Olympic Gravity Water System (OGWS)
Operations White Paper

June 7, 2021

Preface

The City of Port Townsend and the Port Townsend Paper Mill have a historical partnership of supplying water to the Quimper Peninsula, City of Port Townsend, and the Port Townsend Paper Mill dating back to 1928. The City and Port Townsend Paper Company are in the process of developing a new partnership agreement that will address water supply looking forward to the next 100 years.

Like the development of the Olympic Gravity Water System in the late 1920's, the development of an agreement between the City of Port Townsend (City) and Port Townsend Paper Company (PTPC) is a significant undertaking with the stakes being high for both parties. As such, the negotiation of a mutually beneficial agreement warrants thoughtful collaboration based on the best data possible.

As a way to ensure good factual data is available for the negotiation, eight technical white papers topic areas break down information into manageable segments. In the following specific white paper categories, the City and PTPC have worked together to develop these white papers for potential items to consider during the negotiation of the agreement.

1. Assets: Understanding each entities assets and capacities that support investment.
2. Stakeholders: The public, private property owners, and many agencies are stakeholders.
3. Planning and Environmental Considerations: Future water supply needs, climate change and water supply availability are important factors to plan for and include planning for the future.
4. Operations: Operational requirements, efficiencies and goals, cost, and reliability as well as determining the line between capital and ordinary wear and tear is a major part of any public private partnership agreement.
5. Capital Investments: Capital needs are extensive and need to be informed by a value engineering study for system reliability.
6. Funding and Resources: In order to address operational and capital needs, a plan is necessary to fund system needs ensuring that sustainability is achieved.
7. Legal considerations impact the form of the agreement depending on negotiation outcomes. Surety and performance are two key legal discussion points.

The intent of developing these white papers is to provide a resource to inform negotiations and as background for the public and decision makers. All of the white papers will be assembled into a comprehensive technical report in support of the development of a comprehensive recommendation for the City of Port Townsend City Council and the Port Townsend Paper Mill Board of Directors.

The following white paper addresses the operations of the Olympic Gravity Water System.

Introduction

The OGWS originating from Snow Creek, which began operation in 1905, was decaying and having difficulty supporting the water needs of the community by the mid-1920s. The Port Townsend community actively competed to be the site of the new Crown Zellerbach kraft paper mill to help revive the city's economic fortunes and renovate the water system. As part of the process the City acquired water rights on the Big and Little Quilcene Rivers and the voters approved issuing municipal bonds to pay for the construction of a dam and pipeline from the Big Quilcene River. Port Townsend has maintained ownership the OGWS facilities and water rights but leased the operation and maintenance of the source water collection and transmission system to the National Paper Products Company. In addition to lease payments, the mill and its various owners have continued to assume responsibility for the operation of the OGWS since its completion. Sections of wood stave pipeline installed in 1928 were replaced between the 1950s and 1972 with welded steel pipe. Construction of the Little Quilcene diversion and Lords Lake reservoir in 1955/1956 added a new source of supply and 500 million gallons of storage to the water system.

With more than 29 miles of pipeline that varies in age from 39 to 93 years, there are substantial costs associated with the annual operation and maintenance as well as funding the eventual replacement of the pipeline and associated facilities. Looking forward, a number of scenarios are available for continuing with the future operation of the system as outlined in the Legal white paper.

Background

The original lease between the City of Port Townsend and the National Paper Products Company was for a term of 30 years starting in 1928 for a total sum of $460,000. This lease was succeeded in 1944 by a transfer to the Crown Zellerbach Corporation. It included a $15,000 per year rental for a period of 10 years beginning in 1958 with the requirement that the City would immediately undertake replacement of deteriorating sections of the pipeline when the lease took effect. In 1956 the lease was renewed for a period of 30 years with a total payment of $3,267,042.17, which was used to pay for the waterline replacement and improvements. The 1956 lease was modified in 1983 extending it to March 15, 2020 and assigning it to the Port Townsend Paper Corporation with substantially no change to the 1956 terms, except for increasing the City share of the water from 4 to 5 million gallons per day. There has been a short term extension of the current lease while the new contract is being negotiated.

Per the contract, it has been PTPC's responsibility to fully pay for the maintenance and repair of the waterworks and to keep it in good and reasonable state of repair at all times, excepting reasonable wear and tears, deterioration, and obsolescence. PTPC currently employs three individuals to operate and maintain the water system and perform caretaking duties at the Big Quilcene Diversion and City Lake. Repairs and maintenance requiring excavation or specialized services such as the cathodic survey are contracted by PTPC or occasionally provided by City staff.

Water consumption

In 2020 an average of 10.3 million gallons of water from the Big Quilcene River and 2.8 million gallons from the Little Quilcene River was diverted daily. Water flow is also monitored as it goes into and out of City Lake. Consumption by the City averages around 1 million gallons per day (mgd), varying from a low of 700,000 gallons per day in the winter to a high of just over 2 mgd in the summer. Mill average daily water use is 10-12 million gallons of untreated water but may swing from less than 7 mgd to more than 14 mgd throughout the day depending on processes operating.

Not only is water demand important for consideration for future capital investments, but it creates operations considerations as well. For example, higher water demand by the Mill coinciding with high demand by the city affects water pressure and production capability at the City's water filtration facility. This may be caused by the pressure loss due to excessive velocity in an approximate 6,100-foot section of 24" diameter transmission line north of City Lake, which may require replacement with a larger diameter pipeline.

The estimated flows split between the City and the Mill is projected as follows:

Maximum Daily Demand			
	Current	2030	2040
City	2.12	2.38	2.66
Mill	14	14	14
Average Daily Demand			
City	1.01	1.13	1.27
Mill	11	11	11

Historical Cost of O&M and Staffing

Operating and maintaining the OGWS has been performed by the Mill consistent with the lease terms. For more 30 years staffing for routine operation and maintenance of OGWS has been conducted by three persons along with the occasional summer help. Manual operation of flow control valves and screen cleaning and extensive hand operated clearing and brushing of the pipeline right of way will continue to dictate staffing levels with at least three full time employees (FTEs) expected for minimum staffing. As the sole source of water to the City and mill and the consequences of supply interruptions, having qualified personnel such as pipefitters readily available (4-8 hour response time) to repair the pipeline is critically important. Automation benefits, particularly valve operation and screen cleaning and improved security could potentially eliminate the need for fulltime caretakers at the Big Quilcene Diversion and City Lake.

