



April 30, 2009

Project No.: RP-05-786

ATCO Electric Ltd.
10035 – 105 Street
Edmonton, Alberta
T5J 2V6

Attention: Chris Clark, P.Eng. – Manager Operational and Facilities Planning

Dear Chris,

RE: Notice (“Notice”) Pursuant to the Direction Issued by the Independent System Operator, operating as the Alberta Electric System Operator (the “AESO”) on October 14, 2008 to ATCO Electric Ltd. (“ATCO”) under s. 35 of the *Electric Utilities Act* (the “EUA”) for Edmonton Region 240kV Line Upgrades - Project No. RP-05-786 (the “Project”)

On October 14, 2008, the AESO issued the attached direction to ATCO (the “Direction”). This Notice is being issued by the AESO in accordance with paragraph b(ii) of the Direction, and forms a part of the Direction.

The AESO received approval of the needs identification document (the “NID”) for the Project from the Alberta Utilities Commission (“AUC”) on February 24, 2009 (Approval No.U2009-62).

The AESO confirms that an acceptable Proposal to Provide Service (“PPS”) for the Project was submitted by ATCO on April 14, 2009. Based on the PPS, the total estimated Project cost for ATCO's scope of work is \$26,680,491.00 (CAD) [+20%/-10%, 2011\$].

As such, the AESO hereby directs ATCO to submit the Facility Proposal to the AUC no later than July 31, 2009. The costs and expenses incurred by ATCO as a consequence of this notice and the attached Direction are not to exceed \$100,000.00.

Please indicate ATCO's acknowledgement of this Notice by having an authorized representative of ATCO sign this letter and by then returning, on or before May 29, 2009, the enclosed copy marked “AESO File Copy” to the attention of Michelle Close at:

Alberta Electric System Operator
2500, 330 - 5th Avenue SW
Calgary, Alberta
T2P 0L4

2500, 330 - 5th Ave SW Calgary, Alberta T2P 0L4
t (403) 539-2450 | f (403) 539-2949 | www.aeso.ca

Should you have any questions regarding this Notice, please contact Alan Xu at (403) 539-2619.

Sincerely,

Alberta Electric System Operator



David Erickson

Interim President and CEO

Enclosure: S35 direction to ATCO dated October 14, 2008

THE FOREGOING NOTICE ACKNOWLEDGED THIS 19th DAY OF
May, 2009.

ATCO Electric Ltd.

Per: Christina Clark

Name: Christina Clark, P.Eng.
Mgr., Operational & Facilities Planning

Title: _____



AESO FILE COPY



October 14, 2008

Project No.: RP-05-786

ATCO Electric Ltd.
10035 - 105 Street
Edmonton, Alberta
T5J 2V6

Attention: Chris Clark, P.Eng. – Manager Operational and Facilities Planning

Dear Chris,

RE: Direction Pursuant to s. 35 of the *Electric Utilities Act* (the “EUA”) from the Alberta Electric System Operator (the “AESO”) to ATCO Electric Ltd. (“ATCO”) to Submit a Transmission Facility Application to the Alberta Utilities Commission (the “Commission”) for the Edmonton Region 240kV Line Upgrades - Project No. RP-05-786 (the “Project”)

On August 26, 2008, the AESO submitted a needs identification document (the “NID”) for the Project to the Commission. The NID is available for viewing on the Commission’s Integrated Application Registry under Application Number 1584342.

Now, pursuant to section 35 of the EUA, the AESO hereby requests and directs (the “Direction”) ATCO to submit, for Commission approval under the *Hydro and Electric Energy Act* (“HEEA”) and in accordance with the requirements of this Direction, a transmission facility application to meet the need identified in the NID (the “Facility Application”).

Once ATCO receives Commission approval of the Facility Application in the form of the appropriate permit(s) and licence(s) under the HEEA (the “Commission Approval”), ATCO shall proceed with the construction of the Project.

In addition to the above, the following requirements apply to this Direction:

- a. ATCO must conduct its participant involvement program for the Facility Application so that stakeholders are made aware that any questions raised regarding the NID will be referred by ATCO to the AESO for the AESO’s response. ATCO must provide such referrals to the AESO in a timely manner. For further clarity and without limiting the preceding sentence, ATCO may

2500, 330 - 5th Ave SW Calgary, Alberta T2P 0L4
t (403) 539-2450 | f (403) 539-2949 | www.aeso.ca

- 1 -

Section 35 Direction RP-05-786, October 14, 2008

respond to stakeholder questions regarding the NID by referring to the information included in the AESO's NID application.

- b. With regard to the submission of the Facility Application to the Commission:
 - i) ATCO must inform the AESO, in a timely manner, when ATCO has completed its preparation of the Facility Application; and
 - ii) ATCO must submit the Facility Application to the Commission in accordance with the further specifics contained in written notice(s) that will be issued by the AESO to ATCO from time to time. The AESO anticipates that such notice(s) will specify, without limitation and as determined by the AESO, the earliest date on which submission of the Facility Application is to occur.

The AESO anticipates that notice(s) under this paragraph will not occur until the AESO has received an acceptable Proposal to Provide Service ("PPS") and until the AESO has received an approval for the NID. Once issued, any such notice(s) will form a part of this Direction unless otherwise expressly stated to the contrary.

- c. The Facility Application must address the interconnection requirements associated with the Project based on the AESO's "Edmonton Region 240kV Line Upgrades Functional Specification" Rev. 0 dated August 26, 2008 and as updated and re-issued from time to time.
- d. The Facility Application should reference the forecasted Project in-service date, as set out in the PPS.
- e. With respect to ATCO's costs and expenses incurred as a consequence of this Direction, the *Transmission Regulation* specifically provides that ATCO may make an application to include such costs and expenses in its tariff filed with the Commission. The AESO expects that ATCO's prudent costs and expenses incurred as a consequence of this Direction will be recoverable by ATCO through its tariff filed with the Commission. If requested, the AESO will support ATCO's inclusion of such costs and expenses incurred as a consequence of this Direction in any tariff application it may make to the Commission, and irrespective of whether the Project proceeds to completion. Similarly, if requested and if determined by the AESO to be appropriate, the AESO is prepared to certify to the Commission that ATCO's costs were incurred as a consequence of this Direction.
- f. The AESO has developed ISO Rules pursuant to Section 20 of the EUA and Part 4 of the Transmission Regulation, including rules to address TFO eligibility, project reporting and procurement of project materials and construction services. The ISO Rules are applicable to this Project and this Direction. ATCO has indicated to the AESO that it has entered into engineering, material procurement and construction service arrangements (the "Arrangements") to address the significant increase in construction activity anticipated by ATCO, and that the Arrangements do not fully comply with the ISO Rules regarding competitive procurement of construction services. ATCO

has confirmed that it has disclosed the Arrangements in its General Tariff Application ("GTA"), which is currently before the Commission for approval, and that the Arrangements may apply to the Project.

