



Annual
Water
Report

2012



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1.0 Introduction

The Town of Oliver operates an extensive Municipal and Rural water system which consists of seven ground water well sites, two surface water sources, and three reservoirs. See Appendix A.

The Town provides domestic water to approximately 2,387 residential and 247 commercial/industrial connections and also provides irrigation water to approximately 513 connections irrigating over 3,900 acres of farmland within the Town of Oliver and a substantial portion of area 'C' of the Regional District of Okanagan Similkameen.

All domestic connections, other than those still receiving canal water in the summer months, are now metered. There are approximately 84 customers in the summer of 2012 receiving canal water during the summer months.

2.0 History

The Liberal Premier of BC, "Honest" John Oliver, helped create, "The Soldiers' Settlement Plan", known as, "The Soldiers Land Act", following the First World War in 1918. This plan was implemented to provide immediate and long term economic opportunities to the soldiers by making land available to them at a reasonable cost.

The challenge for the government was to make the arid rangeland viable by constructing an irrigation system to create thousands of farmable acres. The irrigation project was named the South Okanagan Lands Irrigation Project and commenced.

The "ditch" as it is known was completed in 1923 running 25 miles in length to transport irrigation water from one side of the valley to the other, transforming the arid desert into blossoming orchards and farms.

In 1963 the premier, W.A.C. Bennett, passed the responsibility for the irrigation system from the province to a committee of growers called the South Okanagan Land and Irrigation District (SOLID.) The system was operated by SOLID until 1989 when the Towns of Oliver and Osoyoos assumed control of the system.

On the dissolution of SOLID, in order to give rural water customers a continued voice in the operation of the local water system, two water councillor positions were created by bylaw.

3.0 System Overview

As part of the water distribution system, the Town maintains approximately 130km of water main. (This does not include System 1 twinning.)

The distribution system is made up of AC, PVC, CI, HDPE material, with pipe sizes ranging from 50mm to 600mm diameter.

The age of the water mains range from new to approximately 47 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.

The majority of the Town's rural water system is twinned with the exception of part of System 1 north of Town and part of System 2 / Black Sage. System 1 is discussed under, "Capital Projects and Improvements", but there are currently no plans to complete twinning in System 2. The water system is still referred to by system numbers one through seven, however; the domestic water system is also referred to as Rural North, Municipal, Rural South and Black Sage.

The Town uses ground water for its main source of domestic water, with the only exception being a portion of System 1 customers north of Oliver who have not been twinned yet; these customers still receive surface water in the summer months.

Normal operating pressures range from 70psi to 120psi for standard pressurized services. Our irrigation system also has a number of low pressure users who pump out of the irrigation canal with their own pump houses.

3.1 Irrigation System

Surface water, specifically Okanagan River, is still the primary source for the irrigation water system, but also includes Buchanan well, Fairview well and Black Sage oxbow. The canal system runs from McIntyre Dam (where the diversion is complete with a fish screen) 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 a number of water licences to allow these surface water diversions.

From the canal system, Mud Lake pump house is the first of five pump houses along the canal. Chlorination occurs at this pump station as some customers are still using this for domestic water.

The second pump station along the system is Rockcliffe in System 4. System 4 also includes a 25,000 US gallon (94 cubic metres) irrigation water reservoir.

The third pump station along the system is Fairview irrigation pump station in System 5. System 5 also includes a 50,000 US gallon (189 cubic metres) irrigation water reservoir. There is also Fairview well in System 5 which used to be part of the domestic water system but was switched over when the nitrate levels exceeded the Canadian Drinking Water Standards.

Black Sage Hester Creek irrigation pump station is located in System 6 and Mt Kobau irrigation pump station is in System 7.

Only part of Black Sage or System 2 has a separate irrigation system, while the rest of the area irrigates with domestic water. The area that is twinned uses Black Sage pump station supplied by Black Sage oxbow for irrigation supply.

2012 irrigation season started on April 12th and ended October 10th. Crews began filling the canal and turning on spray fillers April 3rd. There were 58 applications for late irrigation this year. The canal diversion was shut down on October 31st. Notices were posted in the Oliver Chronicle and the Town website. All Town irrigation systems were shut down and winterized in October.

A storm on July 20th caused maintenance issues with debris removal required from the canal and screens. Diversion gates had to be manually adjusted because of downstream pump outages.

3.2 Domestic System

The domestic water system storage capacity is 1,025,000 US gallons (3880 cubic metres) between four reservoirs. Existing municipal reservoirs consist of 360,000 US gallon (1360 cubic metre) reservoir and a 500,000 US gallon (2470 cubic metre) reservoir. The other two reservoirs still in use are located in System 6a; Road 13 reservoir at 150,000 US gallons (cubic metres) and Hester Creek reservoir at 15,000 US gallons (cubic metres).

During the summer months, CPR well has been used to supplement the water supply and is discussed in more detail under 5.3.4. Lions well is not used at all anymore because of the unacceptable uranium levels.

There are three wells at Tucelnuit, of which only #2 and #3 are used to supply the domestic system. See “Capital Projects and Improvements” section for details on the chlorination and contact time project. Rockcliffe well is also a main supplier of domestic water to the Municipal system.

The rural area north of Town (System 1) is only partly twinned. Mud Lake pump house as described in the above section services both domestic and irrigation customers. The twinning work in this area is scheduled to be completed in 2013- 2014, see “Capital Projects and Improvements” section for more detail.

Airport Booster station is typically set to supply water from within the municipal boundaries to the rural area south but can also be used to bring water from the rural area south to the Municipal system.

There are three Black Sage domestic wells accessed from the River dyke supplying System 2. Miller well is used to supply Black Sage/System 2 and the Road 13 reservoir.

3.3 SCADA (Supervisory Control and Data Acquisition)

The Town utilizes a SCADA system to monitor and control many functions at a number of the pump stations and reservoirs. This system allows the Water Operators to monitor reservoir levels, turn pumps on/off and monitor turbidity of the canal water. The operator can change set points and monitor some aspects of the system remotely. For more detail on the extent of the SCADA system, see appendix D.

4.0 Routine Maintenance Program

Fire hydrants are inspected and flushed annually.

Water main flushing program is done annually. True Engineering is working on a unidirectional flushing program for the Town.

The Town does not currently have a formalized valve exercising program.

Each well and pump station is inspected daily. All pumps and motors are inspected and serviced annually as per the operations and maintenance protocols for each facility.

The reservoirs have intrusion alarms and are inspected monthly to ensure the site and structure are secure.

5.0 Water Quality

Oliver has hard water which contains calcium and magnesium compounds. Hard water can cause pipes to fur up and scale to collect in kettles, electric irons, and washing machines, wearing them out sooner and making them less efficient. Many residents have purchased water softeners; the Town encourages the use of Potassium Chloride for the softening products.

In Town the average hardness is 240 mg/L or ppm between the municipal wells but can vary depending on the source. The rural water ranges from 159 at Black Sage #1 to 373 at Black Sage #3. The hardness in the water system fluctuates depending on which wells are being pumped and location.

5.1 Well Assessment/ Protection Plan

The Town received an Assessment of Groundwater Under the Direct Influence of Surface Water (GWUDI) report from Western Water Associates Ltd in May of 2012. The report indicates that Rockcliffe well is not GWUDI while Buchanan, Miller, Tucelnuit wells and Black Sage #2 and #3 wells are low GWUDI risk. CPR, Lions well and Black Sage #1 are moderate GWUDI risk requiring further sampling.

5.2 Disinfection

Chlorination occurs at all domestic pump houses except for Black Sage. In 2012, Black Sage experienced intermittent coliform hits throughout the summer months. Now the Town is looking to resolve this with a future project to allow for chlorination at the Black Sage wells.

5.3 Monitoring Program

A new water room was constructed at Public Works in 2012 for water sampling and meter repairs.

Turbidity of the canal water north of Town is continuously monitored through the SCADA system. Those customers north of Town (System 1) not yet twinned on the west side of Okanagan River were sent notices on May 3rd of a boil water notice due to increased turbidity, (≥ 5 NTU.) The boil water notice for System 1 customers not yet twinned on the west side of Okanagan River was terminated October 31st in conjunction with the canal shutdown, at which time those customers receive municipal water.

System 2 customers were put on a boil water notice June 18th due to a low coliform count. Black Sage well was shut down October 31st with System 2 being supplied from the municipal system. The boil water notice for System 2 was terminated November 20th.

There are four test stations located in the Municipal boundaries. Hillside test station installed April 2012. The rural area north of Town has one test site for canal water during the summer months. There are eight testing sites south of Town, two of which were installed in 2012.

If any sample shows the presence of coliform or any other abnormality, the provincial Drinking Water Officer is consulted in deciding if any action by the purveyor is necessary.

