

TRANSMISSION PLANNING

GENERATION INTERCONNECTION REPORT

2025 TRANSITION CLUSTER STUDY (TCS)

CLUSTER AREA: WESTERN OREGON, PHASE 1, Revision 0

(25TCS CA-WE2 P1-0)

G0793	G0879	G0895
G0794	G0880	G0899
G0801	G0883	G0902
G0803	G0884	G0904
G0806	G0885	G0905
G0807	G0886	G0918
G0808	G0889	G0969
G0811	G0892	G0970
G0812	G0893	G0971
G0877	G0894	

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**PREPARED BY:
BPA Transmission Planning**



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1 Executive Summary

In 2025, Bonneville Power Administration (BPA) initiated the Transition Cluster Study (TCS) under the new Large Generator Interconnection Transition Process, Attachment R of BPA’s Open Access Transmission Tariff (OATT).¹ BPA received 167 Transition Requests that were eligible to participate in the Transition Cluster Study with a total requested Interconnection Service level of approximately 61,100 MW.

This TCS Phase One Cluster Study (TCS PH1) report examines the feasibility and impact of interconnecting the proposed generation projects to BPA’s transmission system. Requests in the Cluster Area were studied at the Points of Interconnection (POIs) according to table below. The generation type, requested MW of Interconnection Service level, project location, and requested Commercial Operation Date are also shown.

Cluster Area Western Oregon (WE2) is comprised of Generation Interconnection Requests (IRs) in Lane and Linn Counties in Oregon. It includes 29 total IRs seeking combined 6,460 MW total Interconnection Service.

Table 1.1: Participants in 2025 TCS PH1 CA Western Oregon

GI #	Gen Type	Studied POI	MW Requested (Generating)	MW Requested (Charging)	Plant Location (County, State)	Requested COD
G0793	Biofuel, BESS	Albany-Eugene 115 kV (North)	80	-80	Linn, OR	Dec 2028
G0794	Biofuel, BESS	Santiam-Toledo 115 kV	80	-80	Linn, OR	Dec 2028
G0801	BESS	Lane 115 kV	200	-200	Lane, OR	Dec 2028
G0803	BESS	Lane 115 kV	200	-200	Lane, OR	Dec 2028
G0806	Biofuel	Lane 500 kV	600	0	Lane, OR	Dec 2028
G0807	Pump Storage Hydro	Lane 500 kV	600	0	Lane, OR	Dec 2030
G0808	BESS	Lane 500 kV	600	-600	Lane, OR	Dec 2030
G0811	Biofuel	Lane 500 kV	600	0	Lane, OR	Dec 2030
G0812	BESS	Lane 500 kV	600	-600	Lane, OR	Dec 2030
G0877	Biofuel	Lebanon 115 kV	80	0	Linn, OR	Dec 2029
G0879	Solar	Alvey 115 kV	80	0	Lane, OR	Dec 2029
G0880	BESS	Alvey 115 kV	80	-80	Lane, OR	Dec 2030
G0883	Biofuel	Santiam 230 kV	80	0	Linn, OR	Dec 2029
G0884	BESS	Lane 500 kV	80	-80	Lane, OR	Dec 2030
G0885	Biofuel	Santiam-Alvey #1 & #2 230 kV	80	0	Linn, OR	Dec 2029
G0886	BESS	Santiam 230 kV	80	-80	Linn, OR	Dec 2030
G0889	BESS	Lane 500 kV	200	-200	Lane, OR	Dec 2030
G0892	Biofuel, BESS	Santiam 230 kV	200	-200	Linn, OR	Dec 2030
G0893	Biofuel, BESS	Santiam 230 kV	200	-200	Linn, OR	Dec 2030
G0894	Biofuel, BESS	Santiam 230 kV	200	-200	Linn, OR	Dec 2030
G0895	Biofuel, BESS	Santiam 230 kV	200	-200	Linn, OR	Dec 2030
G0899	Biofuel, BESS	Santiam-Alvey #1 & #2 230 kV	200	-200	Linn, OR	Dec 2030
G0902	Biofuel, BESS	Santiam-Alvey #1 & #2 230 kV	200	-200	Linn, OR	Dec 2030
G0904	Biofuel, BESS	Santiam 230 kV	200	-200	Linn, OR	Dec 2030

¹ Capitalized terms that are not defined in the text of this report refer to defined terms in BPA’s OATT.



GI #	Gen Type	Studied POI	MW Requested (Generating)	MW Requested (Charging)	Plant Location (County, State)	Requested COD
G0905	Biofuel, BESS	Santiam 230 kV	200	-200	Linn, OR	Dec 2030
G0918	Wind	Santiam-Alvey #1 230 kV (South)	300	0	Linn, OR	Oct 2029
G0969	Biofuel, BESS	Santiam-Toledo 115 kV	80	-80	Linn, OR	Dec 2028
G0970	Biofuel, BESS	Santiam-Alvey #1 & #2 230 kV	80	-80	Linn, OR	Dec 2028
G0971	Biofuel, BESS	Albany-Eugene 115 kV (South)	80	-80	Linn, OR	Dec 2028

Studied POI locations and requirements for each IR are summarized in Table 1.2. Scalable Plan Blocks (SPB) are indicated where applicable.

All IRs will be required to have the necessary communications and controls equipment installed to be available for generator tripping to maintain flexibility and effectiveness of BPA’s Main Grid Remedial Action Schemes (RAS).

Table 1.2: 2025 TCS PH1 CA WE2 Requirements

GI #	Studied POI	Total GI Scope	Total Cost	Contingent Facilities
G0793	Albany-Eugene 115 kV Line (North)	New 115 kV substation on the Albany-Eugene #1 115 kV line (Albany Side), 1x 115 kV gen-tie terminal	\$72M	L0413 – Weirich-Lebanon 115 kV Albany 230/115 jumper upgrade Chemawa 230/115 bank replacement
G0971	Albany-Eugene 115 kV line (South)	New 115 kV Substation looped in on the Albany-Eugene #1 115 kV line (Eugene Side)	\$72M	Alvey-Dillard 115 kV Reconductor
G0879, G0880	Alvey 115 kV	1x 115 kV gen-tie terminal	\$37M	Alvey-Dillard 115 kV Reconductor
G0877	Lebanon 115 kV	1x 115 kV gen-tie terminal	\$22M	L0413 – Weirich-Lebanon 115 kV Lebanon 230/115 Transformer
G0801, G0803 (partial)	Lane 115 kV	1x 115 kV shared gen-tie terminal	\$44M	Alvey-Dillard 115 kV Reconductor
G0803 (Partial), G0806, G0807	Lane 500 kV	New Lane 500 kV Substation, 1x 500 kV shared gen-tie terminal, New Alvey-Lane 500 kV #2	\$204M	Alvey-Dillard 115 kV Reconductor TSEP: North of Marion Upgrades #1 & #2
G0808, G0811	Lane 500 kV	New Lane 500 kV Substation, 1x 500 kV shared gen-tie terminal, New Alvey-Lane 500 kV #2 SPB1: New Alvey-Lane 500 kV #3, Rebuild Marion-Lane #1 500 kV and Reconductor Alvey-Lane 230 #1 230 kV	\$477M	Alvey-Dillard 115 kV Reconductor TSEP: North of Marion Upgrades #1 & #2
G0812, G0884, G0889	Lane 500 kV	New Lane 500 kV Substation, 1x 500 kV shared gen-tie terminal, New Alvey-Lane 500 kV #2 SPB1: New Alvey-Lane 500 kV #3, Rebuild Marion-Lane #1 500 kV and Reconductor Alvey-Lane 230 #1 230 kV	\$509M	Alvey-Dillard 115 kV Reconductor TSEP: North of Marion Upgrades #1 & #2
G0883, G0892, G0893, G0894, G0895	Santiam 230 kV (west bus)	1x 230 kV shared gen-tie terminal	\$58M	TSEP: North of Marion Upgrades #1 & #2 TSEP: Santiam 230 kV redundant BSB Santiam 500/230 kV Bank upgrade Lebanon 230/115 Transformer



GI #	Studied POI	Total GI Scope	Total Cost	Contingent Facilities
G0886	Santiam 230 kV (east bus)	New terminal at Santiam 230 kV East Bus (Shared with G0904 & G0905)	\$22M	TSEP: North of Marion Upgrades #1 & #2 TSEP: Santiam 230 kV redundant BSB Santiam 500/230 kV Bank upgrade Lebanon 230/115 Transformer
G0904, G0905	Santiam 230 kV (east bus)	New terminal at Santiam 230 kV East Bus (Shared with G0886) SPB: New Santiam 500/230 kV transformer and New Marion-Santiam 500 kV line	\$86M	TSEP: North of Marion Upgrades #1 & #2 TSEP: Santiam 230 kV redundant BSB Santiam 500/230 kV Bank upgrade Lebanon 230/115 Transformer
G0885, G0899	Santiam-Alvey #1 & #2 230 kV (north)	1x 230 kV shared gen-tie terminal (Shared with G0902 and G0970)	\$162M	TSEP: North of Marion Upgrades #1 & #2 TSEP: Santiam 230 kV redundant BSB Santiam 500/230 kV Bank upgrade Lebanon 230/115 Transformer
G0902, G0970	Santiam-Alvey #1 & #2 230 kV (north)	New 230 kV Substation looped in on the Santiam-Alvey #1 & #2 230 kV lines (Shared with G0885, G0889) SPB: New Santiam 500/230 kV transformer and New Marion-Santiam 500 kV line	\$80M	TSEP: North of Marion Upgrades #1 & #2 TSEP: Santiam 230 kV redundant BSB Santiam 500/230 kV Bank upgrade Lebanon 230/115 Transformer
G0918	Santiam-Alvey #1 230 kV (south)	New 230 kV Substation looped in on the Santiam-Alvey #1 230 kV line SPB: New Santiam 500/230 kV transformer and New Marion-Santiam 500 kV line	\$196M	TSEP: North of Marion Upgrades #1 & #2 TSEP: Santiam 230 kV redundant BSB Santiam 500/230 kV Bank upgrade Lebanon 230/115 Transformer
G0794	Santiam-Toledo 230 kV Line	New 230 kV Substation on Santiam-Toledo #1 230 kV line, 1x 230 kV gen-tie terminal (shared with G0969)	\$121M	Chemawa 230/115 bank replacement Lebanon 230/115 Transformer
G0969		New 230 kV Substation on Santiam-Toledo #1 230 kV line, (Shared with G0794) SPB: New Santiam 500/230 kV transformer and New Marion-Santiam 500 kV line	\$23M	TSEP: North of Marion Upgrades #1 & #2 TSEP: Santiam 230 kV redundant BSB Santiam 500/230 kV Bank upgrade

BPA’s construction of equipment and facilities required to interconnect a generator typically takes between 3 and 10 years to complete depending on the scope and scale of the plan of service. The estimated time to construct a plan of service is refined through the subsequent stages of the interconnection process.



2 Purpose

The Bonneville Power Administration (BPA) processes requests to interconnect Large Generating Facilities to the BPA Transmission System under the Large Generator Interconnection Transition Process, Attachment R of BPA's OATT, and the Standard Large Generator Interconnection Procedures (LGIP), Attachment L of BPA's OATT. BPA conducted the TCS PH1 to evaluate the impacts of all eligible Transition Requests in the Transition Cluster on the reliability of BPA's Transmission System. The TCS PH1 evaluates equipment and facilities required to reliably interconnect requests at the requested MW of Interconnection Service. The TCS PH1 consists of short circuit analysis and power flow analysis. The TCS PH1 report preliminarily identifies: (1) equipment where short circuit capability limits or thermal or voltage ratings have been exceeded, and (2) Interconnection Facilities and Network Upgrades expected to be required to address those issues.

BPA performed the TCS PH1 by segmenting and studying the Interconnection Requests according to geographically and electrically relevant areas on BPA's Transmission System; those segments are identified as Cluster Areas. BPA identified plans of service for a subset of Interconnection Requests within a Cluster Area in some instances, identified as Scalable Plan Blocks. Cost and timeframe estimates for plans of service identified in this report are non-binding good faith estimates. Costs are allocated amongst Interconnection Requests as outlined in Section 4.2.3 of the LGIP.

3 Disclaimers

This document contains the technical study results of an evaluation of the impact of all proposed Interconnection Requests in the Cluster Area on the reliability of BPA's Transmission System. The TCS PH1 evaluates providing Interconnection Service, meaning the service provided by BPA to interconnect a Large Generating Facility to BPA's Transmission System to enable BPA's Transmission System to receive energy and capacity from the Large Generation Facility at the Point of Interconnection. The study results reflect evaluation of providing Energy Resource Interconnection Service to all Interconnection Requests, allowing each Large Generating Facility to connect and be eligible to deliver output on an "as available" basis up to the requested MWs of Interconnection Service. The interconnection process for Large Generating Facilities does not evaluate the requirements or potential impediments to providing transmission of the electrical output of a Large Generating Facility beyond the Point of Interconnection. A customer that wishes to obtain the right to deliver or inject energy from a Large Generating Facility beyond the Point of Interconnection must take a separate action to obtain transmission delivery service under BPA's OATT. The provision of Point-to-Point Transmission Service or Network Integration Transmission Service may require the construction of additional transmission equipment and facilities.

In addition, the technical studies results do not address generator balancing services that may be required to interconnect a Large Generating Facility to BPA's Transmission System.

These studies were conducted using the best available information at the time of the study. Findings and recommendations are based on information and assumptions that could change. BPA reserves the right to add, delete, or modify any content in this report if new information is provided.



Additional Disclaimers

- 1) A customer’s inclusion of an optional requested POI on a Transition Request does not guarantee that the customer’s request was studied for interconnection at that POI. BPA, in its sole discretion, determined the POI for each Large Generating Facility to improve the reliability benefits, cost and/or benefits of the interconnection for the Cluster Area.
- 2) Energy storage grid charging is defined for this study as importing energy from beyond the POI to the IR storage device. This study evaluates grid charging where elected by each IR, but does not assess all resultant Transmission System requirements beyond the POI. This study presumes that energy storage grid charging connected to BPA’s Transmission System will be treated as a generator (not a load) in context of expected transmission curtailments, expected transmission operating limits, or generation tripping RAS.
- 3) The TCS PH1 does not include the following analyses, which will be provided in the Transition Cluster Study Phase Two Cluster Study or Interconnection Facilities Study:
 - a) Provision of Network Resource Interconnection Service (NRIS);
 - b) Voltage & Transient Stability studies;
 - c) Electromagnetic Transient (EMT) studies; and
 - d) Fault Duty studies for detailed equipment sizing.
- 4) In electing to participate in the TCS, all customers attested that the Generating Facility proposed in a Transition Request would be designed to meet the BPA Transmission Standard “*Technical Requirements for Interconnection to the BPA Transmission Grid*” (STD-N-000001) posted to the BPA Interconnection webpage.
- 5) Any plan of service identified in this study report that would require access and usage of property associated with the Northwest AC Intertie (NWACI) to construct may require the consent of all owners of NWACI facilities to proceed and be beyond BPA’s ability to grant. BPA will continue to study this plan of service but cannot guarantee that the Large Generating Facility may be interconnected under that plan of service.
 - i) As noted above, the TCS PH1 does not evaluate requirements or potential impediments to providing transmission delivery service. Any plan of service identified in this study report that would provide electrical connectivity between a Large Generating Facility and a NWACI facility does not provide the customer any right or ability to obtain transmission delivery service on a NWACI facility.

4 Study Assumptions

4.1 General Assumptions

BPA Transmission uses PowerWorld for positive sequence analysis (CTG Tool add-on, ATC Tool add-on, PV/QV Tool add-on, Transient Stability Tool add-on).

For TCS-PH1, “MW injection limit” tests are applied at each POI, to determine IR’s MW thresholds at which a steady state system limiter occurs and requires mitigation. Injection limits are also applied in the reverse direction, at POIs that have requested Battery Energy Storage System (BESS) grid charging. PowerWorld’s ATC Tool is used to conduct these injection limit tests.



All analysis presumes Energy Resource Interconnection Service (ERIS) only. BPA Planning presumes IRs are not all dispatched simultaneously. Generally, BPA Planning only presumes IRs are dispatched simultaneously when at most one to two Bulk Electric System (BES) nodes away from the POI under study.

The TCS PH1 assumes all Generating Facilities studied are designed to the standards in STD-N-000001 at the time of publication of this report. Adherence to BPA STD-N-000001 includes many detailed requirements covering but not limited to: minimum BPA communications network transport; BPA control system hardware; participation in BPA RAS; protective relaying; disturbance monitoring; scheduling and metering; voltage control; frequency response; reactive power quality; and more.

4.2 Senior-Queued IRs and Non-BPA IRs

The following list of IRs were deemed impactful and senior to the Cluster Area and were assumed to be dispatched online for the TCS PH1. The list includes Interconnection Requests that were not subject to Attachment R of BPA’s OATT (Bypass IRs), Late-Stage Projects that were eligible and elected to proceed serially, and non-BPA queued IRs in adjacent Transmission Provider queues if known.

Table 4.2: Senior Queued IRs Assumed In-Service

Queue #	POI (owner)	MW Generating	MW Grid-Charging	Fuel Type
G0724	Fairview 230 kV	280	-280	BESS
N1007 (C2-79)	Conser Road 115 kV (PAC)	145	0	BESS

4.3 Communications & Control Capability (C&C)

The TCS PH1 assumed:

1. All POI stations are capable of BPA Main Grid Remedial Action Scheme (RAS) participation. There is WECC-Class 1 communications (fully redundant, alternately routed) to each generation facility where the Main Grid RAS Generation Dropping (GD) will occur.
2. All POI stations have:
 - a. BPA SCADA Control & Indication
 - b. Transfer Trip or Current Differential protective relaying on all gen-ties from BPA station to customer station
 - c. Control Phasor Measurement Units (CPMUs)
 - d. Revenue Metering and telemetry for each IR

5 Study Methodology

5.1 Cluster Area Definition

The following maps illustrate the geographic coordinates for the IRs assessed in Cluster Area Western Oregon.



