

Clearbrook Waterworks District 2017 Water Quality Report



Clearbrook Waterworks District
2564 Clearbrook Road
Abbotsford, BC V2T 2Y5
(604) 850 6621 | office@clearbrookwaterworks.com

Clearbrook Waterworks District 2017 Water Quality Report

Clearbrook Waterworks District
2564 Clearbrook Road
Abbotsford, BC V2T 2Y5
(604) 850-6621
office@clearbrookwaterworks.com

Image on cover page: groundwater discharged-to-ground during well development (part of the well construction phase) of RW 2-63/17 in April of 2017.

Release date: May 10, 2018.

This report was prepared in collaboration with Kalwij Water Dynamics Inc.

This document is made available in PDF format to the rate payers of Clearbrook Waterworks District for information sharing purposes at URL: <https://www.clearbrookwaterworks.com>. Rate payers can direct questions about the report to: office@clearbrookwaterworks.com. Any use, interpretation, or reliance on this information by any third party is at the sole risk of that party, and Clearbrook Waterworks District and their agent accepts no liability for such unauthorized use.

Copyright © 2018 Clearbrook Waterworks District. All rights reserved.

Units & Abbreviations

Length	Unit	Concentrations	Unit
Inch	in	Colony forming units per millilitre	cfu/ml
Foot	ft	Nephelometric Turbidity Unit	NTU
Millimetre	mm	Milligrams per litre	mg/l
Metre	m	Most Probable Number per 100	MPN/100 ml
Kilometre	km	Predictive Active cells per millilitre	PAC/ml
Length	Unit	Electric Conductivity	Unit
Inch	in	Micro Siemens per centimetre	µS/cm
Foot	ft		
Millimetre	mm	Temperature	Unit
Metre	m	Degrees Celsius	°C
Kilometre	km		
Flow Rate	Unit		
Cubic meters per hour	m ³ /hr		
Litres per second	l/s		

Abbreviations (Selected)

Aesthetic Objective	AO
Asbestos Cement	AC
Bacteriological Activity Reaction Test	BART
Cast Iron Outside Diameter	CIOD
Heterotrophic Aerobic Bacteria	HAB
High-density polyethylene	HDPE
Iron Related Bacteria	IRB
Maximum Acceptable Concentration	MAC
Operational Guideline for Water Treatment Plants	OG
Polyvinyl chloride	PVCO
Remote Terminal Unit	RTU
Slime Forming Bacteria	SLYM
Sulphate Reducing Bacteria	SRB
Supervisory Control and Data Acquisition	SCADA
Variable Frequency Drive	VFD

Table of Contents

Units & Abbreviations	ii
Foreword	v
1.0 Introduction	1
2.0 Water System Overview	2
3.0 Water Supply Source Monitoring	4
3.1 Our Aquifer (Water Supply Source).....	4
3.2 Groundwater Monitoring.....	5
4.0 Selected Work and Projects	8
4.1 Maintenance Work, On-Going Programs and Projects Completed in 2017.....	8
4.2 Capital Projects Completed in 2017	11
4.3 Scheduled Capital Projects for 2018.....	14
5.0 Water Quality Assurance	16
5.1 Water Quality Monitoring.....	16
5.2 Water Quality Technician’s Report 2017	17
6.0 Water Quality Review	19
6.1 Annual Water Sampling and Analysis	19
6.2 Water Quality Results.....	20
6.3 Hardness of Our Drinking Water.....	24
6.4 Biological Activity Reaction Test (BART)	26
7.0 References	29

Appendices

- Appendix A** Metals in Drinking Water “Flush” Message from Fraser Health Authority
- Appendix B** Sample Range Report Fraser Health Authority
- Appendix C** Exova Water Quality Reports
- Appendix D** BART Sampling Procedure

Tables

- Table 6.1** Physical Parameters
- Table 6.2** Metals (Extractable)
- Table 6.3** Miscellaneous Parameters: Inorganics, Anions and Nitrogens
- Table 6.4** Microbiological Parameters

Figures

- Figure 3.1** Monthly Extraction Volumes (2017)
- Figure 3.2** Groundwater Hydrograph (2015-2017)
- Figure 6.1** Historical trends in Hardness of our Drinking Water (2013-2017)
- Figure 6.2** BART Results RW 3-93/11
- Figure 6.3** BART Results RW 7-00/13
- Figure 6.4** BART Results RW 1-87/14
- Figure 6.5** BART Results RW 2-63/17

Foreword

Clearbrook Waterworks District (CWD) is pleased to present the 2017 Annual Water Quality Report, prepared in collaboration with Kalwij Water Dynamics Inc. (KWD), and with contributions from James Wiens (CWD's Field Supervisor) and Ryan Federau (CWD's Water Quality Technician). CWD retains the services of a professional hydrogeologist, Dr. Ineke Kalwij (P.Eng.) of KWD, to assist in on-going groundwater monitoring and well maintenance programs. Dr. Kalwij advises CWD Board of Trustees and staff on various aspects pertaining to groundwater supply management and groundwater protection.

Through this report we would like to inform the rate payers about our water system and show our ongoing commitment by the CWD Board of Trustees and staff to deliver the highest quality water. An accomplishment also acknowledged by the awarding of the District's fifth gold medal on February 24, 2018 (preceded by a Gold medal in 2016), for supplying the World's Best Municipal Water, organized by Berkeley Springs International Water Tasting (a yearly occurring event, held in Berkeley Springs, West Virginia).

CWD system operators are highly trained and skilled and certified through the Environmental Operator's Certification Program, with Level 2 Water Distribution System Operators. CWD complies with all provincial and federal regulations relating to the supply and delivery of potable water, while promoting responsible stewardship of our natural resource. We value our collaboration with Fraser Health Authority and their feedback. We remain committed to the protection of public health while ensuring an uninterrupted supply of drinking water to our rate payers.

CWD employs a holistic approach to water quality management, utilizing proactive maintenance schedules and asset management practices while also adopting the latest technologies where possible to achieve efficiencies in operation and redundancies where safety is concerned. CWD recognizes the needs of "due diligence" when it comes to managing the natural asset they rely on: the Abbotsford-Sumas Aquifer.

Last year, CWD constructed a fourth replacement well, RW 2-63/17 at our Autumn Well Field. The addition of the new well leaves us with two high-capacity production wells at each well field. Each well is automated through our Supervisory Control and Data Acquisition (SCADA) system, which controls and monitors the water system 24 hours a day, 7 days a week. Also, in 2017, the pump house at Autumn Well Field was expanded to make room for the new well controls as

well as a generator so that all of our wells can now function without interruption in adverse events such as power outages.

This year, we are excited to begin construction on a new operations facility at our reservoir site, where all of the field equipment and materials will be consolidated at one place, allowing our field crew to be more efficient in their daily operations.

The big advancement for our consumers this year will be the adoption of advanced metering infrastructure (AMI). Starting in 2018, we will be converting all meters over to AMI which will allow us to remotely read the meters every day, as many times as we choose. This will enable us to catch leaks as they happen and customers can be notified instantly, saving money and water.

2018 promises to be a big year for CWD. Check in with us at our Annual Open House on August 24, 2018.

Respectfully submitted,

Jason Hildebrandt
Corporate Administrator

1.0 Introduction

This document, intended for our rate payers and Fraser Health Authority (FHA), summarizes pertinent water system and water quality information. The water system is supplied solely by groundwater, which is extracted from the Abbotsford-Sumas Aquifer. CWD's natural asset monitoring is accomplished by the ongoing implementation of several programs. As per regulatory requirements, under the Drinking Water Protection Act, water purveyors are required to monitor the quality of water supply source(s), the water in the distribution system, and the water supplied to the end users.

For rate payers to stay informed about health related to drinking water we refer to Fraser Health Website:

<http://www.fraserhealth.ca/health-info/health-topics/drinking-water/drinking-water-advisories/drinking-water-advisories>.

For information about preventing water-borne infections for people with weakened immune systems:

<http://www.healthlinkbc.ca/healthfiles/hfile56.stm>. **Appendix A** includes a message from Fraser Health about *metals in drinking water*.

CWD maintains an informative website where rate payers can find information about: (i) the water system & history; (ii) water rates and (e-)billing; (iii) bylaws; (iv) key projects (v) selected documents (water quality reports, water system map, leak relief request forms), and (vi) the schedule of Board meetings and Annual General Meeting. CWD website:

www.clearbrookwaterworks.com.

In the next Section, we provide an overview of the water system, followed by some information about the aquifer and selected groundwater monitoring results (**Section 3.0**). **Section 4.0** summarized selected work and projects completed in 2017 and projects planned for 2018. In **Section 5.0** we explain the water quality assurance protocol, and **Section 6.0** presents the review of the results of the water quality analyses and Bacteriological Activity Reaction Test (BART).

2.0 Water System Overview

IMAGE | PUMP STATION AT THE RESERVOIR SITE



CWD's supply and distribution system (water system) solely relies on groundwater. CWD is the exclusive drinking water provider to residential and commercial units (1,378 connections as of end of 2017) within CWD service area boundaries, serving a population of close to 10,000 through an estimated 32 km of water main (pipe network), with four production wells supplying the system, and 6,820 m³ of combined reservoir storage. The water system is fully metered.

The water supply is primarily used for drinking water but is also used to meet fire flow requirements. The fire hydrants, connected to the water system, have been installed and are maintained by CWD. CWD's operators (four) are all EOCP-certified (EOCP¹ Water Distribution System Operators Level 2); one operator-in-training recently joined CWD in fall of 2017.

The water system relies on four replacement production wells for water supply, located at our Lynden and Autumn Well Fields (two production wells at each well field). The construction of the fourth well was completed in 2017, and the well was placed on line on November 9, 2017.

Through SCADA, CWD has real-time access via Remote Terminal Units (RTU) to pertinent aspects of the water system. This includes the monitoring of flow information (wells, to and from the reservoir), reservoir levels, water system pressure (pump stations), and water temperature (groundwater and reservoirs). SCADA continuously acquires data which is stored in a database. Such data is used by our hydrogeologist for further processing and analysis, which

¹ Environmental Operators Certificate Program; for more information: <http://eocp.ca/>.

is essential to the periodic review of our supply and distribution system. Through SCADA the wells are operated automatically on a rotational basis (alternating between wells and well field).

Through SCADA alarm features are enabled, and CWD's system operators are notified instantaneously (through their hand-held devices) in case there is a problem with the system's operation or in case of an unauthorized intrusion.

At each pump house (Lynden and Autumn well fields), fully functioning emergency chlorinators are installed. These chlorinators are solely used in the event of a water quality related emergency. CWD has an approved (by FHA) Emergency Response Plan in place.



IMAGE | OPEN HOUSE AT LYNDEN WELL FIELD

Since 2015, CWD organizes open houses on an annual basis, as an opportunity for rate payers to informally meet with CWD staff and Board Members, and to learn more about the water system and groundwater under the enjoyment of a barbeque. Invited vendors show case latest technology and educational material. Visit our next Open House on August 24, 2018.

3.0 Water Supply Source Monitoring

3.1 Our Aquifer (Water Supply Source)



(modified and annotated from Google Earth)

IMAGE | ABBOTSFORD-SUMAS AQUIFER DELINEATION

CWD's production wells extract water from the Abbotsford-Sumas Aquifer. The aquifer covers an area of approximately 161 km²; it is a trans-boundary aquifer which extends from the Fraser Valley into Whatcom County of Washington State, USA. It is an unconsolidated aquifer composed of sands and gravels (glacial outwash deposits). Although the aquifer is classified as an unconfined aquifer, some parts of the aquifer are confined. CWD production wells screen the aquifer at a location characterized by an overlaying confining layer. This confining layer of low permeability consists of silt and clay (also termed an *aquitard*); the presence of such *aquitard* is

advantageous from an aquifer protection point of view as they are conducive in protecting the aquifer from possible contamination (introduced at the ground surface).

The aquifer is considered a high-productive aquifer. The City of Abbotsford, Clearbrook Waterworks District, and Fraser Valley Trout Hatchery are the major (single) groundwater users (of the Canadian portion of the aquifer).

As per BC Aquifer Classification System the Abbotsford-Sumas Aquifer is classified as a heavily developed and highly vulnerable aquifer. CWD has a wellhead and aquifer protection program in place to safeguard our groundwater resource.

Regulation

As required under the *Water Sustainability Act* (Government of British Columbia 2014) and *Water Sustainability Regulation* (Government of British Columbia, 2016a), CWD has applied for existing groundwater use license for their production wells. CWD can continue to use the water as they have been, pending issuance of the licence.



IMAGE | GROUNDWATER PROTECTION AREA SIGN

3.2 Groundwater Monitoring

CWD has successfully been implementing a groundwater monitoring program for many years, and since fall 2009, data is recorded through SCADA on a continuous basis. SCADA data is further processed to provide a meaningful interpretation of various data, some of which presented in this document.

Groundwater Extraction

CWD's production wells have been successfully operating (in rotation) throughout 2017.

Figure 3.1 (next page) shows the monthly groundwater extraction for 2017. For each month the figure shows the volumetric contribution of each well. The total height of each bar reflects combined monthly extraction volume (y-axis). The figure contrasts combined monthly volumes with 2016 data (indicated by purple markers).

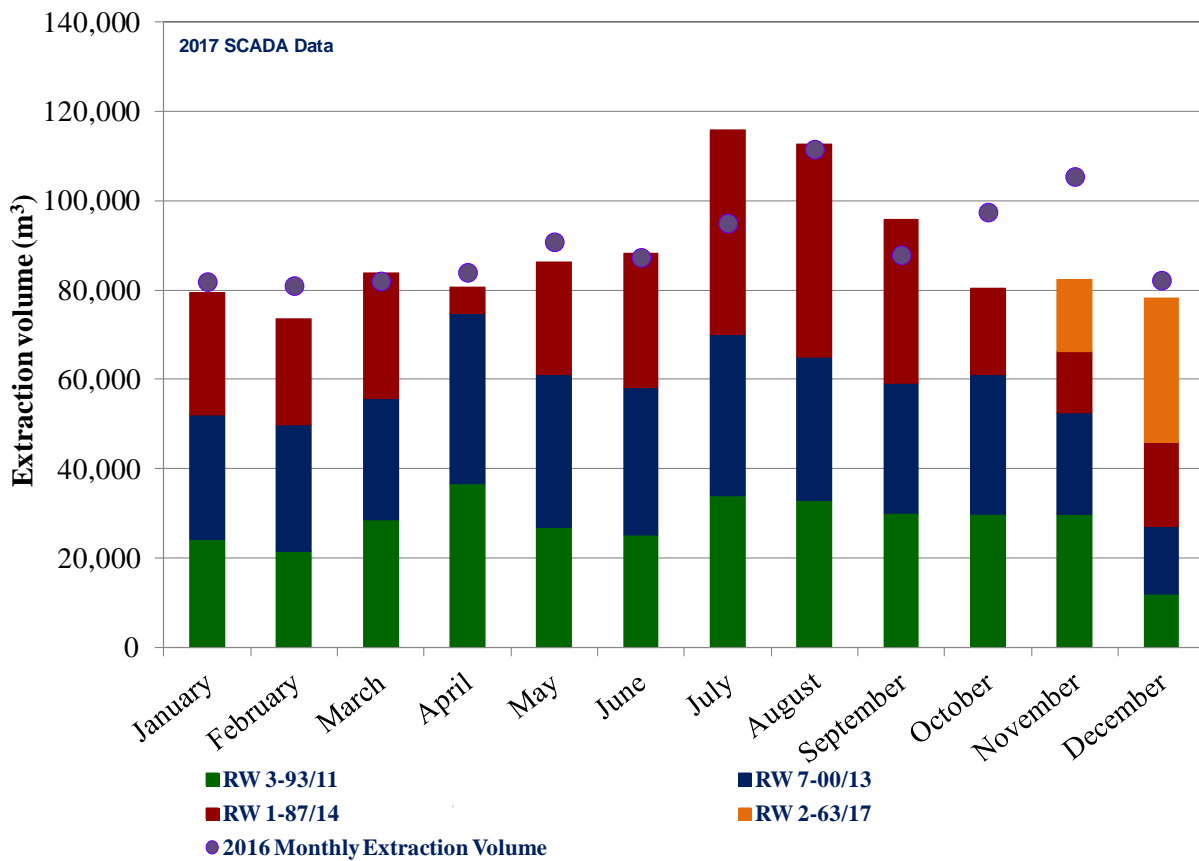


FIGURE 3.1 | MONTHLY EXTRACTION VOLUMES AND DISTRIBUTION BETWEEN PRODUCTION WELLS (2017); CONTRASTED TO 2016 DATA.

Based on the monitoring of the operation of the production wells in 2017:

- 1) The annual total volume of combined extraction is 1.06 Mm³ or 1.06 BL;
- 2) Combined average monthly withdrawal is 88.66 ML;
- 3) The combined average daily withdrawal volume is 2.91 ML; and
- 4) The average pumping rate is 194 m³/hr (53.9 l/s).

Groundwater levels

The groundwater hydrograph (**Figure 3.2**) provides valuable insight in the variation in groundwater levels seasonally, and between years. This is important information to safe guard the sustainability of the aquifer. The hydrograph is based on data collected for one of CWD’s monitoring wells and is representative for the groundwater level trends locally observed.

