

TRANSMISSION PLANNING**GENERATION INTERCONNECTION REPORT****2025 TRANSITION CLUSTER STUDY (TCS)****CLUSTER AREA: NORTH1, PHASE 1, Revision 1****(25TCS CA-NO1 P1-1)**

G0688	G0753	G0828
G0829	G0840	G0853
G0858	G0916	G0953
G0955	G0956	G0985
G1001	G1016	G1025
G1032	G1035	G1037
G1038	G1039	G1040

September 2026

<u>Version</u>	<u>Summary of Edits</u>
0.0	Original
1.0	Errata, Customer Modifications, Cost Allocations. Withdrawals: G0639, G0732, G0744, G0760, G0761, G0817, G0819, G0820, G0914, G0915, G0954, G1010, G1043, G1047

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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, project location, and requested Commercial Operation Date are also shown.

Cluster Area North 1 (NO1) is comprised of Interconnection Requests (IRs) in Grant, Lincoln, Benton, and Douglas counties of Washington state. It includes 21 total IRs seeking a total combined 6,850 MW of Interconnection Service and 3,975 MW of grid charging.

Revision #1 of this report captures customer modifications made after TCS PH1, reallocated costs, minor errata corrections, and withdrawals of the following requests: G0639, G0732, G0744, G0760, G0761, G0817, G0819, G0920, G0914, G0915, G0954, G1010, G1043, G1047.

Table 1: Participants in 2025 TCS PH1 CA North 1

IR #	Gen Type	Studied POI	MW Requested (Generating)	MW Requested (Charging)	Plant Location (County, State)	Requested COD
G0688	Solar, BESS	Wautoma-Rock Creek 500 kV	500	-500	Benton, WA	12/31/2025
G0753	Solar, BESS	Columbia Annex 230 kV	300	-300	Douglas, WA	12/31/2025
G0828	BESS	Vantage 500 kV	100	-100	Grant, WA	12/31/2026
G0829	BESS	Columbia Annex 230 kV	20	-20	Douglas, WA	12/31/2026
G0840	Solar, BESS	Chief Joseph-Sickler 500 kV	300	-300	Douglas, WA	12/31/2027
G0853	Solar, BESS	Chief Joseph-Sickler 500 kV	300	-300	Douglas, WA	12/31/2027
G0858	BESS	Columbia Annex 230 kV	130	-130	Douglas, WA	12/31/2026
G0916	BESS	Grand Coulee 500 kV	500	-500	Douglas, WA	12/1/2028
G0953	Wind	Grand Coulee-Bell 500 kV	600	0	Lincoln, WA	9/1/2026
G0955	Wind	Grand Coulee-Bell 500 kV	350	0	Lincoln, WA	9/1/2026
G0956	Wind	Grand Coulee-Bell 500 kV	400	0	Lincoln, WA	9/1/2026
G0985	Solar, BESS	Grand Coulee-Creston 115 kV (Wilbur Tap)	150	-75	Lincoln, WA	12/31/2027
G1001	Solar	Grand Coulee-Hanford 500 (Rocky Ford 500/230 kV)	150	0	Grant, WA	12/3/2029
G1016	Solar	Chief Joseph-Sickler 500 kV	400	0	Klickitat, WA	12/31/2029
G1025	Wind, Solar, BESS	Columbia Annex 230 kV	250	-250	Douglas, WA	12/1/2029

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



IR #	Gen Type	Studied POI	MW Requested (Generating)	MW Requested (Charging)	Plant Location (County, State)	Requested COD
G1032	Solar	Grand Coulee-Hanford 500 kV	500	0	Grant, WA	10/31/2028
G1035	Solar	Chief Joseph 500 kV	400	0	Douglas, WA	10/28/2028
G1037	Solar, BESS	Wautoma-Rock Creek 500 kV	400	-400	Benton, WA	12/31/2030
G1038	Solar, BESS	Wautoma-Rock Creek 500 kV	400	-400	Benton, WA	12/31/2030
G1039	Solar, BESS	Wautoma-Rock Creek 500 kV	400	-400	Benton, WA	12/31/2030
G1040	Solar, BESS	Wautoma-Rock Creek 500 kV	300	-300	Benton, WA	12/31/2030

POI location requirements for each IR are summarized in Table 2. Scalable Plan Blocks (SPB) are indicated where applicable.

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

Table 2: 2025 TCS PH1 CA North 1 Requirements

IR #	Studied POI	Total Scope	Total Cost	Contingent Facilities
G0688	New Wautoma-Rock Creek Substation 500 kV, 500 kV bus POI #1	New 500 kV substation on the Wautoma-Rock Creek 500 kV line, Participate in AC-RAS near Rock Creek	\$140M	None
G0753	Columbia Annex 230 kV	New Columbia 500 kV yard Loop-in Grand Coulee-Schultz #1 500 kV New Columbia Annex 230 kV yard New Columbia 500/230 kV transformer New Columbia substation 230 kV tie line Remove existing Grand Coulee-Schultz #1 and #2 series capacitors Participate in new North of Schultz RAS	\$130M	None
G0828	Vantage 500 kV	New bay in 500 kV yard	\$41M	None
G0829 G0858	Columbia Annex 230 kV	New Columbia 500 kV yard Loop-in Grand Coulee-Schultz #1 500 kV New Columbia Annex 230 kV yard New Columbia 500/230 kV transformer New Columbia substation 230 kV tie line Remove existing Grand Coulee-Schultz #1 and #2 series capacitors Participate in new North of Schultz RAS	\$122M	None
G0840 G0853	Chief Joseph-Sickler New 500 kV Substation, 500 kV bus POI	New 500 kV substation on the Chief Joseph-Sickler 500 kV line. Participate in new North of Schultz RAS	\$100M	None
G0916	Grand Coulee 500 kV	New 500 kV yard New COUL 500/230 kV transformer (SPB) New 500 kV substation tie-line Participate in new North of Schultz RAS Participate in new Local RAS	\$175M	TSEP: Schultz-Raver #3 and #4 500 kV new series capacitors and line upgrades



IR #	Studied POI	Total Scope	Total Cost	Contingent Facilities
G0953 G0955	New Grand Coulee-Bell 500 kV Substation, 500 kV bus POI	New 500 kV substation on the Grand Coulee-Bell 500 kV line Participate in new North of Schultz RAS New COUL 500/230 kV transformer (SPB)	\$175M	TSEP: Schultz-Raver #3 and #4 500 kV new series capacitors and line upgrades TSEP: New Schultz-Olympia #1 500 kV Line
G0956	New Grand Coulee-Bell 500 kV Substation, 500 kV bus POI	New 500 kV substation on the Grand Coulee-Bell 500 kV line Participate in new North of Schultz RAS New COUL 500/230 kV transformer (SPB)	\$129M	TSEP: Schultz-Raver #3 and #4 500 kV new series capacitors and line upgrades TSEP: New Schultz-Olympia #1 500 kV Line
G0985	Grand Coulee-Creston 115 kV New Substation (Wilbur Tap)	New 115 kV substation on the Grand Coulee-Creston 115 kV line Participate in new North of Schultz RAS	\$87M	TSEP: Schultz-Raver #3 and #4 500 kV new series capacitors and line upgrades TSEP: New Schultz-Olympia #1 500 kV Line
G1001	New Rocky Ford 500/230 kV Station, 230 kV bus POI	New 230 kV bay at the future BPA Rocky Ford 500/230 kV substation Participate in new North of Schultz RAS	\$31M	L0544: New Rocky Ford 500/230 Station TSEP: Schultz-Raver #3 and #4 500 kV new series capacitors and line upgrades TSEP: New Schultz-Olympia #1 500 kV Line
G1016	Chief Joseph-Sickler New 500 kV Substation, 500 kV bus POI	New 500 kV substation on the Chief Joseph-Sickler 500 kV line Participate in new North of Schultz RAS	\$91M	TSEP: Schultz-Raver #3 and #4 500 kV new series capacitors and line upgrades TSEP: New Schultz-Olympia #1 500 kV Line
G1025	Columbia Annex 230 kV	New Columbia 500 kV yard Loop-in Grand Coulee-Schultz #1 500 kV New Columbia Annex 230 kV yard New Columbia 500/230 kV transformer New Columbia substation 230 kV tie line Remove existing Grand Coulee-Schultz #1 and #2 series capacitors Participate in new North of Schultz RAS	\$124M	TSEP: Schultz-Raver #3 and #4 500 kV new series capacitors and line upgrades TSEP: New Schultz-Olympia #1 500 kV Line TSEP: Rock Creek-John Day 500 kV Line Upgrade
G1032	New Grand Coulee-Hanford 500 kV Substation, 500 kV bus POI	New 500 kV substation on the Grand Coulee-Hanford 500 kV line Participate in new North of Schultz RAS	\$190M	TSEP: Schultz-Raver #3 and #4 500 kV new series capacitors and line upgrades TSEP: New Schultz-Olympia #1 500 kV Line TSEP: Rock Creek-John Day 500 kV Line Upgrade
G1035	Chief Joseph 500 kV	Develop a new bay in the Chief Joseph 500 kV yard Participate in new North of Schultz RAS	\$35M	TSEP: Schultz-Raver #3 and #4 500 kV new series capacitors and line upgrades TSEP: New Schultz-Olympia #1 500 kV Line TSEP: Rock Creek-John Day 500 kV Line Upgrade
G1037 G1038 G1039 G1040	New Wautoma-Rock Creek Substation 500 kV, 500 kV bus POI #2	New 500 kV substation on the Wautoma-Rock Creek 500 kV line, Participate in AC-RAS near Rock Creek	\$210M	TSEP: Schultz-Raver #3 and #4 500 kV new series capacitors and line upgrades TSEP: New Schultz-Olympia #1 500 kV Line TSEP: Rock Creek-John Day 500 kV Line 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 study 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 elected to proceed serially, and non-BPA queued IRs in adjacent Transmission Provider queues if known.

Table 3: Senior Queued IRs Assumed In-Service

Queue #	POI (owner)	MW Generating	MW Grid-Charging	Fuel Type
BPA G0335	Rock Creek 230 kV (BPA)	17	0	Biofuel
BPA G0586	Spring Creek 230 kV (BPA)	100	0	Solar
BPA G0589	Knight 500 kV (BPA)	381	0	Solar
BPA G0596	Midway Goose Prairie 115 kV (BPA)	80	0	Solar, BEES
BPA G0598	Knight 500 kV (BPA)	160	0	Solar, BEES
BPA G0602	Vantage 230 kV (BPA)	170	0	Solar
BPA G0626	Vantage 230 kV (BPA)	90	0	Solar
BPA G0637	Knight 500 kV (BPA)	190	0	BESS
Grant PUD No. 7	Columbia-Rocky Ford 230 kV (Grant PUD)	200	0	Solar
BPA G0656	Vantage 500 kV (BPA)	500	-500	BESS
BPA G0660	North Hawk 230 kV (BPA)	200	0	Solar, BEES
BPA G0668	North Hawk 230 kV (BPA)	400	0	Solar, BEES
BPA G0670	Wautoma 500 kV (BPA)	500	-500	Solar, BEES
BPA G0676	Spring Creek 230 kV (BPA)	125	-125	Solar, BEES
PAC C1-37	Pomona-Vantage 230 kV (PAC)	199	0	Solar, BEES
PAC C1-40	Midway-Union Gap 230 (PAC)	150	0	Solar, BEES
BPA G0683	Wautoma (BPA)	200	0	Wind
BPA G0684	Wautoma (BPA)	470	-235	Solar, BEES
BPA G0686	Benton (BPA)	127.5	0	Solar
BPA G0717	Rock Creek (BPA)	75	-75	BESS
BPA L0544	Rocky Ford (BPA)	N/A	N/A	N/A



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

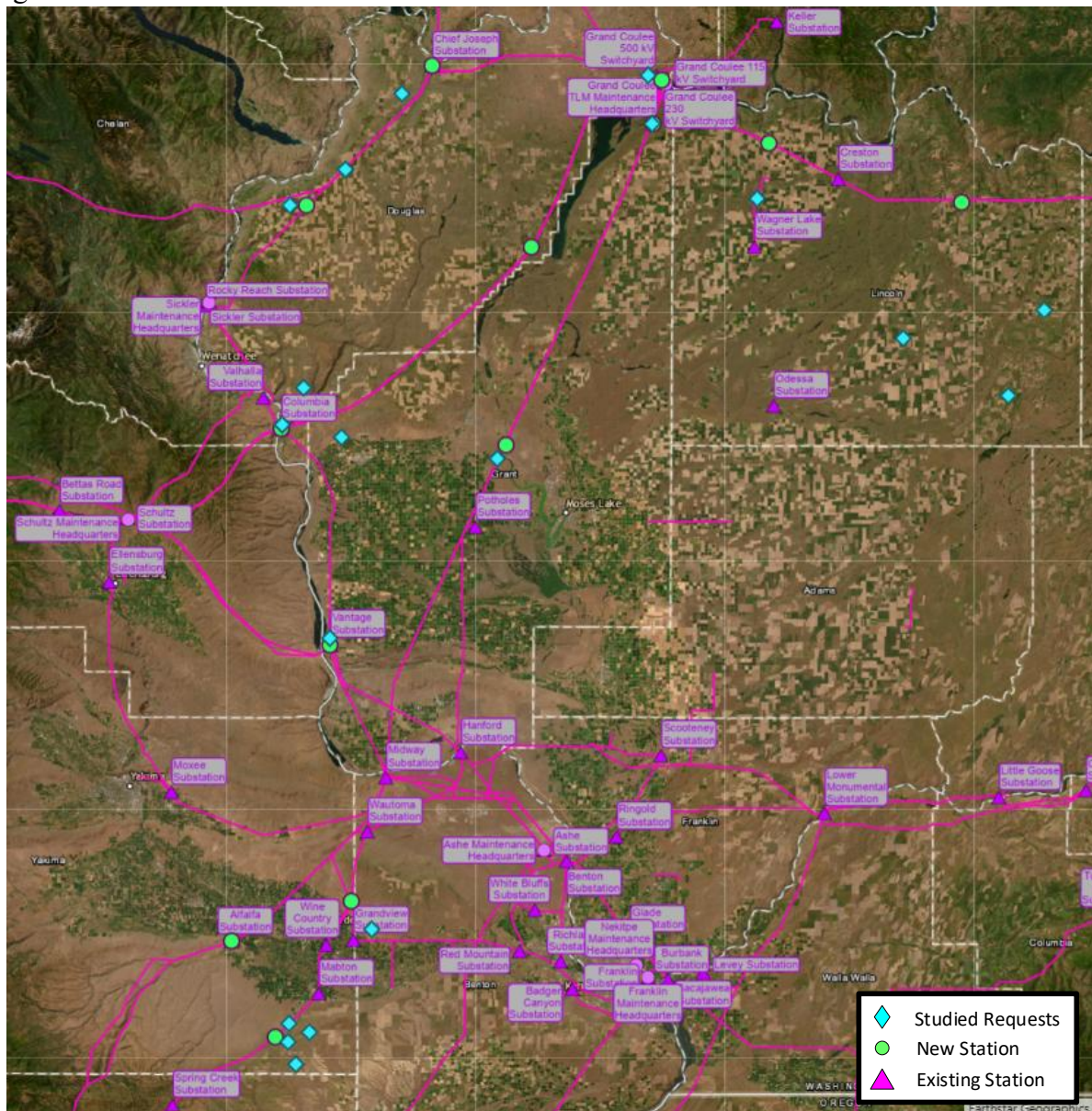
5 Study Methodology

5.1 Cluster Area Definition

The following map illustrates the geographic coordinates for the IRs assessed in North Cluster Area. Locations of new stations are identified in green circles, existing stations are shown as purple triangles, and transition cluster IRs are shown as teal diamonds. IRs with the same coordinates appear as a single point.



