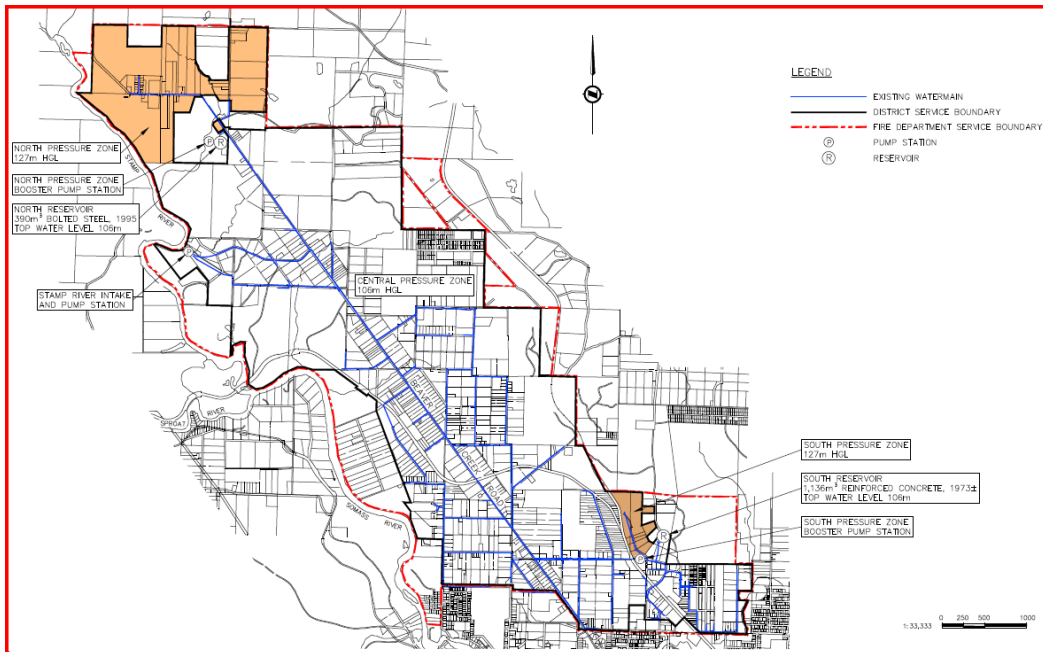


## 2019 Beaver Creek Water Conservation Plan

### Background

The Beaver Creek Water System (BCWS) is a service provided by the ACRD to the residents in the Electoral Area E (Beaver Creek). This is a community of 2,873 (2016 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 water system has over 46 km of watermain with 988 service connections.



The source water for the BCWS comes from the CPA as a bulk water provider. The City’s water has a multi-barrier approach by treating the water with two disinfection systems including ultraviolet light and chlorination. The CPA raw water sources are China Creek and Bainbridge Lake both feeding the system by gravity and there is an emergency water supply from the Somass River. The CPA system has capacity for anticipated growth in the community until at least 2050. The Beaver Creek Water System Infrastructure Assessment 2017 Report provides for a potential increase of service connections from 988 to a full build out of 1314 connections. This was determined using the average growth rate of 0.54% and would be reached in approximately 50 years.

### Water Conservation Targets

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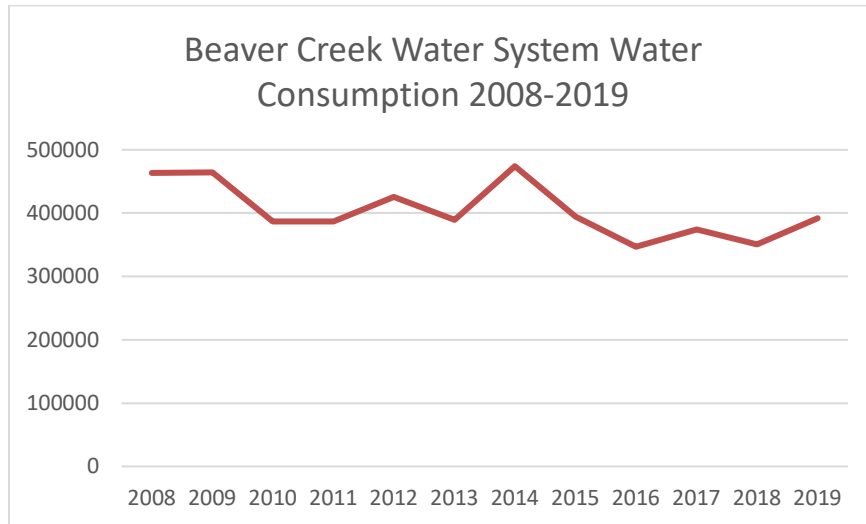
Maintain Average Consumption below 350 lpcd  
Water Loss less than 15%  
Peak Demand Ration of Less than 2:1 PDD:ADD

