2018 Annual Water Report

EXECUTIVE SUMMARY

The Town of Oliver operates an extensive Municipal and Rural water system that consists of seven ground water well sites, two surface water sources, and three reservoirs. The water system covers the Town of Oliver itself and a substantial portion of area 'C; of the Regional District of Okanagan-Similkameen. The Town provides domestic water to approximately 2,393 residential and 174 commercial/ industrial connections, which are all metered. Irrigation water is also provided to 601 connections irrigating approximately 5,200 acres of farmland with 1,025 acres of that pumping their own water from the Town's irrigation canal, excluding 455 acres of non-farm land that is also irrigated from this system.

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1.0 INTRODUCTION

The British Columbia Drinking Water Protection Act requires that each municipal government that supplies or distributes domestic drinking water must provide a water quality report that is reviewed by the local Drinking Water Officer, and published for public access. This report has been prepared for the community of the Town of Oliver, and in accordance with the requirement in the Drinking Water Protection Act.

1.1 HISTORY

In 1918, the Provincial Government, led by "Honest John Oliver", the Premier at this time, purchased over 22,000 acres of land in the South Okanagan to develop an irrigation canal system to convert 8,000 acres of desert land on each side of the Okanagan River into viable agricultural land. This land would then be for sale, at a reasonable cost, designated to the soldiers returning from World War I. This land arrangement was known as the "The Soldiers' Land Act." This project then became SOLP (South Okanagan Lands Project)

Construction of the irrigation system, including the intake dam at the base of McIntyre Bluff, began in 1918. Over the next seven years, the canal, known as "The Ditch", had an overall length of approximately 40 concrete-lined kilometres measuring 5.6m across the top, and 1.5m deep, delivering 6.5m^3 of water per second. The SOLP designed the canal to transport irrigation water from one side of the Valley to the other. To accomplish this, a 2.1m diameter siphon made out of wood stave pipe had to be built underground, which ran approximately 590m long directly beneath the center of Oliver, connecting the North and South parts of the canal.

Over the next forty years, the canal was maintained and run by the provincial government employees (SOLP), until the spring of 1964, as the province decided it was removing itself from the irrigation business. Premiere W.A.C. Bennet passed the canal to the Oliver and Osoyoos Fruit Growers' Association, which volunteered itself to become the cornerstone of the South Okanagan Lands and Irrigation District (SOLID). The district operated and maintained the canal system until 1989 when it was divided into two municipal governments: the Town of Oliver and the Town of Osoyoos. The Town of Oliver was given the responsibility to maintain and operate the canal, which is still a major contributor to the rest of the 100 billion liters of water that Oliver and Osoyoos delivers annually to the parched desert area of the valley.

Today, the Town of Oliver provides domestic water to approximately 2,393 residential (including rural), and 174 commercial and industrial connections. Irrigation water is provided to 601 connections, irrigating approximately 5,200 acres of farmland with 1,025 acres of that pumping their own water from the Town's irrigation canal. 455 acres of non-farm land is also

irrigated from this system. The change in the non-farm arable area from previous years is due to a change in the new Water Regulations Bylaw 1351 where customers previously received a half acre with the payment of their parcel tax.

2.0 WATER SYSTEM OVERVIEW

The Town of Oliver's water system is broken down into seven individual systems, which over time have been inter-connected to provide a more sustainable water supply system as a whole. Each system is defined, or known by, the area and the wells that support it:

(Please See Appendix A: Town of Oliver Water System Map)

- System 1 – also referred to as Rural North – Buchanan Road Pumphouse
- System 2 and 2B – Black Sage Area – Black Sage and Miller Rd Pumphouses
- Municipal System – also referred to as System 3 – Rockcliffe and Tucelnuit Pumphouses
- System 4-7 – also referred to as Rural South – Fairview and Miller Rd 13 Pumphouses

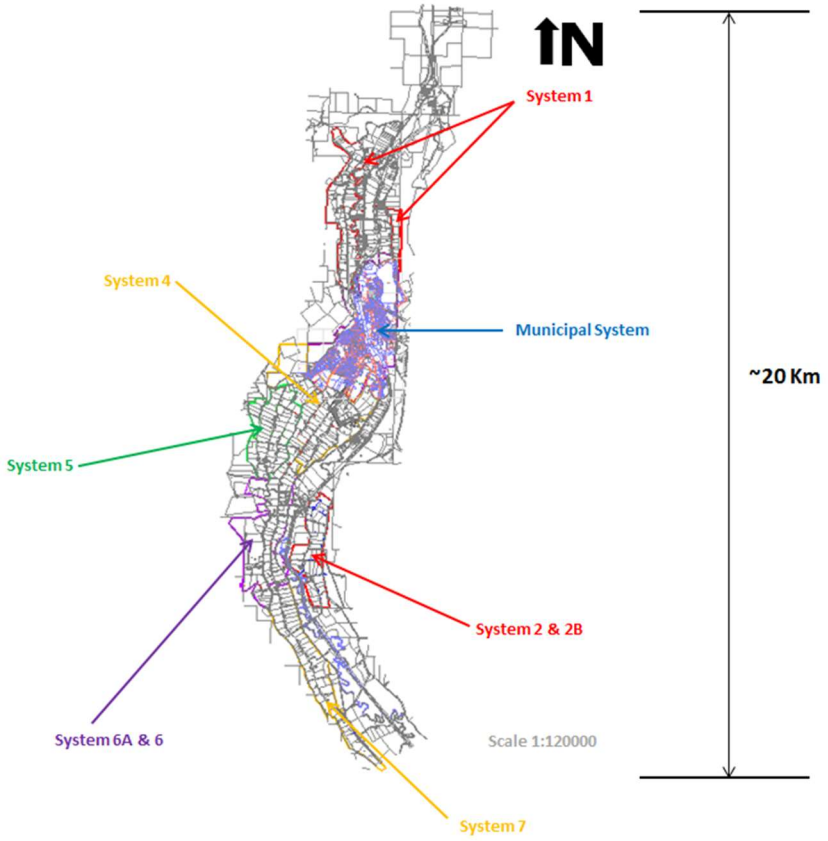


Figure 1: Town of Oliver's 7 Water System Overview

As of 2014, the Town of Oliver uses groundwater for all of its domestic water connections. Therefore, the canal surface water system is providing irrigation only, with the addition of low-pressure users who pump out of the canal using their own private pump houses. Each system is twinned with the exception of System 2 (Black Sage). This system is groundwater only, and there are no current plans to complete the twinning of System 2.

As part of the water distribution system, the Town maintains approximately 143 kilometres of water main. The distribution system is made up of Asbestos Concrete (AC), Polyvinyl Chloride (PVC), Cast Iron (CI), and High Density Polyethylene (HDPE) material, with pipe sizes ranging from 50mm to 600mm in diameter.

The age of the water mains range from new to approximately 50 years old. The age of the pipe does not necessarily reflect the need to replace it as the various material types and installation conditions make for different average life expectancies. Normal operating pressures range from 60psi to 120psi for standard pressurized services.

2.1 DOMESTIC SYSTEM

The domestic water system storage capacity is 1,025,000 US gallons (US GAL) (3880 cubic metres (m^3)) between four reservoirs. Existing Municipal reservoirs consist of a 360,000 US GAL (1360m^3) reservoir and a newer (constructed in 2010) 500,000 US GAL (2470m^3) reservoir. The other two reservoirs still in use are located in System 6a; Road 13 reservoir at 150,000 US gallons (568m^3) and Hester Creek reservoir at 15,000 US gallons (57m^3).

2.1.1 SYSTEM 1 DOMESTIC

System 1, also known as “Rural North,” supplies domestic water to approximately 161 accounts. System 1 has an irrigation main, and a domestic main that runs approximately 4.5km from the edge of town N. to the end of Sportsman Bowl Road. Buchanan pump station, which is located adjacent to 1748 Buchanan Road and near the east side of the Okanagan River, supplies both irrigation surface water to System 1 and domestic ground water to System 1 and into the municipal system #3. Buchanan pump station has one domestic ground water pump having a total 125 horsepower (hp) that has a pumping capacity of 1,000 gallons per minute (gpm).

2.1.2 SYSTEM 2&2B DOMESTIC

System 2, also known as “Black Sage” area, supplies domestic and irrigation water to approximately 52 accounts. System 2 is unique having separated into two areas, System 2, and 2B. System 2B, along with every other system, is twinned. Whereas System 2 is the only system

that does not have separate water sources for both irrigation and domestic water. System 2 and 2B have two domestic pump stations within its boundary; Black Sage pump station, and Miller well pump station. The Black Sage pump station is located approximately 154m W. from Ryegrass Road between Miller Road and Watters Road. The Black Sage well supplies groundwater to both domestic and irrigation services in System 2 and 2B utilizing three pumps having a total 235hp, and a pumping capacity of 2,600gpm. The Miller Well, located on the west end of Miller Road, approximately 67m E. of the Okanagan River, supplements up to 500gpm of domestic groundwater to System 2 and 2B during the peak demand season, along with Systems 4 thru 7, via Reservoir 13.

2.1.3 MUNICIPAL SYSTEM DOMESTIC

The Municipal System, also known as System 3, supplies domestic groundwater to approximately 2400 accounts. Municipal System utilizes two pump stations, and one booster station to supply its users within the Town boundary; Rockcliffe pump station, Tucelnuit pump station, and the Airport Booster station. Rockcliffe is located between the parcels of 781 and 715 Skagit Avenue. Rockcliffe has one pump at 150hp, and a pumping capacity of 1,500gpm. Tucelnuit pump station is located on the SE corner of Merlot Avenue, and Lakeside Drive; W of the Tucelnuit elementary school. Tucelnuit utilizes two pumps having a total pumping capacity of 1,750gpm. The Airport Booster station is located on the NE corner of the intersection of Airport Street, and Road 1. The Airport Booster is typically set to supply water from within the Municipal boundaries to the rural area south, but can also be used to intake water from the rural area south, and supply the Municipal System depending on demands or if there was a maintenance malfunction of another pump.

2.1.4 SYSTEM 4-7 DOMESTIC

System 4-7, also known as “Rural South,” supplies domestic ground water to approximately 483 accounts. The Systems utilize the Miller Well pump station, 6A Domestic Booster station, and the Airport Booster station. Miller Well pump station also aids in a supplement supply of domestic groundwater to System 2 during peak demands, and the Road 13 Reservoir. The Miller Well pump has 125hp, and a pumping capacity of 1,000gpm. 6A Domestic Booster feeds Hester Creek Reservoir (6A), while the Airport Booster has the option to alternate between the Municipal System and the Rural South to have a continuous loop in the system, and so that each pump is working in its most efficient phase.

2.2 IRRIGATION SYSTEM

Surface water, specifically Okanagan River, is still the primary source for the irrigation water system, but also includes Buchannan well, Fairview well and Black Sage oxbow. The canal system runs from McIntyre Dam (where the diversion is complete with a fish screen to divert fish back to the Okanagan River) north of Town to Road 18, south of Town, where it continues past Road 22 as a piped system. The irrigation system in System 2B is supplied by the Black Sage oxbow, with the remainder of System 2 not being twinned. The Town maintains multiple water licences to allow these surface water diversions. There are five additional irrigation pump stations that pump along the canal: Mud Lake, Rockcliffe, Fairview, Hester Creek, and Mount Kobau.

In January 2016, the irrigation canal siphon located at Gallagher Lake was damaged by a large rock fall event. Following the rock fall, the Town of Oliver engaged Golder Associates to conduct a geotechnical assessment of the area to determine the actions required to enable safe access to the site for repair of the siphon. Rock scaling was carried out by T&A Rockworks. A pipe repair was then completed from within the pipe, during which time a 1.2 meter (outer diameter) pipe was grouted into place. This allowed the siphon to operate during the irrigation season with a 32% reduction in supply capacity. While this flow has been sufficient for 2016, 2017 and 2018 so far, it may not be adequate during warmer, drier seasons in the future and hinders the Town to incorporate new customers.

2016 irrigation season started on April 18th and ended October 11th. Crews began filling the canal and turning on spray fillers April 13st. The canal diversion was shut down on October 28th. All Town irrigation systems were shut down and winterized by the end of October.

The Town is still working on re-routing this portion of the canal (damaged siphon) with the help of Provincial and Federal funding. There are hopes that this project could be completed by 2020 once funding is in place and preparation has continued in 2018.

Town staff starting seeing heavier creek flows on many creeks, the last couple of years (2017 & 2018) on the west side of the valley. Staff continued to monitor; Hester, Tinhorn, Reid & Park Rill creeks which can have an affect on our irrigation system, similar to the 2017 debris run-off into the canal. Spending extra time monitoring, working with contractors and periodically removing extra material in creeks or keeping culverts clear that could potentially damage the Town's irrigation infrastructure, seems to be the norm the last two years.

2.2.1 SYSTEM 1 IRRIGATION

System 1 utilizes two pump stations for its irrigation; Mud Lake and Buchanan. Mud Lake pump station intakes water from the canal utilizing two pump units at a combined 200hp, and having a pumping capacity of 5,000gpm. Mud Lake is located 90m W of Buchanan Drive. Buchanan irrigation pump is 50hp, and has a capacity of 500gpm. System 1 covers 420 acres of agriculture that is pressurized irrigated. This result is excluding the number of low-pressure users in the area.

2.2.2 SYSTEM 2&2B IRRIGATION

As mentioned earlier, System 2 is the only system that is not twinned, having pumps that supply groundwater for both domestic and irrigation uses with a combined 235hp, and having a pumping capacity of 2,600gpm. However, System 2B has its own irrigation pump which is called Black Sage Irrigation Pump that intakes from the Black Sage oxbow located 65m S of Road #9, and 100m E of the Okanagan River. This pump has 150hp with a capacity of 1,540gpm. System 2 and 2B provide pressurized irrigation water to approximately 405 acres of agriculture land.

2.2.3 SYSTEM 4-7 IRRIGATION

The second canal pump station is Rockcliffe Irrigation in System 4. This station utilizes three pumps having a combined 500hp, and a pump capacity of 9,100gpm. Rockcliffe supplies pressurized irrigation to approximately 916 acres of agriculture. This pump station is located between the properties of 824 and 760 of Road 2. System 4 also includes a 25,000 US GAL ($94m^3$) irrigation water reservoir, called System 4 Irrigation Reservoir.