In the event ATCO determines that the Arrangements apply to the Project, ATCO must disclose the Arrangements in the Facility Application for the Project and must also provide the AESO with timely written notice confirming both application to the Project and disclosure in the Facility Application. Such notice will assist the AESO in meeting its obligations under the EUA with regard to informing the Market Surveillance Administrator of the application of the Arrangements to the Project, including ATCO's disclosure of the same to the Commission.

As well, the AESO understands and expects that, subject to the Commission Approval, the Project will be designed and constructed in accordance with ATCO's Proposal to Provide Service and the AESO's "Edmonton Region 240kV Line Upgrades Functional Specification" Rev. 0 dated August 26, 2008 and as updated and re-issued from time to time.

Please indicate ATCO's acknowledgement of this Direction by having a duly authorized representative of ATCO sign this letter and by then returning, on or before November 7, the enclosed copy marked "AESO File Copy" to the attention of Hollie Giggle at:

Alberta Electric System Operator
2500, 330 - 5th Avenue SW
Calgary, Alberta
T2P 0L4

Should you have any questions or concerns, please contact Alan Xu at (403) 539-2619.

Sincerely,

Alberta Electric System Operator



M. Dale McMaster
President and Chief Executive Officer

AESO APPROVED FOR EXECUTION	
Promoter	ATU
Legal	AKL
Finance	EY.



THE FOREGOING DIRECTION ACKNOWLEDGED THIS 8 DAY OF November, 2008.

ATCO Electric Ltd.

Per:  _____

Name: **Paul Goguen, P.Eng., MBA**
Vice President, Transmission
ATCO Electric Ltd. _____

Title: _____



Edmonton Region 240kV Line Upgrades

Functional Specification

File No. RP-05-786

Rev. 1

April 9, 2009

APEGGA Permit to Practice P-8200



APPROVALS

	Name	Signature	Date
Author	Alan Xu	<i>Alan Xu</i>	<i>April 9, 2009</i>
Reviewed - Manager	Ron Strem	<i>Ron Strem</i>	<i>April 9, 2009</i>
Approved - Director	Fred Ritter	<i>F. Ritter</i>	<i>April 9, 2009</i>

REVISIONS

Rev. #	Description	Author	Date
0	First Draft	Alan Xu, P.Eng.	August 26, 2008
1	TransAlta's scope of work added. Phase shifter location finalized.	Alan Xu, P.Eng.	April 9, 2009



TABLE OF CONTENTS

1. INTRODUCTION 1

2. DATA DISCLAIMER 1

3. TFO SERVICE PROPOSAL AND ESTIMATE..... 1

4. PROJECT OVERVIEW..... 1

 4.1 Proposed Facility Additions..... 1

 4.2 Related System Development 2

 4.3 Future System Development 2

5. SCOPE OF WORK 4

 5.1 General 4

 5.2 Standards 4

 5.3 Substation Equipment Specifications..... 5

 5.3.1 General Environmental and Electrical Ratings 5

 5.3.2 Circuit Interrupting Device 5

 5.4 AltaLink Scope of Work..... 6

 5.4.1 Transmission Line 904L 6

 5.4.2 Transmission Lines 908L and 909L 6

 5.4.3 Transmission Line 902L (AltaLink and TransAlta)..... 7

 5.4.4 Wabamun Substation 19S..... 7

 5.4.5 Sundance Substation 310P 7

 5.4.6 Keephills Substation 320P 8

 5.4.7 Studies 9

 5.4.8 Miscellaneous..... 9

 5.5 EPCOR Scope of Work..... 9

 5.5.1 Transmission Line 904L 9

 5.5.2 Jasper Substation 805S 9

 5.5.3 Petrolia Substation 816S..... 10

 5.5.4 Studies 10

 5.5.5 Miscellaneous..... 10

 5.6 ATCO Scope of Work 10

 5.6.1 Dover Substation 888S 10

 5.6.2 Studies 12

 5.6.3 Miscellaneous..... 12

5.7	TransAlta Scope of Work	12
5.7.1	Transmission Line 904L	12
5.7.2	Transmission Line 902L (TransAlta and AltaLink).....	12
5.7.3	Studies	12
5.7.4	Miscellaneous.....	13
6.	TRANSMISSION SYSTEM OPERATING CHARACTERISTICS.....	14
6.1	Short Circuit Current Levels.....	14
6.2	Voltage Levels	14
6.3	Insulation Levels	15
7.	APPENDICES.....	16
7.1	System Configuration - Existing.....	16
7.2	System Configuration – Post Keephills 3 Generator Interconnection	17
7.3	System Configuration – Proposed	18
7.4	System Configuration – Future Development	19

LIST OF TABLES

Table 1: Nominal & Maximum Continuous Equipment Operating Voltages (kV)	5
Table 2: Minimum Continuous Equipment Current Ratings (A).....	5
Table 3: Maximum Fault Levels (kA)	5
Table 4: Maximum Clearing Time at Keephills Substation 310P (cycles).....	8
Table 5: Area 2010 WP Anticipated Short Circuit Levels	14
Table 6: Acceptable Range of Steady State Voltage (kV)	15
Table 7: BIL Levels (kV)	15

LIST OF FIGURES

Figure 1: System Configuration – Existing	16
Figure 2: System Configuration – Post Keephills 3 Generator Interconnection.....	17
Figure 3: System Configuration – Proposed.....	18
Figure 4: System Configuration – Future Development.....	19

1. INTRODUCTION

This Alberta Electric System Operator (“AESO”) Functional Specification (“the Specification”) provides functional direction to the Transmission Facilities Owners (“TFO’s”), Generation Facilities Owners (“GFO’s”), as well as interconnected Customers when impacted, for the development of new transmission facilities for the Alberta Transmission System (“ATS”). The Specification also serves to delineate the work to be completed by various parties involved in the development of such facilities, outline the electrical environment in which such facilities will operate, and provide reference to the applicable rules and templates for the format required for proposals and estimates to be submitted by the TFO’s.