Figure 1: North 1 Cluster Area IR Locations



5.2 Studied POIs

The following Table 4 indicates the final studied POI for each request in the Cluster Area.

Table 4: Studied POI locations

IR #	Studied POI	Gen Type	MW Generating	MW Grid-Charging
G1035	Chief Joseph 500 kV	Solar	400	0
G1016	Chief Joseph-Sickler 500 kV	Solar	400	0
G0840	Chief Joseph-Sickler 500 kV	Solar, BESS	300	-300
G0853	Chief Joseph-Sickler 500 kV	Solar, BESS	300	-300
G1025	Columbia Annex 230 kV	Wind, Solar, BESS	250	-250
G0753	Columbia Annex 230 kV	Solar, BESS	300	-300
G0829	Columbia Annex 230 kV	BESS	20	-20
G0858	Columbia Annex 230 kV	BESS	130	-130
G1032	Coulee-Hanford 500 New Substation, 500 kV bus POI	Solar	500	0
G0916	Grand Coulee 500 kV	BESS	500	-500
G0953	Grand Coulee-Bell 500 kV	Wind	600	0
G0955	Grand Coulee-Bell 500 kV	Wind	350	0
G0956	Grand Coulee-Bell 500 kV	Wind	400	0
G0985	Grand Coulee-Creston 115 kV (Wilbur Tap)	Solar, BESS	150	-75
G1001	Rocky Ford 500/230 kV New Substation, 230 kV bus POI	Solar	150	0
G0828	Vantage 500 kV	BESS	100	-100
G0688	Wautoma-Rock Creek 500 kV	Solar, BESS	500	-500
G1037	Wautoma-Rock Creek 500 kV	Solar, BESS	400	-400
G1038	Wautoma-Rock Creek 500 kV	Solar, BESS	400	-400
G1039	Wautoma-Rock Creek 500 kV	Solar, BESS	400	-400
G1040	Wautoma-Rock Creek 500 kV	Solar, BESS	300	-300

5.3 Starting Base Cases

The following WECC cases were used for NO1.

- 2026 Heavy Summer (HS)
- 2026 Heavy Winter (HW)
- 2026 Light Spring (LSP)

These 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. The study cases were updated to include North area projects estimated to be energized in the next 5 to 10 years. The following system updates were made:

- Alfalfa- North Bonneville 230 kV line section upgrade
- Midway-Ashe (Hanford) 230 kV loop project
- Grant PUD's Wanapum-Mountain View 230 kV line
- Jump-off Ridge loads increased to 43.3 MW each
- Clovis substation and load on the Urban Industry-Rapids 230 kV line



- Rocky Reach-Maple Valley returned to 345 kV operation

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

5.3.1 Load and Resource Scenario Descriptions

The cases represent typical demands and system transfers in the area by season. The loads were left at the levels provided in the WECC cases and the following tables provide interface flows and existing generation amounts. The values in the tables include the senior queue IRs (at maximum active power) in the North area. The senior queue IRs total power (4335 MW) was exported out of the North area and absorbed by sink loads added to the 500 kV buses at major delivery substations in the Northwest. The senior queue IR power was divided evenly across each of the sink loads. The assumption is that regional load growth will continue to be served by resource expansion in the North area rather than simply displacing local hydro generation. The sink loads provide a means to absorb the POI injections outside of the North area, approximating regional load growth.

Sink Load Buses

Number	Name	kV
41007	SNO_KING	500
40693	MAPLE_VA	500
40869	RAVER	500
40821	PAUL	500
40045	ALLSTON	500
40601	KEELER	500
40827	PEARL	500
40809	OSTRANDER	500
40723	MCNARY	500
40325	LONGHORN	500
40687	MALIN	500

Area Generation

Name	26HW	26LSP	26HS
Grand Coulee	3445	5237	4800
Grand Coulee 230	1890	1602	1689
Grand Coulee 500	1555	3634	3111
Chief Joe	2396	2139	2044
Chief Joe 230	1296	1086	1140
Chief Joe 500	1100	1053	905
Upper Columbia Hydro	5841	7376	6845
Wells	750	751	750
Rocky Reach	1060	1062	1060
Rock Island	475	476	475
Wanapum	1020	1021	1020
Priest Rapids	801	802	801
Mid-Columbia Hydro	4106	4112	4106
McNary	498	276	588
John Day	1389	808	1262



Name	26HW	26LSP	26HS
The Dalles	1087	741	1094
Bonneville	613	486	553
Lower Columbia Hydro	3587	2310	3496
Lower Granite	395	501	376
Little Goose	528	501	528
Lower Monumental	640	501	509
Ice Harbor	88	285	285
Lower Snake Hydro	1651	1788	1697
CGS	1100	1100	1100
Chelan Hydro	60	60	60
North Mid-C East Headwork	0	25	25
North Mid-C East Sub Avista Lind and Rattlesnake	18	18	18
North Mid-C East Sub Grant Quin CH and PEC	0	6	9
North Mid-C East Summer Fall	0	90	90
North Mid-C West Goose Prairie	70	70	70
North Mid-C West Roza and Tieton	11	11	11
North Mid-C West Wind Ridge	0	0	0
Bettas Road	0	0	0
Big Horn	0	0	0
Wild Horse	0	0	0

Area Path Flows

Name	26HW	26LSP	26HS
Columbia Injection	-292	-761	-708
Wanapum Injection	-3	-95	114
NORTH OF HANFORD	-2590	2324	1442
MONTANA - NORTHWEST	462	1705	278
WEST OF HATWAI	575	2407	542
WEST OF LOWER MONUMENTAL	2165	2931	2347
WEST OF CASCADES - NORTH*	10704	8942	7439
WEST OF CASCADES - SOUTH	7677	4833	6360
WEST OF MCNARY	776	515	1386
WEST OF SLATT	1739	1929	2772
WEST OF JOHN DAY	1118	1140	2831
NORTHERN INTERTIE	1334	-674	-1683
NORTHERN INTERTIE - EAST	0	141	-166
NORTHERN INTERTIE - WEST	1336	-813	-1514
NWACI	1060	3010	2535
PACIFIC DC INTERTIE (PDCI)	-1837	1601	2601

*Includes the new Schultz-Olympia 500 kV line contingent facility

5.4 Phase 1 POI Injection Tests

Steady state contingency analysis was conducted at each POI injecting total generating or grid-charging amounts. POIs were evaluated one at a time to determine injection capability at each POI. To keep the North area generation and load unchanged the POI power injection was delivered to a group of “sink” loads placed at 500 kV buses in the Northwest. The “sink” loads were placed at 500 kV buses representing substations located near major delivery points. Detailed findings of these injection tests can be found in the Results Section.



“Sink” Loads Applied

Number	Name	kV
41007	SNO_KING	500
40693	MAPLE_VA	500
40869	RAVER	500
40821	PAUL	500
40045	ALLSTON	500
40601	KEELER	500
40827	PEARL	500
40809	OSTRANDER	500
40723	MCNARY	500
40325	LONGHORN	500
40687	MALIN	500

In addition to the individual POI injection capability evaluations, the total North area injection capability was evaluated. Steady state contingency analysis was conducted at each POI increasing total generating or grid-charging amounts until a reliability limit was reached. The active power total (approximately 11 GW) is much larger than the individual POI active power evaluations. To sink the 11 GW ramp, a large Northwest generation injection group was used. This injection group includes:

- Large hydro plants in the Northwest on the Columbia and Snake Rivers
- Northwest area gas generation plants
- Northwest area wind generation plants
- Large hydro plants in British Columbia: Mica, Revelstoke, Gordon M. Shrum, Site C (Peace Canyon)

5.5 Phase 1 POI Short Circuit Ratio Strength Tests

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

All evaluated POIs passed BPA’s SCR strength test except two: new midline POI on Wautoma-Rock Creek 500 kV, and new midline POI on Grand Coulee-Bell 500 kV. Configuration of these POIs results in simple 2-line connections outbound from the new BPA 500 kV station. The lowest short circuit ratios identified at both POIs are in the light spring season.

Grand Coulee-Bell 500 kV POI SCR is 1.3, for Grand Coulee 500 kV end out of service with 1700 MW injected at the POI. Reducing injections to 740 MW increases the SCR to 3.

Wautoma-Rock Creek 500 kV POI#1 and POI #2 SCR is 2.1 for Wautoma 500 kV end out of service with 1410 MW injected at the POI. Reducing injection to 990 MW at each site increases the SCR to 3.

These three POIs will require additional evaluation in TCS Phase Two Cluster Study, including confirmation that the new resources can operate in a manner that improves the system strength and stability during radial service (one POI 500 kV line out of service). Alternatively, the POI will be evaluated for local 500 kV line N-1 RAS and generation restrictions during N-1 system conditions at the POI to meet the SCR strength test requirements. Failing those potential



mitigations, new networked transmission lines might be required at the POI during the Phase Two Cluster Study if the total requested MW amounts are not reduced to levels with SCR of at least 3.

6 Contingent Facilities Assumed In-Service

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

Table 6.1: Required Contingent Facilities for TCS POIs

Project Name	Total Cluster Area MW Threshold	Required for IRs	Driver	Cost	Estimated I/S Date
None (existing system)	1,989	G0688, G0753, G0828, G0829, G0840, G0853, G0858 (ISL total 1650 MW)	N/A	N/A	N/A
TSEP: Schultz-Raver #3 and #4 500 kV Line upgrades	1,990	G0916, G0953, G0955, G0956, G0985, G1001, G1016, G1025, G1032, G1035, G1037, G1038, G1039, G1040	Commercial TSRs	\$350 M	Dec 2031
TSEP: Schultz-Raver #3 and #4 500 kV Line new series capacitors at Schultz				N/A*	N/A*
TSEP: New Schultz-Olympia #1 500 kV Line	2,695	G0953, G0955, G0956, G0985, G1001, G1016, G1025, G1032, G1035, G1037, G1038, G1039, G1040	Commercial TSRs	N/A*	N/A*
TSEP: Rock Creek-John Day 500 kV Line Upgrade	4,745	G1025, G1032, G1035, G1037, G1038, G1039, G1040	Commercial TSRs	\$114 M	Dec 2030
L0544: new BPA 500/230 kV substation on the Grand Coulee-Hanford 500 kV line near Rocky Ford	N/A	G1001	L0544	\$270 M	Dec 2028

*Project is still in pre-scoping, total costs and schedule not available

Additional details on the TSEP contingent facilities:

- Reconductor & rebuild portions of the existing Schultz-Raver #3 and Schultz-Raver #4 500 kV lines to match higher line ratings.
- Install new series capacitors on the Schultz-Raver #3 and Schultz-Raver #4 500 kV lines.
- Rebuild the portion of the Coulee-Olympia 230 kV line from Schultz to Olympia to 500 kV to create a new Schultz-Olympia 500 kV line
- Rebuild Rock Creek-John Day #1 500 kV line to achieve a higher line rating.

The L0544 BPA Rocky Ford substation on the Grand Coulee-Hanford 500 kV line is a unique contingent facility for G1001. The L0544 project develops a new substation well situated as the POI for interconnection of G1001. The new substation location is estimated to be about 53 miles south of Grand Coulee along the Grand Coulee-Hanford 500 kV line.



Seven of the twenty-one North area IRs (roughly 1650 MW of incremental generation) can be added without these Contingent Facilities:

- G0688 (POI: Wautoma-Rock Creek substation #1)
- G0753 (POI: Columbia Annex substation)
- G0828 (POI: Vantage substation)
- G0829 (POI: Columbia Annex substation)
- G0840 (POI: Chief Joseph-Sickler)
- G0853 (POI: Chief Joseph-Sickler)
- G0858 (POI: Columbia Annex substation)

7 Technical Analysis & Study Results

There are three existing and new constraints for the entire NO1 Cluster Area, and two locational specific constraints for NO1.

The following figure 7.1 shows the three wider area system constraints for NO1:

- 1) West of Cascades North (WOCN): Several parallel transmission lines limit this path (Schultz-Raver #3 and #4 500 kV; and Grand Coulee-Olympia 230 kV). To resolve the constraint three Contingent Facility plans must be assumed in-service:
 - TSEP: Schultz-Raver #3 and #4 500 kV Line new series capacitors at Schultz
 - TSEP: Schultz-Raver #3 and #4 500 kV Line upgrades
 - TSEP: New Schultz-Olympia #1 500 kV Line
- 2) Rock Creek-John Day 500 kV line: An existing system limiter for flows inside and out of NO1. To resolve the constraint the following contingent facility must be assumed in-service:
 - TSEP: Rock Creek-John Day 500 kV Line Upgrade
- 3) New North of Schultz (NOSZ): Multiple new lines north of the Schultz substation are new limiters and require new mitigations.

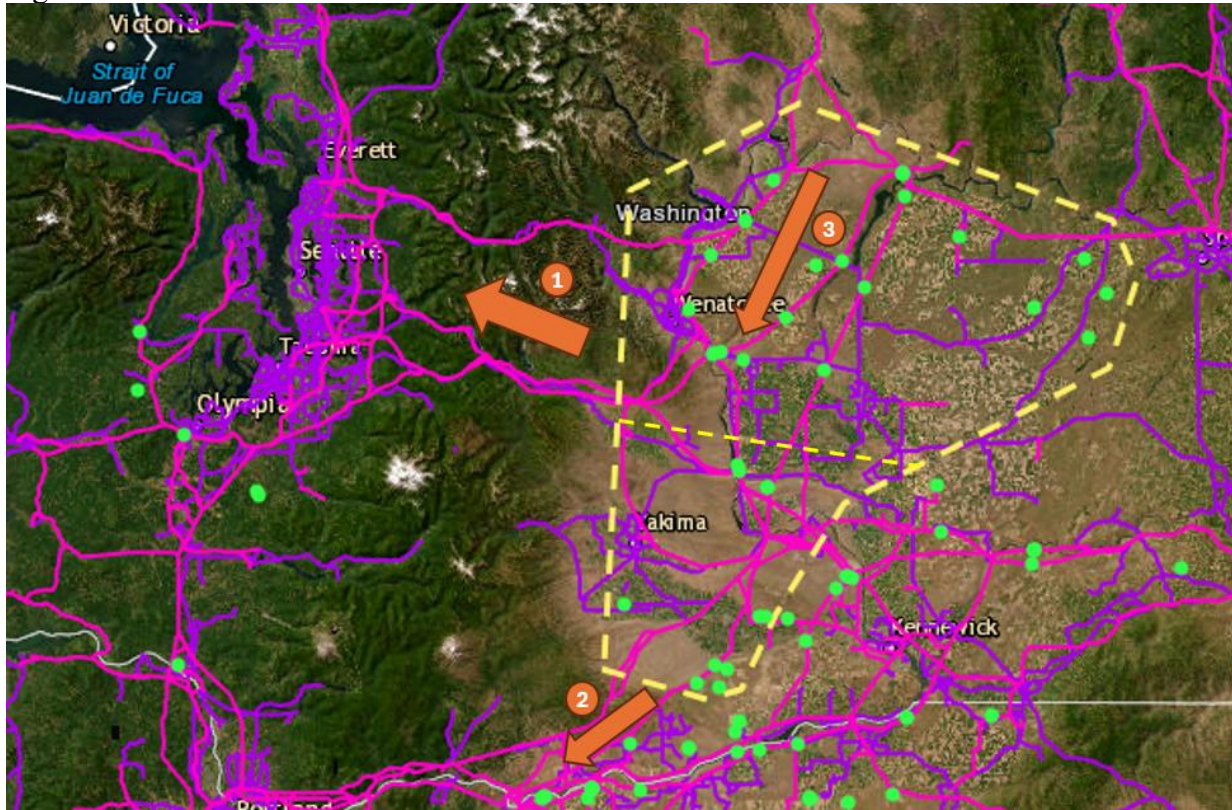
There is also one new locational specific constraint in NO1:

- Grand Coulee 500/230 kV transformer (requires new mitigation)

Sections 7.1 and 7.2 contain more details about the new constraints and new mitigations.



