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CONNECTION ASSESSMENT & APPROVAL PROCESS

Preliminary Assessment Report For Caledonia TS

Applicant: Hydro One Networks Inc.

CAA ID 2002-056

Final Report

Long Term Forecasts & Assessments Department
Consistent Information Set Department

August 8, 2002

Preliminary Assessment Report

Caledonia TS

Acknowledgement

The IMO wished to acknowledge the assistance of Hydro One in completing this assessment.

Disclaimers

IMO

This report has been prepared solely for the purpose of assessing, on a preliminary basis, whether the connection applicant's proposed connection with the IMO-controlled grid would have an adverse impact on the reliability of the integrated power system and whether a System Impact Assessment of the proposed connection should be conducted under Chapter 4, section 6 of the *Market Rules*. This report has not been prepared for any other purpose and should not be used or relied upon by any person for another purpose. This report has been prepared solely for use by the connection applicant, Hydro One and the IMO in accordance with Chapter 4, section 6 of the *Market Rules*. The IMO assumes no responsibility to any third party for any use which it makes of this report. Any liability which the IMO may have to the connection applicant in respect of this report is governed by Chapter 1, section 13 of the *Market Rules*. In the event that the IMO provides a draft of this report to the connection applicant, you must be aware that the IMO may revise drafts of this report at any time in its sole discretion without notice to you. Although the IMO will use its best efforts to advise you of any such changes, it is the responsibility of the connection applicant to ensure that it is using the most recent version of this report.

Executive Summary

This Preliminary Assessment has examined the impact of a new proposed system reconfiguration and transformer station, Caledonia TS, on the reliability of the IMO-controlled grid. This project was subject to an expedited Connection Assessment process and it is not required to undergo a System Impact Assessment.

Proposed Project

Hydro One Networks Inc. proposes to install two new 230/115 kV auto-transformers with rated installed transformation of 75/125MVA each, at Caledonia TS and modify the system connectivity in the area to facilitate the supply of Norfolk TS from the new auto-transformers.

Norfolk TS load is presently being supplied from Allanburg TS via approximately 65 km of 115 kV double circuit line, A8N and A11N, which is approaching end-of life. HONI is proposing to install the new auto-transformers at Caledonia TS and re-supply the Norfolk load off the 230 kV circuits between Nanticoke TS and Middleport TS instead of refurbishing the 115 kV circuits. This proposed arrangement is easily attainable because the A8N/A11N right of way passes through the northeast corner of Caledonia TS and the station was originally designed to accommodate four transformers.

The target in-service data for the facility is May 1, 2004.

Impact on System Reliability

Connectivity

HONI submitted with their application two options for incorporation of the new autotransformers. The IMO assessment concluded that, from a system reliability perspective, option A is the preferred alternative.

It is required that Hydro One Networks Inc. implement the proposed option A for this development, whereby the 230 kV side of the new autotransformers will be connected to the 230 kV circuits N2M and N6M, respectively.

Fault Levels

Fault analysis studies were performed to determine the impact of the proposed Caledonia TS development on the existing transmission facilities.

The short circuit analysis results indicate that the new system reconfiguration and addition of the two autotransformers result in an increase in short circuit levels. However the capability of the existing station beakers is not exceeded.

Impact on Interface Transfer Capability

The proposed transmission modification will result in the removal of the Norfolk TS load from the Allanburg 115 kV pocket and re-supply of this load directly from the Nanticoke TGS to Middleport TS 230 kV circuits. Consequently, the Allanburg 115 kV load will be reduced.

This assessment concluded that the proposed development will have some contribution to congestion on the QFW interface, and reduce the loading of the Allanburg autotransformers and the power flow from Nanticoke GS to Middleport 230 kV.

Voltage

The system voltage analysis was performed for system peak and off peak load conditions taking into account previous year's system loads and voltages.

The outcome of the study indicates that, the new autotransformers and proposed reconfiguration will result in improved 115 kV voltage at Norfolk TS.

The study results show that connecting the new autotransformers to the lower off-load tap position will provide the required 115 kV voltage range for peak and off peak load conditions, in the initial stage.

The study results show that the new configuration will result in a slight increase in the voltage at Allanburg TS.