2. DATA DISCLAIMER

This Specification should not be used, nor relied upon, by any Customer, TFO, or other party for any purpose other than that stated in section 1. The information presented in this Specification is based on data provided by third parties to the AESO. These third parties have made no guarantees, expressed or implied, with respect to the completeness or accuracy of the provided data. AESO has taken reasonable steps to verify this data where possible and believes it to be accurate.

3. TFO SERVICE PROPOSAL AND ESTIMATE

The TFO’s Service Proposal and Estimate must be submitted and prepared in accordance with the terms of ISO Rule 9.1, section “9.1.2.4 Obligation to Provide Service Proposal and Service Proposal Estimate”.

The final scope of work and any TFO requested exceptions from the scope of work must be approved by the AESO and no work is to be commenced until a “Direction” has been provided in accordance with ISO Rule 9.1, Section 9.1.2.3 b).

4. PROJECT OVERVIEW

4.1 PROPOSED FACILITY ADDITIONS

The objective of Edmonton region 240kV line upgrades project (the "project") is to address overloads on the existing 240kV transmission lines in Edmonton region, and to increase transfer capability on the North-East transmission path out of Edmonton region.

In accordance with the Electric Utilities Act, Section 34, AESO has prepared and submitted a Need Application to the AUC supporting the project (application No. 1584342). The Need Application was approved by the AUC on February 24, 2009 (approval No. U2009-62).

The proposed facility additions and modifications for the project include the following: (refer to Figure 3):

- Rebuild approximately 40km of the existing 240kV transmission line 904L (the " rebuilt section of 904L") between structure #101 near Jackfish Lake and Petrolia substation 816S.
- Construct approximately 14km of 240kV transmission line from structure #101 of 904L near Jackfish Lake to structure # 33 of transmission lines 190L/903L using double circuit

structures with one side strung to re-terminate the rebuilt 904L to Keephills substation 320P.

- Cut open the existing transmission line 908L near structure # 200. Connect the two sections of existing transmission line 904L between structures # 280A, #280B and Jasper substation 805S (the "904L Jasper in/out line sections") to the two sections of 908L.
- Re-string approximately 24km of the 904L Jasper in/out line sections.
- Re-string approximately 4.5 km of the existing transmission line 908L and 4.5km of 909L out of Sundance substation 310P.
- Upgrade switch gear and bus work at Jasper substation 805S and Petrolia substation 816s to accommodate the increased transmission line capacity rating.
- Re-string approximately 4km of transmission line 902L out of Wabamun substation 19S and approximately 4.4 km of transmission line 902L out of Sundance substation 310P.
- Re-terminate 240kV transmission line 902L from Keephills substation 320P to Sundance substation 310P.
- Add two (2) 240kV circuit interrupting devices at Keephills substation 320P to re-terminate 240kV transmission line 903L.
- Add one (1) 600MVA 240kV phase shifting transformer (the "PST") to the existing 240kV transmission line 9L57 and two (2) 240kV circuit interrupting devices for PST switching at Dover substation 888S.

The target In Service Date (ISD) for AltaLink and EDTI's scope of work is March, 2011. The target ISD for ATCO's scope of work is June, 2011.

4.2 RELATED SYSTEM DEVELOPMENT

The related system development includes the following additions and modifications of Keephills 3 generator interconnection (refer to Figure 2):

- Convert transmission line 1202L from 240kV operation to 500kV operation.
- Add two (2) 500kV circuit interrupting devices at Ellerslie substation 89S.
- Add three (3) 500kV circuit interrupting devices at Keephills substation 320P.
- Add one (1) 240kV 600MVA phase shifting transformer (the "PST") and three (3) 240kV circuit interrupting devices for the PST switching.
- Re-terminate 240kV transmission line 902L from Sundance substation 310P to Keephills substation 320P.

4.3 FUTURE SYSTEM DEVELOPMENT

The future system development could include the following additions and modifications in Edmonton region (refer to Figure 4):

- Keephills 4 generator connection to 500kV
- Two future 500kV transmission line connections at Keephills substation 320P
- One future 500kV transmission line connection at Genesee substation 330P
- One future 500kV transmission line connection at Ellerslie substation 89S
- One future 240kV transmission line connection at Ellerslie substation 89S

- One 100MVar 240kV capacitor bank addition at Dover substation 888S

The future development represents the potential long term system development, and is included for substation development planning purposes only.

5. SCOPE OF WORK

5.1 GENERAL

TFOs and Customers are accountable for all engineering, design, land or land-use acquisition, siting, applicable regulatory approvals and permits, material procurement, construction, commissioning, and associated permitting requirements for their facilities. TFOs and customers shall coordinate as required on all design details (e.g., protection & control, grounding, insulation, point of interconnection, site layout, power quality, etc.) and develop Joint Operating Procedures and/or Interconnection Agreements as required to ensure that interconnected facilities are operated safely and reliably.

In accordance with ISO Rule 9.1 the TFO's must provide, as a minimum, project reporting as per Section 9.1.3 Project Reporting by Designated TFO's and project material and labor procurement as per Section 9.1.5 Project Procurement.

All final design and as-built facility information shall be supplied in the format and content as required by the AESO for purposes of updating and maintaining the AESO's technical records and system models. This information shall be submitted under signature of a registered Professional Engineer in Alberta who is representing the facility owner and is assuming responsibility for the preparation and accuracy of the submission. The AESO accepts no responsibility for facilities designed by or for any third party, or installed on a third parties behalf, to accomplish the interconnection. The facility owners shall ensure that their facilities have been inspected and declared safe for operation prior to energization. No facilities are to be energized until an Energization Certificate has been issued by the AESO.

5.2 STANDARDS

All work undertaken by TFOs and customers must be designed, constructed, and operated to meet the functional requirements of the Specification and all applicable standards, guidelines, codes and regulations governing such installations including, but not limited those listed below. All AESO documentation can be found on the AESO website (www.aeso.ca).

- AESO Operating Policies and Procedures
- AESO Measurement System Standard Rev 1 (dated Sept 2007)
- AESO Generation and Load Interconnection Standard (dated September 19, 2006)
- Technical Requirements (Part 3) for Connecting Transmission Facilities (dated June 1999)
- AESO AEIS Protection Standard (dated December 2004)
- AESO Operational Communication Standard (dated September 7 2005)
- AESO SCADA Standard (dated September 6 2005)
- AESO Transmission Modeling Data Requirements (dated April 29, 2003)

In case there is a discrepancy between this functional specification and the aforementioned standards, this functional specification shall be the overriding requirement.