5.3.1 Bacteriological

As required by Interior Health, municipal staff takes weekly water samples for bacteriological testing for Total Coliforms and e-Coli Bacteria at various sites throughout the system. See Appendix D for a list of sites and Appendix E for test results.

If a water sample is found to contain the presence of coliform, standard protocol is to flush and resample the water immediately at the same location and resubmit for testing by the lab. We also complete in house presence/ absence tests.

5.3.2 Nitrate / Nitrite Sampling

On approximately February 1, April 1, June 1, October 1, and December 1 of each year, samples are to be drawn from each well and analysed for *Nitrates / Nitrites*. (Note: the intent is to sample for Nitrate / Nitrites every second month, however, the analysis for August will be included in the annual sample.) See Appendix F for results.

5.3.3 THM Sampling

On approximately August 1 of each year, a sample is to be drawn at the Mud Lake pump station and tested for THM's. Typically, this is to be done in the summer when the organic loading is high. See Appendix F for results.

5.3.4 Uranium

CPR & Lion's pump house discharges to the river were upgraded with rip-rap March 2012. Notification was sent to Department of Fisheries and Oceans along with the Ministry of Environment for the start-up of CPR pump station and discharge into Okanagan River. CPR well was flushed into Okanagan River continuously starting May 1st. The purpose of this was to flush out high concentrations of uranium prior to pumping into the Municipal water system. After consistent tests showing uranium concentrations below the standard set by the Canadian Drinking Water Guidelines (<0.02mb/L), and increased demand, the CPR pump station began to pump into the municipal system on July 13th.

As test results showed uranium concentrations increasing above the standard set by the Canadian Drinking Water Guidelines (<0.02mb/L), CPR was shut down August 14th. See Appendix F for test results.

5.3.5 Annual Full Spectrum Sampling

On approximately August 1 of each year an annual sample will be drawn from two to three well site(s) or the raw canal water. The intent is that every source will be tested in a maximum five year rotation. They are to be analysed for the following:

General Parameters:

Fluoride	Nitrite	Hardness
PH	Colour	Sulphate
Chloride	Conductivity	Total Alkalinity
Nitrate (NO ₂)	Turbidity	Total Dissolved Solids

Metals:

Aluminium	Cobalt	Nickel
Arsenic (low level)	Copper	Potassium
Barium	Iron	Selenium (low level)

Boron
Cadmium
Calcium
Chromium

Lead (low level)
Magnesium
Manganese
Molybdenum

Silver
Sodium
Vanadium
Zinc

All of the data from the above analysis will be recorded in a spreadsheet format, and will include comparisons of the results with the standards set in the “Canadian Drinking Water Guidelines”.

5.4 Turbidity Monitoring Program

Turbidity in the surface water is continuously monitored at Mud Lake pump station through SCADA.

6.0 Consumption

The Town pumped 737,446,685 US gallons of ground water in 2012, and 2,371,774,782 US gallons of surface water. This represents a 15% decrease from over 2011 consumption. On the domestic water side, maximum daily water demand peaked at 5,417,132 US gallons on August 8th, while minimum daily demand occurred on January 8th at 647,754 US gallons. Domestic water consumption averaged 2,014,882 US gallons per day or 233 US gallons (882 litres) per person base on a population of 8,648. (2011 Census data of 5,175 for Oliver and 3,473 for Area C.) Average daily consumption per person in the Okanagan is 178 US gallons (675 litres), while in Canada it is 87 US gallons (329 litres.)

Figure 1 – Five Year Trend of Total Groundwater Consumption

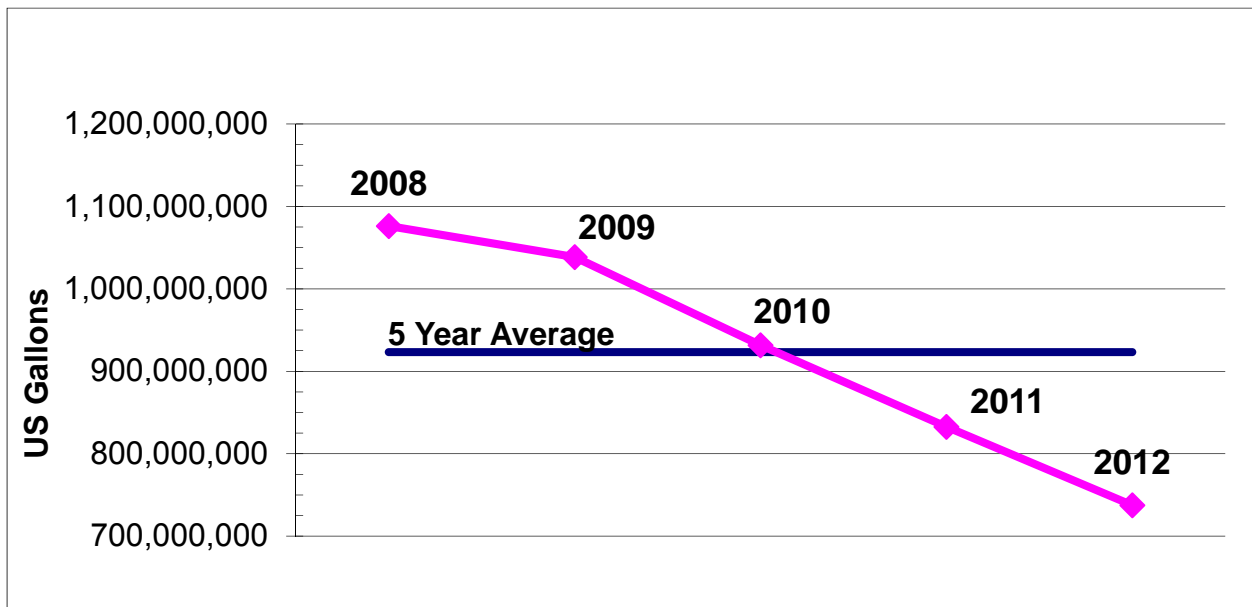
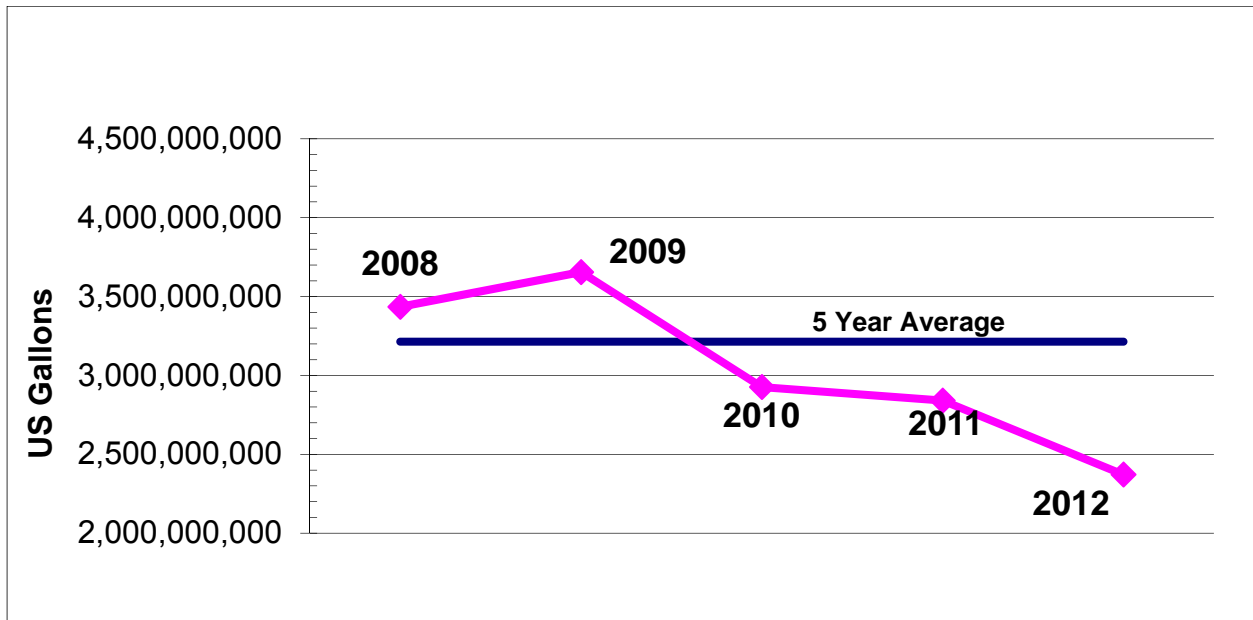


Figure 2 – Five Year Trend of Total Surface Water Consumption



7.0 Staff

According to EOCP (Environmental Operator Certification Program), Oliver’s Water Distribution System is Class III. There are six certified Operators at Public Works; one level I, four level II, and one level IV.