Local Lines Thermal Loading

The assessment concluded that the continuous thermal rating of one of the 115 kV circuits, A8N or A11N, supplying the Norfolk TS load is sufficient to accommodate the continued supply of the Norfolk TS peak load, in the event of permanent loss of the companion circuit.

Availability of Supply

It was noted that the supply to Norfolk TS would be lost entirely in the event of permanent loss of the double circuit 115 kV line A8N/A11N or the loss of the single 115 kV circuit A1N.

The proposed IMO load supply guidelines indicate that, for a single circuit line loss, the supply to a load between 76 and 150 MW should be restorable by switching. Because, under the present system configuration and in the event of a loss of A1N 115 kV circuit this availability of supply guideline is not met, Hydro One Networks Inc. indicated that options to address the availability issue are being considered.

Conclusions and Recommendations

This Preliminary Assessment has examined the impact of connecting two new 230/115 kV autotransformers at Caledonia TS and re-supply the Norfolk TS load via the new autotransformers.

The assessment concluded that the proposed development:

1. Will result in an increase in short circuit levels, however the capability of the existing station beakers is not exceeded,
2. Will contribute to congestion on the QFW interface, and reduce the loading of the Allanburg autotransformers and the power flow from Nanticoke GS to Middleport 230 kV.
3. Will result in improved 115 kV voltage at Norfolk TS,

4. Would provide the required 115 kV voltage range for peak and off peak load conditions when the new autotransformers are positioned on the 116 kV off-load tap position or equivalent, and
5. Would result in a slight increase in the Allanburg TS 115 kV voltage.

IMO Requirements

The IMO's requirements for the incorporation of the two new autotransformers at Caledonia TS and the proposed system reconfiguration, that have been identified in this assessment are as follows:

1. Hydro One Networks Inc. must implement the proposed option A for connecting the two new auto-transformers to the system, whereby the 230 kV sides of the new autotransformers are connected to N2M and N6M, respectively.
2. The low voltage shunt capacitor at Norfolk TS must be available for switching during periods of peak load conditions.
3. The new autotransformers be initially connected on the 116 kV off-load tap position or equivalent.
4. The status of all isolating disconnect switches and breakers must be monitored on a continual basis.
5. The proponent will provide when available, the "as built" transformer information to meet the requirements of the facility registration process.
6. The protection settings associated with the 115 kV circuits A8N and A11N and Norfolk TS must be reviewed and modified if needed, before the facilities are brought to service.

In addition to the Connection Assessment and Approval process any new connection to the IMO controlled grid has to fulfill, before coming into service, the following:

- It is required that Hydro One Networks Inc. meet all the requirements of the IMO Facility Registration process.
- It is required that Hydro One Networks Inc. install all the equipment needed to monitor the system operating information required by the IMO on a continuous basis as described in Chapter 4 section 7.5 and Appendix 4.17 of the *Market Rules*.
- It is required that Hydro One Networks Inc. follow the IMO Meter Registration process.

Notification of Approval

This Connection Assessment has investigated the impact of incorporating the proposed autotransformer installations at Caledonia TS and system reconfiguration, on the reliability of the *IMO-controlled grid* and has identified IMO's requirements for connection, which will ensure that the project does not adversely affect on the reliability of the *IMO-controlled grid*.

It is recommended that approval be granted and *Notification of Approval* be issued subject to the acceptance by the proponent of the IMO requirements.

Preliminary Assessment Report

1.0 Project Description

Hydro One Networks Inc. (HONI) proposes to install two new 230/115 kV autotransformers with rated installed transformation of 75/125MVA each, at Caledonia TS and modify the system connectivity in the area to facilitate the supply of Norfolk TS from the new auto-transformers.

The Norfolk TS load, in Simcoe area, is currently being supplied from Allanburg TS via approximately 65 km of 115 kV double circuit line, A8N and A11N, which is approaching end-of life. HONI is proposing to install two new autotransformers at Caledonia TS and re-supply the Norfolk load off the 230 kV circuits between Nanticoke TS and Middleport TS in lieu of refurbishing the 115 kV circuits, A8N and A11N.

This proposed arrangement is easily attainable because the A8N/A11N right of way passes through the northeast corner of Caledonia TS and there is sufficient space at the station to accommodate the two new units, since the original station was designed for four transformers.

The target in-service data for the facility is May 1, 2004.

