



ALBERNI-CLAYOQUOT
REGIONAL DISTRICT

BAMFIELD WATER SYSTEM

Asset Management Plan
Version 1



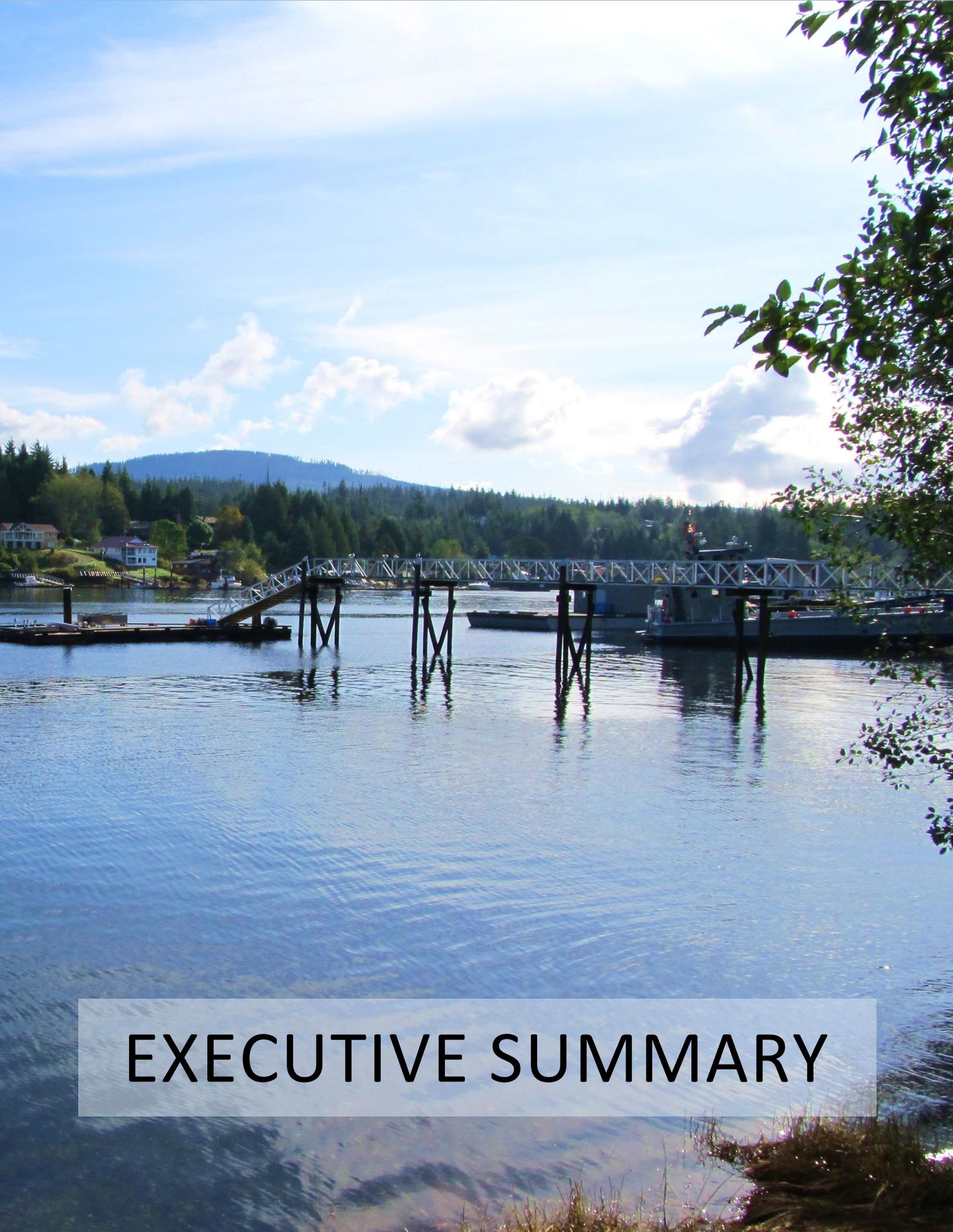
DATE OF ADOPTION: DECEMBER 8, 2021



Bamfield Water System Asset Management Plan

CONTENTS

EXECUTIVE SUMMARY	2
1.1 Purpose of the Plan	3
1.2 Asset Summary	3
1.3 Levels of Service.....	3
1.4 Future Demand.....	3
1.5 Lifecycle Management Plan.....	3
1.6 Financial Summary.....	4
1.7 Asset Management Practices	5
1.8 Monitoring and Improvement Program	5
INTRODUCTION	6
2.1 Background.....	7
2.2 Asset Inventory.....	8
2.3 Water Source & Emergency Preparedness.....	8
2.4 Levels of Service.....	8
2.5 Fire Flows and Required Improvements.....	11
CURRENT STATE OF WATER INFRASTRUCTURE	12
3.1 Inventory.....	13
3.2 Replacement Costs and Dates	13
3.3 Condition Assessments.....	14
3.4 Current Operations and Maintenance Costs	14
3.5 Risk Management Plan	15
ASSET MANAGEMENT IMPROVEMENT PLAN	17
4.1 Water Infrastructure Replacement Priority Ranking	18
4.2 Improvement Plan	19
APPENDIX	20
REFERENCES	23



EXECUTIVE SUMMARY



Bamfield Water System Asset Management Plan

1.1 Purpose of the Plan

The Bamfield Water System (BWS) Asset Management Plan (AMP) is part of the Alberni-Clayoquot Regional District (ACRD) Asset Management program to facilitate informed decision-making and effective allocation of resources for infrastructure. The purpose of an AMP is to deliver sustainable, cost effective services to ACRD communities in a socially, economically, and environmentally responsible manner, while providing the Level of Service agreed upon by the Board. This AMP follows the guidelines of the ACRD's Asset Management Policy and Strategy and will inform operations and maintenance procedures, the 5-year Financial Plan and Long-Term Financial Plan.

1.2 Asset Summary

The Bamfield Water System network includes:

- A water treatment plant
- Two reservoirs with 545 m³ capacity
- 16,500m of water mains and transmission mains
- Sugsaw Lake

1.3 Levels of Service

Levels of Service (LOS) is the convergence of physical performance, customer expectation, and available funding to operate and maintain the asset(s). The present funding levels are insufficient to meet the future capital requirements to provide the existing services at current levels in the medium-term. The main service consequences will be more frequent service interruptions, a decline in water quality or loss of service.

1.4 Future Demand

Increases in future demand will be managed through a combination of maintaining and upgrading existing assets and providing new assets to meet demand. Other practices to accommodate future demand changes also include non-asset solutions such as changes in bylaws and regulations, insuring against risks, and mitigating potential failures.

