Regional District of
Kitimat-Stikine

2020 HAZELTON WASTE MANAGEMENT FACILITY ANNUAL REPORT

June 2021

Prepared for:

British Columbia Ministry of Environment &
Climate Change Strategy
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Hazelton Waste Management Facility Overview

The Hazelton Waste Management Facility (Hazelton WMF) is owned and operated by the Regional District of Kitimat-Stikine (Regional District or RDKS). It is located approximately 4 km east of New Hazelton at 82 Birch Road; access is from Highway 16.

The Hazelton WMF is responsible for the management of municipal solid and liquid waste generated from commercial and residential sources in the greater Hazelton area, which includes the community of South Hazelton, east to Witset, and north up the Kispiox Valley. Waste collected at the Kitwanga Transfer Station is consolidated and hauled to the Hazelton WMF for landfilling. The following communities use the Kitwanga Transfer Station: Cedarvale, Kitwanga, Gitsegukla, Gitwangak, and Gitanyow. The Hazelton WMF is operated in accordance with the Regional District Kitimat-Stikine Solid Waste Management Plan (1995).

Landfill operations are regulated by the Ministry of Environment and Climate Change Strategy (MOECCS) Operation Certificate MR-17226, most recently updated in May 2020, and conducted in accordance with the Design, Operations, and Closure Plan (DOCP) for Hazelton Waste Management Facility, authored by Sperling Hansen and Associates (2018). This annual report follows criteria outlined in the amended Operational Certificate, issued May 2020.

The Hazelton WMF currently contains septage receiving lagoons, a landfill, an equipment storage building, Z-wall for public drop-off of garbage, and U-Bays for drop-off of tires and scrap metal including large appliances and propane tanks. The leachate treatment system includes an equalization pond, a series of four wetlands and discharge of treated effluent to a phytoremediation orchard.

The environmental effects monitoring program, including ground and surface water are discussed in the *Hazelton Waste Management Facility 2020 Annual Environmental Report*, prepared by Sperling Hansen Associates and contained in Appendix A.

Figure 1. Location of the Hazelton Waste Management Facility

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1.1 Introduction

This annual report covers the period from January 1 to December 31, 2020 and has been prepared to fulfill the requirements of the Hazelton Landfill Operational Certificate MR-17226. The Operational Certificate (OC) was issued by the Ministry of Environment and Climate Change Strategy (MOECCS) on May 30, 2013, and most recently amended in May 2020. This report follows criteria as outline in the May 2020 amended version of the OC.

The OC authorizes the discharge of municipal solid and liquid wastes and outlines the criteria for environmental and human protection at the landfill. This report meets the requirements outlined inSection 12.2 of the Operational Certificate by providing the following information:

- Total volume or tonnage of waste discharged to the landfill in 2020;
- Total volume or tonnage of waste recycled and diverted in 2020;
- Total volume of sewage waste discharged to septage facility in 2020;
- Volume of effluent discharged to the phytoremediation orchard and Wetland 4;
- Occurrences or observations of wildlife attempting to access the facility; and
- The results and evaluation of all monitoring programs undertaken in 2020 (Sperling HansenAssociates, Appendix A).

2.1 Waste Discharge

The Hazelton Waste Management Facility (WMF) serves the Hazelton and Kitwanga area. Waste from the Kitwanga Transfer Station is hauled to the Hazelton WMF. Some communities in the Hazelton area provide residential curbside collection, which subsequently haul to the Hazelton WMF. The facility also provides disposal and diversion services to many residents and businesses who self-haul their garbage. Metal (including scrap, propane tanks, and large appliances), tires, and cardboard (commercial and residential) are collected and stored at the facility for recycling. Clean wood is segregated and burned on site as outline in the OC.

The OC permits the discharge of municipal solid waste, municipal liquid waste, asbestos, and contaminated soil (with contaminants in concentrations less than “hazardous waste” as defined by the *Hazardous Waste Regulation*). Some types of municipal solid waste are considered Controlled Waste by RDKS bylaw 688, including: animal carcasses (over 50 kg), loads of construction and demolition debris or land clearing debris greater than 5 m^3, contaminated soils, clean soils, broken asphalt and concrete up to 30 cm in diameter, and waste ash from incinerators.

The annual totals for 2020 of each type of permitted waste discharged at the Hazelton Landfill are shown in Table 1. Additional details about each of these materials is described below.

Table 1. Waste Discharge Quantities for 2020

Waste Material	2020 Quantity (tonnes)	
Waste Discharge*		
Garbage	2626.88	
Demolition	622.37	
Waste from Kitwanga Transfer Station	743.15	
Land Clearing Waste	0.15	
Diverted Wastes		
Tires		8.91**
Metal		355.85**
Cardboard		96**
Clean wood		7.2**
Total Landfilled	**3992.55**	
Total Materials Diverted		**467.96**

*This value is based on pre-compaction volume (m^3) data collected from January to December 2020. The volume of material hauled from Kitwanga is from January to June 2020 and extrapolated to a 12-month data set. Volume data was converted to tonnage using the U.S. Environmental Protection Agency's Volume to Weight Conversion Factors (2016) value of 175 kg/m3 for uncompacted mixed municipal solid waste.
** Value is an estimate.

Municipal Solid Waste (Garbage)

Garbage is defined as discharged materials not including prohibited waste, restricted waste and clean wood. These items are defined as:

- Prohibited waste - hazardous or radioactivewaste, slaughter waste, explosive or highly combustible materials, auto hulks, recyclable Extended Producer Responsibility (EPR) materials, organic materials originating from work camps, and non-EPR tires.
- Restricted Waste - metal, EPR-covered tires, and cardboard.

In 2020, 2,626.88 tonnes of garbage were deposited in the landfill.

Septage

Septage is defined as septic tank pumpage and treated sewage sludge, but does not include other sewage wastes (wastewater, sewage or slurry, including catch basins, oil water separators, shop floor drains). Septage is disposed in the Hazelton septage receiving lagoons. The facility has two lagoons (i.e., septage bays) available for disposal. The liquid fraction is treated in the leachate treatment system. Dewatered solids are buried in the landfill.

The volume of septage was not tracked during 2020.

Treated Effluent Discharged to Phytoremediation or from Wetland #4

Construction of Hazelton Waste Management Facility Phase 2 is near completion. Installation and commissioning of the final permanent leachate pumps and treated effluent pump (with discharge to the phytoremediation orchard) are scheduled for summer of 2021.

Treated effluent is authorized for discharge to either the phytoremediation orchard and or exiting the facility via the weir from Wetland 4. Leachate collected from the closed and open phases of the landfill is collected and pumped into the equalization pond, then filters through a serious of three engineered treatment wetlands, then through a sand filter. The treated leachate can then either be pumped to the phytoremediation orchard or discharged to Wetland 4 (the final treatment stage) prior to discharge from the facility. Wetland 4 also collects run-off from the phytoremediation orchard.

An undetermined, minimal volume of treated leachate was pumped to the phytoremediation orchard to commission the sprinkler system in the summer of 2020. The remainder of the treated leachate was discharged from the facility via the Wetland 4 weir.

Figure 2 Hazelton Wetland #2

3.1 Diverted Materials

The Hazelton Landfill restricts the disposal of recyclable materials that have other disposal options available. The District of New Hazelton provides residents with biweekly collection of recycling (unlimited quantities). Residents of other communities may access recycling depots run by industry-funded programs for no fee. Commercial waste

generators are responsible for making their own arrangements to have some restricted materials collected separately and taken for processing.

The RDKS provides drop-off facilities for restricted materials that are not already managed by other operators in the service area. These include metals, cardboard (primarily for commercial customers,although open to all site users) and tires.

Metals

Metals collected at the Hazelton Waste Management facility are stockpiled and sold as scrap to a Terrace-based metal salvage recycler. Ozone depleting substances are removed from all applicablematerials prior to collection by scrap metal recycler.

In 2020, a total 355.85 tonnes of metal were collected and diverted at the Hazelton Waste ManagementFacility.

Cardboard

To ensure there is an avenue for diversion of institutional and commercial cardboard in the Hazelton Area, the Regional District provides cardboard bins on-site which are emptied weekly under contract for recycling.

During 2020, 96 tonnes of carboard was collected for recycling from the Hazelton Waste ManagementFacility.

Tires

Tires are an Extended Producer Responsibility material in British Columbia, managed by the Tire Stewardship of BC. Since there are no tire depots conveniently located in the Hazelton area, the RDKScollects and stockpiles tires, which are then collected by the Stewardship.

During 2020, approximately 8.91 tonnes of tires were collected for recycling through the Tire Stewardshipof BC at the Hazelton Waste Management Facility.

Clean Wood

Clean wood waste is considered any wood product that has not been treated or painted. Clean wood issegregated and burned as prescribed in the Operational Certificate.

In 2020, 7.2 tonnes total of clean wood waste was collected and diverted.

4.0 Wildlife Occurrences and Observations

The Hazelton Facility is located in an area with bears, wolves, coyotes, several species of birds of prey, and many other species of mammals that may attempt access to the facility. To prevent wildlife from gaining access, the entire facility is enclosed in a fence, and the landfill area is enclosed within an electric fence.

To effectively prevent vectors from gaining access to the landfill active face, as of November 2017, Revelstoke Iron Grizzly (RIG) plates are used as an alternative daily cover. The plates are positioned each day to cover all waste, with soil from site used as intermediate cover.

Facility operators are required to inspect the fence weekly, testing for appropriate voltage, propertension on fence stands, overall condition of the fence, and signs of wildlife activity. The results of the inspections are recorded on the Daily Operation Inspection Form.

There were no mammalian wildlife incidents or encounters observed during 2020 at the Hazelton WasteManagement Facility. There was minimal vector activity from birds, including raptor species (bald eagles), and corvid species (crows and ravens).

5.0 Environmental Monitoring Report

Environmental monitoring for the Hazelton Waste Management Facility was conducted by the RDKS Environmental Technician, following the 2013 British Columbia Field Sampling Manual published by the Ministry of Environment and Climate Change Strategy. In-situ and laboratory data for groundwater, surface water, and leachate monitoring results have been compiled, analyzed and interpreted within the Hazelton Waste Management Facility 2020 Annual Environmental Report by Sperling Hanson Associates, contained in Appendix A.

6.0 Summary

During 2020, 3,992.55 tonnes of total refuse, including garbage, construction and demolition materials, consolidated waste from the Kitwanga Transfer Station, and controlled waste, was disposed of in the Hazelton landfill. An additional 467.96 tonnes of material were diverted from the landfill during 2020. Diverted materials collected at the facility include: 355.85 tonnes of metal, 8.91 tonnes of tires, 7.2 tonnes of clean wood, and 96 tonnes of cardboard. The diverted total does not include septage.

There were no mammalian wildlife occurrences at the Hazelton Waste Management Facility during 2020.

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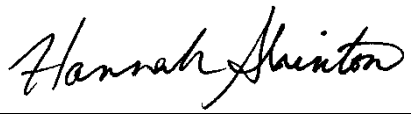

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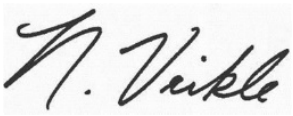

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Appendix A. 2020 Environmental Monitoring Report

Hazelton Waste Management Facility
2020 Annual Monitoring Report
- Final -

PREPARED FOR: REGIONAL DISTRICT OF KITIMAT-STIKINE

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PRJ21015

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Regional District of Kitimat-Stikine

- Landfill Services
- Land Reclamation
- Corporate Management
- Groundwater Hydrogeology

EXECUTIVE SUMMARY

This annual monitoring report provides a synopsis of surface water and groundwater quality at the Hazelton Waste Management Facility, with a focus on water quality observed in 2020 relative to historical trends. Sampling that occurred in 2020 followed the amended Operational Certificate (OC) 17226. The year 2020 is the third year that data has been collected for the new Shallow Groundwater (SGW) wells with the exception of SGW-01 (broken) and SGW-03 (flooded).

There were two uncontrolled discharge events and one controlled discharge event from the Wetland #4 Infiltration Trench in 2020. The two uncontrolled events took place in late March and May of 2020 because of high seasonal precipitation and snow melt. Following the second uncontrolled discharge event, a controlled discharge event continued for the rest of the year with samples taken monthly. All sample events for the uncontrolled and controlled discharge events were compliant with the OC Discharge Criteria, including the acute toxicity tests. Water quality results showed fewer regulatory exceedances than background water quality, suggesting precipitation is the main source of inflow for Wetland #4. Data that was not collected included visual observations of surface discharge and continuous volume of discharge during uncontrolled discharge event. To fill this gap in the data, a water balance was used to infer the magnitude of discharge at these times.

In general, the results from the SGWs do not suggest significant leachate impact at these locations with exceedance values being similar or lower than background concentrations for key leachate indicators, indicating that leachate is not driving exceedances at these locations. The results from the SGW-5 was compared to historic data to evaluate if there are persistent impacts from historic leachate discharge. Water quality at SGW-5 shows signs of historic leachate impacts that are naturally attenuating with declining chloride concentrations, and ammonia and metal concentrations being similar or lower than to background concentrations. The water quality of the SGW-2 was compared to upstream discharge from the Wetland #4 Infiltration Trench. When comparing between these two locations, SGW-02 data shows higher levels for tested parameters, excluding chlorides. The presence of chlorides suggest Wetland #4 Infiltration Trench flows are reaching this location. However, the higher exceedance values are comparable to background concentrations which can be attributed to elevated levels in the sediments and organics, represented by high TOC. Thus, Wetland #4 Infiltration Trench flows could be reaching SGW-02, but they may not cause impacts to water quality. The results of SGW-04 were compared to those of SW-05 that shows that SGW-04 does not appear to be significantly influenced by flows from SW-05 or landfill leachate.

Groundwater quality downgradient of the landfill is only characterized by BH-5B. In general, it is challenging to determine the what portion of contamination is resulting from leachate from the landfill and/or other sources such as nearby highway operations. For instance, chlorides were found to be clearly elevated from background concentrations with the highest values at site. Thus, the landfill cannot be the sole source of chloride at this location. Considering ammonia and metal concentrations, they were slightly lower or comparable to background concentrations. For these reasons, additional monitoring locations are required to determine whether the landfill is impacting groundwater at the downstream BH-5B monitoring location.

BH-03, which would intercept any flow from landfill leachate before it reached the public water well, was dry during 2020. In previous years, there was no concern of leachate impacting this area. Thus, the potential risk with the change in the trend in 2020 is considered to be low.

Surface water quality at the Hazelton Landfill shows varying results with leachate not being considered as the main factor in downstream water quality. It is anticipated that contaminated run-off from highway operations impacts locations SW-05, SW-06, SW-07 and SW-08. This is the case because chloride levels are elevated, but ammonia and metal concentrations are similar to background concentrations. Surface water station SW-09 has slightly elevated chloride and ammonia levels, however they are compliant with the BCWQG criteria. Metals of concern are slightly elevated compared to background concentrations. These values are in excess of the Wetland #4 Infiltration Trench results which suggest sediment and organics, represented by TOC (three times greater at SW-09), are skewing sample results. For these reasons, the data do not provide concrete evidence that water quality exceedances at SW-09 are driven by the leachate discharge. Lastly, SW-10 is affected by landfill leachate with chloride values being non-detectable.

Lastly, VOCs and EPH was tested for the first time at the Hazelton Landfill Site. All tested parameters were not detectable except for toluene at SW-10 and BH-2. In certain cases, biogenic toluene can be generated in specific ecologic systems. It is anticipated that the source of toluene in this case is natural because no other VOCs or EPHs were detected.

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1. INTRODUCTION AND SCOPE

Sperling Hansen Associates (SHA) was retained by the Regional District of Kitimat-Stikine (RDKS) to prepare the 2020 Annual Environmental Monitoring Report for the Hazelton Waste Management Facility (WMF). This report details a review of the site conditions, and the groundwater and surface water quality monitoring results for the year of 2020.

The Hazelton WMF is located at the south-west quadrant of District Lot 1574, Cassiar Land District, and is operated by the RDKS under the Operational Certificate (OC) MR-17226, amended on May 27, 2020. Notably, this amendment included additional monitoring parameters which include extractable petroleum hydrocarbons (EPH), volatile petroleum hydrocarbons (VPH), and benzene, toluene, ethylbenzene, and xylenes (BTEX). This was undertaken by the Ministry as a standard practice for landfill sites that receive contaminated soil.

The Hazelton WMF is located off Highway 16 about 3 km east of New Hazelton. The landfill is accessed by a 1 km long gravel access road that follows the historic alignment of the old Highway 16 to Smithers. The lease property is bound by Hwy 16 to the north and an existing BC Hydro power line to the south. The landfill has been operating as a natural control facility that relies on the native soils and natural attenuation capacity to protect the environment. Landfill upgrades and the construction of a leachate treatment system were completed in 2019.

Figure 1: Hazelton Landfill Site Location

2. SITE SETTING

2.1 Site Topography and Drainage

Surface water run-on generally flows from the east and south of the site and is diverted from the Hazelton WMF by the perimeter ditch network and directed to the low-lying wetlands north and west of the landfill. Surface water from the wetlands eventually forms Rossvale Creek Tributary II and, after joining other tributaries, forms Rossvale Creek. Rossvale Creek then flows into the Bulkley River. The streams, wetlands, and flow divides in the vicinity of the landfill are shown in Figure 2 (Appendix A). Surface water that is intercepted by the perimeter ditch on the east side of the site flows into the Beaver Pond which is located directly north, downgradient of the landfill. The surface water intercepted by the perimeter ditches on the west side of the site flows into wetlands to the west. Surface water from both the wetlands and the Beaver Pond flows into Rossvale Creek where it then flows north under Highway 16 and to the Bulkley River. The surface water flow regime is described in great detail in the Design, Operations and Closure Plan (DOCP) prepared by SHA.

In general, the Hazelton WMF site redirects run-on through a perimeter ditch system and contains any site run-off through the site stormwater management system. Site runoff is contained by on-site ditching and grading which directs these flows to the on-site wetland systemGeological and Hydrogeological Setting

The stratigraphy and groundwater flow of the underlying material was evaluated from a limited number of boreholes and thus is not fully understood. Figure 3 (Appendix A), shows the location of the groundwater boreholes, including three single groundwater monitoring wells (BH-01, BH-02 and BH-03) and two nested shallow and deep monitoring wells (BH-04 and BH-05). Specifically, the shallow and deep sections of the individual wells are referred to as A and B, respectively. For example, the shallow and deep sections of BH-04 will be referred to as BH-4A and BH-4B. The site is comprised of dense till with occasional sandy gravel seams and boulders.

Permeability estimates of the native soil range from $3.4x10^{-7}$ to $9.0x10^{-10}$ m/s, which SHA has determined should make a suitable secondary barrier for leachate.

The groundwater table ranges from a depth of 2 m to 57 m, compared to existing ground elevation which may suggest that there is a perched water table close to the ground surface, and a much deeper water table. For specific groundwater depths with reference elevations, see Table 3-5: Groundwater Table Elevations, July 30, 2014, on page 14. . It is believed that shallow groundwater (perched water table) flows in a north-westerly direction away from potential receptors, including Waterfall Creek and the New Hazelton drinking wells to the southwest of the landfill; however, any deep groundwater migrating from the landfill in a south westerly direction would be intercepted by BH-03, therefore any leachate impact would be identified. The deep groundwater flow system has been intersected by only one well (BH-03), therefore, the groundwater flow direction cannot be determined. Low permeability soil was encountered in the soil samples from the deep and shallow bore holes, which helps reduce the risks associated with the migration of groundwater pollutants as described in SHA's 2018 DOCP Report.

3. WATER QUALITY MONITORING

3.1 Field Techniques

The 2020 monitoring program followed the monitoring program outlined in the amended OC. As in previous years, the water quality monitoring in 2020 was conducted by RDKS personnel following established sampling procedures specified in the *British Columbia Field Sampling Manual for Continuous Monitoring and the Collection of Air, Air-Emission, Water, Wastewater, Soil, Sediment, and Biological Samples* (BC ENV 2013). Monitoring locations are shown in Figure 3 (Appendix A).

3.2 Quality Assurance and Quality Control

The OC 17226 stipulates that the operational certificate holder is required to conduct a Quality Assurance and Control Program to determine the acceptability of data required by the OC 17226 and Section 2(d) of the Environmental Data Quality Assurance Regulation. The OC 17226 stipulates the terms of the quality assurance program under Section 11.5.4 of the permit (Appendix D).

As part of the program, the operational certificate holder must report the results of field duplicates in terms of the degree of variation as the relative percent difference. The calculation of the relative percent difference is provided below for reference:

$$RPD = \frac{D1 - D2}{\frac{D1 + D2}{2}} X\ 100\%$$

Where:

RPD = Relative Percent Difference
D1 = Measured value of the sample
D2 = Measured value of the duplicate

3.3 Water Quality Sampling Background

The analytical results presented in this report for surface water samples have been tabulated and compared to the "British Columbia Approved Water Quality Guidelines Criteria" (BCWQG). The Water Quality Criteria presents both Drinking Water (DW) and Aquatic Life (AW) Guidelines. For groundwater samples, these analytical results have been compared to the BCWQG AW and DW, and the British Columbia Contaminated Sites Regulation (BCCSR) Drinking Water Criteria, as per the amended OC. Groundwater exceedances of AW guidelines (highlighted in blue in the tables) are a regulatory concern only if impacted groundwater reaches surface water. This would be the case if contaminated groundwater is not adequately diluted before reaching a surface water body. However, it is unlikely that impacted groundwater will reach surface waters at the Hazelton Landfill; therefore, exceedances of AW guidelines are noted for discussion and reference purposes only. Furthermore, water quality parameters not listed in the BCWQG Approved Criteria were compared to benchmark (working) guidelines, approved by the Ministry. These working guidelines are entitled "A Compendium of Working Water Quality Guidelines for British Columbia".

Surface water and groundwater analytical results at the applicable locations were analyzed to confirm compliance with Sections 10.7 and 10.9 (Surface Water Quality Assessment and Groundwater Quality

Assessment) of the amended OC. Section 10.7 specifies that the surface water quality at SW-09 must be compliant with the BCWQGL-AW, otherwise the Surface Water Quality Exceedances Response Plan must be implemented. Section 10.9 specifies that the ground water quality at SGW-2, SGW-4, SGW-5, BH-03, and BH-5B must be compliant with the BCCSR-DW, otherwise the Ground Water Quality Exceedances Response Plan must be implemented.

Complete water quality results for surface water and ground water are summarized in Tables 1, 2, 3, and 4 (Appendix B). Some parameter guidelines are dependent on hardness or pH to calculate the guideline limit. This was calculated for these cases.

It should be noted that the BC WQG and BC CSR standards were updated in 2018 and 2019, respectively. As such, the applicable data was compared to the most recent criteria revisions. Historical exceedances of past criteria remain highlighted in the water quality tables.

3.4 Water Quality Results

Landfill leachate typically has elevated concentrations of several indicator parameters. Conductivity is a parameter indicative of the total amount of dissolved minerals in a water sample and higher conductivity levels (>500 µS/cm) are often indicative of leachate impact. Chloride is also used as a leachate indicator at municipal landfills since chlorine is a common constituent of materials disposed of in municipal solid waste. Chloride has low affinity to soil or other matter meaning that it remains dissolved in solution after it enters a water system. Raw leachate from municipal landfills typically has very high chloride concentrations that typically occur in the range of 1,000 mg/l to 3,000 mg/l. Chloride concentrations typically decrease as the leachate becomes diluted by groundwater. Ammonia is another indicator of landfill leachate impact. As such, comparison with background ammonia concentrations provides an indication if leachate is present.

3.4.1 Surface Water Monitoring Stations

The surface water monitoring schedule, as per the amended OC, is shown below in Table 3-1.

Table 3-1: Surface Water Monitoring Schedule as per the amended OC

Location	Parameters	Frequency
SW-01 SW-02 SW-05 SW-06 SW-07 SW-08 SW-09[1]	Lab: total metals, dissolved metals, alkalinity, chloride, fluoride, sulphate, hardness, ammonia, nitrate, nitrite, total Kjeldahl nitrogen, TOC, COD, pH, EPH, BTEX/VPH	Minimum Annually[2] and once during spring, summer, fall if discharging during these seasons
SW-10	Field: Conductivity, temperature, turbidity, flow rate, pH, dissolved oxygen	Minimum annually[2] and once during spring, summer, fall if discharging during these seasons

[1]SW-09 as near to property boundary as possible but at a location where discernible flow begins in ephemeral creek drainage.
[2]Annual sample should be consistent year to year, and preferably taken in fall.

Monitoring locations SW-03 and SW-04 were historic locations for the leachate seep and log weir, respectively. SW-03 historic data represents raw leachate characteristics for this site. SW-04 historic data represents partially attenuated leachate since this was the outlet to a natural retention pond that captured flows from the leachate seep.

A brief description of each sampling location is presented in Table 3-2. Charts 1 to 5, at the end of the report, show surface water quality trends, and Figure 3 (Appendix A) depicts the location of the monitoring sites.

Table 3-2: Description of Surface Water Sampling Locations

Monitoring Locations	UTM Coordinates (+/- 5 m)	Proximity to Landfill	Description	2020 Sampling Notes
SW-01	593039 E 6121908 N	Upstream	South Surface Water Monitoring Station: Measures background concentrations of off-site surface water upgradient of the landfill.	Sampled June 24, August 20, and September 30, 2020
SW-02	593239 E 6122034 N	Upstream	Southeast Surface Water Monitoring Station: Measures background concentrations of off-site surface water upgradient of the landfill.	Sampled June 24, August 20, and September 30, 2020
SW-03	592818 E 6122443 N	N/A	Leachate seep: Measures raw leachate collected from the side slopes of the landfill.	Historic Sampling Location, not sampled in 2020
SW-04	592783 E 6122484 N	N/A	Log Weir: Measures surface water quality at the outlet of a wetland which directly receives flows from SW-03.	Historic Sampling Location, not sampled in 2020
SW-05	592835 E 6122608 N	Downstream	Beaver Pond Outlet: Downstream of the landfill. Flows converge with Rossvale Creek Tributary II.	Sampled June 24, August 20, and September 30, 2020
SW-06	593046 E 6122745 N	Upstream	Highway Inlet to Beaver Pond: Measures upstream water quality on the south side of Highway 16, prior to entering the inlet of Beaver Pond. Site is likely influenced by Highway 16.	Sampled June 24, August 20, and September 30, 2020
SW-07	591675 E 6123069 N	Downstream	Rossvale Creek Tributary II south of Highway 16: Measures downstream surface water flows that converge from SW-05 to form Rossvale Creek Tributary II. Site is likely influenced by Highway 16.	Sampled June 24, August 20, and September 30, 2020
SW-08	593090 E 6122786 N	Upstream	Highway Inlet to Beaver Pond: Measures upstream water quality entering Beaver Pond from the north side of Highway 16.Site is likely influenced by Highway 16.	Sampled June 24, August 20, and September 30, 2020
SW-09	592180 E 6123775 N	Downstream	Downstream of landfill near west property boundary: Measures surface water quality in an ephemeral creek west of the landfill. If water quality parameters exceed BCWQG-AW, the Hazelton WMF Exceedance Response Plan must be initiated.	Sampled June 24, August 20, and September 30, 2020
SW-10	N/A	N/A	Downstream of BH-03, to monitor any run-off towards the drinking water wells	Sampled June 24, August 20, and September 30, 2020

3.4.1.1 SW-01 and SW-02 Background Sites

Upstream surface water sampling locations SW-01 and SW-02, located at the south and south-east corners of the landfill property, were both sampled during the June, August and September sampling

events. Surface water flows are from off-site sources which allow the samples at these locations to be representative of background concentrations.

As in the past, there were exceedances of the BCWQG AW and DW for total metals at both locations. Specifically, aluminum, iron, manganese, and phosphorus were in exceedance of either criterion. During the 2020 sampling events, dissolved metals were also sampled. At both locations there were fewer exceedances of the BCWQG-AW and DW for dissolved metals when compared to total metals. In general, total metal concentrations at SW-01 and SW-02 were similar or lower to previous sampling events.

The field pH at SW-01 and SW-02 was slightly acidic with field pH values between 5.69 and 6.31. Laboratory pH values for these sites ranged from 6.51 to 7.08 The June and August readings were below BCWQG-DW criteria, while the September readings were near neutral. SW-01 and SW-02 conductivity ranged from 24 to 53 µS/cm. This low conductivity value is representative of naturally occurring water with conductivity less than 200 µS/cm that is impacted by metals naturally mobilized due to acidic conditions. SW-01 and SW-02 are both located in ponded wetlands with minimal to no flow, depending on the season. These conditions can be susceptable to anaerobic conditions which promote acidic conditions. At these locations, the field dissolved oxygen (DO) ranges from 2.8 to 3.7 mg/L.

VOC and hydrocarbons were sampled for the first time in 2020. All tested parameters were below the laboratory detection limits.

3.4.1.2 SW-03 Leachate Seep

Sampling location SW-03 is no longer an active surface water sampling location due to the Environmental Upgrades Project. As described in previous Hazelton Monitoring Reports, historic water quality at SW-03 is the most representative of raw leachate that is slightly diluted by surface runoff.

For reference, the following leachate parameter ranges, observed at SW-03 for its operation, are representative of typical leachate concentrations:

- Conductivity: 1,920 to 2,620 µS/cm
- pH: 7.0 to 7.6
- Total Hardness: 726 to 1090 mg/L
- Ammonia: 5.42 to 27.7 mg/L
- Total Aluminum: 0.080 to 9.020 mg/L
- Total Iron: 0.44 to 102.00 mg/L
- Total Phosphorous: 0.10 to 1.78 mg/L

3.4.1.3 SW-04 Log Weir

Sampling location SW-04 is no longer an active surface water sampling location because of redirection of leachate flow, resulting from the Environmental Upgrades Project. As described in previous Hazelton Monitoring Reports, historic water quality data at this location is representative of partially diluted and attenuated leachate in close proximity to the SW-03 leachate seep.

For reference, the following historic SW-04 leachate parameter ranges, observed throughout its operation, are representative of partially attenuated leachate concentrations:

- Conductivity: 963 to 2,320 µS/cm
- pH: 7.0 to 7.7
- Total Hardness: 105 to 826 mg/L
- Ammonia: 0.027 to 3.3 mg/L
- Total Aluminum: 0.025 to 10.4 mg/L
- Total Iron: 0.02 to 22.70 mg/L
- Total Phosphorous: 0.017 to 0.10 mg/L

3.4.1.4 SW-05 Beaver Pond Outlet

SW-05 is a downstream sample site located at the outlet of the Beaver Pond, north of the Hazelton WMF. The Beaver Pond receives surface water flow from two main areas. Firstly, run-off from a ditch that flows along the north and south sides of Highway 16 enters the beaver pond from the north (SW-08 and SW-06 are samples of run-off on the north and south sides of Highway 16, respectively, but have no connectivity to or influence from the Hazelton WMF). Secondly, surface water flows from the run-on ditches bordering the east side of the Hazelton WMF (there are no current sample sites located on this drainage ditch).

The pH readings at SW-05 indicate that the water is slightly acidic (6.6 – 6.9) and below the BCWQG-DW criteria. Conductivity was 98 – 199 µS/cm, which is slightly elevated for naturally occurring water with conductivity less than 200 µS/cm.

SW-05 exceeded the BCWQG-AW and DW total metals criteria for aluminum (AW), iron (DW and AW), manganese (DW), and phosphorus (DW). In general, there were fewer exceedances of the BCWQG-AW and DW for dissolved metals when compared to total metals. Dissolved iron and aluminum both exceeded the BCWQG-AW and DW criteria.

This sampling location no longer receives runoff from the landfill; however, run-off from ditches adjacent Highway 16 flow into the Beaver Pond wetland where SW-05 is located. Exceedances at SW-05 imply that there are exceedances in flows entering the Beaver pond. Chloride values range from 15.9 – 44.2 mg/L at SW-05,whereas chloride was not detectable at background sites. Also, concentrations of total sodium at SW-05 ranged from 10.3 to 24.2 mg/L in 2020; background levels of total sodium ranged from 0.5 to 1.8 mg/L. It may be inferred that elevated concentrations of chloride and sodium at SW-05 are likely a result of road salt (NaCl) applied to Highway 16. However, SW-05 total metals are similar to background concentrations observed at SW-01 and SW-02.

VOC and Hydrocarbons were sampled for the first time in 2020. All tested parameters were below the laboratory detection limits.

3.4.1.5 SW-06

SW-06 is located south of Highway 16 at the inlet to the Beaver Pond. Flows originate from a culvert that flows under Highway 16, downstream of SW-08. In general, exceedances at this location are similar

to SW-08. SW-06 is located cross-stream from the landfill. Surface water at SW-06 flows into the Beaver Pond (located downstream of the landfill) and is not believed to be impacted by or associated with the Hazelton WMF.

SW-06 exceeded the BCWQG-AW and DW total metals criteria for aluminum (AW), iron (AW and DW), manganese (DW), and phosphorus (DW). In general, there were fewer exceedances of the BCWQG-AW and DW for dissolved metals when compared to total metals. Dissolved iron and aluminum both exceeded the BCWQG-AW and DW criteria.

Readings of pH at this location indicate that water is slightly acidic ranging from a pH of 6.5 to 7.2. These values tend to be outside the range for the BCWQG DW criteria. Conductivity at this location was slightly elevated, ranging from 73 to 282 µS/cm which is above natural water conductivity. The elevated conductivity at this location could be caused by impacted runoff originating from the highway. Similar conductivity levels were also observed at SW-08. Chloride was elevated above background, ranging from 5.7 to 59.2 mg/L.

VOC and Hydrocarbons were sampled for the first time in 2020. All tested parameters were below the laboratory detection limits.

3.4.1.6 SW-07

SW-07 is located on Rossvale Creek Tributary II south of Highway 16. The sampling location is immediately upstream of the culvert crossing in the highway ditch. Surface water flows originate from the Beaver Pond (SW-05), which converges with another tributary from the south to form Rossvale Creek Tributary II. This location represents water concentrations downstream of the Beaver Pond and landfill.

SW-07 exceeded the BCWQG-AW and DW total metals criteria for aluminum (AW), iron (DW and AW), manganese (DW), and phosphorus (DW). In general, there were fewer exceedances of the BCWQG-AW and DW for dissolved metals when compared to total metals. Dissolved iron and aluminum both exceeded the BCWQG-AW and DW criteria. In general, water quality values are similar to the 2019 results.

The pH at this location was 7.38 and 7.49 which is compliant with both the AW and DW criteria. Chloride at this location was elevated above background concentration and ranged from 9.34 to 34.4 mg/L. Conductivity at this location ranged from 100 to 210 µS/cm which is comparable to naturally occurring water (less than 200 µS/cm). These three parameters show an improvement in water quality when compared to SW-05.

VOC and Hydrocarbons were sampled for the first time in 2020. All tested parameters were below the laboratory detection limits.

3.4.1.7 SW-08

SW-08 is located in the roadside ditch north of Highway 16 (across the Highway from SW-06). Runoff from the road and ditch make up the majority of the flow in the stream. SW-08 is located cross-stream

from the landfill. Surface water at SW-08 flows into the Beaver Pond (located downstream of the landfill) and is not impacted by or associated with the Hazelton WMF.

SW-08 exceeded the BCWQG-AW and DW total metals criteria for aluminum (AW), cadmium (AW and DW), iron (AW and DW), manganese (DW), and phosphorus (DW). In general, the occurrence of exceedances of the BCWQG-AW and DW for dissolved metals and total metals were similar. Dissolved iron and aluminum both exceeded the BCWQG-AW and DW criteria. Manganese and phosphorus exceeded the BCWQG-DW criteria.

The pH readings at this location indicate that water is slightly acidic, ranging from 6.3 to 6.4. These values are below the BCWQG-DW criteria. Conductivity at this location ranged from 118 to 148 µS/cm which is similar to natural water conductivity. Chloride concentrations were elevated, ranging from 24.7 to 30.5 mg/L.

VOC and Hydrocarbons were sampled for the first time in 2020. All tested parameters were below the laboratory detection limits.

3.4.1.8 SW-09

SW-09 is located downstream of the landfill at the west property boundary where an ephemeral creek forms. This location is a compliance point that will trigger the Surface Water Exceedance Response Plan if water quality is not compliant with BCWQG-AW.

SW-09 exceeded the BCWQG-AW and DW total metals criteria for aluminum (AW), cadmium (AW), iron (AW and DW), manganese (DW), and phosphorus (DW). Notably, the June 2020 sampling event value for manganese was 3.33 mg/L which is an order of magnitude greater than the August 2020 sampling event. The June value could be inconclusive because the duplicate sample from this location had a very high Relative Percentage Difference (RPD) of 80%. Regarding dissolved metals, the occurrence of exceedances of the BCWQG-AW and DW for dissolved metals and total metals were similar, excluding cadmium. Dissolved iron and aluminum both exceeded the BCWQG-AW and DW criteria. Manganese and phosphorus exceeded the BCWQG-DW criteria.

The pH readings at this location indicate that water is slightly acidic to near neutral with values of 6.7 to 7.1. These values are below BCWQG-DW criteria. Conductivity at this location ranged from 96.4 to 231 µS/cm which is slightly above natural water conductivity. Chloride was elevated above background, ranging from 13.9 to 47.3 mg/L.

VOC and Hydrocarbons were sampled for the first time in 2020. All tested parameters were below the laboratory detection limits.

3.4.1.9 SW-10

SW-10 is located downstream of BH-03, near the southwest corner of the Landfill property boundary. SW-10 is a ponded surface water site with minimal flow, situated adjacent to a BC hydro transmission line right of way. This site is cross-stream from the landfill and may be representative of existing conditions in acidic wetlands in proximity to the landfill.

SW-10 exceeded the BCWQG-AW and DW total metals criteria for aluminum (AW), chromium (AW), iron (AW and DW), manganese (DW), and phosphorus (DW). In general, the occurrence of exceedances

of the BCWQG-AW and DW for dissolved metals and total metals were similar. Dissolved iron and aluminum both exceeded the BCWQG-AW and DW criteria. Chromium, manganese and phosphorus exceeded the BCWQG-DW criteria.

The pH readings at this location indicate that water is acidic, ranging from 5.1 to 6.1. These values are the lowest recorded pH at the site, being outside the range for the BCWQG-AW and DW criteria. Conductivity at this location was 36 and 47 µS/cm, which is within the range for natural water. Chloride was not detectable at this location for the 2020 sampling events. As SW-10 is located in a ponded wetland, the acidic pH could be the result of anaerobic conditions due to no surface water flow (DO ranging from 1 to 4 mg/L). It may be inferred that metals exceedances are a result of naturally mobilized metals due to acidic conditions.

VOC and Hydrocarbons were sampled for the first time in 2020. All tested parameters were below the laboratory detection limits, excluding toluene. Toluene values for both sampling events exceeded BCWQG-AW criteria. The high toluene value of 14.2 ug/L recorded in August 2020 may be a results of biogenic (naturally occurring) toluene, which can be found in anaerobic/low oxygen conditions and rich organic environments, like peat bogs and wetlands.

3.4.2 Treated Effluent to Wetland #4 Infiltration Trench

The treated effluent to Wetland #4 Infiltration Trench monitoring schedule, as per the amended OC is shown below in Table 3-3.

Table 3-3: Treated Effluent to Wetland #4 Infiltration Trench

Location	Parameters	Frequency
E309786 Treated Leachate at Wetland #4 Outlet	Lab: total metals, alkalinity, chloride, fluoride, sulphate, hardness, ammonia, nitrate, nitrite, TOC, orthophosphorous, COD, BOD, EPH, BTEW/VPH, pH, total Kjeldahl nitrogen	Lab/Field: Once prior to first discharge event of the year (spring) and once per summer and fall. Monthly if discharging at any time during the other months
	Field: Conductivity, pH temperature, DO, turbidity, volume (flow measurement), visual[1]	Volume: Continuous during discharge Visual: Transverse area between Wetland #4 Infiltration Trench and SW-09 twice per week during any period of discharge to identify any surface breakouts of discharge
	Acute Toxicity: Daphnia magna	Acute Toxicity: Once prior to start of each distinct continuous discharge event or at least once per spring, summer, and fall during discharge, whichever is more frequent

[1]Visual inspection to detect surfacing of effluent between Wetland #4 Infiltration Trench and SW-09. If surface flow of effluent is detected, then the discharge must cease and the director must be notified within 24 hours

Wetland #4 is located on the west side of the landfill as seen in Figure 3. During 2020, there were two uncontrolled and one controlled discharge event. The two uncontrolled events took place in late March (samples were collected in early April) and May of 2020. The cause of these uncontrolled discharge events was high levels of precipitation flooding the wetlands due to snow melt.. In response, RDKS opened the Wetland #4 discharge valve to immediately reduce the overflowing water level. In the first event, RDKS set up a relay pump system between each wetland to recirculate flows to the equalization pond. In the second event, Wetland #4 was drained via the Wetland #4 Infiltration Trench because the other three wetland levels were low. Following both uncontrolled discharge events, water quality samples were taken for all required parameters, excluding EPH and BTEX/VPH, as shown in Table 4: Wetland #4 Water Quality Data. For both events, all tested parameters were compliant with the OC Discharge Criteria, including the acute toxicity tests.

Following the second uncontrolled discharge event, a controlled discharge event continued for the rest of the year with samples taken monthly. During discharge, the OC requirements were confirmed for

compliance, as shown in Table 4: Wetland #4 Water Quality Data. Surface water samples were collected from the Wetland #4 Infiltration Trench from June 2020 to December 2020. For all sampling events, all tested parameters were compliant with the OC Discharge Criteria, including the acute toxicity tests.

Discharge volume was recorded based on visual observations of the discharge flow rate over the weir. These observations were made by field staff during the associated sampling event. Notably, the July 30, 2020, value was not recorded because Wetland #4 was dry at that time. In the future, RDKS intends to improve discharge data collection by installing an instrument to continually measure discharge.

Discharge during the controlled discharge event were directly calculated from weir water levels. The resulting average discharge rates are compiled in Table 4: Wetland #4 Water Quality Data.

Data that was not collected included visual observations of surface discharge between the Wetland #4 Infiltration Trench and SW-09.

3.4.2.1 Wetland #4

In general, all water quality results were compliant with the Amended OC Discharge criteria, during the controlled discharge event. For discussion and reference purposes, samples from Wetland #4 Infiltration Trench have also been compared to the BCWQG-DW and BCWQG-AW which showed few exceedances. There were slightly elevated levels of total organic carbon (TOC), ammonia and chloride at this location. However, only TOC exceeded the BCWQG-DW.

Samples exceeded the BCWQG-AW and DW total metals criteria for aluminum (AW), iron (DW), and manganese (AW and DW). These results show fewer exceedances in water quality when compared to the 2019 sample data. Elevated levels of metals observed during 2019 that are absent in 2020 include arsenic and phosphorous. Furthermore, iron level only exceeded the BCWQG-DW for the September and October sampling events. This shows fewer exceedances when compared to 2019 when iron exceeded one or both of the BCWQG-AW and DW criteria for each sampling event.

In summary, the Wetland #4 Infiltration Trench appears to have much fewer exceedances than background surface water at SW-01 and SW-02. Also, LC-50 results show that the 96-hour LC-50 concentration was greater than 100% for the Wetland #4. For these reasons, Wetland #4 Infiltration Trench water quality is likely the result of significant influences from precipitation inputs to Wetland #4.

3.4.3 Groundwater Monitoring Wells

The groundwater monitoring well network at the Hazelton WMF consists of groundwater wells and shallow groundwater (SGW) wells. The groundwater monitoring schedule as per the amended OC is shown in Table 3-3.

Table 3-4: Groundwater Monitoring Schedule as per Amended OC

Location	Parameters	Frequency
BH-01 BH-02 BH-03 BH-4B BH-5B SGW-1 SGW-2	Lab: Dissolved metals, alkalinity, chloride, fluoride, sulphate, hardness, ammonia, nitrate, nitrite, total Kjeldahl nitrogen, TOC, COD, pH, EPH, BTEX/VPH	Quarterly → Annually[1,3]
SGW-3 SGW-4 SGW-5	Field: Conductivity, temperature, pH water elevation[2]	Monthly → Quarterly[1,3]

[1]Quarterly reduced to annually and monthly reduced to quarterly following two complete years of sampling.
[2]Water elevation quarterly
[3]Spring sampling to be conducted on or before May 15 of each year

The five groundwater wells (BH-01, BH-02, BH-03, BH-04, BH-05) were drilled by Agra in 2009. It is our understanding that the SGW wells (SGW-1, SGW-2, SGW-3, SGW-4, SGW-5) were located in small creek channels and low-lying wetlands to represent ephemeral water. The SGW wells do not have a sand pack around the slots of the well piezometers and the screens run the entire column of the well, which means that the SGWs are measuring surface water and shallow groundwater, and there is a higher potential for sediment to infiltrate into the wells. A brief description of the groundwater and SGW sampling locations is presented in Tables 3-6 and 3-7. The Hazelton WMF groundwater sampling locations are shown in Figure 3. Groundwater table elevations from July 2014 are shown in Table 3-5 for reference.

Table 3-5: Groundwater Table Elevations, July 30, 2014

GW Wells	Ground Elev.	Stick Up (m)	Well Depth (m)	WL Depth (m)	GW Elev. (m)
BH-01	141.77	0.36	44.50	21.32	120.81
BH-02	141.84	0.32	33.24	21.30	120.86
BH-03	114.9	0.44	60.05	56.65	58.69
BH-4A	122.31	0.92	17.59	14.58	108.65
BH-4B	122.31	1.02	3.00	2.68	120.65
BH-5A	93.94	0.51	18.53	dry	dry
BH-5B	93.94	0.49	5.60	3.56	90.87

Note: Agra surveyed borehole elevations to an arbitrary datum.

SHA estimates that actual elevations are 330 m higher than Agra's reported values in this Table.

Table 3-6: Description of Groundwater Sampling Locations

Monitoring Locations	UTM Coordinates (+/- 5m)	Description	2019 Sampling Notes
BH-01	593609 E 6121753 N	Southeast of the Landfill and considered to be up-stream, representing background groundwater quality	2020 Sampling Dates: Mar 31, June 22, Aug 25, Oct 21
BH-02	593264 E 6121910 N	Southeast of the Landfill and considered to be up-stream and thus represents background groundwater quality	2020 Sampling Dates: Mar 31, June 24, Aug 25, Oct 21
BH-03	592642 E 6122053 N	Located at the southwest corner of the property line and it is between the Landfill and the closest public drinking water well which is approximately 2 km southwest from the Landfill, Exceedance Response Plan Monitoring Location	Dry during all 2020 sampling events
BH-4A	593506 E 6122164 N	Deep piezometer in BH-04. Southeast of the Landfill and considered to be up-stream and thus represents background groundwater quality	Not Sampled in 2020
BH-4B	593506 E 6122164 N	Shallow piezometer in BH-04. Southeast of the Landfill and considered to be up-stream and thus represents background groundwater quality	2020 Sampling Dates: Mar 31 Dry during June 22, 2020 sampling event
BH-5A	592591 E E6123018 N	Deep piezometer in BH-05 and historically dry. Directly downstream of the landfill and is situated near the intersection of the landfill access road and Highway 16	Not sampled in 2020
BH-5B	592591 E 6123018 N	Shallow piezometer in BH-05. Directly downstream of the landfill and is situated near the intersection of the landfill access road and Highway 16, Exceedance Response Plan Monitoring Location	2020 Sampling Dates: Mar 30, June 22, Aug 25, Oct 21

Table 3-7: Description of Shallow Groundwater Sampling Locations

Monitoring Locations	UTM Coordinates (+/- 5m)	Description	2019 Sampling Notes
SGW-1	592698.027 E 6 6122231.314 N	Downstream of the southwest corner of the Phytoremediation perimeter ditch	Not sampled in 2020, well broken
SGW-3	592673.678 E 6122409.984 N	Downstream of the northwest corner of the WMF site, located in the Wetland #4 infiltration trench (i.e., weir pond)	Not sampled in 2020, well frozen or flooded by Wetland #4 weir
SGW-2	592533.158 E 6122444.271 N	Downstream of SGW-3 at property boundary, Exceedance Response Plan Monitoring Location	2020 Sampling Dates: June 25, Aug 26, Oct 22, Nov 12 Additional 2020 Field Sampling Dates: May 11, Sept 9, Nov 12 Well frozen: March 30 and Dec 16
SGW-4	592524.282 E 6122701.595 N	Downstream of Beaver Pond at property boundary, Exceedance Response Plan Monitoring Location	2020 Sampling Dates: June 25, Aug 26, Oct 22, Nov 12 Additional 2020 Field Sampling Dates: May 11, Sept 9, Nov 12, Dec 16
SGW-5	592525.999 E 6122269.748 N	Downstream of SGW-1, at property boundary, Exceedance Response Plan Monitoring Location	2020 Sampling Dates: June 25, Aug 26, Oct 22, Nov 12 Additional 2020 Field Sampling Dates: May 11, Sept 9, Nov 12 Well frozen: March 30 and Dec 16

3.4.4 Shallow Ground Water Quality Results

Shallow groundwater quality results are tabulated in Table 2 (Appendix B). Charts 6 to 11 show the overall shallow groundwater quality trends. During 2020, SGW-02, SGW-04, and SGW-05 were sampled on June 25, 2020, August 26, 2020, and October 22, 2020, for parameters outlined in the amended OC. Additional field measurements were taken on a monthly basis for these locations. SGW-01 and SGW-03 were not sampled in 2020 because SGW-01 is broken and SGW-03 was flooded by the Wetland #4 Infiltration Trench (i.e., weir pond).

3.4.4.1 SGW-1

Shallow ground water well SGW-1 is located in an ephemeral creek which is similar to the wetland areas bordering the landfill site. Currently, run-on flowing into the creek is from the perimeter ditch bordering the south and west sides of the Phase 2 expansion area, and the south phytoremediation perimeter ditch. This location was not sampled in 2020 because the well is broken.

3.4.4.2 SGW-3

Shallow groundwater well SGW-3 is located in the Wetland #4 Infiltration Trench (weir pond) at the NW corner at site. This site historically monitored shallow groundwater downstream of Wetland #4.

However, construction of the Wetland #4 weir pond, also referred to as Infiltration Trench, flooded this well location, rendering it inoperable. As such, SGW-3 was not sampled during 2020.

3.4.4.3 SGW-2

Shallow groundwater well SGW-2 is located within ponded stagnant water adjacent to an ephemeral creek downstream of SGW-3, as observed in Figure 3. This monitoring location is situated near the property boundary. When comparing the 2020 sampling results to the November 2019 sampling results, the groundwater at this location appears to be improving. In general, the 2020 results were similar to 2019 for analyte parameters and lower for dissolved metals. This general trend can be partially explained by comparing data from Wetland #4 Infiltration Trench and variations in TOC concentrations.

Samples from this location showed varying results for key leachate indicating parameters. Conductivity, pH, alkalinity, ammonia, and TOC were similar to values observed in 2019. Conductivity ranged from 489 µS/cm to 760 µS/cm, which is slightly lower than the November 2019 value of 799 µS/cm. This range is above the conductivity of typical surface water (<200 µS/cm). The pH ranged from 6.96 to 7.46 which is similar to 2019 values. Alkalinity ranged from 226 to 347 mg/L which is slightly lower than 2019 values. Ammonia ranged from 0.504 to 0.616 mg/L, which is slightly lower than the maximum 2019 value. Lastly, TOC ranged from 95.3 to 141 mg/L, which is within the 2019 range.

There were consistent exceedances of BCWQG-DW, BCWQG-AW and BC CSR-DW criteria for several metals. Dissolved metals exceeding either criteria in one or more cases include arsenic, cobalt, iron, manganese, and phosphorous. In general, there are key leachate indicating parameters which show a decrease in concentration when compared to 2019 results. These metals include arsenic, cobalt, iron and manganese. Notably, the maximum iron value in 2020 (13.1 mg/L) was lower than the minimum 2019 iron value. Furthermore, less parameters in 2020 experienced exceedances when compared to 2019. Specially, aluminum, beryllium, cadmium, chromium, and lithium did not have exceedances in 2020.

When comparing the 2020 SGW-2 results to the 2020 Wetland #4 Infiltration Trench data, Wetland #4 Infiltration Trench parameters have lower or similar values. Wetland #4 Infiltration Trench parameters that were lower than SGW-2 parameters include dissolved metals, conductivity, alkalinity, ammonia and TOC. Notably, the dissolved metals concentrations for Wetland #4 Infiltration Trench are significantly lower than those at SGW-2. This could be impacted by varying TOC values. The TOC range for Wetland #4 Infiltration Trench was 4 to 12.8 mg/L which is significantly lower than that of 2020 SGW-2 values (95.3 to 141 mg/L). Furthermore, the 2020 SGW-2 TOC range had a lower maximum than the 2019 range. It appears that dissolved metals concentrations decline when TOC concentrations decline. For this reason, it is difficult to conclude that the SGW-2 samples with high TOCs are representative of leachate impacts from the Wetland #4 Infiltration Trench discharge.

This point is also supported by chloride concentration observations. 2020 SGW-2 chloride concentrations ranged from 23.7 to 49.9 mg/L, whereas the 2019 values ranged from 51.1 to 123 mg/L. When comparing chloride ranges between 2020 SGW-2 and 2020 Wetland #4 Infiltration Trench, and 2019 SGW-2 and 2019 Wetland #4 Infiltration Trench, the comparison in both years show similar ranges. This is explainable because any discharge from the Wetland #4 Infiltration Trench would transport chlorides to SGW-2 at the property boundary. Thus, the Wetland #4 Infiltration Trench discharge is detectable at the property boundary.

Of importance, there were exceedances of the CSR-DW criteria for arsenic, cobalt, iron, and manganese. Arsenic levels are elevated compared to background concentrations. However, exceedances of arsenic have been observed at BH-4B and in background concentrations at BH-01. Also, the 2020 arsenic maximum value of 0.0142 mg/L was below the maximum arsenic value observed in BH-01. Cobalt levels were lower than values recorded during 2019 sampling and lower than background concentrations at BH-4B. Iron levels during the 2020 sampling events were all below the 2019 minimum iron value and the 2020 value at BH-4B. Furthermore, iron is commonly observed in background concentrations for groundwater and surface water. For this reason, to completely attribute elevated iron concentrations to leachate discharge would require further investigation. Lastly, 2020 manganese levels are elevated with concentrations ranging from 2.38 mg/L to 3.94 mg/L. The maximum value in this range was below the minimum 2019 value. Furthermore, historic values at BH-4B have experienced these levels of manganese.

It may be inferred that exceedances of BCWQG parameters may be exacerbated by the fact that SGW-2 is sitting in stagnant ponded surface water and the entire well column is screened.

3.4.4.4 SGW-4

SGW-4 is located within the ephemeral creek downstream of the Beaver Pond, as observed in Figure 3. This monitoring location is situated near the property boundary. 2018 was the first year that samples were collected from this location.

Samples from this location showed similar or lower results for conductivity, pH, chlorides and TOC when compared to 2019 values. Conductivity ranged from 475 to 701 µS/cm for 2020, which is similar to 2019 conductivity. The pH ranged from 7.55 to 8.02, which is similar to 2019 values. Chlorides ranged from 1.07 to 3.49 mg/L, which is lower than 2019 values ranging from 3.52 to 14.3 mg/L. TOC ranged from 11.6 to 20.6 mg/L, which is similar to 2019 values.

There were exceedances of BCWQG-DW, BCWQG-AW and BC CSR-DW criteria for several metals. Metals exceeding either criteria in one or more cases include cobalt, iron, and manganese. Cobalt ranged from 0.0050 to 0.0061 mg/L, which is similar to 2019 results. Iron ranged from 0.136 to 3.88 mg/L, which is similar to 2019 values. Notably, the iron values for 2020 and 2019 vary by one order of magnitude without a discernible pattern. Furthermore, the 2020 values are below background iron concentrations at BH-4B. Elevated iron in background water has also been observed at BH-01 and BH-02. Manganese ranged from 1.35 to 1.4 mg/L, which is slightly lower when compared to 2019 values. Notably, manganese values decreased to compliant levels in 2020.

CSR-DW exceedances include cobalt for all 2020 samples. Background concentrations at BH-4B have shown consistent exceedances an order of magnitude greater than the SGW-4 2020 results.

3.4.4.5 SGW-5

Shallow groundwater well SGW-5 is located within the ephemeral creek/wetland downstream of SGW-1, as observed in Figure 3. This monitoring location is situated near the property boundary.

Samples from this location showed similar or lower results for conductivity, pH, chlorides and TOC when compared to 2019 values. Conductivity ranged from 386 to 701 µS/cm for 2020, which was similar to conductivity in 2019. The pH ranged from 7.64 to 7.94, which is slightly lower than 2019 values. Chlorides ranged from 1.88 to 3.49 mg/L, which is slightly lower than 2019 values ranging from 3.49 to

4.50 mg/L. TOC values for the August 2020 and October 2020 sample events were 11.6 mg/L and 9.7 mg/L, respectively. These two values were similar to the results in 2019. However, the June 2020 sample had noticeably higher TOC value of 58.8 mg/L. This is the largest TOC recorded for this location.

There were consistent exceedances of BCWQG-DW, BCWQG-AW and BC CSR-DW for several metals. Metals exceeding either criteria in one or more case include cobalt, iron, and manganese. Cobalt values ranged from 0.00378 to 0.00503 mg/L, which is similar to 2019 results. Iron levels ranged from 0.22 to 2.74 mg/L, which is lower than 2019 values. Manganese values ranged from 0.952 to 1.48 mg/L, which is similar to 2019.

CSR-DW exceedances include cobalt for the August and October 2020 samples. Similar to SGW-4, BH-4B has shown consistent exceedances an order of magnitude greater than the SGW-5 2020 results.

3.4.5 Groundwater Quality Results

Groundwater quality results are tabulated in Table 3 in Appendix B. Charts 12 to 18 in Appendix C show the overall groundwater quality trends. Of importance, BH-03 was dry during each sampling event and BH-4B was only sampled during the March sampling event.

3.4.5.1 Background Groundwater Quality

Groundwater monitoring locations BH-01, BH-02, and BH-04 are all upstream of the landfill and are assumed to represent background water quality. Monitoring well BH-04 has nested piezometers with one deep and one shallow piezometer labelled as BH-4A and BH-4B, respectively. Samples from these monitoring locations show that the groundwater in the area tends to exceed BCWQG-AW and DW, and BC CSR-DW standards for several parameters.

Deep wells, BH-02 and BH-4A have high conductivity, ranging from 812 to 949 µs/cm and 751 to 773 µs/cm, respectively. Both wells had high alkalinity with values ranging from 355 to 1095 mg/L and 260 to 277 mg/L for BH-02 and BH-4A, respectively. Similarly, the shallow piezometer BH-4B had elevated conductivity ranging from 76.5 to 666 µs/cm and alkalinity ranging from 19 to 404 mg/L.

Upstream BH-01 has lower conductivity than BH-02, BH-4A, and BH-4B; however, it is still relatively high, ranging from 387 to 687 µs/cm. Notably, the 2020 sampling events experienced the highest conductivity readings at this location in that range. The water at BH-01 was also hard, with alkalinity ranging from 210 to 392 mg/L. Notably, the March 2020 value for alkalinity was 2,180 mg/L which is significantly higher than typical values at BH-01.

There were exceedances in 2020 for several metal concentrations at the background wells. Monitoring wells BH-4A, BH-4B, BH-02 and BH-01 exceed either BCWQG-AW and DW, or BCCSR-DW guidelines for aluminum, arsenic, cadmium, cobalt, copper, iron, manganese, phosphorous. Specifically, exceedances of BC CSR-DW criteria were experienced for cobalt and iron at BH-04B, the shallow nested piezometer. Cobalt was measured at 0.00989 mg/L for the March sampling event. Iron was measured at 15.9 mg/L for the March sampling event. This is the highest iron concentration recorded at the Hazelton Landfill for all groundwater samples.

VOCs and EPHs were sample for the first time in 2020. All tested parameters were none detectable, excluding toluene at BH-02. These values exceeded the BCWQG – AW limit. It is likely that toluene at this location is naturally occurring because of the absence of other BTEX compounds. Furthermore,

biogenic toluene can be found in anaerobic/low oxygen conditions and rich organic environments, like peat bogs and wetlands. However, additional testing is required in order to establish if this well has elevated toluene concentrations or if these readings had anomalies.

3.4.5.2 Groundwater Quality Downgradient of Landfill

Monitoring well BH-5B is the only groundwater well located downgradient from the landfill. It is located at the NW corner of the Hazelton WMF property boundary, along Highway 16. The depth to water in BH-5B is typically only 3.5 m. As such, the groundwater at this location is likely influenced by surficial infiltration. Similarly, the depth to water in background well BH-4B is typically less than 3 m. For this reason, a comparison between water quality at BH-5B and background water quality at BH-4B is representative because of similar environmental conditions. Comparison with background water quality at BH-01 and BH-02 may not be as representative because the depth to water in these wells is more than 20 m, which could be less affected by surficial impacts.

The groundwater from BH-5B is hard, has high conductivity, and has higher chloride concentrations than all of the background wells, as shown in Charts 12, 13, and 16 in Appendix C. Alkalinity values for 2020 ranged from 380 to 570 mg/L, which are above values at BH-4B, but they are below values at BH-02. Conductivity ranged from 1350 to 1620 µs/cm which is well above background concentrations. This could be attributed to high chloride levels, ranging from 210 to 226 mg/L for 2020. These values are significantly elevated compared to background concentrations where chlorides are commonly not detected. Typically, these elevated chloride levels may indicate potential leachate impact.

Another parameter that is associated with leachate impact is ammonia. The ammonia levels at BH-5B range between 0.0399 and 0.0808 mg/L, which are similar to values at BH-4B and significantly lower than BH-01 and BH-02. This information suggests that ammonia concentrations at BH-5B are not influenced by leachate impact.

There were metals in exceedance of the BCWQG-DW, BCWQG-AW and BC CSR-DW. Metals exceeding any criteria in one or more cases include aluminum, arsenic, cobalt, iron, manganese, and phosphorous.

Of importance, there were exceedances of the CSR-DW standards at BH-5B for arsenic, cobalt, iron, and manganese concentrations in 2020. Arsenic exceedances ranged from 0.0046 to 0.0173 mg/L, which are similar to values observed at BH-01 where arsenic is commonly elevated. During the March 2020 sampling event, arsenic was non-compliant with the BCWQG-AW criteria. Cobalt exceedances ranged from 0.00341 to 0.00582 mg/L. This range is similar to background concentrations observed at BH-4B. Iron exceedances ranged from 0.98 to 15.3 mg/L, which is similar to values observed at BH-4B. Manganese concentrations ranged from 1.35 to 4.08 mg/L, which is similar to values observed at BH-4B, and BH-01 and BH02. In general, it is difficult to conclude if water quality at BH-5B is predominately influenced by leachate impact, or background water condition and contamination from Highway 16 operations.

4. DISCUSSION ON SURFACE WATER AND GROUNDWATER QUALITY RESULTS

4.1 Surface Water Quality

4.1.1 Surface Water

Surface water entering the site has slightly improved when compared to historical data. SW-01 and SW-02 had elevated concentrations of metals that are regularly in non-compliance with BCWQG-AW and DW criteria. Notably, SW-01 and SW-02 chromium results were at compliant levels in 2020as opposed to those in 2019. Also, at SW-02, cadmium results were at compliant in 2020, as opposed to those in 2019. However, these variables fluctuate over the long term. Historically, these locations have shown naturally occurring exceedances of the BCWQG criteria, particularly for metals. Both of these background sites are located in ponded wetlands with minimal to no flow. The pH at both of these sites has historically been non-compliant with BCWQG. It may be inferred that acidic conditions have mobilized metals from the surface water bodies. Thus, elevated metals at downstream surface water locations cannot be solely attributed to leachate impact.

Chloride and ammonia levels at SW-01 and SW-02 are commonly not detectable. The presence of these key leachate indicating parameters may indicate potential leachate impact. However, a common issue at the Hazelton WMF is potential contamination from Highway 16 operations (i.e., road salt). In this case, elevated chlorides and sodium can be observed without elevated ammonia levels. Surface water locations that are affected by this include SW-05, SW-06, SW-07 and SW-08. This inference is supported by the fact that these sites all show elevated levels of chloride, and only SW-05 and SW-07 are located downstream of the Hazelton WMF; SW-06 and SW-08 are located on the north and south sides of Highway 16, respectively, and are not influenced by the landfill.

In 2020, surface water sampling location SW-06 at the inlet to Beaver Pond had the highest chloride concentrations when compared to SW-05 and SW-08. The lower values at SW-05 are to be expected because of dilution in the Beaver Pond. When comparing ammonia levels for these three locations, the results are similar to background concentrations. Notably, there is a decrease in ammonia levels between SW-05 and SW-06 which shows that the Beaver Pond has a natural capacity to treat ammonia. Because ammonia levels are similar to background levels, surface water quality downstream of the Hazelton WMF is believed to be impacted primarily by highway run-off opposed to leachate. Lastly, metal exceedances found at these three locations are similar to each other, with minor natural attenuation observed at SW-5 compared to SW-06. However, these values are not significantly elevated when compared to background concentrations.

Similarly, SW-07 water quality results do not indicate significant signs of leachate impact. SW-07 ammonia levels are consistent with background concentrations, which suggests that elevated chloride is caused by Highway 16 contamination. Furthermore, chloride values at SGW-04 (located between SW-05 and SW-07) are lower than results at both SW-5 and SW-07. Based on location and proximity to the highway, it may be inferred that the source of chlorides at SW-05 and SW-07 are from independent sources of run-off from Highway 16. Lastly, metal exceedances at SW-07 are similar to background concentrations.

SW-09 is located at the west property boundary at the intersection of two ephemeral creeks that receive discharge from the Wetland #4 Infiltration Trench. Elevated chlorides and ammonia are observed at this location, however they are compliant the BCWQG criteria. Metal exceedances of concern include aluminum, iron, and magnesium. In one or more cases, these values were not compliant with the BCWQG–AW. Aluminum exceedances were slightly elevated or similar when compared to background concentrations. Iron concentration were elevated compared to background concentrations. Manganese was only non-compliant for the June sampling event, with a value above background concentrations. When comparing these three metals to Wetland #4 Infiltration Trench water quality (the source of treated leachate discharge), SW-09 values exceed those at the Wetland #4 Infiltration Trench. This could be caused by elevated sediments and organics at SW-09, skewing the total metals results. This inference is supported by the fact that the TOC at SW-09 is roughly three times greater than corresponding values at the Wetland #4 Infiltration Trench. In conclusion, the data does not provide concise evidence that water quality exceedances at SW-09 are driven by the treated leachate discharge.

SW-10 is located at the SW corner of site. Chloride was not detected at this location and ammonia was consistent with background concentrations. Thus, landfill leachate impacts at this location are not present.

Lastly, VOCs and EPH was tested for the first time in surface water. All tested parameters were non-detectable with the exception of toluene at SW-10. In certain cases, biogenic toluene can be created in specific ecologic systems. It is anticipated that the source of toluene in this case is natural because no other VOCs or EPHs were detected.

4.2 Groundwater Quality

4.2.1 Shallow Groundwater Wells

In general, the results from the SGW wells show elevated concentrations of conductivity, chlorides, alkalinity, ammonia and TOC in all samples. Typically, SGW locations at the property boundary are compared to the corresponding upstream SGW to evaluate leachate attenuation. However, upstream SGW locations SGW-01 (upstream of SGW-05) and SGW-03 (upstream of SGW-02) were not sampled in 2020. For this reason, SGW-5 was compared to historic data to evaluate if there are persistent impacts from historic leachate discharge from Phase 2B. Leachate discharge from this location has not occurred since 2018. SGW-02 was compared to Wetland #4 Infiltration Trench data because it is the source of any leachate flows to SGW-02. Lastly, SGW-4 is located at the property boundary, downstream of SW-05. As such, water quality results will be compared at these two locations.

Sampling location SGW-5 is located at the property boundary downstream of the southwest corner of the phytoremediation perimeter ditch. When compared to the 2019 data, SGW-5 data show decreases for key leachate indicating parameters including chlorides and ammonia. 2020 chloride values ranged from 1.88 to 3.49 mg/L, whereas 2019 chlorides ranged from 3.49 to 4.50 mg/L. 2020 ammonia levels ranged from 0.0594 to 0.19 mg/L, whereas 2019 values ranged from 0.115 to 0.323 mg/L. When comparing these ammonia values to background water quality at BH-4B, BH-01 and BH-02, the values are similar if not slightly lower. Metal exceedances of concern for SGW-05 include cobalt, iron and manganese. These parameters exceeded the BCWQG-DW criteria in one or more cases. Cobalt values

ranged from 0.00378 to 0.00503 mg/L, which was similar to 2019 results and lower than background concentrations at BH-4B. Iron levels ranged from 0.22 to 2.74 mg/L, which is lower than 2019 values and background concentrations at BH-4B. Manganese values ranged from 0.952 to 1.48 mg/L, which was similar to 2019 and lower than background concentrations at BH-4B. In conclusion, water quality at SGW-5 shows signs of historic leachate impacts that are naturally attenuating. Metal exceedances at this location are comparable to background concentrations, suggesting leachate impact is not the driving cause of exceedances at this location.

Sampling location SGW-2 is located at the property boundary downstream of Wetland #4 Infiltration Trench. When comparing the SGW-02 data to the Wetland #4 Infiltration Trench results, SGW-02 data shows higher levels for tested parameters, excluding chlorides. Chloride values for the 2020 June, August and October sampling events were 49.9 mg/L, 33.7 mg/L, and 23.7 mg/L. The corresponding Wetland #4 Infiltration Trench values were 49.6 mg/l, 40 mg/L, and 48.2 mg/L. This comparison shows that Wetland #4 Infiltration Trench discharge is being naturally attenuated and diluted prior to reaching SGW-02. Aside from chlorides, other leachate indicating parameters and metals experience higher concentrations at SGW-02. For instance, ammonia values are roughly 0.5 mg/L above those at Wetland #4 Infiltration Trench. However, these values are similar to background concentrations at BH-01 and BH-02. Metal exceedance of concern include arsenic, cobalt, iron, and manganese. These values are consistently in excess of the corresponding Wetland #4 Infiltration Trench data. When compared to background water quality, the SGW-02 parameters with exceedances are similar or below background concentrations. These metal results could be attributed to sample impacts from elevated TOC. TOC values at SGW-02 are 10 times greater when compared to Wetland #4 Infiltration Trench, suggesting significant sediments and organics in the sample. This is further supported by the fact that SGW-2 is located in stagnant ponded surface water and the entire well column is screened).

SGW-4 is located at the property boundary downstream of SW-05. When comparing the SGW-04 data to the SW-05 data, SGW-04 results show higher levels for tested parameters, excluding chlorides. Chloride values for the 2020 June and August were 2.36 mg/L and 3.49 mg/L, respectively. The corresponding SW-05 values were 44.2 mg/L and 26.8 mg/L. Ammonia values are roughly 0.5 mg/L above those at SW-05. However, these values are similar to background concentrations at BH-01 and BH-02. The only metal exceedance of concern was cobalt, but this value was similar to background concentrations. In general, water quality at SGW-04 does not appear to be significantly influence by flows from SW-05 or landfill leachate.

Lastly, VOCs and EPH were tested for the first time in surface water. All tested parameters were not detectable with the exception of toluene at SGW-2, SGW-4, and SGW-5. In certain cases, biogenic toluene can be generated in specific ecologic systems. It is anticipated that the source of toluene in this case is natural because no other VOCs or EPHs were detected.

4.2.2 Groundwater Wells

The background groundwater quality at BH-01 and BH-02 was found to have elevated conductivity, hardness, manganese and phosphorous. Background water quality at BH-4B contrastingly has low conductivity and hardness with far more exceedances of metals, including aluminum, cadmium, cobalt, copper, iron, manganese and phosphorous. Furthermore, BH-4B experiences regular BC CSR-DW exceedances for cobalt and iron. The contrast in results is attributed to BH-4B being a shallow well which is likely influenced by surficial wetland waters.

The water in BH-03, which would intercept any flow from landfill leachate before it reached the public water well was dry during 2020. In previous years, there was no concern of leachate impacting this area. Thus, the risk with this trend changing in 2020 is considered to be low.

Monitoring location BH-5B is the only well that is downgradient of the landfill. Its results showed potential evidence of leachate impact. It had elevated conductivity values that were higher than background and elevated chloride concentrations that were much higher than background conditions. However, several of the exceedances are less or similar to background conditions. For instance, ammonia levels at BH-5B are similar to background concentrations at BH-4B and lower than levels at BH-01 and BH-02. Furthermore, these ammonia values are well below those observed in Wetland #4 Infiltration Trench. In general, it is challenging to determine the portion of contamination resulting from leachate or other sources such as nearby highway operations.

5. QUALITY ASSURANCE AND QUALITY CONTROL

A quality assurance and quality control (QA/QC) program is a system of procedures, checks, audits and corrective actions that will assist in ensuring that the data generated at the laboratory is of the highest achievable quality. This is of prime importance, as the monitoring data forms the basis for all of the conclusions regarding the impact of the Landfill on the surrounding environment. As per the OC, one duplicate sample should be collected during each sampling event from one of the discharge points. Furthermore, each duplicate sample should be submitted to the laboratory; one of the pair identified as the regular sample, and the other, as a blind sample identified by a fictitious site-name established solely to identify the duplicate sample. The results of the field duplicates in terms of the degree of variation as the relative percent difference should be reported for each parameter, as specified in the OC.

In 2020, duplicate samples were obtained during multiple sampling events for the surface water, ground water and Wetland #4 Infiltration Trench sampling event. The results of the duplicate samples and the degree of variation, calculated as the relative percent difference, for each parameter are presented in Table 3. A summary of the analytes which were out of compliance (RPD > 20%) are listed below in Table 5-1. Furthermore, these values were tabulated because the tested concentrations exceeded five times the laboratory detection limit. Otherwise, non-compliant RPD values were not listed.

Table 5-1: Summary of Duplicate Sample Non-Compliance

Sampling Location	Monitoring Event	Analyte	RPD
SW-01	September 30, 2020	Total Kjeldahl Nitrogen	53.3%
SW-05	August 20, 2020	Total Molybdenum	33.7%
SW-09	June 24, 2020	Total Aluminum	40.9%
		Total Arsenic	52.8%
		Total Barium	95.7%
		Total Cobalt	83.9%
		Total Copper	49.9%
		Total Iron	72.3%
		Total Manganese	79.6%
		Total Nickel	49.0%
		Total Phosphorous	29.9%
		Total Titanium	23.0%
		Total Zinc	96.1%
BH-01	June 25, 2020	Ammonia	23.4%
		Nitrate	80.4%
		Total Phosphorous	127.7%
		COD	59.8%
		TOC	111.2%
		Dissolved Aluminum	32.3%
		Dissolved Antimony	24.6%
		Dissolved Arsenic	55.8%
		Dissolved Cobalt	87.7%
		Dissolved Copper	27.6%
		Dissolved Manganese	94.5%
		Dissolved Nickel	25.4%

		Dissolved Selenium	32.6%
		Dissolved Zinc	34.5%
BH-01	October 21, 2020	Total Kjeldahl Nitrogen	59.9%
		Dissolved Aluminum	54.3%
BH-02	June 24, 2020	Nitrate	21.9%
		Chemical Oxygen Demand	36.4%
		Dissolved Aluminum	32.6%
		Dissolved Cadmium	24.7%
		Dissolved Copper	142.1%
		Dissolved Selenium	44.7%
		Dissolved Zinc	66.7%
Wetland #4	September 6, 2020	Total Cadmium	34.9%
		Total Titanium	34.9%
Wetland #4	December 22, 2020	Nitrate	33.3%
		Total Chromium	153.7%
		Total Iron	29.6%

Notably, the SW-05 August 20, 2020, sample duplicate had only one non-compliant result. This is likely a result of adequate surface water mixing in the Beaver pond, which is a large homogeneous sample source. When analyzing the RPD for SW-09, it was observed that there are higher degrees of variation. This is particularly common in total metals readings. Such a phenomenon could be explained by characteristics of the sample source. SW-09 is located at an ephemeral creek to the west of site which is characterized by a low-lying swamp. This could impact the sample quality because of suspended solids and organics. When comparing the TOC of each sample, the original sample TOC value was 37.5 mg/L and the duplicate was 40.3 mg/L. The RPD for these two values was only 7.2% which is compliant with the OC. However, this becomes an apparent issue for total metals results. For parameters with RPD values exceeding 20%, the duplicate value was always greater than the original value (excluding selenium and phosphorous). For this reason, sample results in low lying swamp areas, including the SGW sample locations, could be impacted by sediment and organics in the water sample.

6. CONCLUSIONS AND RECOMMENDATIONS

The Operational Certificate 17226 for the Hazelton Regional Landfill was amended on May 27, 2020. As such, the environmental monitoring program in 2020 followed the amended OC.

Surface water sampling results show consistently exceedances of BCWQG for aluminum, cadmium, copper, iron, manganese, and phosphorous. This is true of both the background samples taken from SW-01, and SW-02. As such, the background water quality could affect downstream values, making results difficult to interpret. Parameters that are more indicative of leachate impact are chlorides and ammonia. Typically, landfill leachate has high concentrations of both key leachate indicating parameters. However, elevated chlorides in the absence of elevated ammonia suggest an alternate source of chlorides. This was observed at SW-05, SW-06, SW-07, and SW-08, which are all influenced by flows from the adjacent Highway 16. Furthermore, the absence of leachate run-off impacts in these surface waters systems (on-site leachate treatment wetlands) support the inference that contamination at SW-05, SW-06, SW-07, and SW-08 is from highway run-off.

SW-09, located downstream of the landfill discharge location, does not have concise evidence of significant leachate impact. In general, there are elevated chlorides, ammonia and total metals at this location. However, chloride and ammonia results were compliant with BCWQG, and total metals were not significantly elevated compared to background concentrations. When comparing metal values to Wetland #4 discharge data, these elevated values are likely caused by elevated TOC. TOC values are roughly 3 times greater at SW-09. In summary, SW-09 could be partially impacted by treated leachate discharge, but it is unlikely that this is the driving force for exceedances at this location.

Lastly, SW-10 is not impacted by landfill leachate because of the absence of chlorides and ammonia.

Shallow groundwater wells typically show elevated conductivity, chlorides, alkalinity, ammonia, and TOC with decreasing concentrations moving away from the landfill. However, SGW-01 (upstream of SGW-05) and SGW-03 (upstream of SGW-02) were not sampled in 2020. Because of this, SGW-05 was compared to 2019 data and SGW-02 was compared to Wetland #4 Infiltration Trench discharge. When comparing SGW-05 to the 2019 data, SGW-5 data show decreases for key leachate indicating parameters including chlorides, ammonia and select metals. In general, water quality at SGW-5 shows signs of historic leachate impacts are naturally attenuating. Metal exceedances at this location are comparable to background concentrations suggesting leachate impact is not the driving cause of exceedances at SGW-05.

Regarding SGW-02, potential impact for the Wetland #4 Infiltration Trench discharge is not considered a driving force for water quality at this location. When comparing the SGW-02 data to the Wetland #4 Infiltration Trench results, SGW-02 data shows higher levels for tested parameters, excluding chlorides. Chloride reduction suggests that Wetland #4 discharge would be partially attenuated prior to reaching SGW-02. Other leachate indicating parameters and metals experience higher concentrations at SGW-02. These values are consistently more than Wetland #4 Infiltration Trench values, which could be attributed to high TOC in the stagnant surface water where the SGW is located. TOC values at SGW-02 are 10 times greater when compared to Wetland #4 Infiltration Trench. For these reasons, water quality at SGW-02 is not believed to be driven by leachate impacts.

Lastly, water quality at SGW-04 does not appear to be significantly influenced by flows from SW-05 or landfill leachate. Metals and ammonia concentrations at this location are similar to background concentrations and chlorides are not significantly elevated above background concentrations.

Groundwater downstream of the landfill at BH-5B showed elevated levels of leachate indicators. However, several of these exceedances are similar to background conditions. Also, it is difficult to determine the portion of contamination resulting from nearby highway operations. For these reasons, it is challenging to determine whether the landfill is impacting groundwater in the vicinity of the Hazelton WMF site. In order to determine if groundwater is in fact impacted by the landfill, at least two more downstream groundwater monitoring wells are required. Furthermore, these wells should have nested wells with shallow and a deep well to partition perched water table effects and deep groundwater effects. Moreover, the nested wells would be similar in depth to SGW wells, providing data from a similar source to make comparisons more accurate.

The water in BH-03, which would intercept any flow from landfill leachate before it reached the public water well, was dry during 2019. However, the risk of landfill leachate impact is low when considering historical trends.

Lastly, VOCs and EPHs were tested for the first time in for the Hazelton Landfill Site. All tested parameters were non-detectable except for toluene in the surface water and groundwater program. In certain cases, biogenic toluene can be generated in specific ecologic systems. It is anticipated that the source of toluene in this case is natural because no other VOCs or EPHs were detected.

Wetland #4 experienced two uncontrolled discharge events and one controlled discharge event in 2020. For both uncontrolled events, all tested parameters were compliant with the OC Discharge Criteria, including acute toxicity. This is likely due to high dilution from excessive seasonal precipitation and snow melt.

After a thorough review of the 2020 monitoring data submitted by RDKS staff, SHA recommends the following:

- The Hazelton Landfill Environmental Monitoring program should be reviewed and revised based on current operations. Reasonings for this recommendation are listed as follows.
- Monitoring results have a large range of variability because of the existing environment and sampling infrastructure. Specifically, the surrounding areas are predominately swampy and interspersed with ephemeral creeks. Thus, stagnant water creates poor water quality results.
- Currently, the monitoring program includes several monitoring locations that are likely being impacted by highway run-off.
- Sampling locations SGW-01 and SGW-03 need to be re-instated and/or the efficacy of the SGW system needs to be evaluated. This could be an opportunity to make impactful upgrades to these sampling locations.
- SGW-01 needs to be re-instated to allow water quality data immediately adjacent to the landfill to be compared to downstream water quality.
- SGW-03 should be re-located outside the Wetland #4 discharge weir catchment.

