

Functional Specification

RESC Enterprise MPC Solar

AESO Project Number: P2300

Issued to:

AltaLink Management Ltd. (as the legal owner of a transmission facility),

City of Lethbridge (as the legal owner of a transmission facility), and to

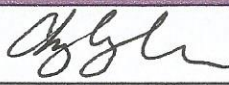
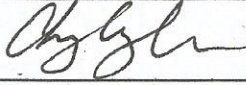
Renewable Energy Systems Canada Inc. (as the market participant)

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Permit-to-Practice 

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1 PURPOSE

(1) The purpose of this document (the “Functional Specification”) is to set out the technical specifications, requirements and approved variances related to the design, construction, development and commissioning of certain new or modified facilities (the “Project”) that have been proposed for or are related to a physical facilities connection with the Alberta **interconnected electric system** (AIES) (the “Purpose”). This Functional Specification is issued by the Alberta Electric System Operator (AESO) to:

- (i) AltaLink Management Ltd., in its capacity as general partner of AltaLink, L.P., (AltaLink), as the **legal owner** of a **transmission facility** eligible under Section 24 of the Transmission Regulation to apply for the construction or operation, or both, as the case may be, of transmission facilities described in the Functional Specification.
- (ii) City of Lethbridge, (Lethbridge), as the **legal owner** of a **transmission facility** eligible under Section 24 of the Transmission Regulation to apply for the construction or operation, or both, as the case may be, of transmission facilities described in the Functional Specification.
- (iii) Renewable Energy Systems Canada Inc., (RESC), as the **market participant** that has submitted a request for **system access service** and that has submitted, or intends to submit, a proposal to the AESO pursuant to subsection 24.31 (2) of the Transmission Regulation, for the construction and temporary operation of certain transmission facilities described in this Functional Specification.

(2) This Functional Specification is issued for the Purpose only. All of the parties named in Section 1(1) must comply with the Functional Specification provisions.

(3) This functional specification is being provided by the AESO in response to a **system access service** request and any applicable change proposals that were submitted by the **market participant**. The AESO makes no representations or warranties with respect to whether this Functional Specification meets the requirements of any contract or other arrangement associated with this project that has not been accounted for in the **system access service** request and subsequent change proposals, whether or not such contract or arrangement has been disclosed to the AESO by other means.

(4) The AESO is not responsible for any facilities designed by or for any third party, or installed on a third party’s behalf, to accomplish the connection of the Project facilities.

(5) This Functional Specification includes:

- (i) certain specific engineering, technical and functional requirements for the Project;
- (ii) the requirements to comply with **ISO rules**, including Operating Policies & Procedures (OPPs), **reliability standards**, technical standards, and **ISO tariff** provisions (collectively called the “Authoritative Documents”);
- (iii) the electrical system environment in which the connecting facilities must be designed and operated; and
- (iv) any approved variances from requirements set out in any applicable AESO Authoritative Documents.

2 INTERPRETATION AND VARIANCES

(1) Subject to Section 2(2), any revision or variance to any of the Functional Specification provisions by the parties named in Section 1(1) is prohibited.

(2) Any party named in Section 1(1) may make application, jointly or individually, in writing to the AESO requesting a variance to AESO Authoritative Documents, and the AESO may in writing approve of the variance after the AESO has completed an analysis of the implications to the AIES with respect to the requested variance.

(3) Words or phrases appearing in bold have the meanings set out in the AESO's *Consolidated Authoritative Document Glossary*.

3 PROJECT OVERVIEW

(1) System access service request

The **market participant** submitted a request for **system access service** to the AESO to connect its proposed **aggregated generating facility** (Facility) to the AIES. The Facility is located in the AESO transmission planning area of Stavely (Area 49). The **market participant's** Facility includes a proposed collector substation, to be designated Enterprise 1070S. The **maximum authorized real power** (MARP) of generation is 91 MW and the **maximum capability** (MC) is 90 MW.

The **market participant's** request includes a Rate STS, *Supply Transmission Service*, contract capacity of 90 MW and a Rate DTS, *Demand Transmission Service*, contract capacity of 1 MW at the proposed Enterprise 1070S substation.

(2) Facility connection to the AIES

The **market participant's** request can be met by the following transmission development:

- Add one 138 kV circuit, approximately 0.4 km in length¹, to be designated as 161AL, to connect the proposed Facility to the existing 138 kV transmission line 161L in a T-tap configuration.
- Add or modify associated equipment as required for the above transmission developments.

The Facility will be constructed, owned and operated by RESC. The proposed 138 kV circuit 161AL will be owned and operated by AltaLink.

In accordance with the proposal that RESC has submitted, or intends to submit to the AESO under subsection 24.31 (2) of the *Transmission Regulation*, RESC proposes to construct, and to jointly operate for a temporary period with AltaLink, the proposed 138 kV circuit 161AL.

¹ The actual line length shall be identified and determined in the Facility Application prepared by the market participant.

(3) Scope of work

The scope of work for the Project consists of developments that involve the following facilities:

- (i) **transmission facilities** that are owned and constructed by AltaLink, including modification of protection and control equipment at the existing Vulcan 255S and Queenstown 504S substations (the AltaLink Facilities);
- (ii) **transmission facilities** that RESC will own and construct but that will be transferred to AltaLink in accordance with subsection 24.31 (2) of the *Transmission Regulation*, including the proposed 138 kV circuit 161AL between the proposed Facility and the existing 138 kV transmission line 161L (the Market Participant Choice (MPC) Facilities) and;
- (iii) the Facility, which includes RESC' proposed Enterprise 1070S substation.

(4) Project in-service date

The scheduled in-service date (ISD) for this Project is August 31, 2021.

4 FORECAST OF FUTURE DEVELOPMENT IN THE PROJECT AREA

Proposed long term developments in the Stavely Area (Area 49) are described in the AESO 2020 Long-term Transmission Plan. Please refer to the AESO's website (www.aeso.ca) for more details of the long term transmission developments in the area.

5 ALTALINK Facilities

5.1 General

AltaLink must:

- (1) complete all engineering, design, land or land-use acquisition, siting, public consultation, applicable regulatory approvals and permits, material procurement, construction, commissioning, and associated permitting requirements for the AltaLink facilities detailed in Section 5.4 of this Functional Specification.
- (2) coordinate with RESC, as required, on AltaLink facility design details, including protection and control, grounding, insulation, **point of connection**, and site layout with proper consideration of maintenance coordination.
- (3) develop joint operating procedures and any connection agreements with RESC, as required, such that the AltaLink facilities will operate safely and reliably.
- (4) deliver to the AESO all final design and as-built Project facility information and records for the AltaLink facilities detailed in Section 5.4 of this Functional Specification, in the format and content required by the AESO, to enable the AESO to update and maintain its transmission technical records and system models.

(5) submit the Project information and records referred to in subsection 5.1(4) above, under the professional stamp and signature of a registered professional engineer in Alberta who assumes responsibility for the preparation and accuracy of the content of the information and records.

(6) agree with RESC to each party's respective roles and responsibilities regarding inspection of all facilities of the Project prior to energization of the facilities.

(7) ensure prior to energization of any or all of AltaLink facilities detailed in Section 5.5 of this Functional Specification, that the facilities to be energized have been inspected by qualified personnel, so that the facilities are declared to be:

- (a) safe for operation; and
- (b) in compliance with this Functional Specification and any Authoritative Documents for which the Project must comply.

(8) Do not energize any AltaLink facilities until an energization authorization has been issued by the AESO in accordance with the **ISO rules**.

5.2 Compliance with AESO Authoritative Documents

All work undertaken by AltaLink for the AltaLink facilities must comply with the Authoritative Documents provisions which are applicable to the Project and which requirements must be satisfied and incorporated into the design, construction, commissioning and operation of the connecting facilities and other connection Project work, including but not limited to these provisions contained herein:

- AESO Operating Policies and Procedures
- Alberta Reliability Standards
- **ISO rules** including:
 - Section 502.3, *Interconnected Electric System Protection Requirements* (effective December 11, 2019);
 - Section 502.7, *Load Facility Technical Requirements* (effective December 11, 2019);
 - Section 502.8, *SCADA Technical and Operating Requirements* (effective December 11, 2019);
 - Section 502.15, *Reporting Facility Modelling* (effective December 11, 2019);

5.3 Modelling Data Requirements

All modelling data shall be provided as per the Information Document ID# 2010-001R *Facility Modelling Data* (issued on December 20, 2018), which relates to Section 502.15 of the **ISO rules**, *Reporting Facility Modelling*.

5.4 Substation Equipment Specifications – AltaLink Facilities

All new substation equipment² must meet the following minimum specifications:

- Temperature rating of -40°C for all outdoor equipment.
- Equipment maximum and minimum continuous voltage ratings as indicated in Table 5.
- Minimum continuous equipment current ratings as indicated in Table 1.
- Equipment maximum fault duty: 31.5 kA for 138 kV

Table 1: Minimum Continuous Equipment Current Ratings (A)

Component ^{note 5}	138 kV
Main Bus ^{Note 1}	1200
Cross Bus ^{Note 2, 3}	600
Equipment or line terminal ^{Note 4}	600

Notes for Table 1:

- Note 1: Main bus includes all sections of ring bus scheme or single bus of simple bus or breaker and a half scheme except the portion of the bus connecting to a transformer.
- Note 2: Cross bus includes diameter sections of breaker and a half or breaker and a third schemes.
- Note 3: Cross bus can have higher minimum current rating based on bus configuration and equipment connectivity.
- Note 4: Line terminal includes all equipment and conductor from the transmission line to the line breakers.
- Note 5: Current rating of the equipment below 69 kV within the substation shall be determined by the **legal owner** of a **transmission facility**, in consultation with the **market participants**.

5.5 Specific Scope of Work for AltaLink – AltaLink Facilities

(1) General Requirements

For the AltaLink facilities detailed in Section 5.4 of this Functional Specification:

- Coordinate with RESC to develop necessary connection agreements and joint operating procedures.
- Ensure project safety is appropriately managed from design through energization.
- Undertake all required grounding studies, testing and mitigation, as required, for electrical safety and any mitigation for electrical effects on communication systems.
- Complete insulation coordination studies and coordinate with RESC, as required, to establish appropriate insulation levels.

² Equipment includes such items as the power transformer, circuit breaker, capacitor bank, shunt reactor, high voltage current transformer, potential transformer, bus work, air break, and switchgear.