The main demands for new services are created by:

- Growth rate (requests for new connections)
- Board of Directors and resident level of service expectations
- Legislative regulations including Island Health operating permit
- Change in community needs or vision

1.5 Lifecycle Management Plan

Asset Management assists in conscious and calculated decisions for all assets covered in AMPs from acquisition, operation, maintenance, disposal and renewal or upgrade. During the course of an asset's life, the future replacement value is estimated based on current or historical costs plus inflation as well as estimated date of replacement based on age and condition, if applicable. Required annual



Bamfield Water System Asset Management Plan

contributions are calculated for each component within the AMP to measure the funding gap between current and desired Levels of Service in order to align funding and service expectations. The AM Program, adopted by the ACRD in 2018, achieves responsible and reliable lifecycle management practices.

The Bamfield Water System AMP was created with the assistance of Koers & Associates Engineering Ltd., operations staff, and contractor. Asset Management systems will continue to be maintained by the Asset Management & Grant Coordinator and staff prior to the creation of subsequent AMPs.

Estimated service life (ESL) and replacement costs of the water system infrastructure were determined through field research and data collection by Koers & Associates Engineering Ltd. While the ACRD believes this information to be reliable and accurate, it is recognized that assets may exceed estimated service life. Every effort will be made to extend service lives to the fullest extent through maintenance programs and balancing risks with available resources. Management staff provided risk assessments and goals used within risk registers and matrices intended to identify and mitigate unacceptable threats to ACRD assets and their users.

1.6 Financial Summary

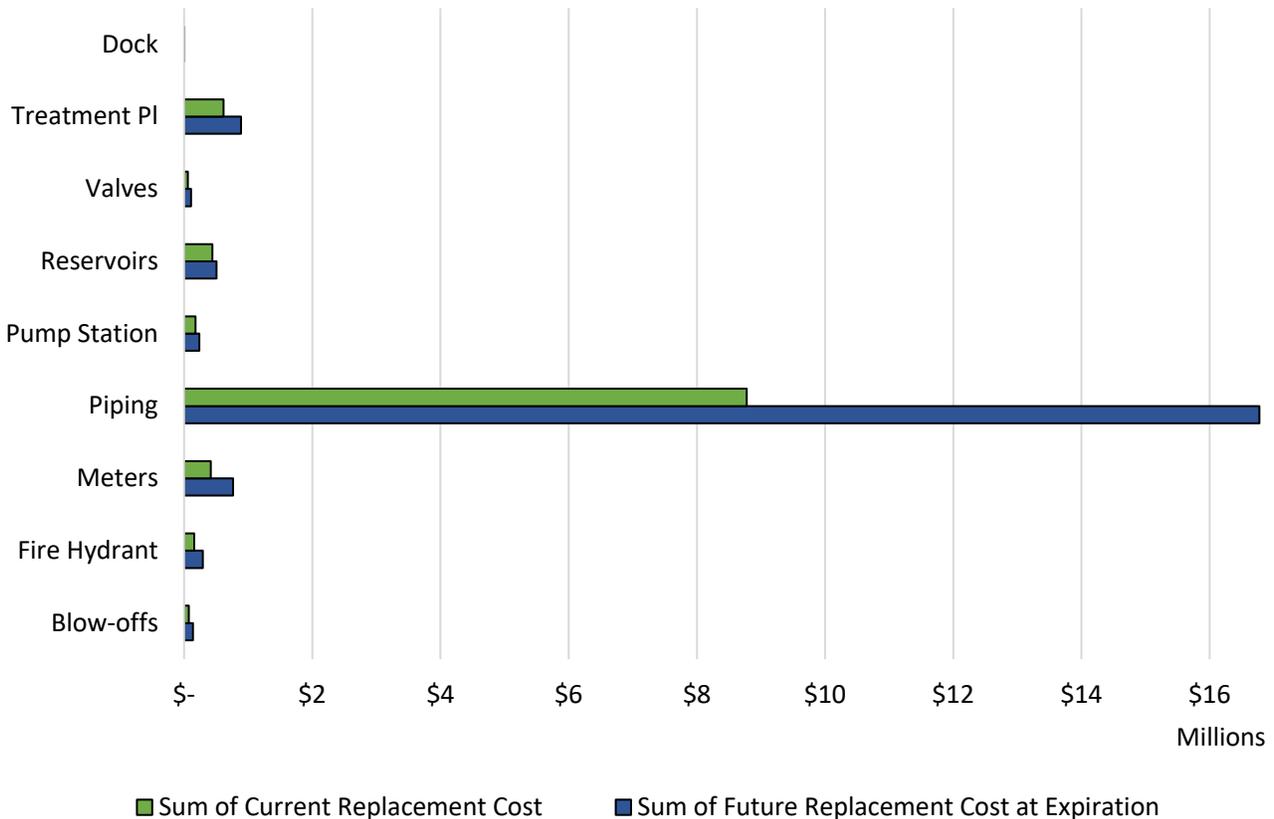
The BWS has a total current replacement value of \$11.9 million. This does not include a contingency for construction, engineering, financial, legal or administration costs. With an estimated inflation rate of 1.5%, estimated future replacement costs are \$22.1 million for current infrastructure at the end of the components estimated service life. Not included in the estimates are projections for future demand and projected capital upgrades. The current water treatment plant can accommodate an increase in demand although the water mains may require upgrading depending on location. The current system was not originally constructed with the intention to support a fire department; however, the Bamfield Volunteer Fire Department relies on the water system to provide fire flows. Total “All-In” project costs for pipe replacement are generally 150% of the cost of pipe materials. Total current project costs for upgrading pipes below 150mm in diameter to meet fire flows would cost approximately \$6.3 million with a total project cost of \$15-18 million to upgrade the entire system for storage and flow requirements.

There are approximately 204 water connections within the Bamfield Water System that contributed \$92,260 in parcel taxes in 2021, including treatment plant borrowing; in addition, approximately \$165,000 will be collected in quarterly water fees for a total contribution of \$257,260. The current budget allows for approximately \$34,000 in capital contributions annually. Based on projected future renewal costs and the current reserve level, funding of the water system would require annual combined contributions of approximately \$474,000 to cover operations, maintenance and capital costs. In reality, renewal of system components will occur in cycles based on asset life, completion of major improvements and according to their condition and use. A summary of current and future replacement costs by asset category is shown in Figure 1.1.



