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LOCAL PLANNING REPORT

Sam Lake DS Capacity Need
Region: Northwest Ontario

Revision: Final
Date: January 12, 2023

Prepared by:

Hydro One Transmission

Hydro One Distribution

Sioux Lookout Hydro

This report is prepared on behalf of the Northwest Ontario Local Planning technical working group with the participation of representatives from the following organizations:

Organization
Hydro One Networks Inc. (Lead Transmitter)
Hydro One Networks Inc. (Distribution)
Sioux Lookout Hydro

Disclaimer

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

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LOCAL PLANNING EXECUTIVE SUMMARY

REGION	Northwest Ontario (the "Region")		
LEAD	Hydro One Networks Inc. ("Hydro One")		
START DATE	February 2, 2022	**END DATE**	January 12,2023

1. INTRODUCTION

The purpose of this Local Planning (LP) report is to develop wires-only options and recommend a preferred wires solution that will address the local need identified in the second cycle Needs Assessment (NA) report (dated July 17, 2020) for the Northwest Ontario Region,. As per the NA report, the technical working group (TWG) recommended that no further coordinated regional planning was required to address the Sam Lake DS Capacity need and that it should be addressed through local planning led by Hydro One and with participation of the impacted LDCs.

The development of the LP report is in accordance with the regional planning process as set out in the Ontario Energy Board's (OEB) Transmission System Code (TSC) and Distribution System Code (DSC) requirements and the "Planning Process Working Group (PPWG) Report to the Board".

2. LOCAL NEEDS ADDRESSED IN THIS REPORT

The Sam Lake area (Town of Sioux Lookout and the Town of Hudson) capacity is a local need addressed in this report.

3. ALTERNATIVES CONSIDERED

Hydro One (Transmitter) and Hydro One Distribution and Sioux Lookout Hydro (LDCs) have considered addressing the above need with the following options:

- Alternative 1 – T1 and T2 Transformer both in service at Sam Lake DS
- Alternative 2 – Install fan monitoring on T1 and T2 at Sam Lake DS
- Alternative 3 – Install an additional (3rd) transformer at Sam Lake DS
- Alternative 4 – Construct a new 115kV/25kV station supplied from circuit K3D of Hydro One Transmission System
- Alternative 5 – Construct a new 230kV/25kV station supplied from Wataynikaneyap transmission system

Please see section 3 for further details.

4. PREFERRED SOLUTION

The preferred solution is Alternative 2 – Install Fan Monitoring on Transformer T1 and T2 at Sam Lake DS.

Please see Section 4 for further details.

5. NEXT STEPS

Hydro One Distribution will lead on execution of the preferred solution as soon as possible. Sioux Lookout Hydro will provide necessary support to Hydro One Distribution on next step.
The TWG will continue to monitor the load growth and trigger the next regional planning cycle earlier if needed based on how the load forecast scenario materializes.

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1. Introduction

The Needs Assessment (NA) for the second regional planning cycle of the Northwest Ontario region was completed in July 2020 in accordance with the Ontario Energy Board's (OEB) Regional Planning process. The Technical Working Group (TWG) identified needs that are emerging in the Northwest Ontario Region over the next ten years (from the date of the NA). One of the needs identified by the TWG was a local capacity need for the Town of Sioux Lookout and the Town of Hudson One. The TWG determined that this need did not require further coordinated regional planning and recommended that it be further assessed through the transmitter-led Local Planning (LP) process.

Some of the considerations the TWG took in recommending that this need be addressed through LP includes (but not limited to):

- A SA or IRRP phase would not yield a different result, i.e., a "non-wires" solution or a different "wires" solution
- Resource options (i.e., CDM, DG) are clearly not practical nor economical
- The scope and magnitude of the infrastructure investments would not typically require (i.e., trigger):
  - Upstream transmission investments
  - Leave to Construct and/or Environmental Assessment approvals
- Typically involves one or two distributors

Further, since no upstream system voltage and flow violations were observed in the NA study the TWG recommended that no further regional coordination was necessary and that Sioux Lookout Hydro, Hydro One Distribution and Hydro One Transmission should collaborate to develop a suitable solution to address this need as part of an LP study. However, the TWG acknowledges that this need may be revisited at a later date should additional findings during subsequent phases of this regional planning cycle occur.

The purpose of this LP assessment is to develop and evaluate options to address the need and recommend a preferred solution(s).

Note that a confidential version with more details is available upon request if applicable.

1.1 Northwest Ontario Region and Sam Lake DS Area

Electrical supply to the Northwest Ontario Region is provided through a combination of local generation stations connected to the 230 kV and 115 kV network, the East-West Tie transmission corridor, the 230kV and 115kV connections to Manitoba and the 115kV connection to Minnesota. The boundaries of the Northwest subregions are shown in Figure 1. A single-line diagram of the Northwest region is shown in Figure 2.

Sam Lake DS is located in the West of Thunder Bay sub-region. Supply to this sub-region is provided from a 230 kV transmission system consisting of Kenora TS, Fort Frances TS, Dryden TS, and Mackenzie TS. In addition, Sam Lake DS is radially supplied from the 115kV circuit K3D supplied out of Dryden TS.