The third canal pump station along the system is Fairview irrigation pump station, which is located in System 5 on the NE corner of Road 5 and the canal intersection. Fairview utilizes two pumping units with a combined horsepower of 300hp, and having a pumping capacity of 4,400gpm. There is also another Fairview Irrigation well in System 5, which used to be part of the domestic water system but was switched over to the irrigation system when the nitrate levels exceeded the Canadian Drinking Water Standards. Its primary use now is to supply water in the shoulder seasons or low demand portions in the irrigation year but it can also help supplement peak demands. System 5 includes a 50,000 US GAL ($189m^3$) irrigation water reservoir, called Fairview Irrigation Reservoir.

Hester Creek irrigation pump station is located in System 6 at the NE corner of the W end of Road 11 and the canal intersection. Hester Creek pump station utilizes two pumping units having a combined horsepower of 175hp, and a pumping capacity of 4,000gpm. Hester Creek

Irrigation pump station delivers pressurized irrigation to approximately 426 acres of land. System 6 also contains a booster pump station that has two 15hp pumps, and is utilized during the peak season.

Mt Kobau irrigation pump station is the most southern in the water system, in System 7, located at the west end of Road 18. Mt Kobau has two pumping units that have a combined total of 150hp, with a capacity of 4,000gpm. Mt Kobau provides pressurized irrigation to approximately 545 acres of land.

3.0 WATER QUALITY, SAMPLING, AND MONITORING PROGRAM

The Town of Oliver has utilized two sources of water: surface water (Okanagan River) and groundwater (well water). The surface water is now restricted to irrigation water only. Groundwater is the ONLY source of water used for domestic purposes, and the only source that is thoroughly monitored and sampled for quality purposes.

3.1 SAMPLING AND MONITORING

The Town of Oliver works closely with CARO Analytical Services out of Kelowna, BC to monitor drinking water quality in accordance with the BC Drinking Water Protection Act, and Guidelines for Canadian Drinking Water Quality (GCDWQ). The Town's staff submits weekly samples for bacteriological testing for Total Coliforms, and E-Coli Bacteria at various sampling sites throughout the domestic system. In congruence with the submittals, the Town also conducts their own in house presence/absence tests. The Town also monitors the Nitrate levels in the drinking water sampling six times a year in February, April, June, August, October, and December. Once a year, and usually mid-summer, the Town will commence a full spectrum test on the domestic water system. The spectrum analyzes all physical parameters and characteristics of The Town of Oliver's drinking water. The results are then compared to the GCDWQ.

- *(Please See Appendix A: The Town of Oliver Water System Map for Sampling Sites)*
- *(Please See Appendix B: 2018 Full Spectrum Results and GCDWQ)*
- *(Please See Appendix C: 2018 Weekly Water Sampling Result Table)*

There are seven test stations located in the Municipal boundaries. The rural area north of Town has one test station and there are six testing sites (excluding wells) south of Town. When any sample shows the presence of Total Coliform or E-Coli, the Interior Health Environmental

Health Officer is consulted and standard protocols are initiated with a flushing of the contaminated system and a resampling of water where contamination was located. The sample is then immediately resubmitted for testing by the lab.

4.0 WATER CONSUMPTION

4.1 TOTAL CONSUMPTION

The water works system again is twinned in Oliver, meaning that the groundwater used for domestic purposes has its own pipe network along with the surface water, used for irrigation purposes, also has its own pipe network except for System 2, which is using groundwater for both irrigation and domestic purposes. The Town of Oliver consumed 3,553,952,830 US GAL of water in 2018. That is 13,453,174,922 liters (L) of water or 13,453,175m^3 of water.

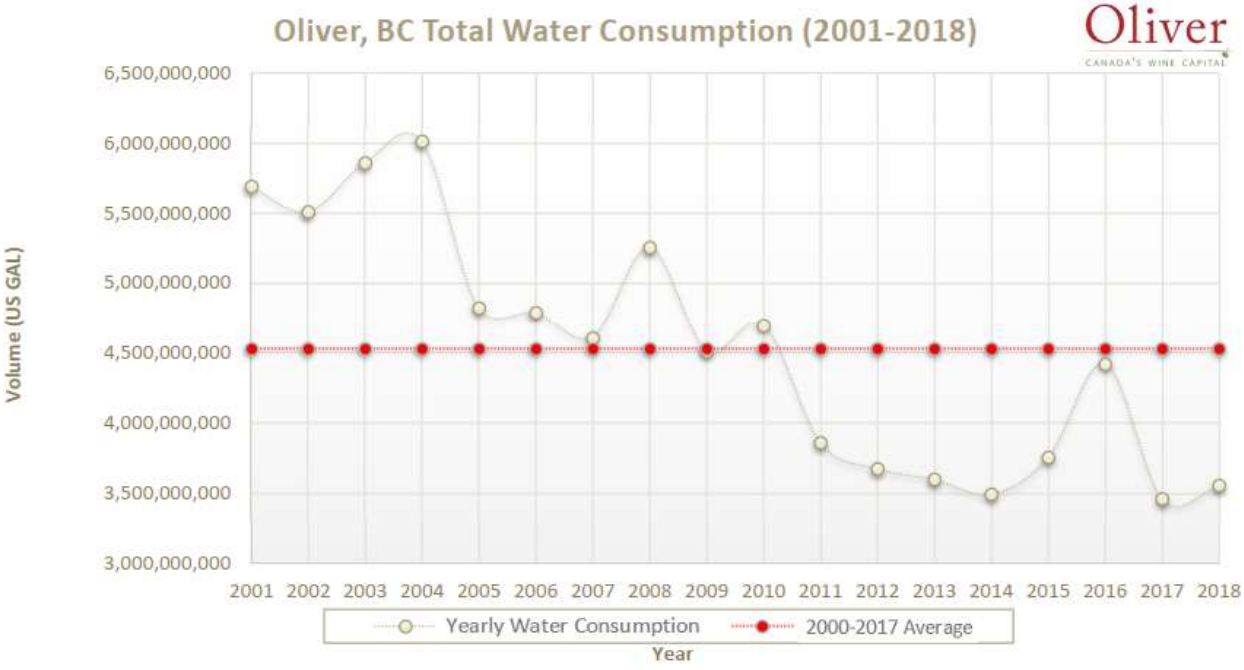


Figure 2: Total Water Consumption 6 Year Trend

As we can see in *Figure 2,* Oliver consumed 3.32% more water than the previous year in 2018. The seventeen-year average is 4,529,608,050 US GAL. In 2018, Oliver consumed 21.54% less than the seventeen-year average. The demand is influenced by the population and irrigation usage, and population has been slightly increasing each year in Oliver and the area surrounding it. The 2016 Census reported Oliver having a population of 4,928 but the Town of Oliver's water systems extend beyond its borders and it is hard to define how many people it actually serves but is estimated over 6,000 people.

Irrigation has seen improvements over the years for ground crops, orchards and vineyards which have had a significant change on the water demand and peak demand decreases. Irrigation practices and water conservation through these practices have been the major influence of the change in water demand, and also the final twinning stages of the water system in 2014. The other major contributing factor is weather and precipitation. The South Okanagan was declared, by the government of BC, a drought level of 4 in 2015. In 2016, the South Okanagan did not reach a drought level of four, instead it had a normal snowpack season, and was considered a "dry" year, but did not see the same level of drought as 2015. 2017 had seen above normal snowpack, late winter/early spring precipitation and caused unsuspected flooding throughout the region. In 2018, the Okanagan was in a valley wide emergency state due to flooding again. The snow back in March was 85% above normal, and then April rains came along with high temperatures. The melt increased and creeks that have been dry for years started flowing again. Agriculture development over the years had changed the lay of the land and the natural watercourses, causing the spring runoff to flow through vineyards and orchards damaging crops. The spring flooding caused Oliver's agriculture to be a wet one, and the large amount of precipitation influenced the irrigation demand. Oliver's max residential domestic water demand was on August 04, 2018. *See Figure 3.* Oliver had a maximum daily water demand peak at 34,778.53m^3, while minimum daily demand occurred on November 17, 2018 at 2,152.84 m^3.

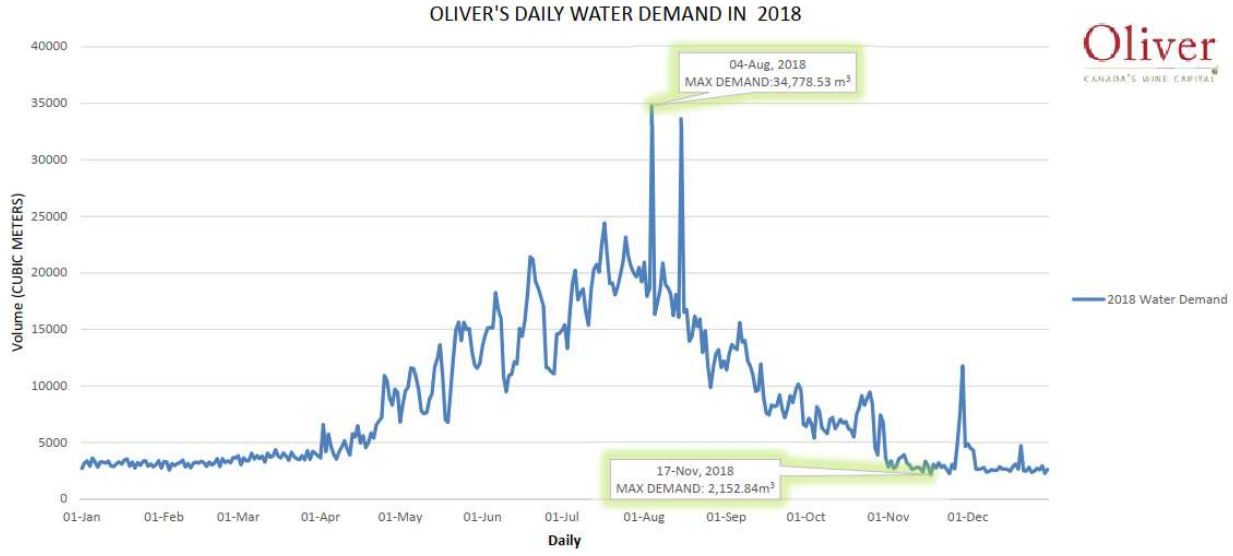


Figure 3: Oliver's 2018 Max and Min Domestic Water Demand

4.2 BREAKDOWN OF CONSUMPTION

The Town of Oliver consumed 833,976,828 US GAL (3,156,946m^3, 3,156,945,712L) of groundwater in 2018. This amount is 23.47% of the total consumption. The remaining 76.53% is surface water, which is primarily used for irrigation, having a total consumption of 2,719,976,003 US GAL (10,153,135m^3, 10,153,134,533L). *See Table 1 below for the breakdown of percentages*.

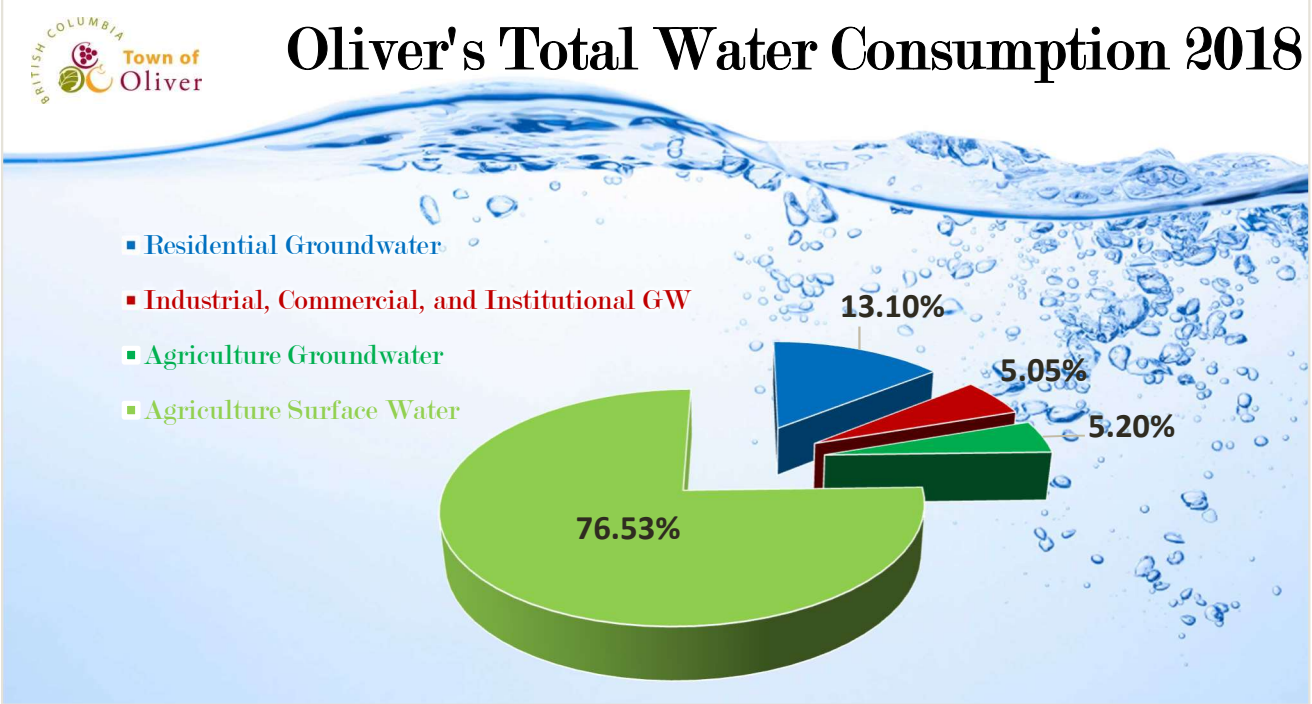


Figure 4: Oliver's Total Water Consumption 2017

WURC CALCULATIONS	US GAL	CUBIC METERS	PERCENTAGE
TOTAL GW USED	833976827.67	3156944.22	23.47%
TOTAL SW USED	2719999103.55	10296311.81	76.53%
TOTAL RES GW	465638577.24	1762632.93	13.10%
TOTAL RES SW	0.00	0.00	0.00%
TOTAL ICI GW	179630206.49	679973.98	5.05%
TOTAL ICI SW	0.00	0.00	0.00%
TOTAL AG GW	184785188.68	699487.70	5.20%
TOTAL AG SW	2719999103.55	10296311.81	76.53%
TOTAL WATER	3553975931.22	13453256.03	100.00%

Table 1: Oliver's Groundwater Breakdown: Groundwater (GW), Surface Water (SW), Residential (RES), Industrial, Commercial, Institutional (ICI), and Agriculture (AG).

