NEEDS ASSESSMENT REPORT

East Lake Superior

Date: October 9, 2024

Needs Assessment Report

East Lake Superior

Date: October 9, 2024

Lead Transmitter:

Hydro One Networks Inc.

Prepared by: East Lake Superior Technical Working Group

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Disclaimer

This Needs Assessment (NA) Report was prepared for the purpose of identifying potential needs in the East Lake Superior region and to recommend which needs a) do not require further regional coordination and can be directly addressed by developing a preferred plan as part of the NA phase and b) require further assessment and regional coordination. The results reported in this NA are based on the input and information provided by the Technical Working Group (TWG) for this region at the time. Updates may be made based on best available information throughout the planning process.

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Executive Summary

REGION	East Lake Superior Region (the "Region")		
LEAD	Hydro One Networks Inc. ("HONI")		
START DATE:	June 11, 2024	**END DATE:**	October 9, 2024

1. INTRODUCTION

This is the third cycle of Regional Planning for the region. The second cycle Regional Planning for the East Lake Superior ("ELS") Region was completed in October 2021 with the publication of the Regional Infrastructure Plan ("RIP") report.

The purpose of this Needs Assessment ("NA") is to:

a) Identify any new needs and reaffirm needs identified in the previous Regional Planning cycle; and,

b) Recommend which needs:

i) require further assessment and regional coordination to develop a preferred plan (and hence, proceed to the next phases of regional planning); and,

ii) do not require further regional coordination (i.e., can be addressed directly between a transmitter and the impacted LDC(s) to develop a preferred plan and/or no regional investment is required at this time and the need may be reviewed during the next regional planning cycle).

2. REGIONAL ISSUE/TRIGGER

In accordance with the Regional Planning process, the Regional Planning cycle should be triggered at least once every five years. Considering these timelines, the third Regional Planning cycle was triggered in June 2024 for the ELS Region.

3. SCOPE OF NEEDS ASSESSMENT

The scope of the ELS Region NA includes:

a) Review and reaffirm needs/plans identified in the previous regional planning cycle RIP (as applicable),

b) Identify any new needs resulting from this assessment,

c) Recommend which need(s) requires further assessment and regional coordination in the next phases of the regional planning cycle to develop a preferred plan; and

d) Recommend which needs do not require further regional coordination (i.e., can be addressed directly between connecting transmitter and the impacted LDC(s) to develop a preferred plan

and/or no regional investment is required at this time and the need may be reviewed during the next regional planning cycle).

The TWG may also identify additional needs during the next phases of the planning process, namely Scoping Assessment ("SA"), Integrated Regional Resource Plan ("IRRP"), and RIP, based on updated information available at that time.

The planning horizon for this NA assessment is ten years.

4. REGIONAL DESCRIPTION AND CONNECTION CONFIGURATION

The ELS region spans from Mississagi TS near Wharncliffe to Wawa TS in the township of Wawa, encompassing the city of Sault Ste. Marie. The 230 kV circuits in the Region provide electric power to the Region and facilitate power flow across the province. The 115 kV network emanating from Third Line TS supplies majority of the load in the city of Sault Ste. Marie, whereas the 115 kV network at Mackay TS connects local wind and hydro generation to the transmission network. The 115 kV system out of Wawa TS is used to supply local load and to connect local generation in the area.

5. INPUTS/DATA

The TWG comprises of representatives from Local Distribution Companies ("LDC"), the Independent Electricity System Operator ("IESO"), PUC-Transmission LP and Hydro One and provides input and relevant information for the ELS Region regarding capacity needs, reliability needs, operational issues, and major high-voltage ("HV") transmission assets requiring replacement over the planning horizon. The LDCs also capture input from municipalities in the development of their 10-year summer and winter load forecast.

In accordance with the regional planning process, stakeholder engagement takes place during the IRRP phase.

6. ASSESSMENT METHODOLOGY

The assessment's primary objective is to identify the electrical infrastructure needs in the Region over the 10-year planning horizon. The assessment methodology includes a review of planning information such as load forecast (which factors various demand drivers and consideration of MEPs and/or CEPs where available), conservation and demand management ("CDM") forecast, distributed generation ("DG") forecast, system reliability and operation, and major HV transmission assets requiring replacement.

A technical assessment of needs is undertaken based on:

a) Current and future station capacity and transmission adequacy;

b) System reliability needs and operational concerns;

c) Major HV transmission equipment requiring replacement with consideration to "right-sizing"; and,

d) Sensitivity analysis to capture uncertainty in the load forecast as well as variability of demand drivers such as electrification.

7. NEEDS

I. Updates on needs identified during the previous regional planning cycle

The following needs and projects discussed in the second ELS RIP cycle have been completed.

- Providing remote arming of Third Line TS Instantaneous Load Rejection ("ILR") scheme to the IESO: completed in 2023/2024.
- Echo River TS – Install new transformer and breaker replacement: project completed in 2024.

Needs from the second ELS RIP cycle that already have a planned project are shown below.

- Third Line TS – End-of-life P21G/P22G protection replacement: planned in-service year for the project is 2027.
- Third Line TS – Autotransformer T2 replacement: planned in-service year for the project is 2027.
- Sault No.3 – End-of-life Line replacement: planned in-service year for the project is 2026.
- Batchawana TS – End-of-life components replacement: Algoma Power Inc ("API") has requested Hydro One Sault Ste. Marie ("HOSSM") to procure equipment and build the LV yard capable of operating at 25 kV in the future. The project is being executed with expected completion in Q4 2024.
- Goulais TS – End-of-life components replacement: API has requested HOSSM to procure equipment and build the LV yard capable of operating at 25 kV in the future. API has also requested for another feeder position to improve reliability within their distribution system. API and HOSSM are to continue coordination activities. Planned in-service year for the project is 2028.
- Patrick St. TS – End-of-life 115 kV breaker replacement: planned in-service year for the project is 2028.
- Northern Ave TS – End-of-life Transformer T1 replacement: planned in-service year for the project is 2030.
- Clergue TS – End-of-life Metal clad switchgear replacement: planned in-service year for the project is 2028.
- Hollingsworth TS – End-of-life protection replacement: planned in-service year for the project is 2031.
- D.A. Watson – End-of-life Metal clad switchgear replacement: planned in-service year for the project is 2031.

II. Newly identified needs or needs requiring further review

a) Asset Renewal for Major HV Transmission Equipment

- St. Mary's MTS and Tarentorous MTS – station refurbishment/upgrade

b) Transformation Capacity

- Anjigami TS and Hollingsworth TS – transformer overload due to growing demand in the load pocket.
- Third Line TS – 230/115 kV autotransformer reaches 90% of LTR upon the loss of companion unit.
- Tagona West TS – 230/115 kV autotransformer overload upon the loss of companion unit.

c) Transmission System Capacity

- Algoma No.1/ No.2/ No.3 – circuit overload after loss of any two Algoma circuits.
- Sault No. 3 – circuit overload.

d) Voltage Performance

- Voltage violation at Third Line TS after the loss of both autotransformers.

e) System Reliability, Operation and Load restoration

- Third Line TS – voltage limitations: The 115 kV bus can only be operated in a narrow range of 118 kV – 124 kV

8. SENSITIVITY ANALYSIS

The objective of a sensitivity analysis is to capture uncertainty in the load forecast as well as variability of electric demand drivers to identify any emerging needs and/or advancement or deferment of recommended investments. Due to the nature of load inquiries in the Region, the TWG agreed to assess sensitivity scenarios by adding a large load of 200 MW at the following locations in the Region:

a. Double circuit tap to the new 230 kV circuits P23G/P24G
b. Direct connection to 230 kV bus at Tagona West TS
c. Direct connection to 230 kV bus at Mackay TS

As per the sensitivity analysis, no new needs arise due to the addition of a large load in the ELS region. However, the analysis does indicate a few emerging needs that can be monitored as the load in the region grows. Based on the analysis findings no immediate action is required.

9. RECOMMENDATIONS

The TWG recommendations are as follows:

I. Needs that require further assessment and regional coordination

These needs may have broader regional impacts and require further assessment and coordination during the next phases[1] of the Regional Planning cycle. A list of these needs is provided below.