- All site preparation, fencing, foundations, grounding, support structures, termination structures, duct work, cabling, bus work, station service, control building, protection, controls, SCADA equipment, etc., as required.
- Any lines between bus at near substation and bus at remote substation shall not have any terminal equipment that causes a derate of the minimum line capacity specified by the AESO.
- AltaLink shall provide access to the telecommunication system for communication services (SCADA, Operational Voice, Operational Data, and Synchrophasor Measurement Unit) if requested by RESC as required by the AESO for the operation of the AIES.

(2) Existing Vulcan 255S and Queenstown 504S Substations

Protection and Control Requirements

- Complete system protection coordination studies as required and coordinate with the **market participant**, as required, to establish settings appropriate for the facility additions and AIES operations.
- Add new or modify existing the protection and control (P&C) system for the three terminal line configuration after the Facility connection.
- Add any equipment required to implement the control schemes related to the Operational Constraints outlined in Section 9.4.
- Existing trip and reclose function of transmission line 161L are to remain the same.
- Coordinate with RESC to mitigate a risk of reclosing by transmission facilities on the Facility out-of-synchronism using a transfer-trip scheme, generation protection schemes or other technical or operational methods.
- Coordinate with RESC to avoid the Project islanding under N-1-1 (one element out of service and a subsequent element trip) scenario with load served by transmission facilities at, or beyond, the substation to which the Project will connect using an anti-islanding scheme, generation protection schemes or other technical or operational methods. If an anti-islanding scheme is required, the AESO shall be notified.

Telecommunication Requirements

- Install new or modify the existing communication system as required and establish appropriate communication interface such that tele-protection, SCADA, operational voice, operational data and mobile radio requirements are met.

(3) Proposed Enterprise 1070S Substation – See Appendix 9.2.1

Protection and Control Requirements

- Install new protection and control (P&C) system for the three terminal line configuration after the facility additions.

- Install SCADA and telecommunication equipment as required to facilitate the P&C functionality for the proposed 138 kV 161AL transmission line.
- Install any equipment required to implement the control schemes related to the Operational Constraints outlined in Section 9.4.

(4) Existing 138 kV Transmission Line 161L

- Coordinate with RESC to select a tap location on 138 kV transmission line 161L between existing Queenstown 504S and Vulcan 255S substations. The proposed tap location should accommodate potential future development to an in-and-out configuration or provision for a future switching station at or near the tap location.
- Modify 161L as required to accommodate the tap connection.

6 MPC Facilities

6.1 General

RESC must:

(1) complete all engineering, design, land or land-use acquisition, siting, public consultation, applicable regulatory approvals and permits, material procurement, construction, commissioning, and associated permitting requirements for the MPC facilities detailed in Section 6.4 of this Functional Specification.

(2) coordinate with AltaLink, as required, on MPC facility design details, including protection and control, grounding, insulation, **point of connection**, and site layout with proper consideration of maintenance coordination.

(3) develop joint operating procedures and any connection agreements with AltaLink, as required, such that the MPC facilities will operate safely and reliably.

(4) deliver to the AESO all final design and as-built MPC facility information and records for the MPC facilities detailed in Section 6.4 of this Functional Specification, in the format and content required by the AESO, to enable the AESO to update and maintain its transmission technical records and system models.

(5) submit the Project information and records referred to in subsection 6.1(4) above, under the professional stamp and signature of a registered professional engineer in Alberta who assumes responsibility for the preparation and accuracy of the content of the information and records.

(6) mutually agree with AltaLink on each party's roles and responsibilities regarding inspection of all facilities of the Project prior to energization of the facilities.

(7) ensure prior to energization of any or all of the MPC facilities, that the facilities to be energized have been inspected by qualified personnel, so that the facilities are declared to be:

- (a) safe for operation; and
- (b) in compliance with this Functional Specification and any Authoritative Documents for which the Project must comply.

(8) Do not energize any MPC facilities until an energization authorization has been issued by the AESO in accordance with the **ISO rules**.

6.2 Compliance with AESO Authoritative Documents

All work undertaken by RESC for the MPC facilities must comply with the Authoritative Documents provisions which are applicable to the Project and which requirements must be satisfied and incorporated into the design, construction, commissioning and operation of the connecting facilities and other connection Project work, including but not limited to these provisions contained herein:

- AESO Operating Policies and Procedures
- Alberta Reliability Standards
- **ISO rules** including:
 - Section 502.2, *Bulk Transmission Line Technical Requirements* (effective December 11, 2019);
 - Section 502.15, *Reporting Facility Modelling* (effective December 11, 2019)

6.3 Modelling Data Requirements

All modelling data shall be provided as per the Information Document ID# 2010-001R *Facility Modelling Data* (issued on December 20, 2018), which relates to Section 502.15 of the **ISO rules**, *Reporting Facility Modelling*.

6.4 Scope of Work for RESC – MPC Facilities

(1) General Requirements

- Ensure project safety is appropriately managed from design through energization.
- Undertake all required grounding studies, testing and mitigation as required for electrical safety.
- Complete grounding studies, testing and mitigation as required for electrical effects on communication systems.
- Complete insulation coordination studies and coordinate with AltaLink as required to establish appropriate insulation levels.
- All site preparation, fencing, foundations, grounding, support structures, termination structures, duct work, cabling, bus work, station service, control building, protection, controls, etc. as required.

(2) Proposed 138 kV Transmission Line 161AL – See Appendices 9.2.1

- Coordinate with AltaLink to select a tap location on 138 kV transmission line 161L between existing Queenstown 504S and Vulcan 255S substations. The proposed tap location should accommodate potential future development to an in-and-out configuration or provision for a future switching station at or near the tap location.

- Add a 138 kV circuit, approximately 0.4 km in length³, to connect the proposed Enterprise 1070S substation by tapping on the existing 138 kV transmission line 161L. The 138 kV circuit shall be designated as 161AL.
- The proposed 138 kV transmission line 161AL shall have the minimum capacity of no less than the existing transmission line 161L.
- Ensure lightning protection design takes into account the lightning ground flash densities in the area.

7 RESC Facilities

7.1 General

RESC must:

- (1) complete all engineering, design, land or land-use acquisition, siting, public consultation, applicable regulatory approvals and permits, material procurement, construction, commissioning, and associated permitting requirements for the RESC facilities detailed in Section 7.6 of this Functional Specification.
- (2) coordinate with AltaLink, as required, on RESC facility design details, including protection and control, grounding, insulation, **point of connection**, and site layout with proper consideration of maintenance coordination.
- (3) develop joint operating procedures and any connection agreements with AltaLink, as required, such that RESC facilities will operate safely and reliably.
- (4) deliver to the AESO all final design and as-built RESC facility information and records for the RESC facilities detailed in Section 7.6 of this Functional Specification, in the format and content required by the AESO, to enable the AESO to update and maintain its transmission technical records and system models.
- (5) submit the Project information and records referred to in subsection 7.1 (4) above, under the professional stamp and signature of a registered professional engineer in Alberta who assumes responsibility for the preparation and accuracy of the content of the information and records.
- (6) mutually agree with AltaLink on each party's roles and responsibilities regarding inspection of all facilities of the Project prior to energization of the facilities.
- (7) ensure prior to energization of any or all of the RESC facilities, that the facilities to be energized have been inspected by qualified personnel, so that the facilities are declared to be:
 - (a) safe for operation; and
 - (b) in compliance with this Functional Specification and any Authoritative Documents for which the Project must comply.
- (8) Do not energize any RESC facilities until an energization authorization has been issued by the AESO in accordance with the **ISO rules**.

³ The actual line length shall be identified and determined in the Facility Application prepared by the **market participant**.

7.2 Compliance with AESO Authoritative Documents

All work undertaken by RESC for the RESC facilities must comply with the Authoritative Documents provisions which are applicable to the Project and which requirements must be satisfied and incorporated into the design, construction, commissioning and operation of the connecting facilities and other connection Project work, including but not limited to these provisions contained herein:

- AESO Operating Policies and Procedures
- Alberta Reliability Standards
- AESO Measurement System Standard Rev. 1 (dated September 18, 2007)⁴;
- **ISO rules** including:
 - Section 304.3, *Wind and Solar Power Ramp Up Management* (effective December 11, 2019);
 - Section 304.9, *Wind and Solar Aggregated Generating Facility Forecasting* (effective December 11, 2019);
 - Section 502.1, *Aggregated Generating Facilities Technical Requirements* (effective December 11, 2019);
 - Section 502.3, *Interconnected Electric System Protection Requirements* (effective December 11, 2019);
 - Section 502.4, *Automated Dispatch and Messaging System and Voice Communication System Requirements* (effective March 27, 2015);
 - Section 502.7, *Load Facility Technical Requirements* (effective December 11, 2019);
 - Section 502.8, *SCADA Technical and Operating Requirements* (effective December 11, 2019);
 - Section 502.16, *Aggregated Generating Facilities Operating Requirements* (effective December 11, 2019);
 - Section 502.15, *Reporting Facility Modelling* (effective December 11, 2019);
 - Section 505.3, *Coordinating Synchronization, commissioning, WECC Testing and Ancillary Services Testing* (effective December 31, 2012);
 - Section 505.4, *Coordinating Operational Testing* (effective December 31, 2012);

⁴ The AESO considers this standard to remain in effect, notwithstanding the statement in clause 1.5 in the standard. Efforts to revise the standard are currently underway.

7.3 Modelling Data Requirements

All modelling data shall be provided as per the Information Document ID# 2010-001R *Facility Modelling Data* (issued on December 20, 2018), which relates to Section 502.15 of the **ISO rules, Reporting Facility Modelling**.

7.4 Wind/Solar Power Forecasting and Meteorological Data Requirement

All forecasting data and meteorological data requirements shall be provided as per Section 304.9 with particular attention to the requirements shown in Table 1 of Section 304.9.

