

BEAVER CREEK WATER SYSTEM

ANNUAL REPORT
2022



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1.0 Background

Purpose of the Annual Report

This annual report provides an overview of the Alberni-Clayoquot Regional District's (ACRD) Beaver Creek Water System. It is the ACRD's responsibility to the community and provincial health authority to share this information. This report is for the water consumers to review their individual water systems to be aware of the service provided and of the annual activities.

Regulating Authority

The Province of British Columbia's Drinking Water Protection Act and Regulation prescribes the required performance of drinking water suppliers. The Island Health Authority (IH) is the body that oversees water systems in the ACRD, with the mission to minimize health risks to the public and to assist with providing safe drinking water to our communities. As part of IH regulations, water systems are required to have operators qualified by the Environmental Operators Certification Program to the same classification level as the system.

Management

The ACRD's Community Services Department is responsible for the overall management of the Beaver Creek Water System. The Beaver Creek Water System has an advisory committee made up of the Beaver Creek Electoral Director and volunteer members from the community. This committee provides guidance and advice to the ACRD management regarding infrastructure improvements, bylaws, and costs.

Beaver Creek Water System Overview

Beaver Creek is a community of 2,946 (2021 Census) which borders the City of Port Alberni (CPA) on the south, the Beaufort Electoral Area on the north and east, and the Sproat Lake Electoral Area on the west. The Stamp and Somass Rivers form the western boundary of Beaver Creek. The Beaver Creek Improvement District converted into a local service area of the ACRD on June 1st, 2012.

The majority of the Beaver Creek Water System was constructed in the 1960's. The watermains were originally constructed with asbestos cement pipe and more recent improvements with polyvinyl pipe (PVC). Historically, the source water was from the Stamp River, but it is now from the CPA through a bulk water agreement. The CPA's water is treated with chlorine and enters Beaver Creek at the Strick Road Booster Pump station where it is rechlorinated and distributed.

The water system is certified by the Environmental Operators Certificate Program (EOCP) as a Level Two Water Distribution System. There are three full time staff members that maintain and operate the system with two certified as Level 2 Operators and the other as Level 1.

The Beaver Creek Water System includes:

- Concrete reservoir on Kitsuksis Road, Volume of 1,135 cubic meters
- Bolted steel reservoir on Beaver Creek Road, Volume of 273 cubic meters
- Glass fused reservoir on Kitsuksis Road, Volume of 1,135 cubic meters
- Strick Road Pump Station
- Darnley Road Pump Station
- North Reservoir Pump Station
- Stamp River Pump Station and Intake (currently not active)
- Number of Services (Customers): 1,065 (7 new connections in 2022)
- Number of water parcels: 1,052
- Population: 2,946 (BC Stats 2021)
- Total length of mains: 45 kilometers
- Total number of fire hydrants: 122
- The majority (52%) of the distribution system is Asbestos Cement (AC)
- The total bulk water consumption was for 2022: 406,734 cubic meters
- The average daily flow for 2022: 1,114 cubic meters

2.0 Goal and Targets

*It is our mission to provide potable, cost effective and reliable drinking water
Through continuous improvements*

In order to achieve this mission, measurable targets for potability, cost-effectiveness, and reliability have been set.

Potable Targets:

- 1) No E. coli, no total coliform in any water samples
- 2) Minimum 0.20 mg/L chlorine residual throughout the distribution system
- 3) Less than 1 NTU turbidity in the water
- 4) Meet the Canadian Drinking Water Quality Guidelines for all parameters (including DBPs)