Figure 7.1: North 1 Cluster Area General Constraints



7.1 North of Schultz Performance

This constraint involves the parallel 500 kV transmission lines between the Upper Columbia substations (Grand Coulee 500 kV and Chief Joseph 500 kV) and the Schultz 500 kV substation; and the Grand Coulee-Hanford 500 kV transmission line. The mitigation of this constraint is a new “North of Schultz” RAS algorithm (NOSZ RAS).

Limiter 1: North of Schultz (NOSZ) constraints

Mitigation 1: NOSZ RAS. The NOSZ constraint and RAS described below will be required for all GIs at POIs in the northern half of NO1. The northern half locations increase transfers on the NOSZ constraint.

The NOSZ RAS will automatically trip generation for single line losses (SLL) and double line loss (DLL) events. GIs at POIs in the northern portion of the North area will be included in the new NOSZ RAS algorithm as plants available to be tripped, per **Table 7.2:**

- SLL: Grand Coulee-Columbia #1 500 kV line (after splitting the Grand Coulee-Schultz #1 500 kV line)
- SLL: Columbia-Schultz #1 500 kV line (after splitting the Grand Coulee-Schultz #1 500 kV line)
- SLL: Grand Coulee-Schultz #2 500 kV line
- SLL: Sickler-Schultz #1 500 kV line
- SLL: Chief Joseph-Sickler #1 500 kV line



- DLL: Grand Coulee-Columbia #1 500 kV line (after splitting the Grand Coulee-Schultz #1 500 kV line) and Grand Coulee-Schultz #2 500 kV line
- DLL: Columbia-Schultz #1 500 kV line (after splitting the Grand Coulee-Schultz #1 500 kV line) and Grand Coulee-Schultz #2 500 kV line

7.2 Grand Coulee POI Performance

The Grand Coulee substation POI has a limiter specific to this location and POIs on the 230 kV lines adjacent to Grand Coulee substation. The existing Grand Coulee 500/230 kV transformer brings existing 230 kV connected hydro power to the Grand Coulee 500 kV bus. This transformer can exceed its rating for events forcing more power across it.

Limiter 2: Existing Grand Coulee 500/230 kV transformer.

Mitigation 2: New, 2nd Grand Coulee 500/230 kV transformer.

The existing transformer experiences heavy loading transferring existing 230 kV connected hydro power to the 500 kV bus at Grand Coulee. Any new integration of power on the 230 kV system near Grand Coulee contributes addition loading on the existing transformer and requires mitigation to avoid rating exceedances. This also applies to integration of new resources grid-charging from the 500 kV system at Grand Coulee. Any new GIs that increase power on the existing transformer require a new 500/230 kV transformer at Grand Coulee

Limiter 3: Existing and new Grand Coulee 500/230 kV transformers.

Mitigation 3: Local RAS at Grand Coulee to trip the Grand Coulee 500 kV connected GIs.

Land is constrained at the existing Grand Coulee 500 kV substation, and there are not enough bay positions to enable the number and MW size of IRs. The few remaining vacant bay positions are planned for other BPA line projects. A new Grand Coulee 500 kV “annex” site is required as the POI for new IRs. The new 500 kV POI annex will connect to the existing Grand Coulee 500 kV yard via a short 500 kV station tie-line; and to the existing Grand Coulee 230 kV yard via a new 500/230 kV transformer. Loss of the new 500 kV tie-line will exceed the ratings of both existing and new Grand Coulee 500/230 kV banks. A new local RAS will be required to trip the new GIs for this local POI outage.

The following table summarizes the system constraints relevant to each POI and that require newly identified mitigation plans.



Table 7.2: Results by POI, Specific Limiters and Required Mitigations

POI	IRs Affected	New Limiters (L)	New Mitigation (M)
Chief Joseph 500 kV	G1035, 400 MW (solar) Total: 400 MW	L1. North of Schultz constraint	M1. NOSZ RAS
Chief Joseph-Sickler 500 kV line, 230 bus POI	G0840, +/-300 MW (solar/BESS) G0853, +/-300 MW (solar/BESS) G1016, 400 MW (solar) Total: 1000 MW, -600 MW	L1. North of Schultz constraint	M1. NOSZ RAS
Columbia Annex 230 kV	G0829, +/- 20 MW (BESS) G0858, +/- 130 MW (BESS) G0753, +/- 300 MW (solar/BESS) G1025, 250 MW, -250 MW (wind/solar/BESS) Total: 700 MW, -700 MW	L1. North of Schultz constraint	M1. NOSZ RAS
Grand Coulee 500 kV	G0916, +/- 500 MW (BESS) Total: 500 MW, -500 MW	L1. North of Schultz constraint L2. Existing Grand Coulee 500/230 kV transformer L3. Existing and new Grand Coulee 500/230 kV transformers	M1. NOSZ RAS M2. New, 2nd Grand Coulee 500/230 kV transformer M3. New RAS for loss of the new Grand Coulee 500 kV yard tie-line
Coulee-Bell 500 kV line, 500 bus POI	G0953, 600 MW (wind) G0955, 350 MW (wind) G0956, 400 MW (wind) Total: 1350 MW	L1. North of Schultz constraint L2. Existing Grand Coulee 500/230 kV transformer	M1. NOSZ RAS M2. New, 2nd Grand Coulee 500/230 kV transformer
Coulee-Hanford 500 kV line, 500 bus POI	G1032, 500 MW (solar) Total: 500 MW	L1. North of Schultz constraint	M1. NOSZ RAS
BPA Rocky Ford 500/230 kV Substation, 230 bus POI	G1001, 150 MW (solar) Total: 150 MW	L1. North of Schultz constraint	M1. NOSZ RAS
Vantage 500 bus POI	G0828, +/-100 MW (BESS) Total: 100 MW, -100 MW	None	None
Wautoma-Rock Creek 500 kV line, POI #1	G0688, +/-500 MW (solar/BESS) Total: 500 MW, -500 MW	None	Participation in Existing AC- RAS algorithm (RCCK-JDAY)
Wautoma-Rock Creek 500 kV line, POI #2	G1037, +/-400 MW (solar/BESS) G1038, +/-400 MW (solar/BESS) G1039, +/-400 MW (solar/BESS) G1040, +/-300 MW (solar/BESS) Total: 1500 MW, -1500 MW	None	Participation in Existing AC- RAS algorithm (RCCK-JDAY)
Grand Coulee-Creston #1 115 kV line	G0985, 150 MW, -75 MW (solar/BESS) Total: 150 MW, -75 MW	L1. North of Schultz constraint	M1. NOSZ RAS



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	POI (G#)
Grant PUD	L0544 (COUL-HANF midline station)	Rocky Ford 500/230 (G1001)
PGE & PAC	Chief Joe 500 kV (partial NWACI facility)	CHJO-SICK 500 (G0840, G0853, G1016) CHJO 500 (G1035)

9 Interconnection Requirements

9.1 Chief Joseph Substation

Table 9.2: POI Chief Joseph Substation Facility Requirements

G#	BPA Station Work	BPA Non-Station Work	Contingent Facilities
G1035	New 500 kV terminal	None	TSEP: Schultz-Raver #3 and #4 500 kV new series capacitors and line upgrades TSEP: New Schultz-Olympia #1 500 kV Line TSEP: Rock Creek-John Day 500 kV Line Upgrade

1. Develop a new 500 kV bay with 2 breakers and with associated disconnect switches, control, relaying, and communications equipment.
2. Participate in a new North of Schultz single line loss/double line loss Remedial Action Scheme (NOSZ SLL/DLL 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.

G1035 will construct a 500 kV transmission line from the BPA POI substation to its generation facility. The estimated length of the transmission line is 6 miles.



9.2 Chief Joseph-Sickler 500 kV Line New Substation

Table 9.3: POI Chief Joseph-Sickler 500 kV New Substation Facility Requirements

G#	BPA Station Work	BPA Non-Station Work	Contingent Facilities
G0840 G0853	New 500 kV Yard, 1x shared 500 kV Terminal	N/A	N/A
G1016	New 500 kV Yard, 1x 500 kV Terminal	N/A	TSEP: Schultz-Raver #3 and #4 500 kV new series capacitors and line upgrades TSEP: New Schultz-Olympia #1 500 kV Line

1. Develop a new 500 kV yard 4 breaker ring, BAAH construction with associated disconnect switches, control, relaying, and communications equipment. Include a new 180 MVAR shunt reactor.
2. The Chief Joseph-Sickler 500 kV line will be looped into the new 500 kV yard splitting the line into two new lines.
3. Participate in a new North of Schultz single line loss/double line loss Remedial Action Scheme (NOSZ SLL/DLL RAS)
4. Installation of BPA-required C&C equipment at each customer's collector site (RAS, Meters, relays, Control House space)
5. Minor development of C&C hardware at BPA's POI substation.

G0840 and G0853 will construct a 500 kV line from the BPA POI substation to their generation facilities. The estimated length of the transmission line is 8 miles.

G1016 will construct a 500 kV line from the BPA POI substation to its generation facility. The estimated length of the transmission line is 8 miles.

9.3 Columbia Annex Substation

Table 9.4: POI Columbia Annex Substation Facility Requirements

G#	BPA Station Work	BPA Non-Station Work	Contingent Facilities
G0753	New 500 kV Yard, 1x 230 kV Terminal	POI 500/230 kV transformer, 230 kV substation tie-line	None
G0829 G0858	New 500 kV Yard, 1x shared 230 kV Terminal	POI 500/230 kV transformer, 230 kV substation tie-line	None
G1025	New 500 kV Yard 1x 230 kV Terminal	POI 500/230 kV transformer, 230 kV substation tie-line	TSEP: Schultz-Raver #3 and #4 500 kV new series capacitors and line upgrades TSEP: New Schultz-Olympia #1 500 kV Line TSEP: Rock Creek-John Day 500 kV Line Upgrade

1. The Grand Coulee-Schultz #1 and #2 500 kV line series capacitors are to be removed.
2. Develop a new 500 kV yard with a 3 breaker ring, BAAH construction with associated disconnect switches, control, relaying, and communications equipment. Include a new 180 MVAR shunt reactor



3. The Grand Coulee-Schultz #1 500 kV line will be looped into the new 500 kV yard splitting the line into two new lines.
4. Install a 500/230 kV transformer
5. Install a new 230 kV substation consisting of 8 breakers in BAAH formation with associated disconnect switches, control, relaying, and communications equipment.
6. Install a substation tie-line between the existing Columbia 230 kV yard and the new Annex 230 kV yard
7. Participate in a new North of Schultz single line loss/double line loss Remedial Action Scheme (NOSZ SLL/DLL RAS)
8. Installation of BPA-required C&C equipment at each customer's collector site (RAS, Meters, relays, Control House space)
9. Minor development of C&C hardware at BPA's POI substation.

G0829 and G0858 will construct a 230 kV line from the BPA POI substation to their generation facilities. The estimated length of the transmission line is 0.1 miles.

G0753 will construct a 230 kV line from the BPA POI substation to its generation facility. The estimated length of the transmission line is 9 miles.

G1025 will construct a 230 kV line from the BPA POI substation to its generation facility. The estimated length of the transmission line is 2 miles.

9.4 Grand Coulee Substation

Table 9.5: POI Grand Coulee Annex 500 kV New Substation Facility Requirements

G#	BPA Station Work	BPA Non-Station Work	Contingent Facilities
G0916	New 500 kV Yard 500 kV Terminal	SPB: New Coulee 500/230 kV transformer, 500 kV substation tie line	TSEP: Schultz-Raver #3 and #4 500 kV new series capacitors and line upgrades

1. Develop a new 500 kV 3 breaker yard, BAAH construction with associated disconnect switches, control, relaying, and communications equipment. Include one 180 MVAR shunt reactor.
2. Participate in new Coulee Annex 500/230 transformer bank (SPB)
3. Develop a new substation tie line from the new Annex 500 kV yard to the existing Coulee 500 kV yard.
4. Develop a local RAS for loss of the new substation 500 kV yard tie line. The RAS will trip G0916 to prevent exceeding the ratings on the existing Grand Coulee 500/230 kV transformer.
5. Participate in a new North of Schultz single line loss/double line loss Remedial Action Scheme (NOSZ SLL/DLL RAS)
6. Installation of BPA-required C&C equipment at each customer's collector site (RAS, Meters, relays, Control House space)
7. Minor development of C&C hardware at BPA's POI substation.



G0916 will construct a 500 kV line from the BPA POI substation to their generation facilities. The estimated length of the transmission line is 1.5 miles.

9.5 Grand Coulee-Bell 500 kV Line New Substation

Table 9.6: POI Grand Coulee-Bell 500 kV New Substation Facility Requirements

G#	BPA Station Work	BPA Non-Station Work	Contingent Facilities
G0953 G0955	New 500 kV Yard, 1x shared 500 kV Terminal	New Grand Coulee 500/230 transformer	TSEP: Schultz-Raver #3 and #4 500 kV new series capacitors and line upgrades TSEP: New Schultz-Olympia #1 500 kV Line
G0956	New 500 kV Yard, 1x new 500 kV Terminal	New Grand Coulee 500/230 transformer	TSEP: Schultz-Raver #3 and #4 500 kV new series capacitors and line upgrades TSEP: New Schultz-Olympia #1 500 kV Line

1. Develop a new 500 kV 4 breaker ring, BAAH construction with associated disconnect switches, control, relaying, and communications equipment. Include one 180 MVAR shunt reactor.
2. The Grand Coulee-Bell #6 500 kV line will be looped into the new 500 kV yard splitting the line into two new lines.
3. Participate in a new North of Schultz single line loss/double line loss Remedial Action Scheme (NOSZ SLL/DLL RAS)
4. Participate in new Coulee Annex 500/230 transformer bank (SPB)
5. Installation of BPA-required C&C equipment at each customer's collector site (RAS, Meters, relays, Control House space)
6. Minor development of C&C hardware at BPA's POI substation.

