



Eastsound, Washington

**2021 – 2025
Construction Work Plan
Washington 9 (WA0009) San Juan**

I hereby certify that this 2021-2025 Construction Work Plan was prepared by me or under my direct supervision and that I am a duly registered professional engineer under the laws of the State of Washington.

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I. Executive Summary

A. Introduction and Purpose of Report

The 2021-2025 Construction Work Plan (CWP) provides a review of Orcas Power & Light Cooperatives' (OPALCO) existing system and a guide for improvements required to accommodate anticipated loads for the four years beginning January 1, 2021 through December 31, 2025. This work plan was developed with an emphasis on improving service reliability while minimizing the impact on immediate and long-term retail power costs.

The system improvements recommended herein are consistent with those in the 2020–2040 Long-Range Plan completed January 21, 2021. The anticipated demands, member growth, average usage and peak usage are consistent with the current 2021 Load Forecast. Furthermore, this CWP and recommended improvements reflect the design criteria contained herein.

A loan will be required to implement the construction recommendations in this CWP. The system improvements planned to be financed by the loan are tabulated in the plan listed below. These figures only include the expenditures expected within 2021-2025 and do not include any project cost prior to 2021 carried forward.

Table 1: 2021-2025 CWP Cost Summary
Work Plan

Table with 7 columns: Category, 2021, 2022, 2023, 2024, 2025, Total. Rows include DISTRIBUTION, TRANSMISSION, GENERATION, and GRAND TOTAL CONSTRUCTION WORK PLAN.

The system improvements in the 2021-2025 CWP are those needed to provide service for 15,235 members at an annual average monthly consumption of 1,133 kWh per member. The 2020 system non-coincident peak was 66,417 kW. The projected non-coincident 2025 system peak is ~72,250 kW.

The Cooperative's 2016 Operations and Maintenance (O&M) review, RUS Form 300, was used to determine construction required to replace physically deteriorated equipment and material and improve reliability and quality of service. Additionally, the engineering staff reviewed each improvement in the field prior to its inclusion in this plan to assure its necessity.

B. Present System Analysis

The following Present System Analysis discusses features of the existing transmission and distribution systems as well as current operational conditions as they apply to the current Long-Range Plan. The latest O&M Survey, found in Figure VI-1:

RUS Form 300 - Page 1, was completed in 2016 and reviewed by Rodney Peach, RUS General Field Representative.

1. Service Area

OPALCO has headquarters in Eastsound, WA with district offices in Lopez Island, WA and Friday Harbor, WA. The cooperative’s service territory encompasses parts of San Juan County, WA.

2. Power Supply

OPALCO purchases power from Bonneville Power Administration through a management contract with Pacific Northwest Generation Cooperative. Power is supplied through a delivery point on Lopez Island owned and operated by Bonneville Power Administration. The system has three delivery points at 69 kV from BPA. OPALCO currently owns and maintains 42.7 miles of 69 kV transmission.

3. Substations

OPALCO presently provides service to its members at 12.7/7.2 kV distribution voltage.

4. Distribution Circuits

Overall, the distribution system is, as noted in the RUS Form 300 Review Rating Survey – Operations & Maintenance, in satisfactory condition.

Voltage regulators are presently being used on several feeders to maintain acceptable voltage levels at system extremities and defer capital investment if feasible. In most instances, voltage regulators are used to correct the voltage drop caused by long distances from the source rather than voltage drop caused by large loads. The use of a large number of voltage regulators will result in excessive line losses due to the losses in the regulators as well as those of the smaller conductor and/or single-phase lines serving loads. Re-conductoring and multi-phasing is recommended to improve voltage conditions where economically justifiable.

Examination of the circuit loading suggests that there should be substantial effort directed toward maximizing phase balance on circuits and substation transformers. Multi-phasing improvements are designed to not only correct phase balance, but to improve voltage characteristics, reliability, coordination, and line losses.

In addition, OPALCO will complete a Sectionalizing Study in the first year.

5. System Energy Losses

The system annual energy losses from 2011 through 2020 are as follows:

Table 2: System Losses

Year	Losses	Percentage
2011	3,088,742	1.4%
2012	19,699,502	9.2%
2013	11,353,120	5.2%
2014	14,118,192	6.6%
2015	12,908,377	6.3%
2016	12,285,569	6.1%
2017	13,026,268	6.4%
2018	13,156,011	6.4%
2019	13,287,841	6.4%
2020	13,420,569	6.4%

The losses from 2011 from 2020 in above table has fluctuation in losses due to the change to accounting for unbilled energy sales. This change took place in 2013. This additional process will aid in tracking energy sales and purchases with greater accuracy.

The completion of the CWP improvements will aid in reducing system losses and maintaining adequate service reliability. Increased conductor sizes, shorted feeds through ties, and multi-phasing will decrease losses across our system by effectively reducing the impedance of the system.

6. Service Reliability

Service reliability is an important factor in measuring quality of service provided to the member. Although weather is uncontrollable, some measures can be taken to promote reliable service. A vigorous program of right-of-way re-clearing to alleviate problematic foliage conditions will continue to be maintained. Foliage in rights-of-way cause outages and obstruct the movement of line crews during storms, thereby increasing outage length. Periodic reviews of easements and right-of-way areas will continue and be expanded when needed and feasible.

Replacement of aging poles and conductors in accordance with an ordinary replacement program will lower material failures. These programs will also aid in reducing weather-related outages, particularly those caused by wind and/or ice storms.

Replacement of aging underground conductor when greater than one failure is seen in an installation area, soil type, and conductor type.

Additionally, multi-phasing and load-balancing will significantly reduce the number of members interrupted during a single-phase outage and will reduce outage lengths. In many areas where multi-phasing is required, the existing sectionalizing devices cannot be sized to pick up the entire cold load. This significantly increases the outage lengths since the line crews must re-energize the line in sections. Continued multi-phasing

and the addition of new sectionalizing points will substantially reduce outage time per member. New sectionalizing points will be added as a part of the Sectionalizing Study in addition to the projects included within this plan.

The upgrade of inter-substation tie lines will improve reliability by providing available capacity for load shifts as well as eliminating old, deteriorated conductors from the system. The cooperative will use 336.4 kcmil ACSR conductor on major overhead inter-substation tie lines and 500 kcmil Al conductor on major underground inter-substation tie lines.

Investments in communication infrastructure for field personnel communications and system monitoring and control will aid in reduction of outage times and response. This infrastructure will provide accessibility to system loads, switching status, outage extent and awareness of other personnel in the area.

The table below provides a five-year service interruptions (minutes per consumer) summary based on information derived from the cooperative’s RUS Form 7.

Table 3: Outage Data (in minutes per member)

	2016	2017	2018	2019	2020	5 Year Average	Total	Percentage of Total
Power Supply	0	0	736	60	25	164	820	23.08%
Major Storm	0	667	290	107	0	213	1064	29.96%
Planned	21	175	38	30	52	63	316	8.89%
All Other	114	433	532	128	146	270	1352	38.07%
Total	135	1274	1596	325	222	710	3552	

C. Historical System Data

The Exhibits in this CWP illustrate historical system data utilized in the detailed analysis of system operations. System historical data was reviewed for system peak loads, energy purchased, energy sales, members billed, service interruptions, service extensions, commercial loads, and circuit loads. This data was compiled and analyzed to identify operational trends, positive and negative, to be addressed in the 2021-2025 CWP.

D. Projected System Loads

Load growth is projected at approximately 1% per year. Substation and load projections were based on historical growth rates and proposed load additions, including new subdivisions, commercial loads or large power additions.

E. Reviews with Staff and Use of System Model

The transmission and distribution system at OPALCO is modeled on the MilSoft Distribution Analysis Software, WindMil. One model of the system was prepared utilizing summer peaking data and another using winter peaking data. Projected substation loads were allocated to the model to obtain calculated voltage and loading profiles for each distribution circuit. Recommendations included in this CWP were based in part on the analysis of the WindMil model. Management and operations personnel at the cooperative reviewed each case that the distribution model indicated a potential voltage or capacity

problem. These reviews were used to confirm the computer calculations based upon available field data and experience. Additionally, these interviews review problem areas that did not appear during the WindMil analysis due to local knowledge of proposed subdivisions, increased commercial loads, or condition of distribution facilities. Adjustments were made to the CWP recommendations accordingly.

II. Design Criteria

A. Executive Summary

Improvements recommended in this CWP represent actions required to maintain standards for safety, adequate voltage, thermal loading and service reliability levels. The following outline describes basic design parameters utilized in this study.

1. Transmission Circuits

- Maximum of 50% of line rating
- Submarine terminal stations insulation ratings – one voltage class higher
- Ordinary conductor replacement based on imminent need rather than age
 - Replace when facilities experience in excess of five outages per year per member for two consecutive years (non-ROW related outages)

2. Distribution Circuits

- Maximum voltage drop – 5 volts (120 V base)
- Maximum of one stage of line voltage regulation
- Conductor loading
 - 50% of the thermal capacity for inter-substation ties
 - 80% of the thermal capacity for radial circuits
- Maximum of 35 amps on single-phase taps
- Ordinary conductor replacement based on imminent need rather than age
 - Replace when facilities experience in excess of five outages per year per member for two consecutive years (non-ROW related outages)
 - Replace URD cable after second failure per section or concentric neutral corrosion

3. Substations

- Initial loading of substation transformers to 60% of base capacity rating
- Existing transformer loaded to fan cooled rating for short-term peaks
- Utilize ANSI/IEEE Guide for loading liquid immersed equipment, including power transformers and voltage regulators
- Power loss evaluations of new transformer purchases

4. Voltage Regulation

- Load not exceeding standard manufacturer capacity or thermal rating
- Utilized where voltage drop is greater than 5 volts (120 V base) and conductor replacement is not feasible

5. Distribution Transformers

- Load at or near standard manufacturer capacity rating
- New transformer purchases evaluated for power loss optimization and total ownership costs

6. Conductor Sizing

- Overhead Transmission
 - ▶ 396.5 kcmil ACSR Ibis (26 X .1236, 7 X .1236) (594 amps)
 - ▶ 336.4 kcmil ACSR Linnet (26 X .1137, 7 X .0884) (529 amps)
 - ▶ 4/0 ACSR Penguin (6 X .1878, 1 X .1878) (357 amps)
- Submarine Transmission
 - ▶ Load based
- Overhead Distribution
 - ▶ Single-phase
 - 1/0 ACSR for low-load levels
 - ▶ Three-phase
 - 336.4 kcmil ACSR for main feeders
- Underground Distribution
 - ▶ Single-phase
 - 1/0 AL with Full Concentric Neutral within 2" Conduit
 - 4/0 AL with Full Concentric Neutral within 4" Conduit
 - ▶ Three-phase
 - 1/0 AL with Full Concentric Neutral within 6" Conduit
 - 4/0 AL with Full Concentric Neutral within 6" Conduit
 - 500 MCM AL with Full Concentric Neutral within 6" Conduit
- Submarine Distribution
 - ▶ Single-phase
 - #2 Cu

7. Sectionalizing

- Maximum of 40 momentary outages per feeder per year
- Maximum of 2 hours of outages per member per year – urban
- Maximum of 5 hours of outages per member per year – rural
- Limit loads on reclosers to 80% of trip coil rating
- Minimum phase-to-ground fault pick up capability
- Device use will be as follows:
 - ▶ Underground
 - Vacuum Fault Interrupter (VFI) – Loads greater than 40 Amps
 - Fused Junction Cabinet – Loads up to 40 Amps (when feasible)
 - Fused Elbow – Loads up to 40 Amps (when above not feasible)
 - ▶ Overhead
 - Recloser – Overhead with greater than 40 Amps or based on fusing
 - Fuse K Curve – Loads up to 40 Amps or no greater than 100K sizing

8. Capacitors/Reactors & Power Factor

- Goal of 95% lagging to 95% leading power factor

9. Line Improvements

- Improve voltage levels
- Maintain adequate thermal capacity
- Balance phase loads
- Line-loss reduction
- Improve reliability
- Address O&M Survey, RUS Form 300 concerns
- Underground cable installation and replacement based on outage and corrosion of cables

B. Transmission Circuits

1. Overhead

Transmission line construction, repair and modification shall follow current RUS 7 CFR Part 1728F-810 standards. Yearly average transmission line loading shall not exceed 50% of the yearly average rated capacity of the transmission line conductor. All transmission line poles are inspected on a seven-year schedule. Replacement of existing poles is based on inspection finding and 30-to-50-year maximum pole life. Poles and/or crossarms to be replaced if found to be physically deteriorated by visual inspection and/or tests. Primary new transmission line construction shall be overhead (except for underwater crossings).

