 3-1 and 3-2.

St Lawrence TS is the major transmission station for the region and connects to the main source of supply for the area, Saunders GS via four 230kV circuits. All the 230kV and 115kV circuits listed above connect at St Lawrence TS. Also connecting to the 230kV yard of the station are two International Power Lines (IPL). These IPLs connect Ontario to the State of New York and power exchange across the IPLs are regulated using two phase shifting transformers. The station also has two 230kV/115kV 250MVA autotransformers to connect the 230kV and 115kV networks.

There is a total of seven transformer stations in the area to supply load customers. There are also two industrial customer stations and a customer owned generating station. The stations are broken down into the following categories:

1. **St Lawrence 230 kV Area:** The transformer stations in this area are supplied by the St Lawrence TS to Hinchinbrook TS 230kV transmission lines. In addition, St Lawrence TS DESN is also supplied from the 230kV. The following stations are included:
    - Brockville TS
    - Crosby TS
    - Smith Falls TS
    - St Lawrence TS

    Figure 3-1 shows additional 230kV circuits connected to St Lawrence TS. These circuits were not part of the St Lawrence regional planning scope of work for the following reasons:

    - L24A, B31L: These circuits do not supply stations included in the St Lawrence area.
    - S25L, S26L, S30L, S32L: These circuits connect to OPG Saunders generating station.
    - L33P, L34P. These circuits are International Power Lines that connect Ontario to the State of New York.

2. **St Lawrence 115 kV Area:** The transformer stations in this area are supplied 115kV circuits. The circuits are radial from St Lawrence TS. The 115kV area also includes two industrial customer stations and a customer owned generating station. The following load customer stations are included:
   - Chesterville TS
   - Morrisburg TS
   - Newington DS

   The industrial station and generating stations are also included in the study area, however the study focuses on the regional needs and load customer station.

   Figure 3-2 shows an additional 115kV circuit, L5C. This circuit is normally not supplying load station included in this region. It is a backup supply for the City of Cornwall. This circuit is not included in the scope of the St Lawrence regional planning.