G0956 will construct a 500 kV line from the BPA POI substation to its generation facilities. The estimated length of the transmission line is 20 miles.

G0953 and G0955 will construct a 500 kV line from the BPA POI substation to their generation facilities. The estimated length of the gen-tie lines are 27 miles for G0955 and 18 miles for G0953.

Two 500 kV lines from the BPA POI substation to the generation facilities are required in the design to ensure a single branch loss does not trip power greater than 1500 MW. BPA requirements for interconnection require that there be no Most Severe Single Contingency (MSCC) resulting in a resource loss of more than 1,500 MW.



9.6 Grand Coulee-Hanford 500 kV Line New Substation

Table 9.8: POI Grand Coulee-Hanford 500 kV New Substation Facility Requirements

G#	BPA Station Work	BPA Non-Station Work	Contingent Facilities
G1032	New 500 kV substation, 1x new 500 kV terminal	None	TSEP: Schultz-Raver #3 and #4 500 kV new series capacitors and line upgrades TSEP: New Schultz-Olympia #1 500 kV Line TSEP: Rock Creek-John Day 500 kV Line Upgrade

1. Develop a new 500 kV 3 breaker ring, BAAH construction with associated disconnect switches, control, relaying, and communications equipment. Include 180 MVAR shunt reactor.
2. The Grand Coulee-Hanford 500 kV line will be looped into the new 500 kV yard splitting the line into two new lines.
3. Participate in a new North of Schultz single line loss/double line loss Remedial Action Scheme (NOSZ SLL/DLL 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.

G1032 will construct a 500 kV line from the BPA POI substation to its generation facility. The estimated length of the transmission line is 0.1 miles.

9.7 BPA Rocky Ford 500/230 kV New Substation

Table 9.9: POI Rocky Ford Substation Facility Requirements

G#	BPA Station Work	BPA Non-Station Work	Contingent Facilities
G1001	230 kV Terminal	None	L0544: New BPA Rocky Ford Substation TSEP: Schultz-Raver #3 and #4 500 kV new series capacitors and line upgrades TSEP: New Schultz-Olympia #1 500 kV Line

1. Develop a new 230 kV breaker-and-half bay with associated disconnect switches, control, relaying, and communications equipment.
2. Participate in a new North of Schultz single line loss/double line loss Remedial Action Scheme (NOSZ SLL/DLL 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.

G1001 will construct a 230 kV line from the BPA POI substation to its generation facility. The estimated length of the transmission line is 2 miles.



9.8 Vantage Substation

Table 9.10: POI Vantage Substation Facility Requirements

G#	BPA Station Work	BPA Non-Station Work	Contingent Facilities
G0828	New 500 kV Bay, 500 kV Terminal	None	None

1. Reconfigure Vantage 500 kV yard from ring to BAAH.
2. Add a new 500 kV bay at Vantage Substation
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.

G0828 will construct a 500 kV line from the BPA POI substation to its generation facility. The estimated length of the transmission line is 1 mile.

9.9 Wautoma-Rock Creek 500kV New Substation #1

Table 9.11: POI Wautoma-Rock Creek 500 kV New Substation #1 Facility Requirements

G#	BPA Station Work	BPA Non-Station Work	Contingent Facilities
G0688	New 500 kV yard	None	None

1. Develop a new 500 kV 3 breaker ring, BAAH construction with associated disconnect switches, control, relaying, and communications equipment. Include 180 MVAR shunt reactor.
2. The Wautoma-Rock Creek 500 kV line will be looped into the new 500 kV yard splitting the line into two new lines.
3. Participation in existing BPA AC-RAS algorithms near Rock Creek-John Day.
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.

G0688 will construct a 500 kV line from the BPA POI substation to their generation facilities. The estimated length of the transmission line is 14 miles.

9.10 Wautoma-Rock Creek 500 kV New Substation #2

Table 9.12: POI Wautoma-Rock Creek 500 kV New Substation #2 Facility Requirements

G#	BPA Station Work	BPA Non-Station Work	Contingent Facilities
G1037 G1038 G1039 G1040	New 500 kV yard New 500 kV terminal	None	TSEP: Schultz-Raver #3 and #4 500 kV new series capacitors and line upgrades TSEP: New Schultz-Olympia #1 500 kV Line TSEP: Rock Creek-John Day 500 kV Line Upgrade



1. Develop a new 500 kV 3 breaker ring, BAAH construction with associated disconnect switches, control, relaying, and communications equipment. Include 180 MVAR shunt reactor.
2. The Wautoma-Rock Creek 500 kV line will be looped into the new 500 kV yard splitting the line into two new lines.
3. Participation in existing BPA AC-RAS algorithms near Rock Creek-John Day.
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.

G1037, G1038, G1039, and G1040 will construct a 500 kV line from the BPA substation to their generation facilities. The estimated length of the transmission line is 3 to 5 miles.

9.11 Grand Coulee-Creston 115 kV New Substation

Table 9.13: POI Grand Coulee-Creston 115 kV New Substation Facility Requirements

G#	BPA Station Work	BPA Non-Station Work	Contingent Facilities
G0985	New 115 kV yard	None	TSEP: Schultz-Raver #3 and #4 500 kV new series capacitors and line upgrades TSEP: New Schultz-Olympia #1 500 kV Line

1. Develop a new 115 kV 4 breaker ring, BAAH construction with associated disconnect switches, control, relaying, and communications equipment.
2. The Grand Coulee-Creston 115 kV line will be looped into the new 115 kV yard splitting the line into two new lines
3. Participate in a new North of Schultz single line loss/double line loss Remedial Action Scheme (NOSZ SLL/DLL 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 to the BPA's POI substation.

G0985 will construct a 115 kV line from the BPA POI substation to its generation facility. The estimated length of the transmission line is 5 miles.

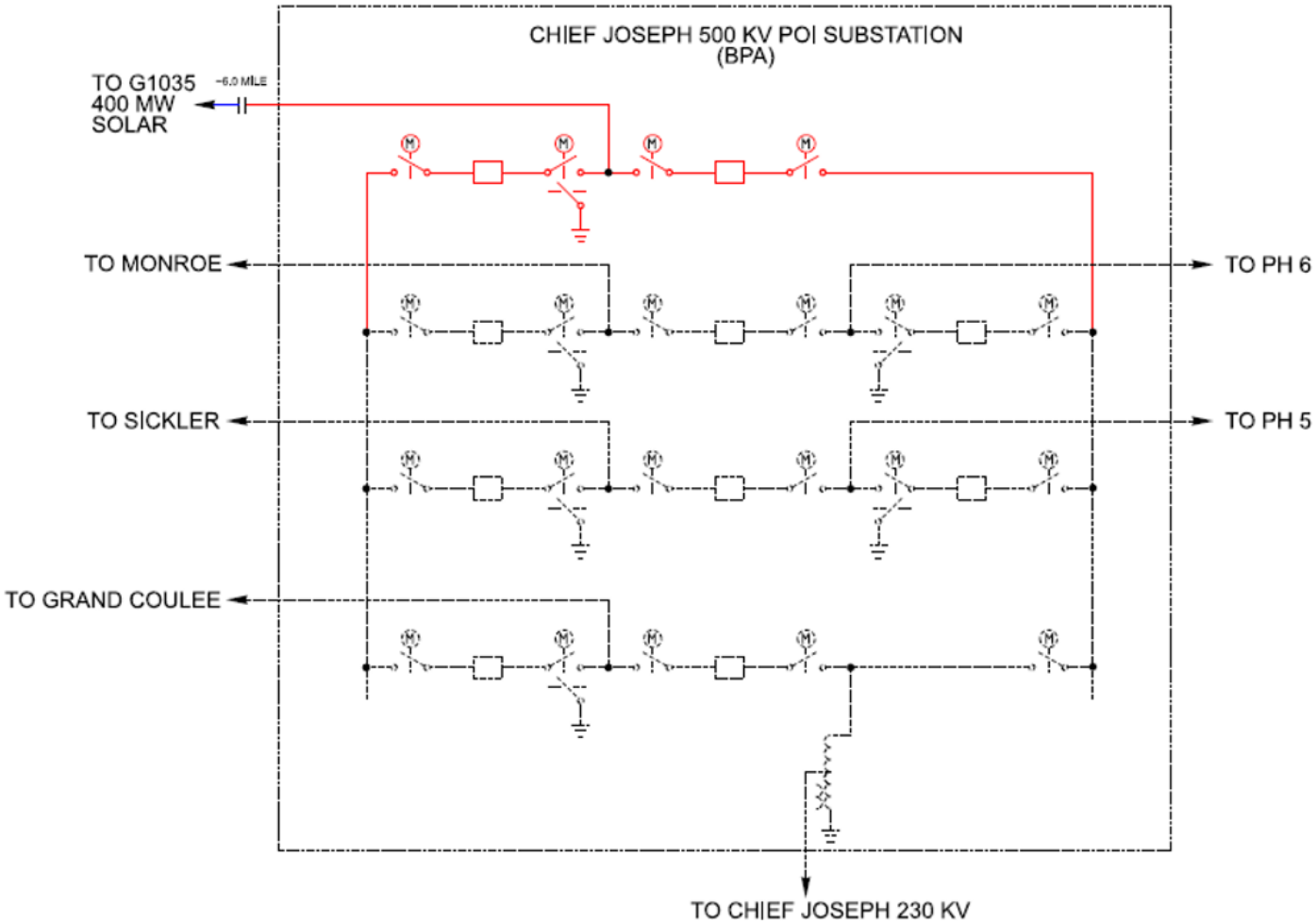
The new 115 kV substation site location is the existing Wilbur Tap point on the Grand Coulee-Creston 115 kV line.



10 Project One-Line Drawings

10.1 Chief Joseph Substation POI

DISTRICT: WENATCHEE



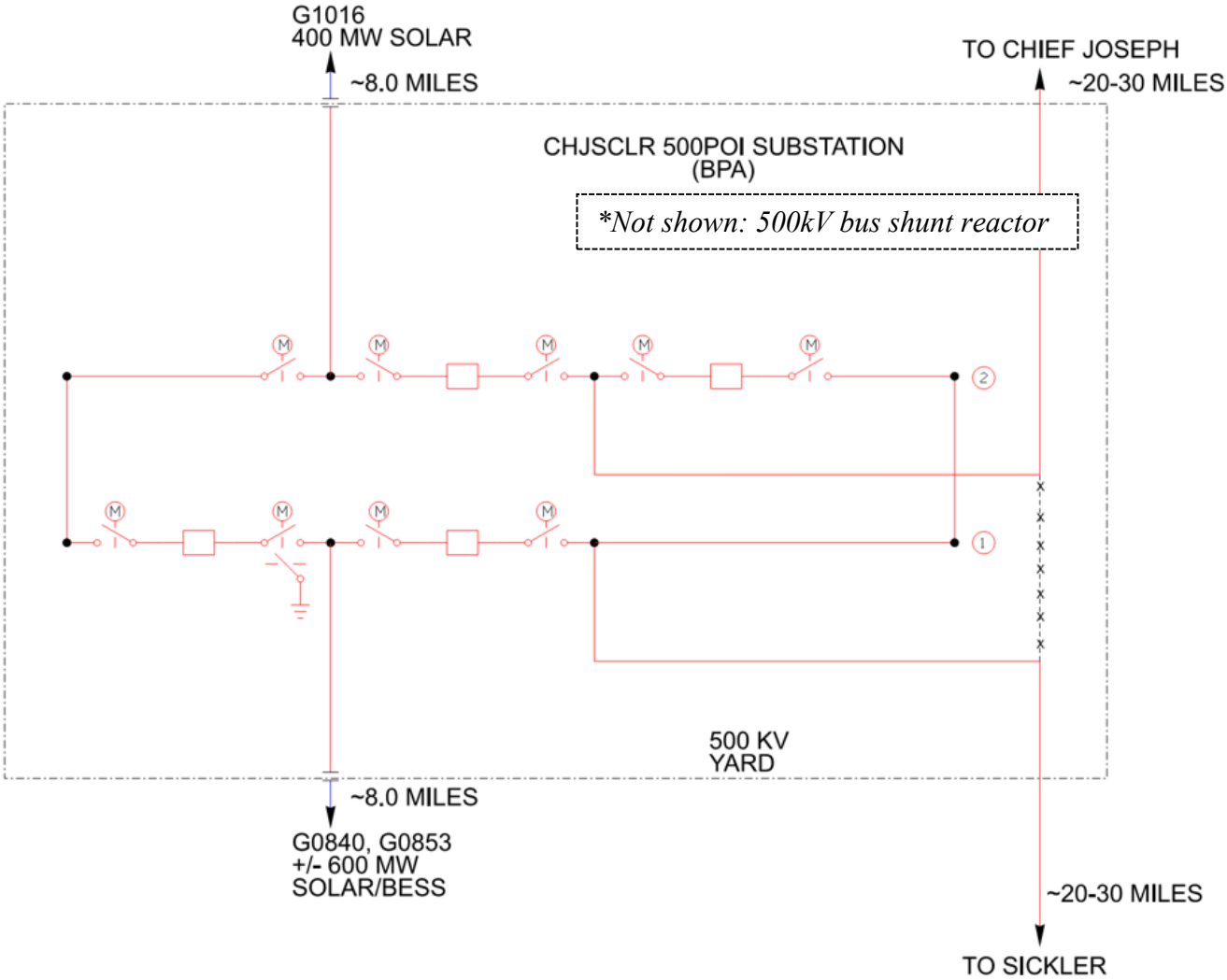
PROJECT REQUIREMENTS DIAGRAM						
UNITED STATES DEPARTMENT OF ENERGY BONNEVILLE POWER ADMINISTRATION PORTLAND, OREGON						
ENERGIZATION DATE(S) 1 OCT 2047	OPERATIONS & PLANNING					
PRELIMINARY APPROVAL —	DATE —	PH1CS NORTH AREA CHIEF JOSEPH POI				
COORDINATING ENGINEER ERIC HEREDIA	—					
FINAL APPROVAL —	DATE —	SERIAL PH1CS N 02	SOURCE TP	SIZE D	SHEET 1 of 1	REV 0