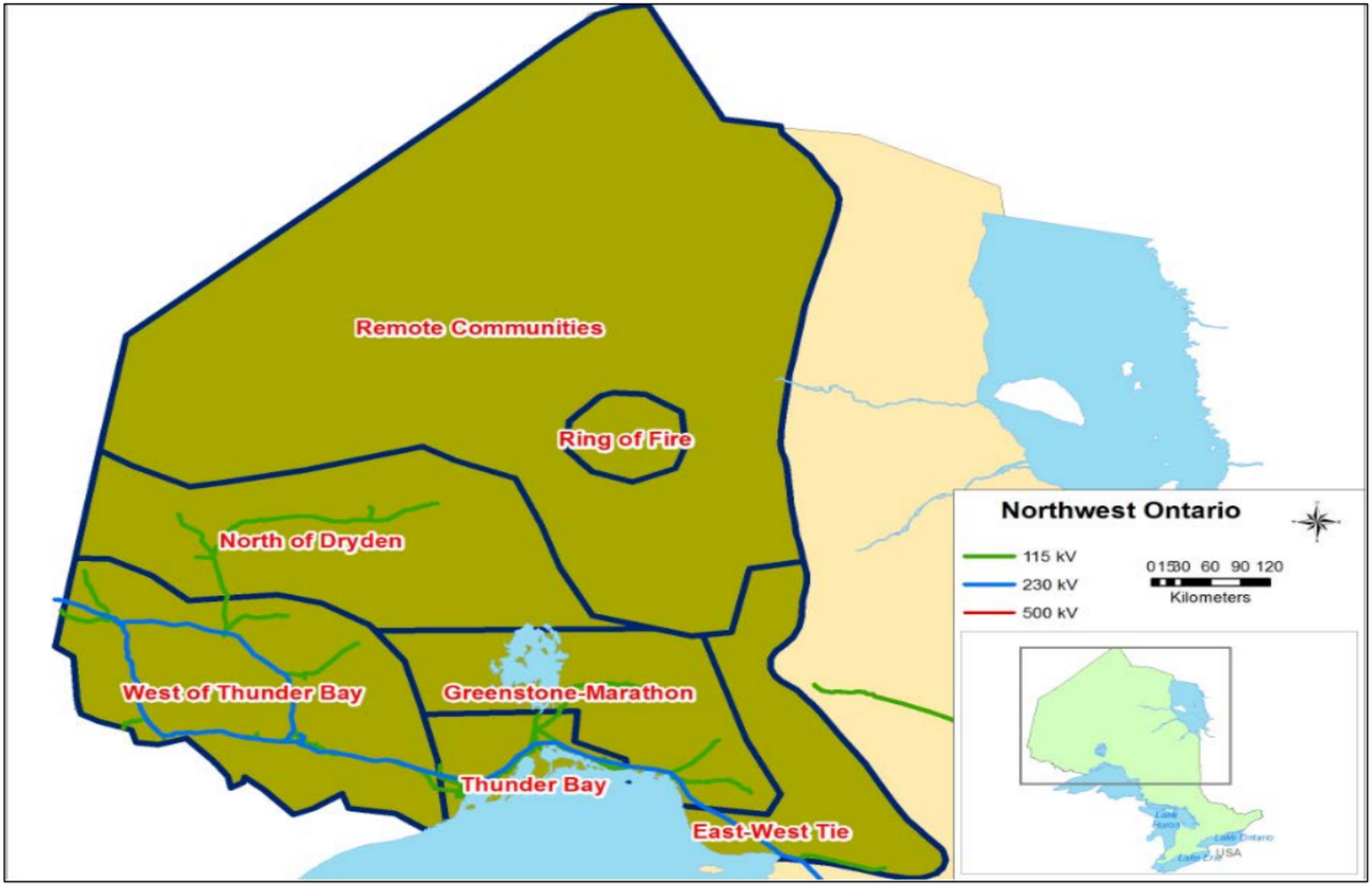

Figure 1: Northwest Ontario Region Map

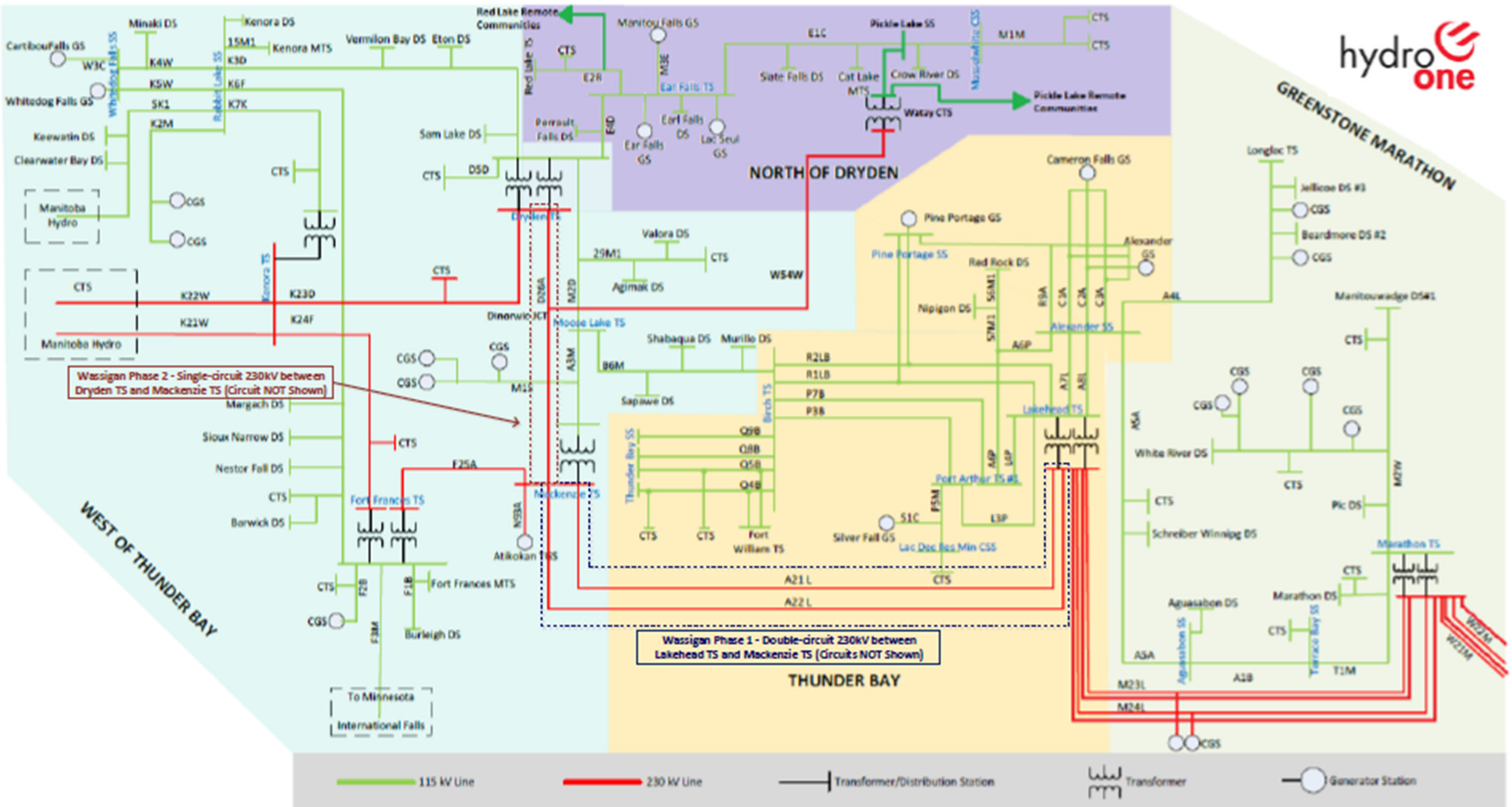

Figure 2: Northwest Ontario region single line diagram

2. Sam Lake DS Capacity Need

Sam Lake DS is a Hydro One Distribution owned 115/25kV high voltage distribution station (HVDS) located approximately 75km northeast of Dryden TS, supplied from 115kV circuit K3D. The station is the sole supply for Sioux Lookout Hydro LDC. A single-line diagram of Sam Lake DS is shown in Figure 3. It contains two 115kV/25kV 15/20/25MVA transformers (T1 and T2), which connect the 115kV system to four 25kV feeders. As shown in the single-line diagram, although two transformers are connected, only one of the