BEAVER CREEK WATER SYSTEM

ANNUAL REPORT

2019

ALBERNI-CLAYOQUOT
REGIONAL DISTRICT

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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 in order 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 Environmental 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 2,873 (2016 Census) which borders the City of Port Alberni 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 water mains 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 City of Port Alberni through a bulk water agreement. The City'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 two full time staff members that maintain and operate the system who are both certified as Level 2 Operators.

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)
- Service connections: 988 (6 new connections in 2019)
- Number of water parcels: 1,037
- Population: 2,873 (BC Stats 2016)
- Total length of mains: 46.3 kilometers
- Total number of fire hydrants: 114
- The majority (67.5%) of the distribution system is Asbestos Cement (AC)
- The remainder is made up of polyvinyl chloride (PVC)
- The total bulk water consumption was for 2019: 392,193 cubic meters
- The average daily flow for 2019: 1,075 cubic meters

2.0 Goal and Targets

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

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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.

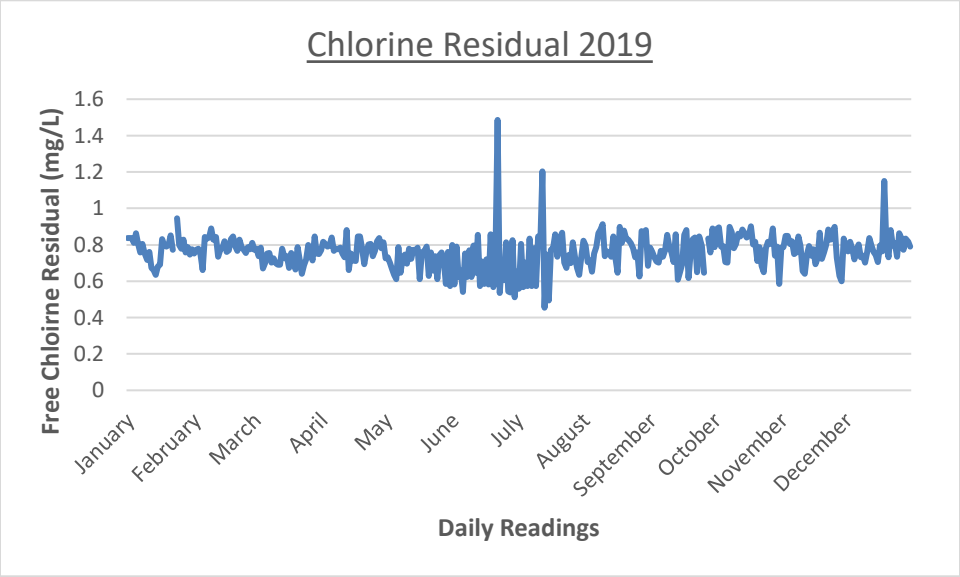
Potable Target 1 – No E.coli and No Total Coliform in any water samples

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 all of samples taken in 2019 tested negative for Total Coliforms and E.coli with only one exception that was considered a sampling or lab error.