Recent cost of operations and maintenance have been approximately $416,000 per year the last four years.

Cost Category	2016	2017	2018	2019	2020 (estimate)
City Lake House					
Repair Labor	$ -	$ -	$ -	$ -	$ -
Contract Maintenance	$ -	$ 176	$ -	$ -	$ -
Repair Materials	$ 305	$ -	$ -	$ -	$ -
Misc Supplies and Expenses	$ 9,170	$ 5,406	$ 5,182	$ 3,484	$ 4,758
Big Quil Diversion House					
Repair Labor	$ -	$ -	$ -	$ -	$ -
Contract Maintenance	$ -	$ -	$ 21,425	$ -	$ -
Repair Materials	$ 497	$ -	$ 8	$ 1,509	$ 11,014
Misc Supplies and Expenses	$ 7,577	$ 4,103	$ 3,230	$ 2,031	$ 1,500
Fresh Water System					
Repair Labor	$ -	$ -	$ -	$ -	$ -
Contract Maintenance	$ 22,266	$ 11,521	$ 19,144	$ 14,972	
Repair Materials	$ 12,102	$ 51	$ 13,439	$ 16,806	
Misc Supplies and Expenses	$ 11,098	$ 67,709	$ 82,008	$ 139,215	$ 59,523
Leases	$ 19,595	$ 21,498	$ 20,523	$ 20,824	$ 6,941
Fuel	$ 17,520	$ 10,066	$ -	$ -	$ -
Cathodic Protection	$ 21,823	$ 3,267	$ 1,752	$ 2,898	$ 3,498
Telephone	$ 2,448	$ 6,649	$ 3,801	$ 3,083	$ 3,660
Labor Costs					
Salaries/Benefits	$238,962	$303,941	$ 240,374	$251,918	$ 267,637
Sub Total Annual Cost	$ 363,363	$ 434,387	$ 410,886	$ 456,740	$ 358,531

Various City staff manage permits, conduct watershed patrols and ensure compliance with water supply regulations, which requires about 0.5 FTE or approximately $75,000 per year including equipment. In addition, the City spends around $27,000 annually for OGWS operations, including payments to the Natural Resources Conservation Service for the SNOTEL site maintenance, US Geological Survey for stream flow gaging maintenance, DOE Dam Safety fees and USFS Special Use Permit fees.

Annual City of Port Townsend OGWS Maintenance Costs	
NRCS SNOTEL Maintenance	$7,000
USGS Streamflow Gaging	$13,500
DOE Dam Safety	$1,300
USFS Permit Fees	$5,000

Thus, the historical total cost of the Mill and City combined to operate and maintain the system has been approximately $518,000 per year. An option of having the City run the system in its entirety was evaluated and estimated at $763,000 per year beginning in 2021. From a financial standpoint, the cost of the PTPC to continue to operate and maintain the system is appropriate.

Looking forward the costs of operations and maintenance is expected to increase to achieve the maintenance obligations specified below.

Standard of care

The standard of care is commonly determined by the action or inaction a reasonable, professional person with similar training would take in a similar situation under similar conditions. In some cases, a professional organization defines the standard. Other times, it's determined by the typical behavior of professionals in the industry.

Standards of Maintenance and Repair

Maintenance standards will be part of the contract negotiations. Discussions should include the following items:

- Transmission pipeline
    - Maintenance of right of way – annual clearing and brushing. Major brushing (every 7 years). The difficulty in reaching some of the vegetation may require contracting for the use of mechanical brushing equipment.
        - One of the priorities is to remove the large trees growing over and next to some sections of pipeline.
        - Clearing is necessary to maintain access for inspection and repairs.
        - Identify on a GIS map the landowner or easement holder responsibility for maintaining the right of way.
        - The PTPC has a cost sharing agreement with the Jefferson PUD for the maintenance of powerline rights of way that serve the mill. Where there is an overlap of the pipeline easement with the transmission line there is an associated benefit for the rights of way clearing and brushing.
    - Encroachment enforcement and gate coordination. As the easement owner, the City is responsible for addressing the necessary enforcement actions.
    - Right of way staking and monument protection.
    - Air relief valves and drain valves – annual inspection and operational and exercising check.
    - Maintenance of air relief/hydrant valve boxes. Eventual replacement of wood boxes with more secure concrete boxes with locking lids.
    - Coordination with logging and construction operations. Underground utility locates as necessary.
    - Culverts – Periodic condition assessment with an annual inspection and check after major storms. Clean and replace as required to maintain proper function.
    - Flow meter maintenance and calibration – Flow meters to be repaired and replaced as necessary. Meter readings to be reported daily to the City. Calibration should be checked annually.
    - Valves – annual inspection and operational and exercise check.
    - Cathodic protection system – annual inspection and operational check and follow up repairs.
    - Leak repairs – if necessary, temporary until pipeline shut down then permanent to approximate lifespan of pipeline with restoration of corrosion protection.
- Diversions
    - Valves – annual inspection and operational check.
    - USGS staff gage maintenance – USGS service visits 3-4 times per year with annual funding requirement.
    - Big Quilcene diversion buildings (Houses and outbuildings) and grounds maintenance –

        - Painting, roofing, fencing, electrical, septic, and general maintenance and repairs as required.
    - Roads – pothole filling and brushing as required.
- Lords Lake
    - Dam maintenance and monitoring – daily inspection; monthly piezometer and seepage monitoring; clearing, brushing and hole filling as required.
    - Annual debris removal from lake.
    - Spillway – weekly inspection and cleaning as required.
    - Valves – annual inspection and operational check.
    - Fence – monthly inspection and repairs as required.
    - Survey monuments – survey on 5-year cycle.
- City Lake
    - Valves – annual inspection and operational check.
    - Fence – monthly inspection and repairs as required.
    - Buildings and grounds – Fencing, electrical, septic, roofing, painting, and repairs as required.

