

# **CONNECTION ASSESSMENT & APPROVAL PROCESS**

## **Preliminary Assessment Report 115 kV Shunt Capacitor Installation at Port Arthur Birch TS**

***CAA ID 2002-060***

**Final Report**

**Long Term Forecasts & Assessments Department and  
Consistent Information Set Department**

**November 19, 2002**

## **Preliminary Assessment Report**

Birch TS – 115 kV Shunt Capacitor Installation

### **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.

#### **Hydro One**

The results reported in this preliminary feasibility study are based on the information available to Hydro One Networks Inc., at the time of the study, suitable for a preliminary assessment of a new generation or load connection proposal.

The short circuit and thermal loading levels have been computed based on the information provided by the connection proponent at the time of the study. These levels may be higher or lower if the connection information changes as a result of, but not limited to, subsequent design modifications or when more accurate test measurement data is available.

This study does not assess the short circuit or thermal loading impact of the proposed connection on facilities owned by other load and generation (including OPGI) customers.

In this preliminary feasibility study, short circuit adequacy is assessed only for Hydro One Networks Inc. breakers and does not include other Hydro One Networks Inc. facilities. The short circuit results are only for the purpose of assessing the capabilities of existing Hydro One Networks Inc. breakers and identifying upgrades required to incorporate the proposed connection. These results should not be used in the design and engineering of new facilities for the proposed connection. The necessary data will be provided by Hydro One Networks Inc. and discussed with the connection proponent upon request.

The ampacity rating of Hydro One Networks Inc. facilities are established based on assumptions used in Hydro One Networks Inc. for power system planning studies. The actual ampacity ratings during operations may be determined in real-time and are based on actual system conditions, including ambient temperature, wind speed and facility loading, and may be higher or lower than those stated in this study.

The additional facilities or upgrades which are required to incorporate the proposed connection have been identified to the extent permitted by a preliminary assessment. Additional facility studies may be necessary to confirm constructability and the time required for construction. System impact or further studies at more advanced stages of the project development may identify additional facilities that need to be provided or that require upgrading.

## **Executive Summary**

This assessment examined the effect of the 115 kV shunt capacitor proposed for installation at Port Arthur Birch 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. submitted a connection assessment application for the installation of a new 115 kV, 80 Mvar shunt capacitor at Port Arthur Birch TS.

A diagram showing the area transmission system and the location of the proposed new facilities is displayed in Figure 1.

This project was subject to an expedited CAA process; whereby an extended Preliminary Assessment was performed to address all the related concerns and a System Impact Assessment was not required.

## **Conclusions and Recommendations**

This Preliminary Assessment has examined the effect that Hydro One Networks Inc.'s proposal to install one 115 kV, 80 Mvar shunt capacitor at Birch TS would have on the system voltages in the area and the reliability of load supply. The assessment concluded the following:

1. The addition of the 80 Mvar shunt capacitor at Birch TS will result in an improvement of the 115 kV voltage profile in the area and increased reliability in peak load supply.
2. Any switching associated with the new facility will result in abrupt voltage changes that are less than 4%, which represents the acceptable level.
3. The new shunt capacitor would provide a voltage improvement of about 1.7 kV at Birch TS, and about 1.8 kV at James Jct.
4. After the installation of the new shunt capacitor the supply of the existing peak load in the area may require both the shunt capacitor and the Thunder Bay synchronous condenser in service, in order to meet the voltage requirements of the most sensitive area loads.

## **Notification of Approval**

It is recommended that Notification of Approval be granted for the connection of the new 115 kV, 80 Mvar shunt capacitor and associated equipment at Birch TS.

## **Preliminary Assessment Report**

### **1.0 Project Description**

Hydro One Networks Inc. submitted a connection assessment application for the installation of a new 115 kV, 80 Mvar shunt capacitor at Port Arthur Birch TS.

The planned in service date for this project is Q4 2003.

A diagram showing the area transmission system and the location of the proposed new facilities is displayed in Figure 1.

This project was subject to an expedited CAA process; whereby an extended Preliminary Assessment was performed to address all the related concerns and a System Impact Assessment was not required.

### **2.0 Assessment Scope**

Connection Assessment studies that were previously performed for a load development in the Thunder Bay area indicated that the 115 kV transmission system in area is approaching its limit of reliability, and that the supply of any future increase in area peak load might be jeopardized. The report recommended that options for reinforcing the area transmission system be considered.