7.5 Substation Equipment Specifications

All new substation equipment⁵ must meet the following minimum specifications:

- Temperature rating of -40°C for all outdoor equipment.
- Equipment maximum and minimum continuous voltage ratings as indicated in Table 4.
- Minimum continuous equipment current ratings as indicated in Table 2.
- Equipment maximum fault duty: 31.5 kA for 138 kV

Table 2: Minimum Continuous Equipment Current Ratings (A)

Component ^{note 5}	138 kV
Main Bus ^{Note 1}	1200
Cross Bus ^{Note 2, 3}	600
Equipment or line terminal ^{Note 4}	600

Notes for Table 1:

- Note 1: Main bus includes all sections of ring bus scheme or single bus of simple bus or breaker and a half scheme except the portion of the bus connecting to a transformer.
- Note 2: Cross bus includes diameter sections of breaker and a half or breaker and a third schemes.
- Note 3: Cross bus can have higher minimum current rating based on bus configuration and equipment connectivity.
- Note 4: Line terminal includes all equipment and conductor from the transmission line to the line breakers.
- Note 5: Current rating of the equipment below 69 kV within the substation shall be determined by the **legal owner** of a **transmission facility**, in consultation with the **market participants**.

⁵ Equipment includes such items as the power transformer, circuit breaker, capacitor bank, shunt reactor, high voltage current transformer, potential transformer, bus work, air break, and switchgear.

7.6 Scope of Work for RESC

(1) General Requirements

- Coordinate with AltaLink to develop necessary connection agreements and joint operating procedures.
- For Wind/Solar aggregated generating facilities:
 - The wind/solar aggregated generating facility may not cause a phase-to-phase voltage unbalance greater than 1.0%.
 - The facility must be capable of providing the full range of dynamic and static reactive power on the collector bus, as per Information Document ID# 2018-014R *Aggregated Generating Facility Technical Requirements* (issued September 4, 2018), which relates to subsection 4(3) of Section 502.1 of the **ISO rules**. RESC shall submit the relevant study reports to the AESO for review.
- Undertake all required grounding studies, testing, and mitigation to ensure the connecting transmission facilities are safe.
- Ensure connection project safety is appropriately managed from design through energization.

(2) Proposed Enterprise 1070S Substation – See Appendix 9.2.1

Equipment

- Add one (1) 138 kV circuit breaker and one (1) 138 kV motorized disconnect switch.
- Add other necessary equipment as required by RESC.
- Complete insulation coordination studies and coordinate with AltaLink as required to establish appropriate insulation levels.

Protection and Control Requirements

- Complete protection coordination studies and coordinate with AltaLink, as required, to establish settings appropriate for the RESC' facility additions and the AIES operations.
- Coordinate with AltaLink to mitigate a risk of reclosing by transmission facilities on the Facility out-of-synchronism using operating procedures, a transfer-trip scheme, generation protection schemes or other methods.
- Install synch check functionality, as required on the 138 kV circuit breaker for the proposed transmission line 161AL.
- Install any equipment required to implement the control schemes related to the Operational Constraints outlined in Section 9.4.
- Conduct study of generation protection schemes for the proposed Facility in coordination with AltaLink to avoid the Project islanding with transmission facilities at, or beyond, the

substation to which the Project will connect to. The study results shall be shared with AltaLink and the AESO.

- Install all required protection and control equipment to accommodate the new connection.

Revenue metering Requirements

- Install a bi-directional **meter** to meet the metering requirement for the connection of the Facility.
- For RESC owned facilities, provide the AESO with the metering single line diagram to show the physical revenue meter location.

SCADA Requirements

- Establish a communications interface point such that SCADA data can be transmitted back to the **legal owner** of a **transmission facility** and the AESO's System Coordination Centre (SCC) and Backup Coordination Centre (BUCC).
- Coordinate with AltaLink for any equipment required to implement the protection control schemes related to the three terminal line configuration after the facility additions.
- All new Remote Terminal Units (RTU) shall have Global Positioning System (GPS) signaling for time synchronization.
- Implement control center data mapping and verification of SCADA information for the proposed transmission facility modifications and additions and any associated changes required at other area substations as per Section 502.8. A complete listing of energy data requirements can be found in Appendices 10.3 & 10.4 of this document.

Telecommunication Requirements

- Coordinate with AltaLink as required to install communication system to meet the Project requirements for operation, control, protection and SCADA.
- Establish an appropriate communications interface such that the requirements for teleprotection, SCADA, operational voice, and operational data requirements are met.

Synchrophasor Measurement Unit Requirements

- Install Synchrophasor Measurement Unit as required in Section 502.1. The technical specification of Synchrophasor Measurement Unit shall follow IEEE C37.118-2005 (or later versions) with at least 30 samples per second.

(3) Miscellaneous

- All site preparation, fencing, foundations, grounding, support structures, termination structures, duct work, cabling, bus work, station service, control building, protection, controls, SCADA equipment, etc., as required, to complete the additions and/or modifications outlined above.

8 Specific Scope of Work for Lethbridge

(1) General Requirements

- Ensure project safety is appropriately managed from design through energization.
- Undertake all required grounding studies, testing and mitigation as required for electrical safety and any mitigation for electrical effects on communication systems.
- All site preparation, fencing, foundations, grounding, support structures, termination structures, duct work, cabling, bus work, station service, control building, protection, controls, SCADA equipment, and etc., as required.
- Coordinate with AltaLink and RESC to implement the new RAS as described in Section 9.4.

(2) Bowron 674S Substation

Substation Equipment Requirements

- Install equipment as required to implement the new RAS as described in Section 9.4.

Telecommunication Requirements

- Install new or modify/upgrade the existing communication system as necessary to meet the project requirements for new RAS as described in Section 9.4.

9 TRANSMISSION SYSTEM OPERATING CHARACTERISTICS

The **legal owner** of a **transmission facility** and the **market participant** must ensure all facilities are capable of operating in the following electrical environment.

9.1 Short Circuit Current Levels

(1) The short circuit current levels set out in Tables 3 and 4 have been derived by the AESO based on information provided by the **legal owner** of a **transmission facility**, any connecting **generating units**, and adjacent operating areas. Available short circuit current levels will continue to increase as generation, transmission, and system interties are added to the AES. The **legal owner** of a **transmission facility** and the **market participant** must continue to review the short circuit current levels and their equipment ratings for adequacy.

(2) Any future equipment upgrades or protection system setting changes required due to increasing short circuit current levels are the responsibility of the **legal owner** of a **transmission facility** or the **market participant**, as applicable.

(3) The following assumptions were incorporated into the AESO short circuit current models:

- (i) All expected Alberta generation is dispatched.
- (ii) All transmission elements are in service.
- (iii) The proposed Facility/**transmission facility** is connected as per this document.
- (iv) $V_{base} = V_{bus}$, $MVA_{base} = 100$

Table 3a: Summary of Short Circuit Current Levels – 2021 SP Pre Project

Substation Name and Number	Bus Number	Base Voltage (kV)	Pre-Fault Voltage (kV)	3-Phase Fault (kA)	Positive Sequence Thevenin Source Impedance (R1+jX1)(pu)	1-Phase Fault (kA)	Zero Sequence Thevenin Source Impedance (R0+jX0) (pu)
North Lethbridge 370S	167	240	239.1	11.6	0.0043 + 0.0218j	7.3	0.0153 + 0.0596j
North Lethbridge 370S	692	138	138.5	13.0	0.0078 + 0.0339j	9.1	0.0172 + 0.0773j
Fort Macleod 15S	237	138	138.4	5.7	0.0264 + 0.0753j	3.1	0.0644 + 0.2679j
Vulcan 255S	244	138	138.6	2.6	0.0691 + 0.1629j	1.7	0.135 + 0.4623j
West Brooks 28S	430	240	249.9	13.1	0.0047 + 0.0214j	12.9	0.0029 + 0.0227j
West Brooks 28S	276	138	139.0	14.8	0.0066 + 0.0318j	16.3	0.0019 + 0.0229j
East Stavely 928S	279	138	140.3	3.1	0.0564 + 0.14j	1.7	0.1536 + 0.5072j
Queenstown 504S	333	138	137.9	2.9	0.0617 + 0.1511j	3.5	0.0069 + 0.0813j
Stavely 394S	235	138	139.9	2.4	0.0704 + 0.1755j	1.5	0.1612 + 0.554j
Granum 604S	894	138	142.0	3.6	0.0479 + 0.1211j	0.0	0.0 + 1000000.0j

Table 3b: Summary of Short Circuit Current Levels – 2021 SP Post-Project

Substation Name and Number	Bus Number	Base Voltage (kV)	Pre-Fault Voltage (kV)	3-Phase Fault (kA)	Positive Sequence Thevenin Source Impedance (R1+jX1)(pu)	1-Phase Fault (kA)	Zero Sequence Thevenin Source Impedance (R0+jX0) (pu)
North Lethbridge 370S	167	240	238.2	11.6	0.0043 + 0.0217j	7.3	0.0152 + 0.0592j
North Lethbridge 370S	692	138	139.3	12.9	0.008 + 0.0343j	9.1	0.0175 + 0.0784j
Fort Macleod 15S	237	138	139.4	5.7	0.0266 + 0.0756j	3.1	0.0646 + 0.2687j
Vulcan 255S	244	138	142.6	2.7	0.071 + 0.1639j	1.7	0.1418 + 0.4735j
West Brooks 28S	430	240	249.7	13.0	0.0047 + 0.0215j	12.8	0.0029 + 0.0227j
West Brooks 28S	276	138	138.5	14.7	0.0066 + 0.0319j	16.3	0.0019 + 0.0229j

Substation Name and Number	Bus Number	Base Voltage (kV)	Pre-Fault Voltage (kV)	3-Phase Fault (kA)	Positive Sequence Thevenin Source Impedance (R1+jX1)(pu)	1-Phase Fault (kA)	Zero Sequence Thevenin Source Impedance (R0+jX0) (pu)
East Stavelly 928S	279	138	143.2	3.1	0.0574 + 0.1408j	1.7	0.159 + 0.5166j
Queenstown 504S	333	138	138.5	2.9	0.0625 + 0.1516j	3.5	0.007 + 0.0816j
Enterprise 1070S	999004	138	142.8	2.6	0.0725 + 0.1668j	1.8	0.1312 + 0.4357j
Stavelly 394S	235	138	142.8	2.5	0.0715 + 0.1765j	1.5	0.1661 + 0.5633j
Granum 604S	894	138	144.0	3.6	0.0485 + 0.1217j	0.0	0.0 + 1000000.0j

