

ALBERNI CLAYOQUOT REGIONAL DISTRICT

BAMFIELD WATER SYSTEM

ANNUAL REPORT
2022

Prepared by the
Community Services Department
3008 Fifth Avenue, Port Alberni, BC, Canada, V9Y 2E3, Phone 250-720-2700

Table of Contents

1.0	Background	3
	Purpose of the Annual Report	3
	Regulating Authority	3
	Management.....	3
	Bamfield Water System Overview	3
2.0	Goal and Targets	4
	Potable Targets	4
	Target 1 – No E.coli and No Total Coliform in any Water Samples.....	4
	Target 2 - Minimum 0.20 mg/L Chlorine Residual	5
	Target 3 - Less than 1 NTU Turbidity in the Treated Water	5
	Target 4 - Meet the Drinking Water Quality Guidelines	6
	Cost-Effective Targets	8
	Cost Effective Target 1 – Total water demand less than 626 m3/day	8
	Cost Effective Target 2 - Peak Demand Ratio of less than 2:1 PDD:ADD	8
	Cost Effective Target 3 – O&M Cost per Customer less than \$1,500	9
	Reliability Targets.....	9
	Reliability Target 1 – Unaccounted Water Loss less than 15%.	9
	Reliability Target 2 - Maximum # of Breaks less than 5/year.....	9
	Reliability Target 3 - Annual Contribution to Capital meets AMP targets	10
	Summary of Target Results for 2022.....	10
3.0	Improvement Plan	10
	2022 Projects Completed.....	10
	2023 Upcoming Projects	11

1.0 Background

Purpose of the Annual Report

This annual report provides an overview of the Alberni-Clayoquot Regional District's (ACRD) Bamfield Water System (BWS). It is the ACRD's responsibility to the community to share this information. This report is for the water consumers to review their individual water system in order to be aware of the service 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 Vancouver Island Health Authority (Island Health) 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 communities. As part of these regulations, water systems are required to have operators qualified by the Environmental Operators Certification Program (EOCP) to the same classification level of a system.

Management

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

Bamfield Water System Overview

The community of Bamfield is a significant part of Electoral Area "A" which has a population of 256 (2021 Census). Bamfield sees a significant influx of people during the summer months that is estimated to be in the thousands. The majority of the BWS was originally constructed in 1979 and 1980 and water is supplied from Sugsaw Lake which is now treated by a Dissolve Air Flootation (DAF) water treatment plant. The DAF water treatment plant was commissioned in August 2018 to address the high organics in the source water and related formation of disinfection byproducts (DBP) in the drinking water. Intensive water quality testing has shown the treatment plant is effective at significantly improving the water quality, including colour and taste, and has reduced levels of DBP in the drinking water.

The BWS complexity is partially due to the subsurface water lines crossing the inlets in various locations. These underwater marine water lines are challenging to repair and often under layers of sediment. The BWS has a Water Treatment 3 Classification and a Level 2 Water Distribution Certification. The daily operation of the distribution and the treatment plant is performed by a contracted operator who is certified by EOCP for these classifications.

The Bamfield Water System includes:

- Water source: Sugsaw Lake
- Water treatment plant: Dissolved Air Flootation (DAF) with UV and Chlorine disinfection
- Two bolted steel reservoirs: 517 m³ capacity
- Current metered service connections: 237
- Total Length of mains: 18 km
- 26 hydrants

- Water main material: Polyvinyl Chloride (PVC) and High Density Polyethylene (HDPE)
- Average daily flow: 207 m³

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 treated water
- 4) Meet the 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 for consumption. Each water system is provided with an Operational Certificate by Island Health that may outline specific requirements such as individual tests and the frequency.