transformers is in-service at any given time. Occasionally, or in case of a failure of the in-service transformer, the failed transformer is taken out of service, and the other transformer replaces it. The ratings of the existing transformers at Sam Lake DS and the station loading limit are shown in Table 1. The current loading limit of the station is equal to the loading limit of one transformer.

Table 1: Sam Lake DS - Transformer Ratings (T1&T2)

Time	Rating (MVA)	Loading Limit (MVA)
Summer	15/20/25	18.75 MVA
Winter	15/20/25	24.0 MVA

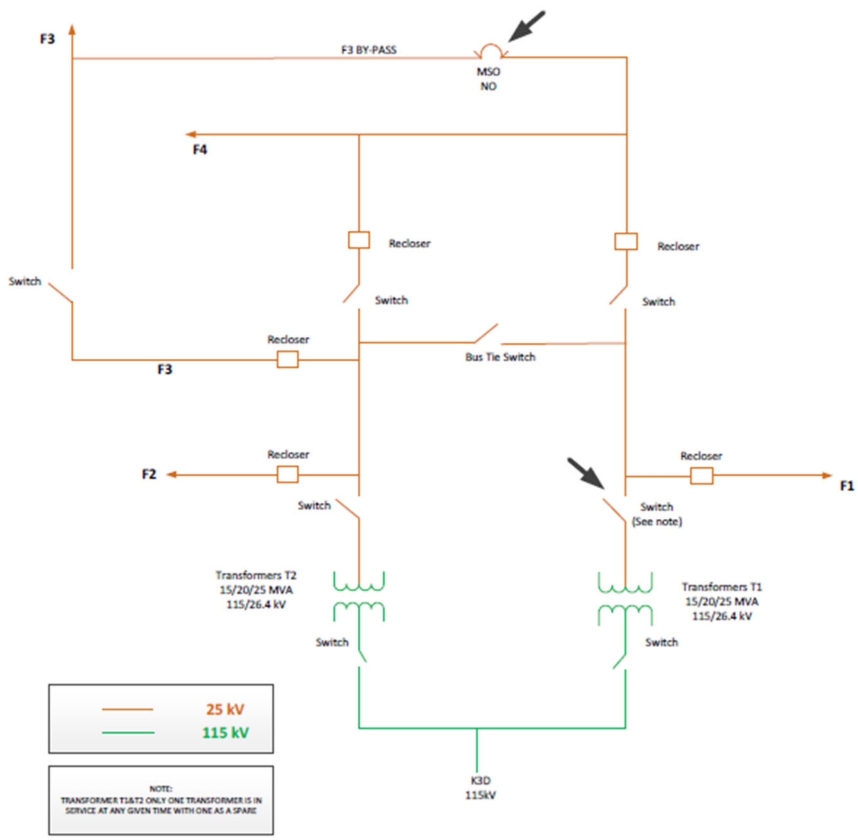

Figure 3:Single Line Diagram of Sam Lake DS

The two transformers at Sam Lake DS are presently equipped with fans, but no fan monitoring system.

