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## **LOCAL PLANNING REPORT**

### **SUPPLY TO EAST OTTAWA AREA**

**Region: Ottawa**

**Revision: Final**

**Date: 26 November 2015**



## **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 IRRP for the City of Ottawa that do not require further coordinated regional planning. The preferred solutions that have been identified through this Local Planning Report may be reevaluated based on the findings of further analysis. The load forecast and results reported in this Local Planning Report are based on the information and assumptions provided by study team participants.

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## LOCAL PLANNING EXECUTIVE SUMMARY

<b>REGION</b>	Greater Ottawa Region (the “Region”)		
<b>LEAD</b>	Hydro One Networks Inc. (“Hydro One”)		
<b>START DATE</b>	12 January 2015	<b>END DATE</b>	26 November 2015
<b>1. INTRODUCTION</b>			
<p>The purpose of this Local Planning (LP) report is to provide a preferred option for the supply of east Ottawa. The development of the LP report is in accordance with the regional planning process as set out in the Ontario Energy Board’s (OEB) Transmission System Code (TSC) and Distribution System Code (DSC) requirements and the “Planning Process Working Group (PPWG) Report to the Board”.</p> <p>This need for further study was identified as part of the city of Ottawa IRRP as the future of Bilberry Creek TS was considered. Hydro One Sustainment has identified a number of key components needing replacement to keep the station operational in the future. Before that work is committed, it was deemed prudent to look at supply options for the area.</p>			
<b>2. LOCAL NEEDS ADDRESSED IN THIS REPORT</b>			
<p>The Local needs addressed in this report include the following:</p> <ul style="list-style-type: none"> <li>• East Ottawa future supply options considering Bilberry Creek TS is approaching end of life.</li> <li>• Costs associated with each option.</li> </ul>			
<b>3. OPTIONS CONSIDERED</b>			
<p>The supply of East Ottawa depends heavily on the decision made for Bilberry Creek TS. The following options were considered</p> <ul style="list-style-type: none"> <li>• Conversion of Orleans TS to 230kV supply and retirement of Bilberry Creek TS.</li> <li>• Refurbishment of Bilberry Creek TS.</li> <li>• Status quo.</li> </ul>			
<b>4. PREFERRED SOLUTION</b>			
<p>The preferred solution at this time is the status quo. This need will be reviewed at the next planning cycle.</p> <p>See Section 4 of the main report for further detail.</p>			
<b>5. NEXT STEPS</b>			
<p>Reassess the situation at the next cycle of regional planning.</p>			

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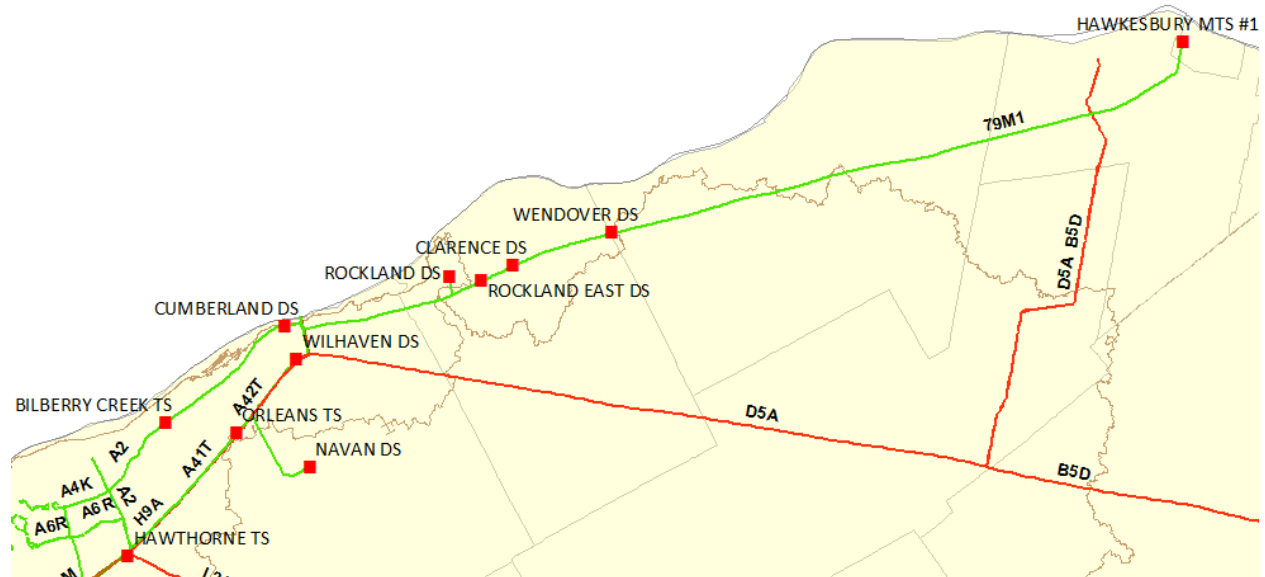