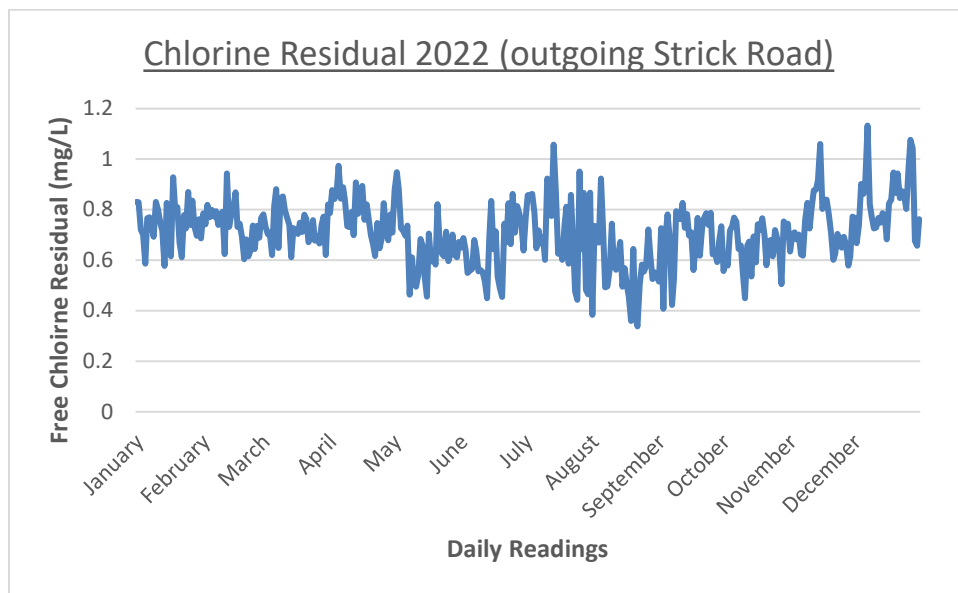
Regular potability sampling of drinking water is conducted for physical, chemical, and biological parameters. This sampling is to ensure that the drinking water meets the Canadian Drinking Water Quality Guidelines and is safe to drink. Each water system is provided with an Operational Certificate by IH that may outline specific testing and frequency requirements.

Potable Target 1 – No E. coli and No Total Coliform in any water samples

Bacteria testing is performed once a week at multiple locations for Total Coliforms and Fecal Coliforms (E. coli). The locations are spread throughout the distribution system for broad representation. The Total Coliforms and Fecal Coliforms are tested as they are good indicator organisms. Indicator organisms are easy and inexpensive to test for, can be correlated with the potential contamination level and are not present in unpolluted waters. IH’s Facility Sampling History shows that most of the samples taken in 2022 tested negative for Total Coliforms and E. coli. Only one sample contained “one coliform” in July but sampling error was suspected in this case.

Potable Target 2 - Minimum 0.20 mg/L Chlorine Residual

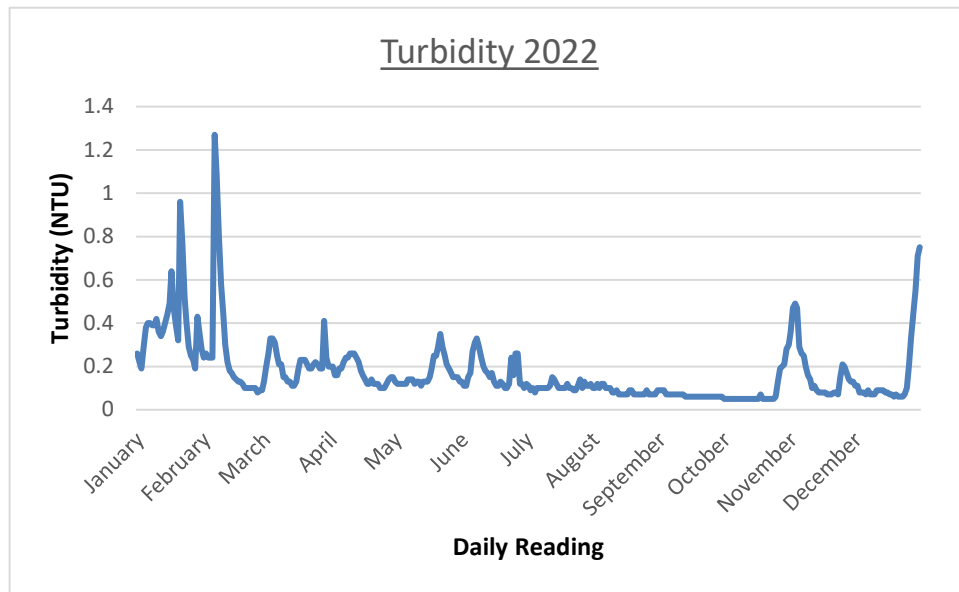
To ensure good water quality throughout the distribution system, water mains are regularly flushed to remove any accumulated silt by creating an increase in velocity to scour the pipes. As water flows within a distribution system, the chlorine is slowly eaten up by organics in the water or any material built up in the pipes. Residual chlorine is an immediate test to measure if the water is safe to drink. While water without a chlorine residual is not necessarily unsafe, other tests to ensure safety (such as bacterial testing) require 3 to 4 days for results. Low to no chlorine residual in the water system can indicate poor circulation of water and a need to increase flushing. The Chlorine graph below illustrates the chlorine residual as it exits the Strick Road Pump House and enters the water system.