The main objects of this assessment were to determine the potential improvement in Thunder Bay area 115 kV transmission voltage profile resulting from the shunt capacitor installation, and to ensure that the new facilities meet the requirements of the *market rules* and have no adverse impact on system reliability.

### **3.0 Connectivity Arrangement and Equipment Ratings**

Hydro One Networks Inc. has indicated that the new capacitor bank is to be equipped with two circuit breakers connected in series and a current limiting reactor. All equipment is to rated for system frequencies of 60 Hz  $\pm$  0.5 Hz.

The new capacitor is to be connected to the 115 kV 'L4' bus at Port Arthur Birch TS via a motorized disconnect and will meet the following specifications:

- Capacitor

|                                  |                            |
|----------------------------------|----------------------------|
| Rated capability                 | 80 Mvar, 3 phase at 127 kV |
| Maximum operating voltage        | 127 kV                     |
| Maximum system voltage unbalance | 2%                         |
| Symmetrical Short Circuit Level  | 40 kA (min)                |
| Configuration                    | Double wye ungrounded      |
| Fusing                           | Fuseless                   |
| Insulation level                 | 550 kV BIL (min)           |

The purpose of current limiting reactors is to control the out-rush current magnitude and frequency to an acceptable level. The three series reactors will be positioned one in each phase between the switching position on the L4 bus and the breaker, and are required to meet the following specifications:

- Reactor

|  |                                   |
|--|-----------------------------------|
| Maximum Continuous Operating Voltage   | 127 kV                            |
| Emergency Operating Voltage            | 150 kV for 5 minutes              |
| Inductance at rated frequency of 60 Hz | 1 mH per phase (0.377 ohms/phase) |
| Continuous current (rms)               | 600 A                             |
| Symmetrical fault current              | 40 kA for 12 cycles               |
| Insulation level: Line (both ends)     | 550 kV BIL                        |
| Insulation level: Across coil          | 550 kV BIL                        |
| Insulation level to ground             | 550 kV BIL                        |

The two new circuit breakers are to be installed in series as shown in Figure 1. The ‘primary’ circuit breaker, CB1, will be a definite purpose Independent Pole Operated (IPO) circuit breaker with a Synchronous Control Unit (SCU) to minimize switching over-voltages. A general purpose SF6 circuit breaker, CB2, will be used as a backup to the ‘primary’ breaker.

The ‘CB1’ breaker alone should operate for all routine switching. The ‘CB2’ breaker should only operate if the ‘primary’ breaker experiences a malfunction or if the capacitor experiences a trip from protection. ‘CB1’ and ‘CB2’ breakers are required to meet the following specifications:

- **CB1 - Definite Purpose Circuit Breaker (IPO)**

|   |   |
|---|---|
| Breaker type  | Definite purpose and independent pole operated (IPO) equipped with provision for synchronized closing                             |
| Interrupting medium                                 | SF6   |
| Rated capability                                    | 2000 A  |
| Maximum rated voltage                               | 145 kV  |
| Interrupting capability                             | 40 kA (min)   |
| Rated Interrupting Time                             | 3 cycles (min)  |
| Tested Transient Recovery Voltage (TRV) across pole | 310 kV peak   |
| Insulation level                                    | 650 kV BIL (min)  |
| Other   | Restrike-free (up to 310 kV peak TRV ) and Pre-strike free when switching a 96 Mvar ungrounded-wye capacitor bank rated at 127 kV |

- **CB2 - General Purpose Circuit Breaker**

|                         |                      |
|-------------------------|----------------------|
| Breaker type            | Ganged Pole Operated |
| Interrupting medium     | SF6                  |
| Rated capability        | 2000 A               |
| Maximum rated voltage   | 145 kV               |
| Interrupting capability | 40 kA (min)          |

|  |  |
|--|--|
| Rated Interrupting Time                                | 3 cycles (min)                         |
| Tested Transient Recovery Voltage (TRV)<br>across pole | 310 kV peak                            |
| Insulation level                                       | 650 kV BIL (min)                       |
| Other  | Restrike-free (up to 310 kV peak TRV ) |

There is no requirement for discharge devices other than those inherent in each capacitor unit (5-minute discharge resistor).