A schematic representation of the existing Allanburg to Niagara 115 kV and 230 kV transmission system electrical connectivity is shown in Figure 1. The proposed system re-connectivity is shown in Figure 2.

2.0 Review of Connection Arrangement

Norfolk TS load is presently supplied via the double circuit 115 kV line A8N/A11N from Allanburg TS to Vanessa Jct. and a single 11.9 km long 115 kV circuit, A1N, from Vanessa Jct. to Norfolk TS.

Hydro One Networks Inc. have submitted two connection arrangement options of the new Caledonia TS auto-transformers as shown in Figures 3A and 3B.

Option A, shown in Figure 3A proposes to connect the high voltage side of each new in-line auto-transformer to the 230 kV circuits N2M and N6M, respectively via a line drop of less than 50m.

Option B, shown in Figure 3B proposes to connect the high voltage side of each new in- auto-transformers s to the 230 kV taps of the existing Caledonia TS transformers T1 and T2.

In both arrangements the new autotransformers T3 and T4 will be connected to the 115 kV circuits A8N and A11N respectively, via two in-line 115 kV breakers. A motorized disconnect switch is provided on the 230 kV connection of each autotransformer. Circuits A8N and A11N from Caledonia to Allanburg are to be disconnected at Caledonia rendered safe and left idle, and the sections west of Caledonia will continue to supply the Norfolk load about 25 km away.

The line tap from the station to the 230 kV circuits will be short and thus its impedance was considered negligible in this assessment.

The station control/protection must be designed to meet the requirements of the Transmission System Code. Based on the single line diagram provided by HONI, for this particular

arrangement any fault associated with any one of new transformers will have to be cleared by sending transfer trip to the Transmitter's breakers at the terminal stations.
In the case of Caledonia TS to isolate a fault associated with one of the new auto-transformers the protection system must:

- for option A, transfer trip signal must be sent to Nanticoke and Middleport TS breakers associated with N2M for fault on T3 or N6M for a fault on T4
- for option B, transfer trip signal must be sent to Caledonia T1 LV breaker and Nanticoke and Middleport TS breakers associated with N1M for a fault associated with T3, or to Caledonia T2 LV breaker and Nanticoke and Middleport TS breakers associated with N5M for a fault associated with T4.

It is also required that the protection system initiate simultaneously both signals for the transfer trip, as described above, and the opening of the disconnect switches D3 or D4. Full opening of the disconnect switch shall then block the sending of the transfer trip signal.

2.1 Comparison of Options

The two connectivity options were compared from the perspective of impact on the reliability of the local transmission system and the reliability of supply to existing customer loads.

Option A was found to be superior to option B because the clearing of a fault associated with one of the new transformers would not affect the supply of the existing Caledonia transformers. Also option A provides for a balanced distribution of the power flows on the 230 kV circuits from Nanticoke to Middleport because the existing Caledonia TS load and the Norfolk load would be supplied from different circuits.

From the perspective of a single or double contingency associated with the 25 km section of 115 kV line, A8N or A11N, and the 11.9 km section of single circuit 115 kV line, A1N, into Norfolk TS the two options are comparable.

It is required that Hydro One Networks Inc. implement the proposed option A for connecting the two new auto-transformers to the system. This arrangement connects the 230 kV side of the new autotransformers to N2M and N6M.

2.2 On-line Monitoring

The *Market Rules* (Chapter 4 section 7.4) require that each transmitter shall provide the IMO on a continual basis with on-line monitored quantities as specified in Appendix 4.16. It is required that Hydro One Networks Inc. install all the equipment needed to monitor the information required by the IMO on a continuous basis. The IMO requires that the status of all isolating disconnect switches and breakers be monitored on a continual basis.

2.3 Protection Systems

With respect to the protection and telecommunication requirements, the connection applicant will have to follow the Transmission System Code technical requirements for tapped transformer stations supplying load.

The protection settings associated with the 115 kV circuits A8N and A11N and Norfolk TS must be modified accordingly.

3.0 Data Verification

The proposed new autotransformers at Caledonia TS are to be rated at 75/100/125 MVA each. The transformers are both identical and configured with a solidly grounded wye winding on the high side and double zigzag winding on the low voltage side. The transformer impedance will be 10% on 125 MVA base.

