AESO FUNCTIONAL SPECIFICATION

Functional Specification

EDTI Southeast Edmonton Area Load and Reliability

AESO Project Number: P2133

Issued to:

EPCOR Distribution & Transmission Inc. (EDTI TFO), (as the **legal owner** of a **transmission facility)**,

and to

EPCOR Distribution & Transmission Inc. (EDTI DFO), (as the **market participant**)

Date: December 8, 2020

Version: V2

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V2
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Functional Specification Revision History

Revision	Description of Revision	By	Date
V1D1	• For internal comments	Henry Ng	April 9, 2020
V1D2	• For External Review	Henry Ng	April 23, 2020
V1	• For Issuance	Henry Ng	April 29, 2020
V2	• ISD change • Project overview revision • For issuance	Henry Ng	December 8, 2020

Contents

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 connection with the Alberta **interconnected electric system** (AIES) (the "Purpose"). This Functional Specification is issued by the Alberta Electric System Operator (AESO) to:

(i) EPCOR Distribution & Transmission Inc. (EDTI TFO), as the **legal owner** of a **transmission facility** described in the Functional Specification.

(ii) EPCOR Distribution & Transmission Inc. (EDTI DFO), as the **market participant** that has submitted a request for **system access service**.

(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 AESO's *Consolidated Authoritative Document Glossary*.

3 PROJECT OVERVIEW

The **market participant** has submitted a request for **system access service** to the AESO to reliably serve growing demand for electricity in southeast Edmonton. The Project is located in the AESO Edmonton planning area (Area 60). The **market participant**'s request includes existing Rate DTS, *Demand Transmission Service*, contract capacity increase of 31 MW, from 40 MW to 71 MW at the existing Summerside substation, and existing Rate DTS contract capacity increase of 5.82 MW, from 36.18 MW to 42 MW at the existing East Industrial substation.

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

- Upgrade the existing Summerside substation, including adding one 240/25 kV transformer and one 240 kV circuit breaker; and
- Add or modify associated equipment as required for the above transmission development.

The scheduled in-service date (ISD) for this Project is April 27, 2022.

4 FORECAST OF FUTURE DEVELOPMENT IN THE PROJECT AREA

Proposed long term developments in the Edmonton area (Area 60) 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 SCOPE OF WORK

5.1 General

The **legal owner** of a **transmission facility** and the **market participant** 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 Project facilities.

(2) coordinate with each other, as required, on all Project 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, as required, such that all connecting **transmission facilities** will operate safely and reliably.

(4) deliver to the AESO all final design and as-built Project facility information and records 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 (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 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 their respective Project 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 Project facilities until an energization authorization has been issued by the AESO in accordance with the **ISO rules**.

5.2 Compliance with AESO Authoritative Documents

Any party named in Section 1(1) must comply with the Authoritative Documents provisions which are applicable to the Project and which 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)[1]
- **ISO rules** including:
    - 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);

[1] 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.

5.3 Modelling Data Requirements

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

5.4 Substation Equipment Specifications

All new substation equipment[3] must meet the following minimum specifications:

- Temperature rating of -40ºC 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 1.
- Equipment maximum fault duty: 40 kA for 240 kV.

Table 1: Minimum Continuous Equipment Current Ratings (A)

Component note 5	**240 kV**	**25 kV**
Main Bus Note 1	2000	2000
Cross Bus Note 2, 3	2000	600
Equipment or line terminal Note 4	2000	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 the Legal Owner of a Transmission Facility [EDTI TFO]

(1) General Requirements

- Coordinate with the **market participant** to develop necessary connection agreements and joint operating procedures.
- Ensure project safety is appropriately managed from design through energization.

[3] 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.

- 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 the **market participant,** 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, 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.
- The **legal owner** of a **transmission facility** shall provide access to the telecommunication system for communication services (SCADA, Operational Voice, and Operational Data) if requested by the **market participant**, as required by the AESO for the operation of the AIES.