- Surface water monitoring frequency can be reduced as per the amended OC.
- Improvements to monitoring discharge from Wetland #4 should be implemented. This could include a level sensor to record water levels behind the weir.
- Groundwater monitoring should continue to be conducted as per the amended OC.
- Continue monitoring water quality at BH-5 and if leachate indicator parameters show an increasing trend, consider installing two groundwater monitoring wells downgradient of the landfill. The new wells will help monitor groundwater sufficiently and confirm the direction of groundwater flow. A survey should be completed in conjunction with the installation of any new well(s) to tie into actual datum.
- A qualified professional should continue to be retained on an annual basis to evaluate the water quality data.
- The sampling program should follow established handling procedures, including preservation of samples and storage to ensure continuity and representativeness of the samples.

7. STATEMENT OF LIMITATIONS

This report has been prepared by Sperling Hansen Associates (SHA) on behalf of the Regional District of Kitimat-Stikine in accordance with generally accepted engineering practices to a level of care and skill normally exercised by other members of the engineering and science professions currently practicing under similar conditions in British Columbia, subject to the time limits and financial and physical constraints applicable to the services.

The report, which specifically includes all tables and figures, is based on engineering analysis by SHA staff of data compiled during the course of the project. Except where specifically stated to the contrary, the information on which this study is based has been obtained from external sources. This external information has not been independently verified or otherwise examined by Sperling Hansen Associates to determine its accuracy and completeness. Sperling Hansen Associates has relied in good faith on this information and does not accept responsibility of any deficiency, misstatements or inaccuracies contained in the reports as a result of omissions, misinterpretation and/or fraudulent acts of the persons interviewed or contacted, or errors or omissions in the reviewed documentation.

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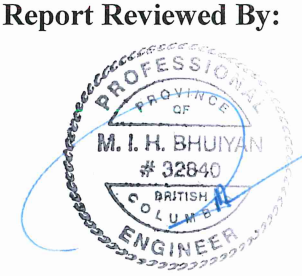
The findings and conclusions of this report are valid only as of the date of this report. The interpretations presented in this report and the conclusions and recommendations that are drawn are based on information that was made available to Sperling Hansen Associates during the course of this project. Should additional new data become available in the future, Sperling Hansen Associates should be requested to re-evaluate the findings of this report and modify the conclusions and recommendations drawn, as required.

Report Prepared By:

Report Reviewed By:



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Senior Environmental Engineer

8. REFERENCES

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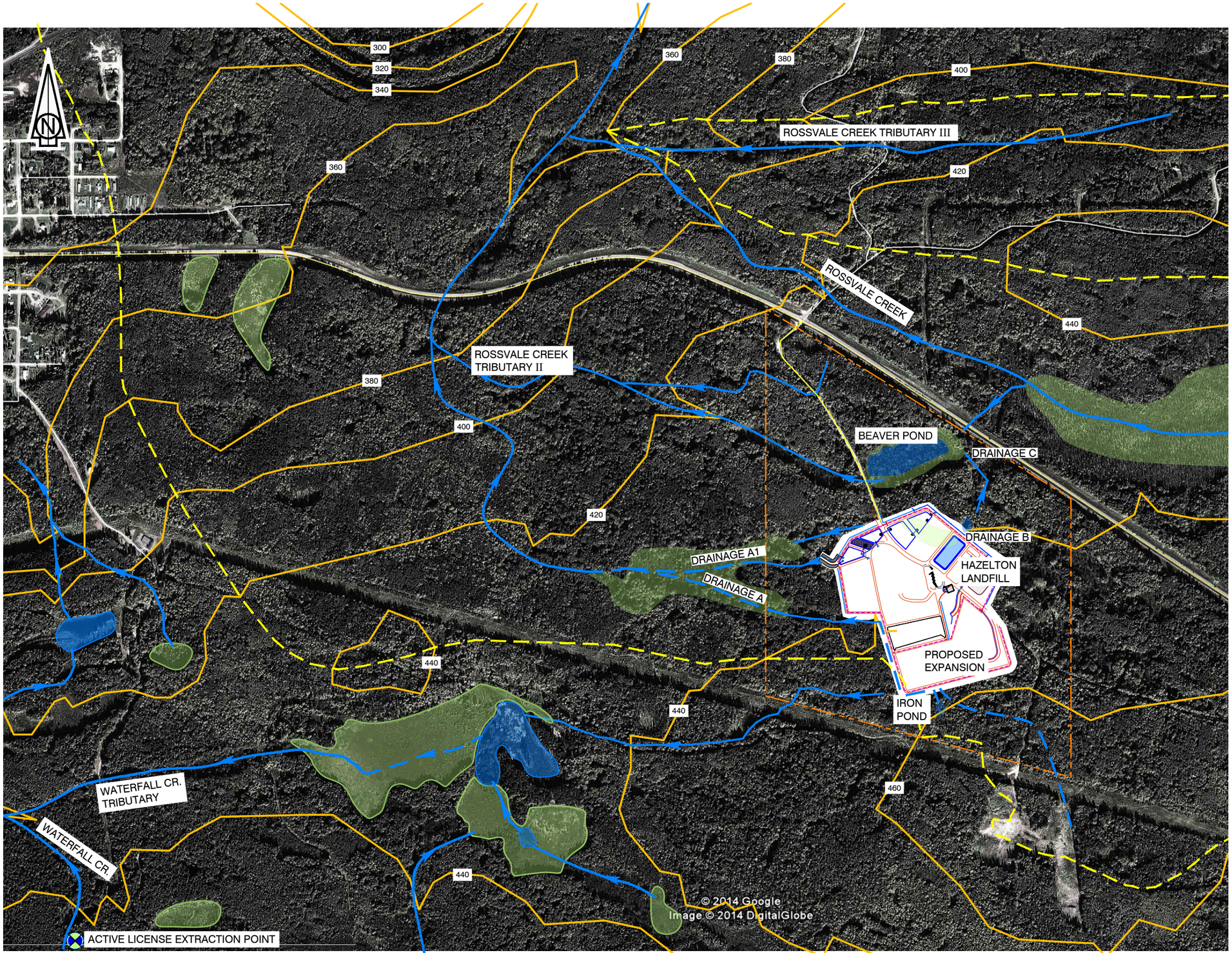
Appendix A: Figures



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LEGEND:

- POND
- WETLAND
- CREEK
- INTERMITTENT CREEK
- LANDFILL LEASE PROPERTY BOUNDARY
- EXISTING TOPO CONTOUR 20m INTERVAL
- SURFACE WATER FLOW DIVIDE

CLIENT: Regional District of Kitimat-Stikine

PROJECT: HAZELTON WMF ANNUAL MONITORING REPORT

TITLE: **STREAMS, WETLANDS AND FLOW DIVIDES IN VICINITY OF HAZELTON LANDFILL**

SCALE:	DATE:	PROJECT NO:
1:10.000	2020/06/28 yyyy/mm/dd	PRJ 21015
DESIGNED	TS	DRAWING NO: **FIGURE 2**
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CHECKED	TS	

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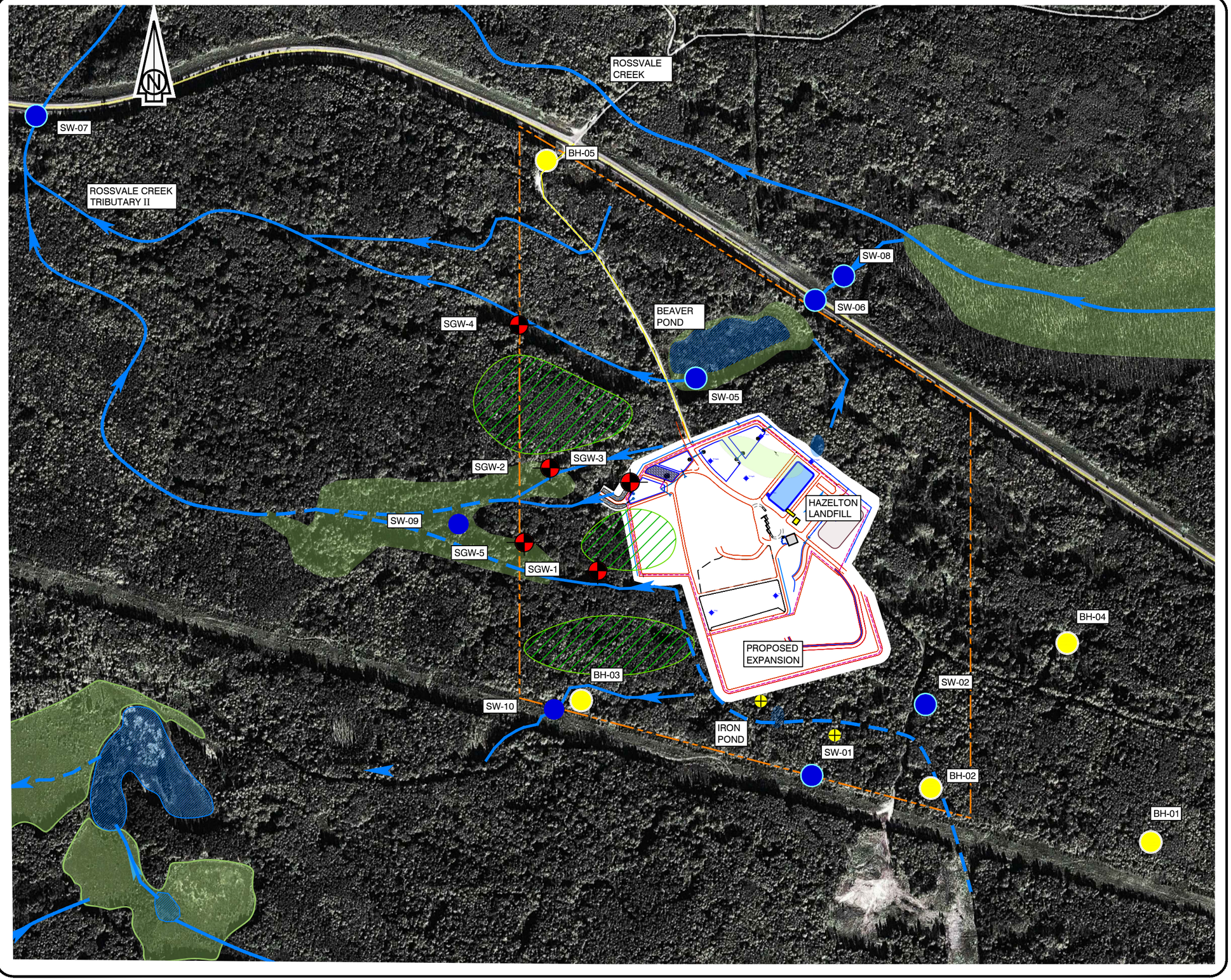

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LEGEND:

- SURFACE WATER MONITORING LOCATION
- GROUNDWATER MONITORING WELL
- PROPERTY LINE
- SHALLOW GROUNDWATER WELL
- CULTURALLY MODIFIED TREE

CLIENT: Regional District of Kitimat-Stikine

PROJECT: HAZELTON WMF ANNUAL MONITORING REPORT

TITLE: **HAZELTON MONITORING WELLS AND SAMPLING LOCATIONS**

SCALE:	DATE:	PROJECT NO:
N.T.S.	2021/06/28 (yyyy/mm/dd)	PRJ 21015

DESIGNED	TS	DRAWING NO: **FIGURE 3**
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LEGEND:

CLIENT:
Regional District of Kitimat-Stikine

PROJECT:
HAZELTON WMF ANNUAL MONITORING REPORT

TITLE:
HAZELTON MONITORING WELLS AND SAMPLING LOCATIONS

SCALE:	DATE:	PROJECT NO:
N.T.S.	2021/06/28 yyyy/mm/dd	PRJ 21015

DESIGNED	TS	DRAWING NO:
DRAWN	AD	**FIGURE 4**
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Appendix B: Tables

Table 1. Hazelton Surface Water Quality Data

Parameters	Units	BC MoE Guidelines		SW01 E309751								
		Freshwater Aquatic Life (1) (2)	Drinking Water (2) (3)									
Date				16-Apr-16	7-Jul-16	25-Oct-16	14-Jun-17	28-May-18	21-Nov-19	24-Jun-20	20-Aug-20	30-Sep-20
Field												
pH	pH Units							5.5		6.31	5.69	5.84
Temperature	°C							10.0		14.1	14.1	9.5
Conductivity	uS/cm							28		34.3	40	38.5
Turbidity	NTU										4.92	5
Flow Rate	m/s											
DO	mg/L									2.8	3.2	3.2
Analyte												
Conductivity	uS/cm			34	44	51	44		38	37	50.1	53.2
pH	pH Units	6.5 - 9.0	7.0 - 10.5	6.2	5.2	6.5	6.1		7	6.57	6.61	7.08
Alkalinity (Total as CaCO3)	mg/L			17	10	23	20		15	16	23.6	22.8
Dissolved Hardness (CaCO3)	mg/L									18.5	24	25.8
Hardness, Total (Total as CaCO3)	mg/L			18	41	23	22	16	17	19.4	24.2	26
Chloride (Cl)	mg/L	600	250, AO	<1.0	<1.0	2	<1.0	<0.50	1	<0.50	<0.50	0.64
Fluoride (F)	mg/L	0.4 - 1.87 (e)	1.5					0.032	0.027	0.024	0.034	0.035
Sulphate (SO4)	mg/L	128 - 429 (e)	500, AO	<1.0	8.8	<1.0	<1.0	<0.30	<0.30	<0.30	<0.30	<0.30
Ammonia (N)	mg/L	0.681 - 28.7 (d)		<0.03	0.11	<0.03	<0.03	0.0121	0.0426	0.015	0.0086	0.0209
Nitrate (N)	mg/L	32.8	10 MAC	0.014	0.01	<0.01	<0.01	0.0061	<0.0050	0.0057	<0.0050	0.0051
Nitrite (N)	mg/L	0.06 - 0.6 (c)	1.0	<0.01	<0.01	<0.01	<0.01	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Nitrate plus Nitrite (N)	mg/L			0.014	0.011	<0.010	<0.010	<0.0071				
Total Kjeldahl Nitrogen	mg/L								1.34	1.04	0.546	0.369
Total Phosphorous (P)	mg/L		0.01									
Total Suspended Solids	mg/L	25 mg/L (background 25-250 mg/l)) (i)	<500, AO									
Misc. Organics												
Chemical Oxygen Demand (COD)	mg/L			42	145	50	92	45	47	64	45	61
Biological Oxygen Demand (BOD)	mg/L			<5.0	28	6.6	4.4	<2.0				
Total Organic Carbon (C)	mg/L	+/- 20% of background	4.0	12.3	41.8	17.6	1.0		17.8	18	16.1	21.5
Dissolved Metals												
Dissolved Aluminum (Al)	mg/L	0.1	0.2						0.76	0.103	0.175	0.335
Dissolved Antimony (Sb)	mg/L	0.02	0.006, MAC						0.00018	<0.00010	0.0001	<0.00010
Dissolved Arsenic (As)	mg/L	0.005	0.025 MAC						0.00064	0.00035	0.00074	0.00059
Dissolved Barium (Ba)	mg/L	5	1.0, MAC						0.0133	0.0122	0.0121	0.0142
Dissolved Beryllium (Be)	mg/L	0.0053 (g)	0.004						<0.00010	<0.000100	<0.000100	<0.000100
Dissolved Bismuth (Bi)	mg/L								<0.000050	<0.000050	<0.000050	<0.000050
Dissolved Boron (B)	mg/L	1.20	5.0, MAC						<0.010	<0.010	<0.010	<0.010
Dissolved Cadmium (Cd)	mg/L	0.00029 - 0.0028 (Hardness 50-455 mg/L) (e)	0.005, MAC						0.0000461	0.0000244	0.0000382	0.0000151
Dissolved Calcium (Ca)	mg/L	48 (Sensitive to acid inputs)							4.95	5.19	7.03	7.44
Dissolved Cesium (Cs)	mg/L								0.00003	<0.000010	<0.000010	<0.000010
Dissolved Chromium (Cr)	mg/L	0.001 (f)	0.05, MAC						0.0009	0.00034	0.00042	0.00052
Dissolved Cobalt (Co)	mg/L	0.11							0.00034	0.00014	0.0003	0.0003
Dissolved Copper (Cu)	mg/L	0.007 - 0.05 (e)	0.5						0.006	0.00078	0.00192	0.00272
Dissolved Iron (Fe)	mg/L	0.35	<0.3, AO						0.519	0.186	0.374	0.434
Dissolved Lead (Pb)	mg/L	0.034 - 0.40 (Hardness 50 - 350 mg/L) (e)	50, MAC						0.000179	<0.000050	<0.000050	0.000073
Dissolved Lithium (Li)	mg/L								<0.0010	<0.0010	<0.0010	<0.0010
Dissolved Magnesium (Mg)	mg/L		700						1.14	1.36	1.56	1.74
Dissolved Manganese (Mn)	mg/L	0.8 - 3.8 (e)	<0.05, AO						0.0564	0.0188	0.052	0.0419
Dissolved Mercury (Hg)	mg/L	0.0001, MAC	0.001, MAC						0.0000093	<0.0000050	<0.0000050	0.0000132
Dissolved Molybdenum (Mo)	mg/L	2	0.25						0.000089	<0.000050	0.000079	0.000054
Dissolved Nickel (Ni)	mg/L	0.025 - 0.15 (e)							0.00088	0.00076	0.0011	0.00123
Dissolved Phosphorus (P)	mg/L	0.005 - 0.015 (for lakes only)	0.01						<0.050	<0.050	<0.050	<0.050
Dissolved Potassium (K)	mg/L	373 - 432							1.36	0.393	1.07	1.34
Dissolved Rubidium (Rb)	mg/L								0.00094	0.00059	0.00106	0.00106
Dissolved Selenium (Se)	mg/L	0.002	0.01, MAC						0.00	<0.000050	0.000097	0.000085
Dissolved Silicon (Si)	mg/L								5.11	2.27	4.46	4.22
Dissolved Silver (Ag)	mg/L	0.001 - 0.003 (e)	0.0001 (g)						0.00	<0.000010	<0.000010	<0.000010
Dissolved Sodium (Na)	mg/L		<200, AO						1.32	1.2	1.67	1.72
Dissolved Strontium (Sr)	mg/L								0.03	0.0382	0.0498	0.0532
Dissolved Sulphur (S)	mg/L								<0.50	<0.50	<0.50	<0.50
Dissolved Tellurium (Te)	mg/L								<0.00020	<0.00020	<0.00020	<0.00020
Dissolved Thallium (Tl)	mg/L	0.0017	2						<0.000010	<0.000010	<0.000010	<0.000010
Dissolved Thorium (Th)	mg/L								<0.00010	<0.00010	<0.00010	<0.00010
Dissolved Tin (Sn)	mg/L								<0.00010	<0.00010	<0.00010	<0.00010
Dissolved Titanium (Ti)	mg/L	2							0.02	0.00066	0.00249	0.00426
Dissolved Tungsten (W)	mg/L								<0.00010	<0.00010	<0.00010	<0.00010
Dissolved Uranium (U)	mg/L	0.3	20						0.00	<0.000010	<0.000010	0.000018
Dissolved Vanadium (V)	mg/L	0.006	0.02						0.00	<0.00050	<0.00050	<0.00050
Dissolved Zinc (Zn)	mg/L	0.033-0.266 (Hardness 90 - 400 mg/L) (e)	5 AO						0.01	0.0086	0.0051	0.0047
Dissolved Zirconium (Zr)	mg/L								0.00108	0.00025	0.00045	0.0005

Table 1. Hazelton Surface Water Quality Data

Parameters	Units	BC MoE Guidelines		SW01 E309751								
		Freshwater Aquatic Life (1) (2)	Drinking Water (2) (3)									
Date				16-Apr-16	7-Jul-16	25-Oct-16	14-Jun-17	28-May-18	21-Nov-19	24-Jun-20	20-Aug-20	30-Sep-20
Total Metals												
Total Aluminum	mg/L	0.023 - 0.1 (j,k)	9.5	0.325	11.1	0.275	0.155	0.115	1.55	0.154	0.25	0.627
Total Antimony (Ab)	mg/L	0.009	0.006	0.0001	0.0005	0.0003	<0.00010	<0.00010	0.00022	<0.00010	<0.00010	<0.00010
Total Arsenic (As)	mg/L	0.005	0.01 MAC	0.0008	0.0064	0.0024	0.00078	0.00053	0.00083	0.0004	0.00089	0.00084
Total Barium (Ba)	mg/L	1	1.0	0.014	0.173	0.020	0.014	0.012	0.020	0.0139	0.0144	0.0172
Total Beryllium (Be)	mg/L	0.00013		<0.0001	0.0003	<0.0001	<0.00010	<0.00010	<0.00010	<0.000100	<0.000100	<0.000100
Total Bismuth (Bi)	mg/L			<0.0001	<0.0001	<0.0001	<0.00010	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Total Boron (B)	mg/L	1.2	5.0, MAC	0.005	0.045	<0.004	0.005	<0.010	<0.010	<0.010	<0.010	<0.010
Total Cadmium (Cd)	mg/L	0.00029 - 0.0028 (Hardness 50-455 mg/L) (e) (k)	0.005, MAC	0.00007	0.00325	0.00017	0.000047	0.0000481	0.0000559	0.0000342	0.0000155	0.0000223
Total Calcium (Ca)	mg/L	<4 sensitive to acid input		5.6	11.9	7.1	6.7	4.76	5.04	5.51	6.88	7.42
Total Cesium (Cs)	mg/L							<0.000010	0.000084	<0.000010	0.000012	0.000039
Total Chromium (Cr)	mg/L	0.001 (f)	0.05, MAC	0.0007	0.0105	0.0009	0.00067	0.0004	0.00157	0.00044	0.00056	0.00085
Total Cobalt (Co)	mg/L	0.11		0.00082	0.0125	0.00272	0.00111	0.00072	0.00049	0.00026	0.00054	0.00063
Total Copper (Cu)	mg/L	0.0032 - 0.0396 (e)	1.0, AO	0.0028	0.0318	0.0017	0.00161	0.00122	0.00711	0.00118	0.00205	0.00333
Total Iron (Fe)	mg/L	1	0.3, AO	1.10	24.80	3.47	1.30	0.66	0.97	0.384	0.718	1.03
Total Lead (Pb)	mg/L	0.034 - 0.40 (Hardness 50 - 350 mg/L) (e)	0.01	0.0002	0.0061	<0.0001	<0.00010	0.000059	0.00037	<0.000050	0.000082	0.00018
Total Lithium (Li)	mg/L			0.0002	0.0046	0.0001	0.00011	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Magnesium (Mg)	mg/L			1.06	2.81	1.36	1.19	1.06	1.26	1.38	1.7	1.83
Total Manganese (Mn)	mg/L	0.8 - 3.4 (e)	0.05, AO	0.183	1.63	0.554	0.165	0.126	0.0634	0.045	0.103	0.102
Total Mercury (Hg)	mg/L.	0.0001	0.001	<0.00002	<0.00002	<0.00002	<0.00002	<0.0000050	0.0000115	<0.0000050	<0.0000050	<0.0000050
Total Molybdenum (Mo)	mg/L	2	0.25	0.0002	0.0019	0.0002	0.00012	0.000153	0.000113	0.000063	0.000117	0.000103
Total Nickel (Ni)	mg/L	0.025 - 0.15 (e)		0.0011	0.0164	0.0016	0.0011	0.00108	0.00178	0.00059	0.0012	0.00162
Total Phosphorus (P)	mg/L	0.005 - 0.015 (for lakes only)	0.01, AO	0.09	1.69	0.1	0.06	0.08	0.10	0.061	<0.050	0.072
Total Potassium (K)	mg/L			0.79	1.71	1.14	0.66	0.172	1.44	0.439	1.07	1.39
Total Rubidium (Rb)	mg/L							0.00025	0.00151	0.00064	0.00102	0.00117
Total Selenium (Se)	mg/L	0.002	0.01, MAC	<0.0005	<0.0005	<0.0005	<0.00050	<0.000050	0.000071	0.000055	0.000071	0.00011
Total Silicon (Si)	mg/L			3.7	15.3	4.8	3.5	1.63	6.3	2.48	4.39	4.81
Total Silver (Ag)	mg/L	0.0001 - 0.003 (e)		<0.00005	0.00026	<0.00005	<0.000050	<0.000010	0.000027	<0.000010	<0.000010	0.000019
Total Sodium (Na)	mg/L		<200, AO	1.45	1.1	1.47	1.47	1.49	1.37	1.27	1.81	1.74
Total Strontium (Sr)	mg/L			0.038	0.082	0.06	0.0424	0.034	0.0351	0.0413	0.0478	0.0504
Total Sulphur (S)	mg/L			<1	3	<1	<3.0	<0.50	<0.50	<0.50	<0.50	<0.50
Total Tellurium (Te)	mg/L			<0.0002	<0.0002	<0.0002	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Total Thallium (Tl)	mg/L	0.0008		<0.00002	0.00005	<0.00002	<0.000020	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Total Thorium (Th)	mg/L			<0.0001	0.00	<0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Total Tin (Sn)	mg/L			<0.0002	<0.0002	<0.0002	<0.00020	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Total Tungsten (W)	mg/L							0.00134	0.0297	<0.00010	<0.00010	<0.00010
Total Titanium (Ti)	mg/L			0.007	0.121	<0.005	<0.0050	<0.00010	<0.00010	0.00201	0.00336	<0.00900
Total Uranium (U)	mg/L	0.0085	0.02	<0.00002	0.00027	<0.00002	<0.000020	<0.000010	0.000044	<0.000010	<0.000010	0.000021
Total Vanadium (V)	mg/L			<0.001	0.024	0.001	<0.0010	<0.00050	0.00285	<0.00050	0.00053	0.00103
Total Zinc (Zn)	mg/L	0.033-0.266 (Hardness 90 - 400 mg/L) (e)	5.0, AO	0.008	0.056	0.008	0.0051	0.0033	0.0096	0.0056	0.0046	0.0125
Total Zirconium (Zr)	mg/L			0.0003	0.0009	0.0002	0.0002	0.000148	<0.0012	0.00022	0.00031	0.00033
Volatile Organic Compounds												
Benzene	µg/L	40	5							<0.50	<0.50	<0.50
Ethylbenzene	µg/L	200	140, 1.6 AO							<0.50	<0.50	<0.50
Methyl tbutyl ether (MTBE)	µg/L	3400	15 AO							<0.50	<0.50	<0.50
Styrene	µg/L									<0.50	<0.50	<0.50
Toluene	µg/L	0.5[l]	60, 24 AO							<0.50	<0.50	<0.50
Xylene, m and p	µg/L									<0.50	<0.50	<0.50
Xylene, o	µg/L									<0.50	<0.50	<0.50
Xylenes, total	µg/L	30	90, 2 AO							<0.75	<0.75	<0.75
BTEX+Styrene, total	µg/L									<1.5		
Hydrocarbons												
EPH (C10C19)	µg/L									<250	<250	<250
EPH (C19C32)	µg/L									<250	<250	<250
TEH (C10C30), BC	µg/L									<250	<250	
VHw (C6C10)	µg/L									<100	<100	<100
VPHw	µg/L									<100	<100	<100

Notes:

2018 data compared to 2018 criteria

A shaded value means exceeded the freshwater aquatic life criteria

A shaded value means reading exceeded the drinking water quality criteria.

A shaded value means exceeded both the aquatic life and drinking water criteria.

A shaded value means reading had detection limit exceeding criteria.

A shaded value means conductivity that exceeds 500 uS/cm

(AO Aesthetic Objective)

1. BC Environment Approved and Working Criteria for Water Quality, last updated March 2018
2. All criteria limits for BCWQG based on Total Metal Concentration except Aluminum and Cadmium (Dissolved)
3. BC Environment Drinking Water Guidelines and Canadian Drinking Water Standards

c. Limit dependent on chloride concentration. (MAC Maximum Acceptable Concentration)

d. Limit pH and temperature dependent.

e. Limit dependant on hardness.

f. Limit for chromium (IV)

g. Limit for total, no dissolved concentrations

h.copper (mg/L) =(0.094* Hardness)/1000

i. Limit for hardness based on total dissolved $CaCO^3$

j. at pH less than 6.5, limit is determined by regression equation, else limit is 0.1 mg/L.

k. Limit for dissolved metals, not total metals

l. Long Term Chronic criteria, average of 5 samples over 30 days not to exceed criteria

Table 1. Hazelton Surface Water Quality Data

Parameters	Units	BC MoE Guidelines		SW02 E309752									
		Freshwater Aquatic Life (1) (2)	Drinking Water (2) (3)										
Date				16-Apr-16	7-Jul-16	25-Oct-16	14-Jun-17	28-May-18	13-Aug-19	21-Nov-19	24-Jun-20	20-Aug-20	30-Sep-20
Field													
pH	pH Units						7	5.95	5.56			5.85	6
Temperature	°C						14	10.70	17.10			14.3	9.8
Conductivity	uS/cm						43	21.40	88.80			23.4	28.2
Turbidity	NTU								38.20			2.68	1.15
Flow Rate	m/s												
DO	mg/L								0.20			3.7	3.1
Analyte													
Conductivity	uS/cm			44	45	64	33			40	24	30	37
pH	pH Units	6.5 - 9.0	7.0 - 10.5	6.4	6.3	7.0	6.6		7	7	6.51	6.54	7.02
Alkalinity (Total as CaCO3)	mg/L			21	22	31	17			21	10.7	13	16.4
Dissolved Hardness (CaCO3)	mg/L										12.2	14.6	16.3
Hardness, Total (Total as CaCO3)	mg/L			22	21	26	14	12	33	15	13.4	14.1	15.7
Chloride (Cl)	mg/L	600	250, AO	<1.0	<1.0	1	<1.0	<0.50	1	<0.50	<0.50	<0.50	<0.50
Fluoride (F)	mg/L	0.4 - 1.87 (e)	1.5					0.024	0.025	<0.020	<0.020	<0.020	<0.020
Sulphate (SO4)	mg/L	128 - 429 (e)	500, AO	<1.0	<1.0	<1.0	<1.0	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Ammonia (N)	mg/L	0.681 - 28.7 (d)		<0.03	<0.03	<0.03	<0.03	0.0107	0.221	0.0549	0.0095	0.521	0.0127
Nitrate (N)	mg/L	32.8	10 MAC	0.011	<0.01	0.012	<0.01	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0065
Nitrite (N)	mg/L	0.06 - 0.6 (c)	1.0	<0.01	<0.01	<0.01	<0.01	<0.0010	<0.0010	<0.0010	0.0022	<0.0010	<0.0010
Nitrate plus Nitrite (N)	mg/L			0.011	<0.010	0.012	<0.010	<0.0060					
Total Kjeldahl Nitrogen	mg/L									1.76	0.702		0.481
Total Phosphorous (P)	mg/L		0.01										
Total Suspended Solids	mg/L	25 mg/L (background 25-250 mg/l)) (i)	<500, AO										
Misc. Organics													
Chemical Oxygen Demand (COD)	mg/L			33	38	35	46	27	145	43	49	44	36
Biological Oxygen Demand (BOD)	mg/L			<5.0	<4.0	<4.0	<4.0	<2.0	30.4				
Total Organic Carbon (C)	mg/L	+/- 20% of background	4.0	9.4	9.1	10.1	1.3			12.4	10.8	8.76	13.6
Dissolved Metals													
Dissolved Aluminum (Al)	mg/L	0.1	0.2							0.101	0.0188	0.0156	0.0502
Dissolved Antimony (Sb)	mg/L	0.02	0.006, MAC							<0.00010	<0.00010	<0.00010	<0.00010
Dissolved Arsenic (As)	mg/L	0.005	0.025 MAC							0.00055	0.00039	0.00035	0.00042
Dissolved Barium (Ba)	mg/L	5	1.0, MAC							0.00777	0.00682	0.00568	0.00728
Dissolved Beryllium (Be)	mg/L	0.0053 (g)	0.004							<0.00010	<0.000100	<0.000100	<0.000100
Dissolved Bismuth (Bi)	mg/L									<0.000050	<0.000050	<0.000050	<0.000050
Dissolved Boron (B)	mg/L	1.20	5.0, MAC							<0.010	<0.010	<0.010	<0.010
Dissolved Cadmium (Cd)	mg/L	0.00029 - 0.0028 (Hardness 50-455 mg/L) (e)	0.005, MAC							0.0000887	0.0000388	0.0000275	0.0000216
Dissolved Calcium (Ca)	mg/L	48 (Sensitive to acid inputs)								3.91	3.53	4.24	4.74
Dissolved Cesium (Cs)	mg/L									<0.000010	<0.000010	<0.000010	<0.000010
Dissolved Chromium (Cr)	mg/L	0.001 (f)	0.05, MAC							0.0002	0.00011	<0.00010	0.0002
Dissolved Cobalt (Co)	mg/L	0.11								0.00021	0.00014	0.00012	0.00012
Dissolved Copper (Cu)	mg/L	0.007 - 0.05 (e)	0.5							0.00095	0.00066	0.00033	0.00026
Dissolved Iron (Fe)	mg/L	0.35	<0.3, AO							0.342	0.205	0.352	0.275
Dissolved Lead (Pb)	mg/L	0.034 - 0.40 (Hardness 50 - 350 mg/L) (e)	50, MAC							0.0	<0.000050	0.000192	<0.000050
Dissolved Lithium (Li)	mg/L									<0.0010	<0.0010	<0.0010	<0.0010
Dissolved Magnesium (Mg)	mg/L		700							1.24	0.829	0.973	1.08
Dissolved Manganese (Mn)	mg/L	0.8 - 3.8 (e)	<0.05, AO							0.175	0.04	0.0394	0.0374
Dissolved Mercury (Hg)	mg/L	0.0001, MAC	0.001, MAC							<0.0000050	<0.0000050	<0.0000050	0.000006
Dissolved Molybdenum (Mo)	mg/L	2	0.25							0.000124	0.000068	0.000133	0.000128
Dissolved Nickel (Ni)	mg/L	0.025 - 0.15 (e)								<0.00050	<0.00050	<0.00050	<0.00050
Dissolved Phosphorus (P)	mg/L	0.005 - 0.015 (for lakes only)	0.01							0.2	<0.050	0.07	0.072
Dissolved Potassium (K)	mg/L	373 - 432								3.33	0.229	1.13	2.73
Dissolved Rubidium (Rb)	mg/L									0.00141	0.00022	0.00069	0.00161
Dissolved Selenium (Se)	mg/L	0.002	0.01, MAC							<0.000050	<0.000050	<0.000050	<0.000050
Dissolved Silicon (Si)	mg/L									1.13	0.997	0.966	1.42
Dissolved Silver (Ag)	mg/L	0.001 - 0.003 (e)	0.0001 (g)							<0.000010	<0.000010	<0.000010	<0.000010
Dissolved Sodium (Na)	mg/L		<200, AO							0.49	0.427	0.181	0.7
Dissolved Strontium (Sr)	mg/L									0.02	0.0241	0.0299	0.0324
Dissolved Sulphur (S)	mg/L									<0.50	<0.50	<0.50	<0.50
Dissolved Tellurium (Te)	mg/L									<0.00020	<0.00020	<0.00020	<0.00020
Dissolved Thallium (Tl)	mg/L	0.0017	2							<0.000010	<0.000010	<0.000010	<0.000010
Dissolved Thorium (Th)	mg/L									<0.00010	<0.00010	<0.00010	<0.00010
Dissolved Tin (Sn)	mg/L									<0.00010	<0.00010	<0.00010	<0.00010
Dissolved Titanium (Ti)	mg/L	2								0.00	0.00044	0.00038	0.00136
Dissolved Tungsten (W)	mg/L									<0.00010	<0.00010	<0.00010	<0.00010
Dissolved Uranium (U)	mg/L	0.3	20							<0.000010	<0.000010	<0.000010	<0.000010
Dissolved Vanadium (V)	mg/L	0.006	0.02							0.00	<0.00050	<0.00050	<0.00050
Dissolved Zinc (Zn)	mg/L	0.033-0.266 (Hardness 90 - 400 mg/L) (e)	5 AO							0.01	0.0113	0.0137	0.0174
Dissolved Zirconium (Zr)	mg/L									<0.00020	<0.00020	<0.00020	<0.00020

Table 1. Hazelton Surface Water Quality Data

Parameters	Units	BC MoE Guidelines		SW02 E309752									
		Freshwater Aquatic Life (1) (2)	Drinking Water (2) (3)										
Date				16-Apr-16	7-Jul-16	25-Oct-16	14-Jun-17	28-May-18	13-Aug-19	21-Nov-19	24-Jun-20	20-Aug-20	30-Sep-20
Total Metals													
Total Aluminum	mg/L	0.023 - 0.1 (j,k)	9.5	0.475	1.640	0.031	0.047	0.033	1.830	0.189	0.0703	0.0183	0.13
Total Antimony (Ab)	mg/L	0.009	0.006	0.0002	0.0004	0.0002	<0.00010	<0.00010	0.00011	<0.00010	<0.00010	<0.00010	<0.00010
Total Arsenic (As)	mg/L	0.005	0.01 MAC	0.001	0.0015	0.0009	0.00066	0.00048	0.00131	0.00059	0.00049	0.00037	0.0007
Total Barium (Ba)	mg/L	1	1.0	0.014	0.024	0.014	0.007	0.008	0.049	0.009	0.0113	0.0062	0.0103
Total Beryllium (Be)	mg/L	0.00013		<0.0001	<0.0001	<0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.000100	<0.000100	<0.000100
Total Bismuth (Bi)	mg/L			<0.0001	<0.0001	<0.0001	<0.00010	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Total Boron (B)	mg/L	1.2	5.0, MAC	0.004	0.015	<0.004	0.005	<0.010	<0.010	<0.010	0.012	<0.010	<0.010
Total Cadmium (Cd)	mg/L	0.00029 - 0.0028 (Hardness 50-455 mg/L) (e) (k)	0.005, MAC	0.00004	0.00051	0.00004	0.000027	0.0000052	0.000352	0.000106	0.0000555	0.000018	0.0000403
Total Calcium (Ca)	mg/L	<4 sensitive to acid input		6.2	6.2	7.3	4.04	3.44	9.28	4.1	3.95	4.04	4.46
Total Cesium (Cs)	mg/L							<0.000010	0.000174	0.000011	<0.000010	<0.000010	0.00001
Total Chromium (Cr)	mg/L	0.001 (f)	0.05, MAC	0.0007	0.0021	<0.0005	<0.00050	0.00018	0.00162	0.00031	0.00014	<0.00010	0.00029
Total Cobalt (Co)	mg/L	0.11		0.00068	0.00082	0.00022	0.00014	0.0003	0.0012	0.00025	0.00052	0.00016	0.00054
Total Copper (Cu)	mg/L	0.0032 - 0.0396 (e)	1.0, AO	0.004	0.0066	0.0004	0.00075	<0.00050	0.00594	0.00136	0.00068	<0.00050	0.00056
Total Iron (Fe)	mg/L	1	0.3, AO	1.10	2.07	0.84	0.31	0.54	3.31	0.53	0.807	0.547	1.15
Total Lead (Pb)	mg/L	0.034 - 0.40 (Hardness 50 - 350 mg/L) (e)	0.01	0.0003	0.0006	<0.0001	<0.00010	<0.000050	0.000664	0.000182	0.000142	<0.000050	<0.000050
Total Lithium (Li)	mg/L			0.0003	0.0008	0.0001	0.0001	<0.0010	0.0014	<0.0010	<0.0010	<0.0010	<0.0010
Total Magnesium (Mg)	mg/L			1.51	1.27	1.94	0.89	0.793	2.35	1.27	0.849	0.976	1.1
Total Manganese (Mn)	mg/L	0.8 - 3.4 (e)	0.05, AO	0.129	0.123	0.101	0.0304	0.117	0.258	0.180	0.179	0.0511	0.203
Total Mercury (Hg)	mg/L.	0.0001	0.001	<0.00002	<0.00002	<0.00002	<0.00002	<0.0000050	<0.000025	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Total Molybdenum (Mo)	mg/L	2	0.25	0.0002	0.0002	<0.0001	<0.00010	0.000095	0.000193	0.000143	0.000194	0.00014	0.000356
Total Nickel (Ni)	mg/L	0.025 - 0.15 (e)		0.0012	0.0021	0.0002	<0.00020	<0.00050	0.00276	<0.00050	<0.00050	<0.00050	<0.00050
Total Phosphorus (P)	mg/L	0.005 - 0.015 (for lakes only)	0.01, AO	0.07	0.11	0.14	<0.050	0.079	0.35	0.21	0.168	0.103	0.3
Total Potassium (K)	mg/L			0.93	0.89	3.19	0.86	0.732	1.83	3.28	0.306	1.12	2.65
Total Rubidium (Rb)	mg/L							0.00049	0.00241	0.00151	0.00023	0.00071	0.00158
Total Selenium (Se)	mg/L	0.002	0.01, MAC	<0.0005	<0.0005	<0.0005	<0.00050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Total Silicon (Si)	mg/L			4.8	5	2.7	2	1.64	4.36	1.38	1.12	0.92	1.7
Total Silver (Ag)	mg/L	0.0001 - 0.003 (e)		<0.00005	<0.00005	<0.00005	<0.000050	<0.000010	0.000028	<0.000010	<0.000010	<0.000010	<0.000010
Total Sodium (Na)	mg/L		<200, AO	1.81	1.02	1.15	0.72	0.795	1.07	0.493	0.47	0.168	0.721
Total Strontium (Sr)	mg/L			0.04	0.035	0.055	0.026	0.0225	0.0655	0.0254	0.0266	0.0277	0.0298
Total Sulphur (S)	mg/L			<1	<1	<1	<3.0	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Total Tellurium (Te)	mg/L			<0.0002	<0.0002	<0.0002	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Total Thallium (Tl)	mg/L	0.0008		<0.00002	<0.00002	<0.00002	0.000048	<0.000010	0.000016	<0.000010	<0.000010	<0.000010	<0.000010
Total Thorium (Th)	mg/L			<0.0001	<0.0001	<0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Total Tin (Sn)	mg/L			<0.0002	<0.0002	<0.0002	<0.00020	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Total Tungsten (W)	mg/L							0.00096	0.022	0.00728	<0.00010	<0.00010	<0.00010
Total Titanium (Ti)	mg/L			0.009	0.034	<0.005	<0.0050	<0.00010	<0.00010	<0.00010	0.00188	0.00046	0.00352
Total Uranium (U)	mg/L	0.0085	0.02	<0.00002	0.00003	<0.00002	<0.000020	<0.000010	0.000022	<0.000010	<0.000010	<0.000010	<0.000010
Total Vanadium (V)	mg/L			0.002	0.003	<0.001	<0.0010	<0.00050	0.00306	0.00098	<0.00050	<0.00050	<0.00050
Total Zinc (Zn)	mg/L	0.033-0.266 (Hardness 90 - 400 mg/L) (e)	5.0, AO	0.006	0.009	0.009	<0.0040	0.0054	0.0243	0.0159	0.0148	0.0118	0.0216
Total Zirconium (Zr)	mg/L			0.0003	0.0014	<0.0001	<0.00010	<0.000060	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Volatile Organic Compounds													
Benzene	µg/L	40	5								<0.50	<0.50	<0.50
Ethylbenzene	µg/L	200	140, 1.6 AO								<0.50	<0.50	<0.50
Methyl tbutyl ether (MTBE)	µg/L	3400	15 AO								<0.50	<0.50	<0.50
Styrene	µg/L										<0.50	<0.50	<0.50
Toluene	µg/L	0.5[l]	60, 24 AO								<0.50	<0.50	<0.50
Xylene, m and p	µg/L										<0.50	<0.50	<0.50
Xylene, o	µg/L										<0.50	<0.50	<0.50
Xylenes, total	µg/L	30	90, 2 AO								<0.75	<0.75	<0.75
BTEX+Styrene, total	µg/L										<1.5		
Hydrocarbons													
EPH (C10C19)	µg/L										<250	<250	<250
EPH (C19C32)	µg/L										<250	<250	<250
TEH (C10C30), BC	µg/L										<250	<250	
VHw (C6C10)	µg/L										<100	<100	<100
VPHw	µg/L										<100	<100	<100

Notes:

2018 data compared to 2018 criteria

A shaded value means exceeded the freshwater aquatic life criteria

A shaded value means reading exceeded the drinking water quality criteria.

A shaded value means exceeded both the aquatic life and drinking water criteria.

A shaded value means reading had detection limit exceeding criteria.

A shaded value means conductivity that exceeds 500 uS/cm

(AO Aesthetic Objective)

1. BC Environment Approved and Working Criteria for Water Quality, last updated March 2018
2. All criteria limits for BCWQG based on Total Metal Concentration except Aluminum and Cadmium (Dissolved)
3. BC Environment Drinking Water Guidelines and Canadian Drinking Water Standards

c. Limit dependent on chloride concentration. (MAC Maximum Acceptable Concentration)

d. Limit pH and temperature dependent.

e. Limit dependant on hardness.

f. Limit for chromium (IV)

g. Limit for total, no dissolved concentrations

h.copper (mg/L) =(0.094* Hardness)/1000

i. Limit for hardness based on total dissolved $CaCO^3$

j. at pH less than 6.5, limit is determined by regression equation, else limit is 0.1 mg/L.

k. Limit for dissolved metals, not total metals

l. Long Term Chronic criteria, average of 5 samples over 30 days not to exceed criteria

Table 1. Hazelton Surface Water Quality Data

Parameters	Units	BC MoE Guidelines		SW03						
		Freshwater Aquatic Life (1) (2)	Drinking Water (2) (3)							
Date				26-Jul-04	25-May-06	10-Jun-08	16-Apr-16	7-Jul-16	25-Oct-16	14-Jun-17
Field										
pH	pH Units									7
Temperature	˚C									17
Conductivity	uS/cm									2,480
Turbidity	NTU									
Flow Rate	m/s									
DO	mg/L									
Analyte										
Conductivity	uS/cm			2,620	2,160	1,970	2,350	1,920	2,400	2,570
pH	pH Units	6.5 - 9.0	7.0 - 10.5	7.0	7.2	7.2	7.6	7.6	7.6	7.4
Alkalinity (Total as CaCO3)	mg/L			1,090	961	1,300	900	570	940	1,000
Dissolved Hardness (CaCO3)	mg/L									
Hardness, Total (Total as CaCO3)	mg/L						1090	726	814	805
Chloride (Cl)	mg/L	600	250, AO	279	270	270	301	344	291	308
Fluoride (F)	mg/L	0.4 - 1.87 (e)	1.5							
Sulphate (SO4)	mg/L	128 - 429 (e)	500, AO	2.9	6.7	10.5	13.1	20.8	18.4	17.8
Ammonia (N)	mg/L	0.681 - 28.7 (d)		27.7	24.6	9.9	17	5.42	23	24.8
Nitrate (N)	mg/L	32.8	10 MAC				6.76	<0.04	3.37	0.38
Nitrite (N)	mg/L	0.06 - 0.6 (c)	1.0				0.039	0.6	0.011	0.02
Nitrate plus Nitrite (N)	mg/L						6.8	4.46	3.38	0.4
Total Kjeldahl Nitrogen	mg/L			28.1	22	30.7				
Total Phosphorous (P)	mg/L		0.01							
Total Suspended Solids	mg/L	25 mg/L (background 25-250 mg/l)) (i)	<500, AO							
Misc. Organics										
Chemical Oxygen Demand (COD)	mg/L			119	146	113	203	125	117	83
Biological Oxygen Demand (BOD)	mg/L			6	16	>71	16	22	9.6	11
Total Organic Carbon (C)	mg/L	+/- 20% of background	4.0				43.2	29.2	33.1	34.3
Dissolved Metals										
Dissolved Aluminum (Al)	mg/L	0.1	0.2							
Dissolved Antimony (Sb)	mg/L	0.02	0.006, MAC							
Dissolved Arsenic (As)	mg/L	0.005	0.025 MAC							
Dissolved Barium (Ba)	mg/L	5	1.0, MAC							
Dissolved Beryllium (Be)	mg/L	0.0053 (g)	0.004							
Dissolved Bismuth (Bi)	mg/L									
Dissolved Boron (B)	mg/L	1.20	5.0, MAC							
Dissolved Cadmium (Cd)	mg/L	0.00029 - 0.0028 (Hardness 50-455 mg/L) (e)	0.005, MAC							
Dissolved Calcium (Ca)	mg/L	48 (Sensitive to acid inputs)								
Dissolved Cesium (Cs)	mg/L									
Dissolved Chromium (Cr)	mg/L	0.001 (f)	0.05, MAC							
Dissolved Cobalt (Co)	mg/L	0.11								
Dissolved Copper (Cu)	mg/L	0.007 - 0.05 (e)	0.5							
Dissolved Iron (Fe)	mg/L	0.35	<0.3, AO							
Dissolved Lead (Pb)	mg/L	0.034 - 0.40 (Hardness 50 - 350 mg/L) (e)	50, MAC							
Dissolved Lithium (Li)	mg/L									
Dissolved Magnesium (Mg)	mg/L		700							
Dissolved Manganese (Mn)	mg/L	0.8 - 3.8 (e)	<0.05, AO							
Dissolved Mercury (Hg)	mg/L	0.0001, MAC	0.001, MAC							
Dissolved Molybdenum (Mo)	mg/L	2	0.25							
Dissolved Nickel (Ni)	mg/L	0.025 - 0.15 (e)								
Dissolved Phosphorus (P)	mg/L	0.005 - 0.015 (for lakes only)	0.01							
Dissolved Potassium (K)	mg/L	373 - 432								
Dissolved Rubidium (Rb)	mg/L									
Dissolved Selenium (Se)	mg/L	0.002	0.01, MAC							
Dissolved Silicon (Si)	mg/L									
Dissolved Silver (Ag)	mg/L	0.001 - 0.003 (e)	0.0001 (g)							
Dissolved Sodium (Na)	mg/L		<200, AO							
Dissolved Strontium (Sr)	mg/L									
Dissolved Sulphur (S)	mg/L									
Dissolved Tellurium (Te)	mg/L									
Dissolved Thallium (Tl)	mg/L	0.0017	2							
Dissolved Thorium (Th)	mg/L									
Dissolved Tin (Sn)	mg/L									
Dissolved Titanium (Ti)	mg/L	2								
Dissolved Tungsten (W)	mg/L									
Dissolved Uranium (U)	mg/L	0.3	20							
Dissolved Vanadium (V)	mg/L	0.006	0.02							
Dissolved Zinc (Zn)	mg/L	0.033-0.266 (Hardness 90 - 400 mg/L) (e)	5 AO							
Dissolved Zirconium (Zr)	mg/L									

Table 1. Hazelton Surface Water Quality Data

Parameters	Units	BC MoE Guidelines		SW03						
		Freshwater Aquatic Life (1) (2)	Drinking Water (2) (3)							
Date				26-Jul-04	25-May-06	10-Jun-08	16-Apr-16	7-Jul-16	25-Oct-16	14-Jun-17
Total Metals										
Total Aluminum	mg/L	0.023 - 0.1 (j,k)	9.5	0.080	0.380	0.011	8.330	9.020	1.340	0.715
Total Antimony (Ab)	mg/L	0.009	0.006	<0.05	ND	ND	0.0015	0.0012	0.0007	0.00031
Total Arsenic (As)	mg/L	0.005	0.01 MAC	<0.05	0.12	0.003	0.016	0.0132	0.0037	0.00977
Total Barium (Ba)	mg/L	1	1.0	1.090	1.290	0.201	1.720	1.020	0.573	0.885
Total Beryllium (Be)	mg/L	0.00013		<0.0002	ND	ND	0.0002	0.0002	<0.0001	<0.00010
Total Bismuth (Bi)	mg/L			<0.05	ND	ND	<0.0001	<0.0001	<0.0001	<0.00010
Total Boron (B)	mg/L	1.2	5.0, MAC	1.9	1.94	1.31	3.33	1.98	2.4	2.94
Total Cadmium (Cd)	mg/L	0.00029 - 0.0028 (Hardness 50-455 mg/L) (e) (k)	0.005, MAC	<0.002	ND	0.00052	0.00067	0.00038	0.00027	0.00009
Total Calcium (Ca)	mg/L	<4 sensitive to acid input		240	229	101	318	214	220	228
Total Cesium (Cs)	mg/L									
Total Chromium (Cr)	mg/L	0.001 (f)	0.05, MAC	<0.005	0.01	0.001	0.0124	0.0104	0.0034	0.00238
Total Cobalt (Co)	mg/L	0.11		<0.005	ND	0.001	0.00896	0.00792	0.00346	0.00402
Total Copper (Cu)	mg/L	0.0032 - 0.0396 (e)	1.0, AO	<0.005	0.008	0.0022	0.0318	0.0238	0.0093	0.00325
Total Iron (Fe)	mg/L	1	0.3, AO	51.30	102.00	0.44	154.00	86.50	8.16	16.20
Total Lead (Pb)	mg/L	0.034 - 0.40 (Hardness 50 - 350 mg/L) (e)	0.01	<0.03	ND	ND	0.0215	0.016	0.0033	0.00036
Total Lithium (Li)	mg/L			ND	ND	ND	0.0115	0.0082	0.005	0.00358
Total Magnesium (Mg)	mg/L			66	54.8	29.9	70.4	46.2	63.9	57.1
Total Manganese (Mn)	mg/L	0.8 - 3.4 (e)	0.05, AO	5.06	6.82	2.03	8.51	3.43	7.13	5.23
Total Mercury (Hg)	mg/L.	0.0001	0.001	<0.00005	ND	ND(1)	<0.00002	<0.00002	<0.00002	<0.00002
Total Molybdenum (Mo)	mg/L	2	0.25	<0.005	ND	ND	0.0006	0.0005	0.0009	0.00122
Total Nickel (Ni)	mg/L	0.025 - 0.15 (e)		0.008	ND	ND	0.0305	0.0223	0.0219	0.0157
Total Phosphorus (P)	mg/L	0.005 - 0.015 (for lakes only)	0.01, AO	0.10	0.30		1.78	0.56	0.12	0.076
Total Potassium (K)	mg/L			54	50	34	63.6	35.5	51.3	54.2
Total Rubidium (Rb)	mg/L									
Total Selenium (Se)	mg/L	0.002	0.01, MAC	<0.03	ND	ND	<0.0005	<0.0005	<0.0005	<0.00050
Total Silicon (Si)	mg/L			<0.01	16	6.74	34.4	26.5	12.9	14.9
Total Silver (Ag)	mg/L	0.0001 - 0.003 (e)		229	ND	0.00009	0.00013	0.00009	<0.00005	<0.000050
Total Sodium (Na)	mg/L		<200, AO	1.62	189	126	289	153	233	249
Total Strontium (Sr)	mg/L			2.3	1.45	0.724	2.03	1.35	1.82	1.63
Total Sulphur (S)	mg/L			<0.05	4.4	1.8	9	10	10	7.6
Total Tellurium (Te)	mg/L						<0.0002	<0.0002	<0.0002	<0.00020
Total Thallium (Tl)	mg/L	0.0008		<0.03	ND	ND	0.00006	0.00006	<0.00002	<0.000020
Total Thorium (Th)	mg/L						0.00	0.00	<0.0001	<0.00010
Total Tin (Sn)	mg/L			<0.02	ND	ND	0.0004	0.0003	0.0003	0.00025
Total Tungsten (W)	mg/L									
Total Titanium (Ti)	mg/L			<0.003	ND	ND	0.172	0.189	0.035	0.021
Total Uranium (U)	mg/L	0.0085	0.02	ND	ND	ND	0.00048	0.00036	0.00036	0.000548
Total Vanadium (V)	mg/L			<0.005	ND	ND	0.021	0.018	0.004	0.0025
Total Zinc (Zn)	mg/L	0.033-0.266 (Hardness 90 - 400 mg/L) (e)	5.0, AO	<0.005	0.055	0.005	0.334	0.163	0.054	0.0094
Total Zirconium (Zr)	mg/L			<0.005	ND	ND	0.0024	0.0018	0.0005	0.00065
Volatile Organic Compounds										
Benzene	µg/L	40	5							
Ethylbenzene	µg/L	200	140, 1.6 AO							
Methyl tbutyl ether (MTBE)	µg/L	3400	15 AO							
Styrene	µg/L									
Toluene	µg/L	0.5[l]	60, 24 AO							
Xylene, m and p	µg/L									
Xylene, o	µg/L									
Xylenes, total	µg/L	30	90, 2 AO							
BTEX+Styrene, total	µg/L									
Hydrocarbons										
EPH (C10C19)	µg/L									
EPH (C19C32)	µg/L									
TEH (C10C30), BC	µg/L									
VHw (C6C10)	µg/L									
VPHw	µg/L									

Notes:

2018 data compared to 2018 criteria

A shaded value means exceeded the freshwater aquatic life criteria

A shaded value means reading exceeded the drinking water quality criteria.

A shaded value means exceeded both the aquatic life and drinking water criteria.

A shaded value means reading had detection limit exceeding criteria.

A shaded value means conductivity that exceeds 500 uS/cm

(AO Aesthetic Objective)

1. BC Environment Approved and Working Criteria for Water Quality, last updated March 2018
2. All criteria limits for BCWQG based on Total Metal Concentration except Aluminum and Cadmium (Dissolved)
3. BC Environment Drinking Water Guidelines and Canadian Drinking Water Standards

c. Limit dependent on chloride concentration. (MAC Maximum Acceptable Concentration)

d. Limit pH and temperature dependent.

e. Limit dependant on hardness.

f. Limit for chromium (IV)

g. Limit for total, no dissolved concentrations

h.copper (mg/L) =(0.094* Hardness)/1000

i. Limit for hardness based on total dissolved $CaCO^3$

j. at pH less than 6.5, limit is determined by regression equation, else limit is 0.1 mg/L.

k. Limit for dissolved metals, not total metals

l. Long Term Chronic criteria, average of 5 samples over 30 days not to exceed criteria

Table 1. Hazelton Surface Water Quality Data

Parameters	Units	BC MoE Guidelines		SW04																		
		Freshwater Aquatic Life (1) (2)	Drinking Water (2) (3)																			
Date				26-May-06	8-Aug-07	10-Jun-08	25-Aug-09	16-Mar-10	22-Jun-10	30-Sep-10	28-Feb-12	14-Aug-12	4-Oct-12	27-Mar-13	17-Oct-13	7-Jul-14	25-Nov-14	26-May-15	1-Nov-15	16-Apr-16	7-Jul-16	25-Oct-16	25-Oct-16	14-Jun-17
Field																								
pH	pH Units																							7
Temperature	˚C																							14
Conductivity	uS/cm																							1,190
Turbidity	NTU																							
Flow Rate	m/s																							
DO	mg/L																							
Analyte																								
Conductivity	uS/cm			963	1,290	1,070	2,320	1,247	1,160	1,550	1,040	1,710	1,250	1,816	1,330	1,150	895	826	1010	1530	1070	1090	1090	1,210
pH	pH Units	6.5 - 9.0	7.0 - 10.5	7.5	7.7	7.6	7	7.5	7.4	7.6	7.2	7.3	7.4	7.8	7.3	7.8	7.3	7.4	7.2	7.8	7.8	7.8	7.8	7.5
Alkalinity (Total as CaCO3)	mg/L			366	480	403	305	473	414	460	440	210	400	640	503	415	316	310	370	530	340	370	370	420
Dissolved Hardness (CaCO3)	mg/L													160		336								
Hardness, Total (Total as CaCO3)	mg/L							398	313	504	403	826	105	594	472	352	293	292	326	549	306	359	359	394
Chloride (Cl)	mg/L	600	250, AO	137	186	140	67	106	139	173	90	72	140	248	140	139	94	77	110	193	15	167	167	140
Fluoride (F)	mg/L	0.4 - 1.87 (e)	1.5																					
Sulphate (SO4)	mg/L	128 - 429 (e)	500, AO	13.3	3.4	ND	1,100	46	3	130	25.1	678	46.8	22.3	4.5	ND	23.4	14.1	6.8	30.4	17.9	6.8	6.8	13.7
Ammonia (N)	mg/L	0.681 - 28.7 (d)		1.69	1.6	3.3	1.2	2.9	ND	0.04	0.27	0.33	ND	0.07	0.06	0.45	0.12	0.250	0.067	0.190	0.550	0.120	0.120	1.1
Nitrate (N)	mg/L	32.8	10 MAC													ND				3.020	0.040	0.014	0.014	0.011
Nitrite (N)	mg/L	0.06 - 0.6 (c)	1.0													ND				<0.01	<0.01	<0.01	<0.01	<0.01
Nitrate plus Nitrite (N)	mg/L																ND			3.020	0.036	0.014	0.014	0.011
Total Kjeldahl Nitrogen	mg/L			2.9	3.3(1)	4.62(2)	2.7	3.52	2.09	1.6	1.13	1.61	1.12	1.86	1.27	1.92	1.93	1.300	7.930					
Total Phosphorous (P)	mg/L		0.01																					
Total Suspended Solids	mg/L	25 mg/L (background 25-250 mg/l)) (i)	<500, AO													8.1								
Misc. Organics																								
Chemical Oxygen Demand (COD)	mg/L			52	62	66	185	38	67	76	86	52	ND	41	34	73	37	42	146	105	50	39	39	<20
Biological Oxygen Demand (BOD)	mg/L			7	ND	6.5	25	ND	5.3	ND	10	ND	ND	ND	5.5	ND	16.0	4.000	35.000	6.900	7.200	4.800	4.800	<4.0
Total Organic Carbon (C)	mg/L	+/- 20% of background	4.0													15.5				26.9	14.1	14.1	14.1	14.8
Dissolved Metals																								
Dissolved Aluminum (Al)	mg/L	0.1	0.2													0.0059								
Dissolved Antimony (Sb)	mg/L	0.02	0.006, MAC													ND								
Dissolved Arsenic (As)	mg/L	0.005	0.025 MAC													0.00297								
Dissolved Barium (Ba)	mg/L	5	1.0, MAC													0.166								
Dissolved Beryllium (Be)	mg/L	0.0053 (g)	0.004													ND								
Dissolved Bismuth (Bi)	mg/L															ND								
Dissolved Boron (B)	mg/L	1.20	5.0, MAC													1.05								
Dissolved Cadmium (Cd)	mg/L	0.00029 - 0.0028 (Hardness 50-455 mg/L) (e)	0.005, MAC													0.000012								
Dissolved Calcium (Ca)	mg/L	48 (Sensitive to acid inputs)														90.6								
Dissolved Cesium (Cs)	mg/L																							
Dissolved Chromium (Cr)	mg/L	0.001 (f)	0.05, MAC													ND								
Dissolved Cobalt (Co)	mg/L	0.11														0.00078								
Dissolved Copper (Cu)	mg/L	0.007 - 0.05 (e)	0.5													ND								
Dissolved Iron (Fe)	mg/L	0.35	<0.3, AO													0.056								
Dissolved Lead (Pb)	mg/L	0.034 - 0.40 (Hardness 50 - 350 mg/L) (e)	50, MAC													ND								
Dissolved Lithium (Li)	mg/L															ND								
Dissolved Magnesium (Mg)	mg/L		700													26.5								
Dissolved Manganese (Mn)	mg/L	0.8 - 3.8 (e)	<0.05, AO													0.180								
Dissolved Mercury (Hg)	mg/L	0.0001, MAC	0.001, MAC													ND								
Dissolved Molybdenum (Mo)	mg/L	2	0.25													ND								
Dissolved Nickel (Ni)	mg/L	0.025 - 0.15 (e)														0.0047								
Dissolved Phosphorus (P)	mg/L	0.005 - 0.015 (for lakes only)	0.01													0.019								
Dissolved Potassium (K)	mg/L	373 - 432														24.1								
Dissolved Rubidium (Rb)	mg/L																							
Dissolved Selenium (Se)	mg/L	0.002	0.01, MAC													ND								
Dissolved Silicon (Si)	mg/L															8.89								
Dissolved Silver (Ag)	mg/L	0.001 - 0.003 (e)	0.0001 (g)													ND								
Dissolved Sodium (Na)	mg/L		<200, AO													93.5								
Dissolved Strontium (Sr)	mg/L															0.816								
Dissolved Sulphur (S)	mg/L															ND								
Dissolved Tellurium (Te)	mg/L																							
Dissolved Thallium (Tl)	mg/L	0.0017	2													ND								
Dissolved Thorium (Th)	mg/L																							
Dissolved Tin (Sn)	mg/L															ND								
Dissolved Titanium (Ti)	mg/L	2														ND								
Dissolved Tungsten (W)	mg/L																							
Dissolved Uranium (U)	mg/L	0.3	20													ND								
Dissolved Vanadium (V)	mg/L	0.006	0.02													ND								
Dissolved Zinc (Zn)	mg/L	0.033-0.266 (Hardness 90 - 400 mg/L) (e)	5 AO													ND								
Dissolved Zirconium (Zr)	mg/L															ND								

Table 1. Hazelton Surface Water Quality Data

Parameters	Units	BC MoE Guidelines		SW04																				
		Freshwater Aquatic Life (1) (2)	Drinking Water (2) (3)																					
Date				26-May-06	8-Aug-07	10-Jun-08	25-Aug-09	16-Mar-10	22-Jun-10	30-Sep-10	28-Feb-12	14-Aug-12	4-Oct-12	27-Mar-13	17-Oct-13	7-Jul-14	25-Nov-14	26-May-15	1-Nov-15	16-Apr-16	7-Jul-16	25-Oct-16	25-Oct-16	14-Jun-17
Total Metals																								
Total Aluminum	mg/L	0.023 - 0.1 (j,k)	9.5	0.060	0.020	0.007	10.4	0.014	0.025	0.050	7.60	0.027	0.007	0.143	0.067		1.40	0.174	1.020	5.990	0.012	0.015	0.015	0.098
Total Antimony (Ab)	mg/L	0.009	0.006	ND	ND	ND	0.0018	ND	0.0003	0.0005	0.00071	0.00071	ND	ND	ND		ND	0.00020	0.00020	0.00030	0.00020	0.00040	0.00040	0.0002
Total Arsenic (As)	mg/L	0.005	0.01 MAC	ND	ND	0.0021	0.0239	0.0017	0.0047	0.0052	0.00607	0.00237	0.00036	0.00057	0.00372		0.00301	0.00210	0.00720	0.00180	0.00240	0.00330	0.00330	0.00286
Total Barium (Ba)	mg/L	1	1.0	0.128	0.201	0.145	0.381	0.164	0.197	0.176	0.214	0.328	0.032	0.159	0.224		0.137	0.10400	0.19800	0.19000	0.07600	0.20100	0.20100	0.190
Total Beryllium (Be)	mg/L	0.00013		ND	ND	ND	0.0003	ND	ND	ND	0.00017	ND	ND	ND	ND		ND	<0.0001	<0.0001	0.00010	<0.0001	<0.0001	<0.0001	<0.00010
Total Bismuth (Bi)	mg/L			ND	ND	ND	ND	ND	ND	ND	0.00006	ND	ND	ND	ND		ND	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.00010
Total Boron (B)	mg/L	1.2	5.0, MAC	1.02	1.31	1.3	0.993	1.01	1.54	1.39	0.69	2.03	0.255	1.17	1.16		0.638	0.83	0.72	1.74	1.17	0.99	0.99	1.18
Total Cadmium (Cd)	mg/L	0.00029 - 0.0028 (Hardness 50-455 mg/L) (e) (k)	0.005, MAC	ND	ND	0.00014	0.00149	0.00014	0.00131	0.00018	0.000605	0.000279	0.000039	0.000077	0.000092		0.000264	0.00034	0.00025	0.00033	0.00002	0.00003	0.00003	0.000027
Total Calcium (Ca)	mg/L	<4 sensitive to acid input		79.8	101	93.1	514	114	74.7	145	109	248	29.9	160	134		81.1	80.90	93.20	152.00	90.00	97.30	97.30	114
Total Cesium (Cs)	mg/L																							
Total Chromium (Cr)	mg/L	0.001 (f)	0.05, MAC	ND	ND	0.001	0.012	ND	0.0013	0.001	0.009	ND	ND	ND	ND		0.0018	0.00070	0.00170	0.00590	<0.0005	<0.0005	<0.0005	0.00056
Total Cobalt (Co)	mg/L	0.11		ND	ND	0.0007	0.0197	0.0018	0.00131	0.0028	0.00645	0.00177	ND	0.00069	0.00217		0.00262	0.00113	0.00536	0.00269	0.00081	0.00172	0.00172	0.00209
Total Copper (Cu)	mg/L	0.0032 - 0.0396 (e)	1.0, AO	ND	ND	0.0013	0.0469	0.0016	0.008	0.0038	0.0226	0.00294	0.00088	0.00279	0.00098		0.00721	0.00270	0.00590	0.01840	0.00050	0.00050	0.00050	0.00063
Total Iron (Fe)	mg/L	1	0.3, AO	0.30	0.44	0.22	22.70	0.41	0.60	0.40	12.7	0.233	0.02	0.16	0.97		2.46	0.56	4.22	5.31	0.24	0.83	0.83	0.98
Total Lead (Pb)	mg/L	0.034 - 0.40 (Hardness 50 - 350 mg/L) (e)	0.01	ND	ND	ND	0.0122	ND	0.00044	ND	0.00515	ND	ND	ND	ND		0.00139	0.00020	0.00130	0.00320	<0.0001	<0.0001	<0.0001	0.00017
Total Lithium (Li)	mg/L					ND	0.011	ND	ND	ND	0.0072	ND	ND	ND	ND		ND	0.0015	0.0022	0.0033	0.0012	0.0016	0.0016	0.00172
Total Magnesium (Mg)	mg/L			22.3	29.9	25.1	58.8	27.4	30.8	34.5	31.7	49.9	7.31	47.5	33.4		22	21.90	22.50	41.40	19.70	28.30	28.30	26.6
Total Manganese (Mn)	mg/L	0.8 - 3.4 (e)	0.05, AO	1.12	2.03	0.123	28.5	1.57	0.5	5.73	1.95	2.09	0.221	0.0112	2.77		1.89	0.52	5.63	0.14	0.57	2.65	2.65	2.99
Total Mercury (Hg)	mg/L.	0.0001	0.001	ND	ND	ND	ND	ND	ND	0.00023	ND	ND	ND	ND	ND		ND	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002
Total Molybdenum (Mo)	mg/L	2	0.25	ND	ND	ND	0.011	ND	0.0007	0.012	0.00182	0.0027	ND	0.001	ND		ND	0.0005	0.0006	0.0006	0.0003	0.0010	0.0010	0.00038
Total Nickel (Ni)	mg/L	0.025 - 0.15 (e)		ND	ND	0.005	0.029	0.005	0.007	0.009	0.0161	0.0056	0.0015	0.0083	0.0066		0.007	0.0045	0.0066	0.0146	0.0046	0.0050	0.0050	0.00546
Total Phosphorus (P)	mg/L	0.005 - 0.015 (for lakes only)	0.01, AO	0.10	ND	ND	ND	ND	ND	ND		0.069	0.017	0.022	0.054		0.337	0.10	0.25	0.21	0.06	0.05	0.05	0.086
Total Potassium (K)	mg/L			23	34	34.2	27.8	22.8	32.9	39.5	22.7	24	6.98	23	31.4		17	18.4	19.8	24.6	18.2	23.1	23.1	22.3
Total Rubidium (Rb)	mg/L																							
Total Selenium (Se)	mg/L	0.002	0.01, MAC	ND	ND	ND	0.0004	ND	ND	ND	0.00017	ND	ND	0.00013	0.0001		ND	0.00080	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.00050
Total Silicon (Si)	mg/L			4.29	6.74	3.74	19.8	5.64	4.48	8.83	16.4	6.2	1.95	4.08	9.55		7.68	7.3	7.5	12.8	12.2	9.5	9.5	9.9
Total Silver (Ag)	mg/L	0.0001 - 0.003 (e)		ND	ND	0.000006	ND	ND	ND	0.000013	0.000065	ND	ND	ND	ND		0.000029	<0.00005	<0.00005	0.00012	<0.00005	<0.00005	<0.00005	<0.000050
Total Sodium (Na)	mg/L		<200, AO	98.7	126	110	64.3	93.4	132	134	72.4	71.9	24.8	164	124		77.1	72.7	82.8	152.0	85.3	88.3	88.3	92.1
Total Strontium (Sr)	mg/L			0.536	0.724	0.689	2.08	0.724	0.637	0.856	0.705	1.66	0.213	1.1	0.879		0.552	0.59	0.57	0.91	0.54	0.79	0.79	0.772
Total Sulphur (S)	mg/L			5.1	1.8	12	468	17	ND	44	ND	245	ND	6.3	ND		8.4	10.0	3.0	13.0	7.0	3.0	3.0	4.2
Total Tellurium (Te)	mg/L																	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.00020
Total Thallium (Tl)	mg/L	0.0008		ND	ND	ND	0.00015	ND	ND	ND	0.000064	ND	ND	ND	ND		ND	<0.00002	<0.00002	0.00003	<0.00002	<0.00002	<0.00002	<0.000020
Total Thorium (Th)	mg/L																	<0.0001	<0.0001	0.00010	<0.0001	<0.0001	<0.0001	<0.00010
Total Tin (Sn)	mg/L			ND	ND	ND	ND	ND	0.0001	ND	0.0004	ND	ND	ND	ND		ND	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.00020
Total Tungsten (W)	mg/L																							
Total Titanium (Ti)	mg/L			ND	ND	ND	0.313	ND	ND	0.005	0.131	ND	ND	ND	ND		0.0258	<0.005	0.014	0.084	<0.005	<0.005	<0.005	<0.0050
Total Uranium (U)	mg/L	0.0085	0.02			0.0001	0.0028	0.0005	0.00013	0.0017	0.000341	0.00135	0.00013	0.00346	0.00017		0.00036	0.0002	0.0002	0.0024	0.0001	0.0003	0.0003	0.000207
Total Vanadium (V)	mg/L			ND	ND	ND	0.023	ND	ND	ND	0.0175	ND	ND	ND	ND		ND	<0.001	0.003	0.009	<0.001	<0.001	<0.001	<0.0010
Total Zinc (Zn)	mg/L	0.033-0.266 (Hardness 90 - 400 mg/L) (e)	5.0, AO	0.007	0.005	0.008	0.131	0.01	0.0144	0.006	0.043	0.0082	ND	ND	ND		0.0161	0.006	0.019	0.031	<0.004	<0.004	<0.004	<0.0040
Total Zirconium (Zr)	mg/L			ND	ND	ND	0.0012	ND	ND	ND	0.0005	ND	ND	ND	ND		ND	0.000	0.000	0.002	<0.0001	<0.0001	<0.0001	<0.00010
Volatile Organic Compounds																								
Benzene	µg/L	40	5																					
Ethylbenzene	µg/L	200	140, 1.6 AO																					
Methyl tbutyl ether (MTBE)	µg/L	3400	15 AO																					
Styrene	µg/L																							
Toluene	µg/L	0.5[l]	60, 24 AO																					
Xylene, m and p	µg/L																							
Xylene, o	µg/L																							
Xylenes, total	µg/L	30	90, 2 AO																					
BTEX+Styrene, total	µg/L																							
Hydrocarbons																								
EPH (C10C19)	µg/L																							
EPH (C19C32)	µg/L																							
TEH (C10C30), BC	µg/L																							
VHw (C6C10)	µg/L																							
VPHw	µg/L																							

Notes:

2018 data compared to 2018 criteria

A shaded value means exceeded the freshwater aquatic life criteria

A shaded value means reading exceeded the drinking water quality criteria.

A shaded value means exceeded both the aquatic life and drinking water criteria.

A shaded value means reading had detection limit exceeding criteria.