According to the OBWB, an average person in the Okanagan uses 675L of water each day. That is twice more water than the Canadian average of 329L per day. On average, Oliver domestic system used approximately 918L of water per person per day in 2018, which is 589L above the Canadian average. *See Figure 5.*

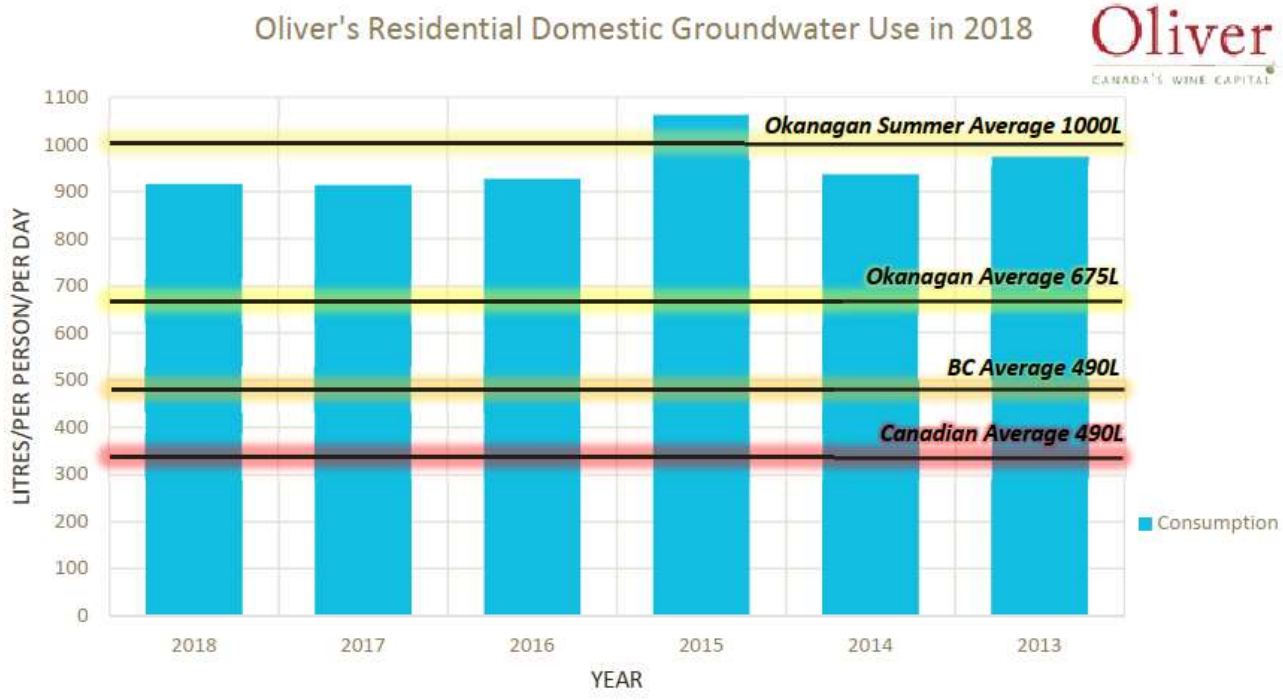


Figure 5: Oliver (2013-2018) vs OBWB Estimated Averages (1996-2006)

During the summer months the average consumption rate exceeds the Okanagan summer average of 1,000L ($1m^3$) with Oliver using 1281L per person per day while the pumps are in Summer Mode (April to October). However, when the pumps are in Winter Mode (November-March), Oliver used 403L per person per day, which is below the Okanagan average of 675L. These numbers are approximate values and estimates; if a person would like to know their household usage from year to year, all you need to do is take the volume consumed on your monthly water bill, convert it to liters, and divide it by the number of people in the household and the number of days in the month, and you will get your answer in liters per person per day. Once you have your results, you can compare your usage of each year to your previous years

along with the Canadian, BC, Okanagan, and Okanagan Summer Averages. *See Below and Figures 5-7*.

1. $Total\ Volume\ of\ Water\ used\ from\ Water\ Bill\ (cubic\ meters) = x(m^3)$

2. $Convert\ x(m^3)\ to\ \big(liters\ (l)\big) = x(m^3) \times 1000 = x(l)$

3. $Divide\ x(l) by\ number\ of\ persons\ in\ household\ (pp) = \dfrac{x(l)}{(\#\ of persons)}$

4. $Then\ Divide\ that\ result\ \left(\dfrac{x(l)}{(pp)}\right)\ by\ the\ number\ of\ days\ the\ water\ bill\ is\ accounting\ for\ (pd) = \dfrac{(x(l/pp\ )}{(\#\ of\ days\ )}$

5. $This\ answer\ is\ your\ final\ result = x(l/pp/pd)$

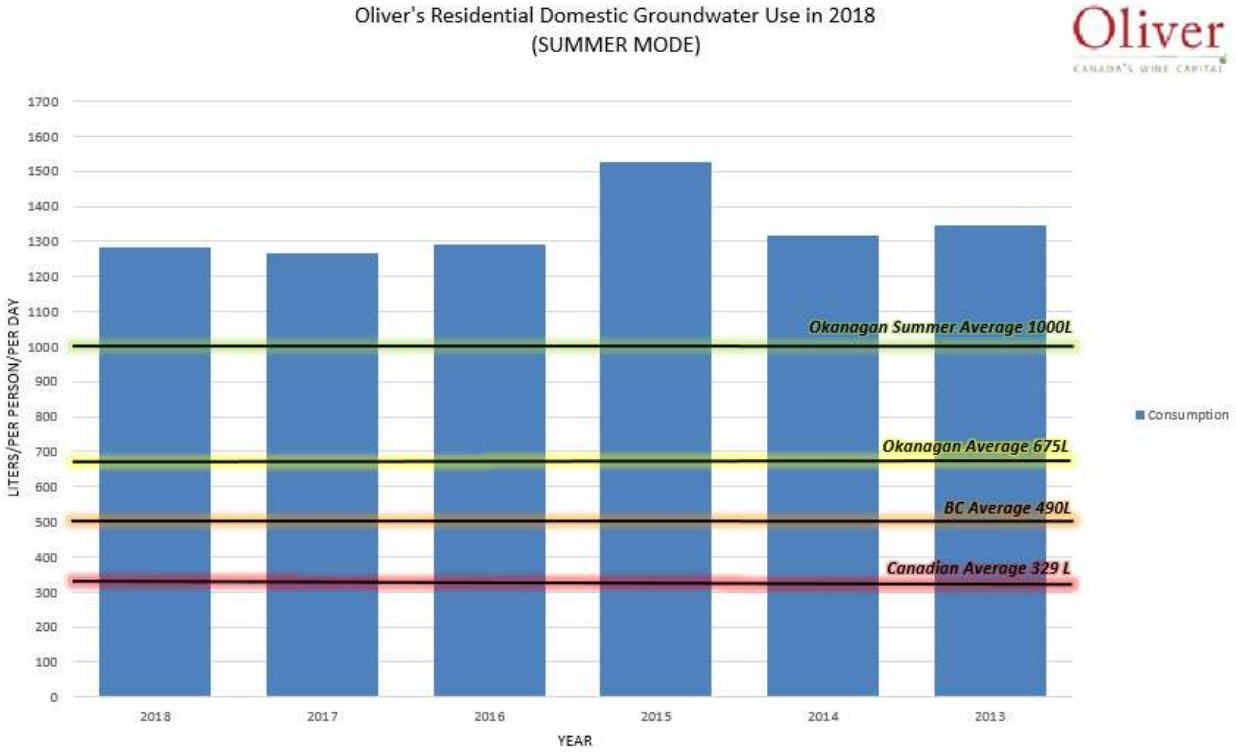


Figure 6: Oliver's (April-October 2013-2018) average vs OBWB Estimated Averages (1996-2006)

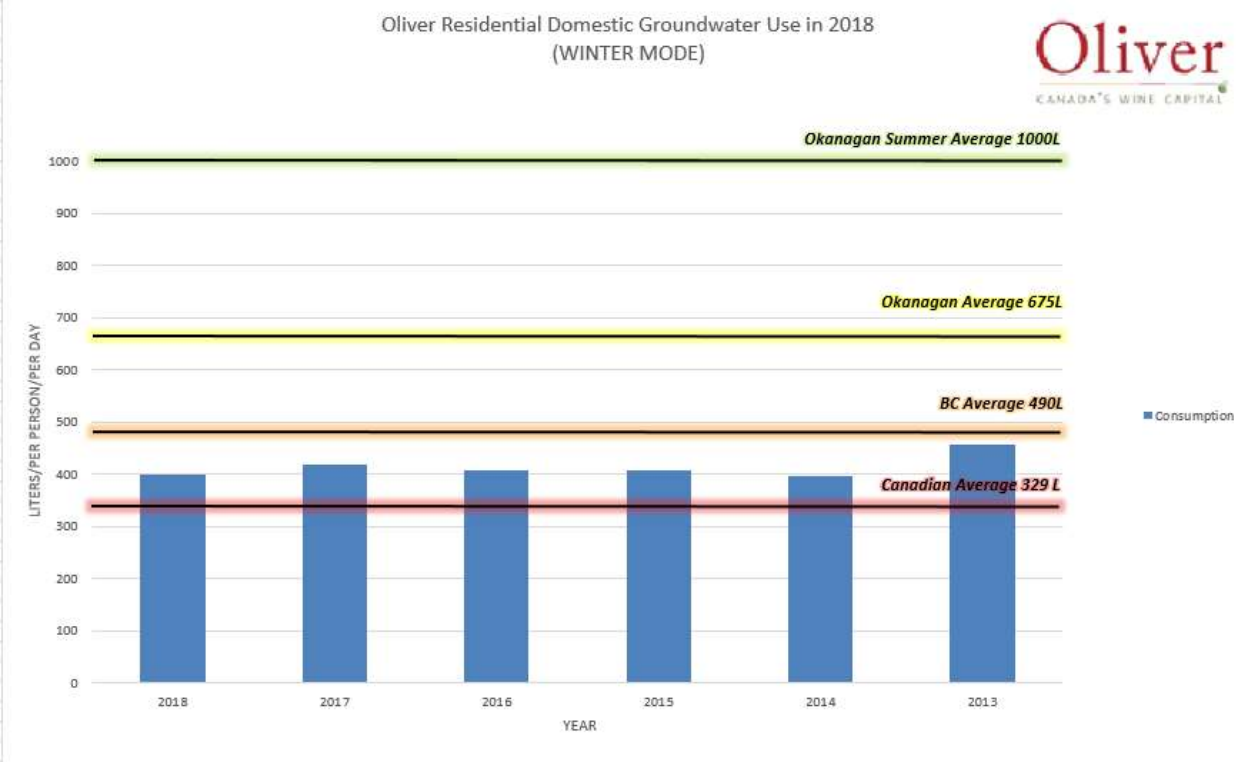


Figure 7: Oliver's (November - March 2013-2018) average vs OBWB Estimate Averages (1996-2006)

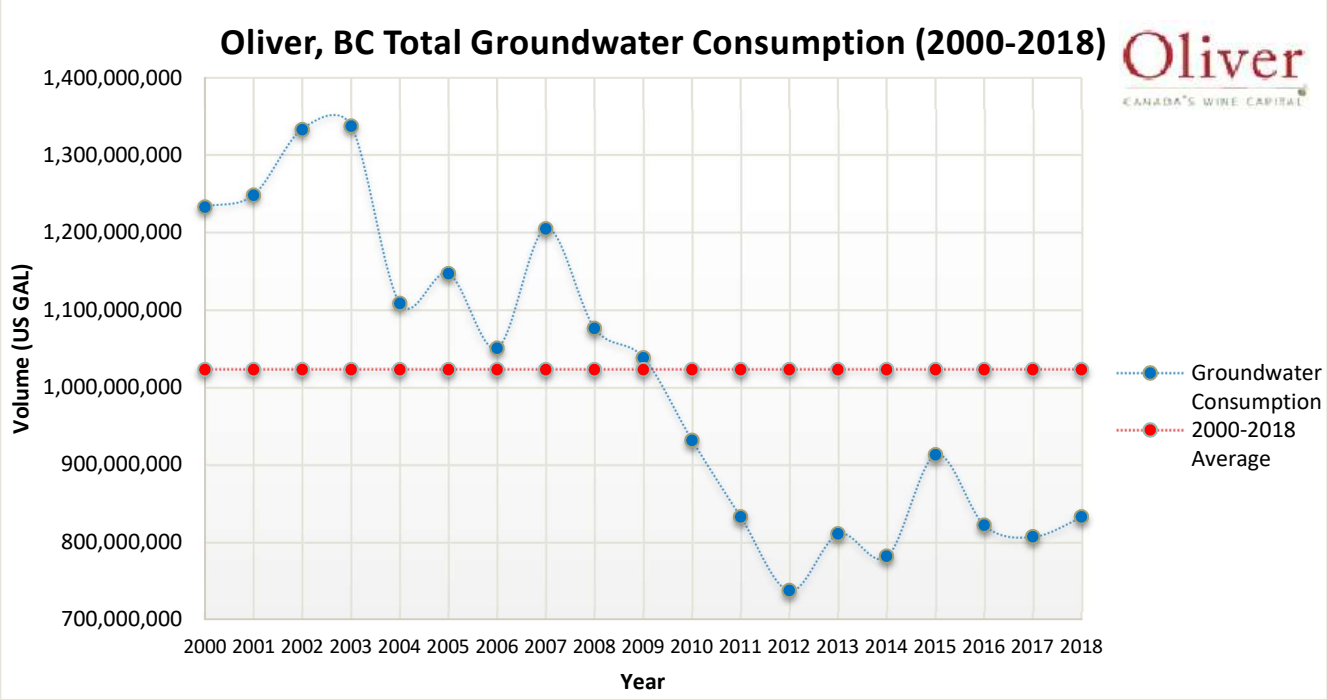


Figure 8: Oliver's Total Groundwater Consumption Trend (2000-2018)