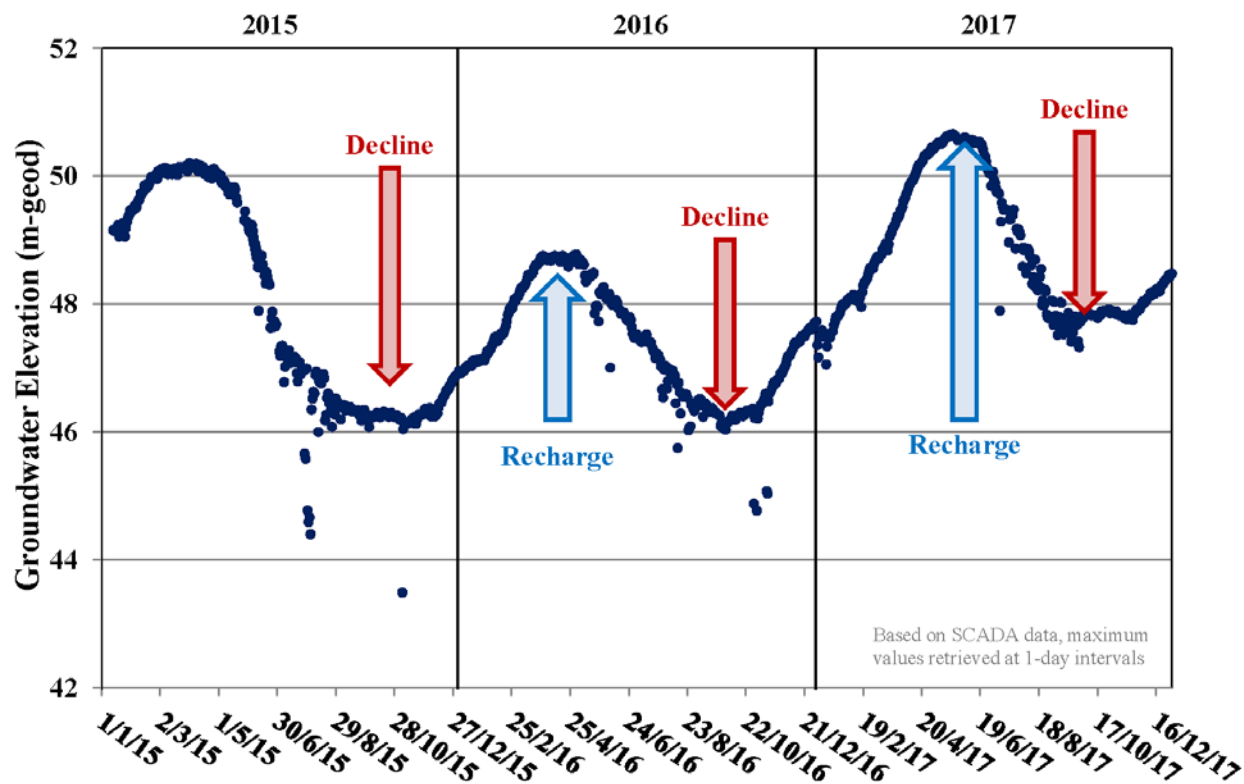


FIGURE 3.2 | GROUNDWATER HYDROGRAPH (CWD MONITORING WELL)

The sine-shaped data series illustrate seasonal variation in groundwater levels (elevation) within a year and between years. The observed trend suggests periods of groundwater recharge (indicated by the blue arrows in the figure) and periods during which the groundwater level declines (indicated by the red arrows in the figure). The figure illustrates that the amount of recharge (and groundwater level decline) varies between years. CWD’s long term groundwater monitoring (since 1989) suggests no concern with the groundwater level.

In 2017, there was a positive balance suggesting that groundwater recharge (2016/2017) exceeded groundwater discharge (groundwater level decline). In 2016, the groundwater recharge (2015/2016) and discharge were balanced.

4.0 Selected Work and Projects

4.1 Maintenance Work, On-Going Programs and Projects Completed in 2017



IMAGE | WATER SYSTEM FLUSHING VIA HYDRANT

Water Quality Monitoring

This is an on-going activity and is addressed in **Section 5.0** and **Section 6.0**.

Water System Maintenance

Water system maintenance is on-going throughout the year. The following is a list of selected maintenance work completed in 2017:

- Completion of the Unidirectional Flushing Program for the entire water system in spring and fall;
- Servicing of all fire hydrants;
- The replacement of failing and low accuracy water meters;
- Leak detection: 189 service line leaks were repaired by property owners after being identified by CWD staff;

- Servicing of all field equipment;
- Exercising of 127 valves located throughout the district; the results are recorded on Mobile 311 (see below); some valves were replaced; and
- Instrumentation checks (level transmitters) were completed for all production wells and one monitoring well.

*With the implementation of **Mobile311 program** we have improved our asset maintenance and work order management. Our field staff are provided with tablets with the Mobile311 map-based interface of our water system, allowing them to directly input all maintenance data, and to directly issue and track work orders, and retrieve historical information.*

Inspection, Flushing Testing for New Developments

Three new developments (town houses) were completed and / or started in 2017 on: Mt. Waddington Avenue, George Ferguson Way, and on Janzen Street. Our field staff completed site inspection and supervision at the time of connecting water supply to the water system. Additionally, flushing and water quality testing (microbiological) was completed (except for the development at Janzen Street which is still under construction).

Hydraulic Capacity Analysis

Our hydraulic model was updated and applied to conduct a water system capacity analysis based on future population growth predictions. The updating and analysis was completed by GeoAdvice Engineering Inc. The outcome of this analysis was used in our decision making regarding prioritizing (ranking) water main improvements and infrastructure upgrades in order to support population growth through 2041. The analysis has provided us with valuable tools for our capital planning for years to come. We will further build on the outcome of the analysis and complete a Water Master Plan in 2018.

Groundwater Monitoring Program

A comprehensive groundwater monitoring program is being implemented for many years. Groundwater levels at production wells and one monitoring location are continuously monitored through SCADA. Additionally, our staff completes manual readings on a bi-weekly basis for selected monitoring well locations. In addition, well discharge rates and groundwater temperature are continuously monitored (via SCADA). Total withdrawal volumes are manually recorded for each production well on a frequent basis (i.e., several times per week during pump checks). KWD processes and analyses SCADA data pertaining to well's operation and groundwater levels (to name a few).

Well System Evaluation & Preventive Maintenance Program



IMAGE | WELL PREVENTIVE MAINTENANCE – WELL FLUSHING FOLLOWING CHEMICAL TREATMENT

In 2017, step-drawdown pumping tests (to assess well hydraulic performance) for the production wells and pump speed tests (to assess pump/motor performance) were completed. KWD assisted CWD in carrying out the different tests. These tests allow for a better understanding of well system performance and possible changes in performance over time. This information is relevant to the timely scheduling of well maintenance.

Furthermore, preventive maintenance was successfully completed for RW 7-00/13 in December of 2017 (Fyfe Well & Water Services completed the work). RW 7-00/13 was commissioned on October 30, 2013, and has been successfully operating since then. The preventive maintenance work was in accordance with the *Groundwater Protection Regulation* (Government of British Columbia 2016b).

Preventive maintenance included completing a down-hole video inspection (to assess the well condition, in particular the well screen), mechanical bailing of sediment accumulated in the well over time, application of liquid acid descaler (chemical treatment) to loosen up and dislodge mineral encrustations, mechanical agitation (air cleaning brush) of the interior surfaces of the well, primarily targeting the screened section, and (following day) a well flushing procedure to extract the dislodged material from the well screen section (and discharge into a holding tank). Throughout the flushing procedure due diligence was maintained and pH (of discharged water) was monitored; ; if needed, the water was neutralized with sodium hydroxide. All discharge-to-ground was contained within the well field.

Permanent Decommissioning of Monitoring Well 5-78

This well, located at the Reservoir site, was permanently closed because of planned construction activities (new operations facility, see **Section 4.3**).

The well casing was cut below grade, and next the casing was completely filled with Bentonite (9.5-mm or 3/8-in sized) angular chips (*sealant*). The sealant was manually poured (by gravity) into the well. The excavated area was filled with a combination of layers of Bentonite and gravel crush. The well closure procedure meets the requirements of the *Groundwater Protection Regulation* (Government of British Columbia 2016b).

Fyfe Well & Water Services carried out the permanent well closure; CWD staff assisted with the excavation and refill by excavator.



IMAGE | PERMANENT DECOMMISSIONING WELL 5-78

4.2 Capital Projects Completed in 2017

Well Replacement Program – RW 2-63 Project

The drilling and construction of the well, the well testing (water quantity and quality), and commissioning of RW 2-63/17 was completed in 2017. Replacement Well (RW) 2-63/17 is the fourth production well constructed under the Well Replacement Program of Clearbrook Waterworks District (CWD). The following work was completed in 2017:

- 1) Production well drilling and construction (April, 2017);
- 2) Pit-less unit installation and well testing (May, 2017);
- 3) Mechanical completion (November, 2017); and
- 4) Electrical completion (completed in October and November, 2017) and tie-in of the well to the distribution system (work was completed in May, July, September, and in October, 2017).



IMAGE | WELLHEAD (LEFT) AND WELL COVER (RIGHT)

Fyfe Well & Water Services provided the well drilling and construction services. Opus International Consultants provided the civil engineering services pertaining to water main (tie-in) design and field inspections. KWD provided the project management and hydrogeological engineering services. CWD staff assisted in various stages of the project, completed the tie-in construction work, and completed the microbiological testing. RW 2-63/17 has been constructed in accordance with applicable *BC Regulation* and industry standards².



IMAGE | CONNECTING A NEW WATER MAIN SECTION (8 MM BIONAX) TO THE WELL PIT-LESS UNIT

² Government of British Columbia (2014 and 2016b) and AWWA (2015).



IMAGE | FURTHER TIE-IN CONSTRUCTION WORK FOR RW 2-63/17

Pump House Expansion Project

The existing pump house at Autumn Well Field was extended to accommodate the variable frequency drive for the new production well, storage of chlorine (for emergency chlorinators), and a separate room to house the generator. The project management was organized in-house (James Wiens, Field Supervisor). Various stages of the construction work were sub-contracted. CWD staff was significantly involved in several stages of the project.

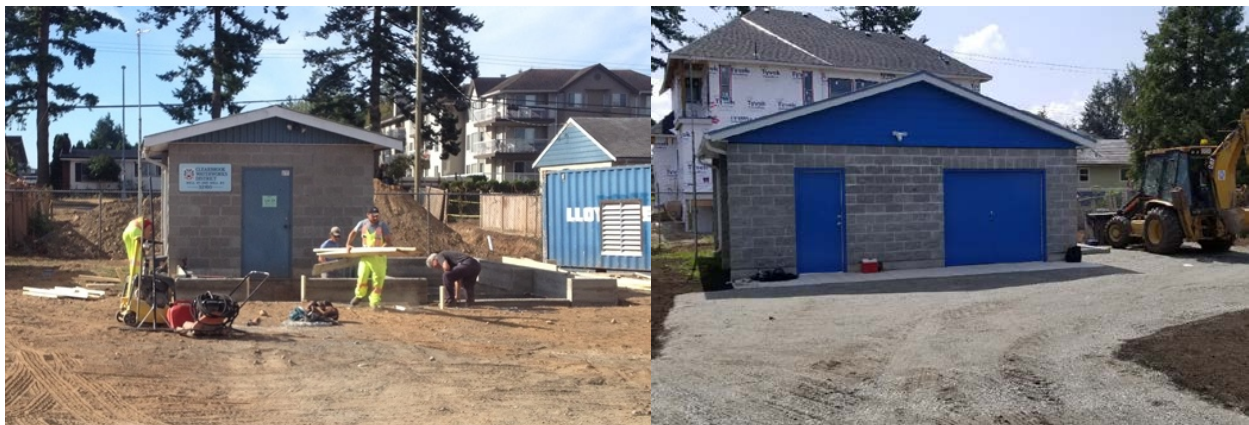


IMAGE | PUMP HOUSE EXPANSION WORK IN PROGRESS (LEFT) AND COMPLETED (RIGHT)

Pipe Replacement Program – Water Main Upgrade

Under this program 130 m of A/C water main (150-mm or 6-in diameter) on Old Yale Road and Springhill Street were replaced with high density polyethylene pipe (250-mm or 10-in diameter). The water main that was replaced was at risk of fracture, as the original trench was situated in an area rich in peat and was sinking. Six service lines were upgraded along with the upgrading the water main.

This project was completed at the request of the City of Abbotsford, as their storm and sanitary infrastructure in the area is also in need of replacement but could not be addressed until the water main upgrade was completed. The water main upgrading was subcontracted to Chet Construction Ltd.

4.3 Scheduled Capital Projects for 2018

The following projects are scheduled for 2018:

New Operations Facility

Late 2017, early groundwork was completed for the new operations facility at the Reservoir Site. The planning is to complete the facility in 2018. For this project, CWD will act as the general contractor, hiring subcontractors in order to reduce construction costs. Our field staff will be involved with the construction of all required civil works; some of the construction (finishing) work will be completed in-house.

Water Main Upgrade

In summer 2018, our field staff will install approximately 260 m of water main on Stanley Street, with the main continuing through the parking lot at Ten Broeck Elementary, and tie in on Hill Tout Street. With this project, eleven (11) residential service connections will be upgraded; 60 m of pipe will be at the developer's cost.

The water main upgrade was a recommendation that resulted from the hydraulic water modeling and capacity analysis. The existing 150 mm (6 in) A/C water main is considered a bottle neck with flow impedances. The upgraded water main will be 250 mm (10-in) Bionax® PVC Pipe (CIOD).



IMAGE | WATER MAIN UPGRADING WORK

Advanced Metering Infrastructure

In 2018, we will begin the process of adopting advanced metering infrastructure. In spring we will start retrofitting existing meters with registers that will send a signal to our office, allowing us to read the meters remotely, more frequently, and in real time. This will enable us to catch leaks at an early stage, saving the rate payers money and boosting our water conservation efforts. Rate payers have the option to install on their iphones an *App* that will give them an alert in the event of a service line leak.

Emergency Water Supply Equipment

In January (2018), we received our first shipment of emergency water supply equipment from Israel and we will be placing a second order this spring. This emergency water supply equipment will enable us to set up temporary mobile water supply stations in the event of an emergency. The idea is that no one should have to walk more than 500 meters to get access to potable water in the event of water system failure due to a catastrophic event. We will have the equipment on display at our Annual Open House on August 24, 2018.

5.0 Water Quality Assurance

5.1 Water Quality Monitoring

Providing safe, reliable and clean water to our rate payers remains CWD's key responsibility. We take pride in providing drinking water of the highest quality at a reasonable cost, thereby meeting water demand, complying with provincial regulations, and working responsibly to protect our aquifer. According to *Section 15 (b) of the Drinking Water Protection Act* (Government of B.C. 2001), a water supplier must make available to the public the results of the monitoring required by the regulations. The Drinking Water Protection Regulation (Government of B.C. 2003) under the Drinking Water Protection Act sets water quality standards for potable water (selected microbiological constituents in drinking water). The Drinking Water Act and Regulation are enforced for community water systems in British Columbia³.

Therefore, as a water purveyor we are required to have our water analyzed to confirm the absence of selected microbiological parameters by an accredited laboratory. This entails the weekly monitoring of our water supply and distribution system: CWD has 20 water sampling locations throughout the District, in addition to our four (4) production wells and two (2) reservoirs, which, on a rotating basis, are sampled and analyzed for *Total Coliforms* and *Escherichia Coliform (E.coli)*. RW 2-63/17 was added to the program late in 2018.



IMAGE | WATER SAMPLING

³ Environmental health officers routinely inspect, sample and assess community water systems for compliance with the Drinking Water Protection Act and Regulation (www.fraserhealth.ca).

The results of the microbiological water quality samples submitted to the Center for Disease Control for FHA for 2017 are presented in **Appendix B**.

Furthermore, once a year (in December) water samples are collected from each of the production wells (and one reservoir) and are submitted to an accredited laboratory (Exova Group Limited - Exova) for potability analysis (**Section 6.2**). In April and November, BART were completed for water samples collected from the well and aquifer formation (**Section 6.3**).

5.2 Water Quality Technician's Report 2017

Year 2017 was another interesting year for our water quality monitoring program. Bi-weekly bacteriological sampling was ongoing, with 226 samples submitted to the Center for Disease Control for FHA, and 286 samples were taken and analyzed in-house. A total of 512 bacteriological analyses (samples) were completed in 2017.

Year end full spectrum water quality analysis was completed in December 2017. Overall, the results were good, with the exception of high manganese concentration observed for RW 7-00/13, and which we suspected was related to the completion of the preventive well maintenance for this well. Repeat chemical analysis (completed in February of 2018) suggests that the manganese concentration were restored to values similar to what has been historically observed for this well.

BART results completed in 2017 showed an increase of iron-related bacteriological activity in RW 1-87/14 (based on comparing March and November tests). RW 2-63/17 (located at the same well field as RW 1-87/14), also showed high aggressivity in iron-related bacteria. However this is not uncommon for a well that has been recently constructed and had a considerable amount of down time before being placed on line.

The Autumn Well Field pump house was expanded in 2017 to allow for additional room for equipment and storage. Storage includes space for safely storing chlorine for emergency chlorinator use. Chlorine dosing tanks were purchased for both well sites. The completion of the emergency chlorinator units will take place in 2018; we are awaiting arrival of our NSF 61 PE tubing (this material is certified to withstand constant exposure to chlorine), as our supplier has it on order.

We completed all the construction of the water main tie-in at Autumn Well Field for RW 2-63/17. We also completed the pressure testing, following by the necessary water quality testing (microbiological) for this water main tie-in, and the necessary follow-up flushing, infrastructure disinfecting, and testing (microbiological) of the final water main tie-in (final connections). Lastly, we completed the necessary water sampling and analysis (microbiological) following the

pump-motor installation for this well. On November 8, 2017, CWD received from FHA the source water approval for RW 2-63/17, thereby permitting the well to be connected to CWD's water system.