A shaded value means conductivity that exceeds 500 uS/cm

(AO Aesthetic Objective)

1. BC Environment Approved and Working Criteria for Water Quality, last updated March 2018
2. All criteria limits for BCWQG based on Total Metal Concentration except Aluminum and Cadmium (Dissolved)
3. BC Environment Drinking Water Guidelines and Canadian Drinking Water Standards

c. Limit dependent on chloride concentration. (MAC Maximum Acceptable Concentration)

d. Limit pH and temperature dependent.

e. Limit dependant on hardness.

f. Limit for chromium (IV)

g. Limit for total, no dissolved concentrations

h.copper (mg/L) =(0.094* Hardness)/1000

i. Limit for hardness based on total dissolved $CaCO^3$

j. at pH less than 6.5, limit is determined by regression equation, else limit is 0.1 mg/L.

k. Limit for dissolved metals, not total metals

l. Long Term Chronic criteria, average of 5 samples over 30 days not to exceed criteria

Table 1. Hazelton Surface Water Quality Data

Parameters	Units	BC MoE Guidelines		SW05 E287409																			
		Freshwater Aquatic Life (1) (2)	Drinking Water (2) (3)																				
Date				26-Jul-04	25-May-06	8-Aug-07	10-Jun-08	25-Aug-09	16-Mar-10	22-Jun-10	30-Sep-10	28-Feb-12	14-Aug-12	4-Oct-12	27-Mar-13	17-Oct-13	7-Jul-14	25-Nov-14	26-May-15	1-Nov-15	16-Apr-16	7-Jul-16	25-Oct-16	24-Apr-17
Field																							
pH	pH Units																						
Temperature	°C																						
Conductivity	uS/cm																						
Turbidity	NTU																						
Flow Rate	m/s																						
DO	mg/L																						
Analyte																							
Conductivity	uS/cm			257	176	193	149	173	187	220	259	243	182	261	602	278	162	271	136	162	130	219	119	152
pH	pH Units	6.5 - 9.0	7.0 - 10.5	6.5	6.6	6.5	6.2	6.9	6.1	6.3	6.7	5.9	6.4	6.4	5.9	6.6	6.5	6.0	6.3	6.1	6.4	6.3	6.7	6.3
Alkalinity (Total as CaCO3)	mg/L			24	21	28	22	20	21	23	32	19	23	34	45	44	17	35	16	23	17	22	21	21
Dissolved Hardness (CaCO3)	mg/L														31		48							
Hardness, Total (Total as CaCO3)	mg/L								41	46	50	43	40	46	103	49	38	59	33	42	35	46	33	33
Chloride (Cl)	mg/L	600	250, AO	60	45	43	39	41	41	47	56	59	37	52	158	54	34	58	34	33	29	52	24	29
Fluoride (F)	mg/L	0.4 - 1.87 (e)	1.5																					
Sulphate (SO4)	mg/L	128 - 429 (e)	500, AO	<0.5	ND	ND	ND	ND	2.9	ND	0.8	ND	ND	ND	ND	ND	ND	ND (1)	<1.0	2.1	<1.0	<1.0	<1.0	<1.0
Ammonia (N)	mg/L	0.681 - 28.7 (d)		0.06	ND	ND	0.04	0.03	0.05	ND	0.03	0.07	0.04	ND	0.69	0.05	0.04	0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.039
Nitrate (N)	mg/L	32.8	10 MAC														ND				<0.01	0.010	0.014	0.013
Nitrite (N)	mg/L	0.06 - 0.6 (c)	1.0														ND				<0.01	<0.01	<0.01	<0.01
Nitrate plus Nitrite (N)	mg/L																	ND			<0.010	0.011	0.014	0.013
Total Kjeldahl Nitrogen	mg/L			0.88	0.96	1.2	0.93	0.82	0.9	1.37	1.3	0.72	2.16	1.42	2.83	1.21	1.03	1.43	1.080	1.220				
Total Phosphorous (P)	mg/L		0.01																					
Total Suspended Solids	mg/L	25 mg/L (background 25-250 mg/l)) (i)	<500, AO														3.8							
Misc. Organics																								
Chemical Oxygen Demand (COD)	mg/L			73	61	88	74	81	53	91	64		120	74	126	65	69	71	83	107	87	70	86	74
Biological Oxygen Demand (BOD)	mg/L			<6	ND	ND	ND	ND	ND	ND	ND	ND	7.6	4.2	21	ND	ND	8.5	6.800	<4.0	<5.0	<4.0	<4.0	<4.0
Total Organic Carbon (C)	mg/L	+/- 20% of background	4.0														24.9				35.5	30.4	40.6	23.0
Dissolved Metals																								
Dissolved Aluminum (Al)	mg/L	0.1	0.2														0.0915							
Dissolved Antimony (Sb)	mg/L	0.02	0.006, MAC														ND							
Dissolved Arsenic (As)	mg/L	0.005	0.025 MAC														0.00073							
Dissolved Barium (Ba)	mg/L	5	1.0, MAC														0.0158							
Dissolved Beryllium (Be)	mg/L	0.0053 (g)	0.004														ND							
Dissolved Bismuth (Bi)	mg/L																ND							
Dissolved Boron (B)	mg/L	1.20	5.0, MAC														ND							
Dissolved Cadmium (Cd)	mg/L	0.00029 - 0.0028 (Hardness 50-455 mg/L) (e)	0.005, MAC														ND							
Dissolved Calcium (Ca)	mg/L	48 (Sensitive to acid inputs)															15.4							
Dissolved Cesium (Cs)	mg/L																							
Dissolved Chromium (Cr)	mg/L	0.001 (f)	0.05, MAC														ND							
Dissolved Cobalt (Co)	mg/L	0.11															ND							
Dissolved Copper (Cu)	mg/L	0.007 - 0.05 (e)	0.5														0.00083							
Dissolved Iron (Fe)	mg/L	0.35	<0.3, AO														0.595							
Dissolved Lead (Pb)	mg/L	0.034 - 0.40 (Hardness 50 - 350 mg/L) (e)	50, MAC														ND							
Dissolved Lithium (Li)	mg/L																ND							
Dissolved Magnesium (Mg)	mg/L		700														2.27							
Dissolved Manganese (Mn)	mg/L	0.8 - 3.8 (e)	<0.05, AO														0.0612							
Dissolved Mercury (Hg)	mg/L	0.0001, MAC	0.001, MAC														ND							
Dissolved Molybdenum (Mo)	mg/L	2	0.25														ND							
Dissolved Nickel (Ni)	mg/L	0.025 - 0.15 (e)															ND							
Dissolved Phosphorus (P)	mg/L	0.005 - 0.015 (for lakes only)	0.01														0.015							
Dissolved Potassium (K)	mg/L	373 - 432															0.059							
Dissolved Rubidium (Rb)	mg/L																							
Dissolved Selenium (Se)	mg/L	0.002	0.01, MAC														ND							
Dissolved Silicon (Si)	mg/L																0.48							
Dissolved Silver (Ag)	mg/L	0.001 - 0.003 (e)	0.0001 (g)														ND							
Dissolved Sodium (Na)	mg/L		<200, AO														15.4							
Dissolved Strontium (Sr)	mg/L																0.0916							
Dissolved Sulphur (S)	mg/L																ND							
Dissolved Tellurium (Te)	mg/L																							
Dissolved Thallium (Tl)	mg/L	0.0017	2														ND							
Dissolved Thorium (Th)	mg/L																							
Dissolved Tin (Sn)	mg/L																ND							
Dissolved Titanium (Ti)	mg/L	2															ND							
Dissolved Tungsten (W)	mg/L																							
Dissolved Uranium (U)	mg/L	0.3	20														ND							
Dissolved Vanadium (V)	mg/L	0.006	0.02														ND							
Dissolved Zinc (Zn)	mg/L	0.033-0.266 (Hardness 90 - 400 mg/L) (e)	5 AO														0.0053							
Dissolved Zirconium (Zr)	mg/L																ND							

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Parameters	Units	BC MoE Guidelines		SW05 E287409																			
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Total Metals																							
Total Aluminum	mg/L	0.023 - 0.1 (j,k)	9.5	0.070	0.200	0.240	0.193	0.363	0.238	0.120	0.050	0.323	0.330	0.222	1.190	0.227		0.345	0.258	0.267	0.216	0.102	0.301	0.238
Total Antimony (Ab)	mg/L	0.009	0.006	<0.05	ND	ND	ND	ND	ND	0.00008	ND	0.00006	ND	ND	ND	ND		ND	0.00010	<0.0001	<0.0001	<0.0001	0.00020	<0.00010
Total Arsenic (As)	mg/L	0.005	0.01 MAC	<0.05	ND	ND	0.0007	0.001	0.0004	0.00093	0.0006	0.00058	0.00102	0.00066	0.00117	0.00055		0.0008	0.00060	<0.0005	0.00060	0.00070	0.00060	0.00094
Total Barium (Ba)	mg/L	1	1.0	0.024	0.014	0.024	0.018	0.016	0.019	0.016	0.024	0.022	0.020	0.021	0.066	0.019		0.031	0.01100	0.01500	0.01000	0.02300	0.01500	0.01790
Total Beryllium (Be)	mg/L	0.00013		<0.0002	ND	ND	ND	ND	ND	0.00001	ND	ND	ND	ND	ND	ND		ND	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.00010
Total Bismuth (Bi)	mg/L			<0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		ND	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.00010
Total Boron (B)	mg/L	1.2	5.0, MAC	<0.008	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		ND	0.00900	0.00600	0.00700	0.00800	0.09100	0.01000
Total Cadmium (Cd)	mg/L	0.00029 - 0.0028 (Hardness 50-455 mg/L) (e) (k)	0.005, MAC	<0.002	ND	ND	0.00006	0.00002	0.00004	0.000298	ND	0.000044	0.000145	0.000023	0.000071	0.000012		0.000021	0.00009	0.00002	0.00021	<0.00001	0.00004	0.000011
Total Calcium (Ca)	mg/L	<4 sensitive to acid input		16.3	12.7	13.2	11.8	11.2	12.2	13.1	14.9	12.8	11.8	13.2	31.3	14.9		17.4	9.4	12.5	10.1	14.5	9.4	9.8
Total Cesium (Cs)	mg/L																							
Total Chromium (Cr)	mg/L	0.001 (f)	0.05, MAC	<0.005	ND	ND	0.001	ND	ND	0.0008	ND	0.0008	ND	ND	0.0015	ND		ND	0.0005	0.0006	0.0005	<0.0005	0.0006	0.0005
Total Cobalt (Co)	mg/L	0.11		<0.005	ND	ND	ND	ND	ND	0.000156	ND	0.00031	0.00083	ND	0.00157	ND		0.00125	0.0001	0.0003	0.0001	0.0002	0.0002	0.0005
Total Copper (Cu)	mg/L	0.0032 - 0.0396 (e)	1.0, AO	<0.005	ND	0.007	0.0023	0.0067	0.0021	0.0033	0.0014	0.0027	0.00232	0.00174	0.00335	0.00118		0.00227	0.0028	0.0016	0.0036	0.0004	0.0016	0.0023
Total Iron (Fe)	mg/L	1	0.3, AO	0.62	0.42	2.13	0.50	0.67	0.60	0.31	0.79	1.11	1.18	0.61	4.25	0.73		2.1	0.43	0.82	0.42	0.54	0.65	0.86
Total Lead (Pb)	mg/L	0.034 - 0.40 (Hardness 50 - 350 mg/L) (e)	0.01	<0.03	ND	ND	ND	0.0004	0.0005	0.000188	ND	0.00027	0.0005	0.00029	0.00139	0.0002		0.00032	0.00010	0.00010	0.00030	<0.0001	0.00010	0.00030
Total Lithium (Li)	mg/L						ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		ND	0.00030	0.00030	0.00020	0.00030	0.00030	0.00020
Total Magnesium (Mg)	mg/L			3.25	2.63	2.53	2.44	2.61	2.56	3.11	3.14	2.6	2.5	3.22	5.92	2.94		3.71	2.39000	2.68000	2.33000	2.28000	2.31000	2.16000
Total Manganese (Mn)	mg/L	0.8 - 3.4 (e)	0.05, AO	0.06	0.021	0.17	0.05	0.041	0.067	0.0152	0.075	0.0736	0.188	0.114	0.53	0.0755		0.653	0.03240	0.07060	0.026	0.060	0.031	0.132
Total Mercury (Hg)	mg/L.	0.0001	0.001	<0.00005	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		ND	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002
Total Molybdenum (Mo)	mg/L	2	0.25	<0.005	ND	ND	ND	ND	ND	0.00011	ND	0.00092	ND	ND	ND	ND		ND	<0.0001	<0.0001	<0.0001	<0.0001	0.00010	0.00018
Total Nickel (Ni)	mg/L	0.025 - 0.15 (e)		<0.008	ND	ND	0.001	ND	ND	0.00098	0.001	0.0011	ND	ND	0.0022	ND		0.0014	0.00090	0.00130	0.00100	0.00050	0.00080	0.00097
Total Phosphorus (P)	mg/L	0.005 - 0.015 (for lakes only)	0.01, AO	<0.1	ND	ND	ND	ND	ND	ND	ND		0.176	0.08	0.222	0.058		0.087	0.0490	0.0300	<0.02	0.0300	<0.02	0.077
Total Potassium (K)	mg/L			<1	ND	ND	0.71	0.32	0.85	0.48	1.36	0.8	0.638	1.54	2.04	0.848		1.18	0.52	0.39	0.51	0.11	0.48	2.47
Total Rubidium (Rb)	mg/L																							
Total Selenium (Se)	mg/L	0.002	0.01, MAC	<0.03	ND	ND	ND	ND	ND	0.00006	ND	0.00007	ND	ND	ND	ND		ND	0.00060	<0.0005	<0.0005	<0.0005	<0.0005	<0.00050
Total Silicon (Si)	mg/L			<0.01	0.36	0.41	0.486	0.547	2.95	ND	0.135	4.15	0.481	1.24	6.22	1.78		3.19	1.40	3.00	1.10	0.60000	2.90	1.60
Total Silver (Ag)	mg/L	0.0001 - 0.003 (e)		32.4	ND	ND	0.000006	ND	ND	ND	ND	0.000006	ND	ND	0.000024	ND		0.000026	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.000050
Total Sodium (Na)	mg/L		<200, AO	0.114	21.7	23.3	16.3	21.9	19.5	27.5	30	27.9	21	39.2	75.7	40.7		29.8	16.2	15.0	16.5	21.9	11.7	16.7
Total Strontium (Sr)	mg/L			0.3	0.076	0.09	0.075	0.08	0.076	0.0924	0.106	0.077	0.0827	0.105	0.202	0.0671		0.108	0.063	0.068	0.057	0.09000	0.070	0.064
Total Sulphur (S)	mg/L			<0.05	0.3	0.7	ND	ND	3	ND	ND	ND	ND	ND	ND	ND		ND	4.00000	<1	<1	1.00000	<1	<3.0
Total Tellurium (Te)	mg/L														<0.0002	<0.0002			<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.00020
Total Thallium (Tl)	mg/L	0.0008		<0.03	ND	ND	ND	ND	ND	ND	ND	0.000004	ND	ND	ND	ND		ND	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.000020
Total Thorium (Th)	mg/L														<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.00010
Total Tin (Sn)	mg/L			<0.02	ND	ND	ND	ND	ND	0.00003	ND	0.0002	ND	ND	ND	ND		ND	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.00020
Total Tungsten (W)	mg/L																							
Total Titanium (Ti)	mg/L			<0.003	ND	ND	ND	0.01	ND	0.0013	ND	ND	0.0064	ND	0.0156	ND		ND	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0050
Total Uranium (U)	mg/L	0.0085	0.02				ND	ND	ND	0.000007	ND	0.000014	ND	ND	ND	ND		ND	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.000020
Total Vanadium (V)	mg/L			<0.005	ND	ND	ND	ND	ND	ND	ND	0.0007	ND	ND	ND	ND		ND	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0010
Total Zinc (Zn)	mg/L	0.033-0.266 (Hardness 90 - 400 mg/L) (e)	5.0, AO	<0.005	0.01	0.023	0.014	0.01	0.028	0.0061	0.006	0.008	0.0096	0.0056	0.0151	ND		0.0112	0.00800	0.00800	0.01000	<0.004	0.00500	0.00510
Total Zirconium (Zr)	mg/L			<0.005	ND	ND	ND	ND	ND	0.0001	ND	0.0003	ND	ND	ND	ND		ND	0.00030	0.00030	0.00030	<0.0001	0.00020	0.00026
Volatile Organic Compounds																								
Benzene	µg/L	40	5																					
Ethylbenzene	µg/L	200	140, 1.6 AO																					
Methyl tbutyl ether (MTBE)	µg/L	3400	15 AO																					
Styrene	µg/L																							
Toluene	µg/L	0.5[l]	60, 24 AO																					
Xylene, m and p	µg/L																							
Xylene, o	µg/L																							
Xylenes, total	µg/L	30	90, 2 AO																					
BTEX+Styrene, total	µg/L																							
Hydrocarbons																								
EPH (C10C19)	µg/L																							
EPH (C19C32)	µg/L																							
TEH (C10C30), BC	µg/L																							
VHw (C6C10)	µg/L																							
VPHw	µg/L																							

Notes:

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2. All criteria limits for BCWQG based on Total Metal Concentration except Aluminum and Cadmium (Dissolved)
3. BC Environment Drinking Water Guidelines and Canadian Drinking Water Standards

c. Limit dependent on chloride concentration. (MAC Maximum Acceptable Concentration)

d. Limit pH and temperature dependent.

e. Limit dependant on hardness.

f. Limit for chromium (IV)

g. Limit for total, no dissolved concentrations

h.copper (mg/L) =(0.094* Hardness)/1000

i. Limit for hardness based on total dissolved $CaCO^3$

j. at pH less than 6.5, limit is determined by regression equation, else limit is 0.1 mg/L.

k. Limit for dissolved metals, not total metals

l. Long Term Chronic criteria, average of 5 samples over 30 days not to exceed criteria

Table 1. Hazelton Surface Water Quality Data

Parameters	Units	BC MoE Guidelines								
		Freshwater Aquatic Life (1) (2)	Drinking Water (2) (3)							
Date				14-Jun-17	28-May-18	13-Aug-19	21-Nov-19	24-Jun-20	20-Aug-20	30-Sep-20
Field										
pH	pH Units			7.6	6.0	6.4		5.35		5.88
Temperature	°C			14.7	13.1	17.1		16.8		11.3
Conductivity	uS/cm			178.0	107.0	201.6		172		74.2
Turbidity	NTU					4.9				1.91
Flow Rate	m/s									
DO	mg/L					1.6		3.4		3.9
Analyte										
Conductivity	uS/cm			170			132	199	163	97.7
pH	pH Units	6.5 - 9.0	7.0 - 10.5	6.6		7.2	7	6.63	6.7	6.93
Alkalinity (Total as CaCO3)	mg/L			34			20	19.6	33.6	17.3
Dissolved Hardness (CaCO3)	mg/L							45	42.7	33.1
Hardness, Total (Total as CaCO3)	mg/L			51	32	50	36	45.5	41.7	31.4
Chloride (Cl)	mg/L	600	250, AO	30	16	49	25	44.2	26.8	15.9
Fluoride (F)	mg/L	0.4 - 1.87 (e)	1.5		0.040	0	0.024	0.03	0.047	0.039
Sulphate (SO4)	mg/L	128 - 429 (e)	500, AO	1.4	<0.30	<0.30	0.55	<0.30	<0.30	<0.30
Ammonia (N)	mg/L	0.681 - 28.7 (d)		<0.03	0.0085	0.0123	0.046	0.016	0.0143	0.0213
Nitrate (N)	mg/L	32.8	10 MAC	0.014	<0.0050	0.0059	<0.0050	<0.0050	<0.0050	<0.0050
Nitrite (N)	mg/L	0.06 - 0.6 (c)	1.0	<0.01	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Nitrate plus Nitrite (N)	mg/L			0.014	<0.0060					
Total Kjeldahl Nitrogen	mg/L						1.52	1.23	1.22	1.04
Total Phosphorous (P)	mg/L		0.01							
Total Suspended Solids	mg/L	25 mg/L (background 25-250 mg/l)) (i)	<500, AO							
Misc. Organics										
Chemical Oxygen Demand (COD)	mg/L			80	69	59	100	95	105	104
Biological Oxygen Demand (BOD)	mg/L			<4.0	2.5	2.1				
Total Organic Carbon (C)	mg/L	+/- 20% of background	4.0	23.7			41.1	35.8	35.8	36.8
Dissolved Metals										
Dissolved Aluminum (Al)	mg/L	0.1	0.2				0.450	0.168	0.201	0.425
Dissolved Antimony (Sb)	mg/L	0.02	0.006, MAC				<0.00010	<0.00010	<0.00010	<0.00010
Dissolved Arsenic (As)	mg/L	0.005	0.025 MAC				0.00058	0.00082	0.0009	0.00074
Dissolved Barium (Ba)	mg/L	5	1.0, MAC				0.0162	0.0221	0.0179	0.0164
Dissolved Beryllium (Be)	mg/L	0.0053 (g)	0.004				<0.00010	<0.000100	<0.000100	<0.000100
Dissolved Bismuth (Bi)	mg/L						<0.000050	<0.000050	<0.000050	<0.000050
Dissolved Boron (B)	mg/L	1.20	5.0, MAC				<0.010	<0.010	<0.010	<0.010
Dissolved Cadmium (Cd)	mg/L	0.00029 - 0.0028 (Hardness 50-455 mg/L) (e)	0.005, MAC				0.0000128	0.0000971	0.0000052	0.000011
Dissolved Calcium (Ca)	mg/L	48 (Sensitive to acid inputs)					10.5	13.6	13	9.88
Dissolved Cesium (Cs)	mg/L						<0.000010	<0.000010	<0.000010	<0.000010
Dissolved Chromium (Cr)	mg/L	0.001 (f)	0.05, MAC				0.0005	0.00038	0.0005	0.00062
Dissolved Cobalt (Co)	mg/L	0.11					0.00019	0.00019	0.00038	0.00018
Dissolved Copper (Cu)	mg/L	0.007 - 0.05 (e)	0.5				0.00233	0.00073	0.00072	0.00182
Dissolved Iron (Fe)	mg/L	0.35	<0.3, AO				0.707	0.514	0.886	0.750
Dissolved Lead (Pb)	mg/L	0.034 - 0.40 (Hardness 50 - 350 mg/L) (e)	50, MAC				0.0	0.000052	0.0001	0.00017
Dissolved Lithium (Li)	mg/L						<0.0010	<0.0010	<0.0010	<0.0010
Dissolved Magnesium (Mg)	mg/L		700				2.41	2.66	2.48	2.05
Dissolved Manganese (Mn)	mg/L	0.8 - 3.8 (e)	<0.05, AO				0.0249	0.0296	0.0716	0.0177
Dissolved Mercury (Hg)	mg/L	0.0001, MAC	0.001, MAC				0.000008	<0.0000050	<0.0000050	0.0000193
Dissolved Molybdenum (Mo)	mg/L	2	0.25				0.000067	<0.000050	0.000137	0.000085
Dissolved Nickel (Ni)	mg/L	0.025 - 0.15 (e)					0.00065	0.00108	0.00118	0.00117
Dissolved Phosphorus (P)	mg/L	0.005 - 0.015 (for lakes only)	0.01				<0.050	<0.050	<0.050	<0.050
Dissolved Potassium (K)	mg/L	373 - 432					0.688	<0.050	0.389	0.773
Dissolved Rubidium (Rb)	mg/L						0.00042	<0.00020	0.00028	0.00069
Dissolved Selenium (Se)	mg/L	0.002	0.01, MAC				0.00	<0.000050	0.00008	0.00014
Dissolved Silicon (Si)	mg/L						3.70	0.925	2.72	3.51
Dissolved Silver (Ag)	mg/L	0.001 - 0.003 (e)	0.0001 (g)				0.00	<0.000010	<0.000010	<0.000010
Dissolved Sodium (Na)	mg/L		<200, AO				13.10	23.8	19.8	10.4
Dissolved Strontium (Sr)	mg/L						0.07	0.096	0.0889	0.0671
Dissolved Sulphur (S)	mg/L						0.52	<0.50	<0.50	<0.50
Dissolved Tellurium (Te)	mg/L						<0.00020	<0.00020	<0.00020	<0.00020
Dissolved Thallium (Tl)	mg/L	0.0017	2				<0.000010	<0.000010	<0.000010	<0.000010
Dissolved Thorium (Th)	mg/L						<0.00010	<0.00010	<0.00010	<0.00010
Dissolved Tin (Sn)	mg/L						<0.00010	<0.00010	<0.00010	<0.00010
Dissolved Titanium (Ti)	mg/L	2					0.01	0.00106	0.00156	0.00683
Dissolved Tungsten (W)	mg/L						<0.00010	<0.00010	<0.00010	<0.00010
Dissolved Uranium (U)	mg/L	0.3	20				0.00	<0.000010	<0.000010	0.000016
Dissolved Vanadium (V)	mg/L	0.006	0.02				0.00	<0.00050	<0.00050	0.00073
Dissolved Zinc (Zn)	mg/L	0.033-0.266 (Hardness 90 - 400 mg/L) (e)	5 AO				0.01	0.0056	0.0095	0.009
Dissolved Zirconium (Zr)	mg/L						0.00065	0.00026	0.00033	0.00049

Table 1. Hazelton Surface Water Quality Data

Parameters	Units	BC MoE Guidelines									
		Freshwater Aquatic Life (1) (2)	Drinking Water (2) (3)								
Date				14-Jun-17	28-May-18	13-Aug-19	21-Nov-19	24-Jun-20	20-Aug-20	30-Sep-20
Total Metals										
Total Aluminum	mg/L	0.023 - 0.1 (j,k)	9.5	1.420	0.619	0.197	0.576	0.204	0.266	0.418
Total Antimony (Ab)	mg/L	0.009	0.006	0.00018	<0.00010	<0.00010	0.0001	<0.00010	<0.00010	<0.00010
Total Arsenic (As)	mg/L	0.005	0.01 MAC	0.0021	0.00224	0.00142	0.00069	0.00087	0.00108	0.00084
Total Barium (Ba)	mg/L	1	1.0	0.033	0.019	0.024	0.017	0.0266	0.0231	0.016
Total Beryllium (Be)	mg/L	0.00013		<0.00010	<0.00010	<0.00010	<0.00010	<0.000100	<0.000100	<0.000100
Total Bismuth (Bi)	mg/L			<0.00010	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Total Boron (B)	mg/L	1.2	5.0, MAC	0.038	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Total Cadmium (Cd)	mg/L	0.00029 - 0.0028 (Hardness 50-455 mg/L) (e) (k)	0.005, MAC	0.000025	0.0000202	0.0000072	0.0000147	0.0000096	0.0000099	0.000015
Total Calcium (Ca)	mg/L	<4 sensitive to acid input		15	9.42	15.1	10.6	13.9	12.4	9.25
Total Cesium (Cs)	mg/L				0.000057	0.000016	0.00003	<0.000010	<0.000010	0.000015
Total Chromium (Cr)	mg/L	0.001 (f)	0.05, MAC	0.00168	0.00087	0.0003	0.00068	0.00039	0.00058	0.00065
Total Cobalt (Co)	mg/L	0.11		0.00099	0.00098	0.00043	0.00025	0.00038	0.00158	0.00032
Total Copper (Cu)	mg/L	0.0032 - 0.0396 (e)	1.0, AO	0.00452	0.00214	0.00084	0.00265	0.00098	0.00086	0.00195
Total Iron (Fe)	mg/L	1	0.3, AO	2.46	1.62	1.00	0.91	0.829	1.99	1.02
Total Lead (Pb)	mg/L	0.034 - 0.40 (Hardness 50 - 350 mg/L) (e)	0.01	0.00163	0.000597	0.000231	0.000239	0.00011	0.000298	0.000245
Total Lithium (Li)	mg/L			0.0011	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Magnesium (Mg)	mg/L			3.34	2.13	3.02	2.51	2.62	2.6	2.03
Total Manganese (Mn)	mg/L	0.8 - 3.4 (e)	0.05, AO	0.172	0.236	0.105	0.0283	0.0752	0.373	0.051
Total Mercury (Hg)	mg/L.	0.0001	0.001	<0.00002	<0.0000050	<0.0000050	0.0000088	<0.0000050	<0.0000050	0.0000065
Total Molybdenum (Mo)	mg/L	2	0.25	0.00023	0.000107	<0.000050	0.000089	<0.000050	0.000444	0.000114
Total Nickel (Ni)	mg/L	0.025 - 0.15 (e)		0.00248	0.00164	0.00093	0.00116	0.00076	0.00122	0.00124
Total Phosphorus (P)	mg/L	0.005 - 0.015 (for lakes only)	0.01, AO	0.069	0.083	0.052	<0.050	0.058	0.066	<0.050
Total Potassium (K)	mg/L			1.26	1.09	0.408	0.665	0.077	0.38	0.749
Total Rubidium (Rb)	mg/L				0.00091	0.00048	0.0005	<0.00020	0.00041	0.00066
Total Selenium (Se)	mg/L	0.002	0.01, MAC	<0.00050	0.000054	0.000054	0.000097	0.000074	0.000079	0.000107
Total Silicon (Si)	mg/L			3.6	2.35	1	3.99	0.99	2.63	3.8
Total Silver (Ag)	mg/L	0.0001 - 0.003 (e)		<0.000050	<0.000010	<0.000010	0.000014	<0.000010	<0.000010	0.000017
Total Sodium (Na)	mg/L		<200, AO	13.6	9.11	20.9	13.6	24.2	19.9	10.3
Total Strontium (Sr)	mg/L			0.0931	0.0649	0.103	0.068	0.101	0.0826	0.0597
Total Sulphur (S)	mg/L			<3.0	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Total Tellurium (Te)	mg/L			<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Total Thallium (Tl)	mg/L	0.0008		<0.000020	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Total Thorium (Th)	mg/L			<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Total Tin (Sn)	mg/L			<0.00020	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Total Tungsten (W)	mg/L				0.00853	<0.0039	0.00702	<0.00010	<0.00010	<0.00010
Total Titanium (Ti)	mg/L			0.0231	<0.00010	<0.00010	<0.00010	0.00144	0.00271	0.0058
Total Uranium (U)	mg/L	0.0085	0.02	0.000028	0.000017	<0.000010	0.000023	0.00001	0.000011	0.000017
Total Vanadium (V)	mg/L			0.0033	0.00142	0.00072	0.00117	<0.00050	0.00067	0.00087
Total Zinc (Zn)	mg/L	0.033-0.266 (Hardness 90 - 400 mg/L) (e)	5.0, AO	0.0105	0.0072	<0.0030	0.0115	0.0063	0.0096	0.0098
Total Zirconium (Zr)	mg/L			0.00031	0.000228	<0.00020	<0.00060	<0.00020	0.00026	0.00038
Volatile Organic Compounds										
Benzene	µg/L	40	5					<0.50	<0.50	<0.50
Ethylbenzene	µg/L	200	140, 1.6 AO					<0.50	<0.50	<0.50
Methyl tbutyl ether (MTBE)	µg/L	3400	15 AO					<0.50	<0.50	<0.50
Styrene	µg/L							<0.50	<0.50	<0.50
Toluene	µg/L	0.5[l]	60, 24 AO					<0.50	<0.50	<0.50
Xylene, m and p	µg/L							<0.50	<0.50	<0.50
Xylene, o	µg/L							<0.50	<0.50	<0.50
Xylenes, total	µg/L	30	90, 2 AO					<0.75	<0.75	<0.75
BTEX+Styrene, total	µg/L							<1.5		
Hydrocarbons										
EPH (C10C19)	µg/L							<250	<250	<250
EPH (C19C32)	µg/L							<250	<250	<250
TEH (C10C30), BC	µg/L							<250	<250	
VHw (C6C10)	µg/L							<100	<100	<100
VPHw	µg/L							<100	<100	<100

Notes:

2018 data compared to 2018 criteria

A shaded value means exceeded the freshwater aquatic life criteria

A shaded value means reading exceeded the drinking water quality criteria.

A shaded value means exceeded both the aquatic life and drinking water criteria.

A shaded value means reading had detection limit exceeding criteria.

A shaded value means conductivity that exceeds 500 uS/cm

(AO Aesthetic Objective)

1. BC Environment Approved and Working Criteria for Water Quality, last updated March 2018
2. All criteria limits for BCWQG based on Total Metal Concentration except Aluminum and Cadmium (Dissolved)
3. BC Environment Drinking Water Guidelines and Canadian Drinking Water Standards

c. Limit dependent on chloride concentration. (MAC Maximum Acceptable Concentration)

d. Limit pH and temperature dependent.

e. Limit dependant on hardness.

f. Limit for chromium (IV)

g. Limit for total, no dissolved concentrations

h.copper (mg/L) =(0.094* Hardness)/1000

i. Limit for hardness based on total dissolved $CaCO^3$

j. at pH less than 6.5, limit is determined by regression equation, else limit is 0.1 mg/L.

k. Limit for dissolved metals, not total metals

l. Long Term Chronic criteria, average of 5 samples over 30 days not to exceed criteria

Table 1. Hazelton Surface Water Quality Data

Parameters	Units	BC MoE Guidelines		SW06 E309754										
		Freshwater Aquatic Life (1) (2)	Drinking Water (2) (3)											
Date				16-Apr-16	7-Jul-16	25-Oct-16	24-Apr-17	14-Jun-17	28-May-18	13-Aug-19	21-Nov-19	24-Jun-20	20-Aug-20	30-Sep-20
Field														
pH	pH Units							8	6	6		6.28	7.36	6.12
Temperature	°C							12	9	15		12.3	12.8	10.7
Conductivity	uS/cm							120	531	2,306		608	103.7	90.7
Turbidity	NTU									8			8.42	1.58
Flow Rate	m/s													
DO	mg/L									2		3.1	4.8	5.7
Analyte														
Conductivity	uS/cm			121	173	132	153	128			86	282	134	72.8
pH	pH Units	6.5 - 9.0	7.0 - 10.5	6.1	6.4	6.5	5.9	5.9		7.74	7.12	6.93	6.52	7.15
Alkalinity (Total as CaCO3)	mg/L			12	26	16	18	11			15	35.8	16.2	21.5
Dissolved Hardness (CaCO3)	mg/L											51.8	39	32.4
Hardness, Total (Total as CaCO3)	mg/L			31	51	34	32	30	36	276	28	58.9	38.7	32.5
Chloride (Cl)	mg/L	600	250, AO	28	33	31	31	28	27	634	13	59.2	24.7	5.63
Fluoride (F)	mg/L	0.4 - 1.87 (e)	1.5						0.035	<0.20	0.027	0.033	0.037	0.041
Sulphate (SO4)	mg/L	128 - 429 (e)	500, AO	<1.0	<1.0	<1.0	<1.0	<1.0	<0.30	<3.0	0.64	<0.30	<0.3	<0.30
Ammonia (N)	mg/L	0.681 - 28.7 (d)		0.030	0.053	<0.03	0.310	0.1	0.138	0.0156	0.049	0.0406	0.0563	0.0365
Nitrate (N)	mg/L	32.8	10 MAC	0.020	0.050	0.016	0.090	0.035	0.111	<0.050	0.0681	0.0059	0.0088	0.0113
Nitrite (N)	mg/L	0.06 - 0.6 (c)	1.0	<0.01	<0.01	<0.01	<0.01	<0.01	0.0042	<0.010	<0.0010	<0.0010	<0.0010	<0.0010
Nitrate plus Nitrite (N)	mg/L			0.020	0.046	0.016	0.090	0.035	0.1152					
Total Kjeldahl Nitrogen	mg/L										1.78	1.3	1.37	1.11
Total Phosphorous (P)	mg/L		0.01											
Total Suspended Solids	mg/L	25 mg/L (background 25-250 mg/l)) (i)	<500, AO											
Misc. Organics														
Chemical Oxygen Demand (COD)	mg/L			94	128	165	62	98	113	49	94	118	143	105
Biological Oxygen Demand (BOD)	mg/L			<5.0	<4.0	<4.0	<4.0	<4.0	<2.0	<2.0				
Total Organic Carbon (C)	mg/L	+/- 20% of background	4.0	42.7	57.7	39.3	20.6	48.6			37.2	43.6	48.9	42.2
Dissolved Metals														
Dissolved Aluminum (Al)	mg/L	0.1	0.2								0.644	0.294	0.244	0.441
Dissolved Antimony (Sb)	mg/L	0.02	0.006, MAC								<0.00010	0.00023	<0.00010	<0.00010
Dissolved Arsenic (As)	mg/L	0.005	0.025 MAC								0.00052	0.00101	0.00088	0.00084
Dissolved Barium (Ba)	mg/L	5	1.0, MAC								0.0148	0.0241	0.0147	0.0162
Dissolved Beryllium (Be)	mg/L	0.0053 (g)	0.004								<0.00010	<0.000100	<0.000100	<0.000100
Dissolved Bismuth (Bi)	mg/L										<0.000050	<0.000050	<0.000050	<0.000050
Dissolved Boron (B)	mg/L	1.20	5.0, MAC								<0.010	<0.010	<0.010	<0.010
Dissolved Cadmium (Cd)	mg/L	0.00029 - 0.0028 (Hardness 50-455 mg/L) (e)	0.005, MAC								0.0000199	0.0000262	0.0000181	0.0000187
Dissolved Calcium (Ca)	mg/L	48 (Sensitive to acid inputs)									8.49	15.9	11.6	9.92
Dissolved Cesium (Cs)	mg/L										<0.000010	<0.000010	<0.000010	<0.000010
Dissolved Chromium (Cr)	mg/L	0.001 (f)	0.05, MAC								0.0008	0.00053	0.00039	0.00088
Dissolved Cobalt (Co)	mg/L	0.11									0.00017	0.00044	0.00056	0.00021
Dissolved Copper (Cu)	mg/L	0.007 - 0.05 (e)	0.5								0.00356	0.00165	0.00092	0.00241
Dissolved Iron (Fe)	mg/L	0.35	<0.3, AO								0.467	1.050	1.210	0.706
Dissolved Lead (Pb)	mg/L	0.034 - 0.40 (Hardness 50 - 350 mg/L) (e)	50, MAC								0.00012	0.000186	0.000466	0.000151
Dissolved Lithium (Li)	mg/L										<0.0010	<0.0010	<0.0010	<0.0010
Dissolved Magnesium (Mg)	mg/L		700								1.65	2.92	2.46	1.85
Dissolved Manganese (Mn)	mg/L	0.8 - 3.8 (e)	<0.05, AO								0.0187	0.152	0.136	0.0369
Dissolved Mercury (Hg)	mg/L	0.0001, MAC	0.001, MAC								0.0000173	<0.0000050	<0.0000050	0.0000195
Dissolved Molybdenum (Mo)	mg/L	2	0.25								0.000058	0.000113	0.00027	0.00017
Dissolved Nickel (Ni)	mg/L	0.025 - 0.15 (e)									0.00101	0.00141	0.00082	0.00154
Dissolved Phosphorus (P)	mg/L	0.005 - 0.015 (for lakes only)	0.01								<0.050	<0.050	<0.050	0.072
Dissolved Potassium (K)	mg/L	373 - 432									0.48	0.556	0.365	0.849
Dissolved Rubidium (Rb)	mg/L										0.00033	0.00047	0.00049	0.00089
Dissolved Selenium (Se)	mg/L	0.002	0.01, MAC								0.00	0.000146	0.00006	0.000137
Dissolved Silicon (Si)	mg/L										4.58	2.48	2.65	4.38
Dissolved Silver (Ag)	mg/L	0.001 - 0.003 (e)	0.0001 (g)								0.00	<0.000010	<0.000010	0.00002
Dissolved Sodium (Na)	mg/L		<200, AO								8.20	29.3	14.1	6.62
Dissolved Strontium (Sr)	mg/L										0.05	0.105	0.0811	0.0659
Dissolved Sulphur (S)	mg/L										0.51	<0.50	<0.50	<0.50
Dissolved Tellurium (Te)	mg/L										<0.00020	<0.00020	<0.00020	<0.00020
Dissolved Thallium (Tl)	mg/L	0.0017	2								<0.000010	<0.000010	<0.000010	<0.000010
Dissolved Thorium (Th)	mg/L										<0.00010	<0.00010	<0.00010	<0.00010
Dissolved Tin (Sn)	mg/L										<0.00010	<0.00010	<0.00010	<0.00010
Dissolved Titanium (Ti)	mg/L	2									0.01	0.00274	0.00303	0.00601
Dissolved Tungsten (W)	mg/L										<0.00010	<0.00010	<0.00010	<0.00010
Dissolved Uranium (U)	mg/L	0.3	20								0.00	0.000017	<0.000010	0.000026
Dissolved Vanadium (V)	mg/L	0.006	0.02								0.00	0.00058	0.00059	0.00092
Dissolved Zinc (Zn)	mg/L	0.033-0.266 (Hardness 90 - 400 mg/L) (e)	5 AO								0.01	0.0728	0.011	0.0042
Dissolved Zirconium (Zr)	mg/L										0.00109	0.00053	0.00025	0.00089

Table 1. Hazelton Surface Water Quality Data

Parameters	Units	BC MoE Guidelines		SW06 E309754										
		Freshwater Aquatic Life (1) (2)	Drinking Water (2) (3)											
Date				16-Apr-16	7-Jul-16	25-Oct-16	24-Apr-17	14-Jun-17	28-May-18	13-Aug-19	21-Nov-19	24-Jun-20	20-Aug-20	30-Sep-20
Total Metals														
Total Aluminum	mg/L	0.023 - 0.1 (j,k)	9.5	0.190	0.249	0.273	0.258	0.221	0.333	0.012	0.639	0.310	0.237	0.425
Total Antimony (Ab)	mg/L	0.009	0.006	<0.0001	<0.0001	0.00020	<0.00010	<0.00010	<0.00010	0.00017	0.00012	0.00012	<0.00010	<0.00010
Total Arsenic (As)	mg/L	0.005	0.01 MAC	0.00050	0.00140	0.00080	0.00057	0.00088	0.00154	0.00064	0.00052	0.00108	0.00099	0.00079
Total Barium (Ba)	mg/L	1	1.0	0.01000	0.01800	0.01600	0.01600	0.012	0.014	0.174	0.014	0.0287	0.0166	0.0152
Total Beryllium (Be)	mg/L	0.00013		<0.0001	<0.0001	<0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.000100	<0.000100	<0.000100
Total Bismuth (Bi)	mg/L			<0.0001	<0.0001	<0.0001	<0.00010	<0.00010	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Total Boron (B)	mg/L	1.2	5.0, MAC	<0.004	0.01000	0.02700	<0.004	0.005	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Total Cadmium (Cd)	mg/L	0.00029 - 0.0028 (Hardness 50-455 mg/L) (e) (k)	0.005, MAC	0.00004	0.00002	0.00005	0.00001	0.000016	0.0000239	<0.0000050	0.0000217	0.0000293	0.0000196	0.00002
Total Calcium (Ca)	mg/L	<4 sensitive to acid input		8.7	15.6	9.5	9.4	8.45	10.2	88.3	9.03	18.4	11.1	9.92
Total Cesium (Cs)	mg/L								0.00002	<0.000010	0.000013	<0.000010	<0.000010	<0.000010
Total Chromium (Cr)	mg/L	0.001 (f)	0.05, MAC	<0.0005	0.0006	0.0006	<0.00050	<0.00050	0.00051	0.00013	0.00079	0.00059	0.00043	0.00075
Total Cobalt (Co)	mg/L	0.11		0.0003	0.0008	0.0004	0.0005	0.00049	0.00106	0.00119	0.00019	0.00061	0.0006	0.00021
Total Copper (Cu)	mg/L	0.0032 - 0.0396 (e)	1.0, AO	0.0019	0.0010	0.0010	0.0022	0.00073	0.00108	<0.00050	0.00377	0.00203	0.001	0.00226
Total Iron (Fe)	mg/L	1	0.3, AO	0.65	1.74	0.97	0.68	0.80	1.65	0.97	0.52	1.11	1.29	0.75
Total Lead (Pb)	mg/L	0.034 - 0.40 (Hardness 50 - 350 mg/L) (e)	0.01	0.00040	0.00040	0.00030	0.00016	0.00022	0.000711	<0.000050	0.000167	0.000202	0.000601	0.000168
Total Lithium (Li)	mg/L			0.00030	0.00040	0.00040	0.00031	0.00029	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Magnesium (Mg)	mg/L			2.29000	2.97000	2.57000	1.98000	2.1	2.5	13.5	1.7	3.14	2.64	1.87
Total Manganese (Mn)	mg/L	0.8 - 3.4 (e)	0.05, AO	0.060	0.183	0.100	0.115	0.128	0.304	1.37	0.0225	0.256	0.151	0.0405
Total Mercury (Hg)	mg/L.	0.0001	0.001	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.0000050	<0.0000050	0.0000184	<0.0000050	<0.0000050	0.0000152
Total Molybdenum (Mo)	mg/L	2	0.25	<0.0001	0.00010	0.00020	0.00014	0.00015	0.000097	0.000201	0.00009	0.000149	0.000099	0.000146
Total Nickel (Ni)	mg/L	0.025 - 0.15 (e)		0.00070	0.00080	0.00080	0.00092	0.00056	0.00111	0.00098	0.00128	0.00136	0.00088	0.00144
Total Phosphorus (P)	mg/L	0.005 - 0.015 (for lakes only)	0.01, AO	<0.02	0.050	<0.02	<0.050	<0.050	0.119	<0.050	0.053	0.063	<0.050	<0.050
Total Potassium (K)	mg/L			0.35	0.40	0.23	1.61	0.81	0.56	3.92	0.473	0.687	0.351	0.829
Total Rubidium (Rb)	mg/L								0.00076	0.00116	0.00032	0.00053	0.00048	0.00067
Total Selenium (Se)	mg/L	0.002	0.01, MAC	<0.0005	<0.0005	<0.0005	<0.00050	<0.00050	0.000053	0.00006	0.000109	0.000105	0.000079	0.000152
Total Silicon (Si)	mg/L			2.50	3.50	3.20	2.10	2.4	2.31	3.5	4.99	2.64	2.49	4.76
Total Silver (Ag)	mg/L	0.0001 - 0.003 (e)		<0.00005	<0.00005	<0.00005	<0.000050	<0.000050	<0.000010	<0.000010	0.000027	0.00001	<0.000010	0.000022
Total Sodium (Na)	mg/L		<200, AO	13.3	15.7	14.8	15.5	13	14.7	332	8	37.8	14.9	6.52
Total Strontium (Sr)	mg/L			0.054	0.082	0.075	0.059	0.0573	0.0696	0.566	0.0548	0.12	0.077	0.0613
Total Sulphur (S)	mg/L			<1	1.0	<1	<3.0	<3.0	<0.50	1.12	0.66	<0.50	<0.50	<0.50
Total Tellurium (Te)	mg/L			<0.0002	<0.0002	<0.0002	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Total Thallium (Tl)	mg/L	0.0008		<0.00002	<0.00002	<0.00002	<0.000020	<0.000020	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Total Thorium (Th)	mg/L			<0.0001	<0.0001	<0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Total Tin (Sn)	mg/L			<0.0002	<0.0002	<0.0002	<0.00020	<0.00020	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Total Tungsten (W)	mg/L								0.00438	<0.00030	0.00655	<0.00010	<0.00010	<0.00010
Total Titanium (Ti)	mg/L			<0.005	<0.005	<0.005	<0.0050	<0.0050	<0.00010	<0.00010	<0.00010	0.00261	0.00251	0.00399
Total Uranium (U)	mg/L	0.0085	0.02	<0.00002	<0.00002	<0.00002	0.00003	<0.000020	0.000011	0.000022	0.000037	0.000022	0.000012	0.000024
Total Vanadium (V)	mg/L			<0.001	<0.001	<0.001	<0.0010	0.0011	0.00106	<0.00050	0.001	0.00067	0.00071	0.0007
Total Zinc (Zn)	mg/L	0.033-0.266 (Hardness 90 - 400 mg/L) (e)	5.0, AO	0.01200	0.00500	0.00500	<0.0040	0.0059	0.0055	0.0286	0.0071	0.0227	0.0112	0.005
Total Zirconium (Zr)	mg/L			0.00020	0.00010	0.00020	0.00030	0.00015	0.000183	<0.00020	0.00062	0.00048	<0.00020	0.00056
Volatile Organic Compounds														
Benzene	µg/L	40	5									<0.50		<0.50
Ethylbenzene	µg/L	200	140, 1.6 AO									<0.50		<0.50
Methyl tbutyl ether (MTBE)	µg/L	3400	15 AO									<0.50		<0.50
Styrene	µg/L											<0.50		<0.50
Toluene	µg/L	0.5[l]	60, 24 AO									<0.50		<0.50
Xylene, m and p	µg/L											<0.50		<0.50
Xylene, o	µg/L											<0.50		<0.50
Xylenes, total	µg/L	30	90, 2 AO									<0.75		<0.75
BTEX+Styrene, total	µg/L											<1.5		
Hydrocarbons														
EPH (C10C19)	µg/L											<250	<250	<250
EPH (C19C32)	µg/L											<250	<250	<250
TEH (C10C30), BC	µg/L											<250	<250	
VHw (C6C10)	µg/L											<100		<100
VPHw	µg/L											<100		<100

Notes:

2018 data compared to 2018 criteria

A shaded value means exceeded the freshwater aquatic life criteria

A shaded value means reading exceeded the drinking water quality criteria.

A shaded value means exceeded both the aquatic life and drinking water criteria.

A shaded value means reading had detection limit exceeding criteria.

A shaded value means conductivity that exceeds 500 uS/cm

(AO Aesthetic Objective)

1. BC Environment Approved and Working Criteria for Water Quality, last updated March 2018
2. All criteria limits for BCWQG based on Total Metal Concentration except Aluminum and Cadmium (Dissolved)
3. BC Environment Drinking Water Guidelines and Canadian Drinking Water Standards

c. Limit dependent on chloride concentration. (MAC Maximum Acceptable Concentration)

d. Limit pH and temperature dependent.

e. Limit dependant on hardness.

f. Limit for chromium (IV)

g. Limit for total, no dissolved concentrations

h.copper (mg/L) =(0.094* Hardness)/1000

i. Limit for hardness based on total dissolved $CaCO^3$

j. at pH less than 6.5, limit is determined by regression equation, else limit is 0.1 mg/L.

k. Limit for dissolved metals, not total metals

l. Long Term Chronic criteria, average of 5 samples over 30 days not to exceed criteria

Table 1. Hazelton Surface Water Quality Data

Parameters	Units	BC MoE Guidelines		SW07 E287410																		
		Freshwater Aquatic Life (1) (2)	Drinking Water (2) (3)																			
Date				26-Jul-04	8-Aug-07	25-Aug-09	16-Mar-10	22-Jun-10	30-Sep-10	28-Feb-12	14-Aug-12	4-Oct-12	27-Mar-13	17-Oct-13	16-Apr-16	7-Jul-16	25-Oct-16	24-Apr-17	14-Jun-17	28-May-18	21-Nov-19	24-Jun-20	20-Aug-20	30-Sep-20
Field																							
pH	pH Units																		7.8	6.4			6.87	6.49
Temperature	℃																		11.3	8.2			12.9	10.5
Conductivity	uS/cm																		109.0	108.8			132.8	72.6
Turbidity	NTU																						6.41	8.77
Flow Rate	m/s																							
DO	mg/L																						4.2	7.3
Analyte																								
Conductivity	uS/cm			1,480	230	2,050	163	421	1,540	118	1,020	196	313	147	132	327	122	142	124	109	126	210	170	99.9
pH	pH Units	6.5 - 9.0	7.0 - 10.5	7.0	6.4	6.7	5.8	6.2	7.0	5.8	6.6	6.1	6.5	6.2	7.1	7.1	7.1	6.4	7.0	6.4	7.55	7.38	7.49	7.45
Alkalinity (Total as CaCO3)	mg/L			132	38	174	14	63	200	10	92	18	33	19	31	67	33	33	44		30	44.2	55.3	31.6
Dissolved Hardness (CaCO3)	mg/L												16									66.1	52.8	40.9
Hardness, Total (Total as CaCO3)	mg/L						44	112	307	32	165	19	64	51	42	74	40	38	42	52	38	66.6	52.9	41.7
Chloride (Cl)	mg/L	600	250, AO	405	49	590	39	84	355	27	240	42	73	29	24	63	19	24	10	15	18	34.4	18.4	9.34
Fluoride (F)	mg/L	0.4 - 1.87 (e)	1.5																	0.033	0.029	0.032	0.049	0.043
Sulphate (SO4)	mg/L	128 - 429 (e)	500, AO	5.6	ND	15.0	ND	1.1	22.0	ND	ND	ND (1)	ND	ND	<1.0	2.5	<1.0	<1.0	<1.0	1.8	2.23	0.44	<0.30	<0.30
Ammonia (N)	mg/L	0.681 - 28.7 (d)		0.05	ND	0.3	ND	0.07	0.07	0.09	0.06	0.11	0.12	0.04	<0.03	0.037	<0.03	0.032	<0.03	0.0155	0.047	0.0129	0.013	0.0366
Nitrate (N)	mg/L	32.8	10 MAC												<0.01	0.02	0.012	0.043	0.012	0.0095	0.0314	<0.0050	<0.0050	0.0056
Nitrite (N)	mg/L	0.06 - 0.6 (c)	1.0												<0.01	<0.01	<0.01	<0.01	<0.01	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Nitrate plus Nitrite (N)	mg/L														<0.010	0.019	0.012	0.043	0.012	<0.105				
Total Kjeldahl Nitrogen	mg/L			1.25	1.92	1.18	0.96	1.97	0.9	0.71	1.46	1.61	1.16	1.65							1.84	0.559	0.844	0.874
Total Phosphorous (P)	mg/L		0.01																					
Total Suspended Solids	mg/L	25 mg/L (background 25-250 mg/l)) (i)	<500, AO																					
Misc. Organics																								
Chemical Oxygen Demand (COD)	mg/L			54	114	246	84	140	71	95	112	120	101	144	69	36	67	<20	53	42	70	48	80	83
Biological Oxygen Demand (BOD)	mg/L			<6	ND	11	ND	ND	ND	ND	8.9	4.9	7.3	ND	<5.0	<4.0	<4.0	<4.0	<4.0	<2.0				
Total Organic Carbon (C)	mg/L	+/- 20% of background	4.0												30.2	14.2	27.9	15.5	15.8		28.5	18.9	26	35.5
Dissolved Metals																								
Dissolved Aluminum (Al)	mg/L	0.1	0.2																		0.807	0.110	0.322	0.285
Dissolved Antimony (Sb)	mg/L	0.02	0.006, MAC																		0.0001	<0.00010	<0.00010	<0.00010
Dissolved Arsenic (As)	mg/L	0.005	0.025 MAC																		0.00057	0.00049	0.00093	0.00076
Dissolved Barium (Ba)	mg/L	5	1.0, MAC																		0.0173	0.0204	0.0194	0.0148
Dissolved Beryllium (Be)	mg/L	0.0053 (g)	0.004																		<0.00010	<0.000100	<0.000100	<0.000100
Dissolved Bismuth (Bi)	mg/L																				<0.000050	<0.000050	<0.000050	<0.000050
Dissolved Boron (B)	mg/L	1.20	5.0, MAC																		0.03	0.039	0.03	0.019
Dissolved Cadmium (Cd)	mg/L	0.00029 - 0.0028 (Hardness 50-455 mg/L) (e)	0.005, MAC																		0.0000098	<0.0000050	0.0000104	0.0000097
Dissolved Calcium (Ca)	mg/L	48 (Sensitive to acid inputs)																			10.5	19.1	15.6	11.9
Dissolved Cesium (Cs)	mg/L																				0.000029	<0.000010	0.000026	<0.000010
Dissolved Chromium (Cr)	mg/L	0.001 (f)	0.05, MAC																		0.0009	0.00027	0.0005	0.00047
Dissolved Cobalt (Co)	mg/L	0.11																			0.00021	0.00021	0.00027	0.00018
Dissolved Copper (Cu)	mg/L	0.007 - 0.05 (e)	0.5																		0.00304	0.00127	0.00171	0.00191
Dissolved Iron (Fe)	mg/L	0.35	<0.3, AO																		0.563	0.141	0.780	0.507
Dissolved Lead (Pb)	mg/L	0.034 - 0.40 (Hardness 50 - 350 mg/L) (e)	50, MAC																		0.0	<0.000050	0.000078	0.000077
Dissolved Lithium (Li)	mg/L																				<0.0010	<0.0010	<0.0010	<0.0010
Dissolved Magnesium (Mg)	mg/L		700																		2.78	4.49	3.36	2.68
Dissolved Manganese (Mn)	mg/L	0.8 - 3.8 (e)	<0.05, AO																		0.00832	0.0727	0.0458	0.0315
Dissolved Mercury (Hg)	mg/L	0.0001, MAC	0.001, MAC																		0.0000097	<0.0000050	<0.0000050	0.0000151
Dissolved Molybdenum (Mo)	mg/L	2	0.25																		0.000084	0.000069	0.000226	0.000136
Dissolved Nickel (Ni)	mg/L	0.025 - 0.15 (e)																			0.00111	0.00107	0.00157	0.0012
Dissolved Phosphorus (P)	mg/L	0.005 - 0.015 (for lakes only)	0.01																		<0.050	<0.050	<0.050	<0.050
Dissolved Potassium (K)	mg/L	373 - 432																			0.908	1.18	1.15	1.16
Dissolved Rubidium (Rb)	mg/L																				0.00056	0.00046	0.00074	0.00049
Dissolved Selenium (Se)	mg/L	0.002	0.01, MAC																		0.00	0.000123	0.000149	0.000119
Dissolved Silicon (Si)	mg/L																				4.43	3.97	4.23	4.06
Dissolved Silver (Ag)	mg/L	0.001 - 0.003 (e)	0.0001 (g)																		0.00	<0.000010	0.000013	<0.000010
Dissolved Sodium (Na)	mg/L		<200, AO																		11.20	17.4	16.7	7.2
Dissolved Strontium (Sr)	mg/L																				0.07	0.123	0.104	0.0775
Dissolved Sulphur (S)	mg/L																				1.10	<0.50	<0.50	<0.50
Dissolved Tellurium (Te)	mg/L																				<0.00020	<0.00020	<0.00020	<0.00020
Dissolved Thallium (Tl)	mg/L	0.0017	2																		<0.000010	<0.000010	<0.000010	<0.000010
Dissolved Thorium (Th)	mg/L																				<0.00010	<0.00010	<0.00010	<0.00010
Dissolved Tin (Sn)	mg/L																				<0.00010	<0.00010	<0.00010	<0.00010
Dissolved Titanium (Ti)	mg/L	2																			0.02	0.0011	0.00535	0.0028
Dissolved Tungsten (W)	mg/L																				<0.00010	<0.00010	<0.00010	<0.00010
Dissolved Uranium (U)	mg/L	0.3	20																		0.00	0.000014	0.000028	0.000023
Dissolved Vanadium (V)	mg/L	0.006	0.02																		0.00	<0.00050	0.00114	0.00056
Dissolved Zinc (Zn)	mg/L	0.033-0.266 (Hardness 90 - 400 mg/L) (e)	5 AO																		0.00	0.0015	0.0027	0.0053
Dissolved Zirconium (Zr)	mg/L																				0.00133	0.00034	0.00113	<0.00060

Table 1. Hazelton Surface Water Quality Data

Parameters	Units	BC MoE Guidelines		SW07 E287410																			
		Freshwater Aquatic Life (1) (2)	Drinking Water (2) (3)																				
Date				26-Jul-04	8-Aug-07	25-Aug-09	16-Mar-10	22-Jun-10	30-Sep-10	28-Feb-12	14-Aug-12	4-Oct-12	27-Mar-13	17-Oct-13	16-Apr-16	7-Jul-16	25-Oct-16	24-Apr-17	14-Jun-17	28-May-18	21-Nov-19	24-Jun-20	20-Aug-20	30-Sep-20
Total Metals																							
Total Aluminum	mg/L	0.023 - 0.1 (j,k)	9.5	0.060	0.850	3.84	0.27	0.38	0.58	0.25	0.94	0.18	1.32	1.27	0.64	1.10	0.58	0.32	0.328	0.620	1.140	0.695	0.642	0.697
Total Antimony (Ab)	mg/L	0.009	0.006	<0.05	ND	0.0009	ND	0.00015	ND	ND	ND	ND	ND	ND	0.0001	0.0001	0.0003	<0.00010	0.0001	0.0001	0.00012	<0.00010	<0.00010	<0.00010
Total Arsenic (As)	mg/L	0.005	0.01 MAC	<0.05	ND	0.0391	0.0005	0.00191	0.0023	0.00058	0.00748	0.00037	0.0013	0.00341	0.0006	0.0015	0.0007	<0.00050	0.00054	0.0009	0.00072	0.00087	0.00092	0.001
Total Barium (Ba)	mg/L	1	1.0	0.129	0.052	0.695	0.017	0.055	0.173	0.011	0.173	0.009	0.035	0.033	0.019	0.035	0.018	0.014	0.015	0.022	0.021	0.0304	0.0187	0.0188
Total Beryllium (Be)	mg/L	0.00013		<0.0002	ND	0.0001	ND	0.00003	ND	ND	ND	ND	ND	ND	<0.0001	<0.0001	<0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.000100	<0.000100	<0.000100
Total Bismuth (Bi)	mg/L			<0.05	ND	ND	ND	0.000011	ND	ND	ND	ND	ND	ND	<0.0001	<0.0001	<0.0001	<0.00010	<0.00010	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Total Boron (B)	mg/L	1.2	5.0, MAC	0.01	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.028	0.014	0.039	0.026	0.048	0.024	0.038	0.041	0.029	0.021
Total Cadmium (Cd)	mg/L	0.00029 - 0.0028 (Hardness 50-455 mg/L) (e) (k)	0.005, MAC	<0.002	0.002	0.00041	0.00019	0.000212	0.00008	0.000052	0.000296	0.000021	0.000077	0.000066	0.00011	0.00005	0.00005	0.000011	<0.000010	0.0000151	0.0000286	0.0000298	0.0000162	0.0000128
Total Calcium (Ca)	mg/L	<4 sensitive to acid input		77.6	21.9	130	12	34.3	98	9	53.6	5.61	18.7	14.7	11.9	22.6	11.1	10.6	12	14.5	11.7	18.7	14.9	12.2
Total Cesium (Cs)	mg/L																			0.000053	0.00008	0.000041	0.000014	0.000043
Total Chromium (Cr)	mg/L	0.001 (f)	0.05, MAC	<0.005	ND	0.005	ND	0.0015	0.002	0.0007	0.0015	ND	0.002	0.0019	0.0009	0.0013	0.0009	0.00055	0.00055	0.00076	0.00112	0.0008	0.00051	0.00086
Total Cobalt (Co)	mg/L	0.11		<0.005	0.007	0.0233	0.0005	0.00707	0.0015	0.00049	0.00651	ND	0.00188	0.00196	0.00024	0.00125	0.00025	0.00017	0.00017	0.00067	0.00036	0.00096	0.00029	0.00035
Total Copper (Cu)	mg/L	0.0032 - 0.0396 (e)	1.0, AO	<0.005	0.006	0.0156	0.0023	0.00512	0.0045	0.0021	0.00464	0.00128	0.00914	0.00289	0.0058	0.003	0.004	0.00237	0.00207	0.00233	0.00384	0.00233	0.00174	0.00251
Total Iron (Fe)	mg/L	1	0.3, AO	1.37	10.90	180.00	0.58	4.20	17.00	1.12	15.70	0.49	2.84	8.57	0.57	2.17	0.60	0.34	0.27	0.84	1.04	1.18	0.78	1.01
Total Lead (Pb)	mg/L	0.034 - 0.40 (Hardness 50 - 350 mg/L) (e)	0.01	<0.03	ND	0.0119	0.0003	0.00092	0.0011	0.00053	0.00191	0.00026	0.00202	0.00213	0.0008	0.0015	0.0002	0.00012	<0.00010	0.000278	0.000252	0.000832	0.000121	0.000171
Total Lithium (Li)	mg/L			ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0003	0.0007	0.0003	0.00016	0.00013	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Magnesium (Mg)	mg/L			11.1	4.1	16.3	3.29	6.48	15.1	2.4	7.47	1.32	4.3	3.34	2.88	4.18	2.86	2.72	2.94	3.71	2.9	4.85	3.82	2.75
Total Manganese (Mn)	mg/L	0.8 - 3.4 (e)	0.05, AO	0.421	1.78	4.49	0.218	2.47	0.648	0.143	5.16	0.0465	0.433	0.344	0.0177	0.329	0.0264	0.0231	0.0293	0.222	0.0153	0.29	0.0765	0.0658
Total Mercury (Hg)	mg/L.	0.0001	0.001	<0.00005	ND	ND	ND	ND	ND	0.0000021	ND	ND	ND	ND	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.0000050	0.0000124	<0.0000050	<0.0000050	0.0000181
Total Molybdenum (Mo)	mg/L	2	0.25	<0.005	ND	0.002	ND	0.00022	ND	0.00085	ND	ND	ND	ND	<0.0001	0.0002	0.0002	0.00012	<0.00010	0.000103	0.000114	0.000154	0.000208	0.000173
Total Nickel (Ni)	mg/L	0.025 - 0.15 (e)		<0.008	ND	0.006	0.001	0.00266	0.002	0.0008	0.0023	ND	0.0023	0.002	0.0016	0.002	0.0015	0.00109	0.00107	0.00167	0.00199	0.00156	0.00159	0.00172
Total Phosphorus (P)	mg/L	0.005 - 0.015 (for lakes only)	0.01, AO	<0.1	0.1	ND	ND	ND	ND		0.23	0.03	0.08	0.15	0.02	0.09	0.03	<0.050	<0.050	<0.050	0.05400	0.066	<0.050	<0.050
Total Potassium (K)	mg/L			2.00	ND	1.94	1.24	0.55	2.34	ND	1.36	0.302	0.962	0.53	1.06	1.09	0.74	1.37	1.19	1.1	0.9	1.26	1.1	1.16
Total Rubidium (Rb)	mg/L																			0.00072	0.00087	0.00082	0.0007	0.00084
Total Selenium (Se)	mg/L	0.002	0.01, MAC	<0.03	ND	0.0001	ND	0.00009	ND	0.00006	ND	ND	ND	0.00016	<0.0005	<0.0005	<0.0005	<0.00050	<0.00050	0.000098	0.000108	0.000094	0.000076	0.00012
Total Silicon (Si)	mg/L			<0.01	4.63	11.8	3.16	3.27	4.7	3.78	5.2	1.29	5.15	4.61	3.9	5.7	4.1	3	3.8	4.6	5.19	4.34	3.66	4.78
Total Silver (Ag)	mg/L	0.0001 - 0.003 (e)		221	ND	0.07	ND	0.000006	0.00002	0.000006	0.000027	ND	0.000022	ND	<0.00005	<0.00005	<0.00005	<0.000050	<0.000050	<0.000020	0.000028	0.00001	<0.000010	0.000023
Total Sodium (Na)	mg/L		<200, AO	0.444	25.4	253	15.3	44.1	176	11.2	134	8.68	32.4	15.9	16	34	11	14.3	8.58	11.6	11.1	17.4	17.7	7.03
Total Strontium (Sr)	mg/L			2.4	0.136	0.767	0.075	0.207	0.624	0.0556	0.352	0.041	0.122	0.0924	0.072	0.115	0.082	0.0687	0.0766	0.0953	0.0724	0.125	0.0971	0.076
Total Sulphur (S)	mg/L			<0.05	0.9	9.0	3.0	ND	5.0	ND	ND	ND	ND	ND	<1	2.0	<1	<3.0	<3.0	<0.50	1.01	<0.50	<0.50	<0.50
Total Tellurium (Te)	mg/L														<0.0002	<0.0002	<0.0002	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Total Thallium (Tl)	mg/L	0.0008		<0.03	ND	ND	ND	0.000003	ND	0.000003	ND	ND	ND	ND	<0.00002	<0.00002	<0.00002	<0.000020	<0.000020	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Total Thorium (Th)	mg/L														<0.0001	<0.0001	<0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Total Tin (Sn)	mg/L			<0.02	ND	ND	ND	0.00002	ND	ND	ND	ND	ND	ND	<0.0002	<0.0002	<0.0002	<0.00020	<0.00020	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Total Tungsten (W)	mg/L																			0.0104	0.0129	<0.00010	<0.00010	<0.00010
Total Titanium (Ti)	mg/L			<0.003	0.009	0.081	ND	0.0055	0.007	ND	0.0121	ND	0.0266	0.019	0.007	0.016	0.006	0.0055	<0.0050	<0.00010	<0.00010	0.00972	0.00975	0.00747
Total Uranium (U)	mg/L	0.0085	0.02	ND	ND	0.0003	ND	0.00007	0.0002	0.000009	ND	ND	ND	ND	0.00003	0.00004	0.00003	0.000024	0.000026	0.000025	0.000042	0.000034	0.000023	0.000029
Total Vanadium (V)	mg/L			<0.005	0.006	0.025	ND	0.0022	ND	0.0007	ND	ND	ND	ND	0.001	0.002	<0.001	<0.0010	<0.0010	0.00136	0.00181	0.00159	0.00078	0.00132
Total Zinc (Zn)	mg/L	0.033-0.266 (Hardness 90 - 400 mg/L) (e)	5.0, AO	<0.005	0.038	0.186	0.013	0.0148	0.028	0.005	0.033	ND	0.0243	0.0181	0.01	0.007	<0.004	<0.0040	<0.0040	0.01	0.0049	0.007	0.0035	0.007
Total Zirconium (Zr)	mg/L			<0.005	ND	0.0006	ND	0.0005	ND	0.0002	ND	ND	ND	ND	0.0007	0.0006	0.0004	0.00046	0.00053	0.000382	0.0006	0.00028	0.00039	0.0005
Volatile Organic Compounds																								
Benzene	µg/L	40	5																			<0.50	<0.50	<0.50
Ethylbenzene	µg/L	200	140, 1.6 AO																			<0.50	<0.50	<0.50
Methyl tbutyl ether (MTBE)	µg/L	3400	15 AO																			<0.50	<0.50	<0.50
Styrene	µg/L																					<0.50	<0.50	<0.50
Toluene	µg/L	0.5[l]	60, 24 AO																			<0.50	<0.50	<0.50
Xylene, m and p	µg/L																					<0.50	<0.50	<0.50
Xylene, o	µg/L																					<0.50	<0.50	<0.50
Xylenes, total	µg/L	30	90, 2 AO																			<0.75	<0.75	<0.75
BTEX+Styrene, total	µg/L																					<1.5		
Hydrocarbons																								
EPH (C10C19)	µg/L																					<250	<250	<250
EPH (C19C32)	µg/L																					<250	<250	<250
TEH (C10C30), BC	µg/L																					<250	<250	
VHw (C6C10)	µg/L																					<100	<100	<100
VPHw	µg/L																					<100	<100	<100

Notes:

2018 data compared to 2018 criteria

A shaded value means exceeded the freshwater aquatic life criteria

A shaded value means reading exceeded the drinking water quality criteria.

A shaded value means exceeded both the aquatic life and drinking water criteria.

A shaded value means reading had detection limit exceeding criteria.

A shaded value means conductivity that exceeds 500 uS/cm

(AO Aesthetic Objective)

1. BC Environment Approved and Working Criteria for Water Quality, last updated March 2018
2. All criteria limits for BCWQG based on Total Metal Concentration except Aluminum and Cadmium (Dissolved)
3. BC Environment Drinking Water Guidelines and Canadian Drinking Water Standards

c. Limit dependent on chloride concentration. (MAC Maximum Acceptable Concentration)

d. Limit pH and temperature dependent.

e. Limit dependant on hardness.

f. Limit for chromium (IV)

g. Limit for total, no dissolved concentrations

h.copper (mg/L) =(0.094* Hardness)/1000

i. Limit for hardness based on total dissolved $CaCO^3$

j. at pH less than 6.5, limit is determined by regression equation, else limit is 0.1 mg/L.

k. Limit for dissolved metals, not total metals

l. Long Term Chronic criteria, average of 5 samples over 30 days not to exceed criteria

Table 1. Hazelton Surface Water Quality Data

Parameters	Units	BC MoE Guidelines		SW08 E273812 (Hwy 16 East Culvert)																	
		Freshwater Aquatic Life (1) (2)	Drinking Water (2) (3)																		
Date				26-Jul-04	25-May-06	8-Aug-07	10-Jun-08	7-Jul-14	25-Nov-14	26-May-15	1-Nov-15	16-Apr-16	7-Jul-16	25-Oct-16	24-Apr-17	14-Jun-17	28-May-18	13-Aug-19	21-Nov-19	24-Jun-20	20-Aug-20	30-Sep-20
Field																					
pH	pH Units															7	6	6		5.92	6.45	5.77
Temperature	℃															11	9	14		17.5	12.8	10.8
Conductivity	uS/cm															234	102	1229		30.1	100	88.6
Turbidity	NTU																	8			2.42	0.42
Flow Rate	m/s																					
DO	mg/L																	5		2.1	2.5	5.6
Analyte																						
Conductivity	uS/cm			336	227	249	143	519	262	134	144	118	148	117	123	128			130	148	127	118
pH	pH Units	6.5 - 9.0	7.0 - 10.5	6.9	7.2	7.1	6.8	6.8	6.2	6.0	6.0	6.0	6.3	6.2	5.6	5.9		7.41	6.32	6.32	6.34	6.36
Alkalinity (Total as CaCO3)	mg/L			107	39	64	50	57	26	11	14	12	22	11	12	11			7	13.7	12.4	7.4
Dissolved Hardness (CaCO3)	mg/L							126												43.8	37	31.1
Hardness, Total (Total as CaCO3)	mg/L							129	59	35	38	31	47	31	25	30	40	246	36	44.1	39.2	30.1
Chloride (Cl)	mg/L	600	250, AO	41	47	43	25	123	57	33	35	24	31	27	27	27	29	436.0	29	30.5	24.7	26.2
Fluoride (F)	mg/L	0.4 - 1.87 (e)	1.5														0.038	<0.10	<0.020	0.024	0.036	0.028
Sulphate (SO4)	mg/L	128 - 429 (e)	500, AO	1.7	0.9	ND	ND	ND	ND	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.30	<1.5	<0.30	<0.30	<0.30	<0.30
Ammonia (N)	mg/L	0.681 - 28.7 (d)		0.24	ND	ND	ND	0.04	0.03	<0.03	0.055	0.030	0.054	0.033	0.470	0.1	0.0572	0.0067	0.039	0.0569	0.0636	0.0345
Nitrate (N)	mg/L	32.8	10 MAC					ND				0.019	0.060	0.019	0.019	<0.01	0.0648	<0.025	0.0071	0.0238	0.0325	0.0074
Nitrite (N)	mg/L	0.06 - 0.6 (c)	1.0					ND				<0.01	<0.01	<0.01	<0.01	0.02	0.0022	<0.0050	<0.0010	0.0031	0.0014	<0.0010
Nitrate plus Nitrite (N)	mg/L								0.039			0.019	0.060	0.019	0.019	0.029	0.067					
Total Kjeldahl Nitrogen	mg/L			1.74	0.76	0.83	0.65	1.05	1.8	0.980	1.100								2.19	1.4	2.07	0.936
Total Phosphorous (P)	mg/L		0.01																			
Total Suspended Solids	mg/L	25 mg/L (background 25-250 mg/l)) (i)	<500, AO					8.6														
Misc. Organics																						
Chemical Oxygen Demand (COD)	mg/L			129	49	38	50	99	87	101	108	91	133	98	88	137	102	63	114	154	138	98
Biological Oxygen Demand (BOD)	mg/L			6.0	ND	ND	ND	ND	ND	<4.0	<4.0	<5.0	5.600	<4.0	<4.0	<4.0	<2.0	2.4				
Total Organic Carbon (C)	mg/L	+/- 20% of background	4.0					27.8				42.0	65.7	40.1	29.5	38.3			46.3	57.9	53.0	38.9
Dissolved Metals																						
Dissolved Aluminum (Al)	mg/L	0.1	0.2					0.125											0.246	0.315	0.246	0.144
Dissolved Antimony (Sb)	mg/L	0.02	0.006, MAC					ND											<0.00010	<0.00010	<0.00010	<0.00010
Dissolved Arsenic (As)	mg/L	0.005	0.025 MAC					0.00131											0.00048	0.00105	0.00086	0.00048
Dissolved Barium (Ba)	mg/L	5	1.0, MAC					0.0669											0.0114	0.0165	0.0139	0.0108
Dissolved Beryllium (Be)	mg/L	0.0053 (g)	0.004					ND											<0.00010	<0.000100	<0.000100	<0.000100
Dissolved Bismuth (Bi)	mg/L							ND											<0.000050	<0.000050	<0.000050	<0.000050
Dissolved Boron (B)	mg/L	1.20	5.0, MAC					ND											<0.010	<0.010	<0.010	<0.010
Dissolved Cadmium (Cd)	mg/L	0.00029 - 0.0028 (Hardness 50-455 mg/L) (e)	0.005, MAC					0.000021											0.0000142	0.0000094	0.0000184	0.000018
Dissolved Calcium (Ca)	mg/L	48 (Sensitive to acid inputs)						40.4											10.1	12.6	10.9	8.99
Dissolved Cesium (Cs)	mg/L																		<0.000010	<0.000010	<0.000010	<0.000010
Dissolved Chromium (Cr)	mg/L	0.001 (f)	0.05, MAC					ND											0.0003	0.00043	0.00037	0.00028
Dissolved Cobalt (Co)	mg/L	0.11						0.00153											0.00013	0.00039	0.0006	0.00034
Dissolved Copper (Cu)	mg/L	0.007 - 0.05 (e)	0.5					0.00090											0.00101	0.00105	0.0008	0.00051
Dissolved Iron (Fe)	mg/L	0.35	<0.3, AO					1.99											0.526	1.24	1.22	0.79
Dissolved Lead (Pb)	mg/L	0.034 - 0.40 (Hardness 50 - 350 mg/L) (e)	50, MAC					ND											0.0	0.000289	0.00051	0.000443
Dissolved Lithium (Li)	mg/L							ND											<0.0010	<0.0010	<0.0010	<0.0010
Dissolved Magnesium (Mg)	mg/L		700					6.20											2.65	3.01	2.39	2.1
Dissolved Manganese (Mn)	mg/L	0.8 - 3.8 (e)	<0.05, AO					1.340											0.0257	0.0836	0.154	0.0956
Dissolved Mercury (Hg)	mg/L	0.0001, MAC	0.001, MAC					ND											0.0000068	<0.0000050	<0.0000050	0.0000172
Dissolved Molybdenum (Mo)	mg/L	2	0.25					ND											<0.000050	0.000076	0.000093	<0.000050
Dissolved Nickel (Ni)	mg/L	0.025 - 0.15 (e)						0.0012											<0.00050	0.00098	0.00082	0.00054
Dissolved Phosphorus (P)	mg/L	0.005 - 0.015 (for lakes only)	0.01					0.018											<0.050	0.052	0.052	<0.050
Dissolved Potassium (K)	mg/L	373 - 432						0.439											0.409	0.326	0.303	0.553
Dissolved Rubidium (Rb)	mg/L																		0.00034	0.00047	0.0005	0.00058
Dissolved Selenium (Se)	mg/L	0.002	0.01, MAC					ND											0.00	0.00009	0.000062	0.000057
Dissolved Silicon (Si)	mg/L							3.15											3.06	2.49	2.58	2.66
Dissolved Silver (Ag)	mg/L	0.001 - 0.003 (e)	0.0001 (g)					ND											<0.000010	<0.000010	<0.000010	<0.000010
Dissolved Sodium (Na)	mg/L		<200, AO					87.0											13.30	15.9	13.8	12.4
Dissolved Strontium (Sr)	mg/L							0.265											0.06	0.0879	0.0764	0.0665
Dissolved Sulphur (S)	mg/L							ND											<0.50	<0.50	<0.50	<0.50
Dissolved Tellurium (Te)	mg/L																		<0.00020	<0.00020	<0.00020	<0.00020
Dissolved Thallium (Tl)	mg/L	0.0017	2					ND											<0.000010	<0.000010	<0.000010	<0.000010
Dissolved Thorium (Th)	mg/L																		<0.00010	<0.00010	<0.00010	<0.00010
Dissolved Tin (Sn)	mg/L							ND											<0.00010	<0.00010	<0.00010	<0.00010
Dissolved Titanium (Ti)	mg/L	2						ND											0.00	0.00296	0.00304	0.00161
Dissolved Tungsten (W)	mg/L																		<0.00010	<0.00010	<0.00010	<0.00010
Dissolved Uranium (U)	mg/L	0.3	20					ND											<0.000010	<0.000010	<0.000010	<0.000010
Dissolved Vanadium (V)	mg/L	0.006	0.02					ND											0.00	0.00078	0.00054	<0.00050
Dissolved Zinc (Zn)	mg/L	0.033-0.266 (Hardness 90 - 400 mg/L) (e)	5 AO					ND											0.00	0.0061	0.0038	0.0069
Dissolved Zirconium (Zr)	mg/L							ND											0.00021	0.00026	0.00024	<0.00020

Table 1. Hazelton Surface Water Quality Data

Parameters	Units	BC MoE Guidelines		SW08 E273812 (Hwy 16 East Culvert)																		
		Freshwater Aquatic Life (1) (2)	Drinking Water (2) (3)																			
Date				26-Jul-04	25-May-06	8-Aug-07	10-Jun-08	7-Jul-14	25-Nov-14	26-May-15	1-Nov-15	16-Apr-16	7-Jul-16	25-Oct-16	24-Apr-17	14-Jun-17	28-May-18	13-Aug-19	21-Nov-19	24-Jun-20	20-Aug-20	30-Sep-20
Total Metals																						
Total Aluminum	mg/L	0.023 - 0.1 (j,k)	9.5	5.00	0.50	0.20	0.41		1.76	0.29	0.29	0.19	0.86	0.24	0.19	0.24	0.31	0.0504	0.36	0.344	0.701	0.138
Total Antimony (Ab)	mg/L	0.009	0.006	<0.05	ND	ND	ND		ND	<0.0001	<0.0001	<0.0001	<0.0001	0.00030	<0.00010	<0.00010	0.00012	0.00012	<0.00010	<0.00010	<0.00010	<0.00010
Total Arsenic (As)	mg/L	0.005	0.01 MAC	<0.05	ND	ND	0.0008		0.0026	0.00070	0.00060	<0.0005	0.00150	0.00070	0.00053	0.00099	0.00173	0.0015	0.00049	0.0011	0.00163	0.0006
Total Barium (Ba)	mg/L	1	1.0	0.101	0.021	0.024	0.022		0.045	0.01300	0.01300	0.01000	0.02400	0.01200	0.00890	0.012	0.019	0.113	0.012	0.0178	0.0268	0.0111
Total Beryllium (Be)	mg/L	0.00013		<0.0002	ND	ND	ND		ND	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.000100	<0.000100	<0.000100
Total Bismuth (Bi)	mg/L			<0.05	ND	ND	ND		ND	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.00010	<0.00010	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Total Boron (B)	mg/L	1.2	5.0, MAC	0.013	0.023	ND	ND		ND	0.00600	<0.004	<0.004	0.00700	0.01600	<0.004	<0.004	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Total Cadmium (Cd)	mg/L	0.00029 - 0.0028 (Hardness 50-455 mg/L) (e) (k)	0.005, MAC	<0.002	ND	ND	0.00006		0.000117	0.00009	0.00001	0.00002	0.00004	0.00085	<0.000010	0.000023	0.0000279	0.0000273	0.0000187	0.0000236	0.0000451	0.0000167
Total Calcium (Ca)	mg/L	<4 sensitive to acid input		35.8	14.4	19.6	13.6		17.0	9.5	10.6	8.7	14.0	8.5	7.0	8.48	11.7	72.4	10.4	12.9	11.3	8.47
Total Cesium (Cs)	mg/L																0.00002	<0.000010	0.000018	<0.000010	0.000048	<0.000010
Total Chromium (Cr)	mg/L	0.001 (f)	0.05, MAC	0.007	ND	ND	0.001		0.0022	<0.0005	0.00070	<0.0005	0.00100	0.00090	<0.00050	<0.00050	0.00051	0.00021	0.00045	0.0005	0.00084	0.00037
Total Cobalt (Co)	mg/L	0.11		0.005	ND	ND	0.0006		0.00182	0.00025	0.00041	0.00024	0.00087	0.00033	0.00038	0.00054	0.00095	0.00316	0.00018	0.00043	0.00185	0.00034
Total Copper (Cu)	mg/L	0.0032 - 0.0396 (e)	1.0, AO	0.01	ND	0.0090	0.0034		0.0072	0.0018	0.0012	0.0013	0.0019	0.0032	0.0010	0.00064	0.00145	0.00054	0.00136	0.00119	0.00193	0.00059
Total Iron (Fe)	mg/L	1	0.3, AO	10.00	0.61	0.63	0.65		4.70	0.71	1.07	0.65	2.31	0.88	0.63	0.88	1.87	2.72	0.63	1.38	3.18	0.83
Total Lead (Pb)	mg/L	0.034 - 0.40 (Hardness 50 - 350 mg/L) (e)	0.01	<0.03	ND	ND	0.0005		0.00299	0.0003	0.0005	0.0003	0.0012	0.0003	0.0002	0.00029	0.000621	0.000104	0.000421	0.000369	0.00244	0.000463
Total Lithium (Li)	mg/L			ND	ND	ND	ND		ND	0.0004	0.0005	0.0003	0.0007	0.0004	0.0003	0.0003	<0.0010	0.0013	<0.0010	<0.0010	<0.0010	<0.0010
Total Magnesium (Mg)	mg/L			7.9	3	4.1	3.04		4.01	2.69	2.69	2.36	2.88	2.35	1.80	2.13	2.72	15.9	2.78	2.87	2.69	2.18
Total Manganese (Mn)	mg/L	0.8 - 3.4 (e)	0.05, AO	5.05	0.036	0.631	0.21		0.344	0.069	0.105	0.059	0.139	0.078	0.099	0.144	0.406	1.750	0.031	0.098	0.410	0.100
Total Mercury (Hg)	mg/L.	0.0001	0.001	<0.00005	ND	ND	ND		ND	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	0.0000051	<0.0000050	0.0000074	<0.0000050	0.0000101	0.0000076
Total Molybdenum (Mo)	mg/L	2	0.25	<0.005	ND	ND	ND		ND	<0.0001	<0.0001	<0.0001	<0.0001	0.00010	<0.00010	<0.00010	0.000119	0.000068	<0.000050	0.000126	0.000108	<0.000050
Total Nickel (Ni)	mg/L	0.025 - 0.15 (e)		0.01	ND	ND	0.002		0.0036	0.00070	0.00100	0.00060	0.00130	0.00070	0.00056	0.00059	0.00125	0.00119	0.00077	0.00071	0.0014	0.00052
Total Phosphorus (P)	mg/L	0.005 - 0.015 (for lakes only)	0.01, AO	0.30	ND	ND	ND		0.14	0.03	<0.02	<0.02	0.12	<0.02	<0.050	<0.050	0.103	0.124	<0.050	0.061	0.108	<0.050
Total Potassium (K)	mg/L			2	1	2	0.94		0.898	0.50000	0.13000	0.31000	0.36000	0.26000	2.26000	0.82	0.741	2.26	0.394	0.331	0.331	0.567
Total Rubidium (Rb)	mg/L																0.00071	0.00099	0.00045	0.00049	0.00072	0.00056
Total Selenium (Se)	mg/L	0.002	0.01, MAC	<0.03	ND	ND	0.0001		ND	0.00060	<0.0005	<0.0005	<0.0005	<0.0005	<0.00050	<0.00050	0.000083	0.000056	<0.000050	0.000064	0.000068	0.000071
Total Silicon (Si)	mg/L			<0.01	2.59	3.67	3.94		5.23	2.40	2.60	2.50	4.00	3.20	1.50	2.6	2.14	3.42	3.28	2.48	2.97	3.02
Total Silver (Ag)	mg/L	0.0001 - 0.003 (e)		28.9	ND	ND	0.000027		0.000061	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.000050	<0.000050	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Total Sodium (Na)	mg/L		<200, AO	0.219	31.3	25.5	15.5		30.7	15.1	13.4	13.8	13.1	12.6	12.5	13.2	16.1	189	13.4	15.8	14.1	12.9
Total Strontium (Sr)	mg/L			0.8	0.084	0.119	0.088		0.11	0.067	0.061	0.056	0.076	0.066	0.046	0.0577	0.0793	0.535	0.0673	0.0888	0.0791	0.0607
Total Sulphur (S)	mg/L			<0.05	0.5	0.6	ND		ND	2.00000	<1	<1	1.00000	<1	<3.0	<3.0	<0.50	0.55	<0.50	<0.50	<0.50	<0.50
Total Tellurium (Te)	mg/L								<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Total Thallium (Tl)	mg/L	0.0008		<0.03	ND	ND	ND		ND	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.000020	<0.000020	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Total Thorium (Th)	mg/L								<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Total Tin (Sn)	mg/L			<0.02	ND	ND	ND		ND	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.00020	<0.00020	<0.00010	<0.00010	<0.00010	0.00014	<0.00010	<0.00010
Total Tungsten (W)	mg/L																0.00386	<0.0012	0.00379	<0.00010	<0.00010	<0.00010
Total Titanium (Ti)	mg/L			0.064	0.003	ND	0.007		0.0238	<0.005	<0.005	<0.005	0.01200	<0.005	<0.0050	<0.0050	<0.00010	<0.00010	<0.00010	0.0036	0.00979	0.00148
Total Uranium (U)	mg/L	0.0085	0.02	ND	ND	ND	ND		ND	<0.00002	<0.00002	<0.00002	0.00003	<0.00002	<0.000020	<0.000020	0.000017	<0.000010	<0.000010	<0.000010	0.000024	<0.000010
Total Vanadium (V)	mg/L			0.008	ND	ND	ND		0.0058	0.00100	0.00100	<0.001	0.00200	<0.001	<0.0010	0.0011	0.0011	<0.00050	0.00104	0.00088	0.00226	<0.00050
Total Zinc (Zn)	mg/L	0.033-0.266 (Hardness 90 - 400 mg/L) (e)	5.0, AO	0.025	0.006	0.021	0.007		0.027	0.00600	0.00700	0.00600	0.00900	0.00800	<0.0040	0.0046	0.148	0.0034	0.005	0.0058	0.0081	0.0102
Total Zirconium (Zr)	mg/L			<0.005	ND	ND	0.0005		ND	0.00020	0.00020	0.00010	0.00020	0.00010	0.00012	0.00014	0.000214	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Volatile Organic Compounds																						
Benzene	µg/L	40	5																	<0.50	<0.50	<0.50
Ethylbenzene	µg/L	200	140, 1.6 AO																	<0.50	<0.50	<0.50
Methyl tbutyl ether (MTBE)	µg/L	3400	15 AO																	<0.50	<0.50	<0.50
Styrene	µg/L																			<0.50	<0.50	<0.50
Toluene	µg/L	0.5[l]	60, 24 AO																	<0.50	<0.50	<0.50
Xylene, m and p	µg/L																			<0.50	<0.50	<0.50
Xylene, o	µg/L																			<0.50	<0.50	<0.50
Xylenes, total	µg/L	30	90, 2 AO																	<0.75	<0.75	<0.75
BTEX+Styrene, total	µg/L																			<1.5		
Hydrocarbons																						
EPH (C10C19)	µg/L																			<250	<250	<250
EPH (C19C32)	µg/L																			<250	<250	<250
TEH (C10C30), BC	µg/L																			<250	<250	
VHw (C6C10)	µg/L																			<100	<100	<100
VPHw	µg/L																			<100	<100	<100

Notes:

2018 data compared to 2018 criteria

A shaded value means exceeded the freshwater aquatic life criteria

A shaded value means reading exceeded the drinking water quality criteria.

