EXH. DJL-7 (Apdx. A)
DOCKETS UE-240004/UG-240005
2024 PSE GENERAL RATE CASE
WITNESS: DAVID J. LANDERS

BEFORE THE
WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION

WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION, Complainant, v. PUGET SOUND ENERGY, Respondent.	Docket UE-240004 Docket UG-240005

APPENDIX A (NONCONFIDENTIAL) TO THE SIXTH EXHIBIT TO THE PREFILED DIRECT TESTIMONY OF

DAVID J. LANDERS

ON BEHALF OF PUGET SOUND ENERGY

FEBRUARY 15, 2024

PUGET SOUND ENERGY

Seabeck Area Reliability

Corporate Spending Authorization (CSA)

Date Created:	Friday, February 10, 2023
Discretionary/ Non-Discretionary:	Discretionary
Multi Year Rate Plan:	Specific
Equity Impact:	Yes
Strategic Alignment:	Operate the Business-Customer Experience
Estimated In-Service Date:	Thursday, December 31, 2026
Current State (Business Need):	As detailed in the Seabeck Area Needs Assessment, there are multiple needs in the study area. There are feeder capacity needs for distribution circuits CHI-12 and SIL-15. Both circuits are above the Distribution Planning Guidelines of 83% utilization capacity under normal system configuration for current peak loading levels. Additionally, CHI-12 is over 100% utilization under the contingent event of a step-up transformer failure during current peak loading levels. There are reliability needs with circuits CHI-12 and SIL-15. They are both circuits that historically have had poor reliability performance. These two circuits serve the entire load in this area and continue to have SAIDI and SAIFI scores significantly worse than PSE's average values for SAIDI and SAIFI . Currently there are operational flexibility needs on both circuits during peak loading including low voltages, inability to back up load, and load balance across phases. These operational concerns are exacerbated during N-1 contingencies. Additional growth without system improvements will compound these concerns. There is a concern related to non-standard equipment at both Chico and Silverdale substations. This equipment was standard when it was installed, but has since become out-of-date. At Chico substation there is high-side fusing that is no longer standard. At Silverdale substation there are yellow-jacket getaways, oil-filled capacitor switch, and Mark V circuit switcher that are no longer standard. This equipment should be evaluated as an opportunity for replacement if there is work being done at the substation.

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Seabeck Area Reliability

Corporate Spending Authorization (CSA)

Desired State (Proposed Solution):

Project Scope: 1. New CHI-14 Feeder (12.47 kV) • Install a new circuit from Chico substation (tentatively named CHI-14) to serve customers near the Wildcat Lake area, including a new 12.47kV station breaker and getaway. The new circuit (CHI-14) would include a combination of underground and overhead wire and other distribution service equipment. Specifically, it would include: o Install approximately 2.8 miles of new underground cable in the existing spare conduit along Seabeck Hwy NW from the Chico substation to Seabeck Hwy (Point A). o Convert existing overhead feeder of CHI-12 to underground cable along NW Holly Rd from Seabeck Hwy (Point A) to Tahuyeh Lake Rd NW (Point B). Note the overhead conductor will remain as laterals to feed existing customers. Convert all services on this section to 12.47kV and relocate the existing auto-transformer to a new location near the intersection of NW Holly Rd and Tahuyeh Lake Rd NW. This will create a Normal Open tie to the new CHI-12 East Sub Circuit. o Create a new Normal Open between new CHI-14 and SIL-16 near intersection of Seabeck Highway NW and NW Holly Rd. o Incorporate the new CHI-14 circuit into the existing Distribution Automation Scheme. 2. Express CHI-12 Feeder (34.5 kV) • Construct a new 35kV UG express feeder for approximately 5 miles along NW Holly Rd between Seabeck Hwy (Point A) and NW Seabeck Holly Rd (Point C). • Create 3 CHI-12 sub feeders (north, east, and south) using existing 35kV SCADA reclosers. 3. Transfer Customers via Normal Open changes • Transfer approximately 200 customers from SIL-15 to CHI-12 north sub feeder. This reduces existing SIL-15 load by 50 amps average. • Transfer approximately 180 customers from SIL-15 to new feeder CHI-14, which reduces SIL-15 demand by 40 amps. Total demand reduction on SIL-15 equals 90 amps. Reducing customers on SIL-15 will improve SAIDI and SAIFI by at least 17% by reducing customer exposure on the circuit from 2192 to 1812. • CHI-12 is reduced by approximately 800 customers and 190 amps by transferring customers along NW Holly Rd to new CHI-14 and increased by approximately 200 customers and 50 amps by transferring customers from SIL-15. Overall decrease on CHI-12 is 600 customers and 140 amps. This will improve CHI-12 SAIDI and SAIFI by at least 25% by reducing customer exposure from 2497 to 1897. • The new circuit CHI-14 will have approximately 180 customers and 40 amps from the SIL-15 transfer and 800 customers and 190 amps from the CHI-12 transfer. Total demand on CHI-14 is expected to be 230 amps and 980 customers when completed.

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Outcome/Results (What are the anticipated benefits):	Increased Feeder Capacity and Reliability. Operational flexibility

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Dependencies: no

Dependencies comment: None.

Escalation Included: No, escalation has not been included.

Total Estimated Costs: $11,850,000

Estimated Five Year Allocation:

Funds Type	ID	Line Item Description	Previous Years Actuals	Fiscal 2024 Requested	Fiscal 2025 Requested	Fiscal 2026 Requested	Fiscal 2027 Requested	Fiscal 2028 Requested
Capital	W_R.10040.01.01.01	E Seabeck Area Reliability Improvement	$ -	$ -	$ 2,000,000	$ 8,850,000	$ -	$ -

Incremental O&M: No

Qualitative Benefits: Customers will experience fewer outages and the outages that do occur will be a shorter duration. System will benefit from operational flexibility when a need arises.

Quantitative Benefits:

Quantitative Benefits	Benefit Type	Previous Years	Fiscal 2023	Fiscal 2024	Fiscal 2025	Fiscal 2026	Fiscal 2027	Fiscal 2028	Remaining Costs	Life Total

Risk Summary: Permitting from local juridications. Aquisition of property rights for PSE equipment

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Change Summary:

Planning Cycle	Change Summary	Last Update Date
2022 Baseline Cycle	This CSA has been migrated into the EPPM tool at go-live as part of the Phase 1 EPPM implementation effort. The projects in this CSA were previously approved for the 2023-2027 capital plan. Please refer to the original CSA document for additional information (if available.)	2/10/2023

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Seabeck Area Reliability

Corporate Spending Authorization (CSA)

Approval History:

Approved By	Date Approved
Approved by Cost Center Owner: Pagano , Tony	4/3/2023
Approved by Director Sponsor: Roque Bamba	4/6/2023
Approved by Executive Sponsor: Koch , Dan	4/6/2023
CSA Status changed to Approved	4/6/2023
Approved by Cost Center Owner: Lim , Thina	12/5/2023
Approved by Director Sponsor: Lim , Thina	12/5/2023
Approved by Executive Sponsor: Lim , Thina	12/5/2023
CSA Status changed to Approved	12/5/2023
Approved by Cost Center Owner: Pagano , Tony	1/25/2024
Approved by Director Sponsor: Bamba , Roque	1/26/2024
Approved by Executive Sponsor: Vargo , Michelle	2/1/2024
CSA Status changed to Approved	2/1/2024

PUGET SOUND ENERGY

Seabeck Area
Needs Assessment

Olympic Mountains from Seabeck Conference Center, Seabeck, WA

Strategic System Planning
May 18, 2023

PUGET SOUND ENERGY

Seabeck Area
Needs Assessment

Prepared By:

Colin O'Brien, PE, *Strategic System Planning*
Chad Larson, PE

Approved By:

Ryan Lambert, PE, *Manager - Strategic System Planning*

DocuSigned by:
Ryan Lambert
48EEB5A77F87404... 05/19/2023

Ryan Lambert *Date*
System Planning, Manager

DocuSigned by:
David Landers
B6002897FD5542C... 05/19/2023

David Landers *Date*
System Planning, Director

Strategic System Planning
May 18, 2023

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Executive Summary

PSE's System Planning department regularly assesses communities' electrical systems, throughout the service area, to ensure that PSE can continue to reliably serve its customers. This report is a needs assessment for the distribution system serving Seabeck, Washington and the surrounding area. Among the findings detailed in this report, PSE has identified a need for increased feeder capacity, improved feeder reliability, and improvements in operational flexibility, over a 10-year planning horizon (2022-2032).

The Seabeck study area, shown below in Figure 0-1, is a scenic, rural region at the edge of PSE's service territory in western Kitsap County. Along with the town of Seabeck, it includes Wildcat Lake, the community of Holly, and Guillemot Cove Nature Reserve. There are numerous trails and creeks – with Hood Canal flowing between Kitsap and the Olympic Peninsula.

Within the area, PSE serves approximately 4,700 electric customers (mostly residential), and local homes are typically on large lots in uncondensed neighborhoods. There is no natural gas system in the area.

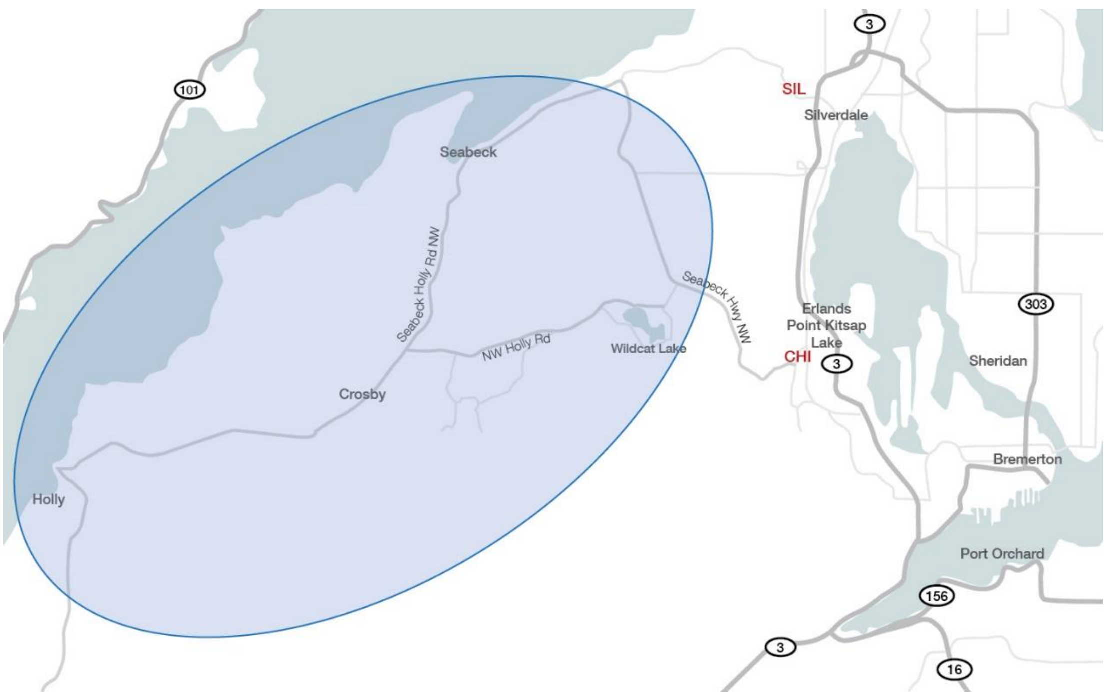

Figure 0-1: Needs assessment study area

The study area is primarily served by two feeders: CHI-12 from Chico substation and SIL-15 from Silverdale substation. Both have poor reliability histories and frequent outages. In fact, CHI-12 is frequently the *worst performing circuit* in all of PSE's service territory. Much of this is due to the circuit's long length and overhead exposure, combined with an abundance of surrounding trees. The local geography can also hamper restoration efforts, making outages last even longer.

With regard to local development, significant residential or commercial growth is not anticipated in this area over the next 10 years. However, PSE's load forecast does indicate a moderate increase, which will further exacerbate the Seabeck area's existing capacity issues.

PSE Needs Assessment Process

PSE defines "need" as a system deficiency that is required to be addressed by a solution, preferably by the identified date of need. A "concern" is a non-critical issue that impacts system operations but is not required to be addressed by a solution; although, a solution that addresses an identified concern provides additional benefit.

For this study, PSE evaluated the following for the Seabeck area's distribution system over the 10-year planning horizon (2022-2032).

Capacity – This is the system's ability to provide enough electricity to meet customer demand (aka "loads"). To project area loads over the 10-year period, this study utilized PSE's F2022 Load Forecast. All forecasted loads in this study factor in PSE's business-as-usual, demand-side management (DSM) [1] energy conservation measures.

When area loads reach approximately 85% of existing capacity under normal conditions, the need to study additional feeder capacity is triggered. This allows time for solutions to be studied and put in place, if needed, before capacity limits are reached.

Reliability – Electric system reliability performance is evaluated through the SAIFI (outage frequency) and SAIDI (outage duration) indexes. CMI (customer minutes of interruption) is another metric used to assess service reliability. PSE's System Planning department monitors outage frequency and durations for each circuit in its service area.

Equipment – Existing infrastructure and equipment is analyzed to determine if it requires replacement, upgrading, or maintenance. This could include identifying new equipment or infrastructure needs.

Operations – This evaluates the electric system's flexibility in adapting to challenges. It includes identifying operational deficiencies and ensuring compliance with transmission and distribution planning guidelines.

PSE's analysis includes testing the electrical system's performance under various planning contingencies. For the Seabeck area assessment, these scenarios were:

N-0 – All system elements in service (no outages)

N-1 – Single contingency (one system element out of service)

[1] DSM measures include energy efficiency, energy conservation and demand response, which are part of PSE's system-wide strategy to incorporate year-round efficiency into its grid operations.

Summary of Seabeck Area Needs and Concerns

The distribution system needs and concerns identified for the Seabeck area are summarized below. As stated earlier, reliability is a currently significant issue for customers. Additionally, within the next 10 years, electrical demand will exceed the existing system's (already strained) capacity limits.

1.1.1 Needs:

- **Feeder Capacity:** Feeders CHI-12 and SIL-15 presently exceed PSE's distribution planning triggers and are forecasted to exceed capacity limits within the 10-year planning period.
  - CHI-12 is forecasted to surpass 100% capacity limit in 2024.
  - CHI-12 has an existing N-1 capacity need in the event of a parallel step-up transformer failure.
  - SIL-15 is forecasted to surpass 100% capacity limit in 2026.
- **Feeder Reliability:** Feeders CHI-12 and SIL-15 have CMI, SAIDI, and SAIFI metrics that are significantly above system average. Reliability improvements are needed for both circuits.
- **Operational Need:** Feeders CHI-12 and SIL-15 experience low voltage under peak demand. Voltage improvements at peak system demand are needed for both feeders.
- **Operational Need:** CHI-12 has phase imbalance during peak loading that exceeds allowable limits. Phase imbalance contributes greatly to system losses due to increased neutral current.

1.1.2 Concerns:

- **Substation Equipment:** There is an existing concern for non-standard substation equipment at both Chico and Silverdale substations. Non-standard equipment includes high-side fusing at Chico substation and yellow jacket getaways, oil-filled capacitor switch, and a Mark V circuit switcher at Silverdale substation. This equipment should be evaluated for replacement when there is planned work at each substation.
- **Non-Standard Operations:** CHI-12 operates at 34.5kV and is the only circuit in Kitsap County at this voltage. This higher voltage class requires specialized equipment and procedures that are non-standard for the region, as well as additional inventory and associated costs.

Conclusion and Next Steps

Energy is essential for communities, and PSE is committed to creating a better energy future for all customers in the Seabeck area.

PSE's assessment of the area's distribution system indicates a need to address its feeder capacity, reliability, and operational flexibility. Additionally, there are concerns about non-standard substation equipment and operating voltage.

The next step in PSE's system planning process is evaluating potential solutions for the needs and concerns identified in this assessment. That analysis will be presented in PSE's forthcoming Seabeck Area Solutions Report.

1 Introduction and Background Information

This document summarizes PSE's distribution needs assessment for the Seabeck area in west Kitsap County. The objective was to identify present and future needs or concerns on the distribution system.

The assessment included:

- Analysis of distribution capacity to serve the study area over the next 10 years (2022-2032)
- Distribution reliability performance
- Distribution operational concerns, including voltage and phase imbalance
- Aging infrastructure analysis

1.1 Existing Distribution System

The Seabeck study area serves approximately 4,700 customers (mostly residential) with a low penetration of natural gas or other fuel commodities. Two distribution circuits (CHI-12 and SIL-15) serve the majority of customers, with a third circuit (SIL-16) that can act as a backup and pick up some customers under light loading conditions. The CHI-12 feeder is supplied from a PSE standard 25 MVA transformer at Chico substation, while SIL-15 and SIL-16 are supplied from the PSE standard 25 MVA transformer at Silverdale substation, as shown in Figure 1-1.