2. Submarine Cables

Transmission line segments using underwater/underground submarine cable(s) shall be design using non-oil filled 69 kV rate armored cables. OPALCO has standardized on 500 MCM Cu lead shielded cables. All submarine cables are designed for 560 amps continuous uses with short period (4 hours) 125% overload rating. All submarine cables are seismically rated for OPALCO's seismic zone. Submarine cable terminal, where OPALCO transitions from underground to overhead are sized one voltage class higher due to the capacitive voltage induced at the terminals by the submarine cable(s) during periods of low usage.

C. Distribution Circuits

Voltage regulation will be utilized to achieve short-term deferral of capital investment.

Loads on single-phase taps should be limited depending on the size of the protective device and the overall sectionalizing coordination. Single-phase line fuses or reclosers should be limited to 50 amp devices, where practical. There will certainly be occurrences where larger single-phase tap line devices are applied, most particularly when these taps are closer to the substation and fault levels, including minimum fault levels, are

higher. Application of sectionalizing equipment along single-phase taps may be required to provide adequate protection while deferring expensive multi-phasing projects.

Conductor replacement of overhead and underground lines will be based on outage occurrences of the cables. Due to the variance of soil types in our service area, the corrosion may vary and requires inspections on a greater frequency after 20 years of installed life. All new installations of URD will be in conduit to provide a maximum cost benefit for the life of the trenched facilities.

The equipment additions within this plan allows for integration to OPALCO's communication infrastructure. This provides monitoring, control, and automation capabilities to increase safety, efficiency and reliability.

D. Substation

Substation transformer average yearly loading shall not exceed 60% of the nameplate rating on the transformer. Substation loading shall not exceed 110% of the transformer nameplate ratings.

The overall system transformation was studied not only on an individual substation basis, but also on a total system basis to determine the optimum capital to power loss ratio while keeping the transformers from exceeding their top forced air rating. A similar evaluation criterion was utilized on substation voltage regulators and line reclosers.

E. Sectionalizing

All circuit leaving substations shall have both instantaneous and overcurrent protection. A sectionalizing study will be conducted within the first year of this CWP. Sectionalizing enhancements will be recommended to reduce momentary outages to 40 per feeder per year and extended outages on urban feeders to an average of 2.0 hours per year per member. The extended outages on rural feeders will be 5.0 hours per year per member.

In general, an acceptable range of set points is defined by a minimum and maximum. When evaluating an existing setting that falls outside of the acceptable range, a preferred value will be determined. For creation of new settings, the preferred value is used when possible.

1. 69 kV Transmission Line Protection

Overcurrent element performance is more susceptible to changes in system fault contribution than distance elements which is why current protection practices at OPALCO require all new line relays to be installed with impedance-based distance elements as well as be capable of line differential protection.

- All new line relay terminals will have the following protective elements:
 - Impedance based distance elements (21P/G)
 - Directional instantaneous overcurrent (67P/G)
 - Differential capable (87L)

- Breakers will be required for all overhead protected lines.
- C400 or greater three phase current transformers and three phase line potential transformers will be required for all future installs.

2. Transformer Protection Guidelines

All new transformer protection packages installed at OPALCO will require a high-side circuit switcher or circuit breaker with dual slope differential protective elements. Additionally, temperature monitoring and alarming that can be viewed remotely will be a requirement for all future installs. Further evaluation of future technologies that provide more information of the transformer health or provide an indication of potential failure will be considered.

3. Distribution Protection Guidelines

Breakers/reclosers as well as switchgear will be capable of time overcurrent and directional overcurrent protection as well as the ability detect line and bus voltage.

F. Capacitors/Reactors

Power factor will be continually monitored. Projects will be submitted for amendment when instances of correction are needed.

G. Line Improvements

Multi-phasing will be utilized to aid in voltage improvement, elimination of overloaded conductors, reduction of power losses and improvements of system sectionalizing performance.

Voltage regulation will be utilized when voltage drop is greater than five volts and where conductor replacement can be delayed.

III. Summary of Report

A. Status of Previous Work Plan Projects

The following summary is a list of improvements proposed in the 2021-2025 Construction Work Plan and the status of each.

<u>Code</u>	<u>Substation Area</u>	<u>Project Name</u>	<u>Miles</u>	<u>Status</u>
215	Friday Harbor	Mullis Road Tie	0.5	Carry Forward

<u>Code</u>	<u>Substation Area</u>	<u>Project Name</u>	<u>Miles</u>	<u>Status</u>
301	Friday Harbor	Egg Lake Road Conversion	1.9	Carry Forward
312	Orcas	Dolphin Bay Road Conversion	1.1	Carry Forward
314	Roche Harbor	Cessna Road Conversion	1.5	Removed
319	Friday Harbor	Beaverton Valley Road Conversion	3.2	Carry Forward
320	Friday Harbor	San Juan Conversion	1.9	Carry Forward
321	Eastsound	Crescent Beach Conversion	0.9	Completed
324	Eastsound	Mt. Constitution Conversion	2.0	Completed
330	Eastsound	Umer-Harrison Point Conversion	0.2	Carry Forward
331	Shaw	Hoffman Cove Road Conversion	0.4	Carry Forward
332	Friday Harbor	San Juan Valley Reconnector	0.6	Carry Forward
333	Orcas	Orcas Hill Overhead Conversion	0.5	Removed
334	Eastsound	Prune Alley Conversion	0.3	Carry Forward
335	Decatur	Center Island Submarine Cable	0.6	Carry Forward
336	Eastsound	Lovers Lane Conversion	0.4	Removed
337	Lopez	Agate Beach Overhead Conversion	0.4	Carry Forward
338	Friday Harbor	Town of Friday Harbor Sidewalk Replacemr	0.4	Carry Forward
339	Lopez	Lopez to Decatur Overhead	0.9	Removed

<u>Code</u>	<u>Substation Area</u>	<u>Project Name</u>	<u>Description</u>	<u>Status</u>
502	Lopez	Lopez Stepdown Transformer Removal	Removal of the 69 kV to 25 kV transformer	Removed
503	Lopez	Lopez Substation VAR Control and Metering	Install a Reactor	Removed
504	Shaw	Shaw Substation Disconnect Switch	Replace an aging switch in the Shaw Substation	Carry Forward
505	Eastsound	Eastsound Substation Insulator Replacement	Replace twenty 69 kV ceramic insulators	Removed
506	Orcas	Orcas LTC Controller Replacement	Replace LTC controller.	Carry Forward
507	Olga	Olga LTC Controller Replacement	Replace LTC controller.	Complete
508	Eastsound	Eastsound LTC Controller Replacement	Replace LTC controller.	Complete
509	Shaw	Shaw LTC Controller Replacement	Replace LTC controller.	Carry Forward
510	Lopez	Lopez LTC Controller Replacement	Replace LTC controller.	Complete
511	Gravel Pit	Gravel Pit LTC Controller Replacement	Replace LTC controller.	Complete
512	Friday Harbor	Friday Harbor LTC Controller Replacement	Replace LTC controller.	Carry Forward
513	Roche Harbor	Roche Harbor LTC Controller Replacement	Replace LTC controller.	Carry Forward
514	Decatur	Decatur Energy Storage System	Installation of battery system.	Carry Forward

<u>Code</u>	<u>Substation Area</u>	<u>Project Name</u>	<u>Description</u>	<u>Status</u>
601	All	Transformer Replacement	Replacement of failed transformers and trans closures	Completed
601	All	Meter Replacement	Replacement of failed meters	Completed

<u>Code</u>	<u>Substation Area</u>	<u>Project Name</u>	<u>Description</u>	<u>Status</u>
603-1	Olga	Orcas to Blakely 15 kV Sectionalizing	Sectionalizing From Orcas to Blakely	Removed
603-15	Friday Harbor	Tucker and Guard VFI	Install new VFI	Complete
603-16	Eastsound	Lovers Lane and Main Street VFI	Replace existing sectionalizing equipment	Removed
603-17	Orcas	Orcas Landing VFI	Install new VFI	Complete
603-18	Roche Harbor	Egg Lake 3 Phase Isolation Switch	Install new isolation equipment	Removed
603-18	Decatur	Center Island VFI	Install new VFI	Removed
603-19	Lopez	Mud Bay VFI	Install new sectionalizing equipment	Carry Forward
603-2	Blakely	Blakely to Orcas 15 kV Sectionalizing	Install new sectionalizing equipment	Removed
603-20	Olga	Moran State Park South VFI	Install new VFI	Removed
603-21	Thatcher	Thatcher VFI	Install new VFI	Removed
603-21	Shaw	Canoe Island VFI	Install new VFI	Removed
603-22	Gravel Pit	Portland Fair VFI	Install new VFI	Removed
603-22	Blakely	Aviation Estates VFI	Install new VFI	Removed
603-23	Lopez	Sperry VFI	Install new VFI	Removed
603-3	Lopez	Lopez to Decatur Sub Cable Sectionalizing	Install new sectionalizing equipment	Removed

<u>Code</u>	<u>Substation Area</u>	<u>Project Name</u>	<u>Description</u>	<u>Status</u>
604-5	Decatur	Decatur Regulators	New Decatur Regulators	Completed
604-6	Thatcher	Thatcher Regulators	New Blakely Regulators	Completed
604-7	Gravel Pit	Bailer Hill Voltage Regulator	New Bailer Hill Regulators	Carry Forward

<u>Code</u>	<u>Substation Area</u>	<u>Project Name</u>	<u>Description</u>	<u>Status</u>
606	All	Ordinary Pole Replacements	Replacement of pole as needed	Completed

<u>Code</u>	<u>Substation Area</u>	<u>Project Name</u>	<u>Description</u>	<u>Status</u>
608	All	URD Replacements	Replacement of URD based on faults, condition, etc.	Completed

<u>Code</u>	<u>Substation Area</u>	<u>Project Name</u>	<u>Description</u>	<u>Status</u>
705-1	Decatur	Decatur AMR SCE Installation	AMR System Install	Completed
705-2	Blakely	Blakely AMR SCE Installation	AMR System Install	Completed
705-3	Olga	Olga AMR SCE Installation	AMR System Install	Completed

<u>Code</u>	<u>Substation Area</u>	<u>Project Name</u>	<u>Description</u>	<u>Status</u>
901	Transmission	Decatur 69 kV Switchyard	Install 69 kV transmission feed to new Boyce Road Substation	Complete
1001	Transmission	Lopez to San Juan Submarine Cable	Installation of 69 kV Switchyard for additional power source	Complete
1002	Transmission	Lopez to Shaw 69 kV Sectionalizing	Upgrade site and structures at cable terminal	Removed
1003	Transmission	Lopez to San Juan 69 kV Sectionalizing	Upgrade site and structures at cable terminal	Complete
1004	Transmission	Shaw to Orcas 69 kV Sectionalizing	Upgrade site and structures at cable terminal	Removed
1009	Transmission	Orcas Road Transmission Relocation	Replace 69 kV submarine cable	Complete
1010	Transmission	Tucker Road Transmission Relocation	Install 69kV circuit switcher at north Lopez cable terminal	Complete
1011	Transmission	Ordinary Pole Replacement	Replacement of aging and deteriorated poles	Completed

B. Summary of 2021-2025 Recommended Plan

The following section is an overview of the recommended improvements for this CWP. This is intended to be a summary of the high-growth areas and of the types of improvements recommended to resolve all voltage and capacity problems through the year 2025. A detailed description and justification for each recommended improvement can be found in Section Description and Justification.