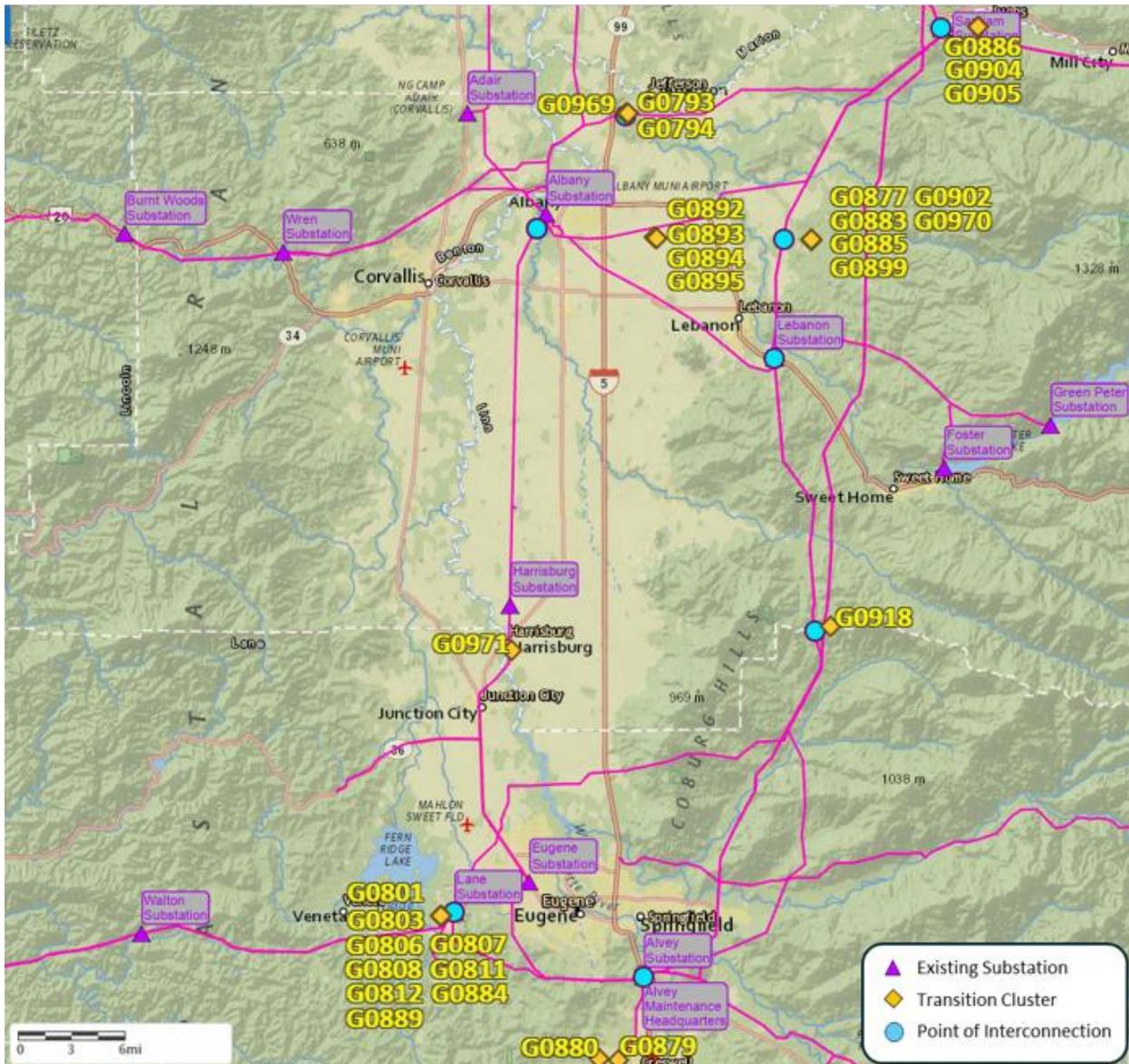


Figure 1: Western Oregon Transition Cluster Area WE1



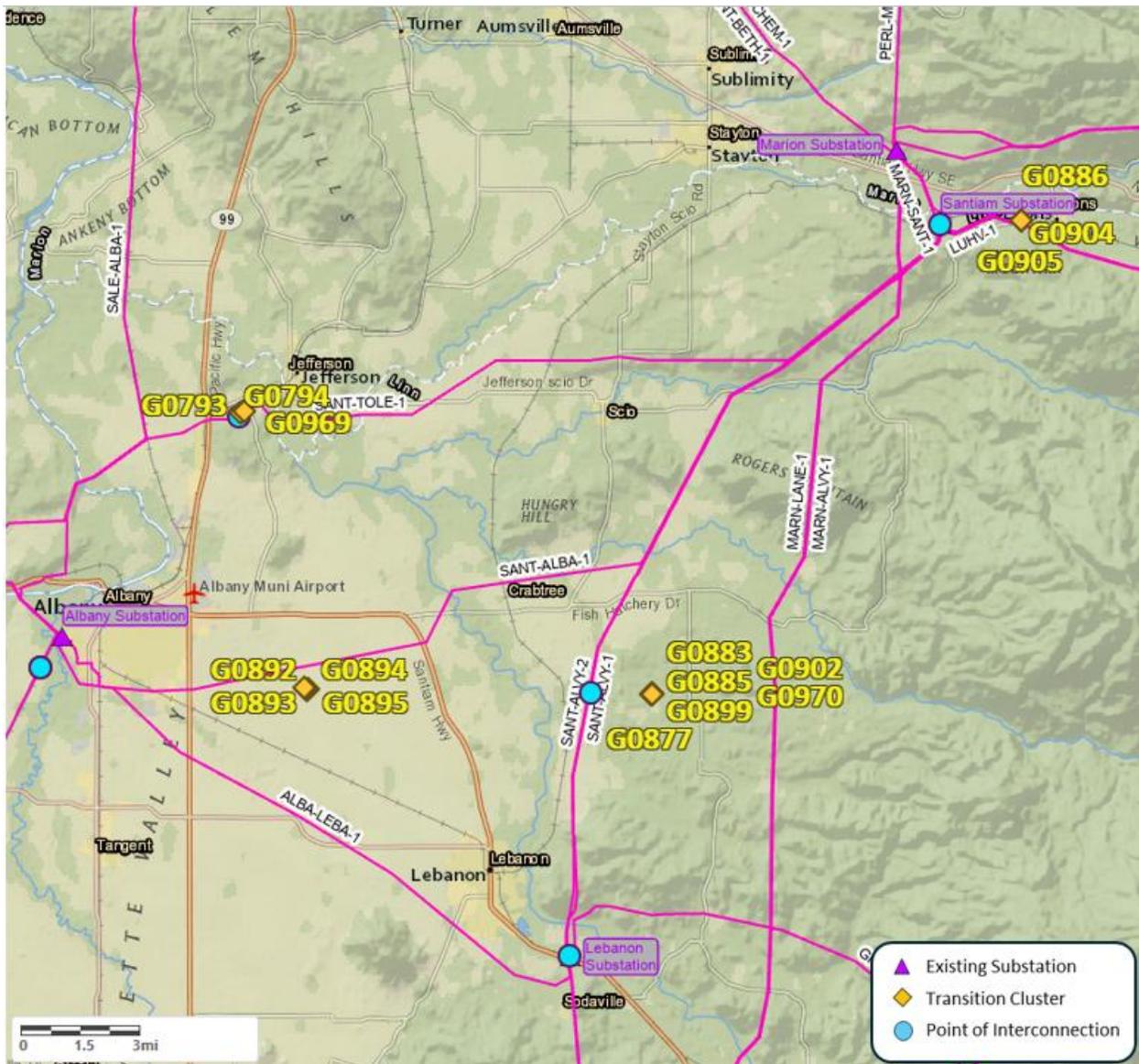


Figure 2: Santiam, Albany, and Lebanon POI Areas



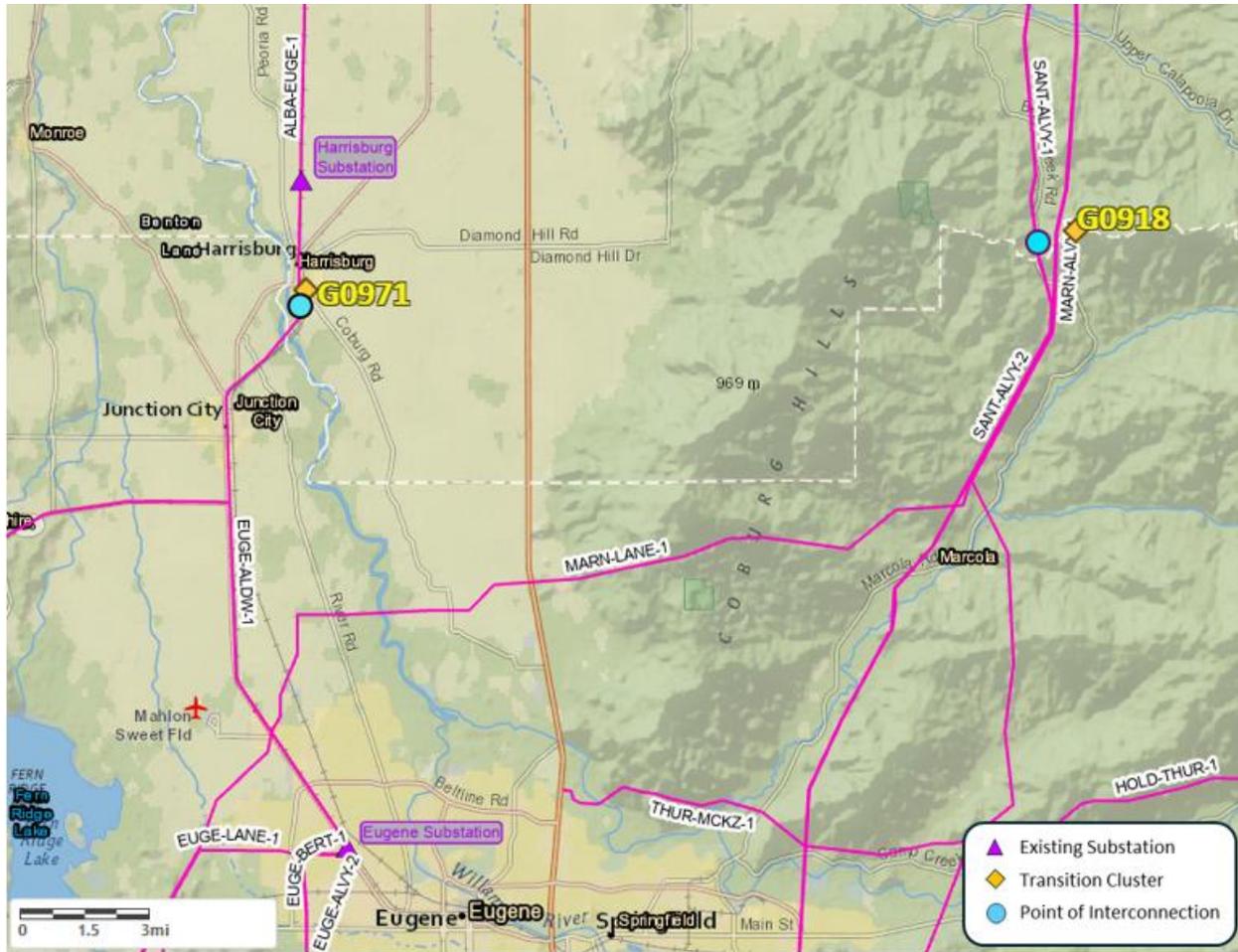


Figure 3: Harrisburg and Santiam-Alvey South POI Areas



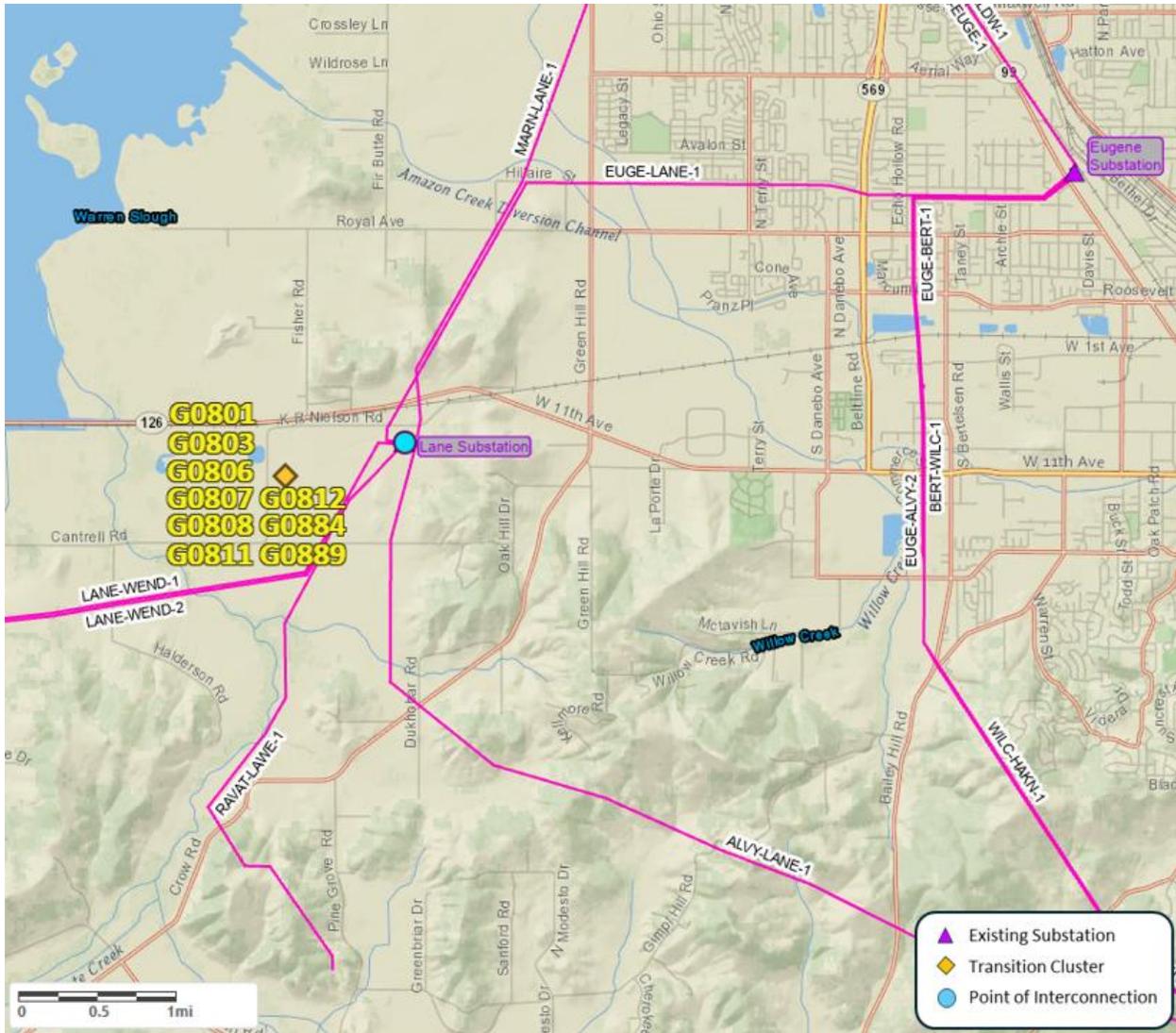


Figure 4: Lane POI Area



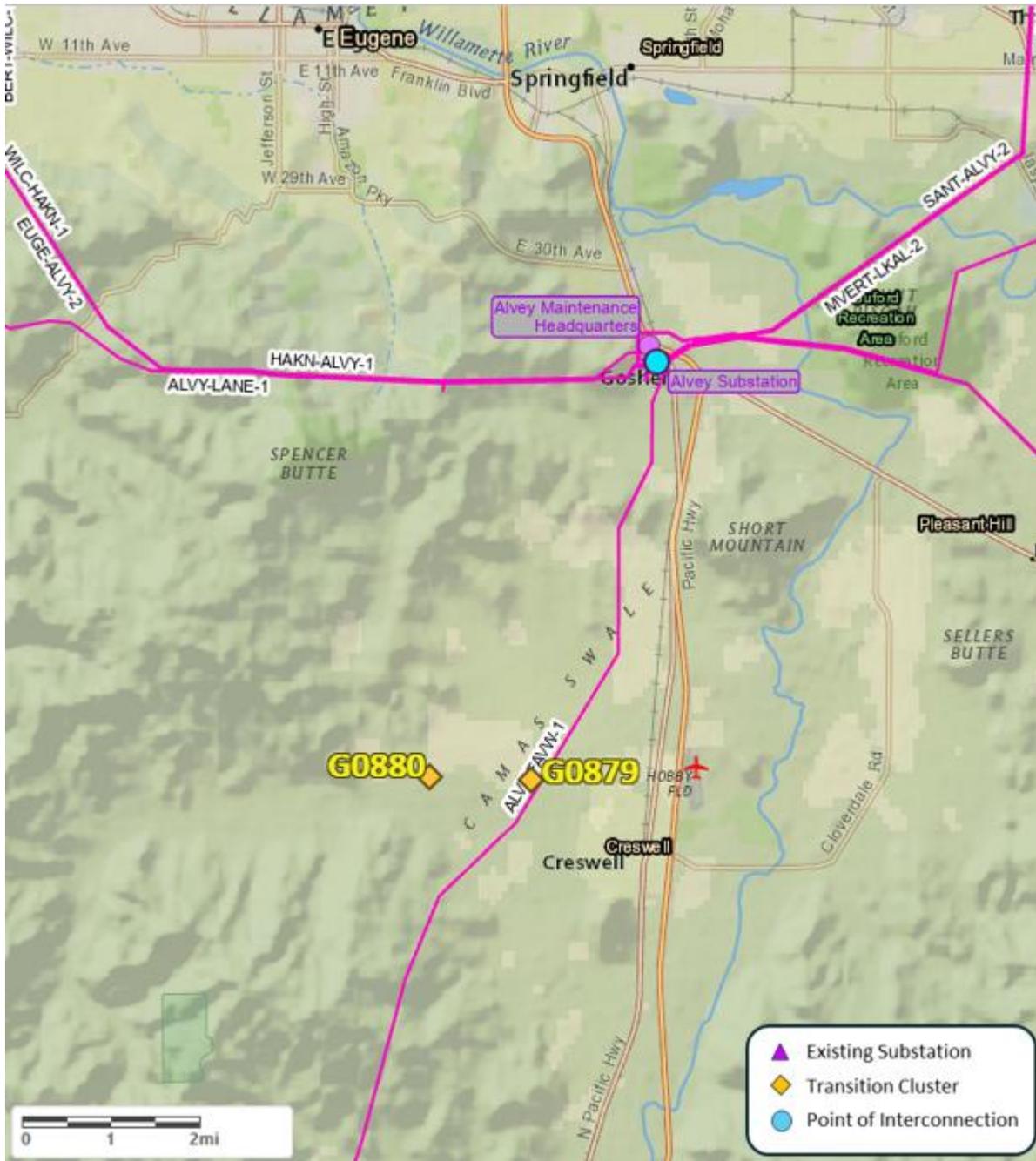


Figure 5: Alvey POI Area



5.2 Studied POIs

The following table indicates the studied POI for each request in the Cluster Area.

Table 5.2: Studied POI locations

GI #	Gen Type	MW Generating	MW Grid-Charging	Studied POI
G0971	Biofuel, BESS	80	-80	Albany-Eugene 115 kV (South)
G0793	Biofuel, BESS	80	-80	Albany-Eugene 115 kV (North)
G0879	Solar	80	0	Alvey 115 kV
G0880	BESS	80	-80	Alvey 115 kV (Shared Gen Tie with G0879)
G0801	BESS	200	-200	Lane 115 kV
G0803	BESS	200	-200	Lane 115 kV (Shared Gen Tie with G0801)
G0806	Biofuel	600	0	Lane 500 kV
G0807	Pump Hydro Storage	600	0	Lane 500 kV (Shared Gen Tie with G0806)
G0808	BESS	600	-600	Lane 500 kV
G0811	Biofuel	600	0	Lane 500 kV (Shared Gen Tie with G0808)
G0812	BESS	600	-600	Lane 500 kV
G0884	BESS	80	-80	Lane 500 kV (Shared Gen Tie with G0812)
G0889	BESS	200	-200	Lane 500 kV (Shared Gen Tie with G0812)
G0877	Biofuel	80	0	Lebanon 115 kV
G0883	Biofuel	80	0	Santiam 230 kV
G0886	BESS	80	-80	Santiam 230 kV
G0892	Biofuel, BESS	200	-200	Santiam 230 kV (Shared Gen Tie with G0883)
G0893	Biofuel, BESS	200	-200	Santiam 230 kV (Shared Gen Tie with G0883)
G0894	Biofuel, BESS	200	-200	Santiam 230 kV (Shared Gen Tie with G0883)
G0895	Biofuel, BESS	200	-200	Santiam 230 kV (Shared Gen Tie with G0883)
G0904	Biofuel, BESS	200	-200	Santiam 230 kV (Shared Gen Tie with G0886)
G0905	Biofuel, BESS	200	-200	Santiam 230 kV (Shared Gen Tie with G0886)
G0885	Biofuel	80	0	Santiam-Alvey #1 & #2 230 kV (North)
G0899	Biofuel, BESS	200	-200	Santiam-Alvey #1 & #2 230 kV (North) (Shared Gen Tie with G0885)
G0902	Biofuel, BESS	200	-200	Santiam-Alvey #1 & #2 230 kV (North) (Shared Gen Tie with G0885)
G0970	Biofuel, BESS	80	-80	Santiam-Alvey #1 & #2 230 kV (North) (Shared Gen Tie with G0885)
G0918	Wind	300	0	Santiam-Alvey #1 230 kV (South)
G0969	Biofuel, BESS	80	-80	Santiam-Toledo 230/115 kV
G0794	Biofuel, BESS	80	-80	Santiam-Toledo 230/115 kV (Shared Gen Tie with G0969)

5.3 Starting Base Cases

The following WECC Cases were used for CA WE2. WECC approved 2026 Heavy Summer (HS), 2030 Heavy Summer (HS), and 2030 Heavy Winter (HW) base cases were used for this interconnection study.