Bamfield Water System Asset Management Plan

Figure 1.1 – Current and Future Replacement Costs by Asset Category

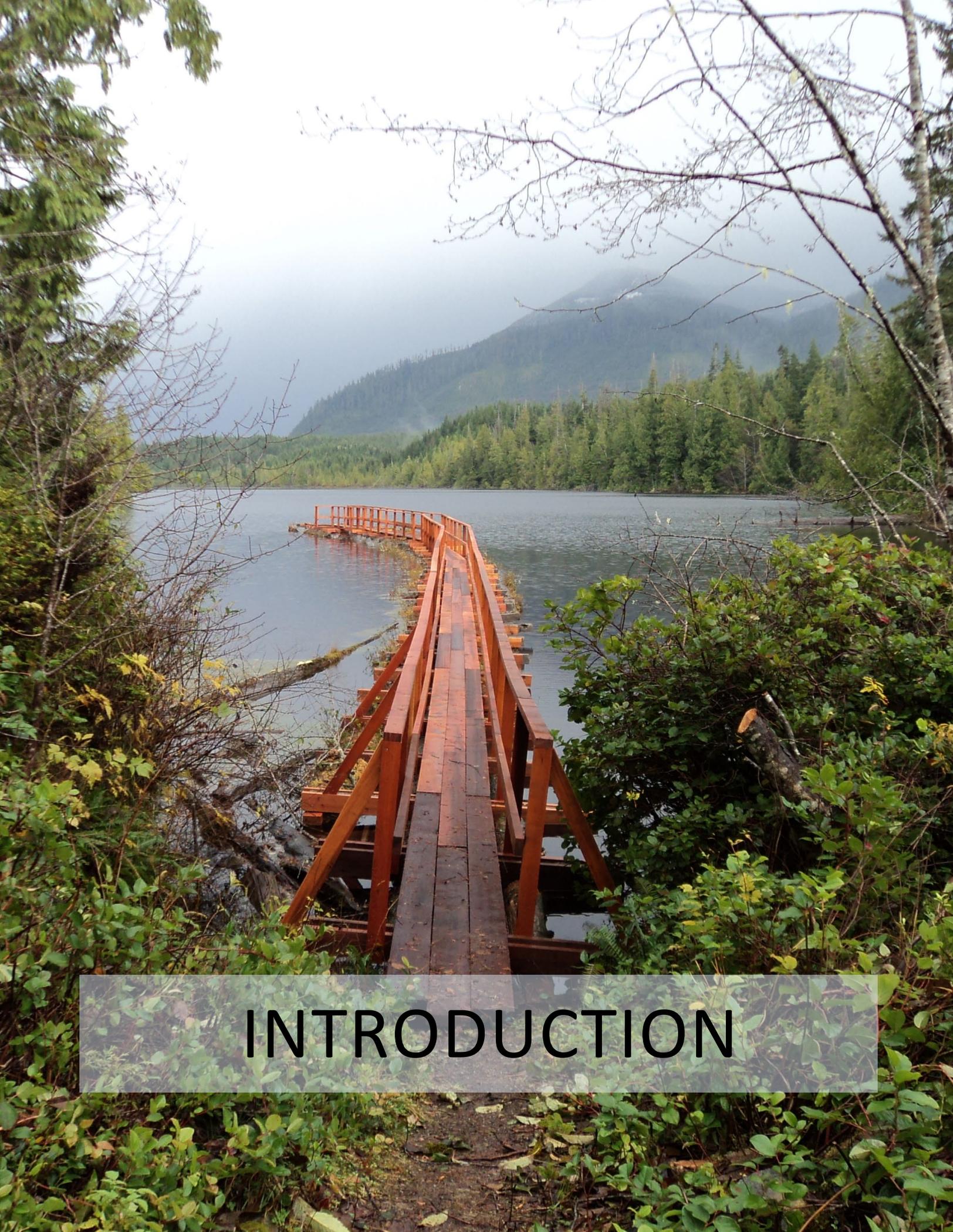


1.7 Asset Management Practices

Assets are managed using a combination of Microsoft Office and iCity/Vadim. The ACRD currently utilizes GIS within the Planning Department and will soon expand to service more departments including the creation of asset databases to aid in the management of existing assets. A dedicated Asset Management Software solution has not been considered at this time but will be reviewed in the future as demands and processes evolve. Registries and AMPs will be reviewed and updated on an annual basis prior to the release of the following version.

1.8 Monitoring and Improvement Program

An Improvement Plan is included within Section 4.2 detailing tasks to improve Asset Management practices within Bamfield Water System services and the Asset Management Program as a whole. Included in Improvement Plans are suggested changes or additions to documented inspections and condition assessments, monitoring of asset-specific operational and maintenance procedures and assigning present risks a numerical rating in order to measure mitigation success.



INTRODUCTION



Bamfield Water System Asset Management Plan

2.1 Background

The Alberni-Clayoquot Regional District is situated in the heart of Vancouver Island with one of the most dramatic and majestic landscapes. The Alberni-Clayoquot Regional District is a federation consisting of member Municipalities, First Nations, and six electoral areas. The Alberni-Clayoquot Regional District is within the traditional territory of ten First Nations.

This AMP encompasses all Bamfield Water System assets, excluding natural assets; however, the ACRD recognizes that natural assets provide critical resources and services to the community. Sugsaw Lake is one of the most prominent natural assets within the ACRD. The delicate nature of managing natural assets is being approached systematically and methodically through training programs and collaboration between departments with complementary backgrounds. As resources allow, natural assets will be included in subsequent AMPs, along with recommended conservation programs and measures.

The purpose of the plan is to facilitate the strategic management of the water system infrastructure and the services provided by it, giving guidance on new and existing infrastructure to maximize use of financial resources long term, reduce risk and provide a prioritized view for service continuity and improvements over a 20-year planning period and beyond.

The ACRD AM Program follows the advice of the Asset Management BC Framework; Plans are designed to be living documents that change with the organization to reflect progress made while continuously striving for sustainable service delivery. Consideration of community priorities and an understanding of trade-offs between resources and desired services is the foundation of sound AM practices. The AMBC Roadmap guides organizations through basic, intermediate and advanced Asset Management Practices. It is the goal of the ACRD to achieve a basic to intermediate level of understanding.

This AMP should be read in the context of the ACRD's Asset Management Policy and Strategy. The Bamfield Water System AMP is a living document and will develop with AM practices and with the influence of the following corporate documents:

- Annual strategic priorities
- Short-term and long-term financial plans
- Water utility maintenance policies
- User rates and fees bylaw
- Grant applications and funding

Asset Management Plans are designed for several reasons: to guide Management and the Board in planning and decision-making, to aid in the creation of short-term and long-term financial plans as well as operational plans, and to spark community engagement for the service. As the ACRD moves through the AM implementation process, knowledge and understanding of the AM program increases and it is expected that this plan evolve further, solidifying assumptions made and filling in any present information gaps where further research or information is required.