- St. Mary's MTS and Tarentorous MTS – need is recommended for further review in the next phases of RP.
- Third Line TS – 230/115 kV autotransformer reaches 90% of LTR upon the loss of companion unit: Continue to monitor the loading of the autotransformers at Third Line TS.
- Tagona West TS – 230/115 kV autotransformer overload upon the loss of companion unit: PUC Transmission intends to implement manual load reduction with connecting load customer to mitigate the need. To be further studied as part of the System Impact Assessment ("SIA") and accordingly documented in the next phases of RP.
- Algoma No.1/ No.2/ No.3 – circuit overload after loss of any two Algoma circuits: Need can be mitigated by cross-tripping overloaded circuit using the Third Line RAS, rejecting all load at Patrick St. TS. Recommended to review refining the amount of load rejected in the next phases of RP.
- Sault No.3 – circuit overload: During an outage of P25W or P26W, a loss of K24G can result in an overload of Sault No.3. The need can be mitigated by cross-tripping Sault No.3 using Mackay Generation Rejection scheme. Recommended to review necessity of Sault No.3 cross-trip in the next phases of RP, in coordination with SIA for the new northeast bulk projects.
- Voltage violation at Third Line TS: The violations can be mitigated by using Load Rejection (LR) schemes and/or RAS at Third Line TS. Recommended to review the necessity Third Line TS LRs and RAS contingencies in the next phases of RP, in coordination with SIA for the new northeast bulk projects.
- Third Line TS – 115 kV voltage limitations: Existing voltage limit at Third Line TS 115 kV bus is restricted to operate between 118 kV - 124 kV range. Recommended to monitor need until PUC Distribution replaces existing transformers with new units equipped with ULTC at St. Mary's MTS and Tarentorous MTS.

II. Needs that do not require further regional coordination

These needs are local in nature and do not have a regional impact. They can be addressed by a straightforward transmission and/or distribution wires solution. They do not require investment in any upstream transmission facility or require Leave to Construct (i.e., Section 92) approvals. These needs

[1] Non-wires options are further considered (i.e. incremental to CDM and DG that is considered in this NA) as potential options in addressing these needs during the IRRP phase.

generally impact a limited number of LDCs and can be addressed directly between applicable transmitter(s) and the LDC(s) to develop a preferred local plan. The need is provided below:

- Anjigami TS and Hollingsworth TS – transformer overload: Assess solution options via a Local Plan between API and HOSSM.

All LDCs in the TWG will be participating in further Regional Planning activities.

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1. INTRODUCTION

The second cycle of the Regional Planning ("RP") process for the East Lake Superior (''ELS'') region (the "Region") was completed in October 2021 with the publication of the Regional Infrastructure Plan ("RIP") Report. The RIP report included a common discussion of all the options and recommended plans for preferred wire infrastructure investments to address the near- and medium-term needs.

This Needs Assessment initiates the third regional planning cycle for the ELS Region. The purpose of this Needs Assessment ("NA") is to:

a) Identify any new needs and reaffirm needs identified in the previous regional planning cycle; and,
b) Recommend which needs:
   i) require further assessment and regional coordination to develop a preferred plan (and hence, proceed to the next phases of regional planning); and,
   ii) do not require further regional coordination (i.e., can be addressed directly between transmitter(s) and the impacted LDC(s) to develop a preferred plan and/or no regional investment is required at this time and the need may be reviewed during the next regional planning cycle).

A flow chart of the Regional Planning Process is shown in Figure 1 below.

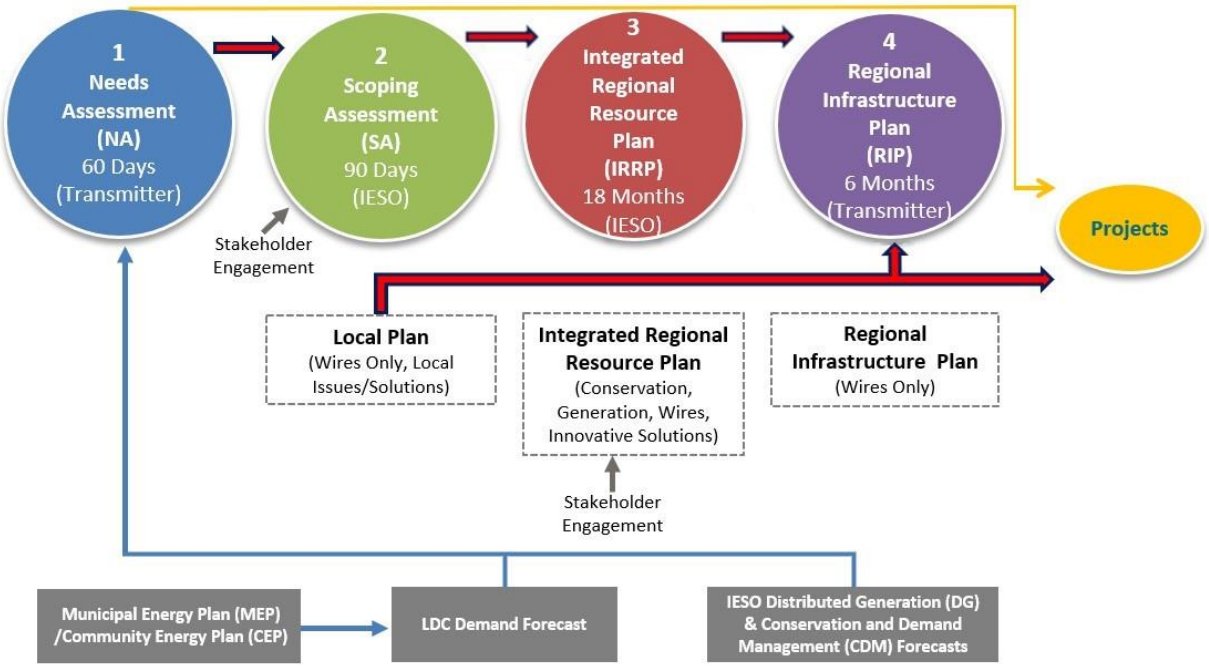

Figure 1: Regional Planning Process

This report was prepared by the ELS Technical Working Group ("TWG"), led by Hydro One Networks Inc (Transmission). The report presents the results of the assessment based on information provided by the

transmitters, the Local Distribution Companies ("LDC") and the Independent Electricity System Operator ("IESO"). Participants of the TWG are listed below in Table 1.

Table 1: East Lake Superior Region TWG Participants

Sr. no.	Name of TWG Participants
1	Algoma Power Inc.
2	PUC Transmission
3	PUC Distribution
4	Hydro One Transmission (HONI, HOSSM)
5	Hydro One Distribution
6	Independent Electricity System Operator

2. REGIONAL ISSUE/TRIGGER

In accordance with the Regional Planning process, the Regional Planning cycle should be triggered at least once every five years. As such, the third Regional Planning cycle was triggered for the ELS region.

3. SCOPE OF NEEDS ASSESSMENT

The scope of this NA covers the East Lake Superior region and includes:

- Review and reaffirm needs/plans identified in the previous cycle RIP (as applicable),
- Identify any new needs resulting from this assessment,
- Recommend which need(s) requires further assessment and regional coordination in the next phases of the regional planning cycle to develop a preferred plan; and,
- Recommend which needs do not require further regional coordination (i.e., can be addressed directly between the connecting transmitter(s) and the impacted LDC(s) to develop a preferred plan and/or no regional investment is required at this time and the need may be reviewed during the next regional planning cycle).

The Technical Working Group ("TWG") may also identify additional needs during the next phases of the planning process, namely Scoping Assessment ("SA"), Integrated Regional Resource Plan ("IRRP"), Local plan ("LP") and RIP, based on updated information available at that time.

The planning horizon for this NA assessment is 10 years.

4. REGIONAL DESCRIPTION AND CONNECTION CONFIGURATION

The ELS region spans from Mississagi Transformer Station ("TS") near Wharncliffe, Ontario to Wawa TS in the town of Wawa, Ontario encompassing the city of Sault Ste. Marie and surrounding areas. The newly formed transmitter, PUC Transmission LP along with Hydro One Sault Ste. Marie ("HOSSM") and Hydro One Network Inc. are the three transmitters in the Region. Algoma Power Inc., PUC Distribution and Hydro One Distribution are the three LDCs in the Region responsible for distribution of electric power to residential, commercial and industrial customers at sub-transmission levels (69 kV and under).

The 230 kV circuits in the Region provide bulk electric power to the Region and facilitate power flow across the province. The 115 kV network emanating from Third Line TS supplies majority of the load in the city of Sault Ste. Marie, whereas the 115 kV network at Mackay TS connects local wind and hydro generation to the transmission network. The 115 kV system out of Wawa TS is used to supply local load and to connect local generation in the area.

After conclusion of the last regional planning cycle in 2021, the IESO completed bulk system studies for northeast Ontario and issued a study report in October 2022. An additional voltage study report identifying reactive requirements for northern Ontario was published in December 2023. The reports recommended the following infrastructure projects to supply growing electricity demand in Sault Ste. Marie and Timmins.

i. A new 500 kV line between Hanmer TS and Mississagi TS – Planned completion by 2029.
ii. A new 230 kV double circuit line between Mississagi TS and Third Line TS – Planned completion by 2029. The nomenclature used for the new circuits in this report is P23G and P24G and is subject to change in the future.
iii. A new 230 kV line between Porcupine TS and Wawa TS, built to operate at 500 kV in the future – Planned completion by 2030.
iv. Reactive devices identified in the voltage study:
    - One new -120 Mvar line reactor at Mississagi TS end for the new 500 kV line between Hanmer TS and Mississagi TS – Planned completion by 2029.
    - One new +/-100 Mvar STATCOM at Mississagi TS (230 kV) – Planned completion by 2029.
    - One new +/-100 Mvar STATCOM at Algoma TS – Planned completion by 2029.