The IMO had concerns about imposing switching restrictions on the new shunt capacitor due to the presence of rod gaps in the area. Hydro One Networks informed the IMO that the customers in the area already have surge arresters on their transformers, and that the existing rod gaps at Fort William TS will be replaced with surge arresters as part of the rod gap replacement program in 2003. Also the independent pole operated breaker used for switching the new shunt capacitor will limit the switching surges and the risk for the possible rod gaps flashover.

#### **4.0 Assessment of Impact on System Reliability**

##### **4.1 Description of Thunder Bay Area Transmission**

The Thunder Bay area loads are supplied, as shown in Figure 1, by the following facilities:

- Four 115 kV circuits connecting Lakehead 115 kV switchyard to Port Arthur TS#1 ( L4P), Port Arthur TS#2 ( L3P) and Birch TS (R1LB, R2LB),
- Two 115 kV circuits between Birch TS and Port Arthur TS#1 (P7B) and Port Arthur TS#2 (P3B).
- Thunder Bay GS comprising of one synchronous condenser unit rated at 111 MVA (C1), two generating units rated at 192 MVA (G2, G3). The maximum power output of the generating units is about 165 MW each,
- Four 115 kV circuits connecting Thunder Bay GS to Birch TS; Q4B from C1 to Birch TS, Q5B and Q8B from G2 to Birch TS and Q9B connecting G3 to Birch TS,

The main connection of this 115 kV power system area to the 230 kV system is provided by the two 115/230 kV Lakehead autotransformers.

In addition to the facilities shown in Figure 1 a number of voltage support devices are connected to the transmission system in this area, and were modeled in the studies as follows:

- At Birch TS – two shunt capacitors each rated 15 Mvar connected to the 25 kV bus,
- At Fort William TS – two shunt capacitors connected to the 25 kV bus, rated 12.3 Mvar (SC1 connected to the Q bus) and 15.9 Mvar (SC2 connected to the J bus) respectively.
- Lakehead TS – one 115 kV shunt capacitor rated at 85 Mvar, and two synchronous condensers connected to the 13.8 kV rated tertiary of the 115/230 kV transformers at Lakehead TS and rated 48 Mvar (C7) and 60 Mvar (C8), respectively.

## 4.2 Study Assumptions and Criteria

### Loads

The *Market Rules* require that all loads connected to the IMO-controlled grid be operated at a power factor within the range 0.9 lagging to 0.9 leading as measured at the Defined Meter Point.

This study was performed for a system with all elements in service under summer peak load conditions. The Thunder Bay area individual loads that were modeled in the study are shown in Table 1. Each load was assumed to have a lagging power factor close to 0.9 measured at the high voltage side of the connection. This study assumption was considered appropriate because it would provide an onerous result.

**Table 1.** Station Loads

| Load Name   | Summer Peak Loads |      | Point of Connection      |
|---|-------------------|------|--------------------------|
|   | MW                | Mvar |                          |
| <b>Abitibi Price</b>  | 50                | 21.5 | Q5B                      |
| <b>Sterling Pulp Chemical</b>                               | 40                | 17.2 | Q5B                      |
| <b>Bowater Canada TMP (Q4B)</b>                             | 120               | 51.6 | Q4B                      |
| <b>Bowater Canada Kraft Mill &amp; Bowater Canada (Q5B)</b> | 80                | 34.4 | Q5B                      |
| <b>Fort William TS</b>                                      | 74                | 31.8 | Q4/5B                    |
| <b>Birch TS</b>   | 88                | 37.8 | -                        |
| <b>Port Arthur DS</b>                                       | 42                | 18   | Port Arthur TS #1 and #2 |
| <b>Thunder Bay Packaging</b>                                | 15                | 6.5  | Port Arthur TS#2         |
| <b>Provincial Papers</b>                                    | 36.5              | 15.7 | Port Arthur TS#2         |
| <b>Lac Des Iles</b>   | 37                | 15.9 | P5M                      |

The total 115 kV Lakehead area load was assumed to be around 700 MW.

In the analysis, the loads in the Thunder Bay area were modeled as variable active and reactive power as follows:

- 50% of the active power was proportional to the square of the voltage and 50% to the voltage
- 100% of reactive power load is proportional to the square of the voltage.