PHASE 1



10.2 Chief Joseph-Sickler 500 kV line New Substation POI

DISTRICT: WENATCHEE



LEGEND

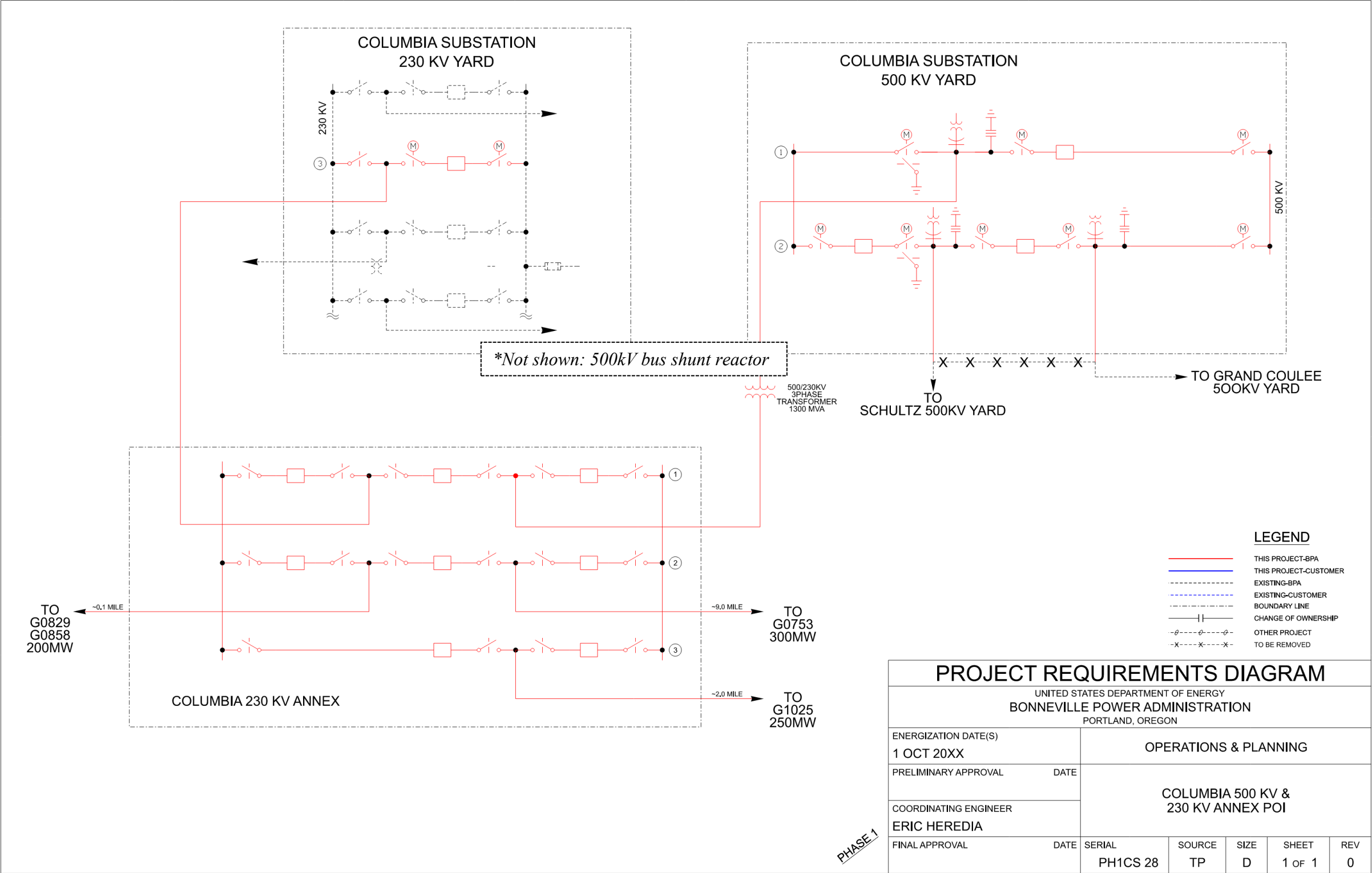
- THIS PROJECT-BPA
- THIS PROJECT-CUSTOMER
- EXISTING-BPA
- EXISTING-CUSTOMER
- BOUNDARY LINE
- CHANGE OF OWNERSHIP
- TO BE REMOVED

PHASE 1

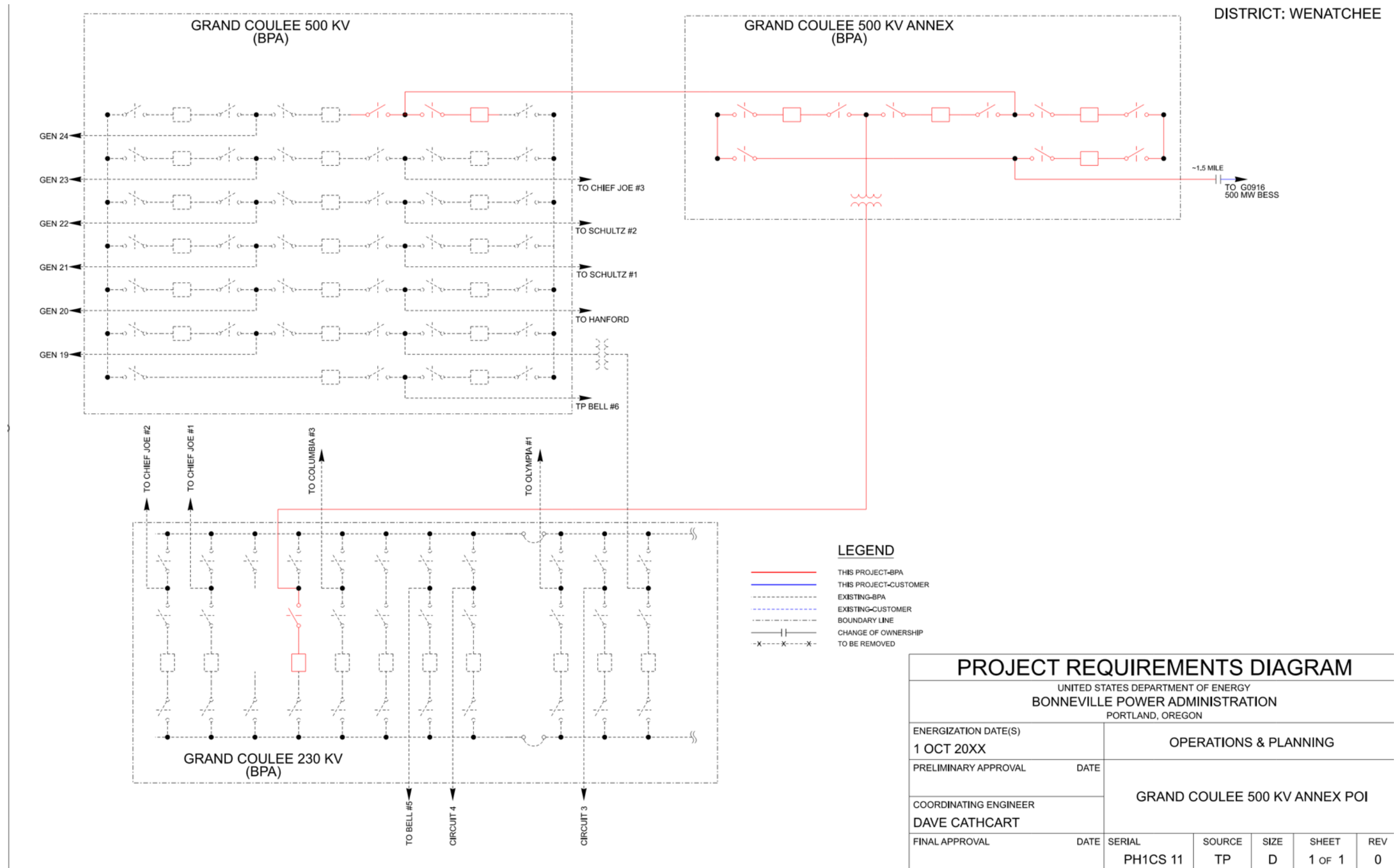
PROJECT REQUIREMENTS DIAGRAM

UNITED STATES DEPARTMENT OF ENERGY BONNEVILLE POWER ADMINISTRATION PORTLAND, OREGON								
ENERGIZATION DATE(S) 1 OCT 20XX		OPERATIONS & PLANNING						
PRELIMINARY APPROVAL		DATE		CHJSCLR 500 KV POI				
COORDINATING ENGINEER DAVE CATHCART								
FINAL APPROVAL		DATE		SERIAL PH1CS 04	SOURCE TP	SIZE D	SHEET 1 OF 1	REV 0

10.3 Columbia Annex Substation POI

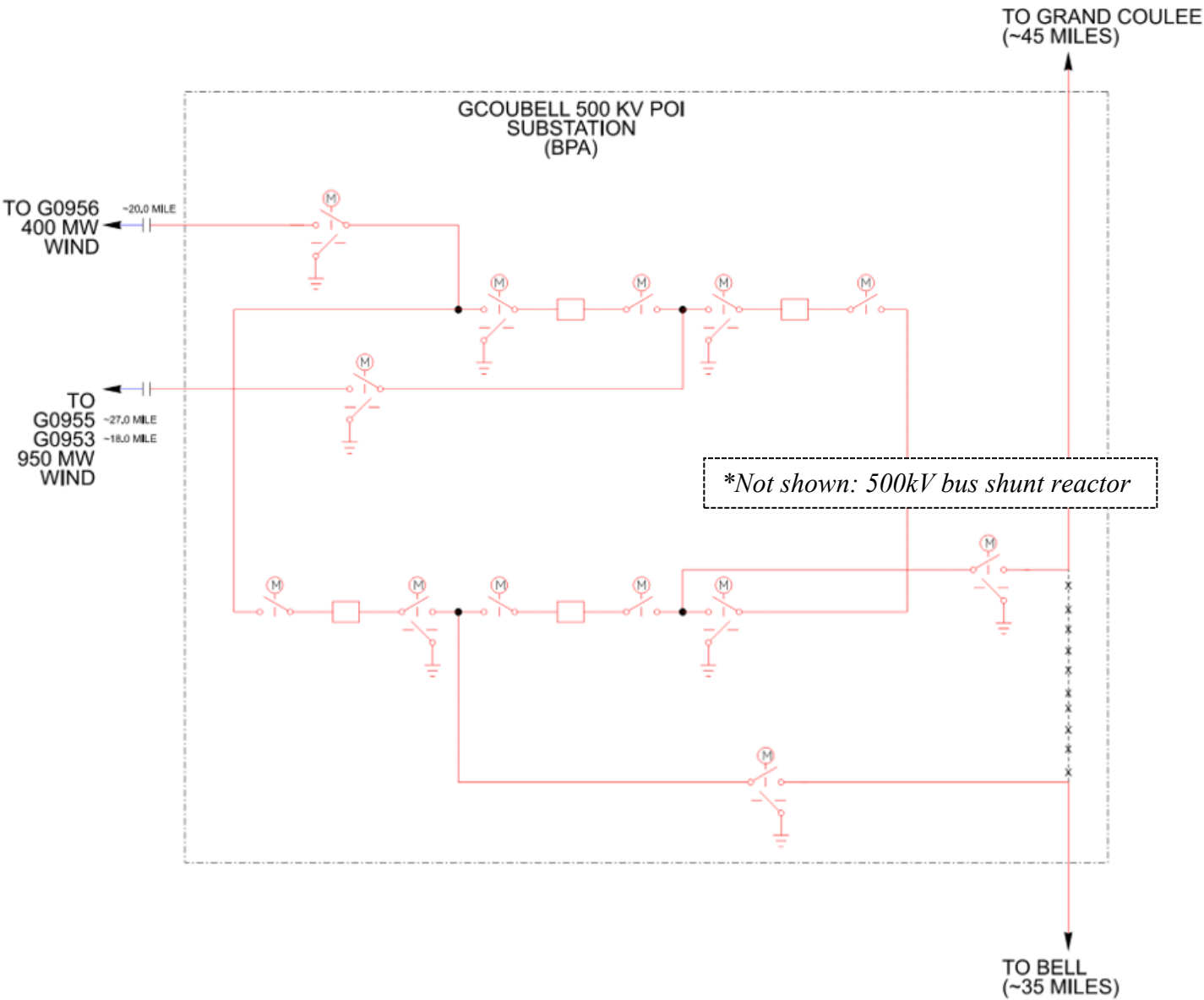


10.4 Grand Coulee Substation POI



10.5 Grand Coulee-Bell 500 kV Line New Substation POI

DISTRICT: WENATCHEE



LEGEND

- THIS PROJECT-BPA
- THIS PROJECT-CUSTOMER
- EXISTING-BPA
- EXISTING-CUSTOMER
- BOUNDARY LINE
- CHANGE OF OWNERSHIP
- TO BE REMOVED

PROJECT REQUIREMENTS DIAGRAM

UNITED STATES DEPARTMENT OF ENERGY
BONNEVILLE POWER ADMINISTRATION
PORTLAND, OREGON

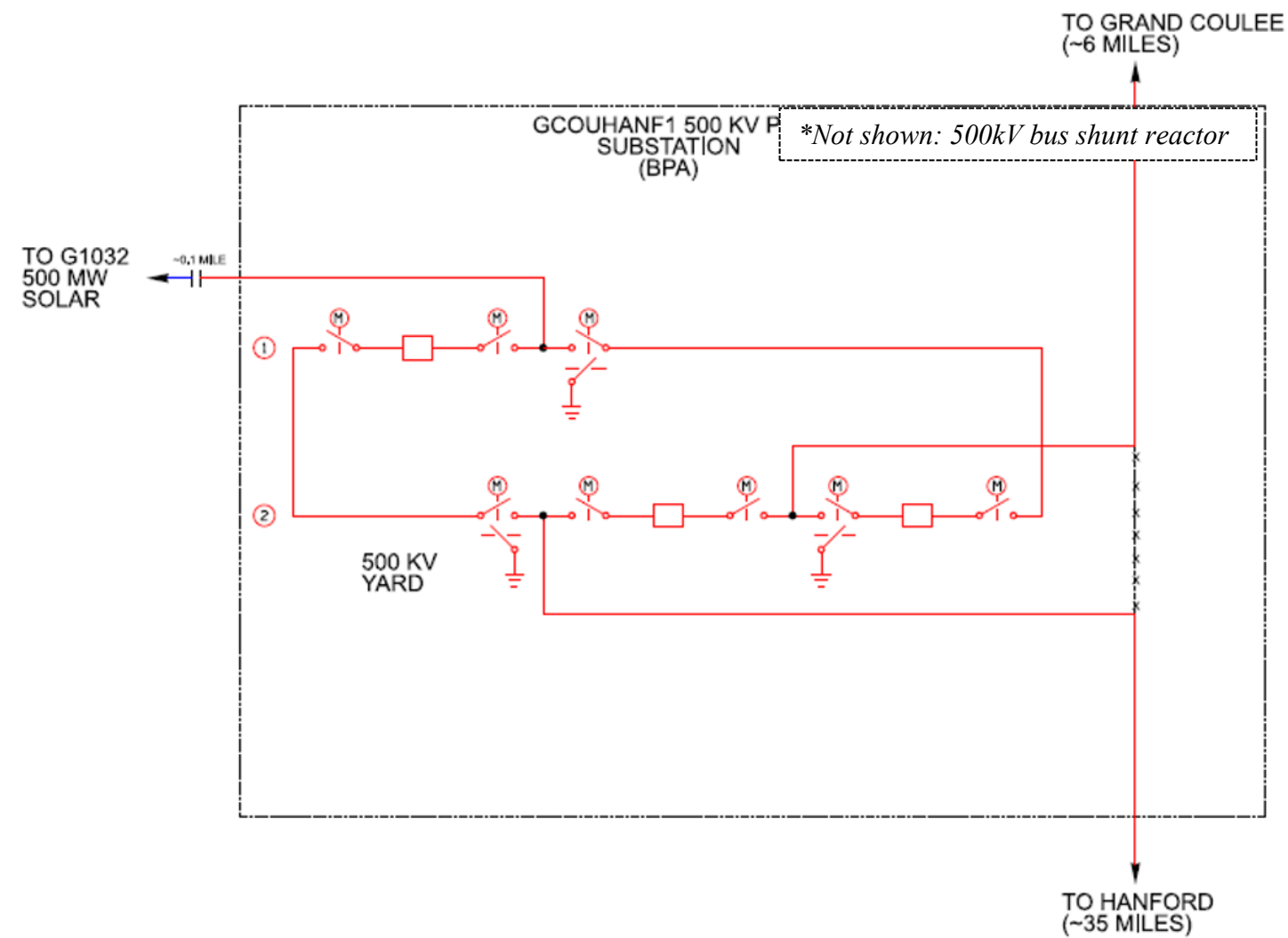
ENERGIZATION DATE(S) 1 OCT 20XX	OPERATIONS & PLANNING					
PRELIMINARY APPROVAL	DATE	GRAND COULEE - BELL 500 KV ANNEX POI				
COORDINATING ENGINEER ANDREAS SCHMITT						
FINAL APPROVAL	DATE	SERIAL PH1CS 09	SOURCE TP	SIZE D	SHEET 1 OF 1	REV 0