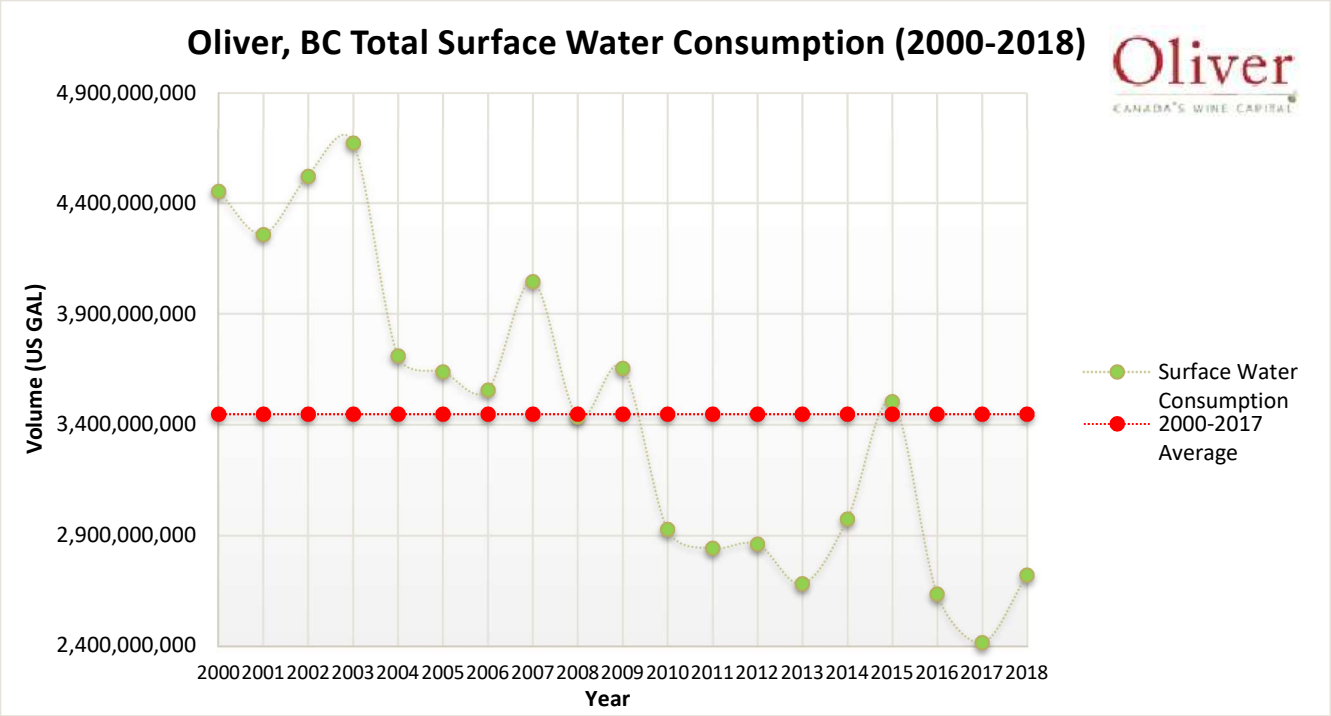


Figure 9: Oliver's Total Surface Water Consumption Trend (2000-2018)

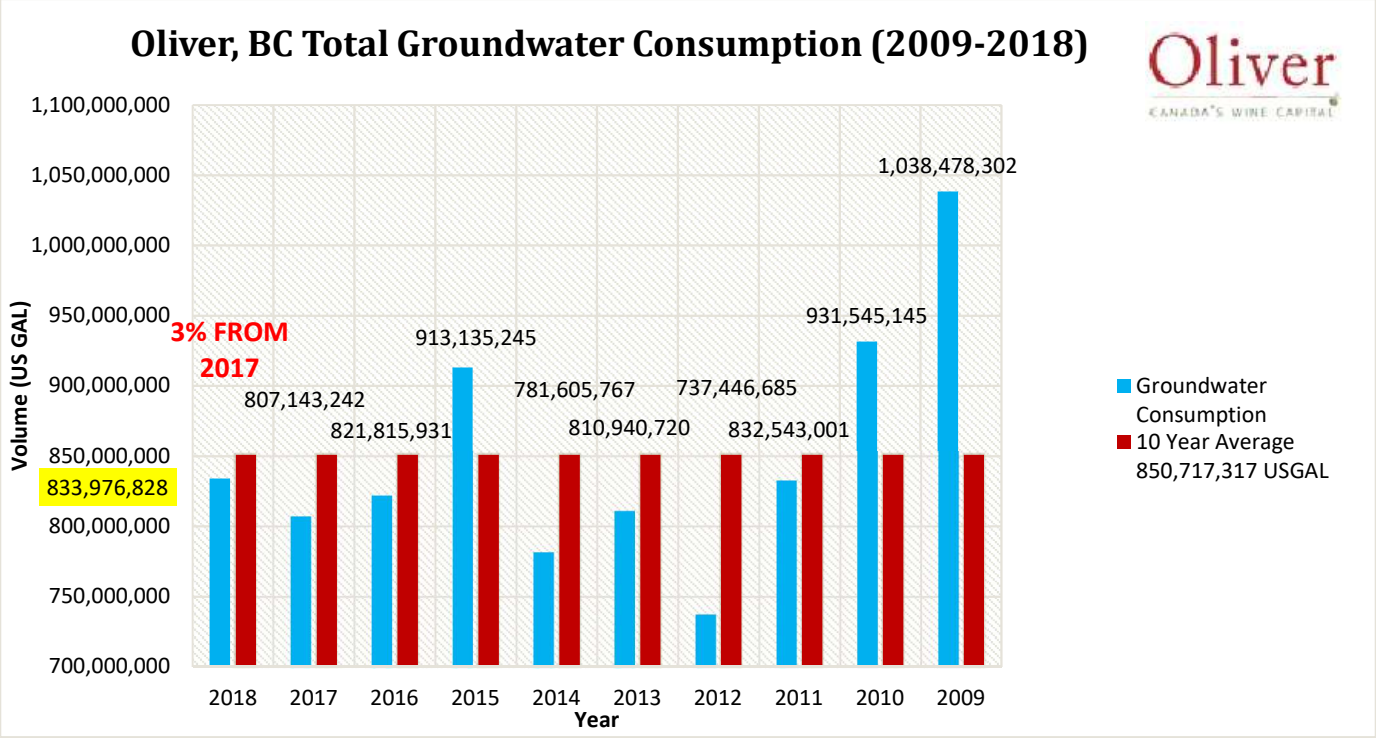


Figure 10: Oliver's Groundwater Consumption (2009-2018)

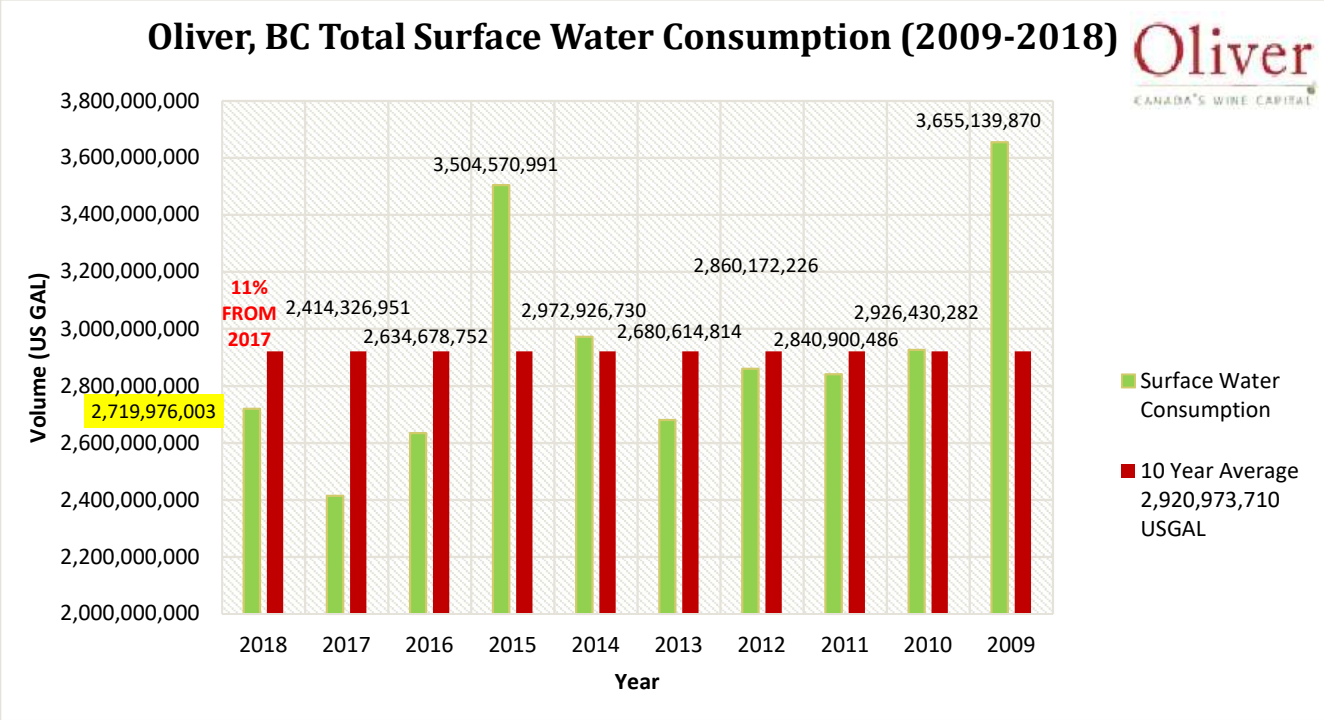


Figure 11: Oliver's Surface Water Consumption (2009-2018)

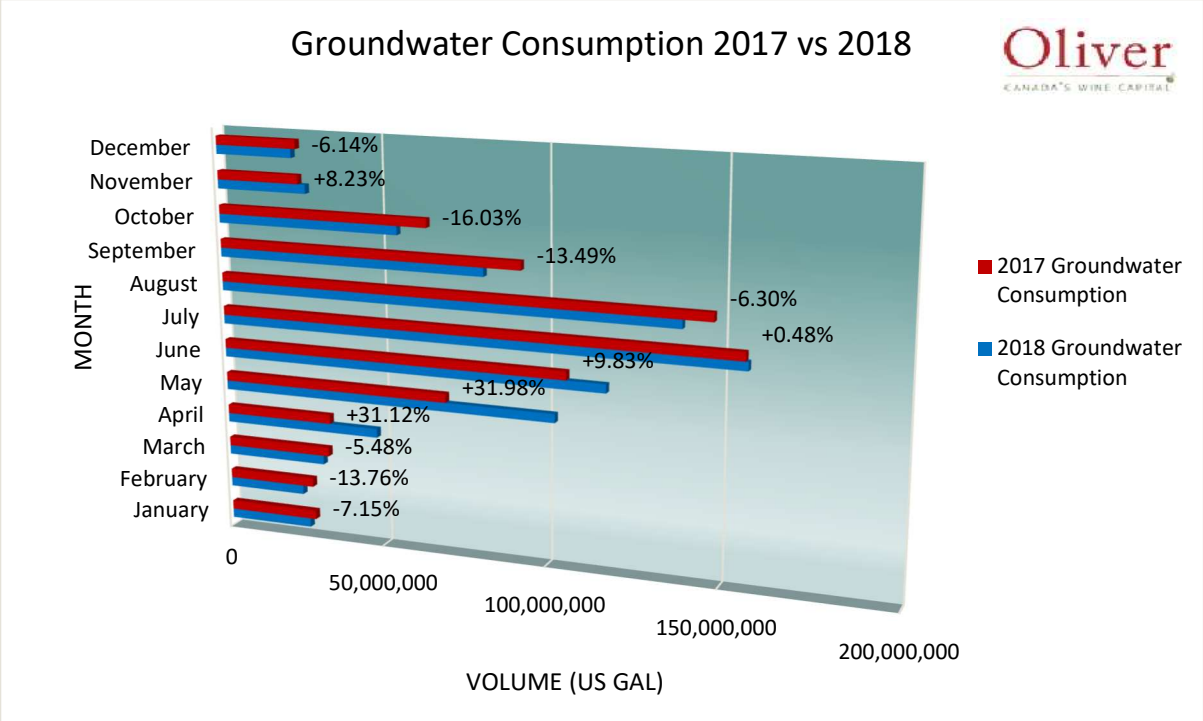


Figure 12: Groundwater Demand Percentages in 2018 Compared to the Previous Year 2017