5.3 SUBSTATION EQUIPMENT SPECIFICATIONS

5.3.1 General Environmental and Electrical Ratings

All transmission equipment must meet the following minimum specifications:

- Temperature rating of -50C for all outdoor equipment
- Nominal and maximum operating voltage ratings as indicated in Table 1
- Minimum continuous current ratings as indicated in Table 2
- Maximum fault levels as indicated in Table 3

Table 1: Nominal & Maximum Continuous Equipment Operating Voltages (kV)

Area	Edmonton Area	Fort McMurray Area	Edmonton Area
Nominal	240	240	500
Maximum	265	275	550

Table 2: Minimum Continuous Equipment Current Ratings (A)

Component	240 kV (Jasper and Petrolia)	240kV (Keephills)	500kV
Main Bus ¹	2000	4000	4000
Cross Bus ²	2000	4000	4000
Transmission Termination ³	2000	3000	3000

1. Main bus includes all sections of ring bus scheme and single bus of simple bus scheme.
2. Cross bus includes diameter sections of breaker and a half or breaker and a third schemes.
3. Transmission termination includes all equipment from the connection to the cross bus up to the transmission line connection point, usually the transmission line disconnect switch.

Table 3: Maximum Fault Levels (kA)

Nominal Voltage	240 kV	500kV
Maximum Fault Levels	40	40

5.3.2 Circuit Interrupting Device

A 240kV circuit interrupting device shall satisfy the following specifications:

- The rated voltage shall be no less than the maximum continuous equipment operating voltages listed in Table 1
- The minimum symmetrical short-circuit breaking current rating shall be no less than the maximum fault levels listed in Table 3
- Be capable of single-pole operation

5.4 ALTALINK SCOPE OF WORK

5.4.1 Transmission Line 904L

The scope of work for transmission line 904L includes the following (refer to Figure 3):

- Rebuild approximately 40km of the existing 240kV transmission line 904L (the "rebuilt section of 904L") between structure #101 near Jackfish Lake and Petrolia substation 816S.
- AltaLink's scope of work does not include the section of approximately 8km of 904L that is owned by TransAlta. Rebuild of that 8km of 904L is TransAlta's scope of work. Please refer to section 5.7.1 for detail.
- The rebuild section of 904L does not include the two sections of 904L between structures #280A, #280B and Jasper substation 805S (the "904L Jasper in/out line sections").
- Disconnect the 904L Jasper in/out line sections from structures # 280A and # 280B respectively.
- The rebuilt section of 904L will extend from structure #101 to Petrolia substation 816S and will not be connected to Jasper substation 805S.
- The minimum continuous capacity rating of the rebuilt section of 904L line should be no less than the thermal capacity of a transmission line with twin ACSR 1033 MCM conductors. The actual line ratings shall be submitted to AESO in the form of a Summer rating at 32 degrees Celsius and a Winter rating at 0 degrees Celsius. These ratings shall be for an assumed wind speed of 0.6m/s and a voltage of 240kV.
- Construct approximately 14km of 240kV transmission line from structure #101 of 904L near Jackfish Lake to structure # 33 of transmission lines 190L/903L using double circuit structures with one side strung to re-terminate the rebuilt 904L to Keephills substation 320P.
- Couple (connect in parallel) the existing transmission lines 903L and 190L at structure # 33 and structure # 23 (the "coupled section of 190L/903L"). Connect the new 14km 240kV transmission line to the coupled section of 190L/903L at structure # 33.
- Terminate the coupled section of 190L/903L into the 240kV terminal currently occupied by transmission line 1202L.
- The minimum continuous capacity rating for the new 14km 240kV transmission line should be no less than the thermal capacity of a transmission line with twin ACSR 1033 MCM conductors. The actual line ratings shall be submitted to AESO in the form of a Summer rating at 32 degrees Celsius and a Winter rating at 0 degrees Celsius. These ratings shall be for an assumed wind speed of 0.6m/s and a voltage of 240kV.
- The rebuilt section of 904L and the 14km new double circuit line shall be designed with 100 years return period gust wind load.
- Renumber the rebuilt section of 904L, the 14km new double circuit line and the coupled section of 190L/903L as 1043L.

5.4.2 Transmission Lines 908L and 909L

The scope of work for transmission lines 908L and 909L includes the following (refer to Figure 3):

- Re-string of approximately 4.5 km of the existing transmission line 908L and 4.5km of the existing transmission line 909L out of Sundance substation 310P that is currently strung with single ACSR 1033 MCM conductors (the "re-strung section of 908L/909L").
- The re-strung section of 908L/909L shall have a minimum continuous capacity rating no less than the thermal capacity of a transmission line with twin ACSR 477 MCM conductors. The actual line ratings shall be submitted to AESO in the form of a Summer rating at 32 degrees Celsius and a Winter rating at 0 degrees Celsius. These ratings shall be for an assumed wind speed of 0.6m/s and a voltage of 240kV.
- Cut open the existing 908L near structure #200. Connect the 904L Jasper in/out line sections to the two sections of 908L.
- Renumber the existing 908L from Petrolia substation 816S to structure #200 as 1044L. Renumber the existing 908L from structure #200 to Sundance substation 310P as 1045L.

5.4.3 Transmission Line 902L (AltaLink and TransAlta)

The scope of work for transmission line 902L includes the following (refer to Figure 3):

- Cut open transmission line 902L near structure # 33.
- Connect the section of 902L between structure #33 and Wabamun substation 19S to the section of 902L that was de-energized after the Keephills 3 generator interconnection, leading to Sundance substation 310S (refer to Figure 2).
- If a section of new transmission line is required to complete the connection, the minimum continuous capacity rating of the new line shall be no less than the thermal capacity of a transmission line with twin ACSR 477 MCM conductors.
- Re-string of approximately 4km of 902L out of Wabamun substation 19S that is currently strung with single ACSR 1033 MCM conductors (the "re-strung 902L").
- Re-string of approximately 4.4km of 902L out of Sundance substation 310P that is currently strung with single ACSR 1033 MCM conductors (the "re-strung 902L").
- The re-strung 902L shall have a minimum continuous capacity rating no less than the thermal capacity of a transmission line with twin ACSR 477 MCM conductors. The actual line ratings shall be submitted to AESO in the form of a Summer rating at 32 degrees Celsius and a Winter rating at 0 degrees Celsius. These ratings shall be for an assumed wind speed of 0.6m/s and a voltage of 240kV.