Cases were modified to include applicable senior-queued IR POIs and their associated Plans of Service, as reported in their associated System Impact or Facility study reports published on host utility’s OASIS.



In addition, select planned BPA Projects were modeled as senior to the TCS and impactful to the POI performance. Impactful topology additions for CA WE2 include:

- Alvey-Dillard Tap 115 kV Reconductor (BPA)
- Chemawa 230/115 kV Bank Replacement (BPA)
- L0413 PAC Weirich-Lebanon 115 kV
- Lebanon 230/115 kV Transformer Install (BPA)
 - Lebanon 230/115 kV Transformer
 - Albany-Lebanon CT Replacement
 - Santiam Alvey #1 & #2 Line Split
- North of Marion Upgrade #1 & #2 Upgrade
- Santiam 230 kV Redundant Bus Sectionalizing Breaker (BPA)
- Santiam 500/230 kV Bank Corrective Action Project (BPA)

Additional summary of significant projects deemed Contingent and assumed in-service as a base-state for this Cluster Area are specified in section 6.

5.3.1 Load and Resource Scenario Descriptions

The 2026 HS, 2030 HS, and 2030 HW WECC cases were further modified to simulate both a north-to-south (British Columbia to California) and a south-to-north operating (California to British Columbia) pattern along the interstate 5 corridor. The Willamette Valley United States Army Corps of Engineers (USACE) hydroelectric dams were simulated at varied outputs to determine the impact of local generation on the POI.

5.3.2 Topology Sensitivity Descriptions

Line load interconnection request, L0558 – 300 MW load at Green Valley Substation along the Alvey-Fairview 230 kV line, was also added to the cases.

5.4 Phase 1 POI Injection Tests

Steady state contingency analysis was conducted at each POI increasing total generating or grid-charging amounts until a reliability limit was reached. The assumed source/sink pairs for these injection tests were as follows. Detailed findings of these injection tests can be found in the Results Section.

Mode	Source	Sink
Generating	POI Generator	Paul 500 kV
Grid Charging	Paul 500 kV	POI Grid Charging BESS

5.5 Phase 1 POI Short Circuit Ratio Strength Tests

Per BPA STD-N-000001, all LIR POIs shall have Short Circuit Ratio (SCR) of 3 or greater for all critical NERC TPL-001 P1 conditions.

All POIs evaluated passed BPA’s SCR strength test, except for the following. These locations will require additional mitigation defined in the results:

Lane 500 kV only allows for a generation amount of 1370 MW to meet the All Lines In Service (ALIS) 5.0 SCR requirement. The worst N-1 outage for Lane 500 only allows a generation



amount of 925 MW to meet the 3.0 SCR requirement. Additional network connections from Lane will be required to overcome this SCR deficiency (see Section 7).

6 Contingent Facilities Assumed In-Service

Cluster Area WE2 has multiple contingent facility requirements for each POI, which are enumerated in the following subsections.

1. 2023 TSEP: North of Marion #1 (NOM #1) upgrade
 - a. Constructs new Chemawa 500 kV bus, installs new Chemawa 500/230 kV transformer bank
 - b. Rebuilds Pearl – Chemawa section of Big Eddy-Chemawa from 230 kV to 500 kV
 - c. Rebuilds Chemawa – Santiam #1 from 230 kV to 500 kV
2. 2023 TSEP: North of Marion #2 (NOM #2) upgrade
 - a. Rebuilds Pearl-Marion #1 500 kV 2.5” expanded conductor to 4000A capacity conductor
3. Albany 230/115 kV secondary jumper reconductor
 - a. Project upgrades bus and conductor connections to the Albany 115 kV bus that match the transformer ratings
4. Alvey-Dillard Tap 115 kV line rebuild
 - a. Project rebuilds 3.31 miles of existing 397.5 ACSR IBIS conductor with new 795 KCMIL AAC/TW Arbutus conductor rated at 100 degrees Celsius maximum operating temperature (MOT)
5. Chemawa 230/115 kV transformer bank replacement
 - a. Project upgrades the bank from 250 MVA to 300 MVA
6. L0413: Weirich-Lebanon 115 kV (PAC)
 - a. Project installs a new Weirich - BPA Lebanon 115 kV line (<1 mile) with new breaker and terminal at BPA Lebanon
7. Lebanon 230/115 kV transformer bank addition
 - a. Project connects new transformer at BPA Lebanon 115 kV to the Santiam-Alvey #1 230 kV line. The Santiam-Alvey #1 and #2 will also be split (remove jumper) and upgraded to 100C MOT. Project also uprates a limiting CT at Lebanon 115 kV.
8. Santiam 230 kV redundant Bus Sectionalizing Breaker addition
 - a. Installs second 230 kV sectionalizing breaker between East and West 230 kV bus sections
9. Santiam 500/230 kV transformer bank upgrades
 - a. Project upgrades breakers and disconnects with 4000A ratings to remove bottlenecks on the Santiam 500/230 kV transformer (1,344 MVA)

The following projects are assumed in-service for each POI as indicated. They are deemed Contingent Facilities for this study and are required to be energized prior to IRs at the indicated POIs taking Interconnection Service.



Table 6.1: Contingent Facilities necessary Per POI

Project Name	Required for POIs	Driver	Estimated Cost (\$M)	Estimated I/S Date
2023 TSEP: NOM#1 upgrade 2023 TSEP: NOM#2 upgrade	Lane 500 kV, Santiam 230 kV, Santiam-Alvey #1 & #2 230 kV (North), Santiam-Alvey #1 230 kV (South), Santiam-Toledo 230 kV	Commercial TSRs	\$300 M ²	2033 ²
Alvey-Dillard Tap 115 kV Line Rebuild	Albany-Eugene 115 kV (South), Alvey 115 kV, Lane 115 kV, Lane 500 kV	BPA internal	\$3 M	2028
Albany 230/115 kV secondary Jumper reconductor	Albany-Eugene 115 kV (North)	BPA internal	\$0.6 M	2027
Chemawa 230/115 kV Bank Replacement	Albany-Eugene 115 kV (North), Santiam 230 kV, Santiam-Alvey #1 & #2 230 kV (North), Santiam-Alvey #1 230 kV (South), Santiam-Toledo 230 kV	BPA internal	\$21 M	2030
Lebanon 230/115 kV Bank addition	Albany-Eugene 115 kV (North), Lebanon 115 kV, Santiam 230 kV, Santiam-Alvey #1 & #2 230 kV (North), Santiam-Alvey #1 230 kV (South)	BPA internal	N/A ¹	2030
L0413: Weirich-Lebanon 115 kV	Albany-Eugene 115 kV (North), Lebanon 115 kV, Santiam-Alvey #1 & #2 230 kV (North), Santiam-Alvey #1 230 kV (South)	LLIR	\$9.1 M	2026
2022 TSEP: Santiam 230 kV Redundant BSB	Santiam 230 kV, Santiam-Alvey #1 & #2 230 kV (North), Santiam-Alvey #1 230 kV (South), Santiam-Toledo 230 kV	Commercial TSRs	N/A ¹	N/A ¹
Santiam 500/230 kV Bank upgrade	Santiam 230 kV, Santiam-Alvey #1 & #2 230 kV (North), Santiam-Alvey #1 230 kV (South), Santiam-Toledo 230 kV	BPA internal	N/A ¹	N/A ¹

1. Project in early pre-scoping phases, estimated costs or schedule not yet available

2. Project in early pre-scoping phase, cost and schedule from 2022 TSEP Report



7 Technical Analysis & Study Results

7.1 Albany-Eugene 115 kV (North)

TCS System Performance

Table 7.1: Results for Albany-Eugene 115 kV (North)

POI MW Threshold	Affected IRs	Limiter (Element or Contingency)	Mitigation
-80 to -26	G0793	Salem 230/115 kV (TPL-001 P2)	No mitigation required
-25 to 0	G0793	Albany-Lebanon 115 kV (TPL-001 P1)	Contingent Projects: L0413 Weirich-Lebanon (PAC) and Lebanon 230/115 bank addition
0 to 80	G0793	None	No mitigation required

Proposed Mitigations

There is no transmission mitigation required for connecting +80 MW on the Albany-Eugene 115 kV (north of the normally open disconnect). All grid charging at this POI is contingent on the L0413 and Lebanon 230/115 kV transformer projects.

7.2 Albany-Eugene 115 kV (South)

TCS System Performance

Table 7.2: Results for Albany-Eugene 115 kV (South)

POI MW Threshold	Affected IRs	Limiter (Element or Contingency)	Mitigation
-80 to -1	G0971	Lane-Willow Creek 115 kV (EWEB) (TPL-001 P2)	New Local RAS
0 to 80	G0971	None	No mitigation required

Proposed Mitigations

There is no transmission mitigation required for connecting 80 MW on the Albany-Eugene 115 kV (north of the normally open disconnect). All grid charging at this POI will be required to participate in multiple new local RAS schemes.

7.3 Alvey 115 kV

TCS System Performance

Table 7.3: Results for Alvey 115 kV

POI MW Threshold	Affected IRs	Limiter (Element or Contingency)	Mitigation
0 (Charge)	G0879, G0880	Lane-Willow Creek (EWEB) (TPL-001 P2)	New Local RAS
+300 (Gen)	G0879, G0880	Alvey-Dillard Tap 115 kV	No mitigation required for 160 MW

Proposed Mitigations

There is no transmission mitigation required for connecting +160 MW at Alvey 115 kV. All grid charging at this POI will be required to participate in a local RAS scheme.



7.4 Lebanon 115 kV

TCS System Performance

Table 7.4: Results for Lebanon 115 kV

POI MW Threshold	IRs at POI	Limiters (Element or Contingency)	Mitigation
0 to 50 (Max Hydro condition)	G0877	Weirich-Crowfoot 115 kV (PAC) (TPL-001 P2)	New Local RAS for Green Peter and Foster Dams Max output conditions
0 to 80 (Min Hydro condition)	G0877	Weirich-Crowfoot 115 kV (PAC) (TPL-001 P2)	No mitigation required for Green Peter and Foster Dams Min output conditions

Proposed Mitigations

There is no transmission mitigation required for connecting 80 MW at Lebanon 115 kV under most operating scenarios. A new Local RAS will be required to interconnect the full 80MW during full simultaneous output of Foster and Green Peter hydro facilities.

7.5 Lane 115 kV

TCS System Performance

Table 7.5: Results for Lane 115 kV POI

POI MW Threshold	IRs at POI	Limiters (Element or Contingency)	Mitigation
-115 to -51	G0801, G0803 G0884	Multiple O/Ls (TPL-001 P2)	Lane 230 kV Redundant bus sectionalizing breaker, New BPA RAS Participation
-50 to -1	G0801, G0803 G0884	Lane 230/115 kV #2 O/L (TPL-001 P2)	New BPA RAS Participation
0 to 300	G0801, G0803 G0884	Lane-Willow Creek 115 kV (EWEB) O/L (TPL-001 P1)	Limit injection at Lane 115 kV to 300 MW, IRs moved to Lane 500 kV
301 to 350	G0801, G0803 G0884	Eugene-Lane 115 kV (BPA) O/L (TPL-001 P1)	Limit injection at Lane 115 kV to 300 MW, IRs moved to Lane 500 kV

Proposed Mitigations

The sub grid network around Lane has unique flow impacts to foreign utilities, so the Lane 115 kV POI must be limited to 300 MW. Additional generation interconnections at this site will be directed to the next higher voltage class. All grid charging at this POI requires a redundant Lane 230 kV bus sectionalizing breaker and participating in a local RAS scheme.

Due to the POI thresholds, G0803 (200MW) will be required to connect at Lane 500 kV or reduce to 100 MW total to connect at Lane 115 kV. The scope and estimates will reflect a 500 kV connection for G0803. G0884 (80MW) will be directed to Lane 500 kV POI.



7.6 Lane 230 kV

TCS System Performance

Table 7.6: Results for Lane 230 kV

POI MW Threshold	IRs at POI	Limitier (Element or Contingency)	Mitigation
0 to 25	G0806,G0807	Lane-Willow Creek 115 kV (EWEB) (TPL-001 P1)	Move to Lane 500 kV
26 to 100	G0806, G0807	Eugene-Lane 115 kV (BPA) (TPL-001 P1)	Move to Lane 500 kV
>100	G0806, G0807	Lane 500/230 bank (BPA) TPL-001 P1s)	Move to Lane 500 kV

Proposed Mitigations

No amount of the requested generation can be connected at Lane 230 kV (after filling Lane 115 kV) without major impacts to a 3rd party utility. The POI will be limited to 0 MW and moved up to the next voltage class at Lane 500 kV.

7.7 Lane 500 kV

TCS System Performance

Table 7.7: Results for Lane 500 kV

POI MW Threshold	IRs at POI	Limitier (Element or Contingency)	Mitigation
0 to 1749	G0803, G0806, G0807, G0808, G0811, G0812, G0884, G0889	Lane-Willow Creek 115 kV (EWEB) (TPL-001 P1)	New Lane-Alvey 500 kV #2 line (14mi)
1750 to 2049	G0808, G0811, G0812, G0884, G0889	Alvey-Lane 230 #1 kV O/L (TPL-001 P1)	Scalable Plan Block 1: New Lane-Alvey 500 kV #3 Line (14mi) & Rebuild Marion-Lane to 100C MOT (67mi) Reconductor Lane-Alvey 230 kV (14mi)
2050 to 3380	G0811, G0812 G0884, G0889	Alvey-Dixonville 230LV (PAC) O/L (TPL-001 P2)	multiple New BPA RAS algorithms
-650 to -1*	G0807, G0808 G0811, G0812 G0884, G0889	Dixonville 500/230 kV (PAC) O/L (TPL-001 P2)	multiple New BPA RAS algorithms

*Charging Breakpoints assume the Generation mitigations are in service.

Proposed Mitigations

Generating any MW at Lane 500 kV requires transmission reinforcement of a new Lane-Alvey 500 kV #2 line. It is also contingent on the North of Marion Upgrade #1 & #2 reinforcement project.

To interconnect the next 1750 MW, another Lane-Alvey 500kv #3 line, rebuild of Marion-Lane 500 kV, reconductor of Lane-Alvey 230 kV, restoring Marion-Lane 500 kV to 100 C MOT, and new local RAS generation tripping will be required.

The total 3680 MW at Lane (3,380 MW at Lane 500 kV; 300 MW at Lane 115 kV) can be interconnected with all these mitigations. Additionally, all grid charging at this POI requires participation in new local RAS algorithms.



7.8 Santiam Area POIs

TCS System Performance

POIs at or adjacent to BPA Santiam station all impact similar system limiters. This includes POIs at: Santiam 230 kV, Santiam-Alvey #1 & #2 30 kV (North), Santiam-Alvey #1 230 kV (South), and Santiam-Toledo 230 kV. To ascribe requirements, the IRs were ramped across all the affected Santiam-area POIs.

Table 7.8.1 Santiam Area Ramp Order

GI #	MW Gen	MW Charge	Studied POI
G0794	80	-80	Santiam-Toledo 230 kV
G0883	80	0	Santiam 230 kV
G0885	80	0	Santiam-Alvey #1 & #2 230 kV (North)
G0886	80	-80	Santiam 230 kV
G0892	200	-200	Santiam 230 kV
G0893	200	-200	Santiam 230 kV
G0894	200	-200	Santiam 230 kV
G0895	200	-200	Santiam 230 kV
subtotal	1120	-960	
G0899	200	-200	Santiam-Alvey #1 & #2 230 kV (North)
subtotal	1320	-1160	
G0902	200	-200	Santiam-Alvey #1 & #2 230 kV (North)
G0904	200	-200	Santiam 230 kV
subtotal	1720	-1560	
G0905	200	-200	Santiam 230 kV
G0918	300	0	Santiam-Alvey #1 230 kV (South)
G0969	80	-80	Santiam-Toledo 230 kV
G0970	80	-80	Santiam-Alvey #1 & #2 230 kV (North)
Total	2380	-1920	

Table 7.8.2: Results for Santiam Area Performance

POI MW Threshold	IRs affected	Limiter (Element or Contingency)	Mitigation
0	All	North of Marion elements (TPL-001 P1, P2, P4, P7)	Contingent Facility (TSEP: NOM#1 and NOM#2)
0 to 500	G0902, G0918, G0969, G0970	Multiple Overloads (TPL-001 P2)	Contingent Facility (Santiam 230 kV BSB addition)
0 to 500	G0918, G0970	Weirich-Crowfoot-Lebanon 115 kV (PAC) (TPL-001 P2)	Affected System Study (PAC)
501 to 650	G0918, G0970	Albany-Lebanon 115 kV (TPL-001 P2)	Contingent Facilities: L0413 Weirich-Lebanon (PAC), Lebanon 230/115 bank addition Albany-Lebanon 115 kV reconductor
651 to 1399	G0794, G0883, G0886, G0892, G0893, G0894, G0895, G0885, G0899	None	None
1400 to 1749	G0902, G904, G0905, G0918, G0969, G0970	Multiple Overloads (TPL-001 P1)	Scalable Plan Block: 2nd Santiam 500/230 kV transformer and New Marion-Santiam 500 kV #2 line
>1750	G0905, G0918, G0969, G0970	Santiam-Alvey #1 230 kV (TPL-001 P7)	SPB: Multiple New RAS algorithms



POI MW Threshold	IRs affected	Limiter (Element or Contingency)	Mitigation
-25 to -1*	G0794, G0969	Toledo-Wendson #1 230 kV O/L (TPL-001 P1,P2)	New RAS algorithms for only Santiam-Toledo POI with multiple algorithms
-150 to -26*	G0899, G0902, G0970	Santiam-Alvey #2 230 kV (TPL-001 P2)	New RAS algorithms for only Santiam-Alvey #1 & #2 POIs
> -1000*	G0899, G0902, G0904, G0905, G0918, G0969, G0970	Dixonville 500/230 kV O/L (PAC) (TPL-001 P2)	Multiple New RAS algorithms across multiple POIs

*Charging thresholds assume the mitigations for discharging/generating are in service.

Proposed Mitigations

Discharging

All Santiam area requests require the North of Marion Upgrade #1 & #2 reinforcement projects as Contingent Facilities, due to impacts from total MW injections at Marion 500 kV.