Maintenance vs. Capital Improvement

Maintenance costs are expenses for routine actions that keep assets in their original condition; these typically fall under maintenance in the operating budget. On the other hand, capital expenditures/ improvements are investments made to increase the value of the asset and benefit the community.

Generally speaking, both routine and preventative maintenance are classified as such if they are performed to restore the asset's physical condition and/or operation to a specified standard, prevent further deterioration, replace or substitute a component at the end of its "useful life," serve as an immediate but temporary repair, or assess ongoing maintenance requirements.

A capital improvement is performed to boost an asset's condition beyond its original or current state. Capital improvements increase an asset's useful function or service capacity, perform a required extension of "useful life," enhance the quality of services, reduce future operating costs, or upgrade essential parts of the asset.

"Useful life" refers to its lifespan – the length of time that a system or piece of equipment is expected to serve its original purpose. Asset components (like its structural, mechanical, and electrical systems) – as well as the asset as a whole – have their own unique useful lives, which can span a wide range of timeframes. Useful life can be affected by a variety of factors, such as wear and tear, environmental effects, obsolescence (technical or commercial), revised compliance and safety regulations, and more. It may or may not correspond with the item's actual physical life or economic life.

Categorizing an expenditure as either maintenance or as a capital expenditure or improvement is a decision that needs to be made each time any type of maintenance, repair or renovation is performed. To get it right, consider the value of the asset, the intended goal of the work to be performed, the scope of work, the actual result and its impact on the asset's value, depreciation, and equity return.

PTPC accounting definitions for capital include threshold of $5,000 for a new item with life of 5 years or more. However, $10,000 would generally be a reasonable cutoff for defining maintenance level projects. Leak repair by definition would not qualify as capital unless it requires sectioning and replacing

pipe. Historically, some leak repairs can cost well in excess of $50,000 depending on whether the repair is done with the water remaining on or not. These leak repairs have been performed by the PTPC in order to prevent shutting the system down. The City defines capital as equipment purchases of $5,000 in one year and projects costing $15,000 with a 5 year pay back. For the purpose of the OGWS, an expenditure of $10,000 with a life of 5 years or more may be a good definition excluding leak repairs.

Deferred Maintenance

Unless brushing work is contracted or handled by the PUD, the level of maintenance is dictated by what can be accomplished by the existing staff using pickup trucks, a small tractor with a loader and brush hog, and various manual and powered hand tools. Much of the spring and summer is spent weed eating but does not undertake areas of the pipeline right of way that have been overgrown with larger trees and shrubs. More mechanized brushing equipment would free up time for maintenance of the mechanical infrastructure. There is also value in the pipeline maintenance crew having access to a backhoe and dump truck to assist with everything from culvert maintenance to leak repairs.

Lords Lake operation

Lords Lake, containing approximately 500 million gallons of water, is typically maintained at full pool level of 34'-6". Drawdown of the reservoir occurs during periods of low stream flow or high turbidity. The diversion system on the Little Quilcene River is operated to supply water to the lake continuously except during turbid river conditions or when stream flows are less than 6 cfs. A 30-inch butterfly valve in the transmission line downstream of the Lords Lake junction allows reservoir filling from the Big Quilcene River by closing the valve. All valves for the reservoir and transmission line are manually operated. The Mill has installed generator for operating lighting and allowing use of a drill motor to operate the outlet gates.

With permission from the Washington State Department of Ecology office of Dam Safety, the reservoir level has occasionally been raised between 1 foot (~25 million gallons) and 2.5 feet (~60 million gallons) during the summer by installing stop logs in the north dam spillway to augment storage for expected drought conditions. Due to the east dam seismic safety concerns, future raising of the lake level is less likely to be approved unless improvements are made to the dam.

Operators perform a daily inspection of the reservoir. Besides routine maintenance and monitoring, dam piezometers and seepage are measured at least monthly.

River diversions and stream flows

Water supply disruption emergencies

- Big Quilcene Diversion
    - The Big Quilcene River is the only reliable source for most of the year to provide an average of 12-14 mgd for typical City and mill operations. Repair urgency for a failure of the diversion or pipeline between the Big Quilcene Diversion and Lords Lake will depend on the volume stored in Lords Lake and City Lake as well as stream flows in the Little Quilcene River. Lords Lake at full capacity will provide approximately 40 days of normal demand and with continued Little Quilcene diversions that could be extended to 70 days.
- Little Quilcene Diversion

    - Little Quilcene River diversions provide up to 6 mgd most of the year for filling and providing freshwater turnover for Lords Lake. Diversions are often restricted between July and October due to low stream flows. Refilling of Lords Lake after the summer drawdown occurs between October and January. Lords Lake can also be augmented by water from the Big Quilcene River via the outlet connection with the transmission pipeline.
- Transmission line between Lords Lake and City Lake
    - Interruption of the pipeline between Lords Lake and City Lake still leaves City Lake storage available, which is usually kept at a full 140,000,000 gallons. City Lake reservoir will provide several days of supply for both City and mill consumption or, for a lengthy transmission line outage, could provide 3-4 months of supply if reserved for municipal use only.
- Transmission line between City Lake and town
    - Major transmission line leaks require shutting off water at City Lake to prevent damage to surrounding properties and State Highway 20, while smaller leaks may be repaired with a repair band clamp or slowed enough to repair when the mill is shut down for other maintenance. A waterline shutdown requires the mill to cease operations, preferably with sufficient lead time to conduct an orderly shutdown, and typically disrupts operations for 24 hours. Municipal water availability will be limited to whatever treated water is in storage at the time, typically 5-6 million gallons, which is generally sufficient for 3-4 days of supply.
- Seasonal Water shortages
    - The City of Port Townsend reserves water in City Lake and/or Lords Lake with the goal to have City Lake at least half full (22’ 6" – 70MG) on November 30th. The Paper Mill will cease production and limit water use to that essential for health and safety (an estimated 1-2 mgd) when Lords Lake is empty or if the volume of water reserved in City Lake for municipal use is reached.

