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Hartland Landfill Groundwater, Surface Water and Leachate Monitoring Program Annual Report

(April 2021 to March 2022)

Capital Regional District

Project number: 60631284

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Executive Summary

Based on our review of historical data and interpretation of groundwater, surface water and leachate quality data collected between April 2021 and March 2022, the annual monitoring program provides an effective assessment of landfill performance and compliance related to groundwater, surface water and leachate flow and quality. The following conclusions are drawn based on our interpretation of the 2021/22 data.

Leachate Flow

Leachate elevation data collected in 2021/22 indicates that leachate mounding persists in the Phase 1 landfill. Leachate elevations in Phase 1 were generally stable and exhibited minor seasonal variations. The leachate mound in the upper portion of the refuse is interpreted as being 'perched' above the regional bedrock groundwater flow system, with relatively high water levels and strong downward hydraulic gradients.

Leachate elevations in the Phase 2 Basin rose above the leachate elevation in the Lower Lagoon in January 2022 and remained elevated for the rest of the monitoring period. Historically, the leachate elevation in Phase 2 has been considerably (approximately 1-2 m) lower than the elevation of the Lower Leachate Lagoon. The leachate levels in Phase 2 remained well below groundwater levels at locations 36 and 37, indicating the hydraulic trap was preserved throughout the year. However, confirmatory monitoring indicated that the increasing trend in leachate levels in the Phase 2 Basin was due to pressure transducer movement or instrument drift. The pressure transducer was recalibrated in April 2022 and leachate levels in the Phase 2 Basin are interpreted to have remained stable in 2021/22.

Daily, monthly, and annual leachate discharge rates for 2021/22 were higher than those observed in 2020/21. The total volume of leachate discharged in 2021/22 was 563,061 m^3, which is approximately 38% higher than in 2020/21. The relatively high leachate discharge volume was likely caused by higher precipitation, which increased by about 12.8% in 2021/22. The highest monthly leachate flow recorded in 2021/2022 was 115,487 m^3 (average monthly flow rate of 43.9 L/s) in November 2021 due to intense precipitation ("atmospheric river") events and diversion of surface water from Sw-N-18 (runoff from Toutle Valley) to the Upper Leachate Lagoon between January and March 2022.

In 2021/22, a total of 18,140 m^3 of leachate was removed by the north purge wells, which was approximately 26.9% less than the volume of leachate removed 2020/21. The highest leachate extraction rate was observed in January 2022, with a peak flow of 173 m^3/day. A total of 35,252 m^3 leachate was removed by the south purge wells, which was approximately 5.2% less than the volume of leachate removed in 2020/21. The average daily flow in 2021/22 was 96.6 m^3/day, which was approximately 4.7% lower than in 2020/21. The lower volume of leachate may indicate the ongoing benefit of cover placement over the Phase 1 landfill in 1997, or possible influence of biofouling of the north purge wells. Ultimately, water levels in the north and south purge wells indicate that the leachate collection system is functioning effectively.

Groundwater Flow

Groundwater flow in 2021/22 generally followed previously established patterns. Regional groundwater flows from Mount Work northeast to the north-south trending valley that underlies the northern portions of the Phase 1 and Phase 2 landfill. Most of the northward groundwater flow in the bedrock below the landfill is captured by the Toutle Valley Underdrain, Phase 2 basin leachate collection system, springs discharging to the lower lagoon, and the north and south purge well systems. Groundwater monitors east of Phase 1 confirm flow from east to west toward the landfill, preventing off-site migration to the east. Groundwater elevations in the North Ridge area exhibited strong seasonal fluctuations, and the Highland Fault continued to function as a barrier to groundwater moving in an easterly direction.

Groundwater Quality

The groundwater quality results for 2021/22 indicated that leachate-impacted groundwater is contained within the landfill property. At the north end of the landfill, leachate-affected groundwater extends just north of the unlined lower leachate lagoon and through the middle of the lined upper leachate lagoon but does not extend off-site. South of the landfill, leachate-affected groundwater does not extend off-site. Leachate related exceedances are confined to the landfill footprint on the east side of Phase 1 and are inferred to extend to the western extent of the waste footprint within the Phase 2 landfill. This indicates the leachate collection system continued to function as intended and minimized impacts to groundwater and surface water.

Boundary Compliance monitoring wells and off-site monitoring wells met CSR AW and DW standards, except for boron. Boron in Boundary Compliance well 20-1-1 marginally exceeded CSR DW standard of 5 mg/L during one sampling event. The majority of CSR exceedances in groundwater were observed in on-site monitoring wells that are located in close proximity to the waste footprint, known leachate sources, or leachate purge wells. In addition, nitrate concentrations in three (3) shallow groundwater wells (78-2-1, 87-2-1, 88-2-1) near the Hartland North Pad exceeded applicable CSR DW standard during Q4 2021 or Q1 2022 sampling events. The nitrate exceedances were primarily attributed to the aggregate stockpiling on the bedrock ridge north of the Phase 2 landfill.

In 2021/22, groundwater wells near the Hartland North Pad and north of Phase 2 exhibited slightly degraded water quality, primarily as a result of aggregate stockpiling on the bedrock ridge north of the Phase 2 landfill. South of the Phase 1 landfill, chloride concentrations in some wells continued to increase, but the source of chloride remains unknown. Present information suggests it is not likely from leachate, road salt or application of herbicide. The groundwater monitoring plan is presently being reviewed to ensure monitoring of groundwater along the northern boundary of the landfill is able to detect changes in groundwater quality now that the RTF is operational and to better characterize groundwater downgradient of the aggregate stockpiles and the NWSP.

North of the Landfill

- In 2021/22, annual average conductivity values in the north purge wells were generally higher than those in 2020/21, indicating more concentrated leachate quality. The overall deteriorated water quality in the north purge wells may reflect a change in the composition of leachate collected by the north purge wells from the Phase 1 landfill and the Lower Leachate Lagoon, or evaporitic concentration of leachate during relatively hot and dry weather.
- Operation of the Phase 1 north purge well system continues to mitigate leachate impacts north of the landfill, as indicated by long-term stable or decreasing concentrations of leachate indicator parameters at locations 40, 20 and 21. In 2021/22, groundwater quality in well 20, 21 and 40 was generally stable and comparable to previous results.
- Groundwater quality in proximity to the Phase 2 basin confirms the hydraulic trap leachate collection system is effectively containing leachate north of Phase 2. Groundwater quality 100 m north of Phase 2 continued to show low concentrations of leachate indicator parameters, indicating groundwater quality is not affected by landfill leachate. The increase in nitrate and sulphate concentrations in groundwater are likely associated with runoff from aggregate stockpiles.
- Groundwater quality in the shallow well at location 27 continued to be affected by ongoing aggregate production and blasting activity close to the Toutle Valley. However, the deep well at this location is not impacted at this time.
- Although groundwater quality at Boundary Compliance monitoring well 31 continued to be influenced by the effluent release from residual solids Pump Station 4 on October 18, 2020, groundwater quality met all applicable CSR AW and DW standards in 2021/22.

Hartland North Pad

- Groundwater quality at the Hartland North Pad was consistent with background concentrations, except for higher sulphate, nitrate and conductivity during Q3 and Q4 2021 sampling events. The concurrent increase in conductivity, sulphate and nitrate concentrations suggests that the background groundwater in 94-1-1 was temporally impacted by nearby aggregate placement.
- Groundwater quality in 91-1-1, 92-1-1 and 93-1-1 were generally consistent with background conditions, except for elevated sulphate concentrations during the November 2021 and February 2022 sampling events. The elevated conductivity and sulphate concentrations indicate that groundwater quality is impacted by on-going quarrying/blasting activities on-site.

South of the Landfill

- Water quality data from the south end of the landfill met the applicable CSR standards. Although ammonia concentrations in some of wells at south of landfill were slightly elevated during winter months, they were within historical ranges, and well below the applicable CSR standards.
- The application of road salt and herbicide continues to complicate interpretation of water quality data in this area. Since 2020, chloride concentrations in some wells were occasionally elevated, and reached a peak in 2021/22. The high molar

Cl/Na ratios (>1) suggest there is an additional source of chloride other than road salt and leachate. The source of chloride is currently unknown, but it is not likely the result of herbicide application as records indicate it was not applied in 2021/22.

- Any long-term improvements in water quality south of the landfill are largely the result of leachate collection and containment measures instituted since 2001. However, the improvement in water quality in 2021/22 was slightly diminished, potentially due to pump failures at the south purge well station, and ongoing maintenance challenges. Ongoing improvements to operational and maintenance protocols should continue improving water quality south of the landfill. Groundwater quality in this area is known to be sensitive to changes in the operation of the south purge wells and should continue to be monitored closely.

East of the Landfill

- Water quality along the east boundary of the Phase 1 landfill remained similar or slightly improved to previous years and concentrations of all parameters remained below applicable CSR standards. The concurrent increase in sulphate and nitrate concentrations were generally observed during the late fall and early winter sampling events (September to November), and may indicate impacts from dilute runoff from aggregate placed on nearby access roads.

Domestic Well Water Quality

As part of the CRD's groundwater quality monitoring program, nineteen (19) domestic wells were sampled in 2021, including 14 routine locations located within a two-kilometre radius of the landfill and five new wells located north of the Hartland North Pad. The water quality monitoring program indicated that groundwater quality in the domestic wells was consistent with previous results and water quality in all five new domestic wells met applicable federal and provincial drinking water quality guidelines (CDWQ and SDWQG) indicating that offsite domestic water wells remain unimpacted by landfill leachate.

Surface Water Quality

Surface water quality data collected in 2021/22 confirmed that nearby surface water bodies, including Tod Creek, Durrance Lake and Durrance Creek and Killarney Lake continued to be unimpacted by landfill leachate. However, water quality at Boundary Compliance Sw-N-05 and downstream along Heal Creek diminished during 2021/22 due to runoff impacts from the aggregate stockpiles north of the Phase 2 landfill and landfill leachate. An ongoing investigation is being conducted to identify the source of water quality impacts. Upgrades to leachate collection and containment infrastructure are currently being implemented north of the Phase 2 Basin to address a possible preferential pathway along historical stormwater conveyance infrastructure and restore compliance at Sw-N-05. CRD is also investigating measures that can be implemented to minimize impacts of runoff and infiltration from aggregate stockpiles.

Water quality at background locations (Sw-S-52 and Sw-CS-s2) met BCWQG-MAC guidelines. Surface water in the vicinity of the landfill exhibited exceedances in TSS, total and dissolved iron, nitrite, nitrate, zinc, aluminum, and dissolved copper concentrations. Elevated TSS, iron, and aluminum concentrations were largely related to seasonal flow variability (high and turbid flow) or construction activities. Total iron concentrations exceeded BCWQG-MAC at seven (7) stations, five (5) of which exhibited dissolved iron concentration exceedances. Nitrite concentrations exceeded the BCWQG-MAC at one (1) sampling station, and nitrate exceedances were observed at three (3) sampling stations northwest of the Phase 2 landfill where there is active blasting, quarrying and aggregate stockpiling.

Dissolved copper concentrations exceeded BCWQG-MAC values at 13 stations. Copper exceedances are generally associated with variability in BCWQG due to relatively low pH, DOC or hardness. Some of the elevated metal concentrations occurred concurrently with high TSS, which may be related to construction and aggregate stockpiling activities.

North of the Landfill

- Surface water quality at the Sw-N-05 Boundary Compliance station degraded throughout the 2021/22 monitoring year, generally showing increases in electrical conductivity, sulphate, nitrate, dissolved copper, chloride and ammonia concentrations. Nitrite, nitrate and dissolved copper concentrations at Sw-N-05 exceeded the BCWQG-MAC during three sampling events, and the Mann-Kendall analysis indicates that Sw-N-05 has exhibited increasing trends in electrical conductivity, nitrate, sulphate and ammonia concentrations over the past five years. The water quality impacts observed at Sw-N-05 have also been observed downstream at offsite sampling stations Sw-N-45 and Sw-N-17, which have exhibited

increasing trends in electrical conductivity, nitrate, and sulphate concentrations. Water quality impacts in Heal Creek are currently being investigated and are thought to be due to a combination of runoff from aggregate stockpiles and discharge of a relatively small volume of leachate primarily during wet winter months. CRD is presently implementing upgrades to the leachate containment and collection system to eliminate a possible preferential pathway associated with historically buried infrastructure.

- Surface water quality at the Sw-N-16 Boundary Compliance Station was consistent with historical data, exhibiting no signs of leachate impacts. All parameters met BCWQG-MAC guidelines in all sampling events at Sw-N-16, except for dissolved and total iron concentrations during one sampling event. The iron exceedances are likely due to the disturbance of sediment during sampling or the upgradient wetland. Overall, water quality at Sw-N-16 improved from the previous monitoring year, with lower electrical conductivity and sulphate concentrations, and fewer BCWQG-MAC exceedances.
- North of the landfill at Sw-N-45, dissolved copper concentrations exceeded BCWQC-MAC criteria during one sampling event. Dissolved copper concentrations at this location are generally low (<10 µg/L), and the exceedance was due to low pH (6.16) and a low DOC concentration (0.83 mg/L), reflecting natural background conditions.

Hartland North Pad

- In the Hartland North Pad area, surface water quality at Boundary Compliance stations (Sw-N-41s1 and Sw-N-42s1) met BCWQG-MAC in 2021/22, except for dissolved copper concentrations during two sampling events and dissolved iron concentrations during one sampling event. At Sw-N-41s1, leachate indicator parameters remained low in 2021/22, indicating that surface water was not impacted by leachate. Moreover, the Mann-Kendall analysis indicates that water quality at Sw-N-41s1 has exhibited a decreasing trend in nitrate over the past five years. At Sw-N-42s1, elevated chloride and ammonia concentrations were observed later in the monitoring year, and minor water quality impacts are evident and likely related to nearby aggregate stockpiling. Mann-Kendall statistical analysis indicates that water quality at Sw-N-42s1 has exhibited increasing trends in sulphate and electrical conductivity over the past five years.
- Station Sw-N-41s3 (not a Boundary Compliance location) is located downstream of Sw-N-41s1 where the drainage from the northwest portion of the Hartland North Pad flows into Durrance Lake. In 2021/22, all parameters met BCWQG-MAC, and water quality continued to improve from previous monitoring years.

South of the Landfill

- Water quality at Boundary Compliance location Sw-S-04 met BCWQG-MAC criteria for all analytes in all samples collected during 2021/22 and was not impacted by leachate.
- Water quality at station Sw-S-52 (not a Boundary Compliance location) is representative of background water quality. In 2021/22, concentrations of all parameters were below the BCWQG-MAC. Leachate parameter concentrations were consistent with previously reported values.
- Surface water quality south of Hartland Landfill was generally consistent with previous years and was not impacted by leachate. Slightly elevated conductivity, sulphate and nitrate concentrations observed at Sw-S-12 and Sw-S-03 during drier months and early fall may be due to runoff from paved areas surrounding the bin facility or dilute leachate. Elevated ammonia concentrations during the wet season may be derived from nitrate reduction via organic matter decomposition in nearby forest soils or wetlands.
- South of Hartland Landfill, dissolved copper concentrations at three (3) stations (none of which are Boundary Compliance locations) exceeded BCWQC-MAC criteria during one or more sampling events. Dissolved copper concentrations at these locations generally remained low (<18 µg/L). Slightly elevated copper concentrations at Sw-S-03 and Sw-S-12 may be related to dust or surface water runoff from the truck wash facility and bin areas.

Leachate

The leachate quality data collected in 2021/22 remained in compliance with the requirements of the Waste Discharge Permit at the Hartland Valve Chamber. Based on discussions with the analytical laboratory, CRD confirmed that the noted COD exceedances in February 2022 were due to the use of compromised/expired preservatives that were provided to CRD by the laboratory, and the exceedances do not likely reflect in-situ leachate quality. The compromised preservatives have since been

disposed and COD concentrations have returned to historical values. Overall, annual average leachate concentrations in 2021/22 were generally comparable with those measured in 2020/21.

Quality Assurance and Quality Control

Upon review of the quality assurance and quality control data collected in 2021/22 groundwater, surface water and leachate sampling and laboratory analysis have produced reliable results that are acceptable for the purposes of this monitoring report.

Compliance with Operating Certificate and Waste Discharge Permit

Groundwater quality, surface water quality and leachate quality data were used to assess compliance with the Amended Operational Certificate and Waste Discharge Permit and are discussed individually below.

Groundwater

A total of 36 groundwater monitoring wells were identified as Boundary Compliance monitoring. Water quality information collected from these wells were compared to the CSR standards for freshwater aquatic life and drinking water to assess compliance with the landfill Operating Certificate and protect both current and future uses of the groundwater resource.

With respect to groundwater, Hartland Landfill remained in compliance with the Operational Certificate in 2021/22. The one (1) boron exceedance in Boundary Compliance well 20-2-1 is likely due to naturally elevated concentrations and seasonal variability and unrelated to landfill operations. All leachate indicator parameters in 20-1-1 remained low throughout 2021/22.

Surface Water

A total of five surface water monitoring stations have been identified as Boundary Compliance stations surrounding Hartland Landfill. These stations are concentrated along the southern and northern property boundaries and are located downgradient of areas that have the potential to be impacted by leachate or runoff from the site. Water quality data collected from these sites was compared to the BCWQG-MAC criteria and used to assess compliance with the landfill Operational Certificate. Some water quality impacts observed at the Boundary Compliance stations were caused by sources other than landfill leachate (e.g., low-flow sampling conditions, construction activities, spill events, blasting, aggregate stockpiling, etc.). Following the identification of nutrient impacts in November 2021, CRD initiated an expanded monitoring program to determine the source of the exceedances, evaluate temporal changes in water quality and develop and initiate mitigation measures. The investigation is underway and will be completed in late 2022.

In 2021/22, water quality was not compliant with BCWQG-MAC at Sw-N-05 and was impacted by nutrient concentrations that exceeded BCWQG-MAC for nitrite (November 2021) and nitrate (February 2022). With respect to surface water, the landfill was non-compliant with the Operational Certificate in 2021/22 due to nitrate and nitrite exceedances at Sw-N-05. Water quality exceedances at Sw-N-16 and Sw-N-41S1 are interpreted to be related to low-flow conditions or other non-leachate sources as noted in Table 9-1. The cause for the water quality impacts at Sw-N-05 is actively being investigated by CRD and remedial efforts are underway to restore water quality.

Table ES-1. Surface Water Quality Compliance at Property Boundary Stations

Station	General Parameters	Metals	Comments
North of the Landfill			
Sw-N-05	Nitrite (1) and Nitrate (1)	Dissolved Copper (2)	• Nitrate and nitrate exceedances are likely associated with the leachate and runoff from the aggregate stockpiles (associated with blasting residue) located in the Toutle Valley and on the bedrock ridge located north of the Phase 2 landfill. • Dissolved copper guidelines are dependent on pH, DOC and hardness values. Copper guidelines become more stringent under lower pH, hardness and DOC levels.
Sw-N-16	None	Total Iron (1), Dissolved Iron (1)	• Exceedances are anticipated to be related to turbid flow conditions following a prolonged dry period. Continued monitoring to assess these anomalous results.
Sw-N-41S1	None	Dissolved Copper (2) Dissolved Iron (1)	• Dissolved iron exceedances are anticipated to be related to turbid flow conditions following a prolonged dry period. Continued monitoring to assess these anomalous results. Refinement of the Standard Operating Procedure for surface water sampling may decrease the potential for artificially elevated concentrations of metals associated with suspended sediments. • Dissolved copper guidelines are dependent on pH, DOC and hardness values. Copper guidelines become more stringent under lower pH, hardness and DOC levels, which are typical of the natural background conditions at Hartland.

Leachate

The Hartland Valve Chamber is the compliance monitoring point for the Waste Discharge Permit. During the monitoring period, leachate discharges at the Hartland Valve Chamber were in compliance with the Waste Discharge Permit requirements.

Recommendations

Based on the findings of this report, our recommendations are summarized in Table ES-2:

Table ES-2. Summary of Recommendations

	Leachate Collection System	Status
1	Water levels and quality in the north purge wells should continue to be closely monitored to verify the effectiveness of the leachate collection system. Increased water levels were noticed in well 52-3-0 and P7. Options for maintaining lower leachate levels in P7 and P9 should be further investigated to continue improving groundwater quality west of the lower leachate lagoon.	New
2	Water levels and quality in the south purge wells should continue to be closely monitored to verify and improve the effectiveness of the leachate collection system. Several pump failures were reported for south purge wells P3 and P10 and P1.	New
3	Pumping levels and the extent of the drawdown cones surrounding the north and south purge well systems should continue to be validated periodically (next assessment in 2024) to confirm the proper functioning of the wells. All procedures should follow the Standard Operating Procedure (SOP) – North Purge Well Drawdown Cone Verification (AECOM 2016), with interpretation of results by a qualified professional. Water levels in purge wells and pump maintenance should be conducted regularly to confirm the efficiency of the purge wells.	Ongoing
4	Pumping elevations in the south purge wells (P2, P3, P4 and P10) should be maintained at elevations below 140 m asl. Pumping elevations in P1 should be maintained near the bottom of the screened interval around 146 m asl.	Ongoing
5	A detailed assessment of the effectiveness of the hydraulic trap and leachate collection systems including the north purge wells and south purge wells is required as the landfill extends further north and west, and as additional lifts are constructed. Recent groundwater and surface water characterization between the Phase 2 Basin and the Northwest Sedimentation Pond suggest additional leachate containment or groundwater management measures need to be implemented to mitigate the potential for off-site leachate migration. The role of historical buried utilities should be investigated as a possible subsurface conveyance pathway contributing to leachate impacts on the Northwest Sedimentation Pond and non-compliant water quality at Sw-N-05.	Ongoing
	Runoff and Infiltration Associated with Aggregate Stockpiles	
6	The location and volume of aggregate stockpiles should continue to be minimized outside of the leachate collection system. Stockpiles should be covered as soon as practical to minimize sulphate, ammonia, nitrate and TSS impacts on downgradient groundwater and surface water bodies. Direct runoff from aggregate stockpiles should be diverted away from natural water courses as it is known to exceed BCWQ guidelines for sulphate.	Ongoing
7	Within the footprint of the leachate collection system, progressive closure and temporary tarps and effective surface water diversion ditches/pipelines should continue to be implemented to minimize infiltration to the underlying leachate collection system and manage sulphide concentrations in leachate. The separation between clean runoff and leachate collection systems should be improved to minimize clean water inputs to the leachate collection system.	Ongoing
	Groundwater Monitoring Program	
8	Groundwater monitoring wells in proximity to the Phase 2 Basin and Northwest Sedimentation Pond should be closely monitored to confirm the hydraulic trap leachate collection system is effectively containing leachate north of Phase 2. Continued quarrying may result in greater connection between the flow system on the west side of the Highland Fault and the Phase 2 hydraulic trap, resulting in increased leachate generation. It will be important to establish monitoring wells west and upslope of the Phase 2 landfill to support continued evaluations of hydraulic trap performance and monitor groundwater quality. It is recommended that the CRD commence early planning for potential future shallow groundwater, surface water and leachate management in the Toutle Valley area to maximize diversion of clean water out of the leachate collection system.	New
9	The existing groundwater monitoring plan should be updated to ensure groundwater quality along northern boundary is closely monitored and confirm that impacted groundwater is retained within landfill.	New
10	Groundwater wells should be surveyed once every five years to verify well condition and ensure geodetic well elevations are accurate (i.e., next survey in 2025).	Ongoing
11	The elevation of the leachate mound in Phase 1 and 2 should be determined at least once every five years (i.e. next assessment in 2025).	Ongoing
12	Monitoring wells on the north ridge and at Hartland North should continue to be monitored to characterize daily groundwater level fluctuations, further define the groundwater divergence and monitor groundwater flow behavior over time as the extents of the quarry within Phase 2 migrate northward. These wells should be protected from site development activities and damage by heavy equipment.	Ongoing
13	There should be a routine review of the landfill development plan and filling plan every two years to ensure the existing monitoring network and monitoring program remain sufficient and interpretation of the data	Ongoing

	benefits from a complete understanding of the landfill design and operations over the next five years. The next review should be conducted in 2023.	
14	As required by the Amended Operational Certificate, the results of the annual monitoring program should continue to be reviewed and interpreted by a Qualified Professional experienced in assessing the impacts of landfill leachate at large municipal landfills similar to Hartland.	Ongoing
Surface and Leachate Monitoring Program		
15	Conduct a review of the monitoring program north of Phase 2 to monitor the effectiveness of remedial efforts to address nutrient impacts to groundwater and surface water observed north of the Phase 2 Basin. Any recommended changes should be implemented immediately. CRD should begin sampling and analysis of sodium in surface water, groundwater and leachate to allow for a more thorough evaluation of the source of chloride (e.g. road salt) in water quality in the future.	New
16	The chemistry of residual wastewater solids and stabilized biosolids (solids and leachate) should be characterized to allow for future evaluation of any impacts to leachate chemistry over time. This information may be available from pilot studies or operational monitoring programs.	Ongoing
17	Water quality north of the Phase 2 landfill should be closely monitored until water quality north of the Phase 2 Basin at Sw-N-05 has been restored.	New
18	The source of chloride, ammonia, dissolved copper and nitrate observed in surface water south of the Phase 1 landfill should be investigated further. Additional waste has been placed on the western and southern portions of Phase 2 over recent years and occasional leachate seeps and runoff from the truck wash have been noted in the past. A multilevel monitoring well cluster should be established west of the bin facility and well 85-1-1 to resolve whether the source of impacts to surface water are due to runoff or discharge of leachate impacted groundwater.	New/Ongoing
19	Leachate sampling from the Phase 2 cleanout should be resumed once the sampling pump is replaced.	New
20	In addition to the Sewer Use Criteria, leachate quality results for trace organic compounds should be compared to CSR standards for the protection of drinking water and aquatic life to allow for screening of data to identify parameters in leachate that exceed CSR standards, and guide any refinements to the monitoring program in future years.	Ongoing
Construction Management		
21	The placement of aggregate, road salt, dust suppressant and herbicides should be carefully considered and documented to help understand the causes of potential future concentrations of conductivity, ammonia, chloride, nitrate, sulphate and select metals at groundwater and surface water monitoring locations.	Ongoing
Quality Assurance and Quality Control		
22	Quality assurance for laboratory analyses should continue to be evaluated quarterly, and any discrepancies should be resolved with the laboratory and CRD sampling personnel within one month of receiving the laboratory results. The appropriate notation should be added to the data files to explain the reason for the low precision and the steps taken, if any, to improve the sampling or laboratory procedures.	Ongoing

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1 Introduction

Hartland Landfill is located at the end of Hartland Avenue approximately 14 kilometres (km) north of Victoria (Figure 1-1). Filling with waste commenced at the site in the 1950s. The site was owned and operated by a private company until 1975 when the property was purchased by the Capital Regional District (CRD). The landfill is currently owned and operated by the CRD and is the primary solid waste disposal site for the 13 member municipalities and three electoral areas of the Capital Region.

The CRD initiated a surface water and groundwater monitoring program for the landfill in 1983. Annual monitoring reports have been prepared and issued by Gartner Lee and AECOM since 1988. The present Hartland Monitoring Program is part of an Amended Operational Certificate # 12659, last amended January 27, 2010, that is required and approved by the BC Ministry of Environment and Climate Change Strategy (ENV).

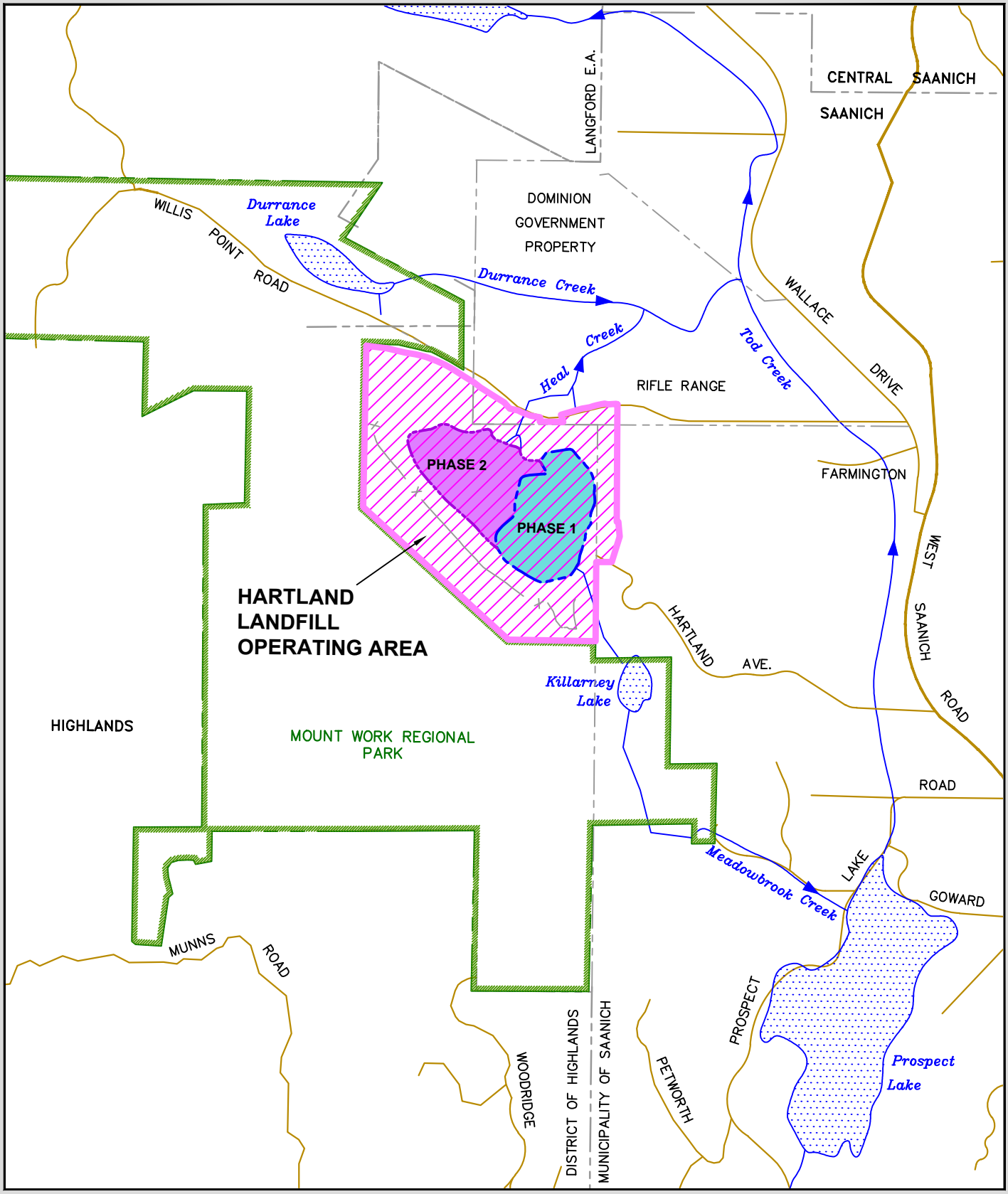
The Hartland Landfill is divided into two distinct areas referred to as Phase 1 and Phase 2. Initially, waste was deposited in Phase 1, which reached capacity in 1996 and was capped in 1997. Phase 2 is engineered and operated as a ‘hydraulic trap” landfill with the maintenance of upward groundwater gradients below the base of the Phase 2 landfill providing leachate containment. Phase 2 is currently receiving waste. Filling of Phase 2 Cell 1 was completed in 2004 and was capped in 2011. During the summer of 2004, the west face of Phase 2 Cell 1 was capped with a geomembrane to reduce passive gas venting and provide an internal leachate collection system for future development of Phase 2 Cell 2. This area is referred to as the West Face closure. In 2016, Phase 2 Cell 3 was developed on the west side of Phase 2 along with new leachate collection infrastructure.

Leachate and surface runoff from the active landfill areas are directed to two leachate lagoons at the north end of the landfill. The leachate is then transported by a pipeline through the northwest trunk sewer system and ultimately to the McLoughlin Point Wastewater Treatment Plant. Leachate discharge to sewer is authorized by CRD Regional Source Control Program Waste Discharge Permit SC97.001 last amended on March 1, 2011 and is subject to the CRD Sewer Use Bylaw (Bylaw No. 2922).

This report presents our interpretation of water quantity and quality data collected between April 2021 and March 2022 to meet the following objectives:

1. Evaluate the effectiveness of the leachate containment and collection systems.
2. Assess the potential impact of landfill leachate and operational activities on groundwater and surface water quality.
3. Assess temporal trends in leachate, groundwater and surface water flow and quality.

Leachate, surface water and groundwater data collected beyond the monitoring timeframe was not considered in this report.



N
W E
S

0 100 200 400 600 800 1000 m

1 : 25,000
UTM Zone 10N, NAD83

Legend

- ROAD
- MUNICIPAL BOUNDARIES
- SURFACE DRAINAGE
- PHASE 1
- PHASE 2
- HARTLAND LANDFILL OPERATIONAL BOUNDARY

Reviewed by: KJ
Date Issued: JUNE 2022
Prepared by: PCJ
Project Number: 60631284

CRD
Making a difference...together

Project: Hartland Landfill Monitoring
Location: Saanich, BC

Site Location Map

AECOM

Figure 1-1

Date Plotted: 2022-06-14 File Location: \\na.aecomnet.com\fs\AMER\Burnaby-CABNY1\Legacy\cabny1fp001\prod\Projects\60631284\900-CAD_GIS\910-CAD\20-SHEETS\CW433 - 2021-22 Annual Report\FIG1.1-Site Location-60631284-2022.dwg

2 Site Description

2.1 Physiography

Hartland Landfill is located in the Tod Creek watershed, in the bedrock highlands of the Gowlland Range northwest of Victoria. The terrain is moderately rugged with relief of up to 446 metres (m) in the area. Undeveloped CRD property (about 320 hectares (ha) in total) lies to the west and south of the landfill site. Mount Work Regional Park lies to the west and the Department of National Defence rifle range is situated north of the landfill. Durrance Lake Regional Park is located northwest of the landfill, and Killarney Lake Regional Park is located to the southeast. Private residential properties are located to the east and southeast of the landfill.

Durrance Lake and Killarney Lake are two major surface water bodies located within one kilometre of the landfill footprint. A lined perimeter ditch collects and diverts natural runoff from upslope areas around the landfill footprint. The water is discharged into ephemeral surface water features that report to Durrance Lake to the northwest and Killarney Lake to the southeast.

A Residuals Treatment Facility (RTF) was constructed at Hartland North to treat effluent from the McLoughlin Point Wastewater Treatment Plant. The RTF became operational in September 2020. Although the RTF is located within the Hartland Landfill Operating Area Boundary, it is managed by CRD as a separate site.

A water main was installed along the East Perimeter Road with a water service installed between leachate lagoons in the northeast corner of the Hartland property. The new water main connects the RTF with Saanich's new water reservoir built on Hartland's eastern boundary. The new water service also supplies water to the newly built Pump Station No. 4, which is part of the Wastewater Treatment Project's Residual Solids Conveyance Line (RSCL). The RSCL conveys processed wastewater from the McLoughlin Point Wastewater Treatment Plant to the RTF. Construction of the RSCL was completed in the summer of 2020.

2.2 Geology

2.2.1 Surficial Geology

A thin veneer of glacial till composed of silty, gravelly sand, with interspersed cobbles and boulders mantles the bedrock in areas of gentle slopes and in valley bottoms. Locally surrounding the landfill, fluvial deposits consisting of well-sorted sands and gravels are observed in bedrock depressions and channels, including the channel that drained Heal Lake prior to development of the Phase 2 landfill. At the landfill, bedrock is mantled by a thin, discontinuous veneer of glacial till (Vashon Drift) composed of silty, gravelly sand, with interspersed cobbles and boulders. Vashon Till is generally absent from the North Ridge and Hartland North areas of the landfill based on visual inspection and borehole log information.

2.2.2 Bedrock Geology

The bedrock geology in the area surrounding the landfill mainly comprises Wark Diorite Gneiss with Colquitz Gneiss outcropping in the northern and eastern margins of the landfill site with thin overlying veneer of glacial till. The Wark Diorite Gneiss is dark green to black in colour. It is competent, except locally in shear zones, where it has been chloritized and weathered into soft, sand size particles and clay. Discontinuities, including joints, shear zones and altered veins have been observed on the bedrock outcrops and noted in borehole logs. Geologic mapping of an exposed bedrock outcrop north of the Phase 2 landfill (AECOM 2018) characterized the undulating bedrock surface and confirmed the presence a complex network of lithologic contacts, faults and fractures observed in exposed bedrock excavations (sub-vertical quarry walls) including the Highland Fault and other faults that were previously inferred based on lineaments identified on aerial photographs (Thurber 1987). Evidence supporting the identification of a major oblique slip fault proximal to the trace of the Highland Fault was also identified in this study and further validated by a drill investigation in the fall of 2019 (AECOM 2019a). Permeability testing has determined that faults and shear zones behave as either conduits or barriers to groundwater flow (AECOM 2018).

2.3 Climate

The climate of this area is classified as "cool Mediterranean". Long-term (1981–2010) average climatic data is available for the Victoria International Airport Climatological Station (Victoria International Airport CS) located approximately 9 km from the

landfill. Average annual temperature is 10.0ºC and mean monthly values range from a low of 4.0ºC in December to a high of 16.9ºC in July. Mean annual precipitation is 882.9 mm.

In 1994, the CRD established a climate station (Victoria Hartland CS) at the landfill office. The original Hartland climate station was replaced in 2009/10 with new equipment at a location on top of Phase 1. The new weather station records temperature, precipitation, wind direction, wind speed, barometric pressure and relative humidity directly to CRD's SCADA system.

Hartland daily precipitation measurements for 2021/22 are provided in Appendix C. The precipitation measured at Hartland Landfill from April 2021 to March 2022 was 1,279.5 mm, which was approximately 45% higher than the 30-year average reported for Victoria International Airport CS (882.9 mm/year), and 13% higher than the 2020/21 total precipitation recorded for Victoria Hartland CS (1,133.5 mm). These data indicate that 2021/22 was a wet year with respect to precipitation. Precipitation during the wet season (i.e. October to February) was 945.5 mm, which contributed over 74% of the total annual precipitation. In November 2021, an atmospheric river brought intense precipitation across British Columbia's South Coast Region. Precipitation recorded at Victoria Hartland CS station was 399 mm for the month of November, which was approximately 2.5 times higher than 30-year average of 152.6 mm.

Climate change projections for the CRD were developed by the Pacific Climate Impacts Consortium to better understand the details of how climate may change in the Capital Region (CRD 2017). Overall, the results indicate that the region can expect warmer winter temperatures, fewer days below freezing, more extreme hot days in the summer, longer dry spells in summer months, more precipitation in fall, winter and spring, and more intense, extreme weather events. A water surplus occurs primarily in the cool, wet winter months (November, December and January) with water deficit conditions occurring in the warm, dry summer months (July, August, and September).

2.4 Significant Site Activities in 2021/22

CRD staff maintain a log of activities at the landfill that are relevant to landfill operations, leachate containment and compliance monitoring activities. Activities that are considered important from a compliance monitoring perspective are paraphrased below:

- Activation of Centrate Return Line: The Centrate Return Line (CRL) is used to return centrate from the RTF and leachate from the Hartland Landfill to the McLoughlin Point Wastewater Treatment Plant. The CRL was activated on December 30, 2020 to convey centrate from the RTF and operated intermittently for leachate in January 2021 when leachate levels in the Upper Lagoon were high. The formal switch from the leachate pipeline to the CRL commenced in March 2021, and flow rates ranged between 60 and 80 L/s.
- Preparation of Leachate Line Decommissioning: The leachate pipeline was deactivated in March 2021 and plugged in April 2021 to prepare for decommissioning. The leachate line has been filled with super-chlorinated water since March 2021. In June 2021, the Regional Source Control program (RSCP) discharge permit (SC97.001) was amended to reflect construction of the CRL and decommissioning of the Markham Valve Chamber.
- Deposition of wastewater residuals in Hartland Landfill: Between April 2021 and March 2022, approximately 2,626 tonnes of dried biosolids (95% solid content) and 4,268 dewatered sludge (20% solid content) were received from the RTF. The dried biosolids were used as daily cover on the active face, and the dewatered sludge was deposited in controlled waste trenches.
- Aggregate Storage Development: Tree falling and clearing activities were completed in early March 2020 to develop the aggregate storage area located in the northeast corner of the landfill property. Aggregate production and blasting for air space, road building and construction at Hartland North continued in 2021/22. The new aggregate storage area will be used for long-term aggregate storage.
- Upper Lagoon Capacity During Extreme Rain Event: On November 14 and 15, 2021, an extremely high amount of rain (150 mm) resulted in widespread flooding, mudslides and road damage across southwestern BC, including the Marigold Pump Station. As a result, flows through the CRL had to be temporarily redirected into the leachate collection system. By the afternoon of November 15, 2021, the leachate levels in the Upper Lagoon peaked at 78% full and then slowly decreased over the next two weeks. Leachate levels returned to their normal operating range (11-13% full) on November 30, 2021. Elevations within the Phase 2 basin were maintained at normal operating levels during this time.

- Impact of “Atmospheric River” Event on Water Quantity and Quality: Water quantity and quality during the November 2021 sampling event appeared to be impacted by the intense precipitation brought by “atmospheric river” event, resulting in temporal changes in leachate flows, surface runoff and groundwater and surface water quality. Water quality in many groundwater wells and surface water locations was temporally altered following fall precipitation. It is interpreted that the natural weathering products accumulated in the unsaturated zone over the dry summer months were flushed from the unsaturated zone to the water table through infiltration/surface water runoff processes more rapidly that in other years. Surface Water Quality at Compliance Location SW-N-05: Since November 2021, surface water in the Northwest Sedimentation Pond (NWSP) and compliance location (SW-N-05) has exhibited increased nutrient and metal concentrations, resulting in non-compliance conditions at SW-N-05. AECOM Canada Ltd. was retained by CRD to implement a phased investigation to determine the cause of elevated nutrient concentrations within and downstream of the NWSP. Between March and April 2022, three (3) drive-point piezometers (DP22-05, DP22-5B, DP22-5C) and nine (9) groundwater monitoring wells (95-1-1, 96-1-1, 97-1-1, 98-1-1, 99-1-1, 100-1-1, 101-1-1, 102-1-1, and 103-1-1) were installed north of the Phase 2 landfill to identify contaminant sources and migration pathways. The investigation was ongoing at the end of the time period covered by this report, but additional subsurface investigations and remedial efforts have advanced to include expanded leachate collection infrastructure.
- Maintenance/Verification of North and South Purge Well Systems: Flow tests were regularly conducted at P1, P7 and P8 to monitor pump efficiency. Pumps installed in several leachate collection wells (P3 and P10) were replaced in response to pump failure.

2.5 Applicable Regulatory Criteria

The Hartland Landfill is required to operate in accordance with the monitoring requirements outlined in the following:

- Amended Operational Certificate (#12659) approved by ENV, last amended on January 27, 2010.
- Waste Discharge Permit SC97.001 issued by the CRD Regional Source Control Program, last amended on March 1, 2011, and subject to the CRD Sewer Use Bylaw.
- Legally enforceable standards defined by the British Columbia Contaminated Sites Regulation (CSR).

The Stage 10 (Omnibus) and Stage 11 (Housekeeping) amendments to the CSR became effective on November 1, 2017. Stage 12 amendments to the CSR were issued January 24, 2019 and included clerical errors related to the Stage 10 and 11 amendments. The Stage 13 amendments (effective February 1, 2021) were developed to improve the process for identifying contaminated sites. These changes were considered in this report.

As part of the update of Stage 10 (Omnibus) and Stage 11 (Housekeeping) amendments, a number of emerging contaminants were added to the water and soil schedules due to their persistence in the environment, toxicity, and relevance to contaminated sites in BC. In April 2017, AECOM conducted a focused review on the applicability of emerging contaminants at the Hartland Landfill based on Schedule 2 activities in the CSR. In 2018, AECOM conducted a detailed emerging contaminant review, to confirm regulatory compliance and to recommend an approach for future monitoring (AECOM 2018). It was recommended to continue sampling and analyzing of emerging contaminants of concern (CECs) at the Hartland Valve Chamber on a quarterly basis in conjunction with the trace organics sampling program. In 2021/22, quarterly samples were collected and submitted for CECs at the Hartland Valve Chamber.

2.5.1 Groundwater

In February 2016, CSR Protocol 21 (P21), Water Use Determination, became legally enforceable. For the purposes of this report, Protocol 21 (Version 2.0, effective October 31, 2017) is considered when determining applicable water use standards at Hartland Landfill.

Groundwater quality data were compared to CSR Schedule 3.2 Generic Numerical Water Standards Column 3 Aquatic Life Use (AW) and Column 6 Drinking Water Use (DW), as required by P21.

Freshwater AW standards apply to groundwater because the landfill is “within 500 m of a surface water body containing aquatic life” (i.e. Heal Creek, Durrance Creek, Durrance Lake, Killarney Creek and Killarney Lake).

Future DW standards apply because the aquifer underlying the landfill has:

- A hydraulic conductivity greater than 10^{-6} m/s and a yield greater than 1.3 L/min.
- Groundwater with natural total dissolved solids (TDS) concentrations of less than 4,000 mg/L.
- An average confined aquifer saturated thickness greater than 1 m.
- An overlying silt or clay aquitard that is less than 5 m thick.

DW standards for iron and manganese do not apply to municipal landfills based on the Stage 8 Amendments to the CSR that came into effect on January 24, 2013 as presented on CSR Schedule 3.2.

The Stage 13 amendments to the BC CSR were effective as of February 1, 2021. As part of the Stage 13 amendments, Protocol 9, which includes the list of regional groundwater background concentrations, was updated. Regional background concentrations are provided in Table 1 of Protocol 9. Regional background concentrations for the Southern Vancouver Island have been considered when assessing groundwater quality data collected at the Hartland Landfill. In several instances, regional background concentrations are greater than the applicable CSR Drinking Water Use standard and/or the most stringent CSR Freshwater Aquatic Life Use standard. Groundwater that contains a substance concentration above the applicable CSR standard but below the regional background concentration for that substance is not considered contaminated under the CSR. All reference to CSR standards in this report consider Stage 13 amendments and included amendments up to July 7, 2021.

2.5.2 Surface Water

Surface water quality data are compared to the *British Columbia Approved and Working Water Quality Guidelines* (BCWQG) for the protection of AW and DW, because CSR Technical Guidance 15 (April 2013) indicates that groundwater in receiving environments (i.e. within 10 m of the high water mark of a surface water body) should be compared to the BCWQG. Both approved and working BCWQGs were last updated in February 2021 and the updated guidelines were considered when assessing data compliance in this report. Furthermore, there are two sets of BCWQG criteria for AW use:

- 30-day average (long-term)
- Maximum allowable concentration (short-term)

The purpose of the 30-day average guideline is to protect the most sensitive species and life stages against chronic exposure. To properly compare data against 30-day average guidelines, the 30-day average concentration is typically calculated by averaging the results of five or more samples collected within a 30-day period.