Potable Target 2 - Minimum 0.20 mg/L Chlorine Residual

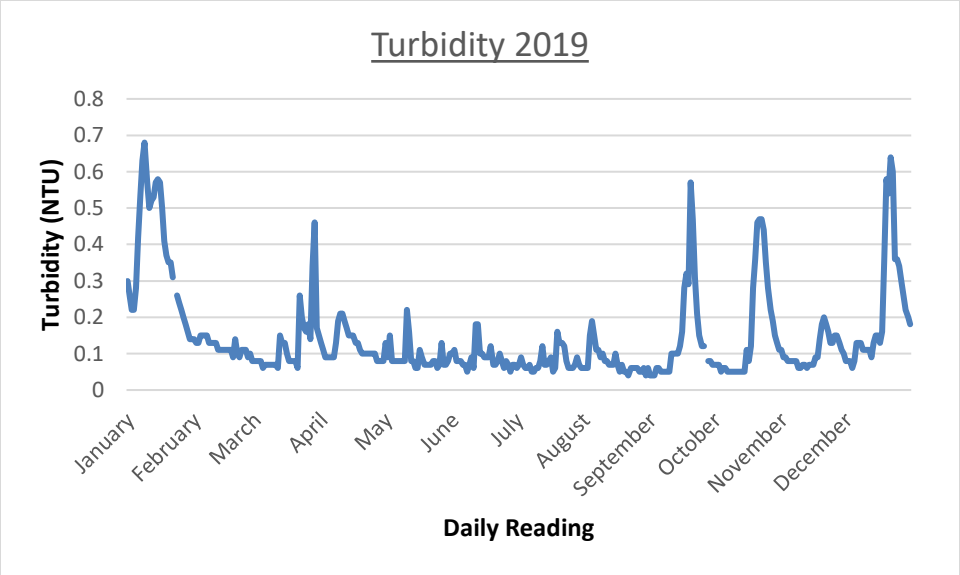
To ensure good water quality throughout the distribution system, water mains are regularly flushed to remove any accumulated silt in the water mains by creating an increase in velocity to scour the pipes. As water flows within a distribution system, the chlorine is slowly eaten up by organics in the water or any material built up in the pipes. Residual chlorine is an immediate test to measure if the water is safe to drink, 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 to increase flushing. The Chlorine graph below illustrates the chlorine residual entering the water system from the Strick Road Pump House.



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

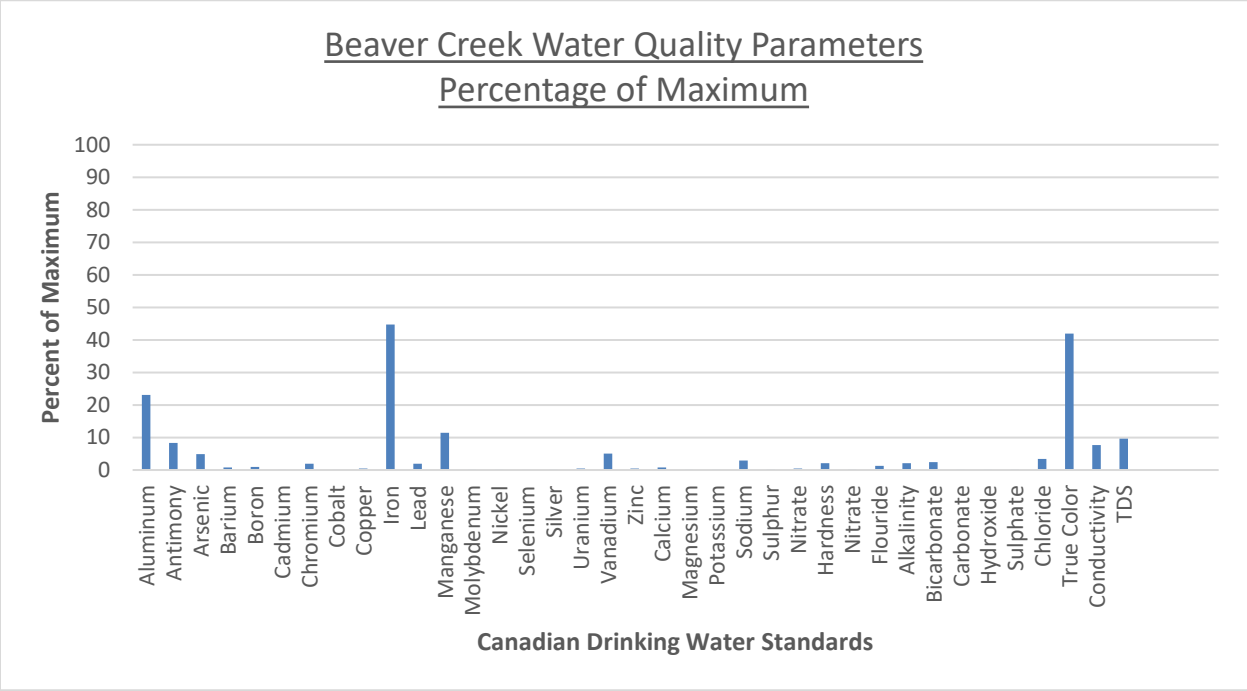
Turbidity is the cloudiness or haziness of a fluid caused by particles in the water. It is often increased in lakes and rivers after a heavy rain when soils enter the water body. This parameter is continually monitored as it negatively effects the ability of chlorine to disinfect.



