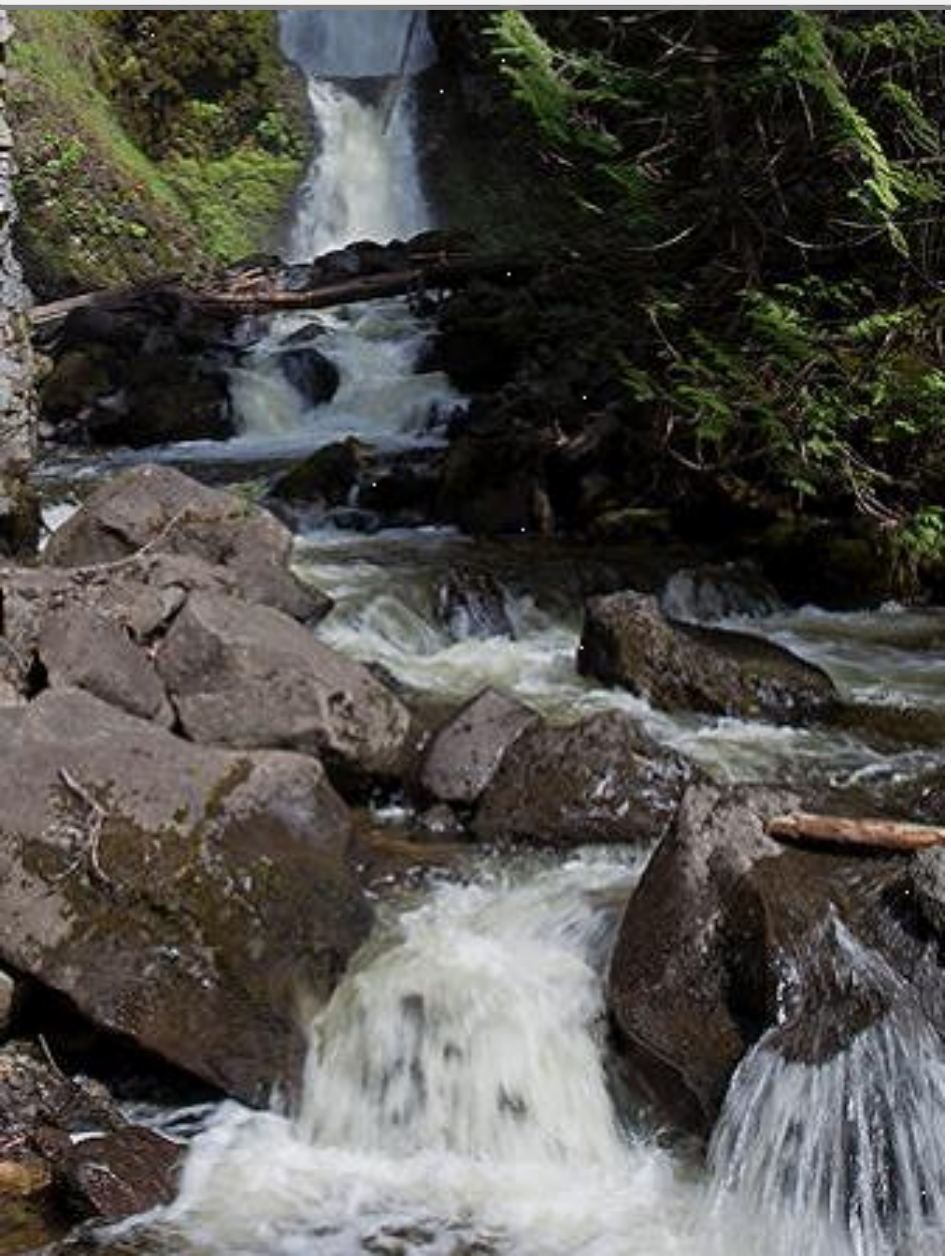
2015 Water System Report



DISTRICT OF CLEARWATER

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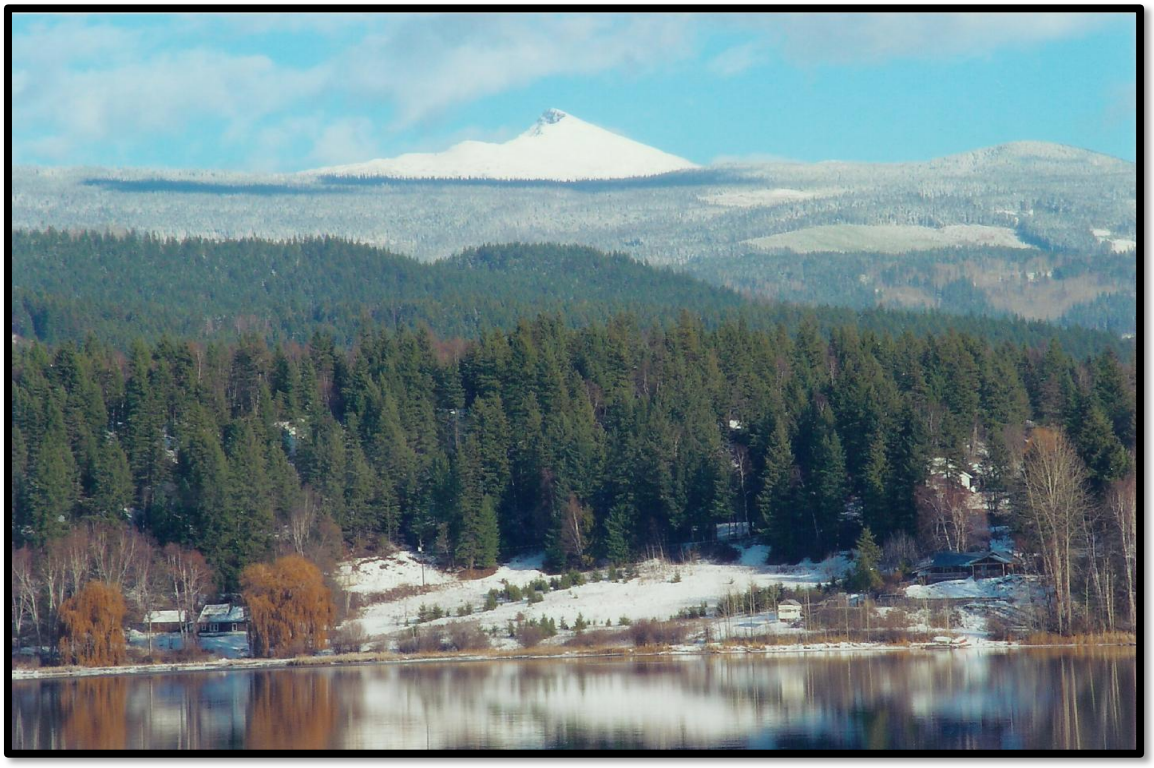
1.0 Introduction