(2) Existing Summerside Substation

Major Equipment

- Add one (1) 240/25 kV transformer with on load tap changer. The transformer shall have a transformation capability of 75 MVA to match the existing transformers;
- Add one (1) 240 kV breaker with associated manual disconnect switches. The new circuit breaker shall have the same operating characteristics as the existing 240kV circuit breakers.
- Add one (1) 240 kV motorized air break switch;
- Add one (1) 25 kV switchgear lineup capable of accommodating four (4) feeder breakers[2], one (1) transformer breaker, and one (1) 25 kV bus tie breaker;
- Add associated instrumentation equipment (current and potential transformers)
- Provide a suitable visible open switch point on the 25 kV side of the transformer with a transmission facility switch number for “Guarantee of Isolation” purposes. The open point shall be able to accommodate a lock and tag and all procedures related to the safe operation of this switch shall be included in the joint operating procedures.

Protection and Control Requirements

- Complete system protection coordination studies and coordinate with the **legal owner** of the adjacent **transmission facility** and the **market participant,** as required, to establish settings appropriate for the facility additions and AIES operations.

[2] Adding two (2) 25 kV feeder breakers at the Summerside E657S substation is adequate to respond to the market participant’s request for system access service. The legal owner of transmission facilities advised the AESO that it intends to install four (4) 25 kV feeder breakers in accordance with its engineering practices and standard substation design template.

- The **legal owner** of a **transmission facility** shall work with the **market participant** to design, modify and install necessary protection schemes to ensure safety and reliable operation.
- Install 240 kV breaker sync-check and breaker failure protection.
- Install under-frequency load shedding (UFLS) relays to meet under-frequency load shedding requirements.
- Install all required protection and control equipment as required to accommodate addition of 240 kV and 25 kV facilities.

Telecommunication Requirements

- Install new or modify/upgrade the existing communications system as necessary to meet the Project requirements for operation, control, protection and SCADA.

SCADA Requirements

- Update or modify existing communications interface point such that SCADA data can be transmitted back to the AESO's System Coordination Centre (SCC) and Backup Coordination Centre (BUCC).
- 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 of the **ISO rules**. A complete listing of energy data requirements can be found in Appendices 7.3 & 7.4 of this document.

Revenue metering Requirements

- Install a bi-directional **meter** to meet the metering requirement for the connection of the Facility.
- Provide the AESO with a metering single line diagram to show physical revenue meter location.

5.6 Scope of Work for the Market Participant [EDTI DFO]

(1) General Requirements

- Coordinate with the **legal owner** of a **transmission facility** to develop necessary connection agreements and joint operating procedures.
- 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) Existing Summerside E657S Substation – See Appendix 7.2

Equipment

- Coordinate all alignments with the **legal owner** of a **transmission facility**, as required, to connect the **market participant**'s facility to the 25 kV connection point.
- Supply and install all risers or other connections, as required, to connect the connecting **transmission facility** to the 25 kV connection point.
- Complete insulation coordination studies and coordinate with the **legal owner** of a **transmission facility** as required to establish appropriate insulation levels.

Protection and Control Requirements

- Complete protection coordination studies and coordinate with the **legal owner** of a **transmission facility** as required, to establish settings appropriate for the **market participant**'s facility additions and the AIES operations.
- All load market participants are required to participate in the AIES **under-frequency load shedding** program as per OPP-804. The **market participant** shall ensure sufficient load is equipped with **under-frequency load shedding** relays armed in each frequency band to meet the program specifications, and that the scheme is installed, tested, and commissioned appropriately.
- Any frequency relays installed to protect equipment for off-nominal frequency operation must function at a transmission system voltage equal to or above 80% of the rated voltage.
- Install all required protection and control equipment as required.

Telecommunication Requirements

- Coordinate with the **legal owner** of a **transmission facility** to install new or modify/upgrade the existing communication system as necessary.

(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.

6 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.