In addition to the bulk reinforcement projects, the newly formed transmitter PUC Transmission, will build a new 230 kV double circuit line from Third Line TS to a new station named Tagona West TS which will

facilitate supply of electric power to the new Electric Arc Furnaces ("EAF") facility. Planned completion of the project is within the assessment study period.

The geographical boundaries of the East Lake Superior region are shown in Figure 2 below.

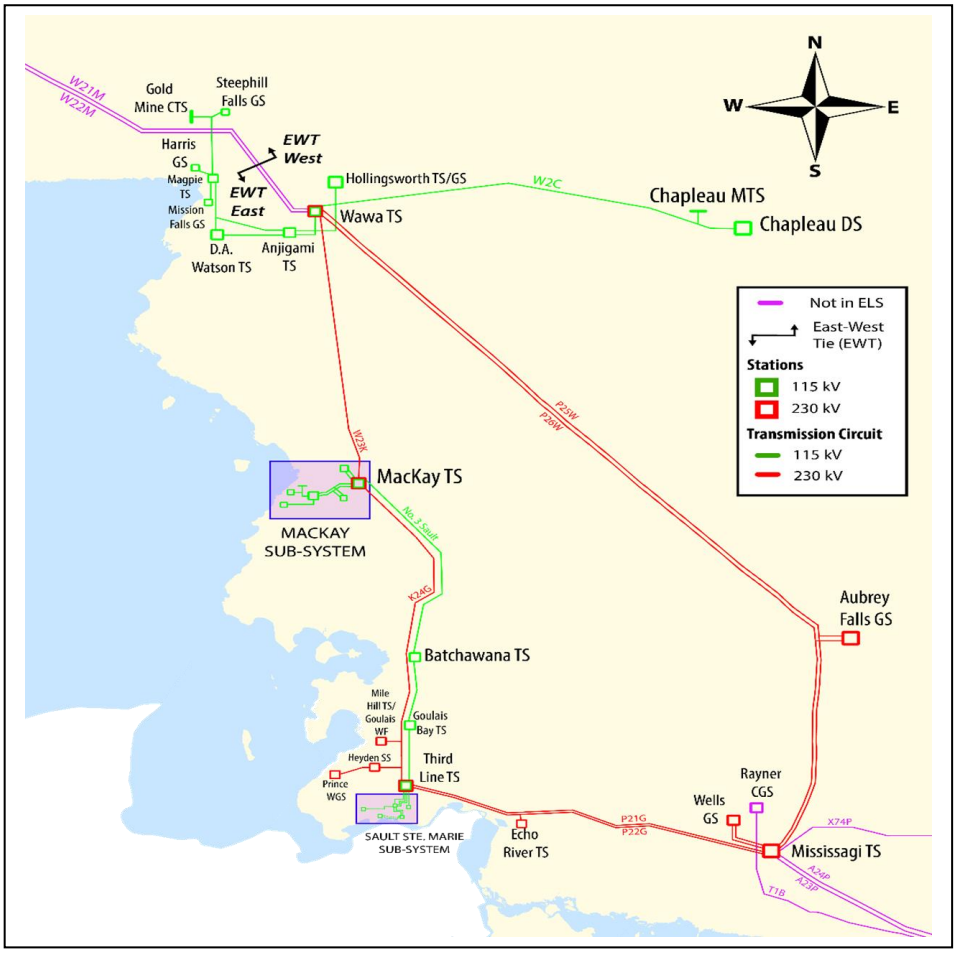

Figure 2: Map of East Lake Superior Regional Planning Area

The circuits and stations of the area are summarized in the Table 2 below:

Table 2: Transmission Station and Circuits in the ELS Region

44 kV circuits	115 kV circuits	230 kV circuits	Transformer Stations	Generation Stations
Anjigami No.1, Limer No.1	Sault No.3, Algoma No.1 / No.2 / No.3, Northern Ave 115kV, GL1SM, GL2SM, GL1TA, GL1TA, Leigh's Bay 115kV, Clergue No.1 / No.2, Mackay No.1 / No.2, Gartshore No.1 / No.2, Hogg 115kV, Andrew 115kV, Mission falls 115kV, Steephill 115kV, Harris 115kV, Magpie 115kV, High Falls No.1/No.2, Hollingsworth 115kV	P21G, P22G; P25W, P26W; K24G; W23K; **Planned ccts:** P23G, P24G; Third Line x Tagona W (double circuit)	Andrews TS, Anjigami TS, Batchawana TS, Chapleau DS, Chapleau MTS, Clergue TS, D.A. Watson TS, Echo River TS, Gartshore TS, Gartshore SS, Goulais Bay TS, Heyden CSS, Hollingsworth TS, Hwy 101 SS, Mackay TS*, Magpie TS, Northern Ave. TS, Patrick ST. TS, St. Mary's MTS, Tarentorous MTS, Third Line TS*, Wawa TS*, CTS1, CTS2, CTS3, CTS4, CTS5, CTS6 **Planned stations** Tagona West TS	Steephill Falls GS, Mission Falls GS, Harris GS, Lake Superior Power GS, Clergue GS, Prince WGS, Wells GS, Goulais WF, Gartshore GS, Mackay GS, Hogg GS, Bow Lake GS, Andrew GS, Aubrey Falls GS, Hollingsworth GS, McPhail GS, Scott GS

**Stations with Autotransformers installed*

The single line diagram of the transmission network of the ELS region is shown in Figure 3 below.

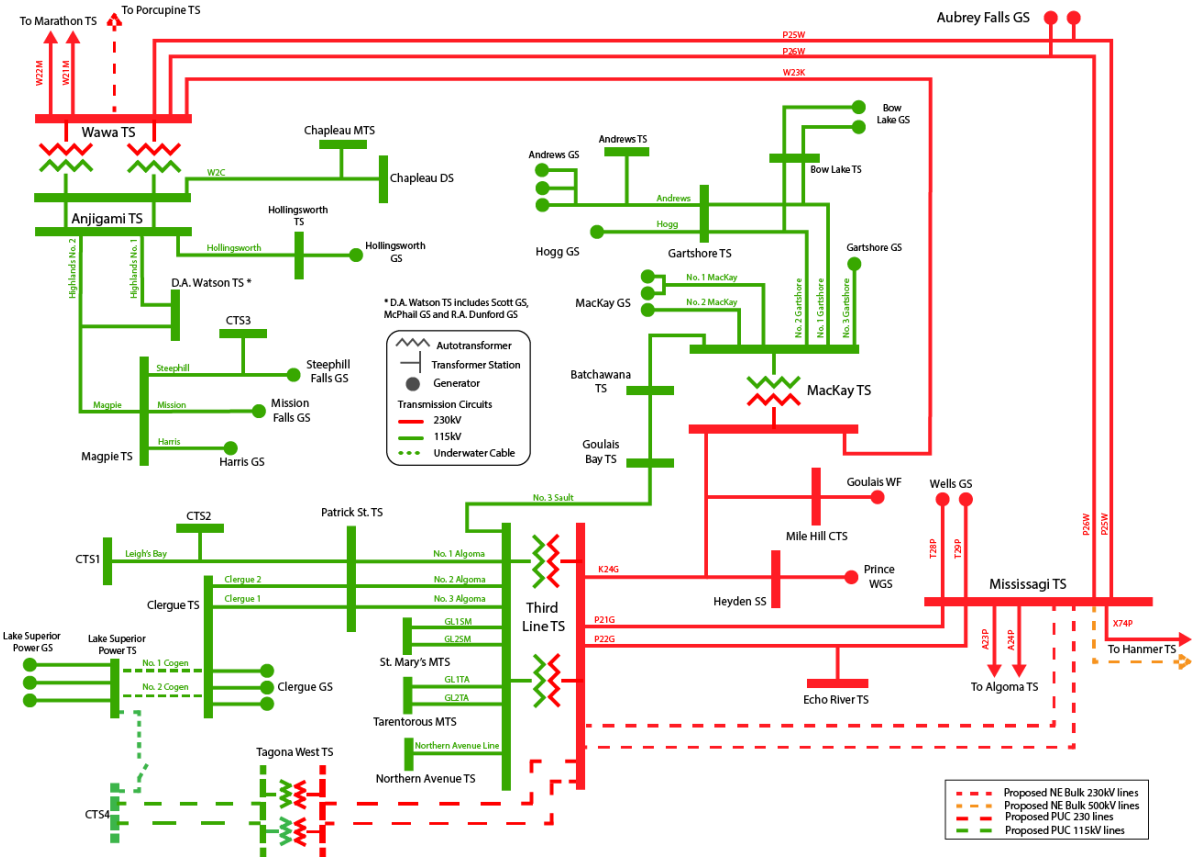

Figure 3: East Lake Superior Transmission Single Line Diagram

5. INPUTS AND DATA

The TWG participants provided information and input required for the preparation of the Needs Assessment report. With respect to the load forecast information, the OEB Regional Planning Process Advisory Group (RPPAG) recently published a document called "Load Forecast Guideline for Ontario" in October 2022. The objective of this document is to provide guidance to the TWG in the development of the load forecasts used in the various phases of the regional planning process with a focus on the NA and the IRRP. One of the inputs into the LDC's load forecast that is called for in this guideline is information from Municipal Energy Plans (MEP) and/or Community Energy Plans (CEP). The list of all the Municipalities falling under the geographical boundaries of the region are given in Appendix E.