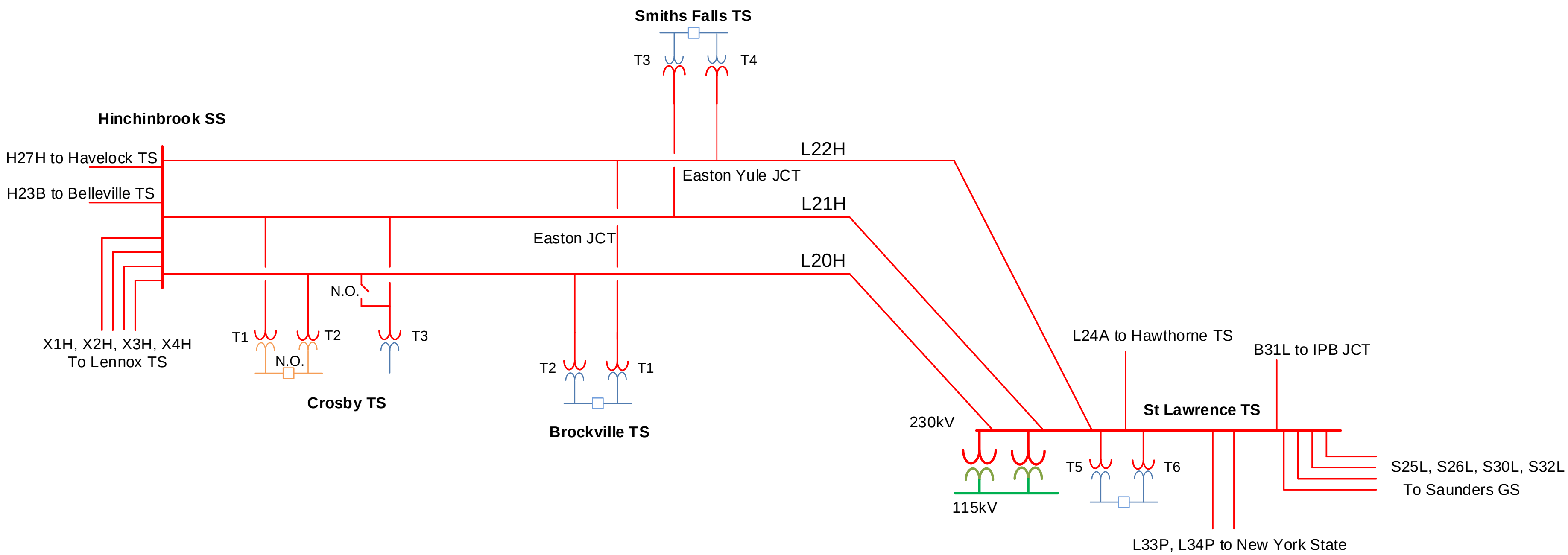

FIGURE 3-1: SINGLE LINE DIAGRAM OF THE ST LAWRENCE REGION 230KV TRANSMISSION NETWORK

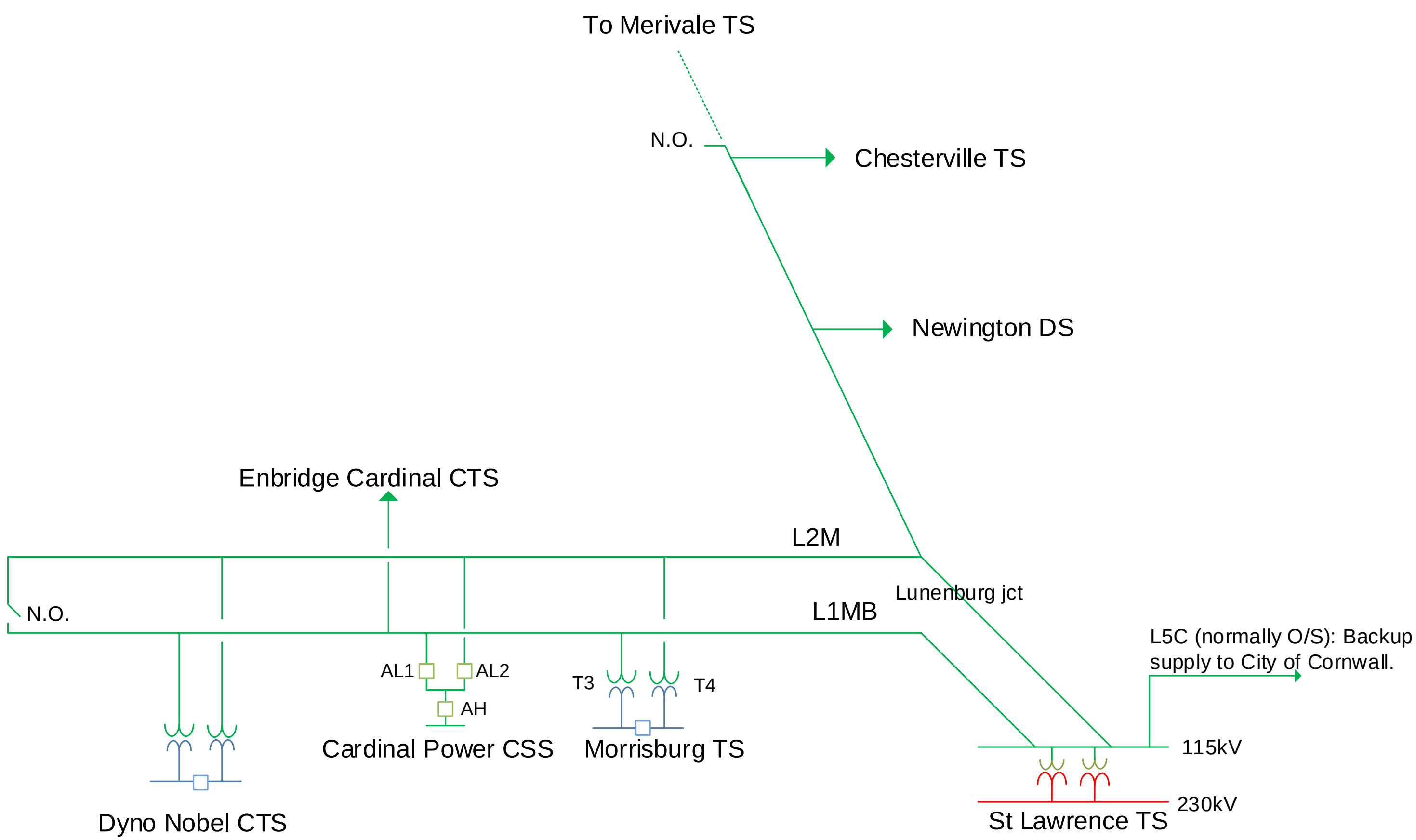

FIGURE 3-2: SINGLE LINE DIAGRAM OF THE ST LAWRENCE REGION 230KV TRANSMISSION NETWORK

4. TRANSMISSION FACILITIES/ PROJECTS COMPLETED AND/OR UNDERWAY OVER THE LAST TEN YEARS

OVER THE LAST TEN YEARS, A NUMBER OF TRANSMISSION PROJECTS HAVE BEEN PLANNED AND UNDERTAKEN BY HYDRO ONE AIMED TO MAINTAIN THE RELIABILITY AND ADEQUACY OF ELECTRICITY SUPPLY TO THE ST LAWRENCE REGION.

A summary and description of the major projects completed over the last 10 years is provided below:

- Chesterville TS (2014): Replaced 25/33/42 MVA, 115/44 kV step down transformers with new 25/33/42 MVA, 115/44 kV – replaced existing transformers with similar units to address asset condition.

A summary and description of the major transmission project currently underway is provided below. This project was initiated as a result of transformer failure and was agreed to by Hydro One, IESO, the New York Power Authority and New York Independent System Operator.

