

August 16, 2011

Mr. John Sabiston
Manager, Transmission Plans - West
Hydro One Networks Inc.
483 Bay Street, 15th Floor North Tower
Toronto, Ontario
M5G 2P5

Dear Mr. Sabiston:

***Reconfigure Wallaceburg TS
Notification of Conditional Approval of Connection Proposal
CAA ID Number: 2010-EX521***

Thank you for the information regarding the proposed replacement of original transformers T1, T2, T3 and T4 with two new transformers T1 and T2 and the interim installation of a smaller transformer T3 until the permanent arrangement is in place.

The IESO has concluded that the proposed changes will not result in a material adverse impact on the reliability of the integrated power system. The IESO is therefore pleased to grant **conditional approval** for the modification detailed in the attached expedited System Impact Assessment report. Please note that any material changes to your proposal may require a re-assessment by the IESO, and may nullify your conditional approval.

You may now initiate the IESO's "Market Entry" process. To do so, please contact Market Entry at market.entry@ieso.ca at least eight months prior to your expected energization date. The SIA report, attached hereto, details the requirements that your company must fulfill during this process, including demonstrating that the equipment *as installed* will not be materially different from the equipment *as approved* by the IESO. The document entitled "**External Guidelines for Connection to the IESO**", provided in the approval email describes the key steps in the Market Entry process.

When your company has successfully completed the IESO's "Market Entry" process, the IESO will provide you with a "final" approval, thereby confirming that the facility is fully authorized to connect to the IESO-controlled grid. For further information, please contact the undersigned.

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Yours truly,

Michael Falvo
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cc: IESO Records

Final Report - Expedited System Impact Assessment – Revised August 22, 2011
Hydro One Networks Inc.

1. GENERAL DESCRIPTION & PROPOSED MODIFICATIONS

Wallaceburg TS is a transformer station in the southwestern part of Ontario. This 115/27 kV transformer station originally consisted of three transformers rated at 11.25/15 MVA and one transformer (T4) rated at 11/18 MVA supplied via the 115 kV circuit N5K from Scott TS.

Transformer T3 failed in March of 2010. At this time Hydro One proposed to install 2 new 115/27 kV transformers rated at 25/41.7 MVA in a standard DESN configuration with an in-service date of December 2012.

Transformer T4 failed in May 2011 and therefore, as an interim measure, a temporary T3 was put in place in August 2011 until the station is rebuilt with new T1 and T2 transformers. The remaining 2 transformers, T1 and T2, are approximately 60 years old and are approaching their end of life.

The existing HV connections and switching equipment for T3 and T4 will be removed. A new disconnect switch will be added on N5K between the T1 and T2 line taps.

The single line diagram showing the final configuration is shown in Figure 3 at the end of this document.

2. TECHNICAL SPECIFICATIONS

2.1 Temporary T3 Replacement

A comparison between the technical specifications of the original transformers and the temporary replacement transformer T3 is given in the following table.

Wallaceburg TS		
	Original T1, T2, T3, T4	Temporary Replacement T3 <i>(All values as specified at the time of order. Actual values to be provided via Hydro One's Secure Web for Operational Information)</i>
Configuration	three phase	three phase
Transformation (kV)	T1, T2 & T3: 110.0 / 28.4 T4: 110 / 28.4 14.2	115.5/ 28.4
Winding Configuration	Y / D	D / Y
Thermal Rating	T1, T2 & T3: 11.25 MVA ONAN 15.0 MVA ONAF T4: 11.0 MVA ONAN 14.5 ONAF 18.0 ONAF	15.0 MVA ONAN 20.0 MVA ONAF 25.0 MVA ONAF
Continuous Thermal Rating (summer 30°C)	T1, T2 & T3: 15.0 MVA; T4: 18.0 MVA	25.0 MVA
10 Day Thermal Rating (summer 30°C)	T1, T2 & T3: 19.6 MVA; T4: 21.9 MVA	33.3 MVA
15 Minutes Thermal Rating (summer 30°C)	T1, T2 & T3: 26.3 MVA; T4: 28.8 MVA	50.0 MVA
Positive Sequence Impedance (H-X)	T1: R = 0.564, X = 9.65% (15 MVA Base) T2: R = 0.595, X = 9.44% (15 MVA Base) T3: R = 0.508, X = 9.77% (15 MVA Base) T4: R = 0.622, X = 9.07% (14.5 MVA Base)	R = 0.379 % X = 6.65 % 15 MVA Base
Impedance to Ground	HV & LV Ungrounded	HV & LV Ungrounded
Under-load tap-changer (ULTC)	28.4 ± 2.84 kV, 16 steps	28.4 + 5.68 kV /- 2.84 kV 24 steps