Emergency Repairs

- Small scale repairs
    - Pipeline repairs between the diversions and City Lake are typically dealt with by shutting down the Big Quilcene diversion and/or Lords Lake and replacing the broken air release valve or welding over the leak.
    - Smaller leaks between City Lake and town may be stopped with a repair band or slowed down sufficiently to either weld the leak during a scheduled mill shutdown or may need a repair clamp, which is considered a permanent repair.
    - If the leak can be repaired with a clamp a company specializing in that type of work will have to measure and fabricate the clamp, which requires several days and costs around $50,000. Installation of repair clamps has been paid for by the Mill to avoid the cost of a shutdown.
    - Repair excavation services are typically contracted with a local construction company and paid for by the mill.
- Large uncontrolled leaks between City Lake and town that threaten adjacent properties will usually require a shutdown of the water supply.
    - A shutdown will have financial consequences to the Mill and leaves City customers relying on the volume of water stored in the 1 MG standpipe and 5 MG reservoir until service can be restored.

    - If possible, water shutoff should occur after the Mill has had time to accomplish an orderly shutdown of their operations to minimize the consequences.
    - Most leaks have been able to be resolved with welding the crack or hole. Pipeline crewmembers have often included pipefitters qualified to conduct welding repairs.
- A value engineering study will help to prepare for future emergencies and determine the quantity of spare materials to maintain in storage. Spare materials to have on hand should include:
    - Sections of pipe in sizes 36", 30", 28", 24" and 20" diameter.
    - Air relief valves.
    - Repair bands in sizes 30", 28", 24" and 20".

In the past that has been agreed to by the City and Mill that the Mill would shut down if the volume in the reservoirs reached a certain point. The minimum agreed Mill draw down level has varied depending on time of year and quantity of water remaining in the reservoirs.

- If pipeline failure is upstream of City lake, there is approximately 9 days of available water storage under normal operations. Evaluation of repair time is necessary to determine if Mill shutdown is necessary to maintain municipal water service.
- During an extended water outage the amount necessary to be reserved for City use will depend on the expected duration of the outage and water availability outlook. Since construction of the water treatment facility there is more possibility of drawing City Lake further down as turbidity is not a concern.

Lords Lake Dam Maintenance

Lords Lake reservoir is an enlargement of a natural lake created by two earthfill dams. Classified as high downstream hazard dams due to the potential for loss of human life and/or property damage if the dams were to fail, the DOE Office of Dam Safety conducts routine inspections every five years.

As the owner, Port Townsend is required to evaluate the safety of the dams and all appurtenant works and to make modifications, as become necessary, to reasonably secure safety to life and property. This includes conducting an annual surficial inspection and maintenance of records of findings and actions taken to correct problem conditions. The annual surficial inspections may be conducted by the owner or by agent(s) designated by the owner, or by a professional engineer. Copies of the annual inspection checklist and other finding documents must be submitted to the DOE within thirty days following the completion.

While the dams have been found to be fairly well maintained structures and the North Dam is considered stable, the East Dam has been assessed to have inadequate seismic stability due to liquefaction potential of the lower portion of the embankment during the design earthquake. To assess dam stability, survey monuments are required to be installed along the dam crests and monitored at least every five years. Installation of the monuments is scheduled for 2021. The 2020 DOE inspection also requires retaining the services of an engineering consultant to develop alternatives to improve the stability of the East Dam under seismic loading conditions to ensure the dam meets the minimum stability requirements as per the dam safety guidelines. Conducting the engineering evaluation is planned for 2022.

The City is required to develop and maintain an Operations and Maintenance manual and Emergency Action Plan (EAP). The O&M outlines responsibilities along with monitoring and maintenance

requirements of the dams and reservoir facilities. The EAP documents procedures for responding to unusual or emergency situations. Both the O&M manual and EAP must be updated within 180 days after a periodic inspection has been completed by the DOE. Regular upkeep of the dams and spillway clearance are necessary to safely operate the reservoir.

Easement right-of-way maintenance

Most of the transmission pipeline is located on private property with a typical 30-foot easement granting access for maintenance of the line. Clearing and brushing are necessary for access and to prevent roots or falling debris from potentially damaging the pipeline. Encroachment on the easement with fences and buildings hinders access in some of the more developed areas and could lead to unintentional damage to the pipeline. Most of the right of way crosses commercial timberland. Logging operators need to be informed of the pipeline location and ensure proper cover of the pipeline for their activities. Monitoring Forest Practice applications is the principal method of tracking proposed logging activities. Development of private properties along the transmission line requires that the City be notified by Jefferson County for potential encroachments.

USFS road maintenance

Road maintenance within the National Forest is primarily a Forest Service responsibility. As the permittee, the City is responsible for the diversions and pipeline access roads commensurate with related use. The road management plan between the City and Forest Service and calculation of provided services is updated annually. Using limited equipment and funding for road maintenance, Mill employees assist with some pothole filling, roadside brushing and culvert clearing along the transmission line right of way. Storm damage and diversion repair work has occasionally provided additional funds for major road maintenance projects.

Cathodic Protection

Cathodic protection (CP) inspection of the transmission line is conducted annually by contractors specializing in corrosion protection and is paid for by PTPC. Previous surveys have determined that the pipeline is not adequately protected at most locations tested and influence from the CP system ends on the upstream section of the pipeline near Lords Lake. The OGWS pipeline needs additional rectifiers/anode beds installed to establish adequate protection in areas with little or no corrosion protection. However, prior to upgrading the CP system, an electrical short connecting the transmission line to the Mill piping needs to be located and removed.

Fencing Repairs

Fencing around critical water system infrastructure is necessary to provide a measure of security, particularly considering the level of staffing. Forested areas around the reservoirs create an ongoing maintenance problem with trees damaging and making it more difficult to monitor the condition of the fencing. The fencing is also often compromised by intruders seeking access to the reservoirs. Small repairs are handled by the pipeline crew on as needed basis while larger repairs are contracted out by the mill. Most repairs have been considered an annual maintenance expense. Windstorms which damage large sections of fencing have been considered “an act of God” under the current contract.

Security

Pipeline crew members visit the diversions and reservoirs at least once per day. However, the reservoirs are an attractive nuisance, and it is an ongoing problem to repair damage from vandalism. Trespassing

at Lords Lake is a particular problem due to its isolation and lack of a fulltime caretaker. Additional remote monitoring and stepped-up prosecution is needed to curtail the problem.