Only the POIs along the Santiam-Alvey #1 & #2 230 kV and Santiam-Toledo 230 kV lines will require a redundant bus-sectionalizing breaker at Santiam 230 kV (contingent facility) when generating beyond 500 MW.

Only the POIs on the Santiam-Alvey #1 & #2 230 kV lines will require an upgrade of BPA Albany-Lebanon 115 kV and an affected system study from the element owner (PAC) for generation beyond 500 MW.

Across all Santiam area POIs, generating more than combined 1400 MW will require building a new Santiam 500/230 kV transformer and a new Marion-Santiam 500 kV #2 line.

Across all Santiam area POIs, generating more than combined 1750 MW will require a new local RAS to trip the generators for P1 outage conditions.

Charging

All grid charging Santiam area POI requests will be required to participate in a local RAS scheme. The interconnections along the Santiam-Alvey #1 & #2 and Santiam-Toledo 230 kV lines will require additional local RAS algorithms.

8 Affected System Impacts

The analysis of the proposed interconnections studied in this Cluster Area identified potential adverse system impacts on the Affected Systems identified below. The results of this study report will be shared with the Affected System Operator/s of those Affected System/s. The Affected System Operator/s identified below may determine a study is required and that actions are required on that Affected System to mitigate the impacts of the proposed interconnection on BPA’s Transmission System. **Plans of service identified in this report may be modified or revised in response to an affected utility system study result.**

Any plans of service identified to interconnect a request, including plans of service identified in an affected system study, that require access and usage of real property associated with the Northwest AC Intertie (NWACI) to construct or impact the rights of an owner of a NWACI



facility may require the consent of all owners to proceed and be beyond BPA’s ability to grant. BPA cannot guarantee that the Large Generating Facility can be interconnected under that plan of service.

Affected System	Elements Impacted	POIs (G#s)
PAC & PGE	Marion 500 kV station: new MARN-SANT 500 kV line, Alvey 500 kV station (new Lane-Alvey 500 lines), Partial NWACI Facilities	SANT 230 (G0902, G904, G0905, G0969) SANT-ALVY 230 North (G0970) SANT-ALVY 230 South (G0918)
PAC	Weirich-Crowfoot-Lebanon 115 kV	SANT-ALVY 230 North (G0885, G0899, G0902, G0970) SANT-ALVY 230 South (G0918)

9 Interconnection Facility Requirements

Contingent Facilities are not included in this section, see Section 6 for POI-specific contingent facility designations

9.1 Albany-Eugene 115 kV (North)

Table 9.1: POI Albany-Eugene 115 kV (North) Facility requirements

G#	BPA Station Work	BPA Non-Station Work
G0793	New 115 kV BAAH substation, 1x 115 kV gen-tie terminal	N/A

The Albany-Eugene #1 115 kV line is a 40 mile line between Albany 115 kV substation and Eugene 115 kV substation both owned by BPA. Switch B975 is operated normally open, 22 miles from Albany. Requirements for this POI:

1. BPA will develop a new 115 kV, 4 breaker ring bus substation at the POI north of the normally open switch including development of a new substation, 4 power circuit breakers, 9 disconnect switches and associated control, relaying, and communications equipment.
2. Participate in Local RAS for grid charging.
3. Installation of BPA-required C&C equipment at each customer’s Collector site (RAS, Meters, relays, Control House space)
4. Moderate development of C&C hardware at BPA’s POI substation.

The customer will construct a 115 kV line from the BPA POI station to their generation facility. The customer will construct a 115/34.5 kV substation directly adjacent to the POI line to support their 34.5 kV feeders at their collector site.



9.2 Albany-Eugene 115 kV (South)

Table 9.2: Albany-Eugene 115 kV (South) Facility requirements

G#	BPA Station Work	BPA Non-Station Work
G0971	New 115 kV BAAH substation, 1x 115 kV gen-tie terminal	N/A

The Albany-Eugene #1 115 kV line is a 40 mile line between Albany 115 kV substation and Eugene 115 kV substation both owned by BPA. Switch B975 is operated normally open, 22 miles from Albany. Requirements for this POI:

1. BPA will develop a 115 kV, 4 breaker ring bus substation at the POI south of the normally open switch including development of a new substation, 4 power circuit breakers, 9 disconnect switches and associated control, relaying, and communications equipment
2. Participate in Local RAS for grid charging
3. Installation of BPA-required C&C equipment at each customer’s Collector site (RAS, Meters, relays, Control House space)
4. Moderate development of C&C hardware at BPA’s POI substation

The customer will construct a 115 kV line from the BPA POI station to their generation facility. The customer will construct a 115/34.5 kV substation directly adjacent to the POI line to support their 34.5 kV feeders at their collector site.

9.3 Alvey 115 kV

Table 9.3: Alvey 115 kV Facility requirements

G#	BPA Station Work	BPA Non-Station Work
G0879, G0880	1x 115 kV shared gen-tie terminal	N/A

BPA Alvey is a 500/230/115 kV substation. The 115 kV yard is comprised of 14 bays. The station is designed as a main-aux bus configuration separated into north and south sections. Requirements for this POI:

1. BPA will develop a 115 kV, main aux bay at Alvey 115 kV, including 1 power circuit breaker, 3 disconnect switches, one line position with arrestors, and associated control, relaying, and communications equipment
2. Participate in Local RAS
3. Installation of BPA-required C&C equipment at each customer’s Collector site (RAS, Meters, relays, Control House space)
4. Moderate development of C&C hardware at BPA’s POI substation

The customer will construct a 115 kV line from the BPA POI station to their generation facility. The customer will construct a 115/34.5 kV substation directly adjacent to the POI line to support their 34.5 kV feeders at their collector site.



9.4 Lebanon 115 kV

Table 9.4: Lebanon 115 kV Facility requirements

G#	BPA Station Work	BPA Non-Station Work
G0877	1x 115 kV gen-tie terminal	N/A

Requirements for this POI:

1. BPA will develop a 115 kV, main aux bay at Lebanon 115 kV which includes 1 power circuit breaker, 3 disconnect switches, one line position with arrestors, and associated control, relaying, and communications equipment
2. Participate in Local RAS
3. Installation of BPA-required C&C equipment at each customer’s Collector site (RAS, Meters, relays, Control House space)
4. Minor development of C&C hardware at BPA’s POI substation

The customer will construct a 115 kV line from the BPA POI station to their generation facility. The customer will construct a 115/34.5 kV substation directly adjacent to the POI line to support their 34.5 kV feeders at their collector site.

9.5 Lane 115 kV

Table 9.5: Lane 115 kV Facility requirements

G#	BPA Station Work	BPA Non-Station Work
G0801	1x 115 kV gen-tie terminal	N/A

BPA Lane is a 230/115 kV substation with a 500/230 kV 1200 MVA transformer-terminated line to BPA Marion substation. The station is designed as a main-aux bus configuration separated into east and west sections. Requirements for this POI:

1. BPA will develop a 115 kV, main aux bay at Alvey 115 kV which includes 1 power circuit breaker, 3 disconnect switches, one line position with arrestors, and associated control, relaying, and communications equipment.
2. Install a new redundant bus sectionalizing breaker at Lane 230 kV substation
3. Participate in Local RAS
4. Installation of BPA-required C&C equipment at each customer’s Collector site (RAS, Meters, relays, Control House space)
5. Moderate development of C&C hardware at BPA’s POI substation

The customer will construct a 115 kV line from the BPA POI station to their generation facility. The customer will construct a 115/34.5 kV substation directly adjacent to the POI line to support their 34.5 kV feeders at their collector site.



9.6 Lane 500 kV

Table 9.6: Lane 500 kV Facility requirements

G#	BPA Station Work	BPA Non-Station Work
G0803, G0806, G0807, G0808, G0811, G0812, G0884, G0889	New Lane 500 kV Substation, 3x bay BAAH, 6x terminals for: 1) Marion-Lane 500 kV 2) Lane 500/230 kV bank #1 3) New Alvey-Lane #2 500 kV 4) 500 kV gen-tie #1 (G0803, G0806, G0807) 5) 500 kV gen-tie #2 (G0808, G0811) 6) 500 kV gen-tie #3 (G0812, G0884, G0889)	New Alvey-Lane #2 500 kV
G0808, G0811, G0812, G0884, G0889	2x 500 kV terminals for new Alvey-Lane #3 500 kV	Rebuild Marion-Lane 500 kV to 100 C MOT (69mi) New Alvey-Lane #3 500 kV (14mi) Reconductor Alvey-Lane #1 230 kV (14mi)

Lane does not have a dedicated 500 kV yard. It currently consists of a 500/230 kV transformer-terminated line. A dedicated BAAH 500 kV substation will need to be built to incorporate terminals for generation interconnections. Requirements for this POI:

1. Develop a 500 kV, four bay BAAH substation at the POI. Includes development of a new substation, 11 power circuit breakers, 23 disconnect switches and associated control, relaying, and communications equipment.
2. Construct a new Alvey-Lane #2 500 kV line (14 Miles)
3. Develop a new line terminal at Alvey 500 kV with 1 power circuit breaker and 2 disconnects
4. Installation of BPA-required C&C equipment at each customer’s Collector site (RAS, Meters, relays, Control House space)
5. Moderate development of C&C hardware at BPA’s POI substation.

After 1750 MW interconnected to Lane 500 kV:

6. Rebuild Marion-Lane #1 500 kV to 100C MOT (69 Miles)
7. Reconductor Alvey-Lane #1 230 kV to 1950A (14 Miles)
8. Construct a new Alvey-Lane #3 500 kV line (14 Miles)
9. Develop a new BAAH bay at Alvey 500 kV with 2 PCB and 5 disconnects

The customer will construct 500 kV line(s) from the BPA POI station to their generation facilities. The customer will then construct 500/34.5 kV substation(s) directly adjacent to the POI line to support their 34.5 kV feeders at their collector site.

9.7 Santiam 230 kV

Table 9.7: Santiam 230 kV Facility requirements

G#	BPA Station Work	BPA Non-Station Work
G0883, G0892, G0893, G0894, G0895	1x 230 kV shared gen-tie terminal, West Bus	N/A
G0886, G0904, G0905	1x 230 kV shared gen-tie terminal, East Bus	N/A
G0904, G0905	N/A (see above)	SPB: 2nd Santiam 500/230 kV transformer and New Marion-Santiam 500 kV #2 line



BPA Santiam is a 230 kV substation comprised of 11 bays with one position for a 500/230 kV 1200 MVA transformer-terminated line to Marion substation. The station is designed as a main-aux bus configuration separated into east and west sections. Requirements for this POI:

1. BPA will develop a 230 kV east bus, main-aux bay which includes 1 power circuit breaker, 3 disconnect switches, one line position with arrestors, and associated control, relaying, and communications equipment for Generation interconnections.
2. BPA will develop a 230 kV west bus, main-aux bay which includes 1 power circuit breaker, 3 disconnect switches, one line position with arrestors, and associated control, relaying, and communications equipment for generation interconnections.
3. Participate in Local RAS.
4. Installation of BPA-required C&C equipment at each customer’s Collector site (RAS, Meters, relays, Control House space)
5. Significant development of C&C hardware at BPA’s POI substation.

The customer will construct 230 kV lines from the BPA POI station to their generation facilities. The customer will construct a 230/34.5 kV substation directly adjacent to the POI lines to support their 34.5 kV feeders at their collector sites.

After 1400 MW of total generation combined from Santiam 230 kV, Santiam-Alvey #1 & #2 230 kV (North), Santiam-Alvey #2 230 kV (South), and Santiam-Toledo 230 kV POIs a Scalable Plan Block is Required:

1. Develop a 230 kV, main aux bay at Santiam West 230 kV which includes 1 power circuit breaker, 3 disconnect switches, one line position with arrestors, and associated control, relaying, and communications equipment for generation interconnections
2. Install a 2nd 500/230 kV 1300 MVA transformer and accompanying Marion-Santiam 500 kV #2 line
3. Install a new 230 kV main-aux bay at Santiam for a new 500/230 kV transformer
4. Develop a new line terminal at Marion 500 kV with 1 power circuit breaker and 2 disconnects

9.8 Santiam-Alvey #1 & #2 230 kV (North)

Table 9.8: Santiam-Alvey #1 & #2 230 kV Facility requirements

G#	BPA Station Work	BPA Non-Station Work
G0885, G0899 G0902, G0970	New 230 kV BAAH substation, 1x 230 kV terminal	N/A
G0902, G0970	N/A (See above)	SPB: 2nd Santiam 500/230 kV transformer and New Marion-Santiam 500 kV line
G0970	N/A (See above)	Albany-Lebanon 115 kV reconductor

The Santiam-Alvey #1 and #2 230 kV lines are 57 mile lines between Santiam 230 kV substation and Alvey 230 kV substation both owned by BPA. The line is currently tied together at each end with jumpers and is currently operated as one line. The Lebanon Transformer install project (contingent facility) will separate the lines into two distinct circuits and restore the line ratings to 100C MOT. The requested generation amount exceeds the summer rating of a single Santiam-



Alvey line so both Santiam-Alvey #1 and #2 lines are looped in instead of reconductoring 57 miles of 230 kV line for a single loop-in.

1. Develop a 230 kV, 3 bay BAAH substation looping in both Santiam-Alvey #1 230 kV and Santiam-Alvey #2 230 kV lines 16 miles south of the Santiam including development of a new substation, 8 power circuit breakers, 16 disconnect switches and associated control, relaying, and communications equipment.
2. Participate in Local RAS.
3. Installation of BPA-required C&C equipment at each customer’s Collector site (RAS, Meters, relays, Control House space)
4. Significant development of C&C hardware at BPA’s POI substation.

The customer will construct a 230 kV lines from the BPA POI station to their generation facilities. The customer will then construct a 230/34.5 kV substation directly adjacent to the POI lines to support their 34.5 kV feeders at their collector sites.

After 500 MW of total generation for Santiam-Alvey #1 & #2 (North) and Santiam-Alvey #2 230 kV (South):

1. Reconductor 17 miles of Albany-Lebanon 115 kV
2. Affected System Study with PacifiCorp is required to determine mitigation for Weirich-Crowfoot-Lebanon (PAC) 115 kV

After 1400 MW of total generation for Santiam 230 kV, Santiam-Alvey #1 & #2 230 kV (North), Santiam-Alvey #2 230 kV (South), and Santiam-Toledo 230 kV a Scalable Plan Block is Required:

1. Develop a 230 kV, main aux bay at Santiam West 230 kV which includes 1 power circuit breaker, 3 disconnect switches, one line position with arrestors, and associated control, relaying, and communications equipment for generation interconnections
2. Install a 2nd 500/230 kV 1300 MVA transformer and accompanying Marion-Santiam 500 kV #2 line
3. Install a new 230 kV main-aux bay at Santiam for a new 500/230 kV transformer
4. Develop a new line terminal at Marion 500 kV with 1 power circuit breaker and 2 disconnects

9.9 Santiam-Alvey #1 230 kV (South)

Table 9.9: Santiam-Alvey #1 230 kV Facility requirements

G#	BPA Station Work	BPA Non-Station Work
G0918	New 230 kV BAAH substation, 1x 230 kV gen-tie terminal	Albany-Lebanon 115 kV reconductor SPB: 2nd Santiam 500/230 kV transformer and New Marion-Santiam 500 kV line

Santiam-Alvey #1 and #2 230 kV circuits span 57 mile lines between BPA Santiam 230 kV substation and BPA Alvey 230 kV substation. The line is currently tied together at each end with jumpers and operated as single circuit. The Lebanon 230/115 kV transformer addition project will split the circuits into two distinct transmission lines (remove jumpers).

Requirements for this POI:



1. BPA will Develop a 230 kV, 4 breaker ring bus substation looping in both Santiam-Alvey #1 230 kV, approximately 38 miles south of the Santiam. Includes 5 power circuit breakers, 10 disconnect switches and associated control, relaying, and communications equipment).
2. Participate in Local RAS.
3. Installation of BPA-required C&C equipment at each customer’s Collector site (RAS, Meters, relays, Control House space)
4. Significant development of C&C hardware at BPA’s POI substation.

The customer will construct a 230 kV line from the BPA POI station to their generation facility. The customer will then construct a 230/34.5 kV substation directly adjacent to the POI line to support their 34.5 kV feeders at their collector site.

After 500 MW of total generation for Santiam-Alvey #1 & #2 (North) and Santiam-Alvey #2 230 kV (South):

1. Reconductor 17 miles of Albany-Lebanon 115 kV
2. Affected System Study with PacifiCorp is required to determine mitigation for Weirich-Crowfoot-Lebanon (PAC) 115 kV

After 1400 MW of total generation for Santiam 230 kV, Santiam-Alvey #1 & #2 230 kV, Santiam-Alvey #2 230 kV (South), and Santiam-Toledo 230 kV a Scalable Plan Block is Required:

1. BPA develop a 230 kV, main aux bay at Santiam West 230 kV which includes 1 power circuit breaker, 3 disconnect switches, one line position with arrestors, and associated control, relaying, and communications equipment for generation interconnections
2. BPA Install a 500/230 kV 1300 MVA transformer and accompanying Marion-Santiam 500 kV line
3. BPA Install a new 230 kV main-aux bay at Santiam for a new 500/230 kV transformer
4. BPA Develop a new line terminal at Marion 500 kV with 1 power circuit breaker and 2 disconnects

9.10 Santiam-Toledo 230 kV

Table 9.10: Santiam-Toledo 230 kV Facility requirements

G#	BPA Station Work	BPA Non-Station Work
G0794, G0969	New 230 kV BAAH substation, 1x gen tie (shared)	N/A
G0969	See Above	SPB: 2nd Santiam 500/230 kV transformer and New Marion-Santiam 500 kV line

BPA Santiam-Toledo #1 230 kV is a 68 mile line between Santiam 230 kV substation and Toledo 230 kV substation both owned by BPA. Requirements for this POI:

1. BPA will Develop a 230 kV, 4 breaker ring bus substation approximately 20 miles west of Santiam, including 5 power circuit breakers, 10 disconnect switches and associated control, relaying, and communications equipment.
2. Participate in Local RAS for grid charging.
3. Installation of BPA-required C&C equipment at each customer’s Collector site (RAS,



Meters, relays, Control House space)

4. Significant development of C&C hardware at BPA's POI substation.

The customer will construct a 230 kV line from the BPA POI station to their generation facility. The customer will then construct 230/34.5 kV substations directly adjacent to the POI line to support their 34.5 kV feeders at their collector site.