The maximum allowable concentration (MAC) guideline is established to protect the most sensitive species and life stages against short-term exposure (i.e., < 96 hours). BCWQGs for MACs are typically used to assess risks associated with short-term exposures.

The dissolved copper data evaluation has been updated to reflect the revised BCWQG AW criteria. The dissolved copper BCWQG varies with hardness, pH, dissolved organic carbon (DOC) and temperature, and is calculated using the Biotic Ligand Model (BLM). BLM is a series of linked equations that predict the toxicity of dissolved copper to aquatic life under specific conditions. In this report, only dissolved copper concentrations with paired DOC data were compared to BCWQG AW criteria.

The BCWQGs apply to surface water on site and on adjacent sites under provincial jurisdiction. The Federal Water Quality Guidelines (CCME) apply on the property owned by the federal government located north of the site. Both the BCWQG and CCME criteria are guidelines and do not have the same regulatory force as the CSR Omnibus standards.

2.5.3 Leachate

Discharges from the leachate pipeline are subject to the CRD Regional Source Control Program (RSCP) Waste Discharge Permit (Waste Discharge Permit Number SC97.001) authorizing the discharge of non-domestic waste to the sanitary sewer in accordance with the CRD's Sewer Use Bylaw 2922. In June 2021, the discharge permit was amended to reflect operation of the CRL and decommissioning of the Markham Valve Chamber. Sampling is conducted monthly.

The Hartland Landfill leachate compliance monitoring location is the Hartland Valve Chamber (flow detection chamber) located near the Lower Lagoon. Authorized discharge limits are identified within the permit.

In 2021/22, quarterly samples were collected at the Hartland Valve Chamber for analysis of emerging contaminants. A leachate sample could not be collected in Q1 2022 due to laboratory shipment/handling issues.

3 Methods and Quality Assurance

3.1 Field Techniques

Sampling locations are shown on Figure 4-1. Boreholes and monitoring wells are identified using a standard system adopted by the CRD consisting of three numbers (e.g., 02-02-01). The first number refers to the monitoring site, the second to the borehole at that site (there may be more than one) and the third number refers to the monitoring well in that borehole (there may be two or three at different depths in older installations). If the third number is a zero, it indicates an open borehole where no PVC monitoring well has been installed. In addition, several leachate purge wells have been installed at the site. Purge wells are denoted with a “P” in front of the purge well number (e.g., P1).

Monitoring well construction details including location coordinates and elevations are summarized in Appendix A.1. Appendix A.1 also lists the status of all the groundwater monitoring wells at the site together with comments describing any problems associated with each monitoring well. Monitoring wells are categorized as active (fully functioning) or inactive (non-functioning or destroyed). In 2020/21, there were 129 active groundwater monitoring wells at 75 locations in the vicinity of Hartland Landfill, of which eight (8) are active purge wells and 13 are landfill gas wells that were regularly used to measure leachate levels in Phase 1. South purge well P1 was replaced and recommissioned in November 2018.

The methods used to develop and sample each monitoring well are indicated in Appendix A.2. The Standard Operating Practice (SOP) for groundwater sampling is periodically updated. A variety of techniques are used depending on the depth of the monitoring well, the groundwater level in the monitoring well, and the permeability of the surrounding geologic formation. A number of dedicated submersible pumps have been installed by CRD in the deeper monitoring wells and open boreholes at the landfill to facilitate more efficient sampling and have resulted in improved data quality. Sampling events were scheduled to avoid heavy rainfall events to avoid sample dilution.

In 2021/22, the monitoring program consisted of the following:

- Groundwater level measurements four times per year.
- Continuous water level monitoring with pressure transducers at north end of the Phase 2 landfill.
- Continuous water level monitoring with pressure transducers at the north and south purge well systems.
- Continuous water level monitoring with pressure transducers east of Phase 1 landfill and Hartland North.
- Quarterly monitoring of wells near the property boundary and key locations to assess the effectiveness of leachate containment.
- Semi-annual monitoring stations with relatively stable long-term historical data.
- Annual sampling of 19 residential wells, including 14 wells within a 2 km radius of the landfill and five (5) domestic wells located north of the Hartland North Pad.
- Quarterly sampling of surface water stations at property boundary points and other selected monitoring locations.
- Quarterly testing of leachate discharge for trace organic compounds.
- Monthly testing of leachate for conventional parameters and metals at the point of discharge and select locations within the leachate collection system.
- Quarterly testing for select emerging contaminants at the Hartland Valve Chamber.

As in previous years, CRD staff carried out surface water, groundwater and leachate sampling and groundwater level measurements at the locations shown in tables in Appendix B and on figures in Appendix E. Further information on the monitoring program field procedures is contained in the CRD Monitoring Procedure Manual.

The CRD employs a continuous improvement and quality assurance program. As part of this work, field methods were updated, and written protocols were updated in 2017. Additionally, AECOM evaluated the sampling network and schedule

(AECOM 2016b). The review recommended modifications to the groundwater, surface water and leachate monitoring program, which were implemented for the 2019/20 monitoring year.

3.2 Quality Assurance

In 2021/22, routine surface water, groundwater and domestic well water laboratory analyses were performed by Bureau Veritas Laboratory (BV) in Victoria and Burnaby, British Columbia. BV also analyzed leachate chemistry samples, which included analysis of trace organic compounds.

A quality assurance program is in place assess the validity of the chemical analysis results. This has involved the submission of randomly selected field replicate, trip blank and "reference" Victoria municipal water samples to the laboratory for analysis. Table 3-1 and Table 3-2 presents quality assurance of groundwater and surface water, respectively. There were 21 surface water and 42 groundwater samples submitted in duplicate between April 2021 and March 2022. Table 3-3 presents quality assurance results for the Hartland Valve Chamber. In this report, each set of replicates were taken from the same source and/or site, and under the same conditions. In all cases, the field replicates were submitted ‘blind’ to the laboratory. This resulted in duplicate sampling frequencies of 14% (42/310 samples) for groundwater, 33% (21/67 samples) for surface water, 33% (4/12 samples) for the Hartland Valve Chamber compliance point, and 7.6% (6/62 samples) for the overall leachate sampling program. Overall, approximately 16% (69/439) of samples were duplicated, which exceeded the targeted duplicate sampling rate of 10%.

Submission of duplicate samples provides an estimate of total uncertainty associated with the data. Typically, one duplicate sample is collected for every ten samples (10%) as part of quality control measures. Total uncertainty is the variability (precision plus bias) associated with the sample collection and sample analyses. In addition, the Limit of Quantification (LOQ) should be considered because the precision of analytical results just above the Method of Detection Limit (MDL) are known to be poor. The LOQ is the range of concentrations between the MDL and five times the MDL for each parameter, as outlined in Part E of the 2013 British Columbia Field Sampling Manual.

The CRD has used several different statistical methods for checking the precision and accuracy of its monitoring program. The CRD uses the relative percent difference (RPD) method, as recommended by ENV, which uses duplicate analyses to determine precision of the analytical results. This method expresses percent of difference between two values as the ratio of their absolute difference to the average value of the sample and the duplicate, as shown in the equation below:

$$RPD= [(|x_1-x_2|)/((x_1+x_2)/2)]$$

Where:

x_1 is the initial sample concentration (mg/L)
x_2 is the duplicate sample concentration (mg/L)

Parameters with RPD values exceeded RPD criteria should be interpreted with caution. Alarm limits were set as per the BC Ministry of Environment Environmental Laboratory Manual. Duplicate samples with RPD values within 30% for general inorganics and metals and within 45% for organic compounds are considered to meet the Data Quality Objectives (DQOs).

3.2.1 Groundwater and Surface Water

Table 3-1 and Table 3-2 present calculated RPD values for replicate groundwater and surface water samples collected near the landfill. In both tables, RPD values were highlighted with an “a” if they were above 30% and it was noted with a “b” if one or more of the parameter concentrations were below the LOQ.

Table 3-1 indicates the following for groundwater samples collected at the landfill in 2021/22:

- A total of 42 duplicate samples were collected and analyzed for 45 parameters. Seventeen (17) samples had RPD values greater than 30% when all concentrations were above the LOQ.
- RPD values for ammonia (1 sample), dissolved arsenic (1 sample), aluminum (10 samples), barium (1 sample), cadmium (1 sample), copper (3 samples), iron (2 samples), lead (2 samples), nickel (4 samples) and zinc (6 samples) were greater than the 30% target when all concentrations were above the LOQ.
- Groundwater field replicates showed good precision for most parameters and the majority of RPD values for the 2020/21 monitoring year were within the acceptable range, except for dissolved aluminum. Over 20% of the duplicate samples had

dissolved aluminum concentrations above the alarm limit of 30%. The majority of duplicate samples had RPD values for dissolved copper and zinc below the alarm limit (30%), indicating overall improved sampling handling procedures when compared to previous years.

- Overall, groundwater quality data is acceptably precise for the purpose of this report. However, dissolved aluminum concentrations should be interpreted with caution. Field blanks should be collected to further investigate/evaluate if the filters are the source of metal contamination. It is recommended that in-line filters be flushed with sample water for at least 30 seconds (or 500 mL) to remove any trace metal particulate in advance of sampling.

Table 3-2 indicates the following for surface water samples collected at the landfill in 2021/22:

- A total of 21 duplicate samples were collected and analyzed for 40 parameters. Eleven (11) samples had parameters with RPD values greater than 30% when all concentrations were above the LOQ.
- RPD values for TSS (2 samples), sulphate (1 sample), total aluminum (3 samples), total cadmium (2 samples), total cobalt (2 samples), total copper (2 samples), total iron (3 samples), total manganese (3 samples), total zinc (1 sample), dissolved aluminum (3 samples), dissolved cadmium (2 samples), dissolved copper (1 sample), dissolved manganese (1 sample) and dissolved zinc (2 samples) were greater than 30% on at least one occasion when all concentrations were above the LOQ.
- Overall, surface water field replicates showed good precision for most parameters and the majority of RPD values for the 2021/22 monitoring year were within the acceptable range. Some of the high RPD values (i.e. iron, aluminum, etc.) may be due to disturbance of the sediments/low flow conditions during sampling in the drier months.

3.2.2 Leachate

Four (4) duplicate leachate samples were collected during April 2021, August 2021, November 2021 and February 2022 events, and analyzed for various parameters. As shown in Table 3-3, three (3) samples and two (8) parameters had calculated RPD values that exceeded alarm limits when concentrations in both replicates were above the LOQ. Duplicate sample collected in November 2021 had most of parameters exceeded alarm limits.

Because landfill leachate is a complex analytical matrix, leachate field replicates showed good precision for most parameters and the majority of RPD values for the 2021/22 monitoring year were within the acceptable range. Leachate quality data is acceptably precise for the purposes of this report.

3.3 Statistical Assessment of Temporal Trends

Seasonal variability in water quality parameters can mask the overall trend of parameters in groundwater, surface water and leachate quality data. To better understand long-term trends in water quality, a non-parametric statistical analysis has been employed to evaluate trends in water quality data at Hartland Landfill since 2005. This test, known as the Mann-Kendall test, was used to evaluate temporal trends in contaminant concentrations. The analysis of trends is intended to promote early detection of statistically significant trends (at the 95% confidence level) in groundwater chemistry at each sampling location. This method does not require normally distributed data and allows for missing data (non-detects) and irregularly spaced measurement periods in the dataset. Non-detect measurements are assigned the value of the detection limit for the purposes of the statistical analysis. Water and leachate quality data at Hartland Landfill often includes concentrations below detection limits and samples are not always collected at regularly spaced intervals. The hypothesis of both increasing and decreasing trends are tested at the same time. The Mann-Kendall test can be used for virtually any water quality or leachate parameter and provides a quantitative means of determining if a given parameter is changing (increasing or decreasing) in a statistically significant manner over time.

A statistical analysis was conducted utilizing data collected between April 2017 and March 2022. A five-year time frame is consistent with the time interval over which most water quality data is plotted within this report and is anticipated to provide a good balance between seasonal variation and the detection of long-term trends in water quality. This analysis is used to identify areas of the landfill where water quality is degrading and/or improving. The time frame over which trend analysis is conducted should be carefully evaluated in conjunction with management and operational changes.

All field and lab replicates were removed from the data set prior to the analysis. Conductivity, ammonia and chloride concentrations were tested for trends using the Mann-Kendall test as they are considered indicators of leachate at Hartland

Landfill. Trends in sulphate and nitrate concentrations were also evaluated because high concentrations have been observed in relation to aggregate generated and used at the site.

The analysis was conducted using data collected from a total of 82 groundwater monitoring wells (36 compliance and 46 routine), 8 leachate purge wells, 23 surface water monitoring stations (5 compliance and 18 routine), and the leachate compliance monitoring station (Hartland Valve Chamber). The rest of the locations are either inactive or do not have sufficient data for Mann-Kendall analysis. The results of the statistical trend analysis for groundwater, surface water and leachate are provided in Appendices G-1, G-2 and G-3, respectively, and are discussed in relevant sections of this report.

Table 3-1. Groundwater Quality QA/QC - Relative Percent Difference 2021-2022

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Table 3-1. Groundwater Quality QA/QC - Relative Percent Difference 2021-2022

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				Fraction	TOT	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS
				Unit	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	mg/L	µg/L	µg/L	µg/L	mg/L	µg/L	µg/L	mg/L	mg/L
Station	Sample Type	Compliance Well (Y/N)?	Date Sampled	Comments																					
31-1-1	FR1	Y	2021-09-15	Clear and colourless	160.	3.93	0.056	0.204	4.35	< 0.01	< 0.005	51.	0.036 8	130.	5.5	< 0.1	0.248	0.487	366.	26.6	0.008	< 0.5	10.2	46.3	0.866	1.9	< 0.005
31-1-1	FR2	Y	2021-09-15		160.	3.82	0.065	0.21	4.31	< 0.01	< 0.005	52.	0.042 3	131.	5.4	< 0.1	0.248	0.476	368.	32.6	0.018 7	< 0.5	10.1	46.7	0.904	0.2	< 0.005
31-1-1	FRM	Y	2021-09-15	Mean of duplicates	160.	3.875	0.060 5	0.207	4.33	< 0.01	< 0.005	51.5	0.039 55	130.5	5.45	< 0.1	0.248	0.481 5	367.	29.6	0.013 35	< 0.5	10.15	46.5	0.885	1.05	< 0.005
31-1-1	RPD	Y	2021-09-15	RPD of duplicates	0.0%	2.8%	14.9%	2.9%	0.9%	0.0%	0.0%	1.9%	13.9%	0.8%	1.8%	0.0%	0.0%	2.3%	0.5%	20.3%	**80.1%** b	0.0%	1.0%	0.9%	4.3%	**161.9%** a	0.0%
31-1-1	FR1	Y	2021-11-26	Clear and colourless	160.	1.88	0.061	0.283	5.82	0.013	< 0.005	47.	0.054 5	165.	5.3	< 0.1	0.319	0.501	463.	6.4	0.012 8	< 0.5	12.6	65.8	0.776	0.65	< 0.005
31-1-1	FR2	Y	2021-11-26		160.	1.35	0.055	0.281	5.8	< 0.01	< 0.005	45.	0.046 2	162.	5.3	< 0.1	0.3	0.512	456.	5.8	< 0.005	< 0.5	12.7	64.6	0.706	0.69	< 0.005
31-1-1	FRM	Y	2021-11-26	Mean of duplicates	160.	1.615	0.058	0.282	5.81	0.011 5	< 0.005	46.	0.050 35	163.5	5.3	< 0.1	0.309 5	0.506 5	459.5	6.1	0.008 9	< 0.5	12.65	65.2	0.741	0.67	< 0.005
31-1-1	RPD	Y	2021-11-26	RPD of duplicates	0.0%	32.8%	10.3%	0.7%	0.3%	26.1%	0.0%	4.3%	16.5%	1.8%	0.0%	0.0%	6.1%	2.2%	1.5%	9.8%	**87.6%** b	0.0%	0.8%	1.8%	9.4%	6.0%	0.0%
31-1-1	FR1	Y	2022-03-07	Clear and colourless	140.	1.27	0.054	0.196	4.38	< 0.01	< 0.005	42.	0.029 6	130.	3.8	< 0.1	0.171	0.499	367.	4.2	< 0.005	< 0.5	10.3	35.9	0.723	< 0.015	< 0.005
31-1-1	FR2	Y	2022-03-07		130.	1.79	0.057	0.196	4.45	< 0.01	< 0.005	42.	0.032 7	126.	3.8	0.39	0.181	0.527	357.	5.7	< 0.005	< 0.5	10.	35.7	0.728	< 0.015	< 0.005
31-1-1	FRM	Y	2022-03-07	Mean of duplicates	135.	1.53	0.055 5	0.196	4.415	< 0.01	< 0.005	42.	0.031 15	128.	3.8	0.245	0.176	0.513	362.	4.95	< 0.005	< 0.5	10.15	35.8	0.725 5	< 0.015	< 0.005
31-1-1	RPD	Y	2022-03-07	RPD of duplicates	7.4%	**34.0%** b	5.4%	0.0%	1.6%	0.0%	0.0%	0.0%	10.0%	3.1%	0.0%	118.4%	5.7%	5.5%	2.8%	**30.3%** b	0.0%	0.0%	3.0%	0.6%	0.7%	0.0%	0.0%
39-1-1	FR1	Y	2021-05-21	Clear and colourless	100.	3.46	0.089	0.367	6.49	< 0.01	< 0.005	16.	0.136	41.2	2.1	< 0.1	0.033 8	0.666	118.	2.2	0.013 5	< 0.5	3.69	0.634	1.88	< 0.015	< 0.005
39-1-1	FR2	Y	2021-05-21		100.	3.76	0.085	0.352	6.3	< 0.01	< 0.005	14.	0.139	41.2	2.2	< 0.1	0.041 2	0.636	118.	1.6	0.012 3	< 0.5	3.6	0.656	1.97	0.054	< 0.005
39-1-1	FRM	Y	2020-05-15	Mean of duplicates	100.	3.61	0.087	0.359 5	6.395	< 0.01	< 0.005	15.	0.137 5	41.2	2.15	< 0.1	0.037 5	0.651	118.	1.9	0.012 9	< 0.5	3.645	0.645	1.925	0.034 5	< 0.005
39-1-1	RPD	Y	2020-05-15	RPD of duplicates	0.0%	8.3%	4.6%	4.2%	3.0%	0.0%	0.0%	13.3%	2.2%	0.0%	4.7%	0.0%	19.7%	4.6%	0.0%	**31.6%** b	9.3%	0.0%	2.5%	3.4%	4.7%	113.0%	0.0%
39-1-1	FR1	Y	2021-09-22	Clear and colourless	100.	10.	0.084	0.319	5.98	< 0.01	< 0.005	13.	0.015 5	43.	2.	< 0.1	0.034 8	0.255	123.	1.5	0.006 1	< 0.5	3.66	< 0.05	2.14	< 0.015	< 0.005
39-1-1	FR2	Y	2021-09-22		110.	3.27	0.088	0.317	6.09	< 0.01	< 0.005	12.	0.017 9	42.9	2.	< 0.1	0.032 2	0.278	122.	3.1	0.006 4	< 0.5	3.7	< 0.05	2.1	0.043	< 0.005
39-1-1	FRM	Y	2021-09-22	Mean of duplicates	105.	6.635	0.086	0.318	6.035	< 0.01	< 0.005	12.5	0.016 7	42.95	2.	< 0.1	0.033 5	0.266 5	122.5	2.3	0.006 25	< 0.5	3.68	< 0.05	2.12	0.029	< 0.005
39-1-1	RPD	Y	2021-09-22	RPD of duplicates	9.5%	**101.4%** a	4.7%	0.6%	1.8%	0.0%	0.0%	8.0%	14.4%	0.2%	0.0%	0.0%	7.8%	8.6%	0.8%	**69.6%** b	4.8%	0.0%	1.1%	0.0%	1.9%	**96.6%** b	0.0%
39-1-1	FR1	Y	2021-11-24	Clear and colourless	110.	3.08	0.091	0.341	5.41	< 0.01	< 0.005	27.	0.009 9	39.8	2.5	< 0.1	0.028	0.232	114.	2.4	< 0.005	< 0.5	3.54	< 0.05	1.85	< 0.015	< 0.005
39-1-1	FR2	Y	2021-11-24		110.	2.14	0.103	0.346	5.4	< 0.01	< 0.005	20.	0.012 2	40.3	2.6	< 0.1	0.030 7	0.272	116.	1.7	0.009 4	< 0.5	3.65	< 0.05	1.88	< 0.015	< 0.005
39-1-1	FRM	Y	2021-11-24	Mean of duplicates	110.	2.61	0.097	0.343 5	5.405	< 0.01	< 0.005	23.5	0.011 05	40.05	2.55	< 0.1	0.029 35	0.252	115.	2.05	0.007 2	< 0.5	3.595	< 0.05	1.865	< 0.015	< 0.005
39-1-1	RPD	Y	2021-11-24	RPD of duplicates	0.0%	**36.0%** b	12.4%	1.5%	0.2%	0.0%	0.0%	29.8%	20.8%	1.2%	3.9%	0.0%	9.2%	15.9%	1.7%	**34.1%** b	**61.1%** b	0.0%	3.1%	0.0%	1.6%	0.0%	0.0%
39-1-1	FR1	Y	2022-02-24	Clear and colourless	100.	2.7	0.123	0.385	5.52	< 0.01	< 0.005	18.	0.012 8	40.6	2.4	< 0.1	0.028 4	0.207	116.	< 1.	0.008 7	< 0.5	3.52	0.108	2.08	< 0.015	< 0.005
39-1-1	FR2	Y	2022-02-24		98.	4.11	0.119	0.364	5.54	< 0.01	< 0.005	16.	0.015 2	41.8	2.4	< 0.1	0.030 9	0.247	119.	1.8	0.009	< 0.5	3.58	0.117	2.07	< 0.015	< 0.005
39-1-1	FRM	Y	2022-02-24	Mean of duplicates	99.	3.405	0.121	0.374 5	5.53	< 0.01	< 0.005	17.	0.014	41.2	2.4	< 0.1	0.029 65	0.227	117.5	1.4	0.008 85	< 0.5	3.55	0.112 5	2.075	< 0.015	< 0.005
39-1-1	RPD	Y	2022-02-24	RPD of duplicates	2.0%	**41.4%** a	3.3%	5.6%	0.4%	0.0%	0.0%	11.8%	17.1%	2.9%	0.0%	0.0%	8.4%	17.6%	2.6%	**57.1%** b	3.4%	0.0%	1.7%	8.0%	0.5%	0.0%	0.0%
41-1-1	FR1	Y	2021-05-27	Clear and colourless	---	1.72	0.041	2.04	2.48	< 0.01	< 0.005	22.	0.005 4	68.9	11.	< 0.1	0.139	0.272	204.	20.4	0.007 5	< 0.5	7.81	264.	1.35	< 0.015	< 0.005
41-1-1	FR2	Y	2021-05-27		---	3.93	0.043	2.11	2.5	< 0.01	< 0.005	22.	< 0.005	69.3	11.	< 0.1	0.135	0.28	206.	26.2	0.010 4	< 0.5	8.06	266.	1.4	0.085	< 0.005
41-1-1	FRM	Y	2020-05-15	Mean of duplicates	---	2.825	0.042	2.075	2.49	< 0.01	< 0.005	22.	0.005 2	69.1	11.	< 0.1	0.137	0.276	205.	23.3	0.008 95	< 0.5	7.935	265.	1.375	0.05	< 0.005
41-1-1	RPD	Y	2020-05-15	RPD of duplicates	---	78.2%	4.8%	3.4%	0.8%	0.0%	0.0%	0.0%	7.7%	0.6%	0.0%	0.0%	2.9%	2.9%	1.0%	24.9%	**32.4%** b	0.0%	3.2%	0.8%	3.6%	**140.0%** b	0.0%
41-1-1	FR1	Y	2021-09-16	Clear and colourless	160.	4.3	0.023	4.35	2.45	< 0.01	< 0.005	25.	0.010 7	70.7	7.8	< 0.1	0.27	0.216	208.	12.5	< 0.005	< 0.5	7.66	765.	2.66	0.033	< 0.005
41-1-1	FR2	Y	2021-09-16		160.	2.51	< 0.02	4.33	2.32	< 0.01	< 0.005	24.	0.010 1	70.2	7.7	< 0.1	0.276	0.237	206.	12.1	< 0.005	< 0.5	7.57	769.	2.65	0.03	< 0.005
41-1-1	FRM	Y	2021-09-16	Mean of duplicates	160.	3.405	0.021 5	4.34	2.385	< 0.01	< 0.005	24.5	0.010 4	70.45	7.75	< 0.1	0.273	0.226 5	207.	12.3	< 0.005	< 0.5	7.615	767.	2.655	0.031 5	< 0.005
41-1-1	RPD	Y	2021-09-16	RPD of duplicates	0.0%	**52.6%** a	14.0%	0.5%	5.5%	0.0%	0.0%	4.1%	5.8%	0.7%	1.3%	0.0%	2.2%	9.3%	1.0%	3.3%	0.0%	0.0%	1.2%	0.5%	0.4%	9.5%	0.0%
41-1-1	FR1	Y	2021-11-26	Clear and colourless	160.	3.02	0.04	2.57	2.48	< 0.01	< 0.005	29.	0.007 6	68.9	7.3	< 0.1	0.155	0.364	204.	29.7	0.007 6	< 0.5	7.75	465.	2.11	0.49	0.007 2
41-1-1	FR2	Y	2021-11-26		160.	2.56	0.037	2.53	2.38	< 0.01	< 0.005	28.	0.006 7	68.	7.3	< 0.1	0.151	0.417	199.	26.4	0.006 9	< 0.5	7.19	453.	2.	0.66	0.007 1
41-1-1	FRM	Y	2021-11-26	Mean of duplicates	160.	2.79	0.038 5	2.55	2.43	< 0.01	< 0.005	28.5	0.007 15	68.45	7.3	< 0.1	0.153	0.390 5	201.5	28.05	0.007 25	< 0.5	7.47	459.	2.055	0.575	0.007 15
41-1-1	RPD	Y	2021-11-26	RPD of duplicates	0.0%	16.5%	7.8%	1.6%	4.1%	0.0%	0.0%	3.5%	12.6%	1.3%	0.0%	0.0%	2.6%	13.6%	2.5%	11.8%	9.7%	0.0%	7.5%	2.6%	5.4%	29.6%	1.4%
41-1-1	FR1	Y	2022-02-25	Clear and slightly oran	140.	1.07	0.075	1.44	1.61	< 0.01	< 0.005	23.	< 0.005	65.9	7.5	< 0.1	0.027 6	0.236	193.	6.1	< 0.005	< 0.5	6.91	25.2	1.01	< 0.015	< 0.005
41-1-1	FR2	Y	2022-02-25		140.	1.07	0.074	1.51	1.58	< 0.01	< 0.005	23.	< 0.005	64.4	7.4	< 0.1	0.030 2	0.309	189.	3.2	< 0.005	< 0.5	6.88	28.7	1.05	< 0.015	< 0.005
41-1-1	FRM	Y	2022-02-25	Mean of duplicates	140.	1.07	0.074 5	1.475	1.595	< 0.01	< 0.005	23.	< 0.005	65.15	7.45	< 0.1	0.028 9	0.272 5	191.	4.65	< 0.005	< 0.5	6.895	26.95	1.03	< 0.015	< 0.005
41-1-1	RPD	Y	2022-02-25	RPD of duplicates	0.0%	0.0%	1.3%	4.7%	1.9%	0.0%	0.0%	0.0%	0.0%	2.3%	1.3%	0.0%	9.0%	26.8%	2.1%	**62.4%** b	0.0%	0.0%	0.4%	13.0%	3.9%	0.0%	0.0%
42-1-1	FR1	Y	2021-05-27	Clear and colourless	---	5.57	< 0.02	0.142	14.3	0.012	< 0.005	68.	< 0.005	92.4	15.	0.13	0.078 4	0.052	255.	713.	0.009	< 0.5	5.82	172.	0.18	0.056	< 0.005
42-1-1	FR2	Y	2021-05-27		---	8.19	< 0.02	0.152	14.2	< 0.01	< 0.005	71.	< 0.005	91.9	15.	0.13	0.079 6	0.358	253.	710.	0.005 5	< 0.5	5.81	168.	0.189	0.057	< 0.005
42-1-1	FRM	Y	2020-05-15	Mean of duplicates	---	6.88	< 0.02	0.147	14.25	0.011	< 0.005	69.5	< 0.005	92.15	15.	0.13	0.079	0.205	254.	711.5	0.007 25	< 0.5	5.815	170.	0.184 5	0.056 5	< 0.005
42-1-1	RPD	Y	2020-05-15	RPD of duplicates	---	**38.1%** a	0.0%	6.8%	0.7%	18.2%	0.0%	4.3%	0.0%	0.5%	0.0%	0.0%	1.5%	**149.3%** b	0.8%	0.4%	**48.3%** b	0.0%	0.2%	2.4%	4.9%	1.8%	0.0%
42-1-1	FR1	Y	2021-09-16	Clear and colourless	200.	5.69	< 0.02	0.195	14.9	< 0.01	< 0.005	63.	< 0.005	107.	17.	0.11	0.044 7	0.1	294.	662.	< 0.005	< 0.5	6.33	169.	0.396	0.061	< 0.005
42-1-1	FR2	Y	2021-09-16		200.	3.47	< 0.02	0.204	15.	< 0.01	< 0.005	64.	< 0.005	108.	17.	< 0.1	0.044 8	0.064	296.	657.	< 0.005	< 0.5	6.29	165.	0.377	0.053	< 0.005
42-1-1	FRM	Y	2021-09-16	Mean of duplicates	200.	4.58	< 0.02	0.199 5	14.95	< 0.01	< 0.005	63.5	< 0.005	107.5	17.	0.105	0.044 75	0.082	295.	659.5	< 0.005	< 0.5	6.31	167.	0.386 5	0.057	< 0.005
42-1-1	RPD	Y	2021-09-16	RPD of duplicates	0.0%	**48.5%** a	0.0%	4.5%	0.7%	0.0%	0.0%	1.6%	0.0%	0.9%	0.0%	9.5%	0.2%	**43.9%** b	0.7%	0.8%	0.0%	0.0%	0.6%	2.4%	4.9%	14.0%	0.0%
42-1-1	FR1	Y	2021-11-26	Clear and colourless	210.	5.75	< 0.02	0.202	16.4	0.017	< 0.005	81.	< 0.005	107.	19.	0.21	0.078 5	0.098	293.	803.	0.007 1	< 0.5	6.17	173.	0.223	< 0.15	0.005 6
42-1-1	FR2	Y	2021-11-26		210.	5.44	< 0.02	0.205	16.4	0.016	< 0.005	82.	< 0.005	106.	19.	0.22	0.079 1	0.075	289.	777.	< 0.005	< 0.5	6.17	170.	0.239	0.73	0.005 3
42-1-1	FRM	Y	2021-11-26	Mean of duplicates	210.	5.595	< 0.02	0.203 5	16.4	0.016 5	< 0.005	81.5	< 0.005	106.5	19.	0.215	0.078 8	0.086 5	291.	790.	0.006 05	< 0.5	6.17	171.5	0.231	0.44	0.005 45
42-1-1	RPD	Y	2021-11-26	RPD of duplicates	0.0%	5.5%	0.0%	1.5%	0.0%	6.1%	0.0%	1.2%	0.0%	0.9%	0.0%	4.7%	0.8%	26.6%	1.4%	3.3%	**34.7%** b	0.0%	0.0%	1.7%	6.9%	**131.8%** b	5.5%
42-1-1	FR1	Y	2022-02-25	Clear and colourless	190.	4.99	< 0.02	0.148	13.3	0.012	< 0.005	64.	< 0.005	94.7	14.	0.15	0.054 3	0.058	259.	677.	< 0.005	< 0.5	5.57	154.	0.223	0.088	< 0.005
42-1-1	FR2	Y	2022-02-25		190.	5.01	< 0.02	0.165	13.2	< 0.01	< 0.005	65.	< 0.005	99.	14.	0.15	0.053 7	0.053	270.	691.	< 0.005	< 0.5	5.52	156.	0.207	0.084	< 0.005
42-1-1	FRM	Y	2022-02-25	Mean of duplicates	190.	5.	< 0.02	0.156 5	13.25	0.011	< 0.005	64.5	< 0.005	96.85	14.	0.15	0.054	0.055 5	264.5	684.	< 0.005	< 0.5	5.545	155.	0.215	0.086	< 0.005
42-1-1	RPD	Y	2022-02-25	RPD of duplicates	0.0%	0.4%	0.0%	10.9%	0.8%	18.2%	0.0%	1.6%	0.0%	4.4%	0.0%	0.0%	1.1%	9.0%	4.2%	2.0%	0.0%	0.0%	0.9%	1.3%	7.4%	4.7%	0.0%

Table 3-1. Groundwater Quality QA/QC - Relative Percent Difference 2021-2022

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Station	Sample Type	Compliance Well (Y/N)?	Date Sampled	Comments	Fraction	TOT	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS
					Unit	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	µg/L	µg/L	mg/L	mg/L
71-1-1	FR1	Y	2021-05-06	Clear and colourless		140.	3.38	0.035	0.356	6.34	< 0.01	< 0.005	531.	0.019 4	52.6	8.2	1.02	0.103	0.111	160.	29.1	< 0.005	< 0.5	6.97	103.	1.62	< 0.015	< 0.005
71-1-1	FR2	Y	2021-05-06			140.	4.37	0.046	0.355	6.52	< 0.01	< 0.005	544.	0.15	52.9	8.1	0.73	0.102	0.369	161.	33.1	0.019 2	< 0.5	7.1	104.	1.22	< 0.015	< 0.005
71-1-1	FRM	Y	2020-05-15	Mean of duplicates		140.	3.875	0.040 5	0.355 5	6.43	< 0.01	< 0.005	537.5	0.084 7	52.75	8.15	0.875	0.102 5	0.24	160.5	31.1	0.012 1	< 0.5	7.035	103.5	1.42	< 0.015	< 0.005
71-1-1	RPD	Y	2020-05-15	RPD of duplicates		0.0%	25.5%	27.2%	0.3%	2.8%	0.0%	0.0%	2.4%	**154.2%** b	0.6%	1.2%	**33.1%** a	1.0%	**107.5%** b	0.6%	12.9%	**117.4%** b	0.0%	1.8%	1.0%	28.2%	0.0%	0.0%
71-1-1	FR1	Y	2021-09-10	Clear and colourless		180.	2.05	0.075	0.283	6.51	< 0.01	< 0.005	444.	< 0.005	63.4	9.1	< 0.1	0.091 1	0.111	193.	8.9	< 0.005	< 0.5	8.3	73.7	0.362	< 0.015	< 0.005
71-1-1	FR2	Y	2021-09-10			170.	1.69	0.072	0.285	6.54	< 0.01	< 0.005	441.	0.005 1	63.3	9.	< 0.1	0.086 5	0.086	193.	9.1	0.006 4	< 0.5	8.48	73.4	0.344	< 0.015	0.005 2
71-1-1	FRM	Y	2021-09-10	Mean of duplicates		175.	1.87	0.073 5	0.284	6.525	< 0.01	< 0.005	442.5	0.005 05	63.35	9.05	< 0.1	0.088 8	0.098 5	193.	9.	0.005 7	< 0.5	8.39	73.55	0.353	< 0.015	0.005 1
71-1-1	RPD	Y	2021-09-10	RPD of duplicates		5.7%	19.3%	4.1%	0.7%	0.5%	0.0%	0.0%	0.7%	2.0%	0.2%	1.1%	0.0%	5.2%	25.4%	0.0%	2.2%	24.6%	0.0%	2.1%	0.4%	5.1%	0.0%	3.9%
71-1-1	FR1	Y	2021-11-04	Clear and colourless		180.	1.61	0.082	0.33	7.72	< 0.01	< 0.005	435.	0.005 4	60.6	9.7	< 0.1	0.101	1.17	184.	31.8	0.015 7	0.51	7.85	120.	0.515	< 0.015	< 0.005
71-1-1	FR2	Y	2021-11-04			180.	1.6	0.076	0.373	7.6	< 0.01	< 0.005	426.	0.005 4	60.	9.6	< 0.1	0.106	< 0.05	183.	29.4	< 0.005	0.52	7.94	118.	0.505	< 0.015	< 0.005
71-1-1	FRM	Y	2021-11-04	Mean of duplicates		180.	1.605	0.079	0.351 5	7.66	< 0.01	< 0.005	430.5	0.005 4	60.3	9.65	< 0.1	0.103 5	0.61	183.5	30.6	0.010 35	0.515	7.895	119.	0.51	< 0.015	< 0.005
71-1-1	RPD	Y	2021-11-04	RPD of duplicates		0.0%	0.6%	7.6%	12.2%	1.6%	0.0%	0.0%	2.1%	0.0%	1.0%	1.0%	0.0%	4.8%	**183.6%** b	0.5%	7.8%	**103.4%** b	1.9%	1.1%	1.7%	2.0%	0.0%	0.0%
71-1-1	FR1	Y	2022-03-02	Clear and colourless		140.	1.81	0.08	0.424	6.87	< 0.01	< 0.005	486.	0.026 5	50.7	8.	< 0.1	0.103	0.088	156.	24.	< 0.005	0.5	7.01	117.	0.555	< 0.015	< 0.005
71-1-1	FR2	Y	2022-03-02			140.	1.75	0.075	0.426	6.91	< 0.01	< 0.005	462.	0.005 7	50.5	8.	< 0.1	0.105	0.081	154.	24.2	0.005 8	0.5	6.83	118.	0.565	< 0.015	< 0.005
71-1-1	FRM	Y	2022-03-02	Mean of duplicates		140.	1.78	0.077 5	0.425	6.89	< 0.01	< 0.005	474.	0.016 1	50.6	8.	< 0.1	0.104	0.084 5	155.	24.1	0.005 4	0.5	6.92	117.5	0.56	< 0.015	< 0.005
71-1-1	RPD	Y	2022-03-02	RPD of duplicates		0.0%	3.4%	6.5%	0.5%	0.6%	0.0%	0.0%	5.1%	**129.2%** b	0.4%	0.0%	0.0%	1.9%	8.3%	1.3%	0.8%	14.8%	0.0%	2.6%	0.9%	1.8%	0.0%	0.0%
72-1-1	FR1	Y	2021-05-06	Clear and colourless		160.	2.	< 0.04	0.11	12.6	< 0.02	< 0.01	1 710.	< 0.01	86.8	75.	0.35	0.077	< 0.1	275.	357.	< 0.01	< 1.	14.2	110.	1.12	< 0.015	< 0.005
72-1-1	FR2	Y	2021-05-06			160.	1.17	< 0.02	0.15	12.7	< 0.01	< 0.005	1 700.	0.008 5	87.2	75.	1.34	0.076 7	< 0.05	276.	355.	< 0.005	0.54	14.2	112.	2.33	< 0.015	< 0.005
72-1-1	FRM	Y	2020-05-15	Mean of duplicates		160.	1.585	< 0.03	0.13	12.65	< 0.015	< 0.007 5	1 705.	0.009 25	87.	75.	0.845	0.076 85	< 0.075	275.5	356.	< 0.007 5	0.77	14.2	111.	1.725	< 0.015	< 0.005
72-1-1	RPD	Y	2020-05-15	RPD of duplicates		0.0%	**52.4%** b	**66.7%** b	**30.8%** a	0.8%	**66.7%** b	**66.7%** b	0.6%	16.2%	0.5%	0.0%	117.2%	0.4%	**66.7%** b	0.4%	0.6%	**66.7%** b	**59.7%** b	0.0%	1.8%	**70.1%** a	0.0%	0.0%
72-1-1	FR1	Y	2021-09-09	Clear and colourless		160.	1.78	< 0.02	0.161	12.8	< 0.01	< 0.005	1 810.	< 0.005	88.9	73.	< 0.1	0.059 8	< 0.05	279.	375.	< 0.005	0.56	13.9	123.	0.704	< 0.015	< 0.005
72-1-1	FR2	Y	2021-09-09			160.	1.53	< 0.02	0.156	12.8	< 0.01	< 0.005	1 760.	< 0.005	87.9	74.	< 0.1	0.058 1	< 0.05	277.	387.	< 0.005	0.52	13.9	124.	0.638	< 0.015	< 0.005
72-1-1	FRM	Y	2021-09-09	Mean of duplicates		160.	1.655	< 0.02	0.158 5	12.8	< 0.01	< 0.005	1 785.	< 0.005	88.4	73.5	< 0.1	0.058 95	< 0.05	278.	381.	< 0.005	0.54	13.9	123.5	0.671	< 0.015	< 0.005
72-1-1	RPD	Y	2021-09-09	RPD of duplicates		0.0%	15.1%	0.0%	3.2%	0.0%	0.0%	0.0%	2.8%	0.0%	1.1%	1.4%	0.0%	2.9%	0.0%	0.7%	3.1%	0.0%	7.4%	0.0%	0.8%	9.8%	0.0%	0.0%
72-1-1	FR1	Y	2021-11-04	Clear and colourless		160.	1.5	< 0.02	0.159	12.5	< 0.01	< 0.005	1 750.	< 0.005	86.	75.	< 0.1	0.075 8	< 0.05	268.	353.	< 0.005	< 0.5	13.	114.	0.696	< 0.015	< 0.005
72-1-1	FR2	Y	2021-11-04			160.	1.26	< 0.02	0.137	12.3	< 0.01	< 0.005	1 700.	< 0.005	83.5	75.	0.11	0.168	< 0.05	261.	359.	< 0.005	0.5	12.7	113.	0.673	< 0.015	< 0.005
72-1-1	FRM	Y	2021-11-04	Mean of duplicates		160.	1.38	< 0.02	0.148	12.4	< 0.01	< 0.005	1 725.	< 0.005	84.75	75.	0.105	0.121 9	< 0.05	264.5	356.	< 0.005	0.5	12.85	113.5	0.684 5	< 0.015	< 0.005
72-1-1	RPD	Y	2021-11-04	RPD of duplicates		0.0%	17.4%	0.0%	14.9%	1.6%	0.0%	0.0%	2.9%	0.0%	2.9%	0.0%	9.5%	**75.6%** a	0.0%	2.6%	1.7%	0.0%	0.0%	2.3%	0.9%	3.4%	0.0%	0.0%
72-1-1	FR1	Y	2022-03-02	Clear and colourless		150.	1.8	< 0.04	0.132	11.9	< 0.02	< 0.01	1 690.	< 0.01	84.7	74.	< 0.2	0.043	< 0.1	268.	375.	0.021	< 1.	13.7	113.	0.69	0.019	< 0.005
72-1-1	FR2	Y	2022-03-02			150.	1.52	< 0.02	0.139	12.2	< 0.01	< 0.005	1 560.	0.028 2	85.	74.	< 0.1	0.042 7	0.08	268.	371.	< 0.005	0.51	13.6	114.	0.669	0.022	< 0.005
72-1-1	FRM	Y	2022-03-02	Mean of duplicates		150.	1.66	< 0.03	0.135 5	12.05	< 0.015	< 0.007 5	1 625.	0.019 1	84.85	74.	< 0.15	0.042 85	0.09	268.	373.	0.013	0.755	13.65	113.5	0.679 5	0.020 5	< 0.005
72-1-1	RPD	Y	2022-03-02	RPD of duplicates		0.0%	16.9%	**66.7%** b	5.2%	2.5%	**66.7%** b	**66.7%** b	8.0%	**95.3%** b	0.4%	0.0%	**66.7%** b	0.7%	22.2%	0.0%	1.1%	**123.1%** b	**64.9%** b	0.7%	0.9%	3.1%	14.6%	0.0%
73-1-1	FR1	Y	2021-09-09	Clear and colourless		170.	2.2	0.02	0.179	13.	< 0.01	< 0.005	116.	0.023 5	68.8	21.	< 0.1	0.195	0.144	222.	< 1.	0.010 8	< 0.5	12.2	82.2	0.9	< 0.015	< 0.005
73-1-1	FR2	Y	2021-09-09			170.	1.59	0.023	0.197	12.7	< 0.01	< 0.005	117.	0.020 7	69.6	21.	< 0.1	0.204	0.154	223.	< 1.	0.012	< 0.5	12.	82.7	0.86	< 0.015	< 0.005
73-1-1	FRM	Y	2021-09-09	Mean of duplicates		170.	1.895	0.021 5	0.188	12.85	< 0.01	< 0.005	116.5	0.022 1	69.2	21.	< 0.1	0.199 5	0.149	222.5	< 1.	0.011 4	< 0.5	12.1	82.45	0.88	< 0.015	< 0.005
73-1-1	RPD	Y	2021-09-09	RPD of duplicates		0.0%	**32.2%** b	14.0%	9.6%	2.3%	0.0%	0.0%	0.9%	12.7%	1.2%	0.0%	0.0%	4.5%	6.7%	0.4%	0.0%	10.5%	0.0%	1.7%	0.6%	4.5%	0.0%	0.0%
73-1-1	FR1	Y	2021-11-02	Clear and colourless		160.	36.3	0.024	0.227	12.9	< 0.01	< 0.005	128.	0.015 7	65.9	22.	< 0.1	0.26	1.07	213.	59.1	0.036 4	< 0.5	11.8	80.1	0.87	< 0.015	< 0.005
73-1-1	FR2	Y	2021-11-02			160.	7.65	0.027	0.206	12.8	< 0.01	< 0.005	126.	0.018 4	66.2	22.	< 0.1	0.18	0.264	213.	2.6	0.020 2	< 0.5	11.5	77.7	0.881	< 0.015	< 0.005
73-1-1	FRM	Y	2021-11-02	Mean of duplicates		160.	21.975	0.025 5	0.216 5	12.85	< 0.01	< 0.005	127.	0.017 05	66.05	22.	< 0.1	0.22	0.667	213.	30.85	0.028 3	< 0.5	11.65	78.9	0.875 5	< 0.015	< 0.005
73-1-1	RPD	Y	2021-11-02	RPD of duplicates		0.0%	**130.4%** a	11.8%	9.7%	0.8%	0.0%	0.0%	1.6%	15.8%	0.5%	0.0%	0.0%	**36.4%** b	**120.8%** a	0.0%	**183.1%** b	**57.2%** b	0.5	2.6%	3.0%	1.3%	0.0%	0.0%
73-1-1	FR1	Y	2022-03-02	Clear and colourless		160.	1.16	0.027	0.208	10.3	< 0.01	< 0.005	116.	0.010 5	67.3	22.	< 0.1	0.073 4	0.187	215.	< 1.	< 0.005	< 0.5	11.4	1.61	1.27	< 0.015	< 0.005
73-1-1	FR2	Y	2022-03-02			160.	1.32	0.03	0.208	10.3	< 0.01	< 0.005	116.	0.016	67.4	22.	< 0.1	0.084 4	0.19	215.	< 1.	< 0.005	< 0.5	11.3	1.67	1.24	< 0.015	< 0.005
73-1-1	FRM	Y	2022-03-02	Mean of duplicates		160.	1.24	0.028 5	0.208	10.3	< 0.01	< 0.005	116.	0.013 25	67.35	22.	< 0.1	0.078 9	0.188 5	215.	< 1.	< 0.005	< 0.5	11.35	1.64	1.255	< 0.015	< 0.005
73-1-1	RPD	Y	2022-03-02	RPD of duplicates		0.0%	12.9%	10.5%	0.0%	0.0%	0.0%	0.0%	0.0%	**41.5%** b	0.1%	0.0%	0.0%	13.9%	1.6%	0.0%	0.0%	0.0%	0.5	0.9%	3.7%	2.4%	0.0%	0.0%