Wallaceburg TS – continued		
	Original T1, T2, T3, T4	Temporary Replacement T3
Off-load tap-changer (OLTC)	Tap 1 – 121.0 kV Tap 2 – 118.25 kV Tap 3 – 115.5 kV Tap 4 – 112.75 kV Tap 5 – 110.0 kV	Not Applicable
In service off-load tap Position	Tap 4 – 112.75 kV	Not Applicable

Table 1 – Comparison of Original Transformers and Temporary Replacement T3 at Wallaceburg TS

2.2 Permanent T1/T2 Replacement

A comparison between the technical specifications of the original transformers and the replacement transformers T1 and T2 is given in the following table.

Wallaceburg TS		
	Original T1, T2, T3, T4	Replacement T1 and T2 <i>(All values as specified at the time of order. Actual values to be provided via Hydro One's Secure Web for Operational Information)</i>
Configuration	three phase	three phase
Transformation (kV)	T1, T2 & T3: 110.0 / 28.4 T4: 110 / 28.4 14.2	115.0 / 27.6
Winding Configuration	Y / D	Y / Zig Zag
Thermal Rating	T1, T2 & T3: 11.25 MVA ONAN 15.0 MVA ONAF T4: 11.0 MVA ONAN 14.5 ONAF 18.0 ONAF	25.0 MVA ONAN 33.3 MVA ODAN 41.7 MVA ODAF
Continuous Thermal Rating (summer 30°C)	T1: 15.0 MVA; T2: 15.0 MVA T3: 15.0 MVA; T4: 18.0 MVA	41.7 MVA
10 Day Thermal Rating (summer 30°C)	T1: 19.6 MVA; T2: 19.6 MVA T3: 19.6 MVA; T4: 21.9 MVA	59.7 MVA
15 Minutes Thermal Rating (summer 30°C)	T1: 26.3 MVA; T2: 26.3 MVA T3: 26.3 MVA; T4: 28.8 MVA	84.3 MVA
Positive Sequence Impedance (H-X)	T1: R = 0.564, X = 9.65% (15 MVA Base) T2: R = 0.595, X = 9.44% (15 MVA Base) T3: R = 0.508, X = 9.77% (15 MVA Base) T4: R = 0.622, X = 9.07% (14.5 MVA Base)	R = 0.22 % X = 7.05 % 25 MVA Base
Impedance to Ground	HV & LV Ungrounded	LV 1.5 Ω via neutral reactor
Under-load tap-changer (ULTC)	28.4 ± 2.84 kV, 16 steps	115.0 +/- 22 kV, 16 steps
Off-load tap-changer (OLTC)	Tap 1 – 121.0 kV Tap 2 – 118.25 kV Tap 3 – 115.5 kV Tap 4 – 112.75 kV Tap 5 – 110.0 kV	Not Applicable
In service off-load tap Position	Tap 4 – 112.75 kV	Not Applicable

Table 2 – Comparison of Original Transformers and Replacement T1/T2 at Wallaceburg TS

2.3 New Disconnect Switch

The technical specifications of the new disconnect switch are given in the table below.

Motorized Disconnect Switch Specifications (on N5K at Wallaceburg TS)	
Configuration	3 phase
Maximum Continuous Rated Voltage	127
Rated Continuous Current	1200
Short Circuit Symmetrical Duty Rating	50 kA

Table 3 – Specifications of New Disconnect Switch at Wallaceburg TS

3. REQUIREMENTS

Hydro One must notify the IESO as soon as it becomes aware of any changes to the assumptions made in the connection assessment. The IESO will determine whether these changes require a re-assessment.

Maximum Voltage

Appendix 4.1, reference 2 of the Market Rules states that under normal conditions voltages are maintained within the range of 113 kV to 127 kV. Thus, the IESO requires that the 115 kV equipment in Ontario must have a maximum continuous voltage rating of at least 127 kV.