The water system operators continually check the free chlorine disinfection levels with the aim to keep the free chlorine levels between 0.4 mg/l and 0.6 mg/l in the reservoirs and 0.2 mg/l at all the ends of the distribution system. Winter months see a more consistent chlorine residuals than the summer as the chlorine reacts faster with the warmer water and higher flow rates.

Potable Target 3 - Less than 1 NTU Turbidity in the water

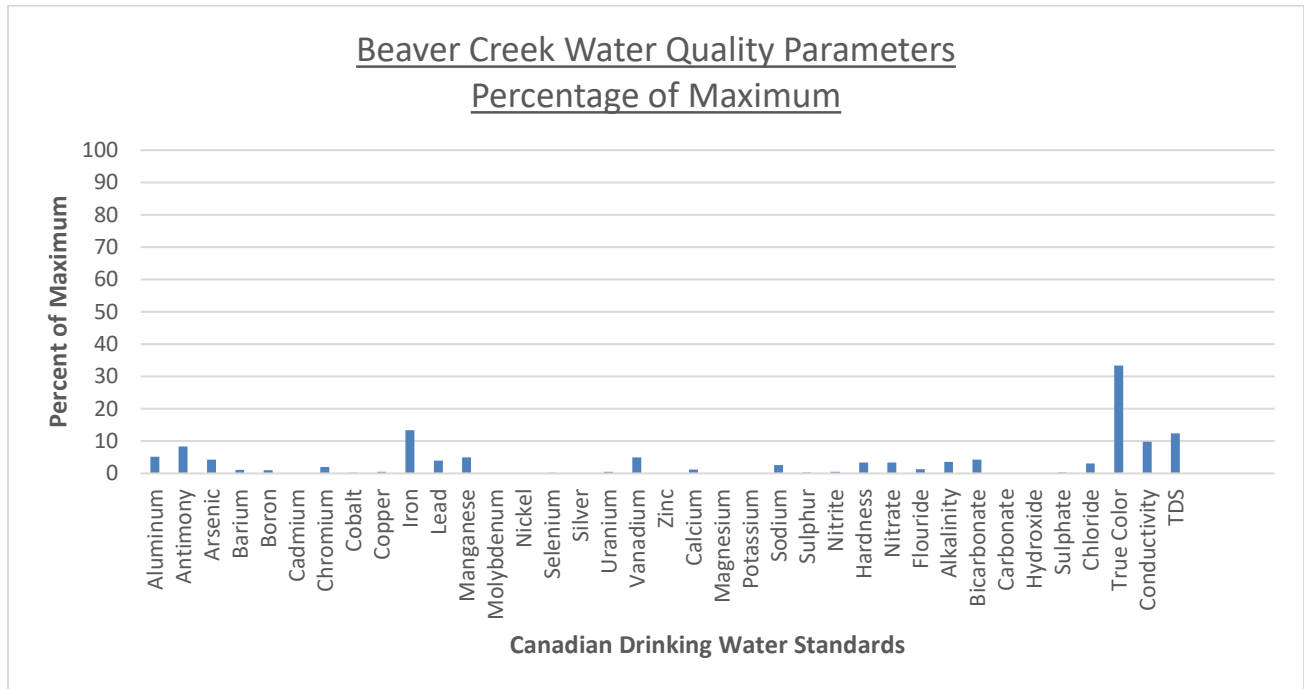
Turbidity is the cloudiness or haziness of a fluid caused by particles in the water. It is often increased in lakes and rivers after a heavy rain when soils enter the water body. This parameter is continually monitored as it negatively effects the ability of chlorine to disinfect.



The turbidity readings are taken from the Strick Road Pump Station as water enters the system. The turbidity can have some variability due to events in the City’s water system such as water line breaks or source water changes. Breaks cause high velocity water flows and changes in normal flow patterns that pick up the accumulated silt. This is the reason that proper water main flushing techniques are used to avoid high turbidity events. The higher turbidity reading in February of 2022 was due to three days of high rainfall, following three weeks of little to no precipitation. High rainfall events during the winter months can cause high turbidity events as sediment in the surrounding mountains enter the source water. In the event of high turbidity entering the system, the automation in the pump house can stop pumping to protect the system. China Creek, the main source of water, has low dissolved organics and turbidity for the majority of the year. However, during heavy rain events, the turbidity increases above the maximum acceptable limit of 1 NTU, requiring the use of the back-up water source, Bainbridge Lake.