PHASE 1



10.6Grand Coulee-Hanford 500 kV New Substation POI

DISTRICT: WENATCHEE



LEGEND

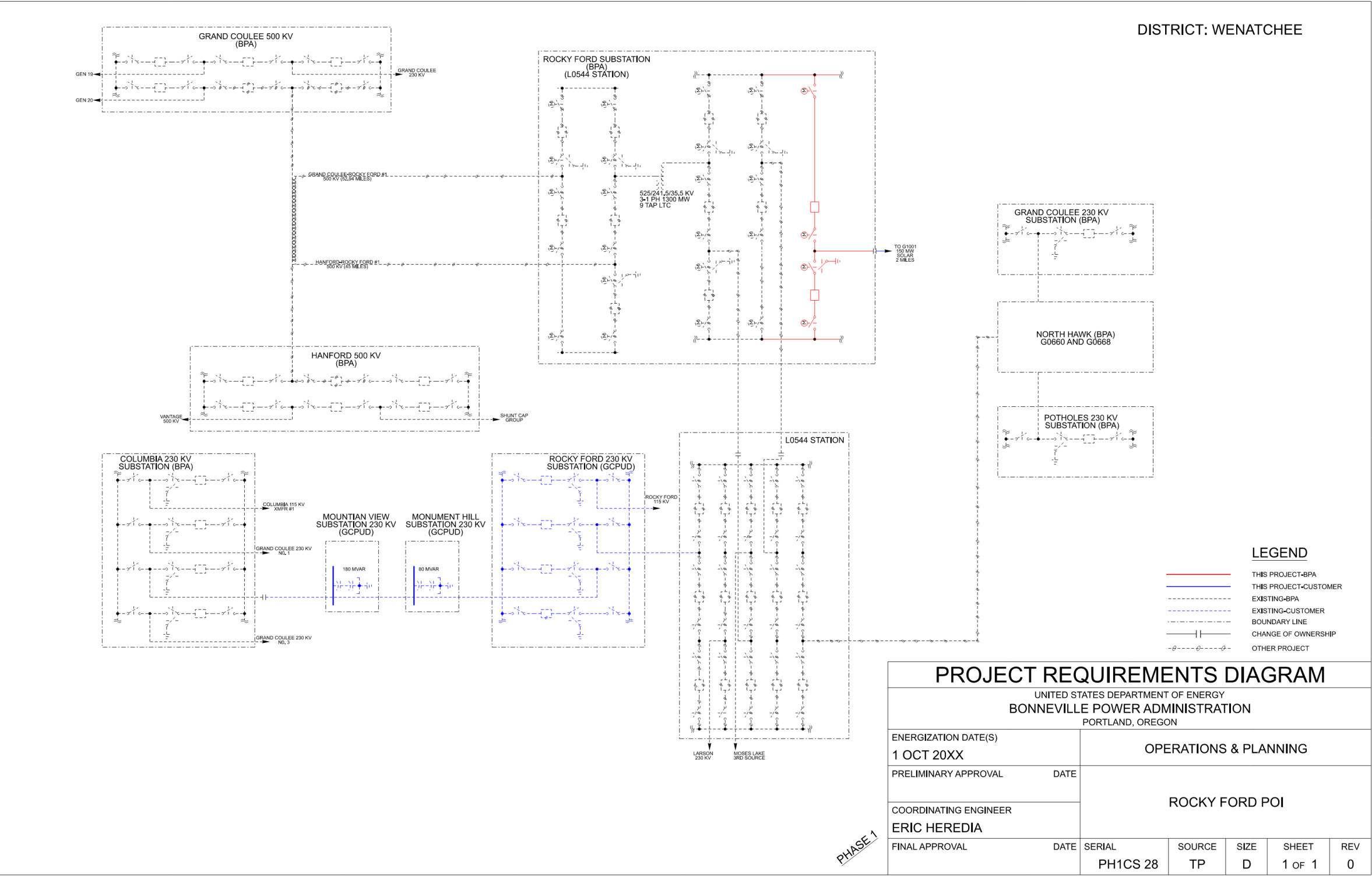
	THIS PROJECT-BPA
	THIS PROJECT-CUSTOMER
	EXISTING-BPA
	EXISTING-CUSTOMER
	BOUNDARY LINE
	CHANGE OF OWNERSHIP
	TO BE REMOVED

PROJECT REQUIREMENTS DIAGRAM							
UNITED STATES DEPARTMENT OF ENERGY BONNEVILLE POWER ADMINISTRATION PORTLAND, OREGON							
ENERGIZATION DATE(S) 1 OCT 2047		OPERATIONS & PLANNING					
PRELIMINARY APPROVAL	DATE	PH1CS NORTH AREA GRAND COULEE- HANFORD 500 KV SUBSTATION POI					
—	—						
COORDINATING ENGINEER ERIC HEREDIA							
FINAL APPROVAL	DATE	SERIAL	SOURCE	SIZE	SHEET	REV	
—	—	PH1CS N 06	TP	D	1 of 1	0	

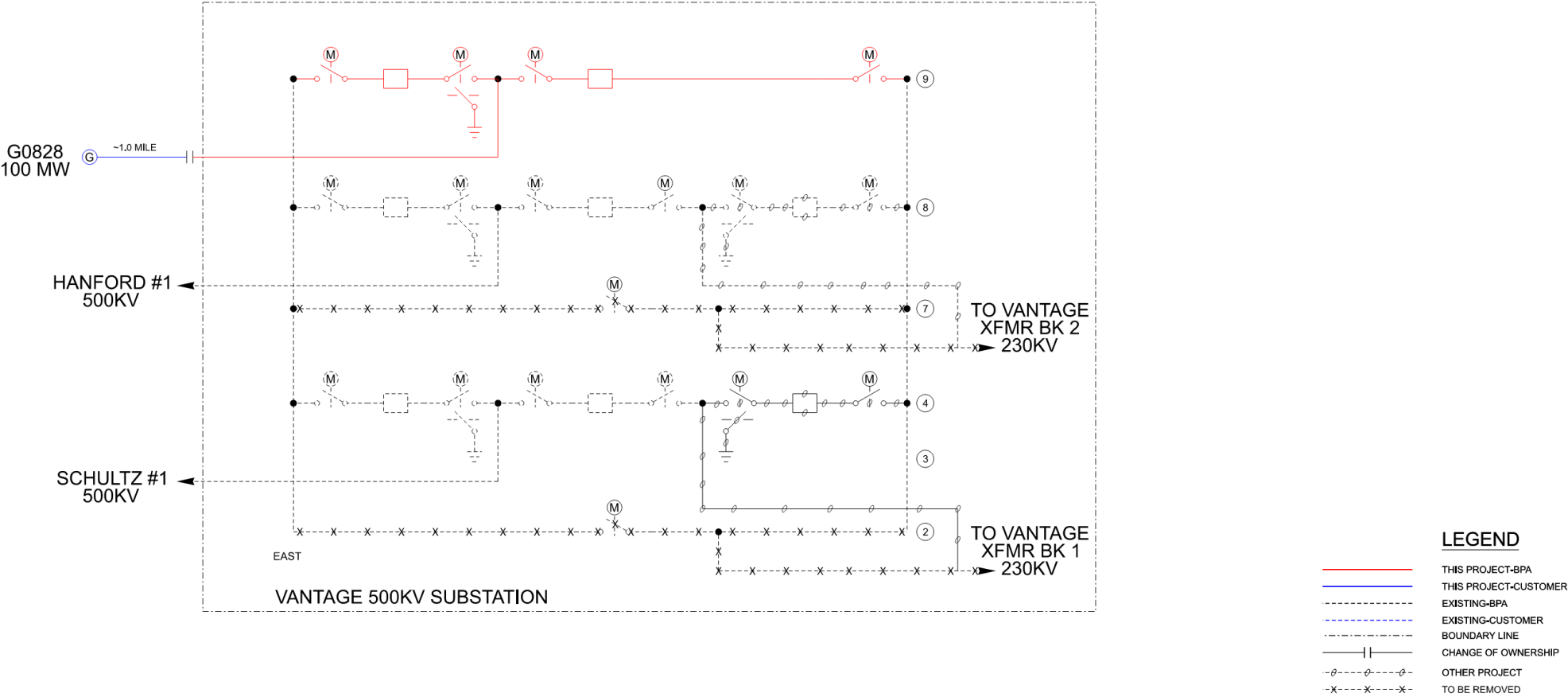
PHASE 1



10.7BPA Rocky Ford New Substation POI



10.8Vantage Substation POI

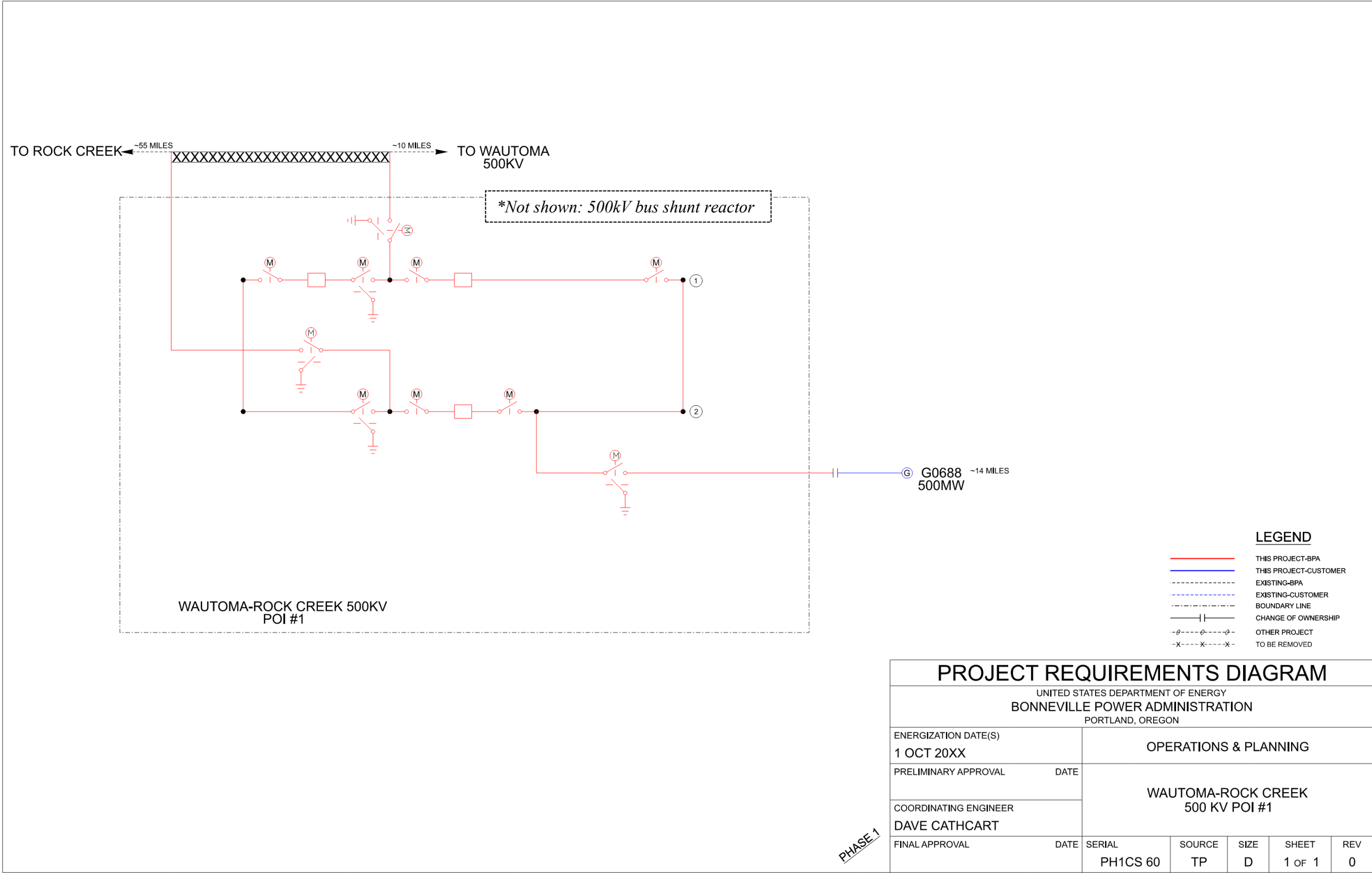


PROJECT REQUIREMENTS DIAGRAM						
UNITED STATES DEPARTMENT OF ENERGY BONNEVILLE POWER ADMINISTRATION PORTLAND, OREGON						
ENERGIZATION DATE(S) 1 OCT 20XX	OPERATIONS & PLANNING VANTAGE 500 KV POI					
PRELIMINARY APPROVAL						
COORDINATING ENGINEER DAVE CATHCART						
FINAL APPROVAL	DATE	SERIAL PH1CS 63	SOURCE TP	SIZE D	SHEET 1 OF 1	REV 0