The purpose of this report is to provide an annual update on the operation, maintenance and monitoring of the District of Clearwater's (District) water distribution system for the 2015 calendar year. Included within the scope of this report is the following:

- Water system overview:
- Operator certification;
- Operation and maintenance activities;
- 2015 water consumption information;
- Drinking water quality monitoring;
- 2015 challenges and successes; and
- Upcoming capital improvements.

The information enclosed herein is intended to satisfy the requirements of the Interior Health Authority's 'Conditions on Operating Permit' and confirm that the District is continuing to provide residents with safe and reliable drinking water.



2.0 Water System Overview

The community of Clearwater is located on the Yellowhead Highway 5, approximately 125 km north of Kamloops. The population of Clearwater is approximately 2,400 and the primary industries are forestry, tourism and agriculture.

The District's community water system has two sources, groundwater and surface water. Surface water is provided from the Russell, Hascheak and McDougall Creek watersheds. Groundwater is supplied from two groundwater sources; Clearwater River Aquifer (Well No. 1) and the Dutch Lake Aquifer (Well No. 2).

Raw water from all three production sites is treated using sodium hypochlorite with the exception of the surface water source which is also treated using Ultra Violet (UV) Light Reactors. The water is then distributed throughout the community using approximately 40 km of watermain as well as the Archibald Road reservoir.

2.1 Russell Creek Source

The reservoir and intake on Russell Creek were constructed in 1971-1972. The works also include a small diversion structure on Hascheak Creek which allows flow to be diverted into the Russell Creek reservoir. In 1973, a diversion structure and ditch were constructed to direct flow from McDougall Creek to the upper reaches of Hascheak Creek.

From the Russell Creek intake, a 250 mm (10") diameter ductile iron watermain conveys flow to the UV Treatment station (upgraded in 2013) approximately 60m below the intake. The water is then treated using two UV reactors and sodium hypochlorite. The supply main continues to the Russell Creek booster station, which was constructed in 1997 and upgraded in 2013.

The upgrades completed in 2013 were designed to provide 44 L/sec at a design TDH of 20.5m. Following completion of the booster station upgrades, District staff realized that operation of the booster station at the design flow rate resulted in cavitation issues in the UV treatment building. To resolve the cavitation issues identified following construction, the current operating capacity of the downstream booster station

has been reduced to approximately 24 L/sec. District staff will be taking steps in 2016 to rectify the reduced capacity of the Russell Creek source.

2.2 Clearwater River Aquifer – Well #1

The Clearwater River Aquifer - Well #1 was constructed in 1980 to provide an alternate supply to the Russell Creek source. The construction of the well was prompted by inadequate flows from the Russell Creek source in the winter of 1979 to 1980.

Well #1 is located on the east bank of the Clearwater River about 25 m from the average river water level. On the basis of pump testing, the safe yield of the well was reported to be 35 L/s (550 USgpm) with a drawdown of 7.4 m (24.4 feet).

The original design for the well indicated a vertical turbine pump. However, during pump installation it was realized that the well alignment could not accommodate a vertical turbine pump. Consequently, a 75 hp submersible pump was installed, with a rated capacity of 31 L/s (500 USgpm) at 131.1m (430 feet) total dynamic head.

Previous studies of Well #1 have indicated that this well source has limited capacity when the adjacent Clearwater River is at seasonal low water levels, historically winter through early spring. During this time, water depth above the pump has been measured to be approximately 7.0 m. At a pumping rate of 30 L/s, the drawdown is anticipated to be approximately 7.0 m. Therefore, Well #1 only provides a reliable source during the summer months, when the water level in the Clearwater River is expected to be higher than seasonal minimums. The operating capacity of Well No. 1 as determined by night reservoir drawdown assessments is 27 L/s.

Water pumped from Well #1 is treated using sodium hypochlorite; the injection point is located in the pump discharge piping. An assessment of Well #1 completed by AMEC Earth and Environmental (AMEC) in 2009 indicated that the well is under the direct influence of the Clearwater River, and may be classified as groundwater at risk (GWAR).

2.3 Dutch Lake Aquifer – Well #2

The Dutch Lake Aquifer - Well #2 was constructed in 1999 and is located on the south side of the Old North Thompson Highway approximately 100 m from Dutch Lake. The well completion report indicates that the capacity of the well is 70 L/s (1100 USGPM). The well is equipped with a 150 hp vertical turbine pump.

The operational capacity of Well #2 is limited by the capacity of the supply main between the well and the Archibald Road reservoir. The pump has a speed control system which limits the discharge pressure at the well to 160 psi. Furthermore, the District has received water quality complaints regarding the presence of black solids in the drinking water. This is likely a result of manganese oxidation caused by chlorination of the raw water. Manganese concentrations appear to be limited when Well #2 operates at lower frequencies. As such, operation has been adjusted so as to allow the aquifer to "re-charge" between pumping cycles. Manganese does not have a health limit in the Guidelines for Canadian Drinking Water Quality; however, there is an aesthetic objective of 0.05 mg/L.