Notes:

SS Single sample

FR1 Field replicate 1

FR2 Field replicate 2

FRM Average of field replicates

RPD Relative percent difference of field replicates

na - Not applicable, some replicates less than the detection limit.

a - Coefficient of variation greater than 30% and all replicates greater than the limit of quantitation.

b *- Coefficient of variation greater than 30% with some replicates less than the limit of quantitation.*

Table 3-1. Groundwater Quality QA/QC - Relative Percent Difference 2021-2022

AECOM

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Table 3-1. Groundwater Quality QA/QC - Relative Percent Difference 2021-2022

AECOM

					Fraction	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	TOT	TOT	TOT
					Unit	mg/L	mg/L	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pH	µS/cm	°C
Station	Sample Type	Compliance Well (Y/N)?	Date Sampled	Comments																					
31-1-1	FR1	Y	2021-09-15	Clear and colourless		0.092	0.095	0.31	6.7	0.688	< 0.04	5 770.	< 0.005	7.31	395.	180.	72.6	< 0.002	< 0.2	< 0.5	0.389	< 0.2	0.29	< 0.1	7.71	530.	10.9
31-1-1	FR2	Y	2021-09-15			0.059	0.059	0.348	6.4	0.683	< 0.04	5 840.	< 0.005	7.48	403.	200.	73.6	< 0.002	< 0.2	< 0.5	0.394	< 0.2	0.83	< 0.1	7.72	530.	10.9
31-1-1	FRM	Y	2021-09-15	Mean of duplicates		0.075 5	0.077	0.329	6.55	0.685 5	< 0.04	5 805.	< 0.005	7.395	399.	190.	73.1	< 0.002	< 0.2	< 0.5	0.391 5	< 0.2	0.56	< 0.1	7.715	530.	10.9
31-1-1	RPD	Y	2021-09-15	RPD of duplicates		**43.7%**	**b** **46.8%**	**b** 11.6%	4.6%	0.7%	0.0%	1.2%	0.0%	2.3%	2.0%	10.5%	1.4%	0.0%	0.0%	0.0%	1.3%	0.0%	**96.4%**	**b** 0.0%	0.1%	0.0%	0.0%
31-1-1	FR1	Y	2021-11-26	Clear and colourless		0.688	0.688	0.372	5.7	0.728	0.087	4 920.	< 0.005	7.78	537.	350.	105.	0.003 1	< 0.2	< 0.5	0.472	0.23	1.22	< 0.1	7.64	940.	10.2
31-1-1	FR2	Y	2021-11-26			0.701	0.701	0.353	5.6	0.715	0.082	4 700.	< 0.005	7.59	533.	390.	99.	< 0.002	< 0.2	< 0.5	0.456	0.25	0.91	< 0.1	7.7	940.	10.2
31-1-1	FRM	Y	2021-11-26	Mean of duplicates		0.694 5	0.694 5	0.362 5	5.65	0.721 5	0.084 5	4 810.	< 0.005	7.685	535.	370.	102.	0.002 55	< 0.2	< 0.5	0.464	0.24	1.065	< 0.1	7.67	940.	10.2
31-1-1	RPD	Y	2021-11-26	RPD of duplicates		1.9%	1.9%	5.2%	1.8%	1.8%	5.9%	4.6%	0.0%	2.5%	0.7%	10.8%	5.9%	**43.1%**	**b** 0.0%	0.0%	3.4%	8.3%	29.1%	0.0%	0.8%	0.0%	0.0%
31-1-1	FR1	Y	2022-03-07	Clear and colourless		0.261	0.261	0.232	4.4	0.673	0.044	5 470.	< 0.005	7.07	414.	300.	76.5	< 0.002	< 0.2	< 0.5	0.307	0.25	0.37	< 0.1	6.78	720.	10.3
31-1-1	FR2	Y	2022-03-07			0.254	0.254	0.41	4.1	0.665	0.048	5 450.	< 0.005	6.9	412.	290.	77.5	< 0.002	< 0.2	< 0.5	0.306	0.26	0.38	< 0.1	6.78	522.	10.3
31-1-1	FRM	Y	2022-03-07	Mean of duplicates		0.257 5	0.257 5	0.321	4.25	0.669	0.046	5 460.	< 0.005	6.985	413.	295.	77.	< 0.002	< 0.2	< 0.5	0.306 5	0.255	0.375	< 0.1	6.78	621.	10.3
31-1-1	RPD	Y	2022-03-07	RPD of duplicates		2.7%	2.7%	**55.5%**	**a** 7.1%	1.2%	8.7%	0.4%	0.0%	2.4%	0.5%	3.4%	1.3%	0.0%	0.0%	0.0%	0.3%	3.9%	2.7%	0.0%	0.0%	**31.9%**	**b** 0.0%
39-1-1	FR1	Y	2021-05-21	Clear and colourless		0.066	0.066	0.276	3.	0.312	0.089	6 150.	< 0.005	4.57	249.	21.	6.8	< 0.002	< 0.2	< 0.5	0.129	1.99	4.1	< 0.1	7.98	190.	12.2
39-1-1	FR2	Y	2021-05-21			0.069	0.069	0.263	3.4	0.307	0.091	6 160.	< 0.005	4.54	255.	21.	7.1	< 0.002	< 0.2	< 0.5	0.124	2.03	4.08	< 0.1	7.95	190.	12.2
39-1-1	FRM	Y	2020-05-15	Mean of duplicates		0.067 5	0.067 5	0.269 5	3.2	0.309 5	0.09	6 155.	< 0.005	4.555	252.	21.	6.95	< 0.002	< 0.2	< 0.5	0.126 5	2.01	4.09	< 0.1	7.965	190.	12.2
39-1-1	RPD	Y	2020-05-15	RPD of duplicates		4.4%	4.4%	4.8%	12.5%	1.6%	2.2%	0.2%	0.0%	0.7%	2.4%	0.0%	4.3%	0.0%	0.0%	0.0%	4.0%	2.0%	0.5%	0.0%	0.4%	0.0%	0.0%
39-1-1	FR1	Y	2021-09-22	Clear and colourless		0.056	0.056	0.108	3.2	0.262	0.088	5 960.	< 0.005	4.41	268.	23.	7.6	< 0.002	< 0.2	< 0.5	0.136	1.88	0.68	< 0.1	8.05	192.	11.5
39-1-1	FR2	Y	2021-09-22			0.053	0.053	0.144	3.4	0.253	0.083	5 810.	< 0.005	4.37	265.	24.	7.4	< 0.002	< 0.2	< 0.5	0.14	1.94	0.61	< 0.1	8.08	192.	11.5
39-1-1	FRM	Y	2021-09-22	Mean of duplicates		0.054 5	0.054 5	0.126	3.3	0.257 5	0.085 5	5 885.	< 0.005	4.39	266.5	23.5	7.5	< 0.002	< 0.2	< 0.5	0.138	1.91	0.645	< 0.1	8.065	192.	11.5
39-1-1	RPD	Y	2021-09-22	RPD of duplicates		5.5%	5.5%	28.6%	6.1%	3.5%	5.8%	2.5%	0.0%	0.9%	1.1%	4.3%	2.7%	0.0%	0.0%	0.0%	2.9%	3.1%	10.9%	0.0%	0.4%	0.0%	0.0%
39-1-1	FR1	Y	2021-11-24	Clear and colourless		0.357	0.357	0.122	2.	0.234	0.15	5 650.	< 0.005	3.84	240.	21.	6.9	< 0.002	< 0.2	< 0.5	0.104	1.83	0.59	0.14	7.47	179.	11.
39-1-1	FR2	Y	2021-11-24			0.353	0.353	0.105	5.1	0.246	0.139	5 680.	< 0.005	3.98	256.	21.	6.6	< 0.002	< 0.2	< 0.5	0.11	1.91	0.57	< 0.1	7.47	179.	11.
39-1-1	FRM	Y	2021-11-24	Mean of duplicates		0.355	0.355	0.113 5	3.55	0.24	0.144 5	5 665.	< 0.005	3.91	248.	21.	6.75	< 0.002	< 0.2	< 0.5	0.107	1.87	0.58	0.12	7.47	179.	11.
39-1-1	RPD	Y	2021-11-24	RPD of duplicates		1.1%	1.1%	15.0%	**87.3%**	**b** 5.0%	7.6%	0.5%	0.0%	3.6%	6.5%	0.0%	4.4%	0.0%	0.0%	0.0%	5.6%	4.3%	3.4%	**33.3%**	**b** 0.0%	0.0%	0.0%
39-1-1	FR1	Y	2022-02-24	Clear and colourless		0.275	0.275	0.15	< 2.	0.244	0.144	5 550.	< 0.005	4.17	242.	23.	7.3	< 0.002	< 0.2	< 0.5	0.132	1.95	0.8	< 0.1	7.5	186.	10.6
39-1-1	FR2	Y	2022-02-24			0.274	0.274	0.141	< 2.	0.248	0.15	5 670.	< 0.005	4.15	240.	23.	7.4	< 0.002	< 0.2	< 0.5	0.133	1.92	1.23	< 0.1	7.5	186.	10.6
39-1-1	FRM	Y	2022-02-24	Mean of duplicates		0.274 5	0.274 5	0.145 5	< 2.	0.246	0.147	5 610.	< 0.005	4.16	241.	23.	7.35	< 0.002	< 0.2	< 0.5	0.132 5	1.935	1.015	< 0.1	7.5	186.	10.6
39-1-1	RPD	Y	2022-02-24	RPD of duplicates		0.4%	0.4%	6.2%	0.0%	1.6%	4.1%	2.1%	0.0%	0.5%	0.8%	0.0%	1.4%	0.0%	0.0%	0.0%	0.8%	1.6%	**42.4%**	**a** 0.0%	0.0%	0.0%	0.0%
41-1-1	FR1	Y	2021-05-27	Clear and colourless		0.022	0.022	0.129	< 2.	1.43	0.058	6 910.	< 0.005	6.61	204.	58.	20.8	0.002 4	< 0.2	< 0.5	0.239	< 0.2	0.59	< 0.1	7.8	318.	9.9
41-1-1	FR2	Y	2021-05-27			0.035	0.035	0.136	< 2.	1.46	0.062	6 870.	< 0.005	6.82	210.	58.	20.5	0.002 1	< 0.2	< 0.5	0.249	< 0.2	0.49	< 0.1	7.7	318.	9.9
41-1-1	FRM	Y	2020-05-15	Mean of duplicates		0.028 5	0.028 5	0.132 5	< 2.	1.445	0.06	6 890.	< 0.005	6.715	207.	58.	20.65	0.002 25	< 0.2	< 0.5	0.244	< 0.2	0.54	< 0.1	7.75	318.	9.9
41-1-1	RPD	Y	2020-05-15	RPD of duplicates		**45.6%**	**b** **45.6%**	**b** 5.3%	0.0%	2.1%	6.7%	0.6%	0.0%	3.1%	2.9%	0.0%	1.5%	13.3%	0.0%	0.0%	4.1%	0.0%	18.5%	0.0%	1.3%	0.0%	0.0%
41-1-1	FR1	Y	2021-09-16	Clear and colourless	< 0.02	< 0.02	0.184	2.7	0.925	< 0.04	7 740.	< 0.005	4.73	213.	65.	17.7	0.002 4	< 0.2	< 0.5	0.295	< 0.2	0.31	0.71	8.24	343.	11.6
41-1-1	FR2	Y	2021-09-16		< 0.02	< 0.02	0.145	2.5	0.883	< 0.04	7 520.	< 0.005	4.79	212.	63.	17.9	0.002 6	< 0.2	< 0.5	0.291	< 0.2	0.11	< 0.1	8.12	343.	11.6
41-1-1	FRM	Y	2021-09-16	Mean of duplicates	< 0.02	< 0.02	0.164 5	2.6	0.904	< 0.04	7 630.	< 0.005	4.76	212.5	64.	17.8	0.002 5	< 0.2	< 0.5	0.293	< 0.2	0.21	0.405	8.18	343.	11.6
41-1-1	RPD	Y	2021-09-16	RPD of duplicates	0.0%	0.0%	23.7%	7.7%	4.6%	0.0%	2.9%	0.0%	1.3%	0.5%	3.1%	1.1%	8.0%	0.0%	0.0%	1.4%	0.0%	**95.2%**	**b** **150.6%**	1.5%	0.0%	0.0%
41-1-1	FR1	Y	2021-11-26	Clear and colourless		0.176	0.183	0.222	3.3	1.16	0.056	6 370.	< 0.005	6.03	218.	68.	19.9	0.003 8	< 0.2	< 0.5	0.286	< 0.2	1.25	< 0.1	7.76	306.	10.9
41-1-1	FR2	Y	2021-11-26			0.19	0.197	0.245	3.9	1.11	0.056	6 240.	< 0.005	5.7	210.	67.	19.	0.003 1	< 0.2	< 0.5	0.277	< 0.2	0.69	< 0.1	7.94	306.	10.9
41-1-1	FRM	Y	2021-11-26	Mean of duplicates		0.183	0.19	0.233 5	3.6	1.135	0.056	6 305.	< 0.005	5.865	214.	67.5	19.45	0.003 45	< 0.2	< 0.5	0.281 5	< 0.2	0.97	< 0.1	7.85	306.	10.9
41-1-1	RPD	Y	2021-11-26	RPD of duplicates		7.7%	7.4%	9.9%	16.7%	4.4%	0.0%	2.1%	0.0%	5.6%	3.7%	1.5%	4.6%	20.3%	0.0%	0.0%	3.2%	0.0%	**57.7%**	**a** 0.0%	2.3%	0.0%	0.0%
41-1-1	FR1	Y	2022-02-25	Clear and slightly oran		0.056	0.056	0.07	< 2.	1.06	0.073	7 100.	< 0.005	5.6	190.	57.	17.3	< 0.002	< 0.2	< 0.5	0.196	< 0.2	0.11	< 0.1	6.8	400.	9.4
41-1-1	FR2	Y	2022-02-25			0.055	0.055	0.055	< 2.	1.05	0.072	6 950.	< 0.005	5.52	186.	54.	16.1	< 0.002	< 0.2	< 0.5	0.192	< 0.2	< 0.1	< 0.1	6.8	400.	9.4
41-1-1	FRM	Y	2022-02-25	Mean of duplicates		0.055 5	0.055 5	0.062 5	< 2.	1.055	0.072 5	7 025.	< 0.005	5.56	188.	55.5	16.7	< 0.002	< 0.2	< 0.5	0.194	< 0.2	0.105	< 0.1	6.8	400.	9.4
41-1-1	RPD	Y	2022-02-25	RPD of duplicates		1.8%	1.8%	24.0%	0.0%	0.9%	1.4%	2.1%	0.0%	1.4%	2.1%	5.4%	7.2%	0.0%	0.0%	0.0%	2.1%	0.0%	9.5%	0.0%	0.0%	0.0%	0.0%
42-1-1	FR1	Y	2021-05-27	Clear and colourless	< 0.02	< 0.02	0.151	5.4	1.1	< 0.04	5 980.	< 0.005	9.28	364.	70.	21.4	< 0.002	< 0.2	< 0.5	0.046 3	0.79	0.88	< 0.1	7.57	363.	9.
42-1-1	FR2	Y	2021-05-27		< 0.02	< 0.02	0.151	4.6	1.09	< 0.04	5 920.	< 0.005	9.26	367.	70.	21.4	< 0.002	< 0.2	< 0.5	0.046 6	0.74	0.26	< 0.1	7.58	363.	9.
42-1-1	FRM	Y	2020-05-15	Mean of duplicates	< 0.02	< 0.02	0.151	5.	1.095	< 0.04	5 950.	< 0.005	9.27	365.5	70.	21.4	< 0.002	< 0.2	< 0.5	0.046 45	0.765	0.57	< 0.1	7.575	363.	9.
42-1-1	RPD	Y	2020-05-15	RPD of duplicates	0.0%	0.0%	0.0%	16.0%	0.9%	0.0%	1.0%	0.0%	0.2%	0.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.6%	6.5%	**108.8%**	**b** 0.0%	0.1%	0.0%	0.0%
42-1-1	FR1	Y	2021-09-16	Clear and colourless	< 0.02	< 0.02	0.117	5.7	0.892	< 0.04	6 660.	< 0.005	10.	405.	110.	31.8	< 0.002	< 0.2	< 0.5	0.107	0.57	0.13	< 0.1	8.08	450.	10.7
42-1-1	FR2	Y	2021-09-16		< 0.02	< 0.02	0.108	5.6	0.877	< 0.04	6 700.	< 0.005	10.3	401.	110.	31.2	< 0.002	< 0.2	< 0.5	0.109	0.54	0.22	< 0.1	8.06	450.	10.7
42-1-1	FRM	Y	2021-09-16	Mean of duplicates	< 0.02	< 0.02	0.112 5	5.65	0.884 5	< 0.04	6 680.	< 0.005	10.15	403.	110.	31.5	< 0.002	< 0.2	< 0.5	0.108	0.555	0.175	< 0.1	8.07	450.	10.7
42-1-1	RPD	Y	2021-09-16	RPD of duplicates	0.0%	0.0%	8.0%	1.8%	1.7%	0.0%	0.6%	0.0%	3.0%	1.0%	0.0%	1.9%	0.0%	0.0%	0.0%	1.9%	5.4%	**51.4%**	**b** 0.0%	0.2%	0.0%	0.0%
42-1-1	FR1	Y	2021-11-26	Clear and colourless	< 0.02	< 0.02	0.154	6.4	0.958	< 0.04	6 180.	< 0.005	9.58	422.	120.	31.3	< 0.002	< 0.2	< 0.5	0.061 2	1.04	1.03	< 0.1	7.87	630.	10.2
42-1-1	FR2	Y	2021-11-26		< 0.02	< 0.02	0.175	5.8	0.931	< 0.04	6 120.	< 0.005	9.65	425.	120.	30.9	< 0.002	< 0.2	< 0.5	0.059 2	0.96	0.7	< 0.1	7.74	630.	10.2
42-1-1	FRM	Y	2021-11-26	Mean of duplicates	< 0.02	< 0.02	0.164 5	6.1	0.944 5	< 0.04	6 150.	< 0.005	9.615	423.5	120.	31.1	< 0.002	< 0.2	< 0.5	0.060 2	1.	0.865	< 0.1	7.805	630.	10.2
42-1-1	RPD	Y	2021-11-26	RPD of duplicates	0.0%	0.0%	12.8%	9.8%	2.9%	0.0%	1.0%	0.0%	0.7%	0.7%	0.0%	1.3%	0.0%	0.0%	0.0%	3.3%	8.0%	**38.2%**	**a** 0.0%	1.7%	0.0%	0.0%
42-1-1	FR1	Y	2022-02-25	Clear and colourless	< 0.02	< 0.02	0.147	4.7	0.856	< 0.04	6 330.	< 0.005	8.86	358.	78.	24.	< 0.002	< 0.2	< 0.5	0.050 6	0.74	0.13	< 0.1	6.82	372.	8.8
42-1-1	FR2	Y	2022-02-25		< 0.02	< 0.02	0.125	5.8	0.862	< 0.04	6 580.	< 0.005	8.98	363.	77.	24.9	< 0.002	< 0.2	< 0.5	0.050 7	0.78	< 0.1	< 0.1	6.82	550.	8.8
42-1-1	FRM	Y	2022-02-25	Mean of duplicates	< 0.02	< 0.02	0.136	5.25	0.859	< 0.04	6 455.	< 0.005	8.92	360.5	77.5	24.45	< 0.002	< 0.2	< 0.5	0.050 65	0.76	0.115	< 0.1	6.82	461.	8.8
42-1-1	RPD	Y	2022-02-25	RPD of duplicates	0.0%	0.0%	16.2%	21.0%	0.7%	0.0%	3.9%	0.0%	1.3%	1.4%	1.3%	3.7%	0.0%	0.0%	0.0%	0.2%	5.3%	26.1%	0.0%	0.0%	**38.6%**	**b** 0.0%

Table 3-1. Groundwater Quality QA/QC - Relative Percent Difference 2021-2022

AECOM

					Fraction	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	TOT	TOT	TOT
					Unit	mg/L	mg/L	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pH	µS/cm	°C
Station	Sample Type	Compliance Well (Y/N)?	Date Sampled	Comments																					
71-1-1	FR1	Y	2021-05-06	Clear and colourless		< 0.02	< 0.02	4.82	11.4	0.245	< 0.04	13 400.	< 0.005	6.61	147.	20.	6.1	0.004 9	< 0.2	< 0.5	0.217	0.25	0.39	< 0.1	8.19	248.	10.7
71-1-1	FR2	Y	2021-05-06			< 0.02	< 0.02	3.46	12.2	0.247	< 0.04	13 000.	< 0.005	6.47	146.	20.	5.7	0.005 8	< 0.2	< 0.5	0.214	0.25	2.26	< 0.1	8.19	248.	10.7
71-1-1	FRM	Y	2020-05-15	Mean of duplicates		< 0.02	< 0.02	4.14	11.8	0.246	< 0.04	13 200.	< 0.005	6.54	146.5	20.	5.9	0.005 35	< 0.2	< 0.5	0.215 5	0.25	1.325	< 0.1	8.19	248.	10.7
71-1-1	RPD	Y	2020-05-15	RPD of duplicates		0.0%	0.0%	**32.9%** a	6.8%	0.8%	0.0%	3.0%	0.0%	2.1%	0.7%	0.0%	6.8%	16.8%	0.0%	0.0%	1.4%	0.0%	**141.1%** b	0.0%	0.0%	0.0%	0.0%
71-1-1	FR1	Y	2021-09-10	Clear and colourless		0.044	0.044	0.289	13.1	0.256	< 0.04	12 800.	< 0.005	7.12	169.	20.	6.9	0.003 2	< 0.2	< 0.5	0.243	< 0.2	0.14	< 0.1	7.98	287.	10.6
71-1-1	FR2	Y	2021-09-10			0.037	0.042	0.31	11.2	0.255	0.04	12 900.	< 0.005	7.12	171.	22.	6.6	0.002 8	< 0.2	< 0.5	0.244	< 0.2	0.18	< 0.1	7.97	287.	10.6
71-1-1	FRM	Y	2021-09-10	Mean of duplicates		0.040 5	0.043	0.299 5	12.15	0.255 5	0.04	12 850.	< 0.005	7.12	170.	21.	6.75	0.003	< 0.2	< 0.5	0.243 5	< 0.2	0.16	< 0.1	7.975	287.	10.6
71-1-1	RPD	Y	2021-09-10	RPD of duplicates		17.3%	4.7%	7.0%	15.6%	0.4%	0.0%	0.8%	0.0%	0.0%	1.2%	9.5%	4.4%	13.3%	0.0%	0.0%	0.4%	0.0%	25.0%	0.0%	0.1%	0.0%	0.0%
71-1-1	FR1	Y	2021-11-04	Clear and colourless		< 0.02	< 0.02	0.378	11.7	0.287	< 0.04	11 600.	< 0.005	8.2	159.	26.	7.2	0.006 9	< 0.2	< 0.5	0.317	0.4	0.87	< 0.1	8.08	390.	10.3
71-1-1	FR2	Y	2021-11-04			< 0.02	< 0.02	0.377	11.3	0.293	< 0.04	11 300.	< 0.005	8.13	159.	26.	6.5	0.007 2	< 0.2	< 0.5	0.325	0.41	0.14	< 0.1	8.09	277.	10.3
71-1-1	FRM	Y	2021-11-04	Mean of duplicates		< 0.02	< 0.02	0.377 5	11.5	0.29	< 0.04	11 450.	< 0.005	8.165	159.	26.	6.85	0.007 05	< 0.2	< 0.5	0.321	0.405	0.505	< 0.1	8.085	333.5	10.3
71-1-1	RPD	Y	2021-11-04	RPD of duplicates		0.0%	0.0%	0.3%	3.5%	2.1%	0.0%	2.6%	0.0%	0.9%	0.0%	0.0%	10.2%	4.3%	0.0%	0.0%	2.5%	2.5%	**144.6%** b	0.0%	0.1%	**33.9%** b	0.0%
71-1-1	FR1	Y	2022-03-02	Clear and colourless		< 0.02	< 0.02	0.448	12.4	0.283	< 0.04	12 600.	< 0.005	8.39	141.	24.	7.1	0.006 1	< 0.2	< 0.5	0.289	0.43	0.29	< 0.1	7.25	340.	9.8
71-1-1	FR2	Y	2022-03-02			< 0.02	< 0.02	0.464	12.6	0.284	< 0.04	12 500.	< 0.005	8.36	137.	23.	7.7	0.007 4	< 0.2	< 0.5	0.297	0.42	0.22	< 0.1	7.25	340.	9.8
71-1-1	FRM	Y	2022-03-02	Mean of duplicates		< 0.02	< 0.02	0.456	12.5	0.283 5	< 0.04	12 550.	< 0.005	8.375	139.	23.5	7.4	0.006 75	< 0.2	< 0.5	0.293	0.425	0.255	< 0.1	7.25	340.	9.8
71-1-1	RPD	Y	2022-03-02	RPD of duplicates		0.0%	0.0%	3.5%	1.6%	0.4%	0.0%	0.8%	0.0%	0.4%	2.9%	4.3%	8.1%	19.3%	0.0%	0.0%	2.7%	2.4%	27.5%	0.0%	0.0%	0.0%	0.0%
72-1-1	FR1	Y	2021-05-06	Clear and colourless		< 0.02	< 0.02	3.39	9.	0.26	< 0.08	21 100.	< 0.01	8.73	308.	48.	16.5	< 0.004	< 0.4	< 1.	0.019 9	< 0.4	0.52	< 0.2	8.11	442.	10.9
72-1-1	FR2	Y	2021-05-06			< 0.02	< 0.02	7.62	9.9	0.245	< 0.04	20 800.	< 0.005	8.57	300.	45.	15.1	< 0.002	< 0.2	< 0.5	0.018 8	< 0.2	0.22	< 0.1	8.15	442.	10.9
72-1-1	FRM	Y	2020-05-15	Mean of duplicates		< 0.02	< 0.02	5.505	9.45	0.252 5	< 0.06	20 950.	< 0.007 5	8.65	304.	46.5	15.8	< 0.003	< 0.3	< 0.75	0.019 35	< 0.3	0.37	< 0.15	8.13	442.	10.9
72-1-1	RPD	Y	2020-05-15	RPD of duplicates		0.0%	0.0%	**76.8%** a	9.5%	5.9%	**66.7%** b	1.4%	**66.7%** b	1.8%	2.6%	6.5%	8.9%	**66.7%** b	**66.7%** b	**66.7%** b	5.7%	**66.7%** b	**81.1%** b	**66.7%** b	0.5%	0.0%	0.0%
72-1-1	FR1	Y	2021-09-09	Clear and colourless		< 0.02	< 0.02	1.67	10.5	0.238	< 0.04	21 100.	< 0.005	8.85	290.	52.	15.4	< 0.002	< 0.2	< 0.5	0.019 7	< 0.2	0.19	< 0.1	7.92	439.	10.7
72-1-1	FR2	Y	2021-09-09			< 0.02	< 0.02	1.65	10.6	0.24	< 0.04	21 000.	< 0.005	9.04	281.	51.	14.8	< 0.002	< 0.2	< 0.5	0.020 7	< 0.2	< 0.1	< 0.1	7.9	439.	10.7
72-1-1	FRM	Y	2021-09-09	Mean of duplicates		< 0.02	< 0.02	1.66	10.55	0.239	< 0.04	21 050.	< 0.005	8.945	285.5	51.5	15.1	< 0.002	< 0.2	< 0.5	0.020 2	< 0.2	0.145	< 0.1	7.91	439.	10.7
72-1-1	RPD	Y	2021-09-09	RPD of duplicates		0.0%	0.0%	1.2%	0.9%	0.8%	0.0%	0.5%	0.0%	2.1%	3.2%	1.9%	4.0%	0.0%	0.0%	0.0%	5.0%	0.0%	**62.1%** b	0.0%	0.3%	0.0%	0.0%
72-1-1	FR1	Y	2021-11-04	Clear and colourless		< 0.02	< 0.02	1.62	7.9	0.245	< 0.04	19 600.	< 0.005	8.58	298.	44.	14.2	< 0.002	< 0.2	< 0.5	0.017 9	< 0.2	< 0.1	< 0.1	7.94	427.	10.6
72-1-1	FR2	Y	2021-11-04			< 0.02	< 0.02	1.73	7.2	0.238	< 0.04	18 800.	< 0.005	8.21	288.	53.	13.5	< 0.002	< 0.2	< 0.5	0.017 4	< 0.2	< 0.1	< 0.1	8.04	590.	10.6
72-1-1	FRM	Y	2021-11-04	Mean of duplicates		< 0.02	< 0.02	1.675	7.55	0.241 5	< 0.04	19 200.	< 0.005	8.395	293.	48.5	13.85	< 0.002	< 0.2	< 0.5	0.017 65	< 0.2	< 0.1	0.105	7.99	508.5	10.6
72-1-1	RPD	Y	2021-11-04	RPD of duplicates		0.0%	0.0%	6.6%	9.3%	2.9%	0.0%	4.2%	0.0%	4.4%	3.4%	18.6%	5.1%	0.0%	0.0%	0.0%	2.8%	0.0%	0.0%	9.5%	1.3%	**32.1%** b	0.0%
72-1-1	FR1	Y	2022-03-02	Clear and colourless		< 0.02	< 0.02	1.7	9.1	0.24	< 0.08	19 700.	< 0.01	8.57	281.	49.	15.3	< 0.004	< 0.4	< 1.	0.017 5	< 0.4	< 0.2	< 0.2	7.29	433.	10.6
72-1-1	FR2	Y	2022-03-02			< 0.02	< 0.02	1.63	7.4	0.243	< 0.04	19 700.	< 0.005	8.58	284.	48.	15.2	< 0.002	< 0.2	< 0.5	0.016 3	< 0.2	0.24	< 0.1	7.29	433.	10.6
72-1-1	FRM	Y	2022-03-02	Mean of duplicates		< 0.02	< 0.02	1.665	8.25	0.241 5	< 0.06	19 700.	< 0.007 5	8.575	282.5	48.5	15.25	< 0.003	< 0.3	< 0.75	0.016 9	< 0.3	0.22	< 0.15	7.29	433.	10.6
72-1-1	RPD	Y	2022-03-02	RPD of duplicates		0.0%	0.0%	4.2%	20.6%	1.2%	**66.7%** b	0.0%	**66.7%** b	0.1%	1.1%	2.1%	0.7%	**66.7%** b	**66.7%** b	**66.7%** b	7.1%	**66.7%** b	**18.2%** b	**66.7%** b	0.0%	0.0%	0.0%
73-1-1	FR1	Y	2021-09-09	Clear and colourless		0.096	0.096	0.808	12.1	0.408	< 0.04	10 100.	< 0.005	6.85	205.	46.	12.8	0.006 8	< 0.2	< 0.5	0.251	0.41	0.58	< 0.1	7.77	333.	11.
73-1-1	FR2	Y	2021-09-09			0.095	0.095	0.768	12.2	0.403	< 0.04	10 200.	< 0.005	6.82	201.	42.	13.7	0.006 5	< 0.2	< 0.5	0.249	0.46	0.49	< 0.1	7.75	333.	11.
73-1-1	FRM	Y	2021-09-09	Mean of duplicates		0.095 5	0.095 5	0.788	12.15	0.405 5	< 0.04	10 150.	< 0.005	6.835	203.	44.	13.25	0.006 65	< 0.2	< 0.5	0.25	0.435	0.535	< 0.1	7.76	333.	11.
73-1-1	RPD	Y	2021-09-09	RPD of duplicates		1.0%	1.0%	5.1%	0.8%	1.2%	0.0%	1.0%	0.0%	0.4%	2.0%	9.1%	6.8%	4.5%	0.0%	0.0%	0.8%	11.5%	16.8%	0.0%	0.3%	0.0%	0.0%
73-1-1	FR1	Y	2021-11-02	Clear and colourless		0.054	0.054	0.845	14.7	0.43	< 0.04	9 590.	< 0.005	6.6	199.	46.	13.7	0.005 9	< 0.2	0.54	0.264	0.82	0.63	< 0.1	8.01	460.	10.1
73-1-1	FR2	Y	2021-11-02			0.053	0.053	0.711	10.1	0.416	< 0.04	9 310.	< 0.005	6.44	202.	47.	13.1	0.006 5	< 0.2	< 0.5	0.25	0.56	0.43	< 0.1	8.01	460.	10.1
73-1-1	FRM	Y	2021-11-02	Mean of duplicates		0.053 5	0.053 5	0.778	12.4	0.423	< 0.04	9 450.	< 0.005	6.52	200.5	46.5	13.4	0.006 2	< 0.2	0.52	0.257	0.69	0.53	< 0.1	8.01	460.	10.1
73-1-1	RPD	Y	2021-11-02	RPD of duplicates		1.9%	1.9%	17.2%	**37.1%** b	3.3%	0.0%	3.0%	0.0%	2.5%	1.5%	2.2%	4.5%	9.7%	0.0%	7.7%	5.4%	**37.7%** b	**37.7%** b	0.0%	0.0%	0.0%	0.0%
73-1-1	FR1	Y	2022-03-02	Clear and colourless		0.047	0.047	0.367	10.4	0.435	< 0.04	9 850.	< 0.005	6.36	200.	44.	13.9	0.003 9	< 0.2	< 0.5	0.253	0.43	0.28	< 0.1	6.89	323.	9.8
73-1-1	FR2	Y	2022-03-02			0.048	0.048	0.372	9.3	0.433	< 0.04	9 730.	< 0.005	6.44	198.	46.	13.9	0.003 6	< 0.2	< 0.5	0.257	0.42	0.45	< 0.1	6.89	323.	9.8
73-1-1	FRM	Y	2022-03-02	Mean of duplicates		0.047 5	0.047 5	0.369 5	9.85	0.434	< 0.04	9 790.	< 0.005	6.4	199.	45.	13.9	0.003 75	< 0.2	< 0.5	0.255	0.425	0.365	< 0.1	6.89	323.	9.8
73-1-1	RPD	Y	2022-03-02	RPD of duplicates		2.1%	2.1%	1.4%	11.2%	0.5%	0.0%	1.2%	0.0%	1.3%	1.0%	4.4%	0.0%	8.0%	0.0%	0.0%	1.6%	2.4%	**46.6%** b	0.0%	0.0%	0.0%	0.0%

Notes:

SS Single sample

FR1 Field replicate 1

FR2 Field replicate 2

FRM Average of field replicates

RPD Relative percent difference of field replicates

na - Not applicable, some replicates less than the detection limit.

a - Coefficient of variation greater than 30% and all replicates greater than the limit of quantitatior

b - Coefficient of variation greater than 30% with some replicates less than the limit of quantitatio

Table 3-2 Surface Water Quality QA/QC - Relative Percent Difference 2021-2022

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Table 3-2 Surface Water Quality QA/QC - Relative Percent Difference 2021-2022

				Parameter	Aluminum		Arsenic	Boron	Cadmium	Chloride	Cobalt	Copper	Hardness (As Caco3)	Iron	Lead	
				Fraction	TOT		TOT	TOT	TOT	DIS	TOT	TOT	TOT	TOT	TOT	
SW-N-41S1	FR1	Y	2021-11-30		27.9		0.187	19.	< 0.005	5.1	0.082 7	0.41	154.	74.5	0.019 3	
SW-N-41S1	FR2	Y	2021-11-30		30.6		0.193	19.	< 0.005	5.1	0.090 9	0.411	153.	82.2	0.022 6	
SW-N-41S1	FRM	Y	2021-11-30	Mean of duplicates	29.25		0.19	19.	< 0.005	5.1	0.086 8	0.410 5	153.5	78.35	0.020 95	
SW-N-41S1	RPD	Y			9.2%		3.2%	0.0%	0.0%	0.0%	9.4%	0.2%	0.7%	9.8%	15.8%	
SW-N-41S1	FR1	Y	2022-02-07	Moderately low flow, clear and colourless	39.5		0.196	19.	< 0.005	6.9	0.118	0.31	157.	130.	0.029	
SW-N-41S1	FR2	Y	2022-02-07	Moderately low flow, clear and colourless	39.4		0.189	18.	< 0.005	6.9	0.114	0.32	158.	126.	0.051	
SW-N-41S1	FRM	Y	2022-02-07	Mean of duplicates	39.45		0.192 5	18.5	< 0.005	6.9	0.116	0.315	157.5	128.	0.04	
SW-N-41S1	RPD	Y			0.3%		3.6%	5.4%	0.0%	0.0%	3.4%	3.2%	0.6%	3.1%	**55.0%**	**b**
SW-N-42S1	FR1	Y	2021-04-26	Moderately low flow, clear and colourless	63.5		0.124	47.	0.007	22.	0.159	0.6	204.	158.	0.094	
SW-N-42S1	FR2	Y	2021-04-26	Moderately low flow, clear and colourless	62.8		0.12	49.	0.007	22.	0.16	0.67	206.	189.	0.096	
SW-N-42S1	FRM	Y	2021-04-26	Mean of duplicates	63.15		0.122	48.	0.007	22.	0.159 5	0.635	205.	173.5	0.095	
SW-N-42S1	RPD	Y			1.1%		3.3%	4.2%	0.0%	0.0%	0.6%	11.0%	1.0%	17.9%	2.1%	
SW-N-42S1	FR1	Y	2021-10-04	Low flow, clear and colourless	41.1		0.168	72.	0.007 2	24.	0.124	0.6	269.	78.3	0.076	
SW-N-42S1	FR2	Y	2021-10-04	Low flow, clear and colourless	80.8		0.221	73.	0.009 4	25.	0.27	2.35	281.	187.	0.109	
SW-N-42S1	FRM	Y	2021-10-04	Mean of duplicates	60.95		0.194 5	72.5	0.008 3	24.5	0.197	1.475	275.	132.65	0.092 5	
SW-N-42S1	RPD	Y			**65.1%**	**a**	27.2%	1.4%	26.5%	4.1%	**74.1%**	**a**	**118.6%**	**a**	4.4%	**81.9%**	**a**	**35.7%**
SW-N-42S1	FR1	Y	2021-11-30		33.4		0.068	61.	0.005 4	8.9	0.088	0.93	144.	51.4	0.05	
SW-N-42S1	FR2	Y	2021-11-30		41.3		0.068	61.	0.009 1	8.9	0.125	0.98	149.	64.7	0.065	
SW-N-42S1	FRM	Y	2021-11-30	Mean of duplicates	37.35		0.068	61.	0.007 25	8.9	0.106 5	0.955	146.5	58.05	0.057 5	
SW-N-42S1	RPD	Y			21.2%		0.0%	0.0%	**51.0%**	**b**	0.0%	**34.7%**	**b**	5.2%	3.4%	22.9%	26.1%	
SW-N-41S1	FR1	Y	2022-02-07	Moderately low flow, clear and colourless	39.5		0.196	19.	< 0.005	6.9	0.118	0.31	157.	130.	0.029	
SW-N-41S1	FR2	Y	2022-02-07	Moderately low flow, clear and colourless	39.4		0.189	18.	< 0.005	6.9	0.114	0.32	158.	126.	0.051	
SW-N-41S1	FRM	Y	2022-02-07	Mean of duplicates	39.45		0.192 5	18.5	< 0.005	6.9	0.116	0.315	157.5	128.	0.04	
SW-N-41S1	RPD	Y			0.3%		3.6%	5.4%	0.0%	0.0%	3.4%	3.2%	0.6%	3.1%	**55.0%**	**b**
SW-N-42S1	FR1	Y	2022-02-07	Moderately low flow, clear and colourless	74.6		0.085	48.	< 0.005	17.	0.12	0.69	161.	107.	0.087	
SW-N-42S1	FR2	Y	2022-02-07	Moderately low flow, clear and colourless	85.7		0.088	49.	0.005 8	17.	0.126	0.76	164.	119.	0.103	
SW-N-42S1	FRM	Y	2022-02-07	Mean of duplicates	80.15		0.086 5	48.5	< 0.005 4	17.	0.123	0.725	162.5	113.	0.095	
SW-N-42S1	RPD	Y			13.8%		3.5%	2.1%	14.8%	0.0%	4.9%	9.7%	1.8%	10.6%	16.8%	
SW-S-04	FR1	Y	2021-04-27	Moderately low flow, clear and colourless	104.		0.177	85.	0.017 4	36.	0.216	3.12	123.	177.	0.17	
SW-S-04	FR2	Y	2021-04-27	Moderately low flow, clear and colourless	101.		0.192	89.	0.015 5	36.	0.235	3.26	128.	177.	0.191	
SW-S-04	FRM	Y	2021-04-27	Mean of duplicates	102.5		0.184 5	87.	0.016 45	36.	0.225 5	3.19	125.5	177.	0.180 5	
SW-S-04	RPD	Y			2.9%		8.1%	4.6%	11.6%	0.0%	8.4%	4.4%	4.0%	0.0%	11.6%	
SW-S-04	FR1	Y	2021-10-05	Moderately low flow, clear and colourless	11.8		0.095	69.	0.014 5	36.	0.075 4	1.34	138.	4.8	0.009 6	
SW-S-04	FR2	Y	2021-10-05	Moderately low flow, clear and colourless	13.1		0.117	69.	0.014 5	36.	0.08	1.32	135.	7.4	0.007 5	
SW-S-04	FRM	Y	2021-10-05	Mean of duplicates	12.45		0.106	69.	0.014 5	36.	0.077 7	1.33	136.5	6.1	0.008 55	
SW-S-04	RPD	Y			10.4%		20.8%	0.0%	0.0%	0.0%	5.9%	1.5%	2.2%	**42.6%**	**b**	24.6%
SW-S-04	FR1	Y	2021-12-01		73.8		0.114	46.	0.009 6	10.	0.11	3.08	66.5	99.6	0.075	
SW-S-04	FR2	Y	2021-12-01		75.2		0.124	47.	0.010 9	9.7	0.122	3.08	68.1	98.1	0.078	
SW-S-04	FRM	Y	2021-12-01	Mean of duplicates	74.5		0.119	46.5	0.010 25	9.85	0.116	3.08	67.3	98.85	0.076 5	
SW-S-04	RPD	Y			1.9%		8.4%	2.2%	12.7%	3.0%	10.3%	0.0%	2.4%	1.5%	3.9%	
SW-S-04	FR1	Y	2022-02-08	Moderate flow, clear and colourless	78.8		0.135	73.	0.013 2	30.	0.209	3.45	96.2	158.	0.175	
SW-S-04	FR2	Y	2022-02-08	Moderate flow, clear and colourless	130.		0.133	76.	0.013 1	30.	0.228	3.52	101.	242.	0.164	
SW-S-04	FRM	Y	2022-02-08	Mean of duplicates	104.4		0.134	74.5	0.013 15	30.	0.218 5	3.485	98.6	200.	0.169 5	
SW-S-04	RPD	Y			**49.0%**	**a**	1.5%	4.0%	0.8%	0.0%	8.7%	2.0%	4.9%	**42.0%**	**a**	6.5%

Notes:

SS *Single sample*

FR1 *Field replicate 1*

FR2 *Field replicate 2*

FRM *Average of field replicates*

RPD Relative percent difference of field replicates

na - Not applicable, some replicates less than the detection limit.

a *- Coefficient of variation greater than 30%*
and all replicates greater than the limit of quantitation.
b *- Coefficient of variation greater than 30%*
with some replicates less than the limit of quantitation.