The information provided includes the following:

- The ELS region 10-year Load Forecast for all supply stations is inclusive of the inputs provided by the municipalities through their MEPs & CEPs and through LDCs engagement with the municipalities and communities.

- Known capacity and reliability needs, operating issues, and/or major assets requiring replacement/ refurbishment.
- Planned/foreseen transmission and distribution investments that are relevant to Regional Planning for the ELS region.
- Captured uncertainty in the load forecast as well as variability of electric demand drivers to identify any emerging needs and/or advancement or deferment of recommended investments.

6. ASSESSMENT METHODOLOGY

The following methodology and assumptions are made in development of this Needs Assessment:

6.1 Technical Assessments and Study Assumptions

The technical assessment of needs was undertaken based on:

- Current and future station capacity and transmission adequacy.
- System reliability and operational considerations.
- Asset renewal for major high voltage transmission equipment requiring replacement with consideration to “right-sizing”.
- Load forecast data provided by LDCs and industrial customers in the region.
- 115 kV circuit Sault No. 3 is operating in network configuration between Third Line TS and Mackay TS.
- Existing load at Tarentorous MTS is assumed to be moved to the new Tagona West TS by 2030.
- This assessment is based on extreme summer and winter peak loads. The sensitivity scenario was developed by adding a large load at different locations in the region to conduct an analysis to cover unforeseen developments such as large industrial loads or higher than expected EV charging demand.

The following other assumptions are made in this report:

- The 10-year study period for this Needs Assessment is 2024-2033.
- The Region is winter peaking; however this assessment is based on summer and winter peak loads to account for equipment ratings often being more limiting in the summer.
- Line and autotransformer capacity adequacy is assessed by using coincident peak loads in the area.
- Load serving 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 Hydro One transformer stations is determined by the summer 10-Day Limited Time Rating (LTR) of a single transformer for Hydro One stations.

- Adequacy assessment is conducted as per Ontario Resource Transmission Assessment Criteria (ORTAC).

6.2 Information Gathering process

6.2.1. Load forecast:

The LDCs provided their load forecast for summer and winter season for all the stations supplying their loads in the ELS region for the 10-year study period including the inputs from the municipalities such as MEPs and CEPs. The IESO provided a Conservation and Demand Management ("CDM"), and Distributed Generation ("DG") forecast for the ELS region. The region's extreme summer/winter non-coincident peak gross load forecasts for each station were prepared by applying the LDC load forecast growth rates to the actual 2023 summer and winter peak extreme weather corrected loads. The extreme summer and winter weather correction factors were provided by Hydro One. The net extreme seasonal weather load forecasts were produced by reducing the gross load forecasts for each station by the percentage CDM and then by the amount of effective DG capacity provided by the IESO for that station. It is to be noted that as contracts for existing DG resources in the region begin to expire, the load forecast may show a decreasing contribution from local DG resources, and an increase in net demand. This extreme summer and winter weather corrected net load forecast for the individual stations in the ELS region is given in Appendix A. The region's extreme winter coincident net load forecast graph is provided in Figure 5. The graph shows the growth of the region within the study period of 2024 – 2033. In 2033, the Region's coincident peak is forecast to be approximately 762 MW.

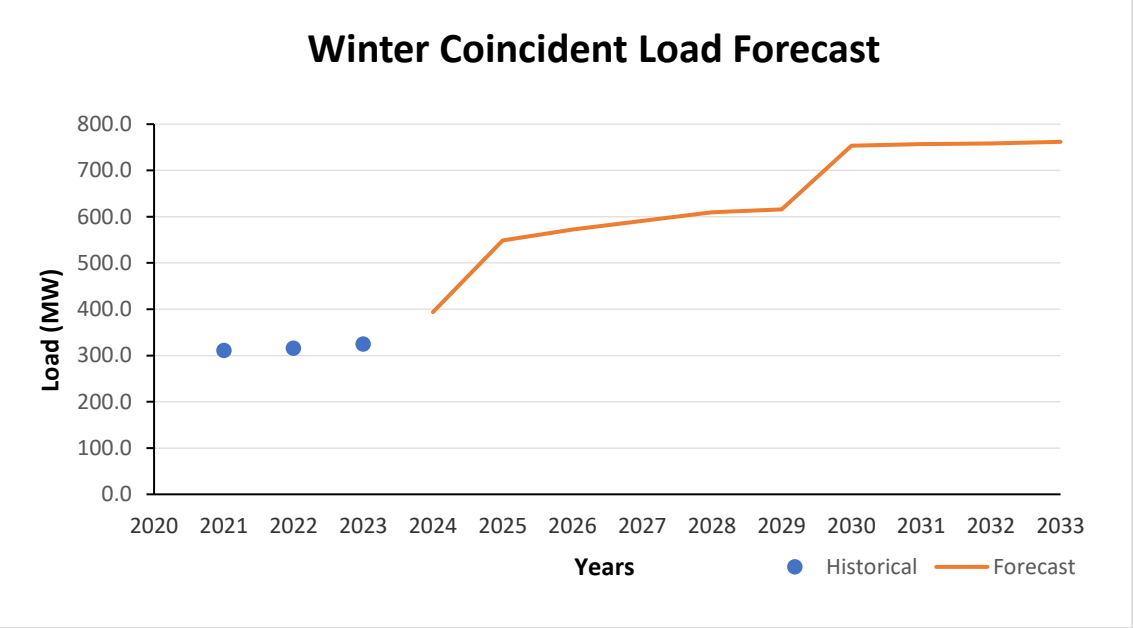

Figure 4: Winter Coincident Load Forecast

6.2.2. Sensitivity Analysis:

A sensitivity analysis was undertaken by the TWG to capture uncertainty in the load forecast as well as variability of drivers such as electrification. The NA recommendations are not necessarily linked to sensitivity scenarios; but rather the sensitivity is used to identify any emerging needs for consideration in developing recommendations. The impact of sensitivity analysis are provided in section 8 of this report.

6.2.3. Asset renewal Needs for Major HV Equipment:

Section 7.1 lists major HV transmission equipment planned and/or identified to be refurbished and/or replaced based on asset condition assessment, relevant for Regional Planning purposes. This includes HV transformers, autotransformers, HV breakers, HV underground cables and overhead lines.

6.2.4. System Reliability and Operational Issues:

Relevant information regarding system reliability and operational issues in the region as feedback provided by the IESO and Hydro One Operations during the NA phase.

7. NEEDS

This section describes emerging new needs identified in the Region and/or updates on previously identified needs since the completion of previous regional planning cycle.

Needs identified and discussed in the previous regional planning cycle, along with associated projects recently completed, as well as reaffirmed needs currently in progress, are briefly outlined below with relevant updates. These will not be discussed further in the report. These projects include:

1. Providing remote arming of Third Line TS Instantaneous Load Rejection ("ILR") scheme to the IESO – completed in 2023/2024.
2. Third Line TS – End-of-life P21G/P22G protection replacement: planned in-service year for the project is 2027.
3. Third Line TS – Autotransformer T2 replacement: planned in-service year for the project is 2027.
4. Echo River TS – Install new transformer and breaker replacement: project completed in 2024.
5. Sault No.3 – End-of-life Line replacement: planned in-service year for the project is 2026.
6. Batchawana TS – End-of-life components replacement: API has requested HOSSM to procure equipment and build the LV yard capable of operating at 25 kV in the future. The project is being executed with expected completion in Q4 2024.
7. Goulais TS – End-of-life components replacement: API has requested HOSSM to procure equipment and build the LV yard capable of operating at 25 kV in the future. API has also

requested for another feeder position to improve reliability within their distribution system. API and HOSSM are to continue coordination activities. Planned in-service year for the project is 2028.

8. Patrick St. TS – End-of-life 115 kV breaker replacement: planned in-service year for the project is 2028.
9. Northern Ave TS – End-of-life Transformer T1 replacement: planned in-service year for the project is 2030.
10. Clergue TS – End-of-life Metal clad switchgear replacement: planned in-service year for the project is 2028.
11. Hollingsworth TS – End-of-life protection replacement: planned in-service year for the project is 2031.
12. D.A. Watson – End-of-life Metal clad switchgear replacement: planned in-service year for the project is 2031.