The loading limit of the transformers is 18.75 MVA in the summer and 24.0 MVA in the winter.

The historical feeder peak loads and capacities are shown in Table 2[1]. Feeder F1 supplies the town of Hudson exclusively, and feeders F2 and F3 supply the town of Sioux Lookout and the areas between Sam Lake DS and the town. Feeder F4 was dedicated to the Old Mill location near Hudson, which is currently not operational.

Table 2: Sam Lake DS historical feeder loads and capacity

Feeder	Peak (kVA)	Month	Capacity (kVA)
F1	3658	February	6400
F2	5716	February	12802
F3	14860	February	17604
F4	Not In Service	N/A	Conductor Capacity = 7773kVA F4 Feeder Recloser = 28806kVA

The approximate locations of the load centers supplied by Sam Lake DS are shown in Figure 4. As can be seen in Table 2, about 85% of the historical peak load is associated with the loads near the town of Sioux Lookout (east of Sam Lake DS). About 15% of the historical peak load is associated with loads near the community of Hudson and across the lake (west of Sam Lake DS). Please note that the peaks in Table 2 may not be coincidental. The peak load shown in Table 2 includes both Hydro One and Sioux Lookout Hydro loads.

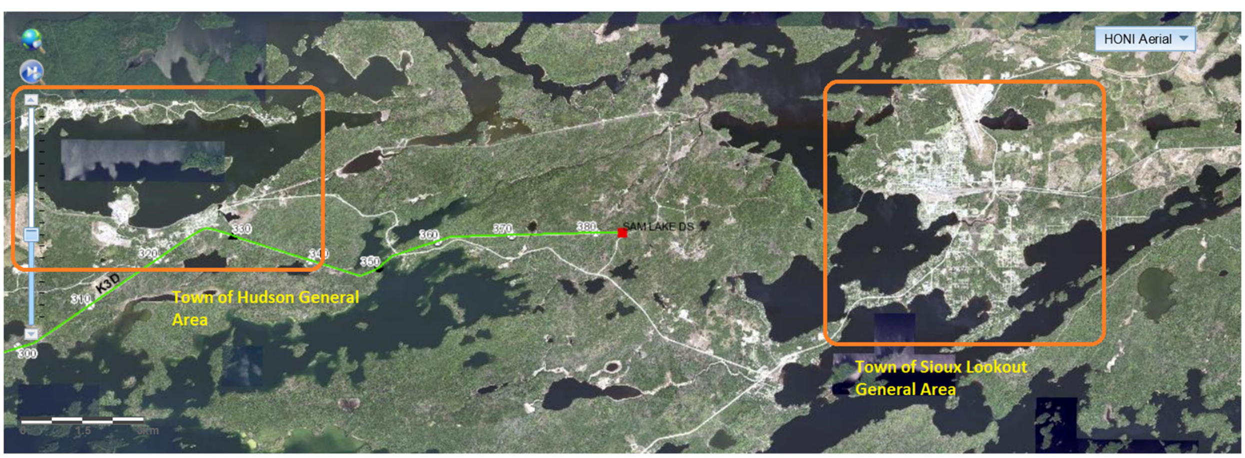

Figure 4: Marked Load Center of the Sam Lake Area

2.1 Sam Lake DS Local Area Future Needs

The capacity needs at Sam Lake DS were first identified in the Sioux Lookout Hydro's letter and were confirmed during the Needs Assessment (NA) phase of Northwest second regional planning

[1] Sioux Lookout Hydro Inc, "System Capacity-Load Forecast Study Report", Date: December 19, 2019, C16-0005

cycle. As per the NA report, due to the significant load increase additional voltage support may be required in the area to address post-contingency voltage decline and voltage change limit requirements as per the Ontario Resource and Transmission Assessment Criteria (ORTAC). No upstream system voltage and flow violations were observed in the NA study.

The load forecast for Sam Lake DS is shown in Table 3 and Table 4. Sioux Lookout Hydro updated their load forecast, including the forecast for Sam Lake DS, after the completion of the NA study. Tables 3 and 4 below show the original and the modified load forecasts under conservative and aggressive load growth scenarios for both summer and winter.

Table 3: Sam Lake DS Winter Load Forecast (extreme weather corrected)

Year	NA Load Forecast (Gross Load) – MW	Updated Conservative Load Forecast (Gross Load) – MW	Aggressive Load Growth Scenario Forecast - MW	Historical Load Peak - MW
2019	-	-	-	23.23
2020	22.22	-	-	22.08
2021	24.41	25.73	25.92	23.53
2022	25.85	26.23	28.90	23.09
2023	26.83	26.94	30.13	-
2024	27.83	27.34	30.81	-
2025	30.37	27.66	31.35	-
2026	31.87	27.76	31.50	-
2027	32.90	27.86	31.65	-
2028	33.93	27.95	31.79	-
2029	34.96	28.05	31.93	-
2030	-	28.15	34.13	-
2031	-	28.25	34.23	-
2032	-	28.35	34.33	-
2033	-	28.45	34.43	-
2034	-	28.55	34.53	-
2035	-	28.65	34.63	-
2036	-	28.75	34.73	-
2037	-	28.86	34.83	-
2038	-	28.96	34.93	-
2039	-	29.06	35.03	-
2040	-	29.17	35.13	-

Table 4: Sam Lake DS Summer Load Forecast (extreme weather corrected)

Year	NA Load Forecast (Gross Load) - MW	Updated Conservative Load Forecast (Gross Load) – MW	Aggressive Load Growth Scenario Forecast - MW
2020	11.3	11.3	11.3
2021	11.5	11.5	11.5
2022	11.6	11.6	11.6
2023	11.8	11.8	11.8
2024	11.9	11.9	11.9
2025	12.0	12.0	12.0
2026	12.1	12.1	12.1
2027	12.2	12.2	12.2
2028	12.3	12.3	12.3
2029	12.4	12.4	12.4

As seen in Table 3 and Table 4, both the original and the updated load forecasts indicate that the load will soon exceed the winter loading limit (24.0MVA) of Sam Lake DS. In addition, winter loading on Sam Lake DS is more than double of the summer loading. Therefore, options presented in the following section of the report will focus on winter load limitations.