5.4.4 Wabamun Substation 19S

The scope of work at Wabamun substation 19S includes the following (refer to Figure 3):

Protection and Control:

- Review and revision of the existing protection and control settings to accommodate the proposed transmission line 902L modifications.

5.4.5 Sundance Substation 310P

The scope of work at Sundance substation 310PS includes the following (refer to Figure 3):

Transmission Equipment:

- Terminate transmission line 902L into Sundance substation 310P.

Protection and Control:

- Review and revision of the existing protection and control settings to accommodate the proposed modifications of transmission lines 902L, 908L and 909L.
- Coordinate with EPCOR regarding protection relay settings.
- Coordinate with EPCOR regarding communication.

5.4.6 Keephills Substation 320P

The scope of work at Keephills substation 320P includes the following (refer to Figure 3):

Transmission Equipment:

- Add two (2) 240kV circuit interrupting devices meeting the specification outlined in section 5.3.2 and associated bus work to create a new 240kV terminal. The nominal interrupting time for the two 240kV circuit interrupting devices shall be 2 cycles at rated interrupting current.
- The minimum continuous current rating for the new 240kV terminal and the associated bus work shall be 4000A.
- Re-terminate 240kV transmission line 903L to the new 240kV terminal.
- Re-terminate 240kV transmission line 190L to the terminal currently occupied by 240kV transmission line 903L.
- Terminate the new 240kV transmission line 908L to the terminal currently occupied by 240kV transmission line 1202L.
- Add isolation switches and grounding switches for proper isolation and safety.
- Add current transformers (CT's) and potential transformers (PT's) to accommodate the proposed equipment additions and modifications.
- Add surge arresters as required to accommodate the proposed equipment additions and modifications

Protection and Control:

- 3-phase faults on transmission line 903L should be cleared (including breaker interrupting time) within the following maximum clearing time:

Table 4: Maximum Clearing Time at Keephills Substation 310P (cycles)

Transmission Line	Near End Fault	Remote End Fault
903L	4.0	5.75

- Provide protection and control functionality for the proposed equipment additions and modifications as required by the AESO AEIS Protection Standard.
- Review and revision of the existing protection and control settings to accommodate the proposed equipment additions and modifications.
- Coordinate with EPCOR regarding protection relay settings.
- Provide communications for the new 908L that meet the requirements in the AESO standards and the following WECC guidelines:

- WECC Guidelines for the Design of Critical Communications Circuits (revised October 2002)
- WECC Communications Systems Performance Guide for Protective Relaying Application (dated November 2001)
- In case there is a discrepancy between AESO standards and the WECC guidelines regarding communication requirements, the discrepancy shall be brought to the AESO for review.
- Coordinate with EPCOR regarding communication.

SCADA:

- Provide SCADA information for the proposed equipment additions and modifications as required by the AESO SCADA Standard
- Control Center data mapping and verification of SCADA information for the proposed equipment additions and modifications

5.4.7 Studies

Undertake transmission line routing, structure design, insulation, grounding, protection and communication studies as necessary to accommodate the proposed system additions and modifications.

Undertake outage studies and coordinate with AESO and other TFOs to optimize the construction sequence and minimize the outage required for the project.

5.4.8 Miscellaneous

All site preparation, fencing, foundations, grounding, support structures, termination structures, cabling, bus work, yard lighting, signage, DC supplies, control building etc. as required to complete the additions and modifications outlined above.

5.5 EPCOR SCOPE OF WORK

5.5.1 Transmission Line 904L

The scope of work for transmission line 904L includes the following (refer to Figure 3):

- Re-string approximately 24km of the 904L Jasper in/out line sections that is currently strung with single ACSR 1033 MCM conductors (the "re-strung 904L Jasper in/out line sections").
- The minimum continuous capacity rating for the re-strung 904L Jasper in/out line sections should be no less than the thermal capacity of a transmission line with twin ACSR 477 MCM conductors. The actual line ratings shall be submitted to AESO in the form of a Summer rating at 32 degrees Celsius and a Winter rating at 0 degrees Celsius. These ratings shall be for an assumed wind speed of 0.6m/s and a voltage of 240kV.
- Renumber the 904L Jasper in/out section as 1044EL and 1045EL.

5.5.2 Jasper Substation 805S

The scope of work at Jasper substation 805S includes the following (refer to Figure 3):

Transmission Equipment:

- Upgrade the switch gear and bus work to accommodate the proposed modifications of the 904L Jasper in/out line sections , due to the re-termination of 904L at Petrolia substation 816S and Sundance substation 310P.
- The minimum continuous current rating for the new switch gear and bus work shall be 2000A.

Protection and Control:

- Review and revision of the existing protection and control settings to accommodate the proposed equipment modifications.
- Coordinate with AltaLink regarding protection relay settings.
- Coordinate with AltaLink regarding communication.

5.5.3 Petrolia Substation 816S

The scope of work at Petrolia substation 816S includes the following (refer to Figure 3):

Transmission Equipment:

- Upgrade the switch gear and bus work to accommodate the proposed re-termination of the existing transmission lines 904L and 908L and the increased line capacities.
- The minimum continuous current rating for the new switch gear and bus work shall be 2000A.

Protection and Control:

- Review and revision of the existing protection and control settings to accommodate the proposed equipment additions and modifications.
- Coordinate with AltaLink regarding protection relay settings.
- Coordinate with AltaLink regarding communication.

5.5.4 Studies

Undertake insulation, grounding, protection and communication studies as necessary to accommodate the proposed system additions and modifications.

Undertake outage studies and coordinate with AESO and other TFOs to optimize the construction sequence and minimize the outage required for the project.

5.5.5 Miscellaneous

All site preparation, fencing, foundations, grounding, support structures, termination structures, cabling, bus work, yard lighting, signage, DC supplies, control building etc. as required to complete the additions and modifications outlined above.