1. Multi-phasing and Re-conductoring

As discussed in the Executive Summary, the entire distribution system is modeled in MilSoft’s WindMil. For each section of line that had capacity or voltage problems based on the year 2025 projections, several options were developed and reviewed by the engineering and operations staffs. The alternatives were reviewed from a least cost and operational standpoint to determine the best solution. Feeders with voltage drop problems were addressed by means of voltage regulators. In areas where feeder regulation already exists or where design criteria dictated, the lines were re-conducted or multi-phased as required. Where conductor capacity was insufficient, the conductor was replaced.

Multi-phasing and re-conductoring project listed in Section IV will be re-constructed in the existing right-of-way unless otherwise stated in the project descriptions.

2. Increased Substation Capacity

All substation loads were evaluated to ensure the substation transformers and voltage regulators limits will not be exceeded by the projected loads. If the projected loads exceed the limits set by the design criteria, this work plan will address one of two options: an increase in substation capacity or the switching of a portion of that substations load to another substation.

3. Sectionalizing

A Sectionalizing Study will be performed within the first year of this CWP.

4. Distribution Line Voltage Regulators

Voltage regulators are utilized throughout the system to correct inadequate voltages. Additional voltage regulators have been recommended as a short-term least-cost alternative to extensive multi-phasing or line re-conductoring improvements.

5. Conductor Replacements

Approximately 60 miles of conductor has been specifically identified by the cooperative personnel as posing significant reliability risks and targeted for replacement. This has been planned for though a single work plan item to allow the cooperative staff to locate and replace lines as needed based on faults, neutral condition, and other factors.

6. Transmission

New protection schemes on OPALCO's submarine cables will increase reliability while also increase the life of the associated asset. By running the San Juan cables in parallel OPALCO will be able to reduce the load on the XLPE cable. Decreasing the load on this cable will decrease insulation degradation which in turn will increase the theoretical life span .

IV. Construction Program

The system improvements recommended in this CWP are listed herein along with their estimated cost, a discussion of their need, and the scheduling of their installation. All costs associated with adding new services and to the system and increasing service sizes are paid for by the prospective members. This policy is in place due to the large initial costs for building to the new service in addition to the high probability of the service remaining idle for most the year.

Periodic replacement of existing poles, crossarms, etc. is required for numerous reasons. When such replacements are made, it is often necessary to install units with greater height or strength requirements. When lines are relocated due to road changes or to eliminate cross-country sections, the Cooperative should install poles of strengths suitable for long range conductor size and, in some instances, to install part or all the long-range conductor. Normal operations require the routine addition of poles in existing lines, either for joint use attachments or to improve clearance.

Table 4: CWP Costs

	Work Plan					
	2021	2022	2023	2024	2025	Total
DISTRIBUTION	\$ 9,655,000	\$11,250,000	\$ 8,445,000	\$10,075,000	\$ 8,700,000	\$48,125,000
TRANSMISSION	\$ 500,000	\$ 900,000	\$ 1,150,000	\$ 750,000	\$ 2,100,000	\$ 5,400,000
GENERATION	\$ -	\$ -	\$ 2,000,000	\$ -	\$ 2,000,000	\$ 4,000,000
GRAND TOTAL CONSTRUCTION WORK PLAN	\$10,155,000	\$12,150,000	\$11,595,000	\$10,825,000	\$12,800,000	\$57,525,000

Inflation of the cost of materials and labor is a continuing factor that must be considered. For this reason, the cost estimate for construction during 2021-2025 was adjusted to reflect the latest indices of the Bureau of Labor Statistics Consumer Price Index for the Seattle-Tacoma-Bremerton area. The recommended system improvements are summarized to conform to RUS Form 740C; however, to facilitate discussion and ease of identification, they are listed in the detailed portion of the estimate by substation area. The RUS Form 740C account code for each improvement is included in the cost estimate.

A. Improvement Items Summary

A.	B.	C.	D.	E.	F.	G.	H.	I.
740c Code	Description	Substation Area	2021	2022	2023	2024	2025	Total
DISTRIBUTION								
200 - New Tie-Lines								
215	Mullis Road Tie	Friday Harbor	\$200,000	-	-	-	-	\$200,000
216	Tarte Road Tie	Roche Harbor	-	\$300,000	-	-	-	\$300,000
218	Crescent Beach Bore	Eastsound	-	-	-	\$500,000	-	\$500,000
200 - New Tie-Lines Subtotal			\$200,000	\$300,000	\$0	\$500,000	\$0	\$1,000,000

300 - Conversions and Line Changes								
300	Warbass Intersection Improvements	Friday Harbor	\$150,000	-	-	-	-	\$150,000
301	Egg Lake Road Conversion	Friday Harbor	-	\$400,000	-	-	-	\$400,000
312	Dolphin Bay Road UG Phase Conversion	Orcas	-	\$400,000	-	-	-	\$400,000
319	Beaverton Valley Road OH Conversion	Gravel Pit	\$300,000	-	-	-	-	\$300,000
320	San Juan Valley Road UG Conversion (Boyce)	Gravel Pit	-	\$500,000	-	-	-	\$500,000
330	Urner-Harrison Point Conversion	Eastsound	\$150,000	-	-	-	-	\$150,000
331	Hoffin an Cove Road Conversion	Shaw	\$150,000	-	-	-	-	\$150,000
332	San Juan Valley Conversion (Hospital to Douglas)	Gravel Pit	\$500,000	-	-	-	-	\$500,000
334	Prune Alley Street Conversion	Eastsound	\$250,000	-	-	-	-	\$250,000
335	Center Island Submarine Cable	Decatur	\$900,000	-	-	-	-	\$900,000
337	Agate Beach Overhead Conversion	Lopez	\$80,000	-	-	-	-	\$80,000
338	Friday Harbor Sidewalk Replacements	Friday Harbor	-	-	-	-	\$150,000	\$150,000
341	C101/C104	Eastsound	\$200,000	-	-	-	-	\$200,000
343	Blanchard UG Rephase	Eastsound	-	\$50,000	-	-	-	\$50,000
344	Montgomery Lane Conversion	Orcas	-	-	\$150,000	-	-	\$150,000
345	Decatur Three Phase to North Terminal	Decatur	-	-	\$20,000	-	-	\$20,000
347	Terrill Beach Road Reconductor	Eastsound	-	-	-	\$75,000	-	\$75,000
348	Doe Bay Conversion	Olga	-	-	-	\$400,000	-	\$400,000
300 - Conversions and Line Changes Subtotal			\$2,680,000	\$1,350,000	\$170,000	\$475,000	\$150,000	\$4,825,000

CONSTRUCTION PROGRAM

A.	B.	C.	D.	E.	F.	G.	H.	I.
740c Code	Description	Substation Area	2021	2022	2023	2024	2025	Total
500 - Substation, Switching Station, Metering Point Changes								
27								
28	501	Gravel Pit Differential	Gravel Pit	\$80,000	-	-	-	\$80,000
29	502	Lopez Substation Redundancy	Lopez	-	-	\$1,400,000	-	\$1,400,000
30	504	Shaw Disconnect Switch Replacement	Shaw	-	-	-	\$100,000	\$100,000
31	505	San Juan Microgrid	San Juan	-	\$4,800,000	-	-	\$4,800,000
32	506	Decatur Lighting	Decatur	\$10,000	-	-	-	\$10,000
33	507	Blakely Lighting	Blakely	\$10,000	-	-	-	\$10,000
34	511	Eastsound Substation Upgrades	Eastsound	-	-	\$75,000	-	\$75,000
35	512	Olga Substation Rebuild	Olga	-	-	\$2,300,000	-	\$2,300,000
36	513	LTC Control Replacements	Multiple	\$60,000	-	-	-	\$60,000
37	515	Orcas Battery Project	Orcas	-	-	-	\$3,200,000	\$3,200,000
38	517	Circuit Switcher protection upgrades	Multiple	-	-	-	\$400,000	\$400,000
39	518	Decatur Energy Storage System	Decatur	\$2,200,000	-	-	-	\$2,200,000
40	519	Friday Harbor Substation Upgrade	Friday Harbor	-	-	-	\$3,000,000	\$3,000,000
41	500 - Substation, Switching Station, Metering Point Changes Subtotal			\$2,360,000	\$4,800,000	\$3,775,000	\$3,300,000	\$17,635,000
600 - Miscellaneous Distribution Equipment								
42								
43	601	Transformers and Meters	All	\$1,000,000	\$1,000,000	\$1,000,000	\$1,000,000	\$5,000,000
44	601-1	Meter Upgrade	All	\$100,000	\$300,000	\$700,000	\$2,200,000	\$5,000,000
45	603-1	Fairgrounds VFI	Gravel Pit	\$150,000	-	-	-	\$150,000
46	603-19	Mud Bay VFI	Lopez	\$100,000	-	-	-	\$100,000
47	603-3	Mt Baker Road VFI Repairs	Eastsound	\$150,000	-	-	-	\$150,000
48	603-4	White Beach 1ph VFI	Orcas	\$20,000	-	-	-	\$20,000
49	603-5	Relay Replacement Program	Multiple	-	\$250,000	-	-	\$250,000
50	603-6	Recloser Control Replacement	Multiple	-	\$100,000	-	-	\$100,000
51	603-7	Fuse pad replacements Rosario	Olga	-	-	\$300,000	-	\$300,000
52	604-1	Orcas Substation Regulators	Orcas	\$100,000	-	-	-	\$100,000
53	604-7	Bailer Hill Voltage Regulator	Gravel Pit	-	\$100,000	-	-	\$100,000
54	606	Distribution Pole Replacements	All	\$400,000	\$400,000	\$400,000	\$400,000	\$2,000,000
55	607-1	October Farm Conversion	Friday Harbor	\$45,000	-	-	-	\$45,000
56	607-2	Price Street OH Conversion	Friday Harbor	\$50,000	-	-	-	\$50,000
57	607-4	Alley Town Margeurite and School OH Conversion	Friday Harbor	-	-	\$50,000	-	\$50,000
58	608	URD Replacements	All	\$2,000,000	\$2,000,000	\$2,000,000	\$2,000,000	\$10,000,000
59	600 - Miscellaneous Distribution Equipment Subtotal			\$4,115,000	\$4,150,000	\$4,450,000	\$5,600,000	\$23,415,000

CONSTRUCTION PROGRAM

A.	B.	C.	D.	E.	F.	G.	H.	I.
740c Code	Description	Substation Area	2021	2022	2023	2024	2025	Total
60	700 - Other Distribution Items							
61	704-1 SCADA Project with ADMS	All	-	\$500,000	-	-	-	\$500,000
62	704-2 SCADA Network Upgrades	All	\$50,000	-	-	-	-	\$50,000
63	704-3 SCADA UPS & SFD Switches	All	\$50,000	-	-	-	-	\$50,000
64	706-2 Pt Laurence Rd Fiber	Olga	\$150,000	-	-	-	-	\$150,000
65	706-3 Judd Cove Fiber	Orcas	-	\$100,000	-	-	-	\$100,000
66	706-4 Mt Baker Rd to Tank Corner Fiber Backbone	Eastsound	-	-	-	\$150,000	-	\$150,000
67	706-5 Active Site Replacements	All	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$250,000
68	700 - Other Distribution Items Subtotal		\$300,000	\$650,000	\$50,000	\$200,000	\$50,000	\$1,250,000
69	Distribution Subtotal		\$9,655,000	\$11,250,000	\$8,445,000	\$10,075,000	\$8,700,000	\$48,125,000
70	TRANSMISSION							
71	1000 - Line and Station Changes							
72	1000 Transmission Pole Replacements	Transmission	\$400,000	\$400,000	\$400,000	\$400,000	\$400,000	\$2,000,000
73	1003 Fault Indication (SCADA)	Transmission	\$100,000	-	-	-	-	\$100,000
74	1004 Lopez to San Juan Sectionalizing	Transmission	-	\$350,000	-	-	-	\$350,000
75	1005 2017 San Juan Cable Temperature Monitoring	Transmission	-	\$150,000	-	-	-	\$150,000
76	1006 LZ to SH Cathodic Protection	Transmission	-	-	\$350,000	-	-	\$350,000
77	1007 Deer Point Sectionalizing	Transmission	-	-	\$400,000	-	-	\$400,000
78	1009 SH to OR Cathodic Protection	Transmission	-	-	-	\$350,000	-	\$350,000
79	1011 San Juan Differential Upgrade	Transmission	-	-	-	-	\$400,000	\$400,000
80	1012 DE to BL Cathodic Protection	Transmission	-	-	-	-	\$350,000	\$350,000
81	1013 BL to OR Cathodic Protection	Transmission	-	-	-	-	\$350,000	\$350,000
82	1014 Shaw South Breaker Replacements	Transmission	-	-	-	-	\$600,000	\$600,000
83	Transmission Subtotal		\$500,000	\$900,000	\$1,150,000	\$750,000	\$2,100,000	\$5,400,000
84	GENERATION							
85	1200 - Generation (including Step-up Station at Plant)							
86	1201 Utility Solar (San Juan)	Generation	-	-	\$2,000,000	-	-	\$2,000,000
87	1202 Utility Solar (Lopez)	Generation	-	-	-	-	\$2,000,000	\$2,000,000
88	Generation Subtotal		\$0	\$0	\$2,000,000	\$0	\$2,000,000	\$4,000,000
89	Grand Total		\$10,155,000	\$12,150,000	\$11,595,000	\$10,825,000	\$12,800,000	\$57,525,000

V. Description and Justification

The following is the descriptions and justifications for all proposed system improvements including cost estimates, associated projects and alternatives. The use of the “*” in conjunction with the 740C Code identification number indicates the construction item is being carried forward from the 2016-2020 Capital Work Plan to be completed in the 2021-2025 Capital Work Plan.