- St Lawrence Phase Shifting Transformers (2023) – replace failed phase shifting transformer PS33 and its companion PSR34. These transformers are used to regulate the power exchanged over the Ontario-New York interconnection at St Lawrence TS.

5. LOAD FORECAST AND STUDY ASSUMPTIONS

5.1. Load Forecast

The electricity demand in the St Lawrence Region is anticipated to grow by about 7.5% over the next ten years (2022-2032). Figure 5-1 shows the St Lawrence Region's planning load forecast (winter net, non-coincident extreme weather corrected peak) developed during this NA phase.

This load forecast, along with the summer forecast, was used to determine the loading that would be seen by transmission lines and autotransformer stations and to identify the need for additional line and auto-transformation capacity.

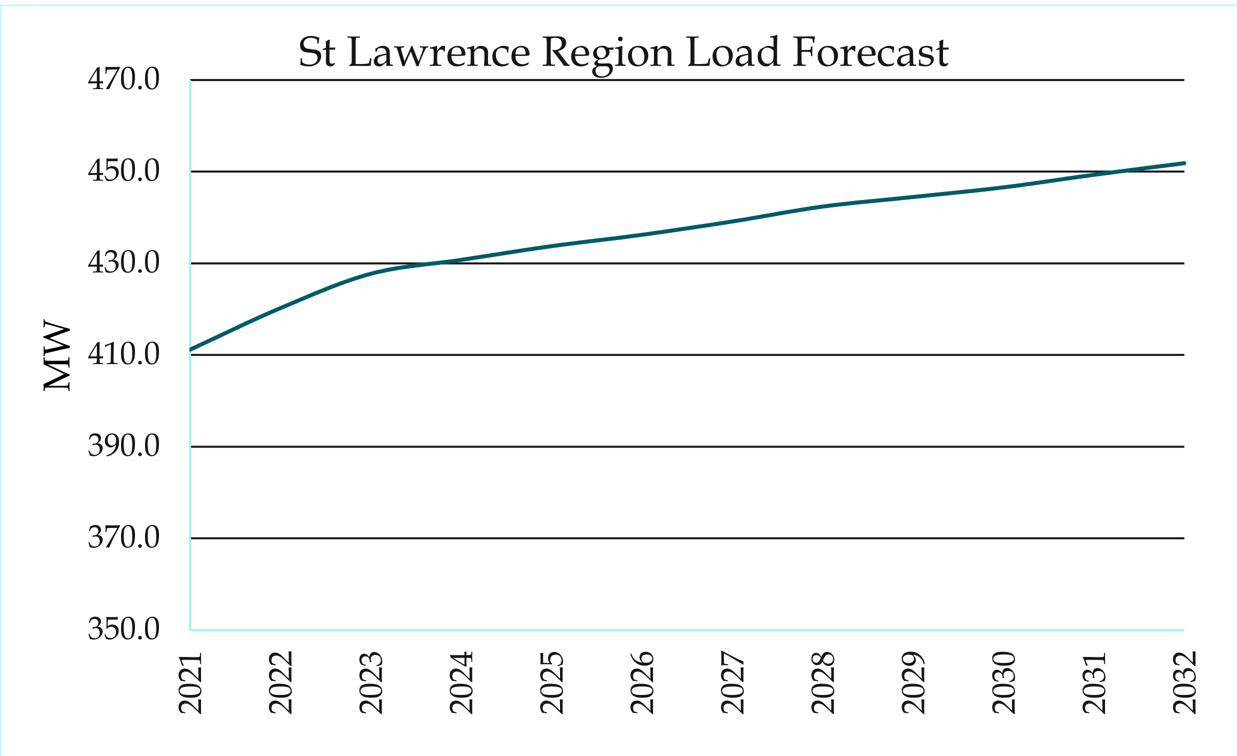

FIGURE 5-1: ST LAWRENCE REGION LOAD FORECAST

The regional-coincident load forecast represents the total peak load of the 7 step-down transformer stations in the St Lawrence Region. The Region's peak winter load is forecasted to increase from 420 MW in 2022 to 452 MW by 2032.

The load forecast for St Lawrence RIP is provided in Appendix D. The load forecast for this RIP was prepared by adjusting the actual 2019/2020 summer and winter peak loads applying an extreme weather correction factor and then applying growth rates derived from the LDCs' forecast. This forecast was further adjusted taking into account the impact of CDM and DGs provided by the IESO. The forecasts shown in Appendix D show a reduction in DG output in the long term of the forecast. This is due to the uncertainty of DG contribution as contracts begin to expire. The forecast is showing the impact assuming the DG remains in operation or stop operation.

The Needs Assessment focuses on a 10 year period. However, a 20 year forecast was completed to review trends of the load over the long term.

Hydro One has also researched to find community energy plans in the region. No energy plans have been identified that would impact the assessment undertaken as part of this report. The TWG will monitor and take them into consideration as they are developed.