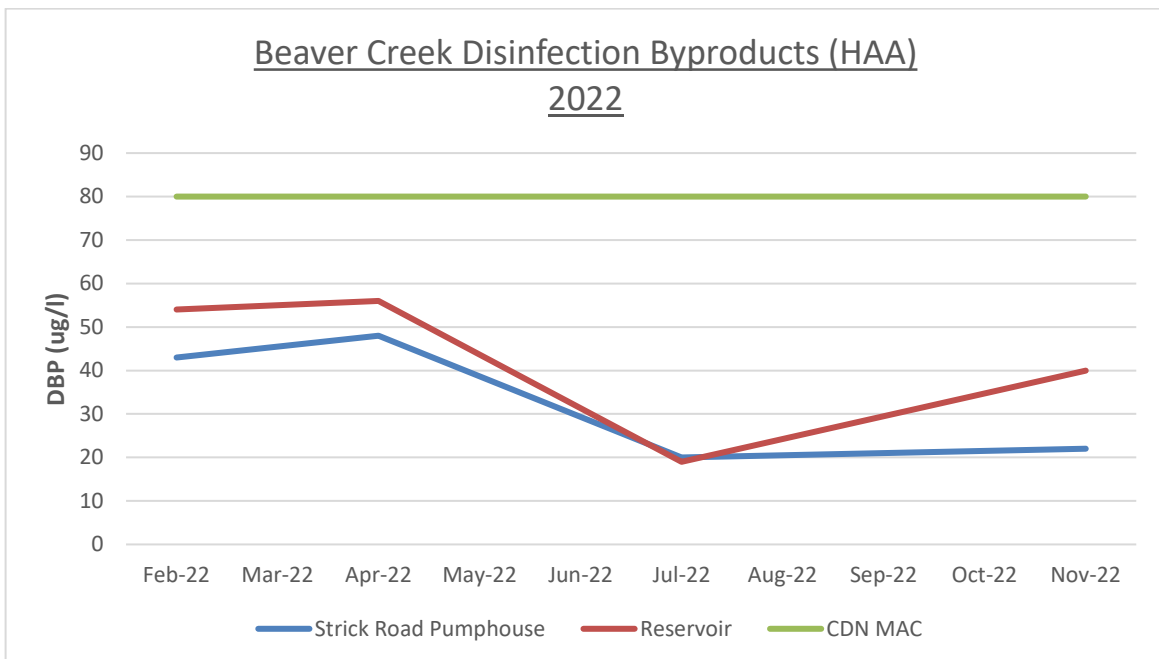
Potable Target 4 - Meet the Drinking Water Quality Guidelines

The ACRD regularly performs tests to ensure that water in the system meets or exceeds the Canadian Guidelines for Drinking Water Quality (CDWQG). The most recent water sampling testing results are shown in the graph below. There are over 40 parameters in the guidelines, all of which were met in the most recent complete sampling event.



The Total Haloacetic Acids maximum acceptable concentrations (MAC) by the Canadian Drinking Water Guidelines (CDWQG) are 80 ug/L based on a running average of a minimum quarterly sampling. The 2022 values obtained at the reservoirs and pump house were all under the MAC running average.

The two CDWQG parameters for disinfection byproducts are Trihalomethanes (THM) and Haloacetic acids (HAA). In 2022 the results show these levels well under the guidelines. Disinfection byproducts occur when chlorine combines with dissolved organics from the water source.



Cost-Effective Targets:

- 1) Average Water Demand less than 350 lpcd
- 2) Peak Demand Ratio of less than 2:1 PDD:ADD
- 3) O&M cost per customer less than \$400