Note: The planned in-service year for the above projects is tentative and is subject to change.

All near, and mid-term needs that are discussed as a part of this report are summarized in Table 3 below.

Table 3: Near/Mid-term Needs Identified in Previous RIP and/or this NA

Need Description	Recommended Plan/Update	Previous RIP Report Section	NA Report Section
Asset Renewal Needs			
St. Mary's MTS and Tarentorous MTS – station refurbishment/upgrade	Recommended for further review in the next phases of RP.	N/A	7.1.1
Station Capacity Needs			
Anjigami TS and Hollingsworth TS – transformer overload	Assess solution options via a Local Plan between API and HOSSM.	7.10	7.2.1
Third Line TS – 230/115 kV autotransformer reaches 90% of LTR upon the loss of companion unit	Continue to monitor the loading of the autotransformers at Third Line TS.	6.2	7.2.2
Tagona West TS – 230/115 kV autotransformer overload upon the loss of companion unit	PUC Transmission intends to implement manual load reduction to mitigate the need. Recommended for further study as part of the SIA and accordingly documented in the next phases of RP.	N/A	7.2.3
Transmission Line Capacity Needs			
Algoma No.1/ No.2/ No.3 – circuit overload after loss of any two Algoma circuits	Need can be mitigated by cross-tripping overloaded circuit using the Third Line RAS, rejecting all load at Patrick St. TS.	7.3	7.3.1

	Recommended for further review in the next phases of RP.		
Sault No. 3 – circuit overload	Need can be mitigated by cross-tripping Sault No.3 upon the loss of K24G (during a P25W or P26W outage) using Mackay Generation Rejection scheme. Recommended to review necessity of Sault No.3 cross-trip in the next phases of RP, in coordination with SIA for the new northeast bulk projects.	6.3.2	7.3.2
Voltage Performance			
Voltage violation at Third Line TS	The violations can be mitigated by using Load Rejection (LR) schemes and/or RAS at Third Line TS. Recommended to review the necessity Third Line TS LRs and RAS contingencies in the next phases of RP, in coordination with SIA for the new northeast bulk projects.	6.1.1	7.4.1
System Reliability, Operation and Load restoration Needs			
Third Line TS – 115 kV voltage limitations	Existing voltage limit at Third Line TS 115 kV bus is restricted to operate between 118 kV - 124 kV range. Recommended to monitor need until PUC Distribution replaces existing transformers with new units equipped with ULTC at St. Mary's MTS.	N/A	7.5.1

7.1 Asset Renewal Needs for Major HV Transmission Equipment

In addition to the previously identified asset renewal needs from the second regional planning cycle, the TWG has also identified new asset renewal needs for major equipment that are expected to be replaced over the next 10 years in the ELS Region. The list of major HV transmission equipment requiring replacement in the ELS Region is provided in table 4 in this section.

Asset Replacement needs are determined by asset condition assessment. Asset condition assessment is based on a range of considerations such as:

- Equipment deterioration due to aging infrastructure or other factors
- Technical obsolescence due to outdated design
- Lack of spare parts availability or manufacturer support

- Potential health and safety hazards, etc.

The major equipment information shared and discussed as part of this process is listed below:

- 230/115 kV autotransformers
- 230 kV and 115 kV load serving step down transformers
- 230 kV and 115kV breakers where:
  Replacement of six breakers or more than 50% of station breakers, the lesser of the two
- 115 kV transmission lines requiring refurbishment where:
  Leave to Construct (i.e., section 92) approval is required for any alternative to like-for-like

The Asset renewal assessment considers the following options for "right sizing" the equipment:

- Maintaining the status quo
- Replacing equipment with similar equipment with *lower* ratings and built to current standards
- Replacing equipment with similar equipment with *lower* ratings and built to current standards by transferring some load to other existing facilities
- Eliminating equipment by transferring all the load to other existing facilities
- Replacing equipment with similar equipment and built to current standards (i.e., "like-for-like" replacement)
- Replacing equipment with higher ratings and built to current standards

From Hydro One's perspective as a facility owner and operator of its transmission equipment, do nothing is generally not an option for major HV equipment due to safety and reliability risk of equipment failure. This also results in increased maintenance cost and longer duration of customer outages.

Table 4: Major HV Transmission Asset assessed for Replacement in the region (New)

Station/Circuit	Need Description	Planned ISD
St. Mary's MTS and Tarentorous MTS	Station Refurbishment/Upgrade	2030

7.1.1 St. Mary's MTS and Tarentorous MTS – Station Upgrade

St. Mary's MTS and Tarentorus MTS are 115/34.5 kV transformer stations owned and operated by PUC Distribution in the city of Sault Ste. Marie. Each station is supplied by two (2) 115 kV circuits from Third Line TS, has four (4) 30 MVA, 115/34.5 kV step-down transformers and four (4) 115 kV disconnect switches. All assets in both stations are approaching end-of-life and recommended for replacement in the near to mid-term planning horizon.

PUC Distribution retained a consultant to assess alternatives for station refurbishment/upgrade for both stations. As part of the assessment, alternatives to change primary supply voltage from 115 kV to 230 kV

at Third Line TS were investigated. The assessment also investigated retiring Tarentorous MTS and moving the station load from Third Line TS to the new Tagona West TS.

The TWG recommends to further review the need in the next Regional Planning phases.

7.2 Station Capacity Needs

A Station Capacity assessment was performed over the study period 2024-2033 for the 230 kV and 115 kV transformer stations in the Region using either the summer or winter peak load forecasts that were provided by the Technical Working Group. Based on the results, the following station capacity needs have been identified in the during the study period:

7.2.1 Anjigami TS and Hollingsworth TS – Transformer Overload

Anjigami TS has a 40 MVA, 115/44 kV transformer supplying a 44 kV circuit named Anjigami No.1. Hollingsworth TS has a 28 MVA, 115/11.5 kV transformer (T1), and a 28 MVA, 11.5/44 kV transformer (T2) supplying a 44 kV circuit, Limer No.1. Anjigami TS and Hollingsworth TS supply the same the load pocket. The 44 kV circuits are connected at Highway 101 SS forming a closed loop between the two stations. See figure 4 below.

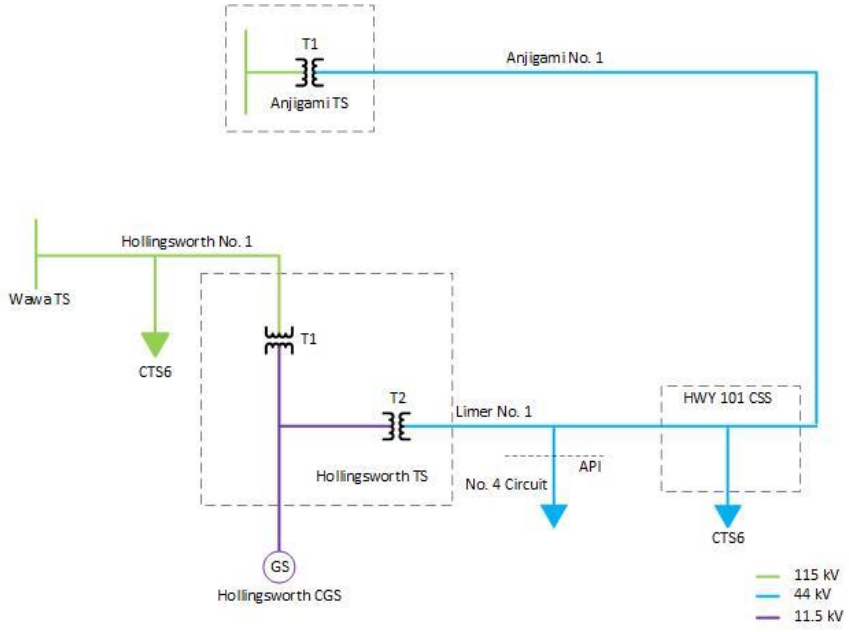

Figure 5: Anjigami TS and Hollingsworth TS - Single Line Diagram

The LDC supplied by the 44 kV circuit, API has recently experienced load growth, from 15 MW to 25 MW, in this pocket. As a result, a loss of supply from Anjigami TS results in thermal overload of both transformers and two (2) 11.5 kV disconnect switches at Hollingsworth TS, when the load exceeds 22 MW.

API will restrict their load to 22 MW to respect the thermal ratings of the equipment at Hollingsworth TS, as an interim measure. An industrial customer in the load pocket is also looking to increase their load from 1 MW to approximately 11 MW by year 2029. If all load increase materializes, a loss of supply from Hollingsworth TS will result in overload of transformer at Anjigami TS. Hence, both stations are at or approaching their maximum capacity to supply load.