The Transmission System Code (TSC) requires that any new tapped transformers of “consumers and distributors shall have adequate on-load tap-changers capability or other voltage-regulating facilities to operate continuously within normal variations of the transmission system as set out in the Market Rules.”

The customer loads connected to the Thunder Bay area 115 kV transmission are tapped off transformers which are not equipped with under-load tap changers, hence do not meet this

requirement.

**Generation**

The generation dispatch that was selected in the studies is listed in Table 2 below.

**Table 2.** Generation Dispatch

| <b>Generating Station</b> | <b>Output MW</b> |
|---------------------------|------------------|
| <b>Alexander GS</b>       | 59.5             |
| <b>Pine Portage GS</b>    | 113              |
| <b>Cameron Falls GS</b>   | 67               |
| <b>TCPL-Nippigon</b>      | 38               |
| <b>Kakabeka GS</b>        | 24.2             |
| <b>Silver Falls GS</b>    | 46.5             |

Because the Thunder Bay generation is the main power supplier in the area, the study concentrated on the impact that various Thunder Bay GS dispatch scenarios have on the system’s ability to supply the peak load.

**Study Criteria**

The study criteria were based on the present system operating requirements, and the IMO proposed guidelines for determining the effect of new developments on the system reliability and establishing the need to reinforce the transmission system. It has been proposed that the following contingencies constitute the “design criteria contingencies” set:

- Single transmission element contingency,
- Double-circuit line contingency,
- Stuck breaker condition.

The proposed guidelines that were used in this study specify that, with all transmission elements in service in pre-contingency:

- following any design-criteria contingency must not result in the loss of 500 MW or more of load.
- if any design criteria contingency results in the loss of 250MW to 500 MW, at least half of the load must be restored within 30 minutes and the remaining load in eight hours.
- if any design-criteria contingency will result in a supply interruption to 150 MW to 250 MW load then, the supply must be restored within eight hours.
- the power flows over the transmission elements must be within their continuous thermal ratings.
- following any design-criteria contingency the power flows must not exceed the limited time ratings of the equipment.
- the steady state voltages must be within the ranges required by the Market Rules.
- the post-contingency decline in voltage must be less than 10%.

Presently, the IMO is directing the system operations such that the voltages at Fort William TS, Birch TS and Port Arthur TS are maintained between 120 and 125 kV, under normal system conditions. This voltage range is more restrictive than the normal voltage range of 113 kV to 127 kV specified in the Market Rules, but it is maintain because the paper mill loads connected to the QxB circuits require a minimum voltage of 118 kV for operation.

The IMO-controlled grid is planned and operated such that with all elements in service a single contingency shall not result in load loss except where the load is directly connected to the faulted element or as a result of operation of a load rejection scheme.

With one element out of service, a single contingency may result in load loss by configuration or operation of the load rejection scheme.

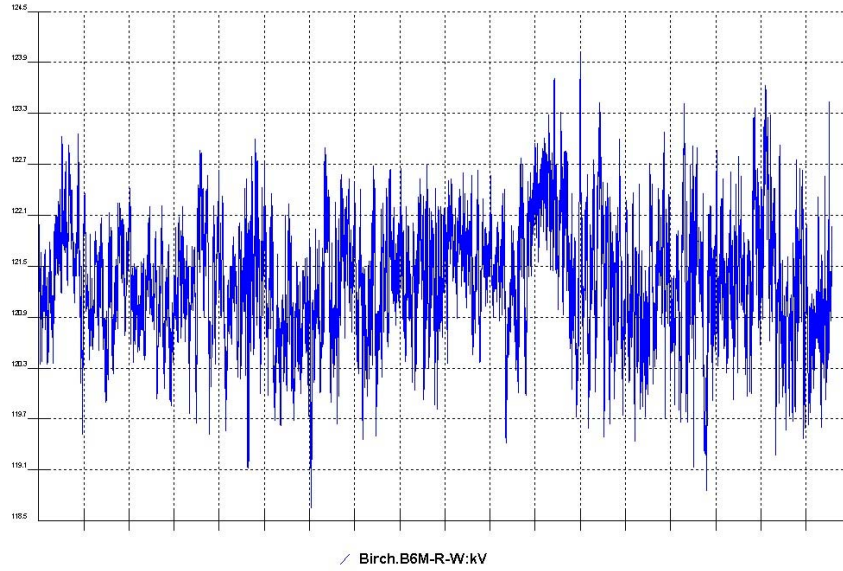
### **Study Scenarios**

The power flow and voltage studies were performed assuming peak load conditions and only one Thunder Bay generator in service. Sensitivity studies were carried out to determine the effect of the proposed shunt capacitor on the Birch TS 115 kV voltage.