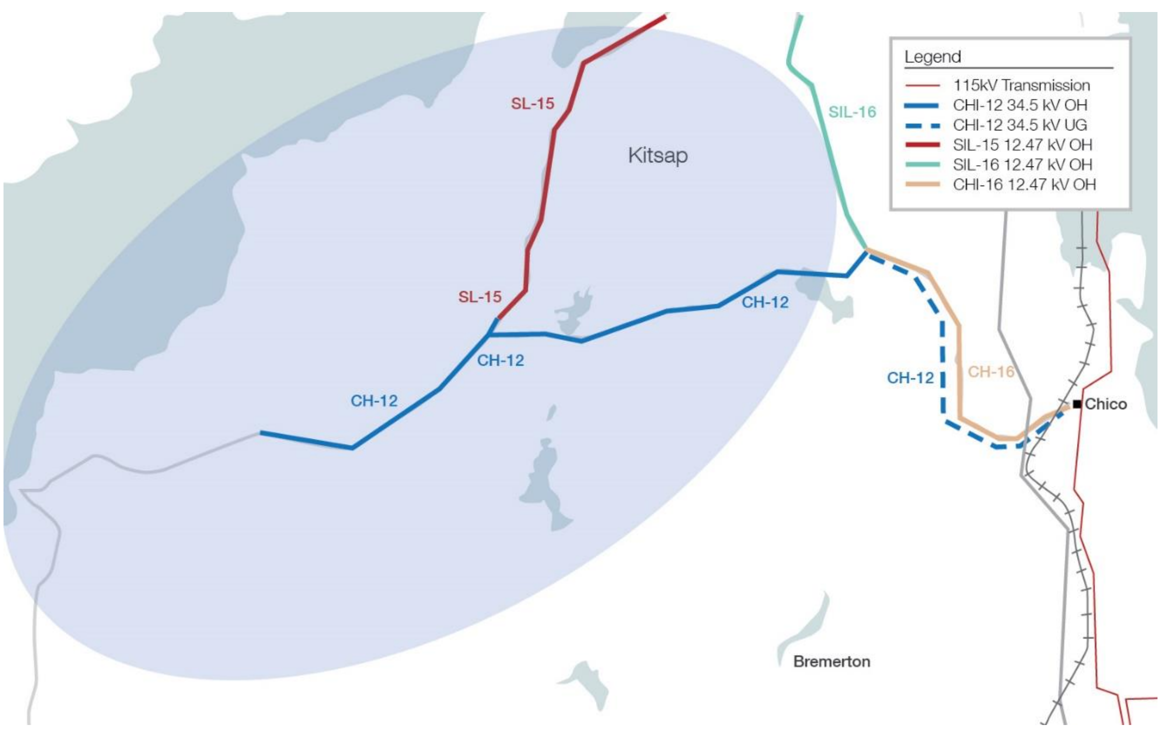

Figure 1-1: Study area distribution system

CHI-12 Description

CHI-12 conductors consists of approximately 3 miles of underground and 8.5 miles of overhead (3.2 miles 4/0 ACSR, 3.4 miles 336 ACSR, and 1.9 miles 397 AAC) three-phase feeder backbone, and approximately 54 miles of overhead laterals. This feeder is served by a 12.47 kV breaker at Chico substation to an overhead 336 ACSR getaway conductor that terminates to parallel underground 750 Al cables, with each set of cables serving one of the two parallel 7.5 MVA, 12.47/34.5kV step-up transformers located within the Chico substation. From the step-up transformers, there are parallel 4/0 Al cables connected to 2.8 miles of 500MCM CU underground cable that then serves the remaining overhead system. The entire feeder system downstream of the step-up transformers is served at 34.5 kV, with several Distribution Automation (DA)[2] enabled reclosers and no voltage regulation equipment.

CHI-12 has two normally-open tie points to neighboring circuits, one to SIL-15 and one to SIL-16. These ties can only be used during light-loading conditions, which generally occur for six to seven months of the year in spring and summer, with only limited application due to concerns with low voltage and high loading on SIL-15 and SIL-16. PSE has added SCADA[3] communication and a DA scheme to the reclosers on CHI-12 and the adjoining normal open on SIL-15. Along with automatic restoration when loading allows, this allows remote switching by system operators and better analysis tools to aid in outage pick up scenarios.

SIL-15 Description

SIL-15 consists of approximately .6 miles of underground 750 AL cable getaways from the Silverdale substation, then 9 miles of overhead three-phase 336 ACSR tree wire feeder backbone, and approximately 34 miles of overhead laterals. SIL-15 is a standard 12.47 kV nominal voltage circuit with two sets of three-phase voltage regulators and several reclosers that have SCADA communication and are included in the area DA scheme. This scheme can only operate during lightly-loaded times of the year for partial back-up and for assisting in restoration after an outage.

SIL-16 Description

SIL-16 ends at the edge of the study area, but provides a tie-point to CHI-12 through a normal-open recloser. This tie can be used to pick up some customers only in the event of a Chico station outage or a cable failure on CHI-12. This tie is not generally effective for backing up CHI-12 in the event of a tree caused outage, especially if the fault location is near the start of the overhead system. SIL-16 is not included in the area's DA scheme.

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[2] Distribution Automation (DA) is a reliability scheme that can automatically operate switches on both sides of faulted equipment to isolate it from the rest of the system and restore service for certain customers during outages.

[3] SCADA (Supervisory Control and Data Acquisition) is telecommunications infrastructure that allows PSE to remotely monitor and control equipment in real time and transmit key information, including circuit breaker status and transformer loading.

2 Key Assumptions and Load Forecast

This section summarizes the study's key assumptions, as well the area's historical and forecasted loads.

2.1 Distribution Study Assumptions

The following key assumptions were utilized for this assessment:

- PSE Distribution Planning Guidelines define performance criteria in this study.
- The assessment horizon selected was the 20-year period from 2022 to 2041 to be in line with the F2022 Load Forecast.
- Historical five-year outage data is used in the assessment.
- There are no known PSE Distributed Energy Resources (DER)[4] on the feeders.
- There is 134kW of interconnected net metering (i.e., customer connected solar) generation capacity on Chico substation on feeders CHI-12 (79kW), CHI-13 (32kW), CHI-15 (5kW), CHI-16 (18kW).
- There is 248kW of interconnected net metering generation capacity on Silverdale substation on feeders SIL-13 (73kW), SIL-15 (106kW), SIL-16 (69kW).

2.2 Kitsap County Historical and Forecasted Load

For this needs assessment, PSE's F2022 Load Forecast was used to model study area loads over the 10-year planning horizon (2022-2032). Kitsap County average annual growth rate varies by year for the study period. See Appendix A for F2022 Kitsap County Load Forecast 2022-2041. Average growth rate for next 10 years with conservation is 0.46%, and without conservation is 1.52%. Average growth rate for next 20 years with conservation is 0.65%, and without conservation is 1.55%.

Historical hourly load data for both distribution substation transformer and distribution feeders were captured for the previous 5 years (2017-2021). The highest temperature-adjusted coincident loading for the identified substation group and feeder group of the previous 3 years (2019-2021) was used and projected for each year of the 10-year planning horizon by applying the annual county growth rates and adding forecasted block loads.

Summer peak loading was identified using historical loading between the months of June to August, while winter peak loading was identified using loading between the months of November to February.

The study area contains some larger pockets of undeveloped property that could see targeted development in the future. This could result in growth levels above the forecasted county levels; these areas were not considered in the analysis as there have been no recent inquiries by developers.

[4] DER (like battery storage and solar panels) are energy resources that are typically sited close to customers and can provide all or some of their immediate electric and power needs. DER can also be used to satisfy the energy, capacity, or ancillary service needs of the distribution grid.

3 Distribution Needs Assessment

3.1 Capacity

PSE regularly monitors the electrical loads throughout its service territory to anticipate and meet system needs, as well as correct deficiencies in the electrical system.

3.1.1 Feeder Capacity

When the loads in an area reach approximately 85% of existing capacity for both overhead (OH) and underground (UG) feeder sections under N-0 system operating conditions the planning need to study adding additional feeder capacity is triggered. This trigger allows for solutions to be studied and put in place before capacity limits are reached and allows for highest loaded phase to remain below capacity limit under acceptable imbalance. When the loads in an area reach 100% of existing capacity, under N-0 and applicable N-1 conditions, there is a need to have the solutions in place to avoid overloads.

3.1.2 Overhead Feeder Capacity

Table 3-1 summarizes the capacity limits for PSE's standard overhead feeder conductors. It applies to the entire overhead portion of feeders in this study that includes CHI-12 and SIL-15.

SIL-15 includes underground sections that are more limiting than the overhead conductors. The 336 ACSR overhead getaway conductor is the limiting factor for CHI-12.

Table 3-1. Distribution Overhead Feeder Capacity Limits[5] [6]

Overhead Feeder Conductor Limits (Amps)		
Conductor	Winter Rating (0°C)	Summer Rating (35°C)
4/0 ACSR	444	325
336 ACSR	659*	483
336 ACSR Tree Wire	645*	440
397 AAC	702*	514
*Note that operations limits N-0 loading to 600A and N-1 to 650A.		

3.1.3 Underground Feeder Capacity

When loading on any UG section reaches limits shown in Table 3-2, the need to add additional feeder capacity is triggered.

Under N-0 and N-1 contingencies, and depending on number of feeder runs in trench, the capacity limit is 394-552 Amps. Any additional load above this capacity limit requires additional feeder capacity to serve the new load. These values apply to the entire underground feeder portion of SIL-15 and the 12.47kV underground feeder portion of CHI-12.

[5] Overhead conductor ratings are based on PSE Standard 0600.0410 effective as of 06/11/2020

[6] Operations limits N-0 loading to 600A and N-1 to 650A based on a standard approach for all system operators to monitor the distribution system.

Table 3-2. Distribution Underground Feeder Capacity Triggers and Capacity Limit

Underground Feeder Conductor - 750 MCM AL (Amps)		
Feeder Runs in Trench	Operational Load (N-0) Planning Trigger (85%)	Capacity Limit (N-0) and Emergency Load (N-1) Planning Trigger (100%)
One	469	552
Two	413	486
Three	368	433
Four	335	394
Five	302	355
Six	271	319

3.1.4 Distribution Substation Capacity

When the loads in an area reach approximately 85% of existing station capacity for a study group of three stations or more, the need to add additional station capacity is triggered to maintain operational flexibility. For individual substations serving load, PSE uses 100% utilization as the capacity limitations of the substation equipment.

Table 3-3 summarizes the N-0 and the N-1 capacity limits for PSE's standard distribution substation transformers. Both the SIL and CHI transformers are standard 25 MVA units.

Table 3-3. Substation Capacity Limits

Single Distribution Substation Loading				
Nominal Rating	Operational Load Limit (N-0)		Emergency Load Limit (N-1)	
	Winter	Summer	Winter	Summer
20 MVA	25.6 MVA	20.6 MVA	28.2 MVA	22 MVA
25 MVA	32 MVA	26 MVA	35 MVA	28 MVA

3.2 Capacity Results

The levels of conservation that can reasonably be achieved in this area are currently difficult to predict. Due to this uncertainty, future capacity needs are studied under multiple scenarios – with predicted system conservation levels and without conservation. The actual need dates presented in this section are based on fully-achieved conservation, as 100% conservation has historically been achieved at a system level. System needs *without* any conservation are also shown to illustrate the earliest need if predicted conservation is not achieved.

3.2.1 Feeder Capacity - CHI-12

Figure 3-1 and Table 3-4 illustrate the historical and projected demand, along with the anticipated capacity need, during the 10-year study period for CHI-12. The highest expected circuit load with and without conservation are also highlighted.

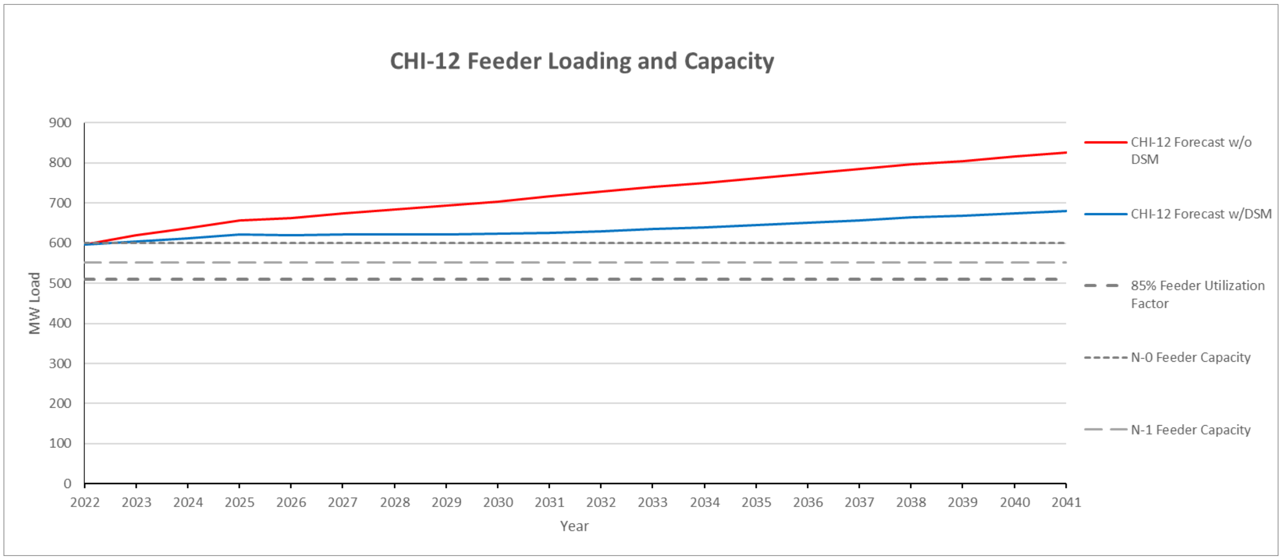


Figure 3-1: CHI-12 Feeder Loading and Capacity

Table 3-4: CHI-12 N-0 Projected Loading w/o Adding Feeder Capacity

CHI-12 Capacity	Feeder Group 85% Utilization		510	Amps		Indicates greater than				
	Feeder Group 100% Utilization		600	Amps		Indicates greater than				
End of year	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**
Winter w/DSM	597	599	611	616	618	619	621	622	624	625
Winter w/o DSM	597	601	618	636	642	653	662	671	682	694
Continued (End of year)	**2032**	**2033**	**2034**	**2035**	**2036**	**2037**	**2038**	**2039**	**2040**	**2041**
Winter w/DSM	631	635	639	643	650	656	656	665	672	680
Winter w/o DSM	717	727	738	749	760	771	780	791	801	812

CHI-12 Capacity Results Summary:

- CHI-12 is presently above the 85% planning trigger to study adding capacity under N-0 conditions during the winter. It is forecasted to exceed the 100% N-0 capacity limit of the feeder in 2024.
- CHI-12 capacity limits for summer are not exceeded within the planning horizon.

3.2.2 N-1 Feeder Capacity – CHI-12

Due to the non-standard nominal voltage and limited tie points for CHI-12, certain N-1 contingencies were considered as part of the needs assessment. The failure of one of the parallel step-up transformers was identified as a risk due to the time associated with replacing this equipment. The CHI-12 circuit is limited to 552A in the event that one of the parallel step-up transformers fails, resulting in the following need on the system:

- CHI-12 is presently above the N-1 contingency limit in the event of the failure of one of the parallel step-up transformers. This contingency would require load shedding of 45 Amps during peak load conditions.

3.2.3 N-0 Feeder Capacity - SIL-15

Figure 3-2 illustrates historical and projected demand for the 10-year study period for SIL-15. Projections are shown with and without conservation. See Table 3-5 for a summary of limits and expected demands, by year, using the F2022 Load Forecast.

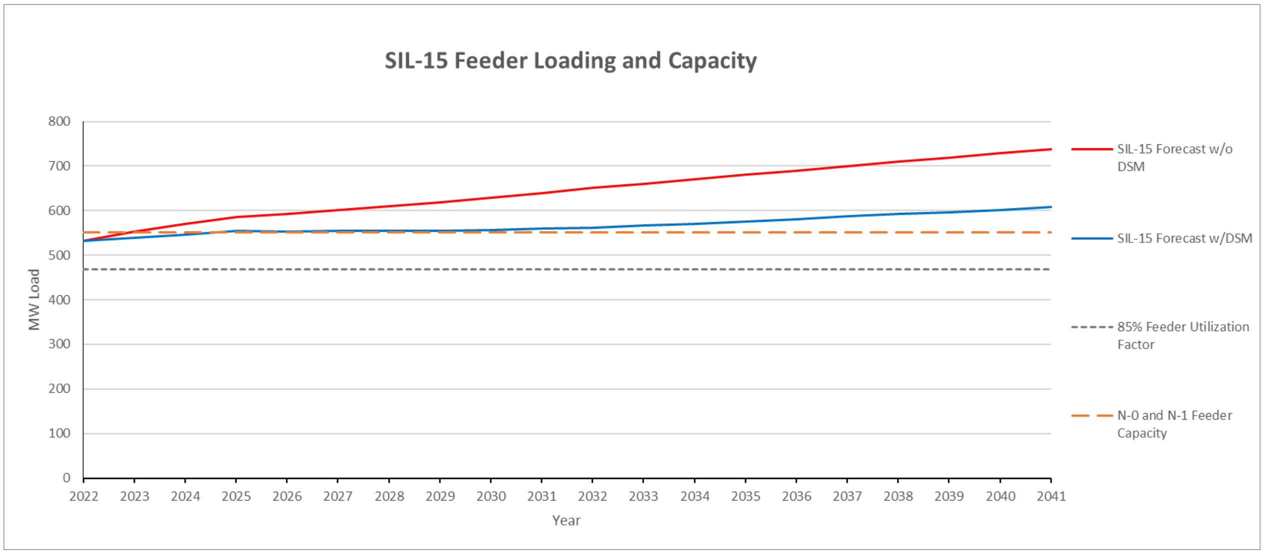


Figure 3-2. SIL-15 Feeder Loading and Capacity

SIL-15 Capacity	Feeder Group 85% Utilization		469 Amps		Indicates greater than					
	Feeder Group 100% Utilization		552 Amps		Indicates greater than					
End of year	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**
Winter w/DSM	535	546	550	552	553	554	556	557	558	559
Winter w/o DSM	536	552	568	574	583	591	599	609	620	631
Continued (End of year)	**2032**	**2033**	**2034**	**2035**	**2036**	**2037**	**2038**	**2039**	**2040**	**2041**
Winter w/DSM	563	567	571	575	581	585	586	594	600	607
Winter w/o DSM	640	649	659	669	679	688	696	706	715	725

Table 3-5: SIL-15 N-0 Projected Loading w/o Adding Feeder Capacity

SIL-15 Capacity Results Summary:

- SIL-15 is presently above the 85% utilization to study adding capacity under N-0 conditions of the OH feeder systems during the winter. It is forecasted to exceed the N-0 capacity of the feeder in 2026.
- SIL-15 capacity limits for summer will not be exceeded within the planning horizon.

3.2.4 Chico Substation Capacity

Figure 3-3 illustrates historical demand and projected demand for the 20-year F2022 Load Forecast period for CHI-1 transformer at the Chico substation. The projected demand includes projections with and without conservation. There are no capacity triggers within the 10-year planning horizon.