2.2 Needs Timeline

Figure 5 illustrates the capacity needs timeline taking both conservative and aggressive load growth scenarios into account.

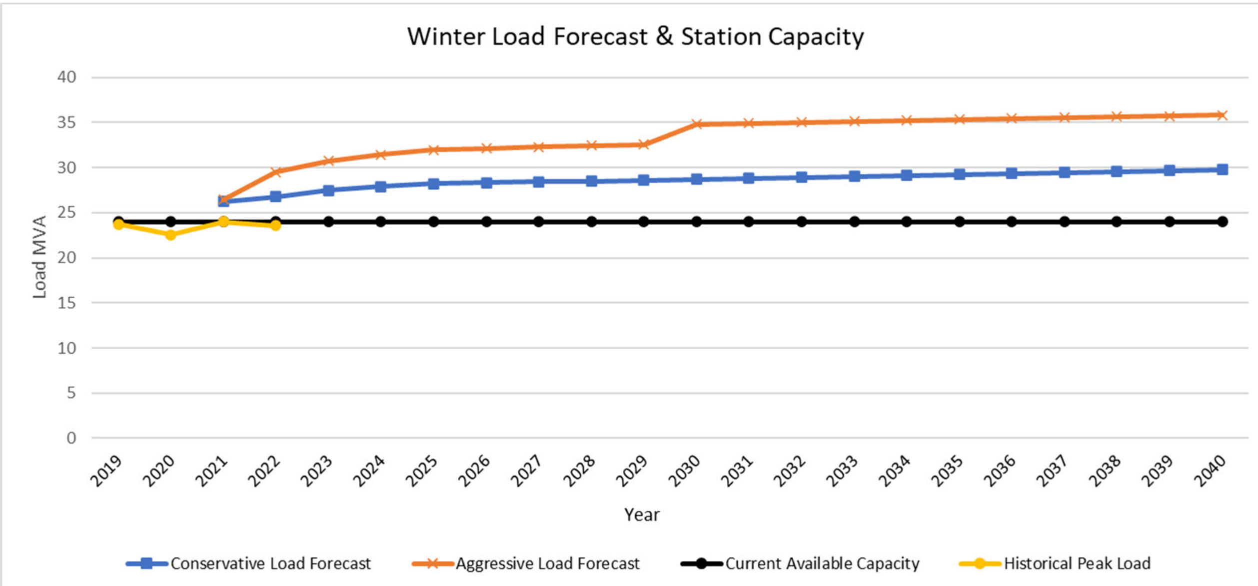

Figure 5: Additional Capacity Needs Timeline

Under the conservative load growth scenario, 3MVA additional capacity is needed as early as 2023 and 4.8MVA by 2030. By 2040, the total additional capacity in the area is expected to be increased by 5.7MVA.

The aggressive load growth scenario was checked for sensitivity. Additional capacity of 6.7MVA could be required by 2023, 8.5MVA by 2029 and ultimately 11.8MVA by 2040.

Near-term and long-term solutions will be provided in the next section.

3. Alternatives Considered

The following options were considered by the Technical Working Group (TWG) in this Local Planning study.

Alternative 1 – T1 and T2 Transformer both in service at Sam Lake DS

Currently, only one of the transformers is on load, while the other is a hot spare in case of a transformer contingency. Therefore, the additional capacity can be made available if both T1 and T2 are in service.

Alternative 2 – Install fan monitoring on T1 and T2 at Sam Lake DS

As discussed in section 2, T1 and T2 transformers at Sam Lake DS are currently equipped with unmonitored fans, and it is not reliable to load the transformers at the maximum fan-cooled rating without a fan monitoring system. Therefore, installing fan monitoring can increase the station capacity at Sam Lake DS.

Alternative 3 – Install an additional (3rd) transformer at Sam Lake DS

An additional transformer at Sam Lake DS can also increase the capacity at Sam Lake DS.

Alternative 4 – Construct a new 115kV/25kV station supplied from Hydro One's K3D Circuit

A new high voltage distribution station (HVDS) can be built to increase the capacity of the area.

Alternative 5 – Construct a new 230kV/25kV station supplied from Wataynikaneyap transmission system

A new station can be built and supplied from the new Wataynikaneyap 230 kV system, which would bring in a new transmission supply and significantly improve the load supply diversity at the Sam Lake DS area in case of a K3D outage.

3.1 Assessment of Alternatives and Recommendation

The assessment of alternatives is based on the station capacity, reliability, and fulfillment timeline. In addition, the NA report indicates the potential need for voltage support at Sam Lake DS. Voltage support requirements were analyzed at the end of this section.

As per Section 3, Sam Lake DS is winter peaking and therefore, this section's analysis only considers the winter load forecast.

Near-term solutions will address the near-term needs of an additional 3-7MW by 2030 and will be discussed under the alternative 1 and 2 section.