DESCRIPTION AND JUSTIFICATION

DISTRIBUTION CONSTRUCTION ITEM: Mullis Road Tie

SUBSTATION AREA: Friday Harbor

YEAR OF COMPLETION: 2021

740C CODE: 215

ESTIMATED COST: \$200,000

DESCRIPTION: Install a three-phase 4/0 Al URD underground distribution system utilizing existing conduit system from location 1160158 to 1591121 (on Mullis Street from Spring Street to Cattle Point Road).

JUSTIFICATION: This tie will allow for back-feed between Circuit 53 of the Friday Harbor Substation and Circuit 113 of the Gravel Pit Substation. This creates loop feed capability providing more efficient flow of energy within the area and potential of alternative feeds during outage situations. The construction will utilize a conduit and vault system installed during a City of Friday Harbor road widening project.

ASSOCIATED PROJECTS: None

ALTERNATES: None

DESCRIPTION AND JUSTIFICATION

DISTRIBUTION CONSTRUCTION ITEM: Tarte Road Tie

SUBSTATION AREA: Roche Harbor

YEAR OF COMPLETION: 2022

740C CODE: 216

ESTIMATED COST: \$300,000

DESCRIPTION: Replace 5,700 ft. of single-phase #2 Al URD underground distribution system with three-phase 1/0 Al URD underground distribution system in 6-inch conduit with 2-inch conduit and 96 count fiber from location 1053202 to 1043310.

JUSTIFICATION: This tie will allow for back-feed between the Friday Harbor Substation and the Roche harbor Substation. This creates loop feed capability providing more efficient flow of energy within the area and potential of alternative feeds during outage situations.

ASSOCIATED PROJECTS: None

ALTERNATES: None

DESCRIPTION AND JUSTIFICATION

DISTRIBUTION CONSTRUCTION ITEM: Crescent Beach Bore

SUBSTATION AREA: Orcas

YEAR OF COMPLETION: 2024

740C CODE: 218

ESTIMATED COST: \$500,000

DESCRIPTION: Install new Horizontal Directionally Drilled underground three-phase tie in conduit behind Crescent Beach to replace existing overhead tie.

JUSTIFICATION: Take advantage of the opportunity to split trenching costs with other local municipalities to help reduce costs. By converting to underground, OPALCO would further reduce overhead assets which should increase reliability on the system during severe weather.

ASSOCIATED PROJECTS: None

ALTERNATES: Continue serving via existing overhead.

DESCRIPTION AND JUSTIFICATION

DISTRIBUTION CONSTRUCTION ITEM: Warbass Intersection Improvements

SUBSTATION AREA: Friday Harbor

YEAR OF COMPLETION: 2021

740C CODE: 300

ESTIMATED COST: \$150,000

DESCRIPTION: Underground power line relocation as required for town of Friday Harbor's Warbass way intersection improvements project

JUSTIFICATION: Relocation required by the town of Friday Harbor.

ASSOCIATED PROJECTS: None

ALTERNATES: None

DESCRIPTION AND JUSTIFICATION

DISTRIBUTION CONSTRUCTION ITEM: Urner-Harrison Point Conversion

SUBSTATION AREA: Eastsound

YEAR OF COMPLETION: 2021

740C CODE: 330

ESTIMATED COST: \$150,000

DESCRIPTION: Replace 1,100 ft. of single phase #6 HD Cu overhead distribution system with a single phase 1/0 URD underground system in 2" conduit for taps south, east, and west from Location 2037118.

JUSTIFICATION: The undergrounding of these line sections provide increased reliability and reduced fire hazards. Standard utility right-of-way management has become increasingly difficult since the trees surrounding these lines have grown to a height excessive of the lines. These facilities are also past useful life and in need of replacement.

ASSOCIATED PROJECTS: None

ALTERNATES: None

DESCRIPTION AND JUSTIFICATION

DISTRIBUTION CONSTRUCTION ITEM: Hoffman Cove Road Conversion

SUBSTATION AREA: Shaw

YEAR OF COMPLETION: 2021

740C CODE: 331

ESTIMATED COST: \$150,000

DESCRIPTION: Replace 2,000 ft. of single phase #6 HD Cu overhead distribution system with 1/0 URD underground distribution system in 2" conduit from Location 4039263 to 4047309 along county road right-of-way.

JUSTIFICATION: The relocation and undergrounding of this line section will increase reliability and provide better access to these facilities for ease of maintenance. These facilities will be relocated to the county road right-of-way for ease of access. This overhead tie line is an important component of the Shaw Island distribution for providing back-feed capabilities between circuits 31 and 32 of the Shaw Substation. The standard utility overhead right-of-way trimming program has been less effective since the surrounding tree height exceeds the height of these line sections.

ASSOCIATED PROJECTS: None

ALTERNATES: None

DESCRIPTION AND JUSTIFICATION

DISTRIBUTION CONSTRUCTION ITEM: C101/C104

SUBSTATION AREA: Eastsound

YEAR OF COMPLETION: 2021

740C CODE: 341

ESTIMATED COST: \$200,000

DESCRIPTION: Reconductor three-phase URD from Eastsound Substation to Tank Corner 1/0 to 500.

JUSTIFICATION: Reconductor will create a loop feed to be used in conjunction with the Olga substation. This will boost OPALCO's ability to feed the island from an alternate source in the event of an outage or maintenance work.

ASSOCIATED PROJECTS: None

ALTERNATES: None

DESCRIPTION AND JUSTIFICATION

DISTRIBUTION CONSTRUCTION ITEM: Agate Beach Overhead Conversion

SUBSTATION AREA: Lopez

YEAR OF COMPLETION: 2021

740C CODE: 337

ESTIMATED COST: \$80,000

DESCRIPTION: Replace 2,200 ft of single-phase 1/0 ACSR overhead distribution with 1/0 Al URD underground distribution from 3561221 to 3561353.

JUSTIFICATION: Poles, insulators, and transformers are aging and need to be replaced in the near future. Moving the system to underground will increase system reliability.

ASSOCIATED PROJECTS: None

ALTERNATES: None

DESCRIPTION AND JUSTIFICATION

DISTRIBUTION CONSTRUCTION ITEM: Egg Lake Road Conversion

SUBSTATION AREA: Friday Harbor

YEAR OF COMPLETION: 2022

740C CODE: 301

ESTIMATED COST: \$400,000

DESCRIPTION: Replace 15,500 ft. of single-phase #6 HD Cu overhead distribution system with three-phase 4/0 Al URD underground distribution system.

JUSTIFICATION: This project will provide a tie between the Friday Harbor and the Roche Harbor Substation. This will increase reliability between substation by creating alternative feeds from multiple circuits from each substation.

ASSOCIATED PROJECTS: None

ALTERNATES: None

DESCRIPTION AND JUSTIFICATION

DISTRIBUTION CONSTRUCTION ITEM: Dolphin Bay Road UG Phase Conversion

SUBSTATION AREA: Orcas

YEAR OF COMPLETION: 2022

740C CODE: 312

ESTIMATED COST: \$400,000

DESCRIPTION: Replace 5,700 ft. of single-phase #2 Al URD underground distribution system with three-phase 1/0 Al URD underground distribution system in 6" conduit along with 2" conduit and 96 count fiber from location 2207458 to 2290228.

JUSTIFICATION: This project completes a three-phase loop and increases system reliability. This route is along Dolphin Bay Road and will complete a three-phase loop and tie between Circuits 42 and 43 of the Orcas Substation. This tie line will provide redundancy and allow faults to be isolated resulting in less consumers being affected during repairs.

ASSOCIATED PROJECTS: None

ALTERNATES: None

DESCRIPTION AND JUSTIFICATION

DISTRIBUTION CONSTRUCTION ITEM: Beaverton Valley Road OH phase
Conversion

SUBSTATION AREA: Friday Harbor

YEAR OF COMPLETION: 2021

740C CODE: 319

ESTIMATED COST: \$300,000

DESCRIPTION: Replace 16,700 ft. of single-phase #6 overhead distribution to three-phase 336.4 kcmil ACSR overhead distribution.

JUSTIFICATION: This will serve as a tie from the Friday Harbor Substation to the Roche Harbor Substation for increased reliability in major outage events. This project will also aid in balancing load, reduce voltage drop and increase reliability for the area.

ASSOCIATED PROJECTS: None

ALTERNATES: None

DESCRIPTION AND JUSTIFICATION

DISTRIBUTION CONSTRUCTION ITEM: San Juan Valley Road UG reconductor
(Boyce)

SUBSTATION AREA: Friday Harbor

YEAR OF COMPLETION: 2022

740C CODE: 320

ESTIMATED COST: \$500,000

DESCRIPTION: Replace 5,280ft. of direct buried 1/0 URD distribution system with three-phase underground 500mcm URD in 6in conduit on Boyce Road from San Juan Valley Road to Beaverton Valley Road.

JUSTIFICATION: The Increasing conductor size will reduce voltage drop and reduce system losses.

ASSOCIATED PROJECTS: None

ALTERNATES: None

DESCRIPTION AND JUSTIFICATION

DISTRIBUTION CONSTRUCTION ITEM: Montgomery Lane Conversion

SUBSTATION AREA: Eastsound

YEAR OF COMPLETION: 2023

740C CODE: 344

ESTIMATED COST: \$150,000

DESCRIPTION: Replace single phase overhead distribution system with single phase underground distribution. Opportunity to replace aging overhead assets.

JUSTIFICATION: Opportunity to replacing aging overhead assets and convert to underground. Shared trenching with local water utility.

ASSOCIATED PROJECTS: None

ALTERNATES: None

DESCRIPTION AND JUSTIFICATION

DISTRIBUTION CONSTRUCTION ITEM: Blanchard UG Rephase

SUBSTATION AREA: Eastsound

YEAR OF COMPLETION: 2022

740C CODE: 343

ESTIMATED COST: \$50,000

DESCRIPTION: Replace single phase underground distribution system with three-phase underground distribution.

JUSTIFICATION: Opportunity to improve underground distribution assets as a joint project with the local water company.

ASSOCIATED PROJECTS: None

ALTERNATES: None

DESCRIPTION AND JUSTIFICATION

DISTRIBUTION CONSTRUCTION ITEM: Terrill Beach Road Reconductor

SUBSTATION AREA: Olga

YEAR OF COMPLETION: 2024

740C CODE: 347

ESTIMATED COST: \$75,000

DESCRIPTION: Replace aging direct buried three-phase underground distribution system with three-phase underground distribution in conduit.

JUSTIFICATION: Opportunity to improve underground distribution assets as a joint project with the local water company.