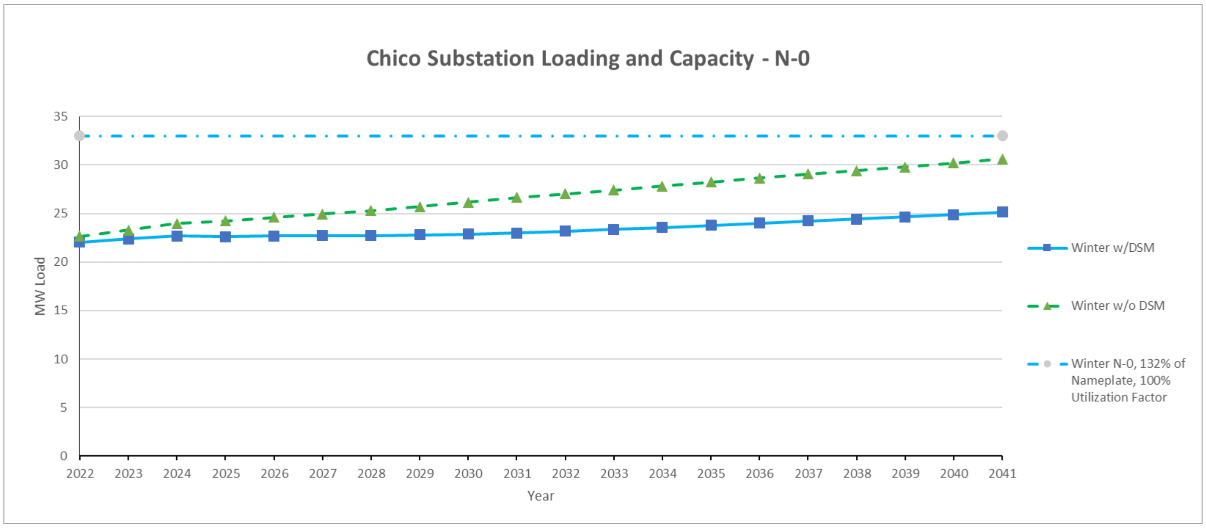


Figure 3-3: Chico Substation N-0 Capacity

3.2.5 Silverdale Substation Capacity

Figure 3-4 illustrates historical demand and projected demand for the 20-year F2022 Load Forecast period for SIL-1 transformer at the Silverdale substation. The projected demand includes projections with and without conservation. There are no capacity triggers within the 10-year planning horizon.

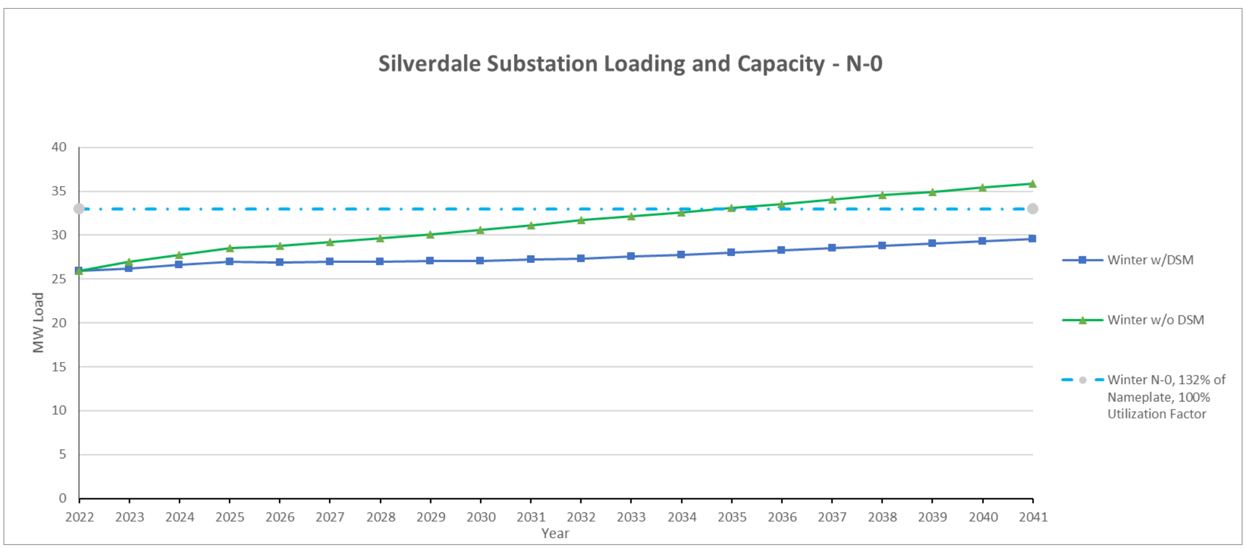


Figure 3-4: Silverdale Substation N-0 Capacity

3.3 Distribution Reliability

The reliability performance of PSE's electric distribution system is evaluated by comparing individual circuits to the system as a whole. The metrics most commonly used to determine reliability performance are Customer Minute Interruptions (CMI), System Average Interruption Frequency Index (SAIFI), and

System Average Interruption Duration Index (SAIDI). These are used to track the frequency and duration of outages experienced by customers on any particular circuit.

Kitsap County is one of PSE's most challenging regions when it comes to maintaining adequate reliability. The area experiences frequent outages, with many that are long-lasting. This is mostly due to large amounts of trees and vegetation, as well as windy conditions associated with the peninsula's geography. Restoring power after an outage is also challenging and time-consuming. The time and effort required to mobilize resources into more rural areas of the county is a contributing factor to the area's longer-duration outages.

CHI-12 has heavy tree exposure along most of the approximately 8.5 miles of overhead three-phase feeder backbone and 54 miles of overhead laterals, which contributes to frequency of outages. There is no existing tree wire on CHI-12 because the feeder is primarily 34.5kV. Presently, 35kV class tree wire is not considered a feasible reliability alternative based on PSE Standard 6550.6060[7], due to construction requirements that limit the viability of the solution. The limited ability to pick up load from adjacent circuits also contributes to longer than average outage durations.

PSE has installed tree wire on the entire OH feeder sections on SIL-15. The installation of tree wire along the feeder sections improved reliability from an average of 580 SAIDI from 2014-2016 to an average of 291 SAIDI from 2017-2021. Even with this improvement, SIL-15 still has poor reliability due to its length – approximately 8.6 miles of overhead three-phase feeder backbone exposure. While tree wire provides the benefit of reducing outages due to limb contact, it does not have the mechanical strength to prevent an outage if a large limb or tree trunk fell into the line. This exposure in heavily-treed areas of the feeder paths contributes to the frequency of outages. The limited ability to pick up load from adjacent circuits also contributes to longer-than-average outage durations.

3.3.1 Reliability Analysis (2017-2021)

Reliability analysis for CHI-12 and SIL-15 was used outage data from 2017-2021. The non-MED[8] CMI, SAIDI, and SAIFI performance of each circuit is compared to the system average over the same timeframe. See 0 for a detailed reliability analysis using data from 2017-2021. Table 3-6 below shows circuit performance in key reliability metrics compared to PSE system average.

Table 3-6. Circuit Reliability Data

Reliability Metric (2017-2021)	PSE Average	SIL-15 (% of Average)	CHI-12 (% of Average)
Non-MED CMI	155,460	629,829 (405%)	1,355,430 (872%)
Non-MED SAIDI	164	291 (177%)	523 (319%)
Non-MED SAIFI	0.96	1.56 (163%)	4.00 (417%)

Analysis shows that the reliability of both CHI-12 and SIL-15 are well above PSE system averages for CMI, SAIFI, and SAIDI. The CMI of SIL-15 is over four times higher, and the CMI of CHI-12 is over eight times

[7] PSE Standard 6550.6060, effective 07/01/2011, explicitly states "Tree wire is not used for 34.5kV circuits".

[8] Non-MED refers to Non-Major Event Day and excluded outages during storm conditions from the reliability analysis.

higher. With all reliability metrics considerably above the PSE system average, distribution reliability in the Seabeck area is identified as a project need.

3.4 Operations

3.4.1 System Voltage

PSE's Distribution Planning Guideline targets a minimum of 119 volts and maximum of 126 volts at the primary side of all distribution service transformers under N-0 (no segment of the system is out of service) conditions. The 119 volt minimum is to allow for up to a 5 volt drop across the service transformer and service conductor to deliver 114 volts minimum at the customer meter or point of service. A minimum of 113 volts is required at the primary side of all distribution service transformers under N-1 (one segment of the system is out of service) conditions to deliver 108 volts minimum at the customer meter or point of service.

Power flow modeling of SIL-15 and CHI-12 shows primary voltage as low as 115 volts on the feeder during peak conditions, which is identified as a need for the Seabeck area.

3.4.2 Phase Balance

Distribution Planning Guidelines state that phase imbalance should be no greater than 100 Amps between any two phases.

During the last 5 years, large phase imbalances were seen at system peak on CHI-12. Winter system peak in 2021 had a maximum phase imbalance of 139 Amps, which is above the planning criteria of 100 Amps.

Phase imbalance contributes greatly to system losses due to increased neutral current. A balanced load has no return current on the neutral, thus eliminating losses. Bringing phases closer to a balanced system will reduce losses on the delivery.

Phase imbalance on CHI-12 is identified as a need for the Seabeck area.

3.4.2.1 Non-Standard Operations

CHI-12 operates at 34.5kV nominal voltage on the feeder backbone. It is the only circuit in Kitsap County that operates at this voltage. The remaining 105 circuits operate at 12.47kV nominal voltage. The higher voltage class requires specialized equipment and procedures that are non-standard in the region, as it represents less than 1% of total circuits. Different equipment needed to serve this unique voltage requires additional inventory to be maintained. This non-standard inventory requires additional yard space and costs to carry before the equipment is installed and placed in service.

The non-standard operating voltage of 34.5kV is identified as a concern for the Seabeck area.

3.4.3 Chico Substation Equipment Condition

One of the two parallel 12.47-34.5kV 7.5 MVA autotransformers at Chico Substation, XFR1384, has shown signs of accelerated aging with an estimated replacement year of 2052. The current asset management plan is to continue monitoring for signs of increased acceleration in the transformer effective age. See 0 for health report on XFR1384. Given its current health condition, this is not considered a need or concern for the system.

The 115/12.5kV 25MVA bank CHI-1, LFR1585, was energized in 2016. There are no present health concerns for the transformer. Most of the station equipment, including 12kV breakers and bus system, was replaced and put in service in 2016. High side fusing is no longer standard, and system planning recommends installing a standard circuit switcher when possible.

There are no other equipment concerns at Chico substation.

3.4.4 Silverdale Substation Equipment Condition

The 115kV/12.5kV 25MVA bank SIL-1, LFR1539, was energized in 2013. There are no present health concerns for the transformer.

The distribution getaway cables are 1970s vintage yellow jacket cables. These cables have a distinct yellow outer layer that makes them easily identifiable. Yellow jacket cables have a history of failures, and PSE generally replaces this type of getaway cable when there is an opportunity to do so. For context, *opportunity* is when other work and/or planned outages can be leveraged to justify replacement. At this time, there are no PSE replacement programs to eliminate yellow jacket cables.

The distribution capacitor switch is oil-filled, which PSE generally upgrades to a vacuum capacitor switch when there is an opportunity to do so. Currently, there is not a replacement program to eliminate existing oil capacitor switches.

There is a 1979 vintage Mark V circuit switcher on the transmission line (GSW0405). This particular switch has not been problematic; however, other switchers of the same model and vintage have been replaced due to failures. Replacement of this switch would be considered if there was opportunity.

There are no other equipment concerns at Silverdale substation.

3.5 Summary of Distribution Needs and Concerns

The identified needs and concerns for the Seabeck study area are summarized below.

Needs:

- **Feeder Capacity:** Feeders CHI-12 and SIL-15 presently exceed PSE's distribution planning triggers and are forecasted to exceed capacity limits within the planning period.
    - CHI-12 is forecasted to surpass 100% capacity limit in 2024
    - CHI-12 has an existing N-1 capacity need in the event of a parallel step-up transformer failure.
    - SIL-15 is forecasted to surpass 100% capacity limit in 2026
- **Feeder Reliability:** Feeders CHI-12 and SIL-15 have CMI, SAIDI, and SAIFI metrics that are significantly above system average. Reliability improvements are needed for both circuits.
- **Operational Need:** Feeders CHI-12 and SIL-15 experience low voltage under peak demand. Voltage improvements at peak system demand are needed for both feeders.
- **Operational Need:** CHI-12 has phase imbalance during peak loading that exceeds allowable limits.

3.5.1 Concerns:

- **Substation Equipment:** There is an existing concern for non-standard substation equipment at both Chico and Silverdale substations. Non-standard equipment includes high-side fusing at

Chico substation and yellow jacket getaways, oil-filled capacitor switch, and a Mark V circuit switcher at Silverdale substation.
This equipment should be evaluated for replacement when there is planned work at each substation.

- **Non-Standard Operations:** CHI-12 operates at 34.5kV, which is a unique operating voltage in Kitsap County and requires additional inventory and costs.

Conclusion and Next Steps

Energy is essential for communities, and PSE is committed to creating a better energy future for all customers in the Seabeck area.

PSE's assessment of the area's distribution system indicates a need to address its feeder capacity, reliability, and operational flexibility. Additionally, there are concerns about non-standard substation equipment and operating voltage.

The next step in PSE's system planning process is evaluating potential solutions for the needs and concerns identified in this assessment. That analysis will be presented in PSE's forthcoming title of Solutions Report.

APPENDIX A: F2022 Kitsap County Winter Load Forecast 2022-2042

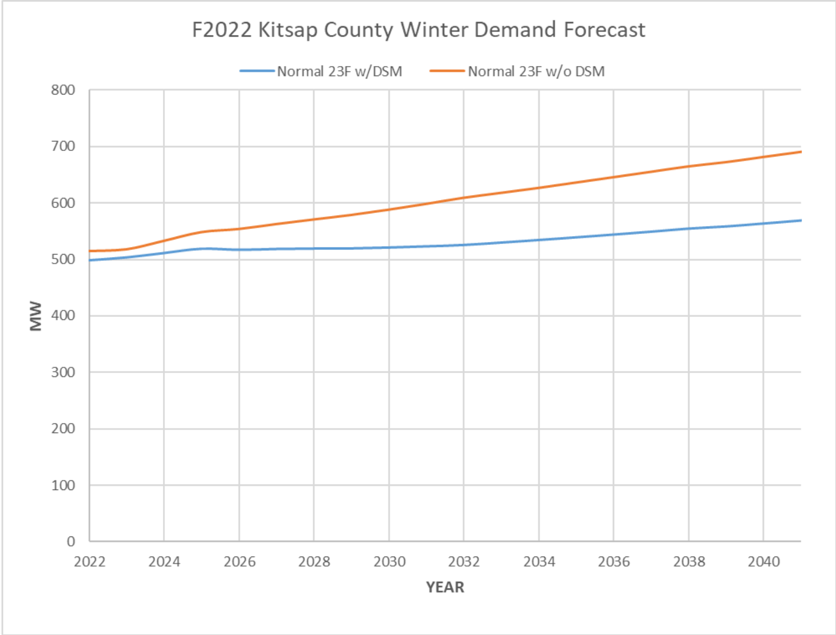


Figure 0-1: F2022 Kitsap County Winter Load Forecast

Table 0-1: Annual Winter Growth Rates F2022 for 2022-2042

F2022 Load Forecast w/DSM			F2022 Load Forecast w/o DSM		
December "Normal" Peak: 23 Degrees			December "Normal" Peak: 23 Degrees		
Year	MW	Annual Rate	Year	MW	Annual Rate
2022	499		2022	515	
2023	504	1.03%	2023	518	0.63%
2024	512	1.51%	2024	533	2.90%
2025	519	1.47%	2025	549	2.90%
2026	517	-0.36%	2026	554	1.01%
2027	519	0.29%	2027	563	1.59%
2028	520	0.14%	2028	571	1.45%
2029	520	0.06%	2029	579	1.40%
2030	521	0.29%	2030	589	1.61%
2031	524	0.40%	2031	599	1.74%
2032	526	0.45%	2032	610	1.81%
2033	530	0.82%	2033	618	1.43%
2034	535	0.84%	2034	627	1.42%
2035	539	0.88%	2035	637	1.52%
2036	544	0.91%	2036	646	1.49%
2037	549	0.93%	2037	656	1.48%
2038	555	0.98%	2038	665	1.46%
2039	558	0.68%	2039	673	1.13%
2040	564	0.92%	2040	682	1.37%
2041	569	0.95%	2041	691	1.32%
2042	576	1.16%	2042	701	1.42%
Avg 10 year (2022 - 2031)		0.48%	Avg 10 year (2022 - 2031		1.52%
Avg 20 year (2023 - 2042)		0.72%	Avg 20 year (2023 - 2042		1.55%

APPENDIX B: F2022 Kitsap County Summer Load Forecast 2022-2042

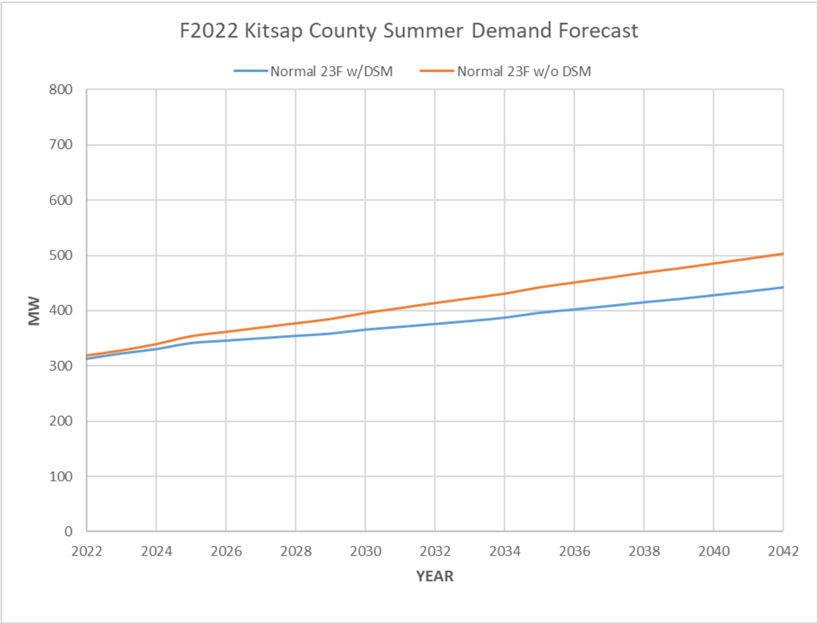


Figure 0-1: F2022 Kitsap County Summer Load Forecast

Table 0-1: Annual Summer Growth Rates F2022 for 2022-2042

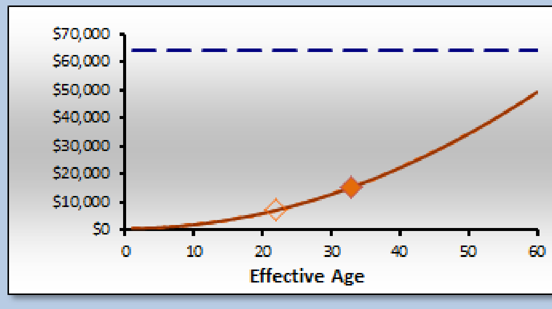
F2022 Load Forecast w/DSM			F2022 Load Forecast w/o DSM		
December "Normal" Peak: 23 Degrees			December "Normal" Peak: 23 Degrees		
Year	MW	Annual Rate	Year	MW	Annual Rate
2022	313		2022	319	
2023	323	3.05%	2023	328	2.86%
2024	330	2.44%	2024	340	3.47%
2025	341	3.26%	2025	354	4.20%
2026	346	1.31%	2026	362	2.24%
2027	350	1.27%	2027	369	2.15%
2028	354	1.20%	2028	377	2.10%
2029	358	1.16%	2029	385	2.06%
2030	365	1.98%	2030	396	2.81%
2031	370	1.38%	2031	405	2.25%
2032	376	1.40%	2032	414	2.27%
2033	381	1.43%	2033	422	2.06%
2034	387	1.57%	2034	431	1.99%
2035	396	2.26%	2035	442	2.63%
2036	402	1.53%	2036	451	1.99%
2037	408	1.57%	2037	460	1.95%
2038	415	1.64%	2038	469	1.95%
2039	421	1.41%	2039	477	1.67%
2040	427	1.61%	2040	485	1.83%
2041	434	1.61%	2041	494	1.80%
2042	442	1.69%	2042	503	1.81%
Avg 10 year (2022 - 2031)		1.70%	Avg 10 year (2022 - 2031		2.41%
Avg 20 year (2023 - 2042)		1.74%	Avg 20 year (2023 - 2042		2.30%