Each autotransformer is to be equipped with a 2000 A, 40 kA, 145 kV SF6 breaker, one 2000 A, 145 kV manually-operated disconnect switch and one 2000 A, 250 kV motorized disconnect switch.

The connection application indicates that the new autotransformers are to be equipped with two off-load tap positions on the LV side at 116 kV and 125 kV measured on a high voltage side of 226 kV. The 116 kV tap is proposed to be the initial in-service tap position. Since HONI has not finalized the purchase of the autotransformers it is possible that the actual unit would have more off-load tap positions at slightly different voltages than those specified in the application. Although this assessment was based on the information provided with the application, it is recognized that the appropriate off-load tap positions will be selected after the purchase of the autotransformers.

It is expected that the proponent will provide when available, the “as built” transformer information to meet the requirements of the facility registration process.

4.0 Fault Level Assessment

Hydro One has submitted the results of a short circuit study which identifies the impact of reconfiguring the system at Caledonia TS on the short circuit currents in the area. The system model used in these studies included all the projects that have completed the CAA process and obtained approval for connection and the projects that have been placed prior to the subject projects in the IMO CAA queue. The results are summarized in table 1 below.

Table 1. Short Circuit Study Results

BUS kV	Existing (kA) Symmetrical		New Configuration(kA) Symmetrical		Change		Breaker Ratings
	3-phase	L-G	3-phase	L-G	3-phase	L-G	Symm.
Middleport 230 kV	58.53	57.02	58.53	57.70	0.00	0.68	**63 kA**
Nanticoke 230 kV	46.71	47.14	46.71	47.28	0.00	0.14	**54.3 kA**
Beck 2 230 kV	54.32	61.43	54.32	61.43	0.00	0.00	**69.5 kA**
Imperial Oil 230 kV	28.08	24.67	28.08	24.72	0.00	0.04	N/A
Stelco 230 kV	24.32	20.17	24.32	20.19	0.00	0.03	N/A

The results indicated that the proposed autotransformer installations and system reconfiguration at Caledonia TS increase the short circuit currents at Middleport TS by about 680A and at Nanticoke about 140A. With the new proposed facilities in service, the current interrupting capability of the existing breakers will not be exceeded.

The studies performed by Hydro One indicate that this development does not significantly affect the short circuit currents at Imperial TS and Stelco TS.

Of special interest would be the effect of the re-arrangement on the short circuit levels at Norfolk TS. The results of a study performed by Hydro One are summarized in Table 2 below.

Table 2. Short Circuit Levels at Norfolk TS

		Symmetrical (kA)		Breaker Symmenrical Rating (kA)
		3-phase	L-G	
Norfolk 115 kV	Base Conditions	2.29	1.14	**40 (new B1, B2 breakers)**
	With New Autos	4.29	3.17	
Change		**2.00**	**2.04**	
Norfolk 27.6 kV	Base Conditions	5.54	6.08	**20.9 (existing LV 1000 MVA breakers)***
	With New Autos	8.15	7.93	
Change		**2.61**	**1.85**	

* The current interrupting capability was calculated based on MVA rating and 27.6 kV voltage.

It is concluded that although the short circuit levels at Norfolk TS increase considerably with the new system configuration they are well within the interrupting capability of the existing LV breakers and the new 115 kV breakers.

The short circuit analysis results indicate that the new system reconfiguration and addition of the two autotransformers result in an increase in short circuit levels. However the capability of the existing station beakers is not exceeded.

5.0 Impact on System Reliability

The connection assessment study concentrated on identifying the effect of the proposed system reconfiguration on the system power transfer capability and the system voltages.

The analysis was performed for system peak load conditions and, minimum and maximum voltages at Nanticoke TGS that were obtained from the 2001 system historical data. The historical information indicates that during 2001 system peak load the Norfolk TS active and reactive power load was about 85 MW and 17.5 Mvar.