Desire for a public access trail along the pipeline right of way and through City owned property at City Lake would create additional security problems. Protection of the municipal water supply would require hardening access points to the pipeline such as valve boxes, installing better fencing/barriers and having more intrusion detection measures around City Lake. In addition to the capital cost for installation, there would be higher ongoing annual costs to maintain these security measures.

Both diversions and Lords Lake facility controls are manually actuated requiring physical access to operate these parts of the water system. City Lake operation is SCADA controlled, necessitating additional cyber security measures to prevent malicious activities that could threaten operation of the system. The City of Port Townsend implements SCADA security measures and permits Mill pipeline crew members limited online access for monitoring purposes. Operations should include a periodic review of physical and cyber security requirements.

Permitting

Operation of the OGWS is contingent on the US Forest Service Special Use Permit approval for the diversion facilities on the Big Quilcene River, Little Quilcene River, and portions of the transmission pipeline that are located on Forest Service property. The National Forest is administered for various renewable resources including water but must consider the sustainability of other resources including wildlife. Current FS permitting for the Big Quilcene diversion pipeline mandates the maintenance of an instream flow of 27 cfs below the diversion if naturally available. Balancing of the relative values of the various resources may dictate future permit conditions, such as changes to the maintenance of minimum instream flows. The three Special Use Permits issued to the City by the Forest Service in 2009 expire on 12/31/2029. Discussion for the renewal process should be started with the FS 2-3 years prior. The 2009 renewal process cost approximately $400,000 for various studies and reviews.

Watershed Protection

In coordination with other local, State and Federal agencies, Port Townsend monitors and manages activities to prevent or minimize threats to source water quality. As the OGWS operator, PTPC monitors activities and water quality trends daily, particularly around the critical headwork facilities, transmission pipeline and reservoirs. Staffing shortages and budget cuts at the Forest Service have reduced watershed monitoring by the Federal government. In order to maintain a minimum level of monitoring and control, entities such as the City will have to increase watershed patrols or develop alternative cost sharing agreements.

Operational Changes Analysis

Transmission pipeline operational deficiencies:

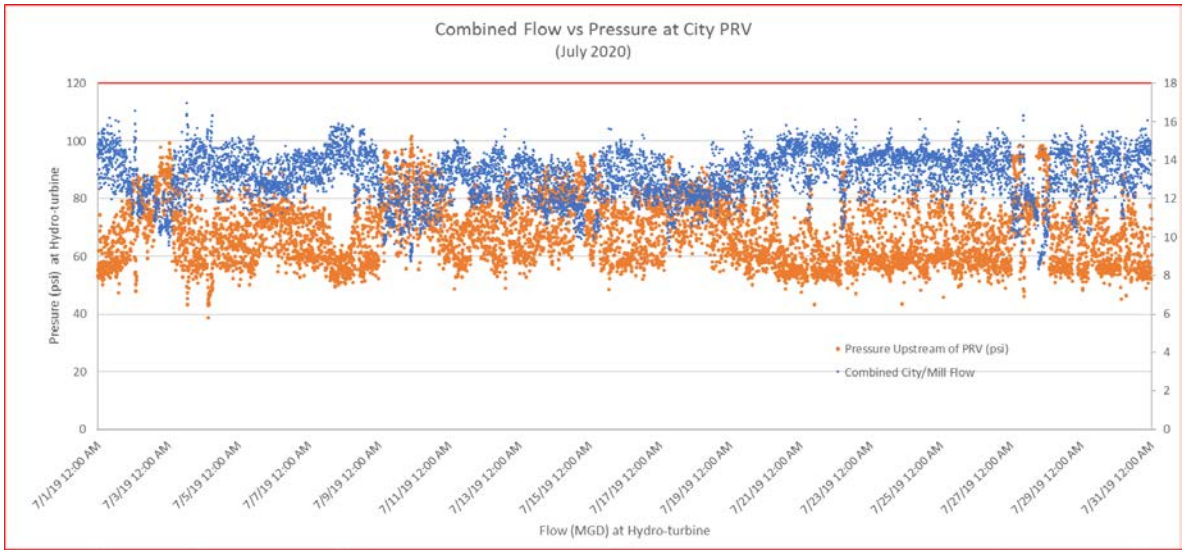
During certain times of the year or when demand of both the City and the Paper Mill are at their highest, the inlet pressure to the City's Water Treatment Facility declines below the threshold required for plant operation. In order to achieve the 4.5 mgd maximum treated water capacity of the treatment plant, the plant's inlet PRV must be set to 65 psi or higher. If the inlet for the PRV is operating at less than 10 psi pressure differential the PRV ceases functioning and the outlet pressure matches the inlet pressure until the 10-psi pressure differential and valve operating water cover are regained, which is often 10-20

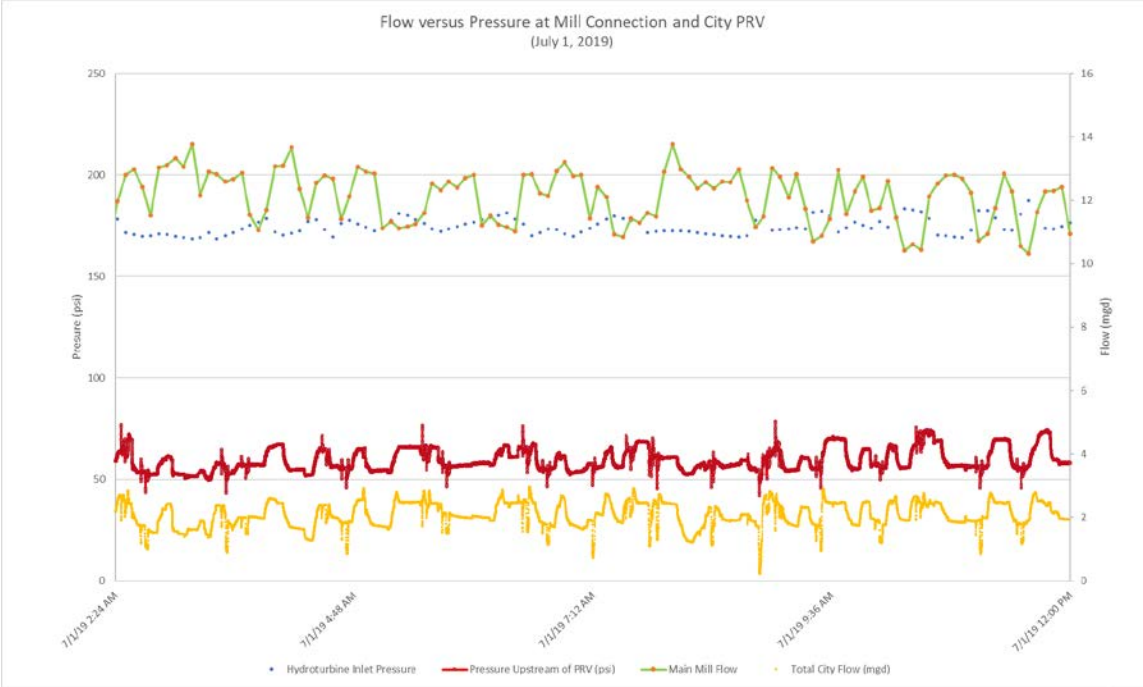
minutes. If flows in the transmission line exceed 14 mgd, pressure declines below 65 psi at the raw water inlet to the treatment plant as a result of friction loss in the pipeline near City Lake. The following plots illustrate the scenarios of when pressure loss is a problem. The effect of this pressure loss can be an automatic shutdown of the city's treatment facility. This is particularly problematic in the summertime when city demand is higher and mill cooling water consumption rises due to the warmer feed water.