No pipe replacement was carried out by CWD in 2017, but CWD oversaw 130 meters of 6-in AC pipe being replaced with 10-in HDPE pipe on Old Yale Road and Springhill Street. The construction work was completed by Chet Construction. We also oversaw three water main tie-in work, completed for newly developed townhouse complexes. All projects met the requirements set out in AWWA C-651, and were completed to CWD standards of practice.

The Unidirectional Flushing Program was not implemented in 2017, but the more conventional semi-annual flushing program was carried out. We will be performing the Unidirectional Flushing program again in 2018.

With the pending completion of the emergency chlorinators, the corresponding chlorine storage facilities, further pipe replacement, and another round of Unidirectional Flushing, 2018 looks to be another exciting year for us.

Ryan Federau

Water Quality Technician, WDSO II

Clearbrook Waterworks District

6.0 Water Quality Review

6.1 Annual Water Sampling and Analysis

Raw water samples were collected from **RW 3-93/11**, **RW 7-00/13**, and **RW 1-87/14** on December 18, 2017⁴. The water samples for RW 2-63/17 were collected on May 26, 2017 (part of the well completion requirements). Water samples are collected from the designated sample point on the water manifold; RW 1-87/14 and RW 2-63/17 share the same water manifold.

On the same day (December 18) water samples were collected in the pump house at the reservoir site (the water flowing into the reservoirs was sampled). The water samples were analyzed by Exova. **Appendix C** includes the original lab reports prepared by Exova:

- ✓ **Lot ID 1245604** (RW 3-93/11, RW 7-00/13, RW 1-87/14, Reservoir C);
- ✓ **Lot ID 1252607** (repeat RW 7-00/13); and
- ✓ **Lot ID 1204487** (RW 2-63/17).

A repeat water sampling was completed for RW 7-00/13 on February 2, 2018. This was carried out due to the outcome of water quality analysis (based on the water sampling on December 18, 2017). The results suggested manganese concentrations exceeding Aesthetic Objective (AO). We suspected that this was related to the (in December) completed well preventive maintenance for the well; the repeat water sampling confirmed that the manganese concentration was reduced to its usual level (< AO). The Exova Water Quality Report is also included in **Appendix C**.

⁴ Water samples were collected and submitted to Exova by Ryan Federau (Water Quality Technician).

6.2 Water Quality Results

Tables 6.1 - 6.4 summarize the results of the water quality analyses, which are evaluated towards the most recent edition of the *Guidelines for Canadian Drinking Water Quality* (Health Canada 2017). For more information about the specific meaning of the various constituents (parameters) we refer to the on-line summary table by Health Canada:

<https://www.canada.ca/en/health-canada/services/environmental-workplace-health/reports-publications/water-quality/guidelines-canadian-drinking-water-quality-summary-table.html>

Results of the water analysis for the four replacement wells suggest that the water quality meets the requirements stated in the most recent edition of the *Guidelines for Canadian Drinking Water Quality* (Health Canada 2017)⁵. Operational Guidelines (OG) apply to water treatment plants. The manganese concentration analyzed for the water sample collected from RW 1-87/14 (0.05 mg/l) suggests that the value is at threshold level.

The water quality results for the reservoir are similar to the results for the replacement wells (water chemistry and physical parameters). However, the reservoir water sample exceeded Maximum Acceptable Concentration (MAC) for *Total coliform bacteria* (a count of 1.0 MPN / 100 ml). Further water sampling for Reservoir C (as part of the weekly microbiological testing for selected points in the water system) showed zero count for *Total coliform bacteria*, and thus below MAC⁶. Therefore, there is no concern with the water quality of Reservoir C.

Furthermore, pH values for RW 3-93/11 and RW 7-00/13 (6.75 and 6.97, respectively) suggest that the sampled water falls within the acidic (< 7.0). The pH values for RW 1-87/14 and RW 2-63/17 are 7.44 and 7.82, respectively, which suggest that the sampled water falls within the basic range (pH > 7.0).

Turbidity values range between 0.15 NTU (RW 1-87/14) and 0.28 NTU (RW 3-93/11). These numbers are not of any concern for the water system as they are well below 1.0 NTU⁷.

⁵ The Guidelines for Canadian Drinking Water Quality Summary Table (February 2017), available at <https://www.canada.ca>, provides information for the various water quality parameters (pertain to guideline limit, common sources (of the parameter), and health considerations).

⁶ CWD Water Quality Technician completed in-house microbiological analyzes for samples collected on Dec. 20, 2017, and on January 17, 2018 (those samples were analyzed for *Total coliform* and *Escherichia coli*).

⁷ For information: Health Canada has set water treatment limits regarding turbidity (not applicable to CWD's water system). For systems that use groundwater that is not under the direct influence of surface water, which are considered less vulnerable to fecal contamination, turbidity should generally be below 1.0 NTU (Health Canada 2012).

In summary:

BASED ON THE RESULTS OF THE WATER QUALITY ANALYSIS OUR DRINKING WATER IS SAFE AND DOES NOT REQUIRE WATER TREATMENT.

TABLE 6.1 PHYSICAL PARAMETERS

Parameter	RW 3-93/11	RW 7-00/13	RW 1-87/14	RW 2-63/17	Reservoir*	Canadian	Units	Guideline comment	
						Drinking Water Guidelines			
Sample date	18/12/17	18/12/17	2/2/18	18/12/17	26/05/2017	18/12/17			
Lot ID	1245604	1245604	1252607	1245604	1204487	1245604			
Reference No.	1245604-2	1245604-3	1252607-1	1245604-1	-	1245604-4			
Report No.	2253686	2253686	2261723	2253686	2193406	2253686			
pH (at 25°C)	6.75	6.36	6.97	7.44	7.82	7.25	7.0-10.5	---	OG
Total dissolved solids (TDS)	139	180	131	184	133	154	500	mg/l	AO
Electric conductivity	278	201	187	293	255	236	<i>no guideline set</i>	µS/cm at 25 °C	-
Turbidity	0.28	0.62	0.19	0.15	0.5	0.11	0.1	NTU	OG
Colour	< 5	< 5	< 5	< 5	5	< 5	<i>no guideline set</i>	Colour units	AO
Hardness (CaCO₃)	110	77	74	128	104	96	<i>no guideline set</i>	mg/l	-

AO = Aesthetic Objective; OG = Operational Guideline for Water Treatment Plants

* The incoming water to the reservoirs is sampled in the pump station.

[value]: outside OG range (pH) or exceeding OG (Turbidity)

TABLE 6.2 METALS (EXTRACTABLE)

Metal Extractable	Symbol	Canadian Drinking Water Guidelines						Units	Guideline comment	
		RW 3-93/11	RW 7-00/13	RW 1-87/14	RW 2-63/17	Reservoir*	Reservoir*			
Sample date		18/12/17	18/12/17	2/2/18	18/12/17	26/05/2017	18/12/17			
Lot ID		1245604	1245604	1252607	1245604	1204487	1245604			
Reference No.		1245604-2	1245604-3	1252607-1	1245604-1	-	1245604-4			
Report No.		2253686	2253686	2261723	2253686	2193406	2253686			
Aluminium	Al	<0.001	0.064	0.001	0.00100	0.007	0.003	0.1	mg/l	OG
Antimony	Sb	0.00003	0.00009	0.00003	0.00011	<0.0002	0.00009	0.006	mg/l	MAC
Arsenic	As	0.0003	0.0005	0.0003	0.0014	0.0007	0.0007	0.01	mg/l	MAC
Barium	Ba	0.0079	0.0095	0.0053	0.0247	0.01	0.0107	1	mg/l	MAC
Boron	Ba	0.02	0.013	0.011	0.027	0.020	0.018	5	mg/l	MAC
Cadmium	Cd	0.00003	0.00013	0.00002	0.00002	0.00002	0.00001	0.005	mg/l	MAC
Chromium	Cr	0.00007	0.00235	0.00026	<0.00005	<0.0005	<0.00005	0.05	mg/l	MAC
Copper	Cu	0.0006	0.0050	0.0015	<0.0005	<0.001	<0.0005	1	mg/l	AO
Lead	Pb	0.00022	0.00017	0.00012	<0.00001	0.0005	0.00003	0.01	mg/l	MAC
Molybdenum	Mo	-	-	-	-	<0.001	-	-	mg/l	-
Nickel	Ni	-	-	-	-	0.0007	-	-	mg/l	-
Selenium	Se	0.0003	0.0014	0.0002	<0.0002	0.0005	0.0005	0.01	mg/l	MAC
Silver	Ag	-	-	-	-	<0.00001	-	-	mg/l	-
Uranium	U	0.00005	0.0002	0.00002	0.00046	<0.0005	0.000150	0.02	mg/l	MAC
Vanadium	V	0.00049	0.00056	0.00065	0.00053	-	0.00049	<i>no guideline set</i>	mg/l	-
Zinc	Zn	0.0086	0.0194	0.0179	<0.0005	0.024	<0.0005	5	mg/l	AO
Calcium	Ca	32	22	21	36	29.2	27	<i>no guideline set</i>	mg/l	-
Iron	Fe	0.053	0.094	0.004	0.014	0.02	0.008	0.3	mg/l	AO
Magnesium	Mg	7.6	5.2	5.2	9.5	7.5	6.9	<i>no guideline set</i>	mg/l	-
Manganese	Mn	0.003	0.47	0.003	0.050	0.010	0.003	0.05	mg/l	AO
Potassium	K	1.6	1.3	1.1	2.7	1.9	1.7	<i>no guideline set</i>	mg/l	-
Silicon	Si	10	11	10	7.2	-	8.8	<i>no guideline set</i>	mg/l	-
Sodium	Na	9.8	7.0	6.7	12.0	9.5	9.0	200	mg/l	AO

MAC = Maximum Acceptable Concentration; OG = Operational Guideline; AO = Aesthetic Objective.

* The incoming water to the reservoirs is sampled in the pump station.

exceeding AO
 at AO threshold

TABLE 6.3 MISCELLANEOUS PARAMETERS: INORGANICS, ANIONS AND NITROGENS

Parameter	Symbol / Chemical Formula	Reservoir*						Canadian Drinking Water Guidelines	Units	Guideline comment
		RW 3-93/11	RW 7-00/13	RW 1-87/14	RW 2-63/17	Reservoir*	Reservoir*	Reservoir*	Reservoir*	Reservoir*
Sample date		18/12/17	18/12/17	2/2/18	18/12/17	26/05/2017	18/12/17			
Lot ID		1245604	1245604	1252607	1245604	1204487	1245604			
Reference		1245604-2	1245604-3	1252607-1	1245604-1	-	1245604-4			
Report No.		2253686	2253686	2261723	2253686	2193406	2253686			
Inorganics										
Alkalinity (total)	CaCO ₃	52	34	43	112	80.6	68	<i>no guideline set</i>	mg/l	-
Fluoride	F ⁻	0.02	0.03	0.02	0.03	< 0.05	0.02	1.5	mg/l	MAC
Anions										
Sulphate - dissolved	SO ₄ ²⁻	21.3	15.6	14.6	25.2	23 (extracted)	22.3	500	mg/l	AO
Dissolved chloride	Cl ⁻	40.8	25.7	17.4	11.6	13.6	16.8	250	mg/l	AO
Nitrogens (N)										
Nitrate - N	NO ₃ ⁻	1.74	2.37	2.33	0.03	0.83	1.18	10.0	mg/l	MAC
Nitrite - N	NO ₂ ⁻	< 0.01	< 0.01	< 0.01	< 0.01	0.006	< 0.01	1.0	mg/l	MAC

MAC = Maximum Acceptable Concentration; AO = Aesthetic Objective.

* The incoming water to the reservoirs is sampled in the pump station.

TABLE 6.4 MICROBIOLOGICAL PARAMETERS

Parameter	Reservoir*						Canadian Drinking Water Guidelines	Units	Guideline comment
	RW 3-93/11	RW 7-00/13	RW 1-87/14	RW 2-63/17	Reservoir*	Reservoir*	Reservoir*	Reservoir*	Reservoir*
Sample date	18/12/17	18/12/17	2/2/18	18/12/17	26/05/2017	18/12/17			
Lot ID	1245604	1245604	1252607	1245604	1204487	1245604			
Reference No.	1245604-2	1245604-3	1252607-1	1245604-1	-	1245604-4			
Report No.	2253686	2253686	2261723	2253686	2193406	2253686			
Total coliform bacteria	< 1.0	< 1.0	-	< 1.0	< 1.0	1.0	0 MPN / 100 ml	MPN / ml	MAC
Escherichia coliform bacteria subgroup (E. Coli)	< 1.0	< 1.0	-	< 1.0	< 1.0	< 1.0	0 MPN / 100 ml	MPN / ml	MAC
Heterotrophic Count - Aerobic	< 2.0	< 2.0	-	80.0	< 2.0	35.0	<i>no guideline set</i>	MPN / ml	-

MAC = Maximum Acceptable Concentration.

* The incoming water to the reservoirs is sampled in the pump station.

 Exceeds MAC

6.3 Hardness of Our Drinking Water

The water quality results for hardness (as calcium carbonate or CaCO_3)⁸ are:

- ✓ RW 3-93/11: 110 mg/l
- ✓ RW 7-00/13: 74 mg/l
- ✓ RW 2-63/17 (104 mg/l);
- ✓ RW 1-87/14 (128 mg/l)⁹.

The following classification applied (Health Canada 1979, reprinted 1995): **soft:** 0 to <60 mg/L; **medium hard:** 60 to <120 mg/L; **hard:** 120 to < 180 mg/L; and very hard, 180 mg/L and above. See side bar for further information about concentrations > 200 mg/L.

Hardness levels between 80 and 100 mg/L (as CaCO_3) are generally considered to provide an acceptable balance between corrosion and incrustation (Health Canada 1979).

Figure 6.1 (next page) summarizes historical hardness data for the production wells. The results suggest that overall our groundwater is classified within the medium hard range.

BASED ON THE ASSESSMENT OF HARDNESS (AS CaCO_3) OUR DRINKING WATER DOES NOT REQUIRE WATER SOFTENERS.

About Hardness in Water (Health Canada 1979, reprinted 1995):

Water hardness is a traditional measure of the capacity of water to react with soap. Hard water requires a considerable amount of soap to produce a lather, and it also leads to scaling of hot water pipes, boilers and other household appliances.

Although hardness may have significant aesthetic effects, a maximum acceptable level has not been established because public acceptance of hardness may vary considerably according to the local conditions. Water supplies with hardness greater than 200 mg/L are considered poor but have been tolerated by consumers; those in excess of 500 mg/L are unacceptable for most domestic purposes. Because water softening by sodium ion exchange may introduce undesirably high quantities of sodium into drinking water, it is recommended that where such a process is employed, a separate unsoftened supply be retained for drinking and culinary purposes.

⁸ Hardness is evaluated based on the concentration of calcium carbonate (CaCO_3) because calcium (Ca^{2-}) and carbonate (CO_3^{2-}) are the dominant ions in most hard waters.

⁹ Moderately hard water: 60 mg/l to < 120 mg/l; hard water: 120 to < 180 mg/l.

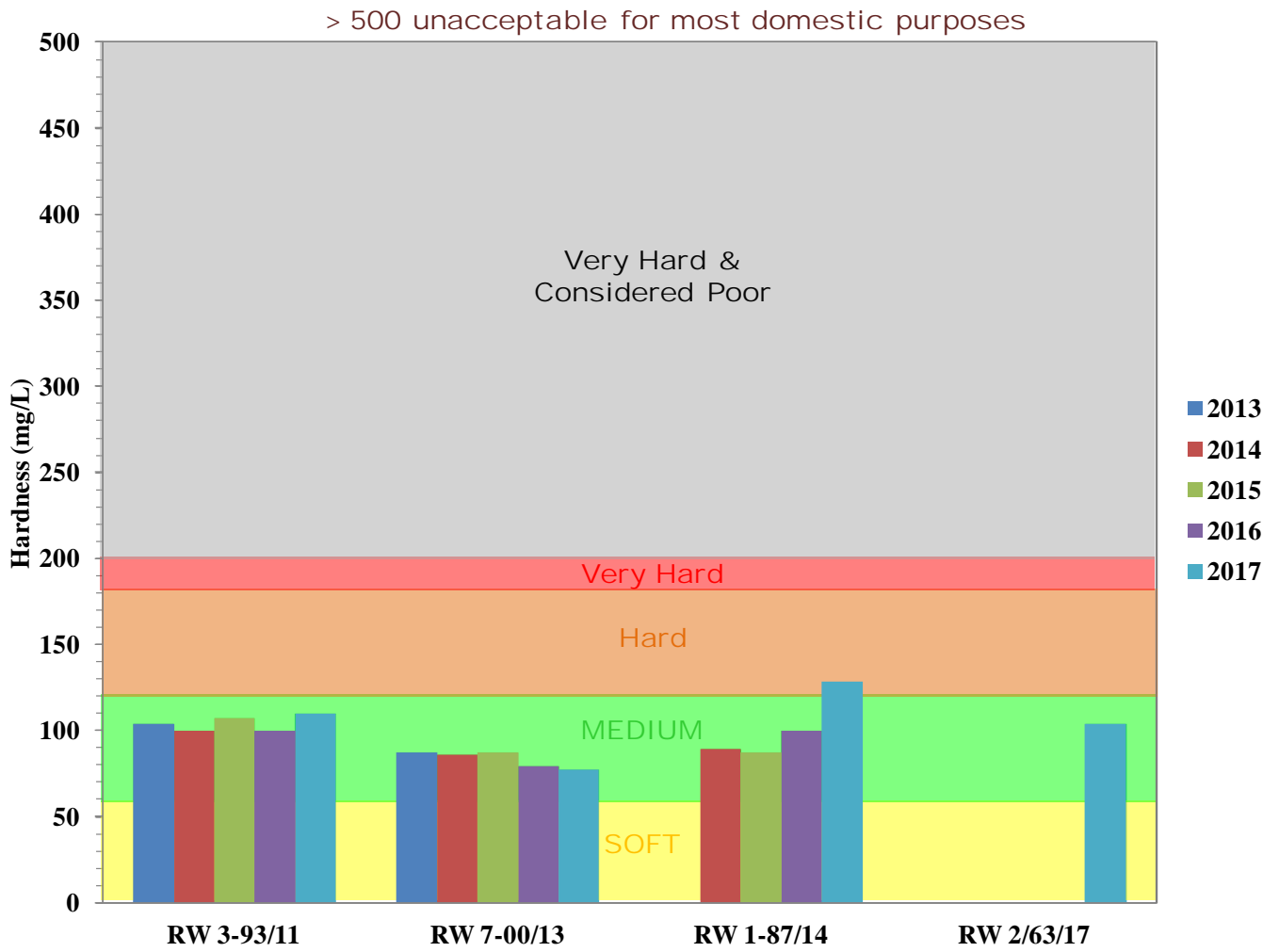


FIGURE 6.1 | HISTORICAL TRENDS IN HARDNESS OF OUR DRINKING WATER (2013-2017).