A shaded value means exceeded both the aquatic life and drinking water criteria.

A shaded value means reading had detection limit exceeding criteria.

A shaded value means conductivity that exceeds 500 uS/cm

(AO Aesthetic Objective)

1. BC Environment Approved and Working Criteria for Water Quality, last updated March 2018
2. All criteria limits for BCWQG based on Total Metal Concentration except Aluminum and Cadmium (Dissolved)
3. BC Environment Drinking Water Guidelines and Canadian Drinking Water Standards

c. Limit dependent on chloride concentration. (MAC Maximum Acceptable Concentration)

d. Limit pH and temperature dependent.

e. Limit dependant on hardness.

f. Limit for chromium (IV)

g. Limit for total, no dissolved concentrations

h.copper (mg/L) =(0.094* Hardness)/1000

i. Limit for hardness based on total dissolved $CaCO^3$

j. at pH less than 6.5, limit is determined by regression equation, else limit is 0.1 mg/L.

k. Limit for dissolved metals, not total metals

l. Long Term Chronic criteria, average of 5 samples over 30 days not to exceed criteria

Table 1. Hazelton Surface Water Quality Data

Parameters	Units	BC MoE Guidelines		SW09 E310968				SW10 E310969		
		Freshwater Aquatic Life (1) (2)	Drinking Water (2) (3)	Rossvale Creek Downstream						
Date				7-Jul-14	24-Jun-20	20-Aug-20	30-Sep-20	24-Jun-20	20-Aug-20	30-Sep-20
Field										
pH	pH Units				6	6.51	6.1	6.71	5.35	4.97
Temperature	℃				15	13.8	10.4	10.9	13.2	8.8
Conductivity	uS/cm				184	130	69.5	37.8	59.9	42.4
Turbidity	NTU					2.88	3.8		5.29	13.7
Flow Rate	m/s									
DO	mg/L				3	3.2	4.5	4	3.6	1
Analyte										
Conductivity	uS/cm			224	231	166	96.4	47.9	47.2	36.4
pH	pH Units	6.5 - 9.0	7.0 - 10.5	7.1	6.74	6.91	7.09	5.15	5.78	6.14
Alkalinity (Total as CaCO3)	mg/L			60	32.6	35.7	20.2	3.6	11.2	9.5
Dissolved Hardness (CaCO3)	mg/L			50	56.4	45.9	33.4	30.6	33.5	25.2
Hardness, Total (Total as CaCO3)	mg/L			56	64.9	46.8	33.8	34.5	35.7	24.4
Chloride (Cl)	mg/L	600	250, AO	32.1	47.3	27.2	13.9	<0.50	<0.50	<0.50
Fluoride (F)	mg/L	0.4 - 1.87 (e)	1.5		0.032	0.048	0.04	0.027	0.044	0.044
Sulphate (SO4)	mg/L	128 - 429 (e)	500, AO	ND	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Ammonia (N)	mg/L	0.681 - 28.7 (d)		0.05	0.0298	0.0242	0.027	0.108	0.0192	0.0722
Nitrate (N)	mg/L	32.8	10 MAC	0.042	<0.0010	0.0124	<0.0050	0.011	<0.0050	0.0062
Nitrite (N)	mg/L	0.06 - 0.6 (c)	1.0	ND	<0.0050	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Nitrate plus Nitrite (N)	mg/L									
Total Kjeldahl Nitrogen	mg/L			0.609	1.25	1.19	1.02	5.17	1.87	1.4
Total Phosphorous (P)	mg/L		0.01							
Total Suspended Solids	mg/L	25 mg/L (background 25-250 mg/l)) (i)	<500, AO	ND						
Misc. Organics										
Chemical Oxygen Demand (COD)	mg/L			28	102	103	102	332	175	145
Biological Oxygen Demand (BOD)	mg/L			ND						
Total Organic Carbon (C)	mg/L	+/- 20% of background	4.0	15.1	37.5	34.2	40.0	118.0	65.5	57.0
Dissolved Metals										
Dissolved Aluminum (Al)	mg/L	0.1	0.2	0.0579	0.134	0.215	0.472	0.769	1.06	1.18
Dissolved Antimony (Sb)	mg/L	0.02	0.006, MAC	ND	<0.00010	<0.00010	<0.00010	<0.00010	0.0001	<0.00010
Dissolved Arsenic (As)	mg/L	0.005	0.025 MAC	0.00060	0.00188	0.00136	0.00097	0.00104	0.00116	0.00104
Dissolved Barium (Ba)	mg/L	5	1.0, MAC	0.0163	0.0239	0.0166	0.0158	0.0258	0.0282	0.0218
Dissolved Beryllium (Be)	mg/L	0.0053 (g)	0.004	ND	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Dissolved Bismuth (Bi)	mg/L			ND	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Dissolved Boron (B)	mg/L	1.20	5.0, MAC	ND	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Dissolved Cadmium (Cd)	mg/L	0.00029 - 0.0028 (Hardness 50-455 mg/L) (e)	0.005, MAC	0.000011	0.000011	0.0000239	0.0000098	0.0000632	0.0000557	0.000046
Dissolved Calcium (Ca)	mg/L	48 (Sensitive to acid inputs)		14.8	16.7	13.9	10.1	9.62	10.3	7.53
Dissolved Cesium (Cs)	mg/L				<0.000010	<0.000010	<0.000010	0.000014	0.000026	0.000029
Dissolved Chromium (Cr)	mg/L	0.001 (f)	0.05, MAC	0.0012	0.0004	0.0005	0.00069	0.00104	0.00168	0.00125
Dissolved Cobalt (Co)	mg/L	0.11		ND	0.00118	0.00046	0.0002	0.00087	0.0008	0.00076
Dissolved Copper (Cu)	mg/L	0.007 - 0.05 (e)	0.5	0.00159	0.00091	0.0011	0.00191	0.00124	0.00187	0.00198
Dissolved Iron (Fe)	mg/L	0.35	<0.3, AO	0.247	1.94	1.53	0.91	2.84	3.16	1.99
Dissolved Lead (Pb)	mg/L	0.034 - 0.40 (Hardness 50 - 350 mg/L) (e)	50, MAC	ND	0.00008	0.000115	0.000126	0.000594	0.000204	0.000393
Dissolved Lithium (Li)	mg/L			ND	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Dissolved Magnesium (Mg)	mg/L		700	3.07	3.54	2.69	2.01	1.61	1.88	1.56
Dissolved Manganese (Mn)	mg/L	0.8 - 3.8 (e)	<0.05, AO	0.145	0.549	0.0929	0.0209	0.0514	0.0513	0.0661
Dissolved Mercury (Hg)	mg/L	0.0001, MAC	0.001, MAC	ND	<0.0000050	<0.0000050	0.0000223	<0.0000050	0.0000099	0.0000176
Dissolved Molybdenum (Mo)	mg/L	2	0.25	ND	0.000117	0.000156	0.000141	0.000203	<0.000050	0.00006
Dissolved Nickel (Ni)	mg/L	0.025 - 0.15 (e)		ND	0.00132	0.00131	0.00124	0.00195	0.0023	0.00186
Dissolved Phosphorus (P)	mg/L	0.005 - 0.015 (for lakes only)	0.01	0.012	0.1	0.059	0.063	0.071	<0.050	0.248
Dissolved Potassium (K)	mg/L	373 - 432		0.871	0.661	0.655	0.936	0.835	0.806	1.43
Dissolved Rubidium (Rb)	mg/L				0.00057	0.00061	0.00071	0.00109	0.00145	0.00178
Dissolved Selenium (Se)	mg/L	0.002	0.01, MAC	ND	0.00	0.000093	0.000128	0.000131	0.000252	0.000145
Dissolved Silicon (Si)	mg/L			3.62	1.73	2.92	3.72	4.14	6.17	5
Dissolved Silver (Ag)	mg/L	0.001 - 0.003 (e)	0.0001 (g)	ND	<0.000010	<0.000010	<0.000010	<0.000010	0.000018	0.000014
Dissolved Sodium (Na)	mg/L		<200, AO	20.7	24.20	19.3	9.13	1.48	2.22	1.49
Dissolved Strontium (Sr)	mg/L			0.0994	0.12	0.0952	0.0684	0.0747	0.0752	0.0551
Dissolved Sulphur (S)	mg/L			ND	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Dissolved Tellurium (Te)	mg/L				<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Dissolved Thallium (Tl)	mg/L	0.0017	2	ND	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Dissolved Thorium (Th)	mg/L				<0.00010	<0.00010	<0.00010	<0.00010	0.00016	<0.00010
Dissolved Tin (Sn)	mg/L			ND	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Dissolved Titanium (Ti)	mg/L	2		ND	0.00	0.00294	0.0132	0.011	0.0177	0.0229
Dissolved Tungsten (W)	mg/L				<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Dissolved Uranium (U)	mg/L	0.3	20	ND	0.00	0.000012	0.000019	0.000031	0.000214	0.000062
Dissolved Vanadium (V)	mg/L	0.006	0.02	ND	<0.00050	<0.00050	0.00082	0.00164	0.00218	0.0021
Dissolved Zinc (Zn)	mg/L	0.033-0.266 (Hardness 90 - 400 mg/L) (e)	5 AO	ND	0.01	0.0104	0.0089	0.0052	0.0059	0.0071
Dissolved Zirconium (Zr)	mg/L			ND	0.00036	0.00042	0.00055	0.00064	0.00164	0.001

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Parameters	Units	BC MoE Guidelines		SW09 E310968				SW10 E310969		
		Freshwater Aquatic Life (1) (2)	Drinking Water (2) (3)	Rossvale Creek Downstream						
Date				7-Jul-14	24-Jun-20	20-Aug-20	30-Sep-20	24-Jun-20	20-Aug-20	30-Sep-20
Total Metals										
Total Aluminum	mg/L	0.023 - 0.1 (j,k)	9.5		0.428	0.185	0.461	0.831	0.906	1.900
Total Antimony (Ab)	mg/L	0.009	0.006		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Total Arsenic (As)	mg/L	0.005	0.01 MAC		0.00462	0.00146	0.00099	0.00103	0.00119	0.00137
Total Barium (Ba)	mg/L	1	1.0		0.048	0.0174	0.0164	0.0278	0.0329	0.0243
Total Beryllium (Be)	mg/L	0.00013			<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Total Bismuth (Bi)	mg/L				<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Total Boron (B)	mg/L	1.2	5.0, MAC		<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Total Cadmium (Cd)	mg/L	0.00029 - 0.0028 (Hardness 50-455 mg/L) (e) (k)	0.005, MAC		0.0000624	0.0000093	0.0000132	0.0000567	0.000047	0.0000302
Total Calcium (Ca)	mg/L	<4 sensitive to acid input			19.5	13.9	10.1	11.0	10.9	7.08
Total Cesium (Cs)	mg/L				0.000022	<0.000010	0.00002	0.000012	0.00003	0.000091
Total Chromium (Cr)	mg/L	0.001 (f)	0.05, MAC		0.0007	0.00052	0.00072	0.00106	0.00157	0.00194
Total Cobalt (Co)	mg/L	0.11			0.00769	0.00058	0.00018	0.00092	0.00093	0.00097
Total Copper (Cu)	mg/L	0.0032 - 0.0396 (e)	1.0, AO		0.00152	0.00088	0.00202	0.00138	0.00183	0.00321
Total Iron (Fe)	mg/L	1	0.3, AO		8.07	1.91	1.12	2.94	4.15	2.85
Total Lead (Pb)	mg/L	0.034 - 0.40 (Hardness 50 - 350 mg/L) (e)	0.01		0.000408	0.000155	0.000154	0.000643	0.0003	0.000543
Total Lithium (Li)	mg/L				<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Magnesium (Mg)	mg/L				3.92	2.92	2.08	1.7	2.09	1.62
Total Manganese (Mn)	mg/L	0.8 - 3.4 (e)	0.05, AO		3.33	0.131	0.0126	0.0547	0.0694	0.0565
Total Mercury (Hg)	mg/L.	0.0001	0.001		<0.0000050	<0.0000050	0.0000076	0.0000059	<0.0000050	0.0000156
Total Molybdenum (Mo)	mg/L	2	0.25		0.00022	0.00017	0.000156	0.000264	0.00009	0.000281
Total Nickel (Ni)	mg/L	0.025 - 0.15 (e)			0.00174	0.00132	0.00129	0.00191	0.00233	0.00289
Total Phosphorus (P)	mg/L	0.005 - 0.015 (for lakes only)	0.01, AO		0.25	0.056	<0.050	0.082	0.069	0.17
Total Potassium (K)	mg/L				0.752	0.581	0.94	0.932	1.08	1
Total Rubidium (Rb)	mg/L				0.0007	0.00048	0.00074	0.00116	0.00202	0.00154
Total Selenium (Se)	mg/L	0.002	0.01, MAC		0.000115	0.000082	0.000106	0.000122	0.000299	0.000181
Total Silicon (Si)	mg/L				1.89	2.71	4.12	4.03	5.43	6.93
Total Silver (Ag)	mg/L	0.0001 - 0.003 (e)			0.000015	<0.000010	0.000015	<0.000010	0.000016	0.000036
Total Sodium (Na)	mg/L		<200, AO		25.3	19.1	8.92	1.53	2.09	1.59
Total Strontium (Sr)	mg/L				0.134	0.087	0.0671	0.0754	0.0767	0.0478
Total Sulphur (S)	mg/L				<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Total Tellurium (Te)	mg/L				<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Total Thallium (Tl)	mg/L	0.0008			<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Total Thorium (Th)	mg/L				<0.00010	<0.00010	<0.00010	<0.00010	0.00012	<0.00010
Total Tin (Sn)	mg/L				<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Total Tungsten (W)	mg/L				<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Total Titanium (Ti)	mg/L				0.00524	0.00237	0.00589	0.0129	0.015	0.0318
Total Uranium (U)	mg/L	0.0085	0.02		0.000021	0.000014	0.000022	0.000035	0.000195	0.000088
Total Vanadium (V)	mg/L				0.0019	0.00058	0.00088	0.00168	0.0024	0.00337
Total Zinc (Zn)	mg/L	0.033-0.266 (Hardness 90 - 400 mg/L) (e)	5.0, AO		0.0228	0.0088	0.0078	0.0072	0.007	0.0081
Total Zirconium (Zr)	mg/L				0.00029	0.00026	<0.00060	0.00058	0.00088	0.00049
Volatile Organic Compounds										
Benzene	µg/L	40	5		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Ethylbenzene	µg/L	200	140, 1.6 AO		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Methyl tbutyl ether (MTBE)	µg/L	3400	15 AO		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Styrene	µg/L				<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Toluene	µg/L	0.5[l]	60, 24 AO		<0.50	<0.50	<0.50	0.55	14.2	0.73
Xylene, m and p	µg/L				<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Xylene, o	µg/L				<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Xylenes, total	µg/L	30	90, 2 AO		<0.75	<0.75	<0.75	<0.75	<0.75	<0.75
BTEX+Styrene, total	µg/L				<1.5			<1.5		
Hydrocarbons										
EPH (C10C19)	µg/L				<250	<250	<250	<250	<250	<250
EPH (C19C32)	µg/L				<250	<250	<250	<250	<250	<250
TEH (C10C30), BC	µg/L				<250	<250		<250	<250	
VHw (C6C10)	µg/L				<100	<100	<100	<100	<100	<100
VPHw	µg/L				<100	<100	<100	<100	<100	<100

Notes:

2018 data compared to 2018 criteria

A shaded value means exceeded the freshwater aquatic life criteria

A shaded value means reading exceeded the drinking water quality criteria.

A shaded value means exceeded both the aquatic life and drinking water criteria.

A shaded value means reading had detection limit exceeding criteria.

A shaded value means conductivity that exceeds 500 uS/cm

(AO Aesthetic Objective)

1. BC Environment Approved and Working Criteria for Water Quality, last updated March 2018
2. All criteria limits for BCWQG based on Total Metal Concentration except Aluminum and Cadmium (Dissolved)
3. BC Environment Drinking Water Guidelines and Canadian Drinking Water Standards

c. Limit dependent on chloride concentration. (MAC Maximum Acceptable Concentration)

d. Limit pH and temperature dependent.

e. Limit dependant on hardness.

f. Limit for chromium (IV)

g. Limit for total, no dissolved concentrations

h.copper (mg/L) =(0.094* Hardness)/1000

i. Limit for hardness based on total dissolved $CaCO^3$

j. at pH less than 6.5, limit is determined by regression equation, else limit is 0.1 mg/L.

k. Limit for dissolved metals, not total metals

l. Long Term Chronic criteria, average of 5 samples over 30 days not to exceed criteria

Table 2. Hazelton Shallow Groundwater Quality Data

Parameters	Units	BC MoE Guidelines		BC CSR Standards	SGW1													
		Freshwater Aquatic Life (1) (2)	Drinking Water (2) (3)	BC CSR-DW (4)														
Date					14-Jun-17	7-Jul-17	13-Jul-17	20-Jul-17	27-Jul-17	1-Aug-17	9-Aug-17	16-Aug-17	5-Oct-17	30-May-18	10-Jul-18	11-Sep-18	16-Apr-19	12-Aug-19	21-Nov-19
Field																			
pH	pH	6.5 - 9.0	7.0 - 10.5		8	6.6	6.7	7	6.7	6.6	6.6	6.1							
Conductivity	uS/cm				107	1625	1414	1345	1309	1250	1230	1187			1470.00	1124.00	460	657	586
Temperature	℃				13	8.8	9.8	10.7	9.8	9.3	9.8	11.9			9.00	13.20	3.9	15.1	4.5
Water Elevation	m				2	1.09	1.19	1.06	1.15	1.16	1.22	1.32			1.09	1.13	0.95	0.5	1.09
Analyte																			
Conductivity	uS/cm				185	1350	1660	1220	1860	1760	1780	1860	704						915
pH	pH Units	6.5 - 9.0	7.0 - 10.5		6.8	6.6	6.4	6.8	6.4	6.5	6.5	6.5	7					7.78	8.14
Alkalinity (Total as CaCO3)	mg/L				91	560	690	520	790	720	750	770		707	854	934	237	382	481
Dissolved Hardness (CaCO3)	mg/L																		
Hardness, Total (Total as CaCO3)	mg/L				103	507	1050	712	1110	954	977	880	299	1080	611	878	205	296	457
Chloride (Cl)	mg/L	600	250, AO	250	2	122	123	132	152	145	152	142	58.1	105	98.1	98.3	7.08	11.7	59.9
Fluoride (F)	mg/L	0.4 - 1.87 (e)	1.5	1.5															
Sulphate (SO4)	mg/L	128 - 429 (e)	500, AO	500	<1.0	1.2	<1.0	1.8	1.1	1.2	2.2	<1.0	51.7	<3.0	<3.0	<3.0	7.28	6.42	11.3
Ammonia (N)	mg/L	0.681 - 28.7 (d)			0.14	0.33	1.04	0.4	0.54	0.53	0.43	0.39	0.08	3.09	1.28	1.2	0.257	0.292	0.335
Nitrate (N)	mg/L	32.8	10 MAC	10	<0.01	0.015	0.011	0.036	0.083	0.064	<0.01	0.073	0.03	<0.050	<0.050	0.064	<0.0050	<0.0050	<0.025
Nitrite (N)	mg/L	0.06 - 0.6 (max) (c)	1.0	1.0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.010	<0.010	0.013	<0.001	<0.0010	<0.0050
Nitrate plus Nitrite (N)	mg/L			10	<0.010	0.0149	0.0107	0.0361	0.0832	0.0635	<0.0100	0.0729	0.0296	<0.060	<0.060	0.077			
Total Kjeldahl Nitrogen	mg/L																		6.19
Misc. Organics																			
Chemical Oxygen Demand (COD)	mg/L				83	770	944	902	900	681	570	350	160	1050	672	255	91	80	71
Biological Oxygen Demand (BOD)	mg/L				6.9	230.000	590	200	430	390	390	330	<38						
Total Organic Carbon (C)	mg/L		4.0		26.8	89	395	136	279	224	210	152	68	342	245	75	14.1	9.48	24.4
Dissolved Metals																			
Dissolved Aluminum (Al)	mg/L	0.023 - 0.1 (b,c)	9.5	9.5										0.0421	0.0217	0.16	3.1	0.0153	0.0643
Dissolved Antimony (Sb)	mg/L	0.009	0.006	0.006										0.00018	<0.00050	<0.00050	0.00011	<0.00010	<0.00010
Dissolved Arsenic (As)	mg/L	0.005	0.01 MAC	0.01										0.00904	0.00448	0.0116	0.00836	0.00466	0.00297
Dissolved Barium (Ba)	mg/L	1	1.0	1										0.499	0.282	0.47	0.234	0.233	0.228
Dissolved Beryllium (Be)	mg/L	0.00013		0.008										<0.00010	<0.00050	<0.00050	<0.00010	<0.00010	<0.00010
Dissolved Bismuth (Bi)	mg/L													<0.000050	<0.00025	<0.00025	<0.000050	<0.000050	<0.000050
Dissolved Boron (B)	mg/L	1.20	5.0, MAC	5.00										0.107	0.127	0.212	0.101	0.155	0.083
Dissolved Cadmium (Cd)	mg/L	0.00029 - 0.0028 (Hardness 50-455 mg/L) (e) (k)	0.005	0.005										<0.0000050	0.00003	<0.000025	0.00053	<0.0000050	0.0000094
Dissolved Calcium (Ca)	mg/L	<4 sensitive to acid input												287	162	237	62	87	117
Dissolved Cesium (Cs)	mg/L													<0.000010	<0.000050	<0.000050	0.000157	<0.000010	<0.000010
Dissolved Chromium (Cr)	mg/L	0.001 (e, f)	0.05, MAC	0.05 (VI), 6 (III)										0.00042	<0.00050	0.00071	0.00350	<0.00010	0.00015
Dissolved Cobalt (Co)	mg/L	0.11		0.001										0.0193	0.0037	0.0063	0.00423	0.00146	0.00272
Dissolved Copper (Cu)	mg/L	0.0032 - 0.0396 (e)	1.0, AO	1.5										<0.00050	<0.0010	<0.0010	0.0131	0.00057	0.00107
Dissolved Iron (Fe)	mg/L	0.35	0.3, AO	6.5										80.3	37.8	73	59.3	28	34.4
Dissolved Lead (Pb)	mg/L	0.034 - 0.40 (Hardness 50 - 350 mg/L) (e)	0.01	0.01										<0.000050	<0.00025	<0.00025	0.002380	0.000058	0.000087
Dissolved Lithium (Li)	mg/L			0.008										0.0019	<0.0050	<0.0050	0.0025	<0.0010	0.0014
Dissolved Magnesium (Mg)	mg/L													89	50	70	13	19	40
Dissolved Manganese (Mn)	mg/L	0.8 - 3.4 (e)	0.05, AO	1.5										19.4	13.3	14.1	3.03	4	4.15
Dissolved Mercury (Hg)	mg/L	0.0001, MAC	0.001	0.001										<0.0000050	<0.0000050	<0.000050	0.00002	<0.0000050	<0.0000050
Dissolved Molybdenum (Mo)	mg/L	2	0.25	0.25										0.00063	0.00112	0.00052	0.00038	0.00038	0.00025
Dissolved Nickel (Ni)	mg/L	0.0250.15 (e)		0.08										0.00627	0.0026	0.0043	0.00669	0.00091	0.00238
Dissolved Phosphorus (P)	mg/L	0.005 - 0.015 (for lakes only)	0.01, AO											0.174	<0.25	<0.25	0.234	<0.050	<0.050
Dissolved Potassium (K)	mg/L	373 - 432												12.4	8.83	12.9	3.94	6.07	4.31
Dissolved Rubidium (Rb)	mg/L													0.00115	0.0011	0.0011	0.00133	0.0005	0.00032
Dissolved Selenium (Se)	mg/L	0.002	0.01, MAC	0.01										0.00020	<0.00025	<0.00025	0.000423	0.000154	<0.000050
Dissolved Silicon (Si)	mg/L													14.1	8.4	12.0	7.9	5.6	6.3
Dissolved Silver (Ag)	mg/L	0.001 - 0.003 (e)		0.02										<0.000010	<0.000050	<0.000050	<0.000010	<0.000010	<0.000010
Dissolved Sodium (Na)	mg/L		<200, AO	200										49.9	32.2	51.2	13.5	18.0	29.3
Dissolved Strontium (Sr)	mg/L			2.50										2.22	1.27	1.76	0.42	0.67	0.97
Dissolved Sulphur (S)	mg/L													0.9	<2.5	<2.5	2.64	1.69	3.5
Dissolved Tellurium (Te)	mg/L													<0.00020	<0.0010	<0.0010	<0.00020	<0.00020	<0.00020
Dissolved Thallium (Tl)	mg/L	0.0017												<0.000010	<0.000050	<0.000050	0.00	<0.000010	<0.000010
Dissolved Thorium (Th)	mg/L													<0.00010	<0.00050	<0.00050	0.00	<0.00010	<0.00010
Dissolved Tin (Sn)	mg/L			2.5										0.00031	<0.00050	<0.00050	0.00010	<0.00010	0.00013
Dissolved Titanium (Ti)	mg/L	2												0.00	<0.0015	<0.0045	0.05	0.00	0.00
Dissolved Tungsten (W)	mg/L			0.003										<0.00010	<0.00050	<0.00050	<0.00010	<0.00010	<0.00010
Dissolved Uranium (U)	mg/L	0.3	0.02	0.02										0.0006	0.000614	0.000581	0.000289	0.000124	0.000541
Dissolved Vanadium (V)	mg/L	0.006		0.02										0.0037	<0.0025	0.0032	0.00844	<0.00050	<0.00050
Dissolved Zinc (Zn)	mg/L	0.033-0.266 (Hardness 90 - 400 mg/L) (e)	5.0, AO	3										0.0031	<0.0050	0.0060	0.20	0.0048	0.0094
Dissolved Zirconium (Zr)	mg/L													0.0010	0.0005	0.0014	0.0009	<0.00020	<0.00020

Table 2. Hazelton Shallow Groundwater Quality Data

Parameters	Units	BC MoE Guidelines		BC CSR Standards	SGW1														
		Freshwater Aquatic Life (1) (2)	Drinking Water (2) (3)	BC CSR-DW (4)															
Date					14-Jun-17	7-Jul-17	13-Jul-17	20-Jul-17	27-Jul-17	1-Aug-17	9-Aug-17	16-Aug-17	5-Oct-17	30-May-18	10-Jul-18	11-Sep-18	16-Apr-19	12-Aug-19	21-Nov-19
Volatile Organic Compounds																			
Benzene	µg/L	40	5																
Ethylbenzene	µg/L	200	140, 1.6 AO																
Methyl tbutyl ether (MTBE)	µg/L	3400	15 AO																
Styrene	µg/L																		
Toluene	µg/L	0.5[i]	60, 24 AO																
Xylene, m and p	µg/L																		
Xylene, o	µg/L																		
Xylenes, total	µg/L	30	90, 2 AO																
BTEX+Styrene, total	µg/L																		
Hydrocarbons																			
EPH (C10C19)	µg/L																		
EPH (C19C32)	µg/L																		
TEH (C10C30), BC	µg/L																		
VHw (C6C10)	µg/L																		
VPHw	µg/L																		

Notes:

2018 data compared to updated criteria

A shaded value means exceeded the BC WQG freshwater aquatic life criteria

A shaded value means reading exceeded the BC WQG drinking water quality criteria.

A shaded value means reading exceeded the CSR drinking water quality criteria.

A shaded value means exceeded more than one criteria.

A shaded value means reading had detection limit exceeding criteria.

A shaded value means reading exceeded the CSR drinking water quality criteria for sampling stations that trigger the Ground Water Quality Exceedances Response Plan

(AO Aesthetic Objective)

1. BC Environment Approved and Working Criteria for Water Quality, last updated March 2018
2. All criteria limits for BCWQG based on Total Metal Concentration except Aluminum and Cadmium (Dissolved)
3. BC Environment Drinking Water Guidelines and Canadian Drinking Water Standards
4. BC Contaminated Sites Regulation for Drinking Water (BCCSRDW) Schedule 3.2 , last updated January 2019

c. Limit dependent on chloride concentration. (MAC Maximum Acceptable Concentration)

d. Limit pH and temperature dependent.

e. Limit dependant on hardness. Range given for hardness 50 to 1,000 mg/L.

f. Limit for chromium (IV)

g. Limit for total, no dissolved concentrations

h.copper (mg/L) =(0.094* Hardness)/1000

i. Limit for hardness based on total dissolved $CaCO^3$

j. Long Term Chronic criteria, average of 5 samples over 30 days not to exceed criteria

Table 2. Hazelton Shallow Groundwater Quality Data

Parameters	Units	BC MoE Guidelines		BC CSR Standards	SGW3													
		Freshwater Aquatic Life (1) (2)	Drinking Water (2) (3)	BC CSR-DW (4)														
Date					14-Jun-17	7-Jul-17	13-Jul-17	20-Jul-17	27-Jul-17	1-Aug-17	9-Aug-17	16-Aug-17	5-Oct-17	30-May-18	10-Jul-18	12-Sep-18	16-Apr-19	12-Aug-19	21-Nov-19
Field																			
pH	pH	6.5 - 9.0	7.0 - 10.5		8	6.9	7.1	7.6	6.8	6.8	6.5	6.6							
Conductivity	uS/cm				355	740	653	435	652	414	751	925			803.00	811.00	1126	919	804
Temperature	°C				14	9.4	10.3	11.6	8	10.5	10.2	9.8			11.20	10.50	2.9	11.2	4.2
Water Elevation	m					1.18	1.29	1.24	1.34	1.18	1.39	1.39			1.64	1.84	1.11	1.58	1.07
Analyte																			
Conductivity	uS/cm				1580	685	1090	1360	1620	914	1630	1850	705					736	1120
pH	pH Units	6.5 - 9.0	7.0 - 10.5		6.7	6.7	6.6	6.7	6.5	6.6	6.4	6.5	6.9					7.38	7.67
Alkalinity (Total as CaCO3)	mg/L				640	320	540	680	810	440	800	930		749	557	504	606	752	733
Dissolved Hardness (CaCO3)	mg/L																		
Hardness, Total (Total as CaCO3)	mg/L				827	486	661	760	1020	461	1030	1050	360	714	421	498	623		673
Chloride (Cl)	mg/L	600	250, AO	250	150	45.1	45.7	48.7	49.2	25.9	43.9	46.3	87	43.9	44.3	49.2	9.4	12.4	9.8
Fluoride (F)	mg/L	0.4 - 1.87 (e)	1.5	1.5															
Sulphate (SO4)	mg/L	128 - 429 (e)	500, AO	500	2.0	<1.0	<1.0	<1.0	<1.0	1.4	1.3	<1.0	7.4	<1.5	13.9	6.4	<1.5	<1.5	<1.5
Ammonia (N)	mg/L	0.681 - 28.7 (d)			0.09	0.39	0.4	0.38	0.67	0.38	1.03	0.49	0.09	0.677	0.694	1.05	0.606	1.45	1.28
Nitrate (N)	mg/L	32.8	10 MAC	10	0.082	0.06	0.014	<0.01	0.031	0.013	0.016	0.017	0.13	<0.025	<0.025	0.2	<0.025	0.046	<0.025
Nitrite (N)	mg/L	0.06 - 0.6 (max) (c)	1.0	1.0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Nitrate plus Nitrite (N)	mg/L			10	0.082	0.0596	0.014	<0.0100	0.0309	0.0132	0.0163	0.0174	0.129	<0.030	<0.030	<0.205			
Total Kjeldahl Nitrogen	mg/L																		
Misc. Organics																			
Chemical Oxygen Demand (COD)	mg/L				326	502	518	609	938	385	1100	1000	291	554	365	163	120	129	135
Biological Oxygen Demand (BOD)	mg/L				170	76	200	340	530	210	640	630	<38						
Total Organic Carbon (C)	mg/L		4.0		104.0	60	199	196	322	134	390	372	67	160	114	51	24.7	26.7	36.9
Dissolved Metals																			
Dissolved Aluminum (Al)	mg/L	0.023 - 0.1 (b,c)	9.5	9.5										9.33	0.0522	0.0583	0.0588	0.0208	0.0269
Dissolved Antimony (Sb)	mg/L	0.009	0.006	0.006										0.00044	0.00064	0.0004	<0.00050	<0.00050	<0.00010
Dissolved Arsenic (As)	mg/L	0.005	0.01 MAC	0.01										0.0384	0.0224	0.0278	0.00211	0.00913	0.00855
Dissolved Barium (Ba)	mg/L	1	1.0	1										0.277	0.149	0.161	0.129	0.19	0.148
Dissolved Beryllium (Be)	mg/L	0.00013		0.008										0.00024	<0.00020	<0.00020	<0.00050	<0.00050	<0.00010
Dissolved Bismuth (Bi)	mg/L													<0.000050	<0.00010	<0.00010	<0.00025	<0.00025	<0.000050
Dissolved Boron (B)	mg/L	1.20	5.0, MAC	5.00										0.164	0.288	0.191	<0.050	<0.050	0.014
Dissolved Cadmium (Cd)	mg/L	0.00029 - 0.0028 (Hardness 50-455 mg/L) (e) (k)	0.005	0.005										0.0000597	0.000013	<0.000010	0.000041	0.000034	0.000205
Dissolved Calcium (Ca)	mg/L	<4 sensitive to acid input												189	116	131	154	184	172
Dissolved Cesium (Cs)	mg/L													0.000229	<0.000020	<0.000020	<0.000050	<0.000050	<0.000010
Dissolved Chromium (Cr)	mg/L	0.001 (e, f)	0.05, MAC	0.05 (VI), 6 (III)										0.01090	0.00023	0.00064	<0.00050	<0.00050	0.00016
Dissolved Cobalt (Co)	mg/L	0.11		0.001										0.020	0.008	0.011	0.0101	0.00904	0.00983
Dissolved Copper (Cu)	mg/L	0.0032 - 0.0396 (e)	1.0, AO	1.5										0.0181	<0.00040	0.00052	<0.0010	<0.0010	0.00064
Dissolved Iron (Fe)	mg/L	0.35	0.3, AO	6.5										61.6	24.4	42.2	124	24.9	74.2
Dissolved Lead (Pb)	mg/L	0.034 - 0.40 (Hardness 50 - 350 mg/L) (e)	0.01	0.01										0.00337	<0.00010	<0.00010	<0.00025	<0.00025	<0.000050
Dissolved Lithium (Li)	mg/L			0.008										0.006400	<0.0020	<0.0020	<0.0050	<0.0050	<0.0010
Dissolved Magnesium (Mg)	mg/L													59	32	41	58	67	59
Dissolved Manganese (Mn)	mg/L	0.8 - 3.4 (e)	0.05, AO	1.5										15.5	8.95	11.5	14.5	15.6	13.5
Dissolved Mercury (Hg)	mg/L	0.0001, MAC	0.001	0.001										0.000012	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Dissolved Molybdenum (Mo)	mg/L	2	0.25	0.25										0.000311	0.00068	0.00043	0.00153	0.00112	0.00115
Dissolved Nickel (Ni)	mg/L	0.0250.15 (e)		0.08										0.0	0.0	0.0	0.01120	0.00620	0.00977
Dissolved Phosphorus (P)	mg/L	0.005 - 0.015 (for lakes only)	0.01, AO											0.274	<0.10	<0.10	<0.25	<0.25	0.06
Dissolved Potassium (K)	mg/L	373 - 432												4.92	3.2	2.64	2.08	1.95	2.38
Dissolved Rubidium (Rb)	mg/L													0.0021	0.0005	<0.00040	<0.0010	<0.0010	0.00068
Dissolved Selenium (Se)	mg/L	0.002	0.01, MAC	0.01										0.0003	0.0003	0.0002	<0.00025	<0.00025	0.0002
Dissolved Silicon (Si)	mg/L													21.3	8.26	9.76	6.75	10.1	8.65
Dissolved Silver (Ag)	mg/L	0.001 - 0.003 (e)		0.02										<0.000010	<0.000020	<0.000020	<0.000050	<0.000050	<0.000010
Dissolved Sodium (Na)	mg/L		<200, AO	200										41.7	34.2	30.1	14.5	18.8	14.4
Dissolved Strontium (Sr)	mg/L			2.50										1.240	0.768	0.887	0.953	1.090	1.010
Dissolved Sulphur (S)	mg/L													<0.50	8.7	1.2	<2.5	<2.5	<0.50
Dissolved Tellurium (Te)	mg/L													<0.00020	<0.00040	<0.00040	<0.0010	<0.0010	<0.00020
Dissolved Thallium (Tl)	mg/L	0.0017												0.00001	<0.000020	<0.000020	<0.000050	<0.000050	<0.000010
Dissolved Thorium (Th)	mg/L													0.00024	<0.00020	<0.00020	<0.00050	<0.00050	<0.00010
Dissolved Tin (Sn)	mg/L			2.5										<0.00010	<0.00020	<0.00020	<0.00050	<0.00050	0.0003
Dissolved Titanium (Ti)	mg/L	2												0.03	0.003	0.01	<0.0015	<0.0015	0.00114
Dissolved Tungsten (W)	mg/L			0.003										<0.00010	<0.00020	<0.00020	<0.00050	<0.00050	<0.00010
Dissolved Uranium (U)	mg/L	0.3	0.02	0.02										0.00076	0.000684	0.000403	0.000374	0.00143	0.000765
Dissolved Vanadium (V)	mg/L	0.006		0.02										0.024	0.004	0.006	<0.0025	<0.0025	0.001
Dissolved Zinc (Zn)	mg/L	0.033-0.266 (Hardness 90 - 400 mg/L) (e)	5.0, AO	3										0.04	0.0036	<0.0020	<0.0050	<0.0050	0.0043
Dissolved Zirconium (Zr)	mg/L													0.00239	0.00093	0.00131	<0.00030	<0.0010	0.00033

Table 2. Hazelton Shallow Groundwater Quality Data

Parameters	Units	BC MoE Guidelines		BC CSR Standards	SGW3														
		Freshwater Aquatic Life (1) (2)	Drinking Water (2) (3)	BC CSR-DW (4)															
Date					14-Jun-17	7-Jul-17	13-Jul-17	20-Jul-17	27-Jul-17	1-Aug-17	9-Aug-17	16-Aug-17	5-Oct-17	30-May-18	10-Jul-18	12-Sep-18	16-Apr-19	12-Aug-19	21-Nov-19
Volatile Organic Compounds																			
Benzene	µg/L	40	5																
Ethylbenzene	µg/L	200	140, 1.6 AO																
Methyl tbutyl ether (MTBE)	µg/L	3400	15 AO																
Styrene	µg/L																		
Toluene	µg/L	0.5[i]	60, 24 AO																
Xylene, m and p	µg/L																		
Xylene, o	µg/L																		
Xylenes, total	µg/L	30	90, 2 AO																
BTEX+Styrene, total	µg/L																		
Hydrocarbons																			
EPH (C10C19)	µg/L																		
EPH (C19C32)	µg/L																		
TEH (C10C30), BC	µg/L																		
VHw (C6C10)	µg/L																		
VPHw	µg/L																		

Notes:

2018 data compared to updated criteria

A shaded value means exceeded the BC WQG freshwater aquatic life criteria

A shaded value means reading exceeded the BC WQG drinking water quality criteria.

A shaded value means reading exceeded the CSR drinking water quality criteria.

A shaded value means exceeded more than one criteria.

A shaded value means reading had detection limit exceeding criteria.

A shaded value means reading exceeded the CSR drinking water quality criteria for sampling stations that trigger the Ground Water Quality Exceedances Response Plan

(AO Aesthetic Objective)

1. BC Environment Approved and Working Criteria for Water Quality, last updated March 2018
2. All criteria limits for BCWQG based on Total Metal Concentration except Aluminum and Cadmium (Dissolved)
3. BC Environment Drinking Water Guidelines and Canadian Drinking Water Standards
4. BC Contaminated Sites Regulation for Drinking Water (BCCSRDW) Schedule 3.2 , last updated January 2019

c. Limit dependent on chloride concentration. (MAC Maximum Acceptable Concentration)

d. Limit pH and temperature dependent.

e. Limit dependant on hardness. Range given for hardness 50 to 1,000 mg/L.

f. Limit for chromium (IV)

g. Limit for total, no dissolved concentrations

h.copper (mg/L) =(0.094* Hardness)/1000

i. Limit for hardness based on total dissolved $CaCO^3$

j. Long Term Chronic criteria, average of 5 samples over 30 days not to exceed criteria

Table 2. Hazelton Shallow Groundwater Quality Data

Parameters	Units	BC MoE Guidelines: Freshwater Aquatic Life (1) (2)	BC MoE Guidelines: Drinking Water (2) (3)	BC CSR Standards: BC CSR-DW (4)	SGW2																	
Date					14-Jun-17	7-Jul-17	13-Jul-17	20-Jul-17	27-Jul-17	1-Aug-17	9-Aug-17	16-Aug-17	5-Oct-17	30-May-18	10-Jul-18	16-Apr-19	12-Aug-19	21-Nov-19	30-Mar-20	11-May-20	25-Jun-20	26-Aug-20	9-Sep-20
Field																						
pH	pH	6.5 - 9.0	7.0 - 10.5		7	7.1	6.9	6.7	6.6	6.5	6.3	6.2									6.37	6.55
Conductivity	uS/cm				402	762	538	936	851	635	789	1029			1142.00	1053	625	528			664	747	745
Temperature	℃				15	9.3	11.5	10.6	8.5	10.5	9.3	9.8			11.40	3.9	10.5	3.8			12.3	8.0	11.0
Water Elevation	m					1.13	1.21	1.28	1.43	1.34	1.64	1.91			1.33	1.01	1.89	1.08			0.89	1.1	1.12
Analyte																						
Conductivity	uS/cm				352	643	613	586	830	505	1060	1240	294					799			760	603	
pH	pH Units	6.5 - 9.0	7.0 - 10.5		7	6.6	7	7.1	6.6	6.9	6.7	6.6	6.6				7.24	7.50			6.96	7.27	
Alkalinity (Total as CaCO3)	mg/L				160	340	340	290	460	260	600	690		215	428	488	273	328			347	278	
Dissolved Hardness (CaCO3)	mg/L																					267	
Hardness, Total (Total as CaCO3)	mg/L				159	410	443	477	531	309	710	630	329	175	339	582	303	334			303		
Chloride (Cl)	mg/L	600	250, AO	250	19	12	10.5	12	14.2	10.1	17.6	17.8	7.5	4.66	7.6	123	51.1	75.0			49.9	33.7	
Fluoride (F)	mg/L	0.4 - 1.87 (e)	1.5	1.5																	0.116	0.121	
Sulphate (SO4)	mg/L	128 - 429 (e)	500, AO	500	<1.0	3	<1.0	3.3	<1.0	<1.0	<1.0	<1.0	1.1	<0.30	<1.5	1.6	20.9	4.4			<1.50	0.3	
Ammonia (N)	mg/L	0.681 - 28.7 (d)			0.11	2.18	1.74	0.87	2.04	1.09	2.39	2.5	0.47	1.2	3.07	0.366	0.908	0.481			0.587	0.504	
Nitrate (N)	mg/L	32.8	10 MAC	10	<0.01	<0.01	0.047	0.046	0.049	0.014	0.01	0.013	0.21	<0.0050	<0.025	<0.025	0.0717	<0.025			<0.0050	0.0259	
Nitrite (N)	mg/L	0.06 - 0.6 (max) (c)	1.0	1.0	<0.01	0.03	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.0010	<0.0050	<0.0050	0.0147	<0.0050			<0.0250	0.0041	
Nitrate plus Nitrite (N)	mg/L			10	<0.010	0.0207	0.0468	0.046	0.0488	0.0136	0.0105	0.023	0.209	<0.0060	<0.30			9.95					
Total Kjeldahl Nitrogen	mg/L																				9.2	3.27	
Misc. Organics																						
Chemical Oxygen Demand (COD)	mg/L				128	465	266	509	427	288	528	249	350	854	300	264	397	355			518	132	
Biological Oxygen Demand (BOD)	mg/L				15	96	84	79	92	35	110	94	<20										
Total Organic Carbon (C)	mg/L		4.0		46.3	50	100	75	75.5	51	136	94	56	249	88	82	130	198			141	95	
Dissolved Metals																						
Dissolved Aluminum (Al)	mg/L	0.023 - 0.1 (b,c)	9.5	9.5										0.125	0.0099	20.7	0.123	0.0495			0.042	0.0628	
Dissolved Antimony (Sb)	mg/L	0.009	0.006	0.006										0.0002	<0.00010	0.00052	0.0006	0.0002			0.00018	0.00018	
Dissolved Arsenic (As)	mg/L	0.005	0.01 MAC	0.01										0.00821	0.00703	0.028	0.0226	0.0134			0.0142	0.0122	
Dissolved Barium (Ba)	mg/L	1	1.0	1										0.0527	0.098	0.442	0.124	0.104			0.0844	0.0814	
Dissolved Beryllium (Be)	mg/L	0.00013		0.008										<0.00010	<0.00010	0.00052	<0.00010	<0.00010			<0.000100	<0.000100	
Dissolved Bismuth (Bi)	mg/L													<0.000050	<0.000050	<0.00025	<0.000050	<0.000050			<0.000050	<0.000050	
Dissolved Boron (B)	mg/L	1.20	5.0, MAC	5.00										0.012	0.017	0.286	0.185	0.22			0.286	0.291	
Dissolved Cadmium (Cd)	mg/L	0.00029 - 0.0028 (Hardness 50-455 mg/L) (e) (k)	0.005	0.005										0.0000084	0.0000063	0.00037	0.0000236	0.0000066			<0.0000050	<0.0000050	
Dissolved Calcium (Ca)	mg/L	<4 sensitive to acid input												48.8	89.8	153	80.9	90.6			84.8	76.5	
Dissolved Cesium (Cs)	mg/L													<0.000010	<0.000010	0.000927	<0.000010	<0.000010			<0.000010	<0.000010	
Dissolved Chromium (Cr)	mg/L	0.001 (e, f)	0.05, MAC	0.05 (VI), 6 (III)										0.00021	0.00014	0.01700	0.00043	0.00040			0.00040	0.00041	
Dissolved Cobalt (Co)	mg/L	0.11		0.001										0.004	0.005	0.0197	0.00606	0.00452			0.003	0.00275	
Dissolved Copper (Cu)	mg/L	0.0032 - 0.0396 (e)	1.0, AO	1.5										0.00121	0.00501	0.0396	0.00165	0.00106			0.00162	0.00057	
Dissolved Iron (Fe)	mg/L	0.35	0.3, AO	6.5										7.56	36.2	49.5	15.6	16.0			13.1	8.0	
Dissolved Lead (Pb)	mg/L	0.034 - 0.40 (Hardness 50 - 350 mg/L) (e)	0.01	0.01										0.000083	0.000295	0.00731	0.000149	0.000053			0.000056	0.000067	
Dissolved Lithium (Li)	mg/L			0.008										<0.0010	<0.0010	0.0089	<0.0010	<0.0010			<0.0010	<0.0010	
Dissolved Magnesium (Mg)	mg/L													13	28	49	25	26			22	18.5	
Dissolved Manganese (Mn)	mg/L	0.8 - 3.4 (e)	0.05, AO	1.5										4.3	9.3	9.55	6.6	4.9			3.9	2.8	
Dissolved Mercury (Hg)	mg/L	0.0001, MAC	0.001	0.001										<0.0000050	<0.0000050	0.0000149	0.0000076	<0.0000050			<0.0000050	<0.0000050	
Dissolved Molybdenum (Mo)	mg/L	2	0.25	0.25										0.000647	0.0021	0.00062	0.000581	0.00017			0.000253	0.000349	
Dissolved Nickel (Ni)	mg/L	0.0250.15 (e)		0.08										0.0026	0.0037	0.0267	0.0049	0.0034			0.00295	0.00295	
Dissolved Phosphorus (P)	mg/L	0.005 - 0.015 (for lakes only)	0.01, AO											<0.050	<0.050	0.69	<0.050	<0.050			0.082	0.075	
Dissolved Potassium (K)	mg/L	373 - 432												2.54	3.7	5.66	2.03	3.91			3.69	3.44	
Dissolved Rubidium (Rb)	mg/L													0.00055	0.00085	0.0105	0.00024	0.00042			0.00056	0.00074	
Dissolved Selenium (Se)	mg/L	0.002	0.01, MAC	0.01										0.0001	0.0001	<0.00025	0.0002	0.0002			0.000241	0.000167	
Dissolved Silicon (Si)	mg/L													5.55	5.47	33.9	7.41	6.58			6.56	6.31	
Dissolved Silver (Ag)	mg/L	0.001 - 0.003 (e)		0.02										<0.000010	<0.000010	0.000154	<0.000010	<0.000010			<0.000010	<0.000010	
Dissolved Sodium (Na)	mg/L		<200, AO	200										5.83	10.30	64.00	31.40	48.30			38.0	31.3	
Dissolved Strontium (Sr)	mg/L			2.50										0.2970	0.5690	1.0900	0.5940	0.6000			0.5660	0.49	
Dissolved Sulphur (S)	mg/L													<0.50	<0.50	<2.5	4.56	1.64			<0.50	<0.50	
Dissolved Tellurium (Te)	mg/L													<0.00020	<0.00020	<0.0010	<0.00020	<0.00020			<0.00020	<0.00020	
Dissolved Thallium (Tl)	mg/L	0.0017												<0.000010	<0.000010	0.00	<0.000010	<0.000010			<0.000010	<0.000010	
Dissolved Thorium (Th)	mg/L													<0.00010	<0.00010	0.00	<0.00010	<0.00010			<0.00010	<0.00010	
Dissolved Tin (Sn)	mg/L			2.5										<0.00010	<0.00010	<0.00050	0.0001	0.00013			<0.00010	<0.00010	
Dissolved Titanium (Ti)	mg/L	2												0.0038	0.0005	0.5630	0.0062	0.0022			0.00193	<0.00240	
Dissolved Tungsten (W)	mg/L			0.003										<0.00010	<0.00010	<0.00050	<0.00010	<0.00010			<0.00010	<0.00010	
Dissolved Uranium (U)	mg/L	0.3	0.02	0.02										0.000244	0.000154	0.00108	0.000541	0.000235			0.000261	0.000235	
Dissolved Vanadium (V)	mg/L	0.006		0.02										0.0020	0.0007	0.0489	0.0037	0.0020			0.00176	0.00152	
Dissolved Zinc (Zn)	mg/L	0.033-0.266 (Hardness 90 - 400 mg/L) (e)	5.0, AO	3										0.0030	0.0066	0.0608	0.0050	0.0041			0.00210	0.0021	
Dissolved Zirconium (Zr)	mg/L													0.000529	0.000197	0.00574	0.0008	0.00064			0.00061	0.00053	

Table 2. Hazelton Shallow Groundwater Quality Data

Parameters	Units	BC MoE Guidelines		BC CSR Standards	SGW2																		
		Freshwater Aquatic Life (1) (2)	Drinking Water (2) (3)	BC CSR-DW (4)																			
Date					14-Jun-17	7-Jul-17	13-Jul-17	20-Jul-17	27-Jul-17	1-Aug-17	9-Aug-17	16-Aug-17	5-Oct-17	30-May-18	10-Jul-18	16-Apr-19	12-Aug-19	21-Nov-19	30-Mar-20	11-May-20	25-Jun-20	26-Aug-20	9-Sep-20
Volatile Organic Compounds																							
Benzene	µg/L	40	5																	<0.50	<0.50	
Ethylbenzene	µg/L	200	140, 1.6 AO																	<0.50	<0.50	
Methyl tbutyl ether (MTBE)	µg/L	3400	15 AO																	<0.50	<0.50	
Styrene	µg/L																			<0.50	<0.50	
Toluene	µg/L	0.5[i]	60, 24 AO																	53.1	34.6	
Xylene, m and p	µg/L																			<0.50	<0.50	
Xylene, o	µg/L																			<0.50	<0.50	
Xylenes, total	µg/L	30	90, 2 AO																	<0.75	<0.75	
BTEX+Styrene, total	µg/L																			53.1		
Hydrocarbons																							
EPH (C10C19)	µg/L																			<250	<250	
EPH (C19C32)	µg/L																			<250	<250	
TEH (C10C30), BC	µg/L																			<250		
VHw (C6C10)	µg/L																			<100	<100	
VPHw	µg/L																			<100	<100	

Notes:

2018 data compared to updated criteria

A shaded value means exceeded the BC WQG freshwater aquatic life criteria

A shaded value means reading exceeded the BC WQG drinking water quality criteria.

A shaded value means reading exceeded the CSR drinking water quality criteria.

A shaded value means exceeded more than one criteria.

A shaded value means reading had detection limit exceeding criteria.

A shaded value means reading exceeded the CSR drinking water quality criteria for sampling stations that trigger the Ground Water Quality Exceedances Response Plan

(AO Aesthetic Objective)

1. BC Environment Approved and Working Criteria for Water Quality, last updated March 2018
2. All criteria limits for BCWQG based on Total Metal Concentration except Aluminum and Cadmium (Dissolved)
3. BC Environment Drinking Water Guidelines and Canadian Drinking Water Standards
4. BC Contaminated Sites Regulation for Drinking Water (BCCSRDW) Schedule 3.2 , last updated January 2019

c. Limit dependent on chloride concentration. (MAC Maximum Acceptable Concentration)

d. Limit pH and temperature dependent.

e. Limit dependant on hardness. Range given for hardness 50 to 1,000 mg/L.

f. Limit for chromium (IV)

g. Limit for total, no dissolved concentrations

h.copper (mg/L) =(0.094* Hardness)/1000

i. Limit for hardness based on total dissolved $CaCO^3$

j. Long Term Chronic criteria, average of 5 samples over 30 days not to exceed criteria

Table 2. Hazelton Shallow Groundwater Quality Data

Parameters	Units	BC MoE Guidelines		BC CSR Standards			
		Freshwater Aquatic Life (1) (2)	Drinking Water (2) (3)	BC CSR-DW (4)			
Date					22-Oct-20	12-Nov-20	16-Dec-20
Field							
pH	pH	6.5 - 9.0	7.0 - 10.5			6.77	
Conductivity	uS/cm				609	337	913
Temperature	°C				11.7	5.3	6.5
Water Elevation	m				1.01	1.05	1.04
Analyte							
Conductivity	uS/cm				489		
pH	pH Units	6.5 - 9.0	7.0 - 10.5		7.46		
Alkalinity (Total as CaCO3)	mg/L				226		
Dissolved Hardness (CaCO3)	mg/L				259		
Hardness, Total (Total as CaCO3)	mg/L						
Chloride (Cl)	mg/L	600	250, AO	250	23.7		
Fluoride (F)	mg/L	0.4 - 1.87 (e)	1.5	1.5	0.082		
Sulphate (SO4)	mg/L	128 - 429 (e)	500, AO	500	<0.30		
Ammonia (N)	mg/L	0.681 - 28.7 (d)			0.616		
Nitrate (N)	mg/L	32.8	10 MAC	10	0.0221		
Nitrite (N)	mg/L	0.06 - 0.6 (max) (c)	1.0	1.0	0.0017		
Nitrate plus Nitrite (N)	mg/L			10			
Total Kjeldahl Nitrogen	mg/L				8.96		
Misc. Organics							
Chemical Oxygen Demand (COD)	mg/L				196		
Biological Oxygen Demand (BOD)	mg/L						
Total Organic Carbon (C)	mg/L		4.0		119		
Dissolved Metals							
Dissolved Aluminum (Al)	mg/L	0.023 - 0.1 (b,c)	9.5	9.5	0.0501		
Dissolved Antimony (Sb)	mg/L	0.009	0.006	0.006	0.00012		
Dissolved Arsenic (As)	mg/L	0.005	0.01 MAC	0.01	0.00755		
Dissolved Barium (Ba)	mg/L	1	1.0	1	0.0729		
Dissolved Beryllium (Be)	mg/L	0.00013		0.008	<0.000100		
Dissolved Bismuth (Bi)	mg/L				<0.000050		
Dissolved Boron (B)	mg/L	1.20	5.0, MAC	5.00	0.193		
Dissolved Cadmium (Cd)	mg/L	0.00029 - 0.0028 (Hardness 50-455 mg/L) (e) (k)	0.005	0.005	<0.0000050		
Dissolved Calcium (Ca)	mg/L	<4 sensitive to acid input			72.1		
Dissolved Cesium (Cs)	mg/L				<0.000010		
Dissolved Chromium (Cr)	mg/L	0.001 (e, f)	0.05, MAC	0.05 (VI), 6 (III)	0.00032		
Dissolved Cobalt (Co)	mg/L	0.11		0.001	0.00242		
Dissolved Copper (Cu)	mg/L	0.0032 - 0.0396 (e)	1.0, AO	1.5	0.00335		
Dissolved Iron (Fe)	mg/L	0.35	0.3, AO	6.5	8.7		
Dissolved Lead (Pb)	mg/L	0.034 - 0.40 (Hardness 50 - 350 mg/L) (e)	0.01	0.01	0.000101		
Dissolved Lithium (Li)	mg/L			0.008	<0.0010		
Dissolved Magnesium (Mg)	mg/L				19.1		
Dissolved Manganese (Mn)	mg/L	0.8 - 3.4 (e)	0.05, AO	1.5	2.4		
Dissolved Mercury (Hg)	mg/L	0.0001, MAC	0.001	0.001	<0.0000050		
Dissolved Molybdenum (Mo)	mg/L	2	0.25	0.25	0.000156		
Dissolved Nickel (Ni)	mg/L	0.0250.15 (e)		0.08	0.0024		
Dissolved Phosphorus (P)	mg/L	0.005 - 0.015 (for lakes only)	0.01, AO		0.128		
Dissolved Potassium (K)	mg/L	373 - 432			4.35		
Dissolved Rubidium (Rb)	mg/L				0.00095		
Dissolved Selenium (Se)	mg/L	0.002	0.01, MAC	0.01	0.000168		
Dissolved Silicon (Si)	mg/L				5.68		
Dissolved Silver (Ag)	mg/L	0.001 - 0.003 (e)		0.02	<0.000010		
Dissolved Sodium (Na)	mg/L		<200, AO	200	29		
Dissolved Strontium (Sr)	mg/L			2.50	0.494		
Dissolved Sulphur (S)	mg/L				<0.50		
Dissolved Tellurium (Te)	mg/L				<0.00020		
Dissolved Thallium (Tl)	mg/L	0.0017			<0.000010		
Dissolved Thorium (Th)	mg/L				<0.00010		
Dissolved Tin (Sn)	mg/L			2.5	<0.00010		
Dissolved Titanium (Ti)	mg/L	2			0.00185		
Dissolved Tungsten (W)	mg/L			0.003	<0.00010		
Dissolved Uranium (U)	mg/L	0.3	0.02	0.02	0.000152		
Dissolved Vanadium (V)	mg/L	0.006		0.02	0.00109		
Dissolved Zinc (Zn)	mg/L	0.033-0.266 (Hardness 90 - 400 mg/L) (e)	5.0, AO	3	0.0052		
Dissolved Zirconium (Zr)	mg/L				0.00043		

Table 2. Hazelton Shallow Groundwater Quality Data

Parameters	Units	BC MoE Guidelines		BC CSR Standards			
		Freshwater Aquatic Life (1) (2)	Drinking Water (2) (3)	BC CSR-DW (4)			
Date					22-Oct-20	12-Nov-20	16-Dec-20
Volatile Organic Compounds							
Benzene	µg/L	40	5		<0.50		
Ethylbenzene	µg/L	200	140, 1.6 AO		<0.50		
Methyl tbutyl ether (MTBE)	µg/L	3400	15 AO		<0.50		
Styrene	µg/L				<0.50		
Toluene	µg/L	0.5[i]	60, 24 AO		26.2		
Xylene, m and p	µg/L				<0.50		
Xylene, o	µg/L				<0.50		
Xylenes, total	µg/L	30	90, 2 AO		<0.75		
BTEX+Styrene, total	µg/L						
Hydrocarbons							
EPH (C10C19)	µg/L				<250		
EPH (C19C32)	µg/L				<250		
TEH (C10C30), BC	µg/L						
VHw (C6C10)	µg/L				<100		
VPHw	µg/L				<100		

Notes:

2018 data compared to updated criteria

A shaded value means exceeded the BC WQG freshwater aquatic life criteria

A shaded value means reading exceeded the BC WQG drinking water quality criteria.

A shaded value means reading exceeded the CSR drinking water quality criteria.

A shaded value means exceeded more than one criteria.

A shaded value means reading had detection limit exceeding criteria.

A shaded value means reading exceeded the CSR drinking water quality criteria for sampling stations that trigger the Ground Water Quality Exceedances Response Plan

(AO Aesthetic Objective)

1. BC Environment Approved and Working Criteria for Water Quality, last updated March 2018
2. All criteria limits for BCWQG based on Total Metal Concentration except Aluminum and Cadmium (Dissolved)
3. BC Environment Drinking Water Guidelines and Canadian Drinking Water Standards
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c. Limit dependent on chloride concentration. (MAC Maximum Acceptable Concentration)

d. Limit pH and temperature dependent.

e. Limit dependant on hardness. Range given for hardness 50 to 1,000 mg/L.

f. Limit for chromium (IV)

g. Limit for total, no dissolved concentrations

h.copper (mg/L) =(0.094* Hardness)/1000

i. Limit for hardness based on total dissolved $CaCO^3$

j. Long Term Chronic criteria, average of 5 samples over 30 days not to exceed criteria

Table 2. Hazelton Shallow Groundwater Quality Data

Parameters	Units	BC MoE Guidelines		BC CSR Standards	SGW4												
		Freshwater Aquatic Life (1) (2)	Drinking Water (2) (3)	BC CSR-DW (4)													
Date					10-Jul-18	11-Sep-18	16-Apr-19	12-Aug-19	21-Nov-19	30-Mar-20	11-May-20	22-Jun-20	26-Aug-20	9-Sep-20	22-Oct-20	13-Nov-20	16-Dec-20
Field																	
pH	pH	6.5 - 9.0	7.0 - 10.5							7.41		6.98	6.99		7.26		
Conductivity	uS/cm				762.00	710.00	421	644	291	338.1	293	376.1	716	445	311	702	636
Temperature	℃				7.10	9.10	2.5	10.9	2.9	2.3	9.1	11.8	7.2	10.4	7.8	7.3	3.8
Water Elevation	m				1.81	2.57	0.93	2.01	0.91	0.77	0.9	1.04	0.82	0.74	0.92	0.87	0.99
Analyte																	
Conductivity	uS/cm								690	543		515	701		475		
pH	pH Units	6.5 - 9.0	7.0 - 10.5					7.89	8.07	8.23		7.55	7.74		8.02		
Alkalinity (Total as CaCO3)	mg/L				454	547	523	519	418	351		305	403		251		
Dissolved Hardness (CaCO3)	mg/L									276		319	371		318		
Hardness, Total (Total as CaCO3)	mg/L				494	656	454	506	426								
Chloride (Cl)	mg/L	600	250, AO	250	13	12.7	14.3	8.7	6.3	3.52		2.36	3.49		1.07		
Fluoride (F)	mg/L	0.4 - 1.87 (e)	1.5	1.5						0.045		0.067	<0.100		0.062		
Sulphate (SO4)	mg/L	128 - 429 (e)	500, AO	500	23.4	13.9	8.2	4.4	8	3.3		2.48	2.67		1.03		
Ammonia (N)	mg/L	0.681 - 28.7 (d)			0.0298	0.0689	0.078	0.0698	0.0707	0.0465		0.0539	0.0594		0.0352		
Nitrate (N)	mg/L	32.8	10 MAC	10	<0.025	<0.025	<0.025	<0.025	0.049	0.0011		<0.0010	<0.0250		0.0062		
Nitrite (N)	mg/L	0.06 - 0.6 (max) (c)	1.0	1.0	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050		<0.0050	<0.0050		<0.0010		
Nitrate plus Nitrite (N)	mg/L			10	<0.03	<0.03			2.77								
Total Kjeldahl Nitrogen	mg/L									2.22		0.404	0.412		0.758		
Misc. Organics																	
Chemical Oxygen Demand (COD)	mg/L				55	24	85	72	35	92		76	30		76		
Biological Oxygen Demand (BOD)	mg/L																
Total Organic Carbon (C)	mg/L		4.0		10.6	9	12.6	10.5	19.2	23.9		11.7	11.6		20.6		
Dissolved Metals																	
Dissolved Aluminum (Al)	mg/L	0.023 - 0.1 (b,c)	9.5	9.5	0.0571	0.278	0.0051	0.0040	0.0081	0.0053		0.0041	0.0065		0.0169		
Dissolved Antimony (Sb)	mg/L	0.009	0.006	0.006	0.00011	0.00012	<0.00010	<0.00010	<0.00010	<0.00010		<0.00010	<0.00010		0.0001		
Dissolved Arsenic (As)	mg/L	0.005	0.01 MAC	0.01	0.00351	0.00994	0.00100	0.00200	0.00053	0.00066		0.00086	0.00098		0.00163		
Dissolved Barium (Ba)	mg/L	1	1.0	1	0.0997	0.169	0.1030	0.1320	0.104	0.0652		0.074	0.0917		0.0777		
Dissolved Beryllium (Be)	mg/L	0.00013		0.008	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.000100		<0.000100	<0.000100		<0.000100		
Dissolved Bismuth (Bi)	mg/L				<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050		<0.000050	<0.000050		<0.000050		
Dissolved Boron (B)	mg/L	1.20	5.0, MAC	5.00	0.017	0.024	0.017	0.02	0.015	<0.010		0.012	0.017		0.016		
Dissolved Cadmium (Cd)	mg/L	0.00029 - 0.0028 (Hardness 50-455 mg/L) (e) (k)	0.005	0.005	0.000030	0.0000538	0.000031	0.000017	0.0000781	0.0000491		0.0000233	0.0000353		0.0000287		
Dissolved Calcium (Ca)	mg/L	<4 sensitive to acid input			110.0	148	100.0	109.0	102	59.8		72.7	87.4		73.5		
Dissolved Cesium (Cs)	mg/L				0.0	0.000039	<0.000010	<0.000010	<0.000010	<0.000010		<0.000010	<0.000010		<0.000010		
Dissolved Chromium (Cr)	mg/L	0.001 (e, f)	0.05, MAC	0.05 (VI), 6 (III)	<0.00010	0.00023	<0.00010	<0.00010	<0.00010	<0.00010		<0.00010	<0.00010		<0.00010		
Dissolved Cobalt (Co)	mg/L	0.11		0.001	0.00842	0.00934	0.00772	0.00596	0.00107	0.00644		0.0061	0.00503		0.0057		
Dissolved Copper (Cu)	mg/L	0.0032 - 0.0396 (e)	1.0, AO	1.5	0.00720	0.00212	0.00115	0.00053	0.0021	0.001		0.00304	0.00092		0.0029		
Dissolved Iron (Fe)	mg/L	0.35	0.3, AO	6.5	0.159	2.81	1.760	0.239	0.03	4.59		3.88	2.74		0.136		
Dissolved Lead (Pb)	mg/L	0.034 - 0.40 (Hardness 50 - 350 mg/L) (e)	0.01	0.01	0.000399	0.000705	<0.000050	<0.000050	<0.000050	<0.000050		0.000079	<0.000050		0.000054		
Dissolved Lithium (Li)	mg/L			0.008	0.0022	0.002900	0.002	0.0024	0.002100	0.0017		0.0015	0.002		0.0017		
Dissolved Magnesium (Mg)	mg/L				53.5	70	49.4	57.1	42	30.6		33.3	37.1		32.5		
Dissolved Manganese (Mn)	mg/L	0.8 - 3.4 (e)	0.05, AO	1.5	1.70	3.02	1.3	1.76	0.8	1.22		1.35	1.48		1.4		
Dissolved Mercury (Hg)	mg/L	0.0001, MAC	0.001	0.001	0.0000162	0.0000133	<0.0000050	<0.0000050	<0.0000050	<0.0000050		<0.0000050	<0.0000050		<0.0000050		
Dissolved Molybdenum (Mo)	mg/L	2	0.25	0.25	0.00447	0.00411	0.00144	0.0024	0.00145	0.00136		0.00202	0.0024		0.0031		
Dissolved Nickel (Ni)	mg/L	0.0250.15 (e)		0.08	0.00377	0.00452	0.00334	0.00317	0.00259	0.00314		0.00273	0.00298		0.00388		
Dissolved Phosphorus (P)	mg/L	0.005 - 0.015 (for lakes only)	0.01, AO		<0.050	<0.050	<0.050	<0.050	<0.050	<0.050		<0.050	<0.050		<0.050		
Dissolved Potassium (K)	mg/L	373 - 432			2.690	3.22	2.300	2.950	2.41	1.73		1.97	2.16		2.24		
Dissolved Rubidium (Rb)	mg/L				0.000	0.00048	0.00034	0.00044	0.00028	0.00021		0.00028	0.00032		0.0003		
Dissolved Selenium (Se)	mg/L	0.002	0.01, MAC	0.01	0.000053	0.00007	0.000055	<0.000050	0.00007	0.000073		0.000112	0.000057		0.000081		
Dissolved Silicon (Si)	mg/L				5.36	6.93	4.63	6.39	5.77	3.51		3.88	4.98		4.72		
Dissolved Silver (Ag)	mg/L	0.001 - 0.003 (e)		0.02	<0.000010	0.000019	<0.000010	<0.000010	<0.000010	<0.000010		<0.000010	<0.000010		<0.000010		
Dissolved Sodium (Na)	mg/L		<200, AO	200	13.7	16.50	10.9	12.3	8.24	5.38		6.74	7.4		6.97		
Dissolved Strontium (Sr)	mg/L			2.50	1.1200	1.5500	1.0700	1.1900	1.0100	0.62		0.736	0.844		0.792		
Dissolved Sulphur (S)	mg/L				6.96	3.34	3.41	1.76	2.95	1.22		0.62	0.79		0.56		
Dissolved Tellurium (Te)	mg/L				<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020		<0.00020	<0.00020		<0.00020		
Dissolved Thallium (Tl)	mg/L	0.0017			<0.000010	<0.000010	<0.000010	0.00001	0.000011	<0.000010		<0.000010	<0.000010		<0.000010		
Dissolved Thorium (Th)	mg/L				<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010		<0.00010	<0.00010		<0.00010		
Dissolved Tin (Sn)	mg/L			2.5	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010		<0.00010	0.00021		<0.00010		
Dissolved Titanium (Ti)	mg/L	2			0.00142	<0.0060	<0.00030	<0.00030	0.0006	<0.00030		<0.00030	<0.00030		0.00044		
Dissolved Tungsten (W)	mg/L			0.003	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010		<0.00010	<0.00010		<0.00010		
Dissolved Uranium (U)	mg/L	0.3	0.02	0.02	0.000984	0.0012	0.000539	0.000867	0.000761	0.000362		0.000498	0.00065		0.000542		
Dissolved Vanadium (V)	mg/L	0.006		0.02	<0.00050	0.0009	<0.00050	<0.00050	<0.00050	<0.00050		<0.00050	<0.00050		<0.00050		
Dissolved Zinc (Zn)	mg/L	0.033-0.266 (Hardness 90 - 400 mg/L) (e)	5.0, AO	3	0.0063	0.0027	0.0022	<0.0010	0.0011	<0.0010		0.0024	0.0013		0.0039		
Dissolved Zirconium (Zr)	mg/L				<0.000060	0.000221	<0.000060	<0.00020	<0.00020	<0.00020		<0.00020	<0.00020		<0.00020		

Table 2. Hazelton Shallow Groundwater Quality Data

Parameters	Units	BC MoE Guidelines		BC CSR Standards	SGW4												
		Freshwater Aquatic Life (1) (2)	Drinking Water (2) (3)	BC CSR-DW (4)													
Date					10-Jul-18	11-Sep-18	16-Apr-19	12-Aug-19	21-Nov-19	30-Mar-20	11-May-20	22-Jun-20	26-Aug-20	9-Sep-20	22-Oct-20	13-Nov-20	16-Dec-20
Volatile Organic Compounds																	
Benzene	µg/L	40	5									<0.50	<0.50		<0.50		
Ethylbenzene	µg/L	200	140, 1.6 AO									<0.50	<0.50		<0.50		
Methyl tbutyl ether (MTBE)	µg/L	3400	15 AO									<0.50	<0.50		<0.50		
Styrene	µg/L											<0.50	<0.50		<0.50		
Toluene	µg/L	0.5[i]	60, 24 AO									<0.50	<0.50		4.65		
Xylene, m and p	µg/L											<0.50	<0.50		<0.50		
Xylene, o	µg/L											<0.50	<0.50		<0.50		
Xylenes, total	µg/L	30	90, 2 AO									<0.75	<0.75		<0.75		
BTEX+Styrene, total	µg/L											<1.5					
Hydrocarbons																	
EPH (C10C19)	µg/L											<250	<250		<250		
EPH (C19C32)	µg/L											<250	<250		<250		
TEH (C10C30), BC	µg/L											<250					
VHw (C6C10)	µg/L											<100	<100		<100		
VPHw	µg/L											<100	<100		<100		

Notes:

2018 data compared to updated criteria

A shaded value means exceeded the BC WQG freshwater aquatic life criteria

A shaded value means reading exceeded the BC WQG drinking water quality criteria.

A shaded value means reading exceeded the CSR drinking water quality criteria.

A shaded value means exceeded more than one criteria.

A shaded value means reading had detection limit exceeding criteria.