APPENDIX C: Transformer 1384 Health Report

Station Transformer: XFR1384

RELOAD ASSET | SAVE ASSET | CREATE ASSET

DEMOGRAPHICS	
Equipment ID	XFR1384
Asset class	Station Transformer
Existing equipment type	XFR DX
Replacement equipment type	XFR DX
Functional location	CHI-1
Project	
Location description	CHICO Bank 1
Equipment description	Station Transformer (MVA)
Manufacturer	EASTERN ELECTRIC
Model number	
Manufacturer serial number	PMR488395
Serial number	XFR1384
City	Bremerton
Location	D-S PENN
Street	NW Cnr.of Northk.Wy.&
Construction year	1995
Calendar age	22



RESULTS	
Age at replacement	68
Years to replacement	35
Year of replacement	2052
Benefit/cost ratio	
Lifecycle cost of new asset	$64,302
Lifecycle interval of new asset	68
Remaining economic value	$519,837

INTERVENTIONS	
Emergency premium %	100%
User defined replacement cost	
Replacement cost	$936,800
Emergency premium cost	$0

HEALTH INDEX	
Health index	49
Health index is valid?	Yes
Adjustment factor	11
Effective age	33

ADDITIONAL DEMOGRAPHICS	
High voltage rating	34.5/0/0
Low voltage rating	12.5/0/0
Cooling	
Number of phases	3
Oil volume (gas)	750 gal
Manufacturer nameplate	
High operating voltage	34.5
Low operating voltage	12.5
Max MVA	7.5
Transformer configuration	
Percent impedance	4.53
Dry shipping weight	
Self cooled MVA	7.5
Tertiary voltage rating	

PROBABILITY OF FAILURE	
Existing shape	3
Existing scale	75
FP based on age	0.77%
Existing failure multiplier	1.0
Replacement failure multiplier	1.0

CONSEQUENCE OF FAILURE EXISTING	
Normal failure	$1,701,806
Catastrophic failure	$179,482
Concurrent failure	$17,914
	$0
	$0
Consequence of failure	$1,899,202

Figure 0-1: Transformer 1384 Health Report

APPENDIX D: 2017-2021 Reliability Data

Table D-1: SAIDI Performance (2017-2021)

	Non-MED SAIDI By Year					
Circuit	**2017**	**2018**	**2019**	**2020**	**2021**	**Average (2017-2021)**
CHI-12	540	302	396	612	767	523
SIL-15	193	129	227	377	530	291

Table D-2: SAIFI Performance Criteria (2017-2021)

	Non-MED SAIFI By Year					
Circuit	**2017**	**2018**	**2019**	**2020**	**2021**	**Average (2017-2021)**
CHI-12	4.85	2.96	2.72	5.05	4.40	4.00
SIL-15	0.95	0.94	0.97	1.90	3.05	1.56

Table D-3: CMI Performance (2017-2019)

	Non-MED CMI By Year					
Circuit	**2017**	**2018**	**2019**	**2020**	**2021**	**Average (2017-2021)**
CHI-12	1,379,600	773,124	1,021,941	1,591,944	2,010,540	1,355,430
SIL-15	416,518	277,751	491,168	815,846	1,147,863	629,829

Tables D-1 through D-3 show that the reliability of both CHI-12 and SIL-15 are significantly above system PSE averages for SAIDI, SAIFI, and CMI. In particular, CHI-12 continues to have performance that is much worse than system average.

APPENDIX E: Glossary

Term	Definition
Block load	A large expected increase in electric energy demand from an existing or new customer.
Circuit	A circuit is an electrically connected path along which power can flow. This can be at transmission or distribution voltage.
Circuit Breaker	A circuit breaker is an electrical interrupting device designed to protect an electrical circuit from damage caused by an electrical fault.
Concern	A "concern" is a non-critical issue identified in a Needs Assessment that is not required to be addressed by a solution. A solution that addresses an identified concern provides additional benefit.
Conservation	Measures to improve efficiency of customer's electric loads reducing energy use and peak demand.
Consumption	Consumption is the amount of electricity that customers use over a period of time and it's measured in watt-hours (Wh).
Contingency	A contingency is a scenario where the electric system experiences the loss of one or more elements.
Curtailable	A load that may be interrupted to reduce load on system during peak periods. Curtailable customers are on a different rate schedule than non-curtailable (firm) customers.
Demand	The amount of power being required by customers at any given moment, measured in watts.
DR- Demand response	Flexible, price-responsive loads, which may be curtailed or interrupted during system emergencies or when wholesale market prices exceed the utility's supply cost. Demand response is also the voluntary reduction of electricity demand during periods of peak electricity demand or high electricity prices. Demand response provides incentives to customers to temporarily lower their demand at a specific time in exchange for reduced energy costs.
DGA - Dissolved Gas Analysis	Dissolved Gas Analysis (DGA) is used throughout the utility industry to monitor transformer winding and insulation condition. PSE tests transformer oil for seven combustible gases, which are monitored against proven levels that indicate concerns.
Distributed Generation	Generation on the distribution system, like rooftop solar panels, located close to the source of the customer's load.
Distribution Feeder	A distribution feeder is the backbone section of a distribution circuit that is larger wire carrying the entire circuit load.

Term	Definition
Term	**Definition**
Block load	A large expected increase in electric energy demand from an existing or new customer.
Business as Usual Distributed Energy Resources (BAU DER)	Acquiring cost effective energy efficiency as a resource, mitigating both energy and peak demand growth by partnering with customers in their efforts to make high efficiency upgrades in their homes and businesses.
Circuit	A circuit is the electric equipment associated with serving all customers under normal configuration from a specific distribution circuit breaker at a substation.
Concern	A “concern” is a non-critical issue that impacts system operations but is not required to be addressed by a solution; a solution that addresses an identified concern provides additional benefit.
Conservation	Measures to improve efficiency of customer’s electric loads reducing energy use and reducing peak demand.
Consumption	Consumption is the amount of electricity that customers use over the course of a year and it’s measured in kilowatt hours.
Contingency	Contingencies are a set of transmission system failure modes, when elements are taken out of service (e.g., loss of equipment).
Curtailable	A load that may be interrupted to reduce load on system during peak periods. Curtailable customers are on a different rate schedule than non-curtailable (firm) customers.
Demand	The amount of power being required by customers at any given moment, and it’s measured in kilowatts.
DR- Demand response	Flexible, price-responsive loads, which may be curtailed or interrupted during system emergencies or when wholesale market prices exceed the utility’s supply cost. Demand response is also the voluntary reduction of electricity demand during periods of peak electricity demand or high electricity prices. Demand response provides incentives to customers to temporarily lower their demand at a specific time in exchange for reduced energy costs.
Distributed Energy Resource (DER)	A resource sited close to customers that can provide all or some of their immediate electric and power needs and can also be used by the system to reduce system demand (such as energy efficiency) or provide supply to satisfy the energy, capacity, or ancillary service needs of the distribution grid. The resources, if providing electricity or thermal energy, are small in scale, connected to the distribution system, and close to load
Distributed generation	Small-scale electricity generators, like rooftop solar panels, located close to the source of the customer’s load.

Term	Definition
Distribution line	A distribution line is a medium-voltage (12.5 kV-35 kV) line that carries electricity from a substation to customers. Roughly half of PSE's distribution lines are underground. Distribution voltage is stepped down to service voltage through smaller transformers located along distribution lines. Distribution lines differ from feeder as it includes the large feeder wire and smaller wire laterals.
Distribution System	A distribution system is the medium-voltage (12.5 kV-35 kV) infrastructure that carries electricity from a substation to customers and includes the substation transformer. System is the collective of all of this infrastructure in an entire study area.
EPRI- The Electric Power Research Institute	The Electric Power Research Institute conducts research, development, and demonstration projects for the benefit of the public in the United States and internationally. As an independent, nonprofit organization for public interest energy and environmental research, they focus on electricity generation, delivery, and use.
Feeder	A feeder is the largest conductor section of a circuit and carries the greatest load as it serves all the laterals (branches)) of the circuit.
Institute of Electrical and Electronics Engineers (IEEE)	A professional association, promoting the development and application of electro-technology and allied sciences for the benefit of humanity, the advancement of the profession, and the well-being of our members.
Integrated Resource Plan (IRP)	The Integrated Resource Plan (IRP) is a forecast of conservation resources and supply-side resource additions that appear to be cost effective to meet the growing needs of our customers over the next 20 years. Every two years, utilities are required to update integrated resource plans to reflect changing needs and available information.
Interim Operating Plan (IOP)	A temporary plan to address a transmission system deficiency and meet performance requirements, until a solution takes effect. An IOP may consist of a series of operational steps to radially operate the system, run generation or implement load shedding.
Kilovolt (kV)	A kilovolt (kV) is equal to 1,000 volts of electric energy. PSE uses kilovolts as a standard measurement when discussing things like distribution lines and the energy that reaches our customers.
Load	The total of customer demand plus planning margins and operating reserve obligations.
Load forecast	A load forecast is a projection of how much power PSE’s customers will use in future years. The forecast allows PSE to plan upgrades to its electric system to ensure that current and future customers continue to have reliable power. Federal regulations require that utilities plan a reliable system based on forecasted loads. When developing a load forecast, PSE takes multiple factors into account like current loads, economic and population projections, building permits, conservation goals, and weather events.

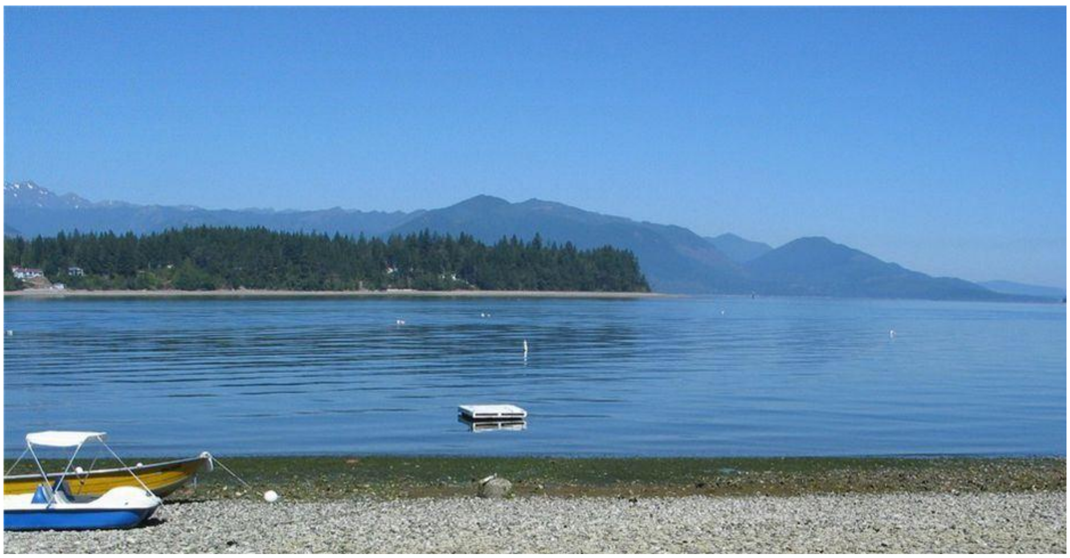
Term	Definition
Load shedding	Load shedding is when a utility intentionally causes outages to customers because demand for electricity is exceeding the capacity of the electric grid. Load shedding is the option of last resort and is conducted to protect the integrity of the electric grid components in order to avoid a larger blackout. This is not a practice that PSE endorses as a long-term solution to meet mandatory performance requirements.
Major Event Day (MED)	Any day in which the daily system SAIDI exceeds the annual threshold value. Outages on those days are excluded from the SAIDI performance calculation.
Megawatt (MW)	A megawatt (MW) is equal to 1,000,000 watts of electric energy. PSE uses megawatts as a standard measurement when discussing things like system load and peak demand. MW differs from MVA in that it is generally always lower and translates as energy that performs work. The amount of MW vs MVA is determined by load characteristics. Motor loads generally have a lower power factor (PF) than heating loads for example and as a result. MW=MVA*PF
Mega Volt-Amp (MVA)	A MVA is equal to 1,000,000 (Volt*Amps). MVA is generally slightly higher than MW. Equipment ratings are in MVA as the equipment heat rise is determined by actual MVA.
N-0	This is a planning term describing that the electric grid is operating in a normal condition and no components have failed.
N-1	This is a planning term describing an outage condition when one system component has failed or has been taken out of service for construction or maintenance.
N-1-1	This is a planning term describing outage conditions where two failures occur one after another with a time delay between them.
N-2	This is a planning term describing outage conditions where two failures occur nearly simultaneously.
Native Load Growth	Load growth associated with existing customers or new customers less than 1 MW.
Need	A constraint or limitation on the delivery system in providing safe and reliable electric supply to customers. A need is a “must-have” that is required to be addressed for the system in a timely manner (by a certain Need Date, as determined in a needs assessment)
Non-wires alternatives	Alternatives that are not traditional poles, wires and substations. These alternatives can include demand reduction technologies, battery energy storage systems, and distributed generation.

Term	Definition
NERC- North American Electric Reliability Corporation	NERC establishes the reliability standards for the North American grid. NERC is a not-for-profit international regulatory authority whose mission is to ensure the reliability of the bulk power system in North America, as certified by FERC. NERC develops and enforces Reliability Standards and annually assesses seasonal and long-term reliability. PSE is required to meet the Reliability Standards and is subject to fines if noncompliant.
Peak demand	Customers' highest demand for electricity at any given time, and it's measured in megawatts.
Proven technology	Technology that has successfully operated with acceptable performance and reliability within a set of predefined criteria. It has a documented track record for a defined environment, meaning there are multiple examples of installations with a history of reliable operations. Such documentation shall provide confidence in the technology from practical operations, with respect to the ability of the technology to meet the specified requirements.
Reasonable project cost	Reasonable project cost means holistically comparing costs and benefits to project alternatives. This includes dollar costs, as well as duration of the solution, risk to the electric system associated with the type of solution (e.g., is the solution an untested technology), and impacts to the community.
Right of way	A corridor of land on which electric lines may be located. PSE may own the land in fee, own an easement, or have certain franchise, prescription, or license rights to construct and maintain lines.
Sensitivities	Sensitivities are circumstances or stressors under which the contingencies are tested (e.g., forecasted demand levels, interchange, various generation configurations).
Spacer Cable	Spacer cable is a product by Hendrix that is supported by a strong messenger cable and has insulated phase conductors. This product prevents most tree outages by blocking falling limbs from the phase conductors.
Substation	A substation is a vital component of electricity distribution systems, containing utility circuit protection, voltage regulation and equipment that steps down higher-voltage electricity to a lower voltage before reaching your home or business.
Substation group	A grouping of 2-5 substation transformers that are situated close enough to each other that loads in the study area can be switched from one station to an adjacent station for maintenance, construction, or permanent load shifting. For Seabeck, the substation group includes 2 distribution substations – Silverdale and Chico.
Substation group capacity	The aggregate distribution transformer capacity of the substation group for winter and summer rating, calculated in MVA.

Term	Definition
SAIDI- System Average Interruption Duration Index	SAIDI is the length of non-major-storm power outages per year, per customer. SAIDI is commonly used as a reliability indicator by electric power utilities. Outages longer than 5 minutes are included.
SAIFI- System Average Interruption Frequency Index	SAIFI is the frequency of non-major-storm power outages per year, per customer. SAIFI is commonly used as a reliability indicator by electric power utilities. Interruptions longer than 1 minute are included.
Transformer	A transformer is a device that steps electricity voltage down from a higher voltage, or steps it up to a higher voltage, depending on use. On the distribution system, transformers typically step the voltage down from a distribution voltage (12.5 kV) to 120 to 240 volts for customers' residential use. Transformers are the green boxes in some residences' front yard or the barrel-like canisters on utility poles.
Transmission line	Transmission lines are high-voltage lines that carry electricity from generation plants to substations or from substation to substation. Transformers at the substation "step down" the electricity's transmission voltage (55 to 230 kilovolts) to our primary distribution voltage (12.5 kV).

PUGET SOUND ENERGY

Seabeck Area Solutions Report



Olympic Mountains from Seabeck Conference Center, Seabeck, WA

Strategic System Planning May 18, 2023

PUGET SOUND ENERGY

Seabeck Area
Solutions Report

Prepared By:

Colin O'Brien, PE, *Strategic System Planning*
Chad Larson, PE

Approved By:

Ryan Lambert, PE, *Manager - Strategic System Planning*

DocuSigned by: Ryan Lambert
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05/19/2023

Ryan Lambert *Date*
System Planning, Manager

DocuSigned by: David Landers
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David Landers *Date*
System Planning, Director

Strategic System Planning
May 18, 2023

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Executive Summary

PSE's System Planning department regularly assesses communities' electrical system needs, throughout the service area, to ensure that PSE can reliably serve its customers. The first step in PSE's planning process is completing a *Needs Assessment* for the area being considered. Once those needs have been determined, planners prepare a *Solutions Report* that analyzes a range of feasible approaches to address them – eventually determining a preferred solution.

This document is the Solutions Report for the distribution system serving Seabeck, Washington and the surrounding area. Puget Sound Energy (PSE) and Guidehouse (formerly Navigant Consulting) analyzed traditional wires, non-wires, and hybrid options to determine the ideal solution for addressing the area's distribution needs over a 10-year planning horizon (2022-2032).

The Seabeck study area, shown below in Figure 0-1, is a scenic, rural region at the edge of PSE's service territory in western Kitsap County. Along with the town of Seabeck, it includes Wildcat Lake, the community of Holly, and Guillemot Cove Nature Reserve. There are numerous trails and creeks – with Hood Canal flowing between Kitsap and the Olympic Peninsula.