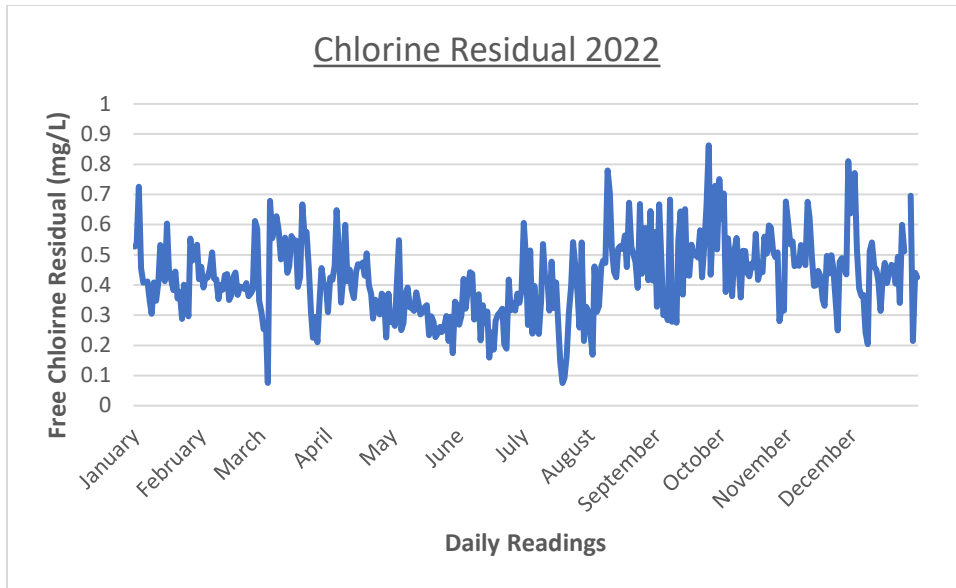
Target 1 – No E. coli and No Total Coliform in any Water Samples

Bacteria testing is performed monthly at multiple locations for Total Coliforms and E. coli. The locations are spread throughout the distribution system to capture a monthly representation. Island Health's 2022 Water Sample Report shows that all 64 samples taken tested negative for any bacteria.

The Total Coliforms and E. coli organisms 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.

Target 2 - Minimum 0.20 mg/L Chlorine Residual

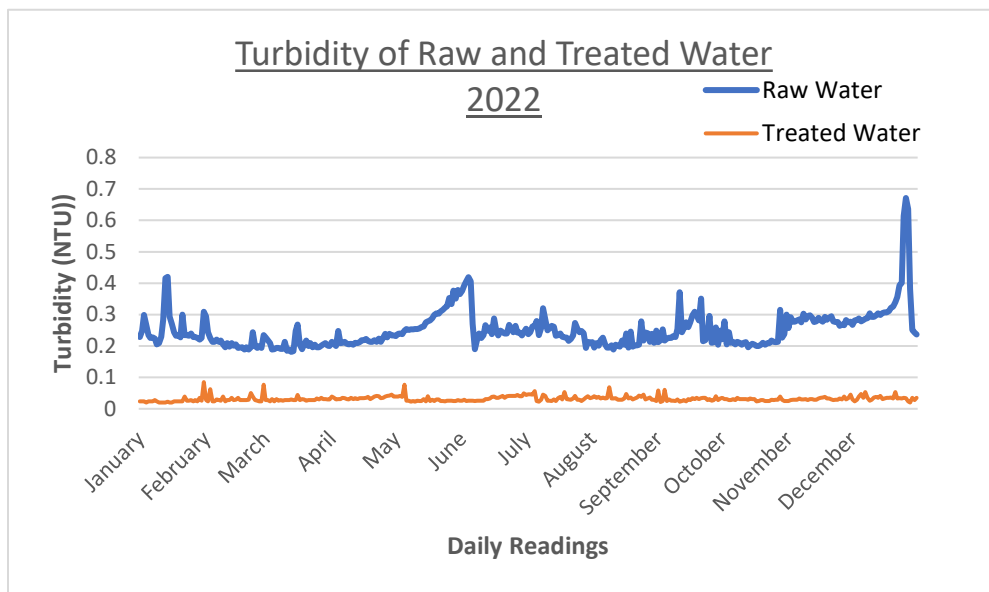
As water flows within a distribution system, the chlorine is slowly eaten up by organics in the water or any material built up in the pipes. Residual chlorine is an immediate test to measure if the water is safe to drink, although water without a chlorine residual is not necessarily unsafe. Other tests 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 for increased flushing.



The graph above shows that the free chlorine level leaving the water treatment plant is usually between 0.2 and 0.8 ppm with some fluctuations above or below. This variation has significantly reduced since the operation of the treatment plant began, prior to which levels would range between 0.2 and 3.0 ppm. The water system has additional chlorine injection at the reservoirs to ensure the entire water system has adequate disinfection.