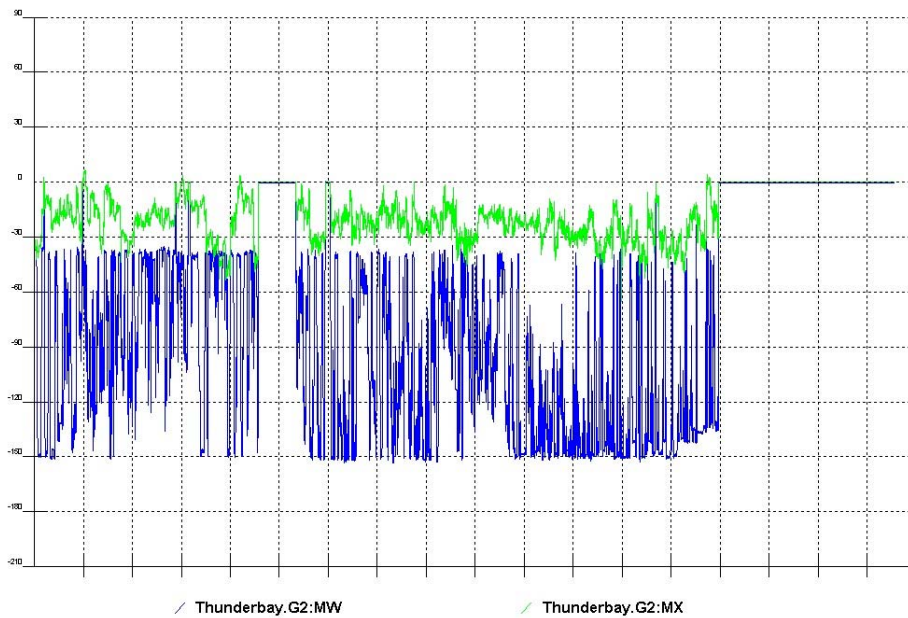
The assessment of the impact and the voltage enhancement obtained due to the new shunt capacitor was performed assuming the most critical contingency for each scenario representation.

### **5.0 Thunder Bay 115 kV System Past Performance**

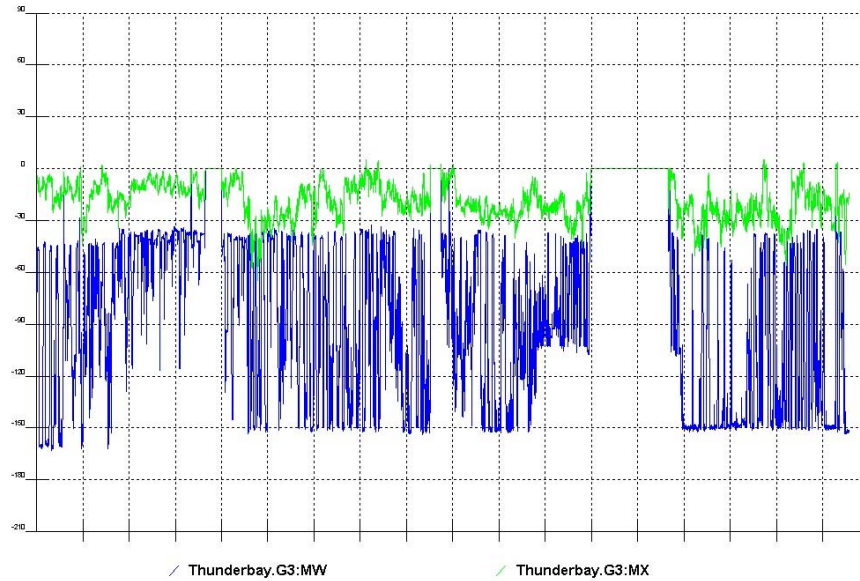
Past operating practices require that the minimum voltages in the Thunder Bay area be maintained at about 118 kV in order to ensure secure supply of some of the paper mill loads connected to the QxB circuits. Historical records indicate that during 2002 the voltage at Birch TS was maintained above 120 kV, as shown in Figure 2. A further analysis of records indicates that at all times during 2002 at least one Thunder Bay generating unit was in service. Figure 3 and 4 below show that G2 was out of service during the month of September, and G3 was removed from service during the month of August.