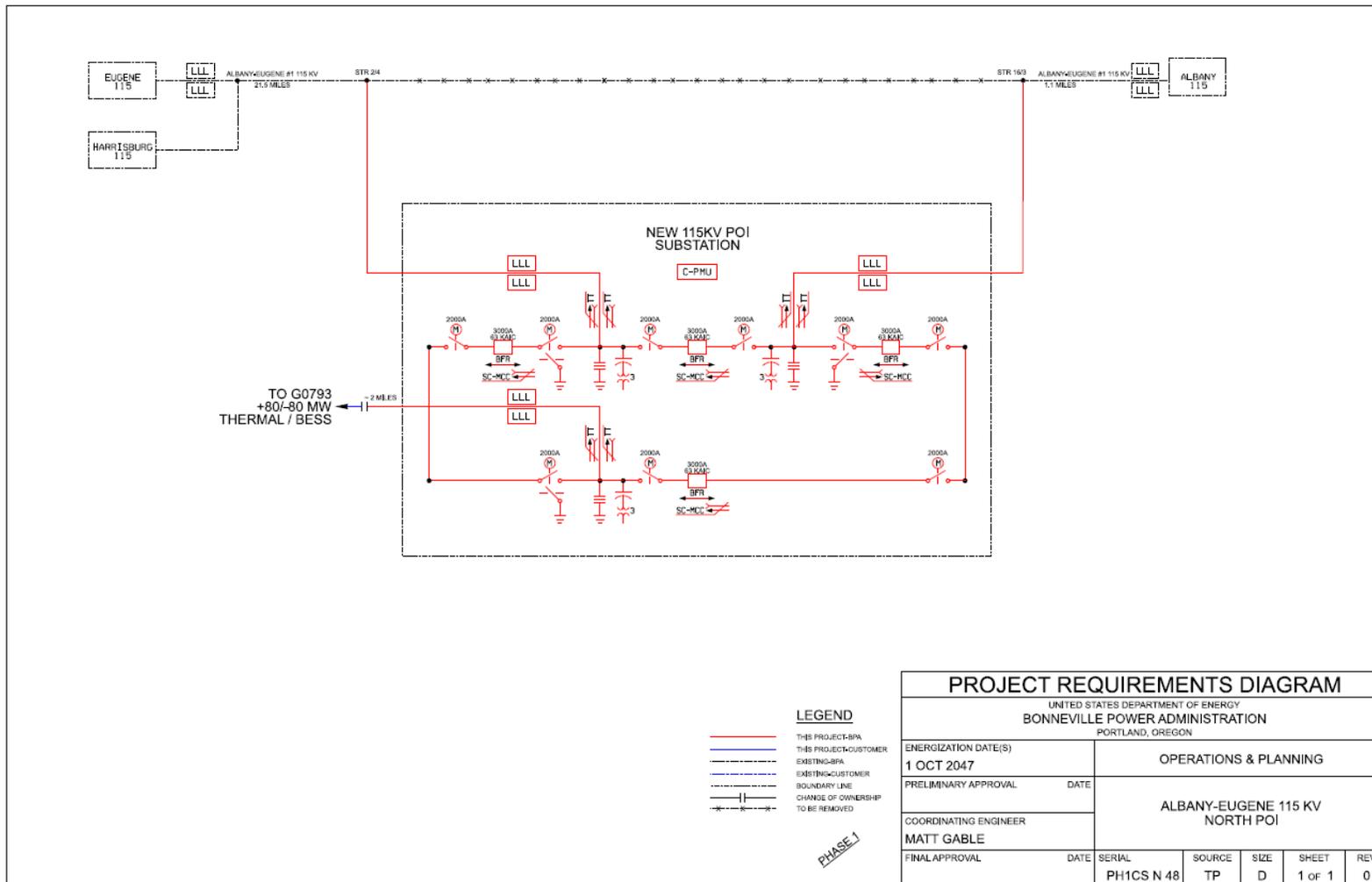
After 1400 MW of total generation for Santiam 230 kV, Santiam-Alvey #1 & #2 230 kV, Santiam-Alvey #2 230 kV (South), and Santiam-Toledo 230 kV a Scalable Plan Block is Required:

1. Develop a 230 kV, main aux bay at Santiam West 230 kV which includes 1 power circuit breaker, 3 disconnect switches, one line position with arrestors, and associated control, relaying, and communications equipment for generation interconnection
2. Install a 500/230 kV 1300 MVA transformer and accompanying Marion-Santiam 500 kV line
3. Install a new 230 kV main-aux bay at Santiam for a new 500/230 kV transformer
4. Develop a new line terminal at Marion 500 kV with 1 power circuit breaker and 2 disconnects

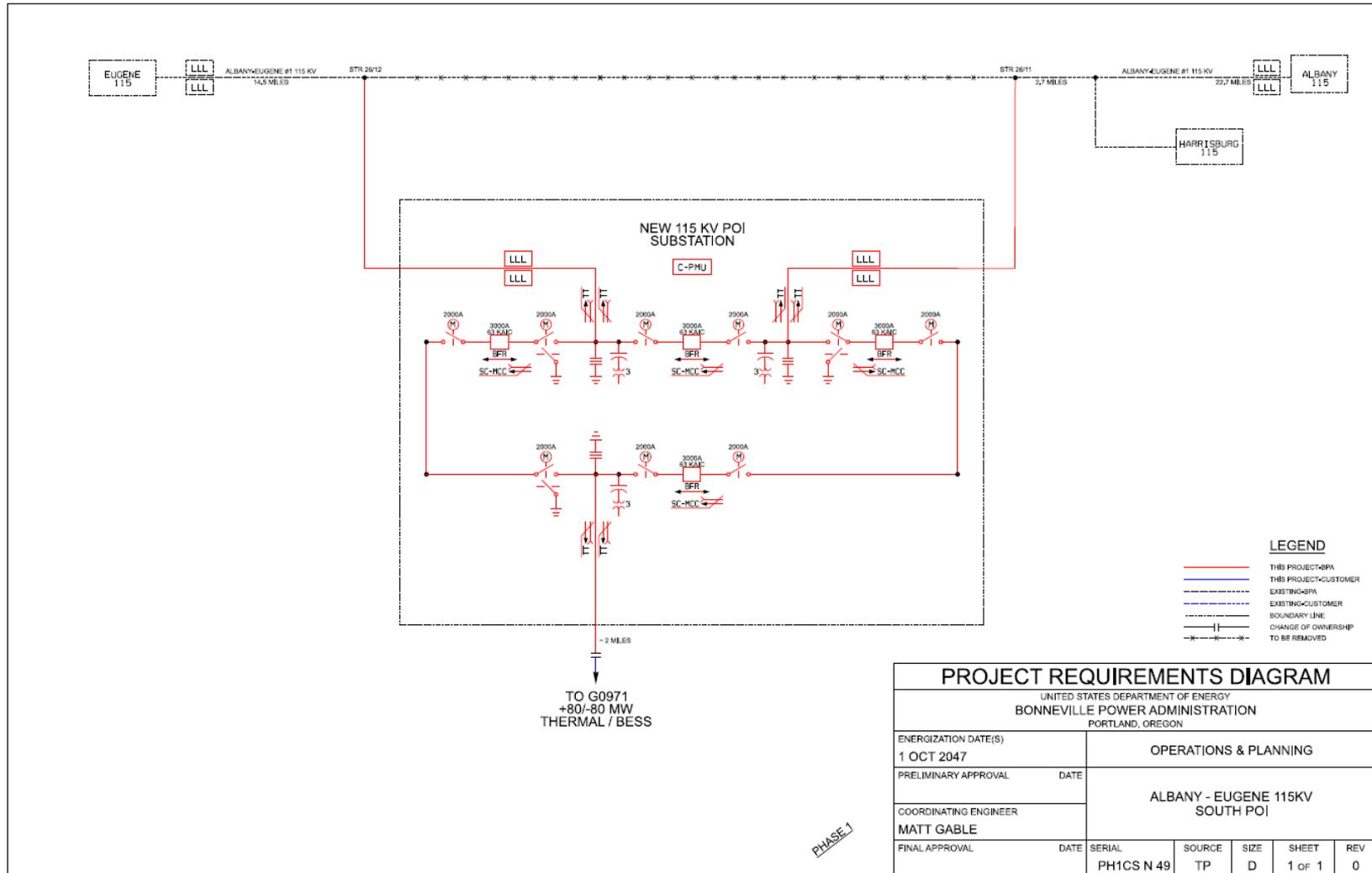


10 Project One-Line Drawings

10.1 Albany-Eugene 115 kV (North) POI



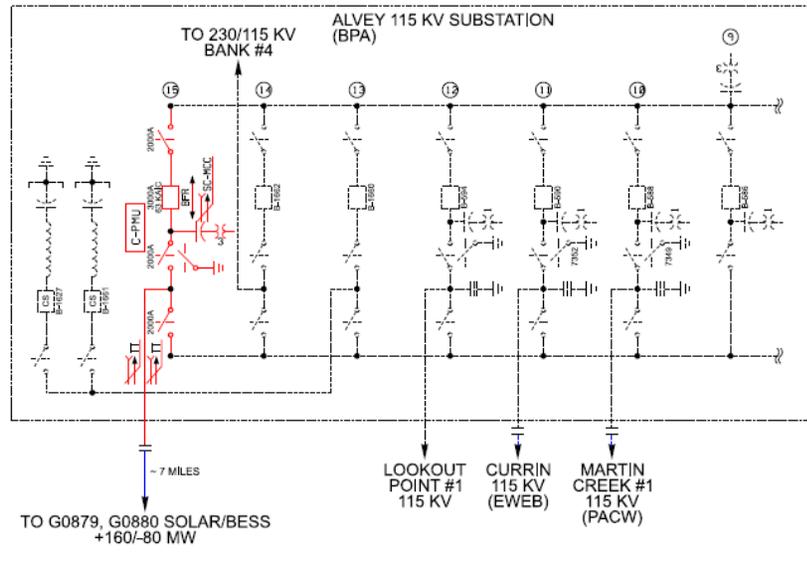
10.2 Albany-Eugene 115 kV (South) POI



PROJECT REQUIREMENTS DIAGRAM							
UNITED STATES DEPARTMENT OF ENERGY BONNEVILLE POWER ADMINISTRATION PORTLAND, OREGON							
ENERGIZATION DATE(S) 1 OCT 2047	OPERATIONS & PLANNING						
PRELIMINARY APPROVAL	DATE	ALBANY - EUGENE 115KV SOUTH POI					
COORDINATING ENGINEER MATT GABLE							
FINAL APPROVAL	DATE	SERIAL	SOURCE	SIZE	SHEET	REV	
		PH1CS N 49	TP	D	1 of 1	0	



10.3 Alvey 115 kV POI



LEGEND

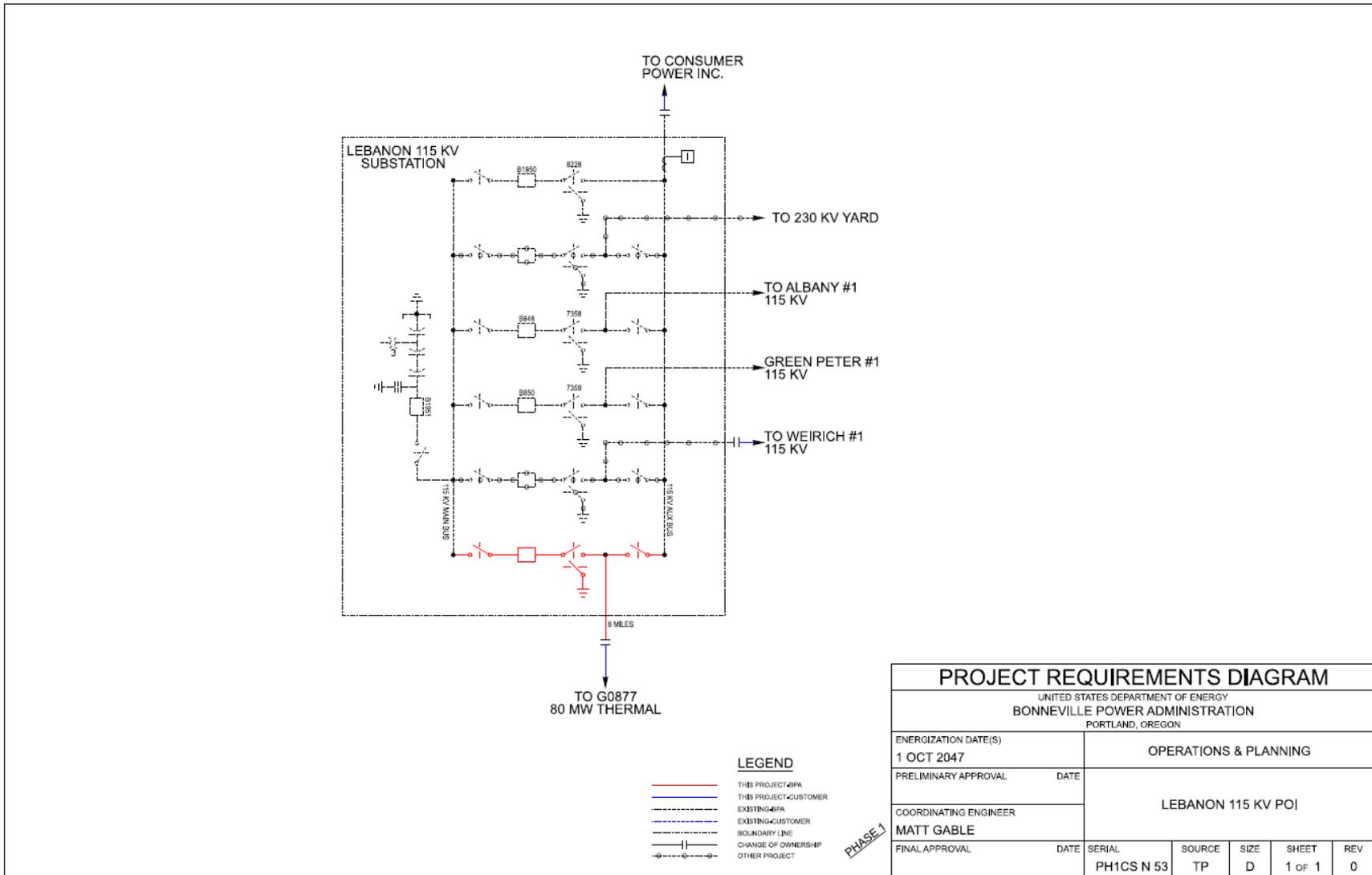
- THIS PROJECT-BPA
- THIS PROJECT-CUSTOMER
- - - - - EXISTING-BPA
- - - - - EXISTING-CUSTOMER
- ○ ○ ○ ○ OTHER PROJECT
- ⊖ ⊖ ⊖ ⊖ ⊖ RELOCATE EQUIPMENT
- ⊗ ⊗ ⊗ ⊗ ⊗ TO BE REMOVED
- ⊕ ⊕ ⊕ ⊕ ⊕ FUTURE EQUIPMENT-BPA
- ⊕ ⊕ ⊕ ⊕ ⊕ FUTURE EQUIPMENT-CUSTOMER
- ⋯⋯⋯ BOUNDARY LINE

PROJECT REQUIREMENTS DIAGRAM						
UNITED STATES DEPARTMENT OF ENERGY BONNEVILLE POWER ADMINISTRATION PORTLAND, OREGON						
ENERGIZATION DATE(S)		OPERATIONS & PLANNING				
1 OCT 2047						
PRELIMINARY APPROVAL		DATE				
COORDINATING ENGINEER		ALVEY 115 KV POI				
MATT GABLE						
FINAL APPROVAL	DATE	SERIAL	SOURCE	SIZE	SHEET	REV
		PH1CS N 40	TP	D	1 of 1	0