All Operators are required to keep up their education and to maintain 2.4 certified education units (CEU’s) every two years.

Two of our Operators completed a “Chlorine Handling” course in 2012. Various other courses were put on at the Town regarding safe work practices.

8.0 Capital Projects & Improvements

8.1 Completed in 2012

8.1.1 Tucelnuit Hypo-chlorination Building & Equipment

This project was started in 2012 and scheduled to finish in spring 2013. It incorporates a new chlorination building at our Tucelnuit domestic well site and is attached to the existing well #3 building. This project will consist of a new on-site hypo chlorination generator that makes a lower diluted percentage of chlorine to inject into the domestic water system for one stage of water treatment against bacteria in the system. It uses salt as a base product and through a chemical process, chlorine is created. The cost estimates for this project were approximately \$180,000 but with

construction, equipment required and electrical/control work required at this site, the costs have increased.

8.1.2 Chlorine Contact Time Piping

This project consisted of placing extra piping into the ground at our Rockcliffe and Tucelnuit domestic well sites. This pipe was over-sized, using high density polyethylene (HDPE) for hundreds of meters so the Town can comply with Interior Health requirements/standards for chlorine contact time. This gives the chlorine sufficient time to disinfect any bacteria in the water system before reaching our first customers.

8.1.3 Chlorine Residual Improvements/Upgrades

With the recent upgrades for chlorine contact time and adding a hypo chlorination pump at Rockcliffe well a few years ago, we were undertaking some further improvements at the pump house. This incorporated moving pump and storage into a separate room, installing ducting and fan for room, and improved alarm controls were added to the system.

8.1.4 Finished Water Twinning Phase 2 Project

Phase 2 of water twinning, which started in water systems 4 & 5 in previous years, was completed; with enough money saved to start twinning System 1. Like other twinning projects the Town has been undertaking since 2007, this project involved laying separate domestic water piping for the inclusive use of domestic water for our customers. The existing piping would be left for irrigation water use only, using pressured water from our irrigation canal system to supply customers.

8.1.5 Repair and Restore Section of Irrigation Canal

As the concrete canal was built over 90 years ago, we generally restore sections yearly. There is constant upgrades and patch work required before the beginning of the spring irrigation season. We restored approximately 700 feet (213 meters) of canal, located north of our Hester Creek Pump station which involved pressure washing, rebarring the floor and walls, shot-creting walls, pouring concrete and finishing the canal floor.

8.1.6 (Ministry of Transportation and Infrastructure (MOTi) Initiated Canal Box Culvert Upgrades Project

This project was initiated by the Ministry of Transportation and Infrastructure, in preparation of the four-laning project happening north of Gallagher Lake. This would replace sections of the canal and existing bridge with 160 box culverts. MOTi asked the Towns Consultant Engineer to help design and coordinate this project as well as cover 100% of the funding. It started winter 2012 and will carry over to March 2013. It was a tight timeline to complete the project before the irrigation season start up.

8.2 Proposed for 2013

8.2.1 Hollow Upgrades

The Hollow Street neighbourhood upgrade project consists of three main elements; water, sewer and road upgrades. This area has older infrastructure and under-sized water mains for proper fire hydrant flows. All service lines to property line will also be upgraded. This is projected to start late spring and continue to the end of September.

8.2.2 Buchanan Well/ Directional Drilling

The Town is looking to build and add another well in the domestic water system at the existing Buchanan well site. This will be for domestic purposes only and the Town is currently working on land tenures in the meantime. Also required to complete the tie-in into the domestic water system (System 1), a 350mm (14 inch) pipe will need to be directionally drilled under the Okanagan River from the east side to the west. The Town has received extra funding to help towards the construction of the well.

8.2.3 Twinning Phase 3 – System 1

This will complete the last of the twinning upgrades started 7 years ago. This last section will complete the twinning for the remaining customers in the north section of System 1. The Town has received a grant to help with these costs.

8.2.4 Chlorine Contact Time Piping – Black Sage

The project will consist of some extra over-size piping being placed in order for customers to receive adequate chlorination prior to receiving domestic water. We have received some funding to help with this portion of the project. This project will consist of adding a chlorination component

for the Black Sage well sites. Adding a small building to the site and constructing piping and telemetry tie-ins to our existing Miller Road well.

8.2.5 Flume 3 Upgrades

This project was tendered in 2012 but tender bids came in considerably higher than originally anticipated. Some tweaking of the original design and sourcing different materials will take place in 2013. This will upgrade the existing Flume 3, the highest and largest flume on the irrigation canal system.

8.2.6 Manganese Pilot Project – Miller Well

This will be a pilot project to determine how much manganese our Miller Road well produces and what it would take to combat and reduce these levels in the future. It will be reported and inform us on further action for future.

8.2.7 Finish Chlorine Residual Improvements/Upgrades

This is a carryover project for the upgrades at Rockcliffe domestic well, started in 2012.

8.2.8 Repair and Restore Section of Irrigation Canal

We will be restoring another section of the concrete canal system located near Nk'Mip golf course, encompassing approximately 1000+ feet (over 300 meters).

8.2.9 Hester Creek Pump Station Upgrades

This project includes installing more information/controls to the Towns SCADA system at this site as well as some electrical upgrades.

8.3 Long-term Plans for Improvements

The Town has a 5 year budgeted capital plan for known upgrades and new infrastructure or for projects that may get pushed out of the current budget to later years. Some of these projects would include:

- More domestic water treatment & water quality solutions at various sites,
- Mainline and service line upgrades (McGowan Subdivision, Station Street & other areas),
- Possible back-up power generation at Tucelnuit well site, siphon and diversion sites on canal,

- Future domestic water main looping at the head of Tucelnuit Lake,
- Irrigation canal upgrades,
- Electrical control improvements at various sites,
- Possible reservoir expansion or control improvements for water System 4.

9.0 Emergency Response Plan

The Town has an Emergency Response Plan pertaining to 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; the plan was updated May 2012.

10.0 Cross Connection Control Program

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 Municipal water system.

The program focuses on premise isolation for commercial and industrial customers. In 2012, nine properties were surveyed with five new testable devices being installed. There are currently 224 testable assemblies in service (including agricultural devices) being tracked.

11.0 Water Conservation

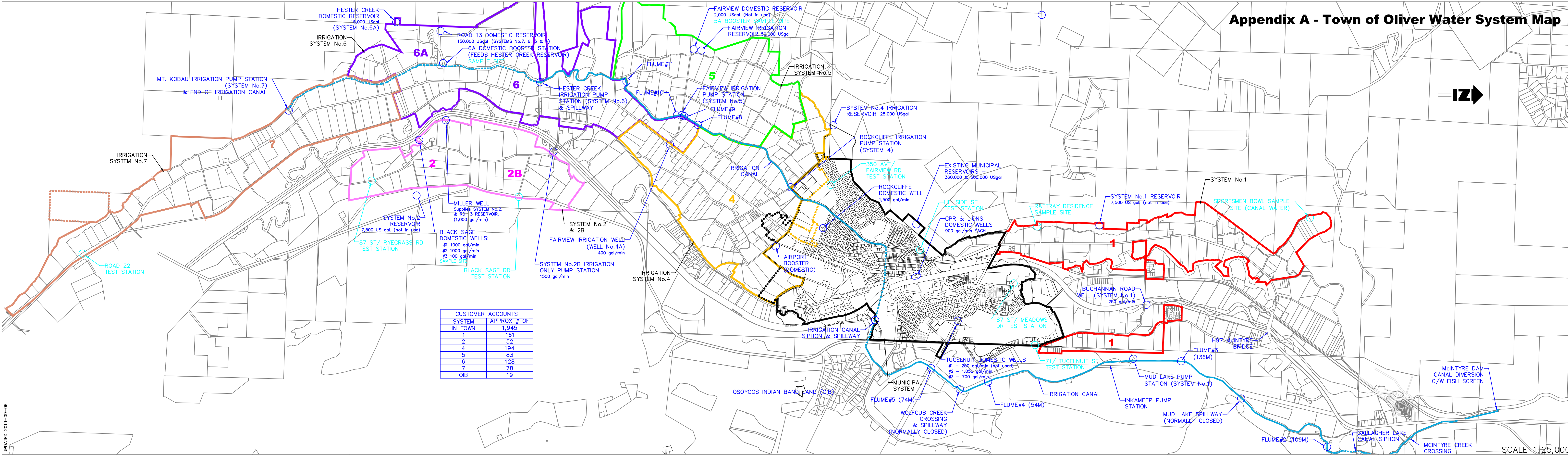
We have worked towards providing public information and education for water conservations. The Town contributed to OBWB, 'Make Water Work' campaign, which is a valley wide ad campaign. "Waterwise Gardening for Home and Small Acreage Owners of the Oliver Area", was released and posted on Town of Oliver's website. The Town also participated in the 'Tap by Tap' program which provided free, easy to install faucet fixtures to help residents across the province save water, energy, and money.