3.1.1 Alternative 1 - T1 and T2 Transformer both in service at Sam Lake DS

As shown in Figure 3, only one of the transformers is in-service at Sam Lake DS. In case of a failure of the on-load transformer, the load will be transferred onto the companion transformer.

Alternative 1 is proposed to put both T1 and T2 at Sam Lake DS in-service. With both transformers in-service, the capacity will be increased to the following levels[2]:

- Winter – 2x24 MVA = 48MVA = **43.2MW** with 0.9 pf assumption
- Summer – 2x18.75 MVA = 37.5MVA = **33.75MW** with 0.9 pf assumption

This alternative would meet the capacity requirement based on the 2040 winter conservative and aggressive load forecast and at the minimum cost. However, the reliability of the area supply would be decreased. Upon the loss of one transformer, load would need to be rejected for the companion transformer to remain within its rating. With the n-1 transformer contingency occurring at the station, the capacity will only be 24MVA in winter, leading to load rejection for partial customers in the area. In addition, bus tie and related switches need to be opened to balance the load on the two transformers.

Therefore, this alternative is rejected in isolation as it introduces a reliability issue.

3.1.2 Alternative 2 - Install fan monitoring on T1 and T2 at Sam Lake DS

This alternative will address the capacity need by installing fan monitoring on both T1 and T2 at Sam Lake DS. With fan monitoring, the transformers can be operated at their ONAF2 ratings. The loading limit can reach 155% ONAF2 in winter and 125% ONAF2 in summer. Therefore, the capacity will increase to:

- Winter – 38.75MVA = **34.89MW** with 0.9 pf assumption
- Summer – 31.25MVA = **28.12MW** with 0.9 pf assumption

This alternative will provide sufficient capacity until 2040 under a conservative load growth scenario. The capacity will be slightly less than the load forecast of the aggressive load growth scenario, which was studied for sensitivity. Thus, this alternative can be considered a near-term solution, and one of the long-term alternatives can be utilized if the aggressive load growth is materialized. Since the fan monitoring will be installed on both T1 and T2 at Sam Lake DS, in the case of a transformer failure, the other can be switched on to supply the entire load in the area with minimum restoration time.

Station configuration is expected to remain unchanged in this alternative. Thus, no feeder or bus work is anticipated for this alternative.

[2]Hydro One Distribution planning loading limit is the sum of the in-service transformers' rating.

3.1.3 Alternative 3 - Install an additional (3rd) transformer at Sam Lake DS

The third alternative will increase the capacity in the area by installing a third transformer at Sam Lake DS. Two transformers will be in service and the other one will be the hot spare for contingency purposes.

A same size transformer as T1&T2 (15/20/25MVA) will be the optimal size for the additional transformer, as a larger size does not increase the area capacity in case of the 3rd transformer outage.

The capacity at Sam Lake DS with the additional transformer will be[2]:

- Winter: 2x24 MVA = 48MVA = **43.2MW** with 0.9 pf assumption
- Summer: 2x18.75 MVA = 37.5MVA = **33.75MW** with 0.9 pf assumption

If this option is combined with alternative 1b (Installing a fan monitoring system), the station capacity will be:

- Winter: 2x38.75MVA = 77.5MVA = **69.75MW** with 0.9 pf assumption
- Summer: 2x31.25MVA = 62.5MVA = **56.25MW** with 0.9 pf assumption

With an additional 3rd transformer of size 15/20/25 MVA, the load can be met until 2040 under the aggressive load growth scenario.

This alternative also improves the reliability in the area. Under n-1 transformer contingency, the spare transformer can be switched in and supply the area with no load loss.

However, while the station capacity may increase to the above levels, the current rating of distribution feeders may not allow the full utilization of the station capacity. Depends on the feeder load forecast of Sioux Lookout Hydro, Hydro One may need to replace hydraulic reclosers with electronic reclosers for feeders that are loaded beyond capability of hydraulic reclosers.

This alternative is associated with a higher cost and longer lead time to address the need as a new transformer is required.

3.1.4 Alternative 4 – Construct a new 115kV/25kV station supplied from Hydro One Circuit K3D

This alternative will address the capacity issue by constructing a new HVDS supplied from K3D. The new station can be built close to one of the existing load centers in the Sam Lake DS area to reduce the distribution losses. Reduced losses would reduce voltage drop along the feeder and improve the power quality for downstream customers. In addition, with shorter feeders, reliability is generally improved due to less exposure to potential faults.

The Town of Sioux Lookout and Hudson community are the primary load centers. The estimated load forecast for 2040 for the two load centers is shown in Table 5 below[3].

Table 5: 2040 Load Centers Estimated Forecast

Area	Conservative Load Forecast by 2040 (MW)	Aggressive Load Forecast by 2040 (MW)
Town of Sioux Lookout	24.8	29.9
Hudson Community	4.4	5.3

3.1.4.1Alternative 4a – HVDS at Town of Sioux Lookout

Building a new HVDS close to the City of Sioux Lookout will require extending the 115kV Circuit K3D for approximately 10km. Based on the Town of Sioux Lookout load in 2040, two 15/20/25 MVA 115kV/25kV transformers (one in service and one spare as contingency use)with a fan monitoring system would be required at the new HVDS. The new HVDS will consist of two feeders to supply the town of Sioux Lookout. Feeder configuration will be designed accordingly based on the specific location of the new HVDS.