Well #2 was also assessed by AMEC in 2009. The results indicated that Well #2 is also under the influence of surface water (Dutch Lake) and that effective in-ground filtration is occurring.

2.4 Water System Control

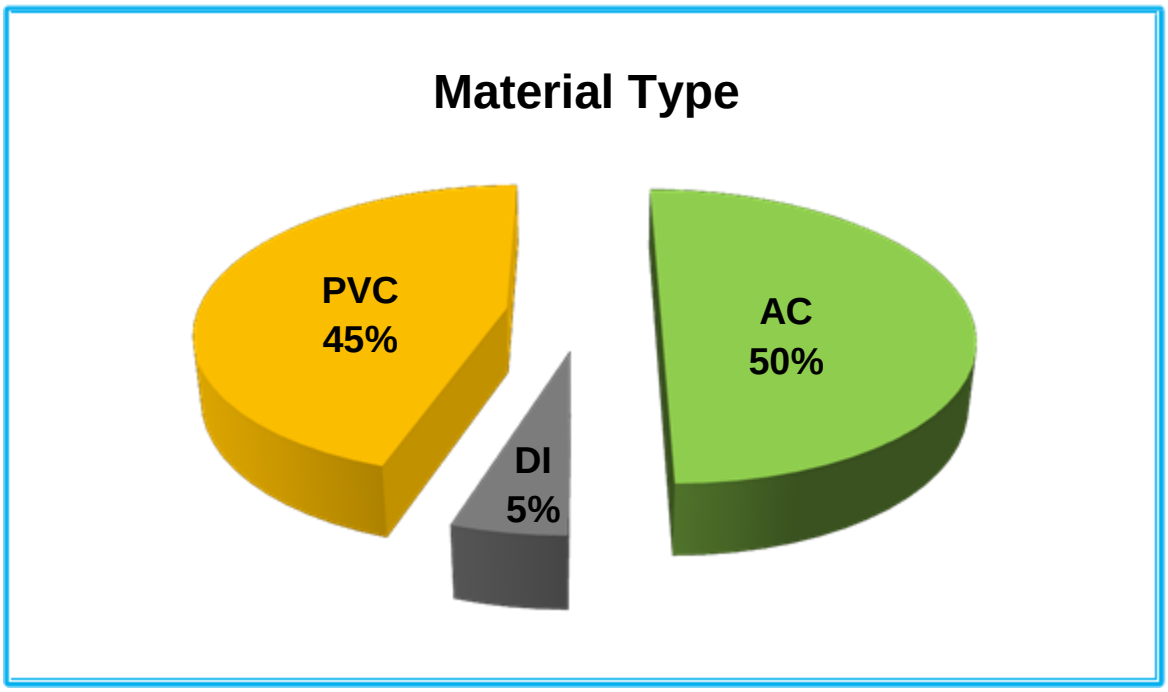
The water system is controlled by a Supervisory Control and Data Acquisition (SCADA) system. The SCADA system allows for each production and detention site (Reservoir) to communicate with one another; allowing the system to operate with little operator involvement. The District is in the process of upgrading this control system; see Section 8.2 for further information.

2.5 Distribution System

The District's water distribution system comprises over 40 km of watermains. The system is made up of approximately:

- 50% (21 km) Asbestos Cement (AC) pipe constructed before 1978;
- 5% (2 km) Ductile Iron (DI) pipe constructed in 1972 and 1981; and
- 45% (17 km) Polyvinyl Chloride (PVC) pipe constructed after 1980.

FIGURE 2-1: DISTRIBUTION PIPE MATERIAL SUMMARY



There are three pressure reducing valve (PRV) stations that divide the distribution system into three pressure zones:

- Zone 1 – Majority of the Distribution system; Sunshine Valley, Weyerhaeuser, Raft River, etc.
    - Supplied by the Archibald Road reservoir.
- Zone 2 – Strawberry Flats
    - Serviced by two PRV stations on Swanson Road and Clearwater Station Road.
- Zone 3 – Harby Road
    - Serviced by a PRV station on the Old North Thompson Highway.

3.0 System Classification, Staffing & Operator Certification

In 2009, the District's water distribution system was classified as a Class II system.

The Environmental Operators Certification Program (EOCP) certification of the District's water system operators is as follows:

Employee	Certification Number	Level
Robert L Griffiths	6549	WD-II, CH, WWC-I
Bryan W Lipp	6545	WD-II, CH, WWC-OIT

As a result of the treatment upgrades on the surface water system; the District is in the process of training one of our operators to a Water Treatment Level I certification.

4.0 System Operation & Maintenance

Regular inspections, maintenance and water quality testing are performed by the system operators to ensure optimal operation of the District's water system. Water quality monitoring is discussed in Section 5.0. Operation and maintenance of the water system involves several daily, weekly, and periodic, or 'as-needed' tasks.

4.1.1 Daily Tasks

- Record flow meter readings at the Russell Creek, Well #1 and Well #2;
- Record sodium hypochlorite use at the Russell Creek, Well #1 and Well #2;
- Sample and record chlorine residuals throughout the water distribution system;
- Inspect the Russell Creek booster station pumps to ensure normal operation;

4.1.2 Weekly Tasks

- Inspect pressure reducing valves and pump standing water from chambers as necessary;
- Clean water system buildings;
- Replace chemicals (as needed);

4.1.3 Monthly Tasks

- Verify calibration of on-line chlorine analyzer at Archibald Road reservoir using field kit;
- Check static water level in Well #1;

4.1.4 Periodic, or "as -needed" Tasks

- Troubleshoot minor electrical and mechanical equipment problems;
- Load and unload sodium hypochlorite containers;
- Record the time and nature of any alarms received on the water system and take appropriate action;
- Flush and clean the watermains (four times per year minimum);
- Exercise control valves, isolation valves, hydrants and related appurtenances (annually); and
- Remove sediment and organics build-up in Russell Creek pond (every 2-3 years).