Table 3-2 Surface Water Quality QA/QC - Relative Percent Difference 2021-2022

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Table 3-2 Surface Water Quality QA/QC - Relative Percent Difference 2021-2022

					Parameter	Manganese		Molybdenum		N - Nh3 (As N)		N - No2 (As N)		N - No3 (As N)		Nickel		Selenium		Silver		Sulphate		TSS	
					Fraction	TOT		TOT		TOT		DIS		DIS		TOT		TOT		TOT		DIS		TOT	
SW-N-41S1	FR1	Y	2021-11-30			49.		0.249		0.049		< 0.005		0.468		0.143		0.084		< 0.005		72.		2.4	
SW-N-41S1	FR2	Y	2021-11-30			56.9		0.278		< 0.015		< 0.005		0.474		0.156		0.081		< 0.005		72.		< 1.	
SW-N-41S1	FRM	Y	2021-11-30	Mean of duplicates		52.95		0.263 5		< 0.032		< 0.005		0.471		0.149 5		0.082 5		< 0.005		72.		< 1.7	
SW-N-41S1	RPD	Y				14.9%		11.0%		**106.3%**	**b**	0.0%		1.3%		8.7%		3.6%		0.0%		0.0%		**82.4%**	**b**
SW-N-41S1	FR1	Y	2022-02-07	Moderately low flow, clear and colourless		107.		0.278		0.043		< 0.005		0.122		0.17		0.065		< 0.01		57.		< 1.	
SW-N-41S1	FR2	Y	2022-02-07	Moderately low flow, clear and colourless		108.		0.273		0.027		< 0.005		0.122		0.15		0.07		< 0.01		56.		2.	
SW-N-41S1	FRM	Y	2022-02-07	Mean of duplicates		107.5		0.275 5		0.035		< 0.005		0.122		0.16		0.067 5		< 0.01		56.5		< 1.5	
SW-N-41S1	RPD	Y				0.9%		1.8%		**45.7%**	**b**	0.0%		0.0%		12.5%		7.4%		0.0%		1.8%		**66.7%**	**b**
SW-N-42S1	FR1	Y	2021-04-26	Moderately low flow, clear and colourless		79.5		0.55		< 0.015		< 0.005		0.053		0.47		0.054		< 0.01		79.		6.8	
SW-N-42S1	FR2	Y	2021-04-26	Moderately low flow, clear and colourless		79.4		0.599		< 0.015		< 0.005		0.058		0.55		0.05		< 0.01		80.		4.8	
SW-N-42S1	FRM	Y	2021-04-26	Mean of duplicates		79.45		0.574 5		< 0.015		< 0.005		0.055 5		0.51		0.052		< 0.01		79.5		5.8	
SW-N-42S1	RPD	Y				0.1%		8.5%		0.0%		0.0%		9.0%		15.7%		7.7%		0.0%		1.3%		34.5%	
SW-N-42S1	FR1	Y	2021-10-04	Low flow, clear and colourless		53.4		0.642		< 0.015		< 0.005		0.047		0.28		0.052		< 0.01		140.		2.4	
SW-N-42S1	FR2	Y	2021-10-04	Low flow, clear and colourless		218.		0.732		0.031		< 0.005		0.049		0.3		0.053		< 0.01		140.		< 1.	
SW-N-42S1	FRM	Y	2021-10-04	Mean of duplicates		135.7		0.687		< 0.023		< 0.005		0.048		0.29		0.052 5		< 0.01		140.		< 1.7	
SW-N-42S1	RPD	Y				**121.3%**	**a**	13.1%		**69.6%**		0.0%		4.2%		6.9%		1.9%		0.0%		0.0%		**82.4%**	
SW-N-42S1	FR1	Y	2021-11-30			18.9		0.386		< 0.015		< 0.005		0.242		0.14		0.047		< 0.01		73.		< 1.	
SW-N-42S1	FR2	Y	2021-11-30			28.8		0.363		< 0.015		< 0.005		0.241		0.16		0.056		< 0.01		73.		< 1.	
SW-N-42S1	FRM	Y	2021-11-30	Mean of duplicates		23.85		0.374 5		< 0.015		< 0.005		0.241 5		0.15		0.051 5		< 0.01		73.		< 1.	
SW-N-42S1	RPD	Y				**41.5%**	**a**	6.1%		0.0%		0.0%		0.4%		13.3%		17.5%		0.0%		0.0%		0.0%	
SW-N-41S1	FR1	Y	2022-02-07	Moderately low flow, clear and colourless		107.		0.278		0.043		< 0.005		0.122		0.17		0.065		< 0.01		57.		< 1.	
SW-N-41S1	FR2	Y	2022-02-07	Moderately low flow, clear and colourless		108.		0.273		0.027		< 0.005		0.122		0.15		0.07		< 0.01		56.		2.	
SW-N-41S1	FRM	Y	2022-02-07	Mean of duplicates		107.5		0.275 5		0.035		< 0.005		0.122		0.16		0.067 5		< 0.01		56.5		< 1.5	
SW-N-41S1	RPD	Y				0.9%		1.8%		**45.7%**	**b**	0.0%		0.0%		12.5%		7.4%		0.0%		1.8%		**66.7%**	**b**
SW-N-42S1	FR1	Y	2022-02-07	Moderately low flow, clear and colourless		32.7		0.502		0.13		< 0.005		0.119		0.19		0.052		< 0.01		67.		< 1.	
SW-N-42S1	FR2	Y	2022-02-07	Moderately low flow, clear and colourless		34.8		0.562		0.13		< 0.005		0.125		0.22		0.051		< 0.01		66.		16.	
SW-N-42S1	FRM	Y	2022-02-07	Mean of duplicates		33.75		0.532		0.13		< 0.005		0.122		0.205		0.051 5		< 0.01		66.5		< 8.5	
SW-N-42S1	RPD	Y				6.2%		11.3%		0.0%		0.0%		4.9%		14.6%		1.9%		0.0%		1.5%		**176.5%**	**b**
SW-S-04	FR1	Y	2021-04-27	Moderately low flow, clear and colourless		22.4		0.272		< 0.015		< 0.005		0.825		0.85		0.072		< 0.01		26.		3.2	
SW-S-04	FR2	Y	2021-04-27	Moderately low flow, clear and colourless		23.5		0.279		< 0.015		< 0.005		0.82		0.94		0.066		< 0.01		25.		3.2	
SW-S-04	FRM	Y	2021-04-27	Mean of duplicates		22.95		0.275 5		< 0.015		< 0.005		0.822 5		0.895		0.069		< 0.01		25.5		3.2	
SW-S-04	RPD	Y				4.8%		2.5%		0.0%		0.0%		0.6%		10.1%		8.7%		0.0%		3.9%		0.0%	
SW-S-04	FR1	Y	2021-10-05	Moderately low flow, clear and colourless		1.02		0.101		2.		< 0.005		1.51		0.305		0.077		< 0.005		71.		< 1.	
SW-S-04	FR2	Y	2021-10-05	Moderately low flow, clear and colourless		1.01		0.108		0.058		< 0.005		1.51		0.299		0.069		< 0.005		71.		< 1.	
SW-S-04	FRM	Y	2021-10-05	Mean of duplicates		1.015		0.104 5		1.029		< 0.005		1.51		0.302		0.073		< 0.005		71.		< 1.	
SW-S-04	RPD	Y				1.0%		6.7%		**188.7%**	**b**	0.0%		0.0%		2.0%		11.0%		0.0%		0.0%		0.0%	
SW-S-04	FR1	Y	2021-12-01			10.6		0.127		0.034		0.034 6		0.843		0.47		0.074		< 0.01		21.		3.6	
SW-S-04	FR2	Y	2021-12-01			11.1		0.123		0.031		0.034 9		0.817		0.52		0.068		< 0.01		21.		1.2	
SW-S-04	FRM	Y	2021-12-01	Mean of duplicates		10.85		0.125		0.032 5		0.034 75		0.83		0.495		0.071		< 0.01		21.		2.4	
SW-S-04	RPD	Y				4.6%		3.2%		9.2%		0.9%		3.1%		10.1%		8.5%		0.0%		0.0%		**100.0%**	**b**
SW-S-04	FR1	Y	2022-02-08	Moderate flow, clear and colourless		21.1		0.163		0.12		< 0.005		1.84		0.667		0.064		< 0.005		24.		< 1.	
SW-S-04	FR2	Y	2022-02-08	Moderate flow, clear and colourless		20.9		0.142		0.21		< 0.005		1.85		0.73		0.065		< 0.01		35.		4.	
SW-S-04	FRM	Y	2022-02-08	Mean of duplicates		21.		0.152 5		0.165		< 0.005		1.845		0.698 5		0.064 5		< 0.007 5		29.5		< 2.5	
SW-S-04	RPD	Y				1.0%		13.8%		**54.5%**	**b**	0.0%		0.5%		9.0%		1.6%		**66.7%**	**b**	**37.3%**	**a**	**120.0%**	**b**

Notes:

SS *Single sample*

FR1 *Field replicate 1*

FR2 *Field replicate 2*

FRM *Average of field replicates*

RPD Relative percent difference of field replicates

na - Not applicable, some replicates less than the detection limit.

a *- Coefficient of variation greater than 30%*
and all replicates greater than the limit of quantitation.
b *- Coefficient of variation greater than 30%*
with some replicates less than the limit of quantitation.

Table 3-2 Surface Water Quality QA/QC - Relative Percent Difference 2021-2022

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Table 3-2 Surface Water Quality QA/QC - Relative Percent Difference 2021-2022

				Parameter	Zinc	pH	Conductivity	Temperature	Aluminum	Arsenic	Boron	Cadmium	Cobalt	Copper	Hardness (As Caco3)
				Fraction	TOT	TOT	TOT	TOT	DIS	DIS	DIS	DIS	DIS	DIS	DIS
SW-N-41S1	FR1	Y	2021-11-30		1.43	7.05	239.	10.5	17.2	0.153	19.	< 0.005	0.073 4	0.475	157.
SW-N-41S1	FR2	Y	2021-11-30		1.19	7.05	239.	10.5	11.3	0.146	19.	< 0.005	0.064 6	0.343	163.
SW-N-41S1	FRM	Y	2021-11-30	Mean of duplicates	1.31	7.05	239.	10.5	14.25	0.149 5	19.	< 0.005	0.069	0.409	160.
SW-N-41S1	RPD	Y			18.3%	0.0%	0.0%	0.0%	**41.4%** **a**	4.7%	0.0%	0.0%	12.8%	**32.3%** **a**	3.8%
SW-N-41S1	FR1	Y	2022-02-07	Moderately low flow, clear and colourless	1.3	7.37	340.	7.9	4.31	0.162	18.	< 0.005	0.087 3	0.207	159.
SW-N-41S1	FR2	Y	2022-02-07	Moderately low flow, clear and colourless	1.1	7.37	340.	7.9	4.69	0.161	17.	< 0.005	0.083 6	0.201	158.
SW-N-41S1	FRM	Y	2022-02-07	Mean of duplicates	1.2	7.37	340.	7.9	4.5	0.161 5	17.5	< 0.005	0.085 45	0.204	158.5
SW-N-41S1	RPD	Y			16.7%	0.0%	0.0%	0.0%	8.4%	0.6%	5.7%	0.0%	4.3%	2.9%	0.6%
SW-N-42S1	FR1	Y	2021-04-26	Moderately low flow, clear and colourless	< 1.	6.56	319.	9.7	5.71	0.125	44.	< 0.005	0.083 2	0.341	195.
SW-N-42S1	FR2	Y	2021-04-26	Moderately low flow, clear and colourless	< 1.	6.56	319.	9.7	9.34	0.119	44.	0.007 1	0.084 8	0.353	192.
SW-N-42S1	FRM	Y	2021-04-26	Mean of duplicates	< 1.	6.56	319.	9.7	7.525	0.122	44.	< 0.006 05	0.084	0.347	193.5
SW-N-42S1	RPD	Y			0.0%	0.0%	0.0%	0.0%	**48.2%** **a**	4.9%	0.0%	34.7%	1.9%	3.5%	1.6%
SW-N-42S1	FR1	Y	2021-10-04	Low flow, clear and colourless	2.6	7.22	439.	10.7	8.84	0.175	74.	0.008 3	0.091	0.551	279.
SW-N-42S1	FR2	Y	2021-10-04	Low flow, clear and colourless	2.6	7.22	439.	10.7	7.82	0.144	75.	0.009 2	0.085 9	0.491	280.
SW-N-42S1	FRM	Y	2021-10-04	Mean of duplicates	2.6	7.22	439.	10.7	8.33	0.159 5	74.5	0.008 75	0.088 45	0.521	279.5
SW-N-42S1	RPD	Y			0.0%	0.0%	0.0%	0.0%	12.2%	19.4%	1.3%	10.3%	5.8%	11.5%	0.4%
SW-N-42S1	FR1	Y	2021-11-30		< 1.	6.57	238.	9.8	11.7	0.103	65.	< 0.005	0.068 3	0.721	144.
SW-N-42S1	FR2	Y	2021-11-30		< 1.	6.57	238.	9.8	13.9	0.091	63.	0.005 1	0.066 5	0.704	144.
SW-N-42S1	FRM	Y	2021-11-30	Mean of duplicates	< 1.	6.57	238.	9.8	12.8	0.097	64.	< 0.005 05	0.067 4	0.712 5	144.
SW-N-42S1	RPD	Y			0.0%	0.0%	0.0%	0.0%	17.2%	12.4%	3.1%	2.0%	2.7%	2.4%	0.0%
SW-N-41S1	FR1	Y	2022-02-07	Moderately low flow, clear and colourless	1.3	7.37	340.	7.9	4.31	0.162	18.	< 0.005	0.087 3	0.207	159.
SW-N-41S1	FR2	Y	2022-02-07	Moderately low flow, clear and colourless	1.1	7.37	340.	7.9	4.69	0.161	17.	< 0.005	0.083 6	0.201	158.
SW-N-41S1	FRM	Y	2022-02-07	Mean of duplicates	1.2	7.37	340.	7.9	4.5	0.161 5	17.5	< 0.005	0.085 45	0.204	158.5
SW-N-41S1	RPD	Y			16.7%	0.0%	0.0%	0.0%	8.4%	0.6%	5.7%	0.0%	4.3%	2.9%	0.6%
SW-N-42S1	FR1	Y	2022-02-07	Moderately low flow, clear and colourless	1.2	7.75	400.	6.6	5.19	0.065	46.	< 0.005	0.052 9	0.467	167.
SW-N-42S1	FR2	Y	2022-02-07	Moderately low flow, clear and colourless	1.2	7.08	400.	6.6	4.76	0.064	45.	< 0.005	0.052 3	0.461	164.
SW-N-42S1	FRM	Y	2022-02-07	Mean of duplicates	1.2	7.415	400.	6.6	4.975	0.064 5	45.5	< 0.005	0.052 6	0.464	165.5
SW-N-42S1	RPD	Y			0.0%	9.0%	0.0%	0.0%	8.6%	1.6%	2.2%	0.0%	1.1%	1.3%	1.8%
SW-S-04	FR1	Y	2021-04-27	Moderately low flow, clear and colourless	3.7	7.66	240.	9.8	18.7	0.159	81.	0.008 1	0.116	2.44	115.
SW-S-04	FR2	Y	2021-04-27	Moderately low flow, clear and colourless	4.1	7.66	240.	9.8	21.2	0.146	79.	0.007 8	0.124	3.01	118.
SW-S-04	FRM	Y	2021-04-27	Mean of duplicates	3.9	7.66	240.	9.8	19.95	0.152 5	80.	0.007 95	0.12	2.725	116.5
SW-S-04	RPD	Y			10.3%	0.0%	0.0%	0.0%	12.5%	8.5%	2.5%	3.8%	6.7%	20.9%	2.6%
SW-S-04	FR1	Y	2021-10-05	Moderately low flow, clear and colourless	2.68	7.45	288.	11.5	8.96	0.108	69.	0.014 8	0.081 4	1.37	137.
SW-S-04	FR2	Y	2021-10-05	Moderately low flow, clear and colourless	2.77	7.45	288.	11.5	13.5	0.102	71.	0.018 1	0.081 3	1.38	136.
SW-S-04	FRM	Y	2021-10-05	Mean of duplicates	2.725	7.45	288.	11.5	11.23	0.105	70.	0.016 45	0.081 35	1.375	136.5
SW-S-04	RPD	Y			3.3%	0.0%	0.0%	0.0%	**40.4%** **a**	5.7%	2.9%	20.1%	0.1%	0.7%	0.7%
SW-S-04	FR1	Y	2021-12-01		9.5	7.65	122.	10.1	30.2	0.136	47.	0.005 5	0.071 9	2.71	65.6
SW-S-04	FR2	Y	2021-12-01		9.4	7.65	122.	10.1	30.9	0.132	46.	0.006 7	0.067 9	2.68	65.5
SW-S-04	FRM	Y	2021-12-01	Mean of duplicates	9.45	7.65	122.	10.1	30.55	0.134	46.5	0.006 1	0.069 9	2.695	65.55
SW-S-04	RPD	Y			1.1%	0.0%	0.0%	0.0%	2.3%	3.0%	2.2%	19.7%	5.7%	1.1%	0.2%
SW-S-04	FR1	Y	2022-02-08	Moderate flow, clear and colourless	5.42	7.49	184.	7.4	10.8	0.117	71.	0.011	0.099 3	2.82	97.6
SW-S-04	FR2	Y	2022-02-08	Moderate flow, clear and colourless	4.7	7.42	300.	7.4	10.8	0.119	72.	0.008 3	0.1	2.82	99.3
SW-S-04	FRM	Y	2022-02-08	Mean of duplicates	5.06	7.455	242.	7.4	10.8	0.118	71.5	0.009 65	0.099 65	2.82	98.45
SW-S-04	RPD	Y			14.2%	0.9%	**47.9%** **b**	0.0%	0.0%	1.7%	1.4%	28.0%	0.7%	0.0%	1.7%

Notes:

SS *Single sample*

FR1 *Field replicate 1*

FR2 *Field replicate 2*

FRM *Average of field replicates*

RPD Relative percent difference of field replicates

na - Not applicable, some replicates less than the detection limit.

a *- Coefficient of variation greater than 30%*
and all replicates greater than the limit of quantitation.
b *- Coefficient of variation greater than 30%*
with some replicates less than the limit of quantitation.

Table 3-2 Surface Water Quality QA/QC - Relative Percent Difference 2021-2022

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Table 3-2 Surface Water Quality QA/QC - Relative Percent Difference 2021-2022

					Iron		Lead		Manganese		Molybdenum		Nickel		Selenium		Silver		Zinc		Dissolved Organic Carbon
Parameter					DIS		DIS		DIS		DIS		DIS		DIS		DIS		DIS		Dissolved
Fraction																					
SW-N-41S1	FR1	Y	2021-11-30		37.9		0.009 4		39.9		0.273		0.118		0.078		< 0.005		2.04		2.7
SW-N-41S1	FR2	Y	2021-11-30		29.6		< 0.005		37.7		0.273		0.126		0.073		< 0.005		1.25		3.2
SW-N-41S1	FRM	Y	2021-11-30	Mean of duplicates	33.75		< 0.007 2		38.8		0.273		0.122		0.075 5		< 0.005		1.645		2.95
SW-N-41S1	RPD	Y			24.6%		**61.1%**	**b**	5.7%		0.0%		6.6%		6.6%		0.0%		**48.0%**	**a**	16.9%
SW-N-41S1	FR1	Y	2022-02-07	Moderately low flow, clear and colourless	52.2		< 0.005		93.3		0.289		0.092		0.066		< 0.005		0.44		1.6
SW-N-41S1	FR2	Y	2022-02-07	Moderately low flow, clear and colourless	50.		< 0.005		92.4		0.339		0.093		0.059		< 0.005		0.44		1.6
SW-N-41S1	FRM	Y	2022-02-07	Mean of duplicates	51.1		< 0.005		92.85		0.314		0.092 5		0.062 5		< 0.005		0.44		1.6
SW-N-41S1	RPD	Y			4.3%		0.0%		1.0%		15.9%		1.1%		11.2%		0.0%		0.0%		0.0%
SW-N-42S1	FR1	Y	2021-04-26	Moderately low flow, clear and colourless	32.		0.007 9		43.1		0.468		0.192		0.046		< 0.005		0.54		4.1
SW-N-42S1	FR2	Y	2021-04-26	Moderately low flow, clear and colourless	34.6		0.011 4		43.		0.443		0.166		0.041		< 0.005		0.59		4.1
SW-N-42S1	FRM	Y	2021-04-26	Mean of duplicates	33.3		0.009 65		43.05		0.455 5		0.179		0.043 5		< 0.005		0.565		4.1
SW-N-42S1	RPD	Y			7.8%		36.3%		0.2%		5.5%		14.5%		11.5%		0.0%		8.8%		0.0%
SW-N-42S1	FR1	Y	2021-10-04	Low flow, clear and colourless	18.1		0.060 5		21.2		0.704		0.218		0.043		< 0.005		2.		5.5
SW-N-42S1	FR2	Y	2021-10-04	Low flow, clear and colourless	19.4		0.012 1		21.		0.713		0.211		0.051		< 0.005		1.9		5.2
SW-N-42S1	FRM	Y	2021-10-04	Mean of duplicates	18.75		0.036 3		21.1		0.708 5		0.214 5		0.047		< 0.005		1.95		5.35
SW-N-42S1	RPD	Y			6.9%		**133.3%**	**b**	0.9%		1.3%		3.3%		17.0%		0.0%		5.1%		5.6%
SW-N-42S1	FR1	Y	2021-11-30		17.9		0.012 6		11.4		0.379		0.136		0.052		< 0.005		1.21		3.9
SW-N-42S1	FR2	Y	2021-11-30		20.9		0.019 7		11.		0.396		0.161		0.048		< 0.005		1.19		3.7
SW-N-42S1	FRM	Y	2021-11-30	Mean of duplicates	19.4		0.016 15		11.2		0.387 5		0.148 5		0.05		< 0.005		1.2		3.8
SW-N-42S1	RPD	Y			15.5%		**44.0%**	**b**	3.6%		4.4%		16.8%		8.0%		0.0%		1.7%		5.3%
SW-N-41S1	FR1	Y	2022-02-07	Moderately low flow, clear and colourless	52.2		< 0.005		93.3		0.289		0.092		0.066		< 0.005		0.44		1.6
SW-N-41S1	FR2	Y	2022-02-07	Moderately low flow, clear and colourless	50.		< 0.005		92.4		0.339		0.093		0.059		< 0.005		0.44		1.6
SW-N-41S1	FRM	Y	2022-02-07	Mean of duplicates	51.1		< 0.005		92.85		0.314		0.092 5		0.062 5		< 0.005		0.44		1.6
SW-N-41S1	RPD	Y			4.3%		0.0%		1.0%		15.9%		1.1%		11.2%		0.0%		0.0%		0.0%
SW-N-42S1	FR1	Y	2022-02-07	Moderately low flow, clear and colourless	10.1		0.005 7		11.1		0.546		0.118		0.047		< 0.005		0.98		2.5
SW-N-42S1	FR2	Y	2022-02-07	Moderately low flow, clear and colourless	9.4		< 0.005		10.9		0.472		0.132		0.042		< 0.005		0.44		2.6
SW-N-42S1	FRM	Y	2022-02-07	Mean of duplicates	9.75		< 0.005 35		11.		0.509		0.125		0.044 5		< 0.005		0.71		2.55
SW-N-42S1	RPD	Y			7.2%		13.1%		1.8%		14.5%		11.2%		11.2%		0.0%		**76.1%**	**b**	3.9%
SW-S-04	FR1	Y	2021-04-27	Moderately low flow, clear and colourless	24.3		0.020 4		2.6		0.197		0.502		0.067		< 0.005		1.82		4.
SW-S-04	FR2	Y	2021-04-27	Moderately low flow, clear and colourless	31.1		0.025 5		4.07		0.198		0.531		0.054		< 0.005		2.26		3.5
SW-S-04	FRM	Y	2021-04-27	Mean of duplicates	27.7		0.022 95		3.335		0.197 5		0.516 5		0.060 5		< 0.005		2.04		3.75
SW-S-04	RPD	Y			24.5%		22.2%		**44.1%**	**a**	0.5%		5.6%		21.5%		0.0%		21.6%		13.3%
SW-S-04	FR1	Y	2021-10-05	Moderately low flow, clear and colourless	2.7		< 0.005		0.705		0.089		0.353		0.065		< 0.005		2.72		3.4
SW-S-04	FR2	Y	2021-10-05	Moderately low flow, clear and colourless	4.3		0.007		0.809		0.094		0.388		0.061		< 0.005		2.64		3.5
SW-S-04	FRM	Y	2021-10-05	Mean of duplicates	3.5		< 0.006		0.757		0.091 5		0.370 5		0.063		< 0.005		2.68		3.45
SW-S-04	RPD	Y			**45.7%**	**b**	**33.3%**	**b**	13.7%		5.5%		9.4%		6.3%		0.0%		3.0%		2.9%
SW-S-04	FR1	Y	2021-12-01		24.1		0.013 5		2.35		0.108		0.427		0.069		< 0.005		7.7		4.9
SW-S-04	FR2	Y	2021-12-01		25.		0.013 2		2.32		0.106		0.42		0.067		< 0.005		7.69		4.9
SW-S-04	FRM	Y	2021-12-01	Mean of duplicates	24.55		0.013 35		2.335		0.107		0.423 5		0.068		< 0.005		7.695		4.9
SW-S-04	RPD	Y			3.7%		2.2%		1.3%		1.9%		1.7%		2.9%		0.0%		0.1%		0.0%
SW-S-04	FR1	Y	2022-02-08	Moderate flow, clear and colourless	21.4		0.010 2		0.89		0.192		0.514		0.061		< 0.005		2.32		3.8
SW-S-04	FR2	Y	2022-02-08	Moderate flow, clear and colourless	20.8		0.008 5		0.834		0.226		0.508		0.064		< 0.005		2.26		3.5
SW-S-04	FRM	Y	2022-02-08	Mean of duplicates	21.1		0.009 35		0.862		0.209		0.511		0.062 5		< 0.005		2.29		3.65
SW-S-04	RPD	Y			2.8%		18.2%		6.5%		16.3%		1.2%		4.8%		0.0%		2.6%		8.2%

Notes:

SS *Single sample*

FR1 *Field replicate 1*

FR2 *Field replicate 2*

FRM *Average of field replicates*

RPD Relative percent difference of field replicates

na - Not applicable, some replicates less than the detection limit.

a *- Coefficient of variation greater than 30%*
and all replicates greater than the limit of quantitation.
b *- Coefficient of variation greater than 30%*
with some replicates less than the limit of quantitation.

Table 3-3 Hartland Valve Chamber Leachate Chemistry QA/QC - Relative Percent Difference 2021 - 2022

State	Parameter	MDL	LOQ	Lab Units	Maximum Acceptable RPD	Hartland Valve Chamber FR1 SAT00110-FR1 21-Apr-2021	Hartland Valve Chamber FR2 SAT00110-FR2 21-Apr-2021	RPD %	COV	Hartland Valve Chamber FR1 SAT00110-FR1 05-Aug-2021	Hartland Valve Chamber FR2 SAT00110-FR2 05-Aug-2021	RPD %	COV
Conventionals													
TOT	Total Sulphide	0.001 8	0.009	mg/L	30%	0.069	0.053	26.2%	13.11	0.085	0.06	**34.5%** **a**	17.24
DISS	Dissolved Sulphide	0.009	0.045	mg/L	30%	0.06	0.058	3.4%	1.69	0.075	0.065	14.3%	7.14
TOT	TSS	1.	5.	mg/L	30%	32.	32.			20.	22.	9.5%	4.76
TOT	BOD	2.	10.	mg/L	30%	26.	27.	3.8%	1.89	30.	34.	12.5%	6.25
TOT	COD	10.	50.	mg/L	30%	516.	519.	0.6%	0.29	561.	560.	0.2%	0.09
DISS	Chloride	1.	5.	mg/L	30%	400.	400.			520.	520.		
DISS	Sulphate	1.	5.	mg/L	30%	36.	34.	5.7%	2.86	17.	20.	16.2%	8.11
TOT	Oil & Grease, Total	1.	5.	mg/L	30%	< 1.	< 1.			< 1.	< 1.		
TOT	Oil & Grease, Mineral	2.	10.	mg/L	45%	< 2.	< 2.			< 2.	< 2.		
TOT	Cyanide - SAD (total)	0.000 5	0.002 5	mg/L	30%	0.018 8	0.018 3	2.7%	1.35	0.012	0.010 6	12.4%	6.19
TOT	Cyanide - WAD	0.000 5	0.002 5	mg/L	30%	0.006 4	0.006 3	1.6%	0.79	0.008 1	0.003 6	**76.9%** **a**	38.46
TOT	Phenols	0.015	0.075	mg/L	45%	0.16	0.033	**131.6%** **b**	65.80	0.007 6	0.008 2	7.6%	3.80
TOT	Ammonia	1.5	7.5	mg/L	30%	310.	280.	10.2%	5.08	280.	290.	3.5%	1.75
TOT	Nitrite	0.005	0.025	mg/L	30%	1.76	1.77	0.6%	0.28	< 0.5	< 0.5		
TOT	Nitrate	0.02	0.1	mg/L	30%	8.7	8.7			< 2.	< 2.		
TOT	pH	0.01	0.05	pH	30%	-	-			8.14	8.14		
TOT	Conductivity	0.1	0.5	µS/cm	30%	4 506.	4 506.			3 633.	3 633.		
TOT	Temperature	0.1	0.5	°C	30%	20.8	20.8			24.6	24.6		
TOT	Dissolved Oxygen	0.01	0.05	mg/L	30%	1.99	1.99			1.57	1.57		
TOT	ORP	1.	5.	mV	30%	76.	76.			49.	49.		
Total Metals													
TOT	Arsenic	0.04	0.2	µg/L	30%	7.87	8.24	4.6%	2.30	9.34	9.45	1.2%	0.59
TOT	Cadmium	0.01	0.05	µg/L	30%	0.058	0.059	1.7%	0.85	0.053	0.06	12.4%	6.19
TOT	Chromium	0.2	1.	µg/L	30%	49.3	50.1	1.6%	0.80	57.4	59.2	3.1%	1.54
TOT	Cobalt	0.02	0.1	µg/L	30%	14.5	14.5			18.8	19.7	4.7%	2.34
TOT	Copper	0.2	1.	µg/L	30%	9.86	9.4	4.8%	2.39	11.8	12.3	4.1%	2.07
TOT	Iron	10.	50.	µg/L	30%	2 110.	2 140.	1.4%	0.71	3 010.	3 100.	2.9%	1.47
TOT	Lead	0.04	0.2	µg/L	30%	1.	1.06	5.8%	2.91	0.72	0.87	18.9%	9.43
TOT	Manganese	0.2	1.	µg/L	30%	626.	627.	0.2%	0.08	751.	753.	0.3%	0.13
TOT	Mercury	0.019	0.095	µg/L	30%	< 0.038	< 0.038			< 0.038	< 0.038		
TOT	Molybdenum	0.1	0.5	µg/L	30%	3.03	3.31	8.8%	4.42	4.04	4.24	4.8%	2.42
TOT	Nickel	0.2	1.	µg/L	30%	42.8	42.5	0.7%	0.35	53.1	54.6	2.8%	1.39
TOT	Selenium	0.08	0.4	µg/L	30%	0.418	0.463	10.2%	5.11	0.48	0.56	15.4%	7.69
TOT	Silver	0.02	0.1	µg/L	30%	< 0.02	< 0.02			< 0.05	< 0.05		
TOT	Zinc	2.	10.	µg/L	30%	15.4	16.6	7.5%	3.75	15.2	15.1	0.7%	0.33
BTEX													
DISS	Benzene	0.4	2.	µg/L	45%	0.59	0.54	8.8%	4.42	0.48	< 0.4	18.2%	9.09
DISS	Toluene	0.4	2.	µg/L	45%	0.55	0.46	17.8%	8.91	< 0.4	< 0.4		
DISS	Ethylbenzene	0.4	2.	µg/L	45%	0.99	0.97	2.0%	1.02	0.85	0.48	55.6%	27.82
DISS	Xylenes	0.4	2.	µg/L	45%	1.9	1.9			1.6	1.3	20.7%	10.34
PAH													
TOT	Total PAH	0.01	0.05	µg/L	45%	5.9	6.6	11.2%	5.60	3.7	4.6	21.7%	10.84
TOT	Acenaphthene	0.01	0.05	µg/L	45%	1.9	2.2	14.6%	7.32	0.86	0.91	5.6%	2.82
TOT	Acenaphthylene	0.01	0.05	µg/L	45%	0.043	0.049	13.0%	6.52	0.024	0.021	13.3%	6.67
TOT	Anthracene	0.01	0.05	µg/L	45%	0.59	0.66	11.2%	5.60	0.047	0.056	17.5%	8.74
TOT	Benzo(a)anthracene	0.01	0.05	µg/L	45%	0.05	0.049	2.0%	1.01	0.013	0.019	37.5%	18.75
TOT	Benzo(a)pyrene	0.005	0.025	µg/L	45%	0.009 2	0.011	17.8%	8.91	< 0.005	0.007 2	36.1%	18.03
TOT	Benzo(b,j)fluoranthene	0.01	0.05	µg/L	45%	0.012	0.014	15.4%	7.69	< 0.01	0.013	26.1%	13.04
TOT	Benzo(g,h,i)perylene	0.02	0.1	µg/L	45%	< 0.02	< 0.02			< 0.02	< 0.02		
TOT	Benzo(k)fluoranthene	0.01	0.05	µg/L	45%	< 0.01	< 0.01			< 0.01	< 0.01		
TOT	Chrysene	0.01	0.05	µg/L	45%	0.053	0.054	1.9%	0.93	0.017	0.023	30.0%	15.00
TOT	Dibenzo(a,h)anthracene	0.02	0.1	µg/L	45%	< 0.02	< 0.02			< 0.02	< 0.02		
TOT	Fluoranthene	0.01	0.05	µg/L	45%	0.48	0.47	2.1%	1.05	0.16	0.19	17.1%	8.57
TOT	Fluorene	0.01	0.05	µg/L	45%	1.4	1.6	13.3%	6.67	0.41	0.45	9.3%	4.65
TOT	Indeno(1,2,3-c,d)pyrene	0.02	0.1	µg/L	45%	< 0.02	< 0.02			< 0.02	< 0.02		
TOT	Naphthalene	0.01	0.05	µg/L	45%	0.36	0.44	20.0%	10.00	0.8	1.5	**60.9%** **a**	30.43
TOT	Phenanthrene	0.01	0.05	µg/L	45%	0.24	0.33	31.6%	15.79	0.14	0.16	13.3%	6.67
TOT	Pyrene	0.01	0.05	µg/L	45%	0.34	0.33	3.0%	1.49	0.12	0.14	15.4%	7.69
Chlorinated Phenols													
TOT	Chlorinated phenols (total)	0.41	2.05	µg/L	45%	< 0.41	< 0.41			-	-		
TOT	Total Dichlorophenols	0.22	1.1	µg/L	45%	< 0.22	< 0.22			-	-		
TOT	Total Monochlorophenols	0.09	0.45	µg/L	45%	< 0.09	< 0.09			-	-		
TOT	Total Nonchlorinated phenols	1.6	8.	µg/L	45%	4.1	4.6	11.5%	5.75	-	-		
TOT	Total Phenolic Compounds	0.17	0.85	#N/A	45%	-	-			-	-		
TOT	Total Tetrachlorophenols	0.17	0.85	µg/L	45%	< 0.17	< 0.17			-	-		
TOT	Total Trichlorophenols	0.24	1.2	µg/L	45%	< 0.24	< 0.24			-	-		
TOT	2-Chlorophenol	0.05	0.25	µg/L	45%	< 0.05	< 0.05			-	-		
TOT	2,4 + 2,5 Dichlorophenol	0.1	0.5	µg/L	45%	< 0.1	< 0.1			-	-		
TOT	2,4,6-Trichlorophenol	0.1	0.5	µg/L	45%	< 0.1	< 0.1			-	-		
TOT	Pentachlorophenol	0.1	0.5	µg/L	45%	< 0.1	< 0.1			-	-		
TOT	2,3,4,5-Tetrachlorophenol	0.1	0.5	µg/L	45%	< 0.1	< 0.1			-	-		
TOT	2,3,4,6-Tetrachlorophenol	0.1	0.5	µg/L	45%	< 0.1	< 0.1			-	-		
Emergening Contaminants													
TOT	Perfluorobutanesulfonic acid	0.02	0.1	µg/L	45%	-	-			-	-		
TOT	Perfluorodecanesulfonic acid (PFDS)	0.02	0.1	µg/L	45%	-	-			-	-		
TOT	Perfluoroheptanesulfonic acid	0.02	0.1	µg/L	45%	-	-			-	-		
TOT	Perfluorohexanesulfonic acid	0.02	0.1	µg/L	45%	-	-			-	-		
TOT	Perfluorononanesulfonic acid	0.02	0.1	µg/L	45%	-	-			-	-		
TOT	Perfluorooctanesulfonic acid	0.02	0.1	µg/L	45%	-	-			-	-		
TOT	Perfluorooctanoic acid (PFOA)	0.02	0.1	µg/L	45%	-	-			-	-		
TOT	Perfluoropentanesulfonic acid	0.02	0.1	µg/L	45%	-	-			-	-		
TOT	PF3A	0.02	0.1	µg/L	45%	-	-			-	-		
TOT	PF4A	0.02	0.1	µg/L	45%	-	-			-	-		
TOT	PFBoA	0.02	0.1	µg/L	45%	-	-			-	-		
TOT	PFDA	0.02	0.1	µg/L	45%	-	-			-	-		
TOT	PFDoA	0.02	0.1	µg/L	45%	-	-			-	-		
TOT	PFHpA	0.02	0.1	µg/L	45%	-	-			-	-		
TOT	PFHxA	0.02	0.1	µg/L	45%	-	-			-	-		
TOT	PFNA	0.02	0.1	µg/L	45%	-	-			-	-		
TOT	PFOSA	0.02	0.1	µg/L	45%	-	-			-	-		
TOT	PFPeA	0.02	0.1	µg/L	45%	-	-			-	-		
TOT	PFUA	0.02	0.1	µg/L	45%	-	-			-	-		
TOT	1,4-Dioxane	0.6	3.	µg/L	45%	-	-			-	-		

Notes:

FR1, FR2 - Field replicates 1 and 2.

FRM - Mean of field replicates.

MDL - Method detection limit.

COV - Coefficient of Variation

LOQ - Limit of quantification.

RPD - Relative percent difference.

na - Not applicable, some replicates less than the detection limit.

a *- Relative Standard Difference greater than 3% for general in o*

b *- Relative Standard Difference greater than 3% for general in o*

Table 3-3 Hartland Valve Chamber Leachate Chemistry QA/QC - Relative Percent Difference 2021 - 2022

State	Parameter	MDL	LOQ	Lab Units	Hartland Valve Chamber FR1 SAT00110-FR1 29-Nov-2021		Hartland Valve Chamber FR2 SAT00110-FR2 29-Nov-2021		RPD %		COV	Hartland Valve Chamber FR1 SAT00110-FR1 24-Feb-2022		Hartland Valve Chamber FR2 SAT00110-FR2 24-Feb-2022		RPD %		COV
Conventionals																		
TOT	Total Sulphide	0.001 8	0.009	mg/L		0.078		0.083	6.2%		3.11		0.071		0.058	20.2%		10.08
DISS	Dissolved Sulphide	0.009	0.045	mg/L		0.068		0.073	7.1%		3.55		0.034		0.055	**47.2%**	**b**	23.60
TOT	TSS	1.	5.	mg/L		26.		22.	16.7%		8.33		24.		18.	28.6%		14.29
TOT	BOD	2.	10.	mg/L	<	15.		25.	**50.0%**	**a**	25.00		20.		20.			
TOT	COD	10.	50.	mg/L		409.		421.	2.9%		1.45		5 470.		5 350.	2.2%		1.11
DISS	Chloride	1.	5.	mg/L		290.		290.					320.		320.			
DISS	Sulphate	1.	5.	mg/L		110.	<	100.	9.5%		4.76		52.		48.	8.0%		4.00
TOT	Oil & Grease, Total	1.	5.	mg/L	<	1.	<	1.					7.1		4.3	**49.1%**	**b**	24.56
TOT	Oil & Grease, Mineral	2.	10.	mg/L	<	2.	<	2.					2.3	<	2.	14.0%		6.98
TOT	Cyanide - SAD (total)	0.000 5	0.002 5	mg/L		0.012		0.024 5	**68.5%**	**b**	34.25		0.010 3		0.010 4	1.0%		0.48
TOT	Cyanide - WAD	0.000 5	0.002 5	mg/L	<	0.005		0.006 4	24.6%		12.28		0.003 27		0.003 71	12.6%		6.30
TOT	Phenols	0.015	0.075	mg/L	<	0.015	<	0.015				<	0.015	<	0.015			
TOT	Ammonia	1.5	7.5	mg/L		250.		250.					250.		280.	11.3%		5.66
TOT	Nitrite	0.005	0.025	mg/L		0.501		0.496	1.0%		0.50		0.896		1.05	15.8%		7.91
TOT	Nitrate	0.02	0.1	mg/L		2.74		2.7	1.5%		0.74		8.08		8.43	4.2%		2.12
TOT	pH	0.01	0.05	pH		7.58		7.58					7.16		7.16			
TOT	Conductivity	0.1	0.5	µS/cm		2 934.		2 934.					3 211.		3 211.			
TOT	Temperature	0.1	0.5	°C		15.1		15.1					11.5		11.5			
TOT	Dissolved Oxygen	0.01	0.05	mg/L		2.76		2.76					0.6		0.6			
TOT	ORP	1.	5.	mV		93.		93.					196.		196.			
Total Metals																		
TOT	Arsenic	0.04	0.2	µg/L		10.6		10.9	2.8%		1.40		6.4		6.43	0.5%		0.23
TOT	Cadmium	0.01	0.05	µg/L		0.079		0.123	**43.6%**	**a**	21.78		0.047		0.051	8.2%		4.08
TOT	Chromium	0.2	1.	µg/L		43.8		45.	2.7%		1.35				41.8			100.00
TOT	Cobalt	0.02	0.1	µg/L		12.5		12.5					12.		12.3	2.5%		1.23
TOT	Copper	0.2	1.	µg/L		25.5		39.5	**43.1%**	**a**	21.54		10.7		10.5	1.9%		0.94
TOT	Iron	10.	50.	µg/L		2 240.		2 310.	3.1%		1.54		1 540.		1 570.	1.9%		0.96
TOT	Lead	0.04	0.2	µg/L		1.55		7.53	######	**a**	65.86		0.761		0.786	3.2%		1.62
TOT	Manganese	0.2	1.	µg/L		506.		500.	1.2%		0.60		636.		653.	2.6%		1.32
TOT	Mercury	0.019	0.095	µg/L	<	0.038	<	0.038				<	0.038	<	0.038			
TOT	Molybdenum	0.1	0.5	µg/L		2.65		2.7	1.9%		0.93		2.79		2.77	0.7%		0.36
TOT	Nickel	0.2	1.	µg/L		35.8		37.3	4.1%		2.05		34.9		36.3	3.9%		1.97
TOT	Selenium	0.08	0.4	µg/L		0.561		0.577	2.8%		1.41		0.5		0.482	3.7%		1.83
TOT	Silver	0.02	0.1	µg/L		0.03		0.03				<	0.02	<	0.02			
TOT	Zinc	2.	10.	µg/L		27.5		65.1	**81.2%**	**a**	40.60		24.		14.7	**48.1%**	**a**	24.03
BTEX																		
DISS	Benzene	0.4	2.	µg/L		0.66		0.66					0.81		0.8	1.2%		0.62
DISS	Toluene	0.4	2.	µg/L		1.6		1.	**46.2%**	**b**	23.08		1.2		0.51	**80.7%**	**b**	40.35
DISS	Ethylbenzene	0.4	2.	µg/L		0.75		0.62	19.0%		9.49		0.66		0.62	6.3%		3.13
DISS	Xylenes	0.4	2.	µg/L		3.2		2.6	20.7%		10.34		2.		1.8	10.5%		5.26
PAH																		
TOT	Total PAH	0.01	0.05	µg/L		8.7		8.3	4.7%		2.35		2.6		2.5	3.9%		1.96
TOT	Acenaphthene	0.01	0.05	µg/L		2.7		2.6	3.8%		1.89		1.2		1.2			
TOT	Acenaphthylene	0.01	0.05	µg/L		0.027		0.025	7.7%		3.85		0.066		0.054	20.0%		10.00
TOT	Anthracene	0.01	0.05	µg/L		0.29		0.28	3.5%		1.75		0.085		0.081	4.8%		2.41
TOT	Benzo(a)anthracene	0.01	0.05	µg/L		0.077		0.091	16.7%		8.33	<	0.01	<	0.01			
TOT	Benzo(a)pyrene	0.005	0.025	µg/L		0.015		0.025	**50.0%**	**b**	25.00	<	0.005	<	0.005			
TOT	Benzo(b,j)fluoranthene	0.01	0.05	µg/L		0.021		0.047	**76.5%**	**b**	38.24	<	0.01	<	0.01			
TOT	Benzo(g,h,i)perylene	0.02	0.1	µg/L	<	0.02	<	0.02				<	0.02	<	0.02			
TOT	Benzo(k)fluoranthene	0.01	0.05	µg/L	<	0.01		0.016	**46.2%**	**b**	23.08	<	0.01	<	0.01			
TOT	Chrysene	0.01	0.05	µg/L		0.075		0.089	17.1%		8.54	<	0.01		0.011	9.5%		4.76
TOT	Dibenzo(a,h)anthracene	0.02	0.1	µg/L	<	0.02	<	0.02				<	0.02	<	0.02			
TOT	Fluoranthene	0.01	0.05	µg/L		0.87		0.82	5.9%		2.96		0.19		0.18	5.4%		2.70
TOT	Fluorene	0.01	0.05	µg/L		1.7		1.7					0.68		0.69	1.5%		0.73
TOT	Indeno(1,2,3-c,d)pyrene	0.02	0.1	µg/L	<	0.02	<	0.02				<	0.02	<	0.02			
TOT	Naphthalene	0.01	0.05	µg/L		0.52		0.37	33.7%		16.85		0.026		0.017	**41.9%**	**b**	20.93
TOT	Phenanthrene	0.01	0.05	µg/L		0.3		0.38	23.5%		11.76		0.079		0.085	7.3%		3.66
TOT	Pyrene	0.01	0.05	µg/L		0.54		0.53	1.9%		0.93		0.11		0.1	9.5%		4.76
Chlorinated Phenols																		
TOT	Chlorinated phenols (total)	0.41	2.05	µg/L		-		-					-		-			
TOT	Total Dichlorophenols	0.22	1.1	µg/L		-		-					-		-			
TOT	Total Monochlorophenols	0.09	0.45	µg/L		-		-					-		-			
TOT	Total Nonchlorinated phenols	1.6	8.	µg/L		-		-					-		-			
TOT	Total Phenolic Compounds	0.17	0.85	#N/A		-		-					-		-			
TOT	Total Tetrachlorophenols	0.17	0.85	µg/L		-		-					-		-			
TOT	Total Trichlorophenols	0.24	1.2	µg/L		-		-					-		-			
TOT	2-Chlorophenol	0.05	0.25	µg/L		-		-					-		-			
TOT	2,4 + 2,5 Dichlorophenol	0.1	0.5	µg/L		-		-					-		-			
TOT	2,4,6-Trichlorophenol	0.1	0.5	µg/L		-		-					-		-			
TOT	Pentachlorophenol	0.1	0.5	µg/L		-		-					-		-			
TOT	2,3,4,5-Tetrachlorophenol	0.1	0.5	µg/L		-		-					-		-			
TOT	2,3,4,6-Tetrachlorophenol	0.1	0.5	µg/L		-		-					-		-			
Emergening Contaminants																		
TOT	Perfluorobutanesulfonic acid	0.02	0.1	µg/L		0.37		0.38	2.7%		1.33		-		-			
TOT	Perfluorodecanesulfonic acid (PFDS)	0.02	0.1	µg/L		0.37		0.41	10.3%		5.13		-		-			
TOT	Perfluoroheptanesulfonic acid	0.02	0.1	µg/L	<	0.02	<	0.02					-		-			
TOT	Perfluorohexanesulfonic acid	0.02	0.1	µg/L		0.054		0.056	3.6%		1.82		-		-			
TOT	Perfluorononanesulfonic acid	0.02	0.1	µg/L	<	0.02	<	0.02					-		-			
TOT	Perfluorooctanesulfonic acid	0.02	0.1	µg/L		0.21		0.23	9.1%		4.55		-		-			
TOT	Perfluorooctanoic acid (PFOA)	0.02	0.1	µg/L		1.1		1.3	16.7%		8.33		-		-			
TOT	Perfluoropentanesulfonic acid	0.02	0.1	µg/L	<	0.02	<	0.02					-		-			
TOT	PF3A	0.02	0.1	µg/L		0.04		0.044	9.5%		4.76		-		-			
TOT	PF4A	0.02	0.1	µg/L	<	0.02	<	0.02					-		-			
TOT	PFBoA	0.02	0.1	µg/L		0.13		0.15	14.3%		7.14		-		-			
TOT	PFDA	0.02	0.1	µg/L		0.74		0.83	11.5%		5.73		-		-			
TOT	PFDoA	0.02	0.1	µg/L	<	0.02	<	0.02					-		-			
TOT	PFHpA	0.02	0.1	µg/L		0.45		0.51	12.5%		6.25		-		-			
TOT	PFHxA	0.02	0.1	µg/L	<	0.02	<	0.02					-		-			
TOT	PFNA	0.02	0.1	µg/L	<	0.02	<	0.02					-		-			
TOT	PFOSA	0.02	0.1	µg/L	<	0.02	<	0.02					-		-			
TOT	PFPeA	0.02	0.1	µg/L		0.39		0.42	7.4%		3.70		-		-			
TOT	PFUA	0.02	0.1	µg/L	<	0.02	<	0.02					-		-			
TOT	1,4-Dioxane	0.6	3.	µg/L		9.2		7.7	17.8%		8.88		14.		13.	7.4%		3.70

Notes:

FR1, FR2 - Field replicates 1 and 2.

FRM - Mean of field replicates.