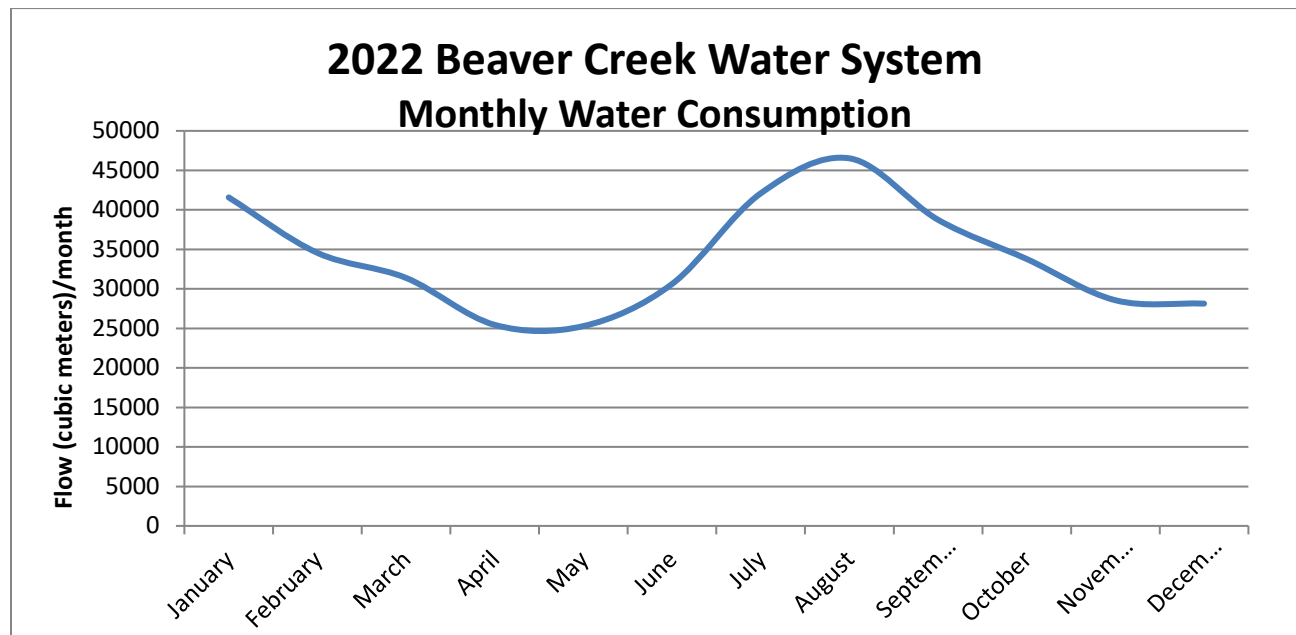
There are many factors that affect how cost effective a system is running. Effective management and planning, bulk water purchase and water demands can all affect system costs.

Cost Effective Target 1 - Average Water Demand less than 350 lpcd

The BCWS purchases bulk water from the City of Port Alberni at \$0.48/m³. It must also treat and distribute water to meet the demands of the system. With a service area population of 2,946 and the total water consumption of 406,734 m³, this produces a daily average of 378 liters per person per day (lpcd). This is just above the target of 350 lpcd and lower than last year's daily average at 382 lpcd but well below the 2016 UBC Survey's provincial average of 494 lpcd. We will want to continue attempt to reduce the water demand in 2023, and will investigate ways to do so, including a possible reduction in the current allowable volume for the base water rates.

Cost Effective Target 2 - Peak Demand Ratio of less than 2:1 PDD:ADD

A water system must be designed to provide the peak water demand and fire flows. If peak demands are excessively high, then the water pipes are required to be oversized which is expensive and causes operational challenges in keeping water fresh in the lower flow time periods. Peak summer demand is approximately 1,296 m³/day compared to the average daily demand of approximately 1,114 m³/day. This is approximately 1.16 to 1 ratio of peak to average demand. This is under the target of 2:1.



Cost Effective Target 3 - O&M cost per customer less than \$400

In 2022, the total operating costs for the system were \$614,229; this excludes capital costs, bulk water costs and costs to install new services. Divided by the 1065 water services (customers), this results in a cost of \$577 per customer. This increase in operating costs is reasonable and expected with increased services on

the system and the economic climate we saw in 2022.

Reliability Targets:

- 1) Unaccounted water loss to be less than 15%.
- 2) Maximum # of breaks less than 5/year.
- 3) Annual contribution to capital meets AMP targets of \$768/year

Reliability Target 1 – Unaccounted water loss to be less than 15%.