6.4 Biological Activity Reaction Test (BART)

BART is a method to analyze several bacterial communities that can cause problems for water quality (e.g. turbidity), aesthetics (e.g. odour, discoloration, cloudiness) and water infrastructure (e.g. corrosion). The following bacterial communities were analyzed twice a year (in spring and fall) for each production well: (i) **Iron Related Bacteria (IRB)**; **Sulphate Reducing Bacteria (SRB)**; **Slime Forming Bacteria (SLYM)**; **Heterotrophic Aerobic Bacteria (HAB)**.

1. **IRB**: cause taste and odour problems and “red water”. This leads to staining of plumbing fittings and laundry; IRB can provide a place in wells for other bacteria to live, can increase corrosion, and can cause encrustation of well screens and pumps;
2. **SRB**: a group of anaerobic bacteria that generate hydrogen sulphide (H_2S) and cause a number of significant problems in water, ranging from “rotten egg” odours to the blackening of equipment, slime formations, and the initiation of corrosive processes;
3. **SLYM**: create slimes, turbidity, foul tastes and odours; and
4. **HAB**: one form is aerobes, which removes organics quickly, and one form is fermentors (anaerobic) that make acids (very low pH).

Appendix D includes a brief explanation for each tested bacterial community, data collection protocol. **Figures 6.2 – 6.5** summarize the results (charts) using color coding in terms of level of aggressivity of each bacteria for each well: in the well (inner circle), near the well screen (middle circle), and in the geological formation (outer circle). The charts were created using BART-SOFT-v.6 (Droycon Bioconcepts Inc.), and were prepared by CWD’s Water Quality Technician (Ryan Federau).

Results suggest that high aggressivity was only observed for IRB for RW 1-87/14 and RW 2-63/17 during the testing in fall. However, reported concentrations for all samples classified as having “high aggressivity” are 2,200 PAC/ml which is borderline with moderate aggressivity. We suspect that the recent well construction activities and prolonged period of downtime for RW 2-63/17 may have an impact on the observed IRB communities. No actions are required at this point, but vigilance through an ongoing testing program should be practiced.

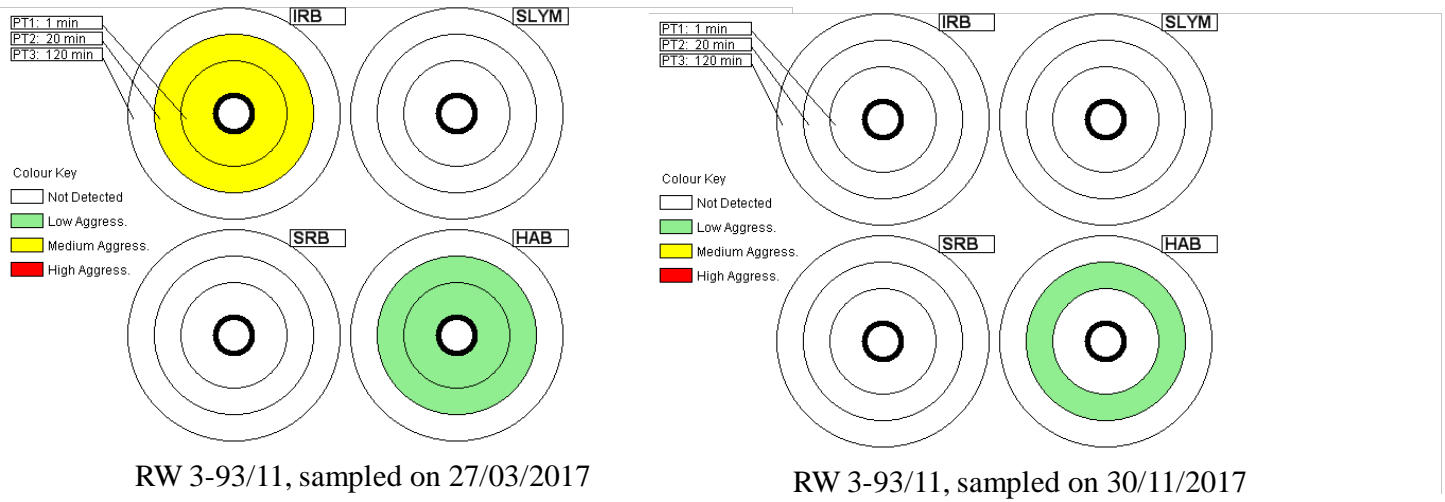


FIGURE 6.2 | BART RESULTS FOR RW 3-93/11.

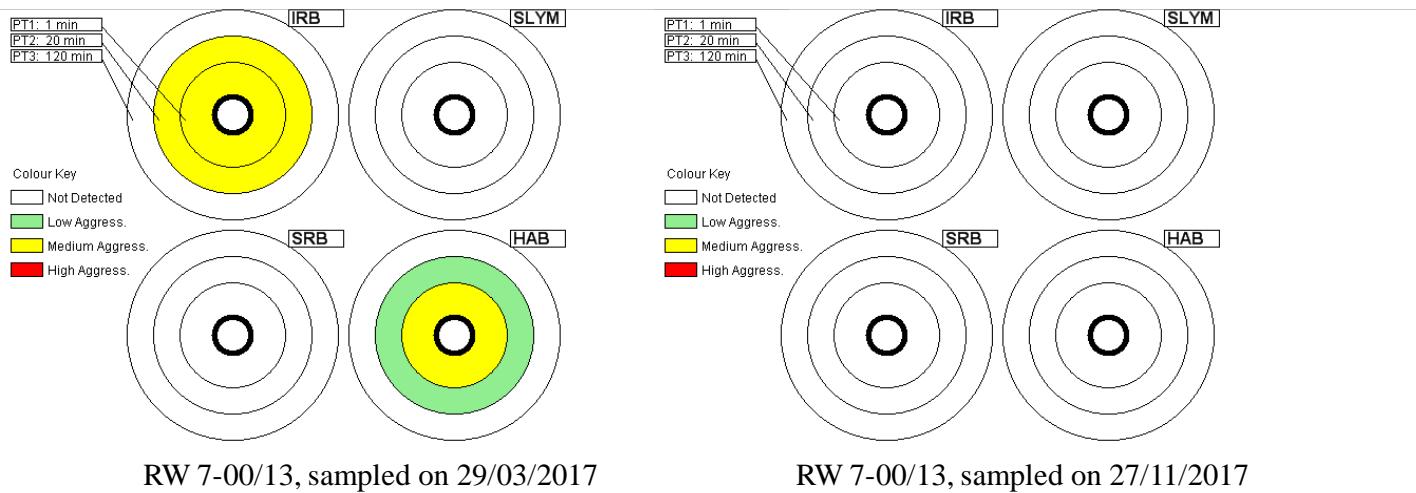


FIGURE 6.3 | BART RESULTS FOR RW 7-00/13.

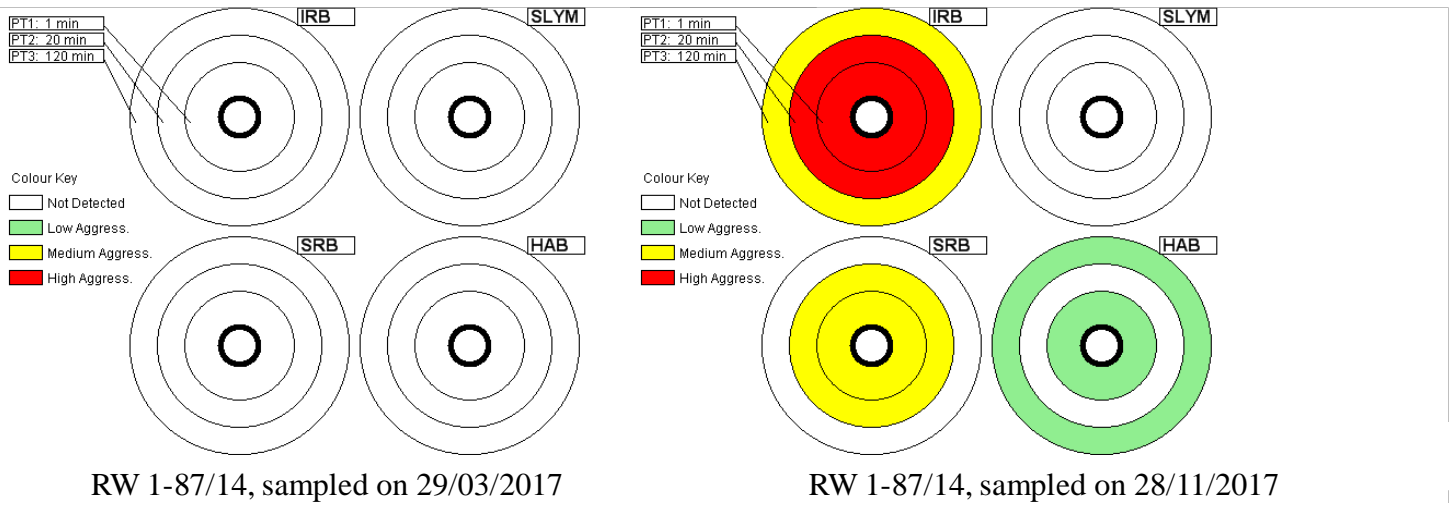


FIGURE 6.4 | BART RESULTS FOR RW 1-87/14.

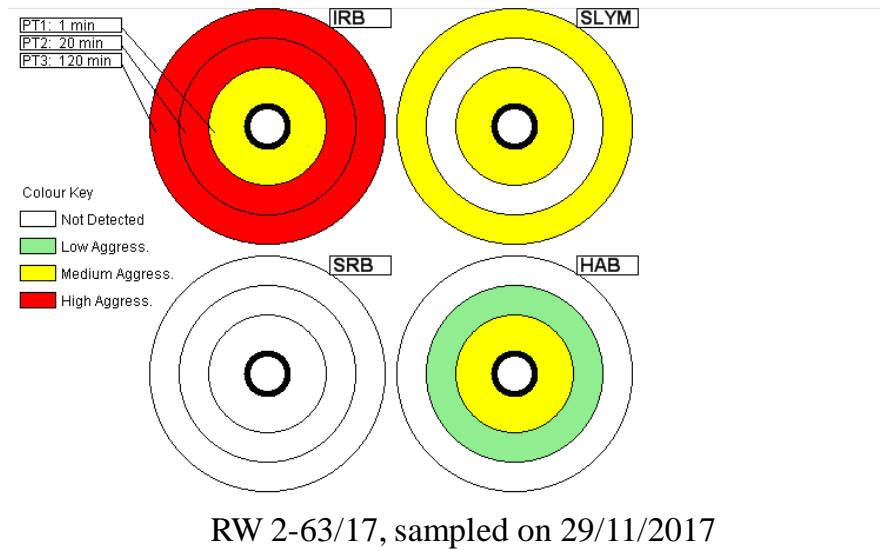


FIGURE 6.5 | BART RESULTS FOR RW 2-63/17.

7.0 References

AWWA. 2015. A100-15 Water Wells. American Water Works Association. 94 pp.

DBI. 2004. Biological Activity Reaction Test (BART™). User Manual. Droycon Bioconcepts Inc., Regina, Saskatchewan, Canada. Available at: <http://www.dbi.ca>.

Government of British Columbia. 2001. Drinking Water Protection Act. Assented to April 11, 2001. Available at: <http://www.bclaws.ca>.

Government of British Columbia. 2003. Drinking Water Protection Regulation. Deposited May 16, 2003; *B.C. Reg. 200/2003, O.C. 508/2003*. Available at: <http://www.bclaws.ca>.

Government of British Columbia. 2014. Water Sustainability Act (WSA). Assented to May 29, 2014. Available at: <http://www.bclaws.ca>.

Government of British Columbia. 2016a. Water Sustainability Regulation. Deposited February 29, 2016. *B.C. Reg. 36/2016, O.C. 110/2016*. Available at: <http://www.bclaws.ca>.

Government of British Columbia. 2016b. Ground Water Protection Regulation (GWPR). Deposited February 29, 2016; *B.C. Reg. 39/2016, O.C. 113/2016*. Available at: <http://www.bclaws.ca>.

Health Canada. 1979. Hardness - Technical Document, February 1979 (reprinted 1995). Available at: <http://www.hc-sc.gc.ca>.

Health Canada. 2012. Turbidity – Technical Document, December 2012.

Health Canada. 2017. Guidelines for Canadian Drinking Water Quality. Summary table. Drinking Water Guidelines. *Prepared by the Federal-Provincial-Territorial Committee on Drinking Water of the Federal-Provincial-Territorial Committee on Health and the Environment*. Available at <http://www.hc-sc.gc.ca> (*most recent update of on-line version: February 2017*).

Appendices

Appendix A

Metals in Drinking Water “Flush”
Message from Fraser Health
Authority



fraserhealth Better health.
Best in health care.

January 22, 2018

Water System Operators

Re: Metals in Drinking Water – “Flush” Message in Annual Reports

Anytime the water in a particular faucet has not been used for six hours or longer, "flush" your cold-water pipes by running the water until you notice a change in temperature. (This could take as little as five to thirty seconds if there has been recent heavy water use such as showering or toilet flushing. Otherwise, it could take two minutes or longer.) The more time water has been sitting in your home's pipes, the more lead it may contain.

Use only water from the cold-tap for drinking, cooking, and especially making baby formula. Hot water is likely to contain higher levels of lead.

The two actions recommended above are very important to the health of your family. They will probably be effective in reducing lead levels because most of the lead in household water usually comes from the plumbing in your house, not from the local water supply.

Conserving water is still important. Rather than just running the water down the drain you could use the water for things such as watering your plants.

If you have any questions, please contact our Drinking Water Program at 604-870-7903 or 1-866-749-7900.