A long-term solution is required to address the growing demand in the 44 kV pocket. The capacity needs are confined to customers in this 44 kV pocket. Hence, the TWG recommends further assessing potential solutions via a Local Plan between API and HOSSM.

7.2.2 Third Line TS – 230/115 kV Autotransformer Overload

Third Line TS has two (2) 250 MVA, 230/115 kV autotransformers presently supplying majority of the load in the city of Sault Ste. Marie. In the previous Regional Planning cycle, it was observed that loss of one autotransformer causes the companion autotransformer to be loaded close to its LTR thermal rating. As part of their asset renewal strategy, PUC Distribution is looking at an alternative to retire Tarentorous MTS and move load to the new Tagona West TS (section 7.1.1). If they decide to do so, the loss of an autotransformer will not result in overload of the companion unit, hence mitigating the emerging need. However, if Tarentorous MTS load is not moved to Tagona West TS, the same contingency will result in the companion autotransformer at approximately 90% LTR loading in year 2033.

In the previously RP cycle, the TWG recommended monitoring the total load supplied by autotransformers at Third Line TS. The TWG maintains the recommendation to monitor the loading of the autotransformers at Third Line TS.

7.2.3 Tagona West TS – 230/115 kV Autotransformer Overload

PUC Transmission will build a new 230/115 kV station called Tagona West TS to supply 300 MW of electric power to the new EAF facility through its 115 kV bus. Tagona West TS will connect to Third Line TS via two (2) 230 kV circuits and will have two (2) 200 MVA, 230/115 kV autotransformers that supply load to the 115 kV bus. The autotransformers will not have overload capability.

For the loss of one of the autotransformers at the new Tagona West TS the companion autotransformer will overload beyond its thermal rating under peak EAF load. PUC Transmission intends to have an agreement with their customer to manually reduce the EAF load so that it is within the thermal rating of their autotransformers under such circumstances. TWG recommends the mitigation measure to be reviewed in the SIA process and documented in the next phases of Regional Planning.

7.3 Transmission Lines Capacity Needs

All line and equipment loads shall be within their continuous ratings with all elements in service and within their long-term emergency (“LTE”) ratings with any one element out of service. Immediately following

contingencies, lines may be loaded up to their short-term emergency ("STE") ratings where control actions such as re-dispatch, switching, etc. are available to reduce the loading to the long-term emergency ratings. A Transmission Lines Capacity Assessment was performed over the study period 2024-2033 for the 230 kV and 115 kV Transmission line circuits in the ELS region by assessing thermal limits of the circuit and the voltage range as per ORTAC to cater this need. Based on the results, the following line capacity needs have been identified in the during the study period:

7.3.1 Algoma No.1/ No.2/ No.3 – 115 kV Circuit Overload

Patrick St. TS is supplied by 115 kV circuits, Algoma No.1, Algoma No.2 and Algoma No.3 from Third Line TS and connects to the local generation via 115 kV circuits Clergue No.1 and Clergue No. 2. Under normal operating conditions the Algoma circuits are adequately rated to supply Patrick St. TS load. However, overloading can be observed on the Algoma circuits under contingency conditions described below.

The loss of any two Algoma circuits or a failure of circuit breaker 214 at Patrick St. TS (loss of Algoma No.2 & No.3) will result in thermal overload of the remaining Algoma circuit beyond its STE rating. Currently, this need is mitigated by manual load curtailment at Patrick St. TS, when any of the Algoma circuits are out of service. A new Third Line Remedial Action Scheme ("RAS") is being installed at Third Line TS which will (i) enable load rejection capability under weak system conditions and (ii) facilitate the connection of the new EAF facility to the transmission network. The RAS is planned to be in-service by Q1 2025. With any Algoma circuit out of service, and the subsequent loss of another Algoma circuit, the new RAS will be capable to cross-trip the remaining circuit to prevent thermal overload. This will result in all load at Patrick St. TS being rejected. This is not a desirable outcome.

Though the need can be mitigated as described above, the TWG recommends to further review in the next Regional Planning phases and develop options requiring smaller load rejection.

7.3.2 Sault No.3 – 115 kV Circuit Overload

Sault No. 3 is a 115 kV circuit between Third Line TS and Mackay TS, currently operating radially out of Third Line TS. Planned refurbishment of the circuit is underway with expected completion in 2026. After refurbishment, the circuit will operate in a network configuration, as considered in this assessment. Under normal operating conditions there is no overload observed on the circuit. During an outage of P25W or P26W, the loss of K24G (the 230 kV parallel path), may result in an overload on Sault No.3. As part of the refurbishment, the Mackay TS – No. 3 Sault 115 kV – Generation Rejection Scheme (Remedial Action Scheme) will be modified to cross-trip Sault No.3 (open circuit at Mackay TS end) for loss of K24G.

It is recommended to review the necessity of this Sault No.3 cross trip in the next phases of Regional Planning and coordinated with the ongoing System Impact Assessments for the northeast bulk projects.

7.4 Voltage Performance

At the time of this assessment there is currently three unique schemes employed at Third Line TS:

1. Third Line TS – Loss of T1/T2 or P21G/P226 GLP Instantaneous Load Rejection Scheme
   - Status based scheme
2. Third Line TS – Under Voltage Load Rejection Scheme
   - 115 kV Voltage-sensing scheme
3. Third Line TS – Northwest Load Rejection Scheme (Sault Ste. Marie portion)
   - Receives a cascaded signal from Mississagi TS for loss of 230 kV circuits P25W and P26W, A23P and A24P and loss of S22A or X74P

7.4.1 Voltage Violation at Third Line TS

Condition 1: Today, the loss of P21G and P22G will result in a severe voltage decline at Third Line TS 230 kV and 115 kV buses. When the future 230 kV circuits between Mississagi TS and Third Line TS, P23G and P24G are in-service during the study period, a loss of P21G and P22G will no longer result in voltage violations at Third Line TS. The TWG recommends that the Third Line TS – Loss of T1/T2 or P21G/P226 GLP Instantaneous Load Rejection Scheme be reviewed in the SIA for the new circuits to verify if the need to monitor for contingency of P21G and P22G remains.

Condition 2: Two (2) 230/115 kV autotransformers, T1 and T2, supply the 115 kV bus at Third Line TS. Under an outage of either autotransformer at Third Line TS, the loss of the companion autotransformer will result in a voltage collapse at Third Line TS 115 kV bus. In this assessment, the load at Tarentorous MTS was moved to Tagona West TS, thereby reducing the load on the 115 kV system at Third Line TS. Even after this relocation of load, the Third Line TS – Loss of T1/T2 or P21G/P226 GLP Instantaneous Load Rejection Scheme is still required to mitigate voltage collapse. Since load rejection is not a desired mitigation method, the TWG recommend the need for further review in next phases of Regional Planning.

It is also recommended to review the necessity of the Third Line TS – Under Voltage Load Rejection scheme in conjunction with the Third Line TS - Loss of T1/T2 or P21G/P226 GLP Instantaneous Load Rejection Scheme. Review to be conducted in the next phases of Regional Planning.

It is further recommended to review the necessity and functionality of the Third Line TS – Northwest Load Rejection Scheme (Sault Ste. Marie portion). Review to be conducted in the next phases of Regional Planning and coordinated with the ongoing System Impact Assessments for the northeast bulk projects.

7.5 System Reliability, Operation and Restoration Needs

The transmission system must be planned to satisfy demand levels up to the extreme weather, median-economic forecast for an extended period with any one transmission element out of service. This section

assesses operational concerns and the Load Security and Load Restoration criteria for the Region over the study period 2024-2033 to cater this need**.**

7.5.1 Third Line TS – 115 kV Voltage Limitation

The 115 kV bus at Third Line TS is restricted to operate within a narrow range of 118 kV to 124 kV. The Operations groups at the IESO and Hydro One have requested a review of the voltage range. The limitation is due to a voltage sensitive load connected to the LV bus of Tarentorous MTS and the transformers not having Under Load Tap Changers ("ULTC") to regulate the bus voltage. As part of St. Mary's MTS and Tarentorous MTS station refurbishment/upgrade, PUC Distribution has decided to replace existing transformers with unit that have ULTC to regulate the LV bus voltage. This is expected to resolve the issue. The TWG recommends continuing to monitor the voltage limitation and further assess as part of the future SIA for station refurbishment for St. Mary's MTS and Tarentorous MTS.

7.5.2 Load Security

As per ORTAC load security criteria:

Criteria #1: With all transmission facilities in service, equipment loading must be within continuous ratings, voltages must be within normal ranges and transfers must be within applicable normal condition stability limits. This must be satisfied coincident with an outage to the largest local generation unit.

An outage of the largest generator, Wells G1 or G2 resulted in all equipment loading to be within continuous rating and voltages to be in normal ranges.