Within the area, PSE serves approximately 4,700 electric customers (mostly residential), and local homes are typically on large lots in uncondensed neighborhoods. There is no natural gas system in the area.

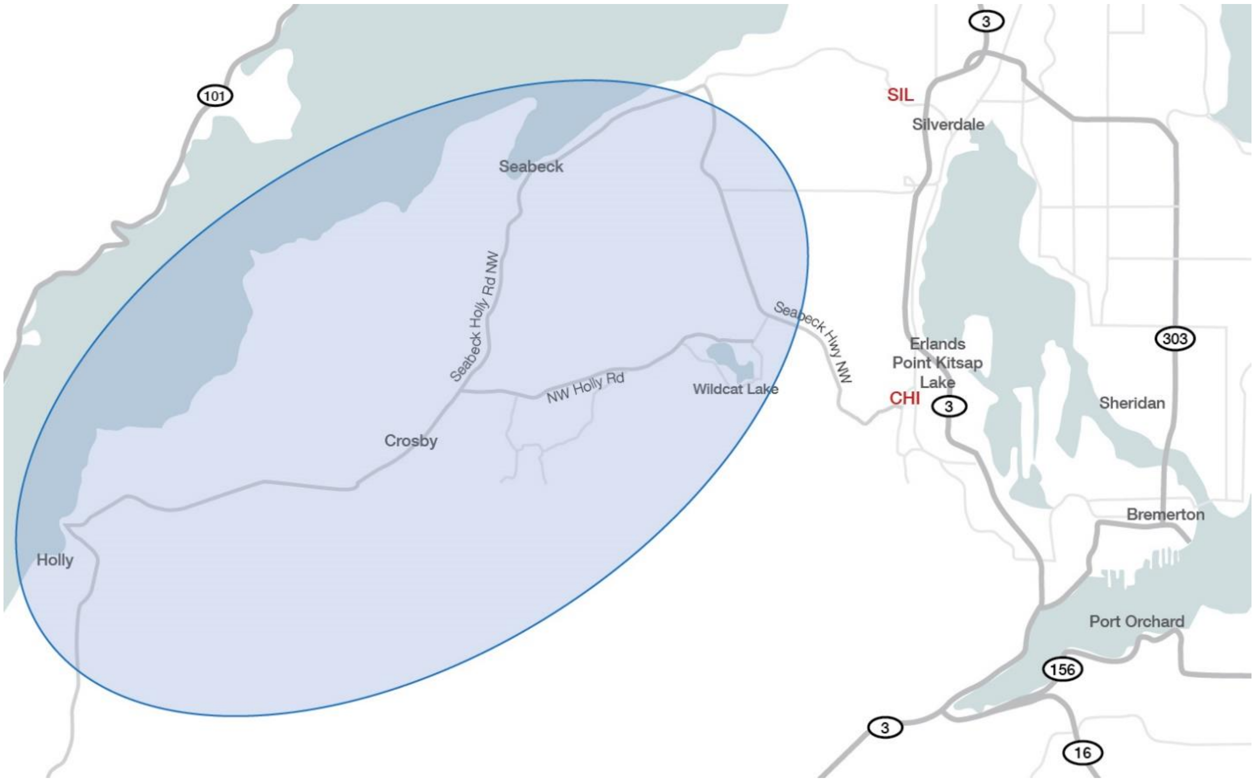

Figure 0-1: Seabeck Needs Assessment Study Area and Existing Distribution System

The study area is primarily served by two feeders: CHI-12 from Chico substation and SIL-15 from Silverdale substation. Both are very heavily loaded and have poor reliability histories, with frequent and often sustained outages. In fact, CHI-12 is oftentimes the *worst performing circuit* in all of PSE's service territory, with SIL-15 in the top 50. Much of this is due to the circuits' long lengths and overhead exposure, combined with an abundance of surrounding trees. The local geography can also hamper restoration efforts, making outages last even longer.

Summary of Seabeck Area Needs and Concerns (detailed in Section 2)

The distribution needs and concerns identified for the Seabeck area are summarized below. As stated earlier, reliability is currently a significant issue for customers. Additionally, within the next 10 years, electrical demand will exceed the existing system's (already strained) capacity limits. Operational issues also negatively impact system function.

Needs:

- **Feeder Capacity:** Feeders CHI-12 and SIL-15 presently exceed PSE's distribution planning triggers and are forecasted to exceed capacity limits within the planning period.
  - CHI-12 is forecasted to surpass 100% capacity limit in 2024.
  - CHI-12 has an existing N-1 capacity need in the event of a parallel step-up transformer failure. N-1 is a planning contingency where one system element is out of service.
  - SIL-15 is forecasted to surpass 100% capacity limit in 2026.
- **Feeder Reliability:** Feeders CHI-12 and SIL-15 have CMI, SAIDI, and SAIFI[1] metrics that are significantly above system average. Reliability improvements are needed for both circuits.
- **Operational Need:** Feeders CHI-12 and SIL-15 experience low voltage under peak demand. Voltage improvements at peak system demand are needed for both feeders.
- **Operational Need:** CHI-12 has phase imbalance during peak loading that exceeds allowable limits. Phase imbalance contributes greatly to system losses due to increased neutral current.

Concerns:

- **Substation Equipment:** There is an existing concern for non-standard substation equipment at both Chico and Silverdale substations. Non-standard equipment includes high-side fusing at Chico substation and yellow jacket getaways, oil-filled capacitor switch, and a Mark V circuit switcher at Silverdale substation. This equipment should be evaluated for replacement when there is planned work at each substation.
- **Non-Standard Operations:** CHI-12 operates at 34.5kV, which is a unique operating voltage in Kitsap County and requires additional inventory and associated costs.

[1] SAIDI (System Average Interruption Duration Index), SAIFI (System Average Interruption Frequency Index), and CMI (Customer Minutes of Interruption) are all metrics used as reliability indicators by electric power utilities.

Solutions Analyzed (detailed in Section 3)

Working with Guidehouse, PSE studied multiple options for meeting the Seabeck area's distribution needs and concerns. This report details the wires alternatives, non-wires alternatives, and hybrid (combination of wires and non-wires) alternatives that were examined for viability using criteria detailed in Section 1.2. The goal of PSE's analysis was to evaluate each alternative's technical and economic feasibility and determine a preferred solution.

PSE began by analyzing multiple wires options and determining four, top wires alternatives:

- **WA-1:** Build a new 115kV-12kV distribution substation near Seabeck
- **WA-2:** Build a new 35kV-12kV distribution substation near Seabeck
- **WA-3:** Install a third parallel step-up transformer at Chico substation
- **WA-4:** Install a new express feeder from Chico substation to segment the existing feeder

Using PSE's wires alternatives as a comparative baseline, Guidehouse analyzed whether there were non-wires alternatives (NWA) capable of meeting the area's needs. The NWA evaluated consisted of battery energy storage systems in combination with other targeted distributed energy resources (DER)[2]:

- **NWA:** A combination of continued business-as-usual (BAU) distributed energy resources (DER) installations, targeted incremental DER installations based on local technical potential, and an Energy Storage (ES) installation to meet remaining capacity needs

Guidehouse's analysis concluded that NWA could not feasibly meet all Seabeck area needs. Key takeaways from their study[3] include:

- The entire Seabeck need cannot be met with a non-wires solution "due to the inability of non-wires solutions to mitigate phase imbalance in a significant manner".
- Adding an energy storage system (ESS) in an appropriate location on the distribution system will improve the Seabeck area's reliability by allowing the distribution automation scheme (DA)[4] to operate more effectively; however, a wires solution will offer a greater reliability improvement. In general, "differences in reliability improvements between the wires and NWA solution need to be considered qualitatively when selecting the preferred solution".
- Guidehouse found a hybrid alternative that meets capacity needs until 2031 that is cost-effective and technically feasible.

Since non-wires alternatives, alone, could not sufficiently solve the area's reliability need, PSE evaluated hybrid alternatives that added other components to NWA options:

- **Hybrid 1:** Combine NWA with targeted phase balancing effort on distribution circuits
- **Hybrid 2:** Combine NWA with underground (UG) conversion of CH-12 feeder along NW Holly Rd

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[2] DER are energy resources sited close to customers that can provide all or some of their immediate electric and power needs and can also be used to reduce system demand (such as energy efficiency) or provide supply to satisfy the energy, capacity, or ancillary service needs of the distribution grid.

[3] Seabeck Non-Wires Alternative Analysis, Guidehouse Consulting, March 29, 2021.

[4] Distribution Automation (DA) is a reliability scheme that can automatically operate switches on both sides of faulted equipment to isolate it from the rest of the system and restore service for certain customers during outages.

Figure 0-2 below compares all seven options by cost, benefit, and degree to which they can meet Seabeck area needs.[5]

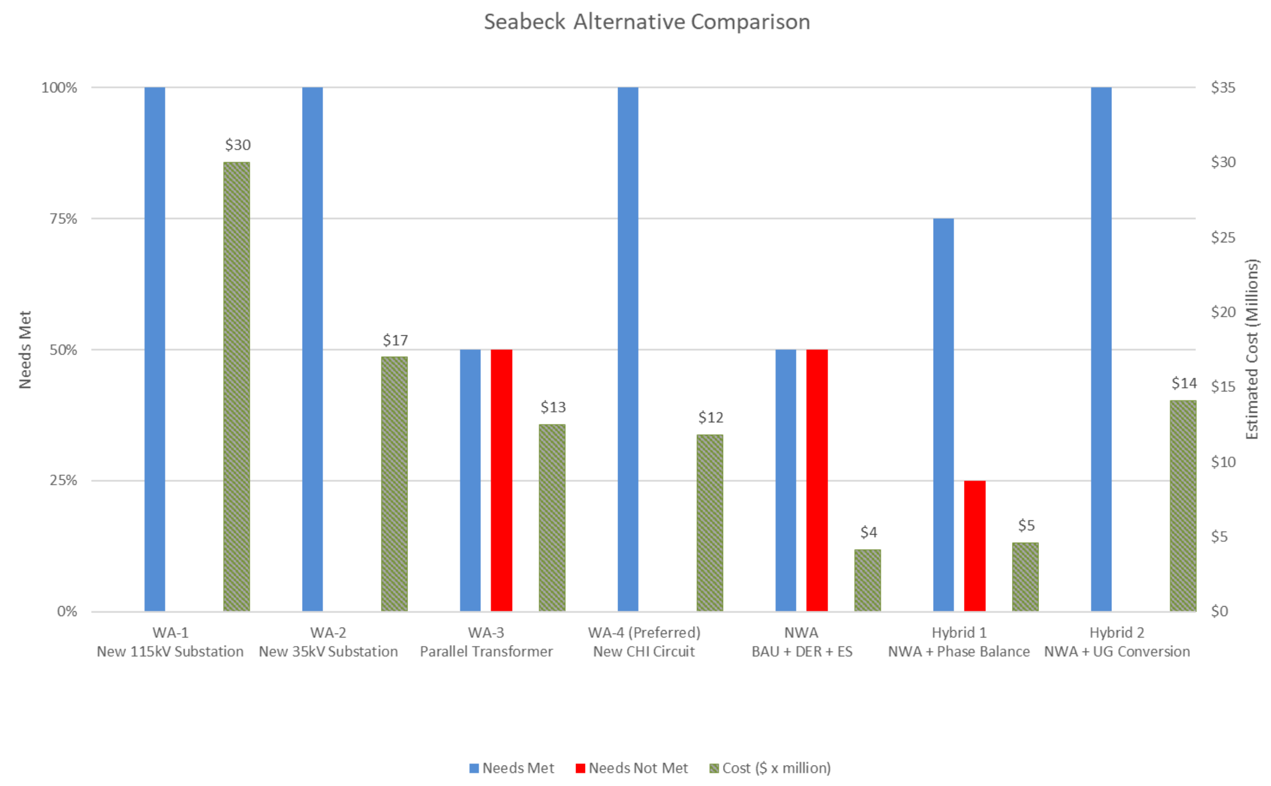

Figure 0-2: Seabeck Alternatives Comparison

Top Alternatives Analysis

Based on the above comparison, PSE selected WA-4 as the top wires alternative – then further evaluated it alongside the non-wires option (NWA) and Hybrid 2.

Table 0-1, on the following page, summarizes each of those three option's benefits, potential risks, and estimated costs. While project costs aren't the only deciding factor, they are an important consideration given their potential impact on PSE customers' energy bills.

Key Takeaways:

- WA-4 offers a 40-year solution vs. 10-year solutions with NWA and Hybrid 2.
- WA-4 is the only solution that would not require additional improvements to accommodate future growth and development in the region.

[5] Cost estimates provided in Figure 0-2 are planning level cost estimates without added contingency.

- WA-4 offers the highest reliability benefit and solves the capacity issue, while also addressing the operational issues.

Table 0-1: Summary of Top Alternatives[6] [7] [8]

		Top Wires Alternative (WA-4)	Full Non-Wires Alternative (NWA)	Hybrid Alternative (Hybrid 2)
Needs	CHI-12 N-1 Capacity	Solved through new Feeder	Solved through Energy Storage and DER improvements	Solved through Energy Storage and DER improvements
	Distribution Feeder Reliability	Improved by reduced tree/vegetation outage exposure and allowing more effective automation, while reducing the number of customers exposed to each outage resulting reduced SAIDI and SAIFI by 25% and 17% for CHI-12 and SIL-15, respectively	Distribution Reliability is not solved in the full non-wire alternative	Improved by reduced tree/vegetation outage exposure and allowing more effective automation
	CHI-12 Phase Balance	Phase imbalance will be spread throughout feeders reducing to less than 100 Amps per feeder.	Phase Balance is not solved in full non-wires alternative	Phase imbalance will be spread throughout feeders reducing to less than 100 Amps per feeder.
	Low Voltage	Reduced loading and express 35kV circuit solves low voltage areas	Reduced loading solves voltage issues	Reduced loading and UG conversion solves voltage issues
Decision Factors	Cost Estimate Range	$11.8 million to $14.8 million	$4.1 million to $5.9 million	$14.1 million to $17.6 million
	Benefits	-40 year solution -Highest reliability benefit -Improved resiliency -Added capacity -Increased operational flexibility -Reduced customer exposure on each circuit	-10 year solution -Local EE and DR	-10 year solution -Improved reliability -Local EE and DR
	Risks	-Easement and Permitting challenges for new construction	-Insufficient Reliability improvement -Easement and Permitting challenges for BESS site -New operational strategies needed -Need additional	-Easement and Permitting challenges for BESS site -New operational strategies needed -Need additional system improvements with growth

[6] Costs are estimated based on similar past projects in other areas of PSE service territory. Does not include site-specific engineering. These costs will be further refined once the project enters later development stages.

[7] Cost estimate range includes base estimate to a high estimate with 25% contingency.

[8] A full non-wires alternative is not considered viable due to the need for phase balancing that cannot be solved by NWAs.

			improvements with growth	

Seabeck Area Preferred Solution (detailed in Section 4)

Based on the above comparison, PSE determined that WA-4 was the preferred solution for meeting Seabeck area distribution system needs. It offers a significant improvement in reliability, capacity, and operational benefits when compared to the non-wires and hybrid alternatives – while also being cost-effective.

In brief, the preferred solution will:

- Increase area capacity by adding a new 12 kV feeder (CHI-14) from the Chico substation
- Improve reliability by transferring loads between area feeders
- Improve reliability by converting approximately 5 miles of CHI-12 to an express underground feeder – and undergrounding a portion of CHI-14
- Address operational needs by balancing phases of both new and existing circuits to be within PSE guidelines

Figure 0-3 illustrates the preferred solution for the Seabeck area's distribution system.

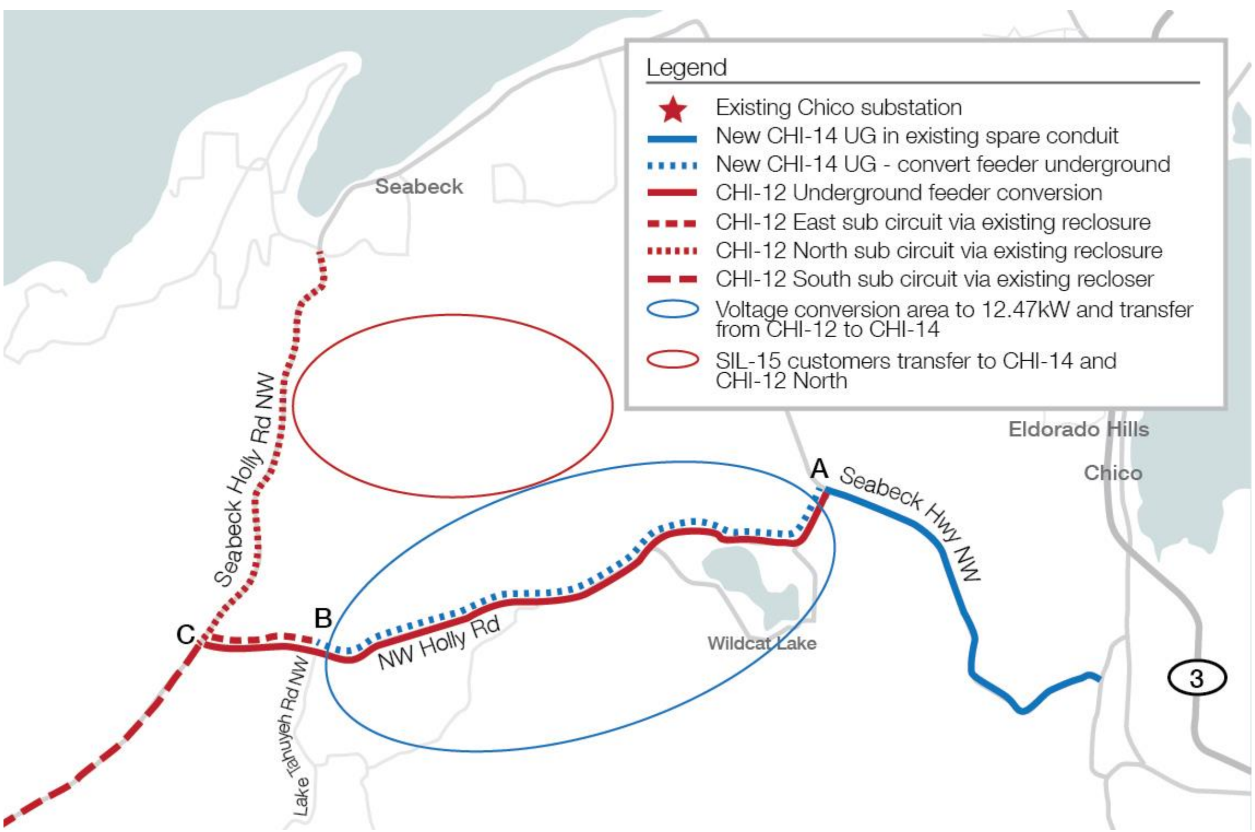

Figure 0-3: Preferred Solution - WA-4

Conclusion

Energy is essential for communities, and PSE is committed to creating a better energy future for all customers in the Seabeck area.