A shaded value means reading exceeded the CSR drinking water quality criteria for sampling stations that trigger the Ground Water Quality Exceedances Response Plan

(AO Aesthetic Objective)

1. BC Environment Approved and Working Criteria for Water Quality, last updated March 2018
2. All criteria limits for BCWQG based on Total Metal Concentration except Aluminum and Cadmium (Dissolved)
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4. BC Contaminated Sites Regulation for Drinking Water (BCCSRDW) Schedule 3.2 , last updated January 2019

c. Limit dependent on chloride concentration. (MAC Maximum Acceptable Concentration)

d. Limit pH and temperature dependent.

e. Limit dependant on hardness. Range given for hardness 50 to 1,000 mg/L.

f. Limit for chromium (IV)

g. Limit for total, no dissolved concentrations

h.copper (mg/L) =(0.094* Hardness)/1000

i. Limit for hardness based on total dissolved $CaCO^3$

j. Long Term Chronic criteria, average of 5 samples over 30 days not to exceed criteria

Table 2. Hazelton Shallow Groundwater Quality Data

Parameters	Units	BC MoE Guidelines		BC CSR Standards	SGW5													
		Freshwater Aquatic Life (1) (2)	Drinking Water (2) (3)	BC CSR-DW (4)														
Date					30-May-18	10-Jul-18	11-Sep-18	16-Apr-19	12-Aug-19	21-Nov-19	30-Mar-20	11-May-20	25-Jun-20	26-Aug-20	9-Sep-20	22-Oct-20	12-Nov-20	16-Dec-20
Field																		
pH	pH	6.5 - 9.0	7.0 - 10.5										7.09	6.99		7.19		
Conductivity	uS/cm					422.00	500.00	324	475.9	245.6		117	273.7	410	354	327.3	327	
Temperature	℃					8.00	10.90	2.3	9.4	2.4		9.4	5.5	7.7	10.4	6.9	2.3	
Water Elevation	m					1.50	1.90	1.01	1.49	0.99		0.57	1.1	0.97	1.04	1.1	0.52	
Analyte																		
Conductivity	uS/cm									474			386	701		511		
pH	pH Units	6.5 - 9.0	7.0 - 10.5						8.12	8.31			7.64	7.74		7.94		
Alkalinity (Total as CaCO3)	mg/L				217	276	343	254	345	288			220	403		278		
Dissolved Hardness (CaCO3)	mg/L												227	371		290		
Hardness, Total (Total as CaCO3)	mg/L				256	254	318	228	312	264								
Chloride (Cl)	mg/L	600	250, AO	250	5.62	4	6.99	3.79	4.50	3.49			1.88	3.49		3.49		
Fluoride (F)	mg/L	0.4 - 1.87 (e)	1.5	1.5									0.077	0.081		0.067		
Sulphate (SO4)	mg/L	128 - 429 (e)	500, AO	500	5.59	2.78	2.91	4.5	5.85	5.05			1.32	2.67		3.33		
Ammonia (N)	mg/L	0.681 - 28.7 (d)			0.0179	0.0669	0.183	0.323	0.115	0.299			0.19	0.0594		0.0946		
Nitrate (N)	mg/L	32.8	10 MAC	10	<0.0050	0.012	0.0073	0.358	0.013	<0.0050			<0.0050	<0.0250		<0.0050		
Nitrite (N)	mg/L	0.06 - 0.6 (max) (c)	1.0	1.0	<0.0010	<0.0010	<0.0010	0.0305	0.0053	<0.0010			<0.0010	<0.0050		0.0012		
Nitrate plus Nitrite (N)	mg/L			10	<0.0060	<0.0121	<0.0083			1.07								
Total Kjeldahl Nitrogen	mg/L												0.836	0.412		0.431		
Misc. Organics																		
Chemical Oxygen Demand (COD)	mg/L				90	121	<20	116	55	23			161	30		40		
Biological Oxygen Demand (BOD)	mg/L																	
Total Organic Carbon (C)	mg/L		4.0		27.4	26.7	6	8.55	7.36	6.90			58.8	11.6		9.69		
Dissolved Metals																		
Dissolved Aluminum (Al)	mg/L	0.023 - 0.1 (b,c)	9.5	9.5	0.469	0.0061	0.0026	0.0730	0.0111	0.0023			0.0079	0.0065		0.0299		
Dissolved Antimony (Sb)	mg/L	0.009	0.006	0.006	0.00016	0.0001	0.00012	0.00012	0.00011	<0.00010			<0.00010	<0.00010		<0.00010		
Dissolved Arsenic (As)	mg/L	0.005	0.01 MAC	0.01	0.0018	0.00418	0.00417	0.00129	0.00144	0.00074			0.00263	0.00098		0.0012		
Dissolved Barium (Ba)	mg/L	1	1.0	1	0.0775	0.0698	0.0849	0.0555	0.0858	0.0486			0.0567	0.0917		0.0726		
Dissolved Beryllium (Be)	mg/L	0.00013		0.008	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010			<0.000100	<0.000100		<0.000100		
Dissolved Bismuth (Bi)	mg/L				<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050			<0.000050	<0.000050		<0.000050		
Dissolved Boron (B)	mg/L	1.20	5.0, MAC	5.00	<0.010	<0.010	0.01	<0.010	0.011	<0.010			<0.010	0.017		<0.010		
Dissolved Cadmium (Cd)	mg/L	0.00029 - 0.0028 (Hardness 50-455 mg/L) (e) (k)	0.005	0.005	0.000076	<0.0000050	<0.0000050	0.0000177	0.0000294	0.0000068			<0.0000050	0.0000353		0.0000074		
Dissolved Calcium (Ca)	mg/L	<4 sensitive to acid input			61.3	62.1	79.7	53.7	76.9	64.5			61.1	87.4		79.5		
Dissolved Cesium (Cs)	mg/L				0.00008	<0.000010	<0.000010	0.000017	0.000012	<0.000010			<0.000010	<0.000010		<0.000010		
Dissolved Chromium (Cr)	mg/L	0.001 (e, f)	0.05, MAC	0.05 (VI), 6 (III)	0.00053	<0.00010	<0.00010	0.00010	<0.00010	<0.00010			<0.00010	<0.00010		<0.00010		
Dissolved Cobalt (Co)	mg/L	0.11		0.001	0.005	0.00273	0.019	0.00409	0.00922	0.00092			0.00378	0.00503		0.00283		
Dissolved Copper (Cu)	mg/L	0.0032 - 0.0396 (e)	1.0, AO	1.5	0.00212	0.00040	0.00032	0.00112	0.00102	0.00036			0.00126	0.00092		0.00255		
Dissolved Iron (Fe)	mg/L	0.35	0.3, AO	6.5	0.851	0.918	0.371	1.85	0.194	13.000			1.67	2.74		0.22		
Dissolved Lead (Pb)	mg/L	0.034 - 0.40 (Hardness 50 - 350 mg/L) (e)	0.01	0.01	0.000802	<0.000050	<0.000050	0.000230	0.000055	<0.000050			<0.000050	<0.000050		0.000067		
Dissolved Lithium (Li)	mg/L			0.008	0.002000	0.0015	0.001800	0.0012	0.002	0.0016			0.0012	0.002		0.0015		
Dissolved Magnesium (Mg)	mg/L				25	23.9	29	22.8	29.2	24.9			18	37.1		22.2		
Dissolved Manganese (Mn)	mg/L	0.8 - 3.4 (e)	0.05, AO	1.5	0.718	1.06	2.00	0.909	0.975	1.01			1.27	1.48		0.952		
Dissolved Mercury (Hg)	mg/L	0.0001, MAC	0.001	0.001	0.0000057	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050			<0.0000050	<0.0000050		<0.0000050		
Dissolved Molybdenum (Mo)	mg/L	2	0.25	0.25	0.00169	0.00363	0.00381	0.00236	0.00259	0.00177			0.00284	0.0024		0.00171		
Dissolved Nickel (Ni)	mg/L	0.0250.15 (e)		0.08	0.00267	0.00176	0.00432	0.00183	0.00304	0.00087			0.00198	0.00298		0.002		
Dissolved Phosphorus (P)	mg/L	0.005 - 0.015 (for lakes only)	0.01, AO		<0.050	<0.050	<0.050	<0.050	<0.050	<0.050			<0.050	<0.050		<0.050		
Dissolved Potassium (K)	mg/L	373 - 432			2	2.070	2.26	1.69	2.21	2.03			1.49	2.16		1.58		
Dissolved Rubidium (Rb)	mg/L				0.00042	0.000	0.00054	0.00041	0.00048	0.00044			0.00036	0.00032		0.00031		
Dissolved Selenium (Se)	mg/L	0.002	0.01, MAC	0.01	<0.000050	0.000056	<0.000050	<0.000050	0.000081	0.000053			0.000189	0.000057		<0.000050		
Dissolved Silicon (Si)	mg/L				4.36	4.94	4.97	3.48	5.9	3.67			4.84	4.98		5.45		
Dissolved Silver (Ag)	mg/L	0.001 - 0.003 (e)		0.02	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010			<0.000010	<0.000010		<0.000010		
Dissolved Sodium (Na)	mg/L		<200, AO	200	9.48	8.3	9.52	7.11	9.26	7.30			6.33	7.4		9.92		
Dissolved Strontium (Sr)	mg/L			2.50	0.5660	0.5880	0.7440	0.513	0.732	0.523			0.523	0.844		0.65		
Dissolved Sulphur (S)	mg/L				1.67	0.52	0.99	1.50	1.78	1.43			0.53	0.79		1.14		
Dissolved Tellurium (Te)	mg/L				<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020			<0.00020	<0.00020		<0.00020		
Dissolved Thallium (Tl)	mg/L	0.0017			<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010			<0.000010	<0.000010		<0.000010		
Dissolved Thorium (Th)	mg/L				<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010			<0.00010	<0.00010		<0.00010		
Dissolved Tin (Sn)	mg/L			2.5	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010			<0.00010	0.00021		<0.00010		
Dissolved Titanium (Ti)	mg/L	2			0.01	<0.00030	<0.00030	0.00145	0.00043	<0.00030			<0.00030	<0.00030		0.00038		
Dissolved Tungsten (W)	mg/L			0.003	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010			<0.00010	<0.00010		<0.00010		
Dissolved Uranium (U)	mg/L	0.3	0.02	0.02	0.000407	0.000489	0.000512	0.000275	0.000623	0.000157			0.000302	0.00065		0.000415		
Dissolved Vanadium (V)	mg/L	0.006		0.02	0.00115	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050			<0.00050	<0.00050		<0.00050		
Dissolved Zinc (Zn)	mg/L	0.033-0.266 (Hardness 90 - 400 mg/L) (e)	5.0, AO	3	0.0036	<0.0010	<0.0010	0.0016	0.0016	<0.0010			0.0033	0.0013		0.0021		
Dissolved Zirconium (Zr)	mg/L				<0.000060	<0.000060	<0.000060	<0.000060	<0.00020	<0.00020			<0.00020	<0.00020		<0.00020		

Table 2. Hazelton Shallow Groundwater Quality Data

Parameters	Units	BC MoE Guidelines		BC CSR Standards	SGW5													
		Freshwater Aquatic Life (1) (2)	Drinking Water (2) (3)	BC CSR-DW (4)														
Date					30-May-18	10-Jul-18	11-Sep-18	16-Apr-19	12-Aug-19	21-Nov-19	30-Mar-20	11-May-20	25-Jun-20	26-Aug-20	9-Sep-20	22-Oct-20	12-Nov-20	16-Dec-20
Volatile Organic Compounds																		
Benzene	µg/L	40	5										<0.50	<0.50		<0.50		
Ethylbenzene	µg/L	200	140, 1.6 AO										<0.50	<0.50		<0.50		
Methyl tbutyl ether (MTBE)	µg/L	3400	15 AO										<0.50	<0.50		<0.50		
Styrene	µg/L												<0.50	<0.50		<0.50		
Toluene	µg/L	0.5[i]	60, 24 AO										<0.50	<0.50		2.08		
Xylene, m and p	µg/L												<0.50	<0.50		<0.50		
Xylene, o	µg/L												<0.50	<0.50		<0.50		
Xylenes, total	µg/L	30	90, 2 AO										<0.75	<0.75		<0.75		
BTEX+Styrene, total	µg/L												<1.5					
Hydrocarbons																		
EPH (C10C19)	µg/L												<250	<250		<250		
EPH (C19C32)	µg/L												<250	<250		<250		
TEH (C10C30), BC	µg/L												<250					
VHw (C6C10)	µg/L												<100	<100		<100		
VPHw	µg/L												<100	<100		<100		

Notes:

2018 data compared to updated criteria

A shaded value means exceeded the BC WQG freshwater aquatic life criteria

A shaded value means reading exceeded the BC WQG drinking water quality criteria.

A shaded value means reading exceeded the CSR drinking water quality criteria.

A shaded value means exceeded more than one criteria.

A shaded value means reading had detection limit exceeding criteria.

A shaded value means reading exceeded the CSR drinking water quality criteria for sampling stations that trigger the Ground Water Quality Exceedances Response Plan

(AO Aesthetic Objective)

1. BC Environment Approved and Working Criteria for Water Quality, last updated March 2018
2. All criteria limits for BCWQG based on Total Metal Concentration except Aluminum and Cadmium (Dissolved)
3. BC Environment Drinking Water Guidelines and Canadian Drinking Water Standards
4. BC Contaminated Sites Regulation for Drinking Water (BCCSRDW) Schedule 3.2 , last updated January 2019

c. Limit dependent on chloride concentration. (MAC Maximum Acceptable Concentration)

d. Limit pH and temperature dependent.

e. Limit dependant on hardness. Range given for hardness 50 to 1,000 mg/L.

f. Limit for chromium (IV)

g. Limit for total, no dissolved concentrations

h.copper (mg/L) =(0.094* Hardness)/1000

i. Limit for hardness based on total dissolved $CaCO^3$

j. Long Term Chronic criteria, average of 5 samples over 30 days not to exceed criteria

Table 3. Hazelton Groundwater Quality Data

Parameters	Units	BC MoE Guidelines		BC CSR Standards	BH 01																
		Freshwater Aquatic Life (1) (2)	Drinking Water (2) (3)	BC CSR-DW (4)																	
Date					7-Jul-14	26-May-15	16-Nov-15	16-Apr-16	7-Jul-16	25-Oct-16	24-Apr-17	14-Jun-17	30-May-18	11-Jul-18	11-Sep-18	17-Apr-19	13-Aug-19	20-Nov-19	31-Mar-20	22-Jun-20	25-Aug-20	21-Oct-20
Field																					
pH	pH	6.5 9.0	7.0 - 10.5								7.8	8				7.89	7.32	7.05	7.8	8	7.31	7.52
Conductivity	°C										395	397	383	526	463.00	472.00	455	358.8	396.6	243	495	403.5
Temperature	uS/cm										6.7	7	6.4	6.5	6.50	6.30	6.8	6.4	6.2	7	6.4	6.3
Water level	m										21.08	21.98	21.1	21.05	21.05	22.72	21.17	21.07	21.17	21	21.41	21.18
Analyte																					
Conductivity	uS/cm				464	387	404	394	396	428	404	400						537	580	609	687	658
pH	pH units	6.5 9.0	7.0 - 10.5		7.9	8.1	8.1	8.2	8.1	8.2	8.1	8.4					8.38	8.4	8.14	8.04	8.07	7.99
Alkalinity (Total as CaCO3)	mg/L				>1250	210	210.0	220.0	220.0	220.0	220	220	276	379	392	392	326	325	2180	322	376	362
Dissolved Hardness (CaCO3)	mg/L				148	158	165												267	308	338	334
Hardness, Total (Total as CaCO3)	mg/L							171	154	175	149	158	266	270	329	266	265	260				
Chloride (Cl)	mg/L	600	250, AO	250	<1.0	2.2	5.5	3.3	3.5	14.7	3.5	2.4	0.7	0.6	<2.5	<0.50	<0.50	0.7	<0.50	<0.50	<2.50	<0.50
Fluoride (F)	mg/L	0.4 - 1.87 (e)	1.5	1.5									0.097	0.086	<0.10	0.083	0.074	0.092	0.063	0.057	<0.100	0.044
Sulphate (SO4)	mg/L	128 - 429 (e)	<500, AO	500	9.4	<1.0	<1.0	<1.0	<1.0	<1.0	1	<1.0	15.4	18.2	27.7	13.9	14.4	13.5	15.7	18.1	24.7	19
Ammonia (N)	mg/L	0.68 - 28.7 (d)			0.07	<0.03	0.064	0.08	<0.03	<0.03	<0.03	<0.03	0.426	0.314	0.297	0.365	0.276	0.72	0.574	0.616	0.291	0.345
Nitrate (N)	mg/L	32.8	10 MAC	10.0	0.033	0.040	0.370	0.210	0.460	0.220	0.189	0.018	<0.0050	0.025	<0.025	<0.0050	<0.0050	0.031	0.010	<0.0050	<0.0250	0.012
Nitrite (N)	mg/L	0.06 - 0.6 (c)	1.0	1	<0.01	<0.01	<0.01	0.014	<0.01	0.01	<0.01	<0.01	<0.0010	0.0026	<0.0050	<0.0010	<0.0010	0.0227	0.0044	<0.0010	0.0081	<0.0010
Nitrate+Nitrite (N)	mg/L			10		0.041	0.373	0.224	0.219	0.23	0.189	0.018	<0.0060	0.0276	<0.030							
Total Kjeldahl Nitrogen (N)	mg/L				0.607	<0.5	0.370											6.500	40.200	113.000	0.324	2.680
Misc. Organics																					
Chemical Oxygen Demand	mg/L				471	33	<20	<20	<20	<20	<20	<20	605.00	366.00	<20	64.00	148.00	309.00	1370	5180	29	274
Biochemical Oxygen Demand	mg/L																					
Total Organic Carbon (C)	mg/L															3.61	64.40	737.00	404	1,200	126	263
Dissolved Metals																					
Dissolved Aluminum (Al)	mg/L	0.023 - 0.1 (b,c)	9.5	9.5	0.0190	0.0050	<0.005	0.0150	0.0070	0.0150	<0.0050	0.0075	0.0049	0.2880	0.0942	0.8990	0.0022	0.0047	0.0015	0.0290	0.008	0.0051
Dissolved Antimony (Sb)	mg/L	0.009	0.006	0.006	0.00058	0.00060	<0.0001	0.00010	0.00010	0.00030	<0.00010	0.00021	0.00016	0.00018	<0.00010	0.00021	<0.00010	0.00022	0.00034	<0.00010	<0.00010	0.00041
Dissolved Arsenic (As)	mg/L	0.005	0.01 MAC	0.01	0.00053	0.00180	0.00160	0.00210	0.00160	0.00200	0.00160	0.00181	0.00927	0.00691	0.01650	0.00845	0.00835	0.00692	0.00586	0.01210	0.00925	0.00561
Dissolved Barium (Ba)	mg/L	1	1	1	0.320	0.212	0.262	0.242	0.218	0.243	0.1970	0.2370	0.1130	0.1810	0.1920	0.1380	0.1940	0.1400	0.1590	0.3560	0.243	0.2540
Dissolved Beryllium (Be)	mg/L	0.00013		0.008	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.000100	<0.000100	<0.000100	<0.000100
Dissolved Bismuth (Bi)	mg/L				<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.00010	<0.00010	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Dissolved Boron (B)	mg/L	1.20	5.0, MAC	5.00	0.066	0.069	0.065	0.069	0.076	0.072	0.073	0.065	0.084	0.083	0.11	0.082	0.089	0.08	0.091	0.101	0.115	0.113
Dissolved Cadmium (Cd)	mg/L	0.00029 - 0.0028 (Hardness 50-455 mg/L) (e) (k)	0.005	0.005	<0.00001	0.0002	0.00068	0.00003	0.0009	0.00099	0.000239	0.000365	0.0000058	0.0000162	0.0000063	0.000017	<0.0000050	0.0000282	<0.0000050	<0.0000050	0.0000053	<0.0000050
Dissolved Calcium (Ca)	mg/L	<4 sensitive to acid input			18	18	20	20	20	20	18	20	46.8	44.6	57.8	46	40.7	43.9	41.9	48.7	62.4	58.1
Dissolved Cesium (Cs)	mg/L												<0.000010	0.000023	0.000016	0.000073	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Dissolved Chromium (Cr)	mg/L	0.001 (e, f)	0.05, MAC	0.05 (VI), 6 (III)	<0.0010	<0.0005	<0.0005	<0.0005	<0.0005	0.0006	<0.00050	<0.00050	<0.00010	0.00031	0.00013	0.00087	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Dissolved Cobalt (Co)	mg/L	0.11		0.001	<0.0050	<0.00005	0.00011	<0.00005	<0.00005	0.0001	<0.00010	<0.00010	0.00021	0.00042	0.00017	0.00056	0.00011	0.00028	0.00014	0.00013	0.00013	0.00042
Dissolved Copper (Cu)	mg/L	0.0032 - 0.0396 (e)	1.0, AO	1.5	<0.0050	0.0024	0.0023	0.0014	0.0029	0.0048	0.00213	0.00137	0.00204	0.00073	0.00094	0.00178	<0.00020	0.00047	<0.00020	0.00061	<0.00020	<0.00020
Dissolved Iron (Fe)	mg/L	0.35	0.3, AO	6.5	<0.01	<0.010	<0.010	0.019	<0.010	<0.010	<0.010	0.021	0.217	0.395	0.858	0.903	0.099	0.196	0.175	1.020	0.237	0.026
Dissolved Lead (Pb)	mg/L	0.034 - 0.40 (Hardness 50 - 350 mg/L) (e)	0.01	0.01	<0.0002	<0.0001	<0.0001	0.0002	<0.0001	<0.0001	<0.00010	<0.00010	<0.000050	0.000104	0.000091	0.000345	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Dissolved Lithium (Li)	mg/L			0.008	<0.005	0.0003	0.0003	0.0003	0.0004	0.0004	0.0005	0.0003	0.0014	0.0015	0.002	0.0017	0.0012	0.0012	0.0021	0.0015	0.0018	0.0021
Dissolved Magnesium (Mg)	mg/L				25.3	27.3	28.4	29.1	25.5	30.6	25.2	26.3	36.1	38.4	44.9	36.6	39.6	36.4	39.4	45.4	44.2	45.8
Dissolved Manganese (Mn)	mg/L	0.8 - 3.4 (e)	0.05, AO	1.5	0.0363	0.1280	0.0026	0.0999	0.0009	0.0069	0.0015	0.0926	0.131	0.159	0.175	0.169	0.135	0.47	0.112	0.207	0.109	0.135
Dissolved Mercury (Hg)	mg/L	0.0001, MAC	0.001	0.001	<0.00001	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.0000050	0.0000131	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Dissolved Molybdenum (Mo)	mg/L	2	0.25	0.25	0.0095	0.0027	0.0100	0.0100	0.0100	0.0107	0.0097	0.0095	0.00604	0.00467	0.00339	0.00345	0.00351	0.00382	0.00377	0.00312	0.00315	0.00358
Dissolved Nickel (Ni)	mg/L	0.0250.15 (e)		0.08	<0.001	0.0016	0.0012	0.0004	0.0018	0.0047	0.00053	0.00084	<0.00050	0.00085	<0.00050	0.00113	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00203
Dissolved Phosphorus (P)	mg/L	0.005 - 0.015 (for lakes only)	0.01, AO		0.011	<0.02	0.050	0.070	0.040	0.060	<0.050	<0.050	<0.050	<0.050	<0.050	0.067	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Dissolved Potassium (K)	mg/L	373 - 432			1.83	3.50	2.49	2.05	2.03	2.40	2.01	2.02	2.01	2.32	1.97	2.17	2.1	1.83	2.06	2.33	2.05	2.32
Dissolved Rubidium (Rb)	mg/L												0.0004	0.00061	0.00043	0.00084	0.0004	0.00033	0.00033	0.00052	0.00031	0.0005
Dissolved Selenium (Se)	mg/L	0.002	0.01, MAC	0.01	<0.0001	0.0009	<0.0005	<0.0005	<0.0005	<0.0005	<0.00050	<0.00050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Dissolved Silicon (Si)	mg/L				1.22	9.30	1.10	1.30	1.20	1.30	1.20	1.30	4.23	4.6	6.48	5.52	3.77	3.78	3.35	5.17	5.71	6.15
Dissolved Silver (Ag)	mg/L	0.0010.003 (e)		0.02	<0.00002	<0.00005	<0.00005	<0.00005	<0.00005	0.00023	<0.000050	<0.000050	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Dissolved Sodium (Na)	mg/L		<200, AO	200	27.2	32.0	35.6	33.0	30.3	41.2	30.5	30.0	31.5	30.9	29.8	30.8	30.7	29.8	30.1	30.8	29.9	29.8
Dissolved Strontium (Sr)	mg/L			2.50	0.709	0.672	0.682	0.705	0.642	0.761	0.609	0.694	1.120	1.080	1.370	1.190	1.150	1.050	1.14	1.330	1.45	1.41
Dissolved Sulphur (S)	mg/L				<3.0	2	<1	<1	2	<1	<3.0	<3.0	5.1	6.6	9.3	5.3	4.8	4.5	3.45	6.7	8.17	9.63
Dissolved Tellurium (Te)	mg/L					<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Dissolved Thallium (Tl)	mg/L	0.0017			<0.00005	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.000020	<0.000020	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Dissolved Thorium (Th)	mg/L					<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Dissolved Tin (Sn)	mg/L			2.5	<0.005	<0.0002	<0.0002	<0.0002	0.0002	0.0002	<0.00020	<0.00020	<0.00010	0.00035	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Dissolved Titanium (Ti)	mg/L	2			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0050	<0.0050	<0.00030	<0.0063	0.00164	0.0319	<0.00030	<0.00030	<0.00030	0.00045	<0.00030	<0.00030
Dissolved Tungsten (W)	mg/L			0.003									<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Dissolved Uranium (U)	mg/L	0.3	0.02	0.02	0.00027	0.00004	0.00004	0.00005	0.00005	0.00005	0.00006	0.00006	0.00051	0.00075	0.00105	0.00078	0.00066	0.00061	0.000463	0.00027	0.00113	0.0013
Dissolved Vanadium (V)	mg/L	0.006		0.02	<0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0010	<0.0010	<0.00050	0.00084	<0.00050	0.00204	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Dissolved Zinc (Zn)	mg/L	0.033-0.266 (Hardness 90 - 400 mg/L) (e)	5 AO	3	<0.005	0.004	0.027	<0.004	<0.004	0.027	<0.0040	0.0108	<0.0010	0.002	0.0026	0.0038	<0.0010	<0.0010	<0.0010	0.0011	0.0012	<0.0010
Dissolved Zirconium (Zr)	mg/L				<0.0005	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.00010	<0.00010	<0.000060	0.000157	<0.000060	<0.00072	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020

Parameters	Units	BC MoE Guidelines		BC CSR Standards	BH 01																
		Freshwater Aquatic Life (1) (2)	Drinking Water (2) (3)	BC CSR-DW (4)																	
Date					7-Jul-14	26-May-15	16-Nov-15	16-Apr-16	7-Jul-16	25-Oct-16	24-Apr-17	14-Jun-17	30-May-18	11-Jul-18	11-Sep-18	17-Apr-19	13-Aug-19	20-Nov-19	31-Mar-20	22-Jun-20	25-Aug-20	21-Oct-20
Volatiles																						
Benzene	ug/L	40	5	5	<0.4								<0.50							<0.50	<0.50	<0.50
Ethylbenzene	µg/L	200	140, 1.6 AO																	<0.50	<0.50	<0.50
Methyl tbutyl ether (MTBE)	µg/L	3400	15 AO																	<0.50	<0.50	<0.50
Styrene	µg/L																			<0.50	<0.50	<0.50
Toluene	ug/L	0.5[k]	60, 24 AO	60	<0.4								580							<0.50	<0.50	<0.50
Xylene, m and p	µg/L																			<0.50	<0.50	<0.50
Xylene, o	µg/L																			<0.50	<0.50	<0.50
Xylenes, total	µg/L	30	90, 2 AO																	<0.75	<0.75	<0.75
BTEX+Styrene, total	µg/L																			<1.5		
Hydrocarbons																						
EPH (C10C19)	µg/L																			<250	<250	<250
EPH (C19C32)	µg/L																			<250	<250	<250
TEH (C10C30), BC	µg/L																			<250		
VHw (C6C10)	µg/L																			<100	<100	<100
VPHw	µg/L																			<100	<100	<100

Notes:

2018 data compared to updated criteria

A shaded value means exceeded the freshwater aquatic life criteria

A shaded value means reading exceeded the drinking water quality criteria.

A shaded value means reading exceeded the CSR drinking water quality criteria.

A shaded value means exceeded more than one criteria.

A shaded value means reading had detection limit exceeding criteria.

A shaded value means reading exceeded the CSR drinking water quality criteria for sampling stations that trigger the Ground Water Quality Exceedances Response Plan

(AO Aesthetic Objective)

1. BC Environment Approved and Working Criteria for Water Quality, last updated March 2018
2. All criteria limits for BCWQG based on Total Metal Concentration except Aluminum, Cadmium, and Iron (Dissolved)
3. BC Environment Drinking Water Guidelines and Canadian Drinking Water Standards
4. BC Contaminated Sites Regulation for Drinking Water (BCCSRDW) Schedule 3.2 , last updated January 2019

c. Limit dependent on chloride concentration. (MAC Maximum Acceptable Concentration)
d. Limit pH and temperature dependent.
e. Limit dependant on hardness. Range given for hardness 50 to 1,000 mg/L.
f. Limit for chromium (IV)
g. Limit for total, no dissolved concentrations
h.copper (mg/L) =(0.094* Hardness)/1000
i. Limit for hardness based on total dissolved $CaCO_3$
j. BC Contaminated Sites Regulation for Drinking Water (BCCSRDW) Schedule 3.2 Stage 11 Amendments, last updated March 2019
k. Long Term Chronic criteria, average of 5 samples over 30 days not to exceed criteria

Table 3. Hazelton Groundwater Quality Data

Parameters	Units	BC MoE Guidelines		BC CSR Standards	BH 02																
		Freshwater Aquatic Life (1) (2)	Drinking Water (2) (3)	BC CSR-DW (4)																	
Date					7-Jul-14	26-May-15	16-Nov-15	16-Apr-16	7-Jul-16	25-Oct-16	24-Apr-17	14-Jun-17	30-May-18	11-Jul-18	11-Sep-18	17-Apr-19	13-Aug-19	20-Nov-19	31-Mar-20	24-Jun-20	25-Aug-20	21-Oct-20
Field																						
pH	pH	6.5 9.0	7.0 - 10.5								7.00	7.60				7.25	7	7.31	7.5	7.1		7.5
Conductivity	°C										884.00	894.00	837.00	752	704	736	670	561	566.0	642.0		403.5
Temperature	uS/cm										6.20	6.20	6.40	6.2	6.2	6.2	7	6	5.3	6.9		6.3
Water level	m										21.08	21.90	22.06	23.38	21.05	20.89	21	21.02	20.94	23.68		21.18
Analyte																						
Conductivity	uS/cm				938	947	941	949	944	947	936	946						812	804	921	921	931
pH	pH units	6.5 9.0	7.0 - 10.5		7.5	7.8	7.6	7.5	7.5	7.8	7.4	7.5					8.12	8.11	8.14	7.54	7.88	7.7
Alkalinity (Total as CaCO3)	mg/L				1,095	530	>930	500	490	500	480	490	355	462	501	511	429	476	504	473	472	471
Dissolved Hardness (CaCO3)	mg/L				485	521	533												505	499	52	499
Hardness, Total (Total as CaCO3)	mg/L							548	503	550	497	508	482	479	481	482	457	478				
Chloride (Cl)	mg/L	600	250, AO	250	1.0	2.0	<1.0	1.5	1.9	1.2	1.5	1.1	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.50	<2.50	<2.5	<2.5
Fluoride (F)	mg/L	0.4 - 1.87 (e)	1.5	1.5									<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.100	<0.100	<0.100	<0.100
Sulphate (SO4)	mg/L	128 - 429 (e)	<500, AO	500	69.5	63	55.1	59.8	60.3	59.3	64.1	66.5	59.7	59.5	65.8	57.3	64.3	62.4	59.6	60	76	72.1
Ammonia (N)	mg/L	0.68 - 28.7 (d)			0.07	0.068	0.46	<0.03	0.033	0.036	<0.03	<0.03	0.199	0.0513	0.159	0.103	0.202	0.264	0.187	0.126	0.0533	0.0485
Nitrate (N)	mg/L	32.8	10 MAC	10.0	0.119	0.250	0.060	0.460	0.290	0.150	0.153	0.067	<0.025	0.139	<0.025	0.128	0.050	0.033	0.044	0.134	0.189	0.096
Nitrite (N)	mg/L	0.06 - 0.6 (c)	1.0	1	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.0050	0.0056	<0.0050	<0.0050	0.0147	<0.0050	<0.00500	<0.0050	<0.0050	0.0055
Nitrate+Nitrite (N)	mg/L			10		0.253	0.055	0.459	0.286	0.146	0.153	0.067	<0.030	0.1446	<0.030							
Total Kjeldahl Nitrogen (N)	mg/L				0.502	1.350	2.680											0.734	9.840	0.894	0.236	0.482
Misc. Organics																						
Chemical Oxygen Demand	mg/L				123	136	242	25	<20	<20	<20	<20	162.00	<20	<20	38.00	96.00	40.00	132.00	91.00	34.00	<20
Biochemical Oxygen Demand	mg/L																					
Total Organic Carbon (C)	mg/L															7.83	14.10	83.20	2.54	13.30	4.11	9.11
Dissolved Metals																						
Dissolved Aluminum (Al)	mg/L	0.023 - 0.1 (b,c)	9.5	9.5	0.0030	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0050	<0.0050	0.0042	0.0023	0.0067	0.0026	0.0128	0.0024	1.3000	0.0025	0.0013	0.0442
Dissolved Antimony (Sb)	mg/L	0.009	0.006	0.006	<0.005	0.0005	<0.0001	0.0003	<0.0001	0.0002	<0.00010	0.0003	<0.00010	<0.00010	0.00013	0.00016	0.00011	<0.00010	<0.00010	0.00026	0.00032	0.00015
Dissolved Arsenic (As)	mg/L	0.005	0.01 MAC	0.01	0.00088	0.00130	0.00120	0.00070	0.00070	0.00080	0.00076	0.00078	0.00088	0.00073	0.00078	0.00075	0.00100	0.00186	0.00185	0.00110	0.00062	0.00054
Dissolved Barium (Ba)	mg/L	1	1	1	0.0665	0.1470	0.0650	0.0600	0.0640	0.0680	0.0520	0.0591	0.0635	0.0681	0.0576	0.0804	0.0683	0.0568	0.0908	0.0633	0.0664	0.0616
Dissolved Beryllium (Be)	mg/L	0.00013		0.008	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.000100	<0.000100	<0.000100	<0.000100
Dissolved Bismuth (Bi)	mg/L				<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.00010	<0.00010	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Dissolved Boron (B)	mg/L	1.20	5.0, MAC	5.00	0.079	0.107	0.078	0.097	0.100	0.098	0.099	0.091	0.079	0.074	0.087	0.077	0.081	0.078	0.078	0.087	0.086	0.08
Dissolved Cadmium (Cd)	mg/L	0.00029 - 0.0028 (Hardness 50-455 mg/L) (e) (k)	0.005	0.005	0.00018	0.00022	0.00008	0.00024	0.00263	0.00002	0.000539	0.000456	0.0000174	0.000643	0.0000442	0.0000097	0.0000232	0.0000463	0.000104	0.0000778	0.0000654	0.0000757
Dissolved Calcium (Ca)	mg/L	<4 sensitive to acid input			83	87	91	92	86	87	85	88	84	78	80	84	77	82	86	86	94	85
Dissolved Cesium (Cs)	mg/L												<0.000010	<0.000010	0	<0.000010	0	0	0	<0.000010	<0.000010	<0.000010
Dissolved Chromium (Cr)	mg/L	0.001 (e, f)	0.05, MAC	0.05 (VI), 6 (III)	<0.0010	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.00050	<0.00050	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00143	<0.00010	<0.00010	<0.00010
Dissolved Cobalt (Co)	mg/L	0.11		0.001	0.00053	0.00063	0.00058	<0.00005	<0.00005	0.00045	<0.00010	<0.00010	0.0006	<0.00010	0.0005	0.00072	0.00045	0.00047	0.00198	0.0004	0.00016	0.00025
Dissolved Copper (Cu)	mg/L	0.0032 - 0.0396 (e)	1.0, AO	1.5	0.00132	0.02220	0.00170	0.00230	0.00320	0.00040	0.00345	0.00171	0.00251	0.00428	0.00053	0.00070	0.00078	<0.00020	0.00724	0.00414	0.00053	0.00066
Dissolved Iron (Fe)	mg/L	0.35	0.3, AO	6.5	<0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.058	<0.010	0.077	0.019	0.071	0.195	2.17	<0.010	<0.010	0.103
Dissolved Lead (Pb)	mg/L	0.034 - 0.40 (Hardness 50 - 350 mg/L) (e)	0.01	0.01	<0.0002	0.0002	<0.0001	0.0003	<0.0001	<0.0001	<0.00010	<0.00010	0.000124	<0.000050	<0.000050	<0.000050	0.000064	<0.000050	0.001	0.000068	<0.000050	<0.000050
Dissolved Lithium (Li)	mg/L			0.008	<0.005	0.0043	0.0042	0.0046	0.0046	0.0044	0.00434	0.00428	0.004	0.0039	0.0042	0.0034	0.004	0.0036	0.0047	0.0044	0.0044	0.0045
Dissolved Magnesium (Mg)	mg/L				67.2	73.9	74.3	77.5	70.1	80.9	69.0	70.0	66.2	69.0	68.5	66.3	64.6	66.5	70.3	69.0	69.9	69.4
Dissolved Manganese (Mn)	mg/L	0.8 - 3.4 (e)	0.05, AO	1.5	0.131	0.128	0.158	0.007	0.031	0.119	0.0058	0.0033	0.1660	0.1070	0.1550	0.194	0.176	0.145	0.402	0.0793	0.0293	0.0731
Dissolved Mercury (Hg)	mg/L	0.0001, MAC	0.001	0.001	<0.00001	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	0.0000425	<0.0000050	<0.0000050	<0.0000050
Dissolved Molybdenum (Mo)	mg/L	2	0.25	0.25	0.0027	0.0027	0.0025	0.0024	0.0026	0.0026	0.0024	0.0023	0.0023	0.0022	0.0023	0.0024	0.0023	0.0022	0.0018	0.0028	0.0023	0.0023
Dissolved Nickel (Ni)	mg/L	0.0250.15 (e)		0.08	0.0013	0.0016	0.0009	0.0007	0.0032	0.0020	0.00092	0.00095	0.00086	0.00177	0.00111	0.00164	0.00109	<0.00050	0.00397	0.00124	0.0016	0.00179
Dissolved Phosphorus (P)	mg/L	0.005 - 0.015 (for lakes only)	0.01, AO		<0.01	<0.02	<0.02	<0.02	<0.02	<0.02	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.420	<0.050	<0.050	<0.050
Dissolved Potassium (K)	mg/L	373 - 432			2.70	3.50	2.87	3.27	2.65	2.87	2.67	2.83	2.58	2.68	2.67	2.84	2.56	2.46	2.79	2.58	2.56	2.74
Dissolved Rubidium (Rb)	mg/L												0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dissolved Selenium (Se)	mg/L	0.002	0.01, MAC	0.01	0.00013	0.00090	<0.0005	<0.0005	<0.0005	<0.0005	<0.00050	<0.00050	<0.000050	0.00027	0.00011	0.00006	0.00006	<0.000050	0.00006	0.00031	0.00028	0.00014
Dissolved Silicon (Si)	mg/L				7.72	9.30	7.70	9.00	8.40	8.90	8.20	9.20	7.96	8.07	7.43	6.94	7.71	8.17	10.20	8.09	7.52	7.87
Dissolved Silver (Ag)	mg/L	0.0010.003 (e)		0.02	<0.00002	<0.00005	<0.00005	<0.00005	<0.00005	0.00011	<0.000050	<0.000050	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000014	<0.000010	<0.000010	<0.000010
Dissolved Sodium (Na)	mg/L		<200, AO	200	25.1	28.8	27.2	29.3	26.0	28.2	25.5	25.3	23.7	24.7	23.7	25.0	23.7	24.0	23.6	25.5	23.5	24.0
Dissolved Strontium (Sr)	mg/L			2.50	2.06	1.87	1.96	2.05	1.88	2.19	1.750	1.980	1.950	1.750	1.890	2.030	1.820	1.870	1.990	2.030	2.070	1.930
Dissolved Sulphur (S)	mg/L				20.0	25.0	21.0	23.0	21.0	23.0	19.5	21.3	22.5	22.5	21.2	21.0	21.2	22.8	21.3	23.6	26.8	27.3
Dissolved Tellurium (Te)	mg/L					<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Dissolved Thallium (Tl)	mg/L	0.0017			<0.00005	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.000020	<0.000020	<0.000010	0.000015	<0.000010	<0.000010	<0.000010	<0.000010	0.000011	<0.000010	<0.000010	0.00001
Dissolved Thorium (Th)	mg/L					<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00019	<0.00010	<0.00010	<0.00010
Dissolved Tin (Sn)	mg/L			2.5	<0.005	<0.0002	<0.0002	0.0003	0.0004	<0.0002	<0.00020	0.00027	<0.00010	<0.00010	<0.00010	<0.00010	0.00011	<0.00010	<0.00010	0.00015	<0.00010	<0.00010
Dissolved Titanium (Ti)	mg/L	2			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0050	<0.0050	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	0.0234	<0.00030	<0.00030	<0.00030
Dissolved Tungsten (W)	mg/L			0.003									<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Dissolved Uranium (U)	mg/L	0.3	0.02	0.02	0.00125	0.00118	0.00118	0.00110	0.00116	0.00113	0.00112	0.00114	0.00113	0.00101	0.00114	0.00142	0.00115	0.00105	0.00100	0.00109	0.00133	0.00117
Dissolved Vanadium (V)	mg/L	0.006		0.02	<0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0010	<0.0010	<0.00050	0.00087	<0.00050	<0.00050	<0.00050	<0.00050	0.00328	<0.00050	<0.00050	<0.00050
Dissolved Zinc (Zn)	mg/L	0.033-0.266 (Hardness 90 - 400 mg/L) (e)	5 AO	3	<0.005	0.029	<0.004	0.004	0.008	0.01	0.0147	0.0112	0.0028	0.0035	<0.0010	0.0046	0.0036	0.0012	0.014	0.0034	0.0012	0.0018
Dissolved Zirconium (Zr)	mg/L				<0.0005	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.00010	<0.00010	0.000066	0.000095	<0.000060	0.000088	<0.00020	<0.00020	0.00049	<0.00020	<0.00020	<0.00020

Parameters	Units	BC MoE Guidelines		BC CSR Standards	BH 02															
		Freshwater Aquatic Life (1) (2)	Drinking Water (2) (3)	BC CSR-DW (4)																
Date					7-Jul-14	26-May-15	16-Nov-15	16-Apr-16	7-Jul-16	25-Oct-16	24-Apr-17	14-Jun-17	30-May-18	11-Jul-18	11-Sep-18	17-Apr-19	13-Aug-19	20-Nov-19	31-Mar-20	24-Jun-20	25-Aug-20	21-Oct-20
Volatiles																						
Benzene	ug/L	40	5	5	<0.4								<0.50							<0.50	<0.50	<0.50
Ethylbenzene	µg/L	200	140, 1.6 AO																	<0.50	<0.50	<0.50
Methyl tbutyl ether (MTBE)	µg/L	3400	15 AO																	<0.50	<0.50	<0.50
Styrene	µg/L																			<0.50	<0.50	<0.50
Toluene	ug/L	0.5[k]	60, 24 AO	60	<0.4								0.57							<0.50	3.32	1.88
Xylene, m and p	µg/L																			<0.50	<0.50	<0.50
Xylene, o	µg/L																			<0.50	<0.50	<0.50
Xylenes, total	µg/L	30	90, 2 AO																	<0.75	<0.75	<0.75
BTEX+Styrene, total	µg/L																			<1.5		
Hydrocarbons																						
EPH (C10C19)	µg/L																			<250	<250	<250
EPH (C19C32)	µg/L																			<250	<250	<250
TEH (C10C30), BC	µg/L																			<250		
VHw (C6C10)	µg/L																			<100	<100	<100
VPHw	µg/L																			<100	<100	<100

Notes:

2018 data compared to updated criteria

A shaded value means exceeded the freshwater aquatic life criteria

A shaded value means reading exceeded the drinking water quality criteria.

A shaded value means reading exceeded the CSR drinking water quality criteria.

A shaded value means exceeded more than one criteria.

A shaded value means reading had detection limit exceeding criteria.

A shaded value means reading exceeded the CSR drinking water quality criteria for sampling stations that trigger the Ground Water Quality Exceedances Response Plan

(AO Aesthetic Objective)

1. BC Environment Approved and Working Criteria for Water Quality, last updated March 2018
2. All criteria limits for BCWQG based on Total Metal Concentration except Aluminum, Cadmium, and Iron (Dissolved)
3. BC Environment Drinking Water Guidelines and Canadian Drinking Water Standards
4. BC Contaminated Sites Regulation for Drinking Water (BCCSRDW) Schedule 3.2 , last updated January 2019

c. Limit dependent on chloride concentration. (MAC Maximum Acceptable Concentration)

d. Limit pH and temperature dependent.

e. Limit dependant on hardness. Range given for hardness 50 to 1,000 mg/L.

f. Limit for chromium (IV)

g. Limit for total, no dissolved concentrations

h.copper (mg/L) =(0.094* Hardness)/1000

i. Limit for hardness based on total dissolved $CaCO_3$

j. BC Contaminated Sites Regulation for Drinking Water (BCCSRDW) Schedule 3.2 Stage 11 Amendments, last updated March 2019

k. Long Term Chronic criteria, average of 5 samples over 30 days not to exceed criteria

Table 3. Hazelton Groundwater Quality Data

Parameters	Units	BC MoE Guidelines		BC CSR Standards	BH 03													
		Freshwater Aquatic Life (1) (2)	Drinking Water (2) (3)	BC CSR-DW (4)													DRY	DRY
Date					7-Jul-14	26-May-15	16-Nov-15	16-Apr-16	25-Oct-16	24-Apr-17	14-Jun-17	30-May-18	11-Sep-18	17-Apr-19	13-Aug-19	20-Nov-19	30-Mar-20	22-Jun-20
Field																		
pH	pH	6.5 9.0	7.0 - 10.5							7.6	7.3							
Conductivity	°C									790	791	753	667	686	647	632		
Temperature	uS/cm									6.5	7.2	7.1	7.1	7	7.5	6.8		
Water level	m									57	57.59	56.9	57.72	57.06	51.22	57.12		
Analyte																		
Conductivity	uS/cm				837	817		829	819	813	831						624	
pH	pH units	6.5 9.0	7.0 - 10.5		7.9	7.7		7.7	7.8	8	7.6							
Alkalinity (Total as CaCO3)	mg/L				265	240		250	250	240	240	207	200					
Dissolved Hardness (CaCO3)	mg/L				216	557	239											
Hardness, Total (Total as CaCO3)	mg/L							247	236	220	242	228	177					
Chloride (Cl)	mg/L	600	250, AO	250	2.8	3.9		3.7	3.4	2.7	2.5	1.75	<2.5					
Fluoride (F)	mg/L	0.4 - 1.87 (e)	1.5	1.5								0.080	<0.10					
Sulphate (SO4)	mg/L	128 - 429 (e)	<500, AO	500	176	180		184	181	184	223	185	199					
Ammonia (N)	mg/L	0.68 - 28.7 (d)			0.07	0.04	0.04	<0.03	<0.03	<0.03	<0.03	0.0056	0.0067					
Nitrate (N)	mg/L	32.8	10 MAC	10.0	0.404	0.310	0.320	0.320	0.250	0.246	0.130	0.288	<0.025					
Nitrite (N)	mg/L	0.06 - 0.6 (c)	1.0	1	<0.01	<0.01		<0.01	<0.01	<0.01	<0.01	<0.0010	<0.0050					
Nitrate+Nitrite (N)	mg/L			10		0.311	0.32	0.319	0.254	0.246	0.128	<0.289	<0.030					
Total Kjeldahl Nitrogen (N)	mg/L				0.176	0.370	0.100											
Misc. Organics																		
Chemical Oxygen Demand	mg/L				<20	<20	<20	<20	<20	36.00	<20	<20	<20					
Biochemical Oxygen Demand	mg/L																	
Total Organic Carbon (C)	mg/L																	
Dissolved Metals																		
Dissolved Aluminum (Al)	mg/L	0.023 - 0.1 (b,c)	9.5	9.5	0.0058	<0.005	<0.005	<0.005	<0.005	<0.0050	0.0059	0.0074	0.0060					
Dissolved Antimony (Sb)	mg/L	0.009	0.006	0.006	<0.005	0.0005	0.0001	0.0005	0.0005	0.00029	0.00063	0.00043	0.00036					
Dissolved Arsenic (As)	mg/L	0.005	0.01 MAC	0.01	0.00048	0.00210	<0.0005	<0.0005	<0.0005	<0.00050	<0.00050	0.00040	0.00032					
Dissolved Barium (Ba)	mg/L	1	1	1	0.0347	0.3860	0.0320	0.0320	0.0350	0.0281	0.0327	0.03590	0.03090					
Dissolved Beryllium (Be)	mg/L	0.00013		0.008	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.00010	<0.00010	<0.00010	<0.00010					
Dissolved Bismuth (Bi)	mg/L				<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.00010	<0.00010	<0.000050	<0.000050					
Dissolved Boron (B)	mg/L	1.20	5.0, MAC	5.00	0.056	0.040	0.059	0.072	0.073	0.069	0.07	0.06100	0.06700					
Dissolved Cadmium (Cd)	mg/L	0.00029 - 0.0028 (Hardness 50-455 mg/L) (e) (k)	0.005	0.005	0.00006	0.00007	0.00015	0.00023	0.00032	0.000141	0.000186	0.00012	0.00012					
Dissolved Calcium (Ca)	mg/L	<4 sensitive to acid input			64	141	71	72	67	65	72	68	48					
Dissolved Cesium (Cs)	mg/L											<0.000010	<0.000010					
Dissolved Chromium (Cr)	mg/L	0.001 (e, f)	0.05, MAC	0.05 (VI), 6 (III)	<0.0010	<0.0005	<0.0005	<0.0005	<0.0005	<0.00050	<0.00050	<0.00010	<0.00010					
Dissolved Cobalt (Co)	mg/L	0.11		0.001	<0.0050	0.00783	<0.00005	0.00009	<0.00005	<0.00010	<0.00010	0.00012	<0.00010					
Dissolved Copper (Cu)	mg/L	0.0032 - 0.0396 (e)	1.0, AO	1.5	0.00128	0.00520	0.00350	0.00270	0.00230	0.00069	0.00376	0.00162	0.00109					
Dissolved Iron (Fe)	mg/L	0.35	0.3, AO	6.5	<0.01	0.03	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010					
Dissolved Lead (Pb)	mg/L	0.034 - 0.40 (Hardness 50 - 350 mg/L) (e)	0.01	0.01	<0.0002	<0.0001	<0.0001	0.0004	<0.0001	<0.00010	<0.00010	0.00006	<0.000050					
Dissolved Lithium (Li)	mg/L			0.008	<0.005	0.002	0.0017	0.0019	0.0025	0.00161	0.00191	0.00180	0.00180					
Dissolved Magnesium (Mg)	mg/L				13.7	49.9	15.1	16.3	16.3	14.0	15.0	14.1	14.1					
Dissolved Manganese (Mn)	mg/L	0.8 - 3.4 (e)	0.05, AO	1.5	0.0020	3.97	0.0011	0.0439	0.0046	0.0014	0.0035	0.03180	0.02310					
Dissolved Mercury (Hg)	mg/L	0.0001, MAC	0.001	0.001	<0.00001	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.0000050	<0.0000050					
Dissolved Molybdenum (Mo)	mg/L	2	0.25	0.25	0.0071	0.0012	0.0051	0.0059	0.0060	0.0057	0.0060	0.00534	0.00513					
Dissolved Nickel (Ni)	mg/L	0.0250.15 (e)		0.08	<0.001	0.0126	0.001	0.0016	0.0021	0.00041	0.00073	0.00077	0.00055					
Dissolved Phosphorus (P)	mg/L	0.005 - 0.015 (for lakes only)	0.01, AO		0.035	<0.02	<0.02	0.020	0.030	<0.050	<0.050	<0.050	<0.050					
Dissolved Potassium (K)	mg/L	373 - 432			2.13	3.56	2.15	2.25	2.31	1.98	2.23	2.08	1.90					
Dissolved Rubidium (Rb)	mg/L											0.00049	0.00051					
Dissolved Selenium (Se)	mg/L	0.002	0.01, MAC	0.01	0.00033	0.00080	0.00050	0.00060	0.00050	<0.00050	0.00050	0.00053	0.00059					
Dissolved Silicon (Si)	mg/L				4.01	10.20	3.70	4.40	4.10	3.90	4.60	3.96000	3.69000					
Dissolved Silver (Ag)	mg/L	0.0010.003 (e)		0.02	<0.00002	<0.00005	<0.00005	<0.00005	0.00008	<0.000050	<0.000050	<0.000010	<0.000010					
Dissolved Sodium (Na)	mg/L		<200, AO	200	113	87	100	107	103	94.4	99.6	92.6	93.9					
Dissolved Strontium (Sr)	mg/L			2.50	0.912	1.030	0.893	0.949	1.010	0.829	0.956	0.912	0.846					
Dissolved Sulphur (S)	mg/L				57.1	7.0	63.0	71.0	68.0	59.3	69.7	69.5	66.4					
Dissolved Tellurium (Te)	mg/L					<0.0002	<0.0002	<0.0002	<0.0002	<0.00020	<0.00020	<0.00020	<0.00020					
Dissolved Thallium (Tl)	mg/L	0.0017			<0.00005	<0.00002	<0.00002	0.00002	0.00003	<0.000020	<0.000020	<0.000010	0.00001					
Dissolved Thorium (Th)	mg/L					<0.0001	<0.0001	<0.0001	<0.0001	<0.00010	<0.00010	<0.00010	<0.00010					
Dissolved Tin (Sn)	mg/L			2.5	<0.005	<0.0002	0.0006	0.0004	<0.0002	<0.00020	<0.00020	0.00734	<0.00010					
Dissolved Titanium (Ti)	mg/L	2			<0.005	<0.005	<0.005	<0.005	<0.005	<0.0050	<0.0050	<0.00030	<0.00030					
Dissolved Tungsten (W)	mg/L			0.003								0.00019	0.00031					
Dissolved Uranium (U)	mg/L	0.3	0.02	0.02	0.00245	0.00071	0.00231	0.00239	0.00239	0.00233	0.00250	0.00238	0.00215					
Dissolved Vanadium (V)	mg/L	0.006		0.02	<0.005	<0.001	<0.001	<0.001	<0.001	<0.0010	<0.0010	<0.00050	<0.00050					
Dissolved Zinc (Zn)	mg/L	0.033-0.266 (Hardness 90 - 400 mg/L) (e)	5 AO	3	<0.005	0.037	0.006	<0.004	0.045	<0.0040	0.006	0.0027	0.0015					
Dissolved Zirconium (Zr)	mg/L				<0.0005	0.0002	<0.0001	<0.0001	<0.0001	<0.00010	<0.00010	<0.000060	<0.000060					

Parameters	Units	BC MoE Guidelines		BC CSR Standards	BH 03													
		Freshwater Aquatic Life (1) (2)	Drinking Water (2) (3)	BC CSR-DW (4)													DRY	DRY
Date					7-Jul-14	26-May-15	16-Nov-15	16-Apr-16	25-Oct-16	24-Apr-17	14-Jun-17	30-May-18	11-Sep-18	17-Apr-19	13-Aug-19	20-Nov-19	30-Mar-20	22-Jun-20
Volatiles																		
Benzene	ug/L	40	5	5	<0.4							<0.50						
Ethylbenzene	µg/L	200	140, 1.6 AO															
Methyl tbutyl ether (MTBE)	µg/L	3400	15 AO															
Styrene	µg/L																	
Toluene	ug/L	0.5[k]	60, 24 AO	60	<0.4							11.2						
Xylene, m and p	µg/L																	
Xylene, o	µg/L																	
Xylenes, total	µg/L	30	90, 2 AO															
BTEX+Styrene, total	µg/L																	
Hydrocarbons																		
EPH (C10C19)	µg/L																	
EPH (C19C32)	µg/L																	
TEH (C10C30), BC	µg/L																	
VHw (C6C10)	µg/L																	
VPHw	µg/L																	

Notes:

2018 data compared to updated criteria

A shaded value means exceeded the freshwater aquatic life criteria

A shaded value means reading exceeded the drinking water quality criteria.

A shaded value means reading exceeded the CSR drinking water quality criteria.

A shaded value means exceeded more than one criteria.

A shaded value means reading had detection limit exceeding criteria.

A shaded value means reading exceeded the CSR drinking water quality criteria for sampling stations that trigger the Ground Water Quality Exceedances Response Plan

(AO Aesthetic Objective)

1. BC Environment Approved and Working Criteria for Water Quality, last updated March 2018
2. All criteria limits for BCWQG based on Total Metal Concentration except Aluminum, Cadmium, and Iron (Dissolved)
3. BC Environment Drinking Water Guidelines and Canadian Drinking Water Standards
4. BC Contaminated Sites Regulation for Drinking Water (BCCSRDW) Schedule 3.2 , last updated January 2019

c. Limit dependent on chloride concentration. (MAC Maximum Acceptable Concentration)
d. Limit pH and temperature dependent.
e. Limit dependant on hardness. Range given for hardness 50 to 1,000 mg/L.
f. Limit for chromium (IV)
g. Limit for total, no dissolved concentrations
h.copper (mg/L) =(0.094* Hardness)/1000
i. Limit for hardness based on total dissolved $CaCO_3$
j. BC Contaminated Sites Regulation for Drinking Water (BCCSRDW) Schedule 3.2 Stage 11 Amendments, last updated March 2019
k. Long Term Chronic criteria, average of 5 samples over 30 days not to exceed criteria

Table 3. Hazelton Groundwater Quality Data

Parameters	Units	BC MoE Guidelines		BC CSR Standards	BH 4A								
		Freshwater Aquatic Life (1) (2)	Drinking Water (2) (3)	BC CSR-DW (4)									
Date					7-Jul-14	26-May-15	16-Nov-15	16-Apr-16	7-Jul-16	25-Oct-16	24-Apr-17	14-Jun-17	11-Sep-18
Field													
pH	pH	6.5 9.0	7.0 - 10.5								6.4	6.8	
Conductivity	°C										756	725	624
Temperature	uS/cm										7.7	6.5	6
Water level	m										14.66	14.37	14.45
Analyte													
Conductivity	uS/cm				751	773	756	762	760	760	760	765	
pH	pH units	6.5 9.0	7.0 - 10.5		7.7	7.6	7.9	7.7	7.8	8	7.7	7.8	
Alkalinity (Total as CaCO3)	mg/L				273	270	270	270	270	270	270	260	277
Dissolved Hardness (CaCO3)	mg/L				210	103	217						
Hardness, Total (Total as CaCO3)	mg/L							225	208	222	202	207	203
Chloride (Cl)	mg/L	600	250, AO	250	1.6	2.5	1.2	1.6	2.0	1.6	1.7	1.5	<2.5
Fluoride (F)	mg/L	0.4 - 1.87 (e)	1.5	1.5									<0.10
Sulphate (SO4)	mg/L	128 - 429 (e)	<500, AO	500	147	141	142	135	133	129	139	148	142
Ammonia (N)	mg/L	0.68 - 28.7 (d)			0.05	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.0050
Nitrate (N)	mg/L	32.8	10 MAC	10.0	0.528	0.420	0.560	0.520	0.220	0.340	0.462	0.160	0.458
Nitrite (N)	mg/L	0.06 - 0.6 (c)	1.0	1	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.0050
Nitrate+Nitrite (N)	mg/L			10		0.424	0.555	0.523	0.464	0.341	0.462	0.157	<0.463
Total Kjeldahl Nitrogen (N)	mg/L				0.136	0.330	0.260						
Misc. Organics													
Chemical Oxygen Demand	mg/L				<20	<20	<20	<20	<20	<20	<20	<20	<20
Biochemical Oxygen Demand	mg/L												
Total Organic Carbon (C)	mg/L												
Dissolved Metals													
Dissolved Aluminum (Al)	mg/L	0.023 - 0.1 (b,c)	9.5	9.5	0.0054	0.0080	<0.005	<0.005	<0.005	0.0190	<0.0050	0.0066	0.0018
Dissolved Antimony (Sb)	mg/L	0.009	0.006	0.006	<0.005	0.0003	<0.0001	0.0002	0.0002	0.0004	0.00021	0.00036	0.00021
Dissolved Arsenic (As)	mg/L	0.005	0.01 MAC	0.01	0.00048	0.00070	0.00060	0.00050	<0.0005	0.00060	<0.00050	<0.00050	0.00046
Dissolved Barium (Ba)	mg/L	1	1	1	0.0629	0.1310	0.0710	0.0670	0.0670	0.0710	0.0575	0.0653	0.0753
Dissolved Beryllium (Be)	mg/L	0.00013		0.008	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.00010	<0.00010	<0.00010
Dissolved Bismuth (Bi)	mg/L				<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.00010	<0.00010	<0.000050
Dissolved Boron (B)	mg/L	1.20	5.0, MAC	5.00	<0.05	0.02	0.051	0.062	0.062	0.065	0.06	0.055	0.051
Dissolved Cadmium (Cd)	mg/L	0.00029 - 0.0028 (Hardness 50-455 mg/L) (e) (k)	0.005	0.005	0.000164	0.00005	0.00009	0.00005	0.00011	0.00007	0.000066	0.000066	0.00005
Dissolved Calcium (Ca)	mg/L	<4 sensitive to acid input			57	29	58	59	56	57	54	55	53
Dissolved Cesium (Cs)	mg/L												<0.000010
Dissolved Chromium (Cr)	mg/L	0.001 (e, f)	0.05, MAC	0.05 (VI), 6 (III)	<0.0010	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.00050	<0.00050	<0.00010
Dissolved Cobalt (Co)	mg/L	0.11		0.001	<0.0050	0.0141	0.00019	<0.00005	<0.00005	<0.00005	<0.00010	<0.00010	<0.00010
Dissolved Copper (Cu)	mg/L	0.0032 - 0.0396 (e)	1.0, AO	1.5	0.00060	0.00490	0.00090	0.00140	0.00090	0.00090	0.00075	0.00065	0.00225
Dissolved Iron (Fe)	mg/L	0.35	0.3, AO	6.5	<0.01	4.25	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Dissolved Lead (Pb)	mg/L	0.034 - 0.40 (Hardness 50 - 350 mg/L) (e)	0.01	0.01	<0.0002	<0.0001	<0.0001	0.0002	<0.0001	<0.0001	<0.00010	<0.00010	0.000063
Dissolved Lithium (Li)	mg/L			0.008	<0.005	0.0026	0.0012	0.0013	0.0012	0.0013	0.00109	0.00121	0.0012
Dissolved Magnesium (Mg)	mg/L				16.6	7.3	17.5	18.9	16.8	19.3	16.2	16.8	17.0
Dissolved Manganese (Mn)	mg/L	0.8 - 3.4 (e)	0.05, AO	1.5	0.0011	3.17	0.0512	0.0003	0.0034	0.0009	0.0004	0.0051	0.0005
Dissolved Mercury (Hg)	mg/L	0.0001, MAC	0.001	0.001	<0.00001	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.0000050
Dissolved Molybdenum (Mo)	mg/L	2	0.25	0.25	0.0043	0.0007	0.0036	0.0037	0.0037	0.0035	0.0034	0.0033	0.0033
Dissolved Nickel (Ni)	mg/L	0.0250.15 (e)		0.08	<0.001	0.0181	0.0009	0.0006	0.0004	0.0013	0.00052	0.00596	0.00057
Dissolved Phosphorus (P)	mg/L	0.005 - 0.015 (for lakes only)	0.01, AO		0.035	<0.02	<0.02	0.040	0.030	0.040	<0.050	<0.050	<0.050
Dissolved Potassium (K)	mg/L	373 - 432			1.74	1.85	1.76	1.85	1.63	1.86	1.71	1.85	1.58
Dissolved Rubidium (Rb)	mg/L												0.00
Dissolved Selenium (Se)	mg/L	0.002	0.01, MAC	0.01	0.00086	0.00060	0.00120	0.00170	0.00130	0.00160	0.00142	0.00155	0.00139
Dissolved Silicon (Si)	mg/L				4.00	8.70	3.60	4.40	4.40	4.30	4.10	4.60	3.80
Dissolved Silver (Ag)	mg/L	0.0010.003 (e)		0.02	<0.00002	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.000050	<0.000050	<0.000010
Dissolved Sodium (Na)	mg/L		<200, AO	200	89.0	7.5	98.5	106.0	95.7	106.0	94.2	94.9	91.1
Dissolved Strontium (Sr)	mg/L			2.50	0.821	0.133	0.750	0.792	0.751	0.868	0.702	0.797	0.795
Dissolved Sulphur (S)	mg/L				40.4	2.0	46.0	53.0	46.0	54.0	44.8	49.5	47.3
Dissolved Tellurium (Te)	mg/L					<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.00020	<0.00020	<0.00020
Dissolved Thallium (Tl)	mg/L	0.0017			<0.00005	<0.00002	<0.00002	<0.00002	<0.00002	0.00002	<0.000020	<0.000020	0.000011
Dissolved Thorium (Th)	mg/L					<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.00010	<0.00010	<0.00010
Dissolved Tin (Sn)	mg/L			2.5	<0.005	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.00020	<0.00020	<0.00010
Dissolved Titanium (Ti)	mg/L	2			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0050	<0.0050	<0.00030
Dissolved Tungsten (W)	mg/L			0.003									<0.00010
Dissolved Uranium (U)	mg/L	0.3	0.02	0.02	0.00370	0.00007	0.00351	0.00338	0.00363	0.00357	0.00338	0.00346	0.00331
Dissolved Vanadium (V)	mg/L	0.006		0.02	<0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0010	<0.0010	<0.00050
Dissolved Zinc (Zn)	mg/L	0.033-0.266 (Hardness 90 - 400 mg/L) (e)	5 AO	3	<0.005	0.024	<0.004	<0.004	<0.004	<0.004	<0.0040	<0.0040	0.0041
Dissolved Zirconium (Zr)	mg/L				<0.0005	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.00010	<0.00010	<0.000060

Parameters	Units	BC MoE Guidelines		BC CSR Standards	BH 4A								
		Freshwater Aquatic Life (1) (2)	Drinking Water (2) (3)	BC CSR-DW (4)									
Date					7-Jul-14	26-May-15	16-Nov-15	16-Apr-16	7-Jul-16	25-Oct-16	24-Apr-17	14-Jun-17	11-Sep-18
Volatiles													
Benzene	ug/L	40	5	5	<0.4								
Ethylbenzene	µg/L	200	140, 1.6 AO										
Methyl tbutyl ether (MTBE)	µg/L	3400	15 AO										
Styrene	µg/L												
Toluene	ug/L	0.5[k]	60, 24 AO	60	<0.4								
Xylene, m and p	µg/L												
Xylene, o	µg/L												
Xylenes, total	µg/L	30	90, 2 AO										
BTEX+Styrene, total	µg/L												
Hydrocarbons													
EPH (C10C19)	µg/L												
EPH (C19C32)	µg/L												
TEH (C10C30), BC	µg/L												
VHw (C6C10)	µg/L												
VPHw	µg/L												

Notes:
2018 data compared to updated criteria

A shaded value means exceeded the freshwater aquatic life criteria
A shaded value means reading exceeded the drinking water quality criteria.
A shaded value means reading exceeded the CSR drinking water quality criteria.
A shaded value means exceeded more than one criteria.
A shaded value means reading had detection limit exceeding criteria.
A shaded value means reading exceeded the CSR drinking water quality criteria for sampling stations that trigger the Ground Water Quality Exceedances Response Plan

(AO Aesthetic Objective)

1. BC Environment Approved and Working Criteria for Water Quality, last updated March 2018
2. All criteria limits for BCWQG based on Total Metal Concentration except Aluminum, Cadmium, and Iron (Dissolved)
3. BC Environment Drinking Water Guidelines and Canadian Drinking Water Standards
4. BC Contaminated Sites Regulation for Drinking Water (BCCSRDW) Schedule 3.2 , last updated January 2019
c. Limit dependent on chloride concentration. (MAC Maximum Acceptable Concentration)
d. Limit pH and temperature dependent.
e. Limit dependant on hardness. Range given for hardness 50 to 1,000 mg/L.
f. Limit for chromium (IV)
g. Limit for total, no dissolved concentrations
h.copper (mg/L) =(0.094* Hardness)/1000
i. Limit for hardness based on total dissolved $CaCO_3$
j. BC Contaminated Sites Regulation for Drinking Water (BCCSRDW) Schedule 3.2 Stage 11 Amendments, last updated March 2019
k. Long Term Chronic criteria, average of 5 samples over 30 days not to exceed criteria

Table 3. Hazelton Groundwater Quality Data

Parameters	Units	BC MoE Guidelines		BC CSR Standards	BH 4B												
		Freshwater Aquatic Life (1) (2)	Drinking Water (2) (3)	BC CSR-DW (4)													DRY
Date					26-May-15	16-Apr-16	7-Jul-16	25-Oct-16	24-Apr-17	14-Jun-17	30-May-18	11-Jul-18	17-Apr-19	13-Aug-19	20-Nov-19	31-Mar-20	22-Jun-20
Field																	
pH	pH	6.5 9.0	7.0 - 10.5						6.2	6.5			6.35	7	6.83		
Conductivity	°C								41.6	302	666	628	38	597	74.6		
Temperature	uS/cm								4.6	7.5	5.8	7.8	3.7	5.9	5.3		
Water level	m								1.75	2.18	2.52	2.87	1.37	14.43	1.32		
Analyte																	
Conductivity	uS/cm				228	122	352	170	43.1	240	666	628			76.5	166	
pH	pH units	6.5 9.0	7.0 - 10.5		6.7	6.4	6.7	6.7	5.7	6.3				9	7	8	
Alkalinity (Total as CaCO3)	mg/L				120	63	190	84	19	120	290	404	32	271	40	92	
Dissolved Hardness (CaCO3)	mg/L				223											84	
Hardness, Total (Total as CaCO3)	mg/L					47	163	70	9	103	354	355	20	190	24		
Chloride (Cl)	mg/L	600	250, AO	250	1.1	<1.0	1.2	1.1	<1.0	1.0	0.6	1.2	0.6	<2.5	0.6	<0.50	
Fluoride (F)	mg/L	0.4 - 1.87 (e)	1.5	1.5							0.215	0.176	0.226	<0.10	0.187	0.234	
Sulphate (SO4)	mg/L	128 - 429 (e)	<500, AO	500	<1.0	<1.0	<1.0	1.3	1.9	<1.0	0.78	1.96	1.07	137	1.89	<0.30	
Ammonia (N)	mg/L	0.68 - 28.7 (d)			<0.03	0.03	0.059	<0.03	<0.03	0.24	0.0136	0.048	0.0491	<0.0050	0.058	0.0198	
Nitrate (N)	mg/L	32.8	10 MAC	10.0	<0.01	0.012	0.450	<0.01	0.023	0.012	0.021	0.018	0.015	0.460	0.015	<0.0050	
Nitrite (N)	mg/L	0.06 - 0.6 (c)	1.0	1	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.0010	<0.0010	0.001	<0.0050	<0.0010	<0.0010	
Nitrate+Nitrite (N)	mg/L			10	<0.010	0.012	0.037	<0.010	0.023	0.012	<0.022	<0.019					
Total Kjeldahl Nitrogen (N)	mg/L				1.020										2.410	0.884	
Misc. Organics																	
Chemical Oxygen Demand	mg/L				63.00	64.00	59.00	65.00	<20	61.00	53	81	73	<20	80	72	
Biochemical Oxygen Demand	mg/L																
Total Organic Carbon (C)	mg/L												21.00	2.53	35.30	21.20	
Dissolved Metals																	
Dissolved Aluminum (Al)	mg/L	0.023 - 0.1 (b,c)	9.5	9.5	0.0060	0.0410	0.0060	0.1670	0.0606	0.1400	0.0320	0.0125	0.4230	0.0728	0.4400	0.115	
Dissolved Antimony (Sb)	mg/L	0.009	0.006	0.006	0.0005	0.0001	0.0002	0.0004	<0.00010	0.00087	0.00027	0.00021	0.00012	0.0002	0.00015	0.00013	
Dissolved Arsenic (As)	mg/L	0.005	0.01 MAC	0.01	<0.0005	0.00130	0.00060	0.00290	<0.00050	0.00257	0.00372	0.00281	0.00288	0.00074	0.00198	0.00619	
Dissolved Barium (Ba)	mg/L	1	1	1	0.0670	0.0290	0.0700	0.2380	0.0694	0.0501	0.1050	0.1120	0.0170	0.0821	0.0209	0.0349	
Dissolved Beryllium (Be)	mg/L	0.00013		0.008	<0.0001	<0.0001	<0.0001	<0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00012	<0.000100	
Dissolved Bismuth (Bi)	mg/L				<0.0001	<0.0001	<0.0001	<0.0001	<0.00010	<0.00010	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	
Dissolved Boron (B)	mg/L	1.20	5.0, MAC	5.00	0.059	0.005	0.011	0.033	0.02	0.006	<0.010	<0.010	<0.010	0.052	<0.010	<0.010	
Dissolved Cadmium (Cd)	mg/L	0.00029 - 0.0028 (Hardness 50-455 mg/L) (e) (k)	0.005	0.005	0.00029	0.00028	0.00096	0.00043	0.000439	0.000356	0.000124	0.000709	0.000139	0.000193	0.00207	0.0000215	
Dissolved Calcium (Ca)	mg/L	<4 sensitive to acid input			58	13	48	19	3	31	109	109	6	50	7	25.4	
Dissolved Cesium (Cs)	mg/L										<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	
Dissolved Chromium (Cr)	mg/L	0.001 (e, f)	0.05, MAC	0.05 (VI), 6 (III)	<0.0005	<0.0005	0.0006	0.0009	<0.00050	0.00057	0.00011	<0.00010	0.00088	0.00016	0.00081	0.00075	
Dissolved Cobalt (Co)	mg/L	0.11		0.001	<0.00005	0.0113	0.00973	0.0119	0.00077	0.0158	0.00887	0.00731	0.00433	0.00052	0.00488	0.00989	
Dissolved Copper (Cu)	mg/L	0.0032 - 0.0396 (e)	1.0, AO	1.5	0.00250	0.00370	0.00410	0.04020	0.02260	0.00700	0.00243	0.00256	0.00693	0.00164	0.02130	0.00162	
Dissolved Iron (Fe)	mg/L	0.35	0.3, AO	6.5	<0.010	4.51	0.103	10.9	0.214	10.1	5.51	3.86	11.4	0.251	3.64	15.9	
Dissolved Lead (Pb)	mg/L	0.034 - 0.40 (Hardness 50 - 350 mg/L) (e)	0.01	0.01	<0.0001	0.0005	<0.0001	0.0012	0.00016	0.00051	0.000181	0.000053	0.000846	0.000265	0.00097	0.000365	
Dissolved Lithium (Li)	mg/L			0.008	0.0017	0.0038	0.0034	0.0056	0.00319	0.0034	0.0024	0.0024	0.0032	0.0013	0.004	0.0028	
Dissolved Magnesium (Mg)	mg/L				19.4	3.5	10.1	5.2	0.5	6.2	20.1	20.2	1.4	15.7	1.7	5.01	
Dissolved Manganese (Mn)	mg/L	0.8 - 3.4 (e)	0.05, AO	1.5	0.0070	2.06	3.36	1.49	0.17	2.93	3.19	3.63	0.672	0.0454	0.525	1.44	
Dissolved Mercury (Hg)	mg/L	0.0001, MAC	0.001	0.001	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.0000050	<0.0000050	0.0000086	<0.0000050	0.0000103	<0.0000050	
Dissolved Molybdenum (Mo)	mg/L	2	0.25	0.25	0.0042	0.0002	0.0008	0.0003	<0.00010	0.0003	0.0006	0.0007	0.0004	0.0028	0.0002	0.000359	
Dissolved Nickel (Ni)	mg/L	0.0250.15 (e)		0.08	0.0009	0.0193	0.0195	0.0405	0.00707	0.0457	0.0227	0.0154	0.0133	0.00125	0.0202	0.0202	
Dissolved Phosphorus (P)	mg/L	0.005 - 0.015 (for lakes only)	0.01, AO		0.020	0.030	<0.02	0.060	<0.050	<0.050	<0.050	<0.050	0.198	0.055	0.067	0.104	
Dissolved Potassium (K)	mg/L	373 - 432			2.26	0.62	1.85	1.35	0.25	1.20	2.05	2.80	0.41	1.59	0.74	0.856	
Dissolved Rubidium (Rb)	mg/L										0.0010	0.0012	0.0004	0.0004	0.0006	0.00038	
Dissolved Selenium (Se)	mg/L	0.002	0.01, MAC	0.01	0.00210	<0.0005	<0.0005	<0.0005	<0.00050	<0.00050	0.00011	0.00011	0.00015	0.00113	0.00016	0.000166	
Dissolved Silicon (Si)	mg/L				4.70	7.70	8.70	7.90	5.10	8.60	6.13	5.99	5.86	4.00	7.45	6.62	
Dissolved Silver (Ag)	mg/L	0.0010.003 (e)		0.02	<0.00005	<0.00005	<0.00005	<0.00005	<0.000050	<0.000050	0.00002	<0.000010	<0.000010	<0.000010	0.000057	<0.000010	
Dissolved Sodium (Na)	mg/L		<200, AO	200	105.0	7.0	8.8	11.2	6.1	10.1	11.2	12.3	7.6	87.3	9.7	10.1	
Dissolved Strontium (Sr)	mg/L			2.50	0.820	0.064	0.237	0.112	0.021	0.161	0.483	0.532	0.034	0.725	0.040	0.123	
Dissolved Sulphur (S)	mg/L				56.0	<1	2.0	<1	<3.0	<3.0	<0.50	0.8	<0.50	45.2	1.0	<0.50	
Dissolved Tellurium (Te)	mg/L				<0.0002	<0.0002	<0.0002	<0.0002	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	
Dissolved Thallium (Tl)	mg/L	0.0017			<0.00002	0.00002	0.00005	0.00002	<0.000020	0.000031	0.000018	0.000021	<0.000010	0.000011	0.000015	<0.000010	
Dissolved Thorium (Th)	mg/L				<0.0001	<0.0001	<0.0001	0.0003	<0.00010	0.00018	<0.00010	<0.00010	0.00044	<0.00010	0.00079	0.00023	
Dissolved Tin (Sn)	mg/L			2.5	<0.0002	<0.0002	<0.0002	<0.0002	<0.00020	<0.00020	0.00245	0.00149	0.00011	0.00016	0.00013	<0.00010	
Dissolved Titanium (Ti)	mg/L	2			<0.005	<0.005	<0.005	<0.005	<0.0050	<0.0050	<0.0030	0.00035	0.0191	0.00243	0.00888	0.00365	
Dissolved Tungsten (W)	mg/L			0.003							<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	
Dissolved Uranium (U)	mg/L	0.3	0.02	0.02	0.00352	0.00009	0.00046	0.00040	0.00006	0.00044	0.00247	0.00177	0.00060	0.00337	0.00072	0.000163	
Dissolved Vanadium (V)	mg/L	0.006		0.02	<0.001	<0.001	<0.001	0.002	<0.0010	0.0013	0.00141	0.0008	0.00282	0.00068	0.00242	0.00374	
Dissolved Zinc (Zn)	mg/L	0.033-0.266 (Hardness 90 - 400 mg/L) (e)	5 AO	3	0.005	0.007	0.007	0.12	0.0819	0.0132	0.0048	0.0124	0.0051	0.0068	0.0103	0.0029	
Dissolved Zirconium (Zr)	mg/L				<0.0001	0.0007	0.0002	0.0012	0.0004	0.00099	0.000864	0.000481	0.00202	<0.00020	0.00153	0.00181	

Parameters	Units	BC MoE Guidelines		BC CSR Standards	BH 4B												
		Freshwater Aquatic Life (1) (2)	Drinking Water (2) (3)	BC CSR-DW (4)													DRY
Date					26-May-15	16-Apr-16	7-Jul-16	25-Oct-16	24-Apr-17	14-Jun-17	30-May-18	11-Jul-18	17-Apr-19	13-Aug-19	20-Nov-19	31-Mar-20	22-Jun-20
Volatiles																	
Benzene	ug/L	40	5	5							<0.50						
Ethylbenzene	µg/L	200	140, 1.6 AO														
Methyl tbutyl ether (MTBE)	µg/L	3400	15 AO														
Styrene	µg/L																
Toluene	ug/L	0.5[k]	60, 24 AO	60							<0.45						
Xylene, m and p	µg/L																
Xylene, o	µg/L																
Xylenes, total	µg/L	30	90, 2 AO														
BTEX+Styrene, total	µg/L																
Hydrocarbons																	
EPH (C10C19)	µg/L																
EPH (C19C32)	µg/L																
TEH (C10C30), BC	µg/L																
VHw (C6C10)	µg/L																
VPHw	µg/L																

Notes:

2018 data compared to updated criteria

A shaded value means exceeded the freshwater aquatic life criteria

A shaded value means reading exceeded the drinking water quality criteria.

A shaded value means reading exceeded the CSR drinking water quality criteria.

A shaded value means exceeded more than one criteria.

A shaded value means reading had detection limit exceeding criteria.