5.1 Interface Transfer Capability

The installation of the new autotransformers at Caledonia TS will facilitate the supply of the Norfolk TS load directly from the 230 kV circuits, N2M and N6M which connect Nanticoke TGS and Middleport TS. This proposed system reconfiguration effectively transfers the Norfolk TS load from the Allanburg 115 kV TS and onto the 230 kV circuits between Nanticoke and Middleport, resulting in:

- A decrease in the Allanburg 115 kV area load and the loading of the 115/230 kV Allanburg autotransformers,
- An increase in Queenston Flow West power flow by an amount equivalent to the Norfolk TS load,
- A decrease in the power flowing into Middleport TS from Nanticoke by an amount equivalent to the Norfolk TS load and

It can be concluded that the proposed development will contribute to congestion on the QFW interface, and reduce the loading of the Allanburg autotransformers and the power flow from Nanticoke GS to Middleport 230 kV.

5.2 Voltage Assessment

The system voltage analysis was performed for system peak and off peak load conditions. Historical records indicate that during 2001 the voltage at Nanticoke TGS ranged between 240 kV and 250 kV and the Norfolk load coincident with the system peak and off-peak conditions was 89 MVA and 44 MVA respectively.

As described in section 3.0 the new autotransformers will be equipped with off-load taps at about 116 kV and 125 kV. Although Hydro One has indicated that the in-service off-load tap position will be 116 kV or equivalent the studies also looked at the implications of having the transformers positioned on the higher off-load taps.

Norfolk TS is equipped with two 110/28.4 kV transformers rated at 34/56 MVA each and one low voltage power factor correction shunt capacitor rated at 10.8 Mvar.

A number of scenarios were created for this study in an attempt to cover the extreme system voltage and load conditions and identify the impact of the new configuration of the voltage at Norfolk TS. The selected scenarios are explained below and the study results are summarized in Table 3.

<u>Scenario A</u>

- Nanticoke voltage low, at 245 kV
- One shunt capacitor on at Allanburg TS
- Norfolk load 80 MW, 49.6 Mvar measured on the LV side
- Norfolk LV shunt capacitor in service
- New Caledonia transformers off-load tap positions on the 116 kV tap or the 125 kV tap

Scenario B

- Nanticoke voltage high, at 250 kV
- One shunt capacitor on at Allanburg TS
- Norfolk load 43.5 MW, 35.5 Mvar measured on the LV side
- Norfolk LV shunt capacitor in service
- New Caledonia transformers off-load tap positions on the 116 kV tap or the 125 kV tap

Table 3. Voltage Assessment Results

Monitored Items	**Scenario A Peak Load at Norfolk TS Nanticoke Voltage = 245 kV Norfolk Load= 80 MW, 49.6Mvar**		**Scenario B Off-peak Load at Norfolk TS Nanticoke Voltage = 250 kV Norfolk Load= 43.5 MW, 35.5 Mvar**	
Base Configuration (Existing)				
Caledonia 230 kV Voltage	241 kV		246 kV	
Norfolk 115 kV Voltage	106 kV		116.7 kV	
Norfolk 27.6 TS Voltage	28.2 kV		29.4 kV	
Allanburg Voltage	124.3 kV (with both shunt caps i/s)		123.1 kV (with one shunt cap i/s)	
New Configuration				
	Scenario A		**Scenario B**	
	116 kV tap	**125 kV tap**	**116 kV tap**	**125 kV tap**
Caledonia 230 kV Voltage	241.9 kV	242.1 kV	245.7 kV	Not studied because with the lower tap position voltages are already high.
Norfolk 115 kV Voltage	115.3 kV	126 kV	122 kV	
Norfolk 27.6 TS Voltage	29. kV	28.9 kV	28.9 kV	
Allanburg Voltage	123 .3 kV (with one shunt cap i/s)		123.7 kV (with one shunt cap i/s)	

Present System Configuration (Norfolk load supplied from Allanburg TS)

Under scenario A and present system configuration the results of the studies indicate that for peak load conditions the Norfolk TS voltage could be under that *Market Rules* required minimum system voltage of 113 kV.

Under scenario B and present system configuration the results of the studies indicate that for off peak load at Norfolk TS, the voltage at Norfolk TS is about 117 kV which is within the Market Rules requirements.

New System Configuration (Norfolk load supplied from the New Caledonia autotransformers)

By comparison, the addition of the two new autotransformers and the proposed reconfiguration of supply to Norfolk TS will increase this station voltage to a level which complies with the requirements of the *Market Rules.* A comparison of the voltages at Norfolk TS with and without the new autotransformers shows an improvement of about 8 kV with the new configuration.