MDL - Method detection limit.

COV - Coefficient of Variation

LOQ - Limit of quantification.

RPD - Relative percent difference.

na - Not applicable, some replicates less than the detection limit.

a *- Relative Standard Difference greater than 3% for general in o*

b *- Relative Standard Difference greater than 3% for general in o*

3.4 Summary

In summary, the 2021/22 quality assurance (QA) analysis indicates the following:

- Duplicate sampling frequencies of 14% (42/310 samples) for groundwater, 33% (21/67 samples) for surface water, 33% (4/12 samples) for the Hartland Valve Chamber compliance point, and 7.6% (6/62 samples) for the overall leachate sampling program. Overall, approximately 16% (69/439) of samples were duplicated, which exceeded the targeted duplicate sampling rate of 10%.
- Groundwater sampling and laboratory analysis have produced reliable results. The QA results indicated a total of 17 samples and 33 analytical results exceeded the RPD alert limits where all parameter concentrations were above the LOQ. Dissolved aluminum concentrations should be interpreted with caution, as 20% of the duplicate samples had dissolved aluminum concentrations above the alarm limit where all parameter concentrations were above the LOQ, indicating potential contamination during the sample handling or filtration process.
- Surface water sampling and laboratory analysis have produced reliable results. The QA results indicated a total of 11 samples and 29 analytical results exceeded the RPD alert limits where all parameter concentrations were above the LOQ.
- Leachate sampling and laboratory analysis have produced reliable results. A total of two (3) samples and eight (8) parameters had calculated RPD values that exceeded RPD alert limits when concentrations in both replicates were above the LOQ.
- A Mann-Kendall statistical trend analyses was conducted on water quality data collected from 82 groundwater monitoring wells, 8 leachate purge wells, 23 surface water stations and 1 leachate monitoring point for parameters that are known indicators of leachate and aggregate influences to evaluate temporal trends in water quality at the landfill. The results of trend analyses are discussed in the groundwater and surface water quality sections of this report.

4 Groundwater Flow

4.1 Data

A review of the sampling program was undertaken in early 2016 (AECOM 2016), and recommendations for modifications to the number, location and sampling frequency of compliance monitoring locations were implemented throughout the 2020/21 monitoring year. Groundwater elevations at the landfill were measured on a quarterly basis. The groundwater flow interpretation presented in this section is based on the following data:

- Continuous water level and leachate elevation monitoring using the SCADA system for the lower leachate lagoon, upper leachate lagoon, Phase 2 basin, wells 36-1-1 and 37-1-1, and one monitoring well located north of Phase 1 (40-1-1).
- Continuous water level monitoring in five purge wells south of Phase 1 (P1, P2, P3, P4 and P10).
- Continuous water level monitoring in six wells east of Phase 1 (17-1-1, 18-1-1, 54-1-1, 76-1-1, 89-1-1 and 89-2-1)
- Continuous water level and flow monitoring in or near three north purge wells (80-1-0-P8, 81-1-0-P9 and 52-4-0-P7) and two monitoring wells (52-3-0 and 52-1-1) located north of Phase 1.
- Continuous water level monitoring in ten wells north of Phase 2 (41-1-1, 43-1-1, 44-1-1, 62-1-1, 77-1-1, 78-1-1, 87-1-1, 87-2-1, 88-1-1 and 88-2-1).
- Continuous water level monitoring in four wells in the Hartland North Ridge area (91-1-1, 92-1-1, 93-1-1 and 94-1-1).
- Presence and elevation of topography, refuse, engineered covers, temporary tarps, ditches, and surface water features.
- Daily precipitation data.

Measured groundwater elevations for 2021/22 are presented in Appendix A.3. The data indicate that there are two separate groundwater flow systems at the Landfill. One is a regional groundwater flow system in the bedrock surrounding and underlying the landfill. The second is a perched system contained within the Phase 1 waste itself. A similar system has not been observed within the Phase 2 landfill thus far although low permeability liners, tarps and other barriers to vertical percolation may promote development of localized perched leachate systems during wet weather and over time. Although the two flow systems are separate, the presence of the leachate mound within the waste influences groundwater flow in the bedrock underlying the waste. Understanding these two flow systems is important for evaluating the effectiveness of leachate control and containment measures. The groundwater flow patterns are interpreted based on groundwater elevations measured in September 2021.

Monitoring wells 79-1-1, 79-2-1, 74-1-1 and 74-2-1 were decommissioned in June 2018 to accommodate blasting and site preparation for aggregate storage. The pressure transducer installed in 79-1-1 was removed from the well prior to decommissioning. Four new leachate monitoring wells (89-1-1, 89-2-1, 90-1-1 and 90-2-1) were installed in Phase 1 and Phase 2 in 2018 and 2019 to verify leachate capture and support management decisions.

In April 2020, four (4) pressure transducers were installed at locations 91-1-1, 92-1-1, 93-1-1 and 94-1-1 to continuously monitor water levels in the Hartland North Ridge area. Continuous water data are presented in Figure-4-9.

4.2 Regional Groundwater Flow in the Bedrock

Figure 4-1 presents regional groundwater flow based on groundwater elevations in bedrock wells and deep wells in refuse for August 2020. Within the landfill footprint, several wells (75-1-1, 82-1-1, VLGW-02-D, VLGW-03-D, VLGW-08-D, VLGW-15-D, VLGW-16-D and VLGW-17-D) are screened at or near the bottom of the waste and their water levels are interpreted as being representative of the regional groundwater flow system within bedrock underlying the landfill. Geological structures including the Highland Fault and another inferred fault near monitoring well 77-1-1 are shown in plan on Figure 4-1, and in cross section on Figure 4-2 and Figure 4-3. Measured groundwater levels and hydrogeologic testing indicates these structures influence local-scale groundwater flow patterns. Figure 4-2 is a cross-section that extends from north of the leachate lagoons to south of Phase 1 through the refuse and depicts groundwater flow in a north-south direction. Figure 4-3 shows groundwater flow in an east-west cross-section extending from the bedrock ridge located north and west of Phase 2 eastward to the eastern property boundary.

Groundwater flow patterns were consistent with previous years, with minor variations. Regional groundwater flow near the landfill is influenced by bedrock structures, topographic relief and the presence of surface water features. The regional groundwater flow direction is from southwest to northeast from Mount Work toward the north-south trending valley that underlies the northern portions of the Phase 1 and Phase 2 landfills.

Groundwater flow in the bedrock valley containing the landfill is predominantly northward as shown in Figure 4-1. Most of the leachate-impacted groundwater in the bedrock below the landfill flows northward to the lower leachate lagoon via the Phase 2 basin leachate collection system, micro-tunnel, leachate springs and purge wells (52-4-0-P7, 80-1-0-P8 and 81-1-0-P9) located north of Phase 1.

As shown on Figure 4-1, there is an inferred groundwater flow divide located near the southern end of the landfill and a small portion of groundwater below the southern portion of the Phase 1 landfill flows towards the southeast. This flow divide roughly corresponds to a bedrock high in the valley floor beneath the landfill. Southeastward groundwater flow below the landfill is constrained by a constructed clay berm/bedrock grout curtain installed at the south end of the landfill in the 1980s, and by five purge wells (P1, P2, P3, P4 and P10) which commenced pumping leachate in 2001. Leachate collected by the south purge well network is pumped from the south pumping station northward to the lower leachate lagoon.

Near the North Ridge and Hartland North Pad (northwest of Phase 2), groundwater flows radially from the topographic high north of Phase 2, with flow to the northeast (towards Heal Creek) and to the north (towards Durrance Lake). The groundwater divergence is more apparent during wet fall, winter and early spring months when precipitation inputs increase infiltration and raise groundwater levels below the topographic ridge. During winter months, groundwater elevations have historically been several metres higher west of the Highland Fault than they are immediately east of the fault, indicating that the Highland Fault is a barrier to west-east groundwater flow. Geologic mapping of exposed bedrock on the North Ridge (AECOM 2018a) revealed an undulating bedrock surface with several closed depressions that allow for surface water pooling and enhanced recharge during wet weather, which is important for maintaining the Phase 2 hydraulic trap.

A bedrock ridge is located east of the landfill boundary, running roughly north-south between the Hartland Landfill and Kiowa Place Road. Groundwater in the shallow bedrock along the landfill boundary flows inwards toward the northern portion of Phase 1. Further east of the landfill boundary, the topography begins to slope eastward towards Tod Creek valley and the groundwater flow direction is likely eastward towards Tod Creek.

4.3 Leachate Elevations in Phase 1 and Phase 2

4.3.1 Phase 1

Groundwater monitors installed at varying depths in Phase 1 provide water level data to confirm leachate levels and flow directions within the refuse. In addition to the monitors, water level data is collected manually from selected landfill gas wells in Phase 1.

The leachate mound in the Phase 1 landfill is depicted along a north-south cross section in Figure 4-2**,** based on groundwater level and leachate measurements taken in September 2021. During the operating years of the Phase 1 landfill, the leachate mound within Phase 1 reached elevations of approximately 160 m asl (above mean sea level). Final cover was installed on Phase 1 in 1997 to limit infiltration. As shown on Figure 4-2, the leachate mound in the refuse is above the regional bedrock groundwater flow system, with downward gradients. The downward hydraulic gradients in the central portions of the landfill reverse to upward gradients due to pumping at the leachate collection purge wells at the north and south ends of the landfill. In 2021/22, leachate elevations within Phase 1 generally remained below 155 m asl, indicating an approximate 5 m decrease in the elevation of the leachate mound since Phase 1 landfill closure capping.

Figure 4-5 presents leachate levels in 14 gas monitors in the Phase 1 landfill. Although it is difficult to accurately measure leachate levels in gas wells, they do provide additional landfill leachate level information. Like previous years, leachate levels in the shallow landfill gas monitors typically show minor (i.e., ±1 m) variations, as the refuse has a relatively high porosity and exhibits relatively consistent recharge and discharge patterns. The relatively high leachate elevations in shallow gas wells screened in refuse (e.g., VLGW-21-D and VLGW-26-D) indicate downward vertical gradients from refuse to the underlying bedrock aquifer. A pressure transducer was installed in 89-2-1 in March 2019 to continuously record leachate levels. As shown on Figure 4-5, leachate elevations in the shallow well 89-2-1 were generally stable over time, ranging from 149.4 to 151.2 m asl.

Like previous years, leachate elevations in the deep gas monitors (VLGW-02-D, VLGW-03-D, VLGW-08-D, VLGW-15-D, VLGW-16-D and VLGW-17-D) continued to fluctuate in response to seasonal variability in groundwater recharge, indicating that the lower portions of the Phase 1 landfill are in hydraulic connection with the regional groundwater flow system. Leachate monitoring well 89-1-1 was installed in November 2018 to replace the decommissioned well 74-1-1. Well 89-1-1 was screened at the bottom of the refuse unit to facilitate measurement of leachate mound levels. In 2021/22, leachate levels in 89-1-1 reached higher values and showed greater fluctuations than in 2020/21, ranging from 150.1 to 153.5 m asl. The highest leachate elevation was observed in September 2021.

Well 75-1-1 is located downgradient of the other wells at the north end of Phase 1 and interacts with the deep regional water table. Like previous years, groundwater elevations in well 75-1-1 ranged from approximately 128 to 130 m asl in 2021/22 (Figure 4-5). The relatively high leachate elevations in shallow monitors VLGW-21-D (145.6 m asl) and VLGW-26-D (144.5 m asl), both located within 50 m of well 75-1-1 and screened in refuse, indicate that strong downward vertical gradients are present in this area of the landfill.

4.3.2 Phase 2 Basin

The Phase 2 landfill is in a large bedrock basin situated immediately west of the north end of the Phase 1 landfill. The Phase 2 landfill is segregated into multiple cells. Cell 1 and Cell 2 are complete, and Cell 3 is currently active. Leachate from Cell 1 and Cell 2 is captured via the 350 mm diameter micro-tunnel by gravity and transmitted to the lower leachate lagoon. After reporting to the lower leachate lagoon, all leachate is discharged to the sanitary sewer via the leachate pipeline. A geomembrane liner separates Cell 2 and Cell 3, and leachate from Cell 3 is captured via the new Toutle drain which reports to the upper leachate lagoon prior to final discharge into the leachate pipeline and sanitary sewer.

Figure 4-8 presents hydrographs for the groundwater monitoring wells and leachate wells located north of the Phase 2 basin. For proper operation of the hydraulic trap leachate collection system, groundwater levels north of Phase 2 need to be higher than leachate levels inside the Phase 2 basin. During typical operations, leachate levels within the Phase 2 basin are typically around 113 m asl, 8 to 10 m lower than groundwater elevations outside the basin (AECOM 2020b). In 2021/22, groundwater elevations at surrounding locations 36, 37, 38, 39, 62, 77, and 78 remained higher than leachate levels in the Phase 2 basin, indicating the leachate collection system is functioning effectively.

Leachate monitoring wells (82, 83, 84, 86 and 90) were installed to investigate potential leachate mounding within the Phase 2 refuse. Wells 84 and 86 were damaged and subsequently decommissioned. New leachate monitoring wells (90-1-1 and 90-2-1) were installed in 2018-2019 to verify leachate capture and facilitate measurement of leachate mound levels. Drilling observations and subsequent monitoring indicated that the waste mass was moist, but largely unsaturated. Although higher (i.e., >125 m asl) leachate levels in 82-1-1 and 83-1-1 were observed in the northern Phase 2 area (Figure 4-8), leachate levels were typically within their well screens. Higher leachate levels may be related to the presence of condensate, historical tarping or low permeability strata within the refuse, not the presence of leaching mounding. Well 90-1-1 and 90-2-1 remained dry in 2021/22. Leachate elevations in Phase 2 were typically approximately 0.8 m below the elevation of the unlined lower leachate lagoon, but since January 2022, leachate elevations in Phase 2 began to exceed the leachate elevation in the lower lagoon. Leachate elevations in Phase 2 continued to rise to a maximum of approximately 115 m asl in March 2022 (0.6 m higher than the leachate elevation in the lower lagoon), which may indicate the onset of a small leachate mound in Phase 2.

Figure 4-8 also shows a hydrograph of the leachate levels in the lined upper leachate lagoon and the unlined lower leachate lagoon based on transducer readings recorded by the SCADA system. In 2021/22, leachate levels in upper lagoon generally remained around 124 m asl. On November 19, 2021, the upper lagoon reached to peak of 78% full (128.4 m asl) due to extreme precipitation. Due to the higher flow rate of the CRL, water levels then gradually decreased and return to normal operating level of 124 m asl on November 30, 2021. Water levels in the lower leachate lagoon remained around 114.5 m asl throughout the year, except for short period of time in November 2021 when precipitation levels were exceptionally high. In January 2021, the set points in the lower lagoon were increased to 114.8 m asl in response to elevated leachate volume in the upper leachate lagoon. The available leachate storage capacity in both lower and upper lagoons were not exceeded in 2021/22.

As landfill development continues, it will be important to continue to confirm leachate levels within each phase of the landfill to verify seismic stability, confirm that the Toutle leachate underdrain and Phase 2 hydraulic trap are functioning, and to determine if additional leachate containment measures are necessary. It is recommended that the elevation of the leachate mound within Phase 2 be determined at least once every five years, with the next evaluation required before 2025.

4.4 Groundwater Flow in the Bedrock Aquifer

4.4.1 East of Phase 1

Figure 4-4 shows groundwater elevations at locations 17, 18, 54 and 76, located on the bedrock ridge east of Phase 1. Dramatic change in water levels at location 18 have occurred occasionally since 2001. In 2016/17, groundwater elevations in the deepest wells at location 18 increased by approximately 8 m relative to years prior and resulted in diminishing westward hydraulic gradients. As per 2018/19 annual monitoring recommendations (AECOM 2019a), pressure transducers were installed in wells 18-1-1, 76-1-1, 17-1-1 and 54-1-1 to continue monitor the groundwater elevations and confirm groundwater flow is toward the landfill.

As shown on Figure 4-4, groundwater levels in 18-1-1 have returned to historical levels since 2018, indicating that westward hydraulic gradients restabilized. In 2021/22, groundwater levels in 18-1-1 remained approximately 6-7 m lower than those in 76-1-1. Similarly, groundwater elevations at 54-1-1 are consistently higher than those in 17-1-1, indicating a westward component of groundwater flow at these locations. Like previous years, groundwater data at monitoring station 76 indicate strong downward hydraulic gradients, however groundwater data collected at station 18 in 2021/22 indicate low downward to neutral gradients. Groundwater levels should continue to be monitored in these locations to verify groundwater gradients remain inward toward the landfill.

4.4.2 North of Phase 1

Groundwater quality data at wells downgradient of the north purge wells indicate that the purge well system operated since 1998 has had a mitigating effect on northward migration of leachate. In July 2016, monitoring well 81-1-0-P9 became operational in an ongoing effort to increase leachate collection capacity upgradient of well 40-1-1. The influence of pumping the north purge wells (80-1-0-P8, 52-4-0-P7 and 81-1-0-P9) on groundwater flow directions is illustrated in plan on Figure 4-1, with the 115 m, 120 m and 125 m water table contours deflected southward due to drawdown of the water table surrounding the north purge wells. In 2021/22, a total of 18,140 m^3 of leachate was removed by the north purge wells, which was lower than in 2020/21 (24,790 m^3) and 2019/20 (24,494 m^3). The highest leachate discharge rate was observed in late January 2022, with a peak flow of 173 m^3/day.

Figure 4-6 presents precipitation and groundwater elevation data for monitoring wells located near the Phase 1 north purge well system (40-1-1, 52-1-1, 52-3-0, 52-4-0-P7, 80-1-0-P8 and 81-1-0-P9). Leachate discharge rates for the north purge wells (52-4-0-P7, 80-1-0-P8 and 81-1-0-P9) are also presented to illustrate the volume of leachate extracted and its relationship to precipitation events. Monitoring well 52-3-0 is the original purge well that operated between 1995 and 1998 and is located within 2 m of well 52-4-0-P7. Water levels in well 52-3-0 are affected by the pumping rate in 52-4-0-P7 and seasonal variations in groundwater recharge. Pressure transducers connected to SCADA are installed in wells 40-1-1, 52-3-0, 52-4-0-P7, 80-1-0-P8 and 81-1-0-P9 to provide long-term monitoring of purge well performance north of Phase 1.

As shown on Figure 4-6, leachate discharge from the north purge wells increased significantly in January/February 2022 in response to intense precipitation. A total of 5,839 m^3 of leachate was discharged during that period, and the daily average leachate flow was approximately 99.0 m^3/day.

In 2021/22, groundwater levels in 52-1-1 remained consistent with previous years, but groundwater levels in 52-3-0 increased substantially. The increase in groundwater elevations at 52-3-0 may reflect abundant precipitation during the fall of 2021 and a relatively low leachate discharge rate at 52-4-0-P7. The average water levels in the north purge wells 80-1-0-P8 and 81-1-0-P9 were 113.4 and 118.8 m asl, respectively, which are consistent with those reported in 2020/21. In 2021/22, the average water levels in 52-4-0-P7 was 113.4 m asl, an increase of approximately 1.3 m from the 2020/21 average.

Groundwater elevations in the wells surrounding the north purge well system should continue to be monitored to confirm that the north purge wells are functioning properly. Regular pump and well maintenance is required to maintain leachate capture and therefore minimize potential future leachate impacts around the lower leachate lagoon at locations 40, 20 and 21.

4.4.3 South of Phase 1

The CRD installed six leachate collection purge wells at the south end of the Phase 1 landfill in August 2000 to intercept leachate migrating south of the Phase 1 groundwater divide. Pumps were installed in four of these wells (P1, P2, P3, and P4) and they have been in operation since September 2001 (continuously since May 2002). The remaining two wells (P5 and P6) were not outfitted with pumps due to low well yield. An additional well (P10) was installed in 2010 to augment pumping capacity south of the landfill.

Groundwater elevations measured using pressure transducers in each of the five operational south purge wells are plotted on Figure 4-7. The on/off cycling of the pumps is evident as water levels generally ranged from approximately 133 to 151 m asl, except during a pump failure in P3 between February and April 2022, when groundwater elevations in P3 reached approximately 156 m asl. These large and rapid changes in water levels imply the subsurface materials have a low transmissivity and bulk porosity, and the cone of depression associated with each purge well may be limited in lateral extent. Some fluctuations are related to pump maintenance events and short-term power disruptions.

Groundwater elevations in the south purge wells have fluctuated since 2007. Although elevations have remained somewhat greater than recommended, the installation of P10 in September 2010 and the pump upgrades to P1 between 2015 and 2017 resulted in significantly improved drawdown. Unfortunately, P1 required significant maintenance due to well fouling by leachate due to the well/pump design. In November 2018, P1 was re-installed and produces approximately of 1.01 L/s of leachate. The replacement well is screened in refuse only from 6.10 to 12.19 m below ground surface. Despite the shallower installation depth, the well removes a similar volume of leachate. In November 2020, the pump in P1 was rebuilt and the pressure transducer was re-installed. The lower set point was changed to 147.3 m asl, which is the lowest possible depth without burning out the pump.

In 2021/22, water levels in all south purge wells remained within their normal ranges, except for P1. Groundwater levels in P1 were around 147.7 m asl and stable throughout most of the monitoring year but increased from November 2021 to February 2022, reaching a maximum of approximately 151.6 m asl in February. The increase in groundwater levels in P1 likely reflects a decline in pump performance or increased infiltration following the atmospheric rivers in November 2021. Water levels in P3 and P10 also rapidly increased over 10-15 m during a short period of time due to pump failure. Pumps in both P3 and P10 were replaced and remained functional throughout the rest of 2021/22.

Water levels in the adjacent purge wells P2 and P4 remained below 136 m asl throughout the 2021/22 monitoring year. The pressure transducer in P2 is installed above the pump due to space limitations, but the consistent water level readings indicate that the P2 pump was functional throughout the year.

In 2021/22, a total of 35,252 m^3 leachate was removed by the south purge wells, which is approximately 5.2% less than that removed in 2020/21. The average daily flow in 2021/22 was 96.6 m^3/day, which was approximately 4.7% lower than in 2020/21. Overall, the slightly decreased leachate collection volume and increased water levels in south purge wells indicate the diminished performance of the south purge well system in 2021/22. Water levels south of Phase 1 should continue to be monitored to confirm that the south purge wells are functioning properly.

4.4.4 Phase 2 - North Ridge Area

A detailed assessment of hydrogeologic conditions below the north ridge was conducted in 2016, culminating in a hydrogeological conceptual model of the ridge (AECOM 2016). The report indicated that subvertical strike-slip faults (e.g., the Highland Fault near location 87/88 and inferred fault near location 77) behave as barriers to west-east groundwater flow, and create a compartmentalized groundwater flow system, while sub-horizontal tensile fractures behave as preferential conduits for groundwater flow. It is likely that bedrock discontinuities contribute to the large fluctuations in groundwater elevations observed beneath the North Ridge in response to seasonal precipitation and infiltration events. Geologic mapping of exposed bedrock on the North Ridge (AECOM 2018a) revealed an undulating bedrock surface with several closed depressions that allow for surface water pooling and enhanced recharge during wet weather, which is important for maintaining the Phase 2 hydraulic trap.

Figure 4-9 presents groundwater elevations in North Ridge area. The location of the groundwater divergence below the North Ridge has important implications for maintaining the hydraulic trap as the landfill expands northward in the future. Since 2006, ten new wells have been installed at five separate locations (77, 78, 79, 87 and 88) north of High Level Road to better understand the groundwater divergence and direction of groundwater flow north of Phase 2. Continuous water levels have been recorded at monitoring locations 77-1-1, 78-1-1, 87-1-1, 87-2-1, 88-1-1 and 88-2-1 to better understand natural temporal and spatial variability in groundwater elevations over time. In November 2019, four new groundwater monitoring wells (91-1-1, 92-1-1, 93-1-1 and 94-1-1) were installed in the North Ridge area to increase spatial coverage of groundwater monitoring and further define the groundwater divergence and overall groundwater flow regime at Hartland. Well 94-1-1 is in the northwest corner of Hartland North and considered a background well. Continuous groundwater elevations recorded in these four locations were presented in Figure 4-9. Some of these monitoring wells have been decommissioned in recent years to accommodate infrastructure development and construction of the aggregate stockpile on the North Ridge.

Like previous years, groundwater elevations in the North Ridge area exhibited strong seasonal fluctuations, and the groundwater divergence was more apparent during wet fall, winter and early spring months when precipitation inputs increase infiltration and raise groundwater levels. Groundwater levels are several metres higher west of the Highland Fault than they are immediately east of the fault, indicating that the Highland Fault is a barrier to west-east groundwater flow, especially during winter months. During the dry season, groundwater elevations beneath the North Ridge (62, 87 and 88) indicate a relatively broad and gently sloping piezometric surface near 167 m asl. Wells 93-1-1 and 94-1-1 are located along the inferred the groundwater divergence. Groundwater elevations in these wells indicated strong eastward groundwater flow along the height of land, with average hydraulic gradients of approximately 0.14 and 0.17 during the dry and wet seasons in 2021/22, respectively.

Groundwater discharge to surface near the bottom of the Phase 2 Basin is indicated by upward groundwater gradients that are typically observed at locations 27, 77, 87, 88, and seeps along the western extent of the bedrock quarry and within Toutle Valley. Groundwater from this area and the west side of Phase 1 is captured by the Cell 3 Toutle Valley Leachate Underdrain and the Phase 2 hydraulic trap leachate collection system. Groundwater discharge locations are discussed in detail in the Hydrogeology and Hydrogeology Report (AECOM 2020b). However, the upward hydraulic gradients at well location 27 diminished during the October 2021 and February 2022 monitoring events, which may be related to active quarrying in the Toutle Valley. Groundwater levels in well 27 should be closely monitored.

Given the importance of the groundwater divergence for leachate containment, the planned future quarrying in the Toutle Valley and the North Ridge should continue to be conducted under the direction of a qualified blasting professional to minimize the potential for blast-enhanced fracturing, with possible negative impacts on hydraulic properties, groundwater elevations, groundwater flow rates and leachate containment north of the Phase 2 landfill. There are risks to the performance of the hydraulic trap if blasting is not properly designed and implemented.

4.5 Summary

4.5.1 Leachate Flow

Leachate mounding continues to be present in Phase 1 of the landfill. Leachate elevations in Phase 1 were generally stable and exhibited minor seasonal variations. The leachate mound in the upper portion of the refuse is interpreted as being ‘perched’ above the regional bedrock groundwater flow system, with relatively high water levels and strong downward hydraulic gradients. Between 2016 and 2022, leachate elevations in the upper portion of the refuse generally remained below 155 m asl, indicating an approximate 5 m decrease in the elevation of the leachate mound since closure of the Phase 1 landfill in 1997.

The highest leachate elevations (155-157 m asl) were typically observed in the east/southeast area of the Phase 1 (46-2-1, VLGW-004D and VLGW-011S), which corresponds with higher topography/refuse heights. Leachate levels in deeper parts of the refuse respond to seasonal recharge events, indicating that the lower portions of the Phase 1 landfill are in hydraulic connection with the regional groundwater flow system in bedrock. Leachate well 89-1-1 was screened at the bottom of the refuse, and leachate elevations in 89-1-1 were generally higher than the previous monitoring year and showed greater fluctuations. In September 2021, leachate levels in 89-1-1 reached a maximum of 153.66 m asl, which is the highest leachate elevation that has been observed at 89-1-1. Leachate levels in 89-1-1 subsided through October to December 2021, but leachate levels increased again in January 2022 and have since remained around 1.1 m higher than the January 2021 average. This may reflect a delayed response of the bedrock aquifer below the landfill to the intense precipitation during November 2021.

Leachate elevations in Phase 2 (Phase 2 Basin) were elevated near the beginning of the 2021/22 monitoring period but increased substantially after intense rainfall in November 2021. In 2021/22, 90-1-1 and 90-2-1 were either dry or contained only few centimeters of leachate above the well screen. However, the higher (i.e., >125 m asl) leachate levels in 82-1-1 and 83-1-1 suggests the presence of a localized leachate mound in the northern Phase 2 area. In 2021/22, leachate levels in the Phase 2 basin were higher than in 2020/21, reaching a maximum elevation of 115.9 m asl in November 2021. Historically, leachate elevations in Phase 2 have been 1-2 m below the elevation of the unlined lower leachate lagoon, but leachate levels in Phase 2 began increasing in November 2021 and surpassed the elevation of the lower leachate lagoon in January 2022. Leachate levels in Phase 2 stayed above the elevation of the lower leachate lagoon for the rest of the 2021/22 monitoring period. Compared to the 2020/21 monitoring period, leachate levels in Phase 2 were approximately 0.21 m higher in the wet season and about 0.28 m higher in the dry season, which may be the result of the overall much higher precipitation in 2021/22.

4.5.2 Groundwater Flow

Groundwater flow in 2021/22 generally followed previously established patterns. Regional groundwater flows from Mount Work northeast to the north-south trending valley that underlies the northern portions of the Phase 1 and Phase 2 landfill. Most of the northward groundwater flow in the bedrock below the landfill is captured by the Toutle Valley Underdrain, Phase 2 basin leachate collection system, springs discharging to the lower lagoon and the north and south purge well systems (wells P1, P2, P3, P4, P7, P8, P9 and P10).

Groundwater monitors east of Phase 1 (locations 54, 76, 17 and 18) confirm flow from east to west toward the landfill, preventing off-site migration to the east.

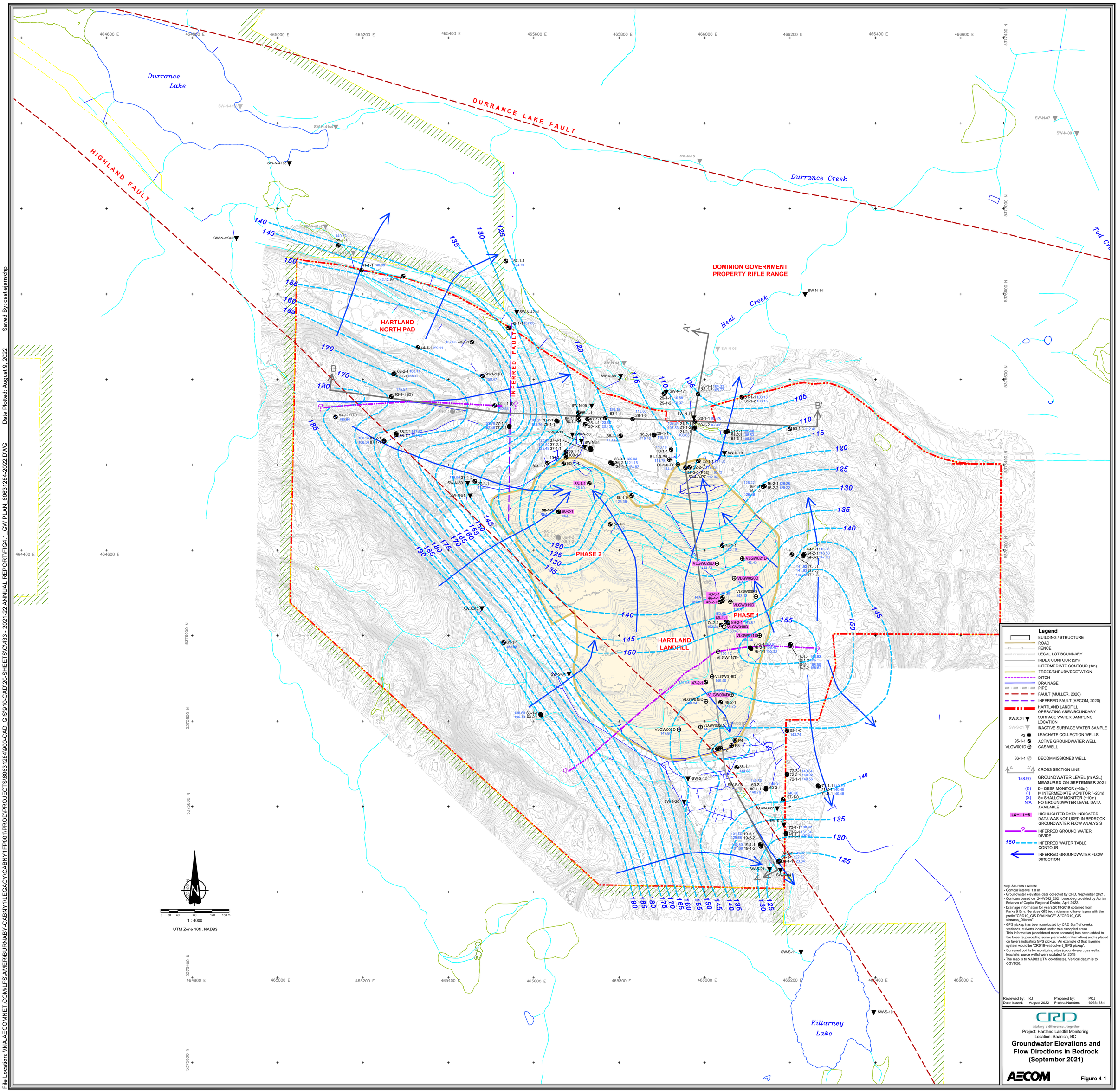
Pressure transducers installed in wells helped delineate the size of the drawdown cone surrounding the north purge wells. In 2021/22, a total of 18,140 m^3 of leachate was removed by the north purge wells, which was approximately 27% lower than that measured in 2020/21. The highest leachate extraction rate was observed in January 2021, with the peak flow of 173 m^3/day. Water levels in 40-1-1, 52-4-0-P7, 80-1-0-P8 and 81-1-0-P9 were generally consistent with historical ranges, indicating the leachate collection system is functioning effectively. However, water levels in 52-3-0 were higher than previous years, which may reflect higher precipitation in 2021 or diminished performance of leachate purge well 52-4-0-P7. Although leachate indicator concentrations in wells near 81-1-0-P9 have been slowly improving with the current pump settings, consideration should be given to either increasing the pumping rates or adjusting set points to achieve the groundwater elevations required to maintain pumping levels below the lower leachate lagoon and collect more leachate migrating from the area around the landfill gas plant. Closure of Phase 2 Cell 1 and the application of tarps to restrict infiltration and leachate generation appears to be slowly improving leachate containment north of the landfill.

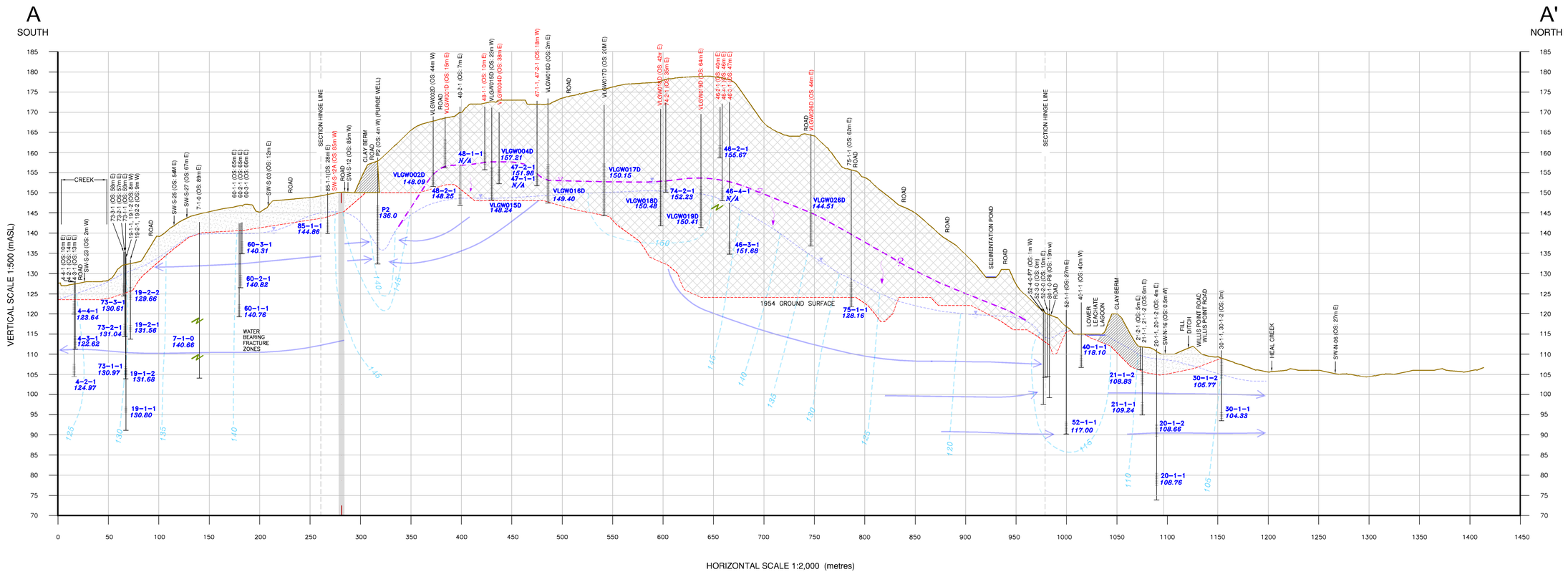
A small amount of groundwater flows southeastward from the south end of Phase 1 in the direction of Killarney Lake. Southeastward groundwater flow below the landfill is constrained by a constructed clay berm and bedrock grout curtain installed at the south end of the landfill and by drawdown cones associated with the south purge wells. In 2021/22, water levels all purge wells remained within their normal ranges, except for P1, P3 and P10. Water levels in P1 gradually increased from November 2021 to February 2022, reaching a maximum elevation of 151.6 m asl in February 2022. Water levels in P1 returned to normal levels at the end of February 2022. The water level increase in P1 may reflect abundant precipitation in 2021 or diminishing pump performance. Water levels in P3 reached relatively high values (i.e., > 155 m asl) during a pump failure in April 2022. Water levels in P10 increased to > 145 m asl during a pump failure in August 2021, and again during a suspected pump failure in December 2021/January 2022.

In 2021/22, a total of 35,252 m^3 leachate was removed by the south purge wells, which was approximately 5.2% less than the volume removed in 2020/21. The average daily flow in 2021/22 was 96.6 m^3/day, which was approximately 4.7% lower than that in 2020/21. Overall, the typical leachate collection volume and relatively consistent water levels in the south purge wells indicate proper function of the south purge well system throughout 2021/22. Water level and flow monitoring should continue to confirm that the south purge wells are functioning properly.

Similar to previous years, groundwater elevations in the North Ridge area exhibited strong seasonal fluctuations and the Highland Fault continued to function as a barrier to east-west moving groundwater. During the wet fall, winter and early spring months, the horizontal hydraulic gradients between 87, 88 and 62 were steeper and exhibited a more prominent groundwater divergence than is apparent in the summer. Wells 93-1-1 and 94-1-1 are located along the inferred groundwater divergence. Groundwater elevations in these wells indicated strong eastward groundwater flow along the height of land, regardless of seasonality.

In 2018, geologic mapping of exposed bedrock revealed several closed depressions and geologic structures that enhance groundwater recharge below the North Ridge. A pattern of divergent groundwater flow beneath the North Ridge has been confirmed, with a component of flow migrating to the east, south and north. Although a weak groundwater divide is currently present, inward (southward) flow must be maintained to preserve the hydraulic trap leachate containment system. To ensure leachate containment, it is necessary to continue close monitoring of this hydraulic divide and conduct detailed planning (including hydrogeologic modelling) prior to landfill development in this area. Engineered solutions may be required following blasting, levelling and development of the North Ridge to maintain the current level of infiltration and the elevation of the groundwater divergence.


DURRANCE LAKE FAULT
HIGHLAND FAULT
INFERRED FAULT
Durrance Lake
Durrance Creek
Heal Creek
Killarney Lake
HARTLAND NORTH PAD
HARTLAND LANDFILL
PHASE 1
PHASE 2
DOMINION GOVERNMENT PROPERTY RIFLE RANGE
A
A'
B
B'
Legend
BUILDING / STRUCTURE
ROAD
FENCE
LEGAL LOT BOUNDARY
INDEX CONTOUR (5m)
INTERMEDIATE CONTOUR (1m)
TREES/SHRUB/VEGETATION
DITCH
DRAINAGE
PIPE
FAULT (MULLER, 2020)
INFERRED FAULT (AECOM, 2020)
HARTLAND LANDFILL OPERATING AREA BOUNDARY
SURFACE WATER SAMPLING LOCATION
INACTIVE SURFACE WATER SAMPLE
LEACHATE COLLECTION WELLS
ACTIVE GROUNDWATER WELL
GAS WELL
DECOMMISSIONED WELL
CROSS SECTION LINE
GROUNDWATER LEVEL (m ASL) MEASURED ON SEPTEMBER 2021
D= DEEP MONITOR (>30m)
I= INTERMEDIATE MONITOR (~20m)
S= SHALLOW MONITOR (~10m)
NO GROUNDWATER LEVEL DATA AVAILABLE
HIGHLIGHTED DATA INDICATES DATA WAS NOT USED IN BEDROCK GROUNDWATER FLOW ANALYSIS
INFERRED GROUND WATER DIVIDE
INFERRED WATER TABLE CONTOUR
INFERRED GROUNDWATER FLOW DIRECTION
Map Sources / Notes:
- Contour interval 1.0 m
- Groundwater elevation data collected by CRD, September 2021.
- Contours based on 24-W542_2021 base.dwg provided by Adrian Betanzo of Capital Regional District, April 2022.
- Drainage information for years 2018-2019 obtained from Parks & Env. Services GIS technicians and have layers with the prefix "CRD19_GIS DRAINAGE" & "CRD19_GIS streams_Ditches".
- GPS pickup has been conducted by CRD Staff of creeks, wetlands, culverts located under tree canopied areas. This information (considered more accurate) has been added to the base (superceding some planimetric information) and is placed on layers indicating GPS pickup. An example of that layering system would be 'CRD19-wat-culvert_GPS pickup'.
- Surveyed points for monitoring sites (groundwater, gas wells, leachate, purge wells) were updated for 2019.
- The map is to NAD83 UTM coordinates. Vertical datum is to CGVD28.
Reviewed by: KJ
Prepared by: PCJ
Date Issued: August 2022
Project Number: 60631284
1 : 4000
UTM Zone 10N, NAD83
0 20 40 80 120 160 m
Making a difference...together
Project: Hartland Landfill Monitoring
Location: Saanich, BC
Groundwater Elevations and Flow Directions in Bedrock (September 2021)
AECOM
Figure 4-1
File Location: \\NA.AECOMNET.COM\LFS\AMERBURNABY-CABNY1\LEGACY\CABNY1FP001\PROD\PROJECTS\60631284\900-CAD_GIS\910-CAD\20-SHEETS\C433 - 2021-22 ANNUAL REPORT\FIG4.1_GW PLAN_60631284-2022.DWG
Date Plotted: August 9, 2022
Saved By: castlejanschp



Legend

- 85-1-1 (6.5m) — MONITORING WELL (NUMBER): INDICATES DISTANCE WELL IS FROM PLANE OF SECTION. WHERE NOT INDICATED, DISTANCE IS LESS THAN 2 m.
- SCREENED INTERVAL
- 85-1-1 (6.5m) — MONITORING WELL WATER LEVEL WAS NOT USED IN THE BEDROCK GROUNDWATER FLOW ANALYSIS
- WATER BEARING FRACTURES
- GROUND SURFACE
- LOCATION OF BEDROCK DERIVED FROM 1954 GROUND CONTOUR OR BEDROCK INTERSECTIONS IN BOREHOLES
- REFUSE
- CLAY BERM
- UNCONSOLIDATED SOIL AND FILL
- INTERPRETED GROUNDWATER POTENTIOMETRIC SURFACE IN BEDROCK
- INFERRED VERTICAL LEACHATE FLOW
- INTERPRETED LEACHATE MOUND
- INFERRED GROUNDWATER POTENTIOMETRIC CONTOUR
- INFERRED GROUNDWATER FLOW DIRECTION IN BEDROCK
- 103.75 — GROUNDWATER ELEVATION (mASL) SEPTEMBER 2021
- FAULT (MULLER, 1980)

Map Sources / Notes:
- Contours based on 24W542_2019-2021 base.dwg, provided by the Capital Regional District, April 2022.
- Stratigraphy between boreholes is inferred and may vary from that shown

0 10 20 40 60 80 m
1 : 2000
Section Looking West

Reviewed by: KJ
Date Issued: August 2022
Prepared by: PCJ
Project Number: 60631248

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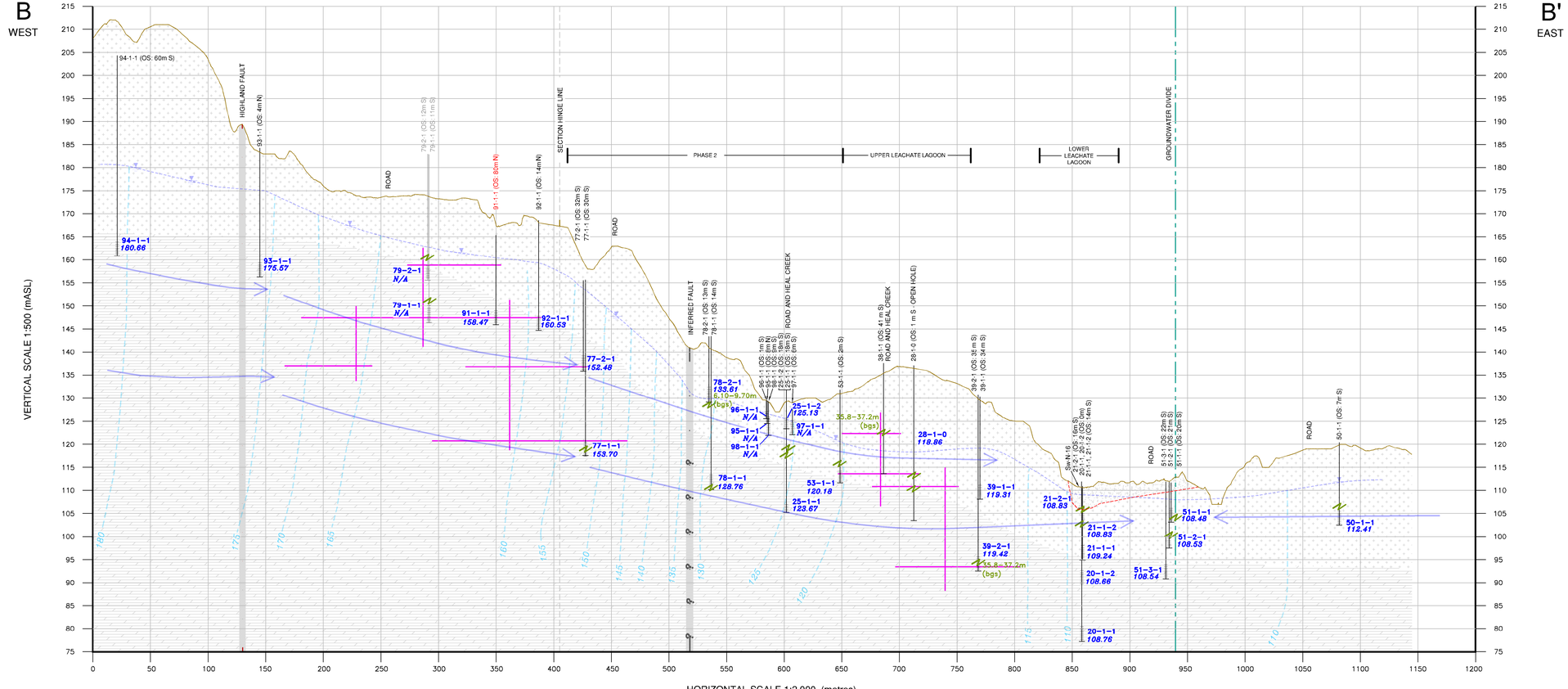
Project: Hartland Landfill Monitoring
Location: Saanich, BC

Groundwater Flow in Cross Section A-A' (September 2021)

AECOM

Figure 4-2

File Location: \\NA.AECOMNET.COM\LFS\AMER\BURNABY-CABNY1\LEGACY\CABNY1FP001\PROD\PROJECTS\60631284\900-CAD_GIS\910-CAD\20-SHEETS\C1433 - 2021-22 ANNUAL REPORT\FIG4.2-GW SECTION A-60631284-2022.DWG Date Plotted: August 8, 2022 Saved By: castlejanschp



Legend

- MONITORING WELL (NUMBER) INDICATES DISTANCE WELL IS FROM PLANE OF SECTION. WHERE NOT INDICATED, DISTANCE IS LESS THAN 2 m.
- SCREENED INTERVAL
- MONITORING WELL WATER LEVEL WAS NOT USED IN THE BEDROCK GROUNDWATER FLOW ANALYSIS
- OBSERVED FRACTURES ON DRILLED LOGS
- GROUND SURFACE
- LOCATION OF BEDROCK DERIVED FROM 1954 GROUND CONTOUR OR BEDROCK INTERSECTIONS IN BOREHOLES
- OVERBURDEN
- UNCONSOLIDATED SOIL AND FILL
- CLAY BERM
- SHALLOW WEATHERED AND BLAST ALTERED BEDROCK
- DEEP BEDROCK
- INTERPRETED GROUNDWATER POTENTIOMETRIC SURFACE IN BEDROCK
- INFERRED GROUNDWATER POTENTIOMETRIC CONTOUR
- INFERRED GROUNDWATER FLOW DIRECTION IN BEDROCK
- GROUNDWATER ELEVATION (mASL) SEPTEMBER 2021
- INFERRED HYDRAULIC CONNECTIONS
- GROUNDWATER DIVIDE
- FAULT (MULLER, 1980)
- INFERRED FAULT (AECOM, 2017)

Map Sources / Notes:
- Contours based on 24W542_2021 base.dwg, provided by the Capital Regional District, April 2022.
- Stratigraphy between boreholes is inferred and may vary from that shown.