# 1 INTRODUCTION

As part of the Ottawa IRRP, a need was identified in east Ottawa for a local planning study to assess the area's future supply options. This study is in response to Hydro One Sustainment advising that Bilberry Creek TS, an important supply for the area, is aging and a number of key components need to be replaced by 2023 for the station to continue operation. This study was initiated to review and compare the Bilberry Creek TS refurbishment option with the alternative option of retiring Bilberry Creek TS in the context of the long term supply plan for the East Ottawa area.

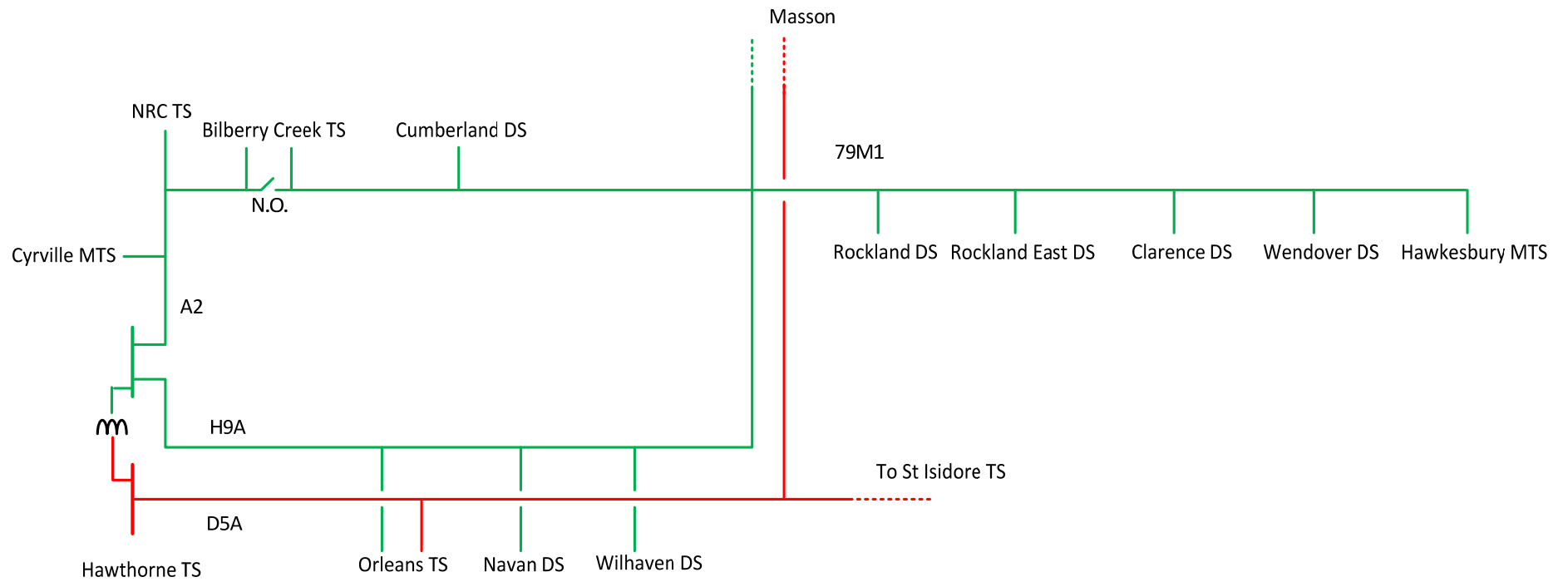
## 1.1 East Ottawa Description

The East Ottawa area including Orleans is supplied by 115kV transmission circuits A2, A4K, and H9A/79M1 and 230kV circuit D5A as shown in Figure 1. Figure 2 shows the electrical connection arrangement. Three stations, Bilberry Creek TS, Cyrville MTS and Orleans TS (in service June 2015) each have dual supply from two of these circuits. The remaining – Wilhaven DS, Navan DS, Rockland DS, Rockland East, Clarence DS, Wendover DS and Hawkesbury MTS - are all supplied from circuit H9A/79M1.