The capacity with the HVDS at the Town of Sioux Lookout Area will be:

- Winter: 24MVA (Sam Lake DS) + 38.75MVA (new HVDS) = 62.75MVA = **56.47MW** with 0.9 pf assumption
- Summer: 18.75MVA (Sam Lake DS) + 31.25MVA (new HVDS) = 50MVA = **45MW** with 0.9 pf assumption

This alternative improves reliability by better managing planned or unplanned outage transfer capability between the existing and new station. Feeder configuration needs to be looked at based on the location of the new HVDS and ownership model. Also, tie switches with the existing feeders from Sam Lake DS can be installed if future feeder specific forecast/study allows.

Overall, this alternative requires significant investment and lead time with transmission circuit extension and new station construction.

3.1.4.2Alternative 4b – HVDS at Hudson Community + Alternative 2

Hudson community is close to the existing K3D circuit corridor. Thus, a direct line tap-off K3D is sufficient for this location. The new HVDS will consist of two 115kV/25kV 7.5/10/12.5MVA transformers (one in service and one spare for contingency purposes). The new HVDS will provide sufficient capacity to the Hudson community up to 2040 for both forecast scenarios.

Compared to alternative 4a, where the new HVDS is in the Sioux Lookout area, the Sam Lake DS capacity issue persists under alternative 4b, with the majority load being at the Sioux Lookout

[3] Load assumed to be divided as 85% for the town of Sioux Lookout and 15% the Hudson community as per Table 2

Town. Thus, alternative 4b needs to work with the near-term solution (installing a fan monitoring system) to address the capacity issue of the entire region.

This alternative will provide capacity as follows:

- Winter: 38.75MVA (Sam Lake DS) + 12MVA (new HVDS) = 50.75MVA = **45.67MW** with 0.9 pf assumption
- Summer: 31.25MVA (Sam Lake DS) + 9.37MVA (new HVDS) =40.62MVA= **36.55 MW** with 0.9 pf assumption

The solution improves the reliability of the Hudson community by shortening rural feeder length and lessening exposure to potential faults. Feeder configuration needs to be looked at based on the location of the new DS and ownership model; also, tie switches with the existing feeder F1 from Sam Lake can be installed if future feeder specific forecast allows; in the case of the new HVDS transformer outage, the Hudson community load can be transferred back to Sam Lake DS with the tie switch close.

This alternative will also have higher investment and longer lead time than Alternative 2 as a new station is to be built.

3.1.5 Alternative 5 – Construct a new 230kV/25kV TS station supplied from Wataynikaneyap transmission system

Wataynikaneyap ("Watay") Power project is a new transmission project currently under construction in Northwest Ontario. This project will be owned and operated by Wataynikaneyap Power. Figure 6 shows an overall view of the southern portion of the project. Figure 7 is zoomed in on the town of Sioux Lookout. As per figure 7, the City of Sioux Lookout is approximately 20km away from Wataynikaneyap 230kV line corridor.

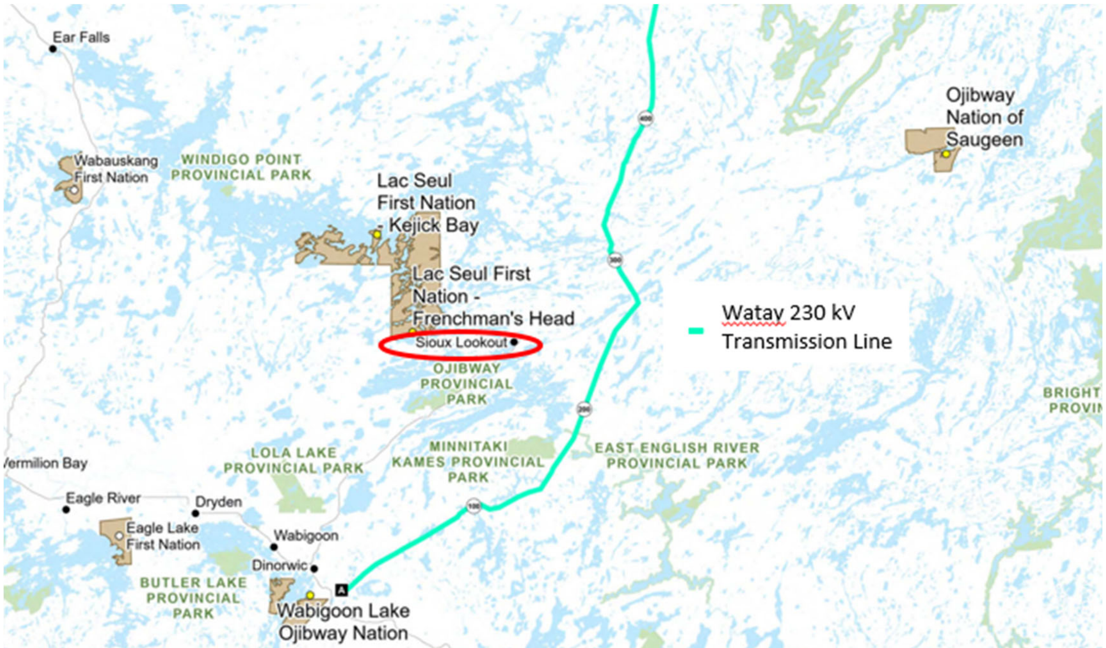

Figure 6:Southern Portion of Wataynikaneyap Project (source: https://www.wataypower.ca/)

Figure 7: Geographical Location of Town of Sioux Lookout & Wataynikaneyap 230kV Transmission Line

Alternative 5 involves constructing a 20 km new 230kV line tap and a new 230kV/25kV station near the load center. This alternative will enable two high voltage sources to supply the general area via 115kV K3D and Wataynikaneyap 230kV system. Under n-1 line contingency, the area load can be transferred between the two sources depending on station capacity size and distribution network configuration.