5.2. Study Assumptions

The following assumptions are made in the NA report.

- The study period is based assessments is 2021-2032.
- Station capacity adequacy is assessed by comparing the non-coincident peak load with the station's normal planning supply capacity, assuming a 90% lagging power factor for stations having no low-voltage capacitor banks and 95% lagging power factor for stations having low voltage capacitor banks. Normal planning supply capacity for transformer stations is determined by the summer 10-day Limited Time Rating (LTR).
- Generating station Saunders GS was assumed to generate at its average 98% of time dependable hydro generation level which is 467MW for winter and 511MW for summer.
- No power exchanges on the Ontario Eastern interconnections.
- Load forecast data was requested from industrial customers in the region. Where data was not provided, the load was assumed to be consistent with historical loads.
- The Region is winter peaking so this assessment is based on winter peak loads. However sensitivity analysis was also done using summer peak loads
- Adequacy assessment is conducted as per Ontario Resource Transmission Assessment Criteria (ORTAC).

6. ADEQUACY OF EXISTING FACILITIES

THIS SECTION REVIEWS THE ADEQUACY OF THE EXISTING TRANSMISSION AND TRANSFORMER STATION FACILITIES SUPPLYING THE ST LAWRENCE REGION OVER THE PLANNING PERIOD (2021-2032).

During this regional planning cycle, the Needs Assessments was completed for the St Lawrence Region. No needs requiring further coordinated regional planning were identified, therefore those findings are presented here.

6.1. 230 kV Transmission Facilities

The three 230 kV transmission circuits considered in the St Lawrence Region are classified as part of the Bulk Electricity System (“BES”). They connect the Region to the rest of the Ontario’s transmission system through the Peterborough to Kingston Region. These circuits also serve local area stations within the Region and the power flow on them depends on the bulk system transfer as well as local area loads. These circuits are as follows (please refer to Figure 3-1):

a) St Lawrence TS to Hinchinbrook TS 230 kV circuits L20H, L21H, and L22H supplies Brockville TS, Crosby TS, and Smith Falls TS

The RIP review of the current load forecast shows that based on the forecasted station loadings, all the above three (3) 230 kV transmission lines are expected to be adequate over the study period under normal and N-1 supply condition.

As discussed in previously Section 3, St Lawrence TS is connected to Saunders generating station, to the State of New York through two IPLs, and to the Province of Quebec through circuit B31L (Beauharnois generating station). As a result of these connections, many operating scenarios and system conditions can influence the flows on circuits L20H, L21H, and L22H. These scenarios are evaluated under Bulk planning and are not part of the scope of the Needs Assessment. However, it should be noted that there is a generation rejection scheme in place that can runback Saunders GS and/or Beauharnois GS under post-contingency conditions. This scheme ensures that the St Lawrence to Hinchinbrook TS lines are not overloaded under peak summer conditions.

6.2. 230/115 kV Autotransformer Facilities

The 230/115 kV autotransformers at St Lawrence TS supplying the Region are within their ratings and are adequate to supply the forecasted load over the study period.

6.3. 115 kV Transmission Facilities

The St Lawrence Region contains two 115 kV circuits. These 115 kV circuits serve three transformer stations, two industrial customers, and connect a customer owned generating station. The 115kV circuits supplying the Region are adequate over the study period for the loss of a single 115kV circuit in the Region under the study assumptions of the Needs Assessment.

6.4. Step-Down Transformer Station Facilities

There are 7 step-down transformer stations within the St Lawrence Region. These stations are listed with the load forecast in Appendix D. There are also two transmission-connected industrial customer transformer stations.

The region is winter peaking. The stations winter and summer peak non-coincident load forecasts are given in Table D-1 and D-2 in Appendix D.

All the transformer stations in the region are forecasted to remain within their normal supply capacity during the study period. Capacity needs for these stations will be reviewed in the next regional planning cycle.

Depending on the load growth and the future decisions on contracts for distributed energy resources connected to the station, the capacity of some stations could reach their limit in the long term (10+ years). The TWG will continue to monitor the load growth at the stations and will re-evaluate the capacity during the next planning cycle.

6.5. System Reliability and Load Restoration

In case of contingencies on the transmission system, ORTAC provides the load restoration requirements relative to the amount of load affected. Planned system configuration must not exceed 600 MW of load curtailment/rejection. In all other cases, the following restoration times are provided for load to be restored for the outages caused by design contingencies.

- All loads must be restored within 8 hours.
- Load interrupted in excess of 150 MW must be restored within 4 hours.
- Load interrupted in excess of 250 MW must be restored within 30 minutes.

Based on the net load forecast, the loss of one element will not result in load interruption greater than 150MW. The maximum load interrupted by configuration due to the loss of two elements is below the load loss limit of 600MW by the end of the 10-year study period.