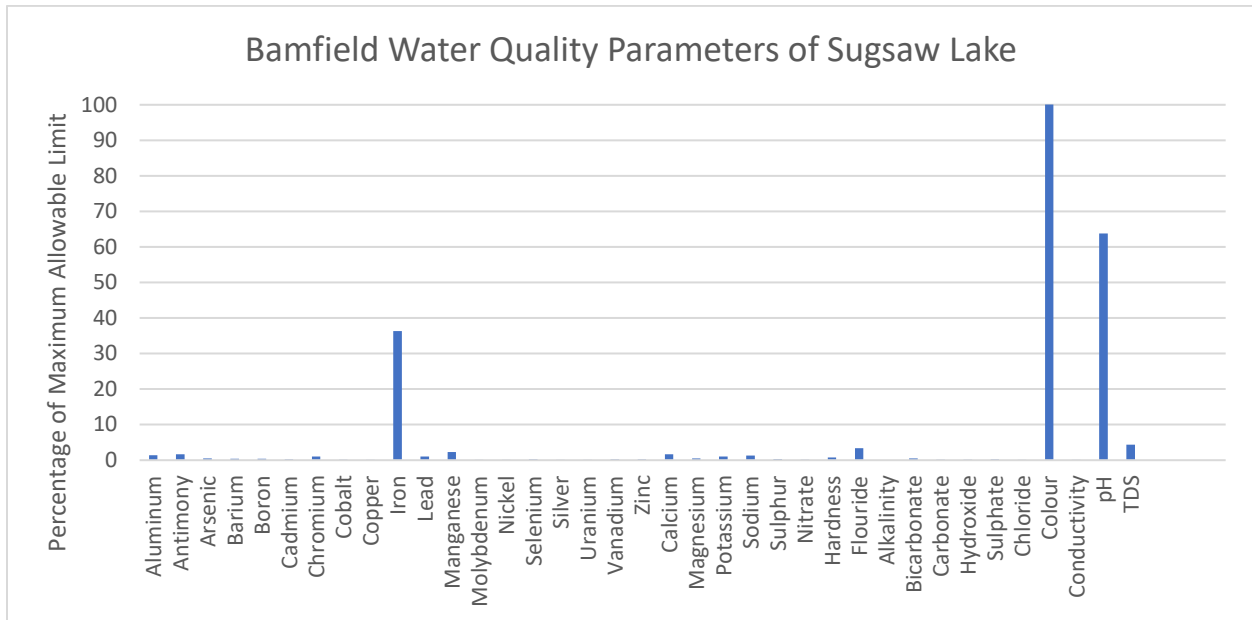
Target 3 - Less than 1 NTU Turbidity in the Treated Water

Turbidity is the cloudiness or haziness of a fluid caused by the suspension of individual particles. This parameter is continually monitored as it effects the ability of chlorine to disinfect. The following graph shows that there was high turbidity in the raw water source in June and December due to heavy rains. However, the treated water's turbidity is consistently between 0.02 and 0.04 NTU. This demonstrates that the water treatment plant is very effective.