1 : 2000
Section Looking North

Reviewed by: KJ
Date Issued: August 2022

Prepared by: PCJ
Project Number: 60631284

Making a difference...together

Project: Hartland Landfill Monitoring
Location: Saanich, BC

Groundwater Flow in Cross Section B-B' (September 2021)

AECOM

Figure 4-3

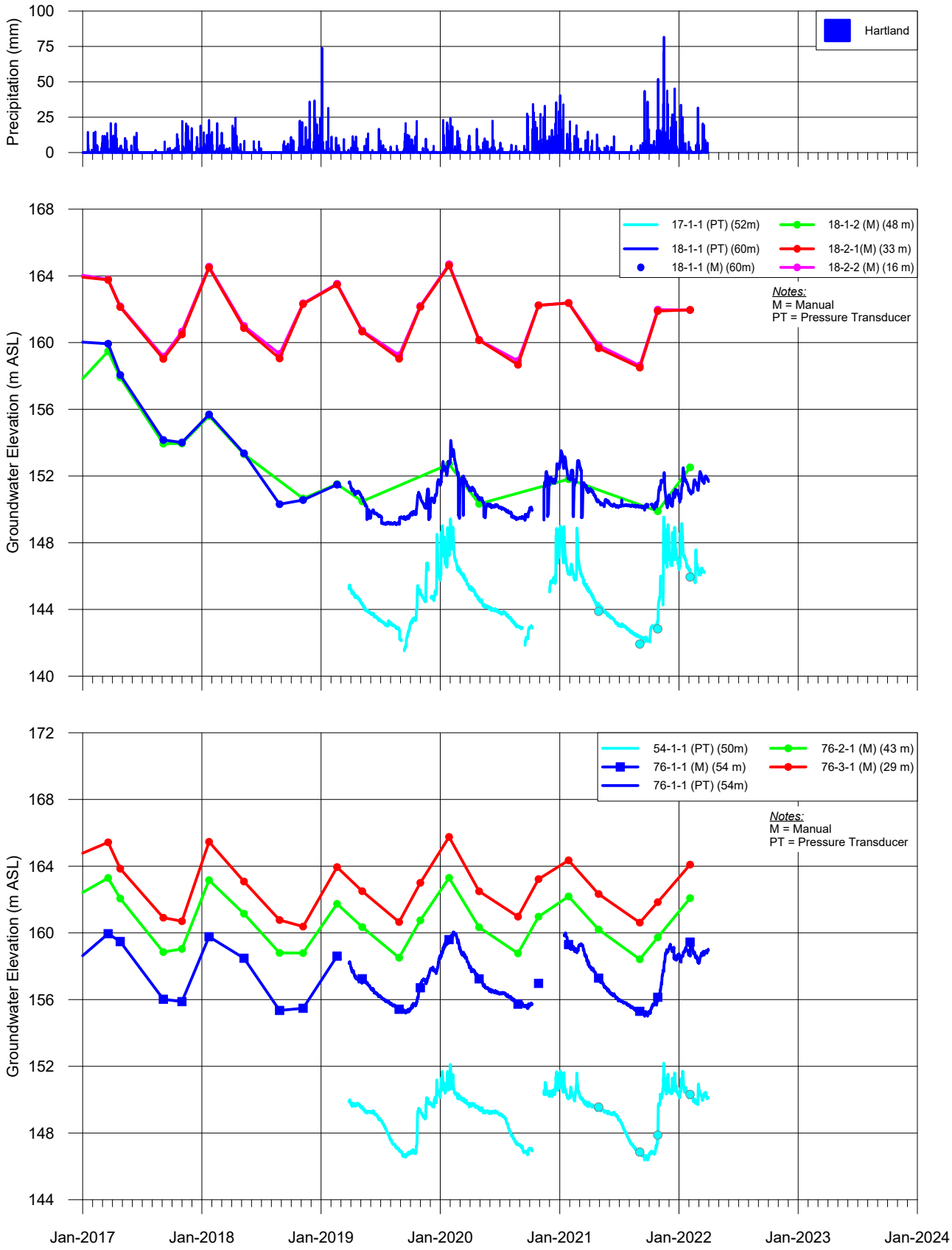


Figure 4-4. Groundwater Elevations East of Phase 1

AECOM

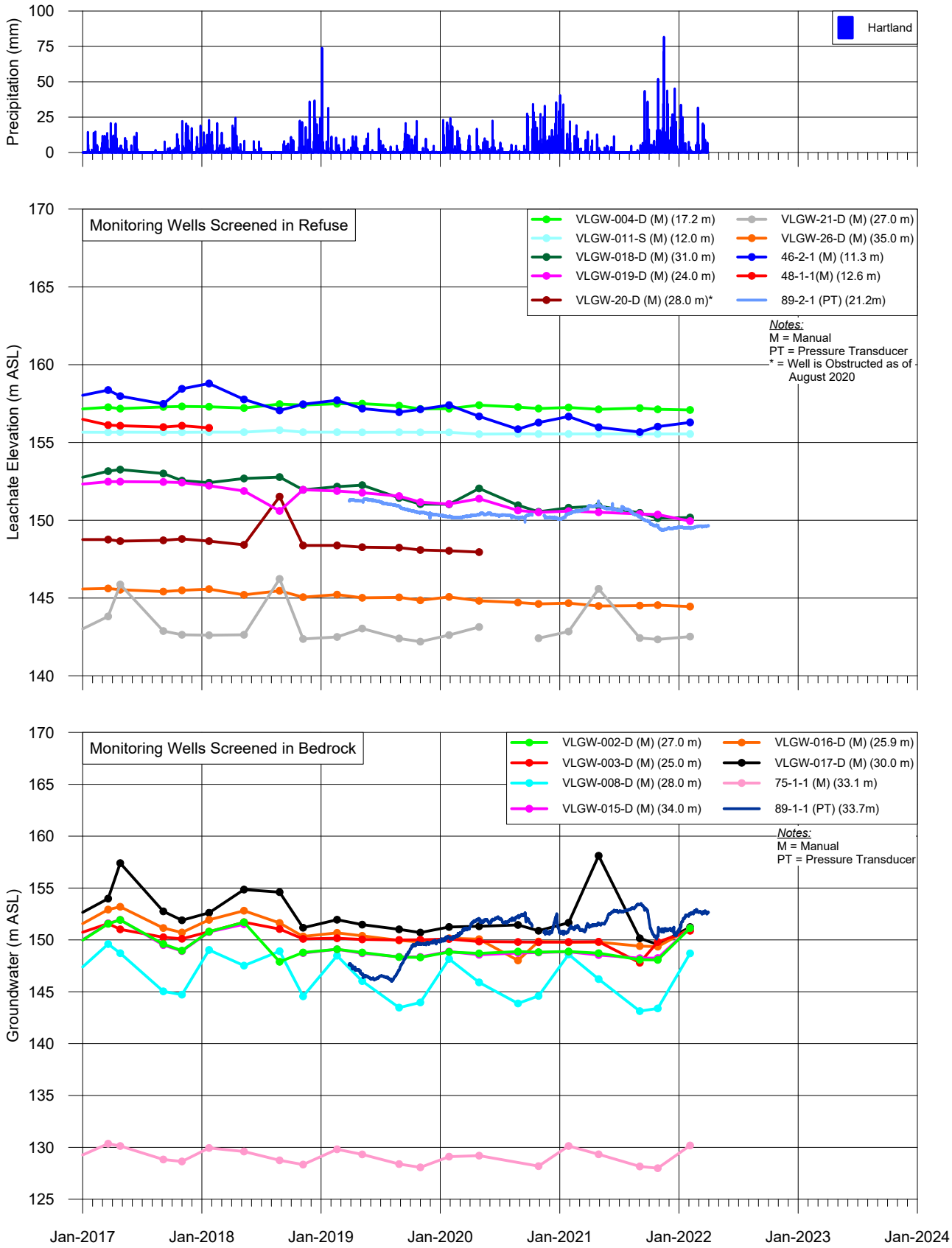


Figure 4-5. Leachate and Groundwater Elevations Within Phase 1

AECOM

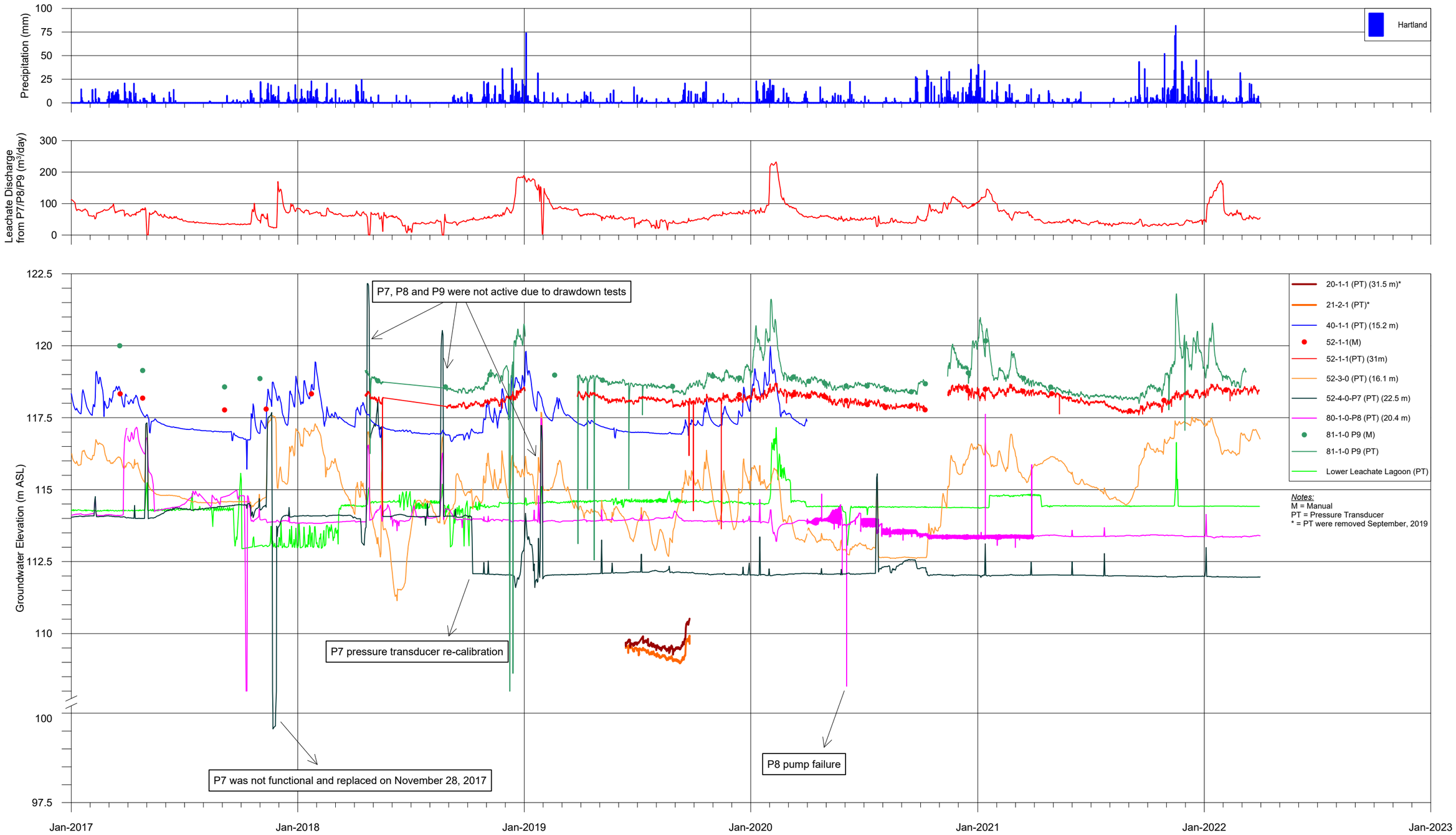


Figure 4-6. Groundwater Elevations Surrounding the North Purge Wells

AECOM

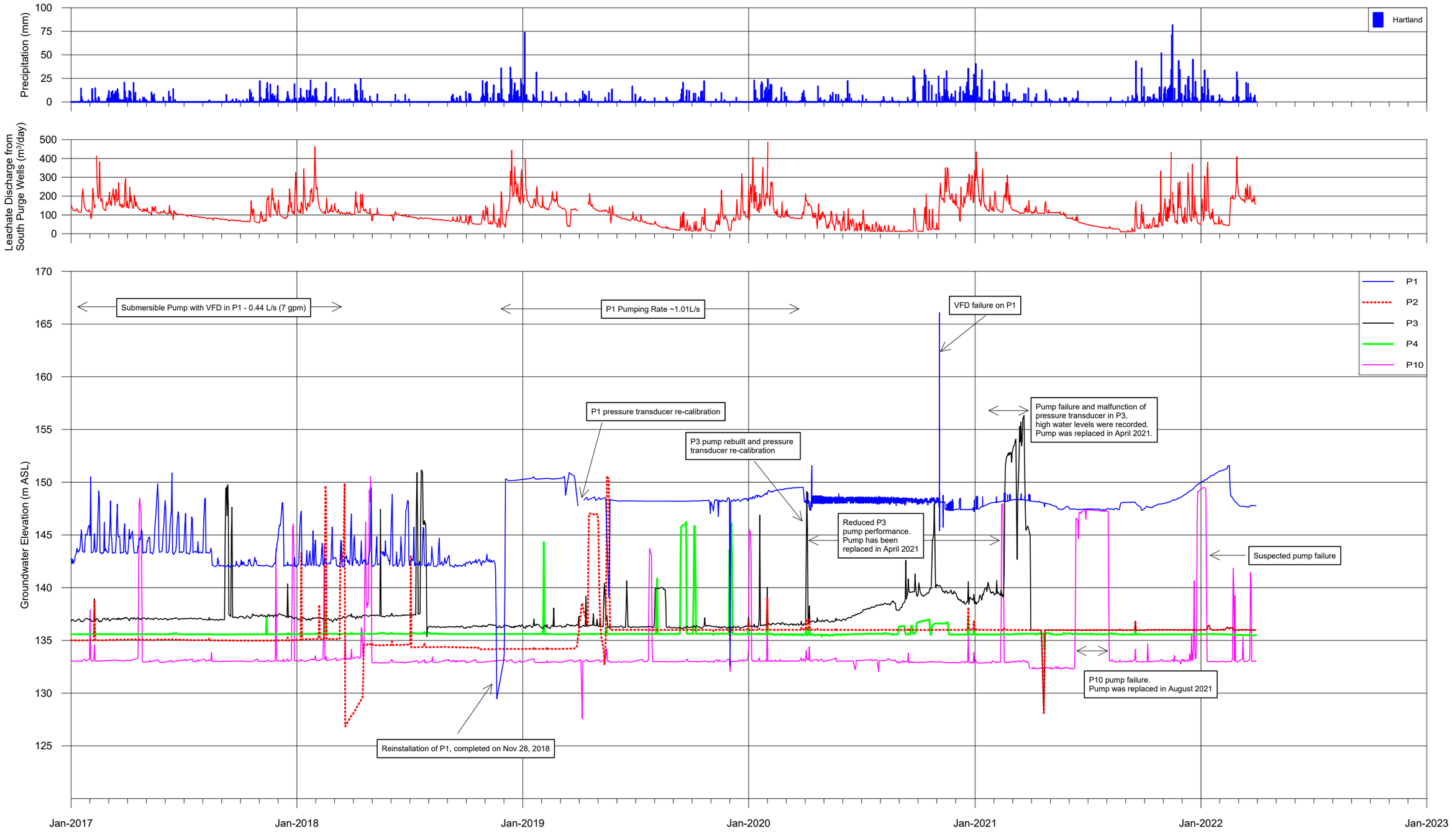


Figure 4-7. Groundwater Elevations in the South Purge Wells

AECOM

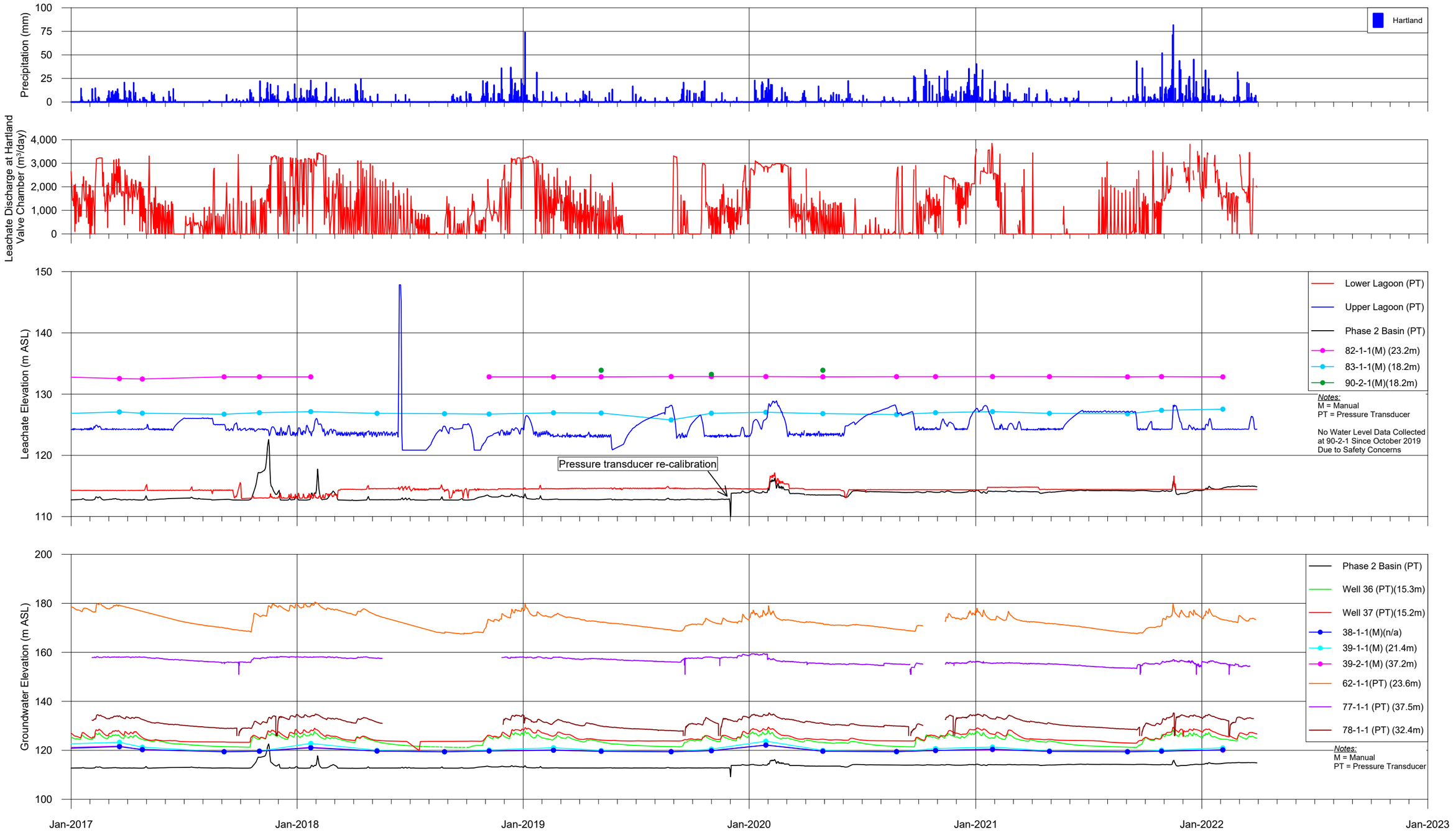


Figure 4-8. Water Elevations Within the Leachate Conveyance System and Surrounding the Phase 2 Basin

AECOM

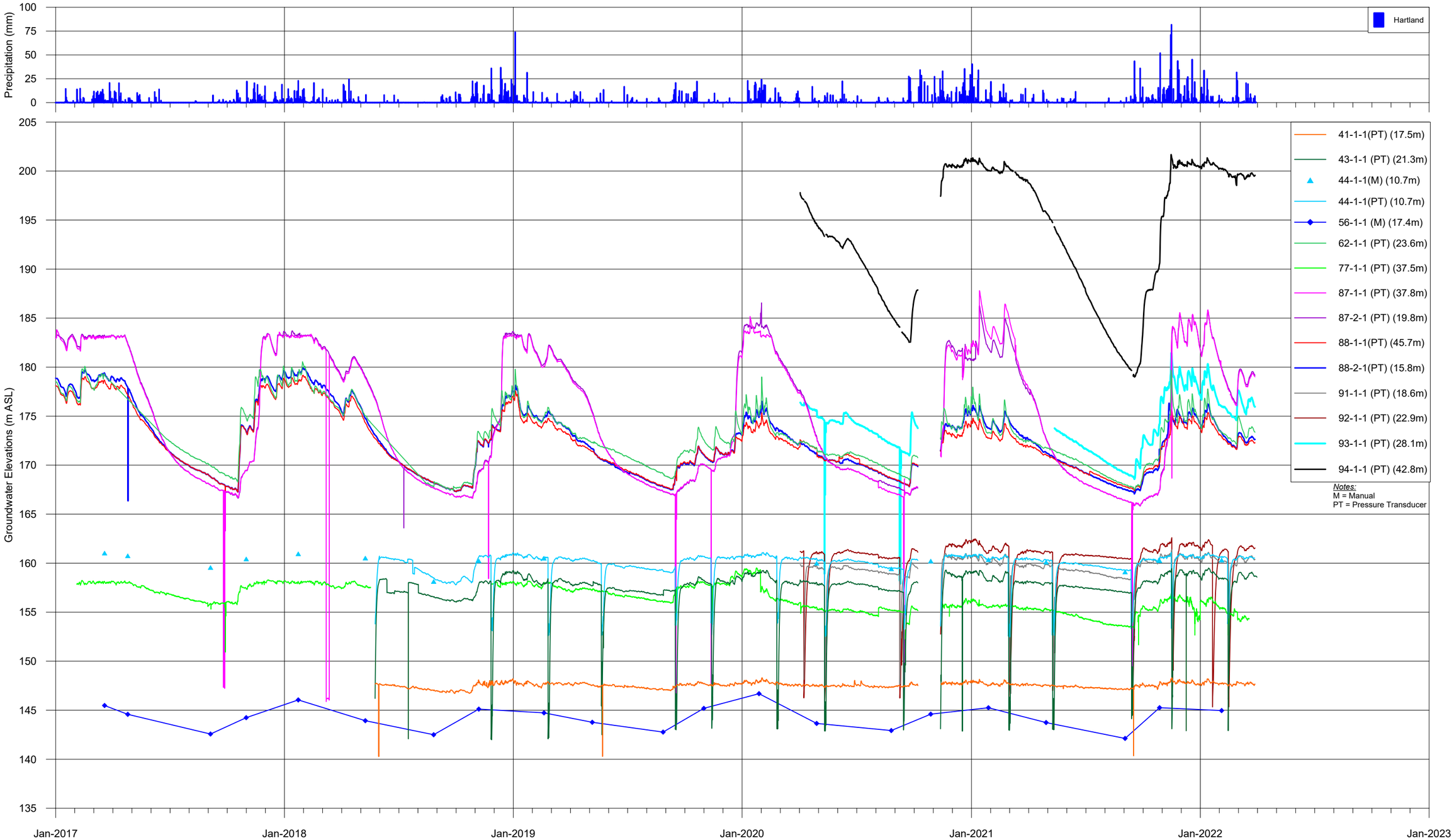


Figure 4-9. Groundwater Elevations in the North Ridge Area

AECOM

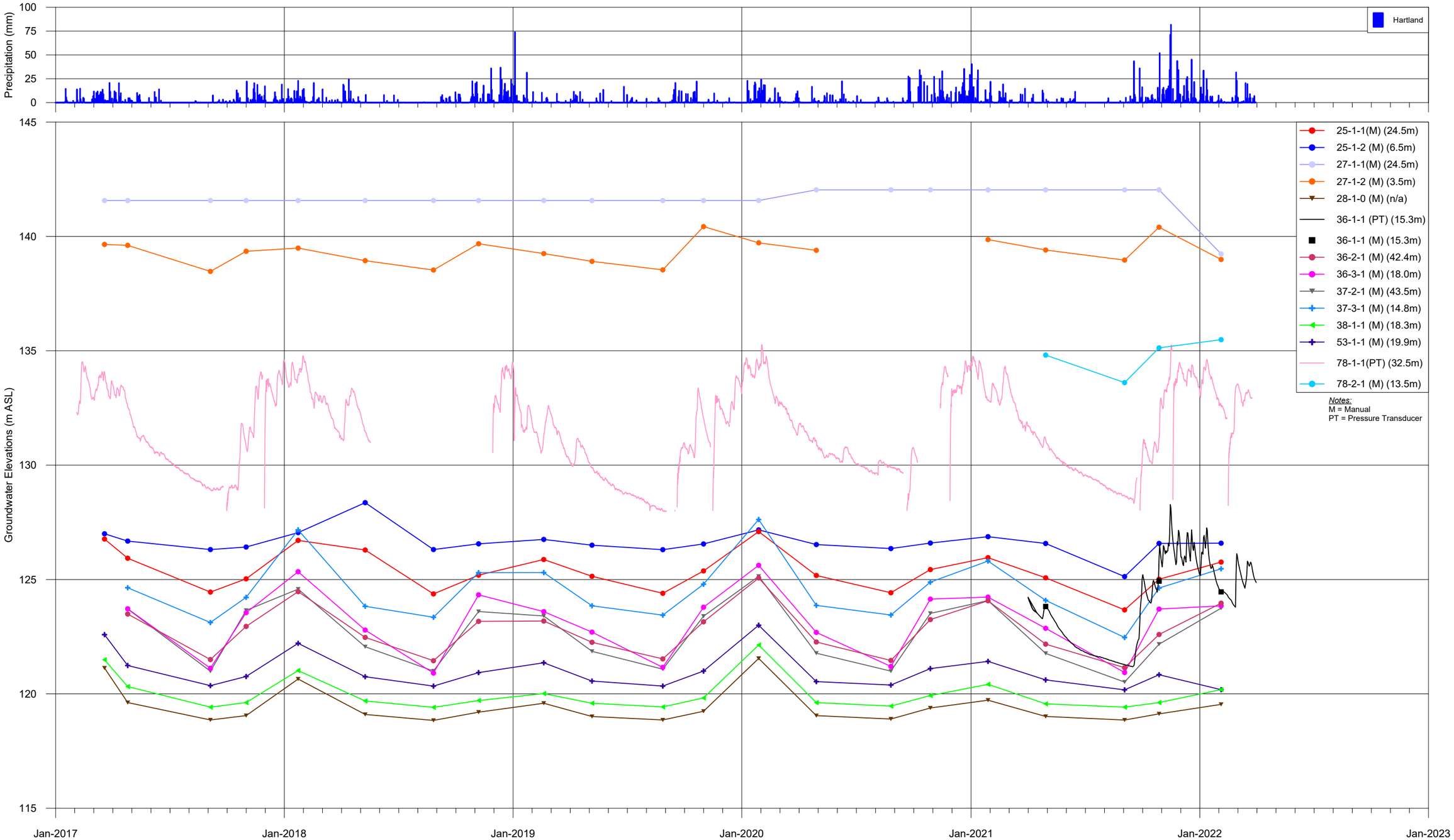


Figure 4-10. Groundwater Elevations North of the Phase 2 Landfill

AECOM

5 Groundwater Quality Monitoring Wells

5.1 Compliance Groundwater Monitoring Locations

A total of 36 compliance monitoring wells have been identified at 19 different locations at the Hartland Landfill. These stations are concentrated along the south, east and northern property boundaries and are located downgradient of areas that have the potential to be impacted by leachate or runoff from the site. With respect to assessing landfill compliance with the landfill operating permit, the monitoring wells listed below are considered Boundary Compliance Wells.

South of the Landfill (10)

- 04-3-1, 04-4-1
- 71-1-1, 71-2-1, 71-3-1
- 72-1-1, 72-3-1
- 73-1-1, 73-2-1, 73-3-1

East of the Landfill (6)

- 17-1-1, 17-1-2, 17-1-3
- 18-1-1, 18-2-1, 18-2-2

North of the Landfill (15)

- 20-1-1, 20-1-2
- 21-1-1, 21-1-2, 21-2-1
- 28-1-0
- 29-1-1, 29-1-2
- 30-1-1, 30-1-2
- 31-1-1, 31-1-2
- 39-1-1, 39-2-1
- 53-1-1

North of the Hartland North Pad (5)

- 41-1-1
- 42-1-1
- 55-1-1
- 56-1-1
- 57-1-1

Compliance was assessed per Section 5.2. All data, including the applicable standards, are provided in Appendix B. Values that exceed CSR standards are noted with footnotes. Analytical results for groundwater samples collected from monitoring wells for the reporting period are presented in Appendix B.1. Table 5-1 presents a summary of the wells that exceeded CSR standards for one or more parameters in 2021/22. The majority of exceedances represent groundwater samples collected from leachate collection wells or in close proximity to leachate collection infrastructure. In addition, nitrate concentrations in some shallow groundwater wells (78-2-1, 87-2-1, 88-2-1) near the Hartland North Pad exceeded applicable CSR DW standard during Q4 2021 or Q1 2022 sampling events reflecting the influence of nearby aggregate stockpiles on groundwater quality.

A review of the sampling program was undertaken in early 2016, and recommendations for modifications to the number, location and sampling frequency of compliance monitoring locations were implemented beginning in the 2016/17 monitoring year. Groundwater quality data at compliance wells 04-2-1 and 72-2-1 has not been collected since 2016 due to the low recharge rate in the wells. These wells are no longer considered compliance locations.

Both DW and AW standards for iron and manganese are no longer applied to municipal landfills, based on the Stage 8 Amendments to the CSR.

Typical quarterly monitoring conducted by the CRD includes both compliance wells and other non-compliance locations that contribute to a fulsome understanding of landfill processes and potential for environmental risk.

5.2 Assessment of Groundwater Quality Impacts

The primary causes for any groundwater quality degradation at the site include leachate, road salt and aggregate production, stockpiling or use for construction purposes. Professional judgement is used to differentiate between different contaminant sources (leachate, road salt and aggregates) and to assess the nature and degree of any impacts. The authors are hydrogeologists and geochemists with considerable experience at other landfills in coastal regions of British Columbia. Groundwater quality may be judged to be impacted relative to background without exceeding regulatory criteria, and therefore compliant. If concentrations exceed CSR AW or DW standards for groundwater quality at the property boundary, standard protocols for notification of affected property owners should be followed.

Relative concentrations and patterns of conductivity, ammonia, chloride, sulphate and nitrate are compared to background concentrations to differentiate between the site's typical contaminant sources as outlined below:

- Background conductivity is typically below 500 µS/cm, but has been observed in some background wells at concentrations up to 1,000 µS/cm immediately after well installation, or following prolonged dry periods. Background ammonia concentrations are typically below 0.1 mg/L, but occasionally reach 0.5 mg/L downgradient of wetland areas. Background chloride concentrations are typically below 20 mg/L. Background sulphate concentrations are typically below 50 mg/L, but are regularly observed at concentrations up to 100 mg/L in wells screened within weathered bedrock and near geologic alteration zones.
- Groundwater is considered to be impacted by leachate when conductivity concentrations are above 1,000 µS/cm, ammonia concentrations are above 1 mg/L and chloride concentrations are above 20 mg/L. Peak concentrations in leachate impacted wells are typically observed during the dry summer and early fall months, when there is limited dilution by precipitation.
- Groundwater is considered impacted by aggregate (e.g. production, stockpiling or site construction works) when sulphate is present at concentrations above 75 mg/L and ammonia or nitrate are present at concentrations above background levels of 0.1 mg/L. Peak concentrations are typically observed during the first sampling event following the onset of wet weather in the fall months.
- Groundwater is considered impacted by road salt when both conductivity (>1,000 µS/cm) and chloride (>20 mg/L) are elevated above background levels, but ammonia and its degradation products (primarily nitrate) are not elevated. Cl/Na molar ratios are also used to assess the source of potential chloride sources. Cl/Na molar ratios in road salt are generally equal to one, by assuming 100% purity in composition. During 2021/22, Cl/Na molar ratios in all purge wells except for P9 ranged from 0.42 to 0.89, with a median ratio of 0.58. Cl/Na ratios in P9 are generally above 1.5. Road salt impacted sites must also be located downgradient (or downstream) of surfaces where road salt is known to be applied. Concentrations of conductivity and chloride typically exhibit peaks following cold weather periods when de-icing salt is often applied to roadways.

5.3 Electrical Conductivity

Figure 5-1 presents the electrical conductivity values in plan for samples collected at Hartland Landfill in September 2021. Figure 5-2 and Figure 5-3 present north-south and east-west cross-sections through the landfill and north of the landfill that show conductivity values in September 2021. Electrical conductivity is a good indicator of the presence of inorganic parameters and a good indicator of potential leachate contamination when elevated ammonia and chloride are also present. The highest conductivity values are typically observed during the dry season (i.e., August/ September), and were utilized to interpret the conductivity contours.

On Figure 5-1, the 1,000 µS/cm conductivity contour line is interpreted as indicating the presence of leachate in groundwater. Figure 5-1 shows that the 1,000 µS/cm contour closely resembles the outline of current refuse disposal and indicates that groundwater in these areas has been affected by leachate.

Like previous years, conductivity values in north and south purge wells were generally above 1,000 µS/cm in 2021/22, except for 81-1-0-P9. As shown on Figure 5-1, conductivity values in the north purge wells were highest in P7, which was close to 4,400 µS/cm in November 2021. In 2021/22, conductivity values in the south purge wells ranged from 721 to 13,590 µS/cm, but the median conductivity was only slightly elevated compared to the previous monitoring year. Like previous years, the 1,000 µS/cm contour runs north of the north purge well system and Lower Leachate Lagoon, and extends south of P1, P2, P3, P4, P5, P6, and P10 of the south purge well system.

The 500 µS/cm conductivity contour is considered indicative of background groundwater quality. In September 2021, the 500 µS/cm conductivity contour along the northern boundary of the landfill expanded beneath the Upper Leachate Lagoon, as indicated by 38-1-1, and slightly further north from the Lower Leachate Lagoon. Additionally, a new 500 µS/cm contour was inferred around 31-1-1. The elevated electrical conductivity in this area may be related to residual impacts from a minor wastewater spill on October 18, 2020.

Like previous years, the 500 µS/cm contour did not extend beyond location 25 at the north end of the landfill. Groundwater collected from location 36 showed that conductivity values during all four sampling events were typically above 1,000 µS/cm and considerably higher than in 2020/21. Along the east boundary of the landfill, the 500 µS/cm contour did not extend beyond location 18. At the west boundary, the location of the 500 µS/cm contour could not be determined due to the absence of monitoring wells on the steep slope. However, the presence of conductivity data for location 27, coupled with eastward and upward groundwater flow in that area indicates the 500 µS/cm contour remains east of location 27. South of the landfill, the 500 µS/cm contour did not extend to 72-3-1.

Source control techniques should continue to be implemented throughout the landfill including minimizing the volume of aggregate stockpiles, application of covers and paving of traffic surfaces to maintain the quality of surface and groundwater in the future.

5.4 Overview of Groundwater Quality Exceedances

Groundwater quality data were compared to applicable BC CSR AW and DW use standards as shown in Appendix B-1. A summary of groundwater quality exceedances is presented in Table 5-1. In 2021/22, boundary Compliance Wells and off-site monitoring wells met CSR AW and DW standards, except for boron. Boron in well 20-1-1 during one sampling event marginally exceeded CSR DW standard of 5 mg/L.

Similar to previous years, most exceedances were present in groundwater wells in close proximity to leachate purge wells and known leachate sources. However, nitrate concentrations in some shallow groundwater wells (78-2-1, 87-2-1, 88-2-1) near the Hartland North Pad exceeded applicable CSR DW standards during Q4 2021 or Q1 2022 sampling events. Ammonia concentrations remained below the detection limit. The nitrate exceedances are primarily attributed to the aggregate stockpiles located on the bedrock ridge north of the Phase 2 landfill, and investigations are ongoing to confirm the source of nutrient impacts and restore water quality in that area.

5.4.1 Boron

During Q1 2022, boron concentrations in well 20-1-1 marginally exceeded the CSR DW standard of 5 mg/L. Boron concentrations in 20-1-1 during the rest of sampling events in 2021/22 ranged from 4.0 to 4.5 mg/L, which were consistent with previous years. Occasional elevated boron concentrations are likely due to sampling disturbance or seasonal variations. All leachate indicator parameters in well 20-1-1 remained low, indicating that well was not impacted by leachate. Furthermore, boron concentrations in purge wells are generally below 4.0 mg/L.

5.4.2 Zinc

During November 2021, zinc concentrations in well 78-2-1 marginally exceeded the CSR AW standard. The occasional zinc exceedance is due to the low hardness (95.1 mg/L as $CaCO_3$), as the zinc standard is dependent on hardness, and water with low hardness generally has significantly lower (more stringent) water quality standards. During subsequent sampling events, hardness values in 78-2-1 returned to historical ranges, and zinc concentrations met CSR standards.

5.5 Monitoring Sites North of the Phase 1 Landfill

Long-term groundwater quality north of the Phase 1 landfill is shown on Figure 5-4.

5.5.1 Monitoring Site 58

Monitoring site 58 (not a Boundary Compliance Well) is located in the transition area between the Phase 1 and Phase 2 landfill 200 m from the property boundary. The well is 19 m deep and screened in bedrock below refuse. Well 58-1-0, has exhibited elevated concentrations of leachate indicator parameters since 2001, shortly after landfilling upslope of the well began. Although concentrations have generally decreased since peak concentrations observed in 2001 to 2004, concentrations of key leachate indicator parameters (conductivity, ammonia, chloride and nitrate) remain highly elevated. Water quality is indicative of leachate-impacted groundwater flowing toward the Lower Leachate Lagoon and the north purge wells.

In 2021/22, four groundwater sampling events were conducted at location 58. Similar to previous years, all four samples from well 58-1-0 exhibited concentrations of ammonia and cobalt concentrations that exceeded CSR AW standards. Further, concentrations of chloride, cobalt, nickel, strontium and vanadium exceeded CSR DW standards during one or more sampling events. Sodium concentrations were above the CSR DW of 200 mg/L but well below the regional background concentration of 1,700 mg/L, and therefore sodium concentrations were in compliance with the CSR at this location. In 2021/22, mean concentrations of ammonia and chloride were 98.5 mg/L and 977 mg/L, respectively, which were consistent with 2020/21 levels. Groundwater quality in 58-1-0 was generally stable for all leachate indicator parameters, except for a statistically increasing trend in sulphate concentrations over the past five years. Since Q1 2020, sulphate concentrations progressively increased over time, from 60 mg/L to 120 mg/L and may reflect the influence of nearby aggregate storage and use to support landfill operations and closure.

Similar to previous years, dissolved cobalt concentrations ranged from 46.4 to 53.3 µg/L, which exceeded both CSR AW and the regional background concentration of 14 µg/L. Continued water quality monitoring at this well over time is important as it provides an indication of the quality of leachate migrating to the Lower Leachate Lagoon and the north purge well system.

5.5.2 Monitoring Sites 52 (P7), 80 (P8) and 81 (P9)

Monitoring sites 52, 80 and 81 (not Boundary Compliance Wells) are located in the centre of the leachate plume between the toe of the Phase 1 landfill and the lower leachate lagoon, approximately 100 m from the property boundary. Leachate flows along the bedrock/refuse interface underlying Phase 1 toward the lower leachate lagoon and the north purge wells (52-4-0-P7, 80-1-0-P8 and 81-1-0-P9). Groundwater quality has been heavily impacted by leachate since monitoring began at these locations in the 1980's.

In 2021/22, groundwater samples were collected from well 52-1-1 (31 m deep) and leachate samples were collected from the north purge wells (80-1-0-P8, 52-4-0-P7 and 81-1-0-P9). Prior to 2016/17, leachate samples had only been collected from the combined discharge at 52-4-0-P7 and 80-1-0-P8.

Similar to previous years, concentrations of chloride in monitoring well 52-1-1 met the CSR DW standard of 250 mg/L during all sampling events in 2021/22. Ammonia and strontium concentrations were similar to previously reported values and exceeded CSR AW/DW standards on four sampling dates. In 2021/22, the mean annual conductivity concentration in 52-1-1 was 1,926 µS/cm, which was slightly higher than values observed in 2020/21 (1,696 µS/cm) and 2019/20 (1,725 µS/cm). No statistically significant trend was observed in 52-1-1 over the past five years.

In 2021/22, conductivity values in 52-4-0-P7 and 80-1-0-P8 were higher than those in 2020/21, indicating degraded leachate quality. Similar to previous years, leachate in P7 was most concentrated, with conductivity ranging from 2,929 to 4,000 µS/cm. Leachate quality in P8 exhibited the most significant degradation, and ammonia, conductivity, chloride and sulphate concentrations were generally 3-10 times higher than those measured in 2020/21. Statistically significant increasing trends in conductivity, chloride and ammonia concentrations were observed in 52-4-0-P7 and 80-1-0-P8. Groundwater quality in 52-4-0 - P7 exceeded CSR AW standards for ammonia and exceeded the CSR DW standard for chloride in all four sampling events. In addition, arsenic concentrations in 52-4-0-P7 marginally exceeded CSR DW standard during one sampling event. Groundwater quality in 80-1-0-P8 exceeded the CSR AW standards for ammonia during all four sampling events. Unlike previous years, arsenic, cobalt and chloride concentrations in 80-1-0-P8 also exceeded CSR DW standards during one or more sampling events. The more frequent CSR exceedances and increased concentrations of leachate indicator parameters further indicate that leachate quality in 80-1-0-P8 was significantly deteriorated in 2021/22. Leachate quality in 81-1-0-P9 has generally been stable over time. In 2021/22, groundwater quality in 81-1-0-P9 met all CSR AW and DW standards in 2021/22. A statistically significant decreasing trend in nitrate was observed in 81-1-0-P9.

Overall, groundwater quality in 52-4-0-P7 and 80-1-0-P8 was degraded in 2022/21, and remained stable/or slightly improved in 81-1-0-P9. Groundwater quality in 80-1-0-P8 exhibited more significant deterioration, supported by more CSR exceedances and much higher conductivity, ammonia and sulphate concentrations. Water quality at these wells should continue to be monitored to assess the impact by aggregate production and stockpiling, temporal changes in leachate quality in response to seasonal changes in precipitation, and verify the effectiveness of the leachate collection system.

In 2021/22, water elevations in 81-1-0-P9 remained elevated, so leachate collection volumes are likely to be relatively low. The drawdown cone is likely to be relatively narrow and steep and may continue to help improve water quality at 40-1-1 over time. The relatively high leachate levels reported in 81-1-0-P9 indicate there are opportunities for improved leachate collection by lowering pump set points, increasing pumping rates, or lowering the pump installed in the well.