Bamfield Water System Asset Management Plan

2.2 Asset Inventory

The Bamfield Water System consists of linear and non-linear components including:

- Over 16 kilometers of water mains
- 204 service connections
- 26 hydrants
- Water treatment plant
- 2 reservoirs
- Sugsaw Lake dock

Current replacement costs were determined by Koers & Associates Engineering firm using unit costs from recent water main projects completed in nearby water systems. Unit costs do not include excavation, backfill, and surface restoration. Remaining useful life estimates were based on installation dates and industry standards for expected service life.

2.3 Water Source & Emergency Preparedness

The BWS pulls water from Sugsaw Lake and treats raw water through a Dissolved Air Floatation followed by UV and chlorine disinfection. The water operator conducts daily tests to ensure chlorine levels.

Since the installation of the water treatment plant in 2018, the water quality has increased significantly and meets the Canadian Drinking Water Quality Guidelines (CDWQG). The Bamfield Water System maintains updated emergency response procedures and has redundancy and back-up systems at the treatment and pump station. An official Water Emergency Response Plan, updated in 2019, outlines steps to respond to a catastrophic event.

2.4 Levels of Service

Levels of Service (LOS) are measures of fact related to the service delivery outcome intended to demonstrate effective performance. LOS measure how the customer receives the service, the value provided by the service, and performance related to allocation of resources to service activities to best achieve the desired outcomes. Other services within the ACRD will typically have LOS separated by both how the customer perceives the service and how the service can be delivered effectively, giving consideration to resources and capacity.

Levels of Service (LOS) are defined using two terms, customer levels of service and technical levels of service.

Customer LOS: measure how the customer receives the service and measure of value we provide.

Technical LOS: technical measures of performance relating to the allocation of resources to service activities to best achieve the desired outcomes and demonstrate effective performance.

- Operations – ongoing activities, day-to-day operations
- Maintenance – activities enabling an asset to provide service for its planned life
- Renewal – activities that return the service capability to near original capacity
- Upgrade – activities that provide a higher level of service



Bamfield Water System Asset Management Plan

Table 2.1 - Customer Level of Service Objectives

Values	Expectation	Objective Measure Used	Current Performance	Requirements to Achieve Desired LOS
Quality	Access to clean, safe potable water	Quality samples meeting or exceeding Island Health and Canadian Guidelines for drinking water quality	100% of samples exceed the Canadian guidelines for drinking water quality and no positive results for Coliform and E.coli.	It is reasonable to expect that this will stay the same
Function	Reliable, consistent water services without interruption of services	Performance: Number of service interruption calls for water main breaks	<5 calls received annually for water disruptions or leaks identified by water contractor	Likely to increase if renewals and upgrades requirements are not met
Capacity and Use	Access to potable water at the lowest possible rate	Water levels are adequate to support demand. Water Treatment Plant has capacity for fire flows but distribution lines are undersized for fire flows	Linear assets do not have fire flow capacity	Reservoir water levels could be depleted from excessive use or drought conditions if not monitored and conserved. No current budget for upgrades.





Bamfield Water System Asset Management Plan

Table 2.2 - Technical Levels of Service

Service	Service Objective	Objective Measure	Current Performance	Requirements to Achieve Desired LOS
Operations	Access to clean, safe, and potable water	Water quality testing required by VIHA	Samples sent monthly to Island Health that all meet required standards	Continue monitoring program
Operations Budget			Budget is sufficient to complete all operations and maintenance activities	Budget will increase with renewals and upgrades to the water system
Maintenance	Reliable, consistent water services without interruption	1) Water main flushing 2) Regular maintenance 3) Condition assessments	1) No current flushing program 2) Pipe repair is reactive 3) Condition assessments are not performed currently	1) Annual flushing program 2) Replacements are proactive vs reactive 3) Regular assessments performed
Maintenance Budget			Budget is sufficient to complete all operations and maintenance activities.	Budget will increase in relation to cost increases
Renewal	Reliable, consistent water services without interruption	Infrastructure renewal needs are identified by operations staff and ESL	Using ESL and condition assessment rankings, 88% of BWS infrastructure is in either fair to very poor condition	Risk and priority frameworks identify required renewals before failures occur. Proactive vs reactive replacements.
Renewal Budget			\$20,000 budgeted annually for renewals	\$668,000 over 20 years to meet renewal needs based on asset life cycles
Upgrade/ New	Upgrade remaining areas to meet fire flow requirements per FUS and user demands	Upgrade piping diameter in applicable areas within project budget amounts	Majority of BWS does not meet fire flows	Fire flow upgrades prioritized in conjunction with current piping upgrade requirements based on ESL and pipe material.
Upgrade/ New Budget			\$422,625 budgeted for effluent project in 2023-2024	Estimated \$15-18 million required to meet piping fire flow requirements



Bamfield Water System Asset Management Plan

For the purposes of this report, customers' LOS expectations are set upon the annual adoption of the financial plan and strategic priorities as it is a reflection of the values, policies, and priorities of the Board of Directors with input from committees and public engagement sessions. This will assist the ACRD's Board of Directors and stakeholders in matching the level of service required, service risks and consequences with the community's ability and willingness to pay for the service.

It is important to monitor the service levels provided regularly as these will change as regulations and expectations change. The current performance is influenced by work efficiencies, technology, and Island Health regulations that will change over time. Review and establishment of the agreed position that achieves the best balance between service, risk and cost is essential.

2.5 Fire Flows and Required Improvements

The majority of BWS does not meet fire flow regulations stipulated by the Fire Underwriters Survey (FUS) in "Water Supply for Public Fire Protection" and MMCD Design Guidelines. In order to meet regulations, pipe diameter and/or material improvement is required. Current flows are between 40-60 L/s depending on the area with a duration of 1.5 hours before flow would diminish. The required fire flows are shown in Figure 2.3 – FUS Fire Flow Requirements.

Table 2.3 – FUS Fire Flow Requirements

Development	Minimum Fire Flow & Duration		Total Volume ⁽³⁾ (m ³)
	Flow ⁽¹⁾ (L/s)	Duration ⁽²⁾ (hrs)	
Single Family Residential	60	1.4	300
Commercial & Institutional	150	2	1,080
Industrial	60 ⁽⁴⁾	1.4 ⁽⁴⁾	300

A large-scale redesign of the system and significant capital upgrades will be required to eliminate the current flow shortage. It is estimated that more than 8,900m of watermains with diameters below 150mm will need to be replaced along with increases in storage capacity. Koers & Associates Engineering Ltd. estimated the costs of upgrading the system to provide adequate fire flows and storage to be \$15-18 million plus taxes.

Future updates and revisions to this plan will incorporate conversations amongst key stakeholders and rights holders regarding aligning the level of service needed by the community, risks and consequences associated with these assets, the taxpayers' ability and willingness to pay for various levels of service and the ACRD's resource capacity. It is most likely that upgrades will occur as assets fail.