The continued twinning, phase three of the water twinning in System 1, is also part of the water conservation program. All properties that are twinned then have their domestic water metered and are charged for consumption.

12.0 Conclusion

The Town of Oliver works hard to maintain water quality and quantity for their residence as well as numerous regional district area 'C' customers. Efforts are made to ensure appropriate water usage and educate the public whenever possible. Without these ongoing efforts, the area would not be the robust agricultural community that it is today.

Appendix A - Town of Oliver Water System Map



SYSTEM	APPROX # OF IN TOWN
1	161
2	52
4	194
5	83
6	128
7	78
OIB	19

SCALE 1:25,000

UPDATED 2013-09-06

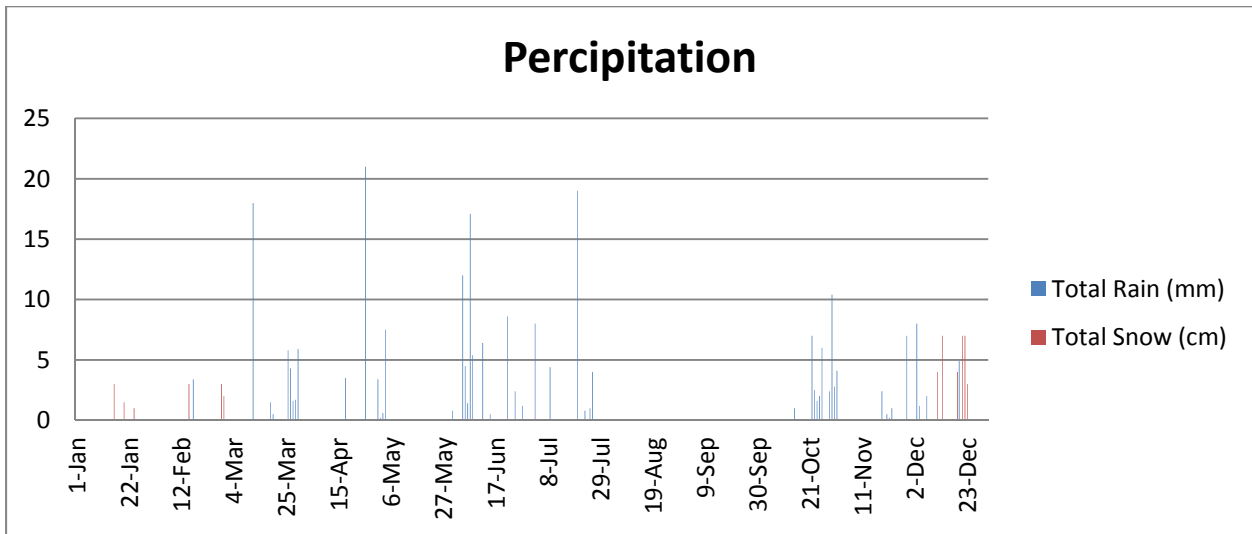
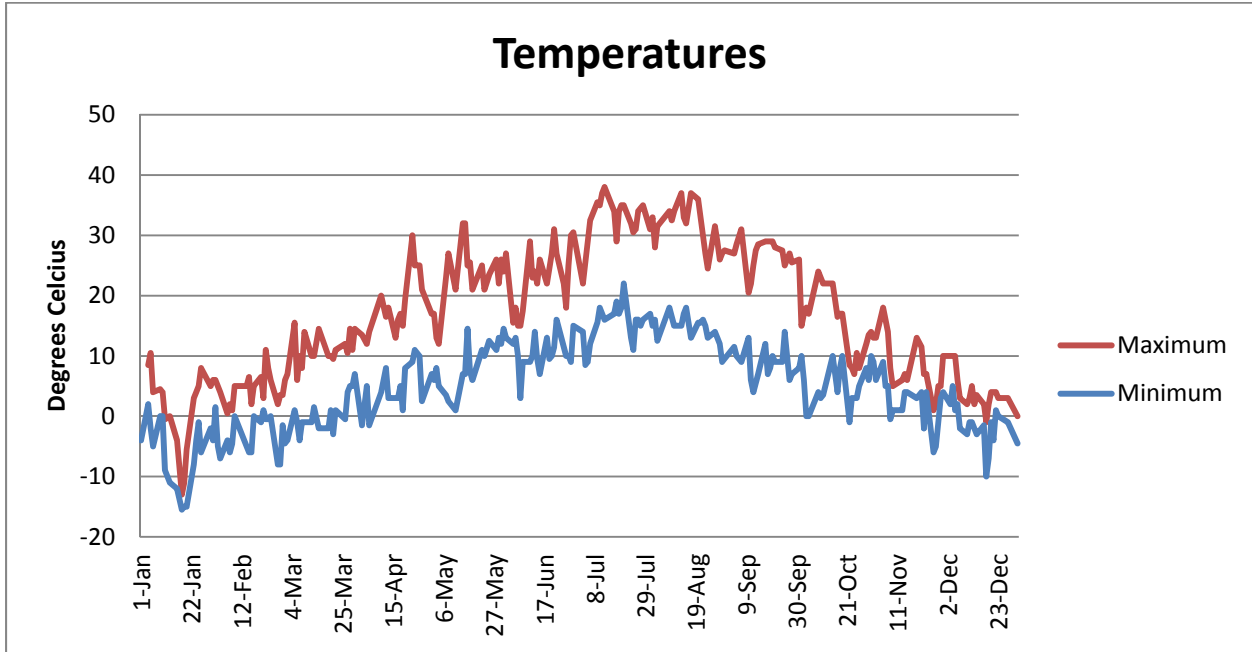
Appendix B – Consumption data (All data converted to US Gallons)

GROUND WATER SOURCES											
MONTH	Scada	Scada	Scada	Scada	Scada	TOTAL	Log	Log	Scada+Log	TOTAL	GRAND TOTALS
	CPR & LIONS PARK PS'S	ROCKCLIFFE DOMESTIC PS	TUCELNUIT PS 2	TUCELNUIT PS 3	MILLER RD RD 13		FAIRVIEW IRR WELL	BUCHANAN ROAD PS *	BLACK SAGE DOM PS		
	Mun	Mun	Mun	Mun	4,5,6,7		Sys 5A	Sys 1	Sys 2		
	used for DOMESTIC	used for DOMESTIC	used for DOMESTIC	used for DOMESTIC	used for DOMESTIC		used for AGRICULTURAL	used for BOTH	used for BOTH		
January	0	6,778,100	12,461,888	7,188,684	15,300	26,443,973	0	0	2,816	2,816	26,446,789
February	3	9,939,950	9,554,210	5,427,057	9,357	24,930,577	0	0	973	973	24,931,551
March	0	17,342,167	4,121,992	5,239,059	4,000	26,707,218	0	0	0	0	26,707,218
April	0	8,660,135	21,862,671	1,495,423	0	32,018,228	0	7,052,000	4,258,659	11,310,659	43,328,887
May	0	28,050,879	24,025,272	0	82,200	52,158,351	0	2,534,000	31,594,959	34,128,959	86,287,310
June	5,573	17,737,320	16,758,695	14,088,412	251,600	48,841,599	0	1,980,000	21,608,139	23,588,139	72,429,739
July	16,985,208	20,312,958	24,079,580	3,574,378	117,300	65,069,424	0	597,000	36,900,831	37,497,831	102,567,255
August	17,343,275	27,909,731	31,386,844	1,896,647	35,000	78,571,498	0	432,000	58,382,191	58,814,191	137,385,689
September	0	34,177,222	22,102,373	5,420,171	47,000	61,746,766	0	0	39,206,406	39,206,406	100,953,172
October	0	17,900,623	3,148,290	18,998,588	13,100	40,060,602	0	8,850	17,645,628	17,654,478	57,715,080
November	0	19,558,500	7,966,828	4,844,889	9,755	32,379,972	0	0	0	0	32,379,972
December	0	10,990,972	13,783,959	1,539,095	0	26,314,026	0	0	0	0	26,314,026
TOTALS	34,334,059	219,358,557	191,252,601	69,712,403	584,612	515,242,232	0	12,603,850	209,600,603	222,204,453	737,446,685
Max Flow	17,343,275	34,177,222	31,386,844	18,998,588	251,600	78,571,498	0	7,052,000	58,382,191	58,814,191	137,385,689
Min Flow	0	6,778,100	3,148,290	0	0	24,930,577	0	0	0	0	24,931,551
Avg Flow	2,861,172	18,279,880	15,937,717	5,809,367	48,718	42,936,853	0	1,050,321	17,466,717	18,517,038	61,453,890