With the proposed modification implemented and new autotransformers connected to the lower off-load tap position, the Norfolk TS voltage could be maintained at acceptable levels for conditions of peak and off peak load.

For off peak load conditions, with the proposed modification implemented and new autotransformers connected to the higher off-load tap position, the Norfolk TS voltage could be too high.

The outcome of the study indicates that, the new autotransformers and proposed reconfiguration will result in improved 115 kV voltage at Norfolk TS.

The study results show that connecting the new autotransformers to the lower off-load tap position will provide the required 115 kV voltage range for peak and off peak load conditions, in the initial stage.

The study results show that the new configuration will result in a slight increase in the voltage at Allanburg TS.

5.3 Local Lines Thermal Loading

The continuous and the 15 minute thermal ratings of the existing kV double circuit line A8N/A11N 115 kV sections which will be retained to provide the connection between the new Caledonia autotransformers and Norfolk TS are as follows:

- Caledonia X Hartford Jct.: 145 MVA/160 MVA,
- Hartford Jct. X Vanessa Jct.: 238 MVA/ 269 MVA,
- A1N (Vanessa Jct. X Norfolk TS): 169 MVA/179 MVA.

The continuous thermal rating of one of the 115 kV circuits, A8N or A11N, is sufficient to accommodate the continued supply of the Norfolk TS peak load, in the event of permanent loss of the companion circuit.

5.4 Availability of Supply

The supply to Norfolk TS would be lost entirely in the event of permanent loss of the double circuit 115 kV line A8N/A11N or the loss of the single 115 kV circuit A1N. In either case, there is not alternative high voltage supply path for the Norfolk TS load and it is not clear if the distribution feeders could be switched to a different supply in the area, for example Tillsonburg TS.

The proposed IMO load supply guidelines indicate that, for a single circuit line loss, the supply to a load between 76 and 150 MW should be restorable by switching. Under the present system configuration the permanent loss of A1N does not meet this availability of supply guideline.

Recently, Hydro One Networks Inc. indicated that options to address the availability issue are being considered. One possible option to eliminate the loss of power supply to Norfolk TS for a single contingency would be to extend the double circuit 115 kV line, A8N and A11N, to Norfolk TS.

The present load supply guidelines also stipulate that, for a non-catastrophic double circuit line loss, the supply to a load between 76 and 150 MW should be restorable by maintenance crews in 8 hours. It is believed that this level of reliability is achievable in this case.

6.0 Customer Impact Assessment

Hydro One Networks Inc. has recommended that a detailed Customer Impact Assessment is not required because there is very little impact to the existing customers created due to the proposed autotransformer installations and Norfolk supply reconfiguration. It is anticipated that during construction, and the required 230 kV N6M circuit outage an alternative supply path can be established for the loads connected to this circuit.

As described in section 1. the proposed development includes the de-energization of the 115 kV circuits A8N/A11N between Caledonia and Allanburg. Hydro One has indicated that these sections will not be removed at this time. Currently, an emergency backup is provided via A11N for the portion of the 115 kV supply to Dunnville TS between Allanburg TS and St. Ann Jct.. There is no backup provided for the portion of supply from St. Ann Jct. to Dunnville TS. Hydro One has confirmed that when needed, A11N can be made available to provide emergency backup for the portion of supply to Dunnville TS between Allanburg TS and St. Ann Jct.

The IMO concurs with Hydro One Networks Inc. recommendation that a detailed CIA process is not required.

7.0 Conclusions and Recommendations

This Preliminary Assessment has examined the impact of connecting two new 230/115 kV autotransformers at Caledonia TS and re-supply the Norfolk TS load via the new autotransformers.

The assessment concluded that the proposed development:

1. Will result in an increase in short circuit levels, however the capability of the existing station beakers is not exceeded,
2. Will contribute to congestion on the QFW interface, and reduce the loading of the Allanburg autotransformers and the power flow from Nanticoke GS to Middleport 230 kV.
3. Will result in improved 115 kV voltage at Norfolk TS,
4. Would provide the required 115 kV voltage range for peak and off peak load conditions when the new autotransformers are positioned on the 116 kV off-load tap position or equivalent, and
5. Would result in a slight increase in the Allanburg TS 115 kV voltage.