Sincerely,

Marc Zubeł
Manager, Drinking Water Program
Health Protection

Appendix B

Sample Range Report
Fraser Health Authority

Sample Range Report

Fraser Health Authority

Facility Name: Clearbrook Waterworks District

Date Range: Jan 1 2017 to Dec 31 2017

<u>Sampling Site</u>	<u>Date Collected</u>	<u>Total Coliform</u>	<u>E. Coli</u>	<u>Fecal Coliform</u>
<u>2580 Langdon St -</u>				
<u>East end of</u>				
<u>driveway, 2580</u>				
<u>Langdon St - East</u>				
<u>end of driveway</u>				
	1/16/2017	L1	L1	
	2/20/2017	L1	L1	
	3/20/2017	L1	L1	
	4/24/2017	L1	L1	
	5/29/2017	L1	L1	
	6/27/2017	L1	L1	
	7/31/2017	L1	L1	
	9/5/2017	L1	L1	
	10/2/2017	L1	L1	
	11/6/2017	L1	L1	
	12/12/2017	<u>L1</u>	<u>L1</u>	
	Total Positive:	0	0	0
<u>2889 Upland Cres.</u>				
<u>2889 Upland Cres</u>				
	1/3/2017	L1	L1	
	2/14/2017	L1	L1	
	3/27/2017	L1	L1	
	5/8/2017	L1	L1	
	6/19/2017	L1	L1	
	7/31/2017	L1	L1	
	9/11/2017	L1	L1	
	10/23/2017	L1	L1	
	12/4/2017	<u>L1</u>	<u>L1</u>	
	Total Positive:	0	0	0
<u>AUDIT - 2743</u>				
<u>Moorland Street,</u>				
<u>2743 Moorland</u>				
<u>Street</u>				
	6/27/2017	<u>L1</u>	<u>L1</u>	
	Total Positive:	0	0	0

2564 Clearbrook Rd.
(Office), 2564
Clearbrook Road

1/9/2017	L1	L1	
2/6/2017	L1	L1	
3/13/2017	L1	L1	
4/18/2017	L1	L1	
5/23/2017	L1	L1	
6/19/2017	L1	L1	
7/24/2017	L1	L1	
8/28/2017	L1	L1	
9/26/2017	L1	L1	
10/30/2017	L1	L1	
12/4/2017	<u>L1</u>	<u>L1</u>	
Total Positive:	0	0	0

2743 Moorland St.
2743 Moorland St

2/6/2017	L1	L1	
3/20/2017	L1	L1	
5/1/2017	L1	L1	
6/12/2017	L1	L1	
7/24/2017	L1	L1	
9/5/2017	L1	L1	
10/16/2017	1	L1	
11/27/2017	<u>1</u>	<u>L1</u>	
Total Positive:	2	0	0

AUDIT - 32171
South Fraser .
32171 South Fraser

6/26/2017	<u>L1</u>	<u>L1</u>	
Total Positive:	0	0	0

AUDIT - 2889
Upland Cres, 2889
Upland Cres

6/27/2017	<u>L1</u>	<u>L1</u>	
Total Positive:	0	0	0

32171 South Fraser
Way (Petro
Canada), 32171
South Fraser Way
(Petro Canada)

1/23/2017	L1	L1	
3/7/2017	L1	L1	
4/3/2017	L1	L1	
5/1/2017	L1	L1	
6/12/2017	L1	L1	
7/10/2017	L1	L1	
8/8/2017	L1	L1	

9/11/2017	L1	L1	
10/16/2017	L1	L1	
11/14/2017	A		
12/18/2017	<u>L1</u>	<u>L1</u>	
Total Positive:	0	0	0

31419 Springhill Court, 31419 Springhill Court

1/23/2017	L1	L1	
2/20/2017	L1	L1	
4/3/2017	L1	L1	
5/15/2017	L1	L1	
6/27/2017	L1	L1	
8/8/2017	L1	L1	
9/18/2017	L1	L1	
10/30/2017	L1	L1	
12/12/2017	<u>L1</u>	<u>L1</u>	
Total Positive:	0	0	0

3089 Claudia Court, 3089 Claudia Court

1/3/2017	L1	L1	
1/31/2017	L1	L1	
3/7/2017	L1	L1	
4/10/2017	L1	L1	
5/8/2017	L1	L1	
6/12/2017	L1	L1	
7/18/2017	L1	L1	
8/14/2017	L1	L1	
9/18/2017	L1	L1	
10/23/2017	L1	L1	
11/20/2017	<u>L1</u>		
Total Positive:	0	0	0

AUDIT - 2459 Center Street (at United Rentals), 2459 Center Street

6/27/2017	<u>L1</u>	<u>L1</u>	
Total Positive:	0	0	0

AUDIT - 3089 Claudia Court, 3089 Claudia Court

6/27/2017	<u>L1</u>	<u>L1</u>	
Total Positive:	0	0	0

AUDIT - 32073 Mt. Waddington Avenue, 32073 Mt.

Waddington Avenue

6/26/2017	<u>L1</u>	<u>L1</u>	
Total Positive:	0	0	0

31898 Royal
Crescent, 31898
Royal Crescent

1/31/2017	L1	L1	
2/27/2017	L1	L1	
4/3/2017	L1	L1	
5/8/2017	L1	L1	
6/5/2017	L1	L1	
7/10/2017	L1	L1	
8/14/2017	L1	L1	
9/11/2017	L1	L1	
10/16/2017	L1	L1	
11/20/2017	T		
12/18/2017	<u>L1</u>	<u>L1</u>	
Total Positive:	0	0	0

31894 Duchess Ave.,
31894 Duchess Ave

1/16/2017	L1	L1	
2/14/2017	L1	L1	
3/20/2017	L1	L1	
4/24/2017	L1	L1	
5/23/2017	L1	L1	
6/27/2017	L1	L1	
7/31/2017	L1	L1	
8/28/2017	L1	L1	
10/2/2017	L1	L1	
11/6/2017	L1	L1	
12/4/2017	<u>L1</u>	<u>L1</u>	
Total Positive:	0	0	0

2749 Braeside
Street, 2749
Braeside Street

1/31/2017	L1	L1	
2/27/2017	L1	L1	
4/10/2017	L1	L1	
5/23/2017	L1	L1	
7/4/2017	L1	L1	
8/14/2017	L1	L1	
9/26/2017	L1	L1	
11/6/2017	L1	L1	
12/18/2017	<u>L1</u>	<u>L1</u>	
Total Positive:	0	0	0

32073 Mt
Waddington Ave.,
32073 Mt

Waddington Ave

1/16/2017	L1	L1	
2/20/2017	L1	L1	
3/27/2017	1	L1	
4/24/2017	L1	L1	
5/29/2017	1	L1	
7/4/2017	1	L1	
7/31/2017	L1	L1	
9/5/2017	L1	L1	
10/10/2017	L1	L1	
11/6/2017	L1	L1	
12/12/2017	<u>L1</u>	<u>L1</u>	
Total Positive:	3	0	0

2903 Palm Crescent,
2903 Palm Crescent

1/23/2017	L1	L1	
2/20/2017	L1	L1	
3/27/2017	L1	L1	
5/1/2017	L1	L1	
5/29/2017	L1	L1	
7/4/2017	L1	L1	
8/8/2017	L1	L1	
9/5/2017	L1	L1	
10/10/2017	L1	L1	
11/14/2017	A		
12/12/2017	<u>L1</u>	<u>L1</u>	
Total Positive:	0	0	0

32350 Diamond
Cres. 32350
Diamond Cres

1/9/2017	L1	L1	
2/6/2017	L1	L1	
2/27/2017	L1	L1	
3/13/2017	L1	L1	
4/3/2017	L1	L1	
4/18/2017	L1	L1	
5/8/2017	L1	L1	
5/15/2017	L1	L1	
6/5/2017	L1	L1	
6/19/2017	L1	L1	
7/24/2017	L1	L1	
8/22/2017	L1	L1	
9/26/2017	L1	L1	
10/30/2017	L1	L1	
11/27/2017	<u>L1</u>	<u>L1</u>	
Total Positive:	0	0	0

2940 Clearbrook
Rd.(Bible Col), 2940
Clearbrook Road

1/3/2017	L1	L1	
----------	----	----	--

1/31/2017	L1	L1	
2/6/2017	L1	L1	
3/13/2017	L1	L1	
4/10/2017	L1	L1	
5/15/2017	L1	L1	
6/19/2017	L1	L1	
7/18/2017	L1	L1	
8/22/2017	L1	L1	
9/26/2017	L1	L1	
10/23/2017	L1	L1	
11/27/2017	<u>L1</u>	<u>L1</u>	
Total Positive:	0	0	0

AUDIT - 32350
Diamond Crescent.
32350 Diamond
Crescent

6/26/2017	<u>L1</u>	<u>L1</u>	
Total Positive:	0	0	0

2464 Sunnyside
Place, 2464
Sunnyside Place

1/9/2017	L1	L1	
3/13/2017	L1	L1	
4/24/2017	L1	L1	
6/5/2017	L1	L1	
7/18/2017	L1	L1	
8/28/2017	L1	L1	
10/10/2017	L1	L1	
11/20/2017	<u>L1</u>	<u>L1</u>	
Total Positive:	0	0	0

AUDIT - 2464
Sunnyside Place.
2464 Sunnyside
Place

6/27/2017	<u>L1</u>	<u>L1</u>	
Total Positive:	0	0	0

Reservoir C (1985).
2886 Grandview
Cres

1/31/2017	L1	L1	
4/3/2017	L1	L1	
6/5/2017	L1	L1	
7/31/2017	L1	L1	
10/2/2017	L1	L1	
12/4/2017	<u>L1</u>	<u>L1</u>	
Total Positive:	0	0	0

2664 Albert Way.
2664 Albert Way

1/16/2017	L1	L1	
3/7/2017	L1	L1	
4/18/2017	L1	L1	
5/29/2017	L1	L1	
7/10/2017	L1	L1	
8/22/2017	L1	L1	
10/2/2017	L1	L1	
11/14/2017	<u>A</u>		
Total Positive:	0	0	0

2459 Centre Street
(at United Rentals).
2459 Centre Street
(at United Rentals)

1/3/2017	L1	L1	
2/14/2017	L1	L1	
3/7/2017	L1	L1	
4/10/2017	L1	L1	
5/15/2017	L1	L1	
6/12/2017	L1	L1	
7/18/2017	L1	L1	
8/22/2017	L1	L1	
9/18/2017	L1	L1	
10/23/2017	L1	L1	
11/27/2017	<u>L1</u>	<u>L1</u>	
Total Positive:	0	0	0

2577 Victoria Street.
2577 Victoria St

1/9/2017	L1	L1	
2/14/2017	L1	L1	
3/20/2017	L1	L1	
4/18/2017	L1	L1	
5/23/2017	L1	L1	
6/27/2017	L1	L1	
7/24/2017	L1	L1	
8/28/2017	L1	L1	
10/2/2017	L1	L1	
10/30/2017	L1	L1	
12/4/2017	<u>L1</u>	<u>L1</u>	
Total Positive:	0	0	0

Reservoir B (1970).
2886 Grandview
Cres

1/3/2017	L1	L1	
2/27/2017	L1	L1	
5/1/2017	L1	L1	
7/4/2017	L1	L1	
9/5/2017	L1	L1	
10/30/2017	<u>L1</u>	<u>L1</u>	

Total Positive: 0 0 0

2425 Lynden Street.
2425 Lynden Street

1/23/2017	L1	L1	
2/27/2017	L1	L1	
3/27/2017	L1	L1	
5/1/2017	L1	L1	
6/5/2017	L1	L1	
7/4/2017	L1	L1	
8/8/2017	L1	L1	
9/11/2017	L1	L1	
10/10/2017	L1	L1	
11/14/2017	A		
12/18/2017	<u>L1</u>	<u>L1</u>	
Total Positive:	0	0	0

32138 George
Ferguson Way.
32138 George
Ferguson Way

7/10/2017	C		
8/14/2017	L1	L1	
9/18/2017	L1	L1	
10/16/2017	L1	L1	
11/20/2017	<u>T</u>		
Total Positive:	0	0	0

Result Values: E - estimated L - less than G - greater than

Samples that contain total coliform:	5		2.23% of total
Samples that contain e. coli:	0		0.00% of total
Samples that contain fecal coliform:	0		0.00% of total
Number of consecutive samples that contain total coliform:	2		
Number of samples that contain total coliform in last 30 days:	0/4		
Total number of samples:	224		

Comments:

Environmental Health Officer
Jan 19 2018

FOR FURTHER INFORMATION PLEASE CALL: Barb Haworth (604) 870-7900

Sample Range Report

Fraser Health Authority

Facility Name: Clearbrook Waterworks District

Date Range: Jan 1 2017 to Dec 31 2017

Sampling Site	Date Collected	Total Coliform	E. Coli	Fecal Coliform
<u>RW 3-93, Lynden St</u>				
	1/31/2017	L1	L1	
	5/1/2017	L1	L1	
	7/31/2017	L1	L1	
	10/30/2017	<u>L1</u>	<u>L1</u>	
	Total Positive:	0	0	0

Result Values: **E - estimated** **L - less than** **G - greater than**

Samples that contain total coliform:	0		0.00% of total
Samples that contain e. coli:	0		0.00% of total
Samples that contain fecal coliform:	0		0.00% of total
Number of consecutive samples that contain total coliform:	0		
Number of samples that contain total coliform in last 30 days:	0/0		
Total number of samples:	4		

Comments:

Environmental Health Officer

Jan 19 2018

FOR FURTHER INFORMATION PLEASE CALL: Barb Haworth (604) 870-7900

Sample Range Report

Fraser Health Authority

Facility Name: Clearbrook Waterworks District

Date Range: Jan 1 2017 to Dec 31 2017

Sampling Site	Date Collected	Total Coliform	E. Coli	Fecal Coliform
<u>Well RW 7 - 00/13,</u>				
<u>Lynden St</u>				
	2/27/2017	L1	L1	
	6/5/2017	L1	L1	
	9/5/2017	L1	L1	
	12/4/2017	<u>L1</u>	<u>L1</u>	
	Total Positive:	0	0	0

Result Values: **E - estimated** **L - less than** **G - greater than**

Samples that contain total coliform:	0		0.00% of total
Samples that contain e. coli:	0		0.00% of total
Samples that contain fecal coliform:	0		0.00% of total
Number of consecutive samples that contain total coliform:	0		
Number of samples that contain total coliform in last 30 days:	0/0		
Total number of samples:	4		

Comments:

Environmental Health Officer

Jan 19 2018

FOR FURTHER INFORMATION PLEASE CALL: Barb Haworth (604) 870-7900

Sample Range Report

Fraser Health Authority

Facility Name: Clearbrook Waterworks District

Date Range: Jan 1 2017 to Dec 31 2017

Sampling Site	Date Collected	Total Coliform	E. Coli	Fecal Coliform
<u>RW 1-87-14,</u>				
<u>Autumn Ave</u>				
	1/3/2017	L1	L1	
	4/3/2017	L1	L1	
	7/4/2017	L1	L1	
	10/2/2017	<u>L1</u>	<u>L1</u>	
	Total Positive:	0	0	0

Result Values: E - estimated L - less than G - greater than

Samples that contain total coliform:	0		0.00% of total
Samples that contain e. coli:	0		0.00% of total
Samples that contain fecal coliform:	0		0.00% of total
Number of consecutive samples that contain total coliform:	0		
Number of samples that contain total coliform in last 30 days:	0/0		
Total number of samples:	4		

Comments:

Environmental Health Officer

Jan 19 2018

FOR FURTHER INFORMATION PLEASE CALL: Barb Haworth (604) 870-7900

Appendix C

Exova Water Quality Reports

Report Transmission Cover Page

Bill To: Clearbrook Waterworks District 2564 Clearbrook Road Abbotsford, BC, Canada V2T 2Y5	Project ID: Project Name: Project Location: LSD: P.O.:	Lot ID: 1245604 Control Number: Date Received: Dec 18, 2017 Date Reported: Jan 9, 2018 Report Number: 2255518
Attn: Accounts Payable Sampled By: Company:	Proj. Acct. code:	

Contact	Company	Address
Accounts Payable	Clearbrook Waterworks District	2564 Clearbrook Road Abbotsford, BC V2T 2Y5 Phone: (604) 850-6621 Fax: (604) 850-7862 Email: office@clearbrookwaterworks.com

Delivery	Format	Deliverables
Email - Single Report	PDF	Invoice

Contact	Company	Address
Ineke Kalwij	Kalwij Water Dynamics Inc	P.O. Box 684 Station Main Port Coquitlam, BC V3B 6H9 Phone: (604) 475-4063 Fax: (604) 475-4062 Email: ineke@kalwijwaterdynamics.com

Delivery	Format	Deliverables
Email - Merge Reports	PDF	COC / Test Report
Email - Single Report	PDF	COR

Contact	Company	Address
Ryan Federau	Clearbrook Waterworks District	2564 Clearbrook Road Abbotsford, BC V2T 2Y5 Phone: (604) 309-3986 Fax: (604) 850-7862 Email: ryan@clearbrookwaterworks.com

Delivery	Format	Deliverables
Email - Merge Reports	PDF	COC / Test Report
Email - Single Report	PDF	COA
Email - Single Report	PDF	COR

Notes To Clients:

- Dec 19, 2017 - Sample 1245604-2; 5962073: Reduction of analytical volume was necessary for chloride to bring results within the analytical range for sample 1245604-2. Detection limits are adjusted accordingly.
- Dec 19, 2017 - Reduction of analytical volume was necessary for metals analysis due to matrix effects in sample #1245604-2 for Boron. Detection limits are adjusted accordingly.
- Dec 22, 2017 - Report was issued to include retest result for Manganese analysis on sample 1245604-3 as requested by Ineke on 2017/12/21. Previous Report 2252587.
- Dec 28, 2017 - Sample 1245604-1; 5962072: The analysis of water sample 1245604-1 is below Maximum Acceptable Concentrations for the chemical and bacteriological health related guidelines specified by the February 2017 Guidelines for Canadian Drinking Water Quality for the parameters tested.
- Dec 28, 2017 - Sample 1245604-2; 5962073: The analysis of water sample 1245604-2 is below Maximum Acceptable Concentrations for the chemical and bacteriological health related guidelines specified by the February 2017 Guidelines for Canadian Drinking Water Quality for the parameters tested.
- Dec 28, 2017 - Sample 1245604-3; 5962074: The analysis of water sample 1245604-3 is below Maximum Acceptable Concentrations for the chemical and bacteriological health related guidelines specified by the February 2017 Guidelines for Canadian Drinking Water Quality for the parameters tested.
- Dec 28, 2017 - Sample 1245604-4; 5962075: The Total Coliforms result in sample 1245604-4 exceeded the maximum acceptable concentration (MAC) as specified by the February 2017 Guidelines for Canadian Drinking Water Quality.
- Dec 29, 2017 - Sample 1245604-3; 5962074: Sample 1245604-3: the repeated result for metals analysis did not differ significantly from the original; it is within expected precision of the test.

The information contained on this and all other pages transmitted, is intended for the addressee only and is considered confidential. If the reader is not the intended recipient, you are hereby notified that any use, dissemination, distribution or copy of this transmission is strictly prohibited. If you receive this transmission by error, or if this transmission is not satisfactory, please notify us by telephone.