6.1 Short Circuit Current Levels

(1) The short circuit current levels set out in Tables 2 and 3 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 AIES. 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 2a: Summary of Short Circuit Current Levels – 2020 Winter Peak (WP) Pre Project

Substation Name and Number	Base Voltage (kV)	Pre-Fault Voltage (kV)	3-Φ Fault (kA)	Positive Sequence Thevenin Source Impedance (R1+jX1) (pu)	1-Φ Fault (kA)	Zero Sequence Thevenin Source Impedance (R0+jX0) (pu)
East Edmonton 38S	240	246.9	21.2	0.00318+0.01134j	17.6	0.00386+0.01856j
East Industrial E52S (fed by 1059L T-tap)	240	246.9	19.4	0.00337+0.01240j	15.6	0.00463+0.02175j
East Industrial E52S (fed by 908L T-tap)	240	247.0	19.5	0.00335+0.01231j	15.7	0.00424+0.02183j
Ellerslie 89S	500	531.8	11.6	0.00171+0.01052j	11.0	0.00206+0.01242j
Ellerslie 89S	240	248.1	25.9	0.00259+0.00931j	24.3	0.00210+0.01154j
Summerside E657S	240	248.1	25.6	0.00260+0.00943j	23.9	0.00216+0.01186j

Note: The above table will be updated to reflect project ISD of April 2022 upon completion of stage 3 ESR

Table 2b: Summary of Short Circuit Current Levels – 2020 WP Post Project

Substation Name and Number	Base Voltage (kV)	Pre-Fault Voltage (kV)	3-Φ Fault (kA)	Positive Sequence Thevenin Source Impedance (R1+jX1) (pu)	1-Φ Fault (kA)	Zero Sequence Thevenin Source Impedance (R0+jX0) (pu)
East Edmonton 38S	240	247.0	21.1	0.00319+0.01135j	17.7	0.00386+0.01854j
East Industrial E52S (fed by 1059L T-tap)	240	247.0	19.4	0.00339+0.01240j	15.6	0.00463+0.02173j
East Industrial E52S (fed by 908L T-tap)	240	247.2	19.5	0.00336+0.01231j	15.7	0.00424+0.02181j
Ellerslie 89S	500	531.9	11.6	0.00172+0.01052j	11.0	0.00206+0.01240j
Ellerslie 89S	240	248.4	25.9	0.00260+0.00932j	24.3	0.00210+0.01151j
Summerside E657S	240	248.3	25.6	0.00262+0.00943j	23.9	0.00217+0.01183j

Note: The above table will be updated to reflect project ISD of April 2022 upon completion of stage 3 ESR.

Table 3: Summary of Short Circuit Current Levels – 2028 WP Post Project

Substation Name and Number	Base Voltage (kV)	Pre-Fault Voltage (kV)	3-Φ Fault (kA)	Positive Sequence Thevenin Source Impedance (R1+jX1) (pu)	1-Φ Fault (kA)	Zero Sequence Thevenin Source Impedance (R0+jX0) (pu)
East Edmonton 38S	240	248.9	22.7	0.00276+0.01068j	18.5	0.00387+0.01840j
East Industrial E52S (fed by 1059L T-tap)	240	248.9	20.7	0.00296+0.01173j	16.3	0.00464+0.02160j
East Industrial E52S (fed by 908L T-tap)	240	249.2	20.9	0.00294+0.01164j	16.4	0.00425+0.02168j
Ellerslie 89S	500	528.5	13.7	0.00123+0.00887j	12.6	0.00202+0.01141j
Ellerslie 89S	240	250.5	28.4	0.00219+0.00862j	26.0	0.00211+0.01131j
Summerside E657S	240	250.5	28.0	0.00220+0.00874j	25.5	0.00217+0.01163j

Note: The above table will be updated to reflect project ISD of April 2022 upon completion of stage 3 ESR

6.2 Voltage Levels

(1) Area Plan Operating Voltage Range

Table 4 provides the steady state voltage range in the area of the proposed Facility/**transmission facility**.

Table 4: 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)
Summerside E657S	240	216	234	252	264

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.

6.3 Insulation Levels

(1) Table 5 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 5: Minimum Basic Impulse Levels (kV)

Nominal Voltage Classification (kV rms)	240	25
Station Post Insulators and Airbreaks	900	150
Circuit Breakers	1050	150
Current and Potential Transformers	1050	150
Transformer Windings (protected by surge arresters)	850	125