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





**Figure 2: Single Line Diagram – Existing east Ottawa system configuration.**

## 2 EAST OTTAWA REGION NEEDS

As an outcome of the IRRP process, the study team identified the need for further assessment for east Ottawa in the context of Bilberry Creek TS's future. The study team recommended that it be assessed under a LP.

Bilberry Creek TS is a Hydro One owned station that has been identified as needing major components replacement work to continue operation beyond 2023. Bilberry Creek TS is an important supply point for the east Ottawa, with a peak load of 85MW. Its future has triggered the need for this local planning study.

## 3 OPTIONS CONSIDERED

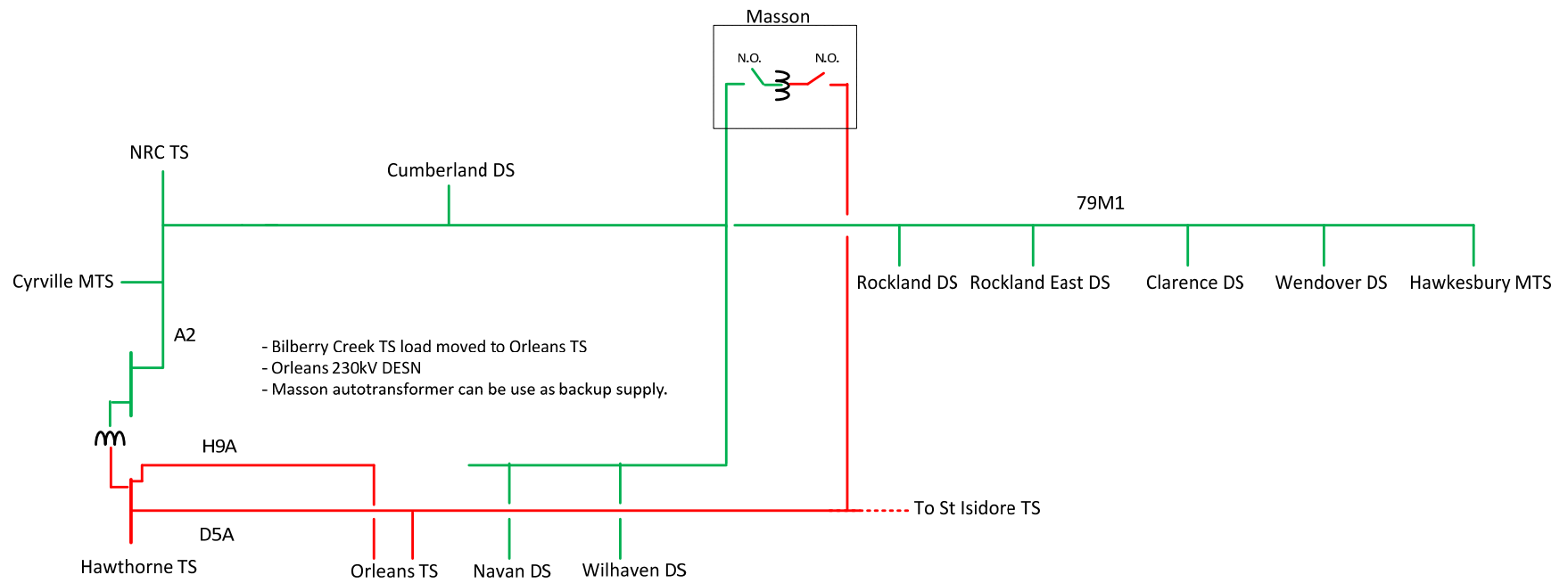
### 3.1 Study Scope and Assumptions

Assumptions were made in order to assess the effects of contingencies to verify the adequacy of the transmission system. The assumptions used in the study were:

1. The IESO 2013-2032 load forecast was extended based on the average annual load growth rate of 0.8% beyond 2032. Please refer to Table A1.
2. A summer assessment was performed as the Orleans area is summer load peaking while the equipment is at its lowest rating during summer ambient conditions.
3. Forecasted loads were provided by the LDC's and IESO in MW, with an assumed power factor of 0.9 lagging. Equipment continuous and limited time ratings were based on an ambient temperature of 35°C for summer and a wind speed of 4 km/hour.