Fault Levels

Fault interrupting devices must be able to interrupt fault current at the maximum continuous voltage of 127 kV.

The Transmission System Code (TSC), Appendix 2 establishes maximum fault levels for the transmission system. For the 115 kV system, the maximum 3 phase symmetrical fault level is 50 kA and the single line to ground (SLG) symmetrical fault level is 50 kA.

The TSC requires that new equipment be designed to sustain the fault levels in the area where the equipment is installed.

Monitoring Requirements for Transmitters

In accordance with the telemetry requirements for transmitters (see Appendices 4.16, 4.20 and 4.21 of the Market Rules) the connection applicant must install equipment at this project with specific performance standards to provide telemetry data to the IESO. The data is to consist of certain equipment status and operating quantities which will be identified during the IESO Market Entry Process.

Protection Requirements

Hydro One is required to meet the requirements with respect to protection systems for the new transformers and coordination with the existing protection systems, as outlined in the Transmission System Code.

Reactive Power Requirements

The Market Rules require that Hydro One have the capability to maintain a power factor (pF) within the range of 0.9 lagging and 0.9 leading as measured at the defined metering point at Wallaceburg TS. This power factor range translates into a load angle range of ± 0.45 radians. All the points above 0.45 radians indicate a lagging power factor below 0.9. All points below -0.45 radians indicate a leading power factor below 0.9.

Provided that the TSC requirements are satisfied, the IESO does not have additional requirements.

4. ASSESSMENT & CONCLUSIONS

4.1. Temporary T3 Transformer

The temporary replacement T3 is an improvement over the failed T4.

4.2. Replacement T1 and T2 Transformers

The information provided by Hydro One Networks Inc. shows that the technical characteristics of the replacement transformers are an improvement over the original transformers. The positive sequence impedances of the new transformers are lower than the original transformers' positive sequence impedances, and the LV side will be grounded through a 1.5 ohm reactor. The short circuit levels on the LV side of the station may change, but it does not represent a concern for the IESO, as we assume that Hydro One has evaluated the impact on their customers.

Each of the original transformers has both an OLTC and a ULTC. The replacement transformers will have a ULTC on the HV side resulting in a greater secondary voltage range. According to the Market Rules, Appendix 4.1, the permissible voltage at the primary side of the transformer can vary from 113 kV to 127 kV in southern Ontario. With the voltage at 127 kV, the secondary voltage ranges are given in the table below.

Secondary Voltage Range Primary voltage = 127 kV	
Original T1 through T4 (in-service tap 3: 115.5 kV)	New T1 & T2
34.4 – 28.1 kV	37.7 – 25.6 kV

Table 4 – Secondary Voltage Ranges for Original and Replacement Transformers at Wallaceburg TS

The replacement transformers with ULTCs provide a greater secondary voltage range than was possible on the original transformers.

4.3. Summer 10-DAY Station Capabilities

The 10-DAY ratings of the original T1 and T2 and the interim T3 are listed in the table below. The summer 10-DAY station capability is determined by removing the transformer with the highest 10-DAY thermal rating from service.

10-DAY Summer Ratings for Wallaceburg TS		
Transformer	10-DAY Thermal Rating (MVA) (summer 30°C)	
	Original T1, T2, & T4	New T1 & T2
T1	19.6	O/S (59.7)
T2	19.6	59.7
T3	O/S (33.3)	Not applicable
T4	Not available	
Summer 10-DAY Station Capability (with highest rated transformer out of service)	39.2 MVA	59.7 MVA

Table 5 – 10-DAY Thermal Ratings for Original and Replacement Transformers at Wallaceburg TS

The current 10-DAY summer station capability with the interim T3 out of service is 39.2 MVA. The summer 10-DAY station capability with the new T1 and T2 will increase by 20.5 MVA to 59.7 MVA.

4.4. Load Peaks and Projections

Revenue meter information from October 23, 2009 through December 13, 2010 was used to evaluate the load on the original T1, T2, T3 and T4 at Wallaceburg TS. The peak load of 45.0 MVA occurred on July 7, 2010 at 13:30. Figure 1 shows the loading at the LV side of T1, T2, T3 and T4.