Detailed feeder configuration needs to be designed based on location of the new DS and ownership model. Also, feeder specific forecast would be required to confirm feeder configuration and tie locations.

However, the Wataynikaneyap connection project is under construction. Further coordination with a larger technical working group is required if the alternative is needed in the future.

3.2 Comparison of Alternatives

All five solutions can provide sufficient capacity up to 2040 under the conservative load growth scenario. The near-term solution 1a is rejected as it allows for additional capacity it does not provide adequate reliability to the area load. The near-term solution 1b will address the upcoming need in 2023 and up to 2037. If the aggressive forecasted load materializes, it could work with one of the long-term solutions when revisiting the local plan. The cost per incremental MW for alternative 2 is $0.14M.

The three long-term solutions require one new 230kV/25kV or 115kV/25kV station transformer to address the capacity issue. The main difference between them is whether to install an additional transformer at Sam Lake DS or construct a new station in the region. Nevertheless, all three long-term solutions improve the reliability of the area to different extents, the long-term alternatives' cost per incremental MW are significantly higher than alternative 2, ranging from $0.16M to $1.04M and the capacity beyond 35MW (2040 load model under aggressive load growth forecast) is not needed in the foreseeable future.

3.3 Thermal Capacity

The NA study did not indicate any thermal issues upstream of Sam Lake DS. Since the updated load forecast is less than the original load forecast that was used in the NA study up to the year 2029, it was assumed that the load growth would not cause any upstream thermal issues. Therefore, the planning exercise briefly examined the K3D thermal limit. Moreover, Sam Lake DS is radially supplied from Dryden TS, and no other customer is connected upstream. Dryden TS was also discussed.

3.3.1 K3D Thermal Capacity

The K3D circuit has a winter rating of approximately 93MW and a summer rating of approximately 72MW.

The load forecast of Sam Lake DS in 2040 is about 35MW in winter and 12MW in summer under the aggressive load growth scenario. Both seasons' loading and line losses will stay within limits.

3.3.2 Dryden Thermal Capacity

The NA has indicated that the Dryden 115kV subsystem can provide up to 240MW of continuous supply to Dryden 115kV subsystem[4] and North of Dryden Sub-Region[5]. As per the current load forecast from Needs Assessment in 2020, the Dryden 115kV subsystem is forecasted to be 80MW, and the North of Dryden Sub-Region is forecasted at 97MW in 2029. The total demand from these two systems is 177MW, which stays well within the Dryden thermal limits.

3.4 Voltage Support Requirement

The NA study indicated that due to the load growth at Sam Lake DS, local voltage support may be needed. A study was done to assess whether local voltage support is required based on the updated load forecast.

The voltage support requirement was assessed for Alternatives 1-3. Under alternative 4 and 5, local voltage support depends on the load at Sam Lake DS and Wataynikaneyap transmission operation, which needs additional details.

A quick analysis of 29MW (conservative forecast) and 35MW (aggressive forecast) load located at Sam Lake DS was conducted. The study shows a minimum of 10MVAR voltage support is required to avoid ORTAC voltage change violation under the conservative load growth scenario. A minimum of 20MVAR voltage support is needed to comply with ORTAC under the aggressive load growth scenario.

[4] Dryden 115kV Sub-System includes Vermillion Bay DS, Eton DS, Sam Lake DS, Agimak DS, Valora DS, Mattabi CTS and Domtar Dryden CTS.

[5] North of Dryden Sub-Region includes Red Lake TS, Cat Lake MTS, Crow River DS, Perrault Falls DS, Slate Falls, Ear Falls DS, Musselwhite CTS and Balmer CTS.

The final voltage support recommendation will be determined with the holistic region during the next regional planning phases. Capacitor bank details will be refined and determined as part of the future project if pursued.

4. Preferred Solution

As the 2020 Need Assessment report identified a local capacity need for the Town of Sioux Lookout and the Town of Hudson, Hydro One Networks, Hydro One Distribution, and Sioux Lookout Hydro have conducted a coordinated review and evaluation of all the alternatives to address the local capacity need.

The Technical Working Group (TWG) recommended Alternative 2 – Install fan monitoring on T1 and T2 at Sam Lake DS. This alternative allows Hydro One Distribution and Sioux Lookout Hydro to address the capacity need in the timeframe required (based on the winter conservative load forecast) and maintain supply reliability to the Sam Lake area customers. This alternative is the lowest cost option and achieves the best balance between cost versus local system benefits.

5. Next Steps

A summary of the next steps required to address the local need is as follows:

Table 6: Solutions and Timeframe

Need	Recommended Solution	Lead Responsibility	Timeframe
Capacity need at Sam Lake DS	• Alternative 2- Install fan monitoring on T1 and T2 at Sam Lake DS	Hydro One Distribution	ASAP

Sioux Lookout Hydro will provide necessary support to Hydro One Distribution on next step.

The TWG will continue to monitor the load growth and trigger the next regional planning cycle earlier if needed based on how the load forecast scenario materializes. If the load level is beyond the available capacity after implementing alternative 2, the need will be revisited in the next cycle of regional planning. Alternatives 4 and 5 can be explored after and further coordinated with other working group members in the next cycle of regional planning if needed.

References

[1] Hydro One, "NEEDS ASSESSMENT REPORT - Northwest Ontario Region", Date: July 17, 2020

Appendix A

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