**Figure 2. Year 2002 Birch TS Voltage (June to October 2002)**



**Figure 3. Thunder Bay G2 (June to October 2002)**



**Figure 4. Year 2002 Thunder Bay G3**

Results of studies carried out in conjunction with a new load connection assessment application in the area indicate that the Thunder Bay synchronous condenser (C1) would be required frequently to provide voltage support. The year 2002 records of C1 reactive power output confirmed this finding.

Apart from requiring voltage support from C1, under conditions of peak load in the area, Thunder Bay GS generator(s) would have to be constrained on to ensure that the supply of load in the area is not jeopardized.

The previous study indicated that with all these operating measures in place, any increase in the area peak load may not be accommodated due to concerns related to the minimum area voltage requirement of 118 kV.

In addition, with the opening of the electricity markets, more uncertainty exists related to the cost of continuing these operating practices and the availability of Thunder Bay generation. Over time, the generation congestion management payments and the ancillary services contracts, which are all borne by all Ontario consumers, could become substantial.

## 6.0 Assessment Results

The assessment concentrated on the effect of the proposed 115 kV shunt capacitor on the reliability of the Thunder Bay area system with special emphasis on the Birch TS voltage.

### 6.1 Proposed Connectivity Assessment

The proposed point of connection for the new shunt capacitor is on the L4 bus at Birch TS, as indicated in Figure 1.

In principle, it would be desirable that the connection of the new shunt capacitor ensures the following:

- The capacitor should remain in service for any contingency which will result in loss of power in-feed from a generator,
- The capacitor could be lost for a contingency resulting in the loss of load.

For the proposed connectivity, a contingency associated with the 115 kV circuit Q4B will remove from service the synchronous condenser C1, the new shunt capacitor and about 120 MW of peak load. In this case, the simultaneous disconnection of a substantial amount of load alleviates concerns related to the impact on voltage of the loss of both reactive sources in the region.

Given that there are no plans to expand Birch 115 kV switchyard, the proposed connection location of the new shunt capacitor is reasonable.

## **6.2 Thermal Loading Assessment**

The thermal capability of the 115 kV circuits between Thunder Bay GS and Birch TS is as follows:

|     | Continuous rating based on 118 kV |
|-----|-----------------------------------|
| Q4B | 190 MVA                           |
| Q5B | 245 MVA                           |
| Q8B | 250 MVA                           |
| Q9B | 275 MVA                           |

The circuit continuous ratings are sufficiently high to accommodate the supply of peak load for conditions of all transmission elements in service and in the event of a contingency associated with one of these circuits.

## **6.3 Voltage Assessment**

The results of the load flow investigations performed for peak load conditions are summarized in Table 3. The table contains a description of the Thunder Bay GS dispatch, critical studied contingencies, the status of the reactive support devices in the area, and the voltages that were registered at the monitored buses.