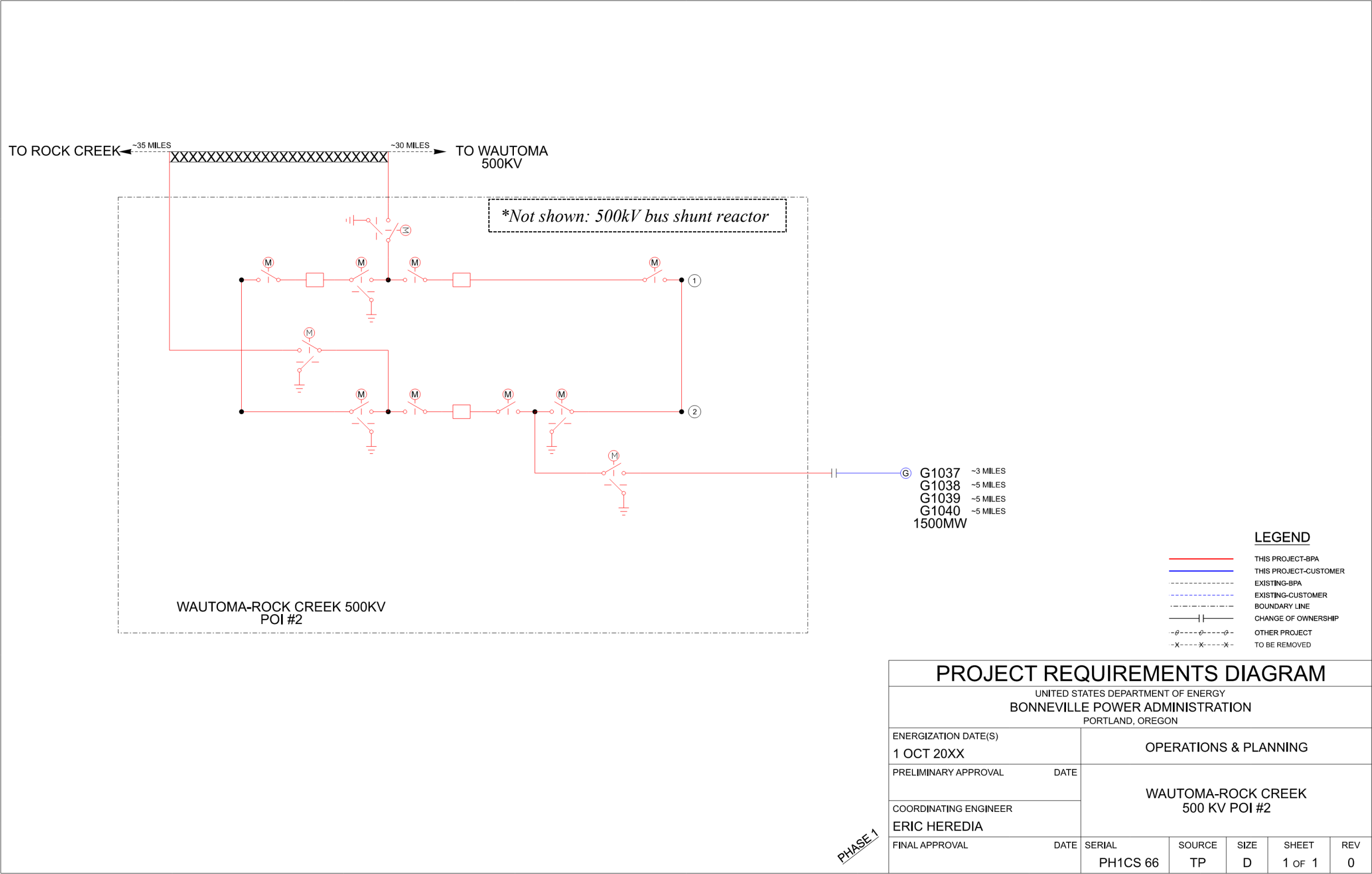
PHASE 1



10.9 Wautoma-Rock Creek 500 kV Line New Substation POI #1



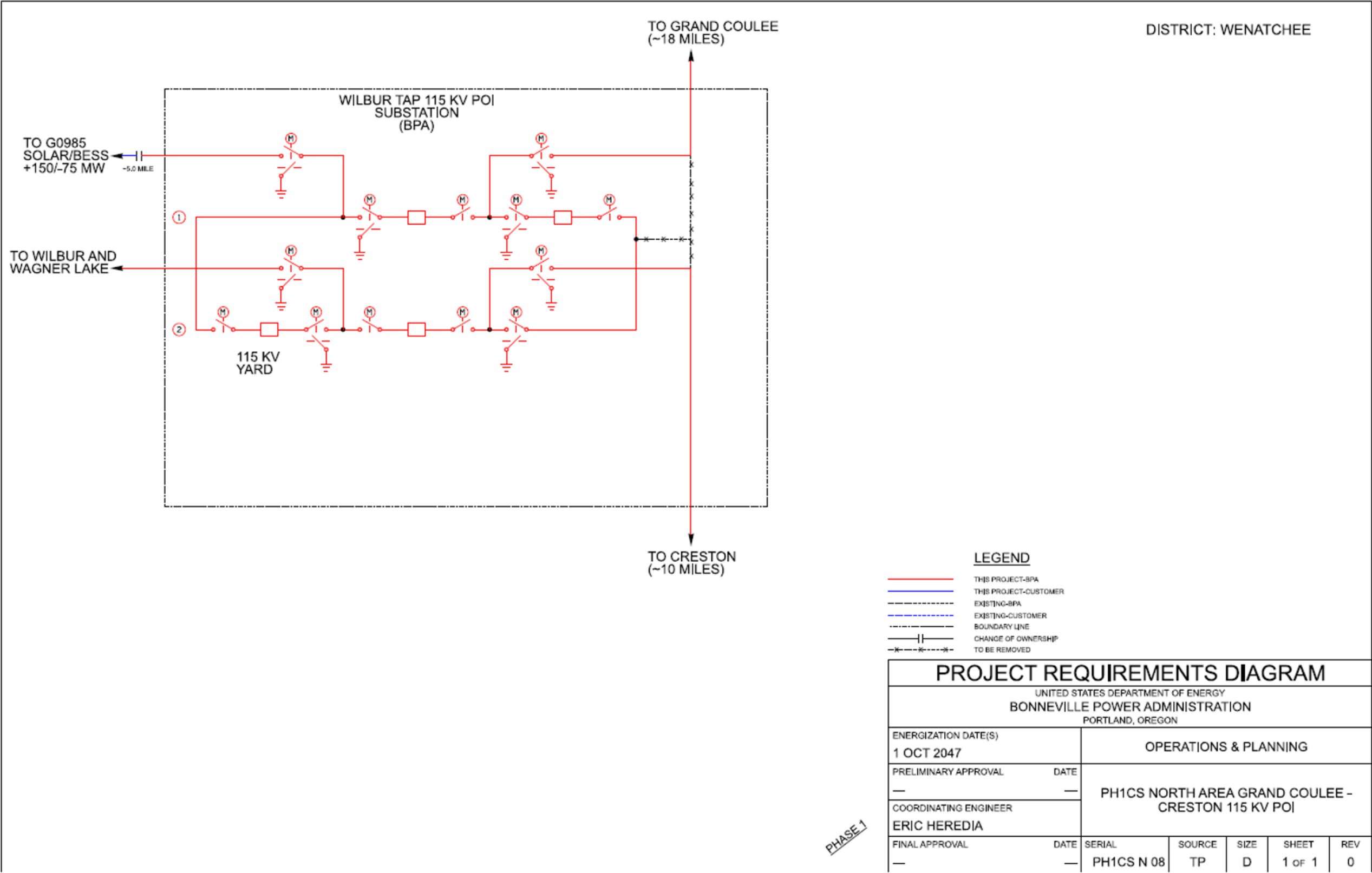
10.10 Wautoma-Rock Creek 500 kV Line New Substation POI #2



PHASE 1



10.11 Grand Coulee-Creston 115 kV Line New Substation POI



11 Costs 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 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 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 Chief Joseph 500 kV Substation

Table 11.1 POI – Chief Joseph 500 kV Station Cost Estimate

Estimate Summary									
Estimate #	Description		Quantity	Contract		BPA		Misc.	Total
				Labor	Material	Labor	Material		
ST-070-65-10	Chief Joe Substation Expansion		-	-	-	-	-	-	-
	500kV Add: 1x bay 2pos BAAH		0.5						
				\$5,854,000	\$4,807,000	\$905,000	\$0	\$29,000	\$11,595,000
	C&C	C&C POI Station	1	\$0	\$0	\$0	\$0	\$5,000,000	\$5,000,000
	C&C	C&C Collector Station	1	\$0	\$0	\$0	\$0	\$5,000,000	\$5,000,000
Contingency %	40%		Subtotal:	\$5,854,000	\$4,807,000	\$905,000	\$0	\$10,029,000	\$21,595,000
Overhead %	Labor	Materials	Contingency:	\$2,341,600	\$1,922,800	\$362,000	\$0	\$4,011,600	\$8,638,000
	26%	9%	Overhead:	\$2,130,856	\$605,682	\$329,420	\$0	\$1,263,654	\$4,329,612
Grand Total:	(rounded to two significant figures)			\$10,300,000	\$7,300,000	\$1,600,000	\$0	\$15,000,000	\$35,000,000

Table 11.2 POI – Chief Joseph 500 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
G1035	400	Chief Joseph Expansion w/ Expanded Comms	100.00%	\$26M	N/A	N/A	N/A	Collector Station C&C and RAS	\$9M	\$35M



11.4 POI: Chief Joseph-Sickler 500 kV Line New Substation

Table 11.3 POI – Chief Joseph-Sickler 500 kV Line Station Cost Estimate

Estimate Summary								
Estimate #	Description		Quantity	Contract		BPA		Misc.
				Labor	Material	Labor	Material	
ST-070-133-7	Chief Joe - Sickler POI station work		-	-	-	-	-	-
	500kV New POI: 4x PCB, 3pos, 2x bay BAAH, w/180 MVAR Shunt Reactor		1	\$44,512,000	\$46,842,000	\$5,690,000	\$816,000	\$0
	C&C C&C POI Station		1	\$0	\$0	\$0	\$0	\$5,000,000
	C&C C&C Collector Station		3	\$0	\$0	\$0	\$0	\$15,000,000
Contingency %	40%		Subtotal:	\$44,512,000	\$46,842,000	\$5,690,000	\$816,000	\$20,000,000
Overhead %	Labor	Materials	Contingency:	\$17,804,800	\$18,736,800	\$2,276,000	\$326,400	\$8,000,000
	26%	9%	Overhead:	\$16,202,368	\$5,902,092	\$2,071,160	\$102,816	\$2,520,000
Grand Total:	(rounded to two significant figures)			\$79,000,000	\$71,000,000	\$10,000,000	\$1,250,000	\$31,000,000
								\$190,000,000

Table 11.4 POI – Chief Joseph-Sickler 500 kV Line 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
G0840	300	New 500kV Substation w/ New Comms	50.00%	\$163M	N/A	N/A	N/A	Collector Station C&C and RAS	\$9M	\$91M
G0853	300		0.00%			N/A		Collector Station C&C and RAS	\$9M	\$9M
G1016	400		50.00%			N/A		Collector Station C&C and RAS	\$9M	\$91M



11.5 POI Columbia Annex 230 kV Substation

Table 11.5 POI – Columbia Annex 230 kV Station Cost Estimate

<i>Estimate Summary</i>		<i>Station work</i>						
Estimate #	Description	Quantity	Contract		BPA		Misc.	Total
			Labor	Material	Labor	Material		
	<u>Columbia Substation Expansion</u>	-	-	-	-	-	-	-
ST-070-133-7	500kV New POI: 4x PCB, 3pos, 2x bay BAAH, w/180 MVAR Shunt Reactor	1	\$44,512,000	\$46,842,000	\$5,690,000	\$816,000	\$0	\$97,860,000
ST-070-39-12	230kV New POI: 3x PCB, 3pos, 2x bay BAAH	1	\$18,348,000	\$12,624,000	\$4,830,000	\$0	\$118,000	\$35,920,000
ST-070-124-6	230kV Add: 1x bay 2pos BAAH	1.5	\$12,345,000	\$7,542,000	\$1,728,000	\$0	\$27,000	\$21,642,000
C&C	C&C POI Station	1	\$0	\$0	\$0	\$0	\$5,000,000	\$5,000,000
C&C	C&C Collector Station	4	\$0	\$0	\$0	\$0	\$20,000,000	\$20,000,000
Contingency %	40%	Subtotal:	\$75,205,000	\$67,008,000	\$12,248,000	\$816,000	\$25,145,000	\$180,422,000
Overhead %	Labor Materials	Contingency:	\$30,082,000	\$26,803,200	\$4,899,200	\$326,400	\$10,058,000	\$72,168,800
	26% 9%	Overhead:	\$27,374,620	\$8,443,008	\$4,458,272	\$102,816	\$3,168,270	\$43,546,986
Grand Total:	<i>(rounded to two significant figures)</i>		\$130,000,000	\$102,000,000	\$22,000,000	\$1,250,000	\$38,000,000	\$300,000,000

Table 11.6 POI – Columbia Annex 230 kV Non-Station Cost Estimate

<i>Estimate Summary</i>		<i>non-station work</i>						
Estimate #	Description	Quantity	Contract		BPA		Misc.	Total
			Labor	Material	Labor	Material		
	<u>Columbia Substation Expansion</u>	-	-	-	-	-	-	-
ST-070-141-6	500kV: 1x 525/241 433 MVA bank (1ph)	3	\$24,306,000	\$28,137,000	\$4,176,000	\$6,384,000	\$0	\$63,003,000
ST-070-124-6	230kV Add: 1x bay 2pos BAAH	0.5	\$4,115,000	\$2,514,000	\$576,000	\$0	\$9,000	\$7,214,000
Contingency %	40%	Subtotal:	\$28,421,000	\$30,651,000	\$4,752,000	\$6,384,000	\$9,000	\$70,217,000
Overhead %	Labor Materials	Contingency:	\$11,368,400	\$12,260,400	\$1,900,800	\$2,553,600	\$3,600	\$28,086,800
	26% 9%	Overhead:	\$10,345,244	\$3,862,026	\$1,729,728	\$804,384	\$1,134	\$16,742,516
Grand Total:	<i>(rounded to two significant figures)</i>		\$50,000,000	\$47,000,000	\$8,400,000	\$9,700,000	\$14,000	\$115,000,000



Table 11.7 POI – Columbia Annex 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
G0753	300	New 500kV Substation, New 230kV Substation w/ New Comms	33.33%	\$264M	New Columbia 500/230kV Transformer	28.57%	\$115M	Collector Station C&C and RAS	\$9M	\$130M
G0829	20		33.33%			1.90%		Collector Station C&C and RAS	\$9M	\$99M
G0858	130		0.00%			12.38%		Collector Station C&C and RAS	\$9M	\$23M
G1025	250		33.33%			23.81%		Collector Station C&C and RAS	\$9M	\$124M



11.6 POI Grand Coulee 500 kV Annex Substation

Table 11.8 POI – Grand Coulee 500 kV Annex Station Cost Estimate

Estimate Summary									
Estimate #	Description		Quantity	Contract		BPA		Misc.	Total
				Labor	Material	Labor	Material		
ST-070-133-7	Grand Coulee POI Station Work		-	-	-	-	-	-	-
	500kV New POI: 4x PCB, 3pos, 2x bay BAAH, w/180 MVAR Shunt Reactor @Annex		0.66	\$29,377,920	\$30,915,720	\$3,755,400	\$538,560	\$0	\$64,587,600
ST-070-65-10	500kV Add: 1x bay 2pos BAAH @COUL		0.5	\$5,854,000	\$4,807,000	\$905,000	\$0	\$29,000	\$11,595,000
C&C	C&C POI Station		1	\$0	\$0	\$0	\$0	\$5,000,000	\$5,000,000
C&C	C&C Collector Station		1	\$0	\$0	\$0	\$0	\$5,000,000	\$5,000,000
Contingency %	40%		Subtotal:	\$35,231,920	\$35,722,720	\$4,660,400	\$538,560	\$10,029,000	\$86,182,600
Overhead %	Labor	Materials	Contingency:	\$14,092,768	\$14,289,088	\$1,864,160	\$215,424	\$4,011,600	\$34,473,040
	26%	9%	Overhead:	\$12,824,419	\$4,501,063	\$1,696,386	\$67,859	\$1,263,654	\$20,353,380
Grand Total:	(rounded to two significant figures)			\$62,000,000	\$55,000,000	\$8,200,000	\$820,000	\$15,000,000	\$140,000,000