Criteria #2: With any one element out of service, equipment loading must be within applicable long-term emergency ratings, voltages must be within applicable emergency ranges, and transfers must be within applicable normal condition stability limits. Planned load curtailment or load rejection, excluding voluntary demand management, is permissible only to account for local generation outages. Not more than 150 MW of load may be interrupted by configuration and by planned load curtailment or load rejection, excluding voluntary demand management.

For all n-1 contingencies in the ELS region, this criterion is satisfied.

Criteria #3: With any two elements out of service, voltages must be within applicable emergency ranges, equipment loading must be within applicable short-term emergency ratings and transfers must be within applicable emergency condition stability limits. Equipment loading must be reduced to the applicable long-term emergency ratings in the time afforded by the short-time ratings. Planned load curtailment or load rejection exceeding 150 MW is permissible only to account for local generation outages. Not more than 600 MW of load may be interrupted by configuration and by planned load curtailment or load rejection, excluding voluntary demand management.

- For a double circuit loss of the new 230 kV circuits between Third Line TS and Tagona West TS, the maximum load lost by configuration would be 380 MW in year 2033 as per this assessment. This will be the largest load lost under an n-2 contingency for the Region. [Meets criterion]

- After the loss of both autotransformers at Third Line TS, a voltage violation is averted by rejecting no more than 150 MW of load. [Meets criterion]

For all n-2 contingencies in the ELS region, this criterion is satisfied.

7.5.3 Load Restoration

The transmission system is planned with design criteria in a way to ensure that the affected loads can be restored within restoration time provided.

- All loads must be restored within approximately 8 hours.
- Load interruption greater than 150 MW, the excess amount of load greater than 150 MW needs to be restored within approximately 4 hours.
- Load interruption greater than 250 MW, the excess amount of load greater than 250 MW needs to be restored within approximately 30 minutes.

In ELS region there are radial circuits and loads that are supplied by single transformers. There can be instances where load may not be restored within 8 hours as per ORTAC criteria. A local planning report was completed for the Batchawana TS and Goulais TS in the previous RIP cycle to assess supply options. Based on the analysis conducted, having a permanent Mobile Unit Substation ("MUS") connection facility will facilitate a faster restoration time upon transformer contingency.

At Echo River TS, HOSSM in consultation with API installed a hot-spare transformer to facilitate fast restoration, upon the loss of the main load serving transformer.

At Andrews TS, HOSSM has a tentative restoration plan to mobilize a MUS nearby in the event of a transformer failure.

8. SENSITIVITY ANALYSIS

The objective of a sensitivity analysis is to capture uncertainty in the load forecast as well as variability of electric demand drivers to identify any emerging needs and/or advancement or deferment of recommended investments. Due to the nature of load inquiries in the Region, the TWG agreed to assess sensitivity scenarios by adding a large load in different pockets of the ELS region.

For the analysis, a 200 MW load is applied at the following locations:

a. Double circuit tap to the new 230 kV circuits P23G/P24G
b. Direct connection to 230 kV bus at Tagona West TS
c. Direct connection to 230 kV bus at Mackay TS

Findings

The sensitivity analysis for winter and summer loading had similar results. Reactive support is required for all connection locations assessed.

a) Double circuit tap to new P23G/P24G circuits
   - There is no need that arises from this finding.

b) Direct connection to 230 kV bus at Tagona West TS
   - Loss of either 230 kV circuit between Third Line TS and Tagona West TS will result in the companion circuit being loaded over 90% of its thermal rating (600 MVA).
   - Loss of new P23G+P24G (n-2) will result in 95-98% of LTE rating for P21G and P22G. [Summer case finding]
   - If load connects to the 115 kV bus at Tagona West TS, new autotransformers will be required. Or else the new load will exacerbate the autotransformer overload discussed in section 7.2.3.

c) Direct connection to 230 kV bus at Mackay TS
   - P25W or P26W outage and subsequent loss of K24G (n-1-1) will result in overload of Sault No.3 circuit. However, this contingency can be mitigated by Mackay TS Generation Rejection scheme.
   - Loss of new P23G+P24G (n-2) will result in 85-90% of LTE rating for P21G and P22G. [Summer case finding]
   - Loss of P25W+P26W (n-2) will result in voltage change close to 10% at the Wawa and Mackay 230 kV buses. [loads not converted to voltage-dependent model]

As per the sensitivity analysis, no new needs arise due to the addition of a large load in the ELS region. However, the analysis does indicate a few emerging needs that can be monitored as the load in the Region grows. Based on the analysis findings no immediate action is required.

9. CONCLUSION AND RECOMMENDATION

The Technical Working Group's recommendations to address the needs identified are as follows:

Table 5: Needs which do not require further regional coordination

Sr.no.	Need	Recommendation
1	Anjigami TS and Hollingsworth TS – transformer overload	Assess solution options via a Local Plan between API and HOSSM.

Table 6: Needs which require further regional coordination

Sr.no.	Need	Recommendation
1	St. Mary's MTS and Tarentorous MTS – station refurbishment/upgrade	Recommended for further review in the next phases of RP.
2	Third Line TS – 230/115 kV autotransformer reaches 90% of LTR upon the loss of companion unit	Continue to monitor the loading of the autotransformers at Third Line TS.
3	Tagona West TS – 230/115 kV autotransformer overload upon the loss of companion unit	PUC Transmission intends to implement manual load reduction to mitigate the need. Recommended for further study as part of the SIA and accordingly documented in the next phases of RP.
4	Algoma No.1/ No.2/ No.3 – circuit overload after loss of any two Algoma circuits	Need can be mitigated by cross-tripping overloaded circuit using the Third Line RAS, rejecting all load at Patrick St. TS. Recommended for further review in the next phases of RP.
5	Sault No. 3 – circuit overload	Need can be mitigated by cross-tripping Sault No.3 upon the loss of K24G (during a P25W or P26W outage) using Mackay Generation Rejection scheme. Recommended to review necessity of Sault No.3 cross-trip in the next phases of RP, in coordination with SIA for the new northeast bulk projects.
6	Voltage violation at Third Line TS	The violations can be mitigated by using Load Rejection (LR) schemes and/or RAS at Third Line TS. Recommended to review the necessity Third Line TS LRs and RAS contingencies in the next phases of RP, in coordination with SIA for the new northeast bulk projects.
7	Third Line TS – 115 kV voltage limitations	Existing voltage limit at Third Line TS 115 kV bus is restricted to operate between 118 kV - 124 kV range. Recommended to monitor need until PUC Distribution replaces existing transformers with new units equipped with ULTC.

10. REFERENCES

[1] Independent Electricity System Operator, Ontario Resource and Transmission Assessment Criteria (issue 5.0 August 22, 2007)

[2] Ontario Energy Board, Transmission System Code (issue July 14, 2000 rev. October 1st, 2024)

[3] Ontario Energy Board, Distribution system Code (issue July 14, 2000 rev. October 1st, 2024)

[4] Ontario Energy Board, Load Forecast Guideline for Ontario (issue October 13, 2022)

[5] Hydro One, second cycle ELS Regional Infrastructure Plan report (Issue October, 2021)

Appendix A: Extreme Summer/Winter Weather Adjusted Net Load Forecast

Table A.1: ELS Region – Summer Non-Coincident Net Load Forecast – Extreme weather

Station/DESN	LTR (MW)	Historical (MW)			Summer Non-Coincident Net Forecast (MW)									
		2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Andrews TS	4.5	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4
Batchawana TS	11.3	1.7	1.3	1.5	1.7	1.8	1.8	1.9	1.9	1.9	2.1	2.0	2.1	2.1
DA Watson TS	87.8	4.4	4.6	4.1	7.0	7.2	7.4	7.7	7.9	8.2	8.3	8.6	8.8	9.1
Echo River TS	29.1	12.4	11.7	12.5	14.1	14.4	14.8	15.0	15.4	15.6	15.9	16.2	16.5	16.8
Goulais TS	13.5	4.6	4.6	4.7	6.2	6.3	6.4	6.5	6.5	6.6	6.7	6.8	6.8	6.9
Mackay TS	4.5	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Northern Ave TS (34.5kV)	24.0	1.8	4.2	2.6	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.07	0.07
Northern Ave TS (12.5kV)	5.4				2.5	2.5	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.5
No. 4 Circuit	N/A	14.6	14.2	15.4	24.9	25.3	25.5	25.7	25.8	26.0	26.2	26.4	26.6	26.8
Chapleau DS	12.4	8.6	8.6	9.1	9.8	9.9	10.0	10.0	10.1	10.1	10.2	10.3	10.4	10.5
St. Mary's MTS	81.0	91.0	86.1	95.7	47.5	58.4	58.7	59.0	0.0	0.0	61.6	62.1	62.5	63.1
Tarentorus MTS	81.0				63.4	64.1	64.8	65.5	66.1	66.8	0.0	0.0	0.0	0.0
Tagona West TS**	180.0	N/A	N/A	N/A	0.0	0.0	0.0	0.0	60.0	70.0	45.0	47.0	48.0	50.0
Patrick St. TS	N/A	122.4	132.2	140.9	176.0	188.0	188.0	188.0	188.0	188.0	188.0	188.0	188.0	188.0
Chapleau MTS	N/A	1.8	1.8	1.8	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
CTS1	N/A	14.8	15.1	15.0	15.5	15.4	15.4	15.3	15.2	15.2	15.1	15.0	15.0	15.0
CTS2	N/A	15.4	15.7	15.4	16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5
CTS3	N/A	8.5	8.4	9.8	15.0	13.1	13.1	15.8	15.8	15.8	15.7	15.6	15.6	15.6
CTS4	N/A	N/A	N/A	N/A	0.0	140.0	140.0	140.0	140.0	140.0	300.0	300.0	300.0	300.0
CTS5	N/A	N/A	N/A	N/A	0.0	0.0	24.0	31.7	42.8	42.8	42.8	42.8	42.8	42.8
CTS6	N/A	0.3	0.4	0.4	0.4	0.4	0.4	11.7	11.7	11.7	11.7	11.7	11.7	11.7