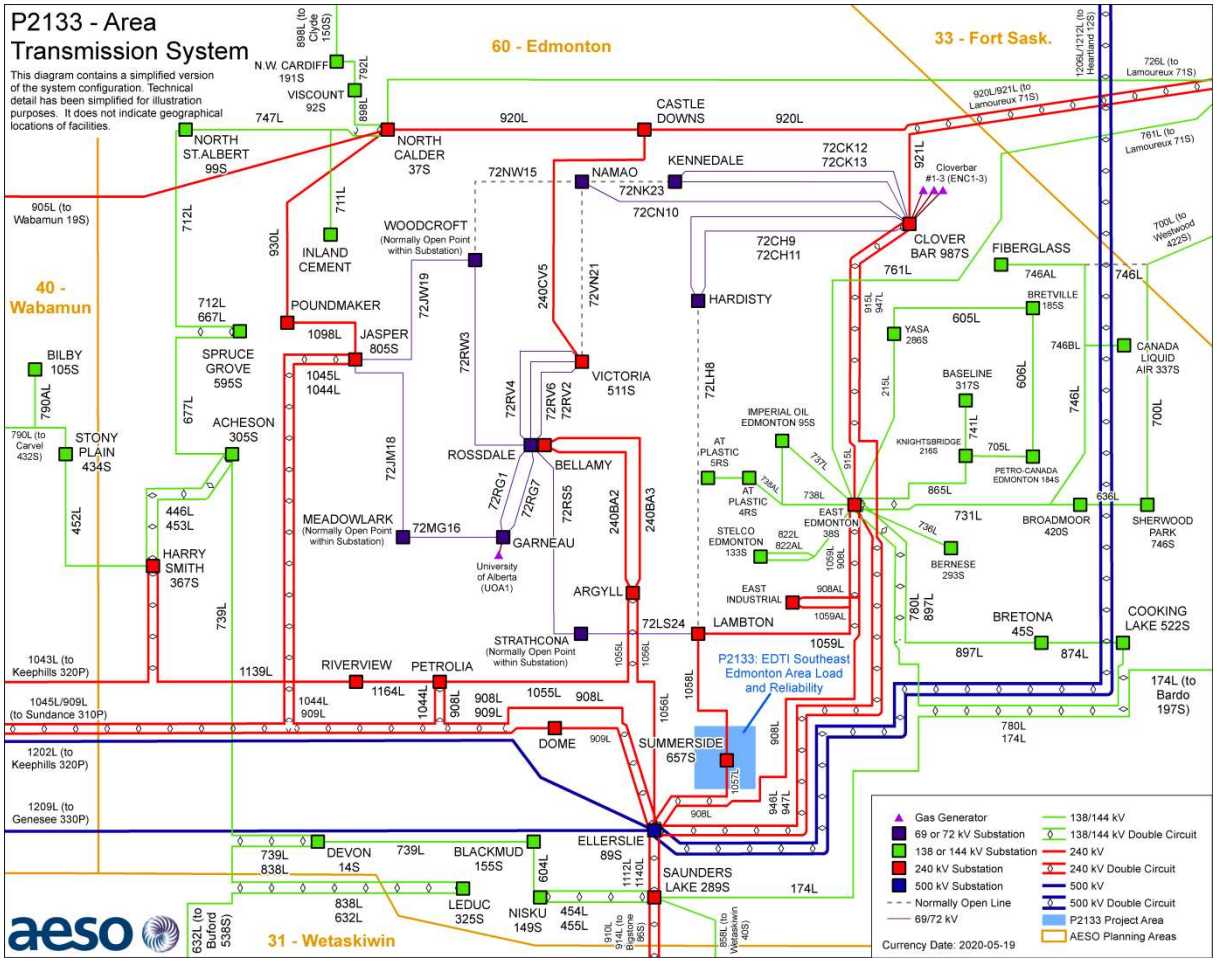
6.4 Specific Project Operational or Transmission Constraints

The Engineering Study Report (ESR) for this Project has indicated that no new or modification to existing and planned RAS(s) or System Control Procedures (SCPs) were identified for this Project, under Category B contingency conditions, based on assumptions used in the study.

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 the **legal owner** of a **transmission facility** and the **market participant** before specifying revised and/or new mitigation measures.