5.0 2015 Water Consumption

A night time water consumption assessment is currently being undertaken by TRUE Consulting on behalf of the District. The purpose of this assessment is to verify the water production data provided by the existing flow meters by measuring the District's water consumption during a period of minimal demand (night time during the winter months). Preliminary results of this assessment conclude that the actual Well #1 production rate is approximately 75% of the production rate provided by the flowmeter. This adjustment has been applied to the recorded 2015 water consumption data as well as water consumption data published for previous years. A comparison between the adjusted 2015 water consumption data and the adjusted 2013 and 2014 water consumption data is summarized as follows. In addition, Table 5-1 and Figures 5-1 and 5-2 are provided to illustrate the production of each raw water source in 2015:

2015:

Total volume – 961,626 m^3 (1.4% increase from 2014)
Average Day – 2,634 m^3

2014:

Total volume – 948,711 m^3 (11.2% increase from 2013)
Average Day – 2,599 m^3

2013:

Total volume – 853,471 m^3
Average Day – 2,338 m^3

TABLE 5-1: 2015 WATER PRODUCTION SUMMARY

	Russell Creek	Well #2	Well #1	Total
January	23,665	19,307	18,071	61,042
February	9	22,762	29,237	52,007
March	21,081	11,153	30,511	62,745
April	18,260	6,753	34,049	59,062
May	57,160	2,624	42,010	101,794
June	74,647	3,866	49,201	127,713
July	80,856	8,490	50,961	140,307
August	13,905	58,107	49,347	121,359
September	18,699	8,401	43,297	70,397
October	17,976	57	39,148	57,181
November	18,449	55	37,745	56,249
December	397	301	51,072	51,770
2015 Summary	**345,102**	**141,876**	**474,648**	**961,626**

FIGURE 5-1: 2015 WATER PRODUCTION SUMMARY

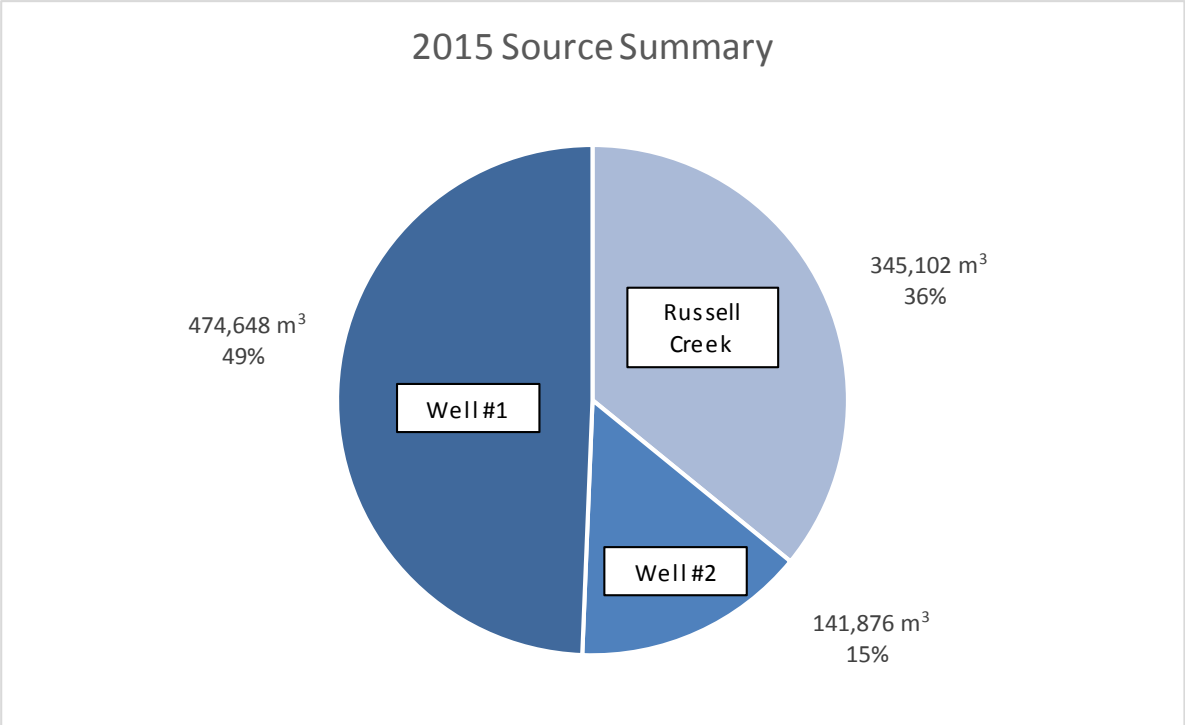
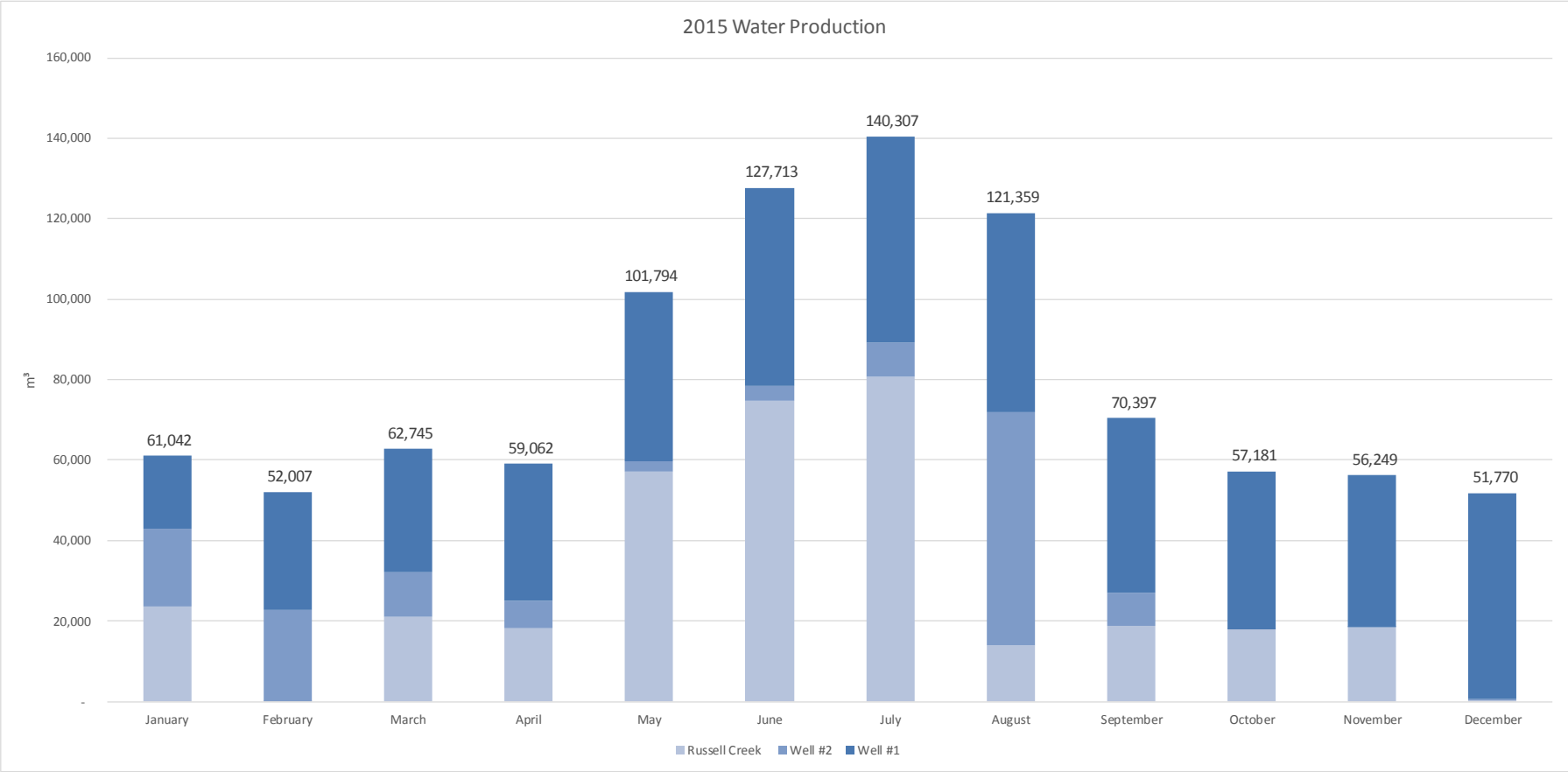