The preferred solution will bring many benefits to the local distribution system, including a substantial reliability improvement. The capacity needs will be solved with the addition of a new circuit, which will also provide significantly improved operational flexibility capable of supporting future growth and development in the region.

Customers will benefit greatly, too. With these improvements, the Seabeck area's history of poor reliability will come to an end. Given the local climate and west Kitsap geography, some outages are inevitable, but their frequency and impact can be greatly reduced for many years to come.

1 Introduction, Methodology, and Solutions Criteria

After completing the Seabeck Area Needs Assessment, PSE and Guidehouse analyzed traditional wires, non-wires, and hybrid alternatives to determine a cost-effective solution capable of addressing the area's needs for the 10-year planning horizon (2022-2032). This report summarizes the results of that analysis.

1.1 Methodology

This solutions study used the following process:

1. Step one: Brainstorm potential solution types to solve the identified system needs, including conventional wires type, non-wires type (DER), and hybrid type that involve combination of wires and non-wires components.
2. Step two: Identify possible alternatives for each solution type. PSE studied conventional wires alternatives and non-wires alternatives.
3. Step three: Assess the most promising alternatives using the solutions criteria for system performance in terms of capacity, reliability, asset life and constructability; and determine "viable" alternatives. An alternative was considered "viable" if it met the solutions criteria.
4. Step four: Identify and compare the most cost effective viable alternatives.
5. Step five: Compare the top alternatives in terms of cost, benefits, drawbacks and risks to identify the proposed solution.

Figure 1-1 shows the process flow for the solutions study methodology.

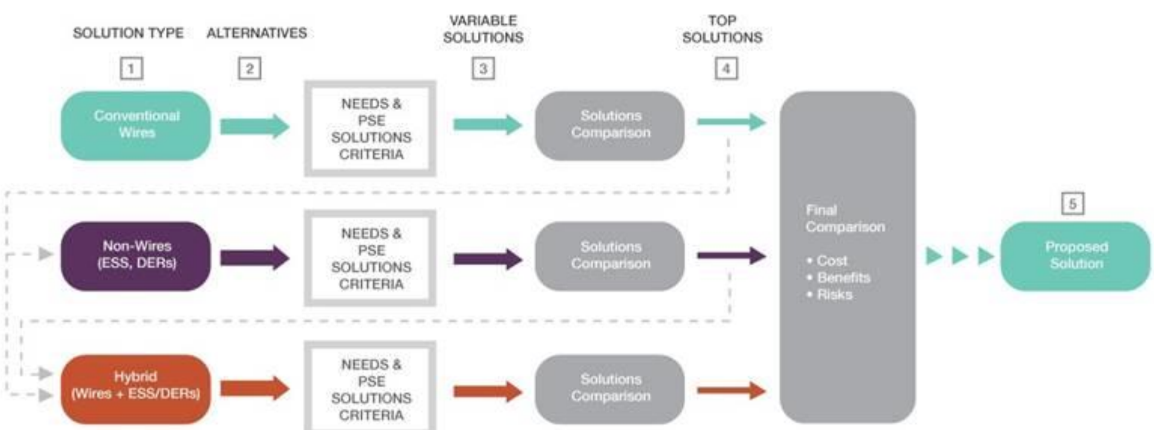

Figure 1-1: PSE Solutions Study Methodology

PSE began its analysis by considering multiple conventional wires alternatives, which were then shortlisted to the most viable alternatives for meeting the solutions criteria. The viable wires alternatives were compared in terms of cost, benefits, drawbacks, and potential risks to generate the preferred wires alternative, which was then used as a reference for developing non-wires and hybrid alternatives. As a final step, the top alternatives for the wires, non-wires, and hybrid categories were compared to determine the preferred solution for best meeting the Seabeck study area's needs.

1.2 Solution Criteria

PSE evaluated all alternatives in this study with electrical and non-electrical criteria. These criteria are based on federal requirements, PSE Planning Guidelines, and industry standards, as well as project implementation considerations.

A proposed alternative is considered viable if it addresses all identified system needs and meets the solutions criteria. A viable alternative is not *required* to address identified concerns, but it may if it's deemed prudent or advantageous to include in the project scope.

Technical Criteria:

1. Must meet all performance criteria:
   - Address needs identified within the 10-year study period (2022-2032)
   - Does not re-trigger any of the needs identified in the Seabeck Area Needs Assessment for 10 years or more after the solution is in service

   Distribution:

   - Applicable PSE Distribution Planning Guidelines as follows:
     - Individual substation utilization in study area ≤ 100% of capacity
     - ≤ 100% of overhead individual feeder limits for N-0 and applicable N-1 scenarios
     - ≤ 100% of underground individual feeder limits for N-0 and applicable N-1 scenarios

   Reliability:

   - For areas with high non-CMI, non-MED[9] SAIDI or non-MED SAIFI, solution must reduce corresponding reliability metric.

   Design Requirements:

   - Must meet applicable Institute of Electrical and Electronics Engineers (IEEE) and NERC standards
   - Must meet Washington Administrative Code (WAC) and National Electrical Safety Code (NESC) safety codes
   - Must use PSE standard equipment and be consistent with the PSE Major Equipment Committee's spare equipment strategy
   - Must meet PSE best practices for operations and maintenance

2. Must address all needs identified in the Needs Assessment report
3. Must not cause any adverse impacts to the reliability or operating characteristics of PSE's or surrounding systems

Non-technical Criteria:

1. Feasible permitting
2. Reasonable project cost

[9] MED (Major Event Day): See definition in Glossary

3. Uses proven technology that may be adopted at a system level[10]

[10] PSE defines "proven technology" as technology that has been operationalized in the utility industry.

2 Needs Summary

As detailed in PSE's Seabeck Area Needs Assessment, multiple distribution system needs were identified in the study area. There are feeder capacity needs for distribution circuits CHI-12 and SIL-15. Both circuits are above PSE Distribution Planning Guidelines of 85% utilization capacity under normal system configuration for current peak loading levels. CHI-12 is forecasted to surpass the N-0 (no elements out of service) loading limit of the circuit by 2024, and SIL-15 is forecasted to surpass the N-0 loading limit by 2026.

CHI-12 has an additional existing capacity need in the event of a parallel step-up transformer failure. The circuit is currently above the conductor loading limitation under this contingency and would require load shedding of up to 45A during peak winder condition.

There are reliability needs with circuits CHI-12 and SIL-15. These circuits have historically had poor reliability performance. Both also serve the area's entire load and continue to have CMI, SAIDI, and SAIFI scores significantly worse than PSE's system-wide averages for those metrics.

Currently, there are operational flexibility needs on both circuits during peak loading, including low voltage conditions and phase imbalance. These operational concerns are exacerbated during N-1 contingencies. Additional growth without system improvements will compound these needs.

Additionally, there is a concern related to non-standard equipment at both Chico and Silverdale substations. This equipment was standard when it was installed, but it has since become outdated. At Chico substation, there is high-side fusing that is no longer standard. At Silverdale substation, there are yellow jacket getaways, oil-filled capacitor switch, and a Mark V circuit switcher that are no longer standard. This equipment should be evaluated as an opportunity for replacement if there is work being done at the substation.

The assessment has identified the following summary of needs and concerns in the study area:

<u>Needs:</u>

- **Feeder Capacity:** Feeders CHI-12 and SIL-15 presently exceed PSE's distribution planning triggers and are forecasted to exceed capacity limits within the planning period.
    - CHI-12 is forecasted to surpass 100% capacity limit in 2024.
    - CHI-12 has an existing N-1 capacity need in the event of a parallel step-up transformer failure.
    - SIL-15 is forecasted to surpass 100% capacity limit in 2026.
- **Feeder Reliability:** Feeders CHI-12 and SIL-15 have CMI, SAIDI, and SAIFI metrics that are significantly above system average. Reliability improvements are needed for both circuits.
- **Operational Need:** Feeders CHI-12 and SIL-15 experience low voltage under peak demand. Voltage improvements at peak system demand are needed for both feeders.
- **Operational Need:** CHI-12 has phase imbalance during peak loading that exceeds allowable limits.

<u>Concerns:</u>

- **Substation Equipment:** There is an existing concern for non-standard substation equipment at both Chico and Silverdale substations. Non-standard equipment includes high-side fusing at Chico substation and yellow jacket getaways, oil-filled capacitor switch, and a Mark V circuit switcher at Silverdale substation. This equipment should be evaluated for replacement when there is planned work at each substation.

- **Non-Standard Operations:** CHI-12 operates at 34.5kV, which is a unique operating voltage in Kitsap County and requires additional inventory and associated costs.

3 Solution Alternatives Analysis

This section of the report details the wires, non-wires, and hybrid alternatives that were considered and examined for viability using the criteria in Section 1.2. The goal of PSE's analysis was to evaluate each alternative's technical and economic feasibility and determine a preferred solution.

Appendix A describes all wires alternatives that were considered in the evaluation. Per PSE Planning Guidelines, each alternative is required to meet the defined solution criteria for the Seabeck area's identified needs. Some alternatives were eliminated and deemed *non-viable* as they did not meet the PSE solution criteria. Alternatives that did meet PSE's solution criteria were deemed *viable* and considered for further evaluation. Viable alternatives for each category were then compared to determine the top alternative for the category.

Key Assumptions for PSE's Solutions Analysis:

For solutions analysis involving battery energy storage systems (BESS), a 4-hour back-up duration was considered sufficient for distribution feeder outage repair and restoration. For outages that exceed the assumed repair duration time, PSE System Operations and crews will have enough time margin, with the BESS backup, to manage area loads and switch the system to restore customers. This approach was considered practical and reasonable for sizing BESS back-up solutions.

3.1 No Action Alternative

Along with assessing multiple alternatives, PSE considered a scenario where *no* action is taken to improve the Seabeck area's distribution capacity and reliability needs.

The advantage to this approach is no initial cost. The disadvantages are that existing capacity and reliability problems would remain and increase over time. This option also does not address the historically poor reliability of the area's circuits, and doing nothing would likely continue that performance trend.

Furthermore, in the event of loss of one of the parallel transformers during peak loading, load shedding might need to be implemented in order to prevent overloads on the remaining in-service transformer[11]. This option would put PSE at risk for being unable to serve customers in the area during peak loading conditions as early as 2024.

Finally, operational needs including low voltage, operational flexibility, and phase imbalance would not be addressed.

3.2 Top Wires Alternative

PSE's top wires alternative is detailed below and illustrated in Figure 3-1. Other wires alternatives that were considered, but not selected, are summarized in Appendix A. This solution was chosen as the top wires alternative as it solved all needs and concerns, and provided the most benefit to customers, at the lowest cost. The benefits are detailed below.

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[11] Load shedding involves disconnecting some customers to ensure distribution equipment is not damaged due to overloading. Load shedding is the option of last resort and is not a practice that PSE endorses as a long-term solution to meet mandatory performance requirements.

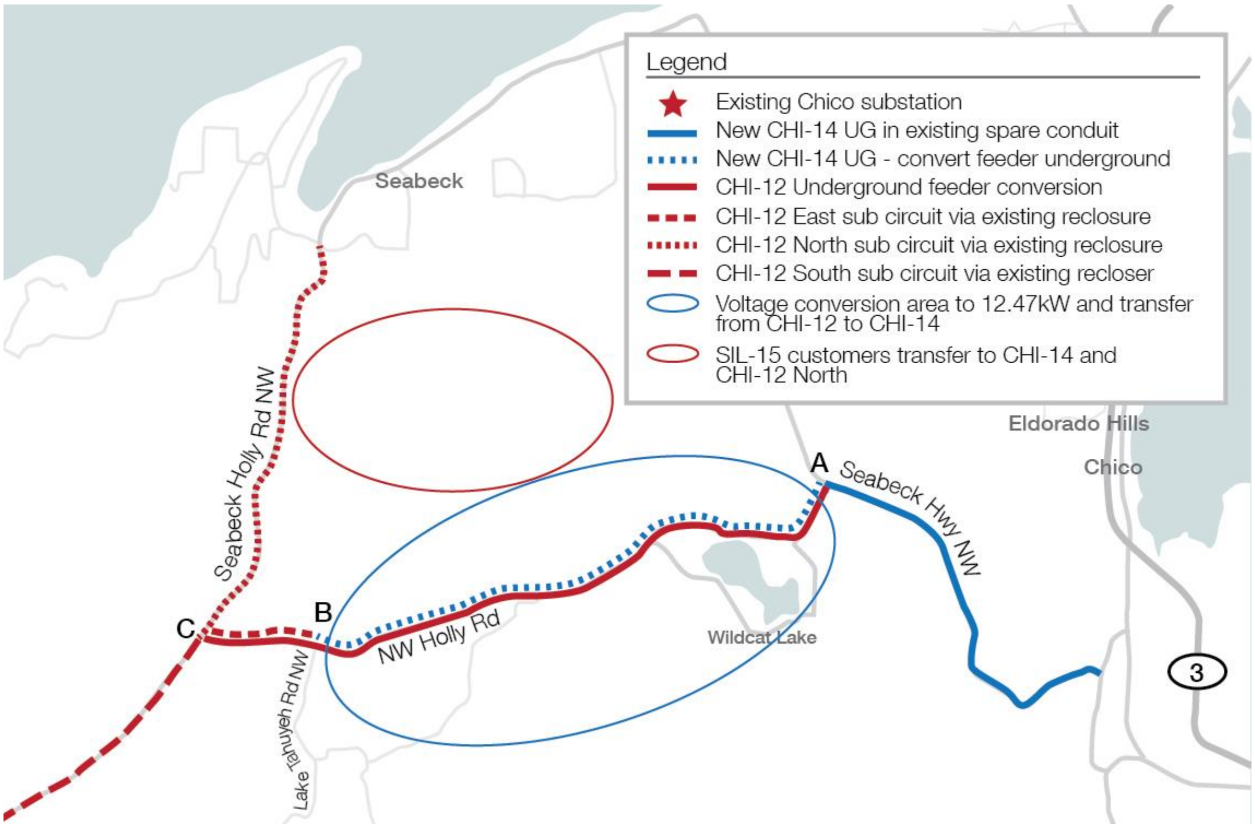

Figure 3-1: Top Wires Alternative

Project Scope:

1. **New CHI-14 Feeder (12.47 kV)**
   - Install a new circuit from Chico substation (tentatively named CHI-14) to serve customers near the Wildcat Lake area, including a new 12.47kV station breaker and getaway. The new circuit (CHI-14) would include a combination of underground and overhead wire and other distribution service equipment. Specifically, it would include:
     - Install approximately 2.8 miles of new underground cable in the existing spare conduit along Seabeck Hwy NW from the Chico substation to Seabeck Hwy (Point A).
     - Convert existing overhead feeder of CHI-12 to underground cable along NW Holly Rd from Seabeck Hwy (Point A) to Tahuyeh Lake Rd NW (Point B). Note that the overhead conductor will remain as laterals to feed existing customers. Convert all services on this section to 12.47kV and relocate the existing auto-transformer to a new location near the intersection of NW Holly Rd and Tahuyeh Lake Rd NW. This will create a normal open tie to the new CHI-12 East Sub Circuit.
     - Create a new normal open between new CHI-14 and SIL-16 near intersection of Seabeck Highway NW and NW Holly Rd.
     - Incorporate the new CHI-14 circuit into the existing distribution automation scheme.

2. **Express CHI-12 Feeder (34.5 kV)**
   - Construct a new 35kV UG express feeder for approximately 5 miles along NW Holly Rd between Seabeck Hwy (Point A) and NW Seabeck Holly Rd (Point C).
   - Create three CHI-12 sub feeders (north, east, and south) using existing 35kV SCADA reclosers.

3. Transfer Customers via Normal Open Changes

- Transfer approximately 200 customers from SIL-15 to CHI-12 north sub feeder. This reduces existing SIL-15 load by 50 amps average.
- Transfer approximately 180 customers from SIL-15 to new feeder CHI-14, which reduces SIL-15 demand by 40 amps. Total demand reduction on SIL-15 equals 90 amps. Reducing customers on SIL-15 will improve SAIDI and SAIFI by at least 17% by reducing customer exposure on the circuit from 2192 to 1812.
- CHI-12 is reduced by approximately 800 customers and 190 amps by transferring customers along NW Holly Rd to new CHI-14 and increased by approximately 200 customers and 50 amps by transferring customers from SIL-15. Overall decrease on CHI-12 is 600 customers and 140 amps. This will improve CHI-12 SAIDI and SAIFI by at least 25% by reducing customer exposure from 2497 to 1897.
- The new circuit CHI-14 will have approximately 180 customers and 40 amps from the SIL-15 transfer and 800 customers and 190 amps from the CHI-12 transfer. Total demand on CHI-14 is expected to be 230 amps and 980 customers when completed. A summary of the new circuit configurations is provided below in Table 3-1.

Table 3-1: Circuit Change Summary

	Existing Configuration		New Configuration	
Circuit	**Customer Count**	**Peak Load (A)**	**Customer Count**	**Peak Load (A)**
CHI-12	2497	561	**1897**	**371**
SIL-15	2192	498	**1812**	**458**
CHI-14	N/A	N/A	**980**	**230**

4. Additional Project Scope

- Balance phases as necessary on CHI-12 and CHI-14 to adhere to PSE's guidelines. This project improves voltage during peak loading for customers at the end of CHI-12, from 116V on the primary to 118V according to distribution modeling software.

<u>Wires Alternative Benefit Overview:</u>

- Offers lowest cost of feasible wires alternatives
- Eliminates capacity needs on both CHI-12 and SIL-15 by shifting load to the new CHI-14 circuit Eliminates N-1 contingency need by reducing loading on CHI-12 so that either step-up parallel transformer can carry the peak load without overload
- Improved circuit reliability for customers along CHI-12 and the new CHI-14 feeder due to use of underground construction for the express feeder and underground feeder conversion for the existing overhead feeder. The expected average annual improvement for the system is ~185,000 CMI and ~2100 CI, which corresponds to 71 SAIDI and 0.80 SAIFI
- Improved reliability for customers in the area due to reduced customer exposure on each circuit, meaning any full circuit outage will affect fewer customers
- Improved reliability and operational flexibility; the added circuit and reduced loading on existing circuits will allow the existing distribution automation scheme to operate more frequently, which will further improve reliability and operational flexibility
- Improved voltage on the circuit by reducing loading and phase balancing on all circuits

3.3 Non-wires Solutions

PSE contracted Guidehouse Consulting to perform non-wires analysis to consider the technical and economic feasibility of an alternative that consists of both energy storage and other targeted distributed energy resources (DER).