Table 4: Summary of Short Circuit Current Levels – 2028 SP Post Project

Substation Name and Number	Bus Number	Base Voltage (kV)	Pre-Fault Voltage (kV)	3-Phase Fault (kA)	Positive Sequence Thevenin Source Impedance (R1+jX1)(pu)	1-Phase Fault (kA)	Zero Sequence Thevenin Source Impedance (R0+jX0) (pu)
North Lethbridge 370S	167	240	240.5	11.7	0.0038 + 0.0203j	10.0	0.0053 + 0.0309j
North Lethbridge 370S	692	138	142.2	12.7	0.0074 + 0.0333j	10.7	0.0077 + 0.0523j
Fort Macleod 15S	237	138	139.8	5.3	0.0267 + 0.0751j	3.5	0.0503 + 0.199j
Vulcan 255S	244	138	140.7	2.4	0.0745 + 0.1649j	1.7	0.1096 + 0.3624j
West Brooks 28S	430	240	250.1	15.6	0.0026 + 0.0159j	15.6	0.0019 + 0.0163j
West Brooks 28S	276	138	141.8	15.6	0.0044 + 0.0274j	17.2	0.0014 + 0.0197j
East Stavelly 928S	279	138	139.9	2.7	0.0608 + 0.1422j	2.1	0.091 + 0.2955j
Queenstown 504S	333	138	140.9	2.3	0.0757 + 0.1675j	1.8	0.1025 + 0.3304j
Enterprise 1070S	999004	138	141.4	2.7	0.0624 + 0.1497j	3.2	0.0075 + 0.0788j
Stavelly 394S	235	138	139.1	2.2	0.076 + 0.1784j	1.6	0.1112 + 0.3867j

9.2 Voltage Levels

(1) Area Plan Operating Voltage Range

Table 5 provides the steady state voltage range in the area of the proposed Facility/**transmission facility**.

Table 5: Steady State Voltage Range (kV) during Normal and Contingency Events

Substation Name and Number	Nominal Voltage (kV)	Emergency Minimum Voltage (kV)	Desired Normal Minimum Voltage (kV)	Desired Normal Maximum Voltage (kV)	Emergency Maximum Voltage (kV)
Vulcan 256S	138	124	135	145	150
Queenstown 504S	138	124	135	145	150
Enterprise 1070S	138	124	135	145	150

Notes:

1. The Desired Normal Operating Minimum and Desired Normal Operating Maximum are generally associated with Category A events and system normal.
2. The Emergency Minimum Voltage and Emergency Maximum Voltage are generally associated with Category B and C events and system abnormal.
3. The facilities must be capable of continuous operation at voltages up to and including the Emergency Maximum Voltage.

9.3 Insulation Levels

(1) Table 6 provides the minimum required basic insulation levels for the **transmission facilities**. Station equipment with lower insulation levels may be used provided that protection and coordination can be maintained with judicious insulation design and use of appropriate surge arresting equipment.

Table 6: Minimum Basic Impulse Levels (kV)

Nominal Voltage Classification (kV rms)	138
Station Post Insulators and Airbreaks	550
Circuit Breakers	650
Current and Potential Transformers	650
Transformer Windings (protected by surge arresters)	550

9.4 Remedial Action Scheme (RAS)

The Engineering Study Report (ESR) for the Project indicated that, during certain N-1 contingency events, the AIES performance criteria cannot be met without the addition/modification of a RAS. A new and/or modified RAS is required to mitigate these performance violations. The functional specifications for the RAS are detailed in Table 7.

Prior to the ISD of the Project, additional operations planning studies will be performed to determine and/or confirm the required mitigation measures, RAS, or procedure, by taking into account other connection and system projects, as appropriate. This will ensure that appropriate mitigation will be in place prior to the ISD of the Project. The AESO will consult with AltaLink, Lethbridge and RESC before specifying revised and/or new mitigation measures.

Table 7: Remedial Action Schemes for RESC enterprise MPC Solar (P2300)

Scheme Number: 170		
Scheme Name: Milo 356S – 1005L Overload Mitigation Scheme		
Scheme Location: 356S Milo		
Scheme Classification: LAPS		
Scheme Redundancy: Yes		
Scheme Remote Enable Yes/No: Yes		
FS Design Notes: <ol style="list-style-type: none"> 1. Requirement for RAS Redundancy is similar to 138/240 kV communication assisted line protection schemes. 2. All RAS components (relays/SCADA, enabled/disabled status if designed and telecommunication) must be monitored and alarmed. 3. If implemented using redundant TPR grade telecommunication channels, a failure of both telecommunication channels will not require automatic tripping of market participant's generation. 4. The RAS actions listed for this RAS are subject to change prior to the ISD of the Project by taking into account other connection projects as appropriate. 		
FS Defined Terms: <ul style="list-style-type: none"> • DTT = Direct Transfer Trip. 		
Scheme Monitoring	Scheme Settings	Scheme Actions
AltaLink Scope of Work: At 356S Milo: <ul style="list-style-type: none"> • 1005L current and its direction 	AltaLink Scope of Work: Overload Alarm Settings: <ul style="list-style-type: none"> • 1005L Loading \geq 100% of line continuous seasonal rating in MVA (converted to current using 240 kV base voltage), for 10 seconds with direction of current into 356S. Trip Settings: <ul style="list-style-type: none"> • If overload alarm continues for 9 minutes OR • 1005L Loading > seasonal 10 minutes line rating in MVA (converted to current using 240 kV base voltage) for 10 sec with direction into 356S. Reset Overload Alarm/Trip Setting Logic : <ul style="list-style-type: none"> • The RAS, once pick up for the above condition, should reset for 1005L Loading \leq 98% of continuous seasonal line rating for 1 sec. RAS Failure: <ul style="list-style-type: none"> • Communication and other RAS Failure 	AltaLink Scope of Work: Overload Alarm Action: <ul style="list-style-type: none"> • Send Overload Alarm signal to Enterprise 1070S Trip Action: <ul style="list-style-type: none"> • Send DTT to Enterprise 1070S to trip the 138 kV connection break RAS Failure: <ul style="list-style-type: none"> • Send alarm to AltaLink ACC and AESO SCC

	Market Participant Scope of Work: <ul style="list-style-type: none"> • Overload alarm received from AltaLink • Trip DTT received from AltaLink RAS Failure: <ul style="list-style-type: none"> • Communication and other RAS Failures 	Market Participant Scope of Work: <ul style="list-style-type: none"> • For overload alarm, runback MW output to avoid hard trip. • For DTT, trip 1070S 138 kV connection breaker. RAS Failure Action: <ul style="list-style-type: none"> • Send alarm to AltaLink ACC and AESO SCC
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Scheme Number: 168		
Scheme Name: Taber 83S – 172L Overload Mitigation Scheme		
Scheme Location: 83S Taber		
Scheme Classification: LAPS		
Scheme Redundancy: Yes		
Scheme Remote Enable Yes/No: Yes		
FS Design Notes: <ol style="list-style-type: none"> 1. 172L thermal overloading exceeding the 10-minute rating occurred in the pre-project scenarios and thus is an existing system issue due to local area load / cross-flow on the 138 kV system that is exasperated by the project; additional mitigation measures, such as system reconfiguration, generation curtailment, or MATL or EATL dispatch adjustments may be required to reliably manage the overload. These pre-contingency mitigation measures would need to be outlined in an SCP and coordinated with the RAS. 2. Requirement for RAS Redundancy is similar to 138/240 kV communication assisted line protection schemes. 3. All RAS components (relays/SCADA, enabled/disabled status if designed and telecommunication) must be monitored and alarmed. 4. If implemented using redundant TPR grade telecommunication channels, a failure of both telecommunication channels will not require automatic tripping of market participant's generation 5. The RAS actions listed for this RAS are subject to change prior to the ISD of the Project by taking into account other connection projects as appropriate. 		
FS Defined Terms: <ul style="list-style-type: none"> • DTT = Direct Transfer Trip. 		
Scheme Monitoring	Scheme Settings	Scheme Actions

<p>AltaLink Scope of Work:</p> <p>At 83S Taber:</p> <ul style="list-style-type: none"> 172L current and its direction 	<p>AltaLink Scope of Work:</p> <p>Overload Alarm Settings:</p> <ul style="list-style-type: none"> 172L Loading \geq 100% of line continuous seasonal rating in MVA (converted to current using 138 kV base voltage), for 10 seconds with direction of current into 83S. <p>Trip Settings:</p> <ul style="list-style-type: none"> If overload alarm continues after 9 minutes OR 172L Loading $>$ seasonal 10-minute line rating in MVA (converted to current using 138 kV base voltage) for 10 sec with direction into 83S. <p>Reset Overload Alarm/Trip Setting Logic :</p> <ul style="list-style-type: none"> The RAS, once pick up for the above condition, should reset for 172L Loading $<$ 98% of continuous seasonal line rating in MVA (converted to current using 138 kV voltage), for 1 sec. <p>RAS Failure:</p> <ul style="list-style-type: none"> Communication and other RAS Failure 	<p>AltaLink Scope of Work:</p> <p>Overload Alarm Action:</p> <ul style="list-style-type: none"> Send overload alarm signal to Enterprise 1070S <p>Trip Actions:</p> <ul style="list-style-type: none"> Send DTT signal to Enterprise 1070S to trip the 138 kV connection breaker. If overload continues for 5 seconds after all projects trip, send DTT to 254S Coaldale to open 254s172E <p>RAS Failure:</p> <ul style="list-style-type: none"> Send alarm to AltaLink ACC and AESO SCC
	<p>Market Participant Scope of Work:</p> <ul style="list-style-type: none"> Overload alarm received from AltaLink Trip DTT received from AltaLink <p>RAS Failure:</p> <ul style="list-style-type: none"> Communication and other RAS Failures 	<p>Market Participant Scope of Work:</p> <ul style="list-style-type: none"> For overload alarm, runback MW output to avoid hard trip. For DTT, trip 1070S 138 kV connection breaker. <p>RAS Failure Action:</p> <ul style="list-style-type: none"> Send alarm to AltaLink ACC and AESO SCC

Scheme Number: 166		
Scheme Name: Fort Macleod 15S-463L Overload Mitigation		
Scheme Location: 15S		
Scheme Classification: LAPS		
Scheme Redundancy: Yes		
Scheme Remote Enable Yes/No: Yes		
FS Design Notes: <ol style="list-style-type: none"> 1. All RAS components (relay/SCADA, enable/disabled status, and telecommunications) failures must be monitored and alarmed. 2. Requirement for RAS Redundancy is similar to 138/240 kV communication assisted line protection schemes. 3. If implemented using redundant TPR grade telecommunication channels, a failure of both telecommunication channels will not require automatic tripping of market participant's generation. 4. MP has the option to install automatic runback on receiving overload alarm to avoid hard trip. 5. The RAS actions listed for this RAS are subject to change prior to the ISD of the Project by taking into account other connection projects as appropriate. 		
FS Defined Terms: <ul style="list-style-type: none"> • DTT = Direct Transfer Trip. 		
Scheme Monitoring	Scheme Settings	Scheme Actions