FIGURE 5-2: 2015 MONTHLY WATER PRODUCTION



6.0 Water Quality Monitoring Program

The District of Clearwater is required to operate the water distribution system as per the "Conditions of Permit" provided by the local health authority; which is the Interior Health Authority (IHA).

Table 6-1 displays the sampling parameters, locations and frequency for the District's water quality monitoring program. This testing is used to monitor the distribution system and alert District staff of potential drinking water quality issues. This program will be reassessed on an annual basis or when system upgrades are undertaken.

Drinking water quality is a function of source water quality, water treatment, and changes to water quality in the distribution system. Therefore, water quality monitoring is comprised of three main components: source water monitoring, treated water monitoring, and distribution system monitoring.

6.1.1 Source Water Monitoring

The source water monitoring undertaken by District staff includes both field and lab tests. Results of these tests are used to assess general raw water chemistry in comparison to the Guidelines for Canadian Drinking Water Quality (GCDWQ) which are published by Health Canada.

6.1.2 Treatment System Monitoring

Additional treatment system performance monitoring is in place; this includes UV transmissivity, chlorine residual, pH and turbidity monitoring. This monitoring is performed in real-time and is connected to the District's SCADA system. The SCADA system will notify District staff in the event the treatment system deviates from pre-set parameters.

6.1.3 Distribution System Monitoring

The Drinking Water Protection Regulation (DWPR) requires that water suppliers monitor for total coliform bacteria and Escherichia coli (E. Coli) at a certified lab. A summary of the total coliform and E. coli parameters is provided in Table 6-2. The distribution system is also monitored for disinfection by-products and chlorine residuals to ensure safe levels are maintained.

TABLE 6-1: WATER QUALITY SAMPLING SUMMARY

Parameter	Frequency	Analysis	Locations
Escherichia coli, Total Coliforms	Weekly	Lab	4 distribution system samples
Escherichia coli, Total Coliforms	Monthly	Lab	Water Production Sites
Turbidity	Continuously	Field	Surface Water
Temperature	Weekly	Field	Raw Creek (combo), 2 wells
pH	Weekly	Field	Raw Creek (combo), 2 wells
Conductivity	Weekly	Field	Raw Creek (combo), 2 wells
Chlorine Residual	Daily	Field	4 distribution system samples, booster station, reservoir outlet
UV Absorbance	Monthly	Lab	Water Production Sites
Total and Dissolved Organic Carbon	Monthly	Lab	Raw Creek (combo), 2 wells
Trihalomethanes (THMs)	Annually	Lab	2 distribution system samples
Haloacetic Acids (HAAs)	Annually	Lab	2 distribution system samples
Comprehensive Drinking Water Test	Annually	Lab	Raw Creek (combo)
Comprehensive Drinking Water Test	Annually	Lab	2 wells

TABLE 6-2: WATER QUALITY STANDARDS

Parameter:	Standard:
Fecal coliform bacteria	No detectable fecal coliform bacteria per 100 mL
Escherichia coli	No detectable *Escherichia coli* per 100 mL
Total coliform bacteria	
(a) 1 sample in a 30 day period	No detectable total coliform bacteria per 100 mL
(b) more than 1 sample in a 30 day period	At least 90% of samples have no detectable total coliform bacteria per 100 mL and no sample has more than 10 total coliform bacteria per 100 mL

7.0 Water Quality Results

District staff conducted treated and raw water sampling throughout 2015 in accordance with Table 6.1. Water samples were sent to Caro Analytical Services as well as ALS Global for bacteriological testing and other laboratory testing.