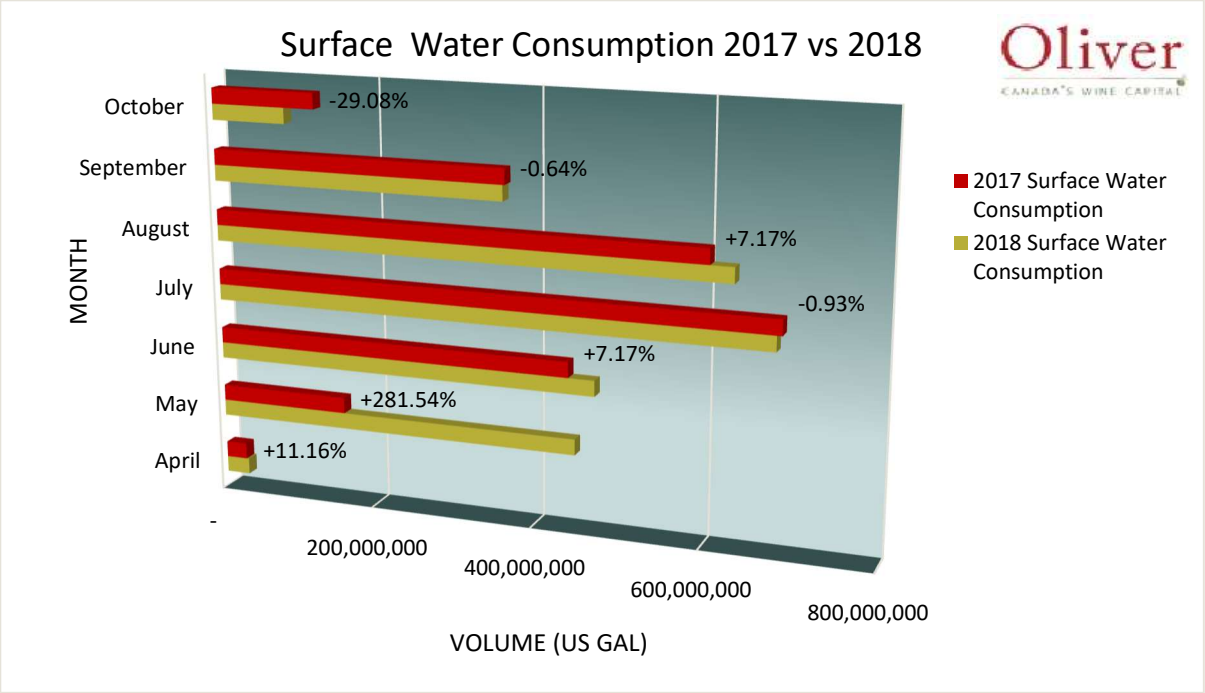


Figure 13: Surface Water Demand Percentages in 2018 Compared to the Previous Year 2017

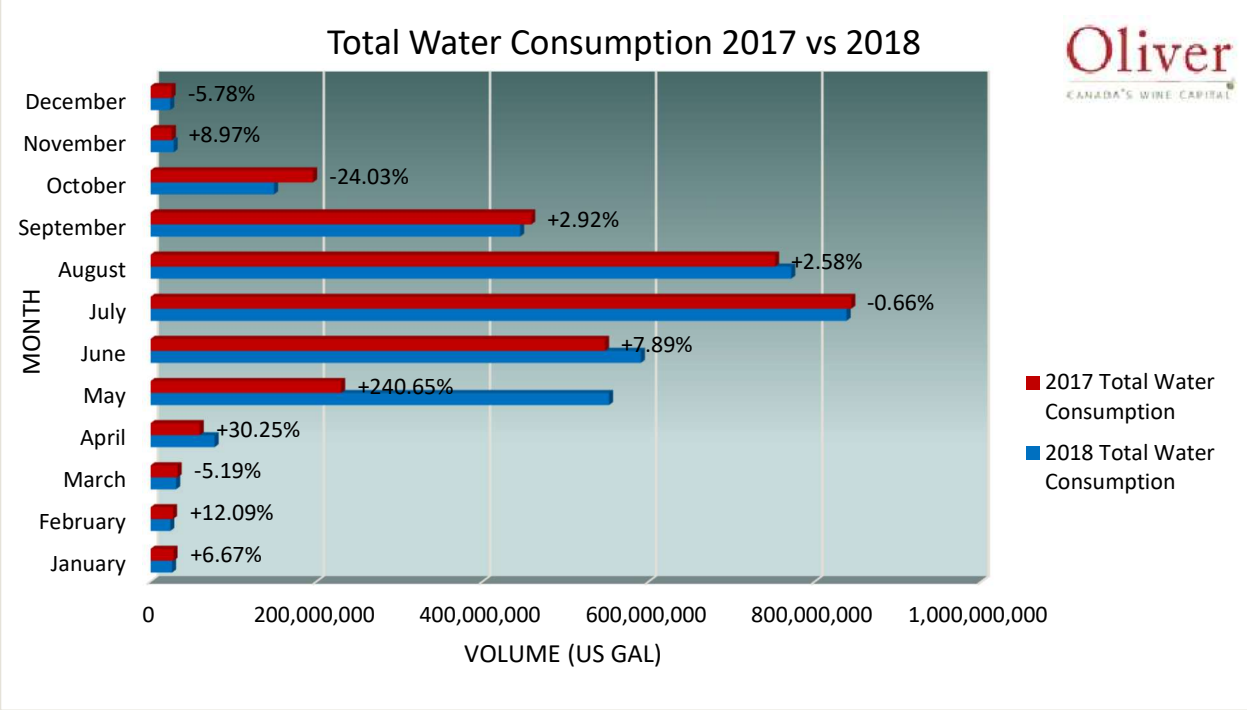


Figure 14: Total Water Demand Percentages in 2018 Compared to the Previous Year 2017

- *(Please See Appendix D: 2018 Pumping Data Table)*
- *(Please See Appendix E: Groundwater and Surface Water Consumption Data Tables)*

4.3 WATER CONSERVATION

The Town of Oliver works closely with the OBWB and its Okanagan Water Wise program called "Make Water Work", to spread a valley wide awareness on water conservation in the Okanagan. The program acts as a campaign where residents take water conservation survey pledges. OBWB will bring awareness in 2019 with more Radio Ads, Facebook Ads, Billboards, other social media support, yard signs, posters, and magnets linking the Make Water Work website. www.makewaterwork.ca.

5.0 STAFF

According to EOCP (Environmental Operator Certification Program), Oliver's Water Distribution System is a Class III. In 2018 Oliver's operations has four certified Water Distribution Operators on staff and one in-training; two Level I, one Level II, and one Level III.

The Town of Oliver is also classified a Level I Water Treatment facility (at multiple locations). We currently have two Operators with Level I and three working on receiving their Level I.

All Operators are required to keep up with their education and to maintain 2.4 certified education units (CEU's) every two years and are monitored by the EOCP. Various accredited courses were put on at the Town regarding safe work practices.

6.0 CAPITAL PROJECTS AND IMPROVEMENTS

6.1 PROJECTS COMPLETED IN 2018

The Town of Oliver continues to make minor and major improvements to the Town's water system every year and works with the Interior Health Authority (IHA) to prioritize some of these goals. Here are the main projects that were completed or started in 2018:

Head of the Lake Watermain Looping

The Watermain Looping at Head of Lake project was started and will help back up (better serve) the Town's overall domestic water system. The new Buchanan well recently built and working and is not running at full efficiency when helping to supply water back in-Town as a main domestic pump or back up because of water mainline bottleneck's in the system. The majority of the work was completed in 2018 which consisted of looping a new mainline domestic pipe from the north end of Tuc-el-nuit Lake and tying into the existing water system at Lakeside

Drive. Part of this project has also brought in a new on-site chlorination generation system installed at the new Buchanan well building for water treatment.

Flood Emergency – Canal Irrigation System

The Town had to close the canal irrigation system that affected most irrigation customers due to mud/debris slides that breached Hester and Tinhorn Creeks in May 2017. 2018 was similar but no breach or shut downs were caused by heaving debris flows because Town Staff and contractors had a better plan of staying on top this inconvenience for months of March, April and May. Over 200+ dump truck loads were taken away from Tinhorn and Hester Creeks to resolve any issues.

Station Street Watermain upgrades/services

Design and tendering was completed in 2017 and the project started and finished in 2018 with a mainline water upgrade and services to properties. The water upgrades coincided with sewer, storm and road upgrades on Fairview Road and a portion of Station Street.

Canal Rehabilitation Continued

Town staff worked with contractors to overlay existing canal floor between Roads 2 and 5. The weather wasn't cooperating in the late winter and only the worst portions of the 800m. was completed.

Fairview Irrigation Pumphouse Revolving Screen Replacement

This project was started in 2017 to replace the ageing and existing revolving screen at our Fairview Irrigation pumphouse. Completion of all work in early 2018.

Flume 3 Seismic Assessment

Allnorth Consultants Canal Assessment report recommended that the Town undertake a seismic assessment for this critical metal structure to ensure it meets standards and has never been undertaken. The Town hired CIMA+ Structural Engineers to conduct this assessment.

Major Irrigation Line Fix

The Town had undertake a major water mainline fix to the irrigation system at Road 2/Primrose Lane which involved replacing mainline water valves on large diameter pipe at this intersection.

6.2 CONTINUING PROJECTS INTO 2019

Water Capital Asset Management Plan

The Town is using an Engineering Consultant to help update and give future direction for a Water Capital Asset Management Plan. This plan will continue into 2019 and the Town received grant funding to help achieve this goal.

Gallagher Lake Siphon Damage Repair

The Town is still working on a permanent solution to relocate the canal away from the rock fall area. The Town has continued to do some Engineering and coordination for; design, property acquisitions and archeological assessments. We are also working with Provincial and Federal government to contribute funding to this project.

Black Sage Dom. VFD (100HP) & Elect. Upgrades

We started a project to install a variable Frequency drive (VFD) for a 100 H.P. pump motor and electrical upgrades in that Pump house. The Town would see some power savings and operation flexibility and should give us a reasonable payback over time.

Restoration from Creek Floods (2017)

The Town has submitted a plan to properly restore our property and infrastructure from the flooding damages and mitigation in May of 2017. This will continue and be finished in 2019.

6.3 LONG TERM IMPROVEMENT PLANS

The Town has a 5 year budgeted capital plan for known upgrades and new infrastructure and/or projects. These projects include Canal rehabilitation on an annual basis:

Other projects for 2019

- McGowan Mainline and service upgrades
- Canal Rehabilitation (241m) Continued
- Risk Assessments & Potential Hazards on Canal
- Town Siphon Load & Stress Assessment
- Flood Preparedness if funding received
- Earle Crescent water upgrades
- Kobau Irrigation Controls & Electrical Improvements
- Minor Repairs to Town Reservoir

2020

- Gallagher Siphon Damage Repair
- Canal Rehabilitation Continued
- Canal Culvert repair at Road 11
- Sawmill Road Extension
- Station Street Phase II
- Continue Risk Assessments & Potential Hazards on Canal
- Kobau Irrigation Control & Electrical Upgrades Continued
- Structural Repairs at Flume 3
- Upgrade some trash racks on Canal

2021

- Canal Rehabilitation Continued
- New control panel and improvements for Fairview Irrigation P.H.
- Upgrade Check gates on canal
- Kootenay Street Water Upgrades
- Sawmill Road Rehabilitation

2022

- Canal Rehabilitation Continued
- Modify Turnouts on canal system
- Okanagan St. & School Avenue Water Upgrades

2023

- Canal Rehabilitation Continued
- Spillway structure upgrade on Canal
- Park Drive Rehabilitation

7.0 EMERGENCY RESPONSE PLAN

The Town of Oliver has an Emergency Response Plan pertaining to any natural disaster, and the water system. The Emergency Response Plan identifies a number of potential emergencies that could occur and provides a systematic approach on how the Town will deal with the emergency.

8.0 CROSS CONNECTION CONTROL PROGAM

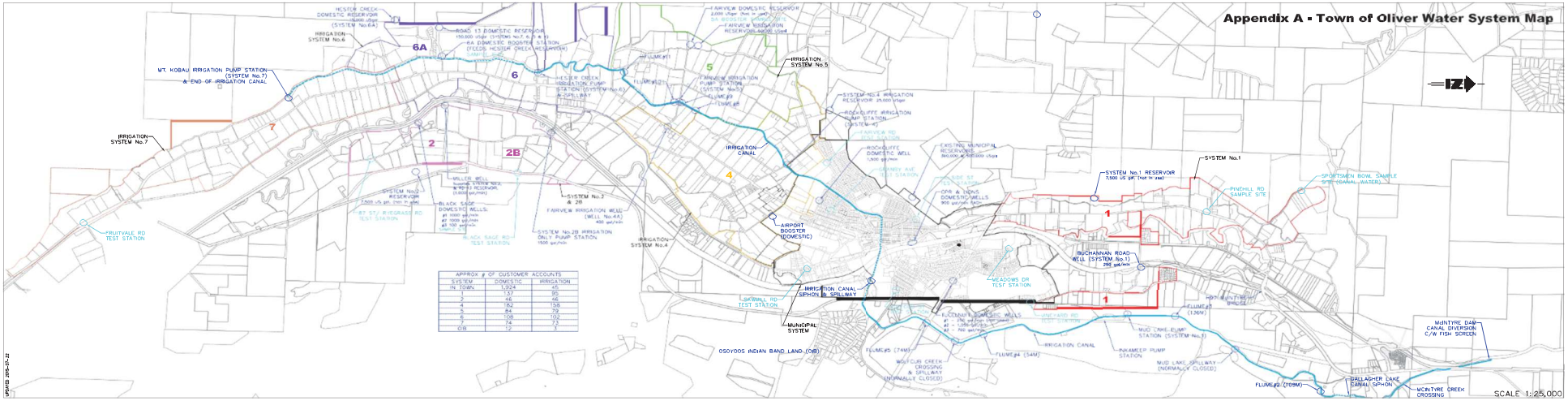
Cross connection is an actual or potential connection between a potable water supply and a non-potable source, where it is possible for a contaminant to enter the drinking water supply.

The Town's Cross Connection Control Program continues to work towards addressing the potential for the water system to be compromised by service connections, which could introduce contaminated water into the domestic water system. The program which is monitored through BPMS Software and staff, focuses on premise isolation for commercial and industrial customers. In 2018, there were 255 testable backflow assemblies in service (including agricultural devices) being tracked.

9.0 CONCLUSION

The Town of Oliver works hard to maintain water quality and quantity for their residents as well as numerous customers in Regional District of Okanagan Similkameen Area 'C'. Efforts are made to ensure appropriate water usage and to educate the public whenever possible. Without these ongoing efforts, the area would not be the robust agricultural community that it is today. If you have any comments regarding this report or other information that you would like to see included, please email works@oliver.ca or request a customer concern form at the Town Hall.