**CURRENT STATE
OF WATER
INFRASTRUCTURE**



Bamfield Water System Asset Management Plan

3.1 Inventory

Table 3.1 - Assets covered by this Plan

Asset Category	2021 Replacement Value
Standpipes/Blow Offs	\$ 74,800
Service Connections/Meters	414,000
Linear Assets	10,183,600
Pump Station	176,900
Reservoir	441,000
Treatment Plant	613,200
Dock	5,000
TOTAL	\$ 11,908,500

Costs are for supplies only; labour, engineering, financial, and administration costs are not included. Estimated total project costs use an “All-In” rate based on number of linear meters of pipe. Depending on the diameter of pipe, All-In rates typically range from 150% of the cost of pipe.

Natural assets, such as Sugsaw Lake, have not been included in this inventory as the ACRD is still in the development stage of identifying and managing these assets. As resources allow, natural assets will be included in subsequent versions of this AMP.

3.2 Replacement Costs and Dates

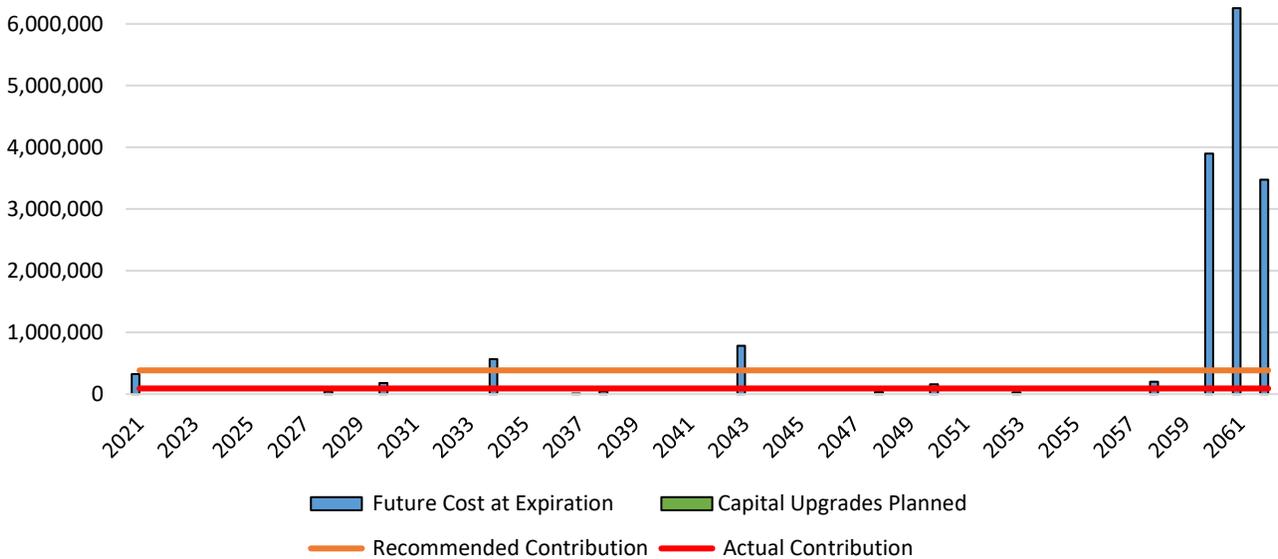
Asset management changes the financial focus from historical cost and annual amortization included in the ACRD’s financial statements to estimated replacement value, estimated service life, and annual capital investment required. This AMP uses current market replacement values, inflation, estimated service life, condition assessments, and annual capital investments required to determine replacement costs and dates. The ACRD’s 5-Year Financial Plan and Tangible Capital Asset registry utilizes historical costs per Public Sector Accounting Board’s PS 3150 (Tangible Capital Assets); however, this does not account for market changes or inflation.

Table 3.2 summarizes suggested infrastructure replacement dates and estimated costs by year until 2060. Due to the age and estimated service life of the assets within BWS, there are significant capital expenditures forecasted in approximately 40 years. Collecting the recommended combined annual contribution from users shown below of \$474,000 will alleviate these spikes in capital expense. This equates to \$1,515 per parcel in annual parcel tax with no change in quarterly water fees or a total \$1,874 in annual water fees with no change in parcel tax. These figures have been averaged over the average life of the current components in an effort to evenly distribute contributions and forecasted capital expenditures. BWS parcels currently contribute \$452 in parcel tax and average annual water fees of \$808.



Bamfield Water System Asset Management Plan

Table 3.2 - Projected Timing for Capital Renewal

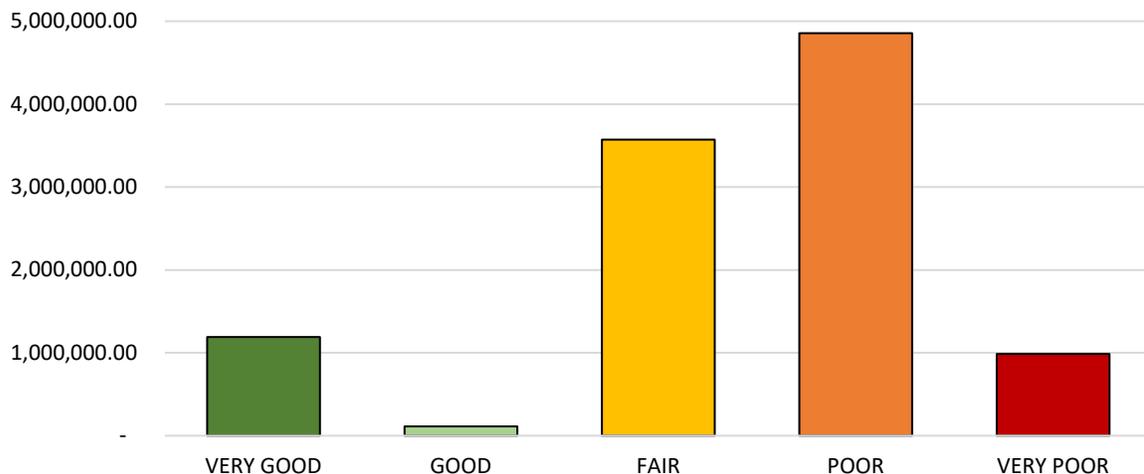


3.3 Condition Assessments

The operations contractor for BWS has provided condition assessment ratings for linear assets. Non-linear assets have been given a condition rating based on remaining estimated service life. Based on these ratings, 88% of BWS assets have a fair to very poor physical condition.

Table 3.3 shows the current cost to replace assets based on the percentage of estimated useful service life remaining.