7.1 Water Source Quality

Through 2015, the District undertook the following monitoring of the raw water (prior to treatment) produced by the three water sources.

- Well No. 1 (PW001) and Well No. 2 (PW002)
  - total and dissolved organic carbon monthly
  - total coliforms and E Coli every two months
- Russell Creek (UV001 Raw)
  - UV absorbance and UV transmittance monthly
  - total and dissolved organic carbon monthly
  - total coliforms and E Coli every two months

The testing results for the 2015 are presented in Table 7.1. From Table 7.1:

- Total Organic Carbon and Dissolved Organic Carbon in Wells 1 and 2 were consistently less than 1.0 mg/L and at or below the detection limit of 0.5 mg/L in more than 60% of the samples. Organic Carbon is a measure of naturally occurring organic matter. While not by itself a constituent of concern, organics can combine with chlorine to produce disinfection by-products which can be potentially harmful constituents.
- There were no positive tests for total coliform or E Coli in any of the raw water bacteriological tests of Well 1 or Well 2 in 2015. Even though there were no positive coliform or E Coli tests of the two well sources, chlorination is provided at both sources.
- Total Organic Carbon in Russell Creek ranged between 1.0 and 2.7 mg/L with the higher concentrations, as would be expected, occurring in the freshet period. For a surface water, Total Organic Carbon concentrations of less than 3.0 mg/L are considered to be low.
- UV transmittance values for Russell Creek ranged between 83.8% and 94.7% with minimum values measured during the freshet. UV transmittance is continuously measured in the UV treatment facility.
- Russell Creek raw water bacteriological testing shows modest concentrations of total coliform and one positive result for E Coli. These results are consistent with expectations for a surface water source but do indicate high water quality in accordance with the filtration exclusion criteria for E. Coli and total coliform.

TABLE 7-1: WATER SOURCE QUALITY DATA

Water Well #1 (Raw) (PW 001)

Date	Total Organic Carbon	Dissolved Organic Carbon	Total Coliform	E. coli	Fecal Coliform
Jan-06	0.8	<0.5			
Feb-03	0.6	0.5			
Feb-10			<1	<1	
Mar-03	<0.5	<0.5			
Apr-07	<0.5	<0.5	<1	<1	
May-05	<0.6	<0.6			
Jul-07	0.5	<0.5	<1	<1	<1
Aug-04	<0.5	<0.5	<1	<1	<1
Sep-08			<1	<1	
Sep-15	1.0	0.9			
Oct-07	<0.5	<0.5			
Oct-21			<1	<1	<1
Nov-04	0.6	0.6			

Water Well #2 (Treated) (PW 002)

Date	Total Organic Carbon	Dissolved Organic Carbon	Total Coliform	E. coli	Fecal Coliform
Jan-06	0.8	0.5			
Feb-03	0.6	0.6			
Feb-10			<1	<1	
Mar-03	<0.5	<0.5			
Apr-07	0.6	<0.5	<1	<1	
May-05	0.7	<0.5	<1	<1	
Jul-07	0.5	<0.5			
Jul-14			<1	<1	<1
Aug-04	<0.5	<0.5	<1	<1	<1
Sep-08			<1	<1	
Sep-15	1.2	1.1			
Oct-07	0.6	0.5			
Nov-04	0.7	<0.5			

Russell Creek UV Station (UV 001 Raw)

Date	UV Absorbance Filtered (%)	UV Absorbance Unfiltered (%)	Total Organic Carbon (mg/L)	Total Dissolved Carbon (mg/L)	UV Transmittance (%)	Total Coliform (#/100ml)	E. coli (#/100ml)
Jan-06	0.03	0.03	1.9	1.8	93.9		
Feb-03	0.03	0.03	1.4	1.3	93.4		
Feb-10						2	1
Mar-03	0.04	0.04	1.4	1.3	91.7		
Apr-07	0.06	0.07	2.7	2.6	83.8	5	1
May-05	0.06	0.06	2.4	2.4	86.4		
Jul-07			1.5	1.5			
Jul-14						52	5
Aug-04	0.03	0.04	1.0	1.0	92.9	72	<1
Sep-08						23	<1
Sep-15	0.02	0.02	1.8	1.6	94.7		
Oct-07	0.03	0.03	1.3	1.3	93.1		
Oct-21						28	<1
Nov-04	0.04	0.04	1.6	1.5	91.8		

7.2 Distribution System Disinfection By-Products

In accordance with the District's operating permit issued by IHA, sampling for Trihalomethanes (THM's) and Haloacetic Acids (HAA's) is undertaken at sites on the extremity of the distribution system service area. The results for 2015 are presented in Table 7.2. All test results for both THM's and HAA's were well within acceptable concentrations (MAC) specified in the Canadian Drinking Water Quality Guidelines.

TABLE 7-2: DISTRIBUTION SYSTEM DISINFECTION BY-PRODUCTS

Location - Fawn Road (FR03)	Date		
	Mar-10	Apr-07	Jul-07
Total HAA	0.014	0.018	0.037
Total Trihalomethanes	0.016	0.019	0.038
Coliform		<1	
E. coli		<1	

TABLE 7-3: DISTRIBUTION SYSTEM DISINFECTION BY-PRODUCTS (CONT'D)

Location - Raft River (RR01)	Date		
	Mar-10	Apr-07	Jul-07
Total HAA	0.018	0.012	0.041
Total Trihalomethanes	0.020	0.012	0.038
Coliform		<1	
E. coli		<1	

Total Trihalomethanes	MAC 0.10mg/L
HAA	MAC 0.08mg/L

7.3 Distribution System Bacteriological Tests

A total of 215 treated water samples were analyzed in 2015 for E Coli and Total Coliforms. Samples were taken at four locations throughout the distribution system (Raft River, Sunshine Valley, Fawn Road and Park Drive) as well as the three water sources. Total coliforms are an indicator organism and do not necessarily indicate that there is an issue with the water. However, their presence likely indicates that for the sample collected there was insufficient chlorine present to kill the coliform bacteria. This could be a result of stagnant water or contamination of the sample (e.g. from the tap where it was collected). Of the 215 samples analyzed, there was one hit for total detectable coliforms (Fawn Road, sampled August 17 and reported August 21). The water system was flushed and resampled. Subsequent samples were clear of detectable total coliforms.