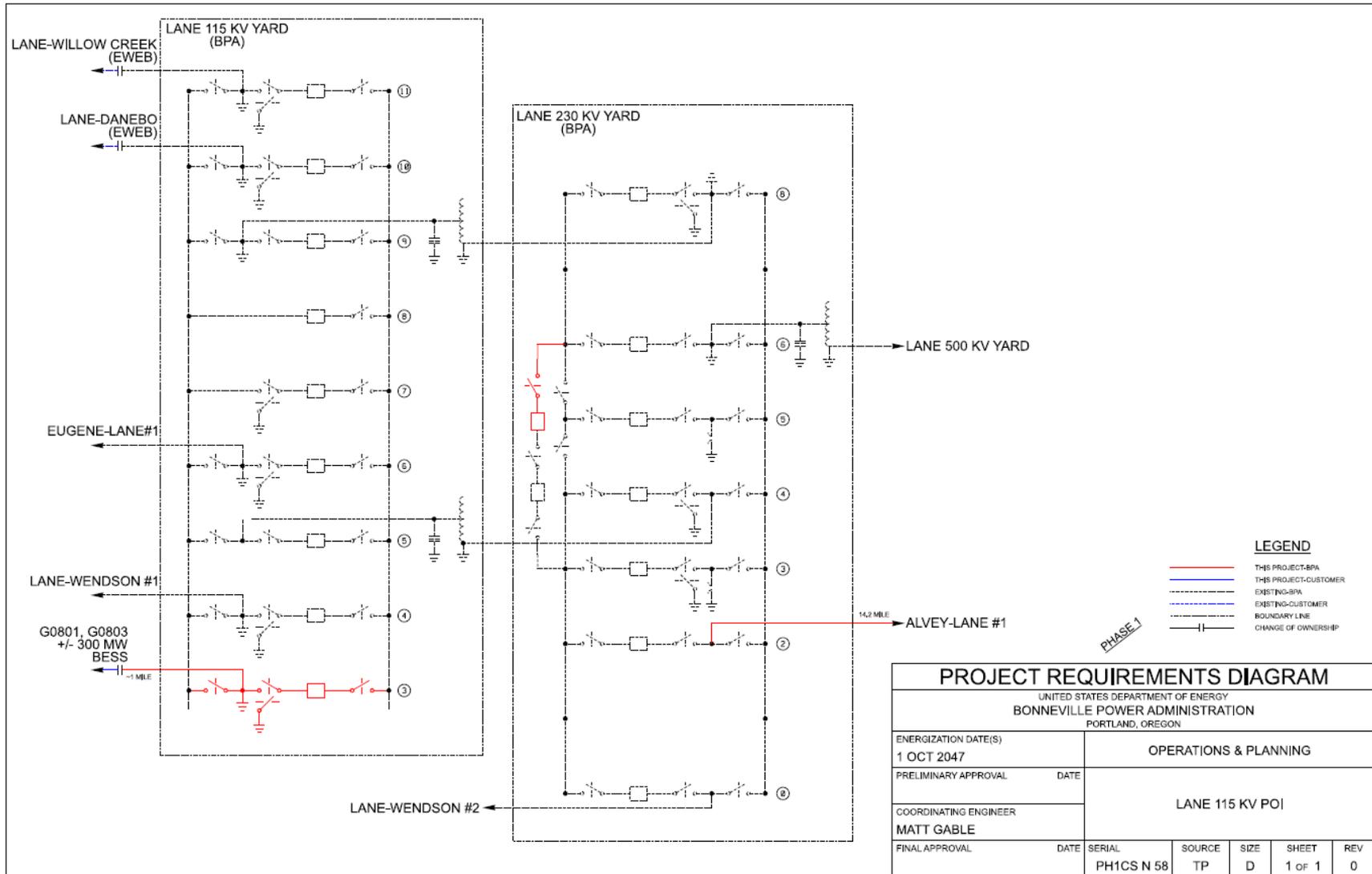
PHASE 1



10.4 Lebanon 115 kV POI



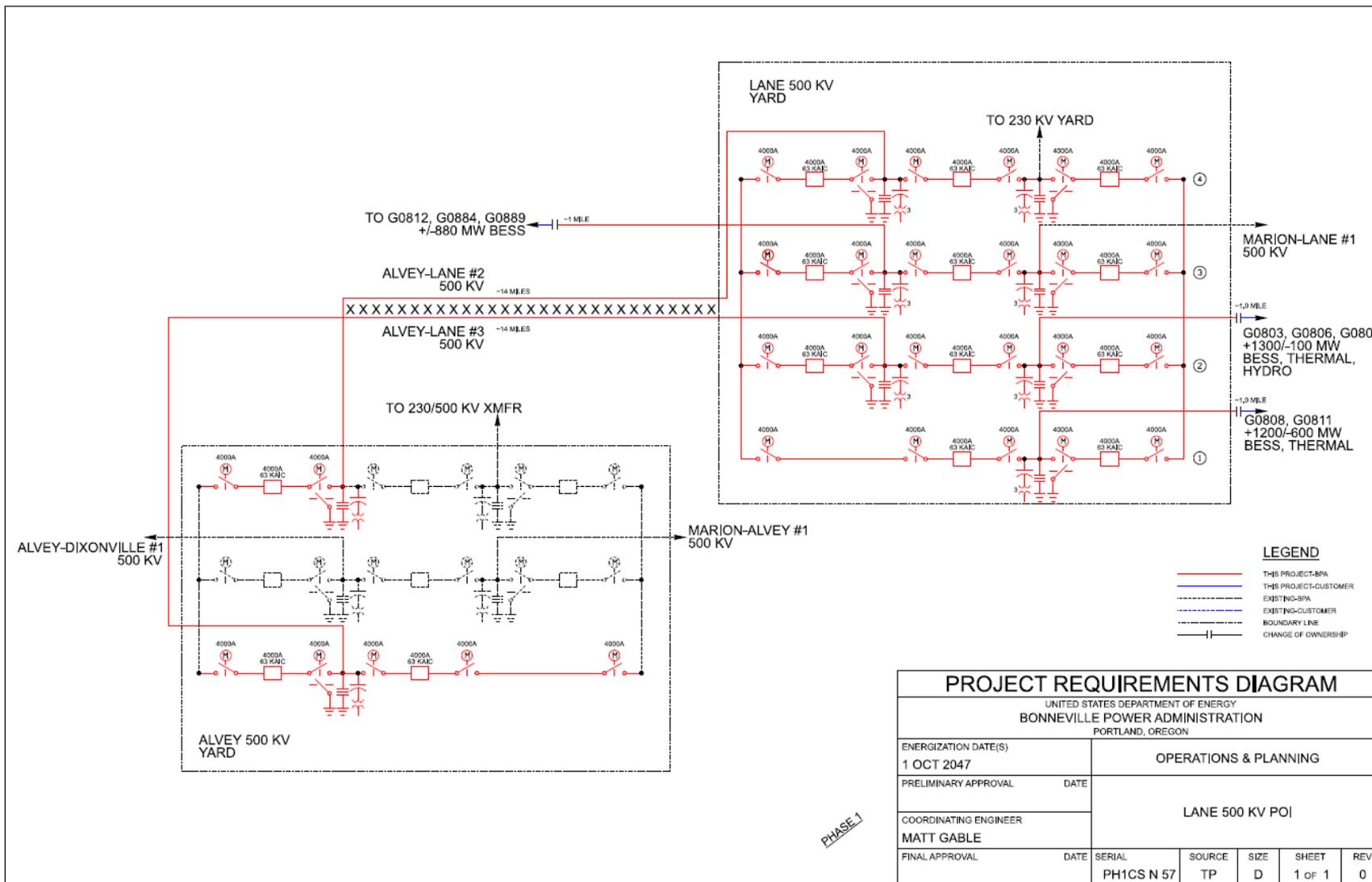
10.5 Lane 115 kV POI



PROJECT REQUIREMENTS DIAGRAM						
UNITED STATES DEPARTMENT OF ENERGY BONNEVILLE POWER ADMINISTRATION PORTLAND, OREGON						
ENERGIZATION DATE(S) 1 OCT 2047		OPERATIONS & PLANNING				
PRELIMINARY APPROVAL		DATE		LANE 115 KV POI		
COORDINATING ENGINEER MATT GABLE						
FINAL APPROVAL	DATE	SERIAL PH1CS N 58	SOURCE TP	SIZE D	SHEET 1 of 1	REV 0



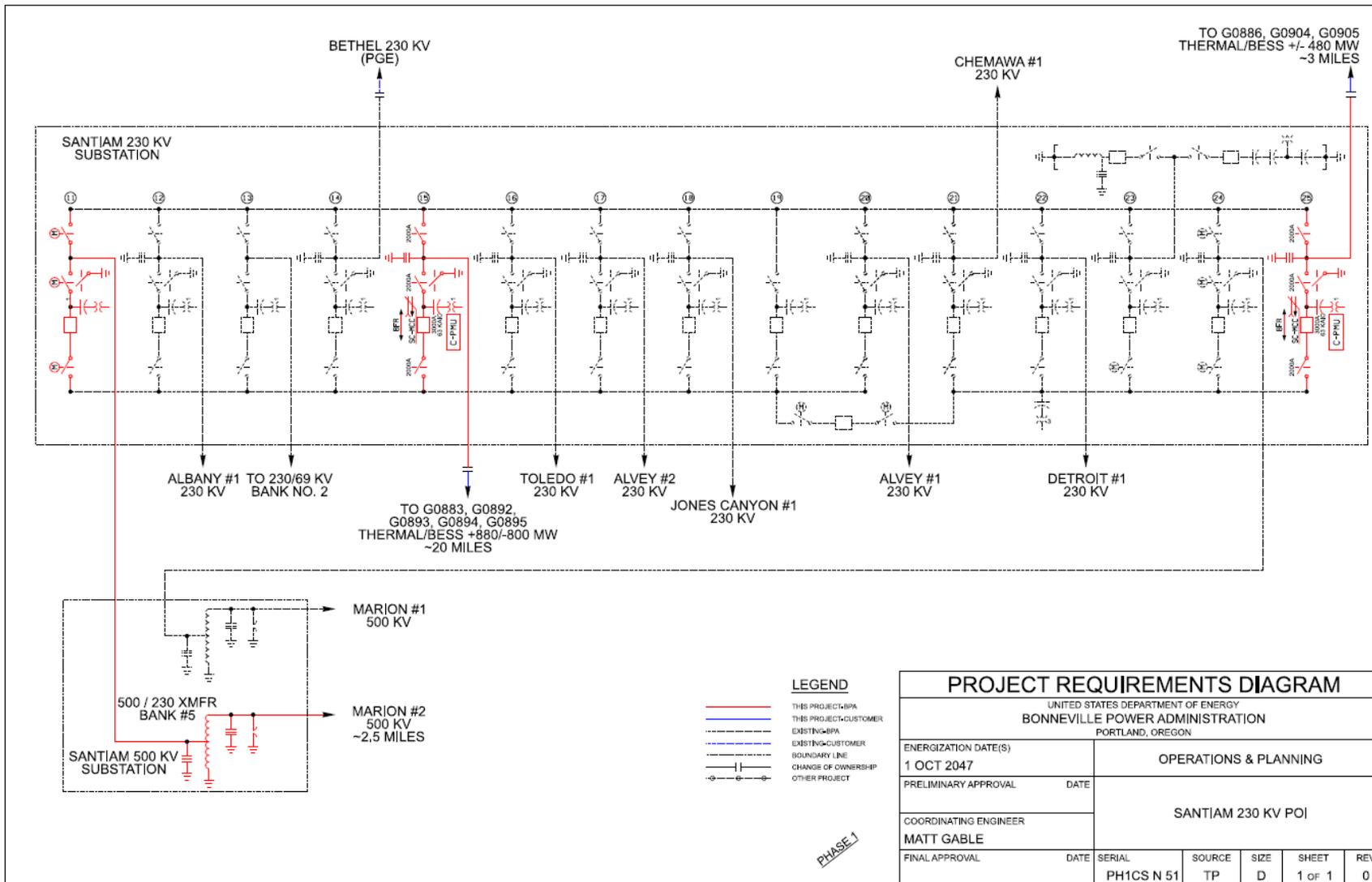
10.6 Lane 500 kV POI and non-station work



PROJECT REQUIREMENTS DIAGRAM						
UNITED STATES DEPARTMENT OF ENERGY BONNEVILLE POWER ADMINISTRATION PORTLAND, OREGON						
ENERGIZATION DATE(S) 1 OCT 2047	OPERATIONS & PLANNING					
PRELIMINARY APPROVAL	DATE	LANE 500 KV POI				
COORDINATING ENGINEER MATT GABLE						
FINAL APPROVAL	DATE	SERIAL PH1CS N 57	SOURCE TP	SIZE D	SHEET 1 of 1	REV 0



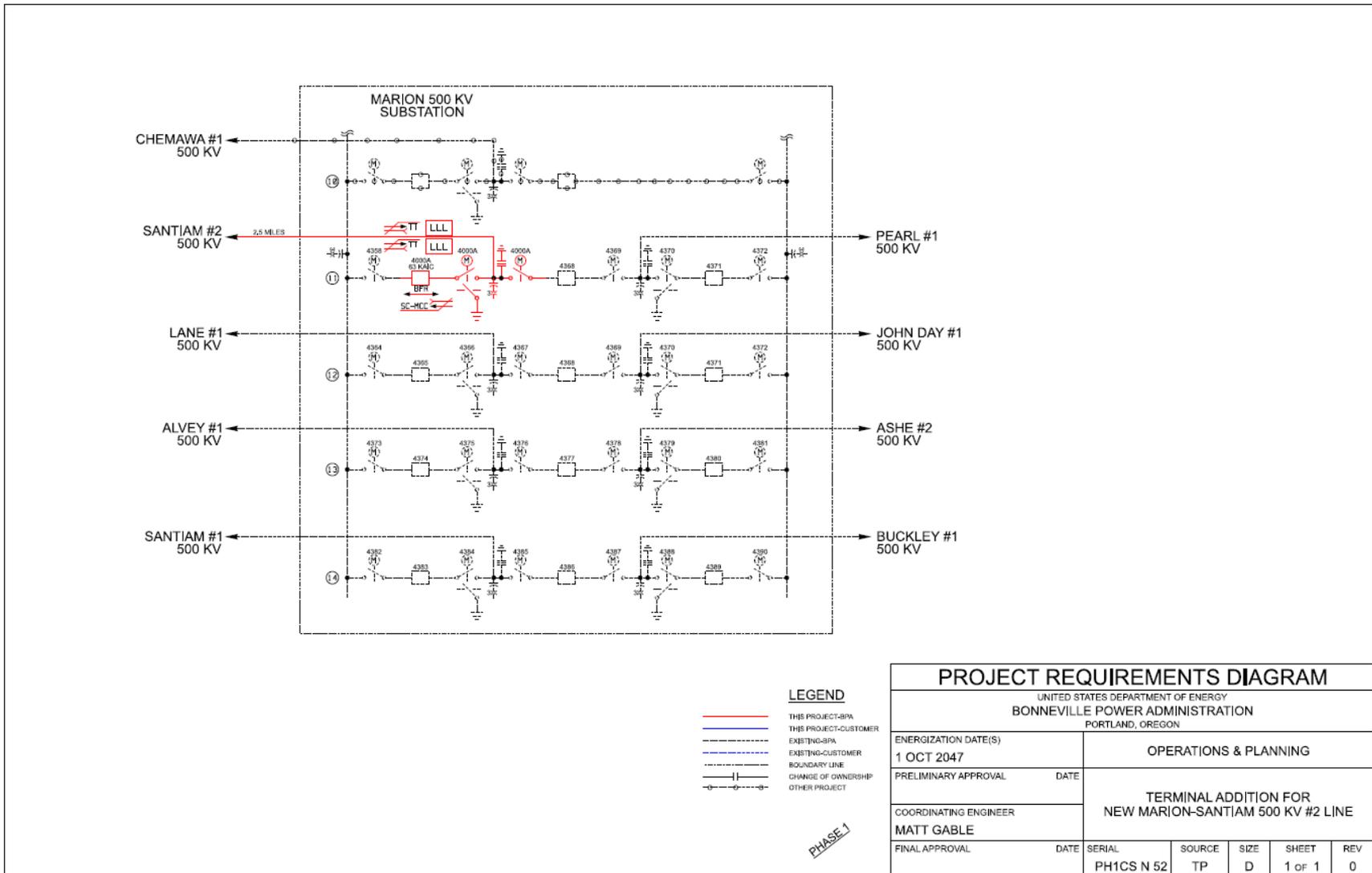
10.7 Santiam 230 kV POI and non-station work



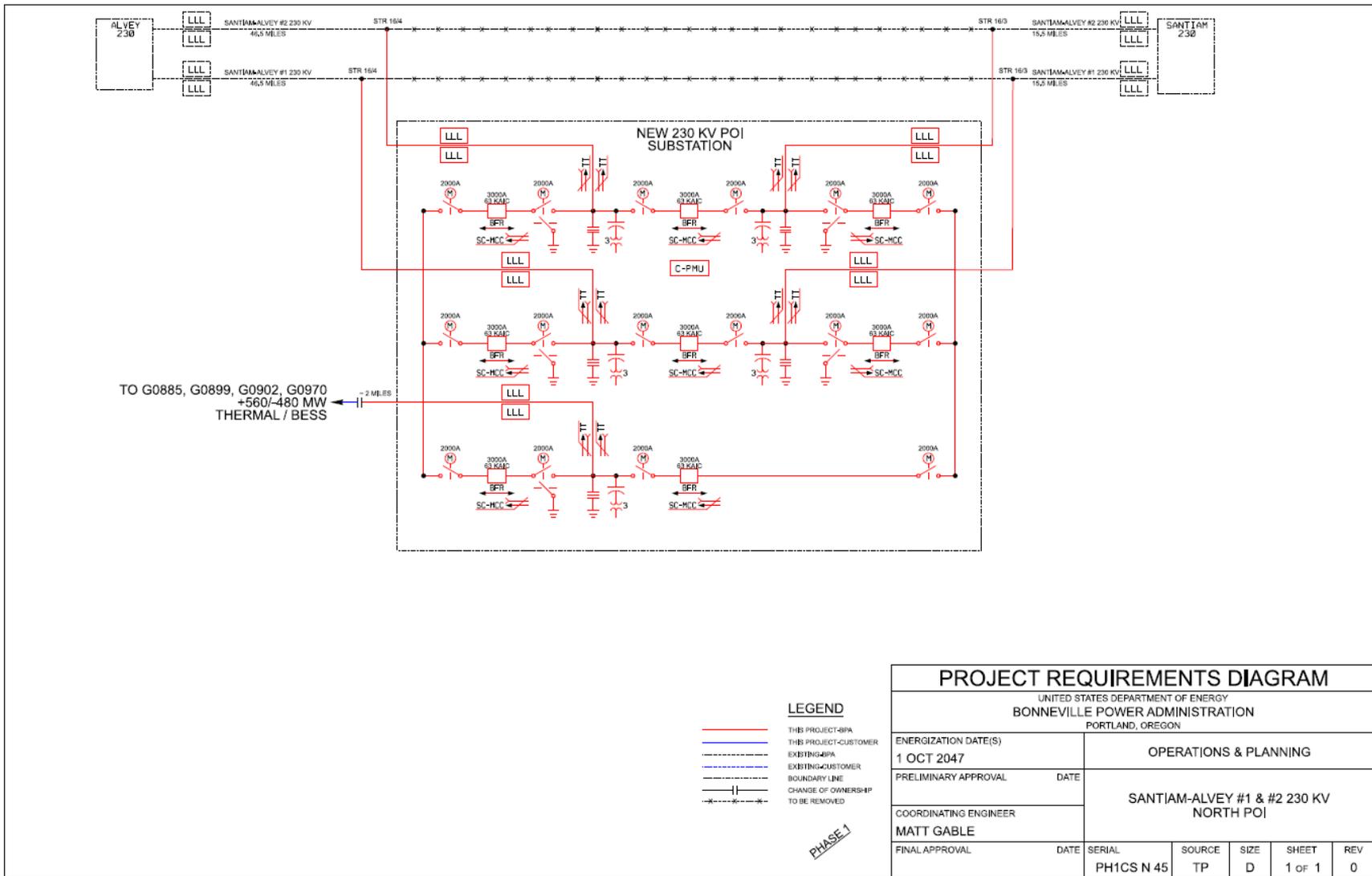
PROJECT REQUIREMENTS DIAGRAM						
UNITED STATES DEPARTMENT OF ENERGY BONNEVILLE POWER ADMINISTRATION PORTLAND, OREGON						
ENERGIZATION DATE(S)		OPERATIONS & PLANNING				
1 OCT 2047						
PRELIMINARY APPROVAL	DATE	SANTIAM 230 KV POI				
COORDINATING ENGINEER						
MATT GABLE						
FINAL APPROVAL	DATE	SERIAL	SOURCE	SIZE	SHEET	REV
		PH1CS N 51	TP	D	1 of 1	0