Analytical Report

Bill To: Clearbrook Waterworks District 2564 Clearbrook Road Abbotsford, BC, Canada V2T 2Y5	Project ID: Project Name: Project Location: LSD: P.O.:	Lot ID: 1245604 Control Number: Date Received: Dec 18, 2017 Date Reported: Jan 9, 2018 Report Number: 2255518
Attn: Accounts Payable Sampled By: Company:	Proj. Acct. code:	

Reference Number	1245604-1
Sample Date	December 18, 2017
Sample Time	09:53
Sample Location	
Sample Description	RW 1-87/14 / 7.9°C
Sample Matrix	Drinking Water

Analyte	Units	Result	Nominal Detection Limit	Guideline Limit	Guideline Comments	
Metals Extractable						
Aluminum	Extractable mg/L	0.001	0.001	0.1	Below OG	
Antimony	Extractable mg/L	0.00011	0.00002	0.006	Below MAC	
Arsenic	Extractable mg/L	0.0014	0.0001	0.010	Below MAC	
Barium	Extractable mg/L	0.0247	0.0001	1	Below MAC	
Boron	Extractable mg/L	0.027	0.002	5	Below MAC	
Cadmium	Extractable mg/L	0.00002	0.00001	0.005	Below MAC	
Chromium	Extractable mg/L	<0.00005	0.00005	0.05	Below MAC	
Copper	Extractable mg/L	<0.0005	0.0005	1.0	Below AO	
Lead	Extractable mg/L	<0.00001	0.00001	0.01	Below MAC	
Selenium	Extractable mg/L	<0.0002	0.0002	0.05	Below MAC	
Uranium	Extractable mg/L	0.00046	0.00001	0.02	Below MAC	
Vanadium	Extractable mg/L	0.00053	0.00005			
Zinc	Extractable mg/L	<0.0005	0.0005	5.0	Below AO	
Microbiological Analysis						
Total Coliforms	Enzyme Substrate Test	MPN/100 mL	<1.0	1.0	0 per 100 mL	Below MAC
Escherichia coli	Enzyme Substrate Test	MPN/100 mL	<1.0	1.0	0 per 100 mL	Below MAC
Heterotrophic Count - Aerobic	SimPlate	MPN/mL	80.0	2		
Physical and Aggregate Properties						
Colour	True	Colour units	<5	5		
Turbidity		NTU	0.15	0.05		
Routine Water						
pH - Holding Time			Exceeded			
pH	at 25 °C		7.44		7.0-10.5	Within Range
Electrical Conductivity		µS/cm at 25 °C	293	1		
Calcium	Extractable	mg/L	36	0.01		
Iron	Extractable	mg/L	0.014	0.004	0.3	Below AO
Magnesium	Extractable	mg/L	9.5	0.02		
Manganese	Extractable	mg/L	0.050	0.001	0.05	Above AO
Potassium	Extractable	mg/L	2.7	0.04		
Silicon	Extractable	mg/L	7.2	0.005		
Sodium	Extractable	mg/L	12	0.1	200	Below AO
T-Alkalinity	as CaCO3	mg/L	112	5		
Chloride	Dissolved	mg/L	11.6	0.05	250	Below AO
Fluoride	Dissolved	mg/L	0.03	0.01	1.5	Below MAC
Nitrate - N	Dissolved	mg/L	0.03	0.01	10	Below MAC
Nitrite - N	Dissolved	mg/L	<0.01	0.01	1	Below MAC
Sulfate (SO4)	Dissolved	mg/L	25.2	0.1	500	Below AO

Analytical Report

Bill To: Clearbrook Waterworks District 2564 Clearbrook Road Abbotsford, BC, Canada V2T 2Y5 Attn: Accounts Payable Sampled By: Company:	Project ID: Project Name: Project Location: LSD: P.O.: Proj. Acct. code:	Lot ID: 1245604 Control Number: Date Received: Dec 18, 2017 Date Reported: Jan 9, 2018 Report Number: 2255518
---	---	--

Reference Number	1245604-1
Sample Date	December 18, 2017
Sample Time	09:53
Sample Location	
Sample Description	RW 1-87/14 / 7.9°C
Sample Matrix	Drinking Water

Analyte		Units	Result	Nominal Detection Limit	Guideline Limit	Guideline Comments
Routine Water - Continued						
Hardness	as CaCO3 (extractable)	mg/L	128	1		
Total Dissolved Solids	Extractable	mg/L	184	1		

Analytical Report

Bill To: Clearbrook Waterworks District
 2564 Clearbrook Road
 Abbotsford, BC, Canada
 V2T 2Y5
 Attn: Accounts Payable
 Sampled By:
 Company:

Project ID:
 Project Name:
 Project Location:
 LSD:
 P.O.:
 Proj. Acct. code:

Lot ID: **1245604**
 Control Number:
 Date Received: Dec 18, 2017
 Date Reported: Jan 9, 2018
 Report Number: 2255518

Reference Number 1245604-2
Sample Date December 18, 2017
Sample Time 09:05
Sample Location
Sample Description RW 3-93/11 / 7.9°C
Sample Matrix Drinking Water

Analyte	Units	Result	Nominal Detection Limit	Guideline Limit	Guideline Comments	
Metals Extractable						
Aluminum	Extractable mg/L	<0.001	0.001	0.1	Below OG	
Antimony	Extractable mg/L	0.00003	0.00002	0.006	Below MAC	
Arsenic	Extractable mg/L	0.0003	0.0001	0.010	Below MAC	
Barium	Extractable mg/L	0.0079	0.0001	1	Below MAC	
Boron	Extractable mg/L	0.02	0.002	5	Below MAC	
Cadmium	Extractable mg/L	0.00003	0.00001	0.005	Below MAC	
Chromium	Extractable mg/L	0.00007	0.00005	0.05	Below MAC	
Copper	Extractable mg/L	0.0006	0.0005	1.0	Below AO	
Lead	Extractable mg/L	0.00022	0.00001	0.01	Below MAC	
Selenium	Extractable mg/L	0.0003	0.0002	0.05	Below MAC	
Uranium	Extractable mg/L	0.00005	0.00001	0.02	Below MAC	
Vanadium	Extractable mg/L	0.00049	0.00005			
Zinc	Extractable mg/L	0.0086	0.0005	5.0	Below AO	
Microbiological Analysis						
Total Coliforms	Enzyme Substrate Test	MPN/100 mL	<1.0	1.0	0 per 100 mL	Below MAC
Escherichia coli	Enzyme Substrate Test	MPN/100 mL	<1.0	1.0	0 per 100 mL	Below MAC
Heterotrophic Count - Aerobic	SimPlate	MPN/mL	<2.0	2		
Physical and Aggregate Properties						
Colour	True	Colour units	<5	5		
Turbidity		NTU	0.28	0.05		
Routine Water						
pH - Holding Time			Exceeded			
pH	at 25 °C		6.75		7.0-10.5	Below Range
Electrical Conductivity		µS/cm at 25 °C	278	1		
Calcium	Extractable	mg/L	32	0.01		
Iron	Extractable	mg/L	0.053	0.004	0.3	Below AO
Magnesium	Extractable	mg/L	7.6	0.02		
Manganese	Extractable	mg/L	0.003	0.001	0.05	Below AO
Potassium	Extractable	mg/L	1.6	0.04		
Silicon	Extractable	mg/L	10	0.005		
Sodium	Extractable	mg/L	9.8	0.1	200	Below AO
T-Alkalinity	as CaCO3	mg/L	52	5		
Chloride	Dissolved	mg/L	40.8	0.05	250	Below AO
Fluoride	Dissolved	mg/L	0.02	0.01	1.5	Below MAC
Nitrate - N	Dissolved	mg/L	1.74	0.01	10	Below MAC
Nitrite - N	Dissolved	mg/L	<0.01	0.01	1	Below MAC
Sulfate (SO4)	Dissolved	mg/L	21.3	0.1	500	Below AO

Analytical Report

Bill To: Clearbrook Waterworks District	Project ID:	Lot ID: 1245604
2564 Clearbrook Road	Project Name:	Control Number:
Abbotsford, BC, Canada	Project Location:	Date Received: Dec 18, 2017
V2T 2Y5	LSD:	Date Reported: Jan 9, 2018
Attn: Accounts Payable	P.O.:	Report Number: 2255518
Sampled By:	Proj. Acct. code:	
Company:		

Reference Number	1245604-2
Sample Date	December 18, 2017
Sample Time	09:05
Sample Location	
Sample Description	RW 3-93/11 / 7.9°C
Sample Matrix	Drinking Water

Analyte		Units	Result	Nominal Detection Limit	Guideline Limit	Guideline Comments
Routine Water - Continued						
Hardness	as CaCO ₃ (extractable)	mg/L	110	1		
Total Dissolved Solids	Extractable	mg/L	180	1		

Analytical Report

Bill To: Clearbrook Waterworks District 2564 Clearbrook Road Abbotsford, BC, Canada V2T 2Y5	Project ID: Project Name: Project Location: LSD: P.O.:	Lot ID: 1245604 Control Number: Date Received: Dec 18, 2017 Date Reported: Jan 9, 2018 Report Number: 2255518
Attn: Accounts Payable Sampled By: Company:	Proj. Acct. code:	

Reference Number	1245604-3
Sample Date	December 18, 2017
Sample Time	08:44
Sample Location	
Sample Description	RW 7.00/13 / 7.9°C
Sample Matrix	Drinking Water

Analyte	Units	Result	Nominal Detection Limit	Guideline Limit	Guideline Comments
Metals Extractable					
Aluminum	Extractable mg/L	0.064	0.001	0.1	Below OG
Antimony	Extractable mg/L	0.00009	0.00002	0.006	Below MAC
Arsenic	Extractable mg/L	0.0005	0.0001	0.010	Below MAC
Barium	Extractable mg/L	0.0095	0.0001	1	Below MAC
Boron	Extractable mg/L	0.013	0.002	5	Below MAC
Cadmium	Extractable mg/L	0.00013	0.00001	0.005	Below MAC
Chromium	Extractable mg/L	0.00235	0.00005	0.05	Below MAC
Copper	Extractable mg/L	0.0050	0.0005	1.0	Below AO
Lead	Extractable mg/L	0.00017	0.00001	0.01	Below MAC
Selenium	Extractable mg/L	0.0014	0.0002	0.05	Below MAC
Uranium	Extractable mg/L	0.00002	0.00001	0.02	Below MAC
Vanadium	Extractable mg/L	0.00056	0.00005		
Zinc	Extractable mg/L	0.0194	0.0005	5.0	Below AO
Microbiological Analysis					
Total Coliforms	Enzyme Substrate Test	MPN/100 mL	<1.0	1.0	0 per 100 mL Below MAC
Escherichia coli	Enzyme Substrate Test	MPN/100 mL	<1.0	1.0	0 per 100 mL Below MAC
Heterotrophic Count - Aerobic	SimPlate	MPN/mL	<2.0	2	
Physical and Aggregate Properties					
Colour	True	Colour units	<5	5	
Turbidity		NTU	0.62	0.05	
Routine Water					
pH - Holding Time			Exceeded		
pH	at 25 °C		6.36		7.0-10.5 Below Range
Electrical Conductivity		µS/cm at 25 °C	201	1	
Calcium	Extractable	mg/L	22	0.01	
Iron	Extractable	mg/L	0.094	0.004	0.3 Below AO
Magnesium	Extractable	mg/L	5.2	0.02	
Manganese	Extractable	mg/L	0.44	0.001	0.05 Above AO
Manganese	Extractable	mg/L	0.47	0.001	0.05 Above AO
Potassium	Extractable	mg/L	1.3	0.04	
Silicon	Extractable	mg/L	11	0.005	
Sodium	Extractable	mg/L	7.0	0.1	200 Below AO
T-Alkalinity	as CaCO3	mg/L	34	5	
Chloride	Dissolved	mg/L	25.7	0.05	250 Below AO
Fluoride	Dissolved	mg/L	0.03	0.01	1.5 Below MAC
Nitrate - N	Dissolved	mg/L	2.37	0.01	10 Below MAC
Nitrite - N	Dissolved	mg/L	<0.01	0.01	1 Below MAC

Analytical Report

Bill To: Clearbrook Waterworks District
2564 Clearbrook Road
Abbotsford, BC, Canada
V2T 2Y5
Attn: Accounts Payable
Sampled By:
Company:

Project ID:
Project Name:
Project Location:
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1245604**
Control Number:
Date Received: Dec 18, 2017
Date Reported: Jan 9, 2018
Report Number: 2255518

Reference Number	1245604-3
Sample Date	December 18, 2017
Sample Time	08:44
Sample Location	
Sample Description	RW 7.00/13 / 7.9°C
Sample Matrix	Drinking Water

Analyte		Units	Result	Nominal Detection Limit	Guideline Limit	Guideline Comments
Routine Water - Continued						
Sulfate (SO ₄)	Dissolved	mg/L	15.6	0.1	500	Below AO
Hardness	as CaCO ₃ (extractable)	mg/L	77	1		
Total Dissolved Solids	Extractable	mg/L	139	1		

Analytical Report

Bill To: Clearbrook Waterworks District 2564 Clearbrook Road Abbotsford, BC, Canada V2T 2Y5	Project ID: Project Name: Project Location: LSD: P.O.:	Lot ID: 1245604 Control Number: Date Received: Dec 18, 2017 Date Reported: Jan 9, 2018 Report Number: 2255518
Attn: Accounts Payable	Proj. Acct. code:	
Sampled By: Company:		

Reference Number	1245604-4
Sample Date	December 18, 2017
Sample Time	10:30
Sample Location	
Sample Description	Res.C / 7.9°C
Sample Matrix	Drinking Water

Analyte	Units	Result	Nominal Detection Limit	Guideline Limit	Guideline Comments	
Metals Extractable						
Aluminum	Extractable mg/L	0.003	0.001	0.1	Below OG	
Antimony	Extractable mg/L	0.00009	0.00002	0.006	Below MAC	
Arsenic	Extractable mg/L	0.0007	0.0001	0.010	Below MAC	
Barium	Extractable mg/L	0.0107	0.0001	1	Below MAC	
Boron	Extractable mg/L	0.018	0.002	5	Below MAC	
Cadmium	Extractable mg/L	0.00001	0.00001	0.005	Below MAC	
Chromium	Extractable mg/L	<0.00005	0.00005	0.05	Below MAC	
Copper	Extractable mg/L	<0.0005	0.0005	1.0	Below AO	
Lead	Extractable mg/L	0.00003	0.00001	0.01	Below MAC	
Selenium	Extractable mg/L	0.0005	0.0002	0.05	Below MAC	
Uranium	Extractable mg/L	0.00015	0.00001	0.02	Below MAC	
Vanadium	Extractable mg/L	0.00049	0.00005			
Zinc	Extractable mg/L	<0.0005	0.0005	5.0	Below AO	
Microbiological Analysis						
Total Coliforms	Enzyme Substrate Test	MPN/100 mL	1.0	1.0	0 per 100 mL	Above MAC
Escherichia coli	Enzyme Substrate Test	MPN/100 mL	<1.0	1.0	0 per 100 mL	Below MAC
Heterotrophic Count - Aerobic	SimPlate	MPN/mL	35.0	2		
Physical and Aggregate Properties						
Colour	True	Colour units	<5	5		
Turbidity		NTU	0.11	0.05		
Routine Water						
pH - Holding Time			Exceeded			
pH	at 25 °C		7.25		7.0-10.5	Within Range
Electrical Conductivity		µS/cm at 25 °C	236	1		
Calcium	Extractable	mg/L	27	0.01		
Iron	Extractable	mg/L	0.008	0.004	0.3	Below AO
Magnesium	Extractable	mg/L	6.9	0.02		
Manganese	Extractable	mg/L	0.003	0.001	0.05	Below AO
Potassium	Extractable	mg/L	1.7	0.04		
Silicon	Extractable	mg/L	8.8	0.005		
Sodium	Extractable	mg/L	9.0	0.1	200	Below AO
T-Alkalinity	as CaCO3	mg/L	68	5		
Chloride	Dissolved	mg/L	16.8	0.05	250	Below AO
Fluoride	Dissolved	mg/L	0.02	0.01	1.5	Below MAC
Nitrate - N	Dissolved	mg/L	1.18	0.01	10	Below MAC
Nitrite - N	Dissolved	mg/L	<0.01	0.01	1	Below MAC
Sulfate (SO4)	Dissolved	mg/L	22.3	0.1	500	Below AO

Analytical Report

Bill To: Clearbrook Waterworks District 2564 Clearbrook Road Abbotsford, BC, Canada V2T 2Y5 Attn: Accounts Payable Sampled By: Company:	Project ID: Project Name: Project Location: LSD: P.O.: Proj. Acct. code:	Lot ID: 1245604 Control Number: Date Received: Dec 18, 2017 Date Reported: Jan 9, 2018 Report Number: 2255518
---	---	--

Reference Number	1245604-4
Sample Date	December 18, 2017
Sample Time	10:30
Sample Location	
Sample Description	Res.C / 7.9°C
Sample Matrix	Drinking Water

Analyte		Units	Result	Nominal Detection Limit	Guideline Limit	Guideline Comments
Routine Water - Continued						
Hardness	as CaCO ₃ (extractable)	mg/L	96	1		
Total Dissolved Solids	Extractable	mg/L	154	1		

Approved by: 
Mathieu Simoneau
Operations Manager

Data have been validated by Analytical Quality Control and Exova's Integrated Data Validation System (IDVS).

Generation and distribution of the report, and approval by the digitized signature above, are performed through a secure and controlled automatic process.