3.3.1 Guidehouse Analysis

Guidehouse initially reviewed whether distributed energy resources alone could meet the needs of the Seabeck area. Their potential was identified in the context of existing DER programs and realistic DER adoption based on assumptions in PSE's Integrated Resource Plan[12] at the time of the study. Using the needs assessment and preferred wires solution developed by PSE as a baseline, Guidehouse analyzed whether there were comparable non-wire solutions that would meet all Seabeck needs.

While Guidehouse identified multiple non-wires solutions that would meet the Seabeck capacity needs, there was not one full, non-wires solution that could address both reliability and operational flexibility needs. The following is a summary of the key points and decision factors presented in Guidehouse's NWA study:

- The Seabeck area needs identified in the document are less than 10 MW and related to distribution reliability and capacity – which are typical candidates for NWA[13].
- Guidehouse first considered deferring or replacing the entire need with a non-wires solution. However, due to the inability of non-wires solutions to mitigate phase imbalance in a significant manner,[14] this element was removed from NWA analysis consideration[15].
- Improvements to reliability are not currently quantified as part of either the *Basic Analysis* or *Detailed Analysis*, these differences in reliability improvements between the wires and NWA solution need to be considered qualitatively when selecting the preferred solution[16].

Removing phase-balancing from consideration, Guidehouse determined that multiple cost-effective and technically feasible DER solutions exist to meet the capacity needs in the Seabeck area until 2031[17]. The non-wires alternative that was developed to meet the remaining area capacity needs is summarized below. This is also referred to as Hybrid 1.

A cost summary for this option is included in Table 3-2. It includes the additional costs to implement phase imbalance, since this need cannot be met with non-wires alternatives.

- Option 1—Business-as-usual DER (BAU) + Energy Storage (ES) assumes a continuation of existing DER levels in the Seabeck area, with an additional Energy Storage System (ESS) located on the existing CHI-12 feeder.

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[12] Puget Sound Energy, "Integrated Resource Plan," PSE, https://www.pse.com/pages/energy-supply/resource-planning

Seabeck Non-Wires Alternative Analysis, Guidehouse, Page 1

[14] It is challenging for typical DER to achieve phase balancing without advanced grid analysis. Smart grid distributed intelligence types of technologies can be deployed for phase balancing and DER management system solutions. However, these technologies are still being developed and piloted for phase balancing activities. Given the lack of maturity of these technologies, and after discussion with PSE, Guidhouse removed phase imbalance from the identified needs to be met by the non-wires analysis.

[15] Seabeck Non-Wires Alternative Analysis, Guidehouse, Page 6

[16] Seabeck Non-Wires Alternative Analysis, Guidehouse, Page 8

[17] Seabeck Non-Wires Alternative Analysis, Guidehouse, Page iv

- Option 2—BAU+DER+ES, considers increased DER above and beyond business-as-usual based on an analysis of the technical potential in the area, in addition to an ESS located on the existing CHI-12 feeder.

Table 3-2: Portfolio Cost for Two Non-Wires Alternative Options for Seabeck (Hybrid 1)

Scenario	ESS Size (MW/MWh)	ESS Cost ($)	Incremental DER Cost ($)	Wires Component Cost	Total Portfolio Cost	Wired Solution WA-4 Cost Estimate Including 25% Contingency ($)
BAU + ES	3.1 MW/ 9.5 MWh	$4,736,500	$0	$500,000	$5,236,500	$14,000,000
BAU + DER + ES	2.4 MW/ 7.3 MWh	$3,625,500	$503,100	$500,000	$4,628,600	$14,000,000

- *Source: Guidehouse Analysis*

The overall conclusion of Guidehouse's non-wires study states:

> In both non-wires solution cases, with and without incremental achievable DER, the non-wires solution is lower net cost than the estimated cost of the wires solution. Using cost-effective DER in combination with energy storage has the potential to save approximately $600,000 in net costs relative to a solution that uses storage-only. However, the lower net cost of the NWA solution does not account for the greater reduction in SAIDI and SAIFI resulting from the preferred wires solution of at least 17% estimated on SIL-15 and 25% on CHI-12. Given that these benefits are not considered in the net cost comparison, Guidehouse concludes that both the NWA solution and the preferred wires solution WA-4 merit further consideration[18].

Given the importance of reliability improvement to this part of the distribution system, PSE performed a qualitative analysis comparing the benefits of the NWA solution to the wires solution, as shown in Section 3.3.3.

3.3.2 Analysis of Hybrid Solutions

After further evaluation of the solution criteria and proposed Hybrid 1 NWA alternative, the team determined that the reliability improvement gained by incorporating the battery system into the existing DA scheme did not represent a proven, dependable solution, and that it would have to first be installed and tested through a pilot process to refine operational procedures and establish benefits. Additionally, the improved DA operation would not provide substantial reliability benefit in order to meet the identified need. Due to this determination, a battery system alone was no longer considered to be a viable option for addressing Seabeck area reliability needs.

[18] Seabeck Non-Wires Alternative Analysis, Guidehouse, Page 23

In order to meet the solution criteria identified in Section 1.2 and clarified above, the two alternatives identified by Guidehouse as part of Hybrid 1 were modified to include a proven, quantifiable reliability improvement for CHI-12. The modified hybrid alternative includes converting the existing CHI-12 feeder underground along NW Holly Rd for approximately 5 miles from Seabeck Hwy to Seabeck Holly Rd. Figure 3-2 shows the scope of the modified hybrid alternative[19].

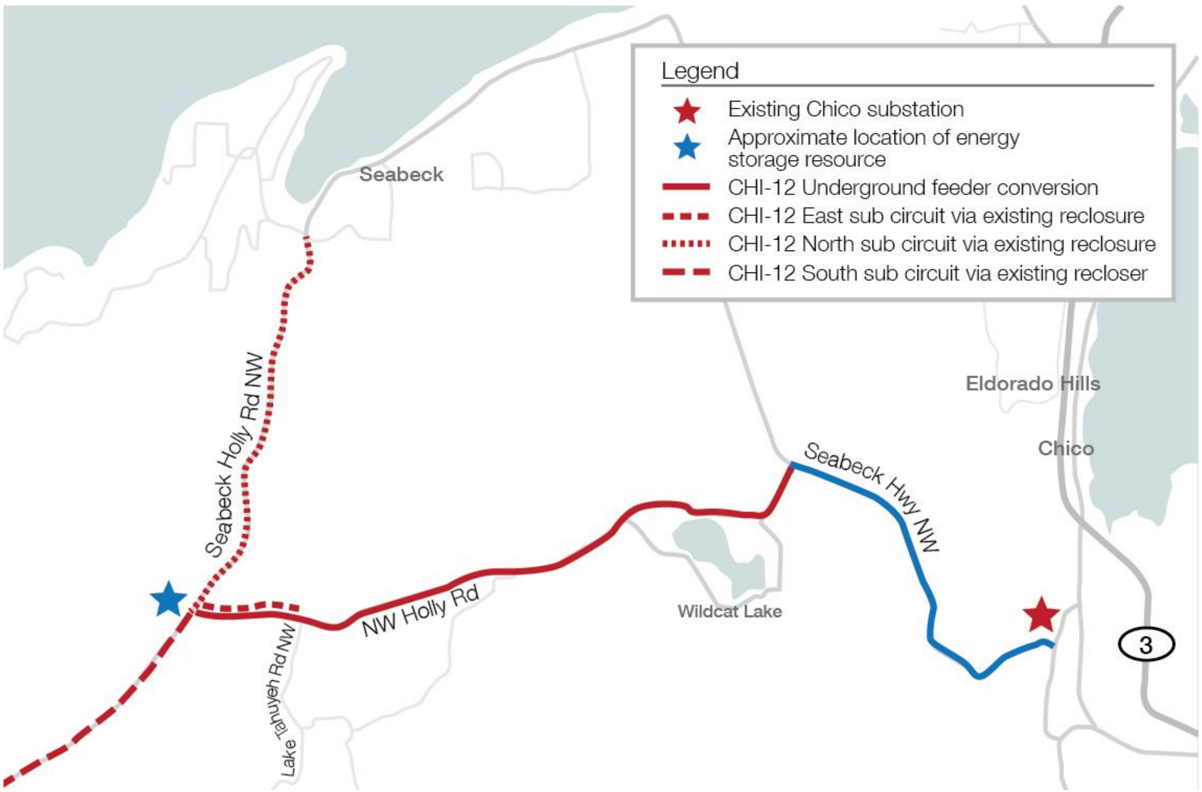

Figure 3-2: Modified Hybrid Alternative (Hybrid 2)

The overall reliability and capacity benefits of the modified hybrid alternative (Hybrid 2) are similar or better than the alternatives proposed in Table 3-2. In order to compare the benefits between the modified hybrid alternative and the top wires alternative, a detailed assessment of each benefit category was performed and summarized in Section 3.3.3.

3.3.3 Qualitative Comparison Between Wires, Non-Wires, and Hybrid Alternatives

The qualitative analysis performed for this area primarily focused on the reliability differences between the wires and non-wires solutions, but also considering the differences in capacity and operational improvements.

The preferred wires alternative has a significant improvement in reliability, capacity, and operational benefits when compared to the non-wires and hybrid alternatives. Table 3-3 below details the comparison between the top wires, non-wires, and hybrid alternative for each of the need categories

[19] The cost estimate for converting the existing feeder underground is significantly more expensive than installing an express underground feeder due to the need for junction boxes and a parallel lateral cable system to feed customers in the area.

addressed by the project. This analysis does not comprehensively list every benefit provided by each solution; however, it does provides an overview of the differences between each alternative and helps inform the overall preferred solution process.

Table 3-3: Wires, Non-Wires, and Hybrid Benefit Comparison

Need Category	Need Attribute	Wires Benefit	Non-Wires Benefit	Hybrid 2 Benefit	Preferred Alternative
Reliability	**Outage Prevention**	Underground conversion eliminates virtually all outages caused by Tree/Vegetation issues along Holly Rd for CHI-12 customers. Underground feeder conversion reduces outages for CHI-14 customers	Outage exposure remains the same	Underground conversion eliminates virtually all outages caused by Tree/Vegetation issues along Holly Rd for CHI-12 customers	**Wires**[20]
	Customer Exposure	Reduces customer exposure to outages by 17% on SIL-15 and 25% on CHI-12	Energy Storage has the potential to island, reducing customer exposure during outages[21]	Energy Storage has the potential to island, reducing customer exposure during outages	**Wires**
	DA Scheme Operation	Improves DA scheme by reducing loading and providing an additional switching option for picking up load	Improves DA scheme by reducing loading during peak conditions	Improves DA scheme by reducing loading during peak conditions	**Wires**
Capacity	**Peak Capacity**	Meets Peak Capacity by adding a new circuit with ~9.6	Meets Peak Capacity by adding 3.1 MW of	Meets Peak Capacity by adding 3.1 MW of	**Non-Wire**[24]

[20] The Wires Alternative is preferred because it meets the need at a lower cost.

[21] Including islanding in the Seabeck battery would require modifications to the distribution system and updates to PSE's operating procedures.

[24] The Non-Wires Alternative is preferred because it meets the need attribute at a lower cost.

		MW of added winter capacity[22]	added DER capacity[23]	added DER capacity	
	Future Capacity	Provides added capacity that meets peak capacity and unexpected future growth	Meets forecasted peak capacity, but does not provide flexibility for future growth	Meets forecasted peak capacity, but does not provide flexibility for future growth	**Wires**
Operations	**Low Voltage**	Reduced loading due to new circuit significantly improves voltage, even during N-1 conditions	Reduced loading improves voltage during peak conditions	Reduced loading improves voltage during peak conditions	**Wires**
	Operational Flexibility	New circuit provides added SCADA controlled switching options for system operators	Circuit configuration remains the same	Circuit configuration remains the same	**Wires**
	Phase Imbalance	Project includes phase balancing	No Phase Balancing included	Project includes phase balancing	**Wires/Hybrid**[25]

After reviewing the comparisons of Table 3-3, it was determined that the top wires alternative provides both quantitative and qualitative benefits that cannot be achieved by the non-wire or hybrid alternatives. Therefore, the top wires alternative is the proposed solution for meeting Seabeck area needs.

[22] Added capacity based on 4/0 limiting factor of new CHI-14 circuit with a current rating of 444 Amps

[23] The added DER capacity is proposed as one of the following:

1. 3.1 MW Energy Storage system
2. 2.4 MW Energy Storage with targeted Energy Efficiency and Demand Response filling the remainder of the need. PSE has reviewed these values and agrees the proposed DER solution is achievable in the region.

[25] Both the Wires and Hybrid alternatives include equivalent cost for Phase Balancing, making this evaluation equal between the two alternatives. The Non-Wires alternative does not address Phase Balancing.

4 Preferred Solution

Due to the considerable benefits provided by the top wires solution, which cannot be achieved using non-wires alternatives, WA-4 was determined to be the best solution for meeting Seabeck area needs. Refer to Section 3.2 for a detailed description of the proposed solution, including full project scope, estimated cost, and projected benefits.

This solution will have many benefits for the PSE distribution system, including a substantial reliability improvement for an area that has experienced historically poor reliability performance. The capacity needs will be solved with the addition of a new circuit, which will also provide significantly improved operational flexibility and allow for ample future growth in the Seabeck area.

The primary needs being addressed by the proposed solution are:

- Reduced loading on both CHI-12 and SIL-15, which will eliminate forecasted capacity needs and allow CHI-12 load to be carried by either transformer in an N-1 contingency during peak loading.

- Improved circuit reliability for CHI-12 due to use of underground construction for express feeder and underground feeder conversion for overhead conductor. The expected average annual improvement of Non-MED reliability metrics is ~185,000 CMI and ~2100 CI, which corresponds to 71 SAIDI and 0.80 SAIFI. These changes will also improve resiliency during storm situations

- Improved reliability for customers in the area due to reduced customer exposure on each circuit, meaning any full circuit outage will affect fewer customers.

- Added feeder capacity and reduced loading on existing circuits will allow the existing distribution automation scheme to operate more frequently, which will further improve reliability and operational flexibility

- Reduced loading and phase balancing will improve voltage problems at peak loading on all circuits

Conclusion

Energy is essential for communities, and PSE is committed to creating a better energy future for all customers in the Seabeck area.

The preferred solution will bring many benefits to the local distribution system, including a substantial reliability improvement. The capacity needs will be solved with the addition of a new circuit, which will also provide significantly improved operational flexibility capable of supporting future growth and development in the region.

Customers will benefit greatly, too. With these improvements, the Seabeck area's history of poor reliability will come to an end. Given the local climate and west Kitsap geography, some outages are inevitable, but their frequency and impact can be greatly reduced for many years to come.

Appendix A Alternatives Considered

Appendix A summarizes the alternatives considered while developing the preferred solution. An alternative is considered viable if it meets all system needs and the solutions criteria; otherwise it is deemed non-viable and eliminated from further consideration.

Table A-1 below provides an overview of the wires alternatives that were considered. The preferred alternative, WA-4, is detailed in Section 3.2 and is not included in this appendix.

Table A-1: Wires Alternatives Comparison[26]

		WA-1	WA-2	WA-3	WA-4
		Scope	**Scope**	**Scope**	**Scope**
Needs	CHI-12 N-1 Capacity	Solved through new substation	New 35kV Substation	Third Parallel step up transformer	New CHI-14 Circuit taking
	CHI-12 Distribution Feeder Reliability	Improved through transmission restoration priority and spreading customers to multiple feeders	Improved through sub transmission restoration priority and spreading customers to multiple feeders	Improved through UG construction	Improved through express underground feeder and creating sub feeders. Some customers transferred to new circuit
	SIL-15 Distribution Feeder Reliability	Improves SIL-15 CMI by placing some customers on a new circuit	Improves SIL-15 CMI by placing some customers on a new circuit	Does not reduce SIL-15 CMI	Improves SIL-15 CMI by placing some customers on new circuit
	Low Voltage	Solved through shorter feeders and more balanced circuits	Solved through LTC at new 35kV substation and sub placed closer to load center	Solved through addition of regulators and reduced load imbalance	Solved through reduction of load on CHI-12 and SIL-15 and reduced load imbalance
	CHI-12 Phase Balance	Phase imbalance will reduced to less than 100 Amps per feeder. More opportunities to balance load.	Phase imbalance will be reduced to less than 100 Amps per feeder. More opportunities to balance load.	Phase balancing will need to be performed	Phase imbalance will be reduced to less than 100 Amps per feeder. More opportunities to balance load.
Decision Factors	Additional Costs - *Land (ROW, Property)*	Sub. property available, Public ROW	Public ROW	Public ROW	Public ROW + CHI-14 getaway route, New Step-Up Transformer Location
	Cost Estimate	$29.8M to $37.3M	$17M to $21.3M	$12.5M to $15.6M	$11.8M to $14.8M
	Reliability Benefits	High	Moderate	Moderate	High
	Benefits	Highest reliability improvement, eliminates most 35kV, increases operational flexibility	Improves reliability, increases operational flexibility	Improves reliability	Improves reliability, eliminates 35kV exposure, increases operational flexibility
	Drawbacks	High Cost	High Cost	35 KV remains, no improvement to SIL-15 CMI	Some 35kV remains
	Risks	Public opposition to new substation and T-Line	Public opposition to new substation	Permitting Challenges	Permitting Challenges
	B/C Ratio	1.22	2.02	2.36	3.27
	Overall Preference	Lowest due to cost	3rd	2nd	1st Highest B/C ratio

[26] Wires Alternatives descriptions and costs are detailed below in Appendix A

The following table format is utilized in this section to describe the alternatives considered, and the determination of viability of these alternatives.