APPENDIX A: THE TOWN OF OLIVER WATER SYSTEM MAP FOR SAMPLING SITES



APPENDIX B: 2018 FULL SPECTRUM

CERTIFICATE OF ANALYSIS

REPORTED TO	Oliver, Town of 5971 Sawmill Road, PO Box 638 Oliver, BC V0H 1T0		
ATTENTION	Patti Hannas	**WORK ORDER**	8102603
PO NUMBER		**RECEIVED / TEMP**	2018-10-30 09:15 / 8°C
PROJECT	Full Spectrum Analysis	**REPORTED**	2018-11-06 14:12
PROJECT INFO	A.1.	**COC NUMBER**	B44351

Introduction:

CARO Analytical Services is a testing laboratory full of smart, engaged scientists driven to make the world a safer and healthier place. Through our clients' projects we become an essential element for a better world. We employ methods conducted in accordance with recognized professional standards using accepted testing methodologies and quality control efforts. CARO is accredited by the Canadian Association for Laboratories Accreditation (CALA) to ISO 17025:2005 for specific tests listed in the scope of accreditation approved by CALA.

Big Picture Sidekicks

You know that the sample you collected after snowshoeing to site, digging 5 meters, and racing to get it on a plane so you can submit it to the lab for time sensitive results needed to make important and expensive decisions (whew) is VERY important. We know that too.

We've Got Chemistry

It's simple. We figure the more you enjoy working with our fun and engaged team members; the more likely you are to give us continued opportunities to support you.

Ahead of the Curve

Through research, regulation knowledge, and instrumentation, we are your analytical centre for the technical knowledge you need, BEFORE you need it, so you can stay up to date and in the know.

If you have any questions or concerns, please contact me at estclair@caro.ca

Authorized By:

Eilish St.Clair, B.Sc., C.I.T.
Client Service Representative

CARO ANALYTICAL SERVICES

TEST RESULTS

REPORTED TO	Oliver, Town of	**WORK ORDER**	8102603
PROJECT	Full Spectrum Analysis	**REPORTED**	2018-11-06 14:12

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
Black Sage #1 (8102603-01) | Matrix: Water | Sampled: 2018-10-29 11:15						
Anions						
Chloride	**8.33**	AO ≤ 250	0.10	mg/L	2018-11-01	
Fluoride	**0.24**	MAC = 1.5	0.10	mg/L	2018-11-01	
Nitrate (as N)	**0.720**	MAC = 10	0.010	mg/L	2018-11-01	
Nitrite (as N)	< 0.010	MAC = 1	0.010	mg/L	2018-11-01	
Sulfate	**41.5**	AO ≤ 500	1.0	mg/L	2018-11-01	
Calculated Parameters						
Hardness, Total (as CaCO3)	**195**	None Required	0.500	mg/L	N/A	
Nitrate+Nitrite (as N)	**0.720**	N/A	0.0200	mg/L	N/A	
General Parameters						
Alkalinity, Total (as CaCO3)	**163**	N/A	1.0	mg/L	2018-10-31	
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	N/A	1.0	mg/L	2018-10-31	
Alkalinity, Bicarbonate (as CaCO3)	**163**	N/A	1.0	mg/L	2018-10-31	
Alkalinity, Carbonate (as CaCO3)	< 1.0	N/A	1.0	mg/L	2018-10-31	
Alkalinity, Hydroxide (as CaCO3)	< 1.0	N/A	1.0	mg/L	2018-10-31	
Colour, True	< 5.0	AO ≤ 15	5.0	CU	2018-11-01	
Conductivity (EC)	**398**	N/A	2.0	µS/cm	2018-10-31	
pH	**7.83**	7.0-10.5	0.10	pH units	2018-10-31	HT2
Solids, Total Dissolved	**239**	AO ≤ 500	15	mg/L	2038-11-05	HT1
Turbidity	**1.03**	OG < 1	0.10	NTU	2018-10-31	
Total Metals						
Aluminum, total	< 0.0050	OG < 0.1	0.0050	mg/L	2018-11-06	
Antimony, total	< 0.00020	MAC = 0.006	0.00020	mg/L	2018-11-06	
Arsenic, total	**0.00076**	MAC = 0.01	0.00050	mg/L	2018-11-06	
Barium, total	**0.0442**	MAC = 1	0.0050	mg/L	2018-11-06	
Beryllium, total	< 0.00010	N/A	0.00010	mg/L	2018-11-06	
Bismuth, total	< 0.00010	N/A	0.00010	mg/L	2018-11-06	
Boron, total	**0.0335**	MAC = 5	0.0050	mg/L	2018-11-06	
Cadmium, total	**0.000053**	MAC = 0.005	0.000010	mg/L	2018-11-06	
Calcium, total	**50.2**	None Required	0.20	mg/L	2018-11-06	
Chromium, total	< 0.00050	MAC = 0.05	0.00050	mg/L	2018-11-06	
Cobalt, total	< 0.00010	N/A	0.00010	mg/L	2018-11-06	
Copper, total	**0.00674**	AO ≤ 1	0.00040	mg/L	2018-11-06	
Iron, total	**0.201**	AO ≤ 0.3	0.010	mg/L	2018-11-06	
Lead, total	**0.00043**	MAC = 0.01	0.00020	mg/L	2018-11-06	
Lithium, total	**0.00538**	N/A	0.00010	mg/L	2018-11-06	
Magnesium, total	**16.8**	None Required	0.010	mg/L	2018-11-06	
Manganese, total	**0.0314**	AO ≤ 0.05	0.00020	mg/L	2018-11-06	
Molybdenum, total	**0.00575**	N/A	0.00010	mg/L	2018-11-06	
Nickel, total	**0.00086**	N/A	0.00040	mg/L	2018-11-06	
Phosphorus, total	< 0.050	N/A	0.050	mg/L	2018-11-06	

CARO ANALYTICAL SERVICES

TEST RESULTS

REPORTED TO	Oliver, Town of	**WORK ORDER**	8102603
PROJECT	Full Spectrum Analysis	**REPORTED**	2018-11-06 14:12

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
Black Sage #1 (8102603-01) | Matrix: Water | Sampled: 2018-10-29 11:15, Continued						
Total Metals, Continued						
Potassium, total	**3.34**	N/A	0.10	mg/L	2018-11-06	
Selenium, total	**0.00064**	MAC = 0.05	0.00050	mg/L	2018-11-06	
Silicon, total	**6.4**	N/A	1.0	mg/L	2018-11-06	
Silver, total	< 0.000050	None Required	0.000050	mg/L	2018-11-06	
Sodium, total	**14.2**	AO ≤ 200	0.10	mg/L	2018-11-06	
Strontium, total	**0.500**	N/A	0.0010	mg/L	2018-11-06	
Sulfur, total	**13.1**	N/A	3.0	mg/L	2018-11-06	
Tellurium, total	< 0.00050	N/A	0.00050	mg/L	2018-11-06	
Thallium, total	< 0.000020	N/A	0.000020	mg/L	2018-11-06	
Thorium, total	< 0.00010	N/A	0.00010	mg/L	2018-11-06	
Tin, total	< 0.00020	N/A	0.00020	mg/L	2018-11-06	
Titanium, total	< 0.0050	N/A	0.0050	mg/L	2018-11-06	
Tungsten, total	< 0.0010	N/A	0.0010	mg/L	2018-11-06	
Uranium, total	**0.00666**	MAC = 0.02	0.000020	mg/L	2018-11-06	
Vanadium, total	**0.0010**	N/A	0.0010	mg/L	2018-11-06	
Zinc, total	**0.0060**	AO ≤ 5	0.0040	mg/L	2018-11-06	
Zirconium, total	< 0.00010	N/A	0.00010	mg/L	2018-11-06	
Black Sage #2 (8102603-02) | Matrix: Water | Sampled: 2018-10-29 11:10						
Anions						
Chloride	**10.2**	AO ≤ 250	0.10	mg/L	2018-11-01	
Fluoride	**0.28**	MAC = 1.5	0.10	mg/L	2018-11-01	
Nitrate (as N)	**1.54**	MAC = 10	0.010	mg/L	2018-11-01	
Nitrite (as N)	< 0.010	MAC = 1	0.010	mg/L	2018-11-01	
Sulfate	**53.3**	AO ≤ 500	1.0	mg/L	2018-11-01	
Calculated Parameters						
Hardness, Total (as CaCO3)	**264**	None Required	0.500	mg/L	N/A	
Nitrate+Nitrite (as N)	**1.54**	N/A	0.0200	mg/L	N/A	
General Parameters						
Alkalinity, Total (as CaCO3)	**221**	N/A	1.0	mg/L	2018-10-31	
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	N/A	1.0	mg/L	2018-10-31	
Alkalinity, Bicarbonate (as CaCO3)	**221**	N/A	1.0	mg/L	2018-10-31	
Alkalinity, Carbonate (as CaCO3)	< 1.0	N/A	1.0	mg/L	2018-10-31	
Alkalinity, Hydroxide (as CaCO3)	< 1.0	N/A	1.0	mg/L	2018-10-31	
Colour, True	< 5.0	AO ≤ 15	5.0	CU	2018-11-01	
Conductivity (EC)	**531**	N/A	2.0	µS/cm	2018-10-31	
pH	**7.90**	7.0-10.5	0.10	pH units	2018-10-31	HT2
Solids, Total Dissolved	**309**	AO ≤ 500	15	mg/L	2038-11-05	HT1
Turbidity	< 0.10	OG < 1	0.10	NTU	2018-10-31	

CARO ANALYTICAL SERVICES

TEST RESULTS

REPORTED TO	Oliver, Town of	**WORK ORDER**	8102603
PROJECT	Full Spectrum Analysis	**REPORTED**	2018-11-06 14:12

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
Black Sage #2 (8102603-02) | Matrix: Water | Sampled: 2018-10-29 11:10, Continued						
Total Metals						
Aluminum, total	< 0.0050	OG < 0.1	0.0050	mg/L	2018-11-06	
Antimony, total	< 0.00020	MAC = 0.006	0.00020	mg/L	2018-11-06	
Arsenic, total	**0.00086**	MAC = 0.01	0.00050	mg/L	2018-11-06	
Barium, total	**0.0559**	MAC = 1	0.0050	mg/L	2018-11-06	
Beryllium, total	< 0.00010	N/A	0.00010	mg/L	2018-11-06	
Bismuth, total	< 0.00010	N/A	0.00010	mg/L	2018-11-06	
Boron, total	**0.0581**	MAC = 5	0.0050	mg/L	2018-11-06	
Cadmium, total	**0.000026**	MAC = 0.005	0.000010	mg/L	2018-11-06	
Calcium, total	**68.5**	None Required	0.20	mg/L	2018-11-06	
Chromium, total	< 0.00050	MAC = 0.05	0.00050	mg/L	2018-11-06	
Cobalt, total	< 0.00010	N/A	0.00010	mg/L	2018-11-06	
Copper, total	**0.00936**	AO ≤ 1	0.00040	mg/L	2018-11-06	
Iron, total	< 0.010	AO ≤ 0.3	0.010	mg/L	2018-11-06	
Lead, total	**0.00054**	MAC = 0.01	0.00020	mg/L	2018-11-06	
Lithium, total	**0.00727**	N/A	0.00010	mg/L	2018-11-06	
Magnesium, total	**22.4**	None Required	0.010	mg/L	2018-11-06	
Manganese, total	**0.00473**	AO ≤ 0.05	0.00020	mg/L	2018-11-06	
Molybdenum, total	**0.00387**	N/A	0.00010	mg/L	2018-11-06	
Nickel, total	**0.00079**	N/A	0.00040	mg/L	2018-11-06	
Phosphorus, total	< 0.050	N/A	0.050	mg/L	2018-11-06	
Potassium, total	**4.32**	N/A	0.10	mg/L	2018-11-06	
Selenium, total	**0.00080**	MAC = 0.05	0.00050	mg/L	2018-11-06	
Silicon, total	**8.6**	N/A	1.0	mg/L	2018-11-06	
Silver, total	< 0.000050	None Required	0.000050	mg/L	2018-11-06	
Sodium, total	**16.8**	AO ≤ 200	0.10	mg/L	2018-11-06	
Strontium, total	**0.730**	N/A	0.0010	mg/L	2018-11-06	
Sulfur, total	**17.5**	N/A	3.0	mg/L	2018-11-06	
Tellurium, total	< 0.00050	N/A	0.00050	mg/L	2018-11-06	
Thallium, total	< 0.000020	N/A	0.000020	mg/L	2018-11-06	
Thorium, total	< 0.00010	N/A	0.00010	mg/L	2018-11-06	
Tin, total	< 0.00020	N/A	0.00020	mg/L	2018-11-06	
Titanium, total	< 0.0050	N/A	0.0050	mg/L	2018-11-06	
Tungsten, total	< 0.0010	N/A	0.0010	mg/L	2018-11-06	
Uranium, total	**0.00708**	MAC = 0.02	0.000020	mg/L	2018-11-06	
Vanadium, total	< 0.0010	N/A	0.0010	mg/L	2018-11-06	
Zinc, total	**0.0105**	AO ≤ 5	0.0040	mg/L	2018-11-06	
Zirconium, total	< 0.00010	N/A	0.00010	mg/L	2018-11-06	

Sample Qualifiers:

HT1 The sample was prepared and/or analyzed past the recommended holding time.

HT2 The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.