6.6. 115kV System

The distributed energy resources (DER) connected to the 115kV stations of the area and the 115kV generating station have resulted in the following, identified in the Cardinal Power G3 Expansion SIA/CIA [3, 4]:

a) Reverse Power Flow at Morrisburg TS and Dyno Nobel CTS

At Morrisburg TS, under light load condition with high output for DER and 115kV connected generation, a reverse power flow issue was identified. This situation occurs if one of the line breakers at Cardinal Power has an inadvertent opening (IBO). This IBO results in all of Cardinal Power’s generation being sent to one line, which causes reverse power at Morrisburg TS beyond its maximum limit. Additional generation connection has been restricted at Morrisburg TS to manage the reverse power flow at the station.

Under the same conditions mentioned above, an IBO at Cardinal Power can also result in power flow through the Dyno Nobel CTS transformers to exceed their rating.

For Morrisburg TS and Dyno Nobel CTS transformer loading issues, Cardinal Power run back scheme is triggered to reduce the flows to within equipment ratings as it was outlined in the SIA and CIA [3, 4]. No further action is recommended within the scope of this regional planning.

b) L2M/L1MB

Under light load condition and with all distributed generation in the area and the Cardinal Power generation at maximum output the section of the L1MB/L2M line between St Lawrence to Lunenburg JCT can be loaded beyond its short time emergency (STE) rating for loss of either circuit [3,4].

To manage the situation, Morrisburg TS has been restricted to accept new generation connection. In addition, there is Cardinal Power's runback scheme which will reduce the plant output following the loss of either circuit and hence reduce the post-contingency loading on either of the L1MB/L2M lines. However, since the lines could be loaded beyond their STE, measures such generation re-dispatch is implemented by the IESO as per the Cardinal Power G3 Expansion studies [3, 4].

6.7. Other Needs Identified during Regional Planning

6.7.1. Asset Renewal for 230 kV circuit L22H

Hydro One identified the need for refurbishment of 230kV circuit L22H between Easton JCT and Hinchinbrooke North JCT within the 10-year planning horizon. The need is based on asset condition assessment. In general, asset condition assessment is based on a range of considerations such as equipment deterioration due to aging infrastructure and other factors; technical obsolescence due to outdated design; lack of spare parts availability or manufacturer support; and/or potential health and safety hazards.

Asset renewal work for L22H is summarized in Table 6-1 below.

TABLE 6-1: ST LAWRENCE REGION – PLANNED ASSET REPLACEMENT WORK

Stations / Lines Project	Details	Timeframe
Circuit L22H	A total of 65 km of 230 kV circuit L22H between Easton JCT X Hinchinbrook North JCT has been identified for refurbishment. The work includes the replacement of conductors, shieldwire, insulators and refurbishment of lattice steel structures.	2026

No other major high-voltage transmission equipment in the St Lawrence region has been identified for replacement at this time.

7. REGIONAL NEEDS AND PLANS

THIS SECTION DISCUSSES ELECTRICAL INFRASTRUCTURE NEEDS IN THE ST LAWRENCE REGION IDENTIFIED IN THE PREVIOUS REGIONAL PLANNING CYCLE, THE NEEDS ASSESSMENT REPORT FOR THIS CYCLE; AND SUMMARIZES THE PLANS DEVELOPED TO ADDRESS THESE NEEDS.

7.1. Asset Renewal for 230 kV circuit

7.1.1. Description

As indicated in Section 6.1, L22H is expected to be adequate over the study period under normal and N-1 contingency conditions, including the section planned for refurbishment.

A total of 65 km of 230 kV circuit L22H between Easton JCT X Hinchinbrook North JCT requires refurbishment. The work includes the replacement of conductors, shieldwire, insulators and refurbishment of lattice steel structures.

The TWG recommends that refurbishment of L22H between Easton JCT X Hinchinbrook North JCT does not require further regional coordination. The implementation and execution plan for this need will be coordinated by Hydro One and affected LDCs. However, as part of IESO-led Bulk Planning Studies, IESO and Hydro One will work together to determine if conductor upgrade is required for the line section in the L22H refurbishment plan.

7.2. Needs Identified in Previous Cycle

7.2.1. Delivery Point Performance at Chesterville TS

The past Needs Assessment had identified that the target delivery point performance had been missed due to momentary outages (due to severe weather patterns). Hydro One was to review the delivery point performance of the station to determine if corrective actions were required. From the review of performance of the delivery point, no corrective actions were identified. Hydro One will continue to monitor the delivery point.

8. CONCLUSIONS AND NEXT STEPS

THIS REGIONAL INFRASTRUCTURE PLAN CONCLUDES THE REGIONAL PLANNING PROCESS FOR THE ST. LAWRENCE REGION.

The major infrastructure investments recommended by the TWG in the near and mid-term planning horizon are provided in Table 8-1 below.

TABLE 8-1: RECOMMENDED PLANS IN ST. LAWRENCE REGION OVER THE NEXT 10 YEARS

Stations / Lines Project	Details	Timeframe
L22H	Refurbishment of 65 km of the circuit between Easton JCT X Hinchinbrook North JCT	2026

The TWG recommends that:

- Hydro One and LDCs to continue with the implementation of infrastructure investments listed in Table 8-1 above while keeping the TWG apprised of project status;
- No other needs have been identified and further assessment of the St. Lawrence region will be undertaken by the TWG in the next regional planning cycle.