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### Water Consumption

The following graph shows the annual total water consumption from 2008 to 2019 demonstrating a gradual decrease from 2008. The BCWS changed source water from the Stamp River to the CPA in 2014. The new source included a new pump station in order to boost pressure and provide reliable flow. The commissioning period caused leaks and the consumption to increase in 2014. Once the startup period of the pump station was complete and with a reduction in water pressure and water flushing, the water use decreased the following years.



### Average Water Demand

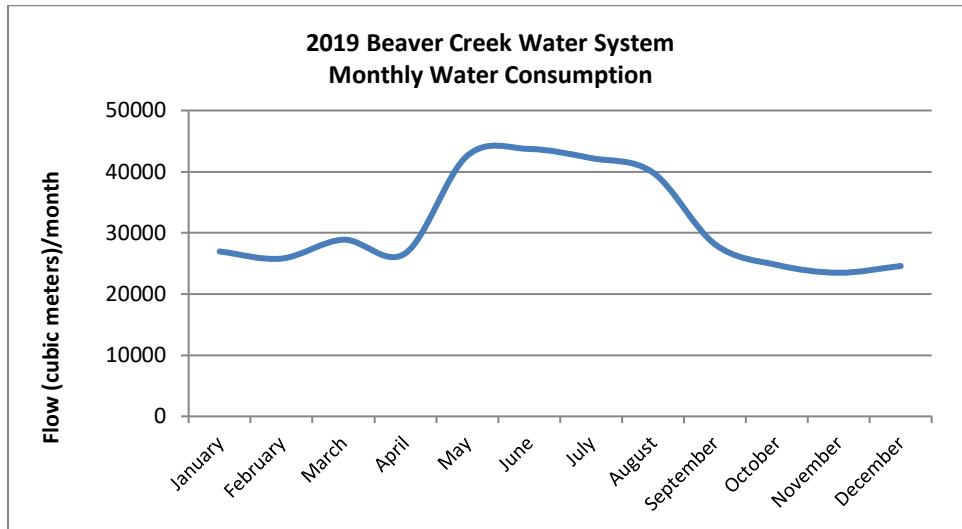
The total demand for the BCWS in 2019 was 392,193 cubic meters and an estimated population of 2873. This gives a per capita annual use of 137 cubic meters per year or 374 liters per capita per day (lpcd). This is above the target of 350 lpcd and higher than 2018’s daily average demand of 363 lpcd but below the 2016 UBC Survey’s provincial average of 494 lpcd.

	Consumption (liters per person per day)
<i>Canadian average in 2016</i>	330 <sup>1</sup>
<i>Average Annual consumption</i>	490 <sup>1</sup>
<i>Beaver Creek Average consumption</i>	374

### Peak Demand Ratio

Peak demands during summer periods can cause stress on the infrastructure capacity and source water during periods of drought. In 2019, peak summer demand was approximately 1,367 m3/day compared to the average daily demand of approximately 1,075 m3/day. This is a ratio of 1.32 to 1 for peak to average demand. This is under the target of 2:1.

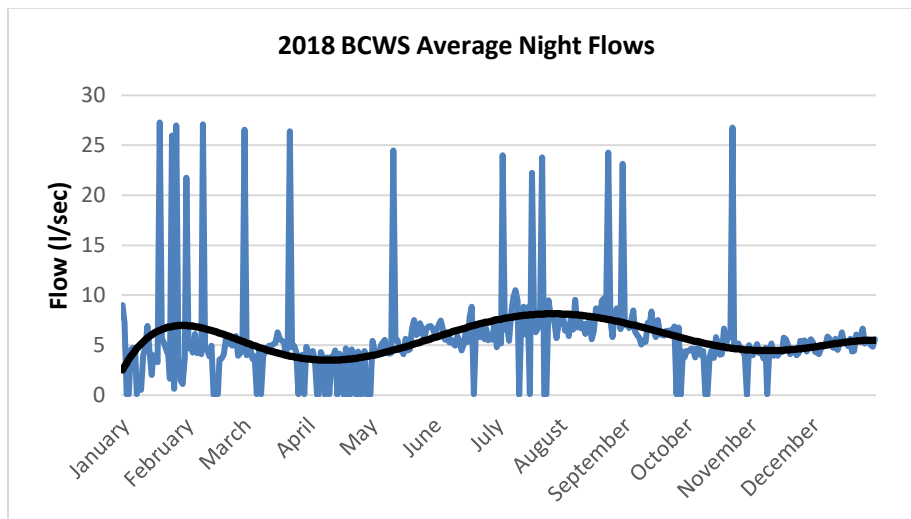
<sup>1</sup> Source: Living Smart BC 2016