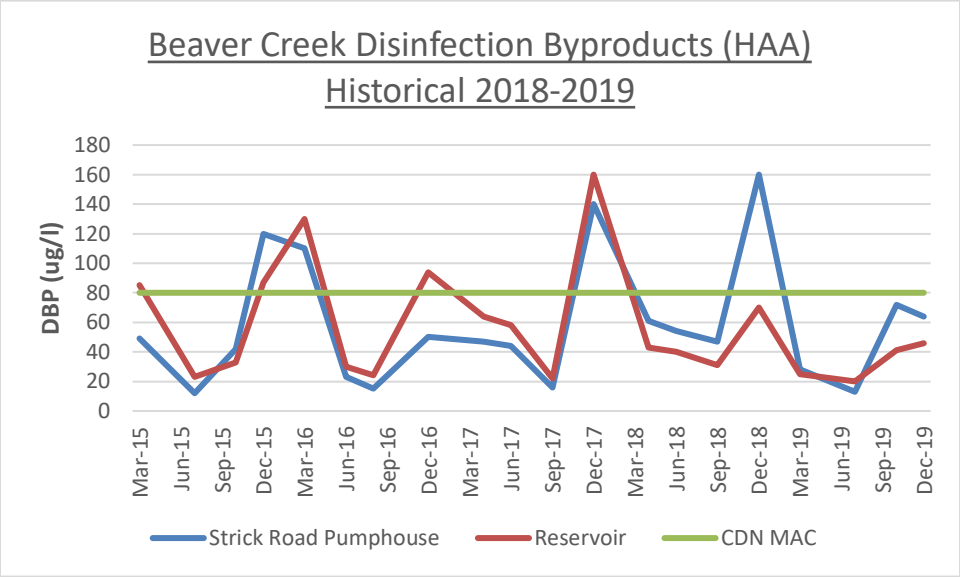
The turbidity readings are taken from the Strick Road Pump Station as water enters the system. The turbidity can have some variability due to events in the City's water system such as water line breaks or source water changes. In the event of high turbidity entering the system, the automation in the pump house can stop pumping to protect the system.

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. 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 2019.



Two of the CDWQG parameters are for disinfection byproducts (THM and HAA) and in past years we have seen individual results exceed the guidelines. These disinfection byproducts occur when chlorine combines with dissolved organics from the water source. 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. This lake has higher dissolved organics than China Creek and when it is used for the source water can create higher levels of THMs as seen in the graph below.



The Total Haloacetic Acids (HAA) maximum acceptable concentrations (MAC) by the Canadian Drinking Water Guidelines are 80 ug/L based on a running average of a minimum quarterly sampling. The 2019 values obtained at the reservoirs and pump house were all under the MAC running average.

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

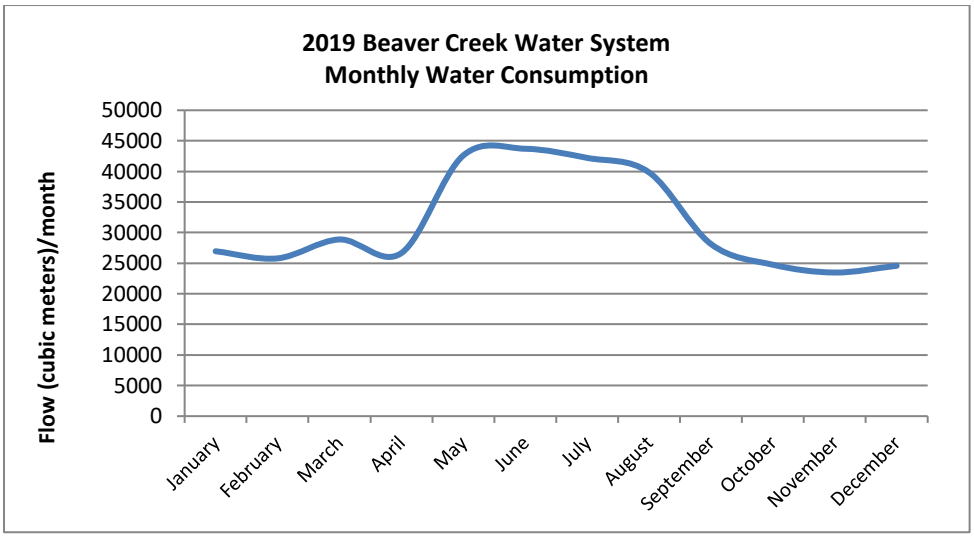
There are many factors that affect how cost effective a system is running. Effective management and planning, bulk water purchase and water demands can all affect system costs.