TABLE 7-4: DISTRIBUTION SYSTEM BACTERIOLOGICAL TESTS

Month	Number of Samples	Number of E. coli Hits	Number of total coliform Hits	Number of Samples within DWPR	Percentage of Samples within DWPR
January	18	0	0	18	100%
February	15	0	0	15	100%
March	22	0	0	22	100%
April	21	0	0	21	100%
May	23	0	0	23	100%
June	28	0	0	28	100%
July	12	0	0	12	100%
August	23	0	1	22	96%
September	11	0	0	11	100%
October	16	0	0	16	100%
November	22	0	0	22	100%
December	6	0	0	6	100%

7.4 Full Spectrum Water Quality Analysis

Full spectrum water quality test results for the District' three water sources are presented in Appendix A.

8.0 Capital Works and Other Initiatives

This section provides a summary of initiatives that were completed in 2015, are underway, or are in the planning stages. There is also discussion on issues that have been identified for possible action.

8.1 Completed in 2015

The following projects were completed in 2015 to upgrade the water supply or distribution system:

- Install fencing around the Russell Creek booster station site.
- Initiate an asset management planning program.
- Complete distribution system leakage repairs at the following locations:
    - February 26 – 444 Clearwater Valley Road
    - March 31 – Roy Road
    - May 25 – 332 Riverside Crescent
    - June 3 – Roy Road
    - June 22 – 333 Wyndhaven Drive
    - August 28 – 424 Hydro Road
    - September 22 – Roy Road
    - September 28 – 308 Dutch Lake Road
    - September 28 – 200 Dutch Lake Road
    - September 29 – Roy Road

8.2 System Improvements

8.2.1 2016 Projects

In 2016 the District will be looking to complete the following minor capital projects to improve water quality sampling as well as some minor operational needs.

- Extend water distribution system along Camp 2 Road
- Complete the cross connection control program
- Continue with the fire hydrant infill program
- Re-write the water service connection & regulation bylaw
- Complete the Night Time Water Consumption Assessment
- Install capacitor for Well #1
- Revise water sampling program

8.2.2 Long Term Goals

The following water system improvement projects are ongoing, but will not be completed during 2016.

- Continue to upgrade the SCADA system, completion of this 5 phase program is expected by 2017.

In addition, the following major improvement projects are in the preliminary design stage. The anticipated timeline of these projects is largely dependent on senior government funding, however the approval status of the infrastructure grant application is not currently available.

- Construct a new Well #3 at the Well #1 site to address reliability and capacity deficiencies,
- Completion of Phase 1 of a 3 Phase 300mm water supply main from Well #3 to the Archibald Reservoir.

9.0 Source Protection

In order to comply with the Interior Health “Conditions of Permit” and the *British Columbia Drinking Water Protection Act*, the District is required to complete source protection plans for each of its sources. Source protection plans are intended to assess the local factors and conditions that may influence the drinking water supply and to provide a strategy to mitigate the risks.

In accordance with the District’s Infrastructure Master Plan, the District has selected a reliable long term water source (Well #3). Once funding has been approved for the development of Well #3, the District will develop a source protection plan for that area.

APPENDIX A

Drinking Water Lab Results

Well #1	1990	1997	2013	2014	2015
Sample Date					**June 2/15**
Carbon, Total Organic			1	0.5	0.5
Carbon, Dissolved Organic			0.6	0.5	<0.5
UV Absorbance @ 254nm					<0.01
UV Absorbance @ 254nm; unfiltered					<0.01
UV Transmittance @ 254nm					97.8
Hardness, Total (Total as CaCO3)	44.6	98.9	47.4	46.6	48.8
Hardness, Total (Diss. as CaCO3)			47	45.7	48.7
Recoverable Metals					
Aluminum, total	<0.1	<0.05	<0.05	<0.05	<0.05
Antimony, total			<0.001	<0.001	0.005
Arsenic, total	<0.001	< 0.0005	<0.005	<0.005	<0.005
Barium, total	0.02	0.061	<0.05	<0.05	<0.05
Beryllium, total			<0.001	<0.001	<0.001
Bismuth, total			<0.001	<0.001	<0.001
Boron, total	<0.01	<0.01	<0.04	<0.04	<0.04
Cadmium, total	<0.0005	<0.005	<0.0001	<0.0001	<0.0001
Calcium, total	14.1	30.8	14	14.1	14.6
Chloride, total	<0.5	0.5			
Chromium, total			<0.005	<0.005	<0.005
Cobalt, total			<0.0005	<0.0005	<0.0005
Copper, total	<0.01	<0.005	<0.002	<0.002	0.005
Iron, total	0.03	0.068	<0.1	<0.10	<0.10
Lead, total	0.001	<0.05	<0.001	<0.001	<0.001
Lithium, total			<0.001	<0.001	<0.001
Magnesium, total	2.29	5.3	3.2	2.8	3.0
Manganese, total	<0.01	0.004	<0.002	<0.002	<0.002
Mercury, total			<0.0002	<0.0002	<0.00002
Molybdenum, total			0.001	<0.001	0.002
Nickel, total			<0.002	<0.002	<0.002
Phosphorus, total		<0.1	<0.2	<0.2	<0.2
Potassium, total			1	0.7	1.0
Selenium, total			<0.005	<0.005	<0.005
Silicon, total			<5	<5	<5
Silver, total			<0.0005	<0.0005	<0.0005
Sodium, total	1.9	1.4	3	2.5	3.1
Strontium, total			0.1	0.09	0.08
Sulfur, total			<10	18	<10
Tellurium, total			<0002	<0.002	<0.002
Thallium, total			<0.0002	<0.0002	<0.0002
Thorium, total			<0.001	<0.001	<0.001
Tin, total			<0.002	<0.002	<0.002
Titanium, total			<0.05	<0.05	<0.05
Uranium, total	<0002		0.0003	0.0002	0.0003
Vanadium, total			<0.01	<0.01	<0.01
Zinc, total	<0.01	0.031	<0.04	<0.04	<0.04
Zirconium, total			<0.001	<0.001	<0.001