### Leakage/ Unaccounted for Water

All systems experience some water loss as an ordinary part of operation. Water leakage is also called 'unaccounted for water' to distinguish it from losses that occur for known reasons, such as hydrant flushing. In 2011 the BCWS completed a Water Infrastructure Assessment and found the unaccounted for water from system leakage to be high, varying between 23% and 38%. A reduction in pressure and an operational leak detection program is believed to have reduced the leakage from 2011.

In 2019, the CPA provided 392,193 cubic meters of water to the BCWS. The total water delivered to customers through all water meters for 2019 was 280,230 m<sup>3</sup> resulting in a water loss of 111,963 m<sup>3</sup> 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. The estimated volume used for flushing in 2019 of 10,005 m<sup>3</sup> or 3% of all water demand. The graph below shows that average night flows in the system are approximately 5 l/s. As household demand is typically nothing during the night in the winter, the flow is attributed mostly to leakage due to failing infrastructure. This is confirmed when commissioning new watermains causing a reduction in nighttime flows.





## Current Conservation Measures in Place

Beaver Creek currently meters all water use and bills for water based on consumption. At each quarterly reading, consumption is reviewed and unusually high readings are investigated. This often results in the identification and repair of homeowner leaks. Further to identifying leaks, meters also provide incentives for conservative water use. Residents are allowed a threshold of 108 m<sup>3</sup> per quarter of water each quarter. Above this amount, residents pay \$2/m<sup>3</sup>. This is an effective tool for motivating changes in water use behavior with approximately 93% of users under this threshold in the winter and 80% of customers under this threshold in the summer.

The BCWS receives bulk water from the City of Port Alberni and is required to follow their water restrictions program. The water restrictions are set up with four stages, increasing restrictions as the stages increase. Stage One Restrictions are put in place every summer even if there is no shortage of water as it provides education and awareness to the consumer for further restrictions during a water shortage. The BCWS installs sandwich board signs on the main arterial roads coming into Beaver Creek indicating the Stage of water restrictions. Other methods is to include water conservation status new letters to educate users of status of water restriction and conservation. City promotion and education in the local paper and media are typically also received by the Beavercreek customers.

## Water Conservation Strategy Options

The following programs were assessed for their expected costs and potential savings:

<b>Water Conservation Strategy Options</b>			
	<i>Reduction</i>	<i>Total Cost Annually</i>	<i>Potential Savings (m<sup>3</sup>) and \$ per year</i>
<b>Financial</b>			
Increasing Block Rate Structure	15%	minimal	59,610 m <sup>3</sup> and \$23,844
Increasing Basic Consumption Rates	5%	minimal	19,870 m <sup>3</sup> and \$7,948
Reduce Volume in Basic Charge	10%	minimal	39,740 m <sup>3</sup> and \$15,896
<b>Education</b>			
School Programs	1%	\$10,000	3,922m <sup>3</sup> and \$1,569
Community events	1%	\$5,000	3,922m <sup>3</sup> and \$1,569
Advertising	1%	\$5,000	3,922m <sup>3</sup> and \$1,569
Conservation tips on the ACRD website	0.5%	minimal	1,961 m <sup>3</sup> and \$784
Website/Newsletters	2%	minimal	3,922 m <sup>3</sup> and \$1,568
Workshops	0.5%	\$5,000	1,961 m <sup>3</sup> and \$784
<b>Regulation</b>			
Outdoor Water Bylaw/ ticketing	1%	\$5,000	3,922m <sup>3</sup> and \$1,569
<b>Rebates for High Efficiency</b>		<b>per household</b>	
Shower head rebates	5%	\$25	19,870 m <sup>3</sup> and \$7,948
Toilet rebates	6%	\$212	23,532 m <sup>3</sup> and \$9,413
Appliance rebate	1.50%	\$59-\$147	5,883 m <sup>3</sup> and \$2,353



The primary focus of this plan will be to focus on conservation efforts and programs to reduce summer demand as this will reduce the peak ratio and the overall water consumption. Summer use is significantly higher than winter consumption as a result of the outdoor water use. Of the available conservation strategies, the most two cost effective options for the BCWS are Conservation Focused Rate Structures and Education:

**Financial Conservation Measures**

Increasing Block Rate Structure: Increasing block rates divide a customer’s consumption into blocks but charge less for initial units of consumption and more for later units of consumption. These rate structures are considered to promote efficiency because of the price signal that conveys higher costs for higher volumes of use. This also can be used to reduce the average and peak demands. A block rate structure for the BCWS would reduce the allowable volume of water in the basic charge from 108 m3 per quarter to 60 m3 with the addition of 3 more rate blocks including: a rate of \$1.40/m3 be charged for water up to the 108 m3, \$2.00/m3 be charged for water over 108 m3 and \$2.80/m3 be charged for consumption over 180 m3 per quarter. This is summarized in the following chart

Block	Volume	Rate
First Block	Under 60 m3	Included in basic charge
Second Block	60 m3 - 108 m3	\$1.40/m3
Third Block	108 m3 – 180 m3	\$2.00/m3
Fourth Block	Above 180 m3	\$2.80/m3

Increasing Basic Consumption Rates: Consumption rates are charges for each unit of water and by increasing this rate provides financial incentive for people to reduce overall water use. Other communities have implemented a seasonal rate where the rates for water consumption are cheaper in the winter and higher in the summer. This can be effective in reducing summer water use. When using conservation rate structures, an education component should also be used to inform the users of why the structure is being used and what the billing system is. It is important to let the consumers know the reasons behind water conservation, what the infrastructure benefits are to the water system, and how they can reduce their water consumption and consequently their water bills.

In the BCWS, only 7% of users are over the basic volume in the winter and 20% in the summer. Therefore increasing the consumption rates would have a limited affect on the majority of water users and is not expected to result in an average reduction above 5%.

Reducing Volume in the Basic Charge: The current block rate for each water connection is described in the ACRD bylaw F1119 as \$51.67 for 108 cubic meters per quarter, which equates to a rate of \$0.70 per m3. After this first block is exceeded the charge is \$2 per cubic meter. This is a large volume of water to be included in the basic charge followed by a very significant jump in rates for all water used above this volume. This volume of water is typically much higher than a conservative water use home which uses on average 40 - 60 m3 per quarter. If 108 m3 was used by each water connection, it would result in a consumption rate of 415 lpcd. This is above our actual rate of 374 lpcd and much higher than the target of 350 lpcd. The average volume of water that should be used per connection to meet our targets would be 64 m3 per quarter. If the majority of customers would use under this volume, the water system would meet it’s goal.



#### Discussion:

An increasing block rate can be a very effective way to affect consumer habits resulting in an average water use reduction of 15%. This is also a complicated system that takes effort to implement in billing software, can seem confusing to customers if adequate engagement and education is not undertaken prior to implementing. Increasing consumption rates would also be expected to reduce water use, but the impact is only likely to reduce consumption by 5% as the majority of water use is under the basic threshold. Reducing the volume allowed in the basic charge is expected to have a larger reduction of over 10%. Changing the consumption rate or the allowable volume in the basic charge are both systems that are easy to implement and educate the public on. The BCWS has seen that the existing rate structure is an effective tool in keeping the majority of users below the threshold. Reducing the allowable volume in the basic charge to under 64 m<sup>3</sup> is expected to have a significant impact on water usage resulting in at least a 10% reduction in consumption.

#### **Education**

The water conservation education program proposed for the BCWS includes the creation and use of brochures, newsletters and sandwich boards. The ACRD website is a good method of providing education as to the reasons why the water system needs a conservation plan and to provide the most up to date incentives. These are cost-effective options to provide education to the community. Although, this type of passive education program would not be effective as a stand-alone effort, coupled with conservation rate structures, is likely to produce an effective result in reducing water use. Future education initiatives could include outreach programs promoting water savings, providing free household water audits, demonstration presentations at community events (ex. Fall Fair) or a school program. However, this later group is expensive and difficult to target the customer of the BCWS.

#### **Water Loss Minimization**

The majority of the Beaver Creek Water System was constructed in the 1960's with asbestos cement pipe which is coming to the end of its useful life. As a result, this infrastructure is beginning to fail resulting in high water loss in the system and high costs for emergency repairs. The BCWS 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. This will reduce water loss and overall water demand.

## Recommendations

The recommendations are to; 1) focus financial investment on replacing old leaking infrastructure, 2) adjust water rates to encourage conservation and 3) support water use reductions through education efforts.