Table 5-1. Groundwater Quality Exceedances 2021-2022

BC CSR				AW Maximum (1)	---	---	90	50	10000	2 (9)	---	12000	0.5-4 (5)
				DW Maximum (2)	---	9500	6	10	1000	8	---	5000	5
Station	Sample Type	Compliance Well (Y/N?)	Date Sampled	Parameter	Alkalinity - Total - Ph 4.5	Aluminum	Antimony	Arsenic	Barium	Beryllium	Bismuth	Boron	Cadmium
				Fraction	TOT	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS
				Unit	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
				Method Detection Limit (MDL)	1	0.5	0.02	0.02	0.02	0.01	0.005	10	0.005
16-1-2	SS	N	09/11/2021	Very silty and moderately grey	110.	2 300.	0.157	1.05	60.1	1.13	0.052	< 20.	0.092
20-1-1	SS	Y	23/02/2022	Clear and colourless	66.	4.6	< 0.1	< 0.1	2.16	< 0.05	< 0.025	5 080. **b**	< 0.025
27-1-1	SS	N	13/05/2021	Very silty and moderately grey	83.	10 400. **b**	< 0.2	1.25	423.	5.34 **a**	0.224	325.	0.074
52-1-1	SS	N	12/05/2021	Clear and slightly yellow	840.	1.7	0.044	0.218	109.	< 0.02	< 0.01	2 890.	< 0.01
52-1-1	SS		23/09/2021	Clear and slightly yellow	910.	1.5	0.042	0.242	112.	< 0.02	< 0.01	2 690.	< 0.01
52-1-1	SS		24/11/2021	Clear and colourless, sudsy	890.	2.6	< 0.04	0.218	108.	< 0.02	< 0.01	2 700.	< 0.01
52-1-1	SS		11/02/2022	Clear and slightly yellow	840.	2.9	< 0.1	0.21	104.	< 0.05	< 0.025	3 230.	< 0.025
58-1-0	SS	N	20/05/2021	Clear, very yellow	1 800.	10.2	0.398	1.37	31.2	< 0.02	< 0.01	3 650.	0.092
58-1-0	SS		29/09/2021	Clear and very yellow	1 800.	13.4	0.55	1.36	34.8	< 0.05	< 0.025	4 100.	0.129
58-1-0	SS		10/11/2021	Clear and moderately brown	1 800.	12.5	0.52	1.67	33.4	< 0.05	< 0.025	4 130.	0.591
58-1-0	SS		10/02/2022	Clear and moderately yellow brown	1 700.	9.9	0.398	1.31	28.3	< 0.02	< 0.01	3 410.	0.077
78-2-1	SS	N	17/11/2021	Clear and colourless	120.	101.	0.067	0.274	8.59	0.021	< 0.005	200.	0.477
78-2-1	SS		17/02/2022	Clear and colourless	76.	42.	0.106	0.232	16.6	< 0.01	< 0.005	219.	0.341
87-2-1	SS	N	17/11/2021	Clear and colourless	69.	1.54	< 0.02	0.053	1.89	< 0.01	< 0.005	10.	< 0.005
88-2-1	SS	N	17/11/2021	Clear and colourless	67.	92.9	0.115	0.191	75.7	< 0.01	< 0.005	26.	0.095 5

Notes:

a	*Above CSR Schedule 3.2 AW Standard.*
b	*Above CSR Schedule 3.2 DW Standard.*
c	*Detection limits above applicable BC CSR standards.*
d	*Above CSR Schedule 3.2 DW Standard, but Below Regional Background Concentrations (South Vanouver Island Region).*
SS	*Single sample*
FRM	*Average of field replicates.*
(1)	*Aquatic Life (AW) Freshwater, Column 3.*
(2)	*Drinking Water (DW), Column 6.*
(3)	*Standard varies with pH. Every ammonia result was compared to a standard based on the associated pH result for that sample.*
(4)	*Standard varies with chloride. Every nitrite result was compared to a standard based on the associated chloride result for that sample.*
(5)	*Standard varies with hardness. Every result was compared to a standard that was based on the associated hardness result for that sample.*
(6)	*BC CSR Schedule 3.2 criterion for iron and manganese were not applied as directed by the Stage 8 CSR Amendments.*
(7)	*Standard is based on the trivalent (Cr(III)) species. The Cr(III) is the most common form of chromium.*
(8)	*Interim standard used for cobalt.*
(9)	*CSR Stage 13 amendments, protocol 9, background concentration is higher than the applicable CSR DW and/or most stringent CSR AW standard. A concentration above the CSR DW or most strigent CSR AW stanadard but below the regional background concentration (South Vancouver Island Region) is not considered contaminated and is not highlighted as a CSR DW or AW exceedance.*

Table 5-1. Groundwater Quality Exceedances 2021-2022

BC CSR				AW Maximum (1)	---	1500	90 (7)	40	20-90 (5)	---	---	40-160 (5)	---
				DW Maximum (2)	---	250	6000	14 (9)	1500	---	---	10	33 (9)
Station	Sample Type	Compliance Well (Y/N?)	Date Sampled	Parameter	Calcium	Chloride	Chromium	Cobalt	Copper	Hardness (As Caco3)	Iron	Lead	Lithium
				Fraction	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS
				Unit	mg/L	mg/L	µg/L	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L
				Method Detection Limit (MDL)	0.05	1	0.1	0.005	0.05	0.5	1	0.005	0.5
16-1-2	SS	N	09/11/2021	Very silty and moderately grey	51.8	3.7	0.72	5.57	4.54	158.	4 820.	14.5 b	1.7
20-1-1	SS	Y	23/02/2022	Clear and colourless	21.2	3.6	< 0.5	< 0.025	11.3	65.4	< 5.	< 0.025	< 2.5
27-1-1	SS	N	13/05/2021	Very silty and moderately grey	98.7	3.8	1.4	5.27	13.4	336.	15 200.	36.4 b	6.9
52-1-1	SS	N	12/05/2021	Clear and slightly yellow	131.	220.	1.09	2.39	0.11	494.	518.	< 0.01	5.4
52-1-1	SS		23/09/2021	Clear and slightly yellow	140.	200.	1.03	2.39	< 0.1	520.	498.	< 0.01	5.2
52-1-1	SS		24/11/2021	Clear and colourless, sudsy	133.	190.	0.99	2.17	0.32	496.	493.	< 0.01	4.9
52-1-1	SS		11/02/2022	Clear and slightly yellow	129.	200.	1.16	2.45	< 0.25	489.	513.	< 0.025	5.2
58-1-0	SS	N	20/05/2021	Clear, very yellow	427.	930. b	8.65	53.2 a b	9.99	1 600.	710.	0.227	< 1.
58-1-0	SS		29/09/2021	Clear and very yellow	367.	1 100. b	13.2	53.3 a b	34.2	1 450.	658.	< 0.025	< 2.5
58-1-0	SS		10/11/2021	Clear and moderately brown	387.	990. b	12.7	49.4 a b	16.	1 510.	1 320.	0.074	< 2.5
58-1-0	SS		10/02/2022	Clear and moderately yellow brown	360.	890. b	7.63	46.4 a b	6.72	1 380.	602.	0.084	< 1.
78-2-1	SS	N	17/11/2021	Clear and colourless	30.5	3.9	0.41	0.18	1.06	95.1	168.	0.139	1.
78-2-1	SS		17/02/2022	Clear and colourless	80.4	3.2	0.21	0.217	0.374	245.	95.6	0.017 4	1.06
87-2-1	SS	N	17/11/2021	Clear and colourless	85.5	4.8	< 0.1	0.112	0.096	265.	3.5	< 0.005	< 0.5
88-2-1	SS	N	17/11/2021	Clear and colourless	114.	4.1	0.14	0.889	1.06	336.	103.	0.044	< 0.5

Notes:

a	*Above CSR Schedule 3.2 AW Standard.*
b	*Above CSR Schedule 3.2 DW Standard.*
c	*Detection limits above applicable BC CSR standards.*
d	*Above CSR Schedule 3.2 DW Standard, but Below Regional Background Concentrations (South Vanouver Island Region).*
SS	*Single sample*
FRM	*Average of field replicates.*
(1)	*Aquatic Life (AW) Freshwater, Column 3.*
(2)	*Drinking Water (DW), Column 6.*
(3)	*Standard varies with pH. Every ammonia result was compared to a standard based on the associated pH result for that sample.*
(4)	*Standard varies with chloride. Every nitrite result was compared to a standard based on the associated chloride result for that sample.*
(5)	*Standard varies with hardness. Every result was compared to a standard that was based on the associated hardness result for that sample.*
(6)	*BC CSR Schedule 3.2 criterion for iron and manganese were not applied as directed by the Stage 8 CSR Amendments.*
(7)	*Standard is based on the trivalent (Cr(III)) species. The Cr(III) is the most common form of chromium.*
(8)	*Interim standard used for cobalt.*
(9)	*CSR Stage 13 amendments, protocol 9, background concentration is higher than the applicable CSR DW and/or most stringent CSR AW standard. A concentration above the CSR DW or most strigent CSR AW stanadard but below the regional background concentration (South Vancouver Island Region) is not considered contaminated and is not highlighted as a CSR DW or AW exceedance.*

Table 5-1. Groundwater Quality Exceedances 2021-2022

BC CSR				AW Maximum (1)	---	---	10000	1.31-18.4 (3)	0.2-2 (4)	400	400	250-1500 (5)	---
				DW Maximum (2)	---	---	250	---	1	10	10	80	---
Station	Sample Type	Compliance Well (Y/N?)	Date Sampled	Parameter	Magnesium	Manganese	Molybdenum	Ammonia	Nitrite	Nitrate	Nitrite + Nitrate	Nickel	Phosphorus
				Fraction	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS
				Unit	mg/L	µg/L	µg/L	mg/L	mg/L	mg/L	mg/L	µg/L	µg/L
				Method Detection Limit (MDL)	0.05	0.05	0.05	0.015	0.005	0.02	0.02	0.02	2
16-1-2	SS	N	09/11/2021	Very silty and moderately grey	6.95	418.	0.32	0.045 a	0.018 7	1.39	1.41	3.49	123.
20-1-1	SS	Y	23/02/2022	Clear and colourless	3.	2.86	0.41	< 0.015	< 0.005	< 0.02	< 0.02	0.27	< 10.
27-1-1	SS	N	13/05/2021	Very silty and moderately grey	21.8	613.	< 0.5	0.21	< 0.005	< 0.02	< 0.02	8.42	4 170.
52-1-1	SS	N	12/05/2021	Clear and slightly yellow	40.4	378.	0.29	23. a	< 0.005	< 0.02	< 0.02	11.9	22.4
52-1-1	SS		23/09/2021	Clear and slightly yellow	41.7	403.	0.33	29. a	< 0.005	< 0.02	< 0.02	11.	14.
52-1-1	SS		24/11/2021	Clear and colourless, sudsy	39.7	369.	0.37	27. a	< 0.005	< 0.02	< 0.02	10.4	12.8
52-1-1	SS		11/02/2022	Clear and slightly yellow	40.3	355.	0.27	27. a	< 0.005	< 0.02	< 0.02	11.7	44.
58-1-0	SS	N	20/05/2021	Clear, very yellow	130.	6 880.	7.26	91. a	0.955	0.22	1.17	79.1	66.9
58-1-0	SS		29/09/2021	Clear and very yellow	129.	5 120.	8.16	89. a	0.152	4.67	4.82	96.8 b	72.
58-1-0	SS		10/11/2021	Clear and moderately brown	132.	5 720.	7.06	120. a	0.052	0.51	0.56	92.1 b	82.
58-1-0	SS		10/02/2022	Clear and moderately yellow brown	116.	5 420.	6.37	94. a	0.007 5	< 0.02	< 0.02	72.7	63.
78-2-1	SS	N	17/11/2021	Clear and colourless	4.57	4.11	1.03	< 0.015	0.022 7	2.44	2.46	2.33	24.6
78-2-1	SS		17/02/2022	Clear and colourless	10.7	3.51	1.25	< 0.015	< 0.005	18.7 b	18.7 b	5.41	19.3
87-2-1	SS	N	17/11/2021	Clear and colourless	12.5	0.173	0.057	< 0.015	0.012 1	47.4 b	47.4 b	0.081	3.7
88-2-1	SS	N	17/11/2021	Clear and colourless	12.2	722.	< 0.05	< 0.015	0.008 4	42.4 b	42.4 b	1.18	30.8

Notes:

a	*Above CSR Schedule 3.2 AW Standard.*
b	*Above CSR Schedule 3.2 DW Standard.*
c	*Detection limits above applicable BC CSR standards.*
d	*Above CSR Schedule 3.2 DW Standard, but Below Regional Background Concentrations (South Vanouver Island Region).*
SS	*Single sample*
FRM	*Average of field replicates.*
(1)	*Aquatic Life (AW) Freshwater, Column 3.*
(2)	*Drinking Water (DW), Column 6.*
(3)	*Standard varies with pH. Every ammonia result was compared to a standard based on the associated pH result for that sample.*
(4)	*Standard varies with chloride. Every nitrite result was compared to a standard based on the associated chloride result for that sample.*
(5)	*Standard varies with hardness. Every result was compared to a standard that was based on the associated hardness result for that sample.*
(6)	*BC CSR Schedule 3.2 criterion for iron and manganese were not applied as directed by the Stage 8 CSR Amendments.*
(7)	*Standard is based on the trivalent (Cr(III)) species. The Cr(III) is the most common form of chromium.*
(8)	*Interim standard used for cobalt.*
(9)	*CSR Stage 13 amendments, protocol 9, background concentration is higher than the applicable CSR DW and/or most stringent CSR AW standard. A concentration above the CSR DW or most strigent CSR AW stanadard but below the regional background concentration (South Vancouver Island Region) is not considered contaminated and is not highlighted as a CSR DW or AW exceedance.*

Table 5-1. Groundwater Quality Exceedances 2021-2022

BC CSR				AW Maximum (1)	---	20	---	0.5-15 (5)	---	---	128-429 (5)	---	3
				DW Maximum (2)	---	10	---	20	1700 (9)	2500	500	---	---
Station	Sample Type	Compliance Well (Y/N?)	Date Sampled	Parameter	Potassium	Selenium	Silicon	Silver	Sodium	Strontium	Sulphate	Sulfur	Thallium
				Fraction	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS
				Unit	mg/L	µg/L	µg/L	µg/L	mg/L	µg/L	mg/L	µg/L	µg/L
				Method Detection Limit (MDL)	0.05	0.04	50	0.005	0.05	0.05	1	3	0.002
16-1-2	SS	N	09/11/2021	Very silty and moderately grey	0.57	< 0.08	9 650.	< 0.01	3.98	182.	20.	< 6.	0.049 8
20-1-1	SS	Y	23/02/2022	Clear and colourless	< 0.25	< 0.2	21 900.	< 0.025	10.5	413.	12.	< 15.	< 0.01
27-1-1	SS	N	13/05/2021	Very silty and moderately grey	1.28	< 0.4	31 800.	< 0.05	33.5	1 500.	13.	< 30.	0.033
52-1-1	SS	N	12/05/2021	Clear and slightly yellow	13.1	0.176	36 400.	< 0.01	229.	3 340. b	< 1.	< 6.	< 0.004
52-1-1	SS		23/09/2021	Clear and slightly yellow	13.4	0.113	36 700.	< 0.01	230.	3 280. b	< 1.	< 6.	0.004 7
52-1-1	SS		24/11/2021	Clear and colourless, sudsy	13.1	0.256	36 900.	< 0.01	220.	3 340. b	< 1.	< 6.	< 0.004
52-1-1	SS		11/02/2022	Clear and slightly yellow	13.3	< 0.2	38 400.	< 0.025	228.	2 930. b	17.	< 15.	< 0.01
58-1-0	SS	N	20/05/2021	Clear, very yellow	46.8	0.361	20 900.	< 0.01	501.	4 080. b	98.	34.3	< 0.004
58-1-0	SS		29/09/2021	Clear and very yellow	87.3	0.87	19 300.	< 0.025	601.	3 850. b	90.	31.	< 0.01
58-1-0	SS		10/11/2021	Clear and moderately brown	96.2	0.44	20 700.	< 0.025	605.	4 140. b	110.	31.	0.019
58-1-0	SS		10/02/2022	Clear and moderately yellow brown	55.9	0.364	20 900.	< 0.01	510.	3 710. b	120.	40.	0.007 1
78-2-1	SS	N	17/11/2021	Clear and colourless	0.229	0.312	13 600.	< 0.005	3.23	52.	89.	6.5	0.013 4
78-2-1	SS		17/02/2022	Clear and colourless	0.376	0.72	13 300.	< 0.005	4.08	145.	110.	28.3	0.016 2
87-2-1	SS	N	17/11/2021	Clear and colourless	0.208	0.936	6 330.	< 0.005	5.09	151.	55.	16.5	< 0.002
88-2-1	SS	N	17/11/2021	Clear and colourless	1.24	0.342	7 430.	0.008 4	7.93	295.	130.	43.2	0.007 2

Notes:

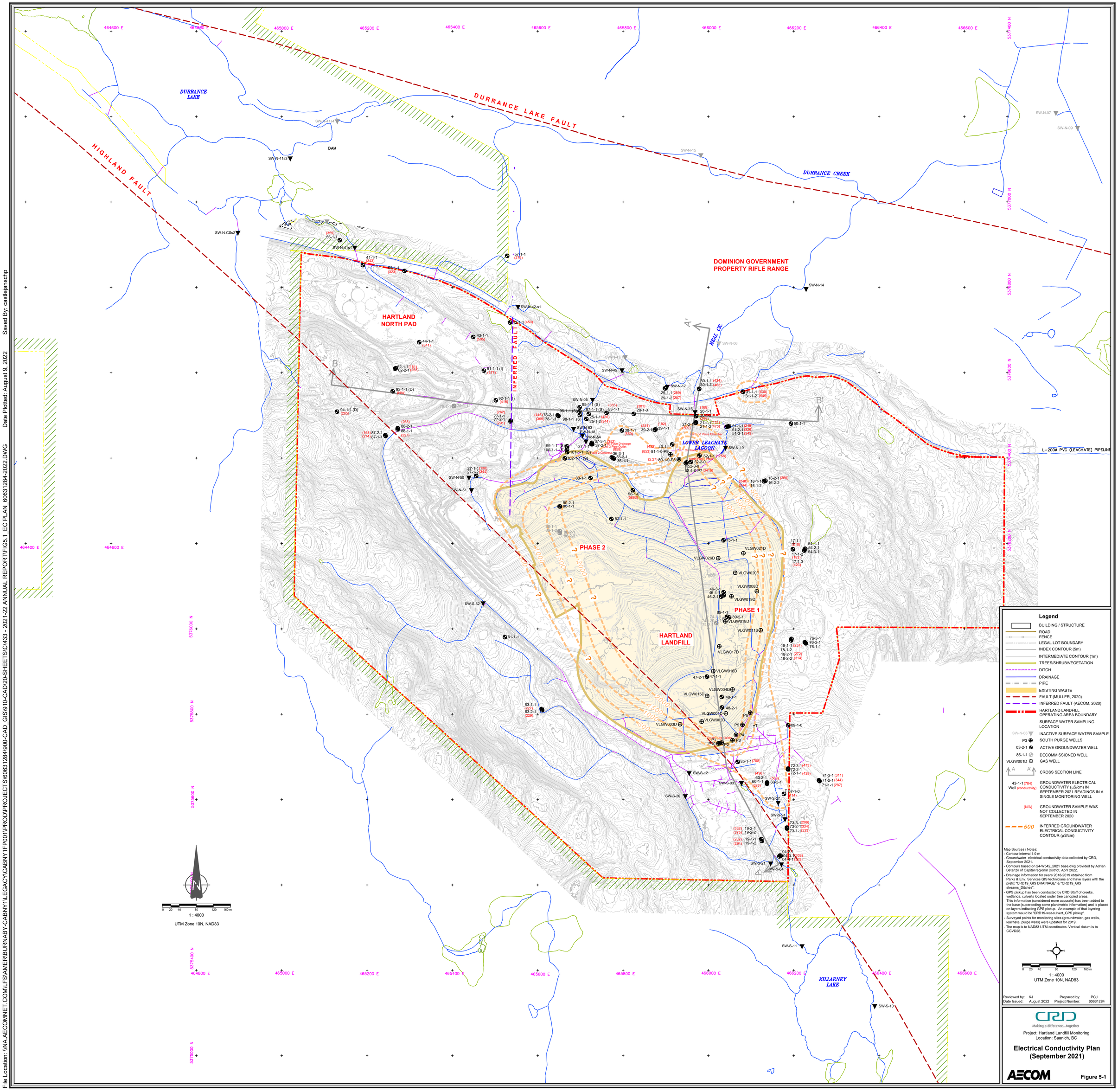
a	*Above CSR Schedule 3.2 AW Standard.*
b	*Above CSR Schedule 3.2 DW Standard.*
c	*Detection limits above applicable BC CSR standards.*
d	*Above CSR Schedule 3.2 DW Standard, but Below Regional Background Concentrations (South Vanouver Island Region).*
SS	*Single sample*
FRM	*Average of field replicates.*
(1)	*Aquatic Life (AW) Freshwater, Column 3.*
(2)	*Drinking Water (DW), Column 6.*
(3)	*Standard varies with pH. Every ammonia result was compared to a standard based on the associated pH result for that sample.*
(4)	*Standard varies with chloride. Every nitrite result was compared to a standard based on the associated chloride result for that sample.*
(5)	*Standard varies with hardness. Every result was compared to a standard that was based on the associated hardness result for that sample.*
(6)	*BC CSR Schedule 3.2 criterion for iron and manganese were not applied as directed by the Stage 8 CSR Amendments.*
(7)	*Standard is based on the trivalent (Cr(III)) species. The Cr(III) is the most common form of chromium.*
(8)	*Interim standard used for cobalt.*
(9)	*CSR Stage 13 amendments, protocol 9, background concentration is higher than the applicable CSR DW and/or most stringent CSR AW standard. A concentration above the CSR DW or most strigent CSR AW stanadard but below the regional background concentration (South Vancouver Island Region) is not considered contaminated and is not highlighted as a CSR DW or AW exceedance.*

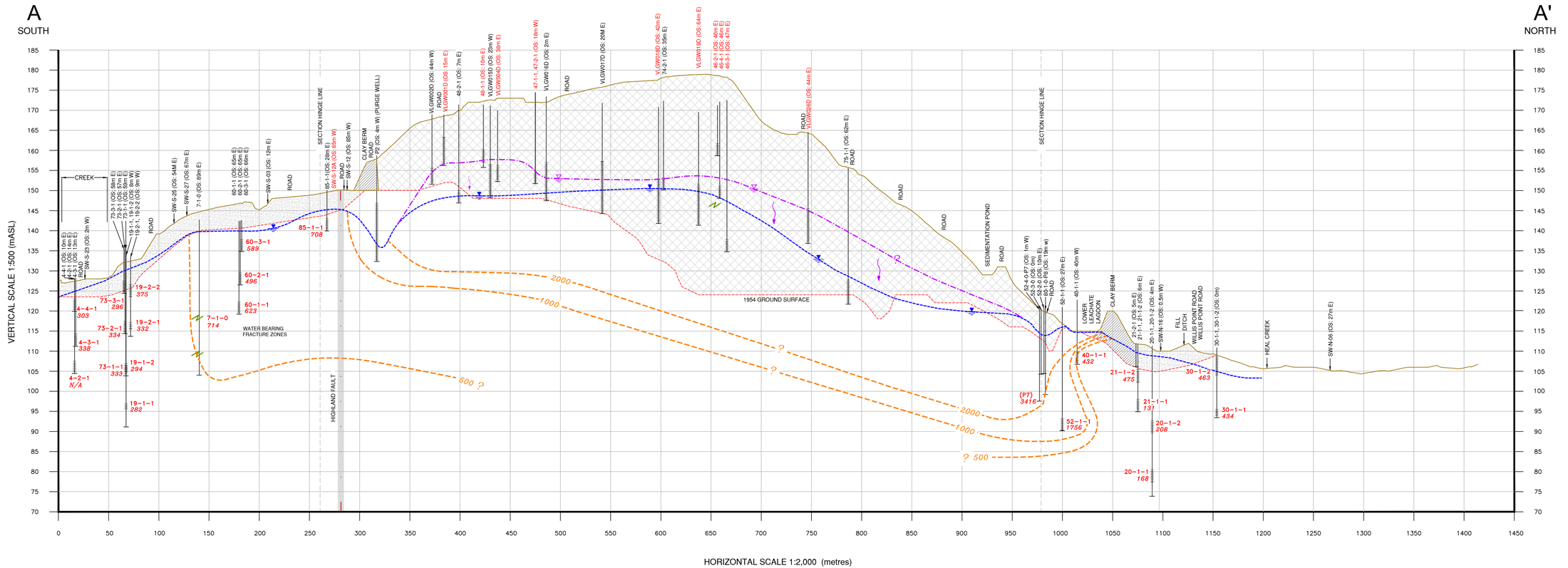
Table 5-1. Groundwater Quality Exceedances 2021-2022

BC CSR				AW Maximum (1)	---	1000	85	---	75-2400 (5)	---	---	---	---
				DW Maximum (2)	2.5	---	20	20	3000	---	---	---	---
Station	Sample Type	Compliance Well (Y/N?)	Date Sampled	Parameter	Tin	Titanium	Uranium	Vanadium	Zinc	Zirconium	pH	Conductivity	Temperature
				Fraction	DIS	DIS	DIS	DIS	DIS	DIS	TOT	TOT	TOT
				Unit	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pH	µS/cm	°C
				Method Detection Limit (MDL)	0.2	0.5	0.002	0.2	0.1	0.1	0	0	0
16-1-2	SS	N	09/11/2021	Very silty and moderately grey	0.41	43.1	2.77	4.04	38.4	1.31	7.5	193.	11.1
20-1-1	SS	Y	23/02/2022	Clear and colourless	< 1.	< 2.5	0.02	< 1.	< 0.5	< 0.5	7.39	160.	10.4
27-1-1	SS	N	13/05/2021	Very silty and moderately grey	< 2.	38.1	17.4	6.1	27.4	< 1.	8.18	129.	10.9
52-1-1	SS	N	12/05/2021	Clear and slightly yellow	< 0.4	< 1.	< 0.004	0.84	0.62	< 0.2	7.8	1 651.	14.
52-1-1	SS		23/09/2021	Clear and slightly yellow	< 0.4	< 1.	< 0.004	0.72	0.72	< 0.2	7.74	1 756.	14.4
52-1-1	SS		24/11/2021	Clear and colourless, sudsy	< 0.4	< 1.	< 0.004	0.79	0.45	< 0.2	7.98	2 200.	13.7
52-1-1	SS		11/02/2022	Clear and slightly yellow	< 1.	< 2.5	< 0.01	< 1.	1.76	< 0.5	7.37	2 100.	13.6
58-1-0	SS	N	20/05/2021	Clear, very yellow	0.69	2.9	0.402	19.6	3.74	2.18	7.25	5 110.	19.8
58-1-0	SS		29/09/2021	Clear and very yellow	< 1.	< 2.5	0.346	12.5	6.37	3.51	7.24	5 883.	21.7
58-1-0	SS		10/11/2021	Clear and moderately brown	< 1.	< 2.5	0.368	22.4 **b**	20.1	3.57	7.22	4 972.	18.1
58-1-0	SS		10/02/2022	Clear and moderately yellow brown	0.54	1.9	0.347	19.9	3.84	1.88	6.99	5 500.	19.
78-2-1	SS	N	17/11/2021	Clear and colourless	< 0.2	4.71	0.1	0.84	171. **a**	0.24	7.31	410.	10.5
78-2-1	SS		17/02/2022	Clear and colourless	< 0.2	2.1	0.104	0.71	239.	< 0.1	7.17	510.	11.7
87-2-1	SS	N	17/11/2021	Clear and colourless	< 0.2	< 0.5	0.053 1	0.46	0.18	< 0.1	6.78	640.	9.2
88-2-1	SS	N	17/11/2021	Clear and colourless	< 0.2	2.79	0.075 2	0.39	47.4	< 0.1	6.69	700.	9.7

Notes:

a	*Above CSR Schedule 3.2 AW Standard.*
b	*Above CSR Schedule 3.2 DW Standard.*
c	*Detection limits above applicable BC CSR standards.*
d	*Above CSR Schedule 3.2 DW Standard, but Below Regional Background Concentrations (South Vanouver Island Region).*
SS	*Single sample*
FRM	*Average of field replicates.*
(1)	*Aquatic Life (AW) Freshwater, Column 3.*
(2)	*Drinking Water (DW), Column 6.*
(3)	*Standard varies with pH. Every ammonia result was compared to a standard based on the associated pH result for that sample.*
(4)	*Standard varies with chloride. Every nitrite result was compared to a standard based on the associated chloride result for that sample.*
(5)	*Standard varies with hardness. Every result was compared to a standard that was based on the associated hardness result for that sample.*
(6)	*BC CSR Schedule 3.2 criterion for iron and manganese were not applied as directed by the Stage 8 CSR Amendments.*
(7)	*Standard is based on the trivalent (Cr(III)) species. The Cr(III) is the most common form of chromium.*
(8)	*Interim standard used for cobalt.*
(9)	*CSR Stage 13 amendments, protocol 9, background concentration is higher than the applicable CSR DW and/or most stringent CSR AW standard. A concentration above the CSR DW or most strigent CSR AW stanadard but below the regional background concentration (South Vancouver Island Region) is not considered contaminated and is not highlighted as a CSR DW or AW exceedance.*


DURRANCE LAKE FAULT
HIGHLAND FAULT
INFERRED FAULT
DURRANCE LAKE
DURRANCE CREEK
HEAL CR.
DAM
DOMINION GOVERNMENT PROPERTY RIFLE RANGE
HARTLAND NORTH PAD
PHASE 2
PHASE 1
HARTLAND LANDFILL
LOWER LEACHATE LAGOON
KILLARNEY LAKE
L~200ø PVC (LEACHATE) PIPELINE
A
A'
B
B'
1 : 4000
UTM Zone 10N, NAD83
0 20 40 80 120 160 m
Legend
BUILDING / STRUCTURE
ROAD
FENCE
LEGAL LOT BOUNDARY
INDEX CONTOUR (5m)
INTERMEDIATE CONTOUR (1m)
TREES/SHRUB/VEGETATION
DITCH
DRAINAGE
PIPE
EXISTING WASTE
FAULT (MULLER, 2020)
INFERRED FAULT (AECOM, 2020)
HARTLAND LANDFILL OPERATING AREA BOUNDARY
SURFACE WATER SAMPLING LOCATION
SW-N-06 INACTIVE SURFACE WATER SAMPLE
P3 SOUTH PURGE WELLS
03-2-1 ACTIVE GROUNDWATER WELL
86-1-1 DECOMMISSIONED WELL
VLGW001D GAS WELL
CROSS SECTION LINE
43-1-1 (784) Well (conductivity) GROUNDWATER ELECTRICAL CONDUCTIVITY (µS/cm) IN SEPTEMBER 2021 READINGS IN A SINGLE MONITORING WELL
(N/A) GROUNDWATER SAMPLE WAS NOT COLLECTED IN SEPTEMBER 2020
500 INFERRED GROUNDWATER ELECTRICAL CONDUCTIVITY CONTOUR (µS/cm)
Map Sources / Notes:
- Contour interval 1.0 m
- Groundwater electrical conductivity data collected by CRD, September 2021.
- Contours based on 24-W542_2021 base.dwg provided by Adrian Betanzo of Capital regional District, April 2022.
- Drainage information for years 2018-2019 obtained from Parks & Env. Services GIS technicians and have layers with the prefix "CRD19_GIS DRAINAGE" & "CRD19_GIS streams_Ditches".
- GPS pickup has been conducted by CRD Staff of creeks, wetlands, culverts located under tree canopied areas. This information (considered more accurate) has been added to the base (superceding some planimetric information) and is placed on layers indicating GPS pickup. An example of that layering system would be 'CRD19-wat-culvert_GPS pickup'.
- Surveyed points for monitoring sites (groundwater, gas wells, leachate, purge wells) were updated for 2019.
- The map is to NAD83 UTM coordinates. Vertical datum is to CGVD28.
1 : 4000
UTM Zone 10N, NAD83
0 20 40 80 120 160 m
Reviewed by: KJ
Prepared by: PCJ
Date Issued: August 2022
Project Number: 60631284
Making a difference...together
Project: Hartland Landfill Monitoring
Location: Saanich, BC
Electrical Conductivity Plan (September 2021)
AECOM
Figure 5-1
File Location: \\NA.AECOMNET.COM\LFSAMER\BURNABY-CABNY1\LEGACY\CABNY1FP0011\PROD\PROJECTS\60631284\900-CAD_GIS\910-CAD\20-SHEETS\C\433 - 2021-22 ANNUAL REPORT\FIG5.1_EC PLAN_60631284-2022.DWG
Date Plotted: August 9, 2022
Saved By: castlejanschp



Legend

- MONITORING WELL (NUMBER) INDICATES DISTANCE WELL IS FROM PLANE OF SECTION. WHERE NOT INDICATED, DISTANCE IS LESS THAN 2 m.
- 85-1-1 (6.5m)
- SCREENED INTERVAL
- WATER BEARING FRACTURES
- GROUND SURFACE
- LOCATION OF BEDROCK DERIVED FROM 1954 GROUND CONTOUR OR BEDROCK INTERSECTIONS IN BOREHOLES
- REFUSE
- CLAY BERM
- UNCONSOLIDATED SOIL AND FILL
- INTERPRETED GROUNDWATER POTENTIOMETRIC SURFACE IN BEDROCK (AUGUST 2020)
- INTERPRETED LEACHATE MOUND
- INFERRED VERTICAL LEACHATE FLOW
- FAULT (MULLER 1980)
- INFERRED ELECTRICAL CONDUCTIVITY CONTOUR (SEPTEMBER 2020).
- 834.0 — ELECTRICAL CONDUCTIVITY SEPTEMBER 2021 (µ S/cm)
- (N/A) — GROUNDWATER SAMPLE WAS NOT COLLECTED IN SEPTEMBER 2021
- 537.0 — ELECTRICAL CONDUCTIVITY DATA WAS NOT USED TO INTERPRET CONDUCTIVITY CONTOUR

Map Sources / Notes:
- Contours based on 24W542_2021 base.dwg, provided by the Capital Regional District, April 2022.
- Stratigraphy between boreholes is inferred and may vary from that shown

0 10 20 40 60 80 m

1 : 2000

Section Looking West

Reviewed by: KJ
Date Issued: August 2022

Prepared by: PCJ
Project Number: 60631284

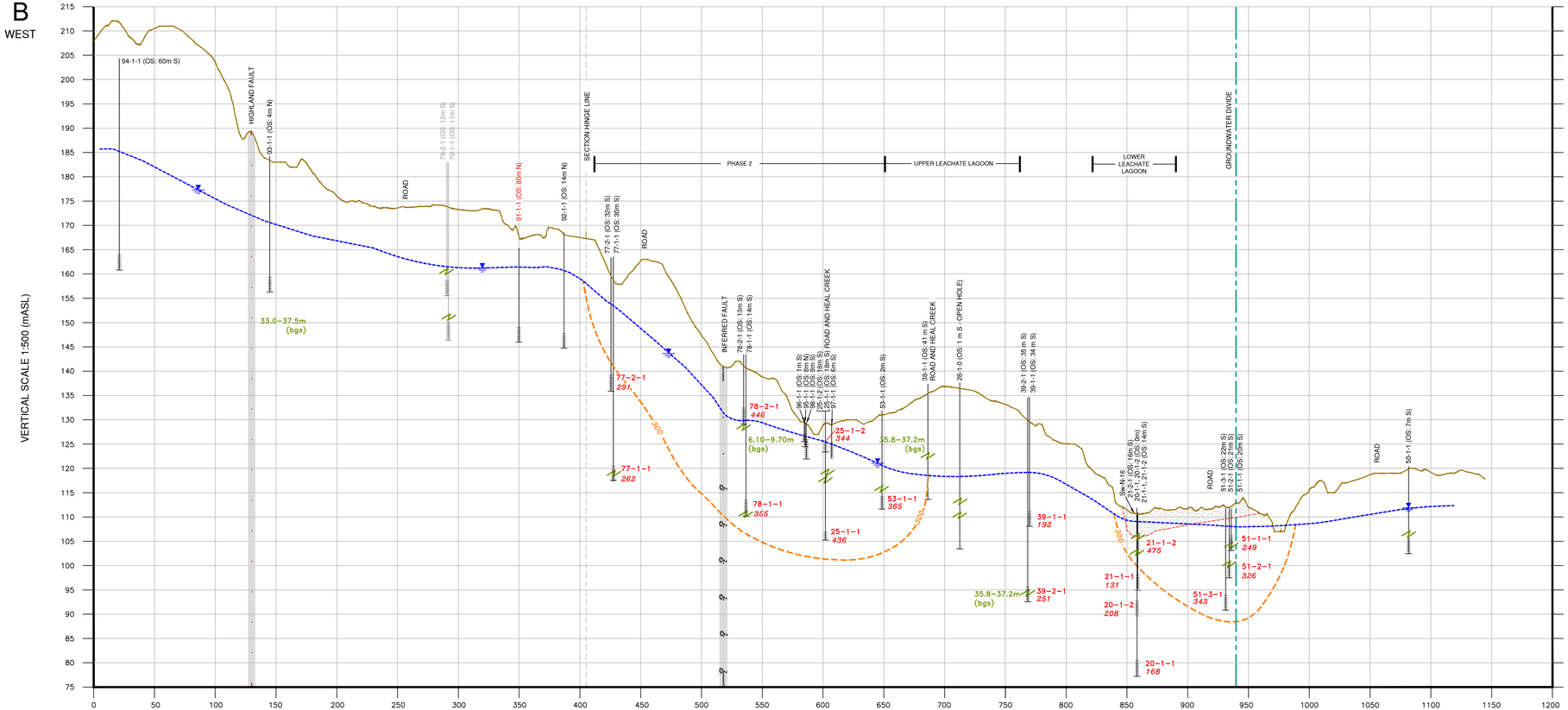
Making a difference...together

Project: Hartland Landfill Monitoring
Location: Saanich, BC

Electrical Conductivity in Cross Section A-A' (SEPTEMBER 2021)

AECOM

Figure 5-2



Legend

- MONITORING WELL (NUMBER) INDICATES DISTANCE WELL IS FROM PLANE OF SECTION. WHERE NOT INDICATED, DISTANCE IS LESS THAN 2 m. (85-1-1 (6.5m))
- SCREENED INTERVAL
- WATER BEARING FRACTURES
- GROUND SURFACE
- LOCATION OF BEDROCK DERIVED FROM 1954 GROUND CONTOUR OR BEDROCK INTERSECTIONS IN BOREHOLES
- UNCONSOLIDATED SOIL AND FILL
- INTERPRETED GROUNDWATER POTENTIOMETRIC SURFACE IN BEDROCK (AUGUST 2020)
- INFERRED ELECTRICAL CONDUCTIVITY CONTOUR (SEPTEMBER 2020).
- 834.0 — ELECTRICAL CONDUCTIVITY SEPTEMBER 2021 (µ S/cm)
- (N/A) — GROUNDWATER SAMPLE WAS NOT COLLECTED IN SEPTEMBER 2021
- FAULT (MULLER, 1980)
- INFERRED FAULT (AECOM, 2017)

Map Sources / Notes:
- Contours based on 24W542_2021 base.dwg, provided by the Capital Regional District, April 2022.
- Stratigraphy between boreholes is inferred and may vary from that shown

0 10 20 40 60 80 m
1 : 2000
Section Looking North

Reviewed by: KJ
Date Issued: August 2022
Prepared by: PCJ
Project Number: 60631248

Making a difference...together

Project: Hartland Landfill Monitoring
Location: Saanich, BC

Electrical Conductivity in Cross Section B-B' (September 2021)

AECOM

Figure 5-3

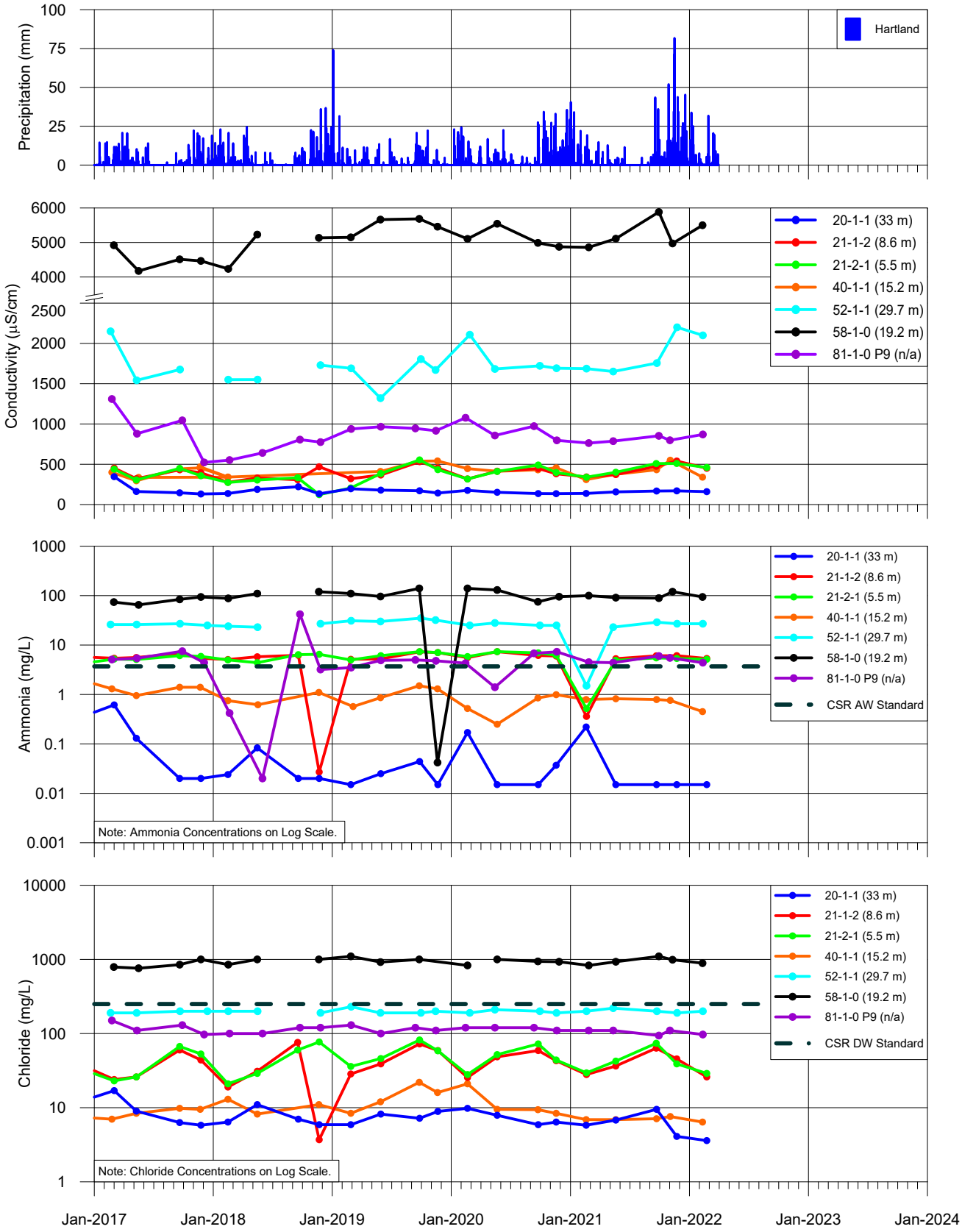


Figure 5-4. Groundwater Quality North of Phase 1

AECOM

5.5.3 Monitoring Site 40

Monitoring well 40-1-1 is not a Boundary Compliance Well and is installed between the upper and lower leachate lagoons, approximately 70 m from the property boundary. Groundwater quality at this location has been affected by leachate since 2002 and continued to be affected in 2021/22.

In 2021/22, all parameters met the CSR AW and DW standards on all four sampling dates. Conductivity values generally remained below 500 µS/cm, except for one sampling event in November 2021. Ammonia, nitrate and chloride concentrations were generally lower than those in 2020/21, indicating improved water quality. Conductivity in 40-1-1 exhibited a pattern that was consistent with the north purge wells, with the most elevated conductivity observed in November 2021.

Although water quality at location 40 is still slightly impacted by leachate, the long-term concentrations of leachate indicator parameters suggest continuing improvement in groundwater quality. This is likely due to reduced leachate generation following closure of Phase 2 Cell 1 in 2011 and operation of 80-1-0-P8 and 81-1-0-P9 as purge wells since 2016. Statistical trend analysis revealed decreasing trends in ammonia concentrations over the past five years. Sulphate concentrations were slightly elevated during the September and November events, but remained much lower than they were prior to the observation of leachate impacts at this location in 2002. Water quality has been investigated at this location in the past and was the subject of a previous report (AECOM 2009a).

Water quality at location 40 should continue to be closely monitored to verify the effectiveness of leachate collection north of the Phase 1 landfill. The ongoing purge well performance evaluation program should be expanded to include 81-1-0-P9, with the value of each well assessed based on the rate of contaminant mass removal.

5.5.4 Monitoring Sites 20 and 21

Monitoring locations 20 and 21 are considered Boundary Compliance Wells and are located directly north of the Phase 1 landfill and the lower leachate lagoon and between 5 and 15 m from the landfill property boundary. These monitors are located in the most probable path for any potential subsurface leachate migration below the unlined lower lagoon. The concentrations of leachate indicator parameters at locations 20, 21, 40, 52, and 58 are plotted against time in Figure 5-4.

In 2021/22, groundwater quality at location 20 and 21 met both CSR AW and DW standards, except for boron. The boron concentration in 20-1-1 during the Q1 2022 sampling event marginally exceeded CSR DW standard of 5 mg/L. Boron concentrations in 20-1-1 generally ranged from 3.5 to 4.5 mg/L, and the slightly higher boron concentration during wet season is inferred to be the result of natural variability in groundwater quality.

Groundwater quality in wells 21-1-2 and 21-2-1 generally have higher concentrations of conductivity, ammonia and chloride concentrations, because they were screened at shallower depths. In 2021/22, conductivity concentrations in wells 21-1-2 and 21-2-1 ranged from 343 to 540 µS/cm, which were consistent with those in 2020/21. Chloride concentrations at location 21 have remained well below the CSR DW standard (250 mg/L) since 1997 and below 120 mg/L since 2002. At location 20, conductivity values remained below 200 µS/cm, and ammonia and chloride concentrations were generally consistent with background ranges. Ammonia concentrations in all four wells remained within their historical ranges.

Over the past five years, groundwater quality data revealed a statistically significant decreasing trend in ammonia in wells 20-1-1 and 20-1-2. Chloride concentrations exhibited a statistically significant decreasing trend in well 20-1-2. Statistically significant decreasing trends in leachate parameters indicate improved water quality at these locations.

Groundwater quality was historically impacted by construction activities during the fall and winter of 2019/20, but water quality at downgradient wells 40-1-1, 20 and 21 returned to historical conditions early in 2021.These rapid improvements highlight the importance of progressive landfill closure, diversion of clean runoff, and operating and maintaining leachate collection infrastructure at the landfill.

5.5.5 Monitoring Site 31

Monitoring wells at location 31 are considered Boundary Compliance Wells and they are located along the landfill north property line, south of Willis Point Road and 160 m northeast of the lower leachate lagoon. They are downgradient of the landfill and have the lowest groundwater elevations measured at the site.

In 2021/22, routine groundwater sampling at location 31 met both CSR AW and DW standards. However, conductivity, ammonia, sulphate and nitrate concentrations in both 31-1-1 and 31-1-2 continued to increase following the wastewater residual spill event occurred on October 18, 2020. Groundwater wells 31-1-1 and 31-1-2 are located approximately 20 m

upgradient (south) of the spill location. Following the release, routine groundwater samples were collected in November 2021, and conductivity, sulphate, hardness, calcium, magnesium concentrations in both samples exhibited higher concentrations, indicating the groundwater quality was likely temporally impacted by the spill (AECOM 2021). In 2021/22, conductivity, hardness, ammonia, sulphate, nitrate reached peak concentrations during Q3 and Q4 2021 sampling events and then decreased in Q1 2022, likely due to intense precipitation and increased dilution. Although water quality improved during Q1 2022 sampling event, conductivity, sulphate and nitrate concentrations remained 3-5 times higher than historical ranges, indicating that water quality remains locally impacted by the residual impacts of the spill. Sulphate and conductivity in 31-1-1 and 31-1-2 exhibited statistically significant increasing trends for the past five years, indicating the degradation of water quality. Water quality at location 31 should continue to be monitored closely to assess the spill impact as well as the runoff from the recently constructed aggregate stockpile located at the northeast corner of the landfill.