Reducing the treatment plant PRV pressure setting acts to partially stabilize plant operation at a lower flow set point. However, this may not be sufficient to produce treated water for higher demand days or boost flow during a fire or waterline break to prevent loss of distribution system pressure. Even at lower pressure settings large fluctuations in mill consumption can still trip the plant offline.

Finished water reservoir storage allows for some variation in water production. Declining storage will result in a reduction of distribution system pressure and compromise emergency storage requirements. Throttling the plant production back or shutting it down overnight reduces the chances that a manual reset is required but this is when refilling the reservoirs typically occurs in conjunction with reduced water demand. Future City growth or resumption of water service to the Tri Area will aggravate the pressure issue at the treatment plant.

The Paper Mill hog fuel boiler requires flushing every 2-4 hours with a flush volume of approximately 1000 gpm for 5-10 minutes. These periodic flushes are the likely cause of the short-term increase in pipeline flow that results in pressure drops at the treatment plant. The following figure illustrates volatility in flow rates throughout the day.





The following table illustrates min and max flows as pressures on a 5 min increment basis.

	June	July	August	September	October	November	December	January	February	March	April	May
Instantaneous Data (5 min. Samples)												
Ave Pressure	183.67	182.89	187.38	189.94	206.51	209.65	191.92	190.32	192.18	191.73	188.89	188.79
Min Pressure	160.80	158.22	130.68	165.25	115.50	67.51	157.23	150.60	150.82	154.23	160.50	157.76
Max Pressure	220.72	213.26	215.61	216.54	241.58	237.23	217.78	218.03	226.84	225.68	216.40	217.67
Ave Flow	11.79	11.73	10.88	11.00	7.81	8.32	11.27	11.59	11.38	11.27	11.42	11.08
Min Flow	6.25	8.11	6.21	7.52	(0.02)	2.07	7.71	7.44	4.53	5.82	7.90	6.65
Max Flow	15.15	15.71	14.27	13.85	14.24	13.40	15.69	16.79	15.32	16.15	14.93	15.25

The following table illustrates min and max flows and pressures on an hourly basis

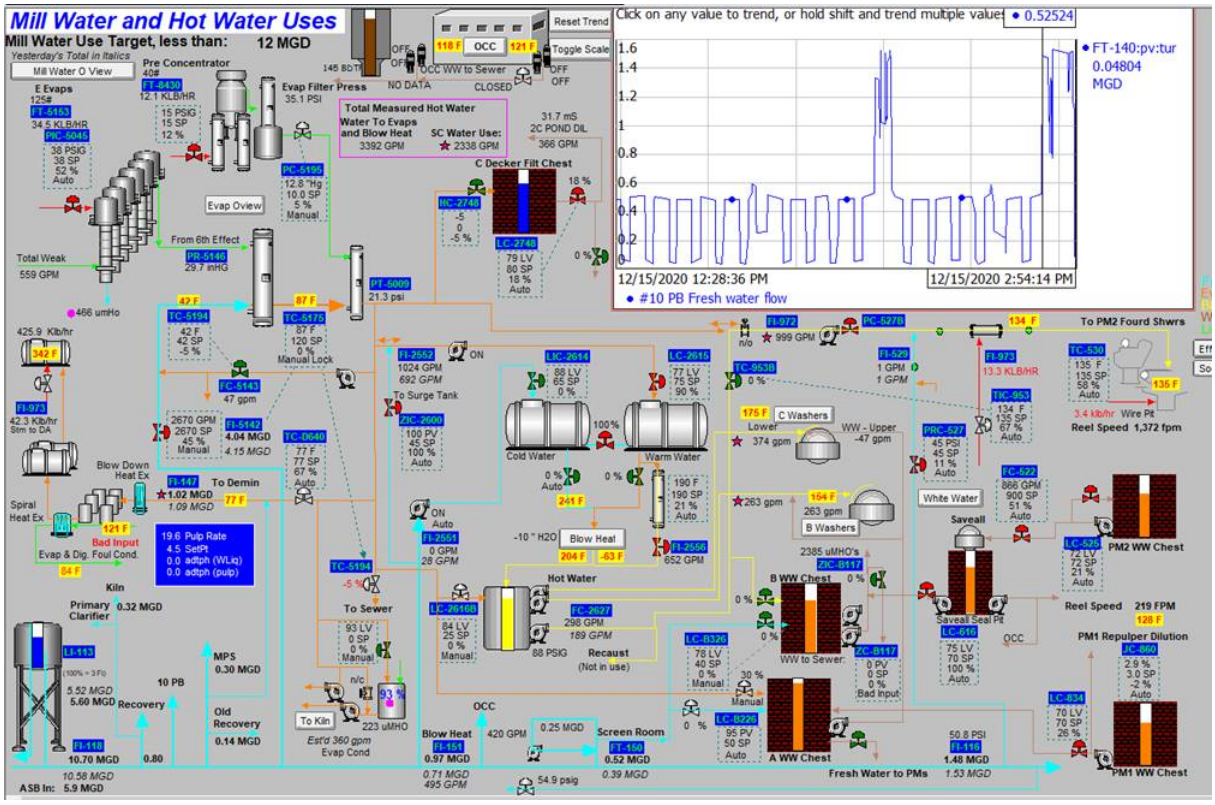
	June	July	August	September	October	November	December	January	February	March	April	May
1-hr Data												
Median Pressure	182.59	181.54	188.09	189.86	194.50	208.09	191.44	190.67	191.96	190.91	187.73	187.89
Min Pressure	167.73	159.56	157.94	168.28	168.96	71.80	163.08	166.89	161.08	171.32	171.63	171.30
Max Pressure	216.88	211.20	209.32	211.83	239.30	234.79	212.37	217.78	222.94	222.65	212.70	214.51
Median Flow	11.94	11.91	10.96	10.98	10.71	8.92	11.40	11.51	11.42	11.45	11.57	11.20
Min Flow	6.72	8.46	6.63	8.05	(0.02)	2.38	8.42	7.94	4.71	6.19	8.31	7.55
Max Flow	14.14	14.22	13.25	13.50	13.23	12.06	14.51	14.96	13.73	13.75	13.39	13.24