<p>AltaLink Scope of Work:</p> <p>At 15S Fort Macleod:</p> <ul style="list-style-type: none"> • 463L current and its direction 	<p>AltaLink Scope of Work:</p> <p>Overload Alarm Settings:</p> <ul style="list-style-type: none"> • 463L loading > seasonal continuous rating in MVA, converted to current using 138 kV voltage, for 10 seconds with direction from 15S to 492S <p>Trip Settings:</p> <ul style="list-style-type: none"> • If overload alarm continues for 9 minutes OR • 463L loading > seasonal 10-minute rating in MVA, converted to current using 138 kV voltage, for 10 seconds with direction from 15S to 492S <p>Reset Logic:</p> <ul style="list-style-type: none"> • 463L loading < 98% of seasonal continuous rating in MVA, converted to current using 138 kV voltage, for 1 second <p>RAS Failure:</p> <ul style="list-style-type: none"> • Communication and other RAS Failure <p>Market Participant Scope of Work:</p> <ul style="list-style-type: none"> • Receive Overload alarm from 15S • Receive DTTs from 15S <p>RAS Failure:</p> <ul style="list-style-type: none"> • Communication and other RAS Failure 	<p>AltaLink Scope of Work:</p> <p>Overload Alarm Actions:</p> <ul style="list-style-type: none"> • Send Overload alarm to 1070S <p>Trip Actions:</p> <ul style="list-style-type: none"> • Send DTTs to the 1070S to sequentially trip LV breaker(s) in 3 groups with 5 seconds between sequential trips <p>RAS Failure:</p> <ul style="list-style-type: none"> • Send alarm to AltaLink ACC and AESO SCC <p>Market Participant Scope of Work:</p> <ul style="list-style-type: none"> • For overload alarm, runback MW output to avoid hard trip • For DTTs, sequentially trip LV breaker(s) to remove all MW in 3 steps. <p>RAS Failure:</p> <ul style="list-style-type: none"> • Send alarm to AltaLink ACC and AESO SCC
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Scheme Number: 169		
Scheme Name: Bowron 674S - 725L Overload Mitigation Scheme		
Scheme Location: 674S		
Scheme Classification: LAPS		
Scheme Redundancy: Yes		
Scheme Remote Enable Yes/No: Yes		
FS Design Notes: <ol style="list-style-type: none"> 1. All RAS components (relay/SCADA, enable/disabled status, and telecommunications) failures must be monitored and alarmed. 2. Requirement for RAS Redundancy is similar to 138/240 kV communication assisted line protection schemes. 3. If implemented using redundant TPR grade telecommunication channels, a failure of both telecommunication channels will not require automatic tripping of market participant's generation. 4. MP has the option to install automatic runback on receiving overload alarm to avoid hard trip. 5. The RAS actions listed for this RAS are subject to change prior to the ISD of the Project by taking into account other connection projects as appropriate. 		
FS Defined Terms: <ul style="list-style-type: none"> • DTT = Direct Transfer Trip. 		
Scheme Monitoring	Scheme Settings	Scheme Actions

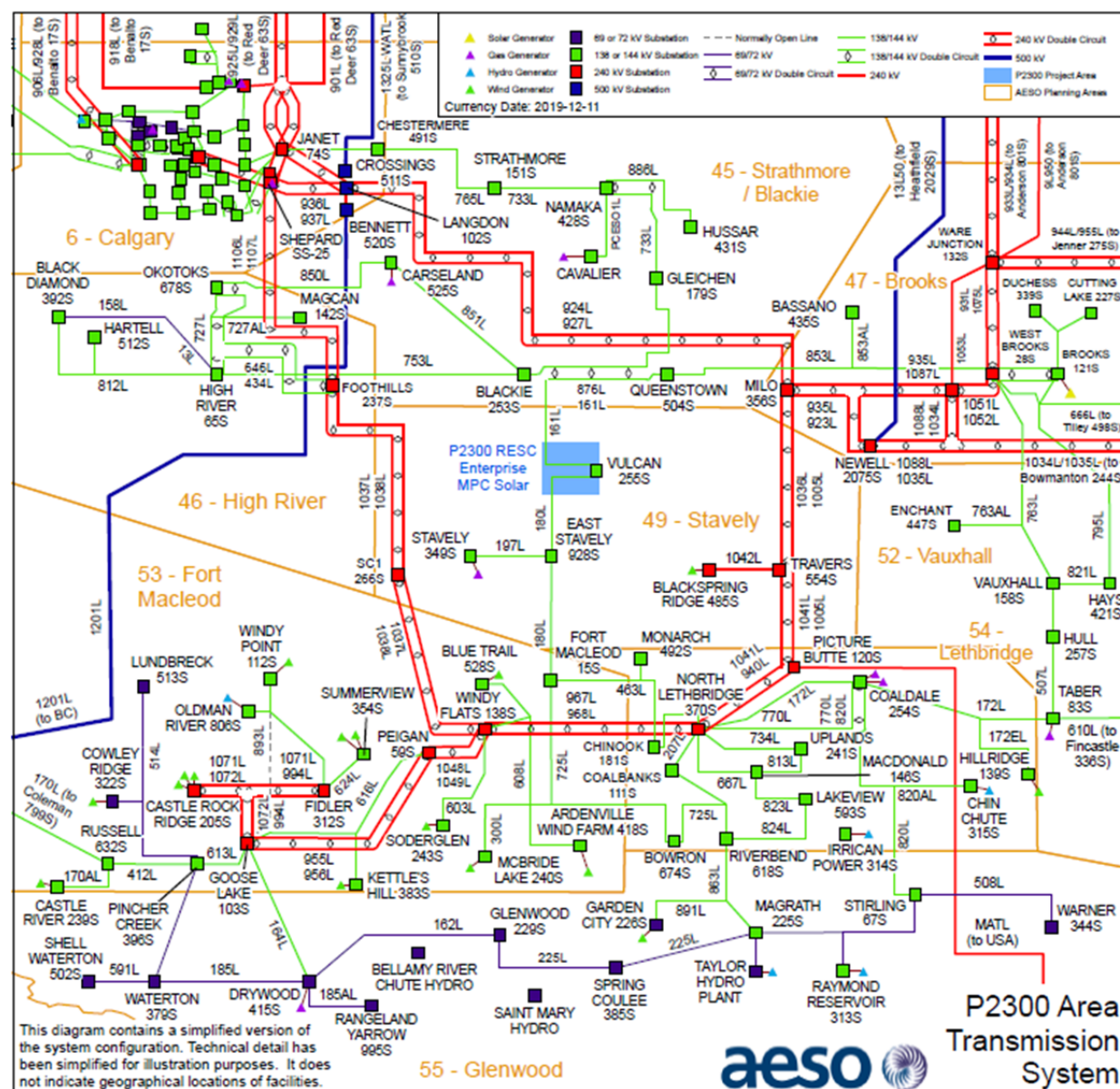
<p>City of Lethbridge Scope of Work:</p> <p>At 674S Bowron:</p> <ul style="list-style-type: none"> • 725L West current and its direction 	<p>City of Lethbridge Scope of Work:</p> <p>Overload Alarm Settings:</p> <ul style="list-style-type: none"> • 725LW loading > seasonal continuous rating in MVA, converted to current using 138 kV voltage, for 10 seconds with direction into 674S <p>Trip Settings:</p> <ul style="list-style-type: none"> • If overload alarm continues for 9 minutes OR • 725LW loading > seasonal 10-minute rating in MVA, converted to current using 138 kV voltage, for 10 seconds with direction into 674S <p>Reset Logic:</p> <ul style="list-style-type: none"> • 725LW loading < 98% of seasonal continuous rating in MVA, converted to current using 138 kV voltage, for 1 second <p>RAS Failure:</p> <ul style="list-style-type: none"> • Communication and other RAS Failure <p>Market Participant Scope of Work:</p> <ul style="list-style-type: none"> • Receive overload alarm from 674S • Receive DTTs from 674S <p>RAS Failure:</p> <ul style="list-style-type: none"> • Communication and other RAS Failure 	<p>City of Lethbridge Scope of Work:</p> <p>Overload Alarm Actions:</p> <ul style="list-style-type: none"> • Send overload alarm to 1070S <p>Trip Actions:</p> <ul style="list-style-type: none"> • Send DTTs to 1070S to sequentially trip LV breaker(s) in 3 groups with 5 seconds between sequential trips <p>RAS Failure:</p> <ul style="list-style-type: none"> • Send alarm to Lethbridge LCC and AESO SCC <p>Market Participant Scope of Work:</p> <ul style="list-style-type: none"> • For overload alarm, runback MW output to avoid hard trip • For DTTs, sequentially trip LV breaker(s) to remove all MW in 3 steps. <p>RAS Failure:</p> <ul style="list-style-type: none"> • Send alarm to Lethbridge LCC and AESO SCC
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Scheme Number: New		
Scheme Name: Queenstown 504S – 161L Overload Mitigation Scheme		
Scheme Location: 504S		
Scheme Classification: LAPS		
Scheme Redundancy: Yes		
Scheme Remote Enable Yes/No: Yes		
FS Design Notes: <ol style="list-style-type: none"> 1. All RAS components (relay/SCADA, enable/disabled status, and telecommunications) failures must be monitored and alarmed. 2. Requirement for RAS Redundancy is similar to 138/240 kV communication assisted line protection schemes. 3. If implemented using redundant TPR grade telecommunication channels, a failure of both telecommunication channels will not require automatic tripping of market participant's generation. 4. MP has the option to install automatic runback on receiving overload alarm to avoid hard trip. 		
FS Defined Terms: <ul style="list-style-type: none"> • DTT = Direct Transfer Trip. 		
Scheme Monitoring	Scheme Settings	Scheme Actions
AltaLink Scope of Work: At 504S Queenstown: <ul style="list-style-type: none"> • 161L current and its direction 	AltaLink Scope of Work: Overload Alarm Settings: <ul style="list-style-type: none"> • 161L Loading \geq 100% of line continuous seasonal rating in MVA (converted to current using 138 kV base voltage), for 10 seconds with direction into 504S. Trip Settings: <ul style="list-style-type: none"> • If overload alarm continues after 9 minutes OR • 161L Loading $>$ seasonal 10-minutes line rating in MVA (converted to current using 138 kV base voltage) for 10 sec with direction into 504S. Reset Overload Alarm/Trip Setting Logic: <ul style="list-style-type: none"> • The RAS, once pick up for the above condition, should reset for 161L Loading $<$ 98% of continuous seasonal line rating in MVA (converted to current using 138 kV voltage), for 1 sec. RAS Failure: <ul style="list-style-type: none"> • Communication and other RAS Failure 	AltaLink Scope of Work: Overload Alarm Actions: <ul style="list-style-type: none"> • Send Overload alarm to 1070S Trip Actions: <ul style="list-style-type: none"> • Send DTTs to the 1070S to sequentially trip LV breaker(s) in 3 groups with 5 seconds between sequential trips RAS Failure: <ul style="list-style-type: none"> • Send alarm to AltaLink ACC and AESO SCC