### 3.2 Option 1: Retire Bilberry Creek TS.

Under this scenario Bilberry Creek TS would be retired and removed from the 115kV network by 2023. Orleans TS would be converted to a higher LTR 230kV-27.6kV DESN by re-terminating H9A at Hawthorne TS 230kV switchyard, and all of Bilberry Creek TS load would be transferred to Orleans TS. The remaining load supplied by H9A, namely the loads on 79M1, Cumberland DS, Navan DS and Wilhaven DS would be supplied from A2 by connecting the A2-H9A open point at Bilberry Creek TS. Figure 3 shows the area with Orleans TS converted to 230kV.



**Figure 3. System configuration with Orleans TS as a 230kV DESN.**

### 3.2.1 Load Meeting Capability

For this option, Orleans TS will meet the area growth. Under the IESO forecast for the IRRP study, Orleans TS, with its higher LTR of 162MW would be adequate until 2031. After this, further load growth could be met by adding up to 16MW at Wilhaven DS. This would be adequate to 2039. The total area load supplied would be 258MW. This would require capacitor banks to be installed on LV of 79M1 (19MX).

### 3.2.2 Further Load Increase

Further area load growth could be met by adding a second DESN at Orleans TS or by converting Wilhaven DS to 230kV. It should be noted that there is enough space within the Orleans TS property to accommodate another DESN station.

## 3.3 Option 2: Refurbish Bilberry Creek TS

Under this scenario Bilberry Creek TS undergoes an almost complete station refurbishment. The station is aging and most of its key components need to be replaced. The work under this option includes the like for like replacement of two step-down transformers and most of the LV breakers, and the installation of a new protection and control building. This work is estimated to cost \$25M. The area existing configuration would remain unchanged, as shown in Figure 2.

### 3.3.1 LOAD MEETING CAPABILITY

The near term area load growth will be met using Orleans TS. Based on IESO's forecast, it is expected that Orleans TS will reach its capacity of 102MW by 2026. Under this forecast, Bilberry Creek TS load is kept constant and under the station's loading limit. Other stations' load growths are well within their capacity. Beyond 2026, existing stations will be able to accommodate the area load growth. Using Bilberry Creek TS and Wilhaven DS to supply the load growth, the area has enough load meeting capability until 2041. Appendix 2 provides details on the study and the area limitations.

### 3.3.2 Further Load Increase

Beyond 2041, the 115kV supply capacity of the existing system will be reached and additional load growth will have to be met using the 230kV network.

## 3.4 Option 3: Status Quo

This alternative retains the system as is and does not commit to either plan yet. No investment for either option is triggered. Bilberry Creek TS's major components need to be replaced by 2023, and so the status-quo allows the east Ottawa load growth to be reassessed in the next Regional Planning cycle. Depending on how the load grows in the area, one option may be favored over the other. A high growth would favor the retirement of Bilberry Creek TS to help mitigate the loading on the Hawthorne TS

autotransformers. A slow growth would favor the refurbishment of Bilberry Creek TS as the strain on the Hawthorne TS autotransformers would be less. The next planning cycle can be triggered at any time before its standard five year cycle should there be a change to the current situation that warrants the reevaluation of the Bilberry Creek TS options.

### 3.5 Comparison of the Investment Options

#### 3.5.1 Cost comparison

The cost of the work under scenarios 3.2 and 3.3 is as follows:

Table 1: Work required by 2023 to retire Bilberry Creek TS and move load to Orleans TS.

Station	Work Description	Cost (\$M)
Hawthorne TS	H9A 230kV conversion	5
Orleans TS	Transformer: 125MVA	5
	Feeder positions (4)	4
Bilberry Creek TS	Retirement removals	2
	Feeder relocation (HOL) <sup>1</sup>	9
	Feeder relocation (H1DX) <sup>1</sup>	1
	Total	26

<sup>1</sup>Cost provided by LDCs during IRRP meeting 19-Jan-2015. Cost driven by feeder work needed in densely populated area of Ottawa.

Table 2: Refurbishment work required by 2023 to continue operation of Bilberry Creek TS.

Station	Work Description	Cost (\$M)
Bilberry Creek TS	Transformer Replacement	15
	P&C upgrades	5
	LV breakers	5
	Total	25

Cost compared in Table 1 and 2 above are not NPV adjusted since the work listed for both options would be required by 2023, the year in which Bilberry Creek is either retired or refurbished.