Table 3.3 – Current Replacement Cost by Condition



3.4 Current Operations and Maintenance Costs

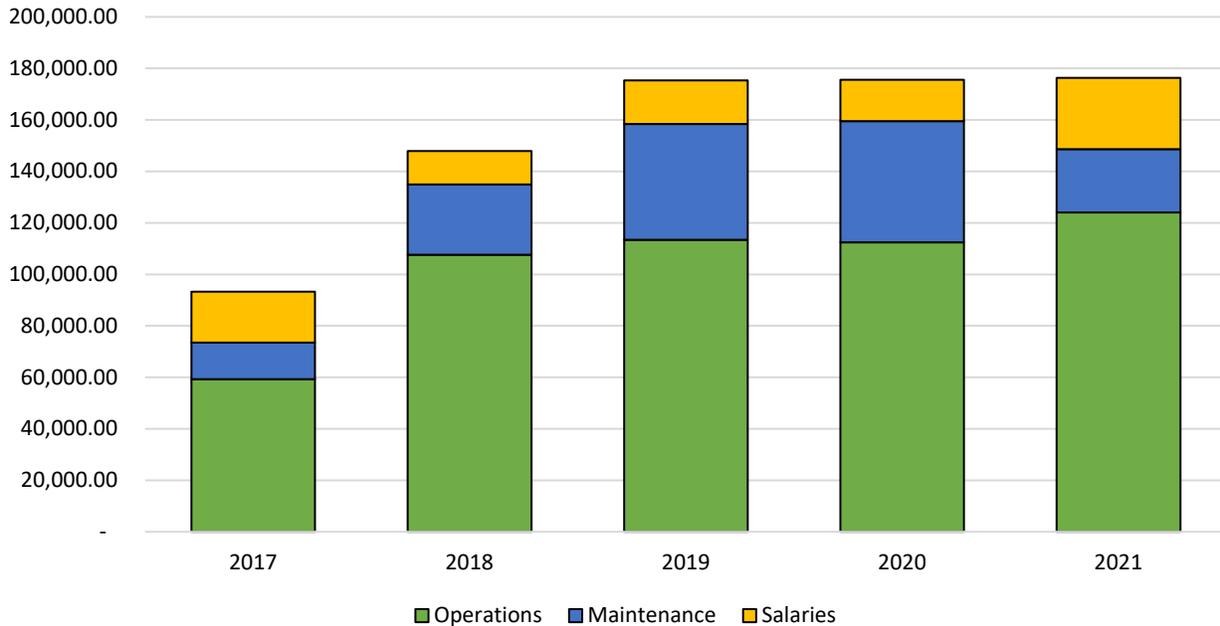
A key function of Asset Management is to track maintenance costs separate from operations costs to identify areas that are requiring more repairs as an indication of failing infrastructure. Table 3.4 shows



Bamfield Water System Asset Management Plan

the trend in combined operations and maintenance costs since 2017. Average operation and maintenance costs total \$153,000 per year, including salaries and benefits.

Table 3.4 – Operations and Maintenance Cost Trends



Bamfield Water System can track unaccounted water loss, or Non-Revenue Water (NRW), by measuring the volume of water produced by the water treatment plant compared to residential meter readings. The system has a goal of no more than 15% NRW loss, however, in 2020 the NRW was 25%. This indicates there are leaks within the system which are likely resulting from the submarine water main that feeds water to West Bamfield that had been damaged. The Community Services Department is confident that recent repairs will further reduce this percentage.

3.5 Risk Management Plan

Risk management is a key objective set out in our Asset Management Policy. With acceptable LOS in mind, we have adopted a risk management framework to assess and rank criticality of the ACRD's infrastructure assets. One of the outcomes of implementing risk management is the ability to prioritize required capital expenditure based on criticality for the BWS.

The goal in adopting a framework is to have a consistent accurate understanding of the state of the BWS's infrastructure. The framework includes a standardized grading system that is easily repeatable, enables comparison of the status of infrastructure condition over time and across municipalities for comparison.

A risk matrix has been prepared and will be used for risk ratings throughout the ACRD. This matrix will also be used in conjunction with regular condition assessments to properly evaluate new and existing risks. The risk assessment process identifies credible risks, the likelihood of the risk event occurring, the

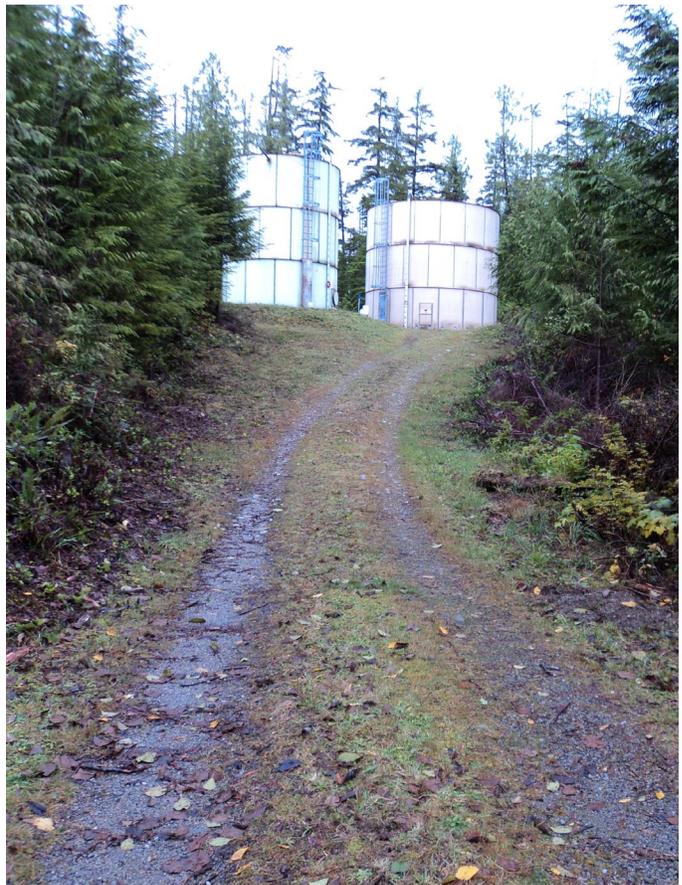


Bamfield Water System Asset Management Plan

consequences should the event occur, develops a risk rating, evaluates the risk and develops a risk treatment plan for non-acceptable risks. Critical risks are those assessed with 'Very High' (requiring immediate corrective action) and 'High' (requiring corrective action) risk ratings identified in the assessment process.