Table 11.9 POI – Grand Coulee 500 kV Annex Cost Allocation

Queue #	Requested MW	Station Equipment Station Equipment	Station Equipment Allocation (Per Capita)	Station Equipment Cost	Non-Station Equipment Non-Station Equipment	Non-Station Equipment Allocation (Per MW)	Non-Station Equipment Cost	Non-Network Direct Assigned	Direct Assigned Cost	Cost Assignment
G0916	500	New 500kV Substation w/ New Comms	100.00%	\$131M	SPB1: New Grand Coulee 500/230kV Transformer	27.03%	\$130M	Collector Station C&C and RAS	\$9M	\$175M



11.7 POI Grand Coulee-Bell 500 kV Line New Substation

Table 11.10 POI – Grand Coulee - Bell 500 kV Station Cost Estimate

<i>Estimate Summary</i>								
Estimate #	Description	Quantity	Contract		BPA		Misc.	Total
			Labor	Material	Labor	Material		
ST-070-133-7	Grand Coulee - Bell POI	-	-	-	-	-	-	-
	500kV New POI: 4x PCB, 3pos, 2x bay BAAH, w/180 MVAR Shunt Reactor	1	\$44,512,000	\$46,842,000	\$5,690,000	\$816,000	\$0	\$97,860,000
ST-070-65-10	500kV Add: 1x bay 2pos BAAH	0.5	\$5,854,000	\$4,807,000	\$905,000	\$0	\$29,000	\$11,595,000
C&C	C&C POI Station	1	\$0	\$0	\$0	\$0	\$5,000,000	\$5,000,000
C&C	C&C Collector Station	3	\$0	\$0	\$0	\$0	\$15,000,000	\$15,000,000
Contingency %	40%	Subtotal:	\$50,366,000	\$51,649,000	\$6,595,000	\$816,000	\$20,029,000	\$129,455,000
Overhead %	Labor Materials	Contingency:	\$20,146,400	\$20,659,600	\$2,638,000	\$326,400	\$8,011,600	\$51,782,000
	26% 9%	Overhead:	\$18,333,224	\$6,507,774	\$2,400,580	\$102,816	\$2,523,654	\$29,868,048
Grand Total: (rounded to two significant figures)			\$89,000,000	\$79,000,000	\$11,600,000	\$1,250,000	\$31,000,000	\$210,000,000

Table 11.11 POI – Grand Coulee – Bell 500 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
G0953	600	New 500kV Substation w/ New Comms	50.00%	\$183M	SPB1: New Grand Coulee 500/230kV Transformer	32.43%	\$130M	Collector Station C&C and RAS	\$9M	\$143M
G0955	350		0.00%			18.92%		Collector Station C&C and RAS	\$9M	\$34M
G0956	400		50.00%			21.62%		Collector Station C&C and RAS	\$9M	\$129M



11.8 POI Grand Coulee-Hanford 500 kV Line New Substation

Table 11.12 POI – Grand Coulee-Hanford 500 kV Station Cost Estimate

Estimate Summary										
Estimate #	Description		Quantity	Contract		BPA		Misc.	Total	
				Labor	Material	Labor	Material			
ST-070-133-7	Grand Coulee - Hanford POI		-	-	-	-	-	-	-	
	500kV New POI: 4x PCB, 3pos, 2x bay BAAH, w/180 MVAR Shunt Reactor		1							
	C&C	C&C POI Station	1	\$44,512,000	\$46,842,000	\$5,690,000	\$816,000	\$0	\$97,860,000	
	C&C	C&C Collector Station	1	\$0	\$0	\$0	\$0	\$15,000,000	\$15,000,000	
				\$0	\$0	\$0	\$0	\$5,000,000	\$5,000,000	
Contingency %		40%	Subtotal:	\$44,512,000	\$46,842,000	\$5,690,000	\$816,000	\$20,000,000	\$117,860,000	
Overhead %		Labor	Materials	Contingency:	\$17,804,800	\$18,736,800	\$2,276,000	\$326,400	\$8,000,000	\$47,144,000
		26%	9%	Overhead:	\$16,202,368	\$5,902,092	\$2,071,160	\$102,816	\$2,520,000	\$26,798,436
Grand Total:		(rounded to two significant figures)			\$79,000,000	\$71,000,000	\$10,000,000	\$1,250,000	\$31,000,000	\$190,000,000

Table 11.13 POI – Grand Coulee-Hanford 500 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
G1032	500	New 500kV Substation w/ New Comms	100.00%	\$181M	N/A	N/A	N/A	Collector Station C&C and RAS	\$9M	\$190M



11.9 POI BPA Rocky Ford 230 kV New Substation

Table 11.14 POI –BPA Rocky Ford 230 kV Station Cost Estimate

Estimate Summary									
Estimate #	Description		Quantity	Contract		BPA		Misc.	Total
				Labor	Material	Labor	Material		
ST-070-124-6	<u>Rocky Ford Expansion</u>		-	-	-	-	-	-	-
	230kV Add: 1x bay 2pos BAAH		0.66						
				\$5,431,800	\$3,318,480	\$760,320	\$0	\$11,880	\$9,522,480
	C&C	C&C POI Station	1	\$0	\$0	\$0	\$0	\$5,000,000	\$5,000,000
	C&C	C&C Collector Station	1	\$0	\$0	\$0	\$0	\$5,000,000	\$5,000,000
Contingency %	40%		Subtotal:	\$5,431,800	\$3,318,480	\$760,320	\$0	\$10,011,880	\$19,522,480
Overhead %	Labor	Materials	Contingency:	\$2,172,720	\$1,327,392	\$304,128	\$0	\$4,004,752	\$7,808,992
	26%	9%	Overhead:	\$1,977,175	\$418,128	\$276,756	\$0	\$1,261,497	\$3,933,557
Grand Total:	(rounded to two significant figures)			\$9,600,000	\$5,100,000	\$1,300,000	\$0	\$15,000,000	\$31,000,000

Table 11.15 POI – BPA Rocky Ford 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
G1001	150	Rocky Ford 230kV Substation Expansion w/ Expanded Comms	100.00%	\$22M	N/A	N/A	N/A	Collector Station C&C and RAS	\$9M	\$31M



11.10 POI Vantage Substation

Table 11.16 POI – Vantage 500 kV Station Cost Estimate

Estimate Summary									
Estimate #	Description		Quantity	Contract		BPA		Misc.	Total
				Labor	Material	Labor	Material		
ST-070-65-10 C&C C&C	Vantage 500 station work		-	-	-	-	-	-	-
	500kV Add: 1x bay 2pos BAAH		0.66	\$7,727,280	\$6,345,240	\$1,194,600	\$0	\$38,280	\$15,305,400
	C&C POI Station		1	\$0	\$0	\$0	\$0	\$5,000,000	\$5,000,000
	C&C Collector Station		1	\$0	\$0	\$0	\$0	\$5,000,000	\$5,000,000
Contingency %	40%		Subtotal:	\$7,727,280	\$6,345,240	\$1,194,600	\$0	\$10,038,280	\$25,305,400
Overhead %	Labor	Materials	Contingency:	\$3,090,912	\$2,538,096	\$477,840	\$0	\$4,015,312	\$10,122,160
	26%	9%	Overhead:	\$2,812,730	\$799,500	\$434,834	\$0	\$1,264,823	\$5,311,888
Grand Total:	(rounded to two significant figures)			\$14,000,000	\$9,700,000	\$2,100,000	\$0	\$15,000,000	\$41,000,000

Table 11.17 POI – Vantage 500 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
G0828	100	Expanded 500kV Substation w/ Updated Comms	100.00%	\$32M	N/A	N/A	N/A	Collector Station C&C and RAS	\$9M	\$41M



11.11 POI Wautoma-Rock Creek 500 kV Line #1 New Substation

Table 11.18 POI– Wautoma-Rock Creek 500 kV Line #1 Station Cost Estimate

Estimate Summary		station work							
Estimate #	Description		Quantity	Contract		BPA		Misc.	Total
				Labor	Material	Labor	Material		
ST-070-133-7	Wautoma Substation Expansion		-	-	-	-	-	-	-
	500kV New POI: 4x PCB, 3pos, 2x bay BAAH, w/180 MVAR Shunt Reactor		1	\$44,512,000	\$46,842,000	\$5,690,000	\$816,000	\$0	\$97,860,000
	C&C	C&C POI Station	1	\$0	\$0	\$0	\$0	\$10,000,000	\$10,000,000
	C&C	C&C Collector Station	1	\$0	\$0	\$0	\$0	\$5,000,000	\$5,000,000
Contingency %	40%		Subtotal:	\$44,512,000	\$46,842,000	\$5,690,000	\$816,000	\$15,000,000	\$112,860,000
Overhead %	Labor	Materials	Contingency:	\$0	\$0	\$0	\$0	\$6,000,000	\$6,000,000
	26%	9%	Overhead:	\$11,573,120	\$4,215,780	\$1,479,400	\$73,440	\$1,890,000	\$19,231,740
Grand Total:	(rounded to two significant figures)			\$56,000,000	\$51,000,000	\$7,200,000	\$890,000	\$23,000,000	\$140,000,000

Table 11.19 POI – Wautoma-Rock Creek 500 kV Line #1 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
G0688	500	New 500kV Substation w/ New Comms	100.00%	\$131M	N/A	N/A	N/A	Collector Station C&C and RAS	\$9M	\$140M



11.12 POI Wautoma-Rock Creek 500 kV Line #2 New Substation

Table 11.20 POI – Wautoma-Rock Creek 500 kV Line #2 Station Cost Estimate

Estimate Summary									
Estimate #	Description		Quantity	Contract		BPA		Misc.	Total
				Labor	Material	Labor	Material		
ST-070-133-7	Wautoma - Rock Creek POI		-	-	-	-	-	-	-
	500kV New POI: 4x PCB, 3pos, 2x bay BAAH, w/180 MVAR Shunt Reactor		1						
				\$44,512,000	\$46,842,000	\$5,690,000	\$816,000	\$0	\$97,860,000
	C&C	C&C POI Station	1	\$0	\$0	\$0	\$0	\$10,000,000	\$10,000,000
	C&C	C&C Collector Station	4	\$0	\$0	\$0	\$0	\$20,000,000	\$20,000,000
Contingency %	40%		Subtotal:	\$44,512,000	\$46,842,000	\$5,690,000	\$816,000	\$30,000,000	\$127,860,000
Overhead %	Labor	Materials	Contingency:	\$17,804,800	\$18,736,800	\$2,276,000	\$326,400	\$12,000,000	\$51,144,000
	26%	9%	Overhead:	\$16,202,368	\$5,902,092	\$2,071,160	\$102,816	\$3,780,000	\$28,058,436
Grand Total:	(rounded to two significant figures)			\$79,000,000	\$71,000,000	\$10,000,000	\$1,250,000	\$46,000,000	\$210,000,000

Table 11.21 POI – Wautoma-Rock Creek 500 kV Line #2 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
G1037	400	New 500kV Substation w/ New Comms	100.00%	\$174M	N/A	N/A	N/A	Collector Station C&Cand RAS	\$9M	\$183M
G1038	400		0.00%			N/A		Collector Station C&Cand RAS	\$9M	\$9M
G1039	400		0.00%			N/A		Collector Station C&Cand RAS	\$9M	\$9M
G1040	300		0.00%			N/A		Collector Station C&Cand RAS	\$9M	\$9M



11.13 POI Grand Coulee-Creston 115 kV Line New Substation

Table 11.22 POI – Grand Coulee-Creston 115 kV Line Station Cost Estimate

Estimate Summary									
Estimate #	Description		Quantity	Contract		BPA		Misc.	Total
				Labor	Material	Labor	Material		
ST-070-28-13	Wilbur Tap POI		-	-	-	-	-	-	-
	115kV New POI: 3x PCB, 3pos Ring		1	\$16,460,000	\$9,152,000	\$3,354,000	\$0	\$96,000	\$29,062,000
ST-070-19-11	115kV POI: 1x PCB, 1pos MainAux Addition		1	\$2,180,000	\$1,402,000	\$522,000	\$0	\$12,000	\$4,116,000
C&C	C&C POI Station		1	\$0	\$0	\$0	\$0	\$15,000,000	\$15,000,000
C&C	C&C Collector Station		1	\$0	\$0	\$0	\$0	\$5,000,000	\$5,000,000
Contingency %	40%		Subtotal:	\$18,640,000	\$10,554,000	\$3,876,000	\$0	\$20,108,000	\$53,178,000
Overhead %	Labor	Materials	Contingency:	\$7,456,000	\$4,221,600	\$1,550,400	\$0	\$8,043,200	\$21,271,200
	26%	9%	Overhead:	\$6,784,960	\$1,329,804	\$1,410,864	\$0	\$2,533,608	\$12,059,236
Grand Total:	(rounded to two significant figures)			\$33,000,000	\$16,000,000	\$6,800,000	\$0	\$31,000,000	\$87,000,000

Table 11.23 POI – Grand Coulee-Creston 115 kV Line 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
G0985	150	New 115kV Substation w/ New Comms	100.00%	\$78M	N/A	N/A	N/A	Collector Station C&C and RAS	\$9M	\$87M



11.14 SPB1: Grand Coulee 500/230 #2 Bank

Table 11.24 SPB1 – Grand Coulee 500/230 #2 Bank Cost Estimate

Estimate Summary									
Estimate #	Description		Quantity	Contract		BPA		Misc.	Total
				Labor	Material	Labor	Material		
ST-070-65-10	Grand Coulee Non-Station Work (500/230kV bank)		-	-	-	-	-	-	-
	500kV Add: 1x bay 2pos BAAH		0.5	\$5,854,000	\$4,807,000	\$905,000	\$0	\$29,000	\$11,595,000
ST-070-141-6	500kV: 1x 525/241 433 MVA bank (1ph)		3	\$24,306,000	\$28,137,000	\$4,176,000	\$6,384,000	\$0	\$63,003,000
ST-070-124-6	230kV Add: 1x bay 2pos BAAH		0.5	\$4,115,000	\$2,514,000	\$576,000	\$0	\$9,000	\$7,214,000
Contingency %	40%		Subtotal:	\$34,275,000	\$35,458,000	\$5,657,000	\$6,384,000	\$38,000	\$81,812,000
Overhead %	Labor	Materials	Contingency:	\$13,710,000	\$14,183,200	\$2,262,800	\$2,553,600	\$15,200	\$32,724,800
	26%	9%	Overhead:	\$12,476,100	\$4,467,708	\$2,059,148	\$804,384	\$4,788	\$19,812,128
Grand Total:	(rounded to two significant figures)			\$60,000,000	\$54,000,000	\$10,000,000	\$9,700,000	\$58,000	\$130,000,000

Table 11.25 SPB1 – Grand Coulee 500/230 #2 Bank Cost Allocation

Queue #	Enabled MW	Percent Allocation	Cost Allocation
G0916	500	27.027%	\$ 35,135,135
G0953	600	32.432%	\$ 42,162,162
G0955	350	18.919%	\$ 24,594,595
G0956	400	21.622%	\$ 28,108,108
Total:	1850	100%	\$ 130,000,000