A shaded value means reading exceeded the CSR drinking water quality criteria for sampling stations that trigger the Ground Water Quality Exceedances Response Plan

(AO Aesthetic Objective)

1. BC Environment Approved and Working Criteria for Water Quality, last updated March 2018
2. All criteria limits for BCWQG based on Total Metal Concentration except Aluminum, Cadmium, and Iron (Dissolved)
3. BC Environment Drinking Water Guidelines and Canadian Drinking Water Standards
4. BC Contaminated Sites Regulation for Drinking Water (BCCSRDW) Schedule 3.2 , last updated January 2019

c. Limit dependent on chloride concentration. (MAC Maximum Acceptable Concentration)
d. Limit pH and temperature dependent.
e. Limit dependant on hardness. Range given for hardness 50 to 1,000 mg/L.
f. Limit for chromium (IV)
g. Limit for total, no dissolved concentrations
h.copper (mg/L) =(0.094* Hardness)/1000
i. Limit for hardness based on total dissolved $CaCO_3$
j. BC Contaminated Sites Regulation for Drinking Water (BCCSRDW) Schedule 3.2 Stage 11 Amendments, last updated March 2019
k. Long Term Chronic criteria, average of 5 samples over 30 days not to exceed criteria

Table 3. Hazelton Groundwater Quality Data

Parameters	Units	BC MoE Guidelines		BC CSR Standards	BH 5B																	
		Freshwater Aquatic Life (1) (2)	Drinking Water (2) (3)	BC CSR-DW (4)																		
Date					7-Jul-14	26-May-15	16-Nov-15	16-Apr-16	7-Jul-16	25-Oct-16	24-Apr-17	14-Jun-17	30-May-18	11-Jul-18	11-Sep-18	17-Apr-19	13-Aug-19	20-Nov-19	30-Mar-20	22-Jun-20	25-Aug-20	9-Sep-20	21-Oct-20
Field																						
pH	pH	6.5 9.0	7.0 - 10.5									6.4				6.6	6.64	6.67	6.79				6.69
Conductivity	°C											1510	780	1409	1154	939	1031	1164	826			841	1096
Temperature	uS/cm											5.6	4.7	6	7.5	5.2	8.7	7.9	4			9.8	8.7
Water level	m											2.55	1.12	3.82	4.29	2.36	2.78	2.19	1.06			2.57	2.31
Analyte																						
Conductivity	uS/cm				1,700	128	1,880	1,740	1,990	1,360	1650	1620						1570	1620	1540	1350		1620
pH	pH units	6.5 9.0	7.0 - 10.5		7.1	6.9	7.3	6.8	6.9	7.2	6.5	6.8			7.73		7.94	8.01	8	7.15	7.25		7.11
Alkalinity (Total as CaCO3)	mg/L				784	540	800	710	910	330	560	560	232	795	801	650	452	592	570	565	380		535
Dissolved Hardness (CaCO3)	mg/L				756	239	853												750	711	636		713
Hardness, Total (Total as CaCO3)	mg/L							885	898	502	608	665	311	892	825	716	614	719					
Chloride (Cl)	mg/L	600	250, AO	250	140	114	177	204	198	259	243.0	236.0	21.4	244.0	205.0	163.0	226.0	215.0	210.0	221.0	212.0		226.0
Fluoride (F)	mg/L	0.4 - 1.87 (e)	1.5	1.5									0.119	<0.20	<0.20	<0.10	<0.10	<0.10	<0.200	<0.200	0.108		<0.100
Sulphate (SO4)	mg/L	128 - 429 (e)	<500, AO	500	3.5	5.5	10.4	2	2.2	21.6	1.1	1.4	23.3	<3.0	5.2	37.5	7.8	2	<3.00	14.4	17.9		3.32
Ammonia (N)	mg/L	0.68 - 28.7 (d)			0.29	<0.03	0.29	<0.03	<0.03	0.042	<0.03	<0.03	0.0302	0.0217	0.0486	0.0374	0.0285	0.078	0.0808	0.0527	0.0399		0.0268
Nitrate (N)	mg/L	32.8	10 MAC	10.0	<0.02	0.01	<0.01	0.014	<0.01	0.029	<0.01	<0.01	<0.0050	<0.050	<0.050	<0.025	<0.025	<0.025	<0.0500	<0.0500	<0.0250		<0.0250
Nitrite (N)	mg/L	0.06 - 0.6 (c)	1.0	1	<0.01	<0.01	<0.01	<0.01	0.016	<0.01	<0.01	<0.01	<0.0010	<0.010	<0.010	<0.0050	<0.0050	<0.0050	<0.0100	<0.0100	<0.0050		<0.0050
Nitrate+Nitrite (N)	mg/L			10		0.013	<0.010	0.014	<0.010	0.029	<0.010	<0.010	<0.006	<0.060	<0.060								
Total Kjeldahl Nitrogen (N)	mg/L				1.060	0.580	2.630											1.610	0.675	0.588	0.510		0.282
Misc. Organics																						
Chemical Oxygen Demand	mg/L				62	59	164	58	49	48	60.00	60.00	220.00	50.00	31.00	35	47	31	66	58	64		<20
Biochemical Oxygen Demand	mg/L																						
Total Organic Carbon (C)	mg/L															13.10	10.10	9.35	18.10	13.60	7.37		5.69
Dissolved Metals																						
Dissolved Aluminum (Al)	mg/L	0.023 - 0.1 (b,c)	9.5	9.5	<0.003	<0.005	<0.005	<0.005	<0.005	0.007	<0.0050	0.0154	0.0076	0.0054	0.0024	0.018	0.0098	0.0072	0.0037	0.12	0.0763		0.0031
Dissolved Antimony (Sb)	mg/L	0.009	0.006	0.006	<0.005	0.0005	0.0002	0.0003	0.0003	0.0006	0.00041	0.00056	0.00015	0.00031	0.00023	0.00026	0.00021	0.00011	0.00055	0.00039	0.00047		0.00025
Dissolved Arsenic (As)	mg/L	0.005	0.01 MAC	0.01	0.00346	<0.0005	0.01020	0.00410	0.00240	0.00410	0.00230	0.00394	0.00111	0.00918	0.01130	0.00570	0.00626	0.00773	0.0173	0.01490	0.0046		0.00531
Dissolved Barium (Ba)	mg/L	1	1	1	0.179	0.032	0.336	0.196	0.179	0.639	0.2810	0.1550	0.0658	0.2890	0.2880	0.246	0.252	0.281	0.333	0.307	0.228		0.248
Dissolved Beryllium (Be)	mg/L	0.00013		0.008	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.000100	<0.000100		<0.000100
Dissolved Bismuth (Bi)	mg/L				<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.00010	<0.00010	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050		<0.000050
Dissolved Boron (B)	mg/L	1.20	5.0, MAC	5.00	<0.05	0.07	0.024	0.014	0.015	0.048	0.027	0.014	0.015	0.01	0.015	0.016	0.012	0.015	0.014	0.014	0.01		0.013
Dissolved Cadmium (Cd)	mg/L	0.00029 - 0.0028 (Hardness 50-455 mg/L) (e) (k)	0.005	0.005	0.000041	0.000320	0.000020	0.000010	0.000100	0.000270	0.000089	0.000051	0.000019	0.000117	<0.0000050	0.0000198	0.0000295	0.0000611	<0.0000050	0.0000373	0.000116		0.0000169
Dissolved Calcium (Ca)	mg/L	<4 sensitive to acid input			205	70	220	228	236	126	162	180	71	229	205	183	154	188	187	181	172		192
Dissolved Cesium (Cs)	mg/L												<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.00002	<0.000010		<0.000010
Dissolved Chromium (Cr)	mg/L	0.001 (e, f)	0.05, MAC	0.05 (VI), 6 (III)	<0.0010	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.00050	<0.00050	<0.00010	<0.00010	<0.00010	<0.00010	0.00011	<0.00010	<0.00010	0.0001	<0.00010		<0.00010
Dissolved Cobalt (Co)	mg/L	0.11		0.001	0.0134	<0.00005	0.0121	0.0183	0.0368	0.0108	0.013	0.013	0.011	0.00645	0.00301	0.00958	0.00483	0.00409	0.00341	0.00394	0.00582		0.00533
Dissolved Copper (Cu)	mg/L	0.0032 - 0.0396 (e)	1.0, AO	1.5	<0.0050	0.0027	0.0014	0.0014	<0.0002	0.0133	0.02670	0.00024	0.00235	0.00050	0.00026	0.0004	0.00041	0.00116	<0.00020	0.00077	0.00059		0.00082
Dissolved Iron (Fe)	mg/L	0.35	0.3, AO	6.5	0.109	<0.010	13.0	15.8	0.017	2.3	5.1	10.7	0.02	10.9	12.4	7.42	7.06	12.2	15.3	9.95	0.975		3.91
Dissolved Lead (Pb)	mg/L	0.034 - 0.40 (Hardness 50 - 350 mg/L) (e)	0.01	0.01	<0.0002	<0.0001	<0.0001	0.0002	<0.0001	<0.0001	<0.00010	<0.00010	0.000089	<0.000050	<0.000050	<0.000050	0.00009	0.00005	<0.000050	0.00019	0.00015		<0.000050
Dissolved Lithium (Li)	mg/L			0.008	<0.005	0.0018	0.0031	0.0025	0.0033	0.0025	0.00207	0.00237	0.002	0.0028	0.0029	0.002	0.002	0.002	0.0033	0.003	0.0026		0.0028
Dissolved Magnesium (Mg)	mg/L				59.0	15.6	74.1	76.5	75.2	45.3	49.5	52.5	32.4	77.6	76.0	63.1	55.8	60.6	68.7	62.8	50.2		57
Dissolved Manganese (Mn)	mg/L	0.8 - 3.4 (e)	0.05, AO	1.5	4.57	0.0135	5.35	5.98	5.96	2.38	5.07	5.81	1.74	5.01	4.51	1.83	2.98	3.62	4.08	3.15	1.35		2.76
Dissolved Mercury (Hg)	mg/L	0.0001, MAC	0.001	0.001	<0.00001	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	0.0000082	<0.0000050	<0.0000050	<0.0000050	0.0000062	<0.0000050	<0.0000050	<0.0000050	<0.0000050		<0.0000050
Dissolved Molybdenum (Mo)	mg/L	2	0.25	0.25	0.0036	0.0063	0.0073	0.0019	0.0025	0.0016	0.0016	0.0004	0.0047	0.0011	0.0011	0.00093	0.000282	0.00025	0.00463	0.00233	0.000924		0.000526
Dissolved Nickel (Ni)	mg/L	0.0250.15 (e)		0.08	0.0141	0.0008	0.0173	0.0233	0.0306	0.0284	0.0183	0.0195	0.00381	0.00811	0.00513	0.01410	0.00430	0.00332	0.00644	0.00768	0.0118		0.0094
Dissolved Phosphorus (P)	mg/L	0.005 - 0.015 (for lakes only)	0.01, AO		<0.01	0.03	<0.02	<0.02	<0.02	<0.02	<0.050	<0.050	<0.050	<0.050	0.111	<0.050	0.135	0.145	0.113	0.082	0.055		0.117
Dissolved Potassium (K)	mg/L	373 - 432			4.22	2.65	5.39	4.39	4.36	4.78	2.41	2.50	2.13	3.58	3.37	3.26	3.32	3.59	3.52	3.45	3.76		3.83
Dissolved Rubidium (Rb)	mg/L												0.00	0.00	0.00	0.00047	0.00066	0.0006	0.00054	0.00062	0.00107		0.00072
Dissolved Selenium (Se)	mg/L	0.002	0.01, MAC	0.01	<0.0001	0.0012	<0.0005	<0.0005	<0.0005	<0.0005	<0.00050	<0.00050	0.00011	0.00011	0.00009	0.000401	0.00233	0.000158	<0.000050	0.000107	0.000091		<0.000050
Dissolved Silicon (Si)	mg/L				8.89	4.60	9.60	11.10	10.70	9.10	9.50	11.30	3.21	10.10	8.75	6.73	7.83	8.51	8.69	8.26	7.63		7.89
Dissolved Silver (Ag)	mg/L	0.0010.003 (e)		0.02	<0.00002	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.000050	<0.000050	<0.000010	<0.000010	0.000028	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010		<0.000010
Dissolved Sodium (Na)	mg/L		<200, AO	200	77.0	105.0	115.0	111.0	105.0	113.0	94.8	94.5	12.4	106.0	95.7	89.900	87.900	84.900	83.1	79.700	79.4		74.9
Dissolved Strontium (Sr)	mg/L			2.50	1.61	0.89	1.67	1.68	1.69	1.06	1.040	1.230	0.713	1.680	1.700	1.55	1.27	1.55	1.64	1.49	1.18		1.38
Dissolved Sulphur (S)	mg/L				<3.0	75	1	<1	3	9	<3.0	<3.0	8.8	1.2	3.1	19.5	6.07	1.09	0.88	5.41	6.22		2.04
Dissolved Tellurium (Te)	mg/L					<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020		<0.00020
Dissolved Thallium (Tl)	mg/L	0.0017			<0.00005	<0.00002	<0.00002	<0.00002	0.00004	<0.00002	<0.000020	0.000021	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000052		0.000038
Dissolved Thorium (Th)	mg/L					<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010		<0.00010
Dissolved Tin (Sn)	mg/L			2.5	<0.005	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.00020	<0.00020	<0.00010	<0.00010	<0.00010	<0.00010	0.000	0.000	<0.00010	<0.00010	<0.00010		<0.00010
Dissolved Titanium (Ti)	mg/L	2			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0050	<0.0050	<0.00030	<0.00030	<0.00030	0.00033	0.00031	<0.00030	<0.00030	<0.00300	0.0014		<0.00030
Dissolved Tungsten (W)	mg/L			0.003									<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010		<0.00010
Dissolved Uranium (U)	mg/L	0.3	0.02	0.02	0.00063	0.00231	0.00210	0.00047	0.00051	0.00235	0.00070	0.00108	0.00065	0.00175	0.00221	0.00500	0.00245	0.00137	0.00207	0.00441	0.00336		0.00245
Dissolved Vanadium (V)	mg/L	0.006		0.02	<0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0010	<0.0010	<0.00050	<0.00050	<0.00050	<0.00050	0.001	<0.00050	0.0009	0.001	0.001		<0.00050
Dissolved Zinc (Zn)	mg/L	0.033-0.266 (Hardness 90 - 400 mg/L) (e)	5 AO	3	<0.005	<0.004	0.032	<0.004	0.005	0.211	0.0953	0.0054	0.002	0.0079	0.0017	0.0026	0.0016	0.0065	<0.0010	0.0027	0.004		0.0035
Dissolved Zirconium (Zr)	mg/L				<0.0005	<0.0001	0.0011	0.0002	0.0001	0.0002	0.00019	0.00023	<0.000060	0.000536	0.000496	0.000286	0.00047	0.00039	0.0005	0.00041	0.00032		<0.00020

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		Freshwater Aquatic Life (1) (2)	Drinking Water (2) (3)	BC CSR-DW (4)																	
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Volatiles																							
Benzene	ug/L	40	5	5	<0.4								<0.50							<0.50	<0.50		<0.50
Ethylbenzene	µg/L	200	140, 1.6 AO																	<0.50	<0.50		<0.50
Methyl tbutyl ether (MTBE)	µg/L	3400	15 AO																	<0.50	<0.50		<0.50
Styrene	µg/L																			<0.50	<0.50		<0.50
Toluene	ug/L	0.5[k]	60, 24 AO	60	<0.4								2.91							<0.50	<0.50		<0.50
Xylene, m and p	µg/L																			<0.50	<0.50		<0.50
Xylene, o	µg/L																			<0.50	<0.50		<0.50
Xylenes, total	µg/L	30	90, 2 AO																	<0.75	<0.75		<0.75
BTEX+Styrene, total	µg/L																			<1.5			
Hydrocarbons																							
EPH (C10C19)	µg/L																			<250	<250		<250
EPH (C19C32)	µg/L																			<250	<250		<250
TEH (C10C30), BC	µg/L																			<250			
VHw (C6C10)	µg/L																			<100	<100		<100
VPHw	µg/L																			<100	<100		<100

Notes:

2018 data compared to updated criteria

A shaded value means exceeded the freshwater aquatic life criteria

A shaded value means reading exceeded the drinking water quality criteria.

A shaded value means reading exceeded the CSR drinking water quality criteria.

A shaded value means exceeded more than one criteria.

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(AO Aesthetic Objective)

1. BC Environment Approved and Working Criteria for Water Quality, last updated March 2018
2. All criteria limits for BCWQG based on Total Metal Concentration except Aluminum, Cadmium, and Iron (Dissolved)
3. BC Environment Drinking Water Guidelines and Canadian Drinking Water Standards
4. BC Contaminated Sites Regulation for Drinking Water (BCCSRDW) Schedule 3.2 , last updated January 2019

c. Limit dependent on chloride concentration. (MAC Maximum Acceptable Concentration)
d. Limit pH and temperature dependent.
e. Limit dependant on hardness. Range given for hardness 50 to 1,000 mg/L.
f. Limit for chromium (IV)
g. Limit for total, no dissolved concentrations
h.copper (mg/L) =(0.094* Hardness)/1000
i. Limit for hardness based on total dissolved $CaCO_3$

j. BC Contaminated Sites Regulation for Drinking Water (BCCSRDW) Schedule 3.2 Stage 11 Amendments, last updated March 2019
k. Long Term Chronic criteria, average of 5 samples over 30 days not to exceed criteria

Table 4. Wetland #4 Water Quality Data

Parameters	Units	BC MOE QC Criteria	BC MoE Guidelines (a) Freshwater Aquatic Life	BC MoE Guidelines (a) Drinking Water	Wetland 4	Wetland 4	Wetland 4	Wetland 4	Wetland 4	Wetland 4	Wetland 4 DUP	Wetland 4	Wetland 4	Wetland 4	Wetland 4	Wetland 4	Wetland 4	Wetland 4	Wetland 4	Wetland 4
Date					13-Sep-18	22-Jul-19	31-Jul-19	7-Aug-19	22-Aug-19	16-Sep-19	16-Sep-19	12-Nov-19	28-Mar-20	11-May-2020	25-Jun-2020	30-Jul-2020	20-Aug-2020	09-Sep-2020	22-Oct-2020	12-Nov-2020	22-Dec-2020
Field																				
Conductivity	uS/cm	-												407.8	516	593	376.5	470	453.5	432.4	465.9
SPC	uS/cm	-												524.5	605	635	465.4	575.7	748	778.7	806.9
pH	pH	**6.5 - 8.5**	6.5 - 9.0	7.0 - 10.5										7.7	7.35	7.59	6.92	6.74	7.2	7.77	7.42
Temperature	°C	-												13.3	17.2	21.5	15.1	15.4	5.8	3.3	2.9
Dissolved Oxygen	mg/L	-												12.1	3.2	8.9	4.1	1.9	3.6	2.2	5.5
Turbidity	NTU	-												7.8	-	-	3.12	4.03	2.68	0.79	0.55
ORP	mV	-												293.6	364.3	301.5	354.4	334.4	240.6	191.3	255.3
Discharge Rate	L/s														0.2		1	1.5	0.5	0.25	0.24
Physical Tests	Units																				
Alkalinity (Total as CaCO3)	mg/L		-	-	518	261	259	263	262	284	283	193	30	205	240	245	233	259	323	323	213
Conductivity	uS/cm		-	-		-	-	645	-			532		520	612	673	560	585	739	730	525
Total Hardness	mg/L		-	-	390	250	236	248	249	293	290	191	23.6	213	232	241	209	238	300	281	269
pH	pH Units	6.5 - 8.5	6.5 - 9.0	7.0-10.5	7.90	8.35	8.57	8.40	8.46	8.16	8.15	8.23	7.03	7.97	8.17	8.24	8.01	7.59	8.1	7.9	8.27
Turbidity	NTU														2.76	-	-	-	-	-	-
Dissolved Oxygen (DO)	mg/L					3.4	2.3	3	4.8	4.1		1.2									
Anions and Nutrients																					
Total Kjeldahl Nitrogen	mg/L	60	-	-									0.418	0.661	0.517	1.07	0.689	1.07	3.06	2.46	2.97
Ammonia (N)	mg/L	30	0.681-28.7 (d)	-	8.61	0.244	0.166	0.0877	0.131	2.81	2.71	0.0912	0.15	0.0099	0.0245	0.0967	0.0167	0.396	2.26	1.89	2.3
Bromide (Br)	mg/L													0.239	0.275	0.214	-	0.227	0.256	<0.250	0.187
Chloride (Cl)	mg/L	3750	600	250, AO	286	59.5	58.6	58.8	54.8	103	103	43.5	5.7	42.7	49.6	52.2	40.0	41.3	48.2	47.0	37.3
Fluoride (F)	mg/L												<0.020	0.093	0.109	0.098	0.098	0.097	<0.100	<0.100	0.078
Nitrate (N)	mg/L		32.8	10 MAC	0.072	0.0191	0.007	<0.0050	0.094	0.145	0.141	1.02	0.103	0.376	0.297	0.343	0.242	0.724	0.803	0.106	0.249
Nitrite (N)	mg/L		0.06 -0.6 (c)	1.0	0.114	0.0015	<0.0010	<0.0010	0.0054	0.0404	0.0425	0.0129	0.0021	0.0051	0.0056	0.129	0.0066	0.0336	0.0222	<0.0050	0.0081
Nitrate plus Nitrite (N)	mg/L		-	-	0.186	-	-	1.29	1.36	3.75	3.92	1.51		1.04	0.82	1.54	0.938	1.83	3.88	2.69	3.23
Orthophosphorous	mg/L					0.0019	<0.0010	<0.0010	<0.0010	0.0022	0.0045	0.0056	0.0033	0.0011	0.0016	0.0014	<0.0010	0.0022	<0.0010	0.0013	<0.0010
Sulphate (SO4)	mg/L		128 - 429 (e)	500, AO	17.2	9.43	7.64	8.34	10.7	24.5	24.7	22.5	1.62	12.8	14.9	9.76	6.37	8.77	6.43	6.55	5.69
Organic / Inorganic Carbon																					
Total Organic Carbon (C)	mg/L		+/- 20% of background	4.0	52	23	20	20	16	15	17	10	3.6	8.4	12.3	12.8	11.2	9.4	9.8	10.3	8.1
TSS	mg/L		25 mg/L (background 25-250 mg/l)) (i)	<500, AO																	
Total Metals																					
Total Aluminum	mg/L		0.023 - 0.1 (b,c)	9.5	0.53	0.69	0.13	0.06	0.18	0.11	0.16	0.64	0.105	0.156	0.11	0.058	0.155	0.0574	0.0274	0.0097	0.0115
Total Antimony (Ab)	mg/L		0.270	0.006	0.00085	0.00028	0.00026	0.00023	0.00018	0.00023	0.00022	0.00025	<0.00010	0.00019	0.00022	0.00026	0.0002	0.00022	0.00022	0.00022	0.00019
Total Arsenic (As)	mg/L		0.005	0.01 MAC	0.0278	0.00764	0.0054	0.00489	0.00278	0.00201	0.00204	0.00121	0.00038	0.00107	0.00086	0.00116	0.00094	0.00094	0.00084	0.00104	0.00083
Total Barium (Ba)	mg/L		1	1.0	0.953	0.122	0.111	0.104	0.104	0.118	0.112	0.0718	0.0105	0.0538	0.0658	0.0554	0.0348	0.0607	0.0893	0.0772	0.0721
Total Beryllium (Be)	mg/L		0.00013	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Total Bismuth (Bi)	mg/L		-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Total Boron (B)	mg/L		1.2	5.0, MAC	2.42	0.592	0.533	0.575	0.48	0.556	0.547	0.251	0.024	0.228	0.363	0.404	0.301	0.307	0.336	0.314	0.193
Total Cadmium (Cd)	mg/L	0.1	0.00029 - 0.0028 (Hardness 50-455 mg/L) (e) (k)	0.005, MAC	0.00001	0.00002	<0.0000050	0.00001	0.00001	0.00001	0.00001	0.00002	0.0000636	0.0000186	0.00001	0.0000104	0.0000095	0.000038	0.0000226	0.0000752	0.000121
Total Calcium (Ca)	mg/L		<4 sensitive to acid input	-	69.2	66.2	62.9	66.2	66.6	83	80.7	52.7	6.54	63.1	67.4	66.4	60.4	71	88.8	83.3	80.5
Total Cesium (Cs)	mg/L		-	-	0.000085	0.000055	0.000011	<0.000010	0.000015	0.000024	0.000027	0.000054	0.000020	0.000014	0.000012	0.000012	0.000016	0.000012	0.000016	0.000011	<0.000010
Total Chromium (Cr)	mg/L		0.001 (f)	0.05, MAC	0.0022	0.0008	0.0003	0.0002	0.0003	0.0003	0.0004	0.0006	0.00020	0.00028	0.0003	0.00026	0.00028	0.00029	0.00046	0.00044	0.00033
Total Cobalt (Co)	mg/L		0.11	-	0.002	0.00088	0.00049	0.00038	0.00032	0.0007	0.0006	0.00045	0.00020	0.00044	0.00024	0.00031	0.00019	0.0003	0.00044	0.00126	0.00194
Total Copper (Cu)	mg/L		0.0032-0.0396 (e)	1.0, AO	0.00197	0.0019	0.0008	0.00075	0.00122	0.00173	0.00173	0.00278	0.00141	0.00199	0.00335	0.00151	0.0016	0.00181	0.00122	0.00204	0.00162
Total Iron (Fe)	mg/L	4.5	1	0.3, AO	2.17	1.93	1.02	0.68	0.53	0.35	0.34	0.57	0.09	0.21	0.10	0.05	0.17	0.37	0.33	0.14	0.05
Total Lead (Pb)	mg/L		0.034 - 0.40 (Hardness 50 - 350 mg/L) (e)	0.01	0.00022	0.000336	0.00016	0.00009	0.00013	0.000091	0.000091	0.000173	0.000068	0.000053	0.000052	<0.000050	0.00005	<0.000050	<0.000050	<0.000050	<0.000050
Total Lithium (Li)	mg/L		-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Magnesium (Mg)	mg/L		-	-	49.5	20.6	19.2	20	20	20.9	21.4	14.5	1.78	13.4	15.5	18.4	14.2	14.8	18.9	17.7	16.5
Total Manganese (Mn)	mg/L		0.8-3.4 (e)	0.05, AO	2.1	1.3	0.8	0.6	0.1	0.6	0.1	0.2	0.18	0.127	0.033	0.013	0.0194	0.269	0.416	1.95	3.87
Total Mercury (Hg)	mg/L.		0.0001	0.001	0.000008	0.000007	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	0.000007	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	0.0000134	0.0000057
Total Molybdenum (Mo)	mg/L		2	0.25	0.00264	0.00158	0.0013	0.00109	0.001	0.00121	0.00134	0.00081	0.00023	0.000927	0.00146	0.00163	0.00113	0.00064	0.000533	0.000694	0.000739
Total Nickel (Ni)	mg/L		0.025 - 0.15 (e)	-	0.0173	0.00461	0.00373	0.00359	0.00356	0.00438	0.00463	0.00261	<0.00050	0.00237	0.00239	0.00367	0.00241	0.0026	0.00362	0.00351	0.00256
Total Phosphorus (P)	mg/L		0.005-0.015 (for lakes only)	0.01, AO	0.222	0.075	<0.050	<0.050	0.051	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Total Potassium (K)	mg/L		-	-	38.8	8.93	8.53	7.92	7.13	8.9	9.39	5.4	1.06	5.07	4.8	7	5.47	5.91	9.3	7.28	7.2
Total Rubidium (Rb)	mg/L				0.00559	0.00113	0.00077	0.00073	0.00084	0.00182	0.00203	0.00088	0.00025	0.00066	0.00042	0.00133	0.00084	0.00117	0.00187	0.00082	0.00058
Total Selenium (Se)	mg/L		0.002	0.01, MAC	0.000223	0.000179	0.000133	8.10E-05	0.000118	0.000172	0.000134	0.000109	<0.000050	0.000091	0.00014	0.000129	0.000056	0.00007	0.000093	0.000098	0.000081
Total Silicon (Si)	mg/L		-	-	7.31	4.1	2.78	2.73	2.87	2.92	3.17	3.33	0.49	0.97	2.3	0.34	1.1	2	2.82	3.22	3.79
Total Silver (Ag)	mg/L		0.0001-0.003 (e)	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000044	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Total Sodium (Na)	mg/L		-	<200, AO	225	45.8	42.7	43.3	43.1	52.1	56.1	31	3.52	28.4	36.4	50.1	33.4	35	43.4	40.3	26.2
Total Strontium (Sr)	mg/L		-	-	0.867	0.535	0.514	0.508	0.485	0.652	0.638	0.38	0.0468	0.384	0.451	0.473	0.375	0.464	0.599	0.534	0.532
Total Sulphur (S)	mg/L		-	-	8.54	4.12	3.5	3.3	4.62	9.79	9.97	7.63	0.87	5.62	5.82	4.5	2.81	4.02	3.13	2.66	2.32
Total Tellurium (Te)	mg/L			-	<0.00020	<0.00020	<0.00020	0.00021	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	0.00026
Total Thallium (Tl)	mg/L		0.0008	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000028	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Total Thorium (Th)	mg/L		-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Total Tin (Sn)	mg/L		-	-	0.00017	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Total Titanium (Ti)	mg/L		-	-	0.00014	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00159	0.00351	0.00206	0.00127	<0.00300	0.00071	0.00052	<0.00030	<0.00030
Total Tungsten (W)	mg/L				0.00807	0.0123	0.00207	0.00105	0.00257	<0.0015	<0.0024	0.011	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Total Uranium (U)	mg/L		0.0085	0.02	0.000631	0.000349	0.000287	0.00028	0.000325	0.000487	0.000508	0.00043	0.000036	0.000369	0.000505	0.000447	0.000343	0.000286	0.00031	0.000312	0.000242
Total Vanadium (V)	mg/L		-	-	0.004	0.002	0.001	0.001	0.001	<0.00050	0.001	0.002	<.00050	0.00071	0.001	<0.00050	0.00051	<0.00050	<0.00050	<0.00050	<0.00050
Total Zinc (Zn)	mg/L	75	0.033-0.266 (Hardness 90 - 400 mg/L) (e)	5.0, AO	0.0049	0.004	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.165	<0.0030	<0.0030	<0.0030	<0.0030	0.0041	0.0036	0.0037	0.0049
Total Zirconium (Zr)	mg/L		-	-	0.000425	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020

Parameters	Units	BC MOE OC Criteria	BC MoE Guidelines (a) Freshwater Aquatic Life	BC MoE Guidelines (a) Drinking Water	Wetland 4	Wetland 4	Wetland 4	Wetland 4	Wetland 4	Wetland 4	Wetland 4 DUP	Wetland 4	Wetland 4	Wetland 4	Wetland 4	Wetland 4	Wetland 4	Wetland 4	Wetland 4	Wetland 4
Date					13-Sep-18	22-Jul-19	31-Jul-19	7-Aug-19	22-Aug-19	16-Sep-19	16-Sep-19	12-Nov-19	28-Mar-20	11-May-2020	25-Jun-2020	30-Jul-2020	20-Aug-2020	09-Sep-2020	22-Oct-2020	12-Nov-2020	22-Dec-2020
Aggregate Organics																					
BOD	mg/L		-	-		2.7	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.3	<2.0	<2.0	<2.0	<2.0	2.3
Chemical Oxygen Demand	mg/L		-	-		69	82	45	43	51	56	28	22	22	27	47	40	40	22	28	<20
Volatiles																					
Benzene	ug/L	40 (a)	5 (a)	5		<0.50				>100					<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Ethylbenzene	µg/L					<0.50									<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Methyl t-butyl ether (MTBE)	µg/L					<0.50									<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Styrene	µg/L					<0.50									<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Toluene	ug/L	0.5 (a)	-	60		<0.45									<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Xylene, m- and p-	µg/L					<0.50									<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Xylene, o-	µg/L					<0.50									<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Xylenes, total	µg/L					<0.75									<0.75	<0.75	<0.75	<0.75	<0.75	<0.75	<0.75
BTEX+Styrene, total	µg/L														<1.5						
Hydrocarbons																					
EPH (C10-C19)	µg/L														<250	<250	<250	<250	<250	<250	<250
EPH (C19-C32)	µg/L														<250	<250	<250	<250	<250	<250	<250
TEH (C10-C30), BC	µg/L														<250		<250				
VHw (C6-C10)	µg/L														<100	<100	<100	<100	<100	<100	<100
VPHw	µg/L														<100	<100	<100	<100	<100	<100	<100
Lethal Toxicity Testing																					
LC-50	%v/v	>100%											>100%	>100%		>100%			>100%		

Notes:

A shaded value means exceeded the freshwater aquatic life criteria
A shaded value means reading exceeded the drinking water quality criteria.
A shaded value means exceeded both the aquatic life and drinking water criteria.
A shaded value means exceeded the OC discharge criteria.
A shaded value means reading had detection limit exceeding criteria.

(AO - Aesthetic Objective)
1. BC Environment Approved and Working Criteria for Water Quality, last updated March 2018
2. All criteria limits for BCWQG - based on Total Metal Concentration except Aluminum and Cadmium (Dissolved)
3. BC Environment Drinking Water Guidelines and Canadian Drinking Water Standards
4. BC Contaminated Sites Regulation for Drinking Water (BC-CSR-DW) Schedule 3.2, last updated January 2019
c. Limit dependent on chloride concentration. (MAC - Maximum Acceptable Concentration)
d. Limit pH and temperature dependent.
e. Limit dependant on hardness. Range given for hardness 50 to 1,000 mg/L.
f. Limit for chromium (IV)
g. Limit for total, no dissolved concentrations
h.copper (mg/L) =(0.094* Hardness)/1000
i. Limit for hardness based on total dissolved CaCO3

Table 5: Hazelton Surface Water Quality Data QA/QC

Parameters	Units	BC MoE Guidelines: Freshwater Aquatic Life (1) (2)	BC MoE Guidelines: Drinking Water (2) (3)	Laboratory Detection Limit	SW01 E309751			SW-05 - E287409			SW-09 - E310968		
Date					30-Sep-20	DUP	RPD	20-Aug-20	DUP	RPD	24-Jun-20	DUP	RPD
Conductivity	uS/cm	-	-	2.0	**53.2**	**53.4**	0.4%	**163**	**162**	0.6%	**231**	**233**	0.9%
pH	pH Units	6.5 - 9.0	7.0-10.5	0.10	**7.08**	**7.11**	0.4%	**6.7**	**6.7**	0.0%	**6.74**	**6.83**	1.3%
Alkalinity (Total as CaCO3)	mg/L	-	-	1.00	**22.8**	**22.2**	2.7%	**33.6**	**34**	1.2%	**32.6**	**30.7**	6.0%
Dissolved Hardness (CaCO3)	mg/L	-	-	0.60	**25.8**	**26.6**	3.1%	**42.7**	**42.5**	0.5%	**56.4**	**57.6**	2.1%
Hardness, Total (Total as CaCO3)	mg/L	-	-	0.60	**26**	**26.1**	0.4%	**41.7**	**41.8**	0.2%	**64.9**	**71.2**	9.3%
Chloride (Cl)	mg/L	600	250, AO	0.50	0.64	0.62	3.2%	**26.8**	**26.5**	1.1%	**47.3**	**47.3**	0.0%
Fluoride (F)	mg/L	0.4-1.87 (e)	1.5	0.020	0.035	0.033	5.9%	0.047	0.047	0.0%	0.032	0.032	0.0%
Sulphate (SO4)	mg/L	128-429 (e)	500, AO	0.30	**<0.30**	**<0.30**		<0.30	<0.30		<0.30	<0.30	
Ammonia (N)	mg/L	0.681-28.7 (d)	-	0.0050	0.0209	0.0204	2.4%	0.0143	0.0149	4.1%	**0.0298**	**0.0352**	16.6%
Nitrate (N)	mg/L	32.8	10 MAC	0.0050	0.0051	<0.0050		<0.0050	<0.0050		<0.0010	0.0102	
Nitrite (N)	mg/L	0.06 -0.6 (c)	1.0	0.0010	<0.0010	<0.0010		<0.0010	<0.0010		<0.0050	0.0019	
Nitrate plus Nitrite (N)	mg/L	-	-					-	-			-	
Total Kjeldahl Nitrogen	mg/L	-	-	0.050	**0.369**	**0.637**	53.3%	**1.22**	**1.27**	4.0%	**1.25**	**1.5**	18.2%
Total Phosphorous (P)	mg/L	-	0.01										
Total Suspended Solids	mg/L	25 mg/L (background 25-250 mg/l)) (i)	<500, AO					-	-			-	
Field pH	pH Units	6.5 - 9.0	7.0-10.5										
Misc. Organics													
Chemical Oxygen Demand (COD)	mg/L	-	-	20	61	57	6.8%	**105**	**102**	2.9%	**102**	**111**	8.5%
Biological Oxygen Demand (BOD)	mg/L	-	-					-	-			-	
Dissolved Organic Carbon (C)	mg/L												
Total Organic Carbon (C)	mg/L	+/- 20% of background	4.0	0.50	**21.5**	**22.4**	4.1%	**35.8**	**37.9**	5.7%	**37.5**	**40.3**	7.2%
Dissolved Metals													
Dissolved Aluminum (Al)	mg/L	0.1	0.2	0.0010	**0.335**	**0.34**	1.5%	**0.201**	**0.208**	3.4%	**0.134**	**0.133**	0.7%
Dissolved Antimony (Sb)	mg/L	0.02	0.006, MAC	0.00010	<0.00010	<0.00010		<0.00010	<0.00010		<0.00010	<0.00010	
Dissolved Arsenic (As)	mg/L	0.005	0.025 MAC	0.00010	**0.00059**	**0.00063**	6.6%	**0.0009**	**0.00083**	8.1%	**0.00188**	**0.00176**	6.6%
Dissolved Barium (Ba)	mg/L	5	1.0, MAC	0.00010	**0.0142**	**0.0149**	4.8%	**0.0179**	**0.0176**	1.7%	**0.0239**	**0.0242**	1.2%
Dissolved Beryllium (Be)	mg/L	0.0053 (g)	0.004	0.000100	<0.000100	<0.000100		<0.000100	<0.000100		<0.000100	<0.000100	
Dissolved Bismuth (Bi)	mg/L	-	-	0.000050	<0.000050	<0.000050		<0.000050	<0.000050		<0.000050	<0.000050	
Dissolved Boron (B)	mg/L	1.20	5.0, MAC	0.010	<0.010	<0.010		**<0.010**	**<0.010**		**<0.010**	**<0.010**	
Dissolved Cadmium (Cd)	mg/L	0.00029 - 0.0028 (Hardness 50-455 mg/L) (e) (k)	5, MAC	0.0000050	0.0000151	0.0000122	21.2%	0.0000052	0.0000075	36.2%	0.000011	0.0000193	54.8%
Dissolved Calcium (Ca)	mg/L	4-8 (Sensitive to acid inputs)	-	0.050	**7.44**	**7.74**	4.0%	**13**	**13**	0.0%	**16.7**	**17.4**	4.1%
Dissolved Cesium (Cs)	mg/L			0.000010	<0.000010	<0.000010		<0.000010	<0.000010		<0.000010	<0.000010	
Dissolved Chromium (Cr)	mg/L	0.001 (f)	0.05, MAC	0.00010	**0.00052**	**0.0005**	3.9%	**0.0005**	0.00048	4.1%	0.0004	0.00045	6.9%
Dissolved Cobalt (Co)	mg/L	0.11	-	0.00010	0.0003	0.0003	0.0%	0.00038	0.00038	0.0%	**0.00118**	**0.00121**	2.5%
Dissolved Copper (Cu)	mg/L	0.007-0.05 (e)	0.5	0.00020	**0.00272**	**0.00278**	2.2%	0.00072	0.00067	7.2%	0.00091	0.00073	22.0%
Dissolved Iron (Fe)	mg/L	0.35	<0.3, AO	0.010	**0.434**	**0.459**	5.6%	**0.886**	**0.891**	0.6%	**1.94**	**1.92**	1.0%
Dissolved Lead (Pb)	mg/L	0.034 - 0.40 (Hardness 50 - 350 mg/L) (e)	50, MAC	0.000050	0.000073	0.000064	13.1%	0.0001	0.000109	8.6%	0.0	0.000074	6.5%
Dissolved Lithium (Li)	mg/L			0.0010	<0.0010	<0.0010		<0.0010	<0.0010		<0.0010	<0.0010	
Dissolved Magnesium (Mg)	mg/L	-	700	0.0050	**1.74**	**1.76**	1.1%	**2.48**	**2.46**	0.8%	**3.54**	**3.43**	3.2%
Dissolved Manganese (Mn)	mg/L	0.8-3.8 (e)	<0.05, AO	0.00010	**0.0419**	**0.0434**	3.5%	**0.0716**	**0.0697**	2.7%	**0.549**	**0.565**	2.9%
Dissolved Mercury (Hg)	mg/L	0.0001, MAC	0.001, MAC	0.0000050	0.0000132	0.0000108		<0.0000050	<0.0000050		<0.0000050	<0.0000050	
Dissolved Molybdenum (Mo)	mg/L	2	0.25	0.000050	0.000054	0.000068	23.0%	0.000137	0.000124	10.0%	0.000117	0.000114	2.6%
Dissolved Nickel (Ni)	mg/L	0.025-0.15 (e)	-	0.00050	0.00123	0.00131	6.3%	0.00118	0.00112	5.2%	0.00132	0.00127	3.9%
Dissolved Phosphorus (P)	mg/L	0.005-0.015 (for lakes only)	0.01	0.050	<0.050	<0.050		<0.050	<0.050		0.1	0.072	0.0%
Dissolved Potassium (K)	mg/L	373-432	-	0.050	**1.34**	**1.39**	3.7%	**0.389**	**0.376**	3.4%	**0.661**	**0.661**	0.0%
Dissolved Rubidium (Rb)	mg/L			0.00020	**0.00106**	**0.00102**	3.8%	0.00028	0.00032	13.3%	0.00057	0.00053	7.3%
Dissolved Selenium (Se)	mg/L	0.002	0.01, MAC	0.000050	0.000085	0.000087	2.3%	0.00008	0.000117	37.6%	0.00	0.000131	21.1%
Dissolved Silicon (Si)	mg/L	-	-	0.050	**4.22**	**4.2**	0.5%	**2.72**	**2.7**	0.7%	**1.73**	**1.84**	6.2%
Dissolved Silver (Ag)	mg/L	0.001-0.003 (e)	0.0001 (g)	0.000010	<0.000010	0.000011		<0.000010	<0.000010		<0.000010	<0.000010	
Dissolved Sodium (Na)	mg/L	-	<200, AO	0.050	**1.72**	**1.76**	2.3%	**19.8**	**19.4**	2.0%	**24.20**	**24**	0.8%
Dissolved Strontium (Sr)	mg/L	-	-	0.00020	**0.0532**	**0.0549**	3.1%	**0.0889**	**0.0885**	0.5%	**0.12**	**0.119**	0.8%
Dissolved Sulphur (S)	mg/L	-	-	0.50	**<0.50**	**<0.50**		<0.50	<0.50		<0.50	<0.50	
Dissolved Tellurium (Te)	mg/L			0.00020	<0.00020	<0.00020		<0.00020	<0.00020		<0.00020	<0.00020	
Dissolved Thallium (Tl)	mg/L	0.0017	2	0.000010	<0.000010	<0.000010		<0.000010	<0.000010		<0.000010	<0.000010	
Dissolved Thorium (Th)	mg/L			0.00010	<0.00010	<0.00010		<0.00010	<0.00010		<0.00010	<0.00010	
Dissolved Tin (Sn)	mg/L	-	-	0.00010	<0.00010	<0.00010		<0.00010	<0.00010		<0.00010	<0.00010	
Dissolved Titanium (Ti)	mg/L	2	-	0.00030	**0.00426**	**0.00511**	18.1%	**0.00156**	**0.00154**	1.3%	**0.00192**	**0.00177**	8.1%
Dissolved Tungsten (W)	mg/L			0.00010	<0.00010	<0.00010		<0.00010	<0.00010		<0.00010	<0.00010	
Dissolved Uranium (U)	mg/L	0.3	20	0.000010	0.000018	0.000016		<0.000010	<0.000010		0.00	<0.000010	
Dissolved Vanadium (V)	mg/L	0.006	0.02	0.00050	<0.00050	<0.00050		<0.00050	<0.00050		<0.00050	<0.00050	
Dissolved Zinc (Zn)	mg/L	0.19-0.72 (Hardness 300-1,000 mg/L) (e)	5 AO	0.0010	0.0047	0.0036	26.5%	**0.0095**	**0.0096**	1.0%	**0.01**	**0.0098**	0.0%
Dissolved Zirconium (Zr)	mg/L	-	-	0.00020	0.0005	0.00049	2.0%	0.00033	0.00033	0.0%	0.00036	0.00031	14.9%

Table 5: Hazelton Surface Water Quality Data QA/QC

Parameters	Units	BC MoE Guidelines: Freshwater Aquatic Life (1) (2)	BC MoE Guidelines: Drinking Water (2) (3)	Laboratory Detection Limit	SW01 E309751			SW-05 - E287409			SW-09 - E310968		
Date					30-Sep-20	DUP	RPD	20-Aug-20	DUP	RPD	24-Jun-20	DUP	RPD
Total Metals													
Total Aluminum	mg/L	0.023-0.1 (j,k)	9.5	0.0030	**0.627**	**0.636**	1.4%	**0.266**	**0.265**	0.4%	**0.43**	**0.648**	40.9%
Total Antimony (Ab)	mg/L	0.009	0.006	0.00010	<0.00010	<0.00010		<0.00010	<0.00010		<0.00010	<0.00010	
Total Arsenic (As)	mg/L	0.005	0.01 MAC	0.00010	**0.00084**	**0.00082**	2.4%	**0.00108**	**0.0011**	1.8%	**0.00462**	**0.00269**	52.8%
Total Barium (Ba)	mg/L	1	1.0	0.00010	**0.0172**	**0.0184**	6.7%	**0.0231**	**0.0235**	1.7%	**0.048**	**0.136**	95.7%
Total Beryllium (Be)	mg/L	0.00013	-	0.000100	<0.000100	<0.000100		<0.000100	<0.000100		<0.000100	<0.000100	
Total Bismuth (Bi)	mg/L	-	-	0.000050	<0.000050	<0.000050		<0.000050	<0.000050		<0.000050	<0.000050	
Total Boron (B)	mg/L	1.2	5.0, MAC	0.010	<0.010	<0.010		**<0.010**	**<0.010**		**<0.010**	**<0.010**	
Total Cadmium (Cd)	mg/L	0.000027 - 0.00280 (e) (k)	0.005, MAC	0.0000050	0.0000223	0.0000229	2.7%	0.0000099	0.000013	27.1%	**0.0000624**	**0.000254**	
Total Calcium (Ca)	mg/L	<4 sensitive to acid input	-	0.050	**7.42**	**7.47**	0.7%	**12.4**	**12.4**	0.0%	**19.5**	**22**	12.0%
Total Cesium (Cs)	mg/L	-	-	0.000010	0.000039	0.00004		<0.000010	<0.000010		0.000022	<0.000010	
Total Chromium (Cr)	mg/L	0.001 (f)	0.05, MAC	0.00010	**0.00085**	**0.00086**	1.2%	**0.00058**	**0.00058**	0.0%	**0.0007**	**0.00077**	9.5%
Total Cobalt (Co)	mg/L	0.11	-	0.00010	**0.00063**	**0.00057**	10.0%	**0.00158**	**0.00167**	5.5%	**0.00769**	**0.0188**	83.9%
Total Copper (Cu)	mg/L	0.0032-0.0396 (e)	1.0, AO	0.00050	**0.00333**	**0.00334**	0.3%	0.00086	0.00094	8.9%	0.00152	**0.00253**	49.9%
Total Iron (Fe)	mg/L	1	0.3, AO	0.010	**1.03**	**1.07**	3.8%	**1.99**	**2.16**	8.2%	**8.07**	**17.2**	72.3%
Total Lead (Pb)	mg/L	0.034 - 0.40 (Hardness 50 - 350 mg/L) (e)	0.01	0.000050	0.00018	0.000204	12.5%	**0.000298**	**0.00031**	3.9%	**0.000408**	**0.000372**	9.2%
Total Lithium (Li)	mg/L	-	-	0.0010	<0.0010	<0.0010		<0.0010	<0.0010		<0.0010	<0.0010	
Total Magnesium (Mg)	mg/L	-	-	0.0050	**1.83**	**1.81**	1.1%	**2.6**	**2.64**	1.5%	**3.92**	**3.94**	0.5%
Total Manganese (Mn)	mg/L	0.8-3.4 (e)	0.05, AO	0.00010	**0.102**	**0.0882**	14.5%	**0.373**	**0.407**	8.7%	**3.33**	**7.73**	79.6%
Total Mercury (Hg)	mg/L.	0.0001	0.001	0.0000050	<0.0000050	0.0000051		<0.0000050	<0.0000050		<0.0000050	<0.0000050	
Total Molybdenum (Mo)	mg/L	2	0.25	0.000050	0.000103	0.000092	11.3%	**0.000444**	**0.000624**	33.7%	0.00022	0.000117	61.1%
Total Nickel (Ni)	mg/L	0.025-0.15 (e)	-	0.00050	0.00162	0.00161	0.6%	0.00122	0.00134	9.4%	0.00174	**0.00287**	49.0%
Total Phosphorus (P)	mg/L	0.005-0.015 (for lakes only)	0.01, AO	0.050	0.072	0.063	13.3%	0.066	0.078	16.7%	**0.25**	0.185	29.9%
Total Potassium (K)	mg/L	-	-	0.050	**1.39**	**1.39**	0.0%	**0.38**	**0.401**	5.4%	**0.752**	**0.881**	15.8%
Total Rubidium (Rb)	mg/L			0.00020	**0.00117**	**0.00142**	19.3%	0.00041	0.00037	10.3%	0.0007	0.00074	5.6%
Total Selenium (Se)	mg/L	0.002	0.01, MAC	0.000050	0.00011	0.000103	6.6%	0.000079	0.000065	19.4%	0.000115	0.000063	58.4%
Total Silicon (Si)	mg/L	-	-	0.10	**4.81**	**4.83**	0.4%	**2.63**	**2.69**	2.3%	**1.89**	**1.77**	6.6%
Total Silver (Ag)	mg/L	0.0001-0.003 (e)	-	0.000010	0.000019	0.000015		<0.000010	<0.000010		0.000015	<0.000010	
Total Sodium (Na)	mg/L	-	<200, AO	0.050	**1.74**	**1.76**	1.1%	**19.9**	**20.3**	2.0%	**25.3**	**25.3**	0.0%
Total Strontium (Sr)	mg/L	-	-	0.00020	**0.0504**	**0.0487**	3.4%	**0.0826**	**0.0846**	2.4%	**0.134**	**0.159**	17.1%
Total Sulphur (S)	mg/L	-	-	0.50	**<0.50**	**<0.50**		<0.50	<0.50		**<0.50**	**<0.50**	
Total Tellurium (Te)	mg/L		-	0.00020	<0.00020	<0.00020		<0.00020	<0.00020		<0.00020	<0.00020	
Total Thallium (Tl)	mg/L	0.0008	-	0.000010	<0.000010	<0.000010		<0.000010	<0.000010		<0.000010	<0.000010	
Total Thorium (Th)	mg/L	-	-	0.00010	<0.00010	<0.00010		<0.00010	<0.00010		<0.00010	<0.00010	
Total Tin (Sn)	mg/L	-	-	0.00010	<0.00010	<0.00010		<0.00010	<0.00010		<0.00010	<0.00010	
Total Tungsten (W)	mg/L			0.00010	<0.00010	<0.00010		<0.00010	<0.00010		<0.00010	<0.00010	
Total Titanium (Ti)	mg/L	-	-	0.00030	<0.00900	0.00874		**0.00271**	**0.00264**	2.6%	**0.00524**	**0.0066**	23.0%
Total Uranium (U)	mg/L	0.0085	0.02	0.000010	0.000021	0.00002	4.9%	0.000011	0.000012	8.7%	0.000021	0.000042	66.7%
Total Vanadium (V)	mg/L	-	-	0.00050	0.00103	0.00106	2.9%	0.00067	0.00068	1.5%	0.0019	0.00222	15.5%
Total Zinc (Zn)	mg/L	0.033-0.266 (Hardness 90 - 400 mg/L) (e)	5.0, AO	0.0030	0.0125	0.007	56.4%	0.0096	0.0106	9.9%	**0.0228**	**0.065**	96.1%
Total Zirconium (Zr)	mg/L	-	-	0.00020	0.00033	0.00035	5.9%	0.00026	0.00027	3.8%	0.00029	0.0004	31.9%
Volatile Organic Compounds													
Benzene	µg/L			0.50	<0.50	<0.50		<0.50	<0.50		<0.50	<0.50	
Ethylbenzene	µg/L			0.50	<0.50	<0.50		<0.50	<0.50		<0.50	<0.50	
Methyl t-butyl ether (MTBE)	µg/L			0.50	<0.50	<0.50		<0.50	<0.50		<0.50	<0.50	
Styrene	µg/L			0.50	<0.50	<0.50		<0.50	<0.50		<0.50	<0.50	
Toluene	µg/L			0.50	<0.50	<0.50		<0.50	<0.50		<0.50	<0.50	
Xylene, m- and p-	µg/L			0.50	<0.50	<0.50		<0.50	<0.50		<0.50	<0.50	
Xylene, o-	µg/L			0.50	<0.50	<0.50		<0.50	<0.50		<0.50	<0.50	
Xylenes, total	µg/L			0.75	<0.75	<0.75		<0.75	<0.75		<0.75	<0.75	
BTEX+Styrene, total	µg/L							-	-		<1.5	<1.5	
Hydrocarbons													
EPH (C10-C19)	µg/L			250	<250	<250		<250	<250		<250	<250	
EPH (C19-C32)	µg/L			250	<250	<250		<250	<250		<250	<250	
TEH (C10-C30), BC	µg/L							<250	<250		<250	<250	
VHw (C6-C10)	µg/L			100	<100	<100		<100	<100		<100	<100	
VPHw	µg/L			100	<100	<100		<100	<100		<100	<100	

Notes:

Bold values are greater or equal to five times the laboratory detection limit

2018 data compared to 2018 criteria

A shaded value means exceeded the freshwater aquatic life criteria

A shaded value means reading exceeded the drinking water quality criteria.

A shaded value means exceeded both the aquatic life and drinking water criteria.

A shaded value means reading had detection limit exceeding criteria.

(AO - Aesthetic Objective)

1. BC Environment Approved and Working Criteria for Water Quality, last updated March 2018
2. All criteria limits for BCWQG - based on Total Metal Concentration except Aluminum and Cadmium (Dissolved)
3. BC Environment Drinking Water Guidelines and Canadian Drinking Water Standards

c. Limit dependent on chloride concentration. (MAC - Maximum Acceptable Concentration)

Table 6: Hazelton Groundwater Quality Data QA/QC

Analyte	Units	BC MoE Guidelines		BC CSR Standards	BH 01			BH 01			BH 02		
		Freshwater Aquatic Life (1) (2)	Drinking Water (2) (3)	BC CSR-DW (4)		Duplicate			Duplicate			Duplicate	
					25-Jun-20	25-Jun-20	RPD	21-Oct-20	21-Oct-20	RPD	24-Jun-20	24-Jun-20	RPD
Conductivity	uS/cm	-	-	-	**913**	**921**	0.9%	**658**	**664**	0.9%	**921**	**913**	0.9%
pH	pH units	6.5 - 9.0	7.0-10.5	-	**-**	**7.88**		**7.99**	**8**		**7.54**	**7.54**	
Alkalinity (Total as CaCO3)	mg/L	-	-	-	**-**	**472**		**362**	**349**		**473**	**466**	
Dissolved Hardness (CaCO3)	mg/L	-	-	-	**-**	**52**		**334**	**336**		**499**		
Hardness, Total (Total as CaCO3)	mg/L		-	-	**501**	**-**						**501**	
Chloride (Cl)	mg/L	600	250, AO	250	<2.50	<2.5		<0.50	<0.50		<2.50	<2.50	
Fluoride (F)	mg/L	0.4-1.87 (e)	1.5	1.5	<0.100	<0.100		**0.044**	**0.043**		<0.100	<0.100	
Sulphate (SO4)	mg/L	128-429 (e)	<500, AO	500	**60.1**	**76**	23.4%	**19**	**18.6**	2.1%	**60**	**60.1**	0.2%
Ammonia (N)	mg/L	0.68-28.7 (d)	-	-	**0.125**	**0.0533**	80.4%	**0.345**	**0.379**	9.4%	**0.126**	**0.125**	0.8%
Nitrate (N)	mg/L	32.8	10 MAC	10.0	**0.167**	**0.189**	12.4%	**0.012**	**0.010**	19.5%	**0.134**	**0.167**	21.9%
Nitrite (N)	mg/L	0.06-0.6 (c)	1.0	1	<0.0050	<0.0050		<0.0010	<0.0010		<0.0050	<0.0050	
Nitrate+Nitrite (N)	mg/L	-	-	10	-	-							
Total Kjeldahl Nitrogen (N)	mg/L	-	-	-	**1.070**	**0.236**	127.7%	**2.680**	**4.970**	59.9%	**0.894**	**1.070**	17.9%
Total Phosphorous (P)	mg/L	-	0.01	-	**-**	**-**							
Total Suspended Solids	mg/L	25 mg/L (background 25-250 mg/l)) (i)	-	-	**-**	**-**							
Total Dissolved Solids	mg/L	-	-	-	**-**	**-**							
Misc. Organics													
Chemical Oxygen Demand	mg/L	-	-	-	**63.00**	**34.00**	59.8%	**274.00**	**328.00**	17.9%	**91.00**	**63.00**	36.4%
Biochemical Oxygen Demand	mg/L	-	-	-									
Dissolved Organic Carbon (C)	mg/L	-	-	-									
Total Organic Carbon (C)	mg/L				**14.40**	**4.11**	111.2%	**263.00**	**253.00**	3.9%	**13.30**	**14.40**	7.9%
Phenols	mg/L	50	-	1.0									
Dissolved Metals													
Dissolved Aluminum (Al)	mg/L	0.023-0.1 (b,c)	9.5	9.5	**0.0018**	**0.0013**	32.3%	**0.0051**	**0.0089**	54.3%	**0.0025**	**0.0018**	32.6%
Dissolved Antimony (Sb)	mg/L	0.009	0.006	0.006	**0.00025**	**0.00032**	24.6%	**0.00041**	**0.0004**	2.5%	**0.00026**	**0.00025**	3.9%
Dissolved Arsenic (As)	mg/L	0.005	0.01 MAC	0.01	**0.00110**	**0.00062**	55.8%	**0.00561**	**0.00581**	3.5%	**0.00110**	**0.00110**	0.0%
Dissolved Barium (Ba)	mg/L	1	1.0	1	**0.0604**	**0.0664**	9.5%	**0.2540**	**0.2580**	1.6%	**0.0633**	**0.0604**	4.7%
Dissolved Beryllium (Be)	mg/L	0.00013	-	0.008	<0.000100	<0.000100		<0.000100	<0.000100		<0.000100	<0.000100	
Dissolved Bismuth (Bi)	mg/L	-	-	-	<0.000050	<0.000050		<0.000050	<0.000050		<0.000050	<0.000050	
Dissolved Boron (B)	mg/L	1.20	5.0, MAC	5.00	**0.093**	**0.086**	7.8%	**0.113**	**0.108**	4.5%	**0.087**	**0.093**	6.7%
Dissolved Cadmium (Cd)	mg/L	0.00029 - 0.0028 (Hardness 50-455 mg/L) (e) (k)	0.005	0.005	**0.0000607**	**0.0000654**	7.5%	<0.0000050	<0.0000050		**0.0000778**	**0.0000607**	24.7%
Dissolved Calcium (Ca)	mg/L	<4 sensitive to acid input	-	-	**89**	**94**	5.6%	**58**	**58**	0.2%	**86**	**89**	3.1%
Dissolved Cesium (Cs)	mg/L	-	-	-	<0.000010	<0.000010		<0.000010	<0.000010		<0.000010	<0.000010	
Dissolved Chromium (Cr)	mg/L	0.001 (e, f)	0.05, MAC	0.05 (VI), 6 (III)	<0.00010	<0.00010		<0.00010	<0.00010		<0.00010	<0.00010	
Dissolved Cobalt (Co)	mg/L	0.11	-	0.001	**0.00041**	**0.00016**	87.7%	**0.00042**	**0.00042**	0.0%	**0.0004**	**0.00041**	2.5%
Dissolved Copper (Cu)	mg/L	0.0032-0.0396 (e)	1.0, AO	1.5	**0.00070**	**0.00053**	27.6%	<0.00020	<0.00020		**0.00414**	**0.00070**	142.1%
Dissolved Iron (Fe)	mg/L	0.35	0.3, AO	6.5	<0.010	<0.010		**0.026**	**0.1**		<0.010	<0.010	
Dissolved Lead (Pb)	mg/L	0.034 - 0.40 (Hardness 50 - 350 mg/L) (e)	0.01	0.01	<0.000050	<0.000050		<0.000050	<0.000050		0.000068	<0.000050	
Dissolved Lithium (Li)	mg/L	-	-	0.008	**0.0045**	**0.0044**	2.2%	**0.0021**	**0.0021**	0.0%	**0.0044**	**0.0045**	2.2%
Dissolved Magnesium (Mg)	mg/L	-	-	-	**67.8**	**69.9**	3.1%	**45.8**	**46.5**	1.5%	**69.0**	**67.8**	1.8%
Dissolved Manganese (Mn)	mg/L	0.8-3.4 (e)	0.05, AO	1.5	**0.0818**	**0.0293**	94.5%	**0.135**	**0.141**	4.3%	**0.0793**	**0.0818**	3.1%
Dissolved Mercury (Hg)	mg/L	0.0001, MAC	0.001	0.001	<0.0000050	<0.0000050		<0.0000050	<0.0000050		<0.0000050	<0.0000050	
Dissolved Molybdenum (Mo)	mg/L	2	0.25	0.25	**0.0027**	**0.0023**	15.9%	**0.0036**	**0.0035**	1.7%	**0.0028**	**0.0027**	3.6%
Dissolved Nickel (Ni)	mg/L	0.025-0.15 (e)	-	0.08	**0.00124**	**0.0016**	25.4%	**0.00203**	**0.00202**	0.5%	**0.00124**	**0.00124**	0.0%
Dissolved Phosphorus (P)	mg/L	0.005-0.015 (for lakes only)	0.01, AO	-	<0.050	<0.050		<0.050	<0.050		<0.050	<0.050	
Dissolved Potassium (K)	mg/L	373-432	-	-	**2.56**	**2.56**	0.0%	**2.32**	**2.33**	0.4%	**2.58**	**2.56**	0.8%
Dissolved Rubidium (Rb)	mg/L	-	-	-	**0.00**	**0.00**	9.1%	**0.00**	**0.00**	0.0%	**0.00**	**0.00**	2.2%
Dissolved Selenium (Se)	mg/L	0.002	0.01, MAC	0.01	**0.00020**	**0.00028**	32.6%	<0.000050	<0.000050		**0.00031**	**0.00020**	44.7%
Dissolved Silicon (Si)	mg/L	-	-	-	**8.43**	**7.52**	11.4%	**6.15**	**5.97**	3.0%	**8.09**	**8.43**	4.1%
Dissolved Silver (Ag)	mg/L	0.001-0.003 (e)	-	0.02	<0.000010	<0.000010		<0.000010	<0.000010		<0.000010	<0.000010	
Dissolved Sodium (Na)	mg/L	-	<200, AO	200	**25.3**	**23.5**	7.4%	**29.8**	**29.9**	0.3%	**25.5**	**25.3**	0.8%
Dissolved Strontium (Sr)	mg/L	-	-	2.50	**1.980**	**2.070**	4.4%	**1.410**	**1.400**	0.7%	**2.030**	**1.980**	2.5%
Dissolved Sulphur (S)	mg/L	-	-	-	**24.7**	**26.8**	8.2%	**9.6**	**9.3**	3.8%	**23.6**	**24.7**	4.6%
Dissolved Tellurium (Te)	mg/L	-	-	-	<0.00020	<0.00020		<0.00020	<0.00020		<0.00020	<0.00020	
Dissolved Thallium (Tl)	mg/L	0.0017	-	-	<0.000010	<0.000010		<0.000010	<0.000010		<0.000010	<0.000010	
Dissolved Thorium (Th)	mg/L	-	-	-	<0.00010	<0.00010		<0.00010	<0.00010		<0.00010	<0.00010	
Dissolved Tin (Sn)	mg/L	-	-	2.5	0.00014	<0.00010		<0.00010	<0.00010		**0.00015**	**0.00014**	
Dissolved Titanium (Ti)	mg/L	2	-	-	<0.00030	<0.00030		<0.00030	<0.00030		<0.00030	<0.00030	
Dissolved Tungsten (W)	mg/L	-	-	0.003	<0.00010	<0.00010		<0.00010	<0.00010		<0.00010	<0.00010	
Dissolved Uranium (U)	mg/L	0.3	0.02	0.02	**0.00114**	**0.00133**	15.4%	**0.00130**	**0.00123**	5.5%	**0.00109**	**0.00114**	4.5%
Dissolved Vanadium (V)	mg/L	0.006	-	0.02	<0.00050	<0.00050		<0.00050	<0.00050		<0.00050	<0.00050	
Dissolved Zinc (Zn)	mg/L	0.033-0.266 (Hardness 90 - 400 mg/L) (e)	5 AO	3	**0.0017**	**0.0012**	34.5%	**<0.0010**	**<0.0010**		**0.0034**	**0.0017**	66.7%
Dissolved Zirconium (Zr)	mg/L	-	-	-	<0.00020	<0.00020		<0.00020	<0.00020		<0.00020	<0.00020	

Analyte	Units	BC MoE Guidelines		BC CSR Standards	BH 01			BH 01			BH 02		
		Freshwater Aquatic Life (1) (2)	Drinking Water (2) (3)	BC CSR-DW (4)		Duplicate			Duplicate			Duplicate	
					25-Jun-20	25-Jun-20	RPD	21-Oct-20	21-Oct-20	RPD	24-Jun-20	24-Jun-20	RPD
Volatiles													
Benzene	ug/L	40 (a)	5 (a)	5	<0.50	<0.50		<0.50	<0.50		<0.50	<0.50	
Ethylbenzene	µg/L				<0.50	<0.50		<0.50	<0.50		<0.50	<0.50	
Methyl t-butyl ether (MTBE)	µg/L				<0.50	<0.50		<0.50	<0.50		<0.50	<0.50	
Styrene	µg/L				<0.50	<0.50		<0.50	<0.50		<0.50	<0.50	
Toluene	ug/L	0.5 (a)	-	60	<0.50	3.32		<0.50	<0.50		<0.50	<0.50	
Xylene, m- and p-	µg/L				<0.50	<0.50		<0.50	<0.50		<0.50	<0.50	
Xylene, o-	µg/L				<0.50	<0.50		<0.50	<0.50		<0.50	<0.50	
Xylenes, total	µg/L				<0.75	<0.75		<0.75	<0.75		<0.75	<0.75	
BTEX+Styrene, total	µg/L				<1.5	-					<1.5	<1.5	
Vinyl chloride	ug/L			2									
Dichloromethane	ug/L	98.1	-	50									
1,4-dichlorobenzene	ug/L	26	-	5									
Hydrocarbons													
EPH (C10-C19)	µg/L				<250	<250		<250	<250		<250	<250	
EPH (C19-C32)	µg/L				<250	<250		<250	<250		<250	<250	
TEH (C10-C30), BC	µg/L				<250	-					<250	<250	
VHw (C6-C10)	µg/L				<100	<100		<100	<100		<100	<100	
VPHw	µg/L				<100	<100		<100	<100		<100	<100	

Notes:

Bold values are greater or equal to five times the laboratory detection limit

2018 data compared to updated criteria

A shaded value means exceeded the freshwater aquatic life criteria

A shaded value means reading exceeded the drinking water quality criteria.

A shaded value means reading exceeded the CSR drinking water quality criteria.

A shaded value means exceeded more than one criteria.

A shaded value means reading had detection limit exceeding criteria.

A shaded value means reading exceeded the CSR drinking water quality criteria for sampling stations that trigger the Ground Water Quality Exceedances Response Plan

(AO - Aesthetic Objective)

1. BC Environment Approved and Working Criteria for Water Quality, last updated March 2018
2. All criteria limits for BCWQG - based on Total Metal Concentration except Aluminum, Cadmium, and Iron (Dissolved)
3. BC Environment Drinking Water Guidelines and Canadian Drinking Water Standards
4. BC Contaminated Sites Regulation for Drinking Water (BC-CSR-DW) Schedule 3.2 , last updated January 2019

c. Limit dependent on chloride concentration. (MAC - Maximum Acceptable Concentration)

d. Limit pH and temperature dependent.

e. Limit dependant on hardness. Range given for hardness 50 to 1,000 mg/L.

f. Limit for chromium (IV)

g. Limit for total, no dissolved concentrations

h.copper (mg/L) =(0.094* Hardness)/1000

i. Limit for hardness based on total dissolved $CaCO_3$

j. BC Contaminated Sites Regulation for Drinking Water (BC-CSR-DW) Schedule 3.2 - Stage 11 Amendments, last updated March 2019

Table 7: Hazelton Wetland #4 Water Quality Data QA/QC

Parameters	Units	BC MOE OC Criteria	BC MoE Guidelines (a) Freshwater Aquatic Life	BC MoE Guidelines (a) Drinking Water	Wetland 4	Wetland 4 Duplicate		Wetland 4	Wetland 4 Duplicate		Wetland 4	Wetland 4 Duplicate	
Date					09-Sep-2020	09-Sep-2020	RPD		12-Nov-20	RPD	22-Dec-20	22-Dec-20	RPD
Physical Tests	Units												
Alkalinity (Total as CaCO3)	mg/L		-	-	**259**	**238**	8.5%	**323**	**314**	2.8%	**213**	**218**	2.3%
Conductivity	uS/cm		-	-	**585**	**591**	1.0%	**730**	**712**	2.5%	**525**	**524**	0.2%
Total Hardness	mg/L		-	-	**238**	**243**	2.1%	**281**	**279**	0.7%	**269**	**278**	3.3%
pH	pH Units	6.5 - 8.5	6.5 - 9.0	7.0-10.5	**7.59**	**7.66**	0.9%	**7.9**	**7.93**	0.4%	**8.27**	**8.27**	0.0%
Turbidity	NTU				-			-			-		
Dissolved Oxygen (DO)	mg/L												
Anions and Nutrients													
Total Kjeldahl Nitrogen	mg/L	60	-	-	**1.07**	**1.07**	0.0%	**2.46**	**2.51**	2.0%	**2.97**	**2.97**	0.0%
Ammonia (N)	mg/L	30	0.681-28.7 (d)	-	**0.396**	**0.388**	2.0%	**1.89**	**1.88**	0.5%	**2.3**	**2.21**	4.0%
Bromide (Br)	mg/L				**0.227**	**0.227**	0.0%	**<0.250**	**0.21**		**0.187**	**0.191**	2.1%
Chloride (Cl)	mg/L	3750	600	250, AO	**41.3**	**41.5**	0.5%	**47**	**46.8**	0.4%	**37.3**	**39**	4.5%
Fluoride (F)	mg/L				0.097	0.094	3.1%	**<0.100**	0.085		0.078	0.08	2.5%
Nitrate (N)	mg/L		32.8	10 MAC	**0.724**	**0.734**	1.4%	**0.106**	**0.123**	14.8%	**0.249**	**0.178**	33.3%
Nitrite (N)	mg/L		0.06 -0.6 (c)	1.0	**0.0336**	**0.0407**	19.1%	<0.0050	0.0025		**0.0081**	**0.0069**	16.0%
Total Metals													
Total Aluminum	mg/L		0.023-0.1 (b,c)	9.5	**0.0574**	**0.0663**	14.4%	0.0097	0.008	19.2%	0.0115	0.0113	1.8%
Total Antimony (Ab)	mg/L		0.270	0.006	0.00022	0.00021	4.7%	0.00022	0.00021	4.7%	0.00019	0.00019	0.0%
Total Arsenic (As)	mg/L		0.005	0.01 MAC	**0.00094**	**0.00096**	2.1%	**0.00104**	**0.001**	3.9%	**0.00083**	**0.00086**	3.6%
Total Barium (Ba)	mg/L		1	1.0	**0.0607**	**0.0602**	0.8%	**0.0772**	**0.076**	1.6%	**0.0721**	**0.0739**	2.5%
Total Beryllium (Be)	mg/L		0.00013	-	<0.000100	<0.000100		<0.000100	<0.000100		<0.000100	<0.000100	
Total Bismuth (Bi)	mg/L		-	-	<0.000050	<0.000050		<0.000050	<0.000050		<0.000050	<0.000050	
Total Boron (B)	mg/L		1.2	5.0, MAC	**0.307**	**0.334**	8.4%	**0.314**	**0.329**	4.7%	**0.193**	**0.21**	8.4%
Total Cadmium (Cd)	mg/L	0.1	0.00029 - 0.0028 (Hardness 50-455 mg/L) (e) (k)	0.005, MAC	**0.000038**	**0.0000267**	34.9%	**0.0000752**	**0.000079**	4.9%	**0.000121**	**0.000114**	6.0%
Total Calcium (Ca)	mg/L		<4 sensitive to acid input	-	**71**	**71.8**	1.1%	**83.3**	**83.2**	0.1%	**80.5**	**83.3**	3.4%
Total Cesium (Cs)	mg/L		-	-	0.000012	0.00001	18.2%	0.000011	0.000012	8.7%	<0.000010	<0.000010	
Total Chromium (Cr)	mg/L		0.001 (f)	0.05, MAC	0.00029	0.00031	6.7%	0.00044	0.00043	2.3%	0.00033	**0.00252**	153.7%
Total Cobalt (Co)	mg/L		0.11	-	0.0003	0.00029	3.4%	**0.00126**	**0.00126**	0.0%	**0.00194**	**0.00196**	1.0%
Total Copper (Cu)	mg/L		0.0032-0.0396 (e)	1.0, AO	0.00181	0.00173	4.5%	0.00204	0.00199	2.5%	0.00162	0.00166	2.4%
Total Iron (Fe)	mg/L	4.5	1	0.3, AO	**0.374**	**0.372**	0.5%	**0.137**	**0.115**	17.5%	0.049	**0.066**	29.6%
Total Lead (Pb)	mg/L		0.034 - 0.40 (Hardness 50 - 350 mg/L) (e)	0.01	<0.000050	<0.000050		<0.000050	<0.000050		<0.000050	<0.000050	
Total Lithium (Li)	mg/L		-	-	<0.0010	<0.0010		<0.0010	<0.0010		<0.0010	<0.0010	
Total Magnesium (Mg)	mg/L		-	-	**14.8**	**15.4**	4.0%	**17.7**	**17.2**	2.9%	**16.5**	**17**	3.0%
Total Manganese (Mn)	mg/L		0.8-3.4 (e)	0.05, AO	**0.269**	**0.271**	0.7%	**1.95**	**1.89**	3.1%	**3.87**	**3.9**	0.8%
Total Mercury (Hg)	mg/L.		0.0001	0.001	<0.0000050	<0.0000050		0.0000134	0.000013		0.000006	0.000007	
Total Molybdenum (Mo)	mg/L		2	0.25	**0.00064**	**0.000653**	2.0%	**0.000694**	**0.000726**	4.5%	**0.000739**	**0.000721**	2.5%
Total Nickel (Ni)	mg/L		0.025-0.15 (e)	-	**0.0026**	**0.00271**	4.1%	**0.00351**	**0.00335**	4.7%	**0.00256**	**0.00263**	2.7%
Total Phosphorus (P)	mg/L		0.005-0.015 (for lakes only)	0.01, AO	<0.050	<0.050		<0.050	<0.050		<0.050	<0.050	
Total Potassium (K)	mg/L		-	-	**5.91**	**5.97**	1.0%	**7.28**	**7.21**	1.0%	**7.2**	**7.28**	1.1%
Total Rubidium (Rb)	mg/L				**0.00117**	**0.00117**	0.0%	0.00082	0.00085	3.6%	0.00058	0.00058	0.0%
Total Selenium (Se)	mg/L		0.002	0.01, MAC	0.00007	<0.000050		0.000098	0.000077		0.000081	0.00008	
Total Silicon (Si)	mg/L		-	-	**2**	**1.97**	1.5%	**3.22**	**3.14**	2.5%	**3.79**	**3.8**	0.3%
Total Silver (Ag)	mg/L		0.0001-0.003 (e)	-	<0.000010	<0.000010		<0.000010	<0.000010		<0.000010	<0.000010	
Total Sodium (Na)	mg/L		-	<200, AO	**35**	**37.3**	6.4%	**40.3**	**39.4**	2.3%	**26.2**	**26.7**	1.9%
Total Strontium (Sr)	mg/L		-	-	**0.464**	**0.459**	1.1%	**0.534**	**0.524**	1.9%	**0.532**	**0.525**	1.3%
Total Sulphur (S)	mg/L		-	-	**4.02**	**3.97**	1.3%	**2.66**	2.43	9.0%	2.32	**2.53**	8.7%
Total Tellurium (Te)	mg/L			-	<0.00020	<0.00020		<0.00020	<0.00020		0.00026	0.00069	
Total Thallium (Tl)	mg/L		0.0008	-	<0.000010	<0.000010		<0.000010	<0.000010		<0.000010	<0.000010	
Total Thorium (Th)	mg/L		-	-	<0.00010	<0.00010		<0.00010	<0.00010		<0.00010	<0.00010	
Total Tin (Sn)	mg/L		-	-	<0.00010	<0.00010		<0.00010	<0.00010		<0.00010	<0.00010	
Total Titanium (Ti)	mg/L		-	-	0.00071	0.00101	34.9%	<0.00030	<0.00030		<0.00030	<0.00030	
Total Tungsten (W)	mg/L				<0.00010	<0.00010		<0.00010	<0.00010		<0.00010	<0.00010	
Total Uranium (U)	mg/L		0.0085	0.02	**0.000286**	**0.000286**	0.0%	**0.000312**	**0.00031**	0.6%	**0.000242**	**0.000245**	1.2%
Total Vanadium (V)	mg/L		-	-	<0.00050	<0.00050		<0.00050	<0.00050		<0.00050	<0.00050	
Total Zinc (Zn)	mg/L	75	0.033-0.266 (Hardness 90 - 400 mg/L) (e)	5.0, AO	0.0041	<0.0030		0.0037	0.0048		0.0049	0.0052	
Total Zirconium (Zr)	mg/L		-	-	<0.00020	<0.00020		<0.00020	<0.00020		<0.00020	<0.00020	

Parameters	Units	BC MOE OC Criteria	BC MoE Guidelines (a) Freshwater Aquatic Life	BC MoE Guidelines (a) Drinking Water	Wetland 4	Wetland 4 Duplicate		Wetland 4	Wetland 4 Duplicate		Wetland 4	Wetland 4 Duplicate	
Date					09-Sep-2020	09-Sep-2020	RPD		12-Nov-20	RPD	22-Dec-20	22-Dec-20	RPD
Aggregate Organics													
BOD	mg/L		-	-	<2.0	<2.0		<2.0	<2.0		**2.3**	**2**	14.0%
Chemical Oxygen Demand	mg/L		-	-	40	46	14.0%	28	30	6.9%	<20	21	
Volatiles													
Benzene	ug/L	40 (a)	5 (a)	5	<0.50	<0.50		<0.50	<0.50		<0.50	<0.50	
Ethylbenzene	µg/L				<0.50	<0.50		<0.50	<0.50		<0.50	<0.50	
Methyl t-butyl ether (MTBE)	µg/L				<0.50	<0.50		<0.50	<0.50		<0.50	<0.50	
Styrene	µg/L				<0.50	<0.50		<0.50	<0.50		<0.50	<0.50	
Toluene	ug/L	0.5 (a)	-	60	<0.50	<0.50		<0.50	<0.50		<0.50	<0.50	
Xylene, m- and p-	µg/L				<0.50	<0.50		<0.50	<0.50		<0.50	<0.50	
Xylene, o-	µg/L				<0.50	<0.50		<0.50	<0.50		<0.50	<0.50	
Xylenes, total	µg/L				<0.75	<0.75		<0.75	<0.75		<0.75	<0.75	
BTEX+Styrene, total	µg/L												
Vinyl chloride	ug/L			2									
Dichloromethane	ug/L	98.1	-	50									
1,4-dichlorobenzene	ug/L	26	-	5									
Hydrocarbons													
EPH (C10-C19)	µg/L				<250	<250		<250	<250		<250	<250	
EPH (C19-C32)	µg/L				<250	<250		<250	<250		<250	<250	
TEH (C10-C30), BC	µg/L												
VHw (C6-C10)	µg/L				<100	<100		<100	<100		<100	<100	
VPHw	µg/L				<100	<100		<100	<100		<100	<100	
Lethal Toxicity Testing													
LC-50	%v/v	100%											

Notes:

Bold values are greater or equal to five times the laboratory detection limit

A shaded value means exceeded the freshwater aquatic life criteria

A shaded value means reading exceeded the drinking water quality criteria.

A shaded value means exceeded both the aquatic life and drinking water criteria.

A shaded value means exceeded the OC discharge criteria.

A shaded value means reading had detection limit exceeding criteria.