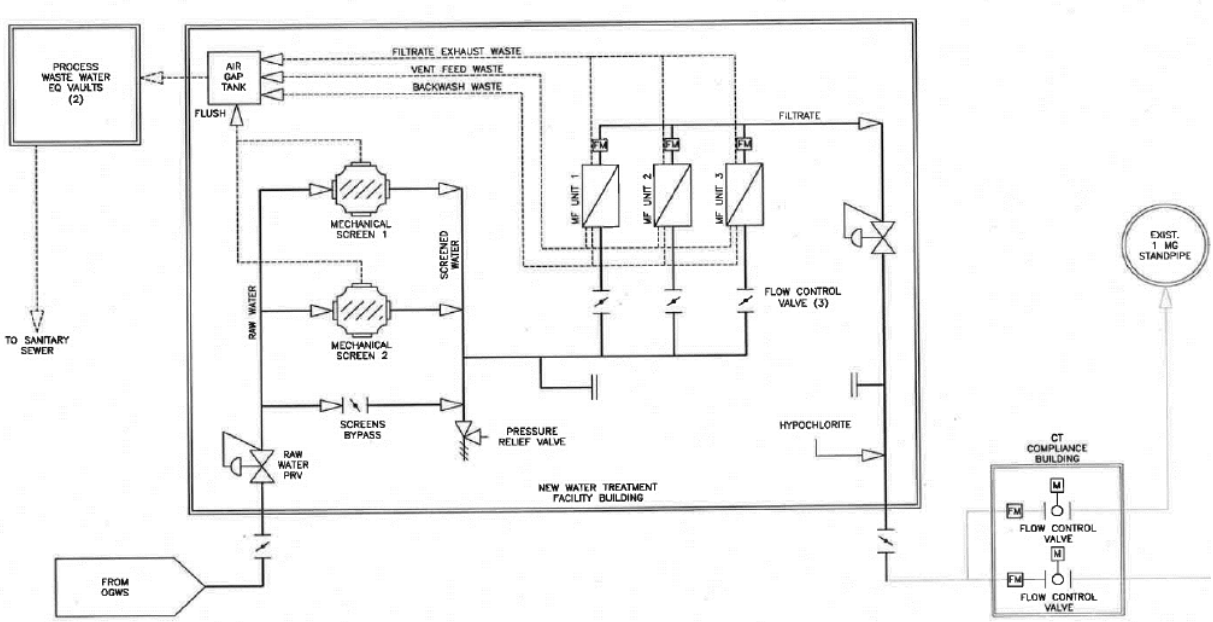
The following table illustrates min and max flows as pressures on a daily basis

	June	July	August	September	October	November	December	January	February	March	April	May
Average Day Data												
Median Pressure (psig)	182.82	181.89	187.90	190.59	191.92	206.80	190.39	191.11	191.58	190.81	187.68	188.30
Min Pressure	177.37	173.54	172.21	178.65	183.88	177.30	177.23	178.73	185.46	184.07	182.46	180.98
Max Pressure	201.95	197.18	200.08	201.10	238.17	232.26	205.86	205.43	205.31	212.35	204.90	203.86
Mill Average Flow (MGD	11.77	11.73	10.90	10.98	7.96	8.20	11.23	11.60	11.37	11.27	11.43	11.06
Mill Median Flow (MGD	11.86	11.94	11.02	10.89	10.95	9.06	11.47	11.50	11.40	11.46	11.58	11.16
Mill Min Flow	9.31	10.07	7.70	9.61	(0.00)	2.37	9.22	9.82	10.01	8.24	9.43	9.09
Mill Max Flow	12.62	12.68	12.20	11.98	11.84	10.16	13.20	13.49	12.13	12.29	12.24	12.04
Mill Volume (MG)	353.0	363.7	337.9	329.5	246.8	245.9	348.0	359.7	329.8	349.5	342.9	343.0
City Average Flow (MGD	1.40	1.49	1.52	1.09	0.86	0.80	0.76	0.75	0.74	0.78	0.91	1.03
City Median Flow (MGD	1.36	1.50	1.46	1.05	0.85	0.83	0.75	0.74	0.75	0.75	0.89	1.02
City Min Flow	1.06	1.06	1.09	0.72	0.62	0.58	0.61	0.24	0.57	0.74	0.74	0.77
City Max Flow	1.75	1.98	2.18	1.58	1.01	1.00	0.97	1.44	0.86	0.86	1.16	1.67
City Volume (MG)	42.1	46.2	47.2	32.6	26.6	24.1	23.4	23.2	21.5	24.1	27.2	31.9
Combined Average Flov	13.17	13.22	12.42	12.07	8.82	9.00	11.98	12.35	12.11	12.05	12.34	12.09
Combined Median Flow	13.22	13.44	12.48	11.93	11.80	9.89	12.22	12.24	12.15	12.21	12.48	12.18
Combined Volume (MG	395.1	409.9	385.1	362.1	273.3	270.0	371.5	383.0	351.3	373.6	370.1	374.9
Annual Volume Mill	3,950	MG	12,122.08	Acre-ft								
Annual Volume City	370	MG	1,135.81	Acre-ft								
Annual Volume Combir	4,320	MG	13,257.89	Acre-ft								

The above analysis for June 2019 through May 2020 illustrates the how the min and max conditions greatly average out over a 24-hour period compared to instantaneous conditions.