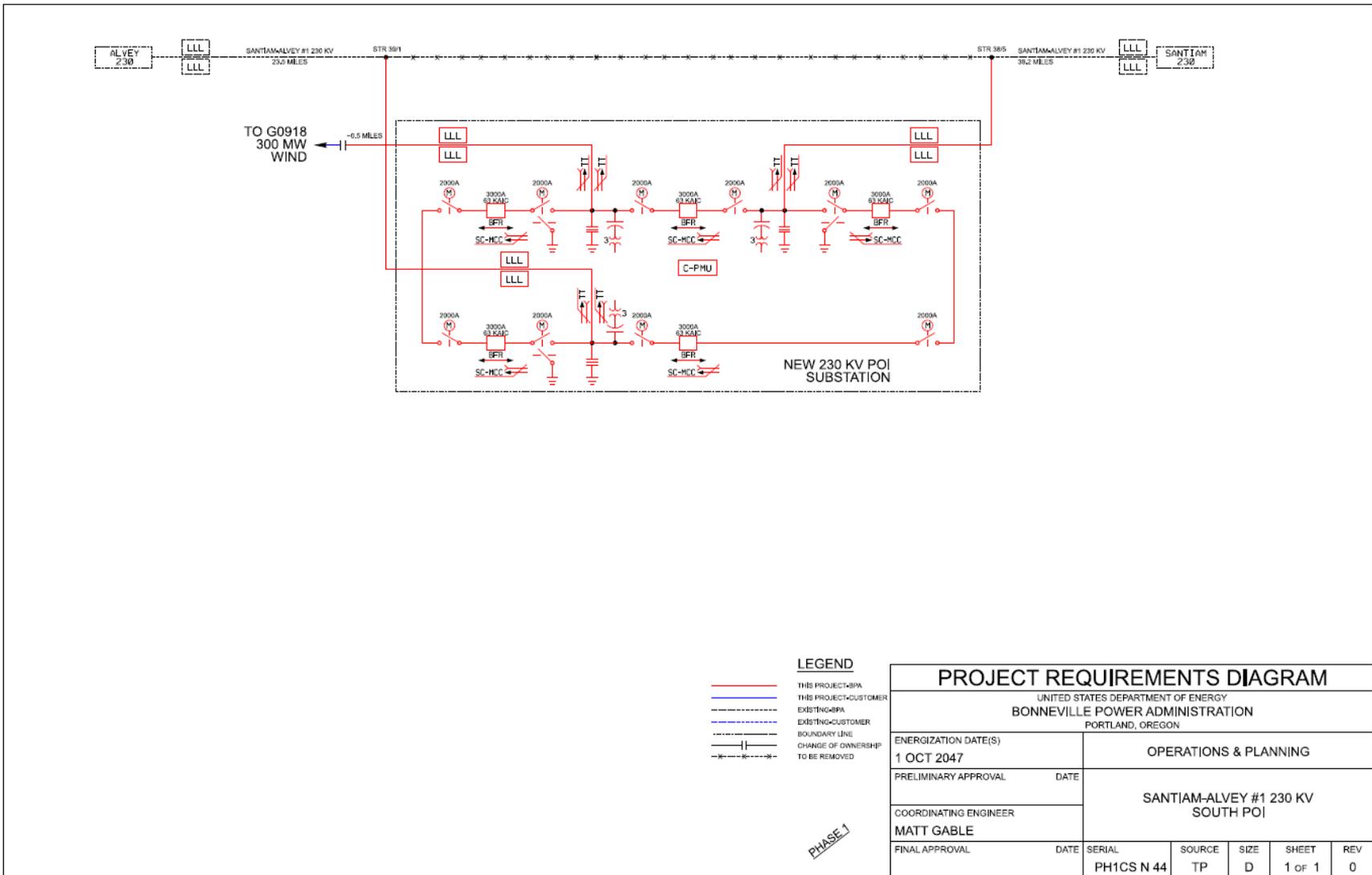
10.8 Marion 500 kV non-station work



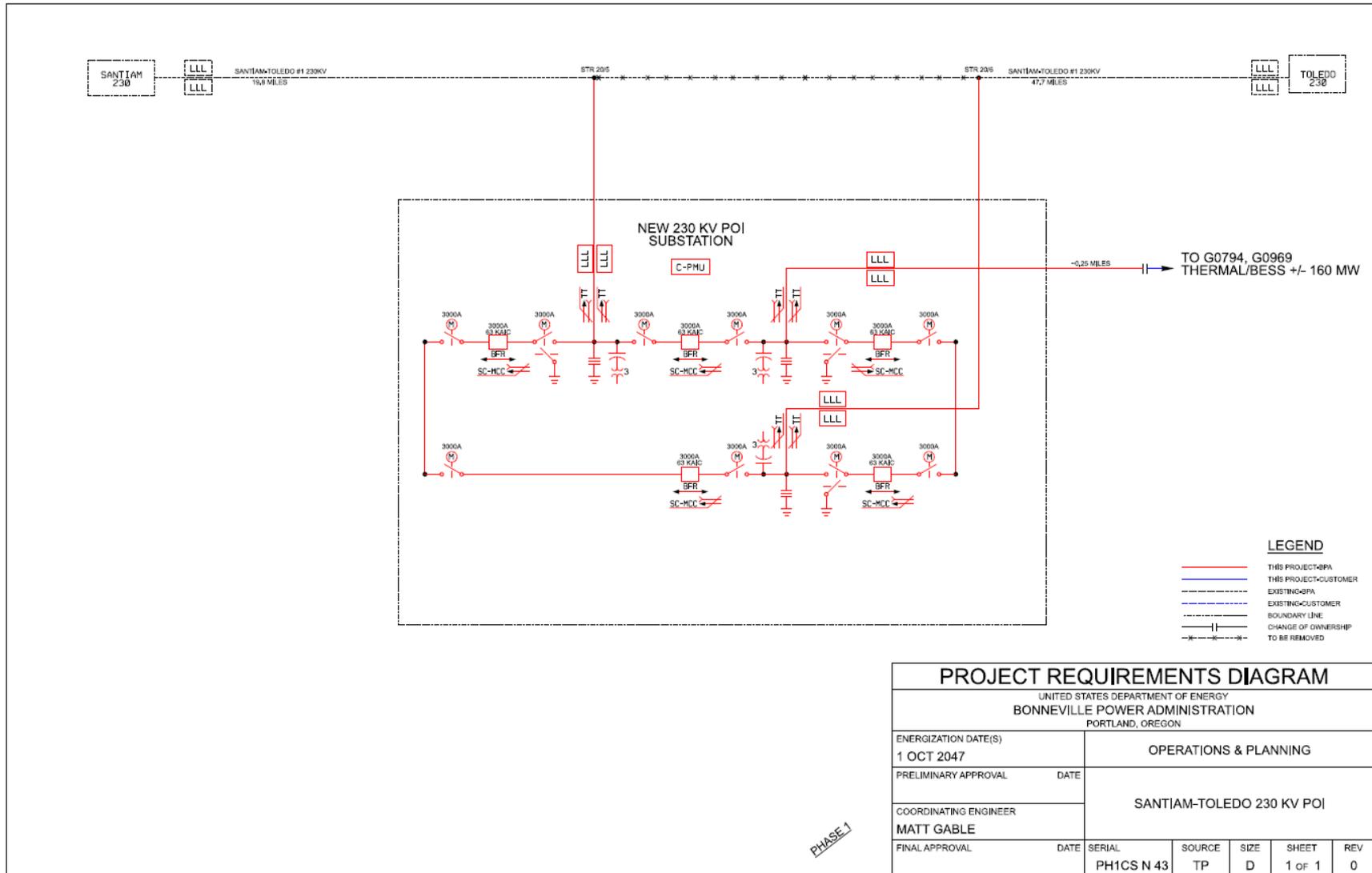
10.9 Santiam-Alvey #1 & #2 230 kV (North) POI



10.10 Santiam-Alvey #1 230 kV (South) POI



10.11 Santiam-Toledo 230 kV POI



11 Cost and Schedules

11.1 Estimated Schedule

The schedule is dependent on,

- 1) The acquisition of long lead time equipment,
- 2) BPA's ability to fit the project into its construction work plan, and
- 3) The customer's ability to obtain any necessary permits for the project and progress through the interconnection process in a timely manner.

A non-binding good faith estimated time to construct is 3-5 years for substation equipment and 7-10 years for transmission line upgrades after design activities begin. The estimated time to construct a plan of service is refined through the subsequent stages of the interconnection process.

BPA will not begin construction of a plan of service required for interconnection until the Interconnection customer has executed a Standard Large Generator Interconnection Agreement (LGIA). BPA's decision to offer an LGIA is dependent on the completion of an environmental compliance decision under the National Environmental Policy Act (NEPA). BPA's environmental compliance decision under NEPA requires the Interconnection customer to have obtained required permitting, certification, and environmental approvals for any facilities that BPA will not own.

11.2 Cost Estimates and Cost Allocations

The following are non-binding good faith estimates of cost based on previous estimates for similar projects. They represent only scopes of work that will be performed by BPA. Costs for any work being performed by the customer are not included. These costs include overhead rates for BPA labor & materials, and for contract labor & materials. The costs also include a 40% contingency. Not included in these estimates are costs for land acquisition, permitting and environmental mitigations. More accurate estimates based on scoping for the project will be available at the completion of the Interconnection Facilities Study.

Detailed Communications and Control (C&C) equipment required for each generation facility and interconnection into the BPA transmission system at the BPA-TS POI substation will be determined in an Interconnection Facilities Study. The TCS PH1 estimates C&C equipment scope and costs based on whether required upgrades fall into the following categories:

- 1) customer Station (\$5M): for BPA-required C&C equipment at a customer's collector site (RAS, Meters, relays, Control House space)
- 2) Minor (\$5M): BES additions to an existing BPA station
- 3) Moderate (\$10M): BES creation of a new BPA substation near existing C&C infrastructure, or significant expansion of an existing BPA substation
- 4) Significant (\$15M): BES creation of BPA substation very remote from any existing C&C infrastructure.

When multiple projects owned by affiliated entities interconnected at the same POI, BPA assumed the IRs to be sharing a tie line where applicable. These IRs were treated as a single customer for per capita cost allocation of station equipment Network Upgrades as outlined in Section 4.2.3(a) of the LGIP. In the below cost estimate tables, this treatment is identified by the senior-queued IR being allocated the full per capita cost share and the junior-queued IR



being allocated 0% of costs for station equipment Network Upgrades. IRs assumed to be sharing a tie line are identified in the one-line drawings provided in section 10 of this report.

11.3 POI 1: Albany-Eugene 115 kV (North)

Table 11.1 POI 1 – Albany-Eugene 115 kV (North) Station Cost Estimate

<i>Estimate Summary</i>									
Estimate #	Description		Quantity	Contract		BPA		Misc.	Total
				Labor	Material	Labor	Material		
	Albany-Eugene (N) 115 kV POI		-	-	-	-	-	-	-
ST-070-28-13	115 kV POI Substation 4 breaker		1	\$16,460,000	\$9,152,000	\$3,354,000	\$0	\$96,000	\$29,062,000
C&C	C&C: BPA station Mid		1	\$0	\$0	\$0	\$0	\$10,000,000	\$10,000,000
C&C	C&C: Collector Stations		1	\$0	\$0	\$0	\$0	\$5,000,000	\$5,000,000
Contingency %	40%		Subtotal:	\$16,460,000	\$9,152,000	\$3,354,000	\$0	\$15,096,000	\$44,062,000
Overhead %	Labor	Materials	Contingency:	\$6,584,000	\$3,660,800	\$1,341,600	\$0	\$6,038,400	\$17,624,800
	26%	9%	Overhead:	\$5,991,440	\$1,153,152	\$1,220,856	\$0	\$1,902,096	\$10,267,544
Grand Total:	<i>(rounded to two significant figures)</i>			\$29,000,000	\$14,000,000	\$5,900,000	\$0	\$23,000,000	\$72,000,000

Table 11.2 POI 1 – Albany-Eugene 115 kV (North) Cost Allocation

Queue #	Requested MW	Station Equipment	Station Equipment Allocation (Per Capita)	Station Equipment Cost	Non-Station Equipment	Non-Station Equipment Allocation (Per MW)	Non-Station Equipment Cost	Non-Network Direct Assigned	Direct Assigned Cost	Cost Assignment
G0793	80	New 115kV Substation w/ New Comms	100%	\$63M	N/A	N/A	N/A	Collector Station C&C and RAS	\$9M	\$72M



11.4 POI 2: Albany-Eugene 115 kV (South)

Table 11.3 POI 2 – Albany-Eugene 115 kV (South) Station Cost Estimate

<i>Estimate Summary</i>									
Estimate #	Description		Quantity	Contract		BPA		Misc.	Total
				Labor	Material	Labor	Material		
	Albany-Eugene (S) 115 kV POI		-	-	-	-	-	-	-
ST-070-28-13	115 kV POI Substation 4 breaker		1	\$16,460,000	\$9,152,000	\$3,354,000	\$0	\$96,000	\$29,062,000
C&C	C&C: BPA station Mid		1	\$0	\$0	\$0	\$0	\$10,000,000	\$10,000,000
C&C	C&C: Collector Stations		1	\$0	\$0	\$0	\$0	\$5,000,000	\$5,000,000
Contingency %	40%		Subtotal:	\$16,460,000	\$9,152,000	\$3,354,000	\$0	\$15,096,000	\$44,062,000
Overhead %	Labor	Materials	Contingency:	\$6,584,000	\$3,660,800	\$1,341,600	\$0	\$6,038,400	\$17,624,800
	26%	9%		Overhead:	\$5,991,440	\$1,153,152	\$1,220,856	\$0	\$1,902,096
Grand Total:	<i>(rounded to two significant figures)</i>			\$29,000,000	\$14,000,000	\$5,900,000	\$0	\$23,000,000	\$72,000,000

Table 11.4 POI 2 – Albany-Eugene 115 kV (South) Cost Allocation

Queue #	Requested MW	Station Equipment	Station Equipment Allocation (Per Capita)	Station Equipment Cost	Non-Station Equipment	Non-Station Equipment Allocation (Per MW)	Non-Station Equipment Cost	Non-Network Direct Assigned	Direct Assigned Cost	Cost Assignment
G0971	80	New 115kV Substation w/ New Comms	100%	\$63M	N/A	N/A	N/A	Collector Station C&C and RAS	\$9M	\$72M



11.5 POI 3: Alvey 115 kV

Table 11.5 POI 3 – Alvey 115 kV Station Cost Estimate

Estimate Summary									
Estimate #	Description		Quantity	Contract		BPA		Misc.	Total
				Labor	Material	Labor	Material		
	Alvey 115 kV POI		-	-	-	-	-	-	-
ST-070-19-11	115 kV Main-Aux Bay		1	\$2,180,000	\$1,402,000	\$522,000	\$0	\$12,000	\$4,116,000
C&C	C&C: BPA station Mid		1	\$0	\$0	\$0	\$0	\$10,000,000	\$10,000,000
C&C	C&C: Collector Stations		2	\$0	\$0	\$0	\$0	\$10,000,000	\$10,000,000
Contingency %	40%		Subtotal:	\$2,180,000	\$1,402,000	\$522,000	\$0	\$20,012,000	\$24,116,000
Overhead %	Labor	Materials	Contingency:	\$872,000	\$560,800	\$208,800	\$0	\$8,004,800	\$9,646,400
	26%	9%		Overhead:	\$793,520	\$176,652	\$190,008	\$0	\$2,521,512
Grand Total:	<i>(rounded to two significant figures)</i>			\$3,800,000	\$2,100,000	\$920,000	\$0	\$31,000,000	\$37,000,000

Table 11.6 POI 3 – Alvey 115 kV Cost Allocation

Queue #	Requested MW	Station Equipment	Station Equipment Allocation (Per Capita)	Station Equipment Cost	Non-Station Equipment	Non-Station Equipment Allocation (Per MW)	Non-Station Equipment Cost	Non-Network Direct Assigned	Direct Assigned Cost	Cost Assignment
G0879	80	Alvey 115kV Expansion w/ New Comms	100%	\$19M	N/A	N/A	N/A	Collector Station C&C and RAS	\$9M	\$28M
G0880	80		0%			N/A		Collector Station C&C and RAS	\$9M	\$9M



11.6 POI 4: Lebanon 115 kV

Table 11.7 POI 4 – Lebanon 115 kV Station Cost Estimate

<i>Estimate Summary</i>									
Estimate #	Description		Quantity	Contract		BPA		Misc.	Total
				Labor	Material	Labor	Material		
	Lebanon 115 kV POI		-	-	-	-	-	-	
ST-070-19-11	115 kV Main-Aux Bay		1	\$2,180,000	\$1,402,000	\$522,000	\$0	\$12,000	\$4,116,000
C&C	C&C: BPA station Small		1	\$0	\$0	\$0	\$0	\$5,000,000	\$5,000,000
C&C	C&C: Collector Stations		1	\$0	\$0	\$0	\$0	\$5,000,000	\$5,000,000
Contingency %	40%		Subtotal:	\$2,180,000	\$1,402,000	\$522,000	\$0	\$10,012,000	\$14,116,000
Overhead %	Labor	Materials	Contingency:	\$872,000	\$560,800	\$208,800	\$0	\$4,004,800	\$5,646,400
	26%	9%	Overhead:	\$793,520	\$176,652	\$190,008	\$0	\$1,261,512	\$2,421,692
Grand Total:	<i>(rounded to two significant figures)</i>			\$3,800,000	\$2,100,000	\$920,000	\$0	\$15,000,000	\$22,000,000

Table 11.8 POI 4 – Lebanon 115 kV Cost Allocation

Queue #	Requested MW	Station Equipment	Station Equipment Allocation (Per Capita)	Station Equipment Cost	Non-Station Equipment	Non-Station Equipment Allocation (Per MW)	Non-Station Equipment Cost	Non-Network Direct Assigned	Direct Assigned Cost	Cost Assignment
G0877	80	Lebanon 115kV Expansion w/ New Comms	100%	\$13M	N/A	N/A	N/A	Collector Station C&C and RAS	\$9M	\$22M



11.7 POI 5: Lane 115/500 kV

Table 11.9 POI 5 – Lane 115 kV Station Cost Estimate

<i>Estimate Summary</i>									
Estimate #	Description		Quantity	Contract		BPA		Misc.	Total
				Labor	Material	Labor	Material		
	Lane 115 kV POI		-	-	-	-	-	-	-
ST-070-19-11	115 kV Main-Aux Bay		1	\$2,180,000	\$1,402,000	\$522,000	\$0	\$12,000	\$4,116,000
ST-070-19-11	230 kV Redundant Bus Sectionalizing Breaker		1	\$2,180,000	\$1,402,000	\$522,000	\$0	\$12,000	\$4,116,000
C&C	C&C: BPA station Mid		1	\$0	\$0	\$0	\$0	\$10,000,000	\$10,000,000
C&C	C&C: Collector Stations		2	\$0	\$0	\$0	\$0	\$10,000,000	\$10,000,000
Contingency %	40%		Subtotal:	\$4,360,000	\$2,804,000	\$1,044,000	\$0	\$20,024,000	\$28,232,000
Overhead %	Labor	Materials	Contingency:	\$1,744,000	\$1,121,600	\$417,600	\$0	\$8,009,600	\$11,292,800
	26%	9%		Overhead:	\$1,587,040	\$353,304	\$380,016	\$0	\$2,523,024
Grand Total:	<i>(rounded to two significant figures)</i>			\$7,700,000	\$4,300,000	\$1,800,000	\$0	\$31,000,000	\$44,000,000

Table 11.10 POI 5 – Lane 500 kV Station Cost Estimate

<i>Estimate Summary</i>		<i>Station work</i>							
Estimate #	Description		Quantity	Contract		BPA		Misc.	Total
				Labor	Material	Labor	Material		
	Lane 500 kV POI		-	-	-	-	-	-	-
ST-070-133-7	4x PCB, 4pos 2xbay BAAH, w/180MVAR Shunt Reactor		1	\$44,512,000	\$46,842,000	\$5,690,000	\$816,000	\$0	\$97,860,000
ST-070-65-10	1x New 500kV 1-bay BAAH Yard (2 terminals, 3 PCB)		2	\$23,416,000	\$19,228,000	\$3,620,000	\$0	\$116,000	\$46,380,000
C&C	C&C: BPA station Mid		1	\$0	\$0	\$0	\$0	\$10,000,000	\$10,000,000
C&C	C&C: Collector Stations		7	\$0	\$0	\$0	\$0	\$35,000,000	\$35,000,000
Contingency %	40%		Subtotal:	\$67,928,000	\$66,070,000	\$9,310,000	\$816,000	\$45,116,000	\$189,240,000
Overhead %	Labor	Materials	Contingency:	\$27,171,200	\$26,428,000	\$3,724,000	\$326,400	\$18,046,400	\$75,696,000
	26%	9%		Overhead:	\$24,725,792	\$8,324,820	\$3,388,840	\$102,816	\$5,684,616
Grand Total:	<i>(rounded to two significant figures)</i>			\$120,000,000	\$101,000,000	\$16,000,000	\$1,250,000	\$69,000,000	\$310,000,000

Table 11.11 POI 5 – Lane 500 kV New Lane-Alvey 500 kV #2 Line Non-Station Cost Estimate

<i>Estimate Summary</i>		<i>non-station work</i>							
Estimate #	Description		Quantity	Contract		BPA		Misc.	Total
				Labor	Material	Labor	Material		
	Lane 500 kV POI		-	-	-	-	-	-	-
ST-070-65-10	1x New 500kV 1-bay BAAH Yard (2 terminals, 3 PCB)		0.5	\$5,854,000	\$4,807,000	\$905,000	\$0	\$29,000	\$11,595,000
LT-040-54-8	NEW Alvey-Lane 500 kV #2 (per mi.)		14	\$25,452,000	\$20,888,000	\$13,580,000	\$0	\$0	\$59,920,000
	Alvey 500 kV Work		-	-	-	-	-	-	-
ST-070-65-10	1x New 500kV 1-bay BAAH Yard (2 terminals, 3 PCB)		0.5	\$5,854,000	\$4,807,000	\$905,000	\$0	\$29,000	\$11,595,000
Contingency %	40%		Subtotal:	\$37,160,000	\$30,502,000	\$15,390,000	\$0	\$58,000	\$83,110,000
Overhead %	Labor	Materials	Contingency:	\$14,864,000	\$12,200,800	\$6,156,000	\$0	\$23,200	\$33,244,000
	26%	9%		Overhead:	\$13,526,240	\$3,843,252	\$5,601,960	\$0	\$7,308
Grand Total:	<i>(rounded to two significant figures)</i>			\$66,000,000	\$47,000,000	\$27,000,000	\$0	\$89,000	\$140,000,000