In 2022, the City of Port Alberni provided 406,734 cubic meters of water to Beaver Creek through a metered bulk water agreement. The total water consumed in Beaver Creek through all customer water meters for 2022 was 281,475 m³. The non-revenue water is the difference between the total water entering the system and the total of all customer meter readings, which was 125,260 m³ or 31%. The resulting unaccounted water loss is calculated by subtracting from the non-revenue water the known volume of water used by water main flushing, analyzer use and by the fire department. For 2022 the unaccounted water was calculated to be 101,628 m³, which made up 25% of all water entering the system. The total unaccounted water loss is lower slightly from 27% in 2021. This loss can be attributed to various factors such as meter error, watermain breaks, unauthorized consumption, and leaks. This also means that the non-revenue water of 125,260 m³ cubic meters of water was purchased from the city and generated no revenue, at a cost of \$60,125.

Reliability Target 2 - Maximum # of breaks less than 5/year.

In 2022, the BCWS had four watermain breaks and one service line repair, compared to four and nine respectively in 2021. The work done through the watermain replacement program over the past five years has begun to show value within the system. While any system will have breaks, the effective capital replacement program has reduced these, and thus reduced emergency repair costs throughout the system. Operating the pumps and subsequently increasing pressure during the night results in an increased likelihood of breaks as water consumption is at its lowest. Therefore, all efforts are made to operate the pumps and fill the reservoirs during higher consumption periods.

Reliability Target 3 – Annual contribution to capital meets AMP targets

The first version of the Beaver Creek Water System Asset Management Plan (AMP) was adopted in 2019. This is a long-term replacement plan to ensure that we are renewing our infrastructure to minimize service interruption, risks, and overall costs. The plan has assessed the age and condition of all of the system's assets to determine the replacement costs and schedule to calculate an annual amount that is required to be invested in capital infrastructure. This target will inform us to whether we are collecting enough money to proactively replace failing infrastructure. Replacement costs can be offset through the savings in the reduction in non-revenue water loss and a reduction in corrective and emergency repair costs.

In 2022 there were 1,052 water parcels contributing \$405,023 towards capital. This works out to be \$385 per parcel. Based on the Asset Management Plan required funding for future renewal the per parcel rate needs to be \$768 (in 2019 dollars, without inflation included).

Summary of Target Results for 2022

All of the water quality targets continued to be met throughout the year. Average daily demand has decreased to 378 liters per capita per day (lpcd) from 382 lpcd in 2021, which is getting us closer to the target of 350 lpcd.

The cost per customer rose in 2022 to \$577 per customer, from \$533 per customer in 2021 and \$556 per customer in 2020. This increase can be attributed to additional staff salary costs, and general inflationary costs that were felt amongst all services. Given the economic climate, this increase is less than expected and speaks to the effective job the operations team did in 2022. Unaccounted for water loss decreased from 27% in 2021 to 25% for 2022. The number of water breaks decreased from 13 in 2021 to 5 in 2022. The target for contribution to the Capital Reserve was established at \$768 per parcel but the system fell short at only \$385 per parcel.

	Target	2022 BCWS
Bacteria Results	0	0
Chlorine Residual	> 0.20 mg/l	> 0.20 mg/l
Turbidity	< 1.0 NTU	<1.0 NTU
CDWQG	< 100%	100%
Average Demand	< 350	378
Peak Demand Ratio	< 2	1.16
Cost per customer	\$300-\$400	\$577
Capital Contribution	\$768	\$385
Water Loss	< 15%	25%
Breaks	< 5	4

3.0 Improvement Plan

2022 Projects Completed

Uni-directional Flushing Program

This newly developed program was implemented and completed in the spring of this year. This was essential to help improve water quality within the water mains, including valves and hydrants. The method of flushing creates a high velocity of flow that scours out any sediment and bacterial growth. The Uni-Directional program flushes dirty water in one direction, and then out through a hydrant. This program will continue as a key component of annual maintenance practices within the Beaver Creek Water System.

Karen Place Watermain Replacement

The Karen Place watermain replacement project went out for tender in early 2022, with construction beginning in September and the project reaching substantial completion in mid-November. This replacement project will reduce the volume of water lost due to watermain breaks that were common on this stretch of main, and thus improving the overall efficiency of the system.

Georgia Road Watermain Transfer to the City of Port Alberni

The BCWS transferred the 750-meter Georgia Road watermain and services to the CPA's parallel watermain. This section of watermain stretches from along Georgia Road from Falls Road, to Saunders Road. This section was one of the highest priority replacement projects in the BCWS capital plan. By transferring this waterline to the CPA, the BCWS will reduce capital costs, eliminate infrastructure redundancy, and remove a dead-end which improves water quality and reduces flushing requirements. The estimate for replacing this stretch of watermain was \$750,000 while the transferring of these services over to the parallel CPA watermain cost the ACRD \$185,000.