ASSOCIATED PROJECTS: None

ALTERNATES: None

DESCRIPTION AND JUSTIFICATION

DISTRIBUTION CONSTRUCTION ITEM: Decatur Three-Phase to North Terminal

SUBSTATION AREA: Decatur

YEAR OF COMPLETION: 2023

740C CODE: 345

ESTIMATED COST: \$20,000

DESCRIPTION: Three-phase existing overhead conductor to Decatur North sub terminal.

JUSTIFICATION: Opportunity to three-phase this distribution path to provide backup three phase power to Decatur or Blakely via the existing unused three phase submarine cable.

ASSOCIATED PROJECTS: None

ALTERNATES: None

DESCRIPTION AND JUSTIFICATION

NEW DISTRIBUTION CONSTRUCTION ITEM: San Juan Valley Reconductor

SUBSTATION AREA: Friday Harbor

YEAR OF COMPLETION: 2021

740C CODE: 332

ESTIMATED COST: \$500,000

DESCRIPTION: Replace 3,400 ft. of direct buried three-phase 4/0 URD Al underground distribution system with three-phase 500 MCM Al underground in 6" conduit from location 1180177 to 1484417 (San Juan valley Road from Franklin Drive to Douglas Road).

JUSTIFICATION: Three-phase direct buried #4/0 AL has failed at least once causing all of circuit 53 to trip off leaving 1300 members out of power. OPALCO would like to put this 5000-foot span of URD underground in conduit before the area becomes developed and OPALCO's ability to access and maintain this line becomes problematic. The existing underground direct buried facilities have sustained several faults. Installation of a conduit and vault system will increase reliability to the 1300 services downline and provide operational opportunities during downline outage events. Conduit has been installed in previous work plan.

ASSOCIATED PROJECTS: None

ALTERNATES: None

DESCRIPTION AND JUSTIFICATION

NEW DISTRIBUTION CONSTRUCTION ITEM: Prune Alley Conversion

SUBSTATION AREA: Eastsound

YEAR OF COMPLETION: 2021

740C CODE: 334

ESTIMATED COST: \$250,000

DESCRIPTION: Replace 1,500 ft. of three-phase #6 HD Cu overhead distribution system with three-phase 1/0 URD underground distribution system in 6" conduit. Tap of direct buried #2 Al open concentric neutral URD will be replaced with 1/0 Al jacketed 220 mil insulated wire in 2" conduit.

JUSTIFICATION: The County is widening the road and is requiring OPALCO to relocate its present facilities that are in the County Right of Way. OPALCO will be required to move its electrical lines into new trenches shared with phone, and fiber, lines.

ASSOCIATED PROJECTS: None

ALTERNATES: None

DESCRIPTION AND JUSTIFICATION

NEW DISTRIBUTION CONSTRUCTION ITEM: Center Island Submarine Cable

SUBSTATION AREA: Decatur

YEAR OF COMPLETION: 2021

740C CODE: 335

ESTIMATED COST: \$900,000

DESCRIPTION: Replace 2,800 ft. of #2 Cu Submarine Cable with 1/0 Cu Submarine Cable with fiber from Decatur Island to Center Island (Location 6101340 to 6103200).

JUSTIFICATION: This distribution submarine cable has faulted once and is nearing end of life.

ASSOCIATED PROJECTS: None

ALTERNATES: None

DESCRIPTION AND JUSTIFICATION

NEW DISTRIBUTION CONSTRUCTION ITEM: Friday Harbor Sidewalk Replacement

SUBSTATION AREA: Friday Harbor and Gravel Pit

YEAR OF COMPLETION: 2025

740C CODE: 338

ESTIMATED COST: \$150,000

DESCRIPTION: Replace facilities and install facilities in conjunction with various Town of Friday Harbors replacement of sidewalks.

JUSTIFICATION: The existing facilities are aging and are not within current specifications and installation methodology. This will also provide opportunities to install ties for increased reliability and efficiencies in an area of congested infrastructure.

ASSOCIATED PROJECTS: None

ALTERNATES: None

DESCRIPTION AND JUSTIFICATION

NEW DISTRIBUTION CONSTRUCTION ITEM: Doe Bay Overhead Phase Conversion

SUBSTATION AREA: Olga

YEAR OF COMPLETION: 2024

740C CODE: 348

ESTIMATED COST: \$400,000

DESCRIPTION: Convert single phase overhead line from Doe Bay to Sea Acres Road on Orcas Island to three-phase. Project includes retirement of 6,600 ft of (2) #6HD Cu overhead line. In addition, add vibration dampeners to the existing fiber optic line.

JUSTIFICATION: Entire load from Doe Bay north has been carried on a single phase. This past winter, loading of the #6 Cu approached line amperage capacity during cold load pickup. Also, with the Olga sub transformer being down, this high single-phase loading forced an unbalanced three-phase load all the way from the Eastsound Substation. It also necessitated installation of a Voltage Regulator at Doe Bay. The change to three-phase would enable system load to split at Sea Acres Road, carrying the Eagle lake and Sea Acres residential communities on separate phases. The net result is improved power quality and more balanced loading in the distribution system.

ASSOCIATED PROJECTS:

ALTERNATES: None

DESCRIPTION AND JUSTIFICATION

NEW DISTRIBUTION CONSTRUCTION ITEM: Gravel Pit Relay Upgrades

SUBSTATION AREA: Gravel Pit

YEAR OF COMPLETION: 2021

740C CODE: 501

ESTIMATED COST: \$80,000

DESCRIPTION: Replace aging relays at Gravel Pit with our new standard relay package. Increase the relay protection of the transformer by adding current differential and restricted earth fault protection. As part of the relay upgrade a new high speed protection scheme will be implemented to reduce the arc flash hazard at the station.

JUSTIFICATION: Upgrading relay protection based on IEEE Std. C37.91-2008 recommendations and industry best practices to increase reliability and safety. High speed protection can decrease damage sustained from internal faults, accurately determine fault location, and reduce the arc flash hazard in the zone of protection. In addition, electronic relays at the substation are approaching their end of life.

ASSOCIATED PROJECTS: None

ALTERNATES: None

DESCRIPTION AND JUSTIFICATION

NEW DISTRIBUTION CONSTRUCTION ITEM: San Juan Micro Grid

SUBSTATION AREA: Gravel Pit

YEAR OF COMPLETION: 2022

740C CODE: 505

ESTIMATED COST: \$4,800,000 (\$2,400,000 from WA DOC)

DESCRIPTION: Installation of 1.0 MW/4.0 MWh Energy Storage System (ESS) on San Juan island. This will connect on the distribution at 12.47kV. Project will enable a microgrid for the town of Friday Harbor. This can be used to provide critical power during outages and sustain itself with the community solar.

JUSTIFICATION: This ESS will be used for load shifting from normal peak instances in the morning and evening to midday and night to increase load factor. It will also provide peak shaving during cold load pickup outage events to allow for a more cost-efficient restoration. In addition, this will be used to condition a planned community solar installation on the same site. OPALCO has received a \$2,400,000 grant from Washington State Department of Commerce (WA DOC) for this project.

ALTERNATES: None

DESCRIPTION AND JUSTIFICATION

NEW DISTRIBUTION CONSTRUCTION ITEM: Blakely Substation Lighting

SUBSTATION AREA: Blakely

YEAR OF COMPLETION: 2021

740C CODE: 507

ESTIMATED COST: \$10,000

DESCRIPTION: Install new lighting for Blakely substation.

JUSTIFICATION: Lighting was never installed at the substation and is a design requirement by OPALCO. Substation lighting is required in all substations and submarine cable terminal.

ASSOCIATED PROJECTS: None

ALTERNATES: None

DESCRIPTION AND JUSTIFICATION

NEW DISTRIBUTION CONSTRUCTION ITEM: Decatur Substation Lighting

SUBSTATION AREA: Decatur

YEAR OF COMPLETION: 2021

740C CODE: 506

ESTIMATED COST: \$10,000

DESCRIPTION: Install new lighting for Decatur substation.

JUSTIFICATION: Lighting was never installed at the substation and is a design requirement by OPALCO. Substation lighting is required in all substations and submarine cable terminal.

ASSOCIATED PROJECTS: None

ALTERNATES: None

DESCRIPTION AND JUSTIFICATION

NEW DISTRIBUTION CONSTRUCTION ITEM: Shaw Disconnect Switch Replacement

SUBSTATION AREA: Shaw

YEAR OF COMPLETION: 2024

740C CODE: 504

ESTIMATED COST: \$100,000

DESCRIPTION: Replace an aging switch in the Shaw Substation with a switch having a higher BIL rating.

JUSTIFICATION: Substations primary three-phase air break disconnect switch requires repair or replacement. Replacement parts are not available for this switch due to age of equipment.

ASSOCIATED PROJECTS: None

ALTERNATES: None

DESCRIPTION AND JUSTIFICATION

NEW DISTRIBUTION CONSTRUCTION ITEM: LTC Controller Replacements

SUBSTATION AREA: Shaw, Lopez, San Juan

YEAR OF COMPLETION: 2021

740C CODE: 513

ESTIMATED COST: \$60,000

DESCRIPTION: Replace LTC controller at Shaw, Friday Harbor, Roche Harbor, and Lopez substation.

JUSTIFICATION: Aging controllers do not provide the level of automation needed for system operations. The expanded control and monitoring capabilities will provide the members with better power quality.

ASSOCIATED PROJECTS: None

ALTERNATES: Replace as failures occur.

DESCRIPTION AND JUSTIFICATION

NEW DISTRIBUTION CONSTRUCTION ITEM: Decatur Energy Storage System

SUBSTATION AREA: Decatur

YEAR OF COMPLETION: 2021

740C CODE: 518

ESTIMATED COST: \$2,200,000 (\$1,000,000 in WA DOC Grant Funds)

DESCRIPTION: Installation of 0.5 MW/2.0 MWh Energy Storage System (ESS) at the Decatur Substation. This will connect at 12.47kV voltage.

JUSTIFICATION: This ESS will be used for load shifting from normal peak instances in the morning and evening to midday and night to increase load factor. It will also provide peak shaving during cold load pickup outage events to allow for a more cost-efficient restoration. In addition, this will be used to condition a planned community solar installation on the same site. OPALCO has received a \$1,000,000 grant from Washington State Department of Commerce (WA DOC) for this project.

ASSOCIATED PROJECTS: 901, 604-5, 501-1

ALTERNATES: None

DESCRIPTION AND JUSTIFICATION

NEW DISTRIBUTION CONSTRUCTION ITEM: Olga Substation Rebuild

SUBSTATION AREA: Olga

YEAR OF COMPLETION: 2023

740C CODE: 512

ESTIMATED COST: \$2,300,000

DESCRIPTION: Substation rebuild and design to accommodate redundant power source from/to Orcas and Eastsound. Bring aging station up to industry and OPALCO standards. Design to include new distribution breakers, auxiliary bus, distribution transformer, and high-side protection. High-side protection required to be able to back-feed Blakely and Decatur.

JUSTIFICATION: Olga substation transformer is nearing capacity limits in the next 10 years and will need to be replaced. Additionally, OPALCO has had several power supply outages that could have resulted in minimal outage time for the island had the substation had the capacity to pick-up the island. High-side protection is required for instances that require back-feed to Blakely and Decatur.

ASSOCIATED PROJECTS: None

ALTERNATES: None

DESCRIPTION AND JUSTIFICATION

NEW DISTRIBUTION CONSTRUCTION ITEM: Lopez Substation Redundancy

SUBSTATION AREA: Lopez

YEAR OF COMPLETION: 2023

740C CODE: 502

ESTIMATED COST: \$1,400,000

DESCRIPTION: Building a second substation on Lopez to provide a back-up source as well as provide a second point of delivery for future projects such as the Lopez micro grid and generation plans. Substation will pick-up two of the Lopez feeders and provide a tie between the two substations.

JUSTIFICATION: Each of the main ferry served islands has the ability to be backed up in the event of a transformer/substation outage. Lopez was identified as a reliability concern due to the lack of a back-up substation/transformer. This has prevented necessary substation maintenance as it would require an island wide outage.