#### 3.5.2 Other Considerations

As shown in section 3.2, 3.3, and 3.4.1, both options are roughly the same in terms of cost and load meeting capability. The following provides other factors to consider.

**Option 1:**

- Both Hydro Ottawa and Hydro One Distribution have expressed their preference for Bilberry Creek TS to continue to supply load. The densely populated area makes it costly and difficult to build feeders from Bilberry Creek TS to Orleans TS. A combined total cost of feeder relocation of \$10M was provided by the LDCs. This cost is a significant portion of the total Bilberry Creek TS retirement option.
- As is shown on Figure 2, there is a normally opened 115kV disconnection switch at Bilberry Creek TS tying H9A and A2 together. This switch allows H9A and A2 to provide backup emergency supply to the loads served by either circuit should the terminal of one of the circuit be unavailable at Hawthorne TS. Under the Bilberry Creek TS retirement scenario, this backup from A2 to H9A will no longer be available since A2 will be the only 115kV supply for the area. Should A2 be unavailable at Hawthorne TS, the A2 loads could be picked up using Lievre Power's autotransformer at Masson. The cost of this emergency backup from an interconnected utility is to be determined.

**Option 2:**

- The growth at Bilberry Creek TS will be limited below the station LTR. The load meeting capability of the 115kV network for the area is limited. Given that voltage stability limits are reached before Bilberry Creek TS's transformer limits, some of the capacity at the station is left stranded.
- Another factor that is being considered by the study team is the 230kV-115kV autotransformer loading in the Ottawa area. These transformers are approaching their continuous load limit of 250MVA. Several options are considered to limit the loading on the autotransformers such as transferring load supplied by the 115kV to 230kV system. The retirement of Bilberry Creek TS and the transfer of its load to Orleans 230kV DESN is a potential candidate for this approach. Retiring Bilberry Creek TS delays the need for autotransformer work.

## **4 PREFERRED SOLUTION**

The study team determined that the preferred solution would be the status quo.

Based on the current sustainment's plan, work has to occur at Bilberry Creek TS by 2023. This work can either be to refurbish the station or to retire it. Based on this timeline, the IRRP study team has decided to move the decision on the future of Bilberry Creek TS to a medium term need.

The findings presented in this report will be evaluated in the next Regional Planning cycle with updated load forecast. A final decision will be taken at that time depending on system conditions and how the load growth evolves in comparison to the forecast used in this study. A lower growth rate would favor retaining Bilberry Creek TS while if the growth forecast is high, it may be more appropriate to retire the station. The next planning cycle can be triggered at any time before its standard five year cycle should there be a change to the current situation that warrants the reevaluation of the Bilberry Creek TS options.

## **5 NEXT STEPS**

Status Quo - Trigger new regional planning cycle for the region if required before the standard five year cycle.

## 6 REFERENCES

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



## APPENDIX 1. LOAD FORECAST.

Load Forecast. The summer peak load forecast used in this assessment was supplied by the IESO and is shown in Table 1 below. The area load increases at an average growth rate of about 1.125% from 2014 to 2024 and at a rate of 0.8% from 2024 to 2034.

The forecast had been developed by the IESO based on Hydro Ottawa and Hydro One Distribution 20 year median-weather, area coincident, gross peak load forecasts. The IESO adjusted the LDC's forecast for extreme weather then subtracted the effective Distributed Generation (DG) capacity and the effective Conservation and Demand Management (CDM) capacity to produce the net load forecast.

Table A1 Orleans and East Ottawa Area Forecast (MW)