* Meter only read on a periodic basis

SURFACE WATER SOURCES							
MONTH	Scada	Scada	Log	Scada	Scada	Log	TOTAL
	MUD LAKE PS	ROCKCLIFFE IRR PS	FAIRVIEW IRR PS	HESTER CREEK PS	MT KOBAN PS	BLK SAGE IRR PS	
	Sys 1	Sys 4	Sys 5	Sys 6	Sys 7	Sys 2B	
	used for BOTH	used for AGRICULTURAL	used for AGRICULTURAL	used for AGRICULTURAL	used for AGRICULTURAL	used for AGRICULTURAL	
January	0	0	0	0	0	0	0
February	0	0	0	0	0	0	0
March	0	0	0	0	0	0	0
April	4,273,926	18,995,573	7,082,000	8,102,485	295,015	15,817,000	50,292,073
May	70,452,210	151,475,120	68,847,000	76,202,242	52,446,448	15,635,334	364,606,144
June	52,249,308	125,082,954	51,711,000	51,346,940	36,241,908	12,442,197	276,825,000
July	95,743,644	178,032,587	71,346,000	74,457,212	61,002,932	17,480,255	402,318,986
August	140,842,677	266,289,424	116,232,000	125,709,688	99,474,946	29,559,829	637,265,887
September	96,210,930	192,770,405	86,045,000	83,204,892	79,650,354	24,231,153	465,901,803
October	28,624,749	67,771,376	42,990,000	30,423,211	24,424,453	8,955,850	174,564,889
November	0	0	0	0	0	0	0
December	0	0	0	0	0	0	0
TOTALS	488,397,444	1,000,417,439	444,253,000	449,446,669	353,536,056	124,121,618	2,371,774,782
Max Flow	140,842,677	266,289,424	116,232,000	125,709,688	99,474,946	29,559,829	637,265,887
Min Flow	0	0	0	0	0	0	0
Avg Flow	40,699,787	83,368,120	37,021,083	37,453,889	29,461,338	10,343,468	197,647,898

Appendix C – Climate data



Appendix D – Test sites

Bacteriological Sampling Sites: Municipal System

Civic Address	Name of Site	Description of Sample Port
Across from 1080 Fairview Road	Fairview Road Test Station	Test Station
7084 Tucelnuit Drive	Tucelnuit Test Station	Test Station
7030 Meadows Drive	Meadows Drive Test Station	Test Station
6521 Hillside Street	Hillside Test Station	Test Station

Rural North

Civic Address	Name of Site	Description of Sample Port
352 Sportsmens Bowl Road	Sportsmens	Blow-off Stand Pipe

Rural South

Sys. No.	Civic Address	Name of Site	Description of Sample Port
2	4480 Ryegrass Road	Ryegrass	Test Station
2	Parcel A, Plan 37485 (Ryegrass Road)	Black Sage Well #1 (125 HP)	Discharge manifold valve
2	Parcel A, Plan 37485 (Ryegrass Road)	Black Sage Well #2 (100 HP)	Discharge manifold valve
2	Parcel A, Plan 37485 (Ryegrass Road)	Black Sage Well #3 (15 HP)	Discharge manifold valve
2	Black Sage Rd / Orchard Grove Ln	Black Sage Road	Test Station
5	Lot 992 Plan 22065 (Road 5)	5A Booster Station	Suction manifold valve
6	Road 13 / Mariposa Road (Canal)	6A Booster Station	Pump bleed-off valve
7	3598 Hwy 97	Road 22	Test Station

Nitrate:

Sys. No.	Civic Address	Name of Site	Description of Sample Port
Municipal	6431 Station Street	CPR Pump Station	Hose bib inside Pumphouse
Municipal	715 Skagit Avenue	Rockcliffe Domestic Pump Station	
Municipal	Block A, Plan KAP2133 (Merlot Avenue)	Tucelnuit Pump Station – Pump #2	
Municipal	Block A, Plan KAP2133 (Merlot Avenue)	Tucelnuit Pump Station – Pump #3	
1	Parcel 3, Plan KAPA1432 (Buchanan Drive)	Buchanan Road Pump Station	
2	202 Miller Road	Miller Road Pump Station	
4	Lot 1, Plan KAP4116 (Corner of Road 5 & Highway 97)	Fairview Irrigation Pump Station	
2	Parcel A, Plan 37485 (Ryegrass Road)	Black Sage Domestic Pump Station – well # 3	
1	Highway 97	Canal	At the canal diversion adjacent to the stilling well

Uranium:

Civic Address	Name of Site	Description of Sample Port
6450 Spartan Street	Town Reservoir	Hose bib in Valve Chamber
6431 Station Street	CPR Pumphouse	Hose bib inside Pumphouse when water going to reservoir
6431 Station Street	CPR Pumphouse	Discharge at river when water going into river

Appendix E – Chlorine residual and coliform sampling results (Target 0.2 to 1.50 Chlorine Residual

DATE	SYSTEM #1				SYSTEM #2				SYSTEM #4				SYSTEM #5				SYSTEM #6				SYSTEM #7				MUNICIPAL			
	Surface Water Source				Groundwater Source				Ground Water Source				Groundwater Source				Groundwater Source				Groundwater Source							
	Chlorine Residual	Sample Location	Coliform		Chlorine Residual	Sample Location	Coliform		Chlorine Residual	Sample Location	Coliform		Chlorine Residual	Sample Location	Coliform		Chlorine Residual	Sample Location	Coliform		Chlorine Residual	Sample Location	Coliform		Chlorine Residual	Sample Location	Coliform	
		Total	Ecoli			Total	Ecoli			Total	Ecoli			Total	Ecoli			Total	Ecoli			Total	Ecoli			Total	Ecoli	
Jan 3rd																0.09	6A PH	<1	<1					0.04	71st	<1	<1	
Jan 9th																	0.05	Rd. #22	OG	OG					0.03	87th	<1	<1
Jan 16th																0.10	6A PH	<1	<1					0.14	350th	<1	<1	
Jan 23rd																0.18	6A PH	<1	<1					0.11	87th	<1	<1	
Jan 24th																				0.32	Rd. #22	≥2	<1					
Jan 30th																0.35	6A PH	<1	<1	0.03	Rd. #22	<1	<1	0.14	71st	<1	<1	
Feb 2nd																			2.5	Rd. #20	<1	<1						
Feb 6th																0.90	6A PH	<1	<1					0.10	350th	<1	<1	
Feb 13th																0.06	6A PH	<1	<1					0.10	87th	<1	<1	
Feb 20th					0.06	87th	<1	<1																0.19	350th	<1	<1	
Feb 27th																0.18	6A PH	<1	<1					0.29	71st	<1	<1	
Mar 5th																			0.13	Rd #22	<1	<1		0.21	87th	<1	<1	
Mar 12th																0.15	6A PH	<1	<1					0.04	350th	<1	<1	
Mar 19th					0.06	87th	<1	<1																0.09	71st	<1	<1	
Mar 26th																			0.08	Rd #22	<1	<1		0.08	87th	<1	<1	
Apr 2nd																0.05	6A PH	<1	<1					0.05	350th	<1	<1	
Apr 10th					0.14	87th	<1	<1																0.08	71st	<1	<1	
Apr 16th																			0.04	Rd # 22	<1	<1		0.05	87th	<1	<1	
Apr 23rd	0.11		<1	<1												0.23	6A PH	<1	<1					0.18	350th	<1	<1	
Apr 30th					0.04	87th	<1	<1																0.08	87th	<1	<1	
May 7th					0.09	87th	<1	<1								0.03	6A PH	<1	<1					0.05	Hillside	<1	<1	
May 14th	1.10	Sportsmen	<1	<1															0.05	Rd # 22	<1	<1		0.15	71st	<1	<1	
May 22nd	0.71	Sportsmen	<1	<1	0.05	Black Sage	1	<1								0.07	6A PH	<1	<1					0.08	350th	<1	<1	
May 28th	1.78	Sportsmen	<1	<1	-	Black Sage	1	<1											0.39	Rd #22	<1	<1		0.29	87th	<1	<1	
May 31st																												
June 4th	1.25	Sportsmen	<1	<1	-	Black Sage	1	<1								0.04	6A PH	<1	<1					0.45	71st	<1	<1	
June 6th					0.10	Black Sage	<1	<1																				
June 11th	0.06	Sportsmen	5	<1	0.06	Black Sage	1	<1																				
June 14th					0.06	87th	1	<1												0.05	Rd #22	<1	<1		0.43	87th	<1	<1
June 14th	2.2	Sportsmen	O/G	O/G	-	Black Sage	2	<1																				
June 14th					-	#2 Well	1	<1																				
June 14th					-	87th	<1	<1																				
June 18th	1.68	Sportsmen	<1	<1	-	Black Sage	<1	<1								0.05	6A PH	<1	<1					0.1	350th	<1	<1	
June 18th					-	87th	<1	<1																				
June 25th	1.82	Sportsmen			-	#1 Well	<1	<1											0.06	Rd #22	<1	<1		0.05	71st	<1	<1	
June 25th						Black Sage	<1	<1																				
June 25th						87th	<1	<1																				
June 27th					-	Black Sage	1	<1																				
June 27th					-	87th	1	<1																				
June 27th					-	#2 Well	3	<1																				
July 3rd	>2.00	Sportsmen	<1	<1	-	Black Sage	<1	<1								0.07	6A PH	<1	<1					0.05	85th	<1	<1	
July 3rd					-	#2 Well	<1	<1																				
July 3rd					-	RyeGrass (87th)	<1	<1																				
July 5th					-	Black Sage	<1	<1																				
July 5th					-	87th	<1	<1																				
July 5th					-	#2 Well	<1	<1																				