According to the General Manager of Community Services and Manager of Operations, the following are credible risks that could create a "High" risk rating at this time:

1. Loss of water system source/supply due to a failure of the water supply line or intake due to damage (i.e., earthquake, damaging event, etc.)
2. Watershed event resulting in excessive turbidity or contamination of source water
3. Failure of unprotected transmission line to West Bamfield due to external damages
4. Major failure of a water reservoir or transmission line resulting in loss of storage for firefighting and possible loss of water supply to community
5. Reduced water flow during a large fire event. The water system is currently limited in its capacity to meet fire flows due to undersized mains and storage capacity





ASSET MANAGEMENT IMPROVEMENT PLAN



Bamfield Water System Asset Management Plan

4.1 Water Infrastructure Replacement Priority Ranking

Table 4.1 lists the components within Bamfield Water System in order of their required estimated replacement based on risk. This information can be used to aid in creating a Long-Term Financial Plan for this class of assets. When budgeting for future projects, it is recommended that a 30% general contingency be added to total project costs. Many factors can change the costs of materials required for projects and while the actual costs may differ, only the most current and available costs are used. Table 4.1 is not exhaustive and includes only infrastructure that requires replacement during the 2021-2025 Financial Plan period.

Table 4.1 – Improvement Works

Component	Current Replacement Costs (pre-tax, pre-contingency)	Risk
Replace existing West Bamfield transmission main with cover	\$ 720,000	High
Replace existing Grappler Inlet transmission main with cover	1,500,000	High
Option 1 Replacement Cost – High Risk	\$ 2,220,000	
West Bamfield transmission main protective cover	\$ 470,000	High
Grappler Inlet transmission main protective cover	2,000,000	High
Option 2 Replacement Cost – High Risk	\$ 2,470,000	
Replace piping below 150mm diameter	\$ 6,300,000	Medium
Upgrade system beyond piping to achieve adequate fire flows	11,700,000	Medium
Fire Flow Upgrade Cost – Medium Risk	\$ 18,000,000	





Bamfield Water System Asset Management Plan

4.2 Improvement Plan

The tasks identified in the Table 4.2 are required to achieve the BWS asset management objectives, manage risks, and close the gap between current and targeted levels to achieve within the AMBC road Map. The table also identifies the integration of these tasks into the organization as recommended by the AMBC Framework.

Table 4.2 – Improvement Plan

Task#	Task	Responsibility	Timeline
1	Implement operations process for documenting condition assessments of water mains, fire hydrants and pumps etc.	Community Services Department	Spring 2022
2	Update and monitor component specific operation and maintenance costs	Asset Management & Grant Coordinator	Semi-annually
3	Update water asset inventory for disposals, additions and changes in useful life - AM fixed asset review	Community Services and Finance Department	As projects occur or annually
4	Regional asset identification system for specific components to record expense at the asset level	Finance Department, Mapping Technician	In progress
5	Identification of funding sources for capital water projects	Finance Department & Community Services Department	Ongoing
6	Implement ArcGIS to gain a better understanding of asset locations and conditions	Mapping Technician/Planning Department	To be determined
7	Create a Risk Framework and annual assessment process	AM committee, Financial Department, Community Services Department	In progress/annually





Bamfield Water System Asset Management Plan

APPENDIX

Name/Location	Description	Component	Qty/ Length (m)	Date Installed	Expected Service Life	Current Replacement Cost
Rance Island Submarine Services	seaboard rd to Rance Island , north end	Piping	100	1981	80	53,000
Seaboard Road	North end to south end	Piping	140	1981	80	74,200
Binnacle Road	Bamfield Rd to Bamfield Inlet foreshore	Piping	300	2008	80	159,000
Burle Island Submarine Service	Bamfield Inlet Foreshore to Cia Rock Rd	Piping	270	2008	80	143,100
Bond St	The Mall to Westminster Ave	Piping	155	1981	80	82,150
Brady's Beach Trail	Wyton Rd to Mathers Lane	Piping	65	1981	80	34,450
Brady's Beach Trail	Wyton Rd to 330m south	Piping	330	1981	80	174,900
Burlington Ave	Bond St to Regent St	Piping	90	1981	80	47,700
Christophers Lane	Wickhams Lane to Scotts Lane	Piping	95	1981	80	50,350
East West SRW	Bamfield Rd to Seaboard Rd	Piping	105	1981	80	55,650
Grapper Inlet submarine main	North Rd to north side	Piping	200	1981	80	106,000
Mathers Lane	Brady's Beach Trail to west end	Piping	90	1981	80	47,700
Michelens Lane	Christophers Ln to 53m north	Piping	55	1981	80	29,150
Michelens Lane	53m north to col-de-sac end	Piping	125	1981	80	66,250
Pachena Rd	Grappler Rd to Nuthatch Rd	Piping	355	1981	80	188,150
Pachena Rd	Hull Rd to north	Piping	30	1981	80	15,900
Regent St	Westminister Ave to The Mall	Piping	110	1981	80	58,300
Regent Street	Burlington Ave to South	Piping	60	1981	80	31,800
SRW off Michelens Ln	53m north to west	Piping	110	1981	80	58,300
SRW off Wickhams Lane	60m north of Burlington - east	Piping	60	1981	80	31,800
SRW South of Wild Duck Rd	Cape Beale Trail to south	Piping	180	1981	80	95,400
Tower Rd	Grappler Rd to North Rd	Piping	525	1981	80	278,250
Westminster Ave	Bond St to Regent St	Piping	95	1981	80	50,350
Wickhams Ln	Customs House Ln to Christophers Ln	Piping	60	1981	80	31,800
Wild Duck Road	Cape Beale Trail to east foreshore	Piping	120	1981	80	63,600
Seabird Way	Binnacle Road to Whistlebouy	Piping	200	1982	80	106,000
Whistlebouy	Seabird Way to east end	Piping	130	1982	80	68,900
Burlington Ave	Bond St to Scotts Lane	Piping	80	1985	80	42,400
SRW South of Wild Duck Rd	south to east	Piping	65	1985	80	34,450
SRW South of Wild Duck Rd	east to south	Piping	50	1985	80	26,500
SRW South of Wild Duck Rd	south to east towards foreshore	Piping	20	1985	80	10,600
SRW South of Wild Duck Rd	east toward foreshore to foreshore	Piping	15	1985	80	7,950