	<p>Market Participant Scope of Work:</p> <ul style="list-style-type: none"> • Overload alarm received from AltaLink • Trip DTTs received from AltaLink <p>RAS Failure:</p> <ul style="list-style-type: none"> • Communication and other RAS Failures 	<p>Market Participant Scope of Work:</p> <ul style="list-style-type: none"> • For overload alarm, runback MW output to avoid hard trip. • For DTTs, sequentially trip LV breaker(s) to remove all MW in 3 steps. <p>RAS Failure Action: Send alarm to AltaLink ACC and AESO SCC</p>
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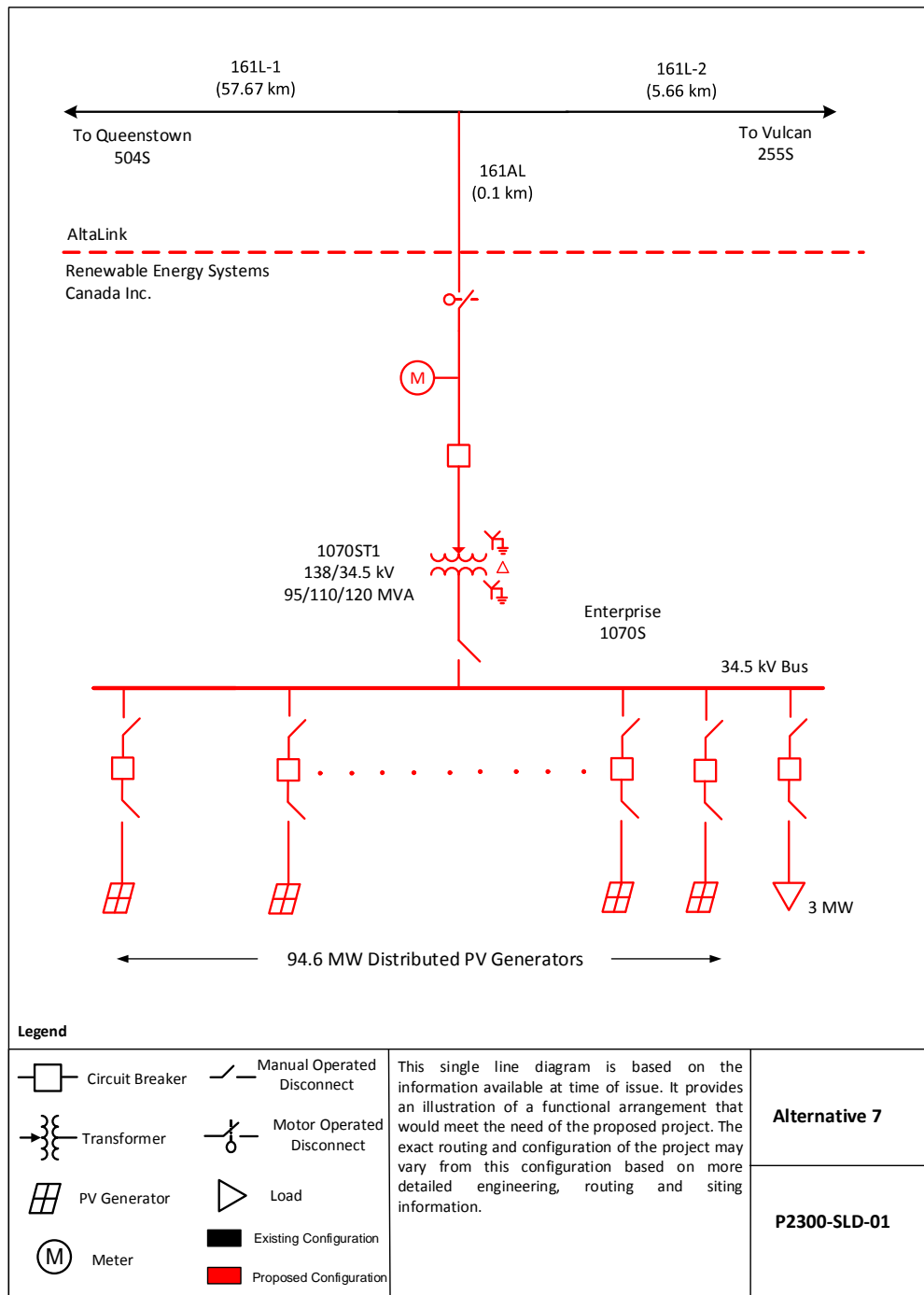
10 APPENDICES

10.1 Area Transmission System – Proposed Project Area



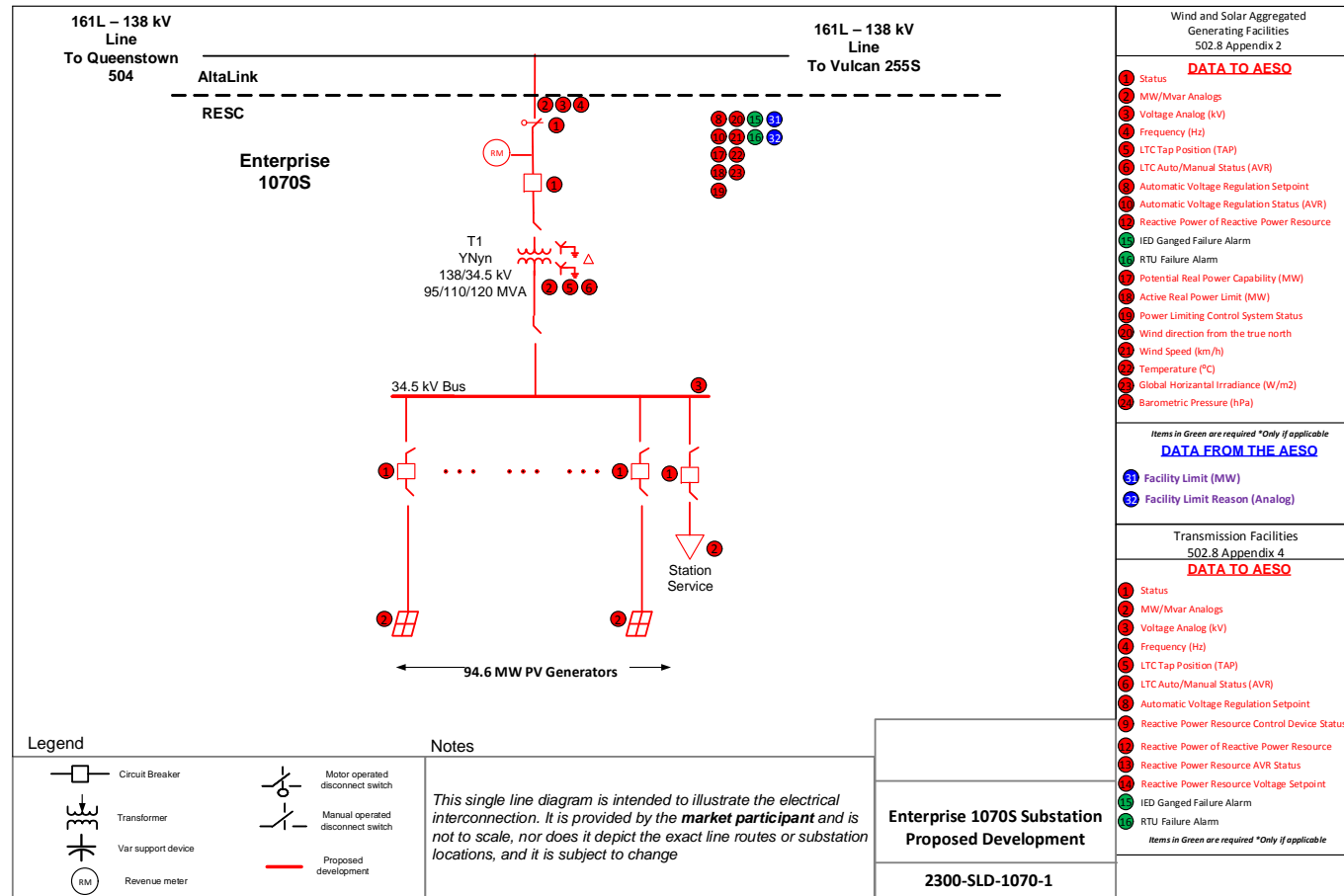
10.2 Single Line Drawing

10.2.1 Single Line Drawing – Enterprise 1070S substation – Proposed Development



10.3 SCADA Requirements

10.3.1 Enterprise 1070S



10.4 SCADA Data Requirements

Facility/ Location	Device	Element	Indication	Max Latency	Notes
Renewable Energy	138kV Point of Connection	Net real power at point of connection	MW	15s	
Systems Canada Inc.	138kV Point of Connection	Net reactive power at the point of connection	MVAr	15s	
Solar	138kV Point of Connection	Voltage at point of connection	kV	15s	
95.1 MW MARP	138kV Point of Connection	Frequency at point of connection	Hz	15s	
	138kV Motor Operated Switch	MOS1 associated with high side of transformer T1	Status	15s	
	138kV Circuit Breaker	CB1 associated with high side of transformer T1	Status	15s	
	138/34.5kV Transformer	Real power on the low side of transformer T1	MW	15s	
	138/34.5kV Transformer	Reactive power on the low side of transformer T1	MVAr	15s	
	138/34.5kV Transformer	T1 Tap Positon	Analog	15s	
	138/34.5kV Transformer	T1 Auto/Manual Status	Status	15s	
	34.5kV BUS	Voltage for collector BUS1	kV	15s	