ASSOCIATED PROJECTS: None

ALTERNATES: Mobile Substation

DESCRIPTION AND JUSTIFICATION

NEW DISTRIBUTION CONSTRUCTION ITEM: Friday Harbor Substation Rebuild

SUBSTATION AREA: Friday Harbor

YEAR OF COMPLETION: 2025

740C CODE: 519

ESTIMATED COST: \$3,000,000

DESCRIPTION: Rebuild Friday Harbor with new transformer, distribution bus and facilities to accommodate future growth such as a battery system or second transformer.

JUSTIFICATION: Friday Harbor has one of OPALCO's oldest transformers, which is slated to be replaced within the next 10 years. Additionally, previously installed equipment has been failing over the past few years which has resulted in unnecessary outages or a lack of protection. This is OPALCO's most heavily loaded transformer, and most of the equipment is near the associated device rating.

ASSOCIATED PROJECTS: None

ALTERNATES: Mobile Substation

DESCRIPTION AND JUSTIFICATION

NEW DISTRIBUTION CONSTRUCTION ITEM: Eastsound Substation upgrades

SUBSTATION AREA: Eastsound

YEAR OF COMPLETION: 2023

740C CODE: 511

ESTIMATED COST: \$75,000

DESCRIPTION: Install a new 12.47 kV disconnect switch.

JUSTIFICATION: New switch will allow for proper transformer maintenance while distribution feeder is back-fed from Olga or Orcas substation.

ASSOCIATED PROJECTS: None

ALTERNATES: None

DESCRIPTION AND JUSTIFICATION

NEW DISTRIBUTION CONSTRUCTION ITEM: Circuit Switcher Protection upgrades

SUBSTATION AREA: Eastsound, Orcas, and Roche Harbor

YEAR OF COMPLETION: 2025

740C CODE: 517

ESTIMATED COST: \$400,000

DESCRIPTION: Install circuit switchers and associated protection at the Orcas, Eastsound, and Roche Harbor Substations. Protection will be used to provide high-speed protection, transformer monitoring and through fault current monitoring.

JUSTIFICATION: New switch will allow for proper transformer maintenance while distribution feeder are back fed from Olga or Orcas substation. Circuit switchers with associated relays would replace fuses. Relay protection based on IEEE Std. C37.91-2008 recommendations and industry best practices to increase reliability and safety. High speed protection can decrease damage sustained from internal faults, accurately determine fault location, and reduce the arc flash hazard in the zone of protection.

ASSOCIATED PROJECTS: None

ALTERNATES:

DESCRIPTION AND JUSTIFICATION

NEW DISTRIBUTION CONSTRUCTION ITEM: Orcas Energy Storage System

SUBSTATION AREA: Eastsound

YEAR OF COMPLETION: 2021

740C CODE: 515

ESTIMATED COST: \$3,200,000

DESCRIPTION: Installation of 0.5 MW/2.0 MWh Energy Storage System (ESS) at the Eastsound Substation. This will connect at 12.47kV voltage.

JUSTIFICATION: This ESS will be used for load shifting from normal peak instances in the morning and evening to midday and night to increase load factor. It will also provide peak shaving during cold load pickup outage events to allow for a more cost-efficient restoration. In addition, this will be used to condition a planned community solar installation on the same site. OPALCO has received a \$1,000,000 grant from Washington State Department of Commerce (WA DOC) for this project.

ASSOCIATED PROJECTS: 901, 604-5, 501-1

ALTERNATES: None

DESCRIPTION AND JUSTIFICATION

NEW DISTRIBUTION CONSTRUCTION ITEM: Transformer and Meter Replacements

SUBSTATION AREA: All

YEAR OF COMPLETION: 2025

740C CODE: 601

ESTIMATED COST: \$5,000,000 (\$1,000,000 per year)

DESCRIPTION: Replace transformers and meters as needed.

JUSTIFICATION: The transformers to be replaced have experience failure, have corrosion or are not to current specifications (transclosures). The transformers purchased for replacement will improve efficiency and reduce losses. The meters purchased for replacement will have greater capabilities for gathering data and conforming to modern billing needs (i.e. time-of-use, demand, etc.)

ASSOCIATED PROJECTS: None

ALTERNATES: None

DESCRIPTION AND JUSTIFICATION

NEW DISTRIBUTION CONSTRUCTION ITEM: Meter System Upgrade

SUBSTATION AREA: All

YEAR OF COMPLETION: 2025

740C CODE: 601-1

ESTIMATED COST: \$5,000,000 (multi-year)

DESCRIPTION: Replace meters and interfacing software to allow for real-time read, outage detection, on-demand service characteristics. To be deployed in the following breakdown:

Year	Amount
2021	\$100,000
2022	\$300,000
2023	\$700,000
2024	\$2,200,000
2025	\$1,700,000

JUSTIFICATION: This will enable for greater system awareness, faster response times, real-time system health,

ASSOCIATED PROJECTS: None

ALTERNATES:

DESCRIPTION AND JUSTIFICATION

NEW DISTRIBUTION CONSTRUCTION ITEM: Fairgrounds VFI

SUBSTATION AREA: Gravel Pit

YEAR OF COMPLETION: 2021

740C CODE: 603-1

ESTIMATED COST: \$150,000

DESCRIPTION: Replace an aging fused switch with new sectionalizing equipment.

JUSTIFICATION: New sectionalizing equipment required to properly sectionalize off taps from this location. This will provide capability to monitor and control loads while better coordinating with the existing protection scheme.

ASSOCIATED PROJECTS: None

ALTERNATES: None

DESCRIPTION AND JUSTIFICATION

NEW DISTRIBUTION CONSTRUCTION ITEM: Mud Bay Road VFI

SUBSTATION AREA: Lopez

YEAR OF COMPLETION: 2021

740C CODE: 603-19

ESTIMATED COST: \$100,000

DESCRIPTION: Replace an aging sectionalizing scheme with a VFI-12 feeding approximately 450 members at location 3512363.

JUSTIFICATION: This will provide capability to monitor and control loads while better coordinating with the existing protection scheme.

ASSOCIATED PROJECTS: None

ALTERNATES: None

DESCRIPTION AND JUSTIFICATION

NEW DISTRIBUTION CONSTRUCTION ITEM: Mt Baker Road VFI

SUBSTATION AREA: Eastsound

YEAR OF COMPLETION: 2021

740C CODE: 603-3

ESTIMATED COST: \$150,000

DESCRIPTION: Replace failing VFI. Existing VFI has a failed structural brace which will lead to a premature failure and could potentially be a safety issue.

JUSTIFICATION: The existing switch has failed to operate in the past due to failure of the equipment's internal electronics. Repair have been made to existing unit, but spare parts are problematic to find. This will provide capability to monitor and control loads while better coordinating with the existing protection scheme.

ASSOCIATED PROJECTS: None

ALTERNATES: None

DESCRIPTION AND JUSTIFICATION

NEW DISTRIBUTION CONSTRUCTION ITEM: White Beach 1PH VFI

SUBSTATION AREA: Orcas

YEAR OF COMPLETION: 2021

740C CODE: 603-4

ESTIMATED COST: \$20,000

DESCRIPTION: New sectionalizing equipment to protect away underground tap.

JUSTIFICATION: Current equipment has failed and has caused multiple upstream mis-operations resulting in additional members unnecessarily out of power.

ASSOCIATED PROJECTS: None

ALTERNATES: None

DESCRIPTION AND JUSTIFICATION

NEW DISTRIBUTION CONSTRUCTION ITEM: Relay Replacement Program

SUBSTATION AREA: Multiple

YEAR OF COMPLETION: 2021

740C CODE: 603-5

ESTIMATED COST: \$250,000

DESCRIPTION: Replace existing controls across the system with a more robust design. This will allow for more sophisticated automation schemes and provide better inter-operability amongst the entire system.

JUSTIFICATION: The existing protective relay controls have been failing on a regular basis. This has caused miscoordination issues due to an inoperable control as well as safety concerns due to controller malfunctions.

ASSOCIATED PROJECTS: None

ALTERNATES: Continue to replace failing protective relay controls with protective relay controls.

DESCRIPTION AND JUSTIFICATION

NEW DISTRIBUTION CONSTRUCTION ITEM: Recloser Control Replacement Program

SUBSTATION AREA: Multiple

YEAR OF COMPLETION: 2021

740C CODE: 603-6

ESTIMATED COST: \$100,000

DESCRIPTION: Replace existing controls across the system with a more robust design. This will allow for more sophisticated automation schemes and provide better inter-operability amongst the entire system.

JUSTIFICATION: The existing Form 6 controls have been failing on a regular basis. This has caused miscoordination issues due to an inoperable control as well as safety concerns due to controller malfunctions.

ASSOCIATED PROJECTS: None

ALTERNATES: None

DESCRIPTION AND JUSTIFICATION

NEW DISTRIBUTION CONSTRUCTION ITEM: Fuse Pedestal Replacements

SUBSTATION AREA: Olga

YEAR OF COMPLETION: 2023

740C CODE: 603-7

ESTIMATED COST: \$300,000

DESCRIPTION: Replace aging fuse pads in the Rosario area with new sectionalizing equipment to provide better coordination, fault location and remote monitoring.

JUSTIFICATION: The sectionalizing equipment is a safety concern and provides sub-optimal protection on downstream equipment. OPALCO is moving away from live front equipment and this is part of our conversion to dead front sectionalizing equipment.

ASSOCIATED PROJECTS: None

ALTERNATES:

DESCRIPTION AND JUSTIFICATION

DISTRIBUTION CONSTRUCTION ITEM: Orcas Substation Voltage Regulators

SUBSTATION AREA: Orcas

YEAR OF COMPLETION: 2021

740C CODE: 604-1

ESTIMATED COST: \$100,000

DESCRIPTION: Install a three-phase bank of voltage regulators at the Orcas Substation 12.47 kV bus and decommission the Orcas Substation LTC.

JUSTIFICATION: These are required to keep adequate voltage levels on the Orcas Substation. The LTC is near end of life and maintenance costs have reached a level where decommissioning and installation of single-phase regulator is more economical. This will also allow per phase control of voltage on a substation with mostly single-phase load improving the power quality of those served.

ASSOCIATED PROJECTS: None

ALTERNATES: None

DESCRIPTION AND JUSTIFICATION

NEW DISTRIBUTION CONSTRUCTION ITEM: Bailer Hill Voltage Regulators

SUBSTATION AREA: Gravel Pit

YEAR OF COMPLETION: 2022

740C CODE: 604-7

ESTIMATED COST: \$80,000

DESCRIPTION: Replace aging three-phase voltage regulator bank at location 1673211.

JUSTIFICATION: Parts for these units are no longer manufactured. This will provide monitoring and control capabilities to increase power quality of serving area.

ASSOCIATED PROJECTS: None

ALTERNATES: None

DESCRIPTION AND JUSTIFICATION

NEW DISTRIBUTION CONSTRUCTION ITEM: Ordinary Replacements

SUBSTATION AREA: All

YEAR OF COMPLETION: 2025

740C CODE: 606

ESTIMATED COST: \$2,000,000 (\$400,000 per year)

DESCRIPTION: Based on historical figures, the anticipated ordinary replacement of poles is estimated at 35 poles per year. These replacements will be based on an annual pole inspection.

JUSTIFICATION: Wooden poles at end of life. Replacement of poles will increase system reliability during period of adverse weather.

ASSOCIATED PROJECTS: None

ALTERNATES: None

DESCRIPTION AND JUSTIFICATION

NEW DISTRIBUTION CONSTRUCTION ITEM: October Farm Conversion

SUBSTATION AREA:

YEAR OF COMPLETION: 2021

740C CODE: 607-1

ESTIMATED COST: \$45,000

DESCRIPTION: Convert three-phase overhead to single-phase underground.

JUSTIFICATION: Currently the right-of-way is seasonally unmaintainable, and the present service condition lacks any three-phase service.

ASSOCIATED PROJECTS: None

ALTERNATES: None

DESCRIPTION AND JUSTIFICATION

NEW DISTRIBUTION CONSTRUCTION ITEM: Price Street OH Conversion

SUBSTATION AREA: Friday Harbor

YEAR OF COMPLETION: 2021

740C CODE: 607-2

ESTIMATED COST: \$50,000

DESCRIPTION: Convert backyard overhead single-phase to underground URD.