Well #2	2005	2006	2013	2014	2015
Sample Date					**June 2/15**
Carbon, Total Organic			0.8	0.7	<0.5
Carbon, Dissolved Organic			0.6	0.6	<0.5
UV Absorbance @ 254nm					<0.01
UV Absorbance @ 254nm; unfiltered					<0.01
UV Transmittance @ 254nm					98.3
Hardness, Total (Total as CaCO3)	110	99	103	108	112
Hardness, Total (Diss. as CaCO3)			105	104	128
Recoverable Metals					
Aluminum, total	0.0097	<0.05	0.07	<0.05	<0.05
Antimony, total			<0.001	<0.001	0.004
Arsenic, total	0.0008	<0.01	<0.005	<0.005	<0.005
Barium, total	0.00077	<0.08	<0.05	<0.05	<0.05
Beryllium, total			<0.001	<0.001	<0.001
Bismuth, total			<0.001	<0.001	<0.001
Boron, total	<0.008	<0.01	<0.04	<0.04	<0.04
Cadmium, total	0.00001	<0.001	<0.0001	<0.0001	<0.0001
Calcium, total	31.7	27.49	26	29.4	30.2
Chloride, total	2.6	4.6			
Chromium, total			<0.005	<0.005	<0.005
Cobalt, total			<0.0005	<0.0005	<0.0005
Copper, total	0.0011	0.011	0.005	0.004	0.002
Iron, total	<0.005	<0.01	0.6	0.19	<0.10
Lead, total	0.00037	<0.21	<0.001	<0.001	<0.001
Lithium, total			<0.001	<0.001	0.001
Magnesium, total	8.49	7.9	9.3	8.3	8.8
Manganese, total	0.0272	0.084	0.081	0.135	0.036
Mercury, total			<0.0002	<0.0002	<0.00002
Molybdenum, total			0.002	0.002	0.003
Nickel, total			<0.002	<0.002	<0.002
Phosphorus, total	0.069	<0.08	<0.2	<0.2	<0.2
Potassium, total			3.5	2.7	3.0
Selenium, total			<0.005	<0.005	<0.005
Silicon, total			8	7	7
Silver, total			<0.0005	<0.0005	<0.0005
Sodium, total	10.4	8.43	69.1	12.6	9.3
Strontium, total			0.16	0.16	0.16
Sulfur, total			10	<10	<10
Tellurium, total			<0.002	<0.002	<0.002
Thallium, total			<0.0002	<0.0002	<0.0002
Thorium, total			<0.001	<0.001	<0.001
Tin, total			<0.002	<0.002	<0.002
Titanium, total			<0.05	<0.05	<0.05
Uranium, total	0.00011	<0.01	<0.0002	<0.0002	<0.0002
Vanadium, total			<0.01	<0.01	<0.01
Zinc, total	0.0011	<0.002	<0.04	<0.04	<0.04
Zirconium, total			<0.001	<0.001	<0.001

Surface Water – Russell Creek	2013	2014	2015
Sample Date			**June 2/15**
Carbon, Total Organic	3.5	1.6	2.3
Carbon, Dissolved Organic	3.3	1.5	2.1
UV Absorbance @ 254nm	0.08	0.05	0.06
UV Absorbance @ 254nm; unfiltered	0.09	0.05	0.06
UV Transmittance @ 254nm	84	88.8	86.8
Hardness, Total (Total as CaCO3)	80.9	84.3	66.9
Hardness, Total (Diss. as CaCO3)		85.5	68.5
Recoverable Metals			
Aluminum, total	<0.05	<0.05	<0.05
Antimony, total	<0.001	<0.001	0.006
Arsenic, total	<0.005	<0.005	<0.005
Barium, total	0.07	0.7	0.05
Beryllium, total	<0.001	<0.001	<0.001
Bismuth, total	<0.001	<0.001	<0.001
Boron, total	<0.04	<0.04	<0.04
Cadmium, total	<0.0001	<0.0001	<0.0001
Calcium, total	26	26.9	21.8
Chromium, total	<0.005	<0.005	<0.005
Cobalt, total	<0.0005	<0.0005	<0.0005
Copper, total	<0.002	<0.002	0.371
Iron, total	<0.1	<0.10	<0.10
Lead, total	<0.001	<0.001	<0.001
Lithium, total	<0.001	<0.001	<0.001
Magnesium, total	3.9	4.2	3.0
Manganese, total	<0.002	<0.002	0.003
Mercury, total	<0.0002	<0.0002	<0.00002
Molybdenum, total	<0.001	<0.001	0.001
Nickel, total	<0.002	<0.002	<0.002
Phosphorus, total	<0.2	<0.2	<0.2
Potassium, total	0.3	<0.2	<0.2
Selenium, total	<0.005	<0.005	<0.005
Silicon, total	<5	<5	<5
Silver, total	<0.0005	<0.0005	<0.0005
Sodium, total	1.2	1	1.0
Strontium, total	0.11	0.11	0.07
Sulfur, total	12	<10	<10
Tellurium, total	<0.002	<0.002	<0.002
Thallium, total	<0.0002	<0.0002	<0.0002
Thorium, total	<0.001	<0.001	<0.001
Tin, total	<0.002	<0.002	<0.002
Titanium, total	<0.05	<0.05	<0.05
Uranium, total	<0.0002	<0.0002	<0.0002
Vanadium, total	<0.01	<0.01	<0.01
Zinc, total	<0.04	<0.04	0.25
Zirconium, total	<0.001	<0.001	<0.001