5.5.6 Monitoring Sites 29 and 30

Monitoring locations 29 and 30 are located north of Willis Point Road and are Boundary Compliance Wells. Conductivity, ammonia and chloride plots for both locations over the past five years are included on Figure 5-5. At locations 29 and 30, all parameters met applicable CSR standards in 2021/22.

At monitoring locations 29 and 30, elevated conductivity and chloride concentrations observed since 2007 are considered related to intermittent road salt application on Willis Point Road. The District of Saanich has confirmed the use of de-icing salt (sodium chloride) on an as-needed basis on this road for several years and that no records of application dates are kept. As shown on Figure 5-5, conductivity and chloride concentrations measured in the shallow monitors at locations 29 and 30 have exhibited seasonal fluctuations for a very long time, with maximum concentrations typically occurring in winter and early spring months. In 2021/22, chloride concentrations at locations 29 and 30 remained below 100 mg/L, and shallow wells generally experienced more seasonal variations. Ammonia concentrations remain very low (<0.02 mg/L) at locations 29 and 30, except for one sampling event at location 29. During November 2021 sampling event, ammonia concentrations in both 29-1-1 and 29-1-2 increased from non-detect (<0.015 mg/L) to up to 0.63 mg/L. Due to the low conductivity, sulphate and nitrate concentrations, it is inferred that landfill leachate is not contributing to groundwater quality impacts north of Willis Point Road. The occasional elevated ammonia concentrations may be due to the denitrification process under reducing conditions that often persist in lowland environments during the winter season and is supported by the observed increase in iron and manganese concentrations.

Groundwater quality data collected from wells at locations 29 and 30 over the past five years revealed a statistically significant decreasing trend in conductivity in 29-1-2, and a decreasing trend in chloride in 30-1-1. This implies that groundwater in 29 and 30 were less impacted by road salt application. However, statistically significant increasing trends in sulphate and nitrate were observed in wells 29-1-1 and 29-1-2. Sulphate in 30-1-2 also exhibited statistically increasing trend for the past five years. During the November 2021 sampling event, nitrate concentration in 29-1-2 increased dramatically from 0.8 mg/L to 5.75 mg/L, and coincided with increased nitrate concentrations at SW-N-05. It is suspected that the increased sulphate and nitrate concentrations at locations 29 and 30 are due to infiltration of runoff from the aggregate stockpiles located on the bedrock ridge north of the Phase 2 landfill.

5.5.7 Monitoring Sites 28 and 39

Groundwater monitoring wells 28 and 39 are located between the upper leachate lagoon and Willis Point Road and are considered Boundary Compliance Wells. In 2021/22, groundwater quality at locations 28 and 39 met CSR standards. Similar to previous years, ammonia values in well 28-1-0 remained low or close to detection limit, indicating groundwater was not impacted by landfill leachate.

Groundwater quality in well 28-1-0 was slightly degraded in 2021/22, supported by increased conductivity and sulphate concentrations. Conductivity in well 28 generally remained below 300 µS/cm, but reached to peak of 400 µS/cm in November 2021. Conductivity values at location 39 remained below 300 µS/cm in 2021/22, indicating relatively stable water quality.

Statistical trend analysis of groundwater quality data collected from well 28-1-0 over the past five years revealed a statistically significant increasing trend in conductivity and sulphate. No statistically significant trend was revealed in 39-1-1 and 39-2-1, indicating relatively stable groundwater quality.

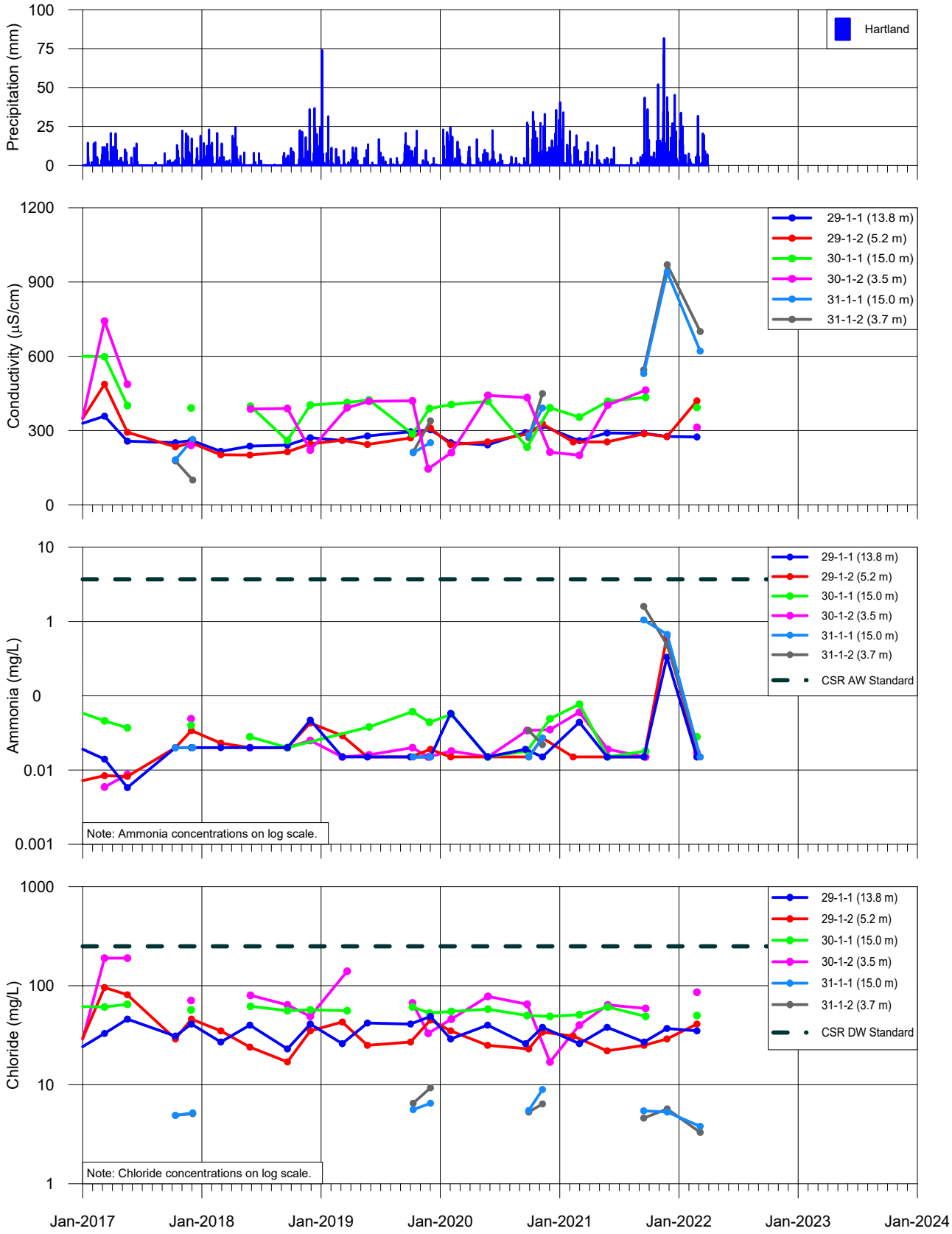


Figure 5-5. Groundwater Quality North of Willis Point Road

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5.6 Monitors West and North of the Phase 2 Landfill and Near the Hartland North Pad

Background water quality has historically been represented by monitoring location 63 on the west side of Phase 2, and five monitoring locations (77, 78, 79, 87 and 88) north of the Phase 2 landfill. Through the winter and spring of 2016/17, a portion of the slope between Phase 2 and the Hartland North Pad was cleared of vegetation to allow for construction of a future aggregate storage area. Since clearing, overburden soils have been stripped to expose the bedrock surface that consists of several closed depressions that may impact groundwater recharge. This work was conducted in the vicinity of monitoring locations 77, 78, 79, 87 and 88. Groundwater monitoring wells 79-1-1 and 79-2-1 were decommissioned in May 2018 to allow for construction of an aggregate stockpile in this area. In 2019/20, excavation and blasting were conducted at the North Pad area and east of the Toutle Valley Road. Given recent land clearing, excavation and quarrying activities, water quality data from locations 77, 78, 87 and 88 should no longer be considered representative of background groundwater quality, and groundwater at these wells should be closely monitored for landfill and construction related impacts.

In November 2019, four new monitoring wells (91-1-1, 92-1-1, 93-1-1, 94-1-1) were installed in Hartland North to characterize hydrogeological conditions near the RTF and monitor impacts from construction, quarrying and operations. Well 94-1-1 was installed as a new background well and is located upgradient of the landfill and the RTF. Quarterly groundwater sampling at these locations commenced in May 2020.

Six monitoring locations (25, 27, 36, 37, 38 and 53) north of the Phase 2 landfill near the upper leachate lagoon, and eight locations (41, 42, 43, 44, 55, 56, 57 and 62) near the Hartland North Pad were monitored for groundwater quality parameters in 2021/22.

5.6.1 Background Groundwater Quality

Monitoring well 63 is located at the western edge of the property. Monitoring Well 94-1-1 is installed in Hartland North area and east of RTF. These monitoring wells are located upgradient of the landfill and their water quality is considered representative of background groundwater chemistry.

At location 63, groundwater quality in 63-1-1 and 63-2-1exhibited slightly higher conductivity during November 2021 sampling event, and conductivity increased from ~200 µS/cm to peak value of 320 µS/cm for the last five years. Other leachate indicator parameters including chloride, ammonia nitrate and sulphate concentrations remained low and consistent with their historical ranges. Groundwater quality data revealed a statistically significant increasing trend in conductivity in well 63-2-1, indicating that groundwater quality slightly degraded in 2021/22. Given the low concentrations of sulphate, nitrate and ammonia concentrations, groundwater was not impacted by leachate or excavation/quarrying activities.

Groundwater quality in 94-1-1 is characterized by slightly elevated and variable conductivity (226 – 430 µS/cm), sulphate (31-110 mg/L), low nitrate (<0.02 mg/L), low chloride (<10 mg/L) and low ammonia (<0.01 mg/L) concentrations. The highest conductivity, sulphate and chloride concentrations were generally observed in the first sampling event in May 2020, and have gradually decreased over time reflecting continued development of the well. Statistically significant decreasing trends in chloride and sulphate were observed in well 94-1-1 since it was installed in 2019. In 2021/22, conductivity, ammonia and/or nitrate in groundwater in 94-1-1 increased in Q3 and Q4 2021 sampling events, but returned to normal ranges in Q1 2022. The concurrent increasing in conductivity, ammonia and nitrate concentrations may suggest that the groundwater in 94-1-1 is affected by oxidation of sulphide minerals in bedrock over the summer and flushing of constituents to the water table following early fall precipitation events. It is also possible that water quality was temporally impacted by nearby aggregate placement.

5.6.2 Wells North of Phase 2 Landfill

Wells north of Phase 2 include 25, 27, 36, 37, 38, and 53. Leachate indicator parameters in wells at locations 25, 36, 37 and 38 are plotted on Figure 5-6.

In 2021/22, Groundwater quality in some wells exhibited increasing concentrations of conductivity, sulphate and nitrate. A subsurface investigation is ongoing to determine the source of the impacts to surface water and groundwater quality in this area. The aggregate stockpiles located in the Toutle Valley and atop the bedrock ridge north of the Phase 2 landfill are interpreted to be the primary source of nitrate and sulphate observed in groundwater wells.

5.6.2.1 Monitoring Site 36

Monitoring location 36 is not a Boundary Compliance Well and is located 20 m northeast and downgradient of the Phase 2 basin. Well 36-3-1 was monitored and sampled on a quarterly basis in 2021/22. Well 36-2-1 has not been monitored since 2016/17 due to well construction related impacts.

Well 36-3-1 is well suited to assess whether leachate is migrating beneath the clay liner along the north side of Phase 2. The elevation of the bottom of the well screen in 36-3-1 is 112 m asl. The bottom of the Phase 2 basin is at 113 m asl. The bottom of the clay liner along the north side of the Phase 2 basin is at 114 m asl. In 2021/22, groundwater quality in 36-3-1 continued to deteriorate, with higher average conductivity and sulphate concentrations than those in 2019/20 and 2020/21. Conductivity values generally remained below 1,000 µS/cm between 2017 and 2020, but were above 1,000 µS/cm during three out of four sampling events in 2021/22. Similarly, sulphate concentrations were generally remained below 250 mg/L, but increased to a peak of 310 mg/L during the November 2021 sampling event. Chloride, nitrate and ammonia concentrations remained low and generally consistent with their historical ranges. Due to the inward hydraulic gradients, low ammonia and chloride concentrations, it is highly unlikely that leachate migration is occurring beneath the clay liner at the north edge of Phase 2. A statistically significant increasing trend in conductivity was observed in 36-3-1 over the past five years.

Elevated sulphate concentrations in 36-3-1 observed since 2008 may be related to infiltration of runoff from aggregate stockpiles and/or aggregate use in landfill infrastructure at the north end of Phase 2. Large volumes of aggregate that have been stored in unused parts of Phase 2 since 2012 have the potential to impact water quality in this area if not managed. Aggregate has also been used extensively in landfill infrastructure throughout Phase 2 (i.e. around leachate and landfill gas collectors, road building, landfill cover, and to construct the NWSP near location 36). Although it is anticipated that elevated conductivity and sulphate concentrations are the result of runoff from aggregate stockpiles, continued monitoring will help confirm cause(s) of groundwater quality changes in this area.

5.6.2.2 Monitoring Site 37

Monitoring location 37 is not a Boundary Compliance Well and it is located 25 m north of the Phase 2 basin. Well 37-3-1 was routinely monitored in 2021/22. Well 37-1-1 has been excluded from the monitoring program due to the limited access. Sampling of 37-2-1 was discontinued since 2017 due to its low concentrations of leachate indicator parameters.

In 2021/22, conductivity and sulphate concentrations ranged from 352 to 630 µS/cm, and 85 to180 mg/L, respectively. Groundwater quality in 37-3-1 exhibited consistent pattern with 36-3-1, with the most elevated conductivity, nitrate and sulphate concentrations observed during the November 2021 sampling event. Chloride and ammonia concentrations remained low and within historical ranges. Elevated conductivity and sulphate concentrations may be related to the infiltration of runoff from aggregate stockpiles and areas where aggregate has been used to construct site infrastructure at the north end of Phase 2. Statistically significant increasing trends were detected at 37-3-1 for sulphate indicating a slight deterioration in groundwater quality at this location. Due to the low ammonia and nitrate concentrations, water quality degradation is interpreted to be the result of onsite aggregate stockpiling and not leachate.

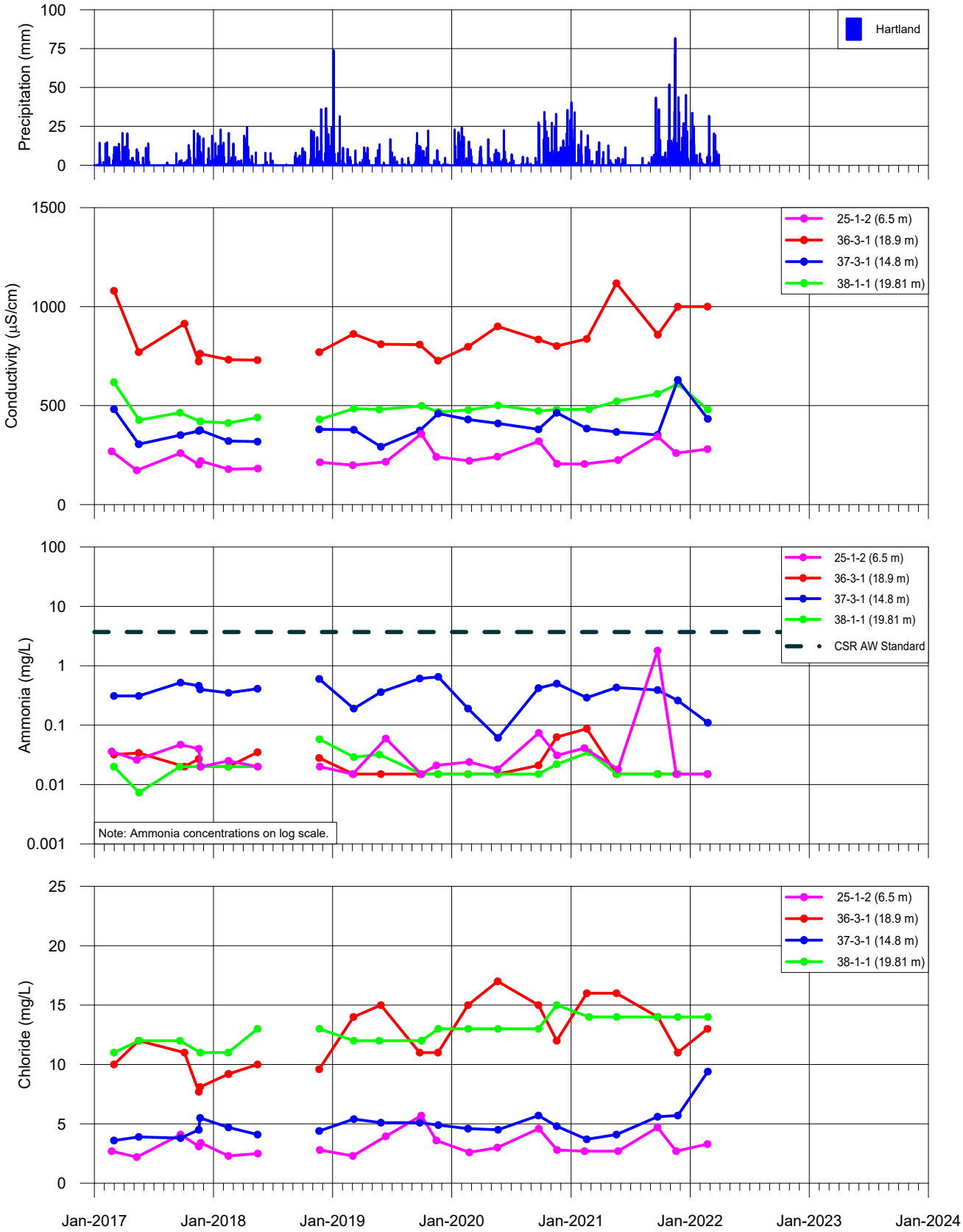


Figure 5-6. Groundwater Quality North of Phase 2

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5.6.2.3 Monitoring Site 38

Location 38 is not a Boundary Compliance Well and is located roughly 80 m north of the Phase 2 basin immediately north of the upper leachate lagoon. Water quality at this location met CSR standards in 2021/22. As presented on Figure 5-6, conductivity in well 38-1-1 exhibited a consistent pattern with 36-3-1 and 37-3-1, with the highest value observed during the November 2021 sampling event. Nitrate concentrations remained within historical ranges, but also increased slightly during November 2021 and February 2022 sampling events. Ammonia and chloride concentrations remained low and within historical ranges. Sulphate concentrations were marginally above 50 mg/L, which were slightly higher than those in previous years. Over the past five years a statistically significant decreasing trend in ammonia was observed at this location. Although increasing conductivity, sulphate and nitrate concentrations were less significant in 38-1-1, water quality at this location was still slightly degraded in 2021/22. Water quality impacts at this location are the subject of an ongoing investigation that will be completed in the fall of 2022.

5.6.2.4 Monitoring Sites 25 and 53

Wells 25-1-1, 25-1-2 (not Boundary Compliance Wells) and 53-1-1 (Boundary Compliance Well) are located on an east-west trending ridge 100 m north of the Phase 2 basin near the property boundary. These wells have exhibited good water quality in the past and remain unaffected by landfill leachate. Since 2009, water quality at all three wells has been relatively stable. In 2020/21, water quality at all three wells exhibited more variability, but concentrations continued to meet CSR AW and DW standards.

In 2021/22, water quality in 25-1-1 and 25-1-2 was slightly degraded, with higher average conductivity, sulphate and nitrate concentrations. Chloride and ammonia concentrations at location 25 remained low during all sampling events, except for one ammonia concentration in 25-1-2. During the September 2021 sampling event, the ammonia concentration in 25-1-2 increased from a non-detected value (<0.015 mg/L) to a peak of 1.8 mg/L, which coincided with increased sulphate and conductivity. Although the nitrate concentration in 25-1-2 remained low in September 2021, it gradually increased 10-15 times during the following consecutive sampling events and reached to maximum value of 1.86 mg/L. Similar to 25-1-2, nitrate concentrations in 25-1-1 also gradually increased up to 7.99 mg/L during the February 2022 sampling event, which were 2-5 times higher than historical ranges. Statistically significant increasing trends in conductivity, sulphate and nitrate at wells 25-1-1, 25-2-1 and increasing trend in sulphate at 25-1-2 were observed over the past five years, indicating degraded groundwater quality. Overall, the concurrent increase in conductivity, sulphate and nitrate concentrations indicated that groundwater at location 25 was primarily impacted by blasting and aggregate placement during construction of a new haul road in 2021. Although the ammonia concentration at 25-1-2 was temporally elevated during one sampling event, it quickly dissipated and exhibited a pattern consistent with sulphate concentrations. Given the low and stable chloride concentrations and observed relationship between ammonia and sulphate, it is suspected that the elevated ammonia was likely related to blasting residuals. It will be important to monitor groundwater at station 25 to confirm it is not impacted by leachate.

In 2021/22, water quality in 53-1-1 was generally stable, with slightly elevated conductivity (322-490 µS/cm), low sulphate (50-62 mg/L), low chloride (<10 mg/L) and low ammonia and nitrate concentrations (<0.04 mg/L). Ammonia and nitrate concentrations increased slightly during Q1 2022 but still remained low. No statistically significant trend was observed in 53-1-1 over the past five years. However, it should be noted that conductivity exhibited more variability than previous years, indicating groundwater quality may be influenced by ongoing aggregate production and use in the area.

Previous groundwater quality changes in these wells (i.e. increased concentrations of leachate indicator parameters) following the 2008 leachate storage test indicate that a hydraulic trap reversal could potentially result in northward leachate migration in this area. As such, groundwater quality and water levels should be closely monitored in this area to verify that the hydraulic trap is effective at containing leachate. Water quality impacts at this location are the subject of an ongoing investigation that will be completed in the fall of 2022.

5.6.2.5 Monitoring Site 27

Monitoring location 27 is located northwest of Phase 2 and adjacent to aggregate stockpiles, where shallow groundwater has been historically impacted by blasting residues. Similar to previous years, groundwater quality in wells 27-1-1 and 27-1-2 met all applicable CSR standards. In 2021/22, water quality in shallow well 27-1-2 continued to be affected by ongoing aggregate production and blasting activity/excavation close to the Toutle Valley.

In 2021/22, nitrate and sulphate concentrations in shallow well 27-1-2 (3.5 m deep) ranged from 0.433 to 3.5 mg/L, and 110 to 170 mg/L, respectively, which were consistent with or slightly higher than concentrations observed in 2020/21. Because ammonia and chloride concentrations remained low, the elevated nitrate and sulphate concentrations are interpreted to be the result of infiltration of runoff from blasting areas and aggregate stockpiles near the Toutle Valley. Nitrate concentrations in deep well 27-1-1 (24.5 m deep) remained at detection limits. Nitrate is an oxidation product of ammonia, which is found in blasting residues and leachate. Similar to previous years, ammonia concentrations at both 27-1-1 and 27-1-2 were near detection limits

and chloride concentrations were below 5.5 mg/L and within the historical range. Conductivity values in deep well 27-1-1 remained below 200 µS/cm, and sulphate concentrations in the deep bedrock monitor 27-1-1 were less than 20 mg/L. Sulphate concentrations were less than 20 mg/L in shallow well 27-1-2 prior to the commencement of quarrying and aggregate stockpiling in 2002. Nearby and upslope quarrying, stockpiling of aggregate and road building continues to affect shallow water quality at location 27.

Groundwater quality at location 27 revealed a statistically significant increasing trend in chloride over the past five years. Increasing trends in sulphate at shallow well (27-1-2) and nitrate at the deep well (27-1-1) were also observed over the past five years. These increasing trends indicate a slight degradation of the groundwater quality, primarily due to quarrying and aggregate stockpiling. Hydraulic conditions and contaminant concentrations should be carefully monitored at this location because groundwater in this area reports to the surface water collection and conveyance system. It is recommended that the CRD commence early planning for potential future shallow groundwater, surface water and leachate management in this area to maximize diversion of clean water out of the leachate collection system.

5.6.3 Wells near Hartland North Pad (Residual Treatment Facility)

The Hartland North Pad has had a variety of uses including yard waste composting (1994 – 2004) and aggregate stockpiling (2006 - present). Additionally, the area was a construction site for the RTF associated with CRD's McLoughlin Point Wastewater Treatment Plant project. The construction of the RTF buildings began in early 2019 and was completed in September 2020. The RTF is now operational and permitted under ENV Operational Certificate #109471.

Monitoring locations 41, 42, 55, 56 and 57 are considered Boundary Compliance Wells around the Hartland North Pad. Monitoring locations 43, 44 and 62 are adjacent to the Hartland North Pad and are not Boundary Compliance Wells. Monitoring locations 91, 92, 93 and 94 were established in November 2019 and located south of the RTF. In 2021/22, groundwater quality in all monitoring wells met all applicable CSR standards, except for nitrate concentrations in 78-2-1, 87-2-1 and 88-2-1 and zinc concentration in 78-2-1 during one or more sampling events. Nitrate exceedances in these wells were observed during the November 2021 sampling event and are interpreted to be the result of runoff and leaching of blasting residues from aggregate stockpiles and areas where aggregate has been utilized for grading and access road construction.

5.6.3.1 Monitoring Sites 44 and 62

Groundwater sampling at well 44-1-1 commenced in 2016/17 to track potential construction related impacts at the Hartland North Pad area. Well 44-1-1 is located southwest of monitoring location 43, and groundwater quality is generally consistent with background conditions. In 2021/22, groundwater quality in 44-1-1 was consistent with the range of background values and exhibited low conductivity (< 400 µS/cm), low sulphate (< 50 mg/L), low chloride (<10 mg/L) and low ammonia (< 0.1 mg/L). Well 44-1-1 is located upgradient of the wastewater residuals spill area, and water quality results indicated that groundwater was not impacted from the wastewater residuals spill or surrounding construction/blasting activities.

Monitoring location 62 is located southwest of monitoring location 44. Similar to previous years, 62-1-1 (23.7 m deep) and 62-2-1 (18.9 m deep) exhibited water quality that was similar to background values throughout 2021/22, except for slightly elevated nitrate and ammonia concentrations. Nitrate and ammonia concentrations at location 62 generally remained close to detection limits, but reached peak values of 0.79 mg/L and 0.589 mg/L, respectively, during the November 2021 sampling event. A statistically significant increasing trend in nitrate was detected in well 62-1-1. Leachate indicator parameters including sulphate, chloride and conductivity were still reflective of background groundwater quality. The slightly elevated nitrate and ammonia concentrations are likely associated with aggregate use and storage in the area. Although concentrations of leachate indicator parameters were still below threshold limits, water quality at location 62 should be closely monitored to assess for changes in water quality.

5.6.3.2 Monitoring Sites 41, 42, 43, 55, 56 and 57

Figure 5-7 shows plots of leachate indicator parameters for monitoring locations 41, 42, 43, 55 and 56. In 2021/22, water quality in all these locations were generally degraded, evident by increased conductivity and ammonia concentrations.

In 2021/22, conductivity and ammonia concentrations at most wells in this area peaked during the November 2021 sampling event and deceased to normal ranges during the subsequent sampling event in February 2022. Sulphate concentrations in wells located further north of RTF (41-1-1, 55-1-1, 56-1-1 and 57-1-1) remained below 60 mg/L, but more elevated in wells 42-1-1 and 43-1-1, ranging from 70 to 120 mg/L. Chloride concentrations at all locations remained below background concentrations.

Well 41-1-1 exhibited a statistically significant decreasing in sulphate over the past five years with a marked reduction since stockpiles were removed from the Hartland North Pad in 2017. A statistically significant increasing trend in chloride was also

detected as chloride concentrations gradually increased from 4 mg/L to 7 mg/L over the past five years. However, chloride concentrations remained within background ranges since 2014. A statistically increasing trend was detected for sulphate in wells 42-1-1 and 43-1-1, indicating the potential impact from aggregate stockpiling in the North Pad area. Water quality in well 56-1-1 exhibited a statistically significant increasing trend in conductivity and chloride. The low chloride concentrations indicate these are not impacted by road salt.

Overall, groundwater quality results indicated that the monitoring wells in close proximity to the RTF were temporally impacted by aggregate stockpiling/ blasting activities during the November 2021 sampling event. Wells located further north of Willis Point Road were less impacted. Impacts dissipated during the subsequent sampling event in February 2022. However, water quality in these wells should be closely monitored to assess for changes in water quality as water quality in these wells has previously been influenced by site activities.

5.6.3.3 Monitoring Sites 77, 78, 87 and 88

Concentrations of all parameters from samples collected in 2021/22 from wells at locations 77, 78, 87 and 88 (not Boundary Compliance Wells) were below applicable CSR standards, except for nitrate and zinc. Zinc concentration in 78-2-1 exceeded CSR AW during November 2021 sampling event. Nitrate concentrations in 78-2-1, 87-2-1 and 88-2-1 exceeded CSR DW standard of 10 mg/L during one out of three sampling events.

In 2021/22, groundwater quality in monitoring wells at location 77 was slightly degraded, with higher conductivity values. Conductivity at location generally remained below 300 μS/cm, but showed concentrations as high as 380 μS/cm. Sulphate concentrations in well 77-2-1 were also slightly elevated, ranging from background values of approximately 25 mg/L to peak of 42 mg/L. The concurrent increase in conductivity and sulphate concentrations suggests minor impacts from the natural flushing of mineral oxidation products from the overlying weathered bedrock and aggregate stockpiles. Chloride, ammonia and nitrate concentrations were generally consistent with background conditions. Although chloride values at wells 77-1-1 and 77-2-1 show statistically significant increasing trends over the past five years, chloride concentrations remained below 10 mg/L. Statistically increasing trend in sulphate is also detected in 77-2-1, indicating water quality has slightly deteriorated over the past five years due to nearby aggregate stockpiles.

Similar to location 77, water quality at location 78 exhibited higher conductivity values in 2021/22, with values ranging from 327 to 510 μS/cm. Ammonia and chloride concentrations remained low or close to background ranges. Sulphate concentrations at deep well 78-1-1 were relatively stable and ranged between 57 and 62 mg/L. Sulphate concentrations at shallow well 78-2-1 reached to peak of 130 mg/L in September 2021 and remained elevated (>80 mg/L) during the consecutive samplings events in November 2021 and February 2022. Nitrate concentrations in 78-2-1 also reached to peak of 18 mg/L in February 2022. The concurrent increase in conductivity, sulphate and nitrate concentrations indicate that groundwater in 78-2-1 is impacted by on-going aggregate stockpiling activities upslope of location 78. Due to the low ammonia and chloride concentrations, it is unlikely that groundwater at location 78 is impacted by leachate. A statistically significant increasing trend in sulphate concentrations was observed at wells 78-1-1 and 78-2-1 over the past five years.

Groundwater wells 87 and 88 are located on either side of the Highland Fault. Similar to locations 77 and 78, water quality in wells 87 and 88 was degraded, with higher conductivity, nitrate and sulphate concentrations. Conductivity values increased from <400 μS/cm to peak of 700 μS/cm during the September and November 2021 sampling events. Nitrate concentrations in 87-2-1 and 88-2-1 also increased dramatically, from <0.1 mg/L to over 40 mg/L. Sulphate concentrations in all nested wells were higher than those observed in previous years, and most elevated in 88-2-1. Ammonia concentrations in deep wells 87-1-1 and 88-1-1 remained below detection limits during all sampling events but increased to a maximum of 1.7 mg/L in the shallow wells during September 2021 sampling event. The elevated conductivity, sulphate and nitrate concentrations at locations 87 and 88 indicate that groundwater quality was impacted by the quarrying and aggregate placement activities, and shallow groundwater quality degraded slightly.

5.6.3.4 Monitoring Sites 91, 92 and 93

Figure 5-7 shows plots of leachate indicator parameters for monitoring locations 91, 92, 93 and 94. Wells 91-1-1, 92-1-1, 93-1-1 (not Boundary Compliance Wells) located near the Hartland North Pad. Groundwater sampling at these locations commenced in March 2020. Since 2021, groundwater was able to be collected at 93-1-1 due to on-site construction. 94-1-1 is a background well and water quality was discussed in section 4.6.1.

In 2021/22, water quality at locations 91 and 92 remained below CSR AW and DW standards. Similar to other wells located near the Hartland North Pad, conductivity and sulphate concentrations at both locations were more elevated during November 2021 and February 2022 sampling events. Chloride and ammonia concentrations were below background groundwater

concentrations. The elevated conductivity and sulphate concentrations indicate that groundwater quality is likely impacted by on-going quarrying/blasting activities on-site.

Statistical trend analysis indicated an increasing trend in sulphate concentrations in well 91-1-1. Groundwater quality at these locations should continue to be monitored for changes in water quality associated with aggregate stockpiling, and construction and operation of the RTF.

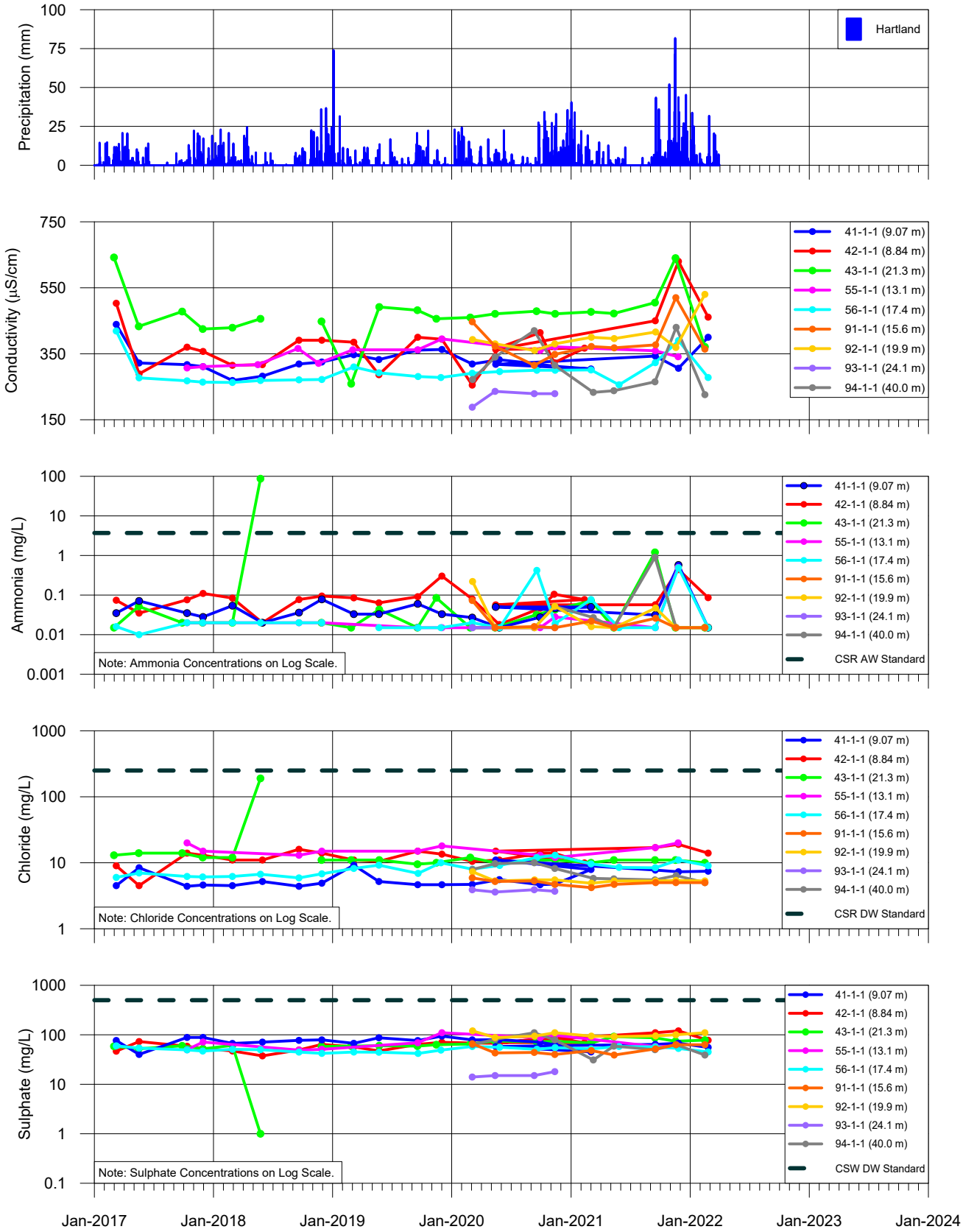


Figure 5-7. Groundwater Quality North of Hartland North Pad

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5.7 Monitors South of the Phase 1 Landfill

Monitoring well locations 4, 7, 19, 60, 71, 72, 73 and 85 are all located south of the Phase 1 landfill. Only wells at locations 4, 71, 72 and 73 are considered Boundary Compliance Wells. Well 71 is located off site along Hartland Avenue. Wells at locations 4, 19, 60, 71, 72 and 73 are multi-level nested monitoring wells, and the well at location 7 is a 37 m deep drilled well (open borehole) that was used until 1989 for domestic water supply at the landfill. Wells at locations 71, 72 and 73 were installed in 2003. Well 85-1-1 was installed in 2009 to replace well 3-2-1, which was decommissioned to permit construction of the bin facility.

Similar to previous years, all analytes in all wells met the applicable CSR standards in 2021/22. Figure 5-8 shows plots of leachate indicator parameters in wells located south and downgradient of the landfill, and Figure 5-9 plots leachate indicator parameters for wells located southeast of the landfill.

Groundwater quality in these wells is sensitive to the performance of the south purge well system (see Section 4.4.3). When the purge well system is functioning properly, concentrations of leachate indicator parameters have been shown to decline and seasonal fluctuations in concentrations of leachate indicator parameters are dampened. The reported concentrations indicate that the south purge well system successfully mitigated southward migration of leachate in 2021/22.

5.7.1 South Purge Wells (P1, P2, P3, P4 and P10)

Groundwater quality data collected from the south purge wells (P1, P2, P3 and P10) exhibited statistically significant increasing trends for multiple leachate indicator parameters for the past five years, indicating water quality degradation and therefore improved leachate capture. In 2021/22, the average conductivity value across all south purge wells was 1,784 µS/cm, which was slightly higher than the average value of 1,625 µS/cm in 2020/21. Conductivity values were generally consistent among all sampling events, and no notable seasonal variations were observed.

Chloride concentrations in the south purge wells have been increasing in recent years and statistically significant increasing trends were detected in P1 and P10. Chloride concentrations in 2021/22 ranged from 43 mg/L (P10) to 220 mg/L (P3), which is similar to ranges previously seen in these south purge wells.

In 2021/22, ammonia concentrations in the south purge wells continuously exceeded CSR standards, ranging from 24 to 97 mg/L. Nitrate concentrations in the south purge wells were mostly below or close to the detection limit. No statistically significant trend in ammonia and nitrate was observed at any of the south purge wells over the past five years.

Sulphate concentrations in south purge wells remained below 50 mg/L, indicating the limited or minor impact from aggregate stockpiling activities south of Phase 1.

5.7.2 Monitoring Site 85

In well 85-1-1 (not a Boundary Compliance Well), chloride concentrations were typically below 50 mg/L, but increased to a peak value of 150 mg/L in February 2017, May 2019 and September 2019 showing the importance of leachate collection systems in maintaining groundwater quality in that area. In 2021/22, chloride concentrations were elevated in September (170 mg/L) and then decreased to 98 mg/L in March 2022. Sulphate concentrations remained below 50 mg/L but slightly increased to 72 mg/L during the November 2021 sampling event, which coincided with increased nitrate concentrations. Ammonia concentrations remained below 0.2 mg/L during all sampling events. Given the low ammonia concentrations, groundwater at this location is unlikely to be impacted by leachate. The concurrent increase in nitrate, sulphate and conductivity during the November 2021 sampling event may be related to runoff from aggregate placed during nearby construction works. The elevated chloride was not from Garlon™ XRT herbicide as it was not applied in 2021/22. The Cl/Na ratio in 85-1-1 was greater than 1, indicating an additional source of chloride other than road salt and leachate.

A statistically significant decreasing trend in conductivity, nitrate and ammonia was observed in well 85-1-1 over the past five years, indicating the benefits of improved performance of the south purge well system in recent years. Groundwater quality should be closely monitored at location 85 to monitor the effectiveness of the south purge wells.

5.7.3 Monitoring Site 60

Three monitoring wells are present at location 60: 60-1-1 (23 m), 60-2-1 (16 m) and 60-3-1 (7 m). These wells are not considered Boundary Compliance Wells. Concentrations met the applicable CSR standards in all three wells at this location, but concentrations of leachate indicator parameters remained slightly elevated. In 2021/22, groundwater quality at location 60

was slightly degraded, with higher conductivity (472 to 910 µS/cm) and chloride (80 to 150 mg/L) in comparison to those measured in 2020/21. Conductivity values in 60-1-1, 60-2-1 and 60-3-1 were most elevated during the November 2021 sampling event, and reached the peak concentrations observed in the past five years. Ammonia concentrations generally remained below detection limits but were slightly elevated during May 2021 sampling event. Sulphate concentrations in shallow well 60-3-1 were also slightly elevated in 2021/22, and gradually increased from background the range of 50 mg/L to 77 mg/L.

Conductivity in 60-1-1, 60-2-1 and 60-3-1 and chloride in 60-1-1 and 60-3-1, sulphate in 60-3-1 exhibited statistically significant increasing trends over the past five years, indicating the overall deterioration of water quality at location 60. Due to the low ammonia concentrations, it is not likely that water quality at location 60 is impacted by dilute leachate. The slightly increased sulphate concentrations may be associated with aggregate runoff. However, additional investigation should be conducted to identify the source of chloride. The Cl/Na ratios in wells 60-1-1, 60-2-1 and 60-3-1 were well above 1 (i.e., 1.8-5.7), indicating an additional source of chloride other than road salt and leachate. The highest Cl/Na ratios (i.e., >5) were observed in wells 60-2-1 and 60-3-1, which are screened at shallower depths. Overall, groundwater quality at location 60 degraded slightly in 2021/22, with higher conductivity, chloride and sulphate concentrations. From February to April 2021, water levels were elevated in P3 due to pump failure, and it is possible that the effectiveness of leachate collection was temporarily reduced until the pump was repaired.

Elevated concentrations of leachate indicator parameters and the sensitivity of water quality to performance of the south purge well system demonstrates the need for continued close monitoring of water quality at this location, review of pumping and water level data in the south purge wells, and active management of the south leachate collection system.

5.7.4 Monitoring Site 07

In 2021/22, all parameters at Boundary Compliance Well 07-1-0 were below applicable CSR standards. Sulphate and nitrate concentrations remained low and comparable to background conditions. However, chloride and conductivity values continued to increase in 2021/22 and statistically significant increasing trends noted over the last five years. Since 2017, chloride concentrations gradually increased from 51 mg/L to 110 mg/L. The high Cl/Na molar ratios (i.e., >4) indicate an additional source of chloride other than road salt and leachate. Ammonia concentrations increased to a peak of 0.14 mg/L in May 2021 but returned to non-detectable levels during subsequent sampling events. The elevated ammonia concentrations in May 2022 may suggest water quality in 07-1-0 was temporally impacted by dilute leachate. However, the degraded water quality is primarily due to the elevated chloride concentrations.

5.7.5 Monitoring Sites 71, 72, 73

Wells 71, 72 and 73 are located at or near the eastern landfill property boundary south of Phase 1 and are considered Boundary Compliance Wells. Concentrations of leachate indicator parameters are shown on Figure 5-8 for wells at location 73 and on Figure 5-9 for wells at locations 71 and 72.

During 2020/21, all samples collected at location 71 met applicable CSR AW and CSR DW standards for all parameters. Water quality in 71-1-1 and 71-3-1 was generally consistent with previous results, with conductivity values ranging from 222 to 340 µS/cm and chloride concentrations below 10 mg/L. Ammonia concentrations were typically near or below detection limits, except for 71-3-1 during the May 2021 sampling event. Water quality in 71-2-1 was slightly degraded, with higher conductivity values that ranged from 350 to 500 µS/cm. However, other leachate indicator parameters including ammonia, nitrate and chloride concentrations remained low and consistent with historical results. Sulphate concentrations in all three wells were slightly higher than previous years but remained below 50 mg/L. A statistically significant increasing trend in sulphate was observed in wells 71-1-1, 71-2-1 and 71-3-1. Sulphate concentrations in all three wells gradually increased over time, from approximately 20 mg/L to up to 42 mg/L over the past five years. Statistically significant increasing trends were detected for conductivity and chloride concentrations in wells 71-1-1 and 71-2-1. Chloride concentrations remained below 10 mg/L during 2021/22. Similar to previous years, groundwater quality at location 71 was not impacted by leachate. The increased sulphate and conductivity concentrations indicated that groundwater quality may be mildly impacted by dilute aggregate runoff.

In 2021/22, all measured concentrations at 72-1-1 and 72-3-1 remained below applicable CSR standards. Groundwater quality exhibited slightly elevated conductivity values (443-610 µS/cm), low ammonia (<0.1 mg/L) and non-detectable to low nitrate concentrations. Chloride and sulphate concentrations ranged from 41 mg/L to 75 mg/L, and 46 mg/L to 66 mg/L, respectively, which were comparable to those measured in 2020/21. Well 72-1-1 exhibited a statistically significant decreasing trend in nitrate and well 72-3-1 also exhibited decreasing trends in chloride and nitrate concentrations. Close monitoring confirmed

adequate leachate containment south of the landfill and indicates the previously elevated conductivity and chloride concentrations in 2018/19 were related to the use of road salt at the bin facility and not leachate. Previous monitoring indicates preservation of water quality in this area relies on effective leachate collection by the south purge wells, highlighting the importance of an effective monitoring and maintenance program for leachate collection infrastructure.

At Boundary Compliance Well 73, located further south along the eastern property boundary, all parameters met applicable CSR standards in 2021/22. Conductivity, sulphate and chloride concentrations were relatively stable, except for slightly elevated conductivity during the November 2021 sampling event. Conductivity remained below the background level of 500 µS/cm. Nitrate and ammonia concentrations were near or below detection limits. Overall, concentrations of parameters at location 73 remained within background levels, and water quality continues to improve with distance from Phase 1. Statistical trend analysis revealed decreasing trends in conductivity values at all three wells, and chloride concentrations in 73-1-1. A statistically significant increasing trend was observed for nitrate in groundwater from well 73-3-1 and for sulphate in groundwater from 73-1-1. Based on the graphical and statistical analysis of groundwater chemistry data, it appears that groundwater quality at location 73 is relatively stable, is continuing to improve and is not impacted by leachate.