Methodology and Notes

Bill To: Clearbrook Waterworks District 2564 Clearbrook Road Abbotsford, BC, Canada V2T 2Y5	Project ID: Project Name: Project Location: LSD: P.O.:	Lot ID: 1245604 Control Number: Date Received: Dec 18, 2017 Date Reported: Jan 9, 2018 Report Number: 2255518
Attn: Accounts Payable Sampled By: Company:	Proj. Acct. code:	

Method of Analysis

Method Name	Reference	Method	Date Analysis Started	Location
Alk, pH, EC, Turb in water (Surrey)	APHA	* Alkalinity - Titration Method, 2320 B	Dec 19, 2017	Exova Surrey
Alk, pH, EC, Turb in water (Surrey)	APHA	* Conductivity, 2510 B	Dec 19, 2017	Exova Surrey
Alk, pH, EC, Turb in water (Surrey)	APHA	* pH - Electrometric Method, 4500-H+ B	Dec 19, 2017	Exova Surrey
Anions by IEC in water (Surrey)	APHA	* Ion Chromatography with Chemical Suppression of Eluent Cond., 4110 B	Dec 19, 2017	Exova Surrey
Heterotrophic (Standard) Plate Count (Aerobic SP) - Surrey	APHA	Enzyme Substrate Method, 9215 E	Dec 18, 2017	Exova Surrey
Metals SemiTrace (Extractable) in water (Surrey)	US EPA	* Metals & Trace Elements by ICP-AES, 6010C	Dec 18, 2017	Exova Surrey
Metals SemiTrace (Extractable) in water (Surrey)	US EPA	* Metals & Trace Elements by ICP-AES, 6010C	Dec 28, 2017	Exova Surrey
Total and E-Coli - Colilert - DW (Surrey)	APHA	Enzyme Substrate Test, APHA 9223 B	Dec 18, 2017	Exova Surrey
Trace Metals (extractable) in Water (Surrey)	US EPA	* Determination of Trace Elements in Waters and Wastes by ICP-MS, 200.8	Dec 18, 2017	Exova Surrey
True Color in water (Surrey)	APHA	* Spectrophotometric - Single Wavelength Method, 2120 C	Dec 19, 2017	Exova Surrey
Turbidity - Water (Surrey)	APHA	* Turbidity - Nephelometric Method, 2130 B	Dec 20, 2017	Exova Surrey

* Reference Method Modified

References

APHA Standard Methods for the Examination of Water and Wastewater
 US EPA US Environmental Protection Agency Test Methods

Guidelines

Guideline Description Health Canada GCDWQ
 Guideline Source Guidelines for Canadian Drinking Water Quality, Health Canada, February 2017
 Guideline Comments MAC = Maximum Acceptable Concentration
 AO = Aesthetic Objective
 OG = Operational Guideline for Water Treatment Plants
 Refer to Health Canada GCDWQ for complete guidelines and additional drinking water information at www.hc-sc.gc.ca

Comments:

- Dec 19, 2017 - Sample 1245604-2; 5962073: Reduction of analytical volume was necessary for chloride to bring results within the analytical range for sample 1245604-2. Detection limits are adjusted accordingly.
- Dec 19, 2017 - Reduction of analytical volume was necessary for metals analysis due to matrix effects in sample #1245604-2 for Boron. Detection limits are adjusted accordingly.
- Dec 22, 2017 - Report was issued to include retest result for Manganese analysis on sample 1245604-3 as requested by Ineke on 2017/12/21. Previous Report 2252587.
- Dec 28, 2017 - Sample 1245604-1; 5962072: The analysis of water sample 1245604-1 is below Maximum Acceptable Concentrations for the chemical and bacteriological health related guidelines specified by the February 2017 Guidelines for Canadian Drinking Water Quality for the parameters tested.
- Dec 28, 2017 - Sample 1245604-2; 5962073: The analysis of water sample 1245604-2 is below Maximum Acceptable Concentrations for the chemical and bacteriological health related guidelines specified by the February 2017 Guidelines for Canadian Drinking Water Quality for the parameters tested.
- Dec 28, 2017 - Sample 1245604-3; 5962074: The analysis of water sample 1245604-3 is below Maximum Acceptable Concentrations for the chemical and bacteriological health related guidelines specified by the February 2017 Guidelines for Canadian Drinking Water Quality for the

Methodology and Notes

Bill To: Clearbrook Waterworks District 2564 Clearbrook Road Abbotsford, BC, Canada V2T 2Y5	Project ID: Project Name: Project Location: LSD: P.O.:	Lot ID: 1245604 Control Number: Date Received: Dec 18, 2017 Date Reported: Jan 9, 2018 Report Number: 2255518
Attn: Accounts Payable Sampled By: Company:	Proj. Acct. code:	

parameters tested.

- Dec 28, 2017 - Sample 1245604-4; 5962075: The Total Coliforms result in sample 1245604-4 exceeded the maximum acceptable concentration (MAC) as specified by the February 2017 Guidelines for Canadian Drinking Water Quality.
- Dec 29, 2017 - Sample 1245604-3; 5962074: Sample 1245604-3: the repeated result for metals analysis did not differ significantly from the original; it is within expected precision of the test.

The comparison of test results to guideline limits is provided for information purposes only. This is not to be taken as a statement of conformance / nonconformance to any guideline, regulation or limit. The data user is responsible for all conclusions drawn with respect to the data and is advised to consult official regulatory references when evaluating compliance.

Please direct any inquiries regarding this report to our Client Services Group or to the Operations Manager at the coordinates indicated at the top left of this page.

Results relate only to samples as submitted.

The test report shall not be reproduced except in full, without the written approval of the laboratory.

Project Information

Project ID: _____
 Project Name: _____
 Project Location: _____
 Legal Location: _____
 POA/FE#: _____
 Proj. Acct. Code: _____
 Quote #: _____

Invoice to: _____
Company: Leah's Soft Waterworks
Address: _____
Attention: _____
Phone: _____
Cell: _____
Fax: _____
E-mail: _____
Agreement ID: _____
Copy of report: _____

Report To: _____
Company: _____
Address: _____
Attention: _____
Phone: _____
Cell: _____
Fax: _____
E-mail 1: _____
E-mail 2: _____
Copy of invoice: _____

Report Results

E-Mail	HCDWQG
Mail	Ab Tier 1
Online	SPIGEC
Fax	BOCSR
PDF	Other (list below)
Excel	
QA/QC	

Regulatory Requirement

Sample Custody (please print)
 Sampled by: _____
 Company: _____
 Date/Time stamp: _____

Emergency (contact lab for turnaround and pricing)
 Priority 1-2 working days (100% surcharge)
 Urgent 2-3 working days (50% surcharge)

When "ASAP" is requested, turn around will default to a 100% RUSH priority, with pricing and turn around time to match. Please contact the lab prior to submitting RUSH samples. If not all samples require RUSH, please indicate in the special instructions.

Date Required: _____ Signature: _____

Special Instructions/Comments (please include contact information including ph. # if different from above): _____

Site I.D.	Sample Description	Depth start end in cm m	Date/Time Sampled	Matrix	Sampling Method	Number of Containers	Enter tests above (✓ relevant samples below)
1	RW 1-877/14		Dec. 18/17 09:53 AM			3	W M q
2	RW 3-93/11		Dec. 18/17 09:05 AM			3	✓
3	RW 7-00/13		Dec. 18/17 08:44 AM			3	✓
4	Ros. C		Dec. 18/17 10:30 AM			3	✓
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							

Submission of this form acknowledges acceptance of Exova's Standard Terms and Conditions (<http://www.exova.com/about/terms-and-conditions/>)

Please indicate any potentially hazardous samples

Page ____ of ____ Control # **C 0066248**

Lot: **1245604** COC



Shipping: _____ # and size of coolers

Temp. received: _____ Delivery Method: HD

Received by: _____ Waybill:

- Indicate in the space allotted any deficiencies by the corresponding number.
1. Indicate any samples that were not packaged well
 2. Indicate any samples not received in Exova supplies
 3. Indicate any samples that were not clearly labeled
 4. Indicate any samples not received within the required hold time or temp.
 5. Indicate any missing or extra samples
 6. Indicate any samples that were received broken
 7. Indicate any samples where sufficient volume was not received
 8. Indicate any samples received in an inappropriate container

Report Transmission Cover Page

Bill To: Clearbrook Waterworks District 2564 Clearbrook Road Abbotsford, BC, Canada V2T 2Y5	Project: ID: RW2-63 Name: Location: Autumn Well Field LSD: P.O.: Acct code:	Lot ID: 1204487 Control Number: C0071716 Date Received: May 26, 2017 Date Reported: Jun 8, 2017 Report Number: 2193406
Attn: Accounts Payable		
Sampled By:		
Company:		

Contact & Affiliation	Address	Delivery Commitments
Accounts Payable Clearbrook Waterworks District	2564 Clearbrook Road Abbotsford, British Columbia V2T 2Y5 Phone: (604) 850-6621 Fax: (604) 850-7862 Email: office@clearbrookwaterworks.com	On [Lot Approval and Final Test Report Approval] send (Test Report, COC, Invoice) by Email - Merge Reports
Carol Nam Surrey QC	104, 19575 - 55 Avenue Surrey, British Columbia V3S 8P8 Phone: (604) 514-3322 Fax: (604) 514-3323 Email: carol.nam@exova.com	On [Report Approval] send (Test Report) by Email - Single Report
Ineke Kalwij Kalwij Water Dynamics Inc	P.O. Box 684 Station Main Port Coquitlam, British Columbia V3B 6H9 Phone: (604) 475-4063 Fax: (604) 475-4062 Email: ineke@kalwijwaterdynamics.com	On [Report Approval] send (Test Report, COC) by Email - Merge Reports
Ryan Federau Clearbrook Waterworks District	2564 Clearbrook Road Abbotsford, British Columbia V2T 2Y5 Phone: (604) 309-3986 Fax: (604) 850-7862 Email: ryan@clearbrookwaterworks.com	On [Lot Verification] send (COA) by Email - Single Report On [Report Approval] send (Test Report, COC) by Email - Merge Reports On [Lot Creation] send (COR) by Email - Single Report

Notes To Clients:

The information contained on this and all other pages transmitted, is intended for the addressee only and is considered confidential. If the reader is not the intended recipient, you are hereby notified that any use, dissemination, distribution or copy of this transmission is strictly prohibited. If you receive this transmission by error, or if this transmission is not satisfactory, please notify us by telephone.

Analytical Report

Bill To: Clearbrook Waterworks District 2564 Clearbrook Road Abbotsford, BC, Canada V2T 2Y5	Project: ID: RW2-63 Name: Location: Autumn Well Field LSD: P.O.: Acct code:	Lot ID: 1204487 Control Number: C0071716 Date Received: May 26, 2017 Date Reported: Jun 8, 2017 Report Number: 2193406
Attn: Accounts Payable		
Sampled By:		
Company:		

Reference Number	1204487-1
Sample Date	May 26, 2017
Sample Time	13:30
Sample Location	
Sample Description	RW2-63 / 7.3 °C
Sample Matrix	Drinking Water

Analyte	Units	Result	Nominal Detection Limit	Guideline Limit	Guideline Comments
Aggregate Organic Constituents					
UV Transmittance	%/cm	99.9	0.1		
Inorganic Nonmetallic Parameters					
Ammonium - N	mg/L	<0.025	0.025		
Sulfide	Total mg/L	<0.002	0.002	0.05	Below AO
Organic Carbon	Total Nonpurgeable mg/L	0.6	0.5		
Metals Extractable					
Aluminum	Extractable mg/L	0.007	0.002	0.1	Below OG
Antimony	Extractable mg/L	<0.0002	0.0002	0.006	Below MAC
Arsenic	Extractable mg/L	0.0007	0.0002	0.01	Below MAC
Barium	Extractable mg/L	0.010	0.001	1	Below MAC
Boron	Extractable mg/L	0.020	0.002	5	Below MAC
Cadmium	Extractable mg/L	0.00002	0.00001	0.005	Below MAC
Chromium	Extractable mg/L	<0.0005	0.0005	0.05	Below MAC
Copper	Extractable mg/L	<0.001	0.001	1	Below AO
Lead	Extractable mg/L	0.0005	0.0001	0.01	Below MAC
Molybdenum	Extractable mg/L	<0.001	0.001		
Nickel	Extractable mg/L	0.0007	0.0005		
Selenium	Extractable mg/L	0.0005	0.0002	0.05	Below MAC
Silver	Extractable mg/L	<0.00001	0.00001		
Uranium	Extractable mg/L	<0.0005	0.0005	0.02	Below MAC
Zinc	Extractable mg/L	0.024	0.001	5	Below AO
Microbiological Analysis					
Total Coliforms	Enzyme Substrate Test	MPN/100 mL	<1.0	1.0	0 per 100 mL Below MAC
Escherichia coli	Enzyme Substrate Test	MPN/100 mL	<1.0	1.0	0 per 100 mL Below MAC
Heterotrophic Count - Aerobic	SimPlate	MPN/mL	<2.0	2	
Approximate Iron Related Bacteria Population	BART Kit	CFU/mL	9000		
Approximate Sulfate Reducing Bacteria Population	BART Kit	CFU/mL	200		
Physical and Aggregate Properties					
Colour	Apparent, Potable	Colour units	5	5	15 Below AO
Turbidity		NTU	0.5	0.1	0.1 Above OG
Routine Water					
pH			7.82	7.0-10.5	Within OG Range

Analytical Report

Bill To: Clearbrook Waterworks District	Project:	Lot ID: 1204487
2564 Clearbrook Road	ID: RW2-63	Control Number: C0071716
Abbotsford, BC, Canada	Name:	Date Received: May 26, 2017
V2T 2Y5	Location: Autumn Well Field	Date Reported: Jun 8, 2017
Attn: Accounts Payable	LSD:	Report Number: 2193406
Sampled By:	P.O.:	
Company:	Acct code:	

Reference Number	1204487-1
Sample Date	May 26, 2017
Sample Time	13:30
Sample Location	
Sample Description	RW2-63 / 7.3 °C
Sample Matrix	Drinking Water

Analyte	Units	Result	Nominal Detection Limit	Guideline Limit	Guideline Comments
Routine Water - Continued					
Electrical Conductivity	at 25 °C	µS/cm	255	1	
Calcium	Extractable	mg/L	29.2	0.2	
Magnesium	Extractable	mg/L	7.5	0.2	
Sodium	Extractable	mg/L	9.5	0.4	200 Below AO
Potassium	Extractable	mg/L	1.9	0.4	
Iron	Extractable	mg/L	0.02	0.01	0.3 Below AO
Manganese	Extractable	mg/L	0.010	0.005	0.05 Below AO
Chloride	Dissolved	mg/L	13.6	0.4	250 Below AO
Fluoride		mg/L	<0.05	0.05	1.5 Below MAC
Nitrate - N		mg/L	0.83	0.01	10 Below MAC
Nitrite - N		mg/L	0.006	0.005	1 Below MAC
Sulfate (SO4)	Extractable	mg/L	23	0.9	500 Below AO
Carbonate		mg/L	<6		
Bicarbonate		mg/L	98		
P-Alkalinity	as CaCO3	mg/L	<5.0	5	
T-Alkalinity	as CaCO3	mg/L	80.6	5	
Total Dissolved Solids		mg/L	133	1	500 Below AO
Hardness	as CaCO3	mg/L	104		
Langelier Index	Extractable		-0.19		
Saturation pH	Extractable	pH	8.01		

Approved by: 
 Mathieu Simoneau
 Operations Manager

Data have been validated by Analytical Quality Control and Exova's Integrated Data Validation System (IDVS).

Generation and distribution of the report, and approval by the digitized signature above, are performed through a secure and controlled automatic process.

Methodology and Notes

Bill To: Clearbrook Waterworks District 2564 Clearbrook Road Abbotsford, BC, Canada V2T 2Y5	Project: ID: RW2-63 Name: Location: Autumn Well Field LSD: P.O.:	Lot ID: 1204487 Control Number: C0071716 Date Received: May 26, 2017 Date Reported: Jun 8, 2017 Report Number: 2193406
Attn: Accounts Payable	Acct code:	
Sampled By:		
Company:		

Method of Analysis

Method Name	Reference	Method	Date Analysis Started	Location
Alkalinity, pH, and EC in water	APHA	* Alkalinity - Titration Method, 2320 B	29-May-17	Exova Edmonton
Alkalinity, pH, and EC in water	APHA	* Conductivity, 2510 B	29-May-17	Exova Edmonton
Alkalinity, pH, and EC in water	APHA	* pH - Electrometric Method, 4500-H+ B	29-May-17	Exova Edmonton
Ammonium-N in Water	APHA	* Automated Phenate Method, 4500-NH3 G	31-May-17	Exova Edmonton
Anions (Routine) by Ion Chromatography	APHA	* Ion Chromatography with Chemical Suppression of Eluent Cond., 4110 B	29-May-17	Exova Edmonton
Approval-Edmonton	APHA	Checking Correctness of Analyses, 1030 E	29-May-17	Exova Edmonton
Carbon Organic (Total) in water (TOC)	APHA	High-Temperature Combustion Method, 5310 B	29-May-17	Exova Edmonton
Chloride in Water	APHA	* Automated Ferricyanide Method, 4500-Cl-E	29-May-17	Exova Edmonton
Colour (Apparent) in water	APHA	* Visual Comparison Method, 2120 B	29-May-17	Exova Edmonton
Heterotrophic (Standard) Plate Count (Aerobic SP) - Surrey	APHA	Enzyme Substrate Method, 9215 E	26-May-17	Exova Surrey
Iron Reducing and Oxidizing Bacteria	IRB-BART	Iron Related Bacteria - BART Method, IRB-BART	26-May-17	Exova Surrey
Metals ICP-MS (Extractable) in water	US EPA	* Determination of Trace Elements in Waters and Wastes by ICP-MS, 200.8	30-May-17	Exova Edmonton
Metals Trace (Extractable) in water	APHA	Hardness by Calculation, 2340 B	29-May-17	Exova Edmonton
Metals Trace (Extractable) in water	APHA	* Inductively Coupled Plasma (ICP) Method, 3120 B	29-May-17	Exova Edmonton
Sulfate Reducing Bacteria - BART	SRB-BART	Sulfate Reducing Bacteria - BART Method, SRB-BART	26-May-17	Exova Surrey
Sulfide in water	APHA	* Gas Dialysis, Automated Methylene Blue Method, 4500-S2- E	01-Jun-17	Exova Edmonton
Total and E-Coli - Collert - DW (Surrey)	APHA	Enzyme Substrate Test, APHA 9223 B	26-May-17	Exova Surrey
Turbidity in Water	APHA	* Turbidity - Nephelometric Method, 2130 B	29-May-17	Exova Edmonton
Ultraviolet Transmittance in Water	APHA	* Ultraviolet Absorption Method, 5910 B	26-May-17	Exova Surrey

* Reference Method Modified

References

APHA	Standard Methods for the Examination of Water and Wastewater
APHA/USEPA	Standard Methods For Water/ Environmental Protection Agency
IRB-BART	IRB-BART. Std Methods for the App. of BART Testers, DBI
SRB-BART	SRB-BART. Std Methods for the App. of BART Testers, DBI
US EPA	US Environmental Protection Agency Test Methods

Guidelines

Guideline Description	Health Canada GCDWQ
Guideline Source	Guidelines for Canadian Drinking Water Quality, Health Canada, February 2017

Methodology and Notes

Bill To:	Clearbrook Waterworks District	Project:		Lot ID:	1204487
	2564 Clearbrook Road	ID:	RW2-63	Control Number:	C0071716
	Abbotsford, BC, Canada	Name:		Date Received:	May 26, 2017
	V2T 2Y5	Location:	Autumn Well Field	Date Reported:	Jun 8, 2017
Attn:	Accounts Payable	LSD:		Report Number:	2193406
Sampled By:		P.O.:			
Company:		Acct code:			

Guideline Comments MAC = Maximum Acceptable Concentration
 AO = Aesthetic Objective
 OG = Operational Guideline for Water Treatment Plants
 Refer to Health Canada GCDWQ for complete guidelines and additional drinking water information at www.hc-sc.gc.ca

Comments:

The comparison of test results to guideline limits is provided for information purposes only. This is not to be taken as a statement of conformance / nonconformance to any guideline, regulation or limit. The data user is responsible for all conclusions drawn with respect to the data and is advised to consult official regulatory references when evaluating compliance.