8.0 IMO Requirements

The IMO's requirements for the incorporation of the two new autotransformers at Caledonia TS and the proposed system reconfiguration, that have been identified in this assessment are as follows:

1. Hydro One Networks Inc. must implement the proposed option A for connecting the two new auto-transformers to the system, whereby the 230 kV sides of the new autotransformers are connected to N2M and N6M, respectively.
2. The low voltage shunt capacitor at Norfolk TS must be available for switching during periods of peak load conditions.
3. The new autotransformers be initially connected on the 116 kV off-load tap position or equivalent.
4. The status of all isolating disconnect switches and breakers must be monitored on a continual basis.
5. The proponent will provide when available, the "as built" transformer information to meet the requirements of the facility registration process.
6. The protection settings associated with the 115 kV circuits A8N and A11N and Norfolk TS must be reviewed and modified if needed, before the facilities are brought to service.

In addition to the Connection Assessment and Approval process any new connection to the IMO controlled grid has to fulfill, before coming into service, the following:

- It is required that Hydro One Networks Inc. meet all the requirements of the IMO Facility Registration process.
- It is required that Hydro One Networks Inc. install all the equipment needed to monitor the system operating information required by the IMO on a continuous basis as described in Chapter 4 section 7.5 and Appendix 4.17 of the *Market Rules*.
- It is required that Hydro One Networks Inc. follow the IMO Meter Registration process.

9.0 Notification of Approval

Section 8.0 of the Preliminary Assessment Report lists all the requirements identified by the IMO CAA process for the incorporation of the proposed autotransformer installations at Caledonia TS and system reconfiguration. It is recommended that approval be granted and Notification of Approval be issued subject to the acceptance by the proponent of the IMO requirements.