Year	Circuit H9A					Circuit 79M1					Total
	Bilberry Creek	Cumberland	Navan	Orleans	Wilhaven	Clarence	Hawkesbury	Rockland	Rockland East	Wendover	
2013	82.9	5.2	17.0	0.0	40.6	2.7	14.2	8.2	11.4	11.7	193.9
2014	83.9	5.4	17.6	4.8	41.7	2.8	14.7	8.2	11.4	11.9	202.4
2015	53.3	5.5	6.1	86.4	3.6	2.8	14.9	8.2	11.5	12.0	204.4
2016	53.5	5.6	6.1	89.8	3.6	2.8	15.1	8.3	11.6	12.1	208.6
2017	53.9	5.7	6.1	91.8	4.6	2.8	15.3	8.4	11.8	12.2	212.5
2018	54.1	5.8	6.1	92.2	4.6	2.9	15.4	8.4	11.9	12.3	213.6
2019	53.9	5.8	6.0	94.1	5.5	2.9	15.3	8.4	11.9	12.3	216.1
2020	53.7	5.8	5.9	95.7	6.4	2.9	15.3	8.4	11.9	12.3	218.4
2021	54.0	5.9	5.9	96.4	6.4	2.9	15.4	8.5	12.0	12.4	219.7
2022	54.1	6.0	5.8	97.7	7.3	2.9	15.5	8.6	12.1	12.5	222.6
2023	54.3	6.0	5.8	99.1	7.3	3.0	15.6	9.2	13.3	13.8	227.3
2024	54.2	6.1	5.7	99.9	9.1	3.0	15.6	9.2	13.3	13.7	229.8
2025	54.5	6.1	5.7	100.4	10.0	3.0	15.7	9.3	13.4	13.7	231.8
2026	54.6	6.2	5.6	101.7	9.9	3.0	15.8	9.3	13.4	13.7	233.3
2027	54.7	6.2	5.6	102.7	10.8	3.0	15.8	9.3	13.4	13.6	235.3
2028	54.7	6.3	5.5	104.5	10.7	3.0	15.9	9.3	13.4	13.6	236.9
2029	55.0	6.3	5.5	104.9	11.6	3.0	16.0	9.3	13.5	13.6	238.7
2030	55.1	6.4	5.5	107.0	11.5	3.1	16.0	9.4	13.5	13.5	240.9
2031	55.2	6.4	5.4	107.1	12.3	3.1	16.0	9.3	13.5	13.5	241.8
2032	55.2	6.5	5.4	108.9	13.1	3.1	16.1	9.3	13.5	13.4	244.5
2033	55.7	6.5	5.4	109.8	13.2	3.1	16.2	9.4	13.6	13.5	246.4
2034	56.1	6.6	5.5	110.7	13.3	3.1	16.4	9.5	13.7	13.6	248.4

## APPENDIX 2. BILBERRY CREEK REFURBISHMENT VOLTAGE STUDY.

Referring to Appendix 1, it can be seen that the load area load growth for circuit H9A will be mainly supplied from Orleans TS. Most of Hydro One Distribution load from Bilberry Creek TS, Navan DS, and Wilhaven DS is transferred to Orleans TS and any further growth at these stations is slow. Based on IESO’s forecast, it is expected that Orleans TS will reach its capacity by 2026. Other stations’ load growths are well within their capacity. Likewise for the load supplied from 79M1.

This study assumes that once Orleans TS loading limit is reached, further growth will be supplied by Bilberry Creek TS and Wilhaven DS. To determine the amount of load that can be added to these two stations, PV analysis were performed for circuit H9A. Other area stations were kept at their 2026 loading given the load increase is minimal.

The load at Bilberry Creek TS and Wilhaven DS was increased for the following three cases: normal supply, loss of D5A, and loss of A2. Based on the results, the loss of A2 is most limiting for load supply. Figure A1 below shows the results of the PV analysis for the loss of A2.