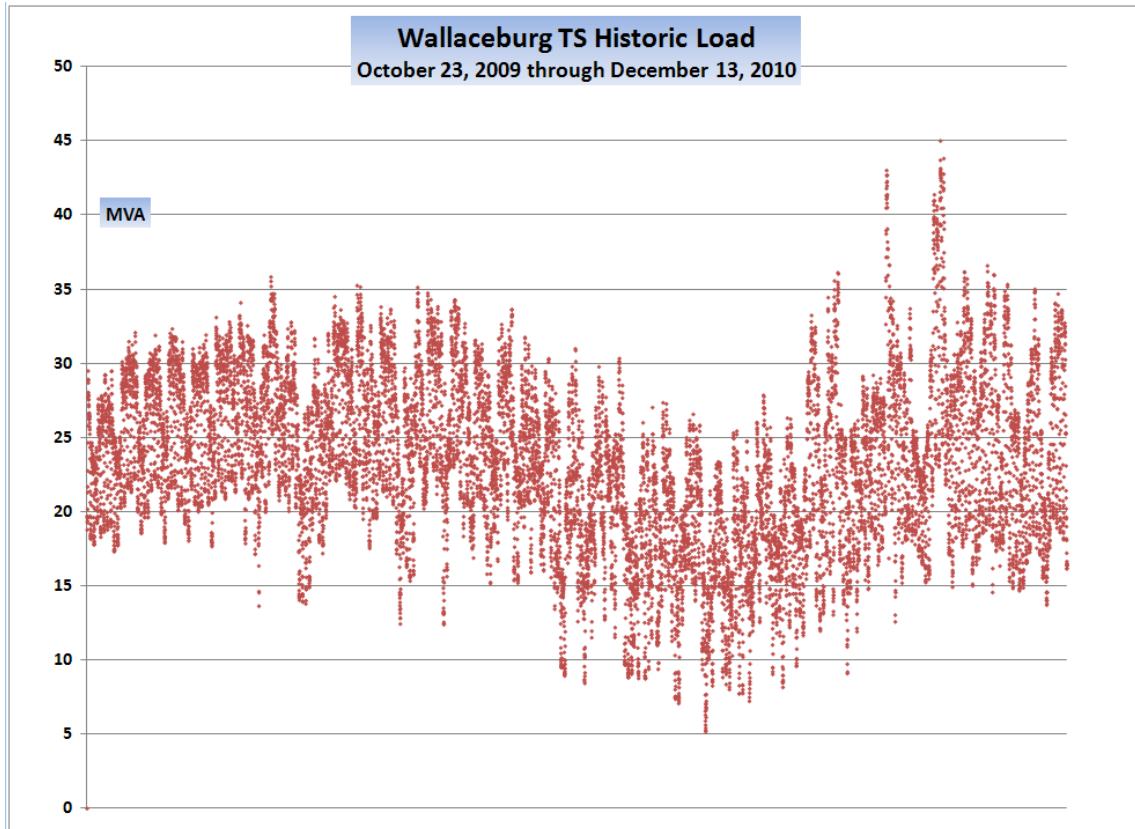


Figure 1 - Wallaceburg TS Historic Load (T1, T2, T3 & T4)

The load on Wallaceburg TS is projected to increase by 1.3% annually as shown in the table below.

Wallaceburg TS Projected Peak Load Growth (assuming a 1.3% annual load growth)		
Year	Projected Peak Load	10-DAY summer capability
2010	45.0 MVA (actual)	<p>39.2 MVA (before replacement)</p> <p>59.7 MVA (after replacement)</p>
2011	45.6 MVA	
2012	46.2 MVA	
2013	46.8 MVA	
2014	47.4 MVA	
2015	48.0 MVA	
2025	54.6 MVA	

Table 6 – Wallaceburg TS Projected Load Growth

With the current 10-DAY summer LTR capabilities, there is a deficit of 6.4 MVA when compared to the 2011 projected peak loads. Hydro One will use load transfers to address peak summer loading combined with the post contingency condition of the loss of another transformer.

Given the increase in the 10-DAY summer capability and the projected loads as shown in Table 2, Wallaceburg TS is not expected to exceed its 10-day summer LTRs after the new transformers are installed.

4.5. Load Angle & Power Factor

Wallaceburg TS is equipped with one low voltage shunt capacitor, SC1, providing reactive compensation of 10.8 MX at 27.6 kV.