JUSTIFICATION: Currently the right of way is unmaintainable.

ASSOCIATED PROJECTS: None

ALTERNATES: None

DESCRIPTION AND JUSTIFICATION

NEW DISTRIBUTION CONSTRUCTION ITEM: Town Marguerite to School Alley
OH Conversion

SUBSTATION AREA: Friday Harbor

YEAR OF COMPLETION: 221

740C CODE: 607-4

ESTIMATED COST: \$50,000

DESCRIPTION: Convert backyard overhead single-phase to underground URD.

JUSTIFICATION: Currently the right of way is unmaintainable.

ASSOCIATED PROJECTS: None

ALTERNATES: None

DESCRIPTION AND JUSTIFICATION

NEW DISTRIBUTION CONSTRUCTION ITEM: URD Replacements

SUBSTATION AREA: All

YEAR OF COMPLETION: 2025

740C CODE: 608

ESTIMATED COST: \$10,000,000 (\$2,000,000 per year)

DESCRIPTION: Replacement of faulted, aging underground distribution conductors and replacement of underground unjacketed exposed concentric neutral conductors with corroded or missing neutrals. The tables below contain the project name, 740c code, substation area, year of completion, estimated length in feet, start and end locations and estimated construction costs.

JUSTIFICATION: OPALCO began installation of underground distribution conductors in the late 1960s. It is anticipated to replace approximately 60 miles of conductors with two or more faults and unjacketed exposed concentric neutral conductors having neutral corrosion enough so to effect power quality and protective scheme effectiveness.

Cable Type	Year of Standard	Est. Miles
Unjacketed, Direct Buried	Prior to 1979	150
Jacketed, Direct Buried	1979 – 2000	750
Jacketed, In Conduit	2000 - Present	300

ASSOCIATED PROJECTS: None

ALTERNATES: None

DESCRIPTION AND JUSTIFICATION

Table 5: URD Projects

<i>NAME</i>	<i>LOAN</i>	<i>LOCATION</i>	<i>COST</i>
Unidentified Lines	608	All	
Country Club Lane URD Replacement	608-3	Gravel Pit	\$66,000.00
Gafford Lane URD Replacement	608-4	Eastsound	\$72,000.00
Garden Path Lane URD Replacement	608-5	Gravel Pit	\$68,000.00
Harper Road URD Replacement	608-6	Eastsound	\$49,000.00
Hodgson Road URD Replacement	608-7	Lopez	\$19,000.00
Home Place URD Replacement	608-8	Friday Harbor	\$32,000.00
Indian Beach URD Replacement	608-10	Gravel Pit	\$100,000.00
Lampard Road URD Replacement	608-12	Friday Harbor	\$97,000.00
Lonesome Cove Road URD Replacement	608-13	Roche Harbor	\$59,000.00
Pavey Blvd URD Replacement	608-15	Lopez	\$34,000.00
Pinedrona Lane URD Replacement	608-16	Gravel Pit	\$66,000.00
Pleasant Valley URD Replacement	608-17	Roche Harbor	\$105,000.00
Prohaska Road URD Replacement	608-18	Friday Harbor	\$120,000.00
Raichland URD Replacement	608-19	Gravel Pit	\$21,000.00
Raven Ridge URD Replacement	608-20	Roche Harbor	\$73,000.00
Smugglers Cove URD Replacement	608-22	Roche Harbor	\$32,000.00
Snug Harbor URD Replacement	608-23	Lopez	\$80,000.00
Trailer Park URD Replacement	608-25	Friday Harbor	\$117,000.00
Veneda Trail Replacement	608-26	Olga	\$42,000.00
Wally Way URD Replacement	608-27	Gravel Pit	\$95,000.00
Bay Lane URD Replacement	608-28	Gravel Pit	\$34,000.00
Center View URD Replacement	608-30	Decatur	\$11,000.00
Evergreen Way URD Replacement	608-32	Orcas	\$11,000.00
Killdeer Lane URD Replacement	608-33	Gravel Pit	\$57,000.00
Maidenhair Road URD Replacement	608-34	Eastsound	\$28,000.00
Ocean Mist/Cascade Tie URD Replacement	608-35	Olga	\$11,000.00
Pine Drive URD Replacement	608-36	Friday Harbor	\$231,000.00
Pioneer Hill Road URD Replacement	608-37	Olga	\$145,000.00
Rocky Bay Road URD Replacement	608-38	Roche Harbor	\$49,000.00
San Juan Drive Taps URD Replacement	608-39	Roche Harbor	\$53,000.00

DESCRIPTION AND JUSTIFICATION

Three Meadows URD Replacement	608-40	Roche Harbor	\$76,000.00
Williams Lane URD Replacement	608-42	Lopez	\$49,000.00
Wold Road URD Replacement	608-43	Gravel Pit	\$78,000.00
Crow Valley Lane URD Replacement	608-44	Friday Harbor	\$59,000.00
EJ Young/Marrymac URD Replacement	608-45	Olga	\$95,000.00
Kanaka Bay Road URD Replacement	608-46	Gravel Pit	\$70,000.00
Miller Road URD Replacement	608-47	Roche Harbor	\$143,000.00
Northstar Road URD Replacement	608-48	Lopez	\$66,000.00
Ocean View Drive URD Replacement	608-49	Gravel Pit	\$61,000.00
Reef Net Road URD Replacement	608-50	Roche Harbor	\$70,000.00
Rosario Road URD Replacement	608-51	Olga	\$68,000.00
Sawmill Road URD Replacement	608-52	Orcas	\$68,000.00
Shoal Bay Lane URD Replacement	608-53	Lopez	\$32,000.00
Burton Lane URD Replacement	608-55	Gravel Pit	\$114,000.00
Decatur NW URD Replacement	608-57	Decatur	\$294,000.00
Emmerling Place URD Replacement	608-59	Friday Harbor	\$45,000.00
Michell Bay URD Replacement	608-60	Roche Harbor	\$177,000.00
Mountain Entrance URD Replacement	608-61	Olga	\$131,000.00
No. 2 Schoolhouse Road URD Replacement	608-62	Friday Harbor	\$175,000.00
Paradise Drive URD Replacement	608-63	Gravel Pit	\$160,000.00
Rossel Lane URD Replacement	608-64	Eastsound	\$57,000.00
Starkman Lane URD Replacement	608-65	Lopez	\$24,000.00
Timber Lane URD Replacement	608-66	Roche Harbor	\$101,000.00
Watmough Head Road URD Replacement	608-67	Lopez	\$122,000.00

DESCRIPTION AND JUSTIFICATION

COMMUNICATION CONSTRUCTION ITEM: SCADA Network Upgrades

SUBSTATION AREA:

YEAR OF COMPLETION: 2021

740C CODE: 704-2

ESTIMATED COST: \$50,000

DESCRIPTION: Replace aging communication switches with new secure switches.

JUSTIFICATION: Aging switches need to be replaced are at or near the end of their life.

ASSOCIATED PROJECTS: None

ALTERNATES: None

DESCRIPTION AND JUSTIFICATION

COMMUNICATION CONSTRUCTION ITEM: SCADA UPS and SFD Switches

SUBSTATION AREA: All

YEAR OF COMPLETION: 2021

740C CODE: 704-3

ESTIMATED COST: \$50,000

DESCRIPTION: Replace aging SCADA field devices (SFD) and uninterruptible power supply (UPS) and provide adequate back-up power during outages.

JUSTIFICATION: Due to some of OPALCO's longer outages it was determined that parts of our system need to be upgraded to provide appropriate battery back-up.

ASSOCIATED PROJECTS: None

ALTERNATES: None

DESCRIPTION AND JUSTIFICATION

COMMUNICATION CONSTRUCTION ITEM: SCADA Project with ADMS

SUBSTATION AREA: All

YEAR OF COMPLETION: 2022

740C CODE: 704-1

ESTIMATED COST: \$500,000

DESCRIPTION: Build out a new SCADA system to incorporate a new automatic distribution management system (ADMS). SCADA system will integrate into OPALCO's outage management software and provide increased reliability.

JUSTIFICATION: Due to limitations of OPALCO's current SCADA system it was determined that moving to a software suite that was geared more toward Utilities was necessary. This move will provide more information into our system, leverage current communication and sectionalizing equipment, and prepare OPALCO for the future of advanced distribution management.

ASSOCIATED PROJECTS: None

ALTERNATES: None

DESCRIPTION AND JUSTIFICATION

COMMUNICATION CONSTRUCTION ITEM: Pt Lawrence Rd Fiber

SUBSTATION AREA: Olga

YEAR OF COMPLETION: 2021

740C CODE: 706-2

ESTIMATED COST: \$150,000

DESCRIPTION: Install fiber backbone as part of OPALCO's fiber plan.

JUSTIFICATION: Identified as OPALCO backbone fiber job.

ASSOCIATED PROJECTS: None

ALTERNATES: None

DESCRIPTION AND JUSTIFICATION

COMMUNICATION CONSTRUCTION ITEM: Judd Cove Fiber

SUBSTATION AREA: Orcas

YEAR OF COMPLETION: 2022

740C CODE: 706-3

ESTIMATED COST: \$100,000

DESCRIPTION: Install fiber backbone as part of OPALCO's fiber plan.

JUSTIFICATION: Identified as OPALCO backbone fiber job.

ASSOCIATED PROJECTS: None

ALTERNATES: None

DESCRIPTION AND JUSTIFICATION

COMMUNICATION CONSTRUCTION ITEM: Mt. Baker Rd Tank Corner Fiber Backbone

SUBSTATION AREA: Eastsound

YEAR OF COMPLETION: 2024

740C CODE: 706-4

ESTIMATED COST: \$150,000

DESCRIPTION: Install fiber backbone as part of OPALCO's fiber plan.

JUSTIFICATION: Identified as OPALCO backbone fiber job.

ASSOCIATED PROJECTS: None

ALTERNATES: None

DESCRIPTION AND JUSTIFICATION

COMMUNICATION CONSTRUCTION ITEM: Active Site Replacements

SUBSTATION AREA:

YEAR OF COMPLETION: 2025

740C CODE: 706-5

ESTIMATED COST: \$250,000 (\$50,000 per year)

DESCRIPTION: Replace failed equipment as it comes up.

JUSTIFICATION: Aging active sites may fail and require replacement. This is part of OPALCO's fiber backbone and is essential to operations.

ASSOCIATED PROJECTS: None

ALTERNATES: None

DESCRIPTION AND JUSTIFICATION

TRANSMISSION CONSTRUCTION ITEM: San Juan Cable Temp Monitoring

SUBSTATION AREA: Transmission

YEAR OF COMPLETION: 2022

740C CODE: 1005

ESTIMATED COST: \$150,000

DESCRIPTION: Install on the new Lopez to San Juan cable to provide real time temperature monitoring.

JUSTIFICATION: By monitoring the temperatures of the submarine cable, OPALCO may be able to extend the life of the cable. The insulation type (XLPE) of this cable has been shown to have its life extended by limiting the temperature of the cable.

ASSOCIATED PROJECTS: None

ALTERNATES: None

DESCRIPTION AND JUSTIFICATION

TRANSMISSION CONSTRUCTION ITEM: Lopez to San Juan Sectionalizing

SUBSTATION AREA: Transmission

YEAR OF COMPLETION: 2022

740C CODE: 1004

ESTIMATED COST: \$350,000

DESCRIPTION: Install a new three-phase 69 kV circuit breaker at the West Lopez Submarine Cable Terminal.

JUSTIFICATION: These devices will assist in isolating faults along the transmission system and preserve the submarine cables. Additionally, this will allow the San Juan cables to be run in parallel which would reduce load (heating) on any one cable thus extending the life of the cables.

ASSOCIATED PROJECTS: None

ALTERNATES: None

DESCRIPTION AND JUSTIFICATION

TRANSMISSION CONSTRUCTION ITEM: Deer Point Sectionalizing

SUBSTATION AREA: Transmission

YEAR OF COMPLETION: 2023

740C CODE: 1007

ESTIMATED COST: \$400,000

DESCRIPTION: Install a new three-phase 69 kV circuit breaker at the Deer Point Submarine Cable Terminal.