5.6 ATCO SCOPE OF WORK

5.6.1 Dover Substation 888S

The scope of work at Dover substation 888S includes the following (refer to Figure 3):

Transmission Equipment:

- Add one (1) phase shifting transformer (PST) to the exiting 240kV transmission line 9L57 at Dover substation meeting the following specifications:
 - The maximum continuous throughput capacity rating is 600MVA. The minimum self-cooled continuous throughput rating is 360MVA.
 - The rated voltage shall be no less than the maximum continuous equipment operating voltages listed in Table 1.
 - The short circuit capacity the PST shall be designed for is 18013MVA (40kA @260kV).
 - The no-load phase angle range of the PST should be 25 degree advance / 25 degrees retard.
 - The steps of the phase angle shall be no less than 32 steps.
 - The impedance of the phase shifter shall be between 10% and 15% on 600MVA bases for all phase angle steps.
 - The PST shall have a load tap changer (LTC).
 - The PST shall have an automatic tap changer control with remote MW set and a manual override with remote phase angle set.
 - Redundancy of the cooling equipment should be considered as a measure to improve the reliability of the PST.
 - The emergency overload rating of the PST is 130% for 30 minutes with a pre-overload of 75% for 8 hours. The overload capability shall be achieved with normal loss of life.
 - The PST shall not be continuously energized from both source and load side when by-pass is closed.
 - The cost of losses is \$7000/kW for both load losses and no load losses.
 - The PST shall be interchangeable with the PST to be installed at Keephills substation 320P.
- Add two (2) 240kV circuit interrupting devices meeting the specification outlined in section 5.3.2 and associated bus work for PST switching. One circuit interrupting device shall be added to the source side, and one as by-pass device. The nominal interrupting time of the two circuit interrupting devices shall be 3 cycles at rated interrupting current.
- Add isolation switches and grounding switches for proper isolation and safety.
- Add current transformers (CT's) and potential transformers (PT's) to accommodate the proposed equipment additions and modifications.
- Add surge arresters as required to accommodate the proposed equipment additions and modifications

Protection and Control:

- Provide protection and control functionality for the proposed equipment additions and modifications as required by the AESO AEIS Protection Standard.

SCADA:

- Provide SCADA information for the proposed equipment additions and modifications as required by the AESO SCADA Standard
- Control Center data mapping and verification of SCADA information for the proposed equipment additions and modifications

5.6.2 Studies

Undertake substation siting, insulation, grounding, protection and communication studies as necessary to accommodate the proposed system additions and modifications.

5.6.3 Miscellaneous

All site preparation, fencing, foundations, grounding, support structures, termination structures, cabling, bus work, yard lighting, signage, DC supplies, control building etc. as required to complete the additions and modifications outlined above.

5.7 TRANSALTA SCOPE OF WORK

5.7.1 Transmission Line 904L

TransAlta's scope of work for transmission line 904L includes the following (refer to Figure 3):

- Rebuild approximate 8km of 240kV transmission line 904L (the "rebuilt section of 904L") that is owned by TransAlta.
- The minimum continuous capacity rating of the rebuilt section of 904L line should be no less than the thermal capacity of a transmission line with twin ACSR 1033 MCM conductors. The actual line ratings shall be submitted to AESO in the form of a Summer rating at 32 degrees Celsius and a Winter rating at 0 degrees Celsius. These ratings shall be for an assumed wind speed of 0.6m/s and a voltage of 240kV.
- The rebuilt section of 904L shall be designed with 100 years return period and match the structure appearance of the portions of 904L being rebuilt by AltaLink.

5.7.2 Transmission Line 902L (TransAlta and AltaLink)

The scope of work for transmission line 902L includes the following (refer to Figure 3):

- Cut open transmission line 902L near structure # 33.
- Connect the section of 902L between structure #33 and Wabamun substation 19S to the section of 902L that was de-energized after the Keephills 3 generator interconnection, leading to Sundance substation 310S (refer to Figure 2).
- If a section of new transmission line is required to complete the connection, the minimum continuous capacity rating of the new line shall be no less than the thermal capacity of a transmission line with twin ACSR 477 MCM conductors.

5.7.3 Studies

Undertake transmission line routing, structure design, insulation, grounding, protection and communication studies as necessary to accommodate the proposed system additions and modifications.

Undertake outage studies and coordinate with AESO and other TFOs to optimize the construction sequence and minimize the outage required for the project.

5.7.4 Miscellaneous

All site preparation, fencing, foundations, grounding, support structures, termination structures, cabling etc. as required to complete the additions and modifications outlined above.

6. TRANSMISSION SYSTEM OPERATING CHARACTERISTICS

The following sections provide data to outline the electrical environment in which the facilities outlined in the Specification will operate. TFOs shall incorporate these characteristics into their facility designs and operating procedures as deemed appropriate.

6.1 SHORT CIRCUIT CURRENT LEVELS

The following short circuit current levels in Table 5 have been developed by the AESO based on information provided by Transmission Facility Owners ("TFO's"), Generation Facility Owners ("GFO's") and adjacent operating areas. Available fault current levels will continue to increase as generation, transmission, and system inter-ties are added to the ATS. Affected TFO's, GFO's and customers providing their own transmission facilities should consider this eventuality and exercise good engineering judgment in the specification of power interrupting equipment and the design and installation of safety grounding systems in and around high voltage power transmission lines and stations. The AESO cannot guarantee and accepts no responsibility for short circuit current growth that may exceed the capabilities of TFO or customer electric power delivery systems and equipment.

Table 5: Area 2010 WP Anticipated Short Circuit Levels

Substation	Vbus (kV)	Pre-fault Voltage ¹ (pu)	Pos. Seq. Impedance (R1 + j X1) ²	3-Phase Fault (kA)
KEEPHILLS 320P	240	1.05	0.00157 + j0.01559	16111
ELLERSLI E 89S	240	1.00	0.00230 + j0.00921	25413
SUNDANCE 310P	240	1.07	0.00149 + j0.00899	28250
WABAMUN 19S	240	1.05	0.00318 + j0.01964	12714
JASPER 805S	240	1.00	0.00417 + j0.01657	13813
SAGITAWA 77S	240	1.08	0.00650 + j0.02657	9551
LAMOUREUX 71S	240	1.00	0.00307 + j0.01325	17603
JANET 74S	240	1.06	0.00382 + j0.01333	18296

NOTES:

1. Vbase= Vbus ; MVAbase= 100.
2. The short circuit levels shown above are for breaker checks. The short circuit levels at a given bus is the highest considering single element outages at the bus.