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

The BCWS purchases bulk water from the City of Port Alberni at $0.40/m3. It must also treat and distribute water to meet the demands of the system. With a service area population of 2,873 and total water consumption of 392,193 cubic meters, this produces a daily average of 374 liters per person per day (lpcd). This is just above the target of 350 lpcd and higher than last year's daily average at 363 lpcd but well below the 2016 UBC Survey's provincial average of 494 lpcd.

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 1,367 m3/day compared to the average daily demand of approximately 1,075 m3/day. This is approximately 1.32 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 2019, the total operating costs for the system were $549,292 excluding bulk water purchase and capital investment. Divided by the 988 water connections, this results in a $556 cost per customer. This is less than the costs in 2018, where the total operating costs were $563,833 with 982 connections for a cost of $574 per customer. Similar sized water systems typically have an operating cost per customer of between $300 and $400 per customer. The BCWS has a higher operating cost per customer because of water system failures and the small size of the system. Emergency breaks and repairs are costly and directly impact this number due to water main breaks. These costs can be reduced by replacing aging infrastructure. The BCWS also has a comparatively high cost as operations require a minimum of two operators to provide holiday and on-call coverage, meet safety requirements and complete activities that require two people. Whereas other systems of similar size are often operated by a water department that runs multiple systems, allowing efficiencies of scale to occur.

Reliability Targets:

1) Unaccounted water loss to be less than 15%.
2) Maximum # of breaks less than 5/year.

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

In 2019, the City of Port Alberni provided 392,193 cubic meters of water to Beaver Creek through a bulk water agreement. The total water consumed in Beaver Creek through all water meters for 2019 was 280,230 m3 resulting in a total unaccounted water loss of 111,963 m3 which made up 29% of all water entering the system. This is about the same percentage as in 2018. This loss can be attributed to meter error, water main breaks, flushing, unauthorized consumption and leaks. This also means that 111,963 cubic meters of water was purchased from the city and generated no revenue, a potential loss of $44,785. A certain amount of this volume is unavoidable loss including water lost due to main breaks and the flushing program. The estimated volume used for flushing in 2019 was 10,005 m3 or 3% of all water used.

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

In 2019, the BCWS had six water main breaks and eleven service line repairs, compared to two and eight respectively in 2018. Through the water main replacement program, the number of total breaks should eventually be reduced as the mains that are breaking get priority in replacement. Often a service line will break at the water main connection due to the asbestos cement pipe being fragile. 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.

Summary of Target Results for 2019

This past year, the BCWS met most targets with a few exceptions. The system was successful in meeting the water quality targets with the exception one bacteria sampling that was suspected to be an error. The other targets that were not met were the cost per customer, the number of water breaks and the water loss. These two targets are related as breaks increase costs due to machine time, parts and labor.

	Target	2019 BCWS
Bacteria Results	0	1
Chlorine Residual	>0.20 mg/l	>0.20 mg/l
Turbidity	< 1.0 NTU	<1.0 NTU
CDWQG	< 100%	100%
Average Demand	<350	374 liters per capita day
Peak Demand Ratio	<2	1.32
Cost per customer	$300-$400	$530
Water Loss	<15%	29%
Breaks	<5	17

3.0 Improvement Plan

2019 Projects Completed

In 2019, the water crew installed 6 new services, attended and repaired 6 main and 11 service breaks

Asset Management Plan - In February 2019, the Board adopted the Beaver Creek Water System Asset Management Plan. This plan identified a capital contribution gap of $532 per parcel to meet the upcoming 20 years of projected renewal costs.