The illustrations below are a representation of the both the City and Mill plant operational schematics respectively for reference.





Several potential solutions have been identified to help remedy the treatment plant pressure operational deficiency.

1. Create increased storage at the PTPC for batch flushing operations. This would require minimum 15-20,000 gallon sized tank, high-capacity pump, and associated piping. Cost for this option needs further study.
2. Upsize the 6,100 foot section of 24" steel downstream of the City Lake screens. Possible opportunity to include pipeline replacement with ODT trail construction grants. Cost estimate of $4.7 million in today's dollars.
3. Throttle flows at the Mill with a back pressure sustaining valve. Throttling flows may not be a viable solution without an operational change within the Mil. and would require an engineering study with substantial capital outlays.
4. Add a booster pump at the headworks of the Water Treatment Facility. Cost for this option needs further study.

The operational pressure issue requires ensuring that future upgrades at the Mill take into account water availability from the standpoint of pipeline capacity.

Pipeline Reliability

As discussed in the assets white paper, reliability is the key requirement for the Mill. The Mill cannot afford more than a 10-minute disruption to flow without having to shut down the boilers. Restarting the boilers is a 24-hour process. At the current production rate of the Mill, this would result in 1,100 tons of lost production over a 24-hour period. Production startup normally begins 24 hours after the pipeline is operational again. The lost opportunity in terms of expenses and lost revenues for being down is $600,000 per day in today's market.

Cathodic System

The cathodic protection system requires an annual inspection and testing to ensure all of the components are functioning property. This work includes a visual inspection of equipment, recording rectifier electrical measurements and measuring structure-to-soil potential at representative test locations for the purpose of evaluating the level of cathodic protection being received. This contracted service costs $8000.

Lords Lake Dam Earthquake Retrofit

The Lords Lake East Dam is considered to be in poor condition based on the dam not meeting the current minimum stability requirements under seismic loading. This condition assessment is in line with the system used by the National Inventory of Dams to classify dams with a dam safety deficiency recognized for loading conditions which may realistically occur, and remedial action is necessary. The Washington State Department of Dam Safety is requiring that an engineer develop alternatives to improve the stability of the East Dam under seismic loading conditions to ensure the dam meets the minimum stability requirements as per the dam safety guidelines; and, to reduce earthquake-induced embankment deformations to minimize the risks of an uncontrolled release of the reservoir contents. The engineering evaluation is planned for 2022.

Operational Efficiencies

Manual control of the water system, equipment shortfalls, and lack of automated monitoring capability has led to excessive time spent in hands-on operation and commuting between facilities. Capital improvements that would provide time and possible future cost savings include:

- Automated control valves at the Big Quilcene Diversion, Little Quilcene Diversion, and Lords Lake. This would allow an operator to remotely make adjustments and avoid having to commute between facilities.
- Telemetry for remote monitoring of the Little Quilcene River stream flow.
- Telemetry for Big and Little Quilcene diversion meter monitoring.
- Remote security system monitoring of diversions, Lords Lake and City Lake facilities.
- Automated screen cleaning of Big and Little Quilcene diversions.
- Brush mower for clearing of rights-of-way and Lords Lake dams.

Projected Operations and Maintenance Costs

Based on standard of care identified in this white paper, a projected annual operations and maintenance is provided. This budget assumes continued operations and maintenance being provided by the PTPC with the City providing oversight, regulatory compliance, financial management and watershed management.

OGWS Projected Operations and Maintenance Proforma			
	Description	Annual Cost	Subtotal
PTPC Costs for Operations			$415,700
	Labor (3 FTEs)	$ 275,000	
	Care taker housing	$ 12,000	
	Equipment & Supplies	$ 72,000	
	Leases	$ 21,000	
	Fuel	$ 15,000	
	Phones	$ 3,700	
	Contract maintenance	$ 17,000	
Increased Cost to meet Standard of Care			$ 40,000
	Brushing	$ 10,000	
	Roads	$ 10,000	
	Valve Boxes	$ 5,000	
	Culverts	$ 5,000	
	Security	$ 5,000	
	Cathodic Surveys	$ 5,000	
Emergency Repairs			$ 60,000
	Supplies	$ 30,000	
	Hired Labor	$ 30,000	
City Watershed Management			$102,000
	Labor	$ 70,000	
	Supplies/Equipment	$ 5,000	
	Permits and Environmental Monitoring	$ 27,000	
City Administration/Fees		$ 200,000	$200,000
		Total	$817,700

The total operations and maintenance cost per year going forward is estimated at $818,000 in 2021 dollars. Typically, O&M costs are indexed to inflation when analyzing utility rates. The operational costs provided here will be inserted into a financial model to help establish the cost of water when combined in the capital investments projected in the Capital Plan.

Conclusion

This white paper demonstrates that costs for O&M looking forward are expected to increase based on a standard of care and work necessary to support long-term investment in the system. This white paper assumes the PTPC will continue to operate the system and the City will continue to provide oversight and watershed management based on the ability for the Mill to operate the system more cost effectively and, most importantly, based on the Mill's need for reliability to offset lost opportunity costs due to Mill down time. In a new partnership agreement, collaboration will be the key especially with the inclusion of large capital replacement projects. The costs for both parties will need to be monitored and evaluated throughout the term of the agreement.

References

1. 2009 Big Quilcene Special Use Permit
2. 2009 Big Quilcene Residence Special Use Permit
3. 2009 Little Quilcene Special Use Permit
4. Mill Pressure and Flow Data Spreadsheets
5. Lords Lake Level and Diversions Multi-Year Summary 1992-2020
6. Olympic Gravity Water System Operating Manual (3-31-20)