(AO - Aesthetic Objective)

1. BC Environment Approved and Working Criteria for Water Quality, last updated March 2018
2. All criteria limits for BCWQG - based on Total Metal Concentration except Aluminum and Cadmium (Dissolved)
3. BC Environment Drinking Water Guidelines and Canadian Drinking Water Standards
4. BC Contaminated Sites Regulation for Drinking Water (BC-CSR-DW) Schedule 3.2, last updated January 2019

c. Limit dependent on chloride concentration. (MAC - Maximum Acceptable Concentration)

d. Limit pH and temperature dependent.

e. Limit dependant on hardness. Range given for hardness 50 to 1,000 mg/L.

f. Limit for chromium (IV)

g. Limit for total, no dissolved concentrations

h.copper (mg/L) =(0.094* Hardness)/1000

i. Limit for hardness based on total dissolved CaCO3

Table 8: Phytoremediation Soil Sample Results

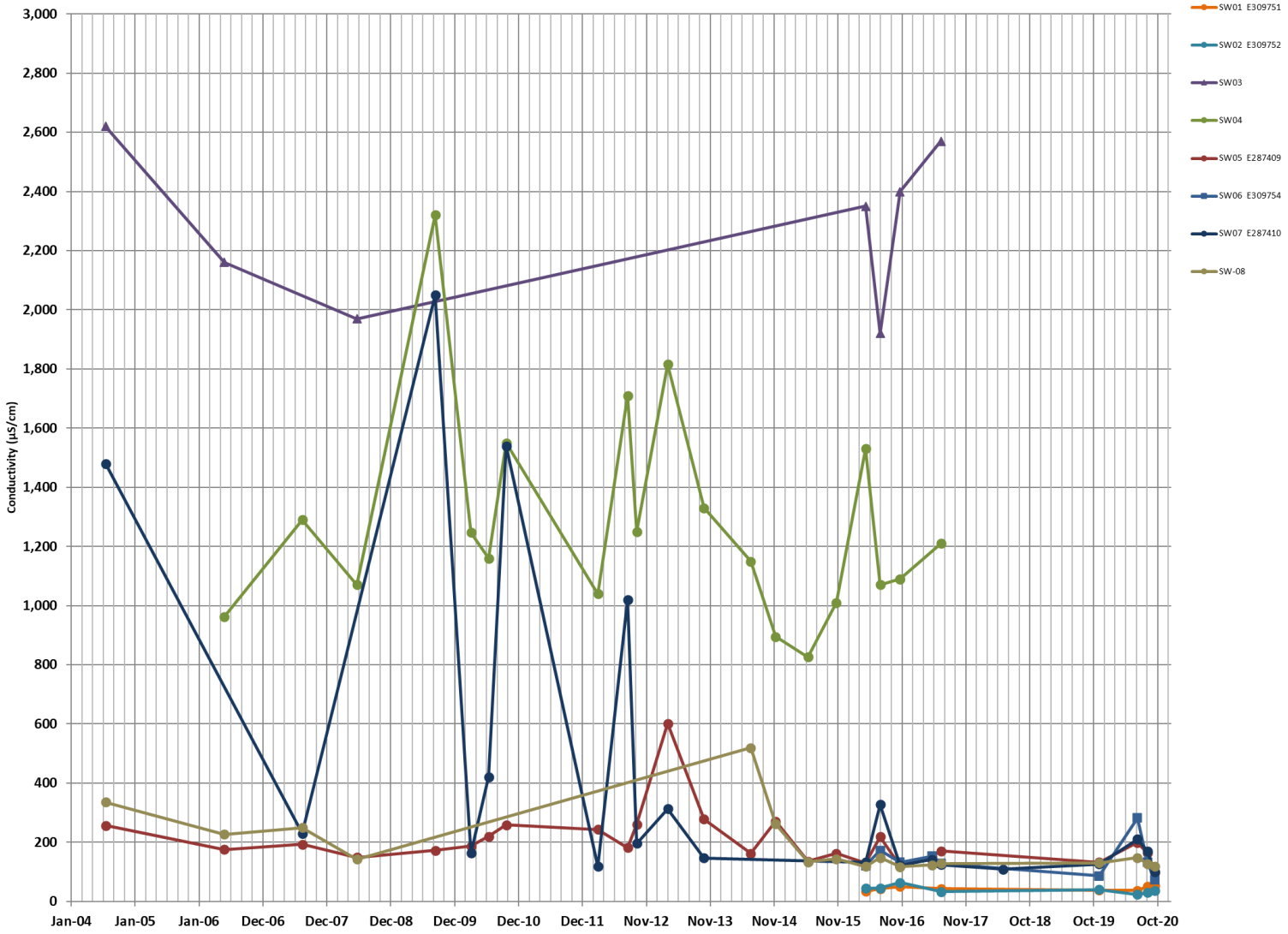
		CSR Standards	CSR Standards	30-Mar-19		29-May-20
Plot				TP #1	TP #2	
Physical Tests (Soil)	**Units**	**CSR-DW (1)**	**CSR-AW (2)**			
pH (1:2 soil:water)	pH	-	-			7.46
Saturated Paste Extractables (Soil)	Units					
Chloride (Cl)	mg/L					35.7
Chloride (Cl)	mg/kg	100	600			16.5
% Saturation	%	-	-	33.2	12	46.3
Sodium (Na)	mg/kg	15,000	-			11.80
Metals (Soil)						
Aluminum (Al)	mg/kg	250,000	-	45,800	22,900	24,600
Antimony (Sb)	mg/kg	40,000	40	0.65	0.54	0.65
Arsenic (As)	mg/kg	10	10	15.20	9.91	12.00
Barium (Ba)	mg/kg	350	3,500	383.0	134.0	164.0
Beryllium (Be)	mg/kg	1 - 2,500 (3)	1 - 500 (4)	1.27	0.34	0.44
Bismuth (Bi)	mg/kg	-	-	0	<0.20	<0.20
Boron (B)	mg/kg	1,000,000	-	<5.0	<5.0	<5.0
Cadmium (Cd)	mg/kg	1 - 70 (5)	1 - 50 (5)	0.422	0.155	0.174
Calcium (Ca)	mg/kg	-	-	6,650	2,150	5,170
Chromium (Cr)	mg/kg	60	60	38.2	25.3	25.9
Cobalt (Co)	mg/kg	25	25	24.1	10.7	13.0
Copper (Cu)	mg/kg	500	75	50.1	18.7	31.9
Iron (Fe)	mg/kg	150,000	-	47,300	37,100	36,500
Lead (Pb)	mg/kg	120 - 8,500 (6)	200 - 90,000 (7)	15.50	5.90	7.95
Lithium (Li)	mg/kg	450	-	25	18	18
Magnesium (Mg)	mg/kg	-	-	7,750	7,110	7,300
Manganese (Mn)	mg/kg	2,000	-	3,650	439	965
Mercury (Hg)	mg/kg	-	75	0	<0.050	<0.0500
Molybdenum (Mo)	mg/kg	15	650	1.51	0.64	0.74
Nickel (Ni)	mg/kg	70 - 500 (8)	90 - 9,500 (7)	43.9	29.2	30.1
Phosphorus (P)	mg/kg	-	-	1,430	672	725
Potassium (K)	mg/kg	-	-	2,080	700	1,050
Selenium (Se)	mg/kg	1	1	0.30	<0.20	<0.20
Silver (Ag)	mg/kg	35,000	40	0.39	<0.10	0.13
Sodium (Na)	mg/kg	-	-	159	87	184
Strontium (Sr)	mg/kg	-	-	72	18	41
Sulfur (S)	mg/kg	-	-	<1000	<1000	<1000
Thallium (Tl)	mg/kg	-	25	0.198	0.052	0.075
Tin (Sn)	mg/kg	1,000,000	300	<2.0	<2.0	<2.0
Titanium (Ti)	mg/kg	-	-	93	441	440
Tungsten (W)	mg/kg	-	-	<0.50	<0.50	<0.50
Uranium (U)	mg/kg	30	150	1.020	0.248	0.361
Vanadium (V)	mg/kg	100	-	78.9	55.2	60.0
Zinc (Zn)	mg/kg	200 - 5,500 (7)	150 - 3,000 (7)	162.0	97.8	90.2
Zirconium (Zr)	mg/kg	-	-	1	<1.0	<1.0

NOTES

(1) BC Contaminated Sites Regulation (CSR) Soil Standards for Drinking Water, Schedule 3.1, 1997 (Amended June 2018)
(2) BC Contaminated Sites Regulation (CSR)Soil Standards for Aquatic Life, Schedule 3.1, 1997 (Amended June 2018)
(3)Limit dependent on pH. At pH less than 5.5, limit is 1 mg/kg.
(4)Limit dependent on pH. At pH less than 6.5, limit is 1 mg/kg.
(5)Limit dependent on pH. At pH less than 7, limit is 1 mg/kg.
(6)Limit dependent on pH. At pH less than 5.5, limit is 120 mg/kg.
(7Limit dependent on pH.
(8)Limit dependent on pH. At pH less than 7.5, limit is 70 mg/kg.

CSR-DW	*BC Contaminated Sites Regulation Soil Standards for Drinking Water, Schedule 3.1*
CSR-AW	*BC Contaminated Sites Regulation Soil Standards for Aquatic Life, Schedule 3.1*
	A shaded value means exceeded both the aquatic wildlife and drinking water criteria.

Appendix C: Charts



SPERLING HANSEN ASSOCIATES

Regional District of Kitimat-Stikine

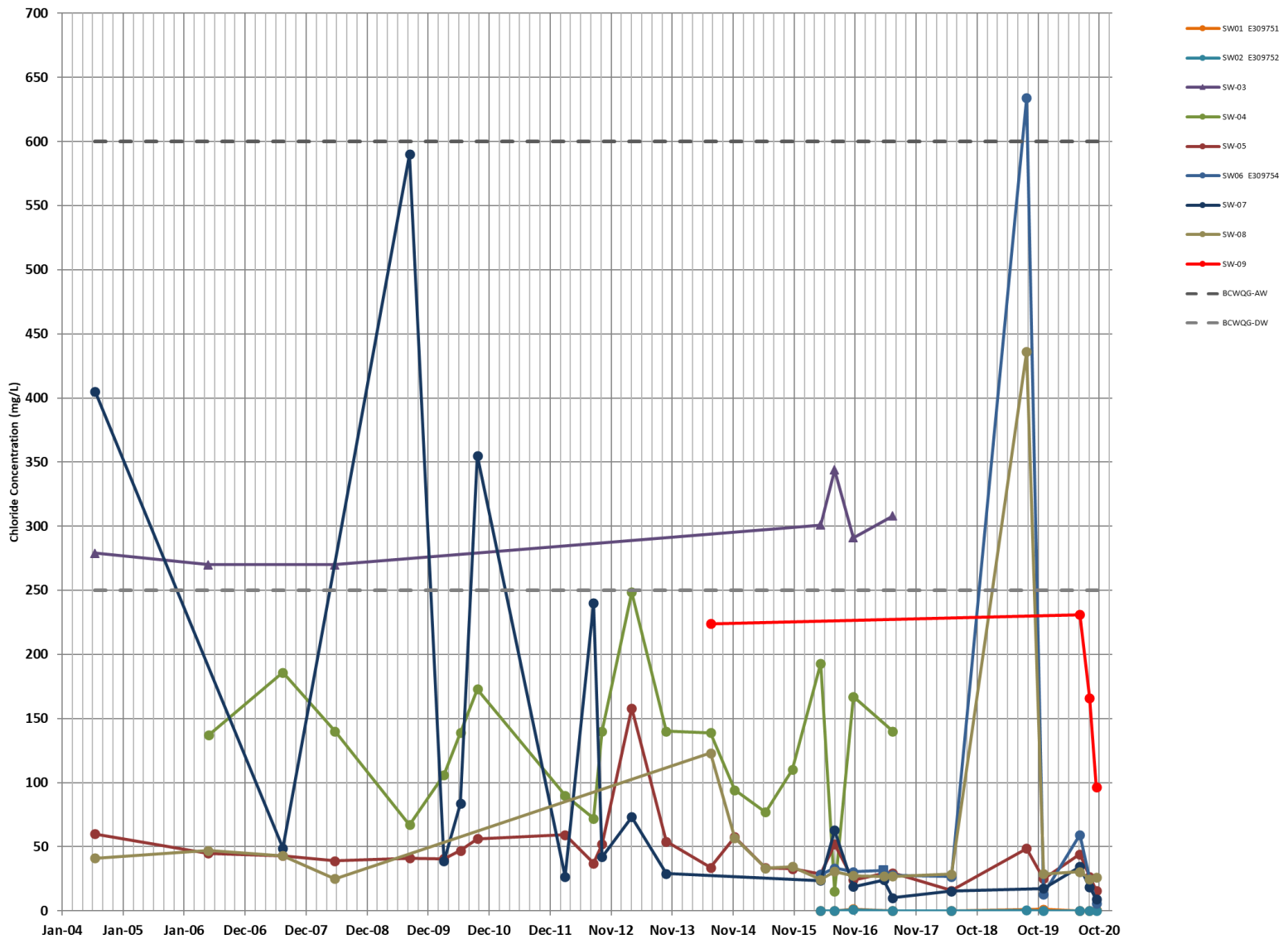
PROJECT:

Hazelton WMF Annual Monitoring Report

TITLE:

Surface Water Conductivity

SCALE:	DATE:	PROJECT NO:
N/A	2021/05/04 (yyyy/mm/dd)	PRJ21015
DESIGNED	AM	DRAWING NO:
DRAWN	AM	**Chart 1**
CHECKED	DK	



Sperling Hansen Associates

Regional District of Kitimat-Stikine

PROJECT:

Hazelton WMF Annual Monitoring Report

TITLE:

Surface Water Chloride

SCALE:	DATE:	PROJECT NO:
N/A	2021/05/04 (yyyy/mm/dd)	PRJ21015
DESIGNED	AM	DRAWING NO:
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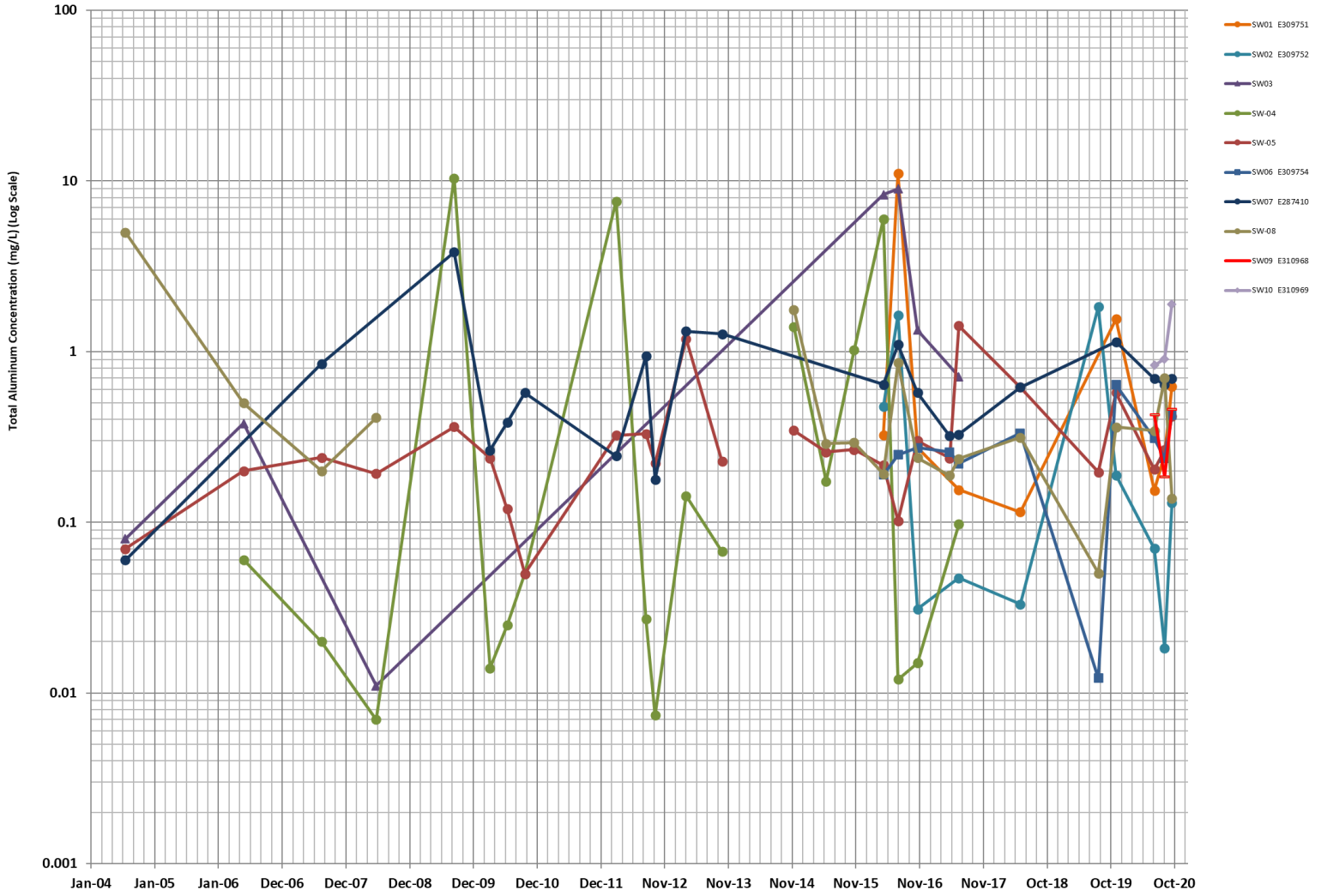

SPERLING HANSEN ASSOCIATES

Regional District of Kitimat-Stikine

PROJECT:

Hazelton WMF Annual Monitoring Report

TITLE:

Surface Water Total Aluminum

SCALE:	DATE:	PROJECT NO:
N/A	2021/05/04 yyyy/mm/dd	PRJ21015
DESIGNED	AM	DRAWING NO:
DRAWN	AM	**Chart 3**
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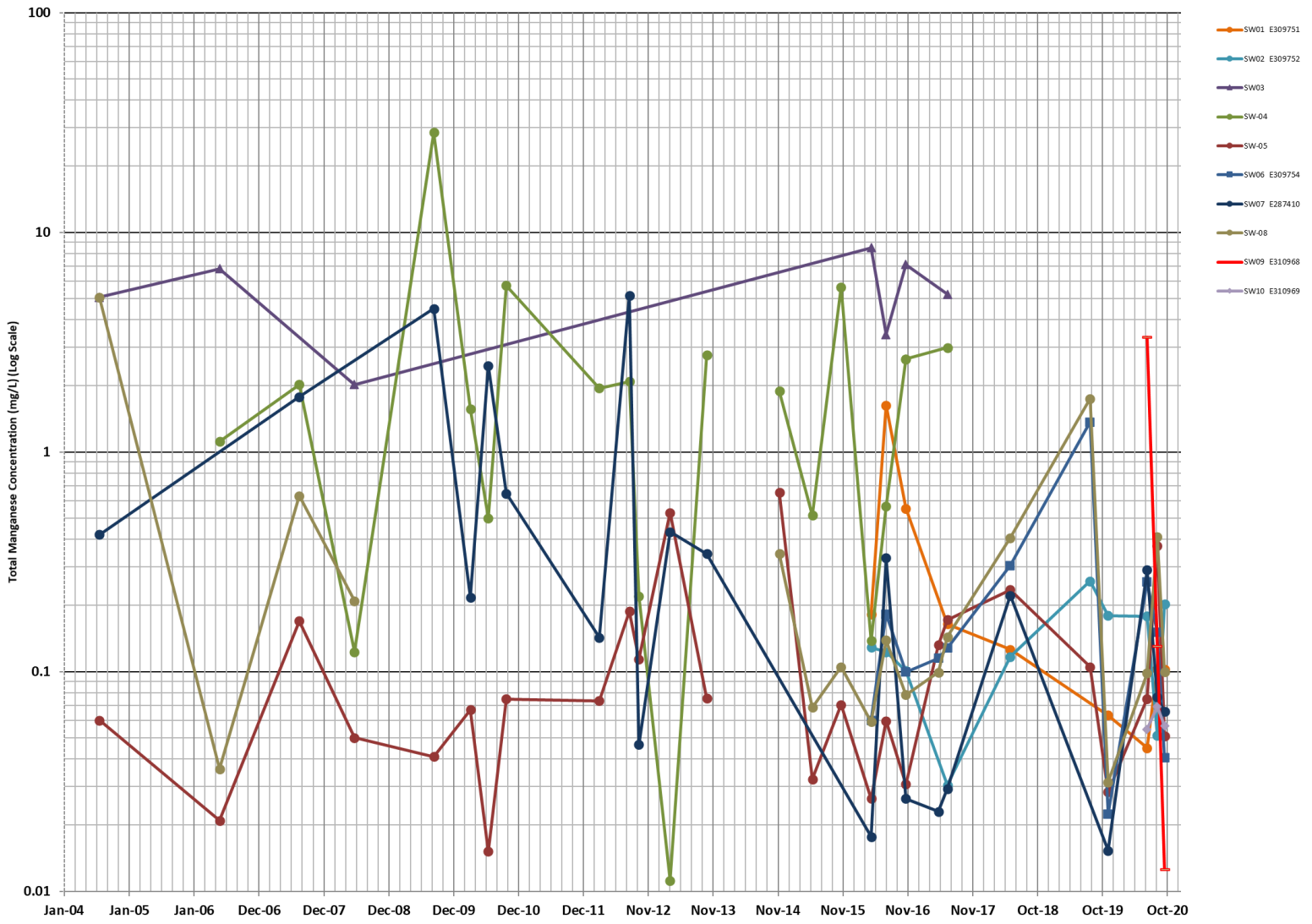

SPERLING HANSEN ASSOCIATES

Regional District of Kitimat-Stikine

PROJECT:

Hazelton WMF Annual Monitoring Report

TITLE:

Surface Water Total Manganese

SCALE:	DATE:	PROJECT NO:
N/A	2021/05/04 (yyyy/mm/dd)	PRJ21015
DESIGNED	AM	DRAWING NO:
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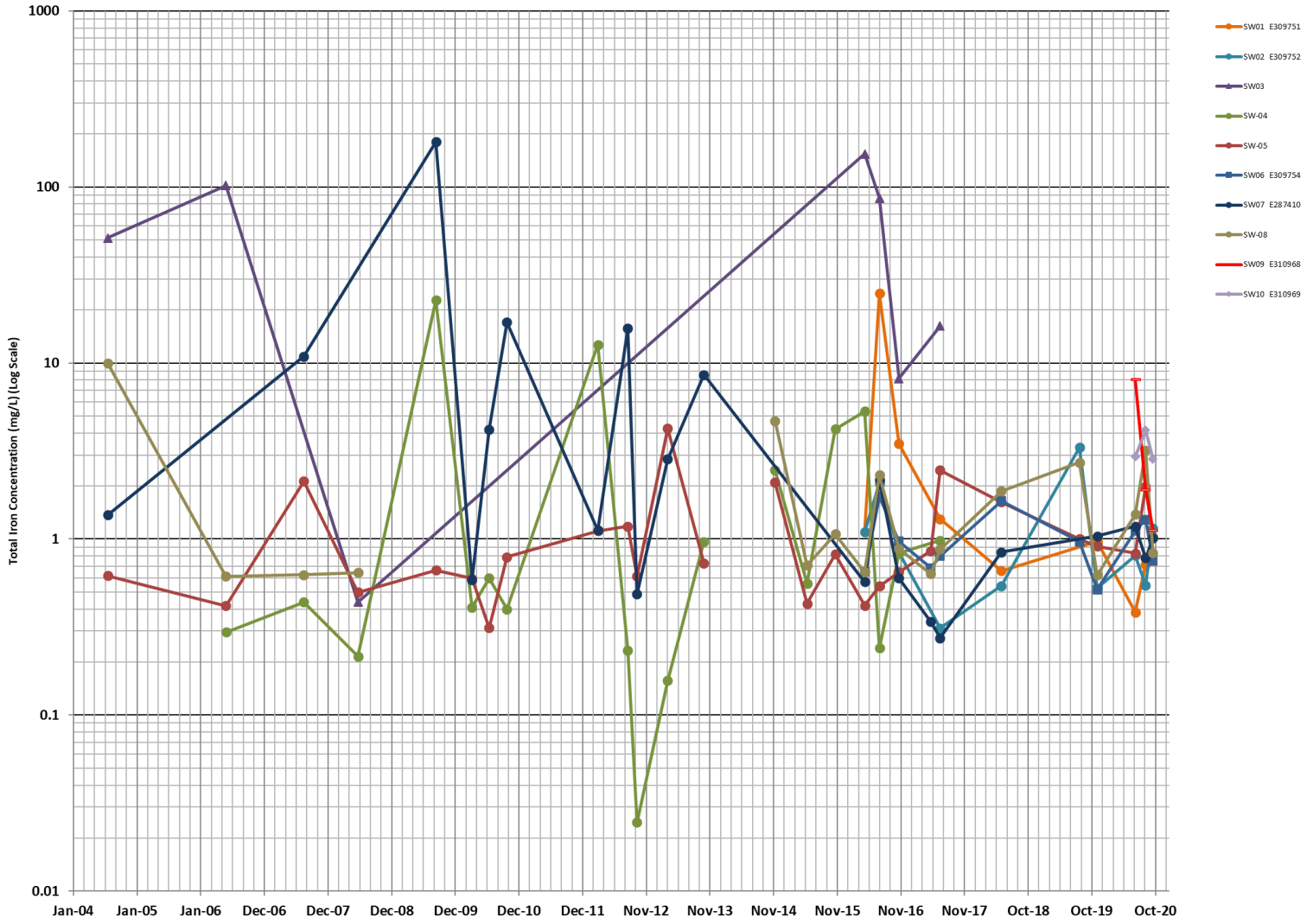

SPERLING HANSEN ASSOCIATES

Regional District of Kitimat-Stikine

PROJECT:

Hazelton WMF Annual Monitoring Report

TITLE:

Surface Water Total Iron

SCALE:	DATE:	PROJECT NO:
N/A	2021/05/04 yyyy/mm/dd	PRJ21015
DESIGNED	AM	DRAWING NO:
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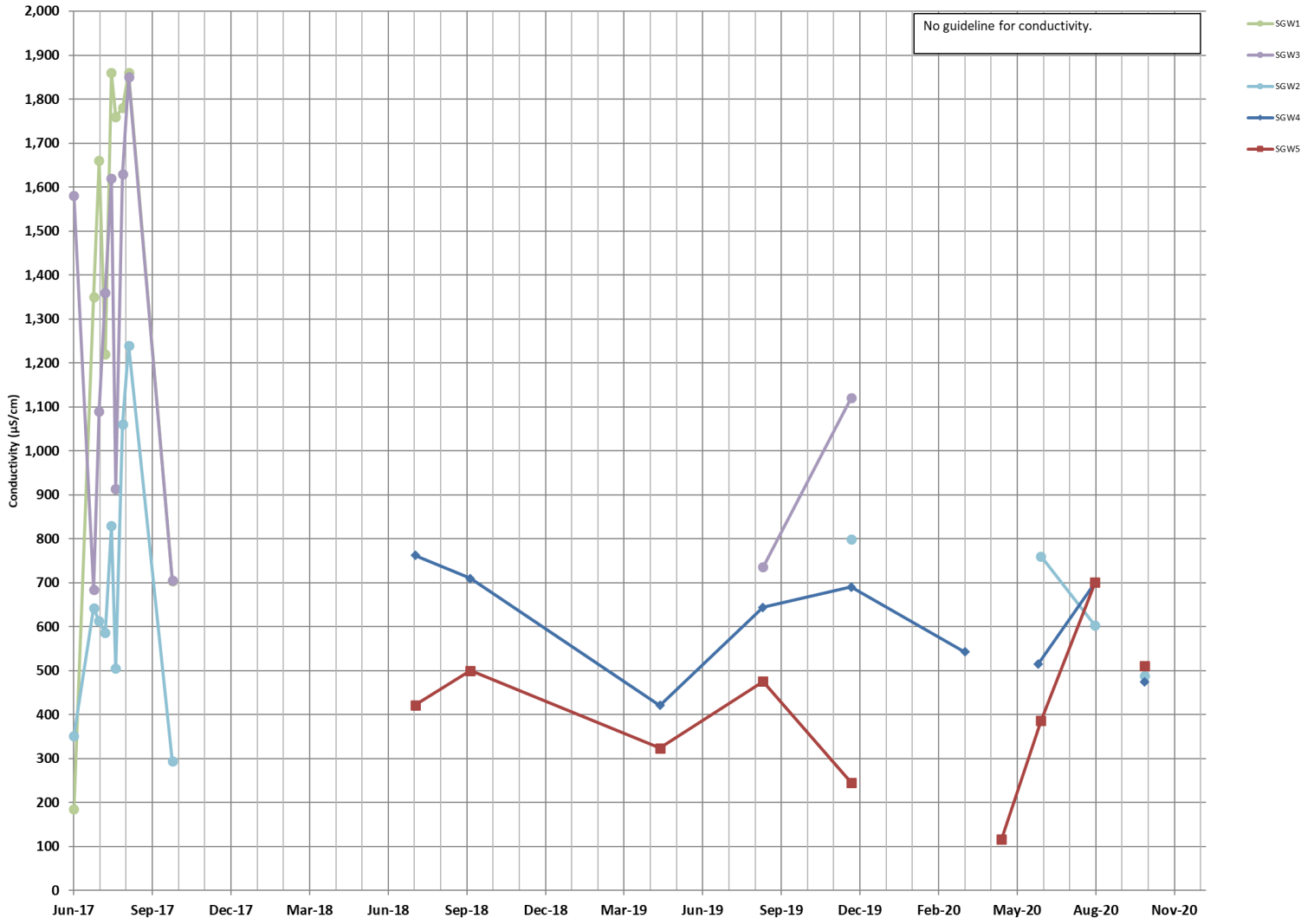

SPERLING HANSEN ASSOCIATES

Regional District of Kitimat-Stikine

PROJECT:

Hazelton WMF Annual Monitoring Report

TITLE:

Shallow Groundwater Conductivity

SCALE:	DATE:	PROJECT NO:
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DESIGNED	AM	DRAWING NO:
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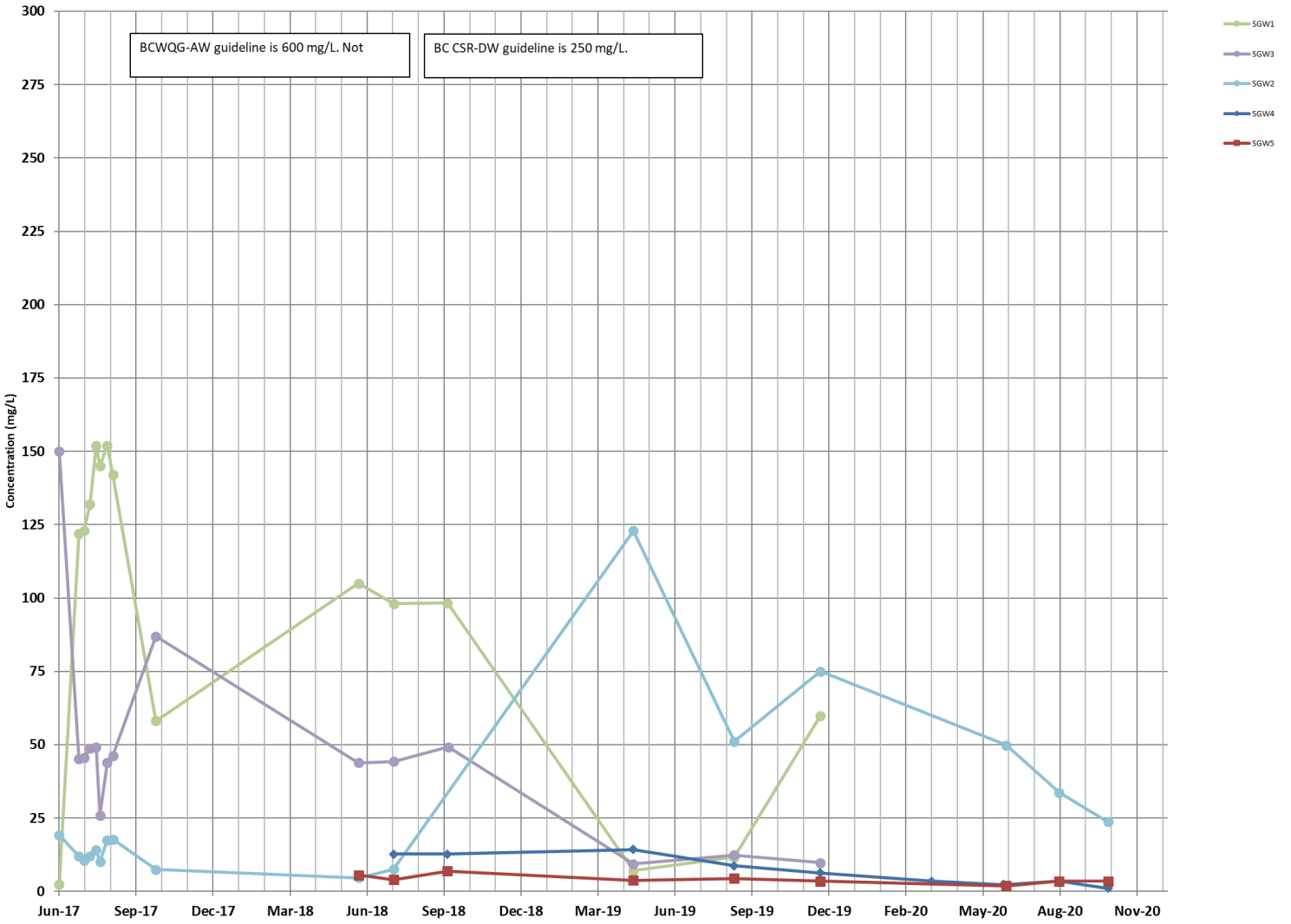

SPERLING HANSEN ASSOCIATES

Regional District of Kitimat-Stikine

PROJECT:

Hazelton WMF Annual Monitoring Report

TITLE:

Shallow Groundwater Chloride

SCALE:	DATE:	PROJECT NO:
N/A	2021/05/04 yyyy/mm/dd	PRJ21015
DESIGNED	AM	DRAWING NO:
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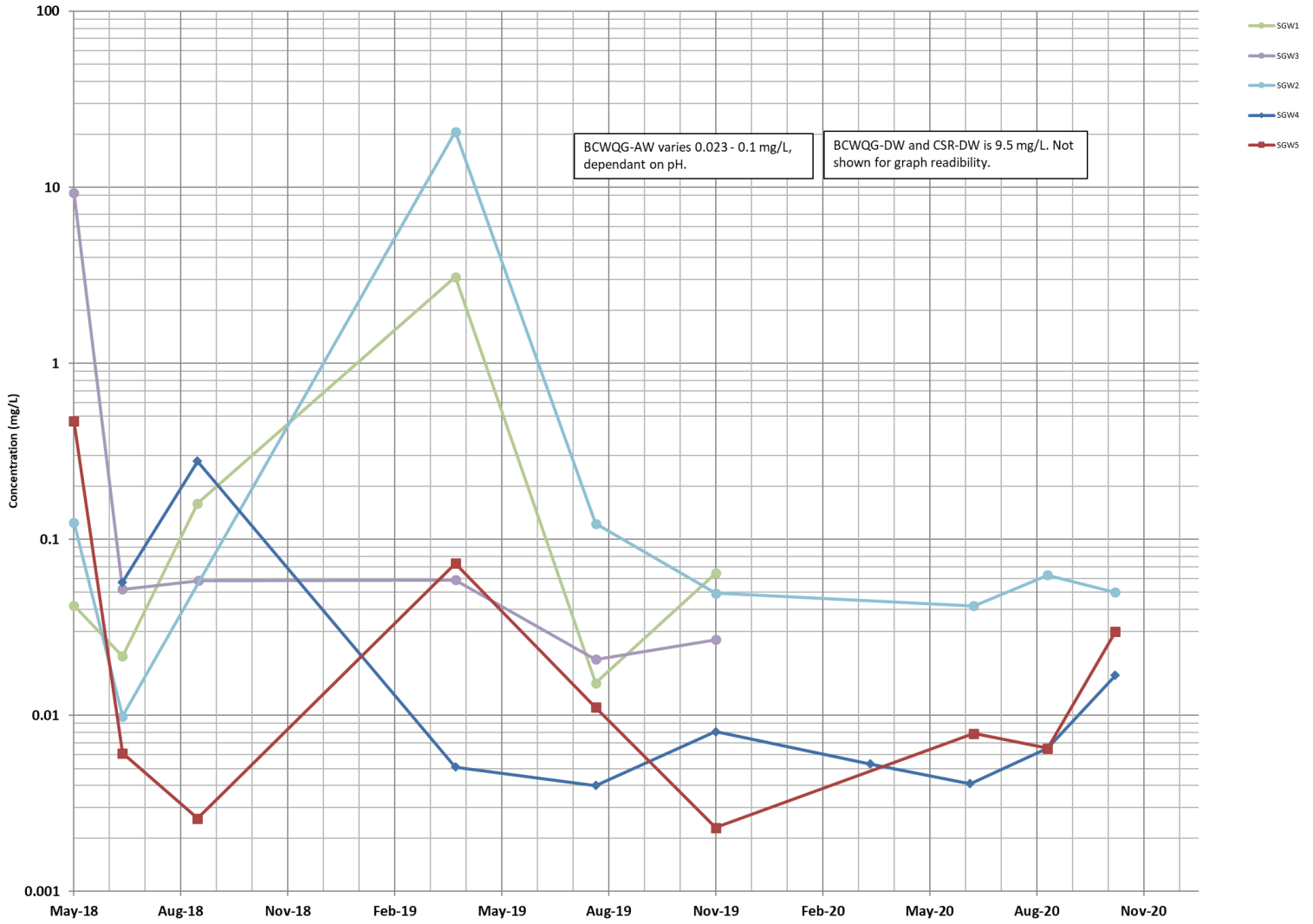

SPERLING HANSEN ASSOCIATES

Regional District of Kitimat-Stikine

PROJECT:

Hazelton WMF Annual Monitoring Report

TITLE:

Shallow Groundwater Dissolved Aluminum

SCALE:	DATE:	PROJECT NO:
N/A	2021/05/04 (yyyy/mm/dd)	PRJ21015
DESIGNED	AM	DRAWING NO:
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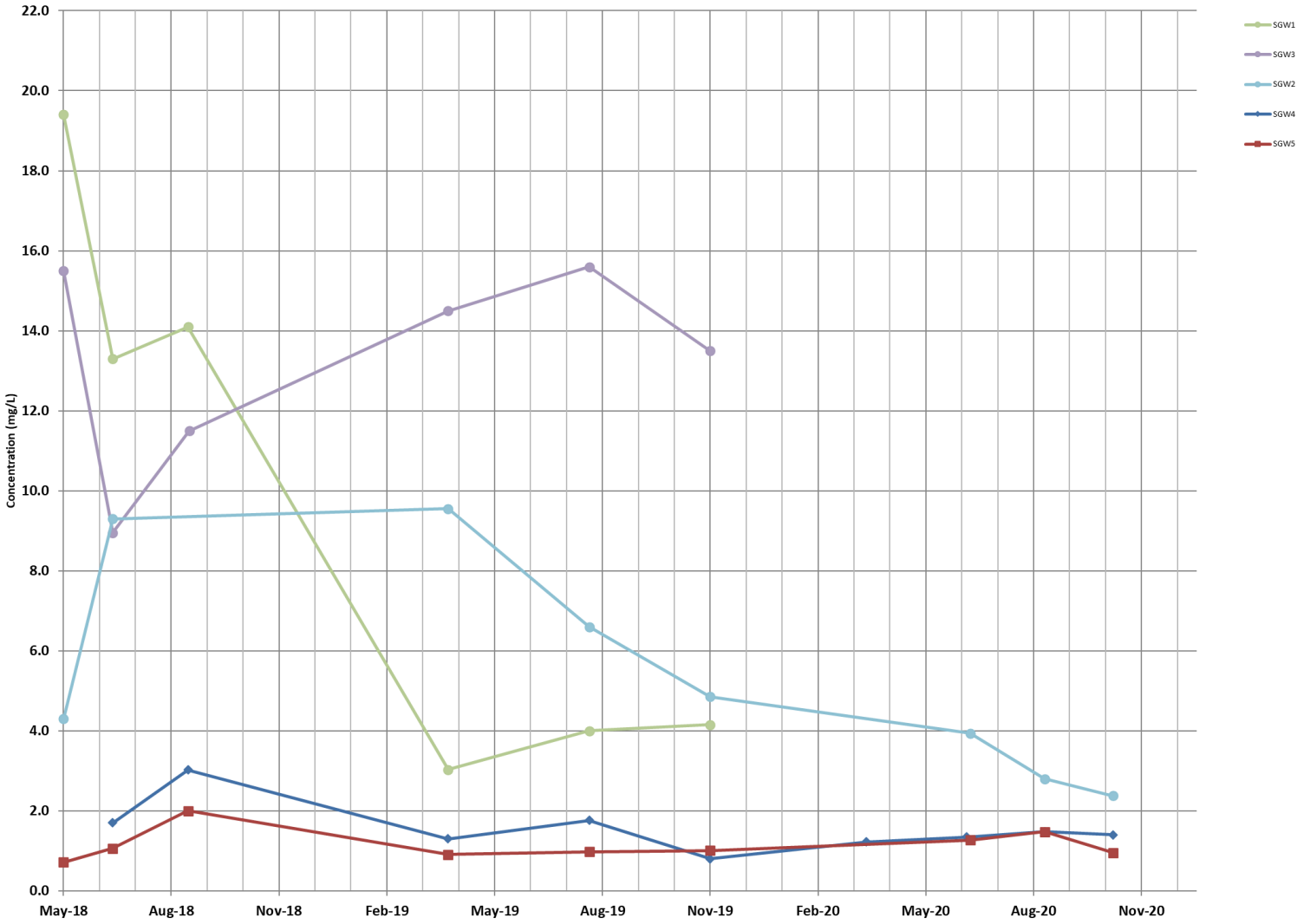

Sperling Hansen Associates

Regional District of Kitimat-Stikine

PROJECT:

Hazelton WMF Annual Monitoring Report

TITLE:

Shallow Groundwater Dissolved Manganese

SCALE:	DATE:	PROJECT NO:
N/A	2021/05/04 (yyyy/mm/dd)	PRJ21015
DESIGNED	AM	DRAWING NO:
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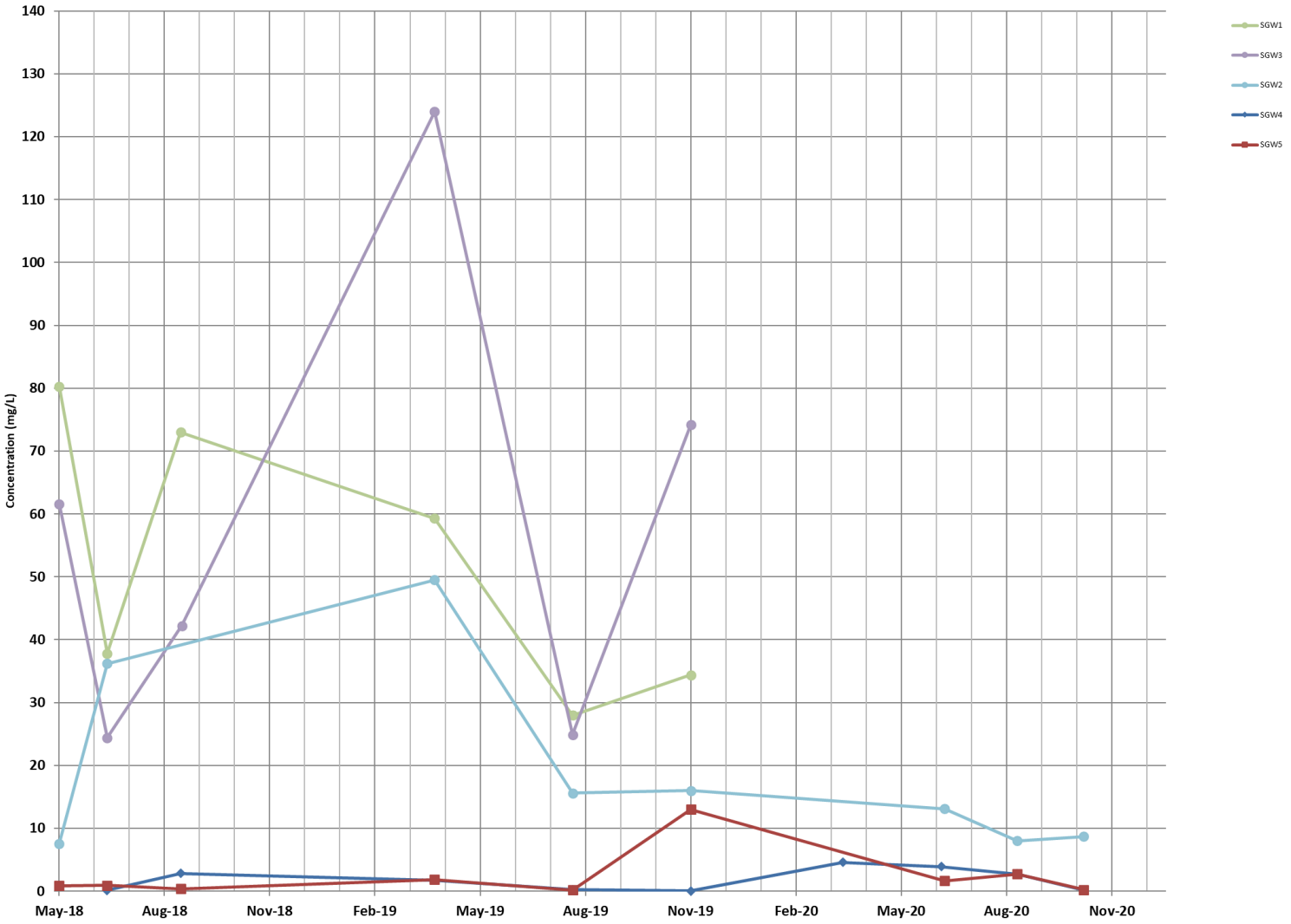

SPERLING HANSEN ASSOCIATES

Regional District of Kitimat-Stikine

PROJECT:

Hazelton WMF Annual Monitoring Report

TITLE:

Shallow Groundwater Dissolved Iron

SCALE:	DATE:	PROJECT NO:
N/A	2021/05/04 yyyy/mm/dd	PRJ21015
DESIGNED	AM	DRAWING NO:
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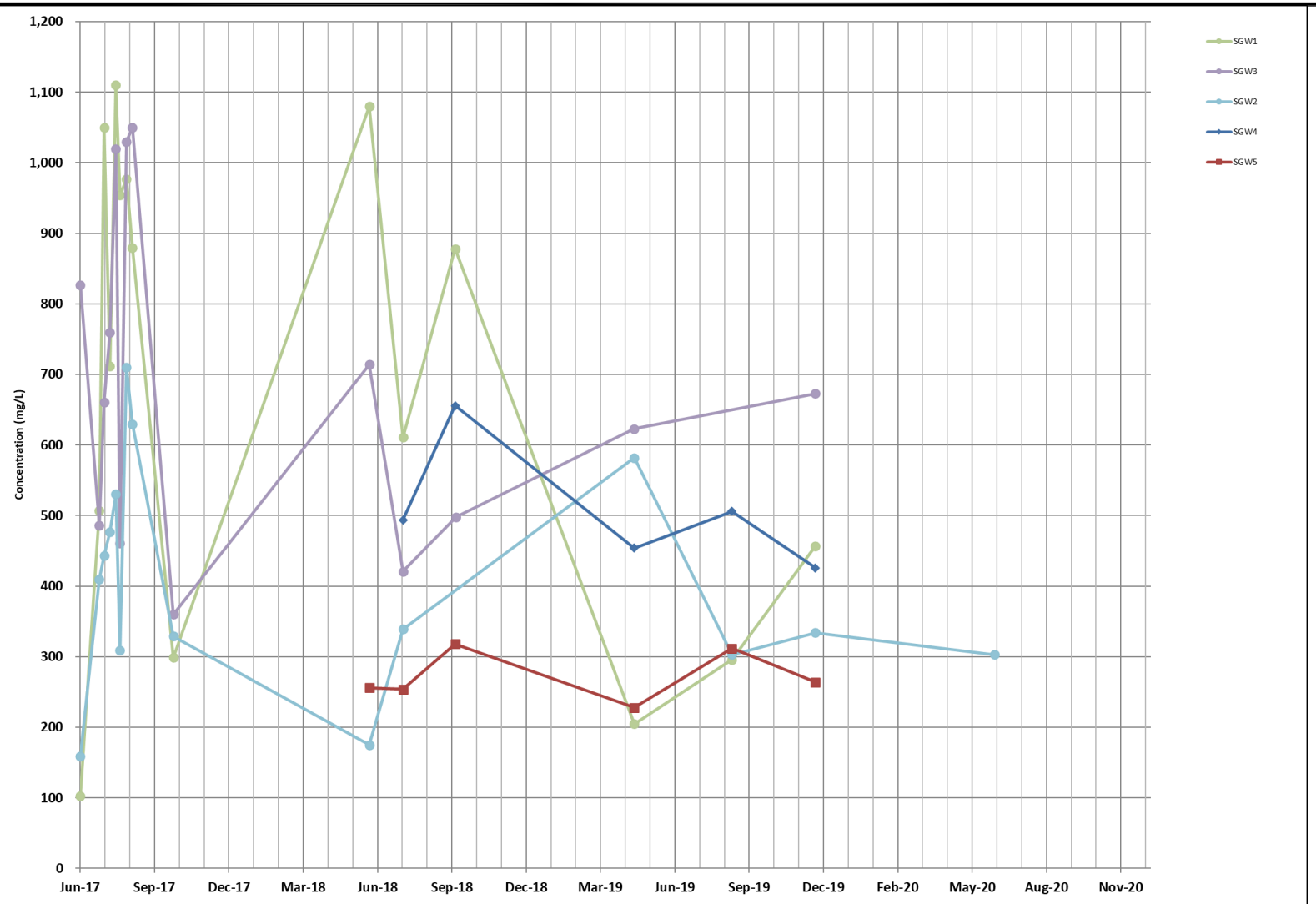

Sperling Hansen Associates

Regional District of Kitimat-Stikine

PROJECT:

Hazelton WMF Annual Monitoring Report

TITLE:

Shallow Groundwater Hardness

SCALE:	DATE:	PROJECT NO:
N/A	2021/05/04 (yyyy/mm/dd)	PRJ21015
DESIGNED	AM	DRAWING NO:
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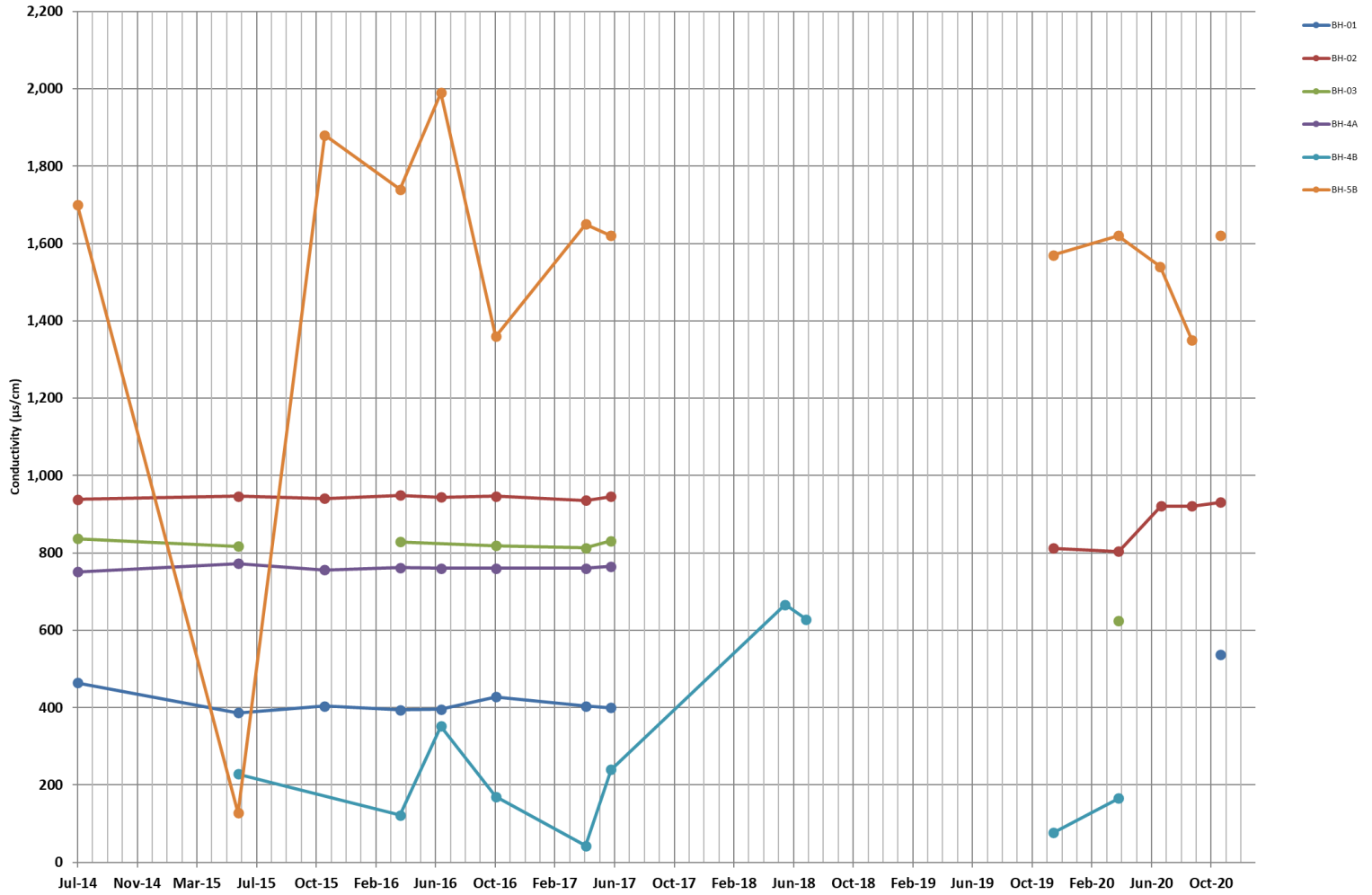

SPERLING HANSEN ASSOCIATES

Regional District of Kitimat-Stikine

PROJECT:

Hazelton WMF Annual Monitoring Report

TITLE:

Groundwater Conductivity

SCALE:	DATE:	PROJECT NO:
N/A	2021/05/04 yyyy/mm/dd	PRJ21015
DESIGNED	AM	DRAWING NO:
DRAWN	AM	**Chart 12**
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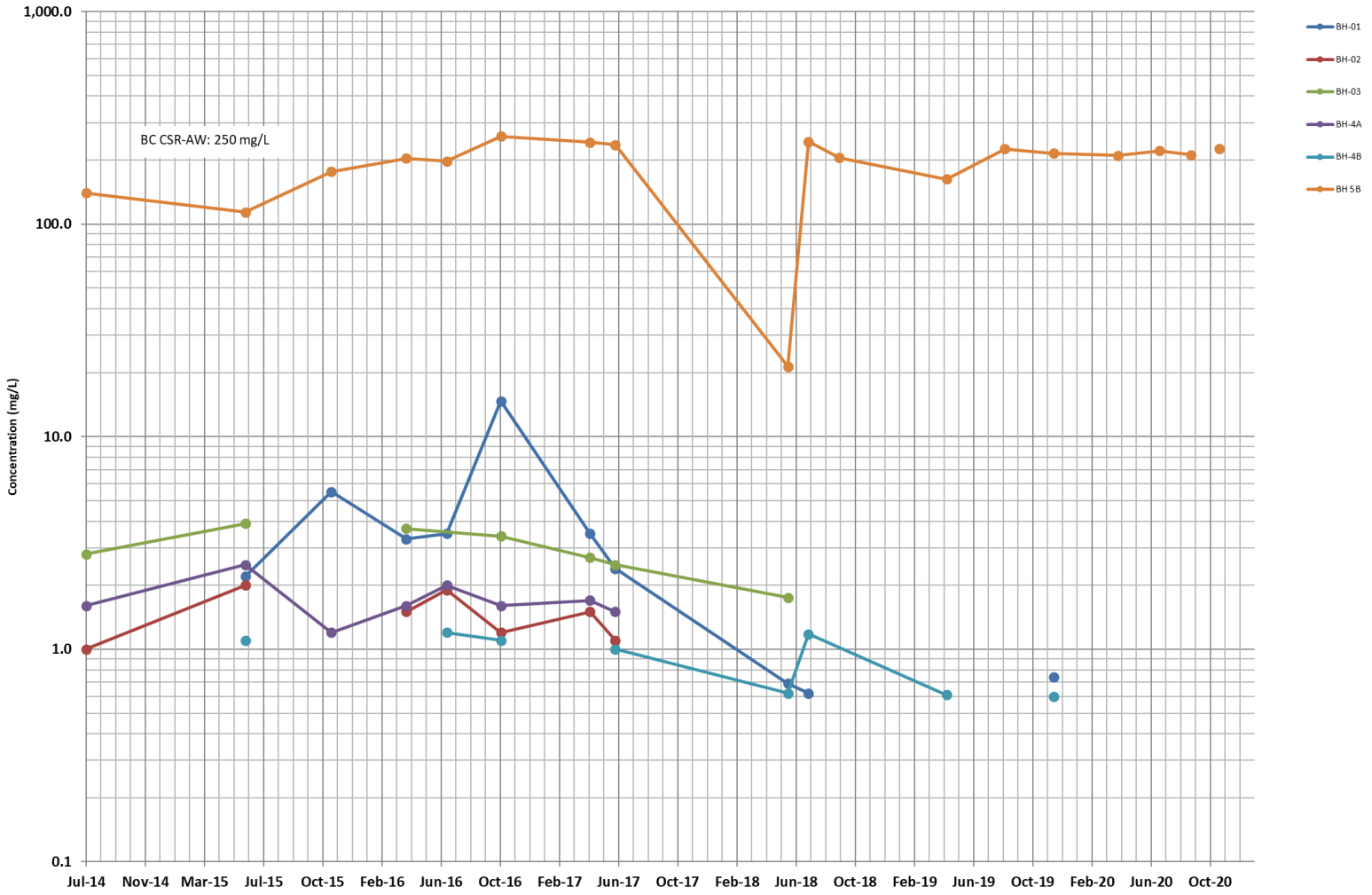

SPERLING HANSEN ASSOCIATES

Regional District of Kitimat-Stikine

PROJECT:

Hazelton WMF Annual Monitoring Report

TITLE:

Groundwater Chloride

SCALE:	DATE:	PROJECT NO:
N/A	2021/05/04 yyyy/mm/dd	PRJ21015
DESIGNED	AM	DRAWING NO:
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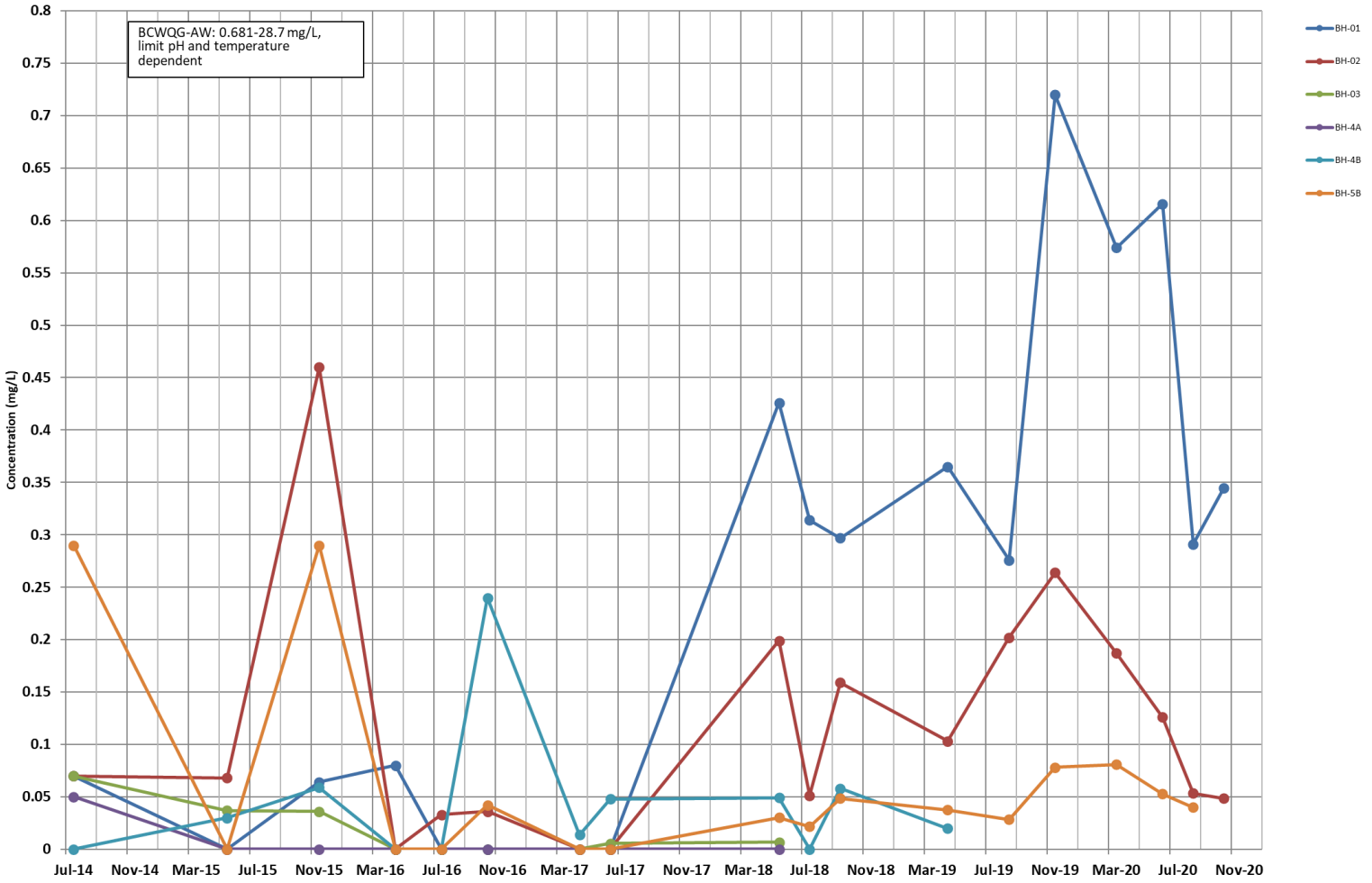

SPERLING HANSEN ASSOCIATES

Regional District of Kitimat-Stikine

PROJECT:

Hazelton WMF Annual Monitoring Report

TITLE:

Groundwater Ammonia

SCALE:	DATE:	PROJECT NO:
N/A	2021/05/04 yyyy/mm/dd	PRJ21015
DESIGNED	AM	DRAWING NO:
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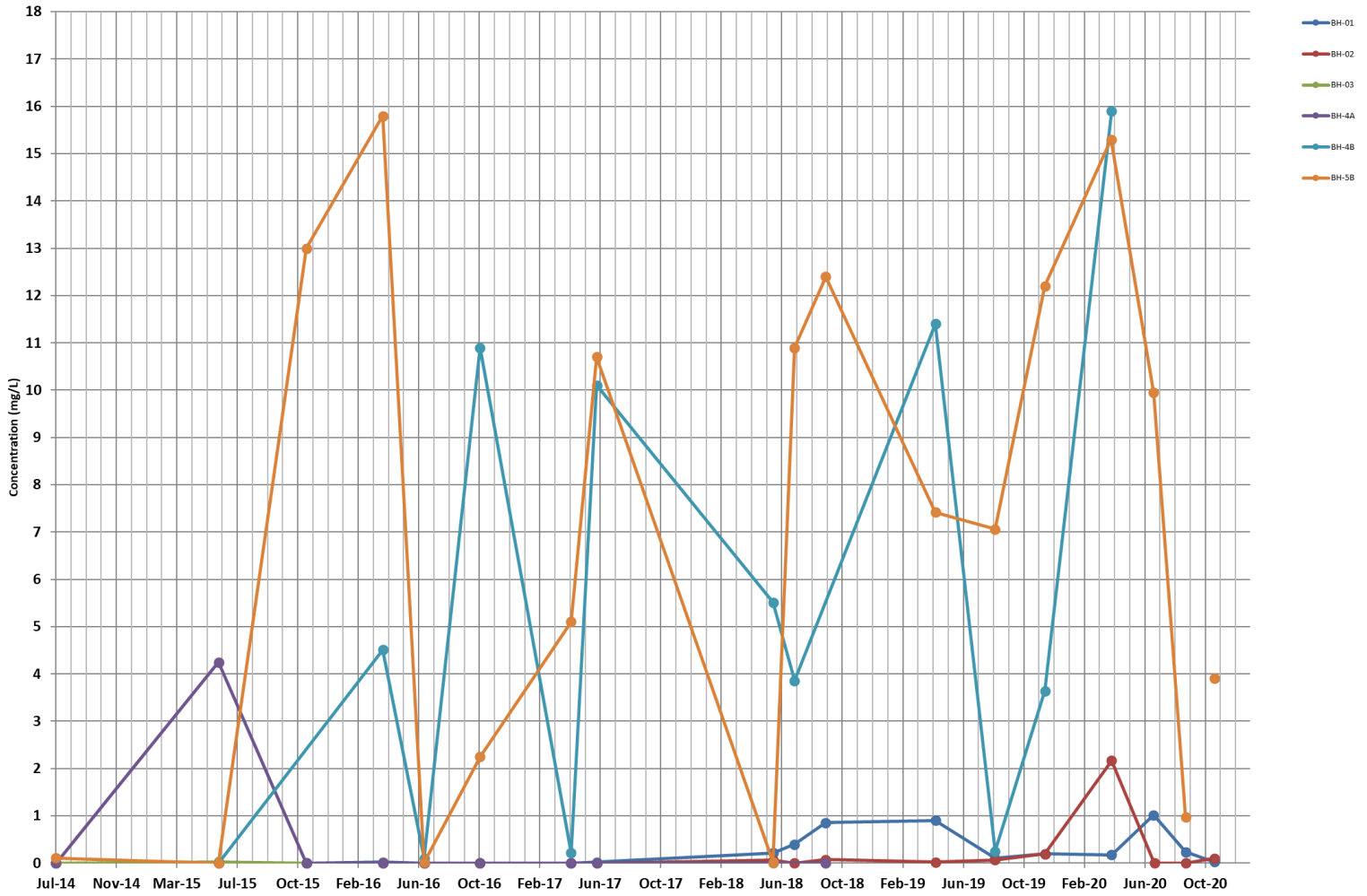

SPERLING HANSEN ASSOCIATES

Regional District of Kitimat-Stikine

PROJECT:

Hazelton WMF Annual Monitoring Report

TITLE:

Groundwater Dissolved Iron

SCALE:	DATE:	PROJECT NO:
N/A	2021/05/04 (yyyy/mm/dd)	PRJ21015
DESIGNED	AM	DRAWING NO:
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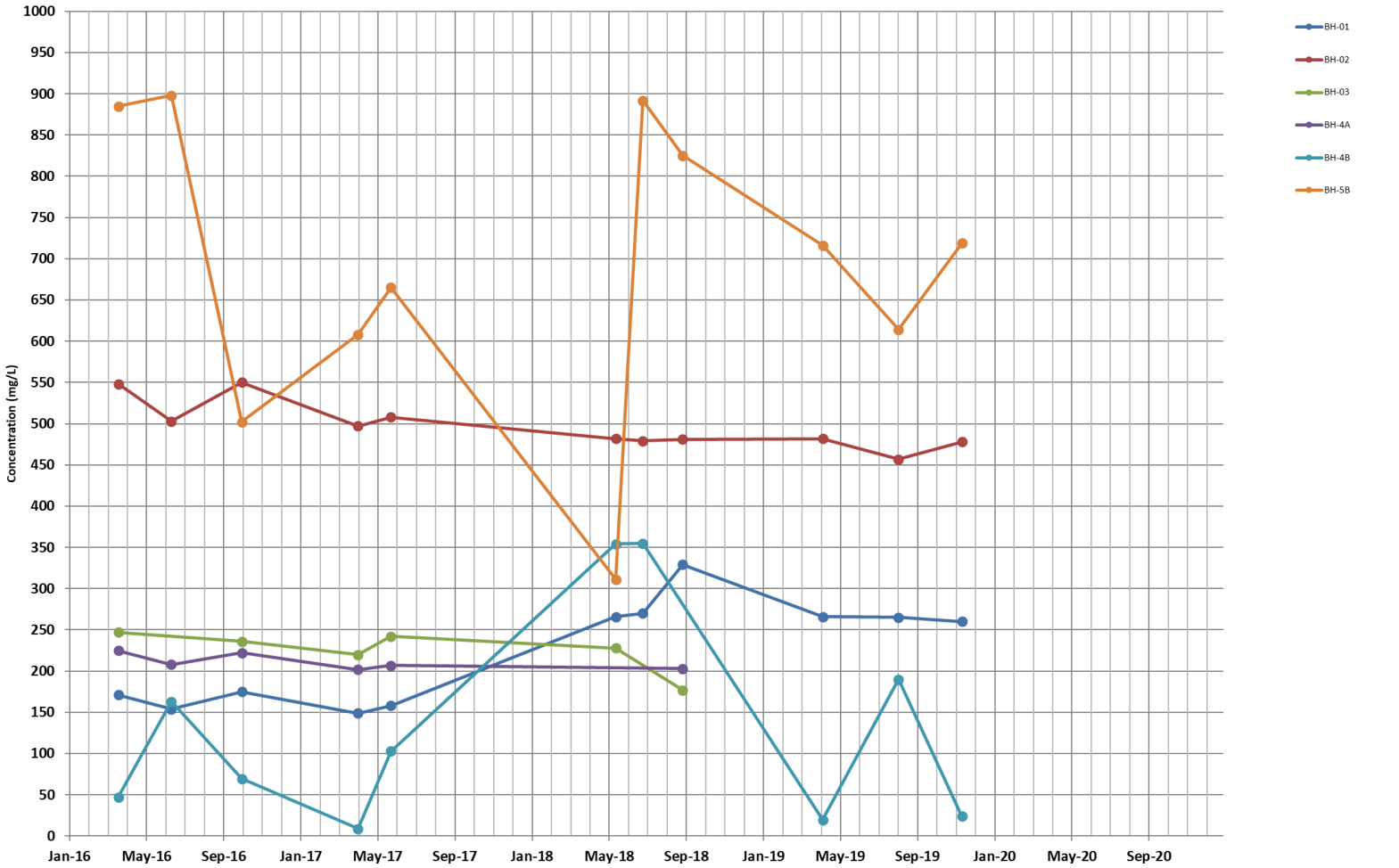

SPERLING HANSEN ASSOCIATES

Regional District of Kitimat-Stikine

PROJECT:

Hazelton WMF Annual Monitoring Report

TITLE:

Groundwater Hardness

SCALE:	DATE:	PROJECT NO:
N/A	2021/05/04 yyyy/mm/dd	PRJ21015
DESIGNED	AM	DRAWING NO:
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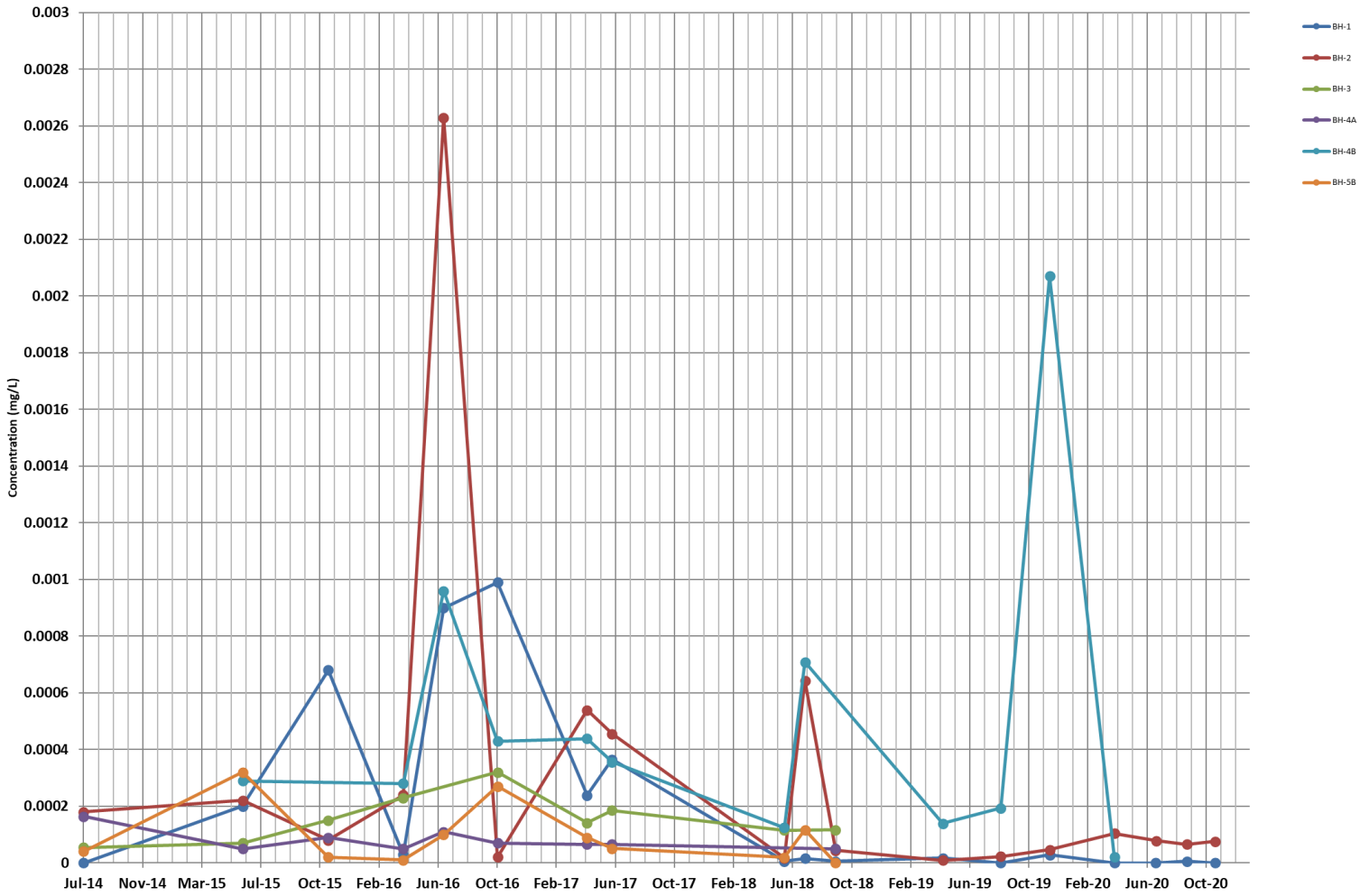


SPERLING HANSEN ASSOCIATES

Regional District of Kitimat-Stikine

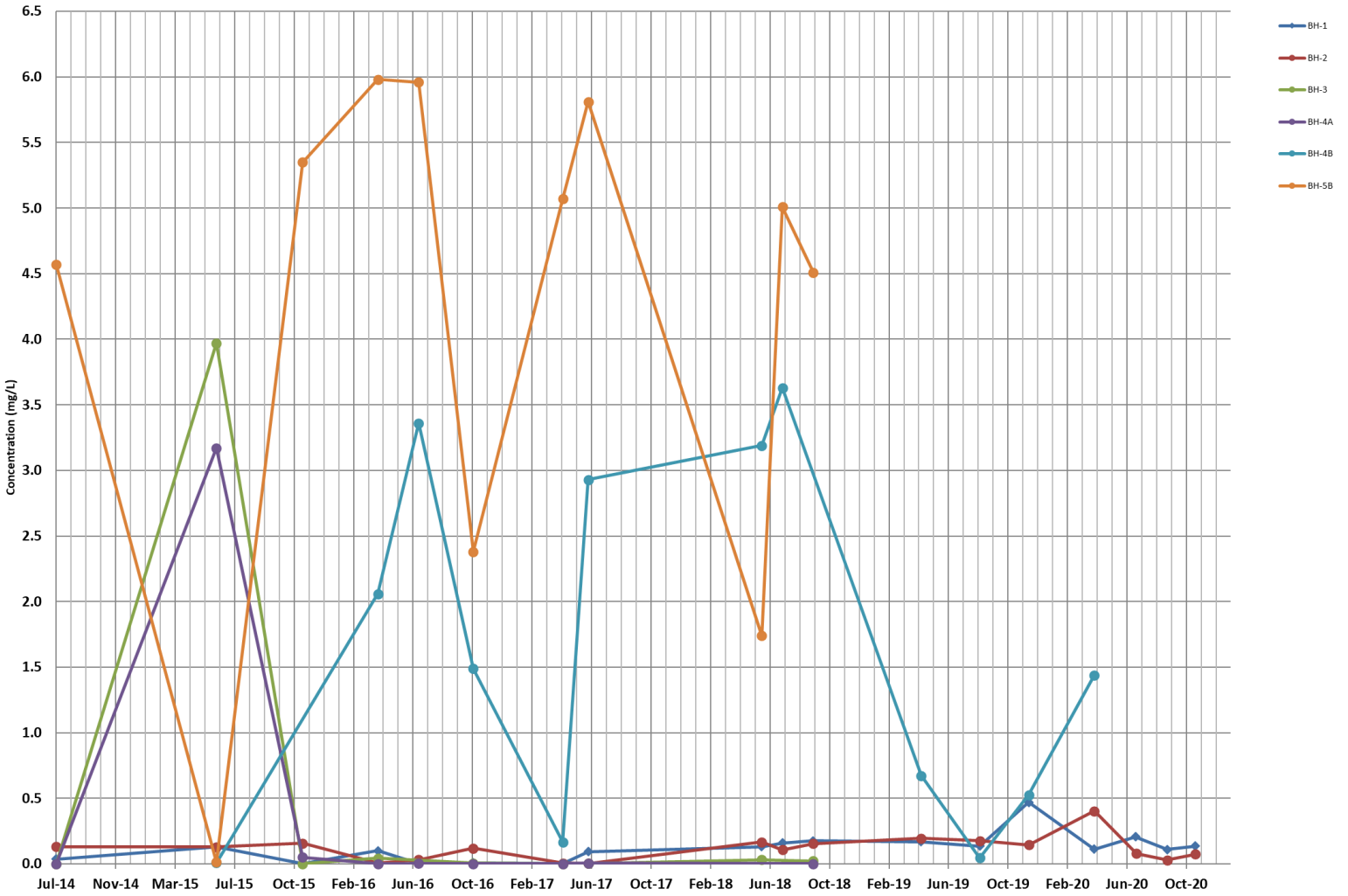
PROJECT:

Hazelton WMF Annual Monitoring Report

TITLE:

Groundwater Dissolved Cadmium

SCALE:	DATE:	PROJECT NO:
N/A	2021/05/04 (yyyy/mm/dd)	PRJ21015
DESIGNED	AM	DRAWING NO:
DRAWN	AM	**Chart 17**
CHECKED	DK	



Sperling Hansen Associates

Regional District of Kitimat-Stikine

PROJECT:

Hazelton WMF Annual Monitoring Report

TITLE:

Groundwater Dissolved Manganese

SCALE:	DATE:	PROJECT NO:
N/A	2021/05/04 (yyyy/mm/dd)	PRJ21015
DESIGNED	AM	DRAWING NO:
DRAWN	AM	Chart 18
CHECKED	DK	

Appendix D: Operational Certificate MR-17226 for the Hazelton Regional Landfill

May 27, 2020

Tracking Number: 392981
Authorization Number: 17226

REGISTERED MAIL

REGIONAL DISTRICT OF KITIMAT-STIKINE
300 4545 LAZELLE AVENUE
TERRACE, BC
V8G 4E1

Dear Operational Certificate Holder:

Enclosed is Operational Certificate 17226 issued under the provisions of the *Environmental Management Act*. Your attention is respectfully directed to the terms and conditions outlined in the operational certificate.

This operational certificate does not authorize entry upon, crossing over, or use for any purpose of private or Crown lands or works, unless and except as authorized by the owner of such lands or works. The responsibility for obtaining such authority rests with the operational certificate holder. It is also the responsibility of the operational certificate holder to ensure that all activities conducted under this authorization are carried out with regard to the rights of third parties and comply with other applicable legislation that may be in force.

This decision may be appealed to the Environmental Appeal Board in accordance with Part 8 of the *Environmental Management Act*. An appeal must be delivered within 30 days from the date that notice of this decision is given. For further information, please contact the Environmental Appeal Board at (250) 387-3464.

Administration of this operational certificate will be carried out by staff from the Environmental Protection Division's Regional Operations Branch. Plans, data, reports, non-compliance notifications and non-compliance reports pertinent to the permit are to be submitted to the Environmental Protection Division via email or other electronic means as directed in the following web link: https://www2.gov.bc.ca/gov/content/environment/waste-management/waste-discharge-authorization/data-and-report-submissions

Yours truly,

Karen Moores, P.Ag.
for Director, *Environmental Management Act*

Environmental Protection Division
Ministry of Environment
3726 Alfred Avenue
Smithers, BC, V0J 2N0
Authorizations - North Region
Telephone: (250) 847-7260
Facsimile: (250) 847-7591

Authorizations - North Region

Enclosure

cc: Environment Canada

MINISTRY OF ENVIRONMENT

OPERATIONAL CERTIFICATE

17226

for the

HAZELTON REGIONAL LANDFILL

Under the Provisions of the Environmental Management Act and in accordance with the Regional District of Kitimat-Stikine's Solid Waste Management Plan, the

REGIONAL DISTRICT OF KITIMAT-STIKINE

Suite 300 – 4545 Lazelle Avenue

Terrace, British Columbia

V8G 4E1

is authorized to store, handle, treat and discharge municipal waste from Hazelton, Kitwanga and surrounding areas at the Hazelton Regional Landfill subject to the conditions listed below. Contravention of any of these conditions is a violation of the *Environmental Management Act* and may result in prosecution.

1. LOCATION OF LANDFILL PROPERTY

The location of the property where discharges are authorized to occur is the SW ¼ Part of District Lot 1574, Cassiar Land District.

2. DESIGN, OPERATIONS and CLOSURE PLAN

The landfill and associated works must be designed by qualified professionals [such as engineer(s) and/or geoscientist(s)] registered in the Province of British Columbia who have expertise in the field of landfill design. These details must be incorporated into a "Design, Operations, and Closure Plan" (DOCP) which must be reviewed, updated and submitted to the Director for approval every 5 years

Date issued: May 30, 2013
Date amended: May 27, 2020
(most recent)

Karen Moores, P.Ag.
for Director, *Environmental Management Act*
Authorizations - North Region

thereafter. The landfill must be operated at all times in accordance with the approved DOCP.

The DOCP must include, at a minimum:

- extent and location of each disposal area, clearly shown on a site plan;
- quantities of wastes (solid, liquid and leachate) discharged;
- works associated with each disposal area;
- any proposed restrictions on salvaging by the public;
- scaled site plan accurately showing the legal survey, the engineered final design footprint, and final design contours;
- proposed litter control measures on-site and at neighbouring properties;
- proposed measures to meet the Landfill Gas Regulation and landfill gas health and safety requirements;
- proposed surface and groundwater management plan including an assessment of the adequacy of the number and location of groundwater monitoring wells;
- proposed preliminary water quality exceedance response plans;
- proposed maximum lift height of compacted waste;
- proposed leachate system design and management plan, including the priority of and circumstances dictating when effluent is sent to the phytoremediation stand and when it is sent to the infiltration trench;
- proposed maximum allowable surface area of exposed waste;
- proposed maximum volume of waste in a cell at any given time;
- proposed method, coverage (area) and timing of progressive closure;

- design, construction and operation of the liquid waste (septic tank pumpage) disposal lagoon(s);
- signage and fencing at and around the liquid waste disposal lagoon(s);
- nature/volume of wastes to be discharged at the liquid waste lagoon(s);
- location of the designated wood residue open burning area;
- groundwater model that, in relation to the final landfill design:
    - (i) is developed by a qualified professional (experienced in groundwater hydrogeology);
    - (ii) outlines the groundwater regime including flow directions, estimated rates, inferred leachate plume, etc. at and in the surrounding area of the landfill site influenced by landfill leachate;
    - (iii) appropriately assesses the correct number and location of wells such that groundwater can be intercepted and assessed to determine groundwater quality and flow direction;
    - (iv) estimates the loadings of Potential Contaminants of Concern (PCOC)'s from landfill leachate to the environment. The groundwater model and PCOC loading estimates must be updated with each review of the DOCP.
- maximum allowable slopes of the various disposal areas;
- engineered final design footprint delineating the maximum extent of solid waste disposal allowable at the facility horizontally and vertically;
- engineered excavation grade for municipal solid waste;
- landfill design waste density;

Date issued: May 30, 2013
Date amended: May 27, 2020
(most recent)

Karen Moores, P.Ag.
for Director, *Environmental Management Act*
Authorizations - North Region

- proposed notification schedule for closure;
- proposed closure plan including:

  i) intended end-use of the landfill property after closure;

  ii) anticipated total waste volume, tonnage, and life remaining of the landfill;

  iii) a topographic plan showing the final elevation contours of the landfill and surface water diversion and drainage controls;

  iv) design of the final cover suited to the intended end-use of the site, including the thickness and permeability of barrier layers and drainage layers, and information on topsoil, vegetative cover and erosion prevention controls;

  v) procedures for notifying the public about the closure and about alternative waste disposal facilities;

  vi) nuisance wildlife control procedures;

  vii) a comprehensive long-term monitoring plan by a qualified professional, including groundwater monitoring, surface water monitoring, aquatic effects monitoring (including acute and chronic toxicity testing if determined to be necessary), landfill gas monitoring, leachate monitoring, final cover monitoring, and erosion and settlement monitoring, for a minimum post-closure period of 25 years;

  viii) design, if necessary, for the collection, storage and treatment/use of landfill gas for a minimum 25-year post-closure period

  ix) plan for the operation of any required pollution abatement engineering works such as leachate collection and treatment systems, for a minimum post-closure period of 25 years; and

x) an estimated cost updated every five years, to carry out closure and post-closure activities for a minimum period of 25 years.