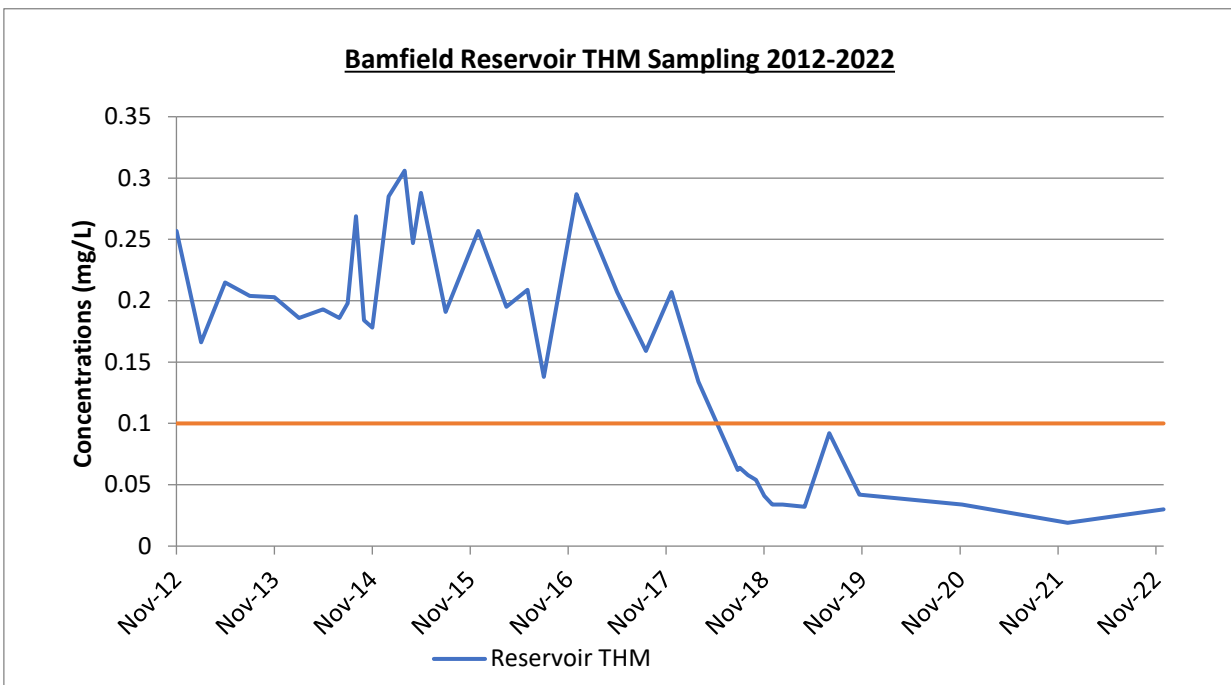


Target 4 - Meet the Drinking Water Quality Guidelines

The ACRD regularly performs tests to ensure that the water is meeting all standards. The water system's latest complete potability sample is shown in the following Water Quality Parameters graph.



The colour is above the acceptable limit in the raw water due to high dissolved organics in Sugsaw Lake but treated water exceeds the standards. Although colour alone is not harmful, the associated organics in water often causes disinfection byproducts (DBP). The treatment plant is successful in removing the precursors of DBP (colour and organics) and the graph below illustrates the effectiveness of the water treatment plant in the reduction in Trihalomethanes (THM), a key DBP.



Cost-Effective Targets:

- 1) Total water demand below 626 m³/day
- 2) Peak Demand Ratio of less than 2:1 PDD: ADD
- 3) O&M cost per customer less than \$1,500

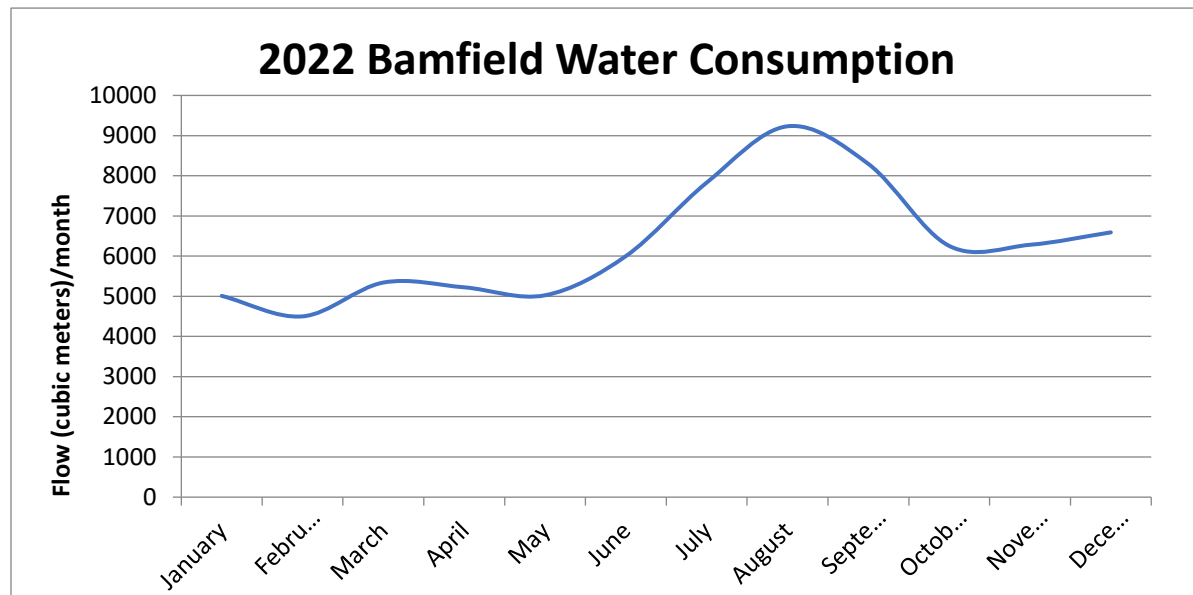
There are many factors that affect how cost effective a system is running. Effective management and planning, good operational practice and changing water demands can all affect system costs.

Cost-Effective Target 1 - Total water demand less than 626 m³/day

The new treatment plant has a maximum capacity of providing 626 m³/day. In 2022, the water system provided 75,584 cubic meters of water to the community water system for an average of 207m³/day demand. In the summer, the peak day demand was 251 m³/day. Both of these are well below the target.