	34.5kV Circuit Breaker	CB2 associated with station service	Status	15s	If station service load is over 0.5 MW
	34.5kV Circuit Breaker	CB3 through X	Status	15s	For each collector system feeder
	34.5kV Load	Real power of station service	MW	15s	If station service load is over 0.5 MW
	34.5kV Load	Reactive power of station service	MVAr	15s	If station service load is over 0.5 MW
	34.5kV Generation Feeder	Feeder1 through X Real power	MW	15s	For each collector system feeder
	34.5kV Generation Feeder	Feeder1 through X Reactive Power	MVAr	15s	For each collector system feeder
	Solar Power Facility	Potential Real Power	MW	15s	
	Solar Power Facility	Real Power Limit	MW	15s	
	Solar Power Facility	Power limiting control system status	Status	15s	
	Solar Power Facility	Automatic voltage regulation status	Status	15s	
	Solar Power Facility	Automatic voltage regulation setpoint	kV	15s	
	Solar Power Facility	Solar facility power limit reason feedback	Analog	15s	
	Meteorological Data	Wind Speed at between 2-10m above ground	km/h	15s	
	Meteorological Data	Wind Direction from the true north at between 2-10m above ground	degrees	15s	
	Meteorological Data	Ambient Temperature	C	15s	
	Meteorological Data	Global Horizontal Irradiance	Watt/m2	15s	



	Communications	Communications Failure	Alarm	15s	
	Communications	RTU Failure	Alarm	15s	
From AESO	Solar Power Ramp Management	Facility Power Limit Reason (Transmission -1, Ramp - 2, No Limit -3)	Analog	On Event	
	Solar Power Ramp Management	Facility Power Limit	MW	On Event	
Note	1. MW and MVar SCADA data shall be gathered independently of the revenue metering data				
	2. An external GPS based signal shall be utilized to provide 1ms time stamped event accuracy				
	3. Additional SCADA measurements may be required for resources to provide ancillary services				

Participant Involvement Program (PIP) Guidelines for Transmission Facility Owners

Date: March 25, 2020

Version: V3.3

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1. Purpose

These guidelines supplement the AESO's direction to an owner of transmission facilities (the "TFO") for assistance in completing the AESO's PIP¹ for system access service requests. Specifically, these guidelines (i) describe the AESO Directed PIP Work² (defined in the PIP direction letter), which will assist the AESO in meeting its PIP requirements under Alberta Utilities Commission (the "AUC") Rule 007: *Applications for Power Plants, Substations, Transmission Lines, Industrial System Designations and Hydro Developments* (the "AUC Rule 007") for system access service requests; and (ii) the AESO's rationale and expectations for PIP assistance by the TFO.

2. Background

Pursuant to Section 34(1) of the *Electric Utilities Act* (Alberta) (the "EUA"), when the AESO determines that an expansion or enhancement of the capability of the transmission system is or may be required to meet the needs of Alberta and is in the public interest, it must prepare and submit a needs identification document (the "NID") or abbreviated needs identification document (the "ANID") to the AUC for approval.

Pursuant to AUC Rule 007, the AESO is required to conduct a PIP when preparing a NID or ANID. ANIDs are typically required for system access service requests. AUC Rule 007 describes the requirements for the AESO's PIP, which may differ from the requirements of a TFO PIP when preparing its facility application.

The AESO also conducts PIPs for projects that are eligible for approval under Section 501.3 of the ISO rules, *Abbreviated Needs Approval Process* (the "ANAP"). For ANAP eligible projects, the AESO's PIP is conducted in accordance with the requirements for ANIDs or NIDs, as applicable.

As the AESO is engaging with, and being contacted by, numerous stakeholders on various initiatives throughout Alberta, it is important for the AESO to be aware of the content and timing of all transmission development notifications that stakeholders may receive. Among other things, these guidelines are meant to assist the AESO in ensuring the coordination and alignment of both the TFO Stakeholder Materials (as defined below) and the AESO stakeholder materials.

3. AESO's PIP Requirements from AUC Rule 007

For the AESO to advance a system access service request, the AESO must be able to provide the information requirements for a NID or an ANID, as applicable, as set out in AUC Rule 007.

AUC Rule 007 sets out specific requirements for the AESO's PIP. These include the following:

- The AESO must describe the PIP that was conducted.
(Rule 007: NID11 for NIDs; NID19, NID27, NID34 for ANIDs)
- The AESO must explain the rationale used to develop the PIP and the rationale that determined the extent of the PIP.
(Rule 007: NID11 for NIDs; NID19, NID27, NID34 for ANIDs)

¹ The AESO has determined that it is appropriate that the TFO assist the AESO in preparing the AESO's ANID or NID as applicable for the Project by completing certain components of the AESO's participant involvement program (PIP) to satisfy the requirements of Alberta Utilities Commission Rule 007 - *Applications for Power Plants, Substations, Transmission Lines, Industrial System Designations and Hydro Developments* ("AESO PIP").

² Those components of the AESO PIP being directed to the TFO to complete will be referred to as the "AESO Directed PIP Work".

- The AESO must summarize issues raised by participants, how these were addressed, and whether or not any issues are outstanding. Issues include those that relate to the AESO's preferred option to meet the need or to respond to the system access service request, and the issues pertaining to the need itself.
(Rule 007: NID11 for NIDs; NID19, NID27, NID34 for ANIDs)
- The AESO must notify stakeholders (as defined in Section 2.1(a), Appendix A2 of AUC Rule 007) in the area in accordance with the consultation and notification requirements identified in Section 5, Appendix A1 of AUC Rule 007, including occupants, landowners, residents, First Nations³, and local authorities, agencies and governments, prior to submitting a NID or an ANID to the AUC.
(Rule 007: Appendix A2, Section 2.1(a) for NIDs, Section 2.2, Section 3.2(a) for ANIDs)
- For ANIDs, the TFO's project-specific PIP notification materials must address the following items:
 - a description of the AESO's preferred transmission development responding to the system access service request;
 - the general area where the facilities could be installed to implement the AESO's preferred option; and
 - AESO contact information for further information.
 (Rule 007: Appendix A2, Section 3.2(a))
- For NIDs, the notification materials must address the following items:
 - a description of the need for transmission development;
 - a description of the AESO's preferred option to meet this need;
 - the general area where the facilities could be installed to implement the AESO's preferred option;
 - the proposed timing for submitting a NID to the AUC; and
 - AESO contact information for further information.
 (Rule 007: Appendix A2, Section 3.1)
- For both ANIDs and NIDs, the AESO must allow a minimum of 14 calendar days from the date that the stakeholder notification is distributed before publishing the AESO's filing notification.
(Rule 007: Appendix A2 Section 3.1(c) for NIDs; and Section 3.2 (a) for ANIDs)
- For ANIDs, the AESO must notify stakeholders regarding the AESO's intention to submit an ANID application to the AUC a minimum of 14 calendar days before filing. This notification can be fulfilled by posting on the AESO's website and other stakeholder notifications.
(Rule 007: Appendix A2, Section 5.2)
- For NIDs, the AESO must notify stakeholders, on the AESO's website and in local newspapers, regarding the AESO's intention to submit a NID application to the AUC a minimum of 14 calendar days before filing. The notification materials must address the following items:
 - a description of the area where the facilities could be installed to implement the AESO's preferred option;
 - a telephone number to contact for further information; and
 - a website location where the NID may be downloaded once submitted to the AUC.
 (Rule 007: Appendix A2, Section 5.1)

³ For the purpose of this document, the AESO interprets this to include Indigenous communities and organizations. Subsequent reference in this document will refer to Indigenous communities and organizations.

4. AESO's Direction to the TFO for PIP Assistance

Pursuant to Section 35 of the EUA, the AESO can direct the TFO to assist the AESO in preparing ANIDs or NIDs. Pursuant to Sections 39 and Section 14 of the *Transmission Regulation*, the TFO, as part of its duties, must, as directed by the AESO, assist the AESO in preparing its ANID or NID, as applicable. The AESO issues a direction to the TFO for PIP assistance when it has determined it is appropriate for the TFO to assist the AESO in preparing the AESO's ANID or NID, by completing certain components of the AESO's PIP. The direction refers the TFO to these guidelines and requires the TFO to complete the AESO Directed PIP Work in accordance with these PIP Guidelines.

Unless otherwise requested by the AESO, all deliverables in response to the direction should be provided by email to the project manager assigned to the project.

5. AESO PIP Plan

As part of the AESO Directed PIP Work, the TFO must submit to the AESO's project manager by email a plan of how the TFO will complete the AESO Directed PIP Work (the "AESO PIP Plan"). The AESO PIP Plan should clearly describe how the TFO plans to complete the AESO Directed PIP Work in accordance with AUC Rule 007 and the AESO direction letter.

The AESO PIP Plan must be approved by the AESO before it is implemented by the TFO. The TFO is expected to inform the AESO as soon as the TFO becomes aware of any changes to the accuracy or completeness of the information in the AESO PIP Plan.

As part of the AESO Directed PIP Work, the TFO must prepare an AESO PIP Plan that includes the following components:

(a) Statement of compliance

A statement confirming that the AESO Directed PIP Work will be completed in accordance with AUC Rule 007 and the AESO direction letter, with a reference to the date of the direction letter.

(b) Facility Application Type

A statement describing the type of facility application applicable to the project, as specified in AUC Rule 007, Appendix A1, Section 5, which will be used to inform the notification methodology described below.

(c) Notification Methodology

A statement providing the TFO's minimum notification area for the type of facility application, as specified in AUC Rule 007, Appendix A1, Section 5, with details of any planned deviations.

The statement should include a description of how the TFO intends to conduct notification and provide details of all anticipated notification methods (e.g., addressed mail, postal code drop, email, hand delivery). It should also specify what stakeholder materials will be distributed for each of the planned distribution methods.