9. REFERENCES

[1] Needs Assessment Report – St Lawrence – April 2016
[2] IESO Ontario Resource and Transmission Assessment Criteria (ORTAC) – Issue 5.0
[3] Cardinal Power 15MW Plant Expansion SIA (2011-432)
[4] Cardinal Power 15MW Plant Expansion CIA

10. APPENDIX A. STATIONS IN THE ST LAWRENCE REGION

Station*	Voltage (kV)	Supply Circuits
Brockville TS	230 kV	L20H/L22H
Chesterville TS	230 kV	L2M
Crosby TS (T1/T2)	230 kV	L20H/L21H
Crosby T3	230 kV	L21H
Morrisburg TS	230 kV	L1MB/L2M
Newington DS	230 kV	L2M
Smith Falls TS	230 kV	L21H/L22H
St Lawrence TS	230 kV	Transformers connected at 230kV switchyard

11. APPENDIX B. TRANSMISSION LINES IN THE ST LAWRENCE REGION

Location	Circuit Designations	Voltage (kV)
St Lawrence TS – Hinchinbrook TS	L20H, L21H, L22H	230 kV
St Lawrence TS – Brockville TS	L1MB	115 kV
St Lawrence TS – Brockville TS – Merivale TS	L2M	115 kV

12. APPENDIX C. DISTRIBUTORS IN THE ST LAWRENCE REGION

Distributor Name	Station Name	Connection Type
Cooperative Hydro Embrun Inc	Chesterville TS	Dx
Hydro One Distribution	Brockville TS	Tx
	Chesterville TS	Tx
	Crosby TS	Tx
	Morrisburg TS	Tx
	Smith Falls TS	Tx
Rideau St Lawrence.	Brockville TS	Dx
	Morrisburg TS	Dx

13. APPENDIX D. ST LAWRENCE REGION LOAD FORECAST

TABLE D1: ST LAWRENCE NON-COINCIDENT WINTER LOAD FORECAST

Station		LTR (MW)	Type	Near Term Forecast (MW)					Medium Term Forecast (MW)					Long Term Forecast (MW)				
				2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2033	2035	2037	2039
Brockville TS	T1/T2	166.2	Load	125.3	130.2	134.6	138.1	140.8	141.9	143.2	144.5	145.7	146.9	148.0	150.2	152.6	154.9	157.2
			DG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.5	-45.3	-45.3	-45.3
			CDM	0.8	1.8	2.8	3.6	4.2	4.4	4.6	4.7	5.2	5.5	5.6	5.8	7.1	6.8	6.4
			NET	124.5	128.4	131.8	134.5	136.7	137.5	138.6	139.8	140.5	141.4	142.4	144.9	190.8	193.4	196.0
			NET_DG	124.5	128.4	131.8	134.5	136.7	137.5	138.6	139.8	140.5	141.4	142.4	144.4	147.1	149.6	152.2
Chesterville TS	T1/T2	61.5	Load	39.5	39.8	40.1	40.4	40.6	40.9	41.2	41.4	41.7	41.9	42.1	42.6	43.0	43.4	43.8
			DG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.4
			CDM	0.3	0.5	0.8	1.0	1.2	1.3	1.3	1.4	1.5	1.6	1.6	1.6	1.6	1.5	1.4
			NET	39.2	39.2	39.3	39.3	39.4	39.6	39.9	40.1	40.2	40.3	40.5	40.9	41.6	42.1	42.8
			NET_DG	39.2	39.2	39.3	39.3	39.4	39.6	39.9	40.1	40.2	40.3	40.5	40.9	41.5	42.0	42.4
Crosby TS	T1/T2	65.6	Load	13.8	13.9	14.0	14.1	14.2	14.3	14.4	14.5	14.6	14.7	14.8	15.0	15.2	15.4	15.6
			DG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			CDM	0.1	0.2	0.3	0.4	0.4	0.4	0.5	0.5	0.5	0.6	0.6	0.6	0.5	0.5	0.5
			NET	13.7	13.7	13.7	13.8	13.8	13.9	14.0	14.1	14.1	14.2	14.3	14.4	14.7	14.9	15.1
			NET_DG	13.7	13.7	13.7	13.8	13.8	13.9	14.0	14.1	14.1	14.2	14.3	14.4	14.7	14.9	15.1
Crosby TS	T3	75.0	Load	22.7	23.0	23.2	23.4	23.6	23.7	24.0	24.2	24.3	24.5	24.7	25.1	25.4	25.8	26.1
			DG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			CDM	0.2	0.3	0.5	0.6	0.7	0.7	0.8	0.8	0.9	0.9	0.9	1.0	0.9	0.9	0.8
			NET	22.6	22.6	22.7	22.8	22.9	23.0	23.2	23.4	23.5	23.6	23.8	24.1	24.5	24.9	25.3
			NET_DG	22.6	22.6	22.7	22.8	22.9	23.0	23.2	23.4	23.5	23.6	23.8	24.1	24.5	24.9	25.3
Morrisburg TS	T3/T4	127.2	Load	56.3	59.1	62.0	62.6	63.2	63.7	64.4	65.0	65.7	66.3	66.8	68.1	69.3	70.6	71.9
			DG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-11.3	-11.3	-11.3	-11.3
			CDM	0.4	0.8	1.3	1.6	1.9	2.0	2.1	2.1	2.3	2.5	2.5	3.1	2.9	2.8	2.6
			NET	55.9	58.3	60.8	61.0	61.3	61.8	62.3	62.9	63.4	63.8	64.3	76.4	77.8	79.1	80.6
			NET_DG	55.9	58.3	60.8	61.0	61.3	61.8	62.3	62.9	63.4	63.8	64.3	65.5	66.8	68.2	69.6
Newington DS	-	13.5	Load	2.3	2.3	2.3	2.3	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.5	2.5	2.5
			DG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			CDM	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
			NET	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.4	2.4	2.4	2.4
			NET_DG	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.4	2.4	2.4	2.4
Smiths Falls TS	T3/T4	176.4	Load	114.1	117.4	119.7	120.4	121.1	121.9	122.7	123.6	124.4	125.1	125.8	127.3	128.7	130.1	131.5
			DG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			CDM	0.8	1.6	2.5	3.1	3.6	3.8	4.0	4.0	4.4	4.7	4.8	4.9	4.6	4.4	4.2
			NET	113.3	115.8	117.2	117.3	117.5	118.1	118.8	119.5	120.0	120.4	121.0	122.4	124.1	125.7	127.4
			NET_DG	113.3	115.8	117.2	117.3	117.5	118.1	118.8	119.5	120.0	120.4	121.0	122.4	124.1	125.7	127.4
St. Lawrence TS	T5/T6	183.5	Load	40.1	40.4	40.7	40.9	41.1	41.3	41.5	41.8	42.0	42.1	42.3	42.7	43.0	43.3	43.7
			DG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			CDM	0.3	0.5	0.8	1.1	1.2	1.3	1.3	1.4	1.5	1.6	1.6	1.7	1.5	1.5	1.4
			NET	39.8	39.8	39.9	39.8	39.9	40.0	40.2	40.4	40.5	40.6	40.7	41.0	41.5	41.9	42.3
			NET_DG	39.8	39.8	39.9	39.8	39.9	40.0	40.2	40.4	40.5	40.6	40.7	41.0	41.5	41.9	42.3