DATE	SYSTEM #1				SYSTEM #2				SYSTEM #4				SYSTEM #5				SYSTEM #6				SYSTEM #7				MUNICIPAL					
	Surface Water Source				Groundwater Source				Ground Water Source				Groundwater Source				Groundwater Source				Groundwater Source									
	Chlorine Residual	Sample Location	Coliform Total Ecoli		Chlorine Residual	Sample Location	Coliform Total Ecoli		Chlorine Residual	Sample Location	Coliform Total Ecoli		Chlorine Residual	Sample Location	Coliform Total Ecoli		Chlorine Residual	Sample Location	Coliform Total Ecoli		Chlorine Residual	Sample Location	Coliform Total Ecoli		Chlorine Residual	Sample Location	Coliform Total Ecoli			
July 9th	1.52	Sportsmen	<1	<1	-	#2 Well	1	<1					0.08	5A Booster	<1	<1					0.08	Fairview (350th)	<1	<1						
					-	#1 well	1	<1																						
					-	Black Sage	1	<1																						
					-	RyeGrass	<1	<1																						
July 11th					-	#1 Well	<1	<1																						
					-	#2 Well	1	<1																						
					-	Black Sage	1	<1																						
					-	RyeGrass	1	<1																						
July 16th	1.01	Sportsmen	4	<1	-	Black Sage	2	<1												0.06	Rd #22	<1	<1	0.59	Fairview	<1	<1			
					-	#1 Well	<1	<1																						
					-	Ryegrass	<1	<1																						
July 19th					-	Black Sage	2	<1																						
					-	#1 Well	1	<1																						
					-	Ryegrass	3	<1																						
July 23th	1.95	Sportsmen	1	<1	-	Black Sage	<1	<1									0.03	6A PH	1	<1				0.21	Hillside	<1	<1			
					-	#2 Well	<1	<1																						
					-	Ryegrass	<1	<1																						
July 26th																	0.07	6A PH	<1	<1										
July 30th	>2.00	Sportsmen	<1	<1	-	Black Sage	<1	<1									0.04	6A PH	<1	<1	0.1	Rd #22	<1	<1	0.17	Meadows	<1	<1		
					-	#1 Well	<1	<1																						
					-	Ryegrass	7	<1																						
Aug 7th	1.41	Sportsmen	<1	<1	-	Black Sage	1	<1					0.23	5A Booster	<1	<1								0.21	Tucelnuit	<1	<1			
					-	#1 Well	1	<1																						
					-	#2 Well	1	<1																						
Aug 9th					-	Black Sage	<1	<1																						
					-	#1 Well	<1	<1																						
					-	#2 Well	<1	<1																						
					-	Ryegrass	<1	<1																						
Aug 13th	>2.00	Sportsmen	14	<1	-	Black Sage	<1	<1												0.01	Rd #22	<1	<1	0.05	Fairview	<1	<1			
					-	#1 Well	<1	<1																						
					-	Ryegrass	<1	<1																						
Aug 15th					-	Black Sage	<1	<1																						
					-	#1 Well	<1	<1																						
					-	Ryegrass	1	<1																						
Aug 20th	1.72	Sportsmen	<1	<1		Black Sage	<1	<1									0.48	6A PH	<1	<1				0.17	Hillside	<1	<1			
						#1 Well	1	<1																						
						Ryegrass	<1	<1																						
Aug 21st						Black Sage	<1	<1																						
						Ryegrass	<1	<1																						
Aug 22nd						Black Sage	<1	<1																						
						Ryegrass	<1	<1																						
Aug 27th	>2.00	Sportsmen	<1	<1		Black Sage	2	<1					0.09	5A Pump	<1	<1								0.12	Tucelnuit	<1	<1			
						#1 Well	<1	<1																						
						Ryegrass	<1	<1																						
Aug 28th						Black Sage	1	<1																						
						#1 Well	<1	<1																						
						Ryegrass	<1	<1																						

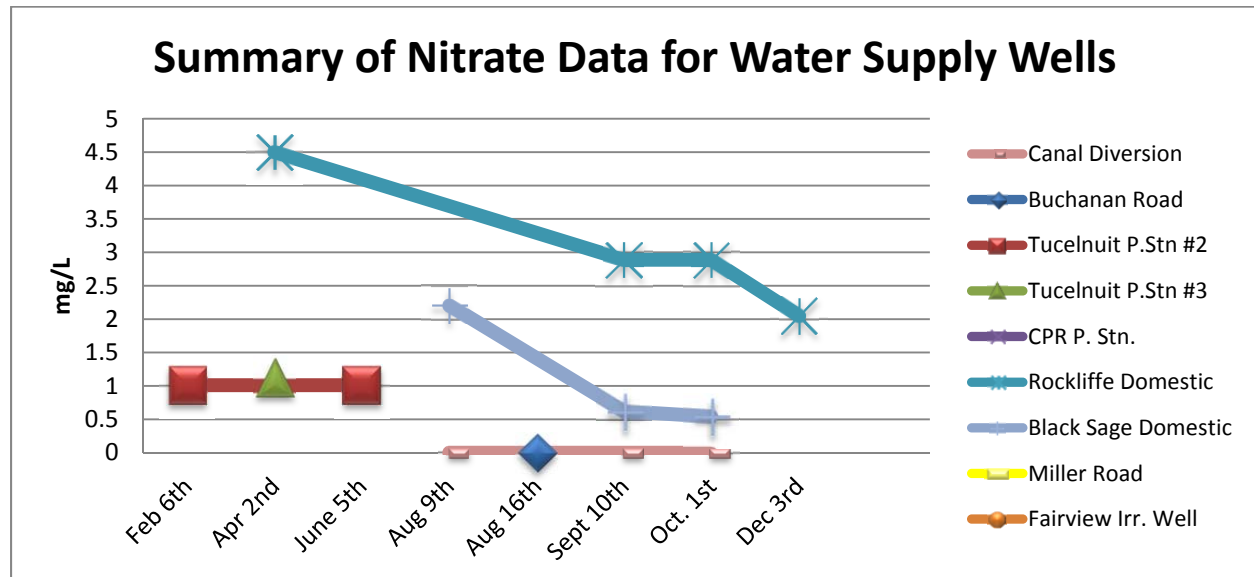
DATE	SYSTEM #1				SYSTEM #2				SYSTEM #4				SYSTEM #5				SYSTEM #6				SYSTEM #7				MUNICIPAL				
	Surface Water Source				Groundwater Source				Ground Water Source				Groundwater Source				Groundwater Source				Groundwater Source								
	Chlorine Residual	Sample Location	Coliform Total Ecoli		Chlorine Residual	Sample Location	Coliform Total Ecoli		Chlorine Residual	Sample Location	Coliform Total Ecoli		Chlorine Residual	Sample Location	Coliform Total Ecoli		Chlorine Residual	Sample Location	Coliform Total Ecoli		Chlorine Residual	Sample Location	Coliform Total Ecoli		Chlorine Residual	Sample Location	Coliform Total Ecoli		
Aug 29th						Black Sage	1	<1																					
						#1 Well	<1	<1																					
						Ryegrass	<1	<1																					
Sept 6th						Black Sage	2	<1								6A PH	<1	<1							Meadows	<1	<1		
						#1 Well	<1	<1																					
						Ryegrass	<1	<1																					
Sept 13th						Ryegrass	<1	<1																0.17	Fairview	<1	<1		
Sept 17th		Sportsmen	<1	<1		Black Sage	2	<1							0.13	6A PH	<1	<1								Tucelnuit	<1	<1	
Sept 24th	>2.00	Sportsmen	<1	<1		Black Sage	2	<1										0.1	Rd #22	<1	<1					Fairview	<1	<1	
Oct 1st		Sportsmen	<1	<1		Black Sage	3	<1					5A Booster	<1	<1												Hillside	<1	<1
Oct 9th		Sportsmen	<1	<1		Black Sage	1	<1							0.05	6A PH	<1	<1							0.12	Tucelnuit	<1	<1	
Oct 15th		Buchanan	<1	<1		Black Sage	<1	<1										0.08	Rd #22	<1	<1			0.08	Meadows	<1	<1		
Oct. 22nd						Black Sage	<1	<1					0.11	5A Booster	<1	<1									0.11	Fairview	<1	<1	
Oct. 29th						Black Sage	1	<1							0.12	6A PH	<1	<1							0.1	Hillside	O/G	O/G	
Nov. 1st																									0.13	Hillside	<1	<1	
Nov. 5th						Black Sage	<1	<1										0.04	Rd #22	<1	<1			0.17	Fairview	<1	<1		
Nov. 13th					0.05	Black Sage	<1	<1							0.06	6A PH	<1	<1							low	Tucelnuit	<1	<1	
Nov. 15th					0.03	Black Sage	<1	<1																					
Nov. 19th						Black Sage	<1	<1					5A Booster	<1	<1										0.12	Meadows	<1	<1	
Nov. 26th																		0.09	Rd #22	<1	<1			0.25	Hillside	<1	<1		
Dec. 3rd																6A PH	<1	<1							0.4	Fairview	<1	<1	
Dec. 10th													5A Booster	<1	<1										0.31	Meadows	<1	<1	
Dec 17th																		0.05	Rd #22	<1	<1			low	Tucelnuit	<1	<1		
Dec 27th													5A Booster	<1	<1												Hillside	<1	<1