(d) Timeline

A timeline with the following information:

- Estimated dates of when the stakeholder materials will be distributed, for each planned distribution method. This information may be broken down according to stakeholder group, as appropriate.
- Estimated dates, times, and locations of open houses and information sessions, if applicable. If no open houses or information sessions are planned, a statement confirming this and explaining

the rationale for the TFO's decision not to host any open houses is required. An acceptable rationale could be that "*open houses are not required for this project*".

- Estimated release or posting dates of other types of planned communications (e.g., website posting, social media announcement of open house dates), if applicable.
- Estimated completion date for the PIP activities.

(e) Stakeholder List

Provide a list that describes the stakeholders to be notified and the TFO's rationale for their inclusion in the AESO Directed PIP Work. The rationale for *excluding* certain stakeholders or stakeholder groups from the AESO Directed PIP Work is also required.

For organizations such as local authorities, elected officials, agencies, government bodies, industries, and stakeholder groups, the stakeholder list should include the name of each representative of the organization to be notified, as available.

For all occupants, residents and landowners, the list should not include these stakeholders' personal information and instead should state the approximate number of these stakeholders.

(f) Notification of Indigenous Communities

Provide a list of all Indigenous communities and organizations in the development area, together with a rationale explaining whether they are to be included or excluded from the notification. If the TFO seeks advisement from the Aboriginal Consultation Office (the "ACO") the TFO must provide⁴ a copy of the ACO's assessment whether notification was or was not required. If the TFO did not seek advisement from the ACO, the TFO must summarize the steps it took to identify and notify with Indigenous groups. If none were undertaken, the TFO must provide an explanation for that decision.

(g) Risk Level

For ANAP projects, the TFO must identify if the perceived risk of stakeholder concerns is high, medium, or low. For ANID projects, this is optional and at the discretion of the TFO.

6. TFO Stakeholder Materials

As part of the TFO's PIP, the TFO will prepare project-specific information documents that include a description of the facilities (the "TFO Stakeholder Materials"). The TFO Stakeholder Materials must be aligned with the AESO's stakeholder materials.

As part of the AESO Directed PIP Work, the AESO requires the TFO to follow the following processes to ensure the alignment between the AESO PIP and TFO PIP:

- (a) TFO Stakeholder Materials include any materials that are distributed with the AESO Need Overview (defined below), or make reference to the AESO's role, the AESO's need, or the AESO's preferred alternative. This may include, but is not limited to the following materials as available at the time of AESO PIP Plan development:
 - brochures (which contain site plans or maps)
 - newsletters (which contain site plans or maps)
 - poster boards for open houses/public information sessions
 - advertisements (print and/or electronic)

⁴ Alberta Utilities Commission Bulletin 2019-20 *Interim direction on Indigenous consultation*

- web pages
- social media posts

The TFO must provide all TFO Stakeholder Materials to the AESO project manager for review and approval. The AESO will advise the TFO of any changes required to the TFO Stakeholder Materials as applicable to AESO's role, the AESO's need, or the AESO's preferred alternative, and will not proceed to provide the AESO Need Overview (defined below) until such changes have been made.

- (b) The TFO Stakeholder Materials provided to the AESO for review, specifically the TFO's newsletter/letter/brochure, must include the following paragraph and the AESO's contact information:

"The AESO is an independent, not-for-profit organization responsible for the safe, reliable and economic planning and operation of the provincial transmission grid. For more information about why this project is needed, please refer to the AESO's Need Overview included with this package, or visit www.aeso.ca. If you have any questions or concerns about the need for this project or the proposed transmission development to meet the need you may contact the AESO directly. You can make your questions or concerns known to a transmission facility owner representative who will collect your personal information for the purpose of addressing your questions and/or concerns to the AESO. This process may include disclosure of your personal information to the AESO."

"Alberta Electric System Operator (AESO)
 stakeholder.relations@aes0.ca
 1-888-866-2959
www.aeso.ca"

- (c) The AESO will prepare an AESO Need Overview which is an overview that outlines the need for the project and includes AESO contact information (the "AESO Need Overview"). The AESO Need Overview must be distributed with the TFO Stakeholder Materials, specifically the TFO's newsletter/letter/brochure. The AESO Need Overview will be provided to the TFO upon completion of the AESO's review and approval of the TFO Stakeholder Materials.

The TFO must coordinate with the AESO regarding subsequent distributions to stakeholders that include changes to, or new TFO Stakeholder Materials.

7. Notifications to the AESO

As part of the AESO Directed PIP Work, the AESO requires the following notifications from the TFO:

(a) Confirmation of Distribution

The TFO must confirm to the AESO project manager when the initial distribution of the TFO Stakeholder Materials along with the AESO Need Overview has been distributed to all stakeholders, and provide a copy of the TFO Stakeholder Materials to the AESO.

(b) Deviations

The TFO must inform the AESO of any deviations from the PIP Plan as they occur. The AESO understands that the stakeholder list may change and may be updated during the PIP. As such, the TFO should notify the AESO periodically as the preliminary stakeholder list is updated to ensure coordination and alignment of the PIP activities between the two parties.

(c) Stakeholder Questions

Within seven days of the TFO receiving stakeholder questions or concerns regarding the need to respond to the request for system access service and/or AESO's preferred option to respond to the request for system access service, the TFO must refer such questions or concerns to the AESO for the AESO's response. This will allow the AESO to promptly address stakeholder concerns. The TFO shall attempt to obtain stakeholder consent to forward their contact information to the AESO when questions relevant to the AESO are received.

Should the AESO receive any questions or concerns that pertain to the TFO's facility application and upon receiving permission from the stakeholder to share his or her contact information, the AESO will ensure these are made available to the TFO within seven days.

8. PIP Report

The TFO must prepare a report (the "PIP Report") executed by an authorized representative of the TFO and delivered to the AESO's project manager by email confirming that the TFO completed the AESO Directed PIP Work and in particular must confirm that the AESO Directed PIP Work was completed in accordance with: (i) the direction, and (ii) the requirements of AUC Rule 007, as applicable. The PIP Report must also list and explain the deviations, if any, from: (i) the direction; (ii) the requirements of AUC Rule 007, as applicable; and (iii) the approved AESO PIP Plan.

If new stakeholders are identified and notified after the PIP Report has been submitted, the AESO expects the TFO to promptly inform the AESO to ensure compliance with the requirements of AUC Rule 007, Appendix A2, Section 3.1(c) for NIDs or Section 3.2(a) for ANIDs. The PIP Report should then be updated accordingly.

The objective of the PIP Report is to describe all the activities that actually occurred during the AESO Directed PIP Work. The PIP Report is used to inform the AESO's PIP Summary that is filed with the AUC as a component of the AESO's NID or ANID. The AESO's PIP Summary is also used to inform the AESO's evaluation of ANAP eligibility for projects. TFOs are reminded that the PIP Report may become an exhibit in related AUC proceedings, and such reports should be prepared with this outcome in mind.

The PIP Report should include the following components:

(a) Statement of Compliance

A statement confirming that the AESO Directed PIP Work was conducted in accordance with AUC Rule 007 and the AESO direction letter, with a reference to the date of the direction letter.

(b) Facility Application Type

A statement providing the type of facility application applicable to the project, as specified in AUC Rule 007, Appendix A1, Section 5.

(c) Notification Methodology

A statement of the TFO's minimum notification area for the type of facility application, as specified in AUC Rule 007, Appendix A1, Section 5. Provide details of any deviations that occurred during completion of the PIP.

This should include a description of how notification was conducted, including details of all notification methods used (e.g., addressed mail, postal code drop, email, hand delivery), and specifying which stakeholder materials were distributed for each distribution method used.

(d) Timeline

A timeline with the following information:

- Actual date(s) of stakeholder material distribution, for each distribution method used. This information may be broken down by stakeholder group, as appropriate. If there were several rounds of notification that were distributed with the AESO's materials or that spoke to the arrangements being made by the AESO, then provide the start and end date of each round.
- Dates, times, and locations of open houses and information sessions, if applicable. If no open houses or information sessions were held, a statement confirming this and explaining the rationale for the TFO's decision is required. An acceptable rationale could be that "*open houses are not required for this project*".
- Release or posting dates for all other communications (e.g., website posting, social media announcement of open house dates), if applicable.
- Posting date and URL for any project-specific information (including the AESO Need Overview) posted on the TFO website. Specify which materials were posted. If no materials were posted on the TFO website, then provide a statement confirming this.
- Actual date of notification completion (i.e. when the last stakeholder received a project-specific information package that included the AESO Need Overview) at the time of PIP Report submission. This allows the AESO to determine the earliest date that it can publicly notify of its intent to file an ANID or a NID with the AUC.

(e) Stakeholder List

Provide a list that includes the stakeholders that were notified and the TFO's rationale for their inclusion in the AESO Directed PIP Work. The rationale for *excluding* certain stakeholders or stakeholder groups from the AESO Directed PIP Work is also required.

For organizations such as local authorities, elected officials, agencies, government bodies, industries, and stakeholder groups, the stakeholder list should include the name of each representative of the organization that was notified, as available.

For all occupants, residents and landowners, the list should not include these stakeholders' personal information and instead should state the approximate number of these stakeholders.

(f) Notification of Indigenous Communities

Provide a list of all Indigenous communities and organizations applicable to the development area that were notified. If the TFO did not seek advisement from the ACO, the TFO must provide a rationale explaining why Indigenous communities and/or organizations were or were not included in the AESO Directed PIP Work. If no steps were undertaken to identify and notify with Indigenous groups, the TFO must provide an explanation for that decision.

(g) Deviations

Include any deviations from, or additions to, the AESO PIP Plan and provide the corresponding rationale.

(h) Questions and Concerns Received

Describe all questions and concerns received by participants regarding the need to respond to the request for system access service and/or AESO's preferred option to respond to the system access service request. If there were no questions or concerns raised, then provide a statement indicating that there were no questions or concerns regarding the need to respond to the request for system access service and/or the AESO's preferred option to respond to the request for system access service, as appropriate.

(i) Stakeholder Materials

Attach all TFO Stakeholder Materials that were distributed or otherwise made available to stakeholders during the AESO Directed PIP Work as appendices to the PIP Report.

TFO Stakeholder Materials include any materials that were distributed with the AESO's Need Overview, or make reference to the AESO's role, the AESO's need, or the AESO's preferred alternative. This may include, but is not limited to the following materials:

- brochures (which contains site plans or maps)
- newsletters (which contains site plans or maps)
- poster boards for open houses/public information sessions
- advertisements (print and/or electronic)
- web pages
- social media posts