TABLE D2: ST LAWRENCE NON-COINCIDENT SUMMER LOAD FORECAST

Transformer Station		LTR (MW)	Type	Near Term Forecast (MW)					Medium Term Forecast (MW)					Long Term Forecast (MW)				
				2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2033	2035	2037	2039
Brockville TS	T1/T2	145.6	Load	97.3	101.4	105.2	108.0	110.2	111.2	112.1	113.1	114.0	114.9	115.8	117.6	119.5	121.3	123.2
			DG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-4.5	-4.6	-49.5	-49.5
			CDM	0.5	1.6	2.8	3.7	4.4	4.6	5.0	5.1	5.3	5.3	5.2	5.2	4.8	6.4	6.4
			NET	96.8	99.8	102.4	104.3	105.9	106.5	107.1	107.9	108.8	109.6	110.6	117.0	119.3	164.3	166.3
			NET_DG	96.8	99.8	102.4	104.3	105.9	106.5	107.1	107.9	108.8	109.6	110.6	112.6	114.9	116.7	118.6
Chesterville TS	T1/T2	50.0	Load	36.1	36.6	37.0	37.2	37.3	37.6	37.9	38.1	38.4	38.6	38.8	39.2	39.6	40.0	40.3
			DG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-3.0	-3.0	-3.2
			CDM	0.2	0.6	1.0	1.3	1.5	1.6	1.7	1.7	1.8	1.8	1.7	1.7	1.7	1.6	1.6
			NET	35.9	36.0	36.0	35.9	35.9	36.0	36.2	36.4	36.6	36.8	37.1	37.6	40.9	41.3	42.0
			NET_DG	35.9	36.0	36.0	35.9	35.9	36.0	36.2	36.4	36.6	36.8	37.0	37.5	38.0	38.5	38.9
Crosby TS	T1/T2	57.6	Load	12.0	12.1	12.3	12.3	12.4	12.5	12.6	12.7	12.8	12.9	13.0	13.1	13.3	13.4	13.6
			DG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-3.0	-3.0	-3.0
			CDM	0.1	0.2	0.3	0.4	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
			NET	11.9	11.9	11.9	11.9	11.9	12.0	12.1	12.1	12.2	12.3	12.4	12.6	15.6	15.8	16.0
			NET_DG	11.9	11.9	11.9	11.9	11.9	12.0	12.1	12.1	12.2	12.3	12.4	12.6	12.8	12.9	13.1
Crosby TS	T3	75.0	Load	21.6	21.9	22.2	22.4	22.5	22.7	22.9	23.1	23.3	23.4	23.6	23.9	24.3	24.6	24.9
			DG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-4.1	-5.5	-5.5	-5.5
			CDM	0.1	0.4	0.6	0.8	0.9	0.9	1.0	1.1	1.1	1.1	1.1	1.2	1.2	1.1	1.1
			NET	21.5	21.5	21.6	21.6	21.6	21.7	21.9	22.0	22.2	22.3	22.5	26.9	28.6	29.0	29.3
			NET_DG	21.5	21.5	21.6	21.6	21.6	21.7	21.9	22.0	22.2	22.3	22.5	22.9	23.3	23.7	24.0
Morrisburg TS	T3/T4	115.2	Load	48.7	51.3	53.9	54.4	54.9	55.4	55.9	56.5	57.0	57.5	58.1	59.2	60.3	61.4	62.4
			DG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-6.8	-6.8	-6.8
			CDM	0.2	0.8	1.4	1.8	2.2	2.3	2.5	2.6	2.6	2.7	2.6	2.5	2.6	2.6	2.6
			NET	48.5	50.5	52.5	52.5	52.7	53.0	53.4	54.0	54.4	54.9	55.5	56.7	64.5	65.6	66.7
			NET_DG	48.5	50.5	52.5	52.5	52.7	53.0	53.4	54.0	54.4	54.9	55.5	56.7	58.0	59.1	60.1
Newington DS	-	13.5	Load	2.0	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.2	2.2	2.2	2.2	2.2	2.2
			DG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			CDM	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
			NET	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.1	2.1	2.1	2.1	2.1	2.2
			NET_DG	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.1	2.1	2.1	2.1	2.1	2.2
Smiths Falls TS	T3/T4	154.9	Load	92.9	95.8	97.9	98.5	99.0	99.7	100.4	101.1	101.7	102.3	102.9	104.1	105.3	106.4	107.6
			DG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-2.8	-7.9	-11.0	-11.2	-11.2
			CDM	0.5	1.5	2.6	3.3	3.9	4.2	4.4	4.6	4.7	4.8	4.7	4.7	4.5	4.4	4.4
			NET	92.4	94.3	95.3	95.1	95.1	95.5	95.9	96.5	97.0	97.6	100.9	107.2	111.7	113.2	114.4
			NET_DG	92.4	94.3	95.3	95.1	95.1	95.5	95.9	96.5	97.0	97.6	98.3	99.7	101.2	102.4	103.6
St. Lawrence TS	T5/T6	168.1	Load	33.3	33.6	33.9	34.1	34.2	34.4	34.6	34.8	35.0	35.1	35.3	35.6	35.9	36.1	36.4
			DG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-2.9	-8.3	-8.3	-9.7
			CDM	0.2	0.5	0.9	1.2	1.4	1.4	1.5	1.6	1.6	1.6	1.6	1.6	1.7	1.7	1.7
			NET	33.1	33.1	33.0	32.9	32.9	33.0	33.1	33.2	33.4	33.5	33.7	36.8	42.5	42.8	44.4
			NET_DG	33.1	33.1	33.0	32.9	32.9	33.0	33.1	33.2	33.4	33.5	33.7	34.1	34.5	34.8	35.0

14. APPENDIX E. LIST OF ACRONYMS

Acronym	Description
A	Ampere
BES	Bulk Electric System
BPS	Bulk Power System
CDM	Conservation and Demand Management
CIA	Customer Impact Assessment
CGS	Customer Generating Station
CSS	Customer Switching Station
CTS	Customer Transformer Station
DESN	Dual Element Spot Network
DG	Distributed Generation
DSC	Distribution System Code
GATR	Guelph Area Transmission Reinforcement
GS	Generating Station
HV	High Voltage
IESO	Independent Electricity System Operator
IRRP	Integrated Regional Resource Plan
kV	Kilovolt
LDC	Local Distribution Company
LP	Local Plan
LTE	Long Term Emergency
LTR	Limited Time Rating
LV	Low Voltage
MTS	Municipal Transformer Station
MW	Megawatt
MVA	Mega Volt-Ampere
MVAR	Mega Volt-Ampere Reactive
NA	Needs Assessment
NERC	North American Electric Reliability Corporation
NGS	Nuclear Generating Station
NPCC	Northeast Power Coordinating Council Inc.
OEB	Ontario Energy Board
ORTAC	Ontario Resource and Transmission Assessment Criteria
PF	Power Factor
PPWG	Planning Process Working Group
RIP	Regional Infrastructure Plan
SA	Scoping Assessment
SIA	System Impact Assessment
SPS	Special Protection Scheme
SS	Switching Station
TS	Transformer Station
TSC	Transmission System Code