**Table 3. Study Results**

| Study Case           | Lakehead Voltage (kV) | Thunder Bay Generation<br>G3 = 0 MW |    | Birch TS Voltage (kV) |          | James Q4B jct. Voltage* (kV) | Thunder Bay Voltage (kV) |       |
|----------------------|-----------------------|-------------------------------------|----|-----------------------|----------|------------------------------|--------------------------|-------|
|                      |                       | G2 MW, Mvar                         | C1 | Immediate Post-fault  | Post AVR |                              | Post AVR                 | D Bus |
| Case A               |                       |                                     |    |                       |          |                              |                          |       |
| Steady-state Cap OFF | 124.5                 | 165, 80                             | 0  | 119.0                 | 119.     | 115.9                        | 118.8                    | 115.9 |
| Birch Cap ON         | 124.7                 | 165, 80                             | 0  | 122.7                 | 120.7    | 117.7                        | 120.4                    | 117.5 |
| % Change             | 0.2%                  |                                     |    | 3.2%                  | 1.4%     | 1.6%                         | 1.7%                     | 1.3%  |
| Case B               |                       |                                     |    |                       |          |                              |                          |       |
| Steady-state Cap OFF | 124.8                 | 165, 80                             | 65 | 120.5                 | 120.6    | 119.4                        | 120.4                    | 120.6 |
| Birch Cap ON         | 124.6                 | 165, 77                             | 58 | 123.9                 | 121.6    | 120.3                        | 121.7                    | 121.6 |
| % Change             | -0.1%                 |                                     |    | 2.8%                  | 0.9%     | .8%                          | 1.1%                     | 0.8%  |
| Case C               |                       |                                     |    |                       |          |                              |                          |       |
| Steady-state Cap ON  | 124.7                 | 165, 74.2                           | 0  | 120.7                 | 120.7    | 117.7                        | 120.9                    | 117.7 |
| Loss of G2**         | 121.4                 | 0,0                                 | 0  | 112.1                 | 115.6    | 112.7                        | 114.6                    | 112.9 |
| % Change             | -2.7%                 |                                     |    | -7.1%                 | -4.2%    | -4.2%                        | -5.2%                    | -4.0% |

\*James Jct. is the 115 kV point of connection for the Bowater TMP load.

\*\*All loads in the area were converted to variable P, Q in post contingency.

The results of the studies indicate, for the particular system scenarios that were studied, that:

- The immediate post contingency voltage variation at Birch TS satisfies the Market Rules requirements of less than 4% for abrupt voltage changes due to capacitor switching.
- The new shunt capacitor would provide a voltage improvement of about 1.7 kV at Birch TS, and 1.8 kV at James Jct.
- For a contingency associated with G2, the post-contingency voltage decline meets the 10% criterion.

The results that are highlighted in yellow in Table 3 indicate that, with Thunder Bay G2 and the new 80 Mvar shunt capacitor in service, the steady state voltage at James jct. meets the Market Rules requirements but is slightly under the 118 kV level required by some of the loads in the area. By comparison, the results highlighted in green seem to indicate that with Thunder Bay G2 and C1 in service the voltages along Q4B are slightly higher. This appears to indicate that with only G2 in service at times of peak load, meeting the voltage requirements of the most sensitive area loads may require both the shunt capacitor and the condenser in service. It should again be noted that the loads in the area were assumed to have a 0.9 power factor.

Immediately after a contingency associated with the 115 kV circuit Q4B, both sources of reactive support comprised of the Thunder Bay synchronous condenser and the proposed Birch shunt

capacitor will be removed from service. However, this contingency will also result in the loss of a large portion of the Bowater Canada load and hence post-contingency voltage decline in the area is not a concern.

The results of the study indicate that the addition of the new shunt capacitor will result in an improvement to the voltage profile in the Thunder Bay area.

The study results show that with Thunder Bay G2 in service at times of peak load, meeting the voltage requirements of the most sensitive area loads may require both the shunt capacitor and the Thunder Bay synchronous condenser (C1) in service.

## **7.0 Conclusions and Recommendations**

This Preliminary Assessment has examined the effect that Hydro One Networks Inc.'s proposal to install one 115 kV, 80 Mvar shunt capacitor at Birch TS would have on the system voltages in the area and the reliability of load supply. The assessment concluded the following:

1. The addition of the 80 Mvar shunt capacitor at Birch TS will result in an improvement of the 115 kV voltage profile in the area.
2. Any switching associated with the new facility will result in abrupt voltage changes that are less than 4%.
3. The new shunt capacitor would provide a voltage improvement of about 1.7 kV at Birch TS, and about 1.8 kV at James Jct.
4. After the installation of the new shunt capacitor the supply of the existing peak load in the area may require both the shunt capacitor and the condenser in service, in order to meet the voltage requirements of the most sensitive area loads. In addition, for conditions of outage to the new shunt capacitor other voltage support sources in the area are to be used.

## **8.0 Customer Impact Assessment**

Hydro One Networks Inc. concluded that a Customer Impact Assessment is not required because the proposed 80 Mvar shunt capacitor at Birch TS will not have short circuit impact to the customers in the area and it will meet the market requirement of 4% step voltage change limit for switching. In addition, in meetings with three large industrial customers in the area Hydro One Networks Inc. explained the impact of the project on the customer supply voltage and the customers indicated that the proposed capacitor bank installation will not present operational concern to them.