6.2 VOLTAGE LEVELS

Table 6 provides the acceptable ranges of steady state voltage in the area of the proposed system modifications and additions. Please refer to AESO Transmission Reliability Criteria, Part II System Planning, Section 5.1, voltage standards for detail information. The document can be found through the following link:

<http://www.aeso.ca/downloads/TransmissionReliabilityCriteriaVersion0cleancopupart2systemplanning.pdf>

Table 6: Acceptable Range of Steady State Voltage (kV)

Nominal	500	240 (Edmonton Area)	240 (Fort McMurray Area)
Extreme Minimum	500	220	220
Normal Minimum	510	240	250
Normal Maximum	540	264	269
Extreme Maximum	550	264	275

6.3 INSULATION LEVELS

Table 7 provides the minimum required Basic Impulse Levels (“BIL”) levels for the ATS. Station equipment with lower BIL levels can be used provided protection and coordination can be maintained with judicious insulation design and use of appropriate surge arresting equipment.

Table 7: BIL Levels (kV)

Nominal Voltage Classification (kV rms)	500	240
Transformer Windings	1425	850
Station Post Insulators and Airbreaks	1550	900
Circuit Breakers	1800	1050
Current and Potential Transformers	1800	1050

7. APPENDICES

7.1 SYSTEM CONFIGURATION - EXISTING

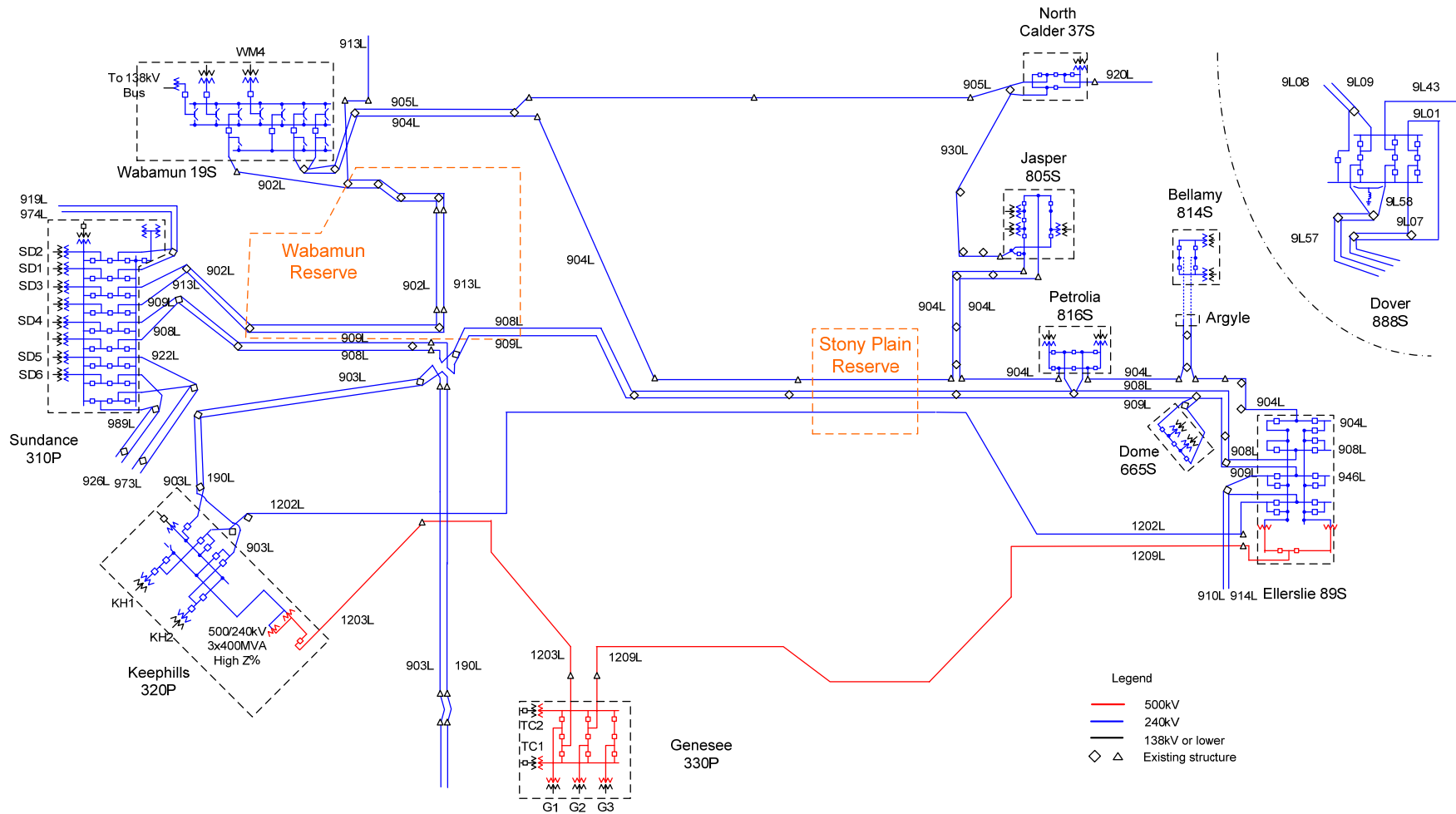


Figure 1: System Configuration – Existing

7.2 SYSTEM CONFIGURATION – POST KEEPHILLS 3 GENERATOR INTERCONNECTION

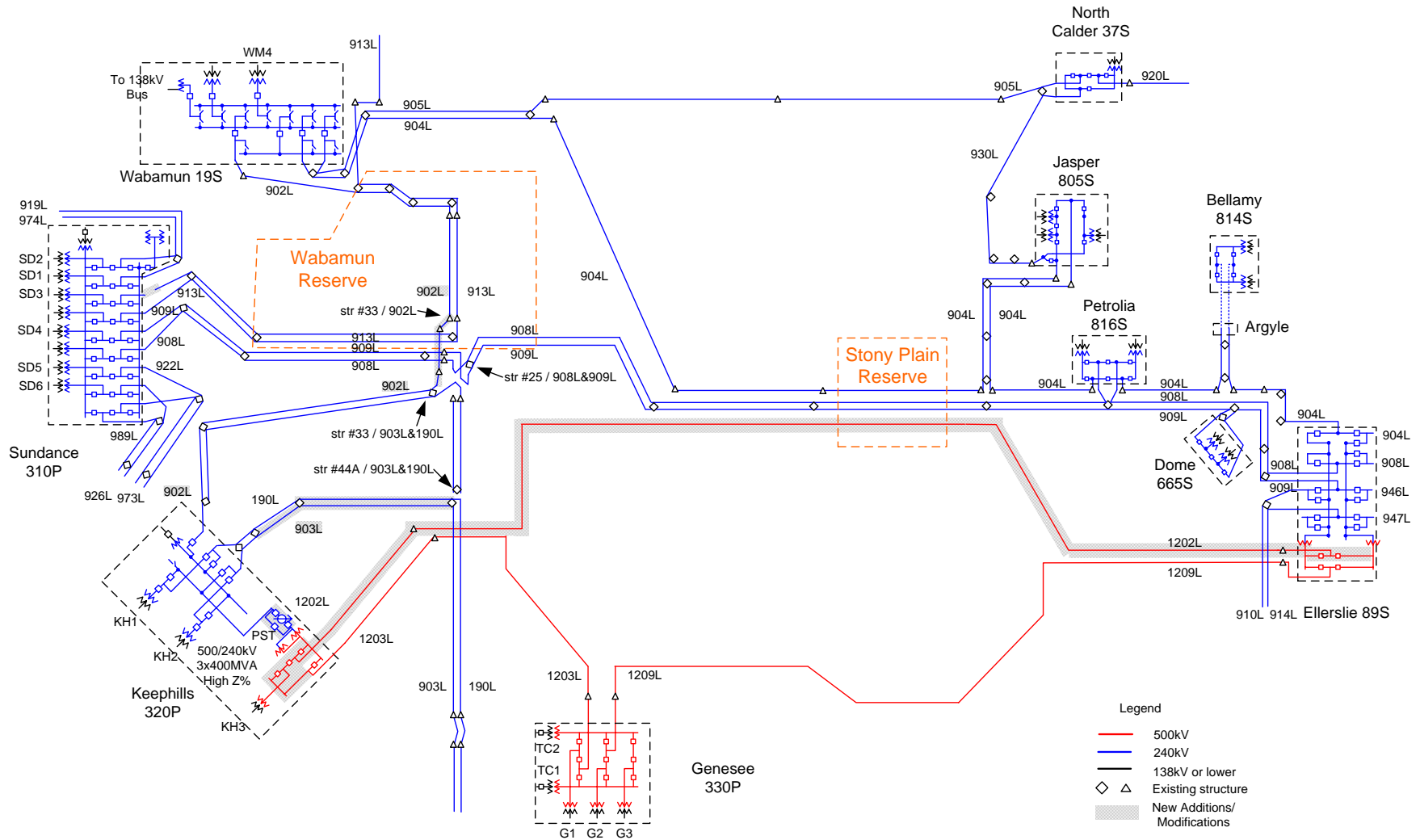


Figure 2: System Configuration – Post Keephills 3 Generator Interconnection

7.3 SYSTEM CONFIGURATION – PROPOSED

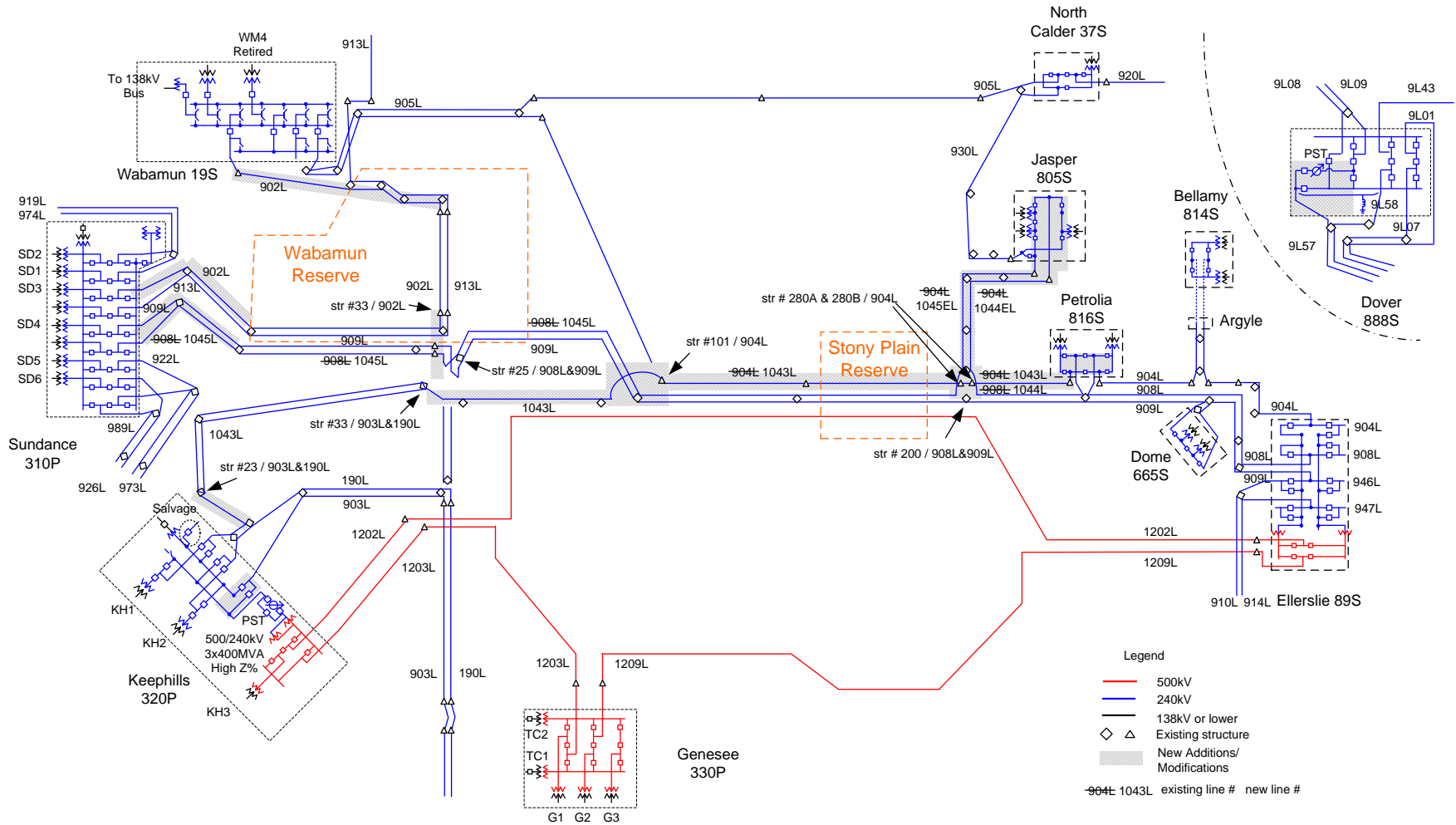


Figure 3: System Configuration – Proposed