Appendix F – Nitrate, THM, Uranium sampling results

Nitrates:

Date	Canal Diver-sion	Buchanan Road	Tucelnuit P.Stn #2	Tucelnuit P.Stn #3	CPR Pump Stn.	Rockliffe Dome-stic	Black Sage Domestic	Miller Road	Fairview Irr. Well
Feb 6th			1.01						
Apr 2nd				1.13		4.50			
June 5th			1.01						
Aug 9th	<0.010						2.21		
Aug 16th		<0.010							
Sept 10th	<0.010					2.89	0.620		
Oct. 1st	<0.010					2.89	0.541		
Dec 3rd						2.05			

*Maximum acceptable concentration per Canadian Drinking Water Guidelines is 10



Annual Trihalomethanes or THM (mg/L):

Date	Sample Site	Result
Aug 17	Sportsmen Bowl	0.076

*Canadian Drinking Water Guideline recommends maximum is 0.1

Uranium (mg/L):

Date	CPR Well	Reservoir Intake	Reservoir Outtake	Notes
1-May				Started pump to river.
7-May	0.03			
14-May	0.02			
22-May	0.02			
28-May	0.02			
5-Jun	0.02			
11-Jun	0.01			
19-Jun	0.01			
25-Jun	0.0145			
9-Jul	0.0147			
13-Jul				Turned into municipal system.
16-Jul		0.0152	0.0148	
23-Jul		0.0152	0.0144	
30-Jul	0.0198			
7-Aug		0.022	0.0217	
13-Aug		0.0223	0.021	
14-Aug				Shut down.

*Maximum acceptable concentration per Canadian Drinking Water Guidelines is 0.02

Appendix G – Full spectrum analysis results

Parameter	Guideline	Unit	In-Town (1)				Rural (2)						
			CPR Station Domestic	Rockcliffe Domestic	Tucelnuit 2 Domestic	Tucelnuit 3 Domestic	Black Sage 1 Both	Black Sage 2 Both	Black Sage 3 Both	Buchanan Rd Both	Canal Irrigation	Fairview Irr Irrigation	Miller Rd Domestic
			Aug 8, 2011	April 19, 2010	Aug 8, 2011	Sept 23, 2009	Aug 1, 2012	Aug 1, 2012	April 19, 2010	April 20, 2010	Aug 8, 2011	Sept 23, 2009	Sept 23, 2009
Colour, True	≤15	TCU	<5	<5	<5	<5	<5	<5	<5	<5	8	<5	<5
Alkalinity, Total as CaCO3	-	mg/L	194	270	187	200	149	180	300	130	108	280	270
Chloride	≤250	mg/L	10.9	15.6	5.79	9.9	5.37	6.9	11.4	3.96	3.81	16	8.4
Fluoride	1.5	mg/L	0.43	0.35	0.45	0.5	0.12	0.11	0.26	0.32	0.15	0.27	0.34
Hardness, Total (as CaCO3)	-	mg/L	206	330	176	215	159	204	373	145	109	395	312
Nitrogen, Nitrate as N	10	mg/L	0.23	3.83	0.52	1.19	0.379	0.824	3.18	0.01	<0.01	9.06	1.5
Nitrogen, Nitrite as N	1	mg/L	<0.01	nt	<0.01	<0.002	<0.01	<0.01	nt	nt	<0.01	<0.002	<0.002
Solids, Total Dissolved	≤500	mg/L	317	405	253	270	211	274	449	166	156	470	370
Sulfate	≤500	mg/L	64.6	67.4	35.6	43	nt	nt	94	25.3	25.7	90	71
Turbidity	Varies	NTU	0.3	0.1	<0.1	nt	nt	nt	0.2	<0.1	0.7	0.14	nt
pH	6.5 to 8.5	pH units	8.18	8	8.12	8.1	7.86	7.92	7.98	8	8.12	8.1	8.3
Conductivity (EC)	-	uS/cm	501	635	412	497	378	456	703	293	263	776	646
Aluminum	≤0.1	mg/L	0.008	<0.005	0.008	0.0013	<0.005	0.005	0.005	0.008	0.028	0.0007	0.0018
Antimony	0.006	mg/L	0.0001	nt	0.0001	nt	nt	nt	nt	nt	<0.0001	nt	nt
Arsenic	0.01	mg/L	0.0043	<0.0005	0.0031	0.00293	0.0008	0.0008		<0.0005	<0.0005	0.00072	0.00302
Barium	1	mg/L	0.093	0.0599	0.055	0.0649	0.039	0.046	0.061	0.0488	0.022	0.0905	0.0797
Beryllium	-	mg/L	<0.0001	nt	<0.0001	nt	nt	nt	nt	nt	<0.0001	nt	nt
Bismuth	-	mg/L	<0.0001	nt	<0.0001	nt	nt	nt	nt	nt	<0.0001	nt	nt
Boron	5	mg/L	0.036	0.074	0.021	<0.050	0.032	0.049	0.104	0.007	0.011	0.141	0.08
Cadmium	0.005	mg/L	0.00005	<0.00001	0.00001	0.000009	0.00006	0.00003	<0.00001	<0.00001	0.00001	0.000019	0.000019
Calcium	-	mg/L	56.5	91.9	48	60.5	37.9	48	90.7	39.7	29.6	114	76.3
Chromium	0.05	mg/L	<0.0005	0.0023	0.0008	0.0001	<0.0005	<0.0005	0.0019	0.0016	<0.0005	0.0006	<0.0001
Cobalt	-	mg/L	0.00005	0.0001	<0.00005	0.00001	<0.00005	<0.00005	0.0001	0.00005	0.00007	0.000176	0.000037
Copper	≤1	mg/L	0.0195	0.0391	0.0126	0.02	0.0258	0.011	0.0035	0.0018	0.0031	0.0703	0.0653
Iron	≤0.3	mg/L	0.03	0.11	<0.01	0.002	<0.01	0.01	0.1	0.05	0.03	0.016	0.005
Lead	0.01	mg/L	0.0011	0.0011	0.0002	0.000481	0.0018	0.0016	0.0003	0.0001	<0.0001	0.0117	0.00704
Lithium	-	mg/L	0.0053	nt	0.0062	nt	nt	nt	nt	nt	0.0031	nt	nt
Magnesium	-	mg/L	15.8	24.4	13.6	15.5	15.7	20.4	35.5	11	8.46	27.1	29.6
Manganese	≤0.05	mg/L	0.174	<0.0002	0.0012	0.00073	0.0196	0.0053	0.0003	0.0597	0.0056	0.00403	0.0806
Mercury	0.001	mg/L	<0.00002	<0.00005	<0.00002	nt	nt	nt	<0.00005	<0.00005	<0.00002	nt	nt
Molybdenum	-	mg/L	0.0127	0.0054	0.0055	0.00438	0.0068	0.0049	0.0077	0.0035	0.0034	0.00506	0.00517
Nickel	-	mg/L	0.0005	0.003	0.0003	0.00023	0.0009	0.0006	0.0028	0.0011	0.0005	0.00188	0.00087
Phosphorus	-	mg/L	0.02	nt	0.03	nt	nt	nt	nt	nt	<0.02	nt	nt
Potassium	-	mg/L	5.19	6.29	3.56	4.3	3.55	4.14	6.34	2.79	2.08	5.79	5.27
Selenium	0.01	mg/L	0.0018	0.0022	0.0015	0.00367	<0.0005	0.001	0.0031	<0.0003	<0.0005	0.00631	0.00301
Silicon	-	mg/L	9.3	nt	8.9	nt	nt	nt	nt	nt	2.6	nt	nt
Silver	-	mg/L	<0.00005	0.0001	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.000021	0.000021
Sodium	≤200	mg/L	23.2	17.6	15.1	17.8	13.8	16	21	11.2	10.2	18.8	13.9
Strontium	-	mg/L	0.709	nt	0.557	nt	nt	nt	nt	nt	0.247	nt	nt
Tellurium	-	mg/L	<0.0002	nt	<0.0002	nt	nt	nt	nt	nt	<0.0002	nt	nt
Thallium	-	mg/L	<0.00002	nt	<0.00002	nt	nt	nt	nt	nt	<0.00002	nt	nt
Thorium	-	mg/L	<0.0001	nt	<0.0001	nt	nt	nt	nt	nt	<0.0001	nt	nt
Tin	-	mg/L	<0.0002	nt	<0.0002	nt	nt	nt	nt	nt	<0.0002	nt	nt
Titanium	-	mg/L	<0.005	nt	<0.005	nt	nt	nt	nt	nt	<0.005	nt	nt
Uranium	0.02	mg/L	0.0236	0.0127	0.00454	0.00716	0.00311	0.00546	0.0093	0.00186	0.00211	0.014	0.00839
Vanadium	-	mg/L	0.003	0.001	0.002	0.0015	0.002	0.002	<0.001	<0.001	0.001	0.0005	0.0011
Zinc	≤5	mg/L	0.026	0.007	<0.004	0.0052	0.036	0.013	0.004	0.01	0.009	0.0069	0.0421
Zirconium	-	mg/L	<0.0001	nt	<0.0001	nt	nt	nt	nt	nt	<0.0001	nt	nt