Revenue meter data from October 23, 2009 through December 13, 2010 was used to calculate the load angle at Wallaceburg TS. Figure 2 illustrates the load angle at the LV side of Wallaceburg TS during the daily on-peak hours (7 a.m. through 11 p.m.).

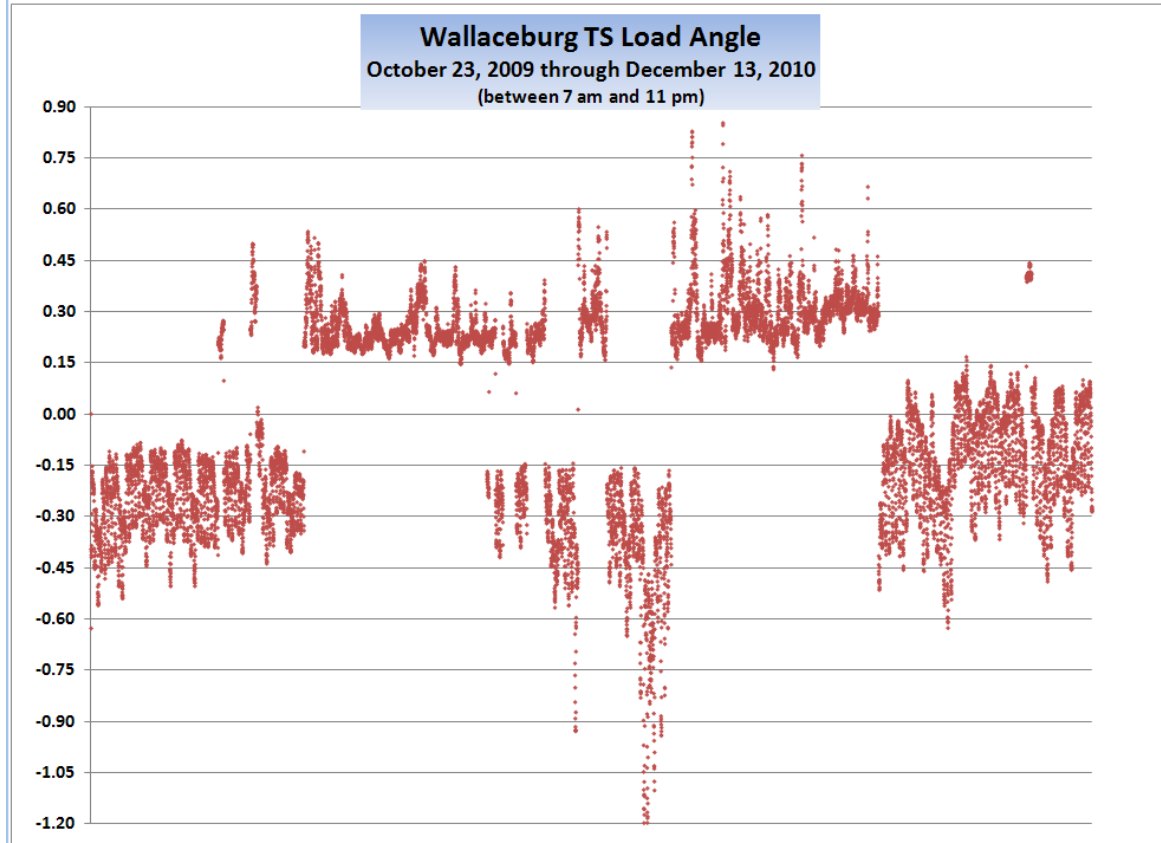


Figure 2 - Load Angle at Wallaceburg TS

Between October 23, 2009 and December 13, 2010 the highest load angle of 0.853 radians at Wallaceburg TS occurred on April 25, 2010 at 300.

The lowest observed power factor on the low voltage side and the corresponding power factor as calculated on the high voltage side are shown in the table below.

Date	Time	P Total (MW)	Q Total (MX)	LV Power Factor (observed)	HV Power Factor (calculated)
April 25, 2010	3:00	3.41	3.90	0.658	0.654

To maintain the power factor in the range of 0.9 lagging to 0.9 leading at the defined meter point, 3 MX of reactive compensation would be required at Wallaceburg TS.

SC1 was not in service on April 25, 2010 and as a result was not providing any reactive compensation. Since SC1 is capable of providing the required reactive compensation, no additional shunt capacitors are required; however, the deployment strategy of the existing shunt capacitor needs to be revisited, so that the power factor requirements are met.