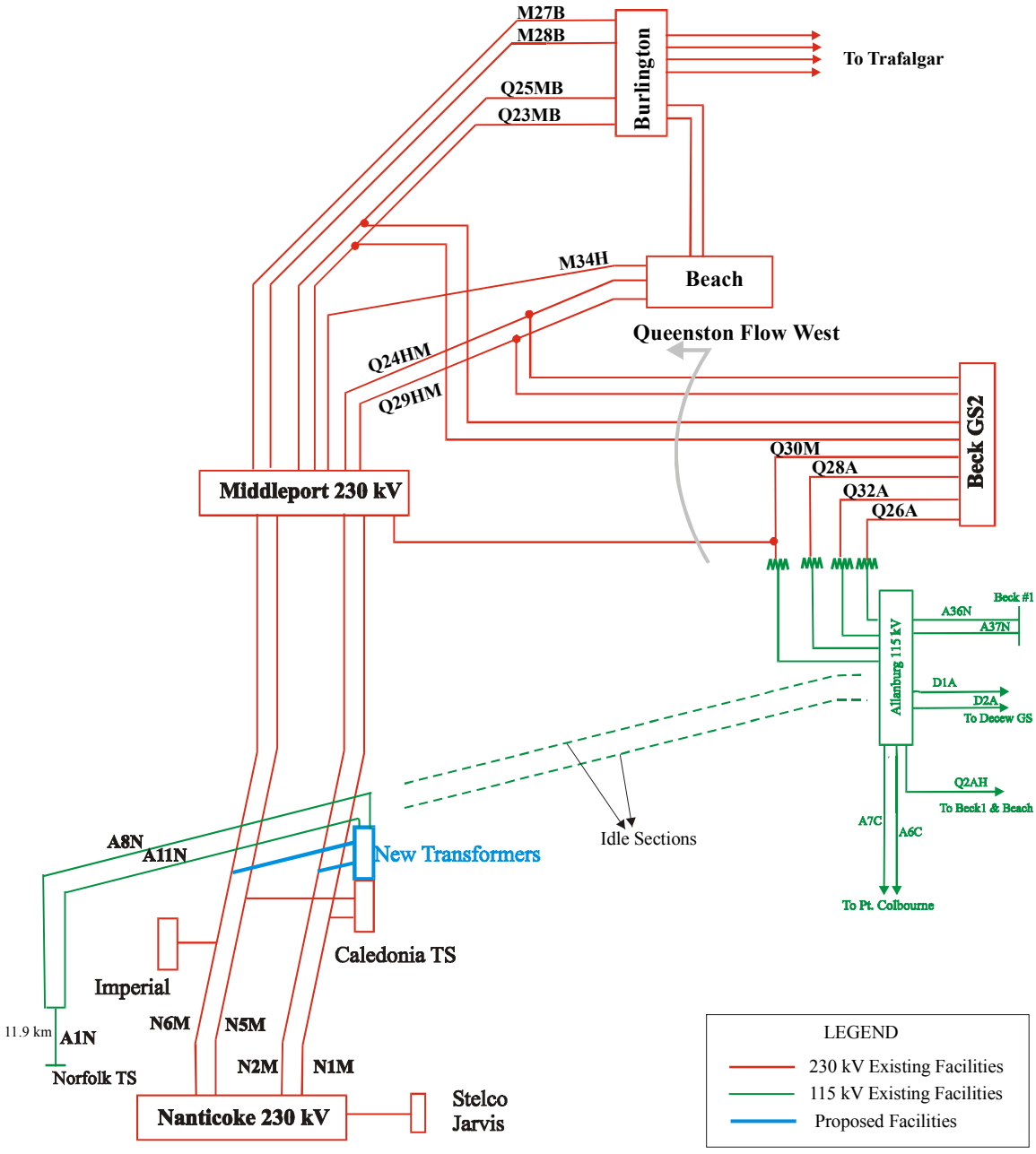

Figure 2. Proposed Caledonia TS Facilities

Figure 3A: New Caledonia TS Autotransformers
Option A: 230kV Connection on N2M / N6M

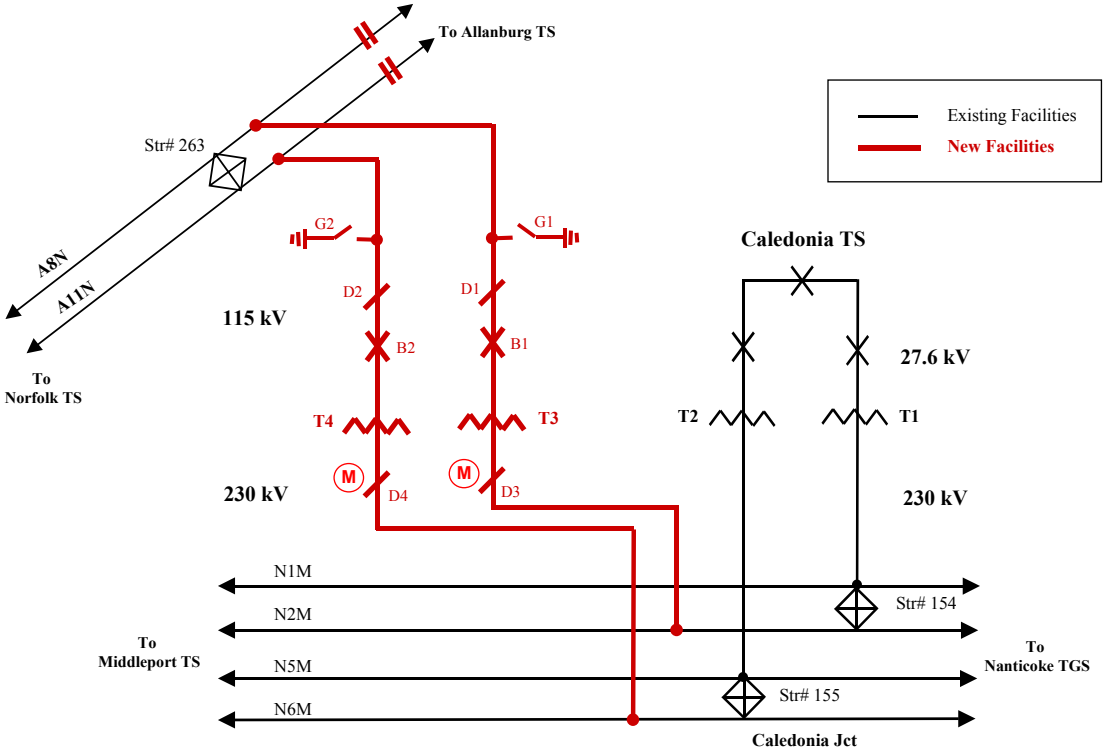

Figure 3B: New Caledonia TS Autotransformers
Option B: 230kV Connection on N1M / N5M