Please direct any inquiries regarding this report to our Client Services group.

Results relate only to samples as submitted.

The test report shall not be reproduced except in full, without the written approval of the laboratory.

Project Information

Project ID: RW2-63
 Project Name: _____
 Project Location: Aulumm Hill Field
 Legal Location: _____
 PO/AFE#: _____
 Proj. Acct. Code: _____
 Quote #: _____

Invoice to:
 Company: Clearbrook
 Address: Watauga District
 Attention: _____
 Phone: _____
 Cell: _____
 Fax: _____
 E-mail: _____
 Agreement ID: _____
 Copy of report: _____

Report To:
 Company: CWD
 Address: _____
 Attention: Ryan Federman
 Phone: _____
 Cell: _____
 Fax: _____
 E-mail 1: _____
 E-mail 2: _____
 Copy of invoice: _____

Report Results		Regulatory Requirement
E-Mail		HCDWQG
Mail		Ab Tier 1
Online		SPIGEC
Fax		BCCSR
PDF		Other (list below)
Excel		
QA/QC		

RUSH Priority

Emergency (contact lab for turnaround and pricing)	When "ASAP" is requested, turn around will default to a 100% RUSH priority, with pricing and turn around time to match. Please contact the lab prior to submitting RUSH samples. If not all samples require RUSH, please indicate in the special instructions.
Priority 1-2 working days (100% surcharge)	
Urgent 2-3 working days (50% surcharge)	

Number of Containers

WAG FXT	CAB1	DW22	DW1RB	DW SRB	M995	MVT
---------	------	------	-------	--------	------	-----

Sample Custody (please print)
 Sampled by: _____
 Company: _____

This section for Lab use only
 Date/Time stamp:
MAY 26 '17 14:10

Date Required: _____ Signature: _____

Special Instructions/Comments (please include contact information including ph. # if different from above).

	Site I.D.	Sample Description	Depth		Date/Time Sampled	Matrix	Sampling Method	Enter tests above (✓ relevant samples below)														
			start in	end in				cm	m	1	2	3	4	5	6	7	8	9	10	11	12	13
1		<u>RW2-63</u>			<u>May 26, 2017</u>	<u>1:30 PM</u>		<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>9</u>	<u>10</u>	<u>11</u>	<u>12</u>	<u>13</u>	<u>14</u>	<u>15</u>
2																						
3																						
4																						
5																						
6																						
7																						
8																						
9																						
10																						
11																						
12																						
13																						
14																						
15																						

Indicate in the space allotted any deficiencies by the corresponding number.

1. Indicate any samples that were not packaged well
2. Indicate any samples not received in Exova supplies
3. Indicate any samples that were not clearly labeled
4. Indicate any samples not received within the required hold time or temp.
5. Indicate any missing or extra samples
6. Indicate any samples that were received broken
7. Indicate any samples where sufficient volume was not received
8. Indicate any samples received in an inappropriate container

Submission of this form acknowledges acceptance of Exova's Standard Terms and Conditions (<http://www.exova.com/about/terms-and-conditions/>)

Please indicate any potentially hazardous samples

Lot: 1204487 COC



Shipping: COD Y/ N
 # and size of coolers _____
 Temp. received: 73°C
 Delivery Method: H
 Waybill: _____
 Received by: LL

ED 120-02

Report Transmission Cover Page

Bill To: Clearbrook Waterworks District 2564 Clearbrook Road Abbotsford, BC, Canada V2T 2Y5	Project ID: Project Name: RW700/13 Project Location: LSD: P.O.:	Lot ID: 1252607 Control Number: C0066718 Date Received: Feb 2, 2018 Date Reported: Feb 8, 2018 Report Number: 2261723
Attn: Accounts Payable Sampled By: Company:	Proj. Acct. code:	

Contact	Company	Address
Accounts Payable	Clearbrook Waterworks District	2564 Clearbrook Road Abbotsford, BC V2T 2Y5 Phone: (604) 850-6621 Fax: (604) 850-7862 Email: office@clearbrookwaterworks.com

Delivery	Format	Deliverables
Email - Single Report	PDF	Invoice

Contact	Company	Address
Ineke Kalwij	Kalwij Water Dynamics Inc	P.O. Box 684 Station Main Port Coquitlam, BC V3B 6H9 Phone: (604) 475-4063 Fax: (604) 475-4062 Email: ineke@kalwijwaterdynamics.com

Delivery	Format	Deliverables
Email - Merge Reports	PDF	COC / Test Report
Email - Single Report	PDF	COR

Contact	Company	Address
Ryan Federau	Clearbrook Waterworks District	2564 Clearbrook Road Abbotsford, BC V2T 2Y5 Phone: (604) 309-3986 Fax: (604) 850-7862 Email: ryan@clearbrookwaterworks.com

Delivery	Format	Deliverables
Email - Merge Reports	PDF	COC / Test Report
Email - Single Report	PDF	COA
Email - Single Report	PDF	COR

Notes To Clients:

The information contained on this and all other pages transmitted, is intended for the addressee only and is considered confidential. If the reader is not the intended recipient, you are hereby notified that any use, dissemination, distribution or copy of this transmission is strictly prohibited. If you receive this transmission by error, or if this transmission is not satisfactory, please notify us by telephone.

Analytical Report

Bill To: Clearbrook Waterworks District	Project ID:	Lot ID: 1252607
2564 Clearbrook Road	Project Name: RW700/13	Control Number: C0066718
Abbotsford, BC, Canada	Project Location:	Date Received: Feb 2, 2018
V2T 2Y5	LSD:	Date Reported: Feb 8, 2018
Attn: Accounts Payable	P.O.:	Report Number: 2261723
Sampled By:	Proj. Acct. code:	
Company:		

Reference Number	1252607-1
Sample Date	February 02, 2018
Sample Time	09:55
Sample Location	
Sample Description	RW700/13 / 12.9 °C
Sample Matrix	Drinking Water

Analyte	Units	Result	Nominal Detection Limit	Guideline Limit	Guideline Comments
Metals Extractable					
Aluminum	Extractable mg/L	0.001	0.001	0.1	Below OG
Antimony	Extractable mg/L	0.00003	0.00002	0.006	Below MAC
Arsenic	Extractable mg/L	0.0003	0.0001	0.010	Below MAC
Barium	Extractable mg/L	0.0053	0.0001	1	Below MAC
Boron	Extractable mg/L	0.011	0.002	5	Below MAC
Cadmium	Extractable mg/L	0.00002	0.00001	0.005	Below MAC
Chromium	Extractable mg/L	0.00026	0.00005	0.05	Below MAC
Copper	Extractable mg/L	0.0015	0.0005	1.0	Below AO
Lead	Extractable mg/L	0.00012	0.00001	0.01	Below MAC
Selenium	Extractable mg/L	0.0002	0.0002	0.05	Below MAC
Uranium	Extractable mg/L	0.00002	0.00001	0.02	Below MAC
Vanadium	Extractable mg/L	0.00065	0.00005		
Zinc	Extractable mg/L	0.0179	0.0005	5.0	Below AO
Physical and Aggregate Properties					
Colour	True	Colour units	<5	5	
Turbidity		NTU	0.19	0.05	
Routine Water					
pH - Holding Time			Exceeded		
pH	at 25 °C		6.97	7.0-10.5	Below Range
Electrical Conductivity		µS/cm at 25 °C	187	1	
Calcium	Extractable mg/L	21	0.01		
Iron	Extractable mg/L	0.004	0.004	0.3	Below AO
Magnesium	Extractable mg/L	5.2	0.02		
Manganese	Extractable mg/L	0.003	0.001	0.05	Below AO
Potassium	Extractable mg/L	1.1	0.04		
Silicon	Extractable mg/L	10	0.005		
Sodium	Extractable mg/L	6.7	0.1	200	Below AO
T-Alkalinity	as CaCO3 mg/L	43	5		
Chloride	Dissolved mg/L	17.4	0.05	250	Below AO
Fluoride	Dissolved mg/L	0.02	0.01	1.5	Below MAC
Nitrate - N	Dissolved mg/L	2.33	0.01	10	Below MAC
Nitrite - N	Dissolved mg/L	<0.01	0.01	1	Below MAC
Sulfate (SO4)	Dissolved mg/L	14.6	0.1	500	Below AO
Hardness	as CaCO3 (extractable) mg/L	74	1		
Total Dissolved Solids	Extractable mg/L	131	1		

Analytical Report

Bill To: Clearbrook Waterworks District	Project ID:	Lot ID: 1252607
2564 Clearbrook Road	Project Name: RW700/13	Control Number: C0066718
Abbotsford, BC, Canada	Project Location:	Date Received: Feb 2, 2018
V2T 2Y5	LSD:	Date Reported: Feb 8, 2018
Attn: Accounts Payable	P.O.:	Report Number: 2261723
Sampled By:	Proj. Acct. code:	
Company:		

Approved by: 
Mathieu Simoneau
Operations Manager

Data have been validated by Analytical Quality Control and Exova's Integrated Data Validation System (IDVS).

Generation and distribution of the report, and approval by the digitized signature above, are performed through a secure and controlled automatic process.

Methodology and Notes

Bill To: Clearbrook Waterworks District 2564 Clearbrook Road Abbotsford, BC, Canada V2T 2Y5	Project ID: Project Name: RW700/13 Project Location: LSD: P.O.:	Lot ID: 1252607 Control Number: C0066718 Date Received: Feb 2, 2018 Date Reported: Feb 8, 2018 Report Number: 2261723
Attn: Accounts Payable Sampled By: Company:	Proj. Acct. code:	

Method of Analysis

Method Name	Reference	Method	Date Analysis Started	Location
Alk, pH, EC, Turb in water (Surrey)	APHA	* Alkalinity - Titration Method, 2320 B	Feb 2, 2018	Exova Surrey
Alk, pH, EC, Turb in water (Surrey)	APHA	* Conductivity, 2510 B	Feb 2, 2018	Exova Surrey
Alk, pH, EC, Turb in water (Surrey)	APHA	* pH - Electrometric Method, 4500-H+ B	Feb 2, 2018	Exova Surrey
Anions by IEC in water (Surrey)	APHA	* Ion Chromatography with Chemical Suppression of Eluent Cond., 4110 B	Feb 3, 2018	Exova Surrey
Metals SemiTrace (Extractable) in water (Surrey)	US EPA	* Metals & Trace Elements by ICP-AES, 6010C	Feb 5, 2018	Exova Surrey
Trace Metals (extractable) in Water (Surrey)	US EPA	* Determination of Trace Elements in Waters and Wastes by ICP-MS, 200.8	Feb 5, 2018	Exova Surrey
True Color in water (Surrey)	APHA	* Spectrophotometric - Single Wavelength Method, 2120 C	Feb 5, 2018	Exova Surrey
Turbidity - Water (Surrey)	APHA	* Turbidity - Nephelometric Method, 2130 B	Feb 5, 2018	Exova Surrey

* Reference Method Modified

References

APHA Standard Methods for the Examination of Water and Wastewater
 US EPA US Environmental Protection Agency Test Methods

Guidelines

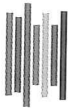
Guideline Description Health Canada GCDWQ
 Guideline Source Guidelines for Canadian Drinking Water Quality, Health Canada, February 2017
 Guideline Comments MAC = Maximum Acceptable Concentration
 AO = Aesthetic Objective
 OG = Operational Guideline for Water Treatment Plants
 (does not apply to private groundwater wells).
 Refer to Health Canada for complete guidelines at www.hc-sc.gc.ca

The comparison of test results to guideline limits is provided for information purposes only. This is not to be taken as a statement of conformance / nonconformance to any guideline, regulation or limit. The data user is responsible for all conclusions drawn with respect to the data and is advised to consult official regulatory references when evaluating compliance.

Please direct any inquiries regarding this report to our Client Services Group or to the Operations Manager at the coordinates indicated at the top left of this page.

Results relate only to samples as submitted.

The test report shall not be reproduced except in full, without the written approval of the laboratory.



Invoice to:		Report To:	
Company: <i>Clearbrook Waterworks</i>	Address:	Company:	Address:
Attention:	Phone:	Attention:	Phone:
Cell:	Fax:	Cell:	Fax:
E-mail:	Agreement ID:	E-mail 1:	E-mail 2:
Copy of report:		Copy of invoice:	

Project Information

Project ID: _____

Project Name: _____

Project Location: _____

Legal Location: _____

PO/AFE#: _____

Proj. Acct. Code: _____

Quote # _____

Report Results	Regulatory Requirement
E-Mail	HCDWQG
Mail	Ab Tier 1
Online	SPIGEC
Fax	BCCSR
PDF	Other (list below)
Excel	
QA/QC	

RUSH Priority

Emergency (contact lab for turnaround and pricing)	When "ASAP" is requested, turn around will default to a 100% RUSH priority, with pricing and turn around time to match. Please contact the lab prior to submitting RUSH samples. If not all samples require RUSH, please indicate in the special instructions.
Priority 1-2 working days (100% surcharge)	
Urgent 2-3 working days (50% surcharge)	

Number of Containers ↓ <i>bbm</i>	

Date Required: _____ Signature: _____

Special Instructions/Comments (please include contact information including ph. # if different from above).

Sample Custody (please print)

Sampled by: _____

Company: _____

This section for Lab use only

Date/Time stamp:
FEB 2 '18 10:35

	Site I.D.	Sample Description	Depth		Date/Time Sampled	Matrix	Sampling Method
			start in	end m			
1		<i>RW 700/13</i>			<i>Feb. 2 / 18 9:55 AM</i>		
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							

Enter tests above (√ relevant samples below)	

Indicate in the space allotted any deficiencies by the corresponding number.

1. Indicate any samples that were not packaged well
2. Indicate any samples not received in Exova supplies
3. Indicate any samples that were not clearly labeled
4. Indicate any samples not received within the required hold time or temp.
5. Indicate any missing or extra samples
6. Indicate any samples that were received broken
7. Indicate any samples where sufficient volume was not received
8. Indicate any samples received in an inappropriate container

Submission of this form acknowledges acceptance of Exova's Standard Terms and Conditions (<http://www.exova.com/about/terms-and-conditions/>)

Please indicate any potentially hazardous samples

Lot: 1252607 COC



Shipping: COD Y/ N

and size of coolers

Temp. received: *12-9*

Received by: *ll*

Delivery Method: *H*

Waybill:

ED 120-02

Appendix D

BART Sampling Procedure

Data collection protocol

BART samples were collected in March and November, 2017, for RW 3-93/11, RW 7-00/13, and RW 1-87/14, and in November, 2017, for RW 2-63/17. Sufficient downtime was practiced prior to taking the water samples (i.e., 48 hours). Water samples for BART were collected after 1 minute of operation (start-up; $t = 1$), after 20 minutes of pumping ($t = 20$) and after 2 hours of pumping ($t = 120$). Samples collected at these times represent various distances from the well (i.e., in the well casing, just outside the well screen, and in the geological formation at $t = 0$, $t = 20$, and $t = 120$, respectively).

Water samples were collected from each well for preparing the IRB, SRB, SLYM and HAB testers. Water samples were collected for each sample retrieval time; yielding twelve (12) samples (vials) per well. These vials were observed and analyzed during the course of nine (9) days following the start of the BART¹. For more information about BART and the interpretation of the results, the reader is referred to DBI (2004). BART-Soft v6 (developed and distributed by DBI) is applied to obtain qualitative and quantitative results.

¹ BART is completed in-house by Ryan Federau (Water Quality Technician).

End of Document
May 2018