Table 11.12 POI 5 – Lane 500 kV New Lane-Alvey 500 kV #3 Line Non-Station Cost Estimate

Estimate Summary									
Estimate #	Description		Quantity	Contract		BPA		Misc.	Total
				Labor	Material	Labor	Material		
	Lane 500 kV POI		-	-	-	-	-	-	-
ST-070-65-10	1x New 500kV 1-bay BAAH Yard (2 terminals, 3 PCB)		0.5	\$5,854,000	\$4,807,000	\$905,000	\$0	\$29,000	\$11,595,000
LT-040-54-8	NEW Alvey-Lane 500 kV #3 (per mi.)		14	\$25,452,000	\$20,888,000	\$13,580,000	\$0	\$0	\$59,920,000
LT-040-54-8	Marion-Lane 500 kV (per mi.)		69	\$125,442,000	\$102,948,000	\$66,930,000	\$0	\$0	\$295,320,000
	Alvey 500 kV Work		-	-	-	-	-	-	-
ST-070-65-10	1x New 500kV 1-bay BAAH Yard (2 terminals, 3 PCB)		0.5	\$5,854,000	\$4,807,000	\$905,000	\$0	\$29,000	\$11,595,000
Contingency %	40%		Subtotal:	\$162,602,000	\$133,450,000	\$82,320,000	\$0	\$58,000	\$378,430,000
Overhead %	Labor	Materials	Contingency:	\$65,040,800	\$53,380,000	\$32,928,000	\$0	\$23,200	\$151,372,000
	26%	9%	Overhead:	\$59,187,128	\$16,814,700	\$29,964,480	\$0	\$7,308	\$105,973,616
Grand Total:	<i>(rounded to two significant figures)</i>			\$290,000,000	\$200,000,000	\$150,000,000	\$0	\$89,000	\$640,000,000

Table 11.13 POI 5 – Lane 500 kV Alvey-Lane #1 230 kV Reconductor Non-Station Cost Estimate

Estimate Summary									
Estimate #	Description		Quantity	Contract		BPA		Misc.	Total
				Labor	Material	Labor	Material		
	Lane 500 kV POI		-	-	-	-	-	-	-
LT-040-54-8	Alvey-Lane 230 kV rebuild (per mi.)		14	\$25,452,000	\$20,888,000	\$13,580,000	\$0	\$0	\$59,920,000
Contingency %	40%		Subtotal:	\$25,452,000	\$20,888,000	\$13,580,000	\$0	\$0	\$59,920,000
Overhead %	Labor	Materials	Contingency:	\$10,180,800	\$8,355,200	\$5,432,000	\$0	\$0	\$23,968,000
	26%	9%	Overhead:	\$9,264,528	\$2,631,888	\$4,943,120	\$0	\$0	\$16,839,536
Grand Total:	<i>(rounded to two significant figures)</i>			\$45,000,000	\$32,000,000	\$24,000,000	\$0	\$0	\$101,000,000

Table 11.14 POI 5 – Lane 115 kV POI Cost Allocation

Queue #	Requested MW	Station Equipment	Station Equipment Allocation (Per Capita)	Station Equipment Cost	Additional Non-Station Cost (Table 11.17)	Non-Network Direct Assigned	Direct Assigned Cost	Cost Assignment
G0801	200	Lane 115kV Expansion w/ New Comms	100%	\$35M	N/A	Collector Station C&C and RAS	\$9M	\$44M



Table 11.15 POI 5 – Lane 500 kV POI Cost Allocation

Queue #	Requested MW	Station Equipment	Station Equipment Allocation (Per Capita)	Station Equipment Cost	Non-Station Equipment	Non-Station Equipment Allocation (Per MW)	Non-Station Equipment Cost	Additional Non-Station Cost (Table 11.16)	Non-Network Direct Assigned	Direct Assigned Cost	Cost Assignment
G0803	200	New Lane 500kV Substation w/ new Comms	33.33%	\$238M	New Lane-Alvey 500kV #2 Line	5.75%	\$140M	\$0M	Collector Station C&C and RAS	\$9M	\$96M
G0806	600		0.00%			17.24%		\$0M	Collector Station C&C and RAS	\$9M	\$33M
G0807	600		0.00%			17.24%		\$0M	Collector Station C&C and RAS	\$9M	\$33M
G0808	600		33.33%			17.24%		\$107M	Collector Station C&C and RAS	\$9M	\$219M
G0811	600		0.00%			17.24%		\$257M	Collector Station C&C and RAS	\$9M	\$290M
G0812	600		33.33%			17.24%		\$257M	Collector Station C&C and RAS	\$9M	\$369M
G0884	80		0.00%			2.30%		\$34M	Collector Station C&C and RAS	\$9M	\$46M
G0889	200		0.00%			5.75%		\$86M	Collector Station C&C and RAS	\$9M	\$103M

Table 11.16 POI 5 – Lane 500 kV Non-Station Cost Allocation

Queue #	Requested MW	MW Split	Plan of Service	MW Enabled	Non-Station Equipment Allocation	Non-Station Equipment Cost	Cost Assignment
G0803	200	200	None	1750	N/A	N/A	\$0M
G0806	600	600			N/A		\$0M
G0807	600	600			N/A		\$0M
G0808	600	350			N/A		\$107M
		250	New Lane-Alvey 500kV #3 Line	1730	14.45%	\$741M	
G0811	600	600			34.68%		\$257M
G0812	600	600	Marion-Lane 500kV Line Rebuild		34.68%		\$257M
G0884	80	80			4.62%		\$34M
G0889	200	200	Alvey-Lane #1 230kV Reconductor		11.56%		\$86M



11.8 POI 6: Santiam 230 kV

Table 11.17 POI 6 – Santiam 230 kV Station Cost Estimate

Estimate Summary										
Estimate #	Description		Quantity	Contract			BPA		Misc.	Total
				Design	Labor	Material	Labor	Material		
	Santiam 230 kV POI		-	-	-	-	-	-	-	
ST-070-19-11	230 kV Main-Aux Bay		2	\$0	\$4,360,000	\$2,804,000	\$1,044,000	\$0	\$24,000	\$8,232,000
C&C	C&C: BPA station Large		1	\$0	\$0	\$0	\$0	\$0	\$15,000,000	\$15,000,000
C&C	C&C: Collector Stations		8	\$0	\$0	\$0	\$0	\$0	\$40,000,000	\$40,000,000
Contingency %	40%		Subtotal:	\$0	\$4,360,000	\$2,804,000	\$1,044,000	\$0	\$55,024,000	\$63,232,000
Overhead %	Labor	Materials	Contingency:	\$0	\$1,744,000	\$1,121,600	\$417,600	\$0	\$22,009,600	\$25,292,800
	26%	9%	Overhead:	\$0	\$1,587,040	\$353,304	\$380,016	\$0	\$6,933,024	\$9,253,384
Grand Total:	<i>(rounded to two significant figures)</i>			\$0	\$7,700,000	\$4,300,000	\$1,800,000	\$0	\$84,000,000	\$98,000,000

Table 11.18 POI 6 – Santiam 230 kV Cost Allocation

Queue #	Requested MW	Station Equipment	Station Equipment Allocation (Per Capita)	Station Equipment Cost	Non-Station Equipment	Non-Station Equipment Allocation (Per MW)	Non-Station Equipment Cost	Non-Network Direct Assigned	Direct Assigned Cost	Cost Assignment
G0883	80	Santiam 230kV Expansion w/ Comm expansion	50.00%	\$26M	SPB1: New Santiam 500/230kV #2 Transformer New Marion-Santiam 500kV Line	0.00%	\$150M	Collector Station C&Cand RAS	\$9M	\$22M
G0886	80		50.00%			0.00%		Collector Station C&Cand RAS	\$9M	\$22M
G0892	200		0.00%			0.00%		Collector Station C&Cand RAS	\$9M	\$9M
G0893	200		0.00%			0.00%		Collector Station C&Cand RAS	\$9M	\$9M
G0894	200		0.00%			0.00%		Collector Station C&Cand RAS	\$9M	\$9M
G0895	200		0.00%			0.00%		Collector Station C&Cand RAS	\$9M	\$9M
G0904	200		0.00%			18.87%		Collector Station C&Cand RAS	\$9M	\$37M
G0905	200		0.00%			18.87%		Collector Station C&Cand RAS	\$9M	\$37M



11.9 POI 7: Santiam-Alvey #1 & #2 230 kV (North)

Table 11.19 POI 7 – Santiam-Alvey #1 & #2 230 kV (North) Station Cost Estimate

<i>Estimate Summary</i>									
Estimate #	Description		Quantity	Contract		BPA		Misc.	Total
				Labor	Material	Labor	Material		
	Santiam-Alvey 230 kV North POI		-	-	-	-	-	-	-
ST-070-39-12	4x PCB, 4pos 2x bay BAAH, w/ 60MVAR Shunt Reactor		1	\$18,348,000	\$12,624,000	\$4,830,000	\$0	\$118,000	\$35,920,000
ST-070-19-11	4X breaker		4	\$8,720,000	\$5,608,000	\$2,088,000	\$0	\$48,000	\$16,464,000
C&C	C&C: BPA station Large		1	\$0	\$0	\$0	\$0	\$15,000,000	\$15,000,000
C&C	C&C: Collector Stations		4	\$0	\$0	\$0	\$0	\$20,000,000	\$20,000,000
Contingency %	40%		Subtotal:	\$27,068,000	\$18,232,000	\$6,918,000	\$0	\$35,166,000	\$87,384,000
Overhead %	Labor	Materials	Contingency:	\$10,827,200	\$7,292,800	\$2,767,200	\$0	\$14,066,400	\$34,953,600
	26%	9%		Overhead:	\$9,852,752	\$1,640,880	\$1,798,680	\$0	\$3,164,940
Grand Total:	<i>(rounded to two significant figures)</i>			\$48,000,000	\$27,000,000	\$11,500,000	\$0	\$52,000,000	\$140,000,000

Table 11.20 POI 7 – Santiam-Alvey #1 & #2 230 kV (North) Cost Allocation

Queue #	Requested MW	Station Equipment	Station Equipment Allocation (Per Capita)	Station Equipment Cost	Non-Station Equipment (1)	Non-Station Equipment (1) Allocation (Per MW)	Non-Station Equipment (1) Cost	Non-Station Equipment (2)	Non-Station Equipment (2) Allocation (Per MW)	Non-Station Equipment (2) Cost	Non-Network Direct Assigned	Direct Assigned Cost	Cost Assignment
G0885	80	New 230kV Substation w/ Comm expansion	100.00%	\$104M	SPB1: New Santiam 500/230kV #2 Transformer	0.00%	\$150M	SPB2: Albany-Lebanon 115kV Upgrade	0.00%	\$68M	Collector Station C&C and RAS	\$9M	\$113M
G0899	200		0.00%		0.00%	Collector Station C&C and RAS			\$9M		\$9M		
G0902	200		0.00%		18.87%	Collector Station C&C and RAS			\$9M		\$37M		
G0970	80		0.00%		7.55%	Collector Station C&C and RAS			\$9M		\$35M		



11.10 POI 8: Santiam-Alvey #1 230 kV (South)

Table 11.21 POI 8 – Santiam-Alvey #1 230 kV (South) Cost Allocation

<i>Estimate Summary</i>									
Estimate #	Description		Quantity	Contract		BPA		Misc.	Total
				Labor	Material	Labor	Material		
	Santiam-Alvey 230 kV South POI		-	-	-	-	-	-	-
ST-070-39-12	4x PCB, 4pos 2x bay BAAH, w/ 60MVAR Shunt Reactor		1	\$18,348,000	\$12,624,000	\$4,830,000	\$0	\$118,000	\$35,920,000
C&C	C&C: BPA station Large		1	\$0	\$0	\$0	\$0	\$15,000,000	\$15,000,000
C&C	C&C: Collector Stations		1	\$0	\$0	\$0	\$0	\$5,000,000	\$5,000,000
Contingency %	40%		Subtotal:	\$18,348,000	\$12,624,000	\$4,830,000	\$0	\$20,118,000	\$55,920,000
Overhead %	Labor	Materials	Contingency:	\$7,339,200	\$5,049,600	\$1,932,000	\$0	\$8,047,200	\$22,368,000
	26%	9%	Overhead:	\$6,678,672	\$1,590,624	\$1,758,120	\$0	\$2,534,868	\$12,562,284
Grand Total:	<i>(rounded to two significant figures)</i>			\$32,000,000	\$19,000,000	\$8,500,000	\$0	\$31,000,000	\$91,000,000

Table 11.22 POI 8 – Santiam-Alvey #1 230 kV (South) Cost Allocation

Queue #	Requested MW	Station Equipment	Station Equipment Allocation (Per Capita)	Station Equipment Cost	Non-Station Equipment (1)	Non-Station Allocation (Per MW)	Non-Station Equipment (1) Cost	Non-Station Equipment (2)	Non-Station Allocation (Per MW)	Non-Station Equipment (2) Cost	Non-Network Direct Assigned	Direct Assigned Cost	Cost Assignment
G0918	300	New 230kV Substation w/ Comm expansion	100.00%	\$82M	SPB1: New Santiam 500/230kV #2 Transformer New Marion-Santiam 500kV Line	28.30%	\$150M	SPB2: Albany-Lebanon 115kV Upgrade	78.95%	\$68M	Collector Station C&C and RAS	\$9M	\$187M



11.11 POI 9: Santiam-Toledo #1 230 kV

Table 11.23 POI 9 – Santiam-Toledo #1 230 kV Cost Estimate

Estimate Summary									
Estimate #	Description		Quantity	Contract		BPA		Misc.	Total
				Labor	Material	Labor	Material		
	Santiam-Toledo 230 kV POI		-	-	-	-	-	-	-
ST-070-39-12	4x PCB, 4pos 2x bay BAAH, w/ 60MVAR Shunt Reactor		1	\$18,348,000	\$12,624,000	\$4,830,000	\$0	\$118,000	\$35,920,000
C&C	C&C: BPA station Large		1	\$0	\$0	\$0	\$0	\$15,000,000	\$15,000,000
C&C	C&C: Collector Stations		2	\$0	\$0	\$0	\$0	\$10,000,000	\$10,000,000
C&C	C&C: Fiber		1	\$0	\$0	\$0	\$0	\$28,000,000	\$28,000,000
Contingency %	26%		Subtotal:	\$18,348,000	\$12,624,000	\$4,830,000	\$0	\$53,118,000	\$88,920,000
Overhead %	Labor	Materials	Contingency:	\$4,770,480	\$3,282,240	\$1,255,800	\$0	\$13,810,680	\$23,119,200
	27%	10%	Overhead:	\$6,241,990	\$1,590,624	\$1,643,166	\$0	\$6,692,868	\$16,168,648
Grand Total:	<i>(rounded to two significant figures)</i>			\$29,000,000	\$17,000,000	\$7,700,000	\$0	\$74,000,000	\$130,000,000

Table 11.24 POI 9 – Santiam-Toledo #1 230 kV Cost Allocation

Queue #	Requested MW	Station Equipment	Station Equipment Allocation (Per Capita)	Station Equipment Cost	Non-Station Equipment	Non-Station Equipment Allocation (Per MW)	Non-Station Equipment Cost	Non-Network Direct Assigned	Direct Assigned Cost	Cost Assignment
G0794	80	New 230kV Substation w/ Comm expansion	100.00%	\$112M	SPB1: New Santiam 500/230kV #2 Transformer	0.00%	\$150M	Collector Station C&C and RAS	\$9M	\$121M
G0969	80		0.00%		New Marion-Santiam 500kV Line	7.55%		Collector Station C&C and RAS	\$9M	\$20M



11.12SPB1: Santiam 500/230 Bank Addition

Table 11.25 SPB1 –Santiam 500/230 kV Bank Addition Cost Estimate

<i>Estimate Summary</i>									
Estimate #	Description		Quantity	Contract		BPA		Misc.	Total
				Labor	Material	Labor	Material		
	<u>Santiam Shared Work</u>		-	-	-	-	-	-	-
ST-070-19-11	230 kV Main-Aux Bay		1	\$2,180,000	\$1,402,000	\$522,000	\$0	\$12,000	\$4,116,000
ST-070-141-6	1ph 525/241 433 MVA bank		3	\$24,306,000	\$28,137,000	\$4,176,000	\$6,384,000	\$0	\$63,003,000
	<u>Marion Shared Work</u>			-	-	-	-	-	-
ST-070-65-10	1x New 500kV 1-bay BAAH Yard (2 terminals, 3 PCB)		0.5	\$5,854,000	\$4,807,000	\$905,000	\$0	\$29,000	\$11,595,000
LT-040-54-8	NEW Marion-Santiam 500 kV #2 per lmi		3	\$5,454,000	\$4,476,000	\$2,910,000	\$0	\$0	\$12,840,000
Contingency %	40%		Subtotal:	\$37,794,000	\$38,822,000	\$8,513,000	\$6,384,000	\$41,000	\$91,554,000
Overhead %	Labor	Materials	Contingency:	\$15,117,600	\$15,528,800	\$3,405,200	\$2,553,600	\$16,400	\$36,621,600
	26%	9%	Overhead:	\$13,757,016	\$4,891,572	\$3,098,732	\$804,384	\$5,166	\$22,556,870
Grand Total:	<i>(rounded to two significant figures)</i>			\$67,000,000	\$59,000,000	\$15,000,000	\$9,700,000	\$63,000	\$150,000,000

Table 11.26 SPB1 –Santiam 500/230 kV Bank Addition Cost Allocation

Queue #	Enabled MW	Percent Allocation	Cost Allocation
G0902	200	18.868%	\$ 28,301,887
G0904	200	18.868%	\$ 28,301,887
G0905	200	18.868%	\$ 28,301,887
G0918	300	28.302%	\$ 42,452,830
G0969	80	7.547%	\$ 11,320,755
G0970	80	7.547%	\$ 11,320,755
Total:	1060	100%	\$ 150,000,000



11.13SPB2: Albany-Lebanon 115 kV Reconductor

Table 11.27 SPB2 – Albany-Lebanon 115 kV Reconductor Cost Estimate

<i>Estimate Summary</i>									
Estimate #	Description		Quantity	Contract		BPA		Misc.	Total
				Labor	Material	Labor	Material		
	Santiam-Alvey 230 kV POIs		-	-	-	-	-	-	
LT-040-19-10	115 kV Reconductor - per 1 mile		17	\$18,802,000	\$9,248,000	\$3,298,000	\$0	\$31,348,000	
C&C	C&C: Fiber - 62 Miles		1	\$0	\$0	\$0	\$0	\$10,000,000	
Contingency %	40%		Subtotal:	\$18,802,000	\$9,248,000	\$3,298,000	\$0	\$41,348,000	
Overhead %	Labor	Materials	Contingency:	\$7,520,800	\$3,699,200	\$1,319,200	\$0	\$16,539,200	
	26%	9%	Overhead:	\$6,843,928	\$1,165,248	\$1,200,472	\$0	\$10,469,648	
Grand Total:	<i>(rounded to two significant figures)</i>			\$33,000,000	\$14,000,000	\$5,800,000	\$0	\$68,000,000	

Table 11.28 SPB2 – Albany-Lebanon 115 kV Reconductor Cost Allocation

Queue #	Enabled MW	Percent Allocation	Cost Allocation
G0918	300	78.947%	\$ 53,684,211
G0970	80	21.053%	\$ 14,315,789
Total:	380	100%	\$ 68,000,000