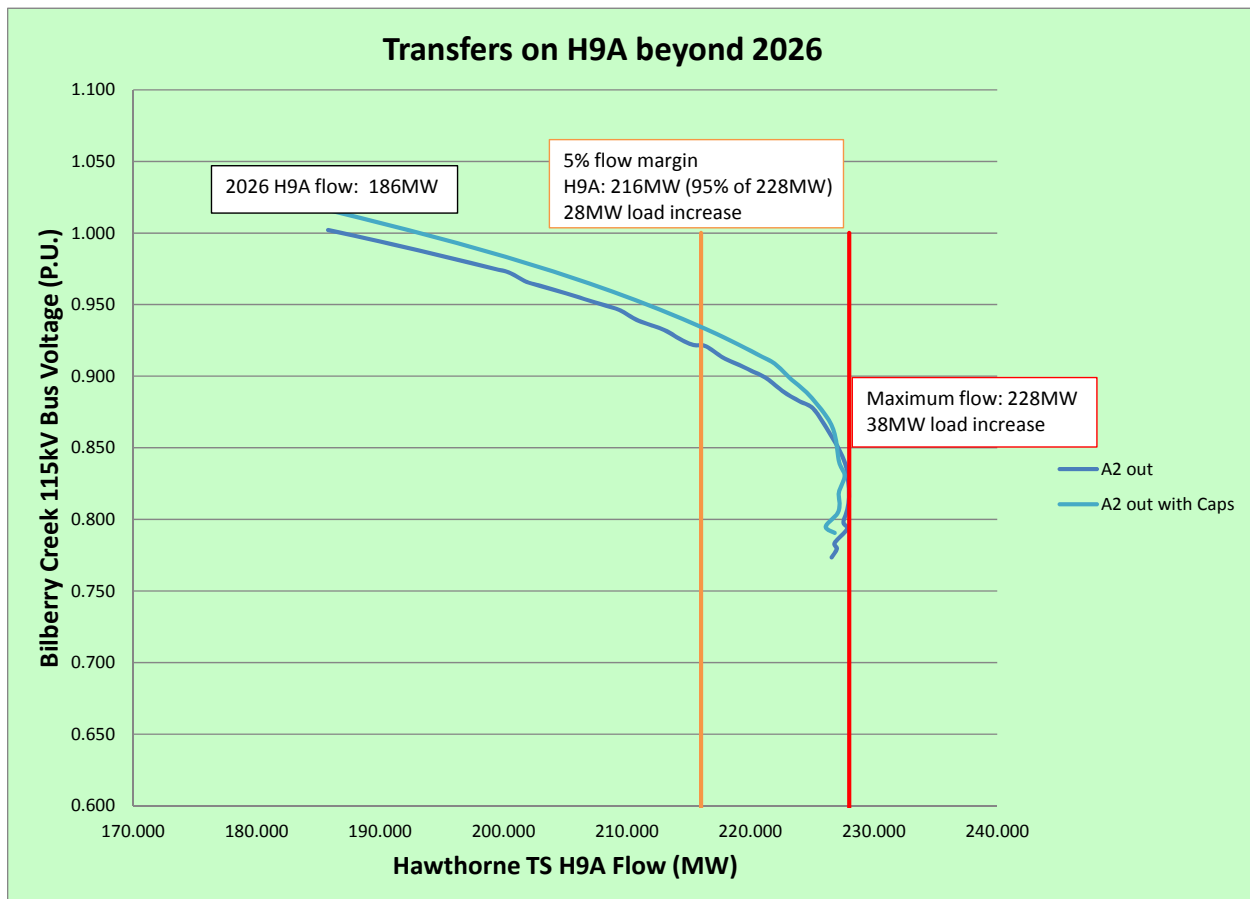


Figure A1. Voltage profile at Bilberry Creek TS for A2 line contingency.

The maximum permissible flow on H9A, limited by voltage stability, is 216MW which is an increase of

about 30MW from the 2026 loading of 186MW on the circuit H9A. The addition of 19MX of capacitor banks at stations on 79M1 (Clarence DS, Wendover DS, and Hawkesbury MTS) was considered. However, as can be seen in Figure A1, the capacitors improve the voltage performance of the line but the maximum amount of load that can be supplied remains unchanged.

Assuming the area load growth from the IESO forecast remains unchanged past 2032, the 30MW capacity is expected to be adequate until 2041 before additional transmission work is required. The total area load would be about 262MW. It should be noted that this load increase and timeline are based on the assumption that area growth is supplied from Bilberry Creek TS and Wilhaven DS only. Load growth at other stations in the area will affect both load increase and timeline. Growth at any stations in the area other than Bilberry Creek TS or Orleans TS will also be under a single supply configuration, with corresponding supply reliability. Further area load growth will have to be met using the 230kV system.

### APPENDIX 3. ACRONYMS

BES	Bulk Electric System
BPS	Bulk Power System
CDM	Conservation and Demand Management
CIA	Customer Impact Assessment
CGS	Customer Generating Station
CTS	Customer Transformer Station
DESN	Dual Element Spot Network
DG	Distributed Generation
DSC	Distribution System Code
GS	Generating Station
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
NPCC	Northeast Power Coordinating Council Inc.
OEB	Ontario Energy Board
OPA	Ontario Power Authority
ORTAC	Ontario Resource and Transmission Assessment Criteria
PF	Power Factor
PPWG	Planning Process Working Group
RIP	Regional Infrastructure Planning
SIA	System Impact Assessment
SS	Switching Station
TS	Transformer Station
TSC	Transmission System Code
ULTC	Under Load Tap Changer