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

A water system must be designed to provide the peak demand and fire flow. If peak demands are excessively high, then the water pipes are required to be oversized which is expensive and creates the operational challenge of keeping water fresh in the lower flow time periods. The target is to have the peak day demand (PDD) less than twice as much as the average day demand (ADD). Peak day demand is 251 m³/day compared to average daily demand of approximately 207 m³/day provides the Peak Demand Ratio of 1.21:1. The 2022 water consumption graph below shows higher volumes (5,000 m³/month) in January to May due to a combination of increased consumption and the possibility of leaks within the system.



Cost-Effective Target 3 - O&M Cost per Customer less than \$1,500

In 2022, the total operating costs for the Bamfield Water System were \$248,724 which excludes both capital contributions and debt repayment. Divided by the 236 services in the system, this results in a

cost of \$1,054 per customer for 2022. This is higher than the cost per customer in 2021 which was \$793, yet still below the target. Factors causing this included increased leakage within the system, increased cost of supplies, additional transport costs both by road and sea, and the increase to the water operator contract in September.

Reliability Targets:

- 1) Unaccounted water loss less than 15%.
- 2) Maximum # of breaks less than 5/year.
- 3) Annual Contribution to capital meets AMP targets of \$905/year

Reliability Target 1 – Unaccounted Water Loss less than 15%.

In 2022, the water system provided 75,584 m³ of water to the community water system. The total water consumed in Bamfield through all water meters for 2022 was 57,076 m³. The difference between two values is called the unaccounted or non-revenue water loss. This loss can be attributed to filter backwash, meter error, water main breaks, flushing, unauthorized consumption and leaks. The unaccounted water loss for 2022 was 18,508 m³ which made up 25% of all water produced. The 2021 unaccounted for water loss was at 27%, therefore there was a small reduction, getting us closer to our target of 15%. With the cost of producing water getting more and more expensive over time, it is important to focus on ways to reduce the unaccounted for water loss. The largest likely culprit for water loss is leaks within the system, which will be an area of focus for staff in 2023.

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

In 2022 we had a total number of 25 leaks within the system, with many of them large and hard to detect. One of the large leaks occurred on the submarine crossing to West Bamfield which was the result of fused joint failure on the HDPE pipe. These joints were stressed by an event in 2019 where a boat anchor caught the pipe and pulled it a significant distance from its original alignment. We saw a few issues in 2022 where 1" services had been reduced down to ¾" at the meter using older galvanized reducer bushings. These bushings have been found to be prone to leaks, however, most have now been changed out. Another common area for leakage and breakage has been at 2" T's branching off of a 6" main. Black iron pipe nipples were often used, and have been corroding, along with sched 40 PVC adapters being common and half as strong as the Sched 80 PVC adapters that are now used. While we saw a lot of freezing pipes causing leaks in late 2021, we didn't see the same abundance in 2022.

Reliability Target 3 – Annual Contribution to capital meets AMP targets

In the Fall of 2021, an Asset Management Plan (AMP) was created for the Bamfield Water system to ensure that we are renewing our infrastructure to minimize service interruption, risks, and overall costs. Along with the Infrastructure Renewal and Long Range Plan developed by Koers and Associates, these plans have assessed the age and condition of all of the system's assets to determine the replacement costs and calculated an annual amount that is required to be invested in capital infrastructure of \$321,000 each year. 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.

A total of \$47,895.06 was contributed to the capital fund in 2022. Last year's AMP stated that approx. \$321,000 should be contributed annually, which when divided by the 247 parcels is \$1,300 per parcel. The 2022 total of \$194 per parcel being contributed is well below this target.

Summary of Target Results for 2022

This past year, most of the targets were met except for the amount of water loss, the number of breaks and capital contributions. The water treatment plant has allowed the BWS to consistently exceed all water quality targets. The unaccounted water loss was down slightly from 27% in 2021 to 25% in 2022. However, with the cost of producing water rising, it is important that steps are taken to bring this number down even more. While an increased number of breaks and leaks within the system cannot be controlled, improved leak detection capabilities could help minimize the effects.