## **9.0 Notification of Approval**

It is recommended that Notification of Approval be granted for the connection of the new 115 kV, 80 Mvar shunt capacitor and associated equipment at Birch TS.

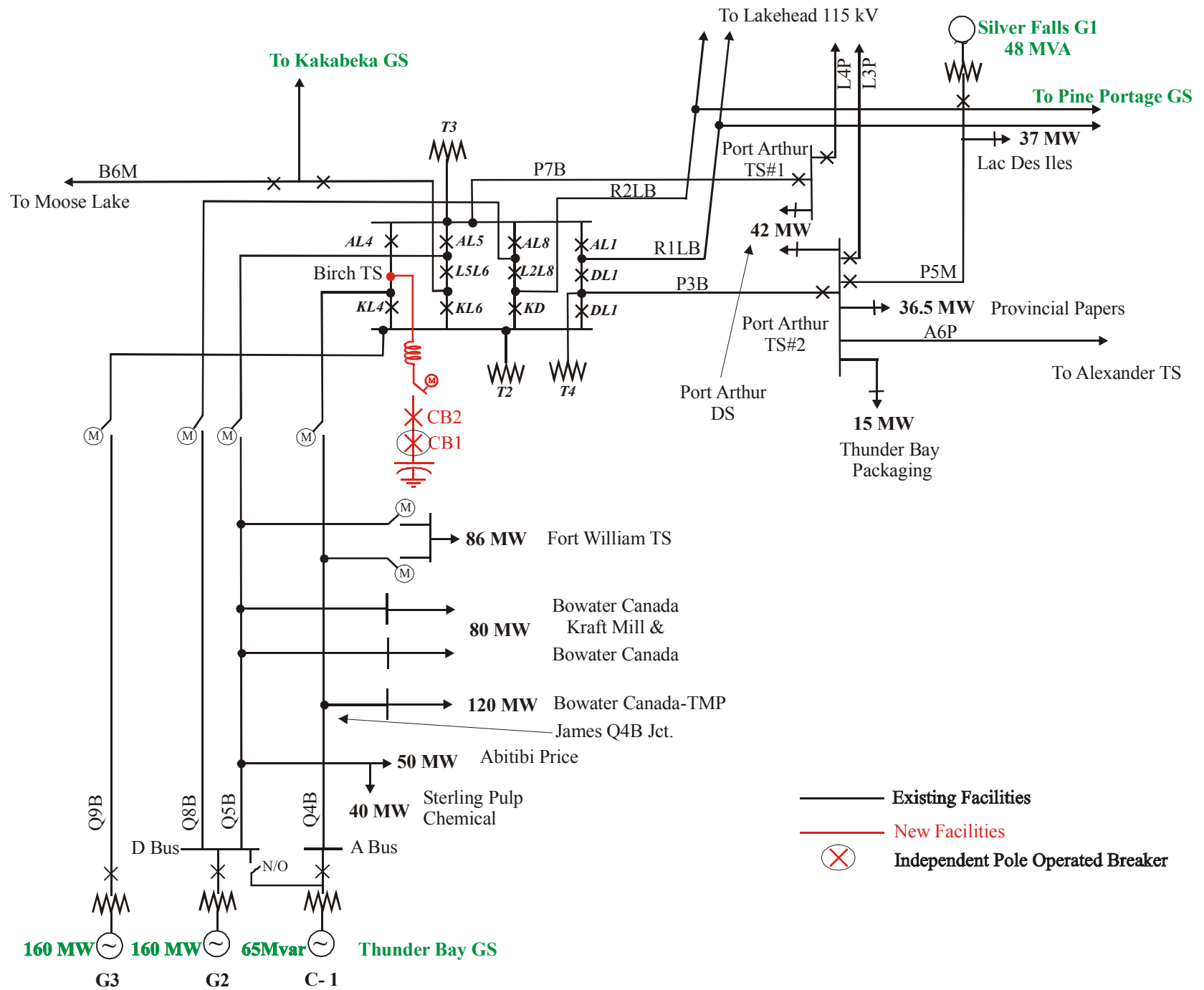


Figure 1. Thunder Bay Area Transmission Configuration - Birch TS New Shunt Capacitor