Appendix H – Turbidity records

2012 CANAL TURBIDITY (Monitored by Scada at #1 Mud Lake Pump Station)

Date	April	May	June	July	August	September	October
1	0.00	2.50	1.18	1.06	0.99	0.80	0.77
2	0.00	7.16	1.27	1.06	1.01	0.81	0.85
3	0.00	5.38	1.11	0.86	1.10	0.82	0.92
4	0.00	4.47	1.19	0.77	0.99	0.80	0.85
5	0.00	0.11	1.17	1.42	0.83	0.85	0.88
6	0.00	1.18	1.25	1.67	0.67	0.84	0.80
7	0.00	0.85	1.11	1.76	0.69	0.85	0.80
8	0.00	2.75	0.14	1.58	0.75	0.76	0.81
9	0.00	3.96	0.16	1.64	0.76	0.72	0.78
10	0.00	3.10	0.20	1.72	0.73	0.74	0.81
11	0.00	2.82	0.68	1.67	0.72	0.79	0.18
12	0.03	2.78	2.18	1.53	0.80	0.86	0.14
13	0.06	2.63	1.63	1.20	0.68	0.80	0.13
14	0.09	2.26	1.40	1.19	0.67	0.91	0.12
15	0.12	2.15	1.49	1.14	0.80	0.77	0.10
16	0.14	2.82	1.36	1.13	0.83	0.81	0.09
17	0.10	2.50	1.44	1.23	0.69	0.88	0.08
18	0.14	2.12	1.47	1.41	0.68	0.85	0.07
19	0.08	1.94	1.57	1.31	0.66	0.83	0.05
20	0.08	1.86	1.49	1.67	0.86	0.86	0.04
21	0.59	1.86	1.42	1.02	0.80	0.95	0.03
22	0.80	1.71	1.65	1.10	0.70	0.98	0.02
23	0.80	1.55	1.08	1.12	0.85	0.85	0.00
24	0.82	1.18	2.08	1.15	0.77	0.80	0.00
25	1.04	1.35	2.10	1.17	0.80	0.84	0.00
26	0.56	1.61	0.69	1.06	0.80	0.80	0.00
27	0.11	1.43	0.40	0.97	0.74	0.80	0.00
28	0.10	1.29	1.42	1.03	0.75	0.71	0.00
29	0.22	1.26	1.52	1.06	0.81	0.76	0.00
30	0.42	1.31	2.59	0.99	0.92	0.84	0.00
31		1.33		1.02	0.76		0.00
MAX	1.04	7.16	2.59	1.76	1.10	0.98	0.92
MIN	0.00	0.11	0.14	0.77	0.66	0.71	0.00

Appendix I – Well details

Groundwater Source	Depth (m)	Diameter (cm)	Pump rate (US gpm)	Notes
Buchanan irrigation well	34.75	20.32	250	Used to supply System No.1 in the shoulder seasons.
Tucelnuit domestic well #1	14.02	20.32	n/a	Not in use, no pumps.
Tucelnuit domestic well #2	14.32	30.48	1,050	
Tucelnuit domestic well #3	13.72	25.40	700	
Lions Park domestic well	25.90	15.24	900	Not used because of uranium levels.
CPR domestic well	15.20	15.24	900	Rarely used because of uranium levels.
Centennial Park	25.90	15.24	n/a	Not in use, no pumphouse. Hydrocarbons?
Rockcliffe domestic well	24.4	40.64	1,500	
Fairview Irrigation well	42.67	20.32	400	Was removed from the domestic system when nitrate levels became too high. Can be used to supplement the irrigation system.
Miller domestic well	17.98	30.48	1,000	Supplies System 2 and Road 13 Reservoir. Has manganese
Black Sage domestic well #1	33.53	40.64	1,000	
Black Sage domestic well #2	33.53	40.64	1,000	
Black Sage domestic well #3	33.22	20.32	100	

Appendix J – SCADA details

MUNICIPAL SYSTEM	CONTROLS
Municipal Reservoirs (2)	Levels, security (hatches), temperatures
Rockcliffe domestic pump station	Pump hours & starts, well levels, pump controls, totalized flows, station pressure, chlorine residual, alarms for low level & discharge flow, room temperatures, security
Tucelnuit wells #2 & #3	Pump hours & starts, well levels, pump controls, totalized flows, station pressure, chlorine residual, alarms for low level & discharge flow, high/ low discharge pressure, room temperatures, security
CPR & Lions	Pump hours & starts, well level, totalized flow and security
Airport booster station	Pump starts, flow (into Town & into rural), pressure c/w high & low set points, reservoir start & stop levels on municipal and Rd 13 reservoirs, pump suction, room temperatures, security
Flow meters & PRV chambers	
Road No. 1	Flow (totalize & system), kiosk temperature, pressure (Municipal & Rural sides)
Road No.2	Flow (totalize & system), kiosk temperature, pressure (Municipal & Rural sides)
Vineyard Rd	Flow (totalize & system), kiosk temperature, pressure (Municipal & Rural sides)
System 1 PRV	Flow (totalize & system), kiosk temperature, pressure (Municipal & Rural sides)
RURAL SYSTEM	CONTROLS
Diversion	Gate controls, river levels, up & down stream levels, high flow alarms, fish screen (vfd speed, different level, cycle timer & number of cycles)
Mud Lake pump station	Canal level, check gate, pump start & stops, chlorine residual, turbidity, pressure, flow, low & high level alarms, level control, voltage, power & current for MCC, security
Syphon	Canal level, flow, low & high alarms, gate and security
Rockcliffe irrigation pump station	Pump hours & starts, canal level, pump controls, totalized flows, pressure, Rockcliffe reservoir level, alarms for low & high, check gate, sump level, security
Flume 6 & 7	Canal level, high level alarm & shutdown, kiosk temperature with high & low alarm
Fairview irrigation pump station	Pump hours & starts, totalized flows, station pressure, Fairview reservoir level, sump level
Hester Creek pump station	Pump hours & starts, canal levels, pump controls, totalized flows, station pressure, low & high level alarms, security
Mount Kobau domestic pump station	Pump hours & starts, totalized flows, station pressure, chlorine residual?, security
Black Sage irrigation pump station	Pump hours & starts, oxbow level with alarm & shutdown, totalized flows, station pressure, alarms for low level & discharge flow, pressure control for vfd, room temperatures, security
Black Sage domestic pump station	Pump hours & starts, totalized flows, station pressure, room temperatures, security
Miller Road domestic pump station	Pump hours & starts, Rd 13 reservoir level, pump controls, system 2 flow, system 6 & 7 flow, station pressure, chlorine residual, NaOCl generator pumps & tank levels, room temperatures, security