Bylaw F1148 Amendment

This Bylaw was amended in June of this year (Bylaw No. F1148-3) that increased the Connection Fee by \$400 to \$4,200 to better reflect actual cost recovery. A new fee was added for a Water Model Analysis Cost of \$850 to determine if the water system can meet peak flows for new services.

Smith Road Watermain Replacement Design Project

This design project for the replacement of the watermain on Smith Road was completed in late 2022. This project contains plans for the water main replacement in two phases. The first portion for replacement would be the 4" AC main from 6485 Smith Road to Lamarque Road. The second portion to be replaced would be the 6" AC main that stretches from 6735 Beaver Creek Road to 6485 Smith Road. This project remained consistent with the strategic approach of the ACRD and BCWS, which is to ensure that one watermain replacement project is always shovel ready. This design project was completed by Koers Engineering and was identified as a priority in the 2017 infrastructure assessment. The first phase of this project has been scheduled for 2024, at an estimated cost of \$700,000.

SCADA System Assessment

The Beaver Creek Water System's SCADA assessment was a success in 2022. White Pacific Controls was able to implement some positive changes that have helped the overall efficiency of the system. These include new network switches at the Darnley and Strick Road pump stations, allowing for SCADA systems to communicate even if the router fails. The HMI system at the North Reservoir was also upgraded, improving the quality of the screen on site, and allowing for improved remote access. SCADA pack upgrades will continue in 2023, as we continue to make improvements to the efficiency of the system.

Upcoming Projects

DCC Amendment

The Beaver Creek Water System Service Area Development Cost Charge (DCC) Bylaw No. F1133 was created in 2017 and adopted in June of 2018. While the Development Cost Charge Best Practices Guide for BC recommends annual minor updates, there have been no amendments to the bylaw since adoption. Staff will enlist Koers Engineering for a minor amendment to this bylaw in 2023. A minor amendment is an adjustment to the DCC charges to reflect current construction costs, changes in land values and the status of government grants. The initial report for the amendment will be completed in Spring of 2023, and the new bylaw should be in effect in Fall of 2023.

North Reservoir Cleaning

The reservoir cleaning is scheduled to take place in 2023. Originally scheduled for 2022, there were some delays in securing the correct equipment to complete the complicated task. It takes a special type of truck to drain and store the water within the reservoir and there aren't many around, as most systems have moved away from this type of reservoir. This is part of the regular maintenance schedule which removes any accumulation of sediment from within the reservoir. During this time, it is also important to inspect the reservoir for corrosion or any other mechanical issues.

Compound Storage Upgrades

This project will improve the quality of storage for the BCWS Operations team at the compound behind the firehall. Currently, valuable inventory is unprotected from the elements, and this has been highlighted as a necessary improvement. This will protect these assets and prolong the service life of items such as piping, meter boxes, fire hydrants and cast fittings. A metal prefabricated roofing structure will be installed between two 20' sea-cans thus protecting these items from the elements. The end result will see the creation of an approximate 20 foot wide covered area for the storage of these items and also allowing an additional space for operations staff to complete projects or work on basic operational duties.

Water Loss Investigation

In 2022, the water loss decreased slightly from 27% in 2021 to 25%. As the water system purchases bulk water, it is important to reduce as much unaccounted for water loss as possible. In 2022, the cost of water loss that was not recoverable was \$60,125. In 2023 the water loss investigation will continue, looking at ways to improve documentation of all water loss. Improvements in tracking water loss from flushing, sampling, and hydrant maintenance were seen in 2022, and the goal is to build off of this for 2023.

Long Term Financial Plan Development

Since the creation of the Asset Management Plan, we have been working towards the goal of putting \$768 per parcel annually into the capital fund. This has always been a lofty goal, but it highlights the need to always keep an eye on the future replacement costs of the Beaver Creek Water System, which was identified at a future cost of \$55.6 million. The BCWS continues to be very successful in replacing capital assets in a timely fashion, and staff will continue to work towards balancing the goal of putting funds into the capital reserve and providing cost-effective services to the citizens of Beaver Creek. Staff are looking towards the creation of a long-term financial plan and identifying ways to meet the future needs in a responsible manner, and how the available funding sources can be used to ensure the long-term sustainability of the service. Staff are working hard to maintain a balance and are very cognizant of financial challenges other services, and the citizens of Beaver creek, are facing.