4.6. CONCLUSIONS

This expedited System Impact Assessment concludes that the temporary installation of the interim T3 transformer, as well as the final configuration with two new T1 and T2 transformers and the new motorized disconnect switch at Wallaceburg TS are not expected to have a material adverse impact on the IESO-controlled grid.

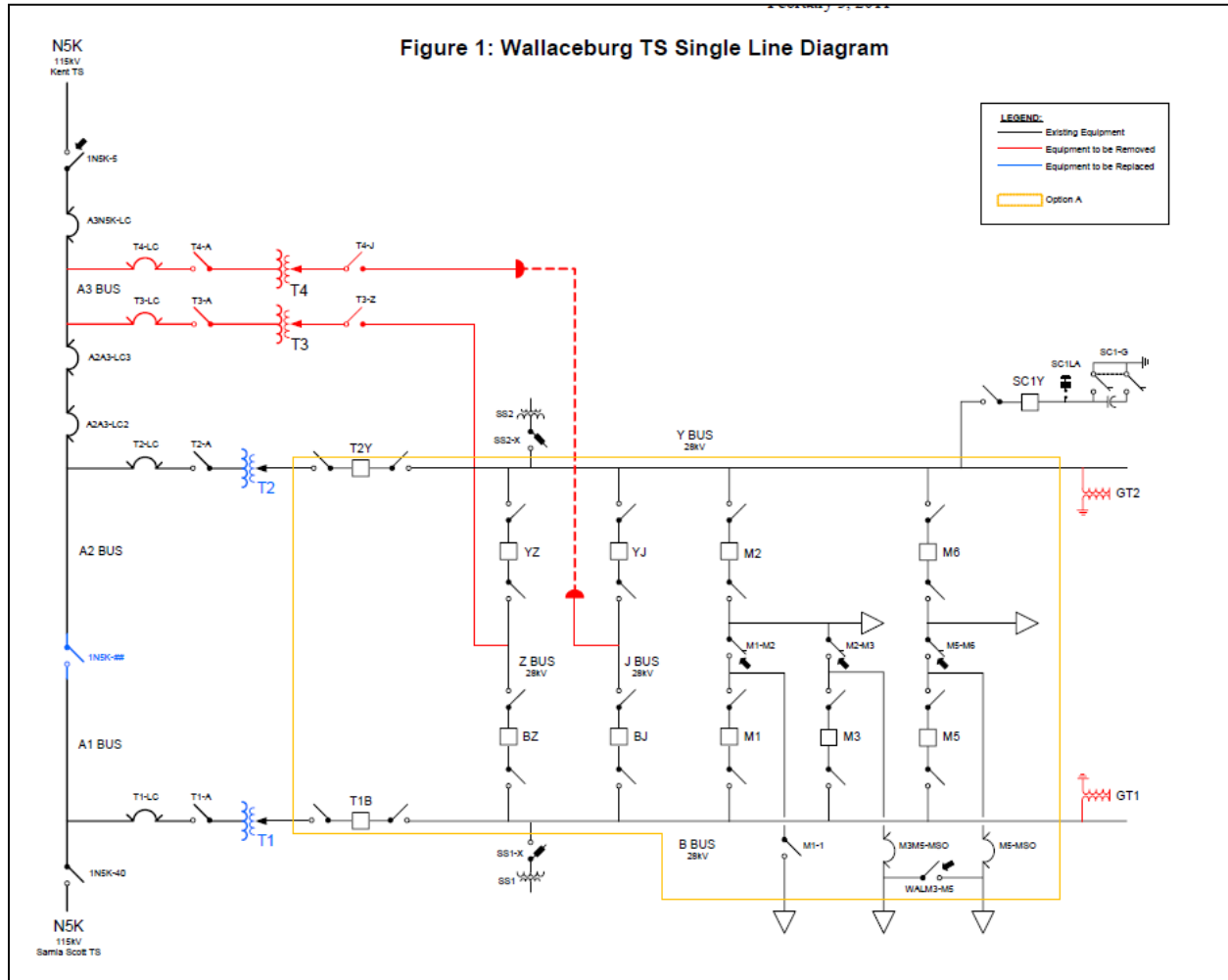


Figure 3 – Final configuration of Wallaceburg TS