APPENDIX 1: SUPPORTING INFORMATION

REPORTED TO	Oliver, Town of	**WORK ORDER**	8102603
PROJECT	Full Spectrum Analysis	**REPORTED**	2018-11-06 14:12

Analysis Description	Method Ref.	Technique	Location
Alkalinity in Water	SM 2320 B* (2011)	Titration with H2SO4	Kelowna
Anions in Water	SM 4110 B (2011)	Ion Chromatography	Kelowna
Colour, True in Water	SM 2120 C (2011)	Spectrophotometry (456 nm)	Kelowna
Conductivity in Water	SM 2510 B (2011)	Conductivity Meter	Kelowna
Hardness in Water	SM 2340 B* (2011)	Calculation: 2.497 [total Ca] + 4.118 [total Mg] (Est)	N/A
pH in Water	SM 4500-H+ B (2011)	Electrometry	Kelowna
Solids, Total Dissolved in Water	SM 2540 C* (2011)	Gravimetry (Dried at 103-105C)	Kelowna
Total Metals in Water	EPA 200.2* / EPA 6020B	HNO3+HCl Hot Block Digestion / Inductively Coupled Plasma-Mass Spectroscopy (ICP-MS)	Richmond
Turbidity in Water	SM 2130 B (2011)	Nephelometry	Kelowna

Note: An asterisk in the Method Reference indicates that the CARO method has been modified from the reference method

Glossary of Terms:

RL	Reporting Limit (default)
<	Less than the specified Reporting Limit (RL) - the actual RL may be higher than the default RL due to various factors
AO	Aesthetic Objective
CU	Colour Units (referenced against a platinum cobalt standard)
MAC	Maximum Acceptable Concentration (health based)
mg/L	Milligrams per litre
NTU	Nephelometric Turbidity Units
OG	Operational Guideline (treated water)
pH units	pH < 7 = acidic, ph > 7 = basic
µS/cm	Microsiemens per centimetre
EPA	United States Environmental Protection Agency Test Methods
SM	Standard Methods for the Examination of Water and Wastewater, American Public Health Association

Guidelines Referenced in this Report:

Guidelines for Canadian Drinking Water Quality (Health Canada, Feb 2017)

Note: In some cases, the values displayed on the report represent the lowest guideline and are to be verified by the end user

General Comments:

The results in this report apply to the samples analyzed in accordance with the Chain of Custody document. This analytical report must be reproduced in its entirety. CARO is not responsible for any loss or damage resulting directly or indirectly from error or omission in the conduct of testing. Liability is limited to the cost of analysis. Samples will be disposed of 30 days after the test report has been issued unless otherwise agreed to in writing. The quality control (QC) data is available upon request

APPENDIX C: 2018 WEEKLY WATER SAMPLING

2018 WEEKLY CHLORINE RESIDUAL & COLIFORM SAMPLING

(Target 0.2 to 1.50 - Chlorine Residual)

	RURAL NORTH				BLACK SAGE				RURAL SOUTH																MUNICIPAL			
	System #1				System #2				System #4				System #5				System #6				System #7							
	Surface Water Source				Groundwater Source				Ground Water Source				Groundwater Source				Groundwater Source				Groundwater Source				Groundwater Source			
	Chlorine	Sample	Coliform		Chlorine	Sample	Coliform		Chlorine	Sample	Coliform		Chlorine	Sample	Coliform		Chlorine	Sample	Coliform		Chlorine	Sample	Coliform		Chlorine	Sample	Coliform	
DATE	Residual	Location	Total	Ecoli	Residual	Location	Total	Ecoli	Residual	Location	Total	Ecoli	Residual	Location	Total	Ecoli	Residual	Location	Total	Ecoli	Residual	Location	Total	Ecoli	Residual	Location	Total	Ecoli
Jan 2	0.15	McGowan	<1	<1									0.12	5A Booster	<1	<1									0.24	Fairview	<1	<1
Jan 8	0.19	Pinehill	<1	<1													0.11	6A Booster	<1	<1					0.07	Hillside	<1	<1
Jan 15	0.18	Mike's	<1	<1					0.12	Snowbrush	<1	<1													0.25	Meadows	<1	<1
Jan 22	0.31	McGowan	<1	<1																	0.08	Fruitvale	<1	<1	0.31	Tucelnuit	<1	<1
Jan 29	0.13	Pinehill	<1	<1									Lo	5A Booster	<1	<1									0.22	Wolfcub	<1	<1
Feb 5	0.12	Mike's	<1	<1													Lo	6A Booster	<1	<1					0.17	Sawmill	<1	<1
Feb 13	0.15	McGowan	<1	<1					0.19	Snowbrush	<1	<1													0.29	Granby	<1	<1
Feb 19	0.13	Pinehill	<1	<1																	0.26	Fruitvale	<1	<1	0.62	Fairview	<1	<1
Feb 26	0.20	Mike's	<1	<1									0.05	5A Booster	<1	<1									0.04	Hillside	<1	<1
Mar 5	0.15	McGowan	<1	<1													-	6A Booster	<1	<1					0.28	Hillside	<1	<1
Mar 5																									0.26	Meadows	<1	<1
Mar 12	0.05	Pinehill	<1	<1					0.28	Snowbrush	<1	<1													0.26	Vineyard	<1	<1
Mar 19	0.05	Mike's	<1	<1																	Lo	Fruitvale	<1	<1	0.34	Wolfcub	<1	<1
Mar 26	0.05	McGowan	<1	<1									Lo	5A Booster	<1	<1									0.21	Sawmill	<1	<1
April 3	0.09	Pinehill	<1	<1													Lo	6A Booster	<1	<1					0.10	Granby	<1	<1
April 9	0.05	Mike's	<1	<1					0.29	Snowbrush	<1	<1													0.27	Fairview	<1	<1
April 16	0.18	McGowan	<1	<1																	0.27	Fruitvale	<1	<1	0.07	Hillside	<1	<1
April 23	0.31	Pinehill	<1	<1									0.15	5A Booster	<1	<1									0.30	Meadows	<1	<1
April 30	0.35	Mike's	<1	<1	0.40	Ryegrass	<1	<1									0.16	6A Booster	<1	<1					0.14	Tucelnuit	<1	<1
May 7	0.10	McGowan	<1	<1	0.16	Blacksage	<1	<1	0.06	Snowbrush	<1	<1													0.40	Wolfcub	<1	<1
May 14	0.15	Pinehill	<1	<1	0.19	Ryegrass	<1	<1													0.06	Fruitvale	<1	<1	0.22	Sawmill	<1	<1
May 22	0.31	Mike's	<1	<1	0.21	Blacksage	<1	<1									0.24	6A Booster	<1	<1					0.24	Granby	<1	<1
May 29	0.12	McGowan	<1	<1	0.19	Ryegrass	<1	<1					0.07	Fairview B.	<1	<1									0.10	Fairview	<1	<1
Jun 04	0.50	Pinehill	<1	<1	0.90	Blacksage	<1	<1	0.20	Snowbrush	<1	<1													0.26	Hillside	<1	<1
Jun 11	0.15	Mike's Auto	<1	<1	0.11	Ryegrass	<1	<1													0.02	Road # 22	<1	<1	0.35	Meadows Dr	<1	<1
Jun 18	0.36	McGowan	<1	<1	0.50	Blacksage	<1	<1									0.19	Hester Bstr	<1	<1					0.33	Meadows Dr	<1	<1
Jun 25	0.15	Pinehill	<1	<1	0.17	Ryegrass Road	<1	<1					0.06	Fairview B	<1	<1									0.26	Wolfcub TS	<1	<1
Jul 03	0.27	Mike's	<1	<1	0.21	Blacksage	<1	<1	0.19	Snowbrush	<1	<1													0.20	Sawmill	<1	<1
Jul 09	0.09	Pinehill	<1	<1	0.27	Ryegrass	<1	<1													0.11	Fruitvale	<1	<1	0.42	Granby	<1	<1
Jul 16	0.19	McGowan	<1	<1	0.21	Black Sage	<1	<1					0.15	5A Booster	<1	<1									0.22	Fairview TS	<1	<1
Jul 23	0.11	Mike's	<1	<1	0.29	Ryegrass	<1	<1					0.19	5A Booster	<1	<1	0.18	WO 502	>=22	<1					0.07	Hillside	<1	<1
Jul 30	0.27	Pinehill	<1	<1	0.30	Blacksage	<1	<1	0.15	Snowbrush	<1	<1					0.22	WO 502	>=2	<1					0.19	Tucelnuit	<1	<1
Aug 01	0.33	McGowan	<1	<1	0.22	Ryegrass	<1	<1									0.18	WO 502	<1	<1	0.21	Fruitvale	<1	<1	0.18	Wolfcub	<1	<1
Aug 13	0.02	Mike's Auto	<1	<1	0.15	Blacksage	<1	<1									0.12	6A Booster	<1	<1					0.21	Sawmill	<1	<1
Aug 20	0.21	McGowan	<1	<1	0.16	Ryegrass	<1	<1	0.05	Snowbrush	<1	<1													0.42	Granby	<1	<1
Aug 27	0.24	Pinehill	<1	<1	0.25	Blacksage	<1	<1													0.27	Fruitvale	<1	<1	0.34	Fairview TS	<1	<1
Sep 04	0.16	Mike's Auto	<1	<1	0.36	Ryegrass	<1	<1					0.28	5A Booster	<1	<1									0.22	Hillside	<1	<1
Sep 10	0.32	McGowan	<1	<1	0.17	Blacksage	<1	<1									0.22	6A Booster	<1	<1					0.31	Meadows	<1	<1
Sep 17	0.17	Pinehill	<1	<1	0.29	Ryegrass	<1	<1	0.38	Snowbrush	<1	<1													0.26	Tucelnuit Dr	<1	<1
Sep 24	0.37	Mike's Auto	<1	<1	0.27	Blacksage	<1	<1													0.31	Fruitvale	<1	<1	0.34	Wolfcub	<1	<1
Oct 1	0.12	McGowan	<1	<1	0.14	Ryegrass	<1	<1					0.30	5A Booster	<1	<1									0.25	Sawmill	<1	<1
Oct 9	0.17	Pinehill	<1	<1	0.10	Blacksage	<1	<1	0.22	Snowbrush	<1	<1													0.41	Granby	<1	<1
Oct 15	0.19	McGowans	<1	<1	0.18	Ryegrass	<1	<1													0.15	Fruitvale	<1	<1	0.26	Fairview	<1	<1
Oct 15																									0.23	Bullrush (MJE)	<1	<1
Oct-18																									0.40	Bullrush (MJE)	<1	<1
Oct 22	0.16	Mike's Auto	<1	<1	0.18	Blacksage	<1	<1									0.11	6A Booster	<1	<1					0.20	Hillside	<1	<1
Oct 29	0.21	Pinehill	<1	<1	0.15	Ryegrass	<1	<1	0.16	Snowbrush	<1	<1													0.28	Meadows	<1	<1
Nov 5	0.18	McGowan	<1	<1																	0.12	Fruitvale	<1	<1	0.20	Vineyard	<1	<1
Nov 13	0.23	Mike's	<1	<1													0.13	6A Booster	<1	<1					0.30	Wolfcub	<1	<1
Nov 19	0.13	Pinehill	<1	<1									0.14	5A Booster	<1	<1									0.12	Sawmill	<1	<1
Nov 26	0.21	McGowan	<1	<1					0.11	Snowbrush	<1	<1													0.24	Granby	<1	<1
Dec 3	0.11	Mike's	<1	<1																	0.04	Fruitvale	<1	<1	0.24	Fairview	<1	<1
Dec 10	0.13	McGowan	<1	<1									0.16	5A Booster	<1	<1									0.10	Hillside	<1	<1
Dec 18	0.07	Pinehill	<1	<1													0.09	6A Booster	<1	<1					0.50	Meadows	<1	<1

Samples around the Christmas Holiday, were missed because lab was closec

Loop of the Lake Project for Mike Johnson Excavation

Work order for install of a watermain extension to property in Rural Area

APPENDIX D: 2018 PUMPING DATA

MONTH	GROUNDWATER SOURCES (US GALLONS)													SURFACE WATER SOURCE (US GALLONS)							TOTAL WATER USED IN 2018
	Scada	Scada	Scada	Scada	Scada		Scada	Scada	Scada	Scada	Scada			Scada	Scada	Scada	Scada	Scada	Scada		
	ROCKCLIFFE DOMESTIC PS	TUCELNUIT PS 2	TUCELNUIT PS 3	BUCHANAN DOM WELL	MILLER RD RD 13	TOTAL GROUNDWATER USED FOR	MILLER RD DOM/IRR PS	BLACK SAGE DOM/IRR PS	TOTAL GROUNDWATER USED FOR	FAIRVIEW IRR WELL	BUCHANAN ROAD PS *	TOTAL GROUNDWATER USED FOR	TOTAL GROUNDWATER USED	MUD LAKE PS	ROCKCLIFFE IRR PS	FAIRVIEW IRR PS	HESTER CREEK PS	MT KOBAU PS	BLK SAGE IRR PS	TOTAL SURFACE WATER USED	
	Mun	Mun	Mun	Sys 1	4,5,6,7		Sys 2	Sys 2		Sys 5A	Sys 1			Sys 1	Sys 4	Sys 5	Sys 6	Sys 7	Sys 2B		
	used for DOMESTIC	used for DOMESTIC	used for DOMESTIC	used for DOMESTIC	used for DOMESTIC	DOMESTIC	used for BOTH	used for BOTH	Both	used for AGRICULTURE	used for AGRICULTURE	AGRICULTURE		used for AGRICULTURE	used for AGRICULTURE	used for AGRICULTURE	used for AGRICULTURE	used for AGRICULTURE	used for AGRICULTURE		
January	9,348,766	6,633,054	3,914,871	5,797,174	0	25,693,865	0	0	0	0	0	0	25,693,865	0	0	0	0	0	0	0	25,693,865
Feburary	12,126,912	3,923,871	3,584,130	4,043,224	0	23,678,138	0	0	0	0	0	0	23,678,138	0	0	0	0	0	0	0	23,678,138
March	14,391,011	11,332,706	4,976,359	0	0	30,700,077	94,994	1,362,703	1,457,697	0	0	0	32,157,774	16,638	0	0	3,277	2,846	339	23,101	32,180,875
April	13,327,603	12,591,870	6,067,864	0	6,500,704	38,488,041	2,261,799	1,244,516	3,506,315	3,572,000	2,530,527	6,102,527	48,096,882	1,961,110	15,642,209	5,409,000	5,278,513	505,524	238	28,796,595	76,893,477
May	29,139,465	17,173,977	7,358,320	0	12,077,200	65,748,962	4,421,500	26,105,054	30,526,554	83,000	6,094,660	6,177,660	102,453,177	60,911,388	163,347,479	70,442,000	81,083,773	60,557,541	12,973,308	449,315,489	551,768,666
June	30,203,300	19,714,350	10,035,880	4,924,546	9,179,500	74,057,575	2,175,100	32,581,405	34,756,505	0	8,557,972	8,557,972	117,372,052	69,708,294	169,232,736	70,010,000	75,613,926	70,536,248	17,609,389	472,710,593	590,082,644
July	35,810,476	19,952,855	13,843,266	11,328,581	12,653,800	93,588,978	3,504,477	49,503,203	53,007,680	0	10,470,796	10,470,796	157,067,454	116,917,347	217,388,283	92,161,000	118,840,633	106,169,443	29,306,912	680,783,618	837,851,071
August	35,750,694	19,200,601	11,595,648	9,251,861	9,564,902	85,363,707	788,779	45,274,747	46,063,526	0	7,279,455	7,279,455	138,706,689	111,641,613	210,903,533	90,901,000	110,668,419	80,846,908	27,521,186	632,482,659	771,189,348
September	15,499,495	17,938,666	2,298,904	10,824,892	6,106,300	52,668,257	583,535	25,098,670	25,682,206	0	3,302,250	3,302,250	81,652,713	52,669,666	128,593,287	52,738,700	61,438,486	51,431,113	16,285,691	363,156,943	444,809,655
October	11,090,829	6,454,034	1,351,704	2,595,735	4,875,800	26,368,102	2,310,300	13,181,320	15,491,620	4,463,283	9,451,732	13,915,015	55,774,737	16,178,310	30,808,314	18,601,000	15,039,326	8,909,221	3,193,935	92,730,107	148,504,844
November	8,685,971	4,654,385	6,111,991	2,002,500	5,215,061	26,669,908	354,639	694,112	1,048,751	0	0	0	27,718,659	0	0	0	0	0	0	0	27,718,659
December	9,945,281	4,366,509	3,992,253	2,054,183	1,150,000	21,508,227	96,248	2,000,214	2,096,462	0	0	0	23,604,690	0	0	0	0	0	0	0	23,604,690
TOTALS	225,319,803	143,936,879	75,131,190	52,822,696	67,323,267	564,533,835	16,591,371	197,045,945	213,637,317	8,118,283	47,687,393	55,805,676	833,976,828	430,004,366	935,915,841	400,262,700	467,966,355	378,958,844	106,890,997	2,719,999,104	3,553,975,931
WHEN ACTIVE					double-check:	564,533,835					double-check:	55,805,676	833,976,828						double-check:	2,719,999,104	3,553,975,931
YTD Max Flow	1,949,921	1,984,718	1,810,196	728,845	794,900	5,542,731	352,300	3,262,754	3,432,054	663,000	731,056	1,074,458	9,187,520	8,464,280	15,801,169	5,391,000	8,282,635	6,971,930	1,933,342	44,365,907	53,553,427
YTD Min Flow	0	0	0	0	0	256,353	0	0	0	0	0	0	568,721	0	0	0	0	0	0	0	568,721
Avg Year Flow	1,179,035	783,985	415,032	291,094	388,718	5,145,838	88,284	1,051,965	1,653,802	#DIV/0!	256,071	517,295	7,815,564	2,291,087	4,964,627	2,249,158	2,478,675	2,014,896	570,097	26,014,633	33,597,016