Bamfield Water System Asset Management Plan

Name/Location	Description	Component	Qty/ Length (m)	Date Installed	Expected Service Life	Current Replacement Cost
Submarine Pipeline	West Bamfield foreshore to Burlo Island	Piping	90	1985	80	47,700
Submarine Pipeline	Burle island north end - Heggstrom rd	Piping	1200	1987	80	636,000
Bamfield Rd	South Bamfield Rd to south end	Piping	395	2008	80	209,350
Brady's Beach Trail	330m south to Winston Ave	Piping	275	2008	80	145,750
Crane Rd	Wild Duck Road to north end	Piping	65	2009	80	34,450
Wild Duck Road	Cape Beale Trail - Crane Road	Piping	180	2009	80	95,400
Bond St	The Mall to Burlington Ave	Piping	165	1981	80	87,450
Cape Beale Trail	Winston ave to the mall	Piping	510	1981	80	270,300
Cape Beale Trail	Winston ave to Wild Duck Road	Piping	190	1981	80	100,700
Nuthatch Rd	Pachena Rd to west end	Piping	255	1981	80	135,150
The Mall	Cape Beale Trail to Bond St	Piping	110	1981	80	58,300
Wickhams Ln	Burlington Ave to Customs House Lane	Piping	115	1981	80	60,950
Reservoir #1	Water Storage	Reservoirs	180	1981	35	153,000
Water treatment system process controls	Water Treatment Plant	Treatment PI	1	2018	10	20,000
Pump station equipment storage building (no foundation)	Pumphouse	Pump Station	4.8	2010	20	4,800
Pump station building electrical	Pumphouse	Pump Station	1	2010	20	20,000
Pump station generator	Pumphouse	Pump Station	1	2010	20	30,000
Pump station pump and motor	Pumphouse	Pump Station	2	2010	20	30,000
Pump station system process controls	Pumphouse	Pump Station	1	2010	20	5,000
Reservoir #2	Water Storage	Reservoirs	360	1999	35	288,000
Sugsaw lake dock		Dock	1	2012	25	5,000
Water treatment electrical	Water Treatment Plant	Treatment PI	1	2018	20	25,000
Water treatment chlorination system	Water Treatment Plant	Treatment PI	1	2018	25	25,000
Water treatment tank	Water Treatment Plant	Treatment PI	1	2018	25	350,000
Water treatment UV system	Water Treatment Plant	Treatment PI	1	2018	25	40,000
Water treatment pumps, valves, blowers, analyzers, meters	Water Treatment Plant	Treatment PI	1	2018	30	20,000
Pumphouse building	Pumphouse	Pump Station	24.75	2010	40	37,125
Pump station piping & appurtenances	Pumphouse	Pump Station	1	2010	40	50,000
Water treatment treated water holding tanks	Water Treatment Plant	Treatment PI	61.5	2018	35	18,450



Bamfield Water System Asset Management Plan

Name/Location	Description	Component	Qty/ Length (m)	Date Installed	Expected Service Life	Current Replacement Cost
Water treatment plant building	Water Treatment Plant	Treatment PI	76.5	2018	40	114,750
Air Release Valve		Valves	17	1982	80	57,800
Fire Hydrants		Fire Hydrant	26	1982	80	158,600
Service connections		Meters	207	1982	80	414,000
Stand pipes		Blow-offs	22	1982	80	74,800
Grappler Inlet Water Supply Main	Water Supply Main	Piping	457	1980	80	326,755
Grappler Inlet Water Supply Main	Water Supply Main	Piping	1737	1980	80	1,241,955
Bamfield Inlet Submarine Line	Nuthatch Rd to Winston Ave	Piping	350	1981	80	750,050
Bamfield Rd	Frigate Rd to Hull Rd	Piping	235	1981	80	124,550
Binnacle Road	Pachena Rd to Seabird Way	Piping	80	1981	80	42,400
Binnacle Road	Seabird Way to reservoir	Piping	405	1981	80	214,650
Frigate Road	Bamfield Rd to west end	Piping	155	1981	80	82,150
Frigate Road	Bamfield Rd to west end	Piping	350	1981	80	185,500
Grappler Road	Grappler Rd to Bamfield Rd	Piping	350	1981	80	185,500
Hull Road	Bamfield Rd to Pachena Rd	Piping	80	1981	80	42,400
Pachena Rd	Hull Rd to Binnacle Rd	Piping	220	1981	80	116,600
Waterfront SRW	Frigate Rd to Nuthatch Rd	Piping	320	1981	80	169,600
Winston Ave	Bamfield Inlet to Cape Beale Trail	Piping	110	1981	80	58,300
Bamfield Rd	Binnacle Rd to South Bamfield Rd	Piping	390	1982	80	206,700
Binnacle Road	Pachena Rd to Bamfield Rd	Piping	125	1982	80	66,250
Heggstrom Rd	South Bamfield Rd to waterfront	Piping	165	1982	80	87,450
Imperial Eagle Dr	Bamfield Rd to Imperial Eagle Drive	Piping	950	1982	80	503,500
South Bamfield Road	Imperial Eagle Drive to Heggstrom Rd	Piping	320	1982	80	169,600
South Bamfield Road	Heggstrom Rd to west end	Piping	330	1982	80	174,900
Wyton Rd	Kings Rd to Brady's Beach Trail	Piping	125	2008	80	66,250
Cape Beale Trail	The mall to Kings Rd	Piping	115	2009	80	60,950
Kings Rd	Cape Beale Trail to Wyton Rd	Piping	390	2009	80	206,700
Grappler Inlet Water Supply Main	Water Supply Main	Piping	823	1980	80	678,975



Bamfield Water System Asset Management Plan

REFERENCES

Alberni-Clayoquot Regional District

- 2020, “Bamfield Water System Annual Report”, Environmental Services Department

Asset Management BC

- 2011, “Asset Management for Sustainable Service Delivery: A BC Framework”
- 2011, “Roadmap Project: A guide for using the Asset Management BC Road Map”, Opus International Consultants Ltd, https://www.assetmanagementbc.ca/wp-content/uploads/Guide_for_using_the_Roadmap-AMBC-Sept_23_2011.pdf
- 2014, “Canadian Infrastructure Report Card: Asset Management Primer”, https://www.assetmanagementbc.ca/wp-content/uploads/Asset_Management_Primer-CIRC-October_2014.pdf
- 2019, “Integrating Natural Assets into Asset Management: A Sustainable Service Delivery Primer”, <https://www.assetmanagementbc.ca/wp-content/uploads/Integrating-Natural-Assets-into-Asset-Management.pdf>

Koers & Associates Engineering Ltd.

- 2021, “Bamfield Water System Infrastructure Renewal & Long Range Plan”

NAMS Canada Certificate Program

- 2006, “International Infrastructure Management Manual”, Institute of Public Works Engineering Australasia, Sydney, www.ipwea.org/IIMM
- 2008, “NAMS.PLUS Asset Management”, Institute of Public Works Engineering Australasia, Sydney, www.ipwea.org/namsplus
- 2015, 2nd edition, “Australian Infrastructure Financial Management Manual”, Institute of Public Works Engineering Australasia, Sydney, www.ipwea.org/AIFMM
- 2015, 3rd edition, “International Infrastructure Management Manual”, Institute of Public Works Engineering Australasia, Sydney, www.ipwea.org/IIMM