JUSTIFICATION: These devices will assist in isolating faults along the transmission system and preserve the submarine cables.

ASSOCIATED PROJECTS: None

ALTERNATES: None

DESCRIPTION AND JUSTIFICATION

TRANSMISSION CONSTRUCTION ITEM: Fault Indication (SCADA)

SUBSTATION AREA: Transmission

YEAR OF COMPLETION: 2021

740C CODE: 1003

ESTIMATED COST: \$100,000

DESCRIPTION: Install new fault indicators and radio system to integrate into OPALCO's SCADA system. These will be used for load and fault data.

JUSTIFICATION: Installation of these devices will defer sectionalizing equipment previously identified. Accurate fault location on the outer islands will reduce outage time and increase reliability.

ASSOCIATED PROJECTS: None

ALTERNATES: None

DESCRIPTION AND JUSTIFICATION

TRANSMISSION CONSTRUCTION ITEM: San Juan Differential Upgrade

SUBSTATION AREA: Transmission

YEAR OF COMPLETION: 2025

740C CODE: 1011

ESTIMATED COST: \$400,000

DESCRIPTION: Upgrade protection to incorporate new differential scheme to run these two cables in parallel.

JUSTIFICATION: Will allow the lines to be run in parallel while also appropriately sectionalizing in the event of a sub cable fault. High speed protection could help prevent additional damage in the event of a fault. Additionally, newer protection technologies can help detect incipient faults.

ASSOCIATED PROJECTS: None

ALTERNATES: None

DESCRIPTION AND JUSTIFICATION

TRANSMISSION CONSTRUCTION ITEM: LZ to SH Cathodic Protection

SUBSTATION AREA: Transmission

YEAR OF COMPLETION: 2023

740C CODE: 1006

ESTIMATED COST: \$350,000

DESCRIPTION: Upgrade submarine cable to incorporate cathodic protection.

JUSTIFICATION: Cathodic protection is one of the most important aspects of a corrosion prevention solution. A properly installed cathodic protection system could significantly extend the life of a submarine cable.

ASSOCIATED PROJECTS: None

ALTERNATES: None

DESCRIPTION AND JUSTIFICATION

TRANSMISSION CONSTRUCTION ITEM: SH to OR Cathodic Protection

SUBSTATION AREA: Transmission

YEAR OF COMPLETION: 2024

740C CODE: 1009

ESTIMATED COST: \$350,000

DESCRIPTION: Upgrade submarine cable to incorporate cathodic protection.

JUSTIFICATION: Cathodic protection is one of the most important aspects of a corrosion prevention solution. A properly installed cathodic protection system could significantly extend the life of a submarine cable.

ASSOCIATED PROJECTS: None

ALTERNATES: None

DESCRIPTION AND JUSTIFICATION

TRANSMISSION CONSTRUCTION ITEM: DE to BL Cathodic Protection

SUBSTATION AREA: Transmission

YEAR OF COMPLETION: 2025

740C CODE: 1012

ESTIMATED COST: \$350,000

DESCRIPTION: Upgrade submarine cable to incorporate cathodic protection.

JUSTIFICATION: Cathodic protection is one of the most important aspects of a corrosion prevention solution. A properly installed cathodic protection system could significantly extend the life of a submarine cable.

ASSOCIATED PROJECTS: None

ALTERNATES: None

DESCRIPTION AND JUSTIFICATION

TRANSMISSION CONSTRUCTION ITEM: BL to OR Cathodic Protection

SUBSTATION AREA: Transmission

YEAR OF COMPLETION: 2025

740C CODE: 1013

ESTIMATED COST: \$350,000

DESCRIPTION: Upgrade submarine cable to incorporate cathodic protection.

JUSTIFICATION: Cathodic protection is one of the most important aspects of a corrosion prevention solution. A properly installed cathodic protection system could significantly extend the life of a submarine cable.

ASSOCIATED PROJECTS: None

ALTERNATES: None

DESCRIPTION AND JUSTIFICATION

TRANSMISSION CONSTRUCTION ITEM: Shaw South Breaker Replacements

SUBSTATION AREA: Transmission

YEAR OF COMPLETION: 2025

740C CODE: 1014

ESTIMATED COST: \$600,000

DESCRIPTION: Install two new three-phase 69 kV circuit breakers at the Shaw South Submarine Cable Terminal.

JUSTIFICATION: These devices will assist in isolating faults along the transmission system and preserve the submarine cables. Additionally, this will allow the Lopez to Shaw cables to be run in parallel which would reduce load (heating) on any one cable thus extending the life of the cables.

ASSOCIATED PROJECTS: None

ALTERNATES: None

DESCRIPTION AND JUSTIFICATION

NEW TRANSMISSION CONSTRUCTION ITEM: Ordinary Replacements

SUBSTATION AREA: Transmission

YEAR OF COMPLETION: 2025

740C CODE: 1000

ESTIMATED COST: \$2,000,000 (\$400,000 per year)

DESCRIPTION: Based on historical figures, the anticipated ordinary replacement of poles is estimated at nine poles per year. These replacements will be based on an annual pole inspection. – 9/year

JUSTIFICATION: Wooden poles at end of life and woodpecker damage. Replacement of poles will increase system reliability during period of adverse weather.

ASSOCIATED PROJECTS: None

ALTERNATES: None

DESCRIPTION AND JUSTIFICATION

NEW GENERATION CONSTRUCTION ITEM: Utility Solar (San Juan)

SUBSTATION AREA: SAN JUAN

YEAR OF COMPLETION: 2023

740C CODE: 1201

ESTIMATED COST: \$2,000,000

DESCRIPTION: Install 1MW utility owned solar facility on San Juan island.

JUSTIFICATION: Renewable energy resources which is in line with OPALCO's IRP and LRP.

ASSOCIATED PROJECTS: None

ALTERNATES: None

DESCRIPTION AND JUSTIFICATION

NEW GENERATION CONSTRUCTION ITEM: Utility Solar (Lopez)

SUBSTATION AREA: LOPEZ

YEAR OF COMPLETION: 2025

740C CODE: 1202

ESTIMATED COST: \$2,000,000

DESCRIPTION: Install 1MW utility owned solar facility on Lopez Island.

JUSTIFICATION: Renewable energy resources which is in line with OPALCO's IRP and LRP.

ASSOCIATED PROJECTS: None

ALTERNATES: None




VI. Appendices

A. RUS Form 300 Review Rating Survey – Operations & Maintenance

According to the Paperwork Reduction Act of 1995, an agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a valid OMB control number. The valid OMB control number for this information collection is 0572-0025. The time required to complete this information collection is estimated to average 4 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

UNITED STATES DEPARTMENT OF AGRICULTURE RURAL UTILITIES SERVICE REVIEW RATING SUMMARY		BORROWER DESIGNATION Orcas Power & Light Cooperative (WA 0009)					
		DATE PREPARED August 1, 2016					
Ratings on form are: 0: Unsatisfactory -- No Records 2: Acceptable, but Should be Improved -- See Attached Recommendations NA: Not Applicable 1: Corrective Action Needed 3: Satisfactory -- No Additional Action Required at this Time							
PART I. TRANSMISSION and DISTRIBUTION FACILITIES							
1. Substations (Transmission and Distribution) (Rating)		4. Distribution - Underground Cable (Rating)					
a. Safety, Clearance, Code Compliance		a. Grounding and Corrosion Control					
b. Physical Conditions: Structure, Major Equipment, Appearance		b. Surface Grading, Appearance					
c. Inspection Records - Each Substation		c. Riser Pole: Hazards, Guying, Condition					
d. Oil Spill Prevention							
2. Transmission Lines		5. Distribution Line Equipment: Conditions and Records					
a. Right-of-Way: Clearing, Erosion, Appearance, Intrusions		a. Voltage Regulators					
b. Physical Condition: Structure, Conductor, Guying		b. Sectionalizing Equipment					
c. Inspection Program and Records		c. Distribution Transformers					
		d. Pad Mounted Equipment					
		Safety: Locking, Dead Front, Barriers					
		Appearance: Settlement, Condition					
		Other					
		e. Kilowatt-hour and Demand Meter					
		Reading and Testing					
3. Distribution Lines - Overhead							
a. Inspection Program and Records							
b. Compliance with Safety Codes:							
Clearances							
Foreign Structures							
Attachments							
c. Observed Physical Condition from Field Checking:							
Right-of-Way							
Other							
PART II. OPERATIONS and MAINTENANCE							
6. Line Maintenance and Work Order Procedures (Rating)		8. Power Quality (Rating)					
a. Work Planning & Scheduling		a. General Freedom from Complaints					
b. Work Backlogs:							
Right-of-Way Maintenance							
Poles							
Retirement of Idle Services							
Other							
7. Service Interruptions		9. Loading and Load Balance					
a. Average Annual Minutes/Consumer (Complete for each of the previous 5 years)		a. Distribution Transformer Loading					
PREVIOUS 5 YEARS	POWER SUPPLIER	MAJOR STORM	PLANNED	ALL OTHER	TOTAL	(Rating)	b. Load Control Apparatus
	a.	b.	c.	d.	e.		c. Substation and Feeder Loading
2011			36.00	110.00	146.00	3	
2012	390.00		42.00	28.00	460.00	3	
2013	145.00		40.00	20.00	205.00	3	
2014	358.00		27.00	179.00	564.00	3	
2015	122.00	507.00	11.00	224.00	864.00	3	
b. Emergency Restoration Plan							
PART III. ENGINEERING							
11. System Load Conditions and Losses (Rating)				13. Load Studies and Planning (Rating)			
a. Annual System Losses		6.20%		a. Long Range Engineering Plan			
b. Annual Load Factor		42.0%		b. Construction Work Plan			
c. Power Factor at Monthly Peak		98.0%		c. Sectionalizing Study			
d. Ratios of Individual Substation Annual Peak kW to kVA		0.44		d. Load Data for Engineering Studies			
12. Voltage Conditions				e. Load Forecasting Data			
a. Voltage Surveys							
b. Substation Transformer Output Voltage Spread							

DESCRIPTION AND JUSTIFICATION

PART IV. OPERATION AND MAINTENANCE BUDGETS						
YEAR	For Previous 2 Years		For Present Year	For Future 3 Years		
	2014	2015	2016	2017	2018	2019
	Actual \$ Thousands	Actual \$ Thousands	Budget \$ Thousands	Budget \$ Thousands	Budget \$ Thousands	Budget \$ Thousands
Normal Operation	3,054,124	3,570,414	3,473,823	3,578,038	3,685,379	3,795,940
Normal Maintenance	1,778,516	1,713,924	1,702,147	1,753,211	1,805,808	1,859,982
Additional (Deferred) Maintenance						
Total	4,832,640	5,284,338	5,175,970	5,331,249	5,491,187	5,655,922
14. Budgeting: Adequacy of Budgets for Needed Work			3	(Rating)		
15. Date Discussed with Board of Directors			8/18/2016	(Date)		
EXPLANATORY NOTES						
ITEM NO.	COMMENTS					
1b	Substation Improvements to Shaw, Blakely and Decatur will occur 2017-2019.					
2a	Transmission Line Right-of-Way clearing is identifying danger trees for removal.					
7a	Service Interruptions are driven primarily by major storm or Power Supplier interruptions.					
10a	Significant improvements in Operating maps have occurred over the last 2 years.					
13a&b	In moving forward with the next 4 year CWP a new LRP will be needed which should include a Sectionalizing study.					
	<p>General Comment:</p> <p>Overall, there have been improvements in all areas and future projects to upgrade the distribution system and substations along with the installation of fiber throughout the system will enhance the utility's overall capabilities to provide safe, reliable, and reasonably affordable electricity.</p>					
				TITLE	DATE	
RAISED BY:	 P.E. Joel Mietzner P.E.			System Engineer	08/01/16	
REVIEWED BY:	 Foster Hildreth			CEO & President	08/01/16	
REVIEWED BY:	 Rodney Peach			RUS GFR	08/01/16	