NOTE< Black Sage PS values are recorded as one combined value. These values have been calculated into agriculture as the activation of the pump pertains to the Irrigation Season

* Meters only read on a periodic basis

MONTH	GROUNDWATER SOURCES (CUBIC METERS)													SURFACE WATER SOURCE							TOTAL WATER USED IN 2018
	Scada	Scada	Scada	Scada	Scada		Scada	Scada	Scada	Scada	Scada			Scada	Scada	Scada	Scada	Scada	Scada		
	ROCKCLIFFE DOMESTIC PS	TUCELNUIT PS 2	TUCELNUIT PS 3	BUCHANAN DOM WELL	MILLER RD RD 13	TOTAL GROUNDWATER USED FOR	MILLER RD DOM/IRR PS	BLACK SAGE DOM/IRR PS	TOTAL GROUNDWATER USED FOR	FAIRVIEW IRR WELL	BUCHANAN ROAD PS *	TOTAL GROUNDWATER USED FOR	TOTAL GROUNDWATER USED	MUD LAKE PS	ROCKCLIFFE IRR PS	FAIRVIEW IRR PS	HESTER CREEK PS	MT KOBAU PS	BLK SAGE IRR PS	TOTAL SURFACE WATER USED	
	Mun	Mun	Mun	Sys 1	4,5,6,7		Sys 2	Sys 2		Sys 5A	Sys 1			Sys 1	Sys 4	Sys 5	Sys 6	Sys 7	Sys 2B		
	used for DOMESTIC	used for DOMESTIC	used for DOMESTIC	used for DOMESTIC	used for DOMESTIC	DOMESTIC	used for BOTH	used for BOTH	Both	used for AGRICULTURE	used for AGRICULTURE	AGRICULTURE		used for AGRICULTURE	used for AGRICULTURE	used for AGRICULTURE	used for AGRICULTURE	used for AGRICULTURE	used for AGRICULTURE		
January	35,389	25,109	14,819	21,945	0	97,262	0	0	0	0	0	0	97,262	0	0	0	0	0	0	0	97,262
Feburary	45,905	14,853	13,567	15,305	0	89,631	0	0	0	0	0	0	89,631	0	0	0	0	0	0	0	89,631
March	54,476	42,899	18,838	0	0	116,212	360	5,158	5,518	0	0	0	121,730	63	0	0	12	11	1	87	121,818
April	50,450	47,665	22,969	0	24,608	145,693	8,562	4,711	13,273	13,521	9,579	23,101	182,066	7,424	59,212	20,475	19,981	1,914	1	109,007	291,073
May	110,305	65,011	27,854	89	212	203,471	16,737	98,818	115,556	314	23,071	23,385	342,411	230,575	618,337	266,652	306,935	229,235	49,109	1,700,843	2,043,254
June	114,332	74,627	37,990	18,641	34,748	280,338	8,234	123,334	131,568	0	32,395	32,395	444,301	263,874	640,615	265,017	286,230	267,009	66,659	1,789,403	2,233,705
July	130,262	68,036	49,383	42,883	45,015	335,579	12,535	178,825	191,360	0	37,267	37,267	564,206	420,839	772,690	329,811	424,517	380,945	105,153	2,433,955	2,998,162
August	135,331	72,682	43,894	35,022	36,207	323,137	2,986	171,383	174,369	0	27,556	27,556	525,062	422,609	798,356	344,098	418,925	306,039	104,179	2,394,206	2,919,268
September	58,672	67,905	8,702	40,977	23,115	199,371	2,209	95,009	97,218	0	12,500	12,500	309,089	199,376	486,778	199,638	232,570	194,688	61,648	1,374,698	1,683,787
October	41,983	24,431	5,117	9,826	18,457	99,814	8,745	49,897	58,642	16,895	35,779	52,674	211,130	61,242	116,622	70,412	56,930	33,725	12,090	351,021	562,152
November	32,880	17,619	23,136	7,580	19,741	100,957	1,342	2,627	3,970	0	0	0	104,926	0	0	0	0	0	0	0	104,926
December	37,647	16,529	15,112	7,776	4,353	81,417	364	7,572	7,936	0	0	0	89,353	0	0	0	0	0	0	0	89,353
TOTALS	847,633	537,366	281,382	200,045	206,456	2,072,882	62,074	737,335	799,409	30,731	178,147	208,878	3,081,170	1,606,002	3,492,611	1,496,103	1,746,101	1,413,565	398,840	10,153,222	13,234,392
WHEN ACTIVE																					
YTD Max Flow	847,633	537,366	281,382	200,045	206,456	2,072,882	62,074	737,335	799,409	30,731	178,147	208,878	3,081,170	1,606,002	3,492,611	1,496,103	1,746,101	1,413,565	398,840	10,153,222	13,234,392
YTD Min Flow	107	1	487	168	140	2,191	0	244	0	30,731	178,147	208,878	2,275	1,606,002	3,492,611	1,496,103	1,746,101	1,413,565	398,840	10,153,222	2,275
Avg Year Flow	35,097	21,804	12,073	8,274	8,251	85,016	2,411	28,835	31,234	1,182	6,852	7,460	122,026	61,769	134,331	57,542	67,158	54,368	15,340	362,615	484,641

APPENDIX E: 2018 GROUNDWATER AND SURFACE WATER CONSUMPTION DATA

Town of Oliver

Groundwater Consumption Data

US GALLONS

YEAR	January	February	March	April	May	June	July	August	September	October	November	December	YTD	Year Average	Average
2018	25,693,865	23,678,138	32,157,774	48,096,882	102,453,177	117,372,052	157,067,454	138,706,689	81,652,713	55,774,737	27,718,659	23,604,690	833,976,828	69,498,069	828,102,955
2017	27,531,385	26,935,811	32,381,863	33,127,917	69,692,881	105,839,743	156,311,916	147,447,499	92,667,928	64,715,211	25,437,142	25,053,945	807,143,242	67,261,937	828,102,955
2016	26,495,703	25,304,817	29,968,727	64,556,558	114,449,576	105,588,928	126,590,568	139,721,723	84,497,704	52,219,628	26,892,706	25,529,293	821,815,931	68,484,661	828,102,955
2015	24,995,670	22,331,907	28,348,130	69,828,360	107,509,652	134,080,260	163,478,571	140,709,274	101,276,667	68,802,269	26,439,576	25,334,906	913,135,245	76,094,604	828,102,955
2014	24,199,544	21,567,526	24,744,328	54,446,855	90,368,412	100,455,656	133,158,307	123,562,365	88,162,857	72,119,009	24,827,571	23,993,338	781,605,767	65,133,814	828,102,955
2013	26,822,480	25,225,568	32,194,465	46,945,213	99,359,703	105,530,172	153,640,351	131,088,478	71,923,869	70,689,721	23,627,363	23,893,335	810,940,720	67,578,393	828,102,955
Average	25,956,441	24,173,961	29,965,881	52,833,631	97,305,567	111,477,802	148,374,528	136,872,672	86,696,956	64,053,429	25,823,836	24,568,251	828,102,955		

CUBIC METERS

YEAR	January	February	March	April	May	June	July	August	September	October	November	December	YTD	Year Average	Average
2018	97,262	89,631	121,730	182,066	387,827	444,301	594,565	525,062	309,089	211,130	104,926	89,353	3,156,944	263,079	3,134,709
2017	104,218	101,963	122,579	125,403	263,816	400,647	591,705	558,149	350,786	244,974	96,290	94,839	3,055,368	254,614	3,134,709
2016	100,297	95,789	113,444	244,373	433,239	399,697	479,197	528,904	319,858	197,673	101,800	96,639	3,110,910	259,243	3,134,709
2015	94,619	84,535	107,309	264,329	406,968	507,549	618,833	532,642	383,374	260,445	100,085	95,903	3,456,591	288,049	3,134,709
2014	91,605	81,642	93,667	206,104	342,081	380,266	504,059	467,734	333,733	273,000	93,983	90,825	2,958,698	246,558	3,134,709
2013	101,534	95,489	121,869	177,707	376,117	399,475	581,592	496,224	272,261	267,590	89,439	90,446	3,069,743	255,812	3,134,709
Average	98,256	91,508	113,433	199,997	368,341	421,989	561,658	518,119	328,184	242,468	97,754	93,001	3,134,709		

Town of Oliver

Surface Water Consumption Data

US GALLONS

YEAR	January	February	March	April	May	June	July	August	September	October	November	December	YTD	Year Average	Average
2018	0	0	0	28,796,595	449,315,489	472,710,593	680,783,618	632,482,659	363,156,943	92,730,107	0	0	2,719,976,003	2,821,182,373	2,821,182,373
2017	0	0	0	25,906,471	159,593,999	441,096,535	687,142,179	604,322,130	365,509,904	130,755,733	0	0	2,414,326,951	2,821,182,373	2,821,182,373
2016	0	0	0	195,820,565	424,420,450	369,144,236	517,489,259	674,696,799	320,877,783	132,229,659	0	0	2,634,678,752	2,821,182,373	2,821,182,373
2015	0	0	0	242,341,115	487,581,169	653,959,751	763,431,674	667,904,291	465,978,262	223,374,730	0	0	3,504,570,991	2,821,182,373	2,821,182,373
2014	0	0	0	9,259,933	450,829,671	532,264,210	770,607,532	655,345,192	415,486,514	139,133,678	0	0	2,972,926,730	2,821,182,373	2,821,182,373
2013	0	0	0	111,513,914	414,598,794	427,810,480	826,320,197	585,448,024	187,664,000	127,259,405	0	0	2,680,614,814	2,821,182,373	2,821,182,373
10 Yr Average	**0**	**0**	**0**	**102,273,099**	**397,723,262**	**482,830,967**	**707,629,076**	**636,699,849**	**353,112,234**	**140,913,885**	**0**	**0**	**2,821,182,373**		
Average	**0**	**0**	**0**	**102,273,099**	**397,723,262**	**482,830,967**	**707,629,076**	**636,699,849**	**353,112,234**	**140,913,885**	**0**	**0**	**2,821,182,373**		

CUBIC METERS

YEAR	January	February	March	April	May	June	July	August	September	October	November	December	YTD	10 YR Average	Average
2018	0	0	0	109,007	1,700,843	1,789,403	2,577,045	2,394,206	1,374,698	351,021	0	0	10,296,224	11,187,387	11,187,387
2017	0	0	0	98,067	604,129	1,669,731	2,601,115	2,287,607	1,383,605	494,964	0	0	9,139,217	11,187,387	11,187,387
2016	0	0	0	741,261	1,606,605	1,397,362	1,958,909	2,554,004	1,214,654	500,543	0	0	9,973,339	11,187,387	11,187,387
2015	0	0	0	917,360	1,845,695	2,475,506	2,889,902	2,528,292	1,763,919	845,565	0	0	13,266,238	11,187,387	11,187,387
2014	0	0	0	35,053	1,706,575	2,014,838	2,917,065	2,480,750	1,572,787	526,678	0	0	11,253,747	11,187,387	11,187,387
2013	0	0	0	422,126	1,569,426	1,619,438	3,127,961	2,216,161	710,385	481,729	0	0	10,147,226	11,187,387	11,187,387
10 Yr Average	**0**	**0**	**0**	**454,684**	**1,519,627**	**1,870,150**	**2,742,587**	**2,591,669**	**1,564,000**	**585,043**	**0**	**0**	**11,327,760**		
Average	***0***	***0***	***0***	***596,500***	***1,791,967***	***2,119,778***	***3,155,101***	***3,033,452***	***1,899,412***	***607,969***	***0***	***0***	***13,204,179***		