Engineering Design Projects – Design of the Walker Road Watermain renewal project was completed in the summer 2019. Design of Fayette and Lamarque watermains was brought to 90% completion at the end of the 2019..

Walker Road Watermain Capital Upgrade – this project began in late October to replace the failing 4 inch AC main with 6 inch PVC main and increase hydrant locations. This project will reduce emergency repairs, improve overall fire flows and help to reduce the number of breaks and water loss within the system.

WERP Update – the Water System Emergency Response Plan was updated to include practical and realistic response plans for all potential emergency situations. During the development, some system vulnerabilities were identified and recommendations for system improvements will be addressed in 2020. The plan has updated maps, action plans and contact numbers.

Preventative Maintenance Review and Plan – Staff developed and implemented a comprehensive preventive maintenance plan and schedule to reduce corrective and emergency work as well as ensure adequate/appropriate resources are planned for the system. Staff were able to complete all scheduled maintenance within the year including 226 line valves, 26 air valves, and 57 hydrants. The schedule will be adjusted to improve efficiencies.

Water Systems Review – was completed to identify options to reduce the Operations Cost per customer. This has looked at staffing allocation and other cost saving measures. The biggest challenge with the BCWS is the relatively small size and minimum staffing requirements needed which can only be addressed by combining services with the operation of other water systems.

Upcoming Projects

Minor Capital Works – There are 4 autoflushing devices scheduled to be installed in 2020. These autoflushers will measure the water used for flushing, and reduce the time required by staff to flush the system while still maintaining water quality throughout the system.

Rates and Bylaw Review – Staff will be updating the rates and regulation bylaw to provide clearer definitions as well as improved language and organization. Staff will also be reviewing the current rates to address the need for adequate revenues to be collected to support the renewal and replacement program developed in the Asset Management Plan.

Engineering Design Project – Fayette and Lamarque watermain replacement designs will be completed early 2020. An application under the ICIP program will be made to begin design work on the next highest

priority replacement project which is the Falls/Georgia Renewal Project. Design of this project will begin in 2020 or 2021 depending on grants and construction proceeding the following year.

Fayette and Lamarque Watermains Capital Upgrade – this project will replace the failing 4 inch AC mains with 6 inch PVC main and increase hydrant locations. This project will also reduce emergency repairs for this main and improve overall fire flows. The asset management plan has highlighted the need to fast track watermain renewal in an effort to address the large sum of aging and failing watermains.

Vehicle Replacement – the Fleet Asset management plan adopted in 2019 identified the secondary Beaver creek water system utility truck, 2001 GMC Sierra, as the highest priority replacement item.

North Reservoir Emergency Generator – the lack of back-up power at the North Reservoir Pump Station results in frequent loss of water to 54 homes and high costs for call-out response. This can be rectified with the installation of a generator which will also improve the reliability and integrity of the system.

Stamp River Intake/McKenzie Pumpstation Assessment – This facility has not been used or maintained in recent years. An assessment needs to be completed to determine the costs to upgrade and maintain the facility to keep as an emergency back-up supply against the cost to decommission the facility.

Water System Audit – All water connections are charged based on the number of units serviced on each property. There may be properties with secondary suits or shops connected to the water system that are not being charged for their portion of the water system. A system audit would identify all existing connections and ensure rates are consistently and equitably applied throughout the system.

Water Conservation Plan – All water systems must have adopted water conservation plans in order to be eligible any provincial or federal grant programs. Water consumption is an average of 363 liters per person per day (lpcd) which is above the target of 350 lpcd. A strategic plan to reduce water usage will reduce costs to the system and benefit users.

Water Loss Investigation – Staff will be reviewing water use records, meter accuracy, and flushing volumes to get a more accurate estimation of the leakage in the water system. Once this has been determined, leak detection and reduction options will be assessed and a plan to reduce leakage to below 15% will be developed.