*** In 2030, PUC Distribution intend to relocate load from Tarentorous MTS to Tagona West TS. To be confirmed and finalized in the next phases of RP.*

Table A.2: ELS Region – Winter Non-Coincident Net Load Forecast – Extreme Weather

Station/DESN	LTR (MW)	Historical (MW)			Winter Non-Coincident Net Forecast (MW)									
		2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Andrews TS	4.5	0.2	0.3	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Batchawana TS	11.3	1.5	1.8	1.7	2.0	2.1	2.1	2.2	2.2	2.3	2.3	2.4	2.5	2.5
DA Watson TS	87.8	7.7	8.3	8.0	9.1	9.2	9.1	9.2	9.2	9.2	9.3	9.3	9.3	9.3
Echo River TS	29.1	14.1	15.2	15.6	16.6	16.7	16.9	17.0	17.3	17.4	17.6	17.9	18.0	18.2
Goulais TS	13.5	7.7	8.9	8.4	9.9	10.0	10.1	10.2	10.3	10.5	10.5	10.7	10.8	11.0
Mackay TS	4.5	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Northern Ave TS (34.5kV)	24.0	2.3	2.5	2.7	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
Northern Ave TS (12.5kV)	5.4				3.0	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9
No. 4 Circuit	N/A	15.0	16.7	16.6	26.5	26.9	27.2	27.5	27.9	28.1	28.3	28.8	29.0	29.4
Chapleau DS	15.4	11.0	10.5	10.7	11.5	11.6	11.7	11.8	11.9	12.0	12.1	12.2	12.3	12.5
St. Mary's MTS	81.0	111.5	119.1	114.5	58.1	69.0	70.5	71.0	0.0	0.0	72.3	73.0	73.3	74.0
Tarentorus MTS	81.0				73.9	78.0	78.9	79.8	80.6	81.5	0.0	0.0	0.0	0.0
Tagona West TS**	180.0	N/A	N/A	N/A	0.0	0.0	0.0	0.0	70.0	75.0	60.0	62.0	63.0	65.0
Patrick St. TS	N/A	143.1	136.8	151.4	176.0	188.0	188.0	188.0	188.0	188.0	188.0	188.0	188.0	188.0
Chapleau MTS	N/A	3.8	4.1	3.7	4.1	4.1	4.1	4.1	4.0	4.0	4.0	4.0	4.0	4.0
CTS1	N/A	15.2	15.9	15.3	15.9	15.8	15.8	15.7	15.6	15.6	15.5	15.5	15.4	15.4
CTS2	N/A	15.7	15.5	15.5	16.4	16.4	16.4	16.3	16.2	16.2	16.1	16.1	16.0	16.0
CTS3	N/A	9.7	9.6	10.1	11.0	11.9	11.9	12.5	12.5	12.4	12.4	12.4	12.3	12.3
CTS4	N/A	N/A	N/A	N/A	0.0	140.0	140.0	140.0	140.0	140.0	300.0	300.0	300.0	300.0
CTS5	N/A	N/A	N/A	N/A	0.0	0.0	24.0	31.7	42.8	42.8	42.8	42.8	42.8	42.8
CTS6	N/A	0.7	0.8	0.7	0.8	0.7	0.7	11.5	11.5	11.4	11.4	11.4	11.3	11.3

*** In 2030, PUC Distribution intend to relocate load from Tarentorous MTS to Tagona West TS. To be confirmed and finalized in the next phases of RP.*

Appendix B: Current Lists of Step-Down Transformer Stations

No.	Transformer Station	Voltage (kV)	Supply Circuits
1	Andrew TS	115/25	Andrew 115kV
2	Anjigami TS	115/44	Hollingsworth 115kV, High Falls No.1, High Falls No.2
3	Batchawana TS	115/12.5	Sault No.3
4	Chapleau DS	115/25	W2C
5	Chapleau MTS	115	W2C
6	Clergue TS	115/12.5	Cogen No.1, Cogen No.2, Clergue No.1, Clergue No.2,
7	DA Watson TS	115/34.5	Magpie 115kV, High Falls No.1, High Falls No.2
8	Echo River TS	230/34.5	P22G
9	Goulais Bay TS	115/12.5	Sault No.3
10	Hollingsworth TS	115/12.5/44	Hollingsworth 115kV, Limer No. 1
11	Northern Ave TS	115/34.5/12.5	Northern Ave 115kV
12	Patrick St TS	115/34.5	Clergue No.1, Clergue No.2, Algoma No.1, Algoma No.2, Algoma No.3
13	St. Mary's MTS	115/34.5	GL1SM, GL2SM
14	Tarentorous MTS	115/34.5	GL2TA, GL1TA
15	Mackay TS	115/25	Gartshore No.1, Gartshore No.2, Mackay No.1, Mackay No.2, Sault No.3

Appendix C: Current Lists of Transmission Circuits

No.	Connecting Stations	Circuit ID	Voltage (kV)
1	Mississagi x Third line	P21G, P22G	230
2	Mississagi x Wawa	P25W, P26W	230
3	Third line x Mackay	K24G	230
4	Mackay x Wawa	W23K	230
5	Third line x Mackay	Sault No.3	115
6	Third line x Patrick st	Algoma No.1 / No.2 / No.3	115
7	Third line x Norther Ave	Northern Ave 115kV	115
8	Third line x St Mary CTS	GL1SM, GL2SM	115
9	Third line x Tarentorus CTS	GL1TA, GL1TA	115
10	Patrick st x Flakeboard CTS	Leigh's Bay 115kV	115
11	Patrick st x Clergue TS	Clergue No.1 / No.2	115
12	Mackay GS x Mackay TS	Mackay No.1 / No.2	115
13	Gartshore SS x Mackay TS	Gartshore No.1 / No.2	115
14	Gartshore SS x Hogg CGS	Hogg 115kV	115
15	Gartshore SS x Andrew CGS	Andrew 115kV	115
16	Magpie SS x Mission Falls CGS	Mission falls 115kV	115
17	Magpie SS x Steephill CGS	Steephill 115kV	115
18	Magpie SS x Harris CGS	Harris 115kV	115
19	Magpie SS x DA Watson TS	Magpie 115kV	115
20	DA Watson TS x Wawa TS	High Falls No.1/No.2	115
21	Hollingsworth TS x Wawa TS	Hollingsworth 115kV	115
22	Anjigami TS x Hwy 101 SS	Anjigami No. 1	44
23	Hollingsworth TS x Hwy 101 SS	Limer No. 1	44

Appendix D: List of LDCs

No.	Name of LDC
1	Algoma Power Inc.
2	PUC Distribution
3	Hydro One Distribution

Appendix E: List of Municipalities in the ELS Region

No.	Name of Municipality
1	City of Sault Ste. Marie

Appendix F: Acronyms

Acronym	Description
A	Ampere
BES	Bulk Electric System
BPS	Bulk Power System
CDM	Conservation and Demand Management
CEP	Community Energy Plan
CIA	Customer Impact Assessment
CGS	Customer Generating Station
CSS	Customer Switching Station
CTS	Customer Transformer Station
DESN	Dual Element Spot Network
DG	Distributed Generation
DS	Distribution Station
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
MEP	Municipal Energy Plan
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.
NUG	Non-Utility Generator
OEB	Ontario Energy Board
ORTAC	Ontario Resource and Transmission Assessment Criteria
PF	Power Factor

PPWG	Planning Process Working Group
RAS	Remedial Action Scheme
RIP	Regional Infrastructure Plan
SA	Scoping Assessment
SIA	System Impact Assessment
SPS	Special Protection Scheme
SS	Switching Station
STG	Steam Turbine Generator
TS	Transformer Station