	Target	2022 BWS
Bacteria Results	0	0
Chlorine Residual	> 0.20 mg/l	> 0.20 mg/l
Turbidity	< 1.0 NTU	< 1.0 NTU
CDWQG	100%	100%
Total Demand	< 626 m ³ /day	207 m ³ /day
Peak Demand Ratio	< 2	1.21
Cost per customer	< \$1,500	\$1,049
Contribution to Capital	\$1,300	\$194
Water Loss	< 15%	25%
Breaks	< 5	25

3.0 Improvement Plan

2022 Projects Completed

Submarine Line Repairs

The West Bamfield submarine transmission line experienced another leak in October (Repair Clamp #8). This large leak occurred due to the result of cracks occurring where the fused HDPE pipes were originally fused, and previous repair clamps had been leaking. These repairs required scuba divers to install self-restraining repair couplings. During this repair, a boil water advisory was issued, and significant water was used to flush water lines.

The 2-inch water main under Grappler Inlet required repair in June as it was damaged by a derelict dock resting on it at low tide.

ICIP Grant Application Submitted for West Bamfield Submarine Line Replacement

In February, an application to Investing in Canada Infrastructure Program (ICIP) was submitted for the replacement of the West Bamfield submarine line. This submarine transmission line is the largest of the two lines that provides potable water to West Bamfield. The replacement of this transmission line is required as the line is at or nearing the end of its useful life, experiencing multiple leaks and repairs over the past few years. The replacement cost of the West Bamfield Transmission Line has been estimated at \$1,175,238.

DCC Review and Update

Koers Engineering completed a Development Cost Charges (DCC) update report in October 2022. The current DCC bylaw for Bamfield included inadequate fees for development as it was based off of construction costs in place in 1997 when it was created. It also includes exemptions for developments of less than 4 units per property, which is the majority of development in the system. The new bylaw will remove this exemption and increase the payable DCC per development type. Staff have taken the new DCC bylaw through community engagement and three readings by the Board of Directors. The bylaw was submitted to the provincial government's Inspector of Municipalities for final approval. Once final approval is received, the bylaw will go to the Board of Directors for final reading and adoption.

Rates and Bylaw review

In June of 2022, the Bamfield Water Advisory Committee was presented with a plan and options on how to help address the current funding gap for the long-term sustainability of the water system. To meet the Asset Management Plan's target, capital funding needed to be increased for water line replacement and renewal. The ACRD Board approved updating the rates within Bylaw No. F1147-2, increasing the basic water charge to \$60 per month. The long-term financial plan for the Bamfield Water System will be a continued project in 2023.

Upcoming Projects 2023

Water Loss Investigation

Continued investigation of unaccounted for water loss will be a priority in 2023. Staff are working to quantify the exact cost of water production on a \$/m³ basis, which will allow a more detailed analysis on what expected leaks are costing. Water production costs are impacted by the rising costs of materials as well as increased freight costs, with both land and sea transport costs increasing, partially the result of current road improvements causing travel delays.

Pump and hauls have increased by 33% due to the increased amount of water and therefore treatment residuals being produced. Reducing non-revenue generating water production, which is 25% of the water produced, will offset these increasing costs. It can be difficult to find leaks within the system in instances where the leak isn't readily visible. Staff are investigating cost-effective ways to introduce leak detection software to the system to help identify and repair these hidden leaks within the system in a timely manner.

West Bamfield Submarine Watermain Replacement Project Design

The engineering design and contract administration request for proposal will be issued in the first half of 2023 for the replacement of the West Bamfield submarine transmission line. This is the highest priority capital project for the Bamfield Water System. Following design, staff anticipate issuing a construction tender for the submarine line replacement in early 2024. This will allow for completion of the replacement project by the end of 2024. This would be the most significant project for the BWS since the completion of the water treatment plant in 2018 and allow staff to focus on other capital replacement projects.

Long-Term Financial Strategy

A long-term financial strategy for the system will continue to be a focus in 2023. A stepped rate increase was implemented in the Fall of 2022 which has resulted in increased monthly water rates in January of 2023 and a future increase in July of 2023, but these only reflect the increase costs of the waterworks contract.

The current funding gap between money contributed to capital reserves and the amount needed is significant, a gap of approximately \$273,105 which is needs to be filled in order to upgrade undersized water mains and those poorly constructed with subpar material that are causing leaks and associated costs to the system. In order to put away these funds for infrastructure renewal and replacement, staff will continue to identify options regarding further rate and parcel tax increases.

As a part of the 2023 financial plan, staff have recommended a total parcel tax increase of \$16,240, to support increased capital contributions. This will be a very small but important step towards increasing the capital reserve and allow us to access future grant opportunities. While this is a good first step, more steps will have to be taken to ensure the long-term sustainability of the system.