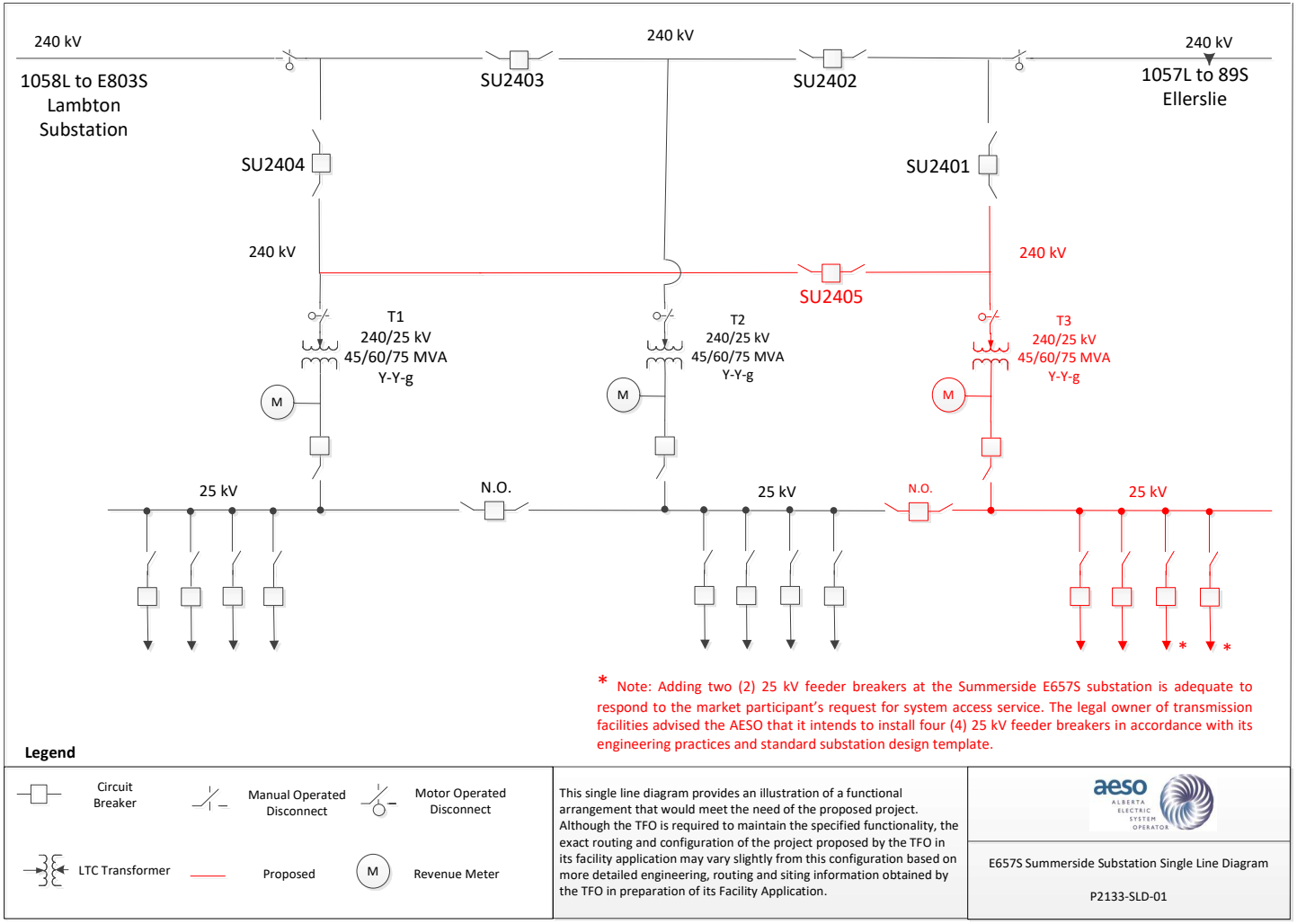
7 Appendices

7.1 Area Transmission System – Project Area

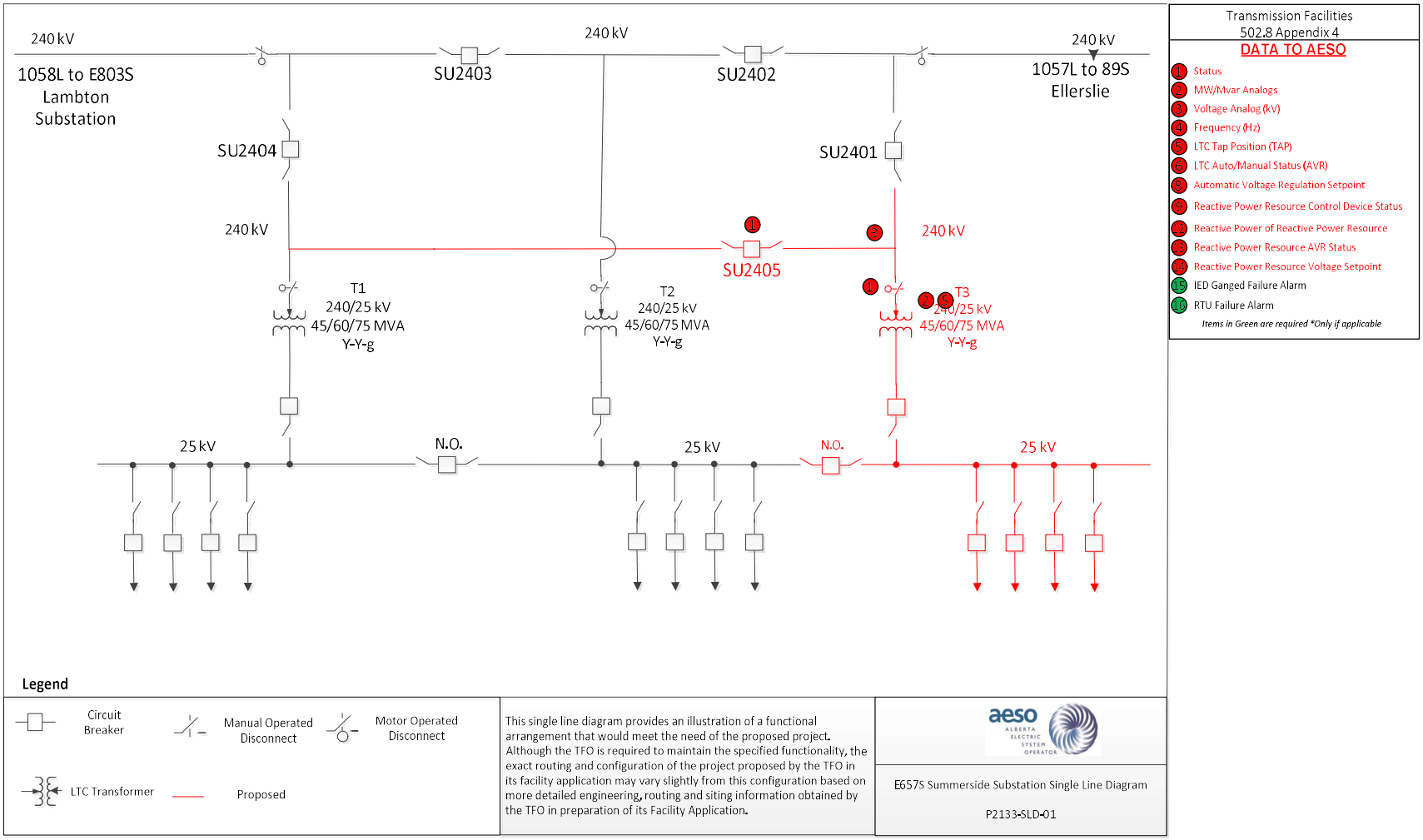


Note: This schematic drawing is intended to illustrate the electrical connection of the area transmission system. It is not to scale, nor does it depict the exact line routes or substation locations.

7.2 Single Line Drawing – Summerside Substation – Existing and Proposed



7.3 SCADA Requirements



7.4 SCADA Data Requirements

Facility/ Location	Device	Element	Indication	Max Latency	Notes
EPCOR	240kV Circuit Breaker	SU2405	Status	15s	
Summerside					
	240kV BUS	BUS1 voltage associated with T3 and SU2405	kV	15s	
	240kV MOS	MOS1 associated with the high side of T3	Status	15s	
	240/25kV Transformer	Real power of the high side of T3	MW	15s	
	240/25kV Transformer	Reactive power of the high side of T3	MVAr	15s	
	240/25kV Transformer	Tap position of T3	Tap Position	15s	If applicable
From AESO					
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				