NAME STATUS	SCOPE SUMMARY	DECISION FACTORS (N) Indicates criteria not met but could be met with cost sharing (X) Indicates criteria not met (Y) Indicates criteria met	

NAME – Name of Alternative

STATUS – Viable or Eliminated

SCOPE SUMMARY – High level description of scope of alternative considered

DECISION FACTORS – N, X or Y (as described above)

Appendix A.1 Wires Alternatives

This section describes the wires alternatives (WA) considered to solve the Seabeck area needs identified in the needs assessment

Table A-1: Alternative Comparison: Wires Alternatives

NAME STATUS	SCOPE SUMMARY	DECISION FACTORS	
WA-1 ELIMINATED HIGH COST	New 115-12kV Distribution Substation	Meets all technical criteria Reasonable project cost Uses proven technology Constructible within reasonable timeframe	Y N Y Y
WA-2 ELIMINATED HIGH COST	New 35-12kV Distribution Substation	Meets all technical criteria Reasonable project cost Uses proven technology Constructible within reasonable timeframe	Y N Y Y
WA-3 ELIMINATED DOES NOT MEET NEEDS	Third Parallel step up transformer	Meets all technical criteria Reasonable project cost Uses proven technology Constructible within reasonable timeframe	X Y Y Y
WA-4 PREFERRED	New CHI-14 Express Feeder from CHI Substation	Meets all technical criteria Reasonable project cost Uses proven technology Constructible within reasonable timeframe	Y Y Y Y Y

Appendix A.1.1 Wires Alternative 1- (WA-1) New 115-12kV Distribution Substation

Construct a new 115-12kV substation and a 115 kV transmission line, over building the existing distribution line, from near the Chico Substation west along Seabeck Hwy then south and west along Holly road for approximately 7 miles. Seabeck Substation would be a 115/12.47 kV, 25 MVA, Y-D-Y substation with 5-12.5 kV circuits. This substation would include SCADA monitoring/control. Cost is estimated at $29.8M.

This scenario presents the following pros and cons:

Benefits

- The existing circuits CHI-12 and SIL-15 are sectionalized from 2 circuits to 7 circuits
- Almost all of the existing OH distributions circuits would be operated at PSE's standard distribution voltage; 12.47 kV
- Eliminates distribution autotransformers
- The transmission lines are trimmed every 3 years, as opposed to every 6 or more years
- Half of the existing distribution poles will be replaced with new transmission poles
- Significant beneficial effect in reducing SAIDI and SAIFI

Drawbacks

- A downed tree can still cause a transmission line and substation outage
- An outage to the transmission line will cause the substation to be out until it is repaired
- The capital cost of this option is the highest at $29.8M
- O&M costs associated with this new infrastructure

Scope Summary:

Construct New Substation with four circuits

Construct 4-12.47 kV underground getaways

Rebuild OH distribution line west to Seabeck-Holly road with two circuits.

Convert 34.5kV to 12.47kV for most customers

Reconstruct the existing OH distribution line to 115kV from the BPA 115 kV line crossing the Seabeck Highway to the new substation site

Install transmission poles and conductors approximately 7 miles

Appendix A.1.2 Wires Alternative 2 (WA-2) New 35-12kV Distribution Substation

Construct New Substation & Complete UG 34.5 kV Sub-and rebuild 35kV overhead to substation to improve reliability using some combination of undergrounding, spacer cable or tree wire. Estimated cost of $17M.

Substation would be a 34.5/12.47 kV, 25 MVA, Y-D-Y substation with 5-12.5 kV circuits. This substation would include SCADA monitoring/control.

This scenario presents the following pros and cons:

Benefits

- The existing circuit is sectionalized from 2 circuits to 7 circuits
- This reduces the load and feeder length of the adjacent circuit; SIL-15
- The third transformer step up transformer at Chico provides the needed redundancy to remove any one transformer from operation for a short period of time.
- The sub-transmission line (34.5 kV), would be bolstered through either undergrounding, spacer cable, or tree wire, or a combination.
- Almost all of the existing OH distributions circuits would be operated at PSE's standard distribution voltage; 12.47 kV
- Eliminates distribution autotransformers
- Significant beneficial effect in reducing SAIDI and SAIFI

Drawbacks

- An outage to the sub-transmission will cause the substation to be out until it is repaired
- De-energizing Chico substation will continue to be difficult and only possible during light loading periods
- The capital cost of a new sub-transmission line and substation

Appendix A.1.3 Wires Alternative 3 (WA-3) Third Parallel Step-Up Transformer

Convert the existing OH 35kV distribution system to underground to improve reliability

Install new third step up transformer and cable at Chico substation to eliminate applicable N-1 scenario overload with loss of an existing transformer.

This scenario presents the following Benefits and Drawbacks:

Benefits

- The additional transformer will reduce loading on existing equipment
- The sub-transmission line (34.5 kV) would have improved reliability
- Improvements to SAIDI and SAIFI

Drawbacks

- This option doesn't reduce feeder length of the adjoining circuit SIL-15
- The existing load may exceed the breaker capacity of CHI-12 and provisions for a large 34.5kV transformer will be required at that time. Currently projected outside of the study period.
- De-energizing Chico substation will continue to be difficult and only possible during light loading

Appendix B Glossary

Term	Definition
Term	Definition
Block load	A large expected increase in electric energy demand from an existing or new customer.
Business as Usual Distributed Energy Resources (BAU DER)	Acquiring cost effective energy efficiency as a resource, mitigating both energy and peak demand growth by partnering with customers in their efforts to make high efficiency upgrades in their homes and businesses.
Circuit	A circuit is the electric equipment associated with serving all customers under normal configuration from a specific distribution circuit breaker at a substation.
Concern	A "concern" is a non-critical issue that impacts system operations but is not required to be addressed by a solution; a solution that addresses an identified concern provides additional benefit.
Conservation	Measures to improve efficiency of customer's electric loads reducing energy use and reducing peak demand.
Consumption	Consumption is the amount of electricity that customers use over the course of a year and it's measured in kilowatt hours.
Contingency	Contingencies are a set of transmission system failure modes, when elements are taken out of service (e.g., loss of equipment).
Curtailable	A load that may be interrupted to reduce load on system during peak periods. Curtailable customers are on a different rate schedule than non-curtailable (firm) customers.
Demand	The amount of power being required by customers at any given moment, and it's measured in kilowatts.
DR- Demand response	Flexible, price-responsive loads, which may be curtailed or interrupted during system emergencies or when wholesale market prices exceed the utility's supply cost. Demand response is also the voluntary reduction of electricity demand during periods of peak electricity demand or high electricity prices. Demand response provides incentives to customers to temporarily lower their demand at a specific time in exchange for reduced energy costs.
Distributed Energy Resource (DER)	A resource sited close to customers that can provide all or some of their immediate electric and power needs and can also be used by the system to reduce system demand (such as energy efficiency) or provide supply to satisfy the energy, capacity, or ancillary service needs of the distribution grid. The resources, if providing electricity or thermal energy, are small in scale, connected to the distribution system, and close to load
Distributed generation	Small-scale electricity generators, like rooftop solar panels, located close to the source of the customer's load.

Term	Definition
Distribution line	A distribution line is a medium-voltage (12.5 kV-35 kV) line that carries electricity from a substation to customers. Roughly half of PSE's distribution lines are underground. Distribution voltage is stepped down to service voltage through smaller transformers located along distribution lines. Distribution lines differ from feeder as it includes the large feeder wire and smaller wire laterals.
Distribution System	A distribution system is the medium-voltage (12.5 kV-35 kV) infrastructure that carries electricity from a substation to customers and includes the substation transformer. System is the collective of all of this infrastructure in an entire study area.
EPRI- The Electric Power Research Institute	The Electric Power Research Institute conducts research, development, and demonstration projects for the benefit of the public in the United States and internationally. As an independent, nonprofit organization for public interest energy and environmental research, they focus on electricity generation, delivery, and use.
Feeder	A feeder is the largest conductor section of a circuit and carries the greatest load as it serves all the laterals (branches)) of the circuit.
Institute of Electrical and Electronics Engineers (IEEE)	A professional association, promoting the development and application of electro-technology and allied sciences for the benefit of humanity, the advancement of the profession, and the well-being of our members.
Integrated Resource Plan (IRP)	The Integrated Resource Plan (IRP) is a forecast of conservation resources and supply-side resource additions that appear to be cost effective to meet the growing needs of our customers over the next 20 years. Every two years, utilities are required to update integrated resource plans to reflect changing needs and available information.
Interim Operating Plan (IOP)	A temporary plan to address a transmission system deficiency and meet performance requirements, until a solution takes effect. An IOP may consist of a series of operational steps to radially operate the system, run generation or implement load shedding.
Kilovolt (kV)	A kilovolt (kV) is equal to 1,000 volts of electric energy. PSE uses kilovolts as a standard measurement when discussing things like distribution lines and the energy that reaches our customers.
Load	The total of customer demand plus planning margins and operating reserve obligations.
Load forecast	A load forecast is a projection of how much power PSE’s customers will use in future years. The forecast allows PSE to plan upgrades to its electric system to ensure that current and future customers continue to have reliable power. Federal regulations require that utilities plan a reliable system based on forecasted loads. When developing a load forecast, PSE takes multiple factors into account like current loads, economic and population projections, building permits, conservation goals, and weather events.

Term	Definition
Load shedding	Load shedding is when a utility intentionally causes outages to customers because demand for electricity is exceeding the capacity of the electric grid. Load shedding is the option of last resort and is conducted to protect the integrity of the electric grid components in order to avoid a larger blackout. This is not a practice that PSE endorses as a long-term solution to meet mandatory performance requirements.
Major Event Day (MED)	Any day in which the daily system SAIDI exceeds the annual threshold value. Outages on those days are excluded from the SAIDI performance calculation.
Megawatt (MW)	A megawatt (MW) is equal to 1,000,000 watts of electric energy. PSE uses megawatts as a standard measurement when discussing things like system load and peak demand. MW differs from MVA in that it is generally always lower and translates as energy that performs work. The amount of MW vs MVA is determined by load characteristics. Motor loads generally have a lower power factor (PF) than heating loads for example and as a result. MW=MVA*PF
Mega Volt-Amp (MVA)	A MVA is equal to 1,000,000 (Volt*Amps). MVA is generally slightly higher than MW. Equipment ratings are in MVA as the equipment heat rise is determined by actual MVA.
N-0	This is a planning term describing that the electric grid is operating in a normal condition and no components have failed.
N-1	This is a planning term describing an outage condition when one system component has failed or has been taken out of service for construction or maintenance.
N-1-1	This is a planning term describing outage conditions where two failures occur one after another with a time delay between them.
N-2	This is a planning term describing outage conditions where two failures occur nearly simultaneously.
Native Load Growth	Load growth associated with existing customers or new customers less than 1 MW.
Need	A constraint or limitation on the delivery system in providing safe and reliable electric supply to customers. A need is a “must-have” that is required to be addressed for the system in a timely manner (by a certain Need Date, as determined in a needs assessment)
Non-wires alternatives	Alternatives that are not traditional poles, wires and substations. These alternatives can include demand reduction technologies, battery energy storage systems, and distributed generation.
NERC- North American Electric Reliability Corporation	NERC establishes the reliability standards for the North American grid. NERC is a not-for-profit international regulatory authority whose mission is to ensure the reliability of the bulk power system in North America, as certified by FERC. NERC develops and enforces Reliability Standards and annually assesses seasonal and long-term reliability. PSE is required to meet the Reliability Standards and is subject to fines if noncompliant.

Term	Definition
Peak demand	Customers' highest demand for electricity at any given time, and it's measured in megawatts.
Proven technology	Technology that has successfully operated with acceptable performance and reliability within a set of predefined criteria. It has a documented track record for a defined environment, meaning there are multiple examples of installations with a history of reliable operations. Such documentation shall provide confidence in the technology from practical operations, with respect to the ability of the technology to meet the specified requirements.
Reasonable project cost	Reasonable project cost means holistically comparing costs and benefits to project alternatives. This includes dollar costs, as well as duration of the solution, risk to the electric system associated with the type of solution (e.g., is the solution an untested technology), and impacts to the community.
Right of way	A corridor of land on which electric lines may be located. PSE may own the land in fee, own an easement, or have certain franchise, prescription, or license rights to construct and maintain lines.
Sensitivities	Sensitivities are circumstances or stressors under which the contingencies are tested (e.g., forecasted demand levels, interchange, various generation configurations).
Spacer Cable	Spacer cable is a product by Hendrix that is supported by a strong messenger cable and has insulated phase conductors. This product prevents most tree outages by blocking falling limbs from the phase conductors.
Substation	A substation is a vital component of electricity distribution systems, containing utility circuit protection, voltage regulation and equipment that steps down higher-voltage electricity to a lower voltage before reaching your home or business.
Substation group	A grouping of 2-5 substation transformers that are situated close enough to each other that loads in the study area can be switched from one station to an adjacent station for maintenance, construction, or permanent load shifting. For Seabeck, the substation group includes 2 distribution substations – Silverdale and Chico.
Substation group capacity	The aggregate distribution transformer capacity of the substation group for winter and summer rating, calculated in MVA.
SAIDI- System Average Interruption Duration Index	SAIDI is the length of non-major-storm power outages per year, per customer. SAIDI is commonly used as a reliability indicator by electric power utilities. Outages longer than 5 minutes are included.
SAIFI- System Average Interruption Frequency Index	SAIFI is the frequency of non-major-storm power outages per year, per customer. SAIFI is commonly used as a reliability indicator by electric power utilities. Interruptions longer than 1 minute are included.

Term	Definition
Transformer	A transformer is a device that steps electricity voltage down from a higher voltage, or steps it up to a higher voltage, depending on use. On the distribution system, transformers typically step the voltage down from a distribution voltage (12.5 kV) to 120 to 240 volts for customers' residential use. Transformers are the green boxes in some residences' front yard or the barrel-like canisters on utility poles.
Transmission line	Transmission lines are high-voltage lines that carry electricity from generation plants to substations or from substation to substation. Transformers at the substation "step down" the electricity's transmission voltage (55 to 230 kilovolts) to our primary distribution voltage (12.5 kV).

PUGET SOUND ENERGY

PROJECT CHANGE REQUEST (PCR)

PCR # 1

WBS Title & Project Title: **SEABECK RELIABILITY**	**Leading Work Order Number: 101109898** **CAP WBS: W_R.10040.01.01.01** **OMRC WBS:**
Date: **10/11/2023**	**Project Manager: Robert Trombley**
Current Phase: Initiation	**Reason for submittal:** Gate change to Planning

SCOPE: Change to Scope beyond original need, benefit or intent? *Click drop down:* NO ***If Yes, explain in summary how system need & alternatives were re-evaluated.***	**Summary:** New CHI-14 Feeder (12.47 kV) • Install a new circuit from Chico substation (tentatively named CHI-14) to serve customers near the Wildcat Lake area, including a new 12.47kV station breaker and getaway. The overhead sections of the feeder will reuse existing CHI-12 infrastructure and convert to tree wire for reliability improvement. Express CHI-12 Feeder (34.5 kV) • Construct a new 34.5kV UG express feeder for approximately 5 miles along NW Holly Rd between Seabeck Hwy and NW Seabeck Holly Rd Transfer Customers via Normal Open changes • Transfer approximately 380 customers from SIL-15 to CHI-12 and new CHI-14. This reduces existing SIL-15 load by 90 amps average. Additional Equipment Installation • Install a new Regulator on CHI-14 to provide voltage support phase balancing as necessary on CHI-12 and CHI-14 which will improve voltage from 116v to 118v **Description of Project Plan Documentation updates:** Solutions report.

SCHEDULE: Change to in-service date greater than one year from baselined need: *Click drop down:* *NO* ***If Yes, explain in summary how system Need Date documentation was updated.***	**Summary:** Project is expected to enter the execution phase in 2025 and be completed in 2026. **Description of Project Plan Documentation updates:**

BUDGET: Change to fiscal year, lifetime capital or OMRC budget beyond contingency?

Click drop down:

YES

Current year Capital budget:	$1,000,000				
Increase $		**Decrease $**	**750,000**	**Total $**	**250,000**
Lifetime Capital budget:	$11,850,000				
Increase $		**Decrease $**	**0**	**Total $**	**11,850,000**
Current year OMRC budget:	$0				
Increase $		**Decrease $**		**Total $**	**0**
Lifetime OMRC budget:	$200,000				
Increase $		**Decrease $**		**Total $**	**200,000**

Summary:

The purpose of this PCR is to document the phase gate from initiation to planning and to capture the forecast adjustment for 2023. The 2023 budget has been reduced to align with the current planning phase work plan and resource availability.

Description of Project Documentation Updates;

Benefit and Need Validation:
For Planning to Design and Design to Execution gates the PCR must be signed by the technical requestor (Planner) and Consulting Engineer (Area Lead).

Phase gate (drop down)	Validation: The project scope, schedule and budget are addressing the need? (drop down)
Choose an item.	*Choose an item.*

Brief statement from technical requestor regarding why technical validation was either approved or rejected: **Equity Considerations:** As part of the solution considerations process, PSE evaluates how customer equity is addressed. PSE leverages Customer Benefit Indicators ("CBI") and information established as part of the Clean Energy Implementation Plan ("CEIP") to identify an equity framework to evaluate system projects. The CBI approach was developed through an iterative process that was coordinated with the Equity Advisory Group. These CBI span the core tenets of energy justice and provide a framework to evaluate the equity benefit of the project. This project was planned and a solution chosen prior to equity considerations being required or defined. The Seabeck Reliability project will provide benefit to two distribution circuits fed from the Chico Substation and one distribution circuit fed from the Silverdale Substation, of which 2 circuits serve customers that are identified as High Vulnerability population and 1 circuit identified as Medium Vulnerability population based on current definitions (i.e. prior to the approved CEIP Final Order). The equity benefit of this project includes the Customer Benefit Indicator of Resilience by providing improvements to the feeders that will improve reliability. This project also improves the Customer Benefit Indicator of Enabling Cleaner Energy by allowing additional circuits to be fed from the substation, which provides additional distribution circuit capacity to support future electrification and DER. Project development, design and permitting will be completed following jurisdictional permitting processes and requirements that include public notices, hearings, comment opportunities and appropriate communication methods following jurisdictional codes. For construction, the jurisdictional permits will dictate working hours, noise restrictions and restoration requirements.	**Electronic signature (DocuSign)** *Acknowledgement from Technical Requestor, **(System Planner)*** ***Colin O'Brien*** DocuSigned by: Colin O'Brien FDDD952EBDDD478... **Electronic signature (DocuSign)** *Acknowledgement from Consulting Engineer, **(Area Lead)*** *(Required for System Projects only)*

Required approvals for this PCR which are based on CPM-20, Commitment Authority and CTM-07, Invoice/Payment Approval limits.

Approvals Necessary as Checked	Approver Title	Approver	Date Signed	Electronic signature (DocuSign)
☒	Manager	Tony Pagano	10/16/2023	DocuSigned by: Tony Pagano C7D3BC09443B4AC...
☒	Director Sponsor	Roque Bamba	10/23/2023	DocuSigned by: Roque Bamba BC203E4E58BB426...
☒	Executive Sponsor	Dan Koch	10/23/2023	DocuSigned by: Dan Koch 7E7434ECBF5B4C0...

Links to source documents included for this submittal:

Description	Links