3. DISCHARGE OF MUNICIPAL SOLID WASTE

Municipal solid waste is authorized to be discharged to ground in accordance with the approved DOCP. The site reference number for this discharge is E288569.

4. STORAGE AND HANDLING OF WASTES FOR SALVAGE AND RECYCLING

Wastes are authorized to be stored and handled for salvage and recycling in accordance with the approved DOCP.

5. DISCHARGE OF MUNICIPAL LIQUID WASTE

Municipal liquid waste is authorized to be discharged to an appropriate discharge facility in accordance with the approved DOCP. The site reference number for this discharge is E288571.

6. DISCHARGE OF TREATED EFFLUENT TO PHYTOREMEDIATION STAND

Treated effluent is authorized to be discharged to the Phytoremediation Stand in accordance with the approved DOCP and Section 9. The site reference number for this discharge is E288572.

7. DISCHARGE OF TREATED EFFLUENT TO WETLAND #4 INFILTRATION TRENCH

Treated effluent is authorized to be discharged to the Wetland #4 Infiltration Trench within the Ephemeral Creek Drainage in accordance with the approved DOCP and Section 9. The site reference number for this discharge is E309786.

8. DISCHARGE OF AIR CONTAMINANTS FROM OPEN BURNING OF WOOD RESIDUE

Air contaminants are authorized to be released from the open burning of wood residue in accordance with this section and the approved DOCP. The site reference number for this discharge is E288570.

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8.1 Location

Any open burning of selected wastes must be restricted to the designated open burning area as shown on the attached site plan and as identified on-site. Signs which identify the nature of the waste acceptable at the designated open burning area must be erected and maintained.

8.2 Quantity, Timing, and Duration of Discharge

The maximum authorized quantity of wood residue to be open burned during each event is that which has accumulated at the time of burn initiation.

The maximum authorized duration of each burn must be limited to the period between two hours after sunrise on the day of ignition, and sunset on the following day. Each open burn must be completely extinguished at the end of the authorized burn duration.

Should a condition arise which prevents the burn pile(s) from being burned within this period, the Director must be notified in accordance with this authorization.

8.3 Nature of Wastes

Acceptable materials for burning may only include dry, unpainted, untreated demolition, construction and packing-related wood residue, clean stumps, prunings, vegetative debris and brush, but must exclude nuisance-causing combustibles such as glue-containing wood, painted and treated wood, sawdust , mulch, wood chips, rubber, plastics, tars, insulation, roofing material, asphalt shingles, etc.

8.4 Favourable Weather for Smoke Dispersion

Open burning must not proceed unless the recorded Environment Canada Ventilation Index Forecast for Smithers is greater than 55 (GOOD) for both days of the proposed burn.

The contact number for the forecast is 1-888-281-2992. Ventilation index forecasts can also be obtained after 7:00 a.m. from the following Environment Canada website:
http://www.weatheroffice.gc.ca/forecast/textforecast_e.html?Bulletin=flcn39.cwvr

Date issued: May 30, 2013
Date amended: May 27, 2020
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A burn registration number must be obtained from the Ministry of Forests (1-888-797-1717) prior to ignition.

Open burning of wood residue must not be initiated or continued if the local air flow will cause the smoke to negatively impact a nearby population or cause pollution. No burning must occur during periods of fire hazard or when burning is prohibited by other agencies.

8.5 Minimization of Smoke

Each burn must be tended in a manner that ensures minimization of smoke emissions. Measures to minimize smoke must include, but not necessarily be limited to: stacking of waste in a manner that eliminates inclusion of dirt; waiting to burn until wastes are reasonably dry after any significant precipitation event; and using adequate equipment and staff.

8.6 Extinguishment Contingency Plan

Prior to burning, a contingency plan must be in place detailing how the open burn will be extinguished in the event of any of the following occurring:

i) Inadequate smoke dispersion in the surrounding environment;

ii) wood continues to smoulder after the authorized burn period; and,

ii) the Director requires that the open burn be extinguished for environmental protection reasons

8.7 Extinguishment

All combustion must be completely extinguished at the end of the authorized period as set out in Section 8.2

Date issued: May 30, 2013
Date amended: May 27, 2020
(most recent)

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9. LEACHATE MANAGEMENT REQUIREMENTS

9.1 Leachate Management

9.1.1 Leachate Containment

A leachate containment and appropriate barrier system must be utilized. The barrier system must consist of a minimum of 2 metres of natural *in-situ* clay with a hydraulic conductivity of 1 x 10^{-6} cm/s or less. Alternatively, an engineered barrier may be used provided it is equivalent to or better than the natural clay barrier specified above.

9.1.2 Leachate Collection

A leachate collection system must be utilized. A continuous drainage blanket must be established beneath all landfill phases. The drainage blanket must consist of, or be equivalent to, a minimum 300 mm thick layer of clean gravel with an effective hydraulic conductivity exceeding 1 x 10^{-1} cm/s. The leachate collection system must be designed such that the hydraulic head on top of the barrier layer does not exceed 300 mm at any time.

9.1.3 Quantity of the Discharge

The maximum authorized quantity of discharge is indeterminate.

9.1.4 Timing of the Discharge

The discharge may occur 24 hours/day, 7 days/week, 365 days/year if in accordance with Sections 9.1.5, 11.1 and 11.2.

9.1.5 Characteristics of the Discharge

Acceptable constituents of the effluent include landfill leachate, liquid waste from the septage facility, site storm water, and run-off from the Phytoremediation Stand. The effluent must be directed in order of priority to the Phytoremediation Stand (Section 6), or to

Wetland #4 Infiltration Trench within the Ephemeral Creek Drainage (Section 7) and as established in the DOCP.

The characteristics of the effluent discharged to the Phytoremediation Stand (Section 6) or Wetland #4 Infiltration Trench within the Ephemeral Creek drainage (Section 7) must not exceed the following limits:

Daphnia magna acute lethality*,[1]	50% survival in 100% concentration, Minimum
Total Nitrogen	60 mg/L
Ammonia	30 mg/L
pH	6.5 to 8.5
Chloride	3750 mg/L
Total Iron	4.5 mg/L
Total Zinc	75 mg/L
Total Cadmium	0.1 mg/L

* not applicable if discharge only occurs to the Phytoremediation Stand

[1] this limit became effective June 30 2019 to allow for commissioning of the works and an assessment of the first year of monitoring data and effectiveness to occur as required in Section 12.2(iii)

9.1.6 Site Water Balance Model and Phytoremediation Stand Uptake Review

By December 31 2023 a qualified professional must re-evaluate the site water balance model including the rate of effluent uptake by the trees in the Phytoremediation Stand. Recommendations for any alterations to the discharge requirements in this section must be submitted to the Director by June 30 2024.

9.1.7 Authorized Works

The authorized works include storm water collection infrastructure, leachate collection and treatment facilities including an equalization basin, 4 engineered wetlands, and a sand filter and

related appurtenances, with the final point of discharge being to either the Phytoremediation Stand or to the Wetland #4 Infiltration Trench within the Ephemeral Creek drainage approximately as shown on the attached Site Plan A. It is permissible to bypass one or more components of the authorized works in order to achieve improved effluent quality through recirculation or additional retention time. In all cases, Section 9.1.5 must be met prior to discharge.

9.1.8 Authorized Works Functionality

The operational certificate holder must not discharge under this authorization unless the authorized works are complete and fully functional according to the treatment flow options as established in the DOCP.

10. GENERAL REQUIREMENTS

10.1 Lethal Toxicity of the Discharge

Commencing July 1, 2019 (post facility commissioning period) for any discharge to the Wetland #4 Infiltration Trench within the Ephemeral Creek Drainage (Section 7) the treated effluent and storm water must not be lethally toxic to aquatic organisms at the point of discharge (Wetland #4 Outlet Culvert) For the purposes of this 48 hour test, in >95% effluent concentration, there must be a minimum 50% survival of Daphnia magna. This Section does not apply to discharges of effluent to the Phytoremediation Stand (Section 6).

10.2 Prohibited Wastes

No wastes as defined by the Hazardous Waste Regulation (B.C. Reg. 243/2016, November 1, 2017) must be treated or disposed of at this site except as authorized by the Director. Materials which are regulated under the Recycling Regulation must not be treated or disposed of at this site if local marshalling and recycling facilities are available.

10.3 Waste Asbestos

Notwithstanding Section 10.2 of this operational certificate, the disposal of waste asbestos under Section 3 of this operational certificate and in

compliance with the requirements of Section 40 of the Hazardous Waste Regulation is hereby authorized.

10.4 **Contaminated Soil**

Soil that contains contaminants in concentrations less than "Hazardous Waste" as defined by the Hazardous Waste Regulation may be disposed at the landfill site. Disposal does not include use as final cover material.

10.5 **Waste Measurement**

The quantity of waste material landfilled at the site must be measured or estimated on an annual basis. This data must be made available for inspection upon request.

10.6 **Surface Water Quality Exceedances Response Plan**

The operational certificate holder must submit to the Director, a response plan detailing how the operational certificate holder will report and respond to:

- exceedances at sampling station SW-09 of the British Columbia Water Quality Guidelines for the Protection of Aquatic Life (BCWQGAL)

The response plan must be submitted a minimum of 60 days prior to the commissioning (first discharge) of the leachate treatment system. Upon completion, the response plan must also form a part of the approved DOCP.

10.7 **Surface Water Quality Assessment**

If, during monitoring under Section 11.4, surface water quality measured at the property boundary (SW-09) exceeds the BCWQGAL then the operational certificate holder must implement the Surface Water Quality Exceedances Response Plan required in Section 10.6. The Director must be notified within 24 hours of the operational certificate holder triggering the response plan required in Section 10.6.

10.8 **Ground Water Quality Exceedances Response Plan**

The operational certificate holder must submit to the Director, a response plan detailing how the operational certificate holder will report and respond to:

- exceedances at sampling stations SGW-2, SGW-4, SGW-5, BH-3 and BH-5B of the Contaminated Sites Regulation Schedule 6 Drinking Water Standards

The response plan must be submitted a minimum of 60 days prior to the commissioning (first discharge) of the leachate treatment system. Upon completion, the response plan must also form a part of the approved DOCP.

10.9 Ground Water Quality Assessment

If, during monitoring under Section 11.3, ground water quality measured at sampling stations SGW-2, SGW-4, SGW-5, BH-3 and BH-5B exceeds the Contaminated Sites Regulation Schedule 6 Drinking Water Standards then the operational certificate holder must implement the Ground Water Quality Exceedances Response Plan required in Section 10.8. The Director must be notified within 24 hours of the operational certificate holder triggering the response plan required in Section 10.8.

10.10 Electric Fencing

10.10.1 Design, Construction and Maintenance

Wherever required, electric fencing and gate systems at the landfill must be designed, constructed, and maintained such that bears are prevented from entering into the landfill through any portion of the fence or gates at any time of the day.

10.10.2 Fence Type

Fencing may be either high tensile smooth wire or fence fabric (e.g., mesh-wire, page-wire, chain link or the like). The configuration of a high tensile smooth wire fence must consist of a minimum of eight strands, with four energized strands alternating with four grounded strands as follows: the bottom strand must be a grounded (-) strand and must not be more than 10 cm from the earth at any location; and thence starting from the bottom strand, the other seven strands must be spaced 15 ± 2 cm, 15 ± 2 cm, 15 ± 2 cm, 20 ± 2 cm, 20 ± 2 cm, 20

± 2 cm, and 25 ± 2 cm. Additional strands to this minimum configuration may be used.

A fence fabric may be used instead of high tensile smooth wire. The fence fabric must: be a minimum of 1.22-metre-high; be constructed of a minimum wire thickness of 11 gauge, and have a maximum mesh size of 15 cm. The bottom of the fabric must not be more than 10 cm from the earth at any location. Any uncharged fence fabric must have a minimum of four strands of charged wires on an outrigger system, spaced as follows: the first strand must not be higher than 25 cm from the earth; and each of the remaining three strands must be spaced approximately 25 cm apart from adjacent charged strands.

10.10.3 Wire Tension

For a high tensile smooth wire fence construction, all strands must be tightened to a minimum of 125 lbs tension at 20°C. The required tension is to be corrected for temperature by use of the following formula for 12-½ gauge high tensile steel wire:

$$Tension = 125 - 2.5(Temperature - 20)$$

where: *Tension* is in lbs force

Temperature is in °C

10.10.4 Post Spacing

Fence posts must be spaced a maximum of 7.5 metres apart.

10.10.5 Grounding System

A grounding system must be installed consisting of solid grounding rods (i.e., not pipe) with a minimum diameter of 16 mm (5/8 inch) that have a buried length of at least 2 metres. A minimum of three grounding rods (spaced at least 3 metres apart) must be installed and connected to the energizer. Alternative energizer grounding systems (e.g., grounding plates, or a deep-driven grounding system) may be used provided the grounding is equivalent to or better than three grounding rods. A grounding rod (or equivalent) must be installed at least once every 450 metres along the fence and connected to the grounded wire strands or uncharged fence fabric. Additional

grounding may be required for dry sites or if other conditions affect proper grounding.

10.10.6 Period of Operation

Electric fencing must be fully operational during the period of April 1 to October 31 inclusive each year and at any other time of year when there is bear activity in the immediate surrounding area. If snow is present during this period, any electrified strands above the snow line must be isolated from the remainder of the system and energized.

10.10.7 Minimum Voltage

Electric fencing must be operated with a minimum voltage of 6,000 volts.

10.10.8 Gate(s)

Any access through electric fencing for vehicles, equipment and personnel must consist of an electrified gate system that is closed during non-operating hours. The gate system must always be electrified to a minimum voltage of 6,000 volts except when being opened or closed. Any gate that is open during operating hours must be periodically checked by the attendant for bear activity during hours of operation. Gaps between the gate and the fence and the earth, and between gate panels (for a double-hung gate), must not exceed 10 cm.

10.10.9 Fence Inspections

The perimeter of the electric fencing must be inspected on every day that the site is open to the public and the voltage of the fencing measured at several points and at each gate using a proper electric fence voltmeter. The results of voltage testing must be recorded in a log book. Any results less than the minimum 6,000 volts must be immediately investigated for the cause of the low voltage (e.g., low battery, litter, vegetation, loose or crossed wires, broken insulators, breaks in the grounding system, etc.). Corrective actions to restore proper voltage must be immediately undertaken.

Any discernible penetrations through electric fencing by bears and other wildlife must be immediately reported to the Conservation Officer Service at 1-877-952-7277 and to the Director at 1-250-847-7260.

Date issued: May 30, 2013
Date amended: May 27, 2020
(most recent)

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In cases of low voltage or signs of penetration attempts, inspections must be increased from once per week to once per day until proper voltage is fully restored and until there are no new signs of penetration attempts, respectively.

10.11 **Dead Animal Disposal**

Dead animals and animal parts must be disposed of in the solid waste disposal area and covered as soon as practicable with a minimum of 60 centimetres of soil and/or waste material such that flies and scavenging animals are prevented from accessing the carrion. Disposal of Specified Risk Material from cattle must only be done in accordance with Canadian Food Inspection Agency requirements and procedures.

11. MONITORING REQUIREMENTS

The operational certificate holder must carry out an environmental monitoring program for the locations specified below and as shown on Site Plan "B" as follows:

11.1 **Treated Effluent to Phytoremediation Stand**

Location	Parameters	Frequency
Effluent: E288572 Treated Leachate Post Sand Filter/Pre Phytoremediation Stand	Lab: total metals, alkalinity, chloride, fluoride, sulphate, hardness, ammonia, nitrate, nitrite, total organic carbon, orthophosphorus, COD, BOD, pH, EPH, BTEX/VPH total Kjeldahl nitrogen Field: conductivity, pH, temperature, DO, turbidity, volume (flow measurement)	Lab/Field: Once prior to first discharge event of the year (spring) and once per summer and fall Volume: Continuous during discharge
Soil: E309686 Composite Soil Sample[1] from Phytoremediation Stand	Lab: metals, salinity, nutrients, cations, ions	Lab: Once annually, prior to first discharge of the year, as well as baseline data collection prior to very first discharge to the phytoremediation stand soil

[1] Composite sample assembled from 4 locations from a pre-established list of 12 locations

11.2 **Treated Effluent to Wetland #4 Infiltration Trench**

Location	Parameters	Frequency

Date issued: May 30, 2013
Date amended: May 27, 2020
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Effluent: E309786 Treated Leachate at Wetland#4 Outlet	Lab: total metals, alkalinity, chloride, fluoride, sulphate, hardness, ammonia, nitrate, nitrite, total organic carbon, orthophosphorus, COD, BOD, EPH, BTEX/VPH, pH, total Kjeldahl nitrogen Field: conductivity, pH, temperature, DO, turbidity, volume (flow measurement), visual[1] Acute Toxicity: Daphnia magna	Lab/Field: Once prior to first discharge event of the year (spring) and once per summer and fall. Monthly if discharging at any time during other months Volume: Continuous during discharge Visual: Traverse area between Wetland # 4 Infiltration Trench and SW-09 twice per week during any period of discharge to identify any surface breakouts of discharge Acute Toxicity: Once prior to start of each distinct continuous discharge event, or at least once per spring, summer and fall during discharge, whichever is more frequent

[1]Visual inspection to detect surfacing of effluent between Wetland #4 Infiltration Trench and SW-09. If surface flow of effluent is detected, then the discharge must cease and the Director must be notified within 24 hours

11.3 **Groundwater Monitoring**

Location	Parameters	Frequency
E251512 BH-01	Lab:	Quarterly → Annually[1,3]

Date issued: May 30, 2013
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E251513 BH-02 E251514 BH-03 E252313 BH-4B E252314 BH-5B E309746 SGW-1 E309747 SGW-2 E309748 SGW-3 E309749 SGW-4 E309750 SGW-5	Dissolved metals, alkalinity, chloride, fluoride, sulphate, hardness, ammonia, nitrate, nitrite, total Kjeldahl nitrogen, TOC, COD, pH, EPH, BTEX/VPH,	
	Field: Conductivity, temperature, pH, water elevation[4]	Monthly→Quarterly[1,3]

[1] Quarterly reduced to annually and monthly reduced to quarterly following two complete years of sampling
[2] Water elevation quarterly
[3] Spring sampling to be conducted on or before May 15 of each year

11.4 **Surface Water Monitoring**

Location	Parameters	Frequency
E309751 SW-01 E309752 SW-02 E287409 SW-05 E309754 SW-06 E287410 SW-07 E273812 SW-08 E310968 SW-09[1](property boundary)	Lab: Total metals, dissolved metals, alkalinity, chloride, fluoride, sulphate, hardness, ammonia, nitrate, nitrite, total Kjeldahl nitrogen, TOC, COD, pH, EPH, BTEX/VPH	Minimum annually[2] and once during Spring, Summer, Fall if discharging during these seasons
E310969 SW-10 (downstream of BH-03)	Field: Conductivity, temperature, pH, turbidity, flow rate, dissolved oxygen	Minimum annually[2] and once during Spring, Summer, Fall if discharging during these seasons

[1] SW-09 As near to property boundary as possible but at a location where discernible flow begins in ephemeral creek drainage
[2] Annual sample date should be consistent year to year, and preferably taken in fall

11.5 **Ground and Surface Water Monitoring Procedures**

11.5.1 Sampling Procedures

The operational certificate holder must carry out sampling in accordance with the procedures described in the "British Columbia Field Sampling

Manual for Continuous Monitoring and the Collection of Air, Air-Emission, Water, Wastewater, Soil, Sediment, and Biological Samples, 2013 Edition (Permittee)" or most recent edition, or by alternative procedures as authorized by the Director.

A copy of the above manual is available on the Ministry web page at www.env.gov.bc.ca/epd/wamr/labsys/lab_meth_manual.html

11.5.2 Analytical Procedures

The operational certificate holder must carry out analyses in accordance with procedures described in the "British Columbia Laboratory Manual (2015 Permittee Edition)", or the most recent edition or by alternative procedures as authorized by the Director.

A copy of the above manual is available on the Ministry web page at www.env.gov.bc.ca/epd/wamr/labsys/lab_meth_manual.html

11.5.3 Toxicity Sampling and Analytical Procedures

Samples must be collected from the discharge described in Section 7 and in accordance with Section 10.1 at frequencies established as per the monitoring program specified in Section 11.2 and tested for Daphnia magna acute lethality. Daphnia magna acute lethality test means the test to determine the acute lethality of effluent to Daphnia magna as set out in Reference Method EPS 1/RM/14.

11.5.4 Quality Assurance/Quality Control (QA/QC)

The operational certificate holder is required to conduct the following Quality Assurance and Control Program to determine the acceptability of data required by this permit and Section 2(d) of the Environmental Data Quality Assurance Regulation.

a) Obtain and keep current, the laboratory precision, accuracy and blank quality control criteria for each laboratory analysed

parameter from the analytical laboratory(ies).

b) Collect one duplicate sample during each sampling session from one of the discharge points.

c) Each duplicate sample must be submitted to the laboratory; one of the pair identified as the regular sample, and the other, as a blind sample identified by a fictitious site-name established solely to identify the duplicate sample.

d) For each parameter, report the results of the field duplicates in terms of the degree of variation as the relative percent difference.

e) A sample collection blank must be prepared, containing distilled water, and preservative if required, and submitted as a blank sample with one sample set per session. If any result for any parameter indicates detectable concentrations, then efforts must be made to determine and control the source of contamination.

12 Data Analyses and Reporting

12.1 Log Book

As required by section 10.10.9 (fence inspections), the operational certificate holder must maintain a log book or electronic record. The log book or electronic record must be made available for inspection upon request by Ministry staff.

12.2 Annual Report

The operational certificate holder must collect and maintain data of effluent and soil analyses, and any other records required under this authorization for inspection when requested by Ministry staff and submit the data for the previous calendar year in a form satisfactory to the Director. The operational certificate holder must submit the annual report on or before June 30 each year for the previous calendar year.

The operational certificate holder must submit all data required to be submitted under this section by email to the Ministry's Routine Environmental Reporting Submission Mailbox (RERSM) at EnvAuthorizationsReporting@gov.bc.ca or as otherwise instructed by the

Director. For guidelines on how to properly name the files and email subject lines or for more information visit the Ministry website:

http://www2.gov.bc.ca/gov/content/environment/waste-management/waste-discharge-authorization/data-and-report-submissions/routine-environmental-reporting-submission-mailbox

The annual report must contain at minimum:

i) The type and tonnage or volume of waste received, recycled, composted and landfilled for the year;

ii) Volume of effluent discharged to each of the Phytoremediation Stand and Wetland #4 Infiltration Trench within the Ephemeral Creek Drainage, with tabulation of volume and duration of each discharge event and the total volume discharged per year;

iii) Occurrences or observations of wildlife attempting to access the facility;

iv) The results of all required monitoring programs undertaken by the operational certificate holder for the site. Trend analysis, evaluation of any identified impacts of the discharges on the receiving environment in the previous year, and evaluation of the effectiveness of the established monitoring programs must be carried out by qualified professionals appropriate to the subject matter. Any identified recommendations must be included as they pertain to the ground water, surface water and aquatic effects (including acute toxicity) monitoring programs. Should the parameters and frequencies of the previous year's monitoring programs be identified as being not representative of receiving environment conditions, recommendations must be made for corrective actions that can be taken. Recommendations can be made to either increase or decrease parameters and frequency of any monitoring program

12.3 **Non-Compliance Notification**

The operational certificate holder must immediately notify the Director or designate by email at EnvironmentalCompliance@gov.bc.ca or as

otherwise instructed by the Director, of any non-compliance with the requirements of this authorization by the operational certificate holder and take remedial action to remedy any effects of such non-compliance. The operational certificate holder must provide to the Director with written confirmation of all such non-compliance events, including available test results, within 24 hours of the original notification, unless otherwise directed by the Director.

12.4 **Non-Compliance Reporting**

If the operational certificate holder fails to comply with any of the requirements of this authorization, the operational certificate holder must, within 30 days of such non-compliance, submit a written report that is satisfactory to the Director and includes, but is not necessarily limited to the following:

a. all relevant test results obtained by the operational certificate holder related to the non-compliance,

b. an explanation of the most probable cause(s) of the non-compliance, and,

c. a description of remedial action planned and/or taken by the operational certificate holder to prevent similar non-compliances in the future.

The operational certificate holder must submit all non-compliance reporting required to be submitted under this section by email to the Ministry's Compliance Reporting Submission Mailbox (CRSM) at EnvironmentalCompliance@gov.bc.ca or as otherwise instructed by the Director. For guidelines on how to report a non-compliance or for more information visit the Ministry website: http://www2.gov.bc.ca/gov/content/environment/waste-management/waste-discharge-authorization/data-and-report-submissions/non-compliance-reporting-mailbox

12.5 **Non-compliance Reporting and Exceedances**

The operational certificate holder must cause each data submission required by this authorization to include a statement outlining the number

of exceedances of permitted discharges that occurred during the reporting period, the dates of each such exceedance, an explanation as to the cause of the exceedances, and a description of the measures taken by the operational certificate holder to rectify the cause of each such exceedance. If no exceedances occurred over the reporting period, the required statement may instead indicate that no exceedance of permitted discharges occurred during the reporting period.

12.6 Toxicity Test Failure Reporting

The operational certificate holder must report any failure of Daphnia magna acute toxicity tests as referenced in Sections 10.1, 11.2 and 11.5.3 to the Director within 24 hours of receiving the test failure result. As required in Section 9.1.5, beginning July 1, 2019, no discharge to the Wetland #4 Infiltration Trench may occur following a failed toxicity test unless there is a successful test result (non-failure) for Daphnia magna toxicity.

13. Closure Requirements

13.1 Notification of Closure

The operational certificate holder must notify the Director in writing of intentions to close the landfill site at least one year prior to closure date.

13.2 Closure Plan

As per Section 2 (Design, Operations and Closure Plan) closure requirements must be included in the DOCP.

13.3 Closure Funding

The operational certificate holder must ensure that sufficient funds will be available to provide for all closure and post-closure requirements as outlined in the closure plan required in Section 2, plus a reasonable contingency for any remediation which may be required.

13.4 Final Cover

The final cover system must be designed by a qualified professional to match the intended end-use of the landfill site and to match the needs of

any required environmental management systems (leachate minimization or recirculation, as the case may be, landfill gas collection and treatment, etc.). The final cover must consist of a layer of a minimum 600 mm of low permeability ($<1 \times 10^{-6}$ cm/s) compacted soil followed by a layer of topsoil suitable for establishment of vegetation. Use of higher permeability soil must first be approved by the Director. The final cover must be constructed with minimum and maximum slopes as specified by a qualified professional in the DOCP to promote runoff and minimize erosion, with appropriate run-on/runoff drainage controls, erosion controls, and gas venting controls. The site must be seeded with a grass/legume mixture suited to the local climate.

13.5 Progressive Application of Final Cover

Completed portions of the landfill must progressively receive final cover during the active life of the landfill. The maximum area of disposed refuse that has not yet received final cover must not exceed 25% of the total final footprint area. Final cover is to be applied according to the specifications identified in section 13.4.

14. ENVIRONMENTAL IMPACT

Inspections of the discharge will be carried out by Environmental Protection personnel as a part of the routine operational certificate inspection procedure. Based on these inspections and any other information available to the Director on the effect of the discharge on the receiving environment, the operational certificate holder may be required to undertake additional monitoring, install additional pollution control works, or change the method of operation.

Date issued: May 30, 2013
Date amended: May 27, 2020
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Site Plan A

Date issued: May 30, 2013
Date amended: May 27, 2020
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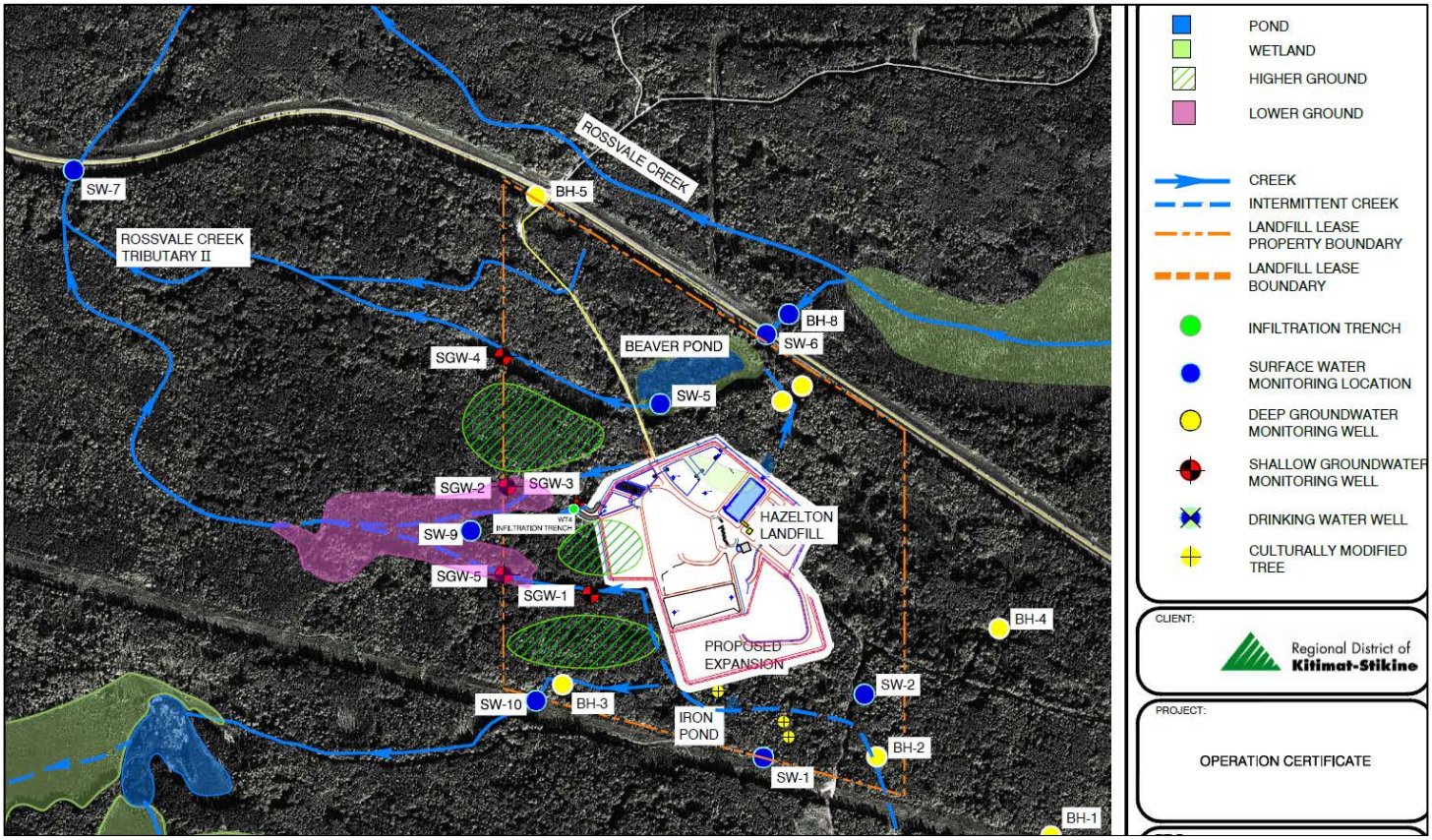
Authorizations - North Region

Site Plan B



Date issued: May 30, 2013
Date amended: May 27, 2020
(most recent)

Karen Moores, P.Ag.
for Director, *Environmental Management Act*
Authorizations - North Region

Appendix E: Acute Toxicity Test Results – Wetland #4

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **VA20A4242**	Page	: 1 of 2
Client	: **Regional District of Kitimat-Stikine**	Laboratory	: Vancouver - Environmental
Contact	: Chris Kerr	Account Manager	: Amber Springer
Address	: # 300 - 4545 Lazelle Avenue Terrace BC Canada V8G 4E1	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: 250 615 6100	Telephone	: +1 604 253 4188
Project	: Hazelton WMF	Date Samples Received	: 01-Apr-2020 10:50
PO	: ----	Date Analysis Commenced	: 15-Apr-2020
C-O-C number	: ----	Issue Date	: 15-Apr-2020 13:37
Sampler	: ----		
Site	: Hazelton Waste Management Facility		
Quote number	: Q62338		
No. of samples received	: 1		
No. of samples analysed	: 1		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Yang Chu	Account Manager Assistant	External Subcontracting, Burnaby, British Columbia

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances
LOR: Limit of Reporting (detection limit).

Unit	*Description*
-	No Unit

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in reports identified as "Preliminary Report" are considered authorized for use.

Analytical Results

Sub-Matrix: **Water** (Matrix: **Water**)					*Client sample ID*	**Pond #4**	**----**	**----**	**----**	**----**
					Client sampling date / time	28-Mar-2020 13:50	----	----	----	----
Analyte	*CAS Number*	*Method*	*LOR*	*Unit*		**VA20A4242-001**	--------	--------	--------	--------
						Result	----	----	----	----
Bioassays										
Daphnia magna LC50	----	DAP-LC50-48	-	-		see attached	----	----	----	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

Acute Toxicity Test Results

Sample VA20A4242,
collected March 28, 2020

Final Report

April 15, 2020

Submitted to: **ALS Environmental**
Burnaby, BC

8664 Commerce Court, Burnaby, BC V5A 4N7

SAMPLE INFORMATION

Sample ID	Dates			Receipt temperature
	Collected	Received	*Daphnia magna* test initiation	
VA20A4242	28-Mar-20 at 1330h	01-Apr-20 at 1355h	01-Apr-20 at 1620h	0.6-3.5°C

TESTS

- *Daphnia magna* 48-h LC50 test

RESULTS

Toxicity test results

Sample ID	LC50 (% v/v)
VA20A4242	>100

LC = Lethal Concentration

QA/QC

QA/QC summary	*Daphnia magna*
Reference toxicant LC50 (95% CL)	7.3 (6.4 – 8.3) g/L NaCl[1]
Reference toxicant historical mean (2 SD range)	6.0 (4.3 – 8.4) g/L NaCl
Reference toxicant CV	17%
Organism health history	Acceptable
Protocol deviations	None
Water quality range deviations	None
Control performance	Acceptable
Test performance	Valid

[1] Test date: March 24, 2020, LC = Lethal Concentration, SD = Standard Deviation, CL = Confidence Limits, CV = Coefficient of Variation

Report By:
Marcus Lee-Fraizer, B.Sc.
Laboratory Biologist

Reviewed By:
Edmund Canaria, R.P. Bio.
Senior Analyst

This report has been prepared by Nautilus Environmental Company Inc. based on data and/or samples provided by our client and the results of this study are for their sole benefit. Any reliance on the data by a third party is at the sole and exclusive risk of that party. The results presented here relate only to the samples tested.

APPENDIX A – Summary of test conditions

Table 1. Summary of test conditions: 48-h *Daphnia magna* LC50 test.

Test species	*Daphnia magna*
Organism source	In-house culture
Organism age	<24-hour old neonates
Test type	Static
Test duration	48 hours
Test vessel	250-mL glass beaker
Test volume	200 mL
Test solution depth	6 cm
Test concentrations	Five concentrations, plus laboratory control
Test replicates	1 per treatment
Number of organisms	10 per replicate
Control/dilution water	Moderately-hard reconstituted water + 2.5 µg/L Se
Test solution renewal	None
Test temperature	20 ± 2°C
Feeding	None
Light intensity	400 to 800 lux
Photoperiod	16 hours light / 8 hours dark
Aeration	None
Test measurements	Temperature, dissolved oxygen and pH measured daily; salinity, hardness and alkalinity measured in the undiluted sample at test initiation; conductivity measured at test initiation and termination; survival checked daily
Test protocol	Environment Canada (2000), EPS 1/RM/14, with 2016 amendments
Statistical software	CETIS Version 1.9.4
Test endpoint	Survival (48-hour LC50)
Test acceptability criterion for controls	Survival ≥90%
Reference toxicant	Sodium chloride (NaCl)

APPENDIX B – Toxicity test data

Daphnia magna Summary Sheet

Client: ALS Environmental
Work Order No.: 200522

Start Date/Time: Apr 01/2020 @ 1620
Test Species: *Daphnia magna*
Set up by: MW

Sample Information:

Sample ID: VA20A4242
Sample Date: Mar 28/2020
Date Received: Apr 01/2020
Sample Volume: 4x10L.

Test Validity Criteria:

≥ 90% mean control survival and/or mobility and ≤2 daphnids exibit immobility and/or mortality in any single control replicate.

WQ Ranges:

T (°C) = 20 ± 2; DO (mg/L) = 3.6 to 9.4; pH = 6 to 8.5

Test Organism Information:

Broodstock No.: 03182019
Age of young (Day 0): <24 h
Avg No. young per brood in previous 7 d: 21
Mortality (%) in previous 7 d: 0
Days to first brood: 9

NaCl Reference Toxicant Results:

Reference Toxicant ID: DmDC48
Stock Solution ID: 20NaCl
Date Initiated: Mar 24/2020
48-h LC50 (95% CL): 7.3 (6.4-8.3) g/L NaCL

Reference Toxicant Mean and Historical Range: 6.0 (4.3-8.4) g/L NaCL
Reference Toxicant CV (%): 17

Test Results: The 48h LC50 is estimated to be >100% (v/v).

Reviewed by: MW

Date reviewed: April 6, 2020

Freshwater Acute
48 Hour Toxicity Test Data Sheet

Client: ALS Environmental
Sample ID: VA20A4242
Work Order No.: 200522

Start Date/Time: Apr 01/2020 @ 1620 h
CER #: 5
No. Organisms/volume: 10/200mL
Test Organism: *D.magna*
Set up by: MHF

Thermometer: CER#5 pH meter/probe: 6/6 DO meter/probe: 6/6 Cond./Salinity meter/probe: 6/6

Concentration % (v/v)	Rep	Number of Live Organisms 24	Number of Live Organisms 48	No. Immobilized 48	Temperature (°C) 0	Temperature (°C) 24	Temperature (°C) 48	Dissolved oxygen (mg/L) 0	Dissolved oxygen (mg/L) 24	Dissolved oxygen (mg/L) 48	pH 0	pH 24	pH 48	Conductivity (µS/cm) 0	Conductivity (µS/cm) 48
Control	A	10	10	0	18.5	19.0	19.0	8.6	8.6	8.5	8.2	8.1	8.0	348	354
	B														
	C														
	D														
6.25	A	10	10	0	18.5	19.0	19.0	8.6	8.6	8.4	8.1	8.1	8.0	342	346
	B														
	C														
	D														
12.5	A	10	10	0	18.5	19.0	19.0	8.6	8.6	8.4	8.1	8.1	8.0	336	339
	B														
	C														
	D														
25	A	10	10	0	19.0	19.0	19.0	8.6	8.6	8.4	8.1	8.0	8.0	324	327
	B														
	C														
	D														
50	A	10	10	0	19.0	19.0	19.0	8.5	8.6	8.4	8.0	8.0	8.0	300	303
	B														
	C														
	D														
100	A	10	10	0	20.5	19.0	19.0	8.4	8.5	8.3	7.6	8.0	8.0	254	257
	B														
	C														
	D														
Technician Initials		MHF	MHF	MHF	MHF	MHF	MHF	MHF	MHF	MHF	MHF	MHF	MHF	MHF	MHF

Concentration	Hardness*	Alkalinity*
	*(mg/L as CaCo3)	
Control (MHW)	98	72
Highest conc.	112	42
Hardness adjusted		

	Initial WQ	Adjustment	Adjusted WQ
Temp (°C)	20.5		
DO (mg/L)	8.4		
pH	7.6		
Cond (µS/cm)	254		
Salinity (ppt)	0.1		

Comments: _____ Mortality: Heartbeat checked under microscope Not req'd

Sample Description: clear colourless liquid, slight pine odour, some particulates

Batch#: 031820A 7-d previous # young/brood: 21 Previous 7-d Mortality (%): 0 Day of 1st Brood: 9

Reviewed by: _____ Date reviewed: April 6, 2020

APPENDIX C – Chain-of-custody form

Chain of Custody

Vancouver - Environmental
8081 Lougheed Highway
Burnaby British Columbia
Canada V5A 1W9

1042

Destination Lab:	**Nautilus Environmental**	Due Date: 09/04/2020	Relinquished By
Address:	(Burnaby) erce Court	HT Expiry:	Date/Time
Client:	Regional District of Kitimat-Stikine	Consignment company and Number	Received By
Work Order Number:	**VA20A4242**		Date/Time
Original Receipt Date/Time	Instructions Received		Receipt Temp
01/04/2020 10:50			

ALS Lab ID	Bottle Code	Matrix	Submatrix	Container Type	Test Codes	Task Remarks
VA20A4242	001-AA	Water	Water	HDPE carboy LC50	DAP-LC50-48	
VA20A4242	001-AB	Water	Water	HDPE carboy LC50		
VA20A4242	001-AC	Water	Water	HDPE carboy LC50		
VA20A4242	001-AD	Water	Water	HDPE carboy LC50		

Sampled: Mar 28/20 @ 13:30

Rec'd Apr 1/2020 @ 1355

Temp: 0.6 – 3.5 °C

4 x 10L

Account Manager: Amber Springer

ALSEVDataSublet@ALSGlobal.com (PDF / EXCEL/ B2B)
ALS Vancouver Phone Number: 604-253-4188

200522

END OF REPORT

Acute Toxicity Test Results

Sample VA20A6394-001 EQ Pond,
collected May 11, 2020

Final Report

May 28, 2020

Submitted to: **ALS Environmental**
Burnaby, BC

8664 Commerce Court, Burnaby, BC V5A 4N7

SAMPLE INFORMATION

Sample ID	Dates			Receipt temperature
	Collected	Received	*Daphnia magna* test initiation	
VA20A6394-001 EQ Pond	11-May-20 at 0930h	14-May-20 at 1522h	14-May-20 at 1810h	7.1°C

TESTS

- *Daphnia magna* 48-h LC50 test

RESULTS

Toxicity test results

Sample ID	LC50 (% v/v)
VA20A6394-001 EQ Pond	>100

LC = Lethal Concentration

QA/QC

QA/QC summary	*Daphnia magna*
Reference toxicant LC50 (95% CL)	5.5 (4.4 – 6.9) g/L NaCl[1]
Reference toxicant historical mean (2 SD range)	6.2 (4.7 – 8.2) g/L NaCl
Reference toxicant CV	14%
Organism health history	Acceptable
Protocol deviations	None
Water quality range deviations	None
Control performance	Acceptable
Test performance	Valid

[1] Test date: May 06, 2020, LC = Lethal Concentration, SD = Standard Deviation, CL = Confidence Limits, CV = Coefficient of Variation

Report By:
Marcus Lee-Fraizer, B.Sc.
Laboratory Biologist

Reviewed By:
Edmund Canaria, R.P. Bio.
Senior Analyst

This report has been prepared by Nautilus Environmental Company Inc. based on data and/or samples provided by our client and the results of this study are for their sole benefit. Any reliance on the data by a third party is at the sole and exclusive risk of that party. The results presented here relate only to the samples tested.

APPENDIX A – Summary of test conditions

Table 1. Summary of test conditions: 48-h *Daphnia magna* LC50 test.

Test species	*Daphnia magna*
Organism source	In-house culture
Organism age	<24-hour old neonates
Test type	Static
Test duration	48 hours
Test vessel	250-mL glass beaker
Test volume	200 mL
Test solution depth	6 cm
Test concentrations	Five concentrations, plus laboratory control
Test replicates	1 per treatment
Number of organisms	10 per replicate
Control/dilution water	Moderately-hard reconstituted water + 2.5 µg/L Se
Test solution renewal	None
Test temperature	20 ± 2°C
Feeding	None
Light intensity	400 to 800 lux
Photoperiod	16 hours light / 8 hours dark
Aeration	None
Test measurements	Temperature, dissolved oxygen and pH measured daily; salinity, hardness and alkalinity measured in the undiluted sample at test initiation; conductivity measured at test initiation and termination; survival checked daily
Test protocol	Environment Canada (2000), EPS 1/RM/14, with 2016 amendments
Statistical software	CETIS Version 1.9.4
Test endpoint	Survival (48-hour LC50)
Test acceptability criterion for controls	Survival ≥90%
Reference toxicant	Sodium chloride (NaCl)

APPENDIX B – Toxicity test data

Daphnia magna Summary Sheet

Client: ALS Environmental
Work Order No.: 200899

Start Date/Time: May 14/2020 @ 1810h
Test Species: *Daphnia magna*
Set up by: MWE

Sample Information:

Sample ID: VAZ0A6394-001
Sample Date: May 11/2020
Date Received: May 14/2020
Sample Volume: 1 X 20L

Test Validity Criteria:

≥ 90% mean control survival and/or mobility and ≤2 daphnids exibit immobility and/or mortality in any single control replicate.

WQ Ranges:

T (°C) = 20 ± 2; DO (mg/L) = 3.6 to 9.4; pH = 6 to 8.5

Test Organism Information:

Broodstock No.: 04/2020 A+B
Age of young (Day 0): <24 h
Avg No. young per brood in previous 7 d: 21
Mortality (%) in previous 7 d: 0
Days to first brood: 8

NaCl Reference Toxicant Results:

Reference Toxicant ID: Dm DC50
Stock Solution ID: 20 NaCl
Date Initiated: May 06/2020
48-h LC50 (95% CL): 5.5 (4.4 - 6.9) g/L NaCL

Reference Toxicant Mean and Historical Range: 6.2 (4.7 - 8.2) g/L NaCL
Reference Toxicant CV (%): 14

Test Results: The 48-h LC50 is estimated to be >100 % (v/v).

Reviewed by: [signature]

Date reviewed: May 21, 2020

Freshwater Acute
48 Hour Toxicity Test Data Sheet

Client: ALS Environmental
Sample ID: VAZ0A6394-001
Work Order No.: 200899

Start Date/Time: May 14/2020 @ 1810h
CER #: 5
No. Organisms/volume: 10/200mL
Test Organism: D.magna
Set up by: MOF

Thermometer: CER#5 pH meter/probe: 6/6 DO meter/probe: 6/6 Cond./Salinity meter/probe: 6/6

Concentration % (v/v)	Rep	Number of Live Organisms 24	Number of Live Organisms 48	No. Immobilized 48	Temperature (°C) 0	Temperature (°C) 24	Temperature (°C) 48	Dissolved oxygen (mg/L) 0	Dissolved oxygen (mg/L) 24	Dissolved oxygen (mg/L) 48	pH 0	pH 24	pH 48	Conductivity (µS/cm) 0	Conductivity (µS/cm) 48
Control	A	10	10	0	19.0	19.0	19.5	9.0	8.6	8.7	8.3	8.1	8.2	355	361
	B														
	C														
	D														
6.25	A	10	10	0	19.0	19.0	19.5	9.0	8.7	8.8	8.3	8.1	8.2	366	377
	B														
	C														
	D														
12.5	A	10	10	0	19.0	19.0	19.5	9.0	8.6	8.5	8.3	8.2	8.3	376	378
	B														
	C														
	D														
25	A	10	10	0	19.0	19.0	19.5	9.0	8.6	8.6	8.3	8.2	8.3	397	399
	B														
	C														
	D														
50	A	10	10②	4	19.5	19.0	19.5	9.0	8.7	8.6	8.3	8.3	8.4	437	438
	B														
	C														
	D														
100	A	10	10②	mort 8	20.0	19.0	19.5	9.0	8.6	8.5	8.3	8.3	8.5	538	522
	B														
	C														
	D														
Technician Initials		MM	MM	MM	MM	MM	MM	MM	MM	MM	MM	MM	MM	MM	MM

Concentration	Hardness*	Alkalinity*
	*(mg/L as CaCo3)	
Control (MHW)	100	78
Highest conc.	198	196
Hardness adjusted	—	—

	Initial WQ	Adjustment	Adjusted WQ
Temp (°C)	20.0		
DO (mg/L)	9.0		
pH	8.3		
Cond (µS/cm)	538		
Salinity (ppt)	0.3		

Comments: ① several on surface

Mortality: Heartbeat checked under microscope Yes

Sample Description: pale yellow liquid, no odour, no particles

Batch#: 04 2920 A+B 7-d previous # young/brood: 21 Previous 7-d Mortality (%): 0 Day of 1st Brood: 8

Reviewed by: MM Date reviewed: May 21, 2020

APPENDIX C – Chain-of-custody form

Chain of Custody

Vancouver - Environmental
8081 Lougheed Highway
Burnaby BC Canada V5A 1W9

1691

Destination Lab:	**Nautilus Environmental (Burnaby)**
Address:	8664 Commerce Court Burnaby BC Canada V5A 4N7
Client:	Regional District of Kitimat-Stikine
Work Order Number:	**VA20A6394**
Original Receipt Date/Time	Instructions Received
14/05/2020 12:15	

Relinquished By
Date/Time
Received By
Date/Time
Receipt Temp

Return as Indicated: Results: Invoice: Electronic Data:

Attention: Amber Springer

ALS Sample ID	Client ID	Matrix	Container Type	Test Codes	Method Description	Due Date	Sampling Date and Time	Remarks
VA20A6394-001	EQ Pond	Water	HDPE carboy LC50	DAP-LC50-48	Survival/LC50 Daphnia Magna (48 hours)	29-05-2020	11/05/2020 09:30	

Account Manager: Amber Springer

ALSEVDataSublet@ALSGlobal.com (PDF / EXCEL/ B2B)
ALS Vancouver Phone Number: 604-253-4188

1x20L

7.1°C

Tyme

May 14/20 @ 15:22

200899

END OF REPORT

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **VA20B1759**	Page	: 1 of 2
Client	: **Regional District of Kitimat-Stikine**	Laboratory	: Vancouver - Environmental
Contact	: Mary Tress	Account Manager	: Amber Springer
Address	: # 300 - 4545 Lazelle Avenue Terrace BC Canada V8G 4E1	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: Hazelton EQ LC50	Date Samples Received	: 01-Aug-2020 12:15
PO	: ----	Date Analysis Commenced	: 11-Aug-2020
C-O-C number	: ----	Issue Date	: 14-Aug-2020 16:39
Sampler	: Mary Tress		
Site	:		
Quote number	: Q62338		
No. of samples received	: 1		
No. of samples analysed	: 1		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Yang Chu	Account Manager Assistant	External Subcontracting, Burnaby, British Columbia

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LOR: Limit of Reporting (detection limit).

Unit	*Description*
-	No Unit

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in reports identified as "Preliminary Report" are considered authorized for use.

Analytical Results

Sub-Matrix: **Effluent** (Matrix: **Water**)					*Client sample ID*	**Wetland 4 Outlet**	----	----	----	----
					Client sampling date / time	30-Jul-2020 13:45	----	----	----	----
Analyte	*CAS Number*	*Method*	*LOR*	*Unit*		**VA20B1759-001**	--------	--------	--------	--------
						Result	----	----	----	----
Bioassays										
Daphnia magna LC50	----	DAP-LC50-48	-	-		see attached	----	----	----	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **VA20B1759**	Page	: 1 of 5
Client	: **Regional District of Kitimat-Stikine**	Laboratory	: Vancouver - Environmental
Contact	: Mary Tress	Account Manager	: Amber Springer
Address	: # 300 - 4545 Lazelle Avenue Terrace BC Canada V8G 4E1	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: Hazelton EQ LC50	Date Samples Received	: 01-Aug-2020 12:15
PO	: ----	Issue Date	: 14-Aug-2020 16:39
C-O-C number	: ----		
Sampler	: Mary Tress		
Site	:		
Quote number	: Q62338		
No. of samples received	: 1		
No. of samples analysed	: 1		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances.
DQO: Data Quality Objective.
LOR: Limit of Reporting (detection limit).
RPD: Relative Percent Difference.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Duplicate outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- No Matrix Spike outliers occur.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 15:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 15:00 is used for calculation purposes.

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Bioassays : Survival/LC50 Daphnia Magna (48 hours)										
HDPE carboy LC50										
Wetland 4 Outlet	DAP-LC50-48	30-Jul-2020	----	----	----		11-Aug-2020	----	----	

Legend & Qualifier Definitions

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

- **No Quality Control data available for this section.**

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by “mod”).

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Survival/LC50 Daphnia Magna (48 hours)	DAP-LC50-48 Nautilus Environmental (Burnaby) - 8664 Commerce Court Burnaby British Columbia Canada V5A 4N7	Water	EPS1/RM/14	See attached report.

QUALITY CONTROL REPORT

Work Order	: **VA20B1759**	Page	: 1 of 2
Client	: Regional District of Kitimat-Stikine	Laboratory	: Vancouver - Environmental
Contact	: Mary Tress	Account Manager	: Amber Springer
Address	: # 300 - 4545 Lazelle Avenue Terrace BC Canada V8G 4E1	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: Hazelton EQ LC50	Date Samples Received	: 01-Aug-2020 12:15
PO	: ----	Date Analysis Commenced	: 11-Aug-2020
C-O-C number	: ----	Issue Date	: 14-Aug-2020 16:39
Sampler	: Mary Tress		
Site	:		
Quote number	: Q62338		
No. of samples received	: 1		
No. of samples analysed	: 1		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits
- Reference Material (RM) Report; Recovery and Acceptance Limits
- Method Blank (MB) Report; Recovery and Acceptance Limits
- Laboratory Control Sample (LCS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Yang Chu	Account Manager Assistant	External Subcontracting, Burnaby, British Columbia

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Services number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percentage Difference
# = Indicates a QC result that did not meet the ALS DQO.

Acute Toxicity Test Results

Sample VA20B1759-001 Wetland 4 Outlet,
collected July 30, 2020

Final Report

August 11, 2020

Submitted to: **ALS Environmental**
Burnaby, BC

8664 Commerce Court, Burnaby, BC V5A 4N7

SAMPLE INFORMATION

Sample ID	Dates			Receipt temperature
	Collected	Received	*Daphnia magna* test initiation	
VA20B1759-001 Wetland 4 Outlet	30-Jul-20 at 1345h	01-Aug-20 at 1350h	01-Aug-20 at 1430h	5.8°C

TESTS

- *Daphnia magna* 48-h LC50 test

RESULTS

Toxicity test results

Sample ID	LC50 (% v/v)
VA20B1759-001 Wetland 4 Outlet	>100

LC = Lethal Concentration

QA/QC

QA/QC summary	*Daphnia magna*
Reference toxicant LC50 (95% CL)	6.8 (5.7 – 8.1) g/L NaCl[1]
Reference toxicant historical mean (2 SD range)	6.4 (4.9 – 8.4) g/L NaCl
Reference toxicant CV	13%
Organism health history	Acceptable
Protocol deviations	None
Water quality range deviations	None
Control performance	Acceptable
Test performance	Valid

[1] Test date: July 28, 2020, LC = Lethal Concentration, SD = Standard Deviation, CL = Confidence Limits, CV = Coefficient of Variation

Report By:
Marcus Lee-Fraizer, B.Sc.
Laboratory Biologist

Reviewed By:
Edmund Canaria, R.P. Bio.
Senior Analyst

This report has been prepared by Nautilus Environmental Company Inc. based on data and/or samples provided by our client and the results of this study are for their sole benefit. Any reliance on the data by a third party is at the sole and exclusive risk of that party. The results presented here relate only to the samples tested.

APPENDIX A – Summary of test conditions

Table 1. Summary of test conditions: 48-h *Daphnia magna* LC50 test.

Test species	*Daphnia magna*
Organism source	In-house culture
Organism age	<24-hour old neonates
Test type	Static
Test duration	48 hours
Test vessel	250-mL glass beaker
Test volume	200 mL
Test solution depth	6 cm
Test concentrations	Five concentrations, plus laboratory control
Test replicates	1 per treatment
Number of organisms	10 per replicate
Control/dilution water	Moderately-hard reconstituted water + 2.5 µg/L Se
Test solution renewal	None
Test temperature	20 ± 2°C
Feeding	None
Light intensity	400 to 800 lux
Photoperiod	16 hours light / 8 hours dark
Aeration	None
Test measurements	Temperature, dissolved oxygen and pH measured daily; salinity, hardness and alkalinity measured in the undiluted sample at test initiation; conductivity measured at test initiation and termination; survival checked daily
Test protocol	Environment Canada (2000), EPS 1/RM/14, with 2016 amendments
Statistical software	CETIS Version 1.9.4
Test endpoint	Survival (48-hour LC50)
Test acceptability criterion for controls	Survival ≥90%
Reference toxicant	Sodium chloride (NaCl)

APPENDIX B – Toxicity test data

Daphnia magna Summary Sheet

Client: ALS Environmental
Work Order No.: 201441

Start Date/Time: Aug 01 / 2020 C. 1430 L
Test Species: *Daphnia magna*
Set up by: YL

Sample Information:

Sample ID: VA20B1759-001 Wetland
Sample Date: July 30/2020 4 Outlet
Date Received: Aug 01/2020
Sample Volume: 1 x 20L.

Test Validity Criteria:

≥ 90% mean control survival and/or mobility and ≤2 daphnids exibit immobility and/or mortality in any single control replicate.

WQ Ranges:

T (°C) = 20 ± 2; DO (mg/L) = 3.6 to 9.4; pH = 6 to 8.5

Test Organism Information:

Broodstock No.: 071520B
Age of young (Day 0): <24 h
Avg No. young per brood in previous 7 d: 17
Mortality (%) in previous 7 d: 0
Days to first brood: 10

NaCl Reference Toxicant Results:

Reference Toxicant ID: DmDC54
Stock Solution ID: 20NaO3
Date Initiated: July 28/2020
48-h LC50 (95% CL): 6.8 (5.7-8.1) g/LNaCL

Reference Toxicant Mean and Historical Range: 6.4 (4.9-8.4) g/L NaCL
Reference Toxicant CV (%): 13

Test Results: The 48h LC50 is estimated to be >100% (v/v)

Reviewed by: [signature]
Date reviewed: Aug 5, 2020

Freshwater Acute
48 Hour Toxicity Test Data Sheet

Client: ALS Environmental
Sample ID: VA20B1759-001 wetland 4 outlet
Work Order No.: 201441

Start Date/Time: August 1, 2020 @ 1430h
CER #: 5
No. Organisms/volume: 10/200mL
Test Organism: *D.magna*
Set up by: YM

Thermometer: CER #5 pH meter/probe: 6 / 6 DO meter/probe: 6 / 6 Cond./Salinity meter/probe: 6 / 6

Concentration % (v/v)	Rep	Number of Live Organisms 24	Number of Live Organisms 48	No. Immobilized 48	Temperature (°C) 0	Temperature (°C) 24	Temperature (°C) 48	Dissolved oxygen (mg/L) 0	Dissolved oxygen (mg/L) 24	Dissolved oxygen (mg/L) 48	pH 0	pH 24	pH 48	Conductivity (µS/cm) 0	Conductivity (µS/cm) 48
Control	A	10	10	0	19.5	19.0	19.5	8.8	8.3	8.6	8.3	8.3	8.3	348	348
	B														
	C														
	D														
6.25	A	10	10	0	19.5	19.0	19.5	8.8	8.5	8.6	8.3	8.3	8.4	365	367
	B														
	C														
	D														
12.5	A	10	10	0	20.0	19.0	19.5	8.9	8.8	8.6	8.3	8.3	8.4	383	384
	B														
	C														
	D														
25	A	10	10	0	20.0	19.0	19.5	8.9	8.7	8.6	8.2	8.4	8.5	419	421
	B														
	C														
	D														
50	A	10	10	0	20.0	19.0	19.5	9.0	8.7	8.5	8.2	8.4	8.6	491	487
	B														
	C														
	D														
100	A	10	10	0	20.5	19.0	19.5	9.0	8.7	8.4	8.2	8.5	8.8	647	634
	B														
	C														
	D														
Technician Initials		MJ			MJ	MJ		MJ	MJ		MJ	MJ		MJ	

Concentration	Hardness* *(mg/L as CaCo3)	Alkalinity* *(mg/L as CaCo3)
Control (MHW)	96	80
Highest conc.	270	266
Hardness adjusted	—	—

	Initial WQ	Adjustment	Adjusted WQ
Temp (°C)	21.0		20.5
DO (mg/L)	10.1	(aerated for 16 min)	9.0
pH	8.2		8.2
Cond (µS/cm)	646		647
Salinity (ppt)	0.3		0.3

Comments: _____ Mortality: Heartbeat checked under microscope not req'd.

Sample Description: clear, light yellow, no odour, slight particulates

Batch#: 071520B 7-d previous # young/brood: 17 Previous 7-d Mortality (%): 0 Day of 1st Brood: 10

Reviewed by: _____ Date reviewed: Aug 5, 2020

APPENDIX C – Chain-of-custody form

Chain of Custody

Vancouver - Environmental
8081 Lougheed Highway
Burnaby BC Canada V5A 1W9

3580

Destination Lab:	**Nautilus Environmental (Burnaby)**
Address:	8664 Commerce Court Burnaby BC Canada V5A 4N7
Client:	Regional District of Kitimat-Stikine
Work Order Number:	**VA20B1759**
Original Receipt Date/Time	Instructions Received
01/08/2020 12:15	

Account Manager: See below

ALSEVDataSublet@ALSGlobal.com (PDF / EXCEL/ B2B)
ALS Vancouver Phone Number: 604-253-4188

Relinquished By	
Date/Time	
Received By	
Date/Time	
Receipt Temp	

Return as Indicated: Results: Invoice: Electronic Data:

Attention: Amber Springer

ALS Sample ID	Client ID	Matrix	Container Type	Test Codes	Method Description	Due Date	Sampling Date and Time	Remarks
VA20B1759-001	Wetland 4 Outlet	Water	HDPE carboy LC50	DAP-LC50-48	Survival/LC50 Daphnia Magna (48 hours)	18-08-2020	30/07/2020 13:45	

regular T&T

- See COC for analysis

Recd
Aug 1/20 @ 1350h
1 x 20L
5.8°C
YW

WO# 201441

ALS Environmental

www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 17-

Page of

Report To	Contact and company name below will appear on the final report
Company:	Regional District of Kitimat-Stikine
Contact:	Mary Tress
Phone:	250-641-4141
	Company address below will appear on the final report
Street:	4545 Lazelle Avenue
City/Province:	Terrace/BC
Postal Code:	V8G4E1
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☑ YES ☐ NO
Company:	Regional District of Kitimat-Stikine
Contact:	Megan Haley

Report Format / Distribution

Select Report Format: ☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)

Quality Control (QC) Report with Report ☑ YES ☐ NO

☐ Compare Results to Criteria on Report - provide details below if box checked

Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax: eblaney@rdks.bc.ca

Email 2: mtress@rdks.bc.ca; mglover@rdks.bc.ca

Email 3: mhaley@rdks.bc.ca; sprouse@rdks.bc.ca

Invoice Distribution

Select Invoice Distribution: ☑ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax: anne-maries@rdks.bc.ca

Email 2: mhaley@rdks.bc.ca

Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4-20%] ☐ | 3 day [P3-25%] ☐ | 2 day [P2-50%] ☐

EMERGENCY: 1 Business day [E1 - 100%] ☐ | Same Day, Weekend or Statutory holiday [E2 -200% (Laboratory opening fees may apply)] ☐

Date and Time Required for all E&P TATs:

For tests that can not be performed according to the service level selected, you will be contacted.

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:		AFE/Cost Center:	PO#
Job #:	Hazelton EQ LC50	Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	

ALS Lab Work Order # (lab use only):

ALS Contact: Amber Springer

Sampler: Mary Tress

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Acute toxicity LC50 Daphnia magna	SAMPLES ON HOLD	Sample is hazardous (please provide further detail)	NUMBER OF CONTAINERS
	Wetland 4 outlet	30-July-20	13:45	Effluent	R			

Terrace Shipping Coolers x 2

Environmental Division Vancouver

Work Order Reference

VA20B1759

Telephone : +1 604 253 4188

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)
Are samples taken from a Regulated DW System? ☐ YES ☑ NO	British Columbia Approved and Working Water Quality Guidelines (MAY, 2015)
Are samples for human consumption/ use? ☐ YES ☑ NO	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ | SIF Observations Yes ☐ No ☐

Ice Packs ☑ Ice Cubes ☐ | Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C				FINAL COOLER TEMPERATURES °C			
6.1	7.8			6	7		

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: Mary Tress	Date: 31 JULY - 20	Time: 09:50	Received by:	Date: July 31/20	Time: 9:50	Received by: JL	Date: Aug 1, 20	Time: 12:15p

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

6EPT 2017 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

END OF REPORT

Chain of Custody (COC) / Analytical Request Form

ALS Environmental

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 17 -

Page of

Report To	Contact and company name below will appear on the final report
Company:	Regional District of Kitimat-Stikine
Contact:	Mary Tress
Phone:	250-641-4141
	Company address below will appear on the final report
Street:	4545 Lazelle Avenue
City/Province:	Terrace/BC
Postal Code:	V8G4E1
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☑ YES ☐ NO
Company:	Regional District of Kitimat-Stikine
Contact:	Megan Haley

Report Format / Distribution	
Select Report Format:	☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report	☑ YES ☐ NO
☐ Compare Results to Criteria on Report - provide details below if box checked	
Select Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	eblaney@rdks.bc.ca
Email 2	mtress@rdks.bc.ca; mglover@rdks.bc.ca
Email 3	mhaley@rdks.bc.ca; sprouse@rdks.bc.ca
Invoice Distribution	
Select Invoice Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	anne-maries@rdks.bc.ca
Email 2	mhaley@rdks.bc.ca

Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)	
Regular [R]	☑ Standard TAT if received by 3 pm - business days - no surcharges apply
PRIORITY (Business Days) 4 day [P4-20%]	☐
PRIORITY (Business Days) 3 day [P3-25%]	☐
PRIORITY (Business Days) 2 day [P2-50%]	☐
EMERGENCY 1 Business day [E1 - 100%]	☐
EMERGENCY Same Day, Weekend or Statutory holiday [E2 -200% (Laboratory opening fees may apply)]	☐
Date and Time Required for all E&P TATs:	
For tests that can not be performed according to the service level selected, you will be contacted.	

Project Information	
ALS Account # / Quote #:	
Job #:	Hazelton EQ LC50
PO / AFE:	
LSD:	

Oil and Gas Required Fields (client use)	
AFE/Cost Center:	PO#
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	

ALS Lab Work Order # (lab use only):

ALS Contact: Amber Springer **Sampler:** Mary Tress

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Acute toxicity LC50 Daphnia magna	SAMPLES ON HOLD	Sample is hazardous (please provide further details)	NUMBER OF CONTAINERS
	Wetland 4 outlet	30-July-20	13:45	Effluent	R			

Terrace Shipping Coolers x 2

Environmental Division Vancouver
Work Order Reference
VA20B1759

Telephone : +1 604 253 4188

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)
Are samples taken from a Regulated DW System? ☐ YES ☑ NO	British Columbia Approved and Working Water Quality Guidelines (MAY, 2015)
Are samples for human consumption/ use? ☐ YES ☑ NO	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☑ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C				FINAL COOLER TEMPERATURES °C			
6.1	7.8			6	7		

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: Mary Tress	Date: 31 JULY - 20	Time: 09:30	Received by:	Date: July 31/20	Time: 9:50	Received by: JL	Date: Aug 1, 20	Time: 12:15

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

SEPT 2017 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **VA20B9049**	Page	: 1 of 2
Client	: **Regional District of Kitimat-Stikine**	Laboratory	: Vancouver - Environmental
Contact	: Mary Tress	Account Manager	: Amber Springer
Address	: # 300 - 4545 Lazelle Avenue Terrace BC Canada V8G 4E1	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: Hazelton EQ LC50	Date Samples Received	: 23-Oct-2020 19:25
PO	: ----	Date Analysis Commenced	: 09-Nov-2020
C-O-C number	: ----	Issue Date	: 12-Nov-2020 11:16
Sampler	: Mary Tress		
Site	:		
Quote number	: Q62338		
No. of samples received	: 1		
No. of samples analysed	: 1		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Erin Gatdula	Account Manager Assistant	External Subcontracting, Burnaby, British Columbia

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances
LOR: Limit of Reporting (detection limit).

Unit	*Description*
-	No Unit

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in reports identified as "Preliminary Report" are considered authorized for use.

Analytical Results

Sub-Matrix: **Effluent** (Matrix: **Water**)					*Client sample ID*	**Wetland 4 Outlet**	----	----	----	----
					Client sampling date / time	22-Oct-2020 13:30	----	----	----	----
Analyte	*CAS Number*	*Method*	*LOR*	*Unit*	**VA20B9049-001**	--------	--------	--------	--------	
					Result	----	----	----	----	
Bioassays										
Daphnia magna LC50	----	DAP-LC50-48	-	-	See attached	----	----	----	----	

Please refer to the General Comments section for an explanation of any qualifiers detected.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **VA20B9049**	Page	: 1 of 5
Client	: **Regional District of Kitimat-Stikine**	Laboratory	: Vancouver - Environmental
Contact	: Mary Tress	Account Manager	: Amber Springer
Address	: # 300 - 4545 Lazelle Avenue Terrace BC Canada V8G 4E1	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: Hazelton EQ LC50	Date Samples Received	: 23-Oct-2020 19:25
PO	: ----	Issue Date	: 12-Nov-2020 11:16
C-O-C number	: ----		
Sampler	: Mary Tress		
Site	:		
Quote number	: Q62338		
No. of samples received	: 1		
No. of samples analysed	: 1		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances.
DQO: Data Quality Objective.
LOR: Limit of Reporting (detection limit).
RPD: Relative Percent Difference.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Duplicate outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- No Matrix Spike outliers occur.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 15:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 15:00 is used for calculation purposes.

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Bioassays : Survival/LC50 Daphnia Magna 48 hours										
HDPE carboy LC50										
Wetland 4 Outlet	DAP-LC50-48	22-Oct-2020	----	----	----		09-Nov-2020	----	----	

Legend & Qualifier Definitions

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

- **No Quality Control data available for this section.**

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by “mod”).

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Survival/LC50 Daphnia Magna 48 hours	DAP-LC50-48 Nautilus Environmental (Burnaby) - 8664 Commerce Court Burnaby British Columbia Canada V5A 4N7	Water	EPS1/RM/14	See attached report.

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **VA20B9049**	Page	: 1 of 2
Client	: Regional District of Kitimat-Stikine	Laboratory	: Vancouver - Environmental
Contact	: Mary Tress	Account Manager	: Amber Springer
Address	: # 300 - 4545 Lazelle Avenue Terrace BC Canada V8G 4E1	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: Hazelton EQ LC50	Date Samples Received	: 23-Oct-2020 19:25
PO	: ----	Date Analysis Commenced	: 09-Nov-2020
C-O-C number	: ----	Issue Date	: 12-Nov-2020 11:16
Sampler	: Mary Tress		
Site	:		
Quote number	: Q62338		
No. of samples received	: 1		
No. of samples analysed	: 1		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits
- Reference Material (RM) Report; Recovery and Acceptance Limits
- Method Blank (MB) Report; Recovery and Acceptance Limits
- Laboratory Control Sample (LCS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Erin Gatdula	Account Manager Assistant	External Subcontracting, Burnaby, British Columbia

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Services number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percentage Difference
# = Indicates a QC result that did not meet the ALS DQO.

Acute Toxicity Test Results

Sample VA20B9049-001 Wetland 4 Outlet,
collected October 22, 2020

Final Report

November 9, 2020

Submitted to: **ALS Environmental**
Burnaby, BC

8664 Commerce Court, Burnaby, BC V5A 4N7

SAMPLE INFORMATION

Sample ID	Dates			Receipt temperature
	Collected	Received	*Daphnia magna* test initiation	
VA20B9049-001 Wetland 4 Outlet	22-Oct-20 at 1330h	24-Oct-20 at 1225h	26-Oct-20 at 1400h	2.2°C

TESTS

- *Daphnia magna* 48-h LC50 test

RESULTS

Toxicity test results

Sample ID	LC50 (% v/v)
VA20B9049-001 Wetland 4 Outlet	>100

LC = Lethal Concentration

QA/QC

QA/QC summary	*Daphnia magna*
Reference toxicant LC50 (95% CL)	5.9 (4.8 – 7.3) g/L NaCl[1]
Reference toxicant historical mean (2 SD range)	6.4 (5.0 – 8.3) g/L NaCl
Reference toxicant CV	13%
Organism health history	Acceptable
Protocol deviations	None
Water quality range deviations	None
Control performance	Acceptable
Test performance	Valid

[1] Test date: October 23, 2020, LC = Lethal Concentration, SD = Standard Deviation, CL = Confidence Limits, CV = Coefficient of Variation

Report By:
Marcus Lee-Fraizer, B.Sc.
Laboratory Biologist

Reviewed By:
Edmund Canaria, R.P. Bio.
Senior Analyst

This report has been prepared by Nautilus Environmental Company Inc. based on data and/or samples provided by our client and the results of this study are for their sole benefit. Any reliance on the data by a third party is at the sole and exclusive risk of that party. The results presented here relate only to the samples tested.

APPENDIX A – Summary of test conditions

Table 1. Summary of test conditions: 48-h *Daphnia magna* LC50 test.

Test species	*Daphnia magna*
Organism source	In-house culture
Organism age	<24-hour old neonates
Test type	Static
Test duration	48 hours
Test vessel	250-mL glass beaker
Test volume	200 mL
Test solution depth	6 cm
Test concentrations	Five concentrations, plus laboratory control
Test replicates	1 per treatment
Number of organisms	10 per replicate
Control/dilution water	Moderately-hard reconstituted water + 2.5 µg/L Se
Test solution renewal	None
Test temperature	20 ± 2°C
Feeding	None
Light intensity	400 to 800 lux
Photoperiod	16 hours light / 8 hours dark
Aeration	None
Test measurements	Temperature, dissolved oxygen and pH measured daily; salinity, hardness and alkalinity measured in the undiluted sample at test initiation; conductivity measured at test initiation and termination; survival checked daily
Test protocol	Environment Canada (2000), EPS 1/RM/14, with 2016 amendments
Statistical software	CETIS Version 1.9.4
Test endpoint	Survival (48-hour LC50)
Test acceptability criterion for controls	Survival ≥90%
Reference toxicant	Sodium chloride (NaCl)

APPENDIX B – Toxicity test data

Daphnia magna Summary Sheet

Client: ALS Environmental
Work Order No.: 202067

Start Date/Time: Oct 26/20 @ 1400 h
Test Species: *Daphnia magna*
Set up by: JEL, GM

Test Validity Criteria:
≥ 90% mean control survival and/or mobility and ≤2 daphnids exibit immobility and/or mortality in any single control replicate.

WQ Ranges:
T (°C) = 20 ± 2; DO (mg/L) = 3.6 to 9.4; pH = 6 to 8.5

Sample Information:

Sample ID: VA20B9049-001 Wetland 4 Outlet
Sample Date: Oct 22/20
Date Received: Oct 24/20
Sample Volume: 1 x 20 L

Test Organism Information:

Broodstock No.: 100720 A
Age of young (Day 0): <24 h
Avg No. young per brood in previous 7 d: 33
Mortality (%) in previous 7 d: 0
Days to first brood: 7

NaCl Reference Toxicant Results:

Reference Toxicant ID: DmDec61
Stock Solution ID: 20NaCl
Date Initiated: OCT 23/20
48-h LC50 (95% CL): 5.9 (4.8 - 7.3) g/L NaCL

Reference Toxicant Mean and Historical Range: 6.4 (5.0-8.3) g/L NaCL
Reference Toxicant CV (%): ~~12.9~~ 13

Test Results: The 48h LC50 is estimated to be >100 % (v/v)

Reviewed by: [signature]
Date reviewed: Nov. 2, 2020

Freshwater Acute
48 Hour Toxicity Test Data Sheet

Client: ALS
Sample ID: VA208 VAB 9049-001 Wetland & Outlet
Work Order No.: 20 2067

Start Date/Time: Oct 26/20 @ 1400h
CER #: 5
No. Organisms/volume: 10/200mL
Test Organism: D.magna
Set up by: JTL, GJU

Thermometer: CER#5 pH meter/probe: 6 / 6 DO meter/probe: 6 / 6 Cond./Salinity meter/probe: 6 / 6

Concentration % (v/v)	Rep	Number of Live Organisms 24	48	No. Immobilized 48	Temperature (°C) 0	24	48	Dissolved oxygen (mg/L) 0	24	48	pH 0	24	48	Conductivity (µS/cm) 0	48
Control	A	10	10	0	18.5	19.0	19.0	8.9	8.5	8.9	8.1	8.0	7.9	348	349
	B														
	C														
	D														
6.25	A	10	10	0	18.5	19.0	19.0	8.8	8.5	8.8	7.9	8.0	8.0	365	364
	B														
	C														
	D														
12.5	A	10	10	0	18.5	19.0	19.0	8.8	8.5	8.9	7.8	8.1	8.1	399	397
	B														
	C														
	D														
25	A	10	10	0	18.5	19.0	19.0	8.6	8.6	8.9	7.5	8.1	8.1	409	410
	B														
	C														
	D														
50	A	10	10	0	18.5	19.0	19.0	8.6	8.5	8.8	7.5	8.1	8.2	558	552
	B														
	C														
	D														
100	A	10	10	0	18.5	19.0	19.0	8.5	8.4	8.9	7.4	8.1	8.3	742	724
	B														
	C														
	D														
Technician Initials		GJU	A	A	JTL	GJU	A	JTL	GJU	A	JTL	GJU	A	JTL	A

	Hardness*	Alkalinity*
Concentration	*(mg/L as CaCo3)	
Control (MHW)	98	80
Highest conc.	270	328
Hardness adjusted	—	—

	Initial WQ	Adjustment	Adjusted WQ
Temp (°C)	18.5		
DO (mg/L)	8.6		
pH	7.4		
Cond (µS/cm)	746		
Salinity (ppt)	0.4		

Comments: _____ Mortality: Heartbeat checked under microscope not rqd

Sample Description: clear, colourless, odourless liquid, no particulates

Batch#: 100720A 7-d previous # young/brood: 33 Previous 7-d Mortality (%): 0 Day of 1st Brood: 7

Reviewed by: _____ Date reviewed: Nov 2, 2020

APPENDIX C – Chain-of-custody form

Chain of Custody

Vancouver - Environmental
8081 Lougheed Highway
Burnaby BC Canada V5A 1W9

6911

Destination Lab:	**Nautilus Environmental (Burnaby)**
Address:	8664 Commerce Court Burnaby BC Canada V5A 4N7
Client:	Regional District of Kitimat-Stikine
Work Order Number:	**VA20B9049**
Original Receipt Date/Time	Instructions Received
23/10/2020 19:25	

Relinquished By	
Date/Time	
Received By	Jesin W
Date/Time	Oct 24/20 @1225h
Receipt Temp	2.2 °C

Return as Indicated: Results: alsev.datasublet@alsglobal.com Invoice: alsev.datasublet@alsglobal.com Electronic Data: alsev.datasublet@alsglobal.com

Attention: Amber Springer

ALS Sample ID	Client ID	Matrix	Container Type	Test Codes	Method Description	Due Date	Sampling Date and Time	Remarks
VA20B9049-001	Wetland 4 Outlet	Water	HDPE carboy LC50 1x 20L	DAP-LC50-48	Survival/LC50 Daphnia Magna (48 hours)	04-11-2020	22/10/2020 13:30	

WO # 202067

END OF REPORT

Chain of Custody (COC) / Analytical Request Form

ALS Environmental

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 17 -

Page of

Report To	Contact and company name below will appear on the final report
Company:	Regional District of Kitimat-Stikine
Contact:	Mary Tress
Phone:	250-641-4141
	Company address below will appear on the final report
Street:	4545 Lazelle Avenue
City/Province:	Terrace/BC
Postal Code:	V8G4E1
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☑ YES ☐ NO
Company:	Regional District of Kitimat-Stikine
Contact:	Megan Haley

Report Format / Distribution

Select Report Format: ☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)

Quality Control (QC) Report with Report ☑ YES ☐ NO

☐ Compare Results to Criteria on Report - provide details below if box checked

Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax: eblaney@rdks.bc.ca

Email 2: mtress@rdks.bc.ca; mglover@rdks.bc.ca

Email 3: mhaley@rdks.bc.ca; sprouse@rdks.bc.ca

Invoice Distribution

Select Invoice Distribution: ☑ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax: anne-maries@rdks.bc.ca

Email 2: mhaley@rdks.bc.ca

Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4-20%] ☐ | 3 day [P3-25%] ☐ | 2 day [P2-50%] ☐

EMERGENCY: 1 Business day [E1 - 100%] ☐ | Same Day, Weekend or Statutory holiday [E2 -200% (Laboratory opening fees may apply)] ☐

Date and Time Required for all E&P TATs:

For tests that can not be performed according to the service level selected, you will be contacted.

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:		AFE/Cost Center:	PO#:
Job #:	Hazelton EQ LC50	Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	

ALS Lab Work Order # (lab use only):

ALS Contact: Amber Springer

Sampler: Mary Tress

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Acute toxicity LC50 Daphnia magna	SAMPLES ON HOLD	Sample is hazardous (please provide further detail)	NUMBER OF CONTAINERS
	Wetland 4 Outlet	22-OCT-20	13:30	Effluent	R			

Environmental Division
Vancouver
Work Order Reference
VA20B9049

Telephone : +1 604 253 4188

Drinking Water (client use) — Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

Are samples taken from a Regulated DW System? ☐ YES ☑ NO

Are samples for human consumption/ use? ☐ YES ☑ NO

British Columbia Approved and Working Water Quality Guidelines (MAY, 2015)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☑ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C	FINAL COOLER TEMPERATURES °C
1.4	6

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
			~~Oct 23 2020~~	23 Oct 2020	1120	TC	OCT 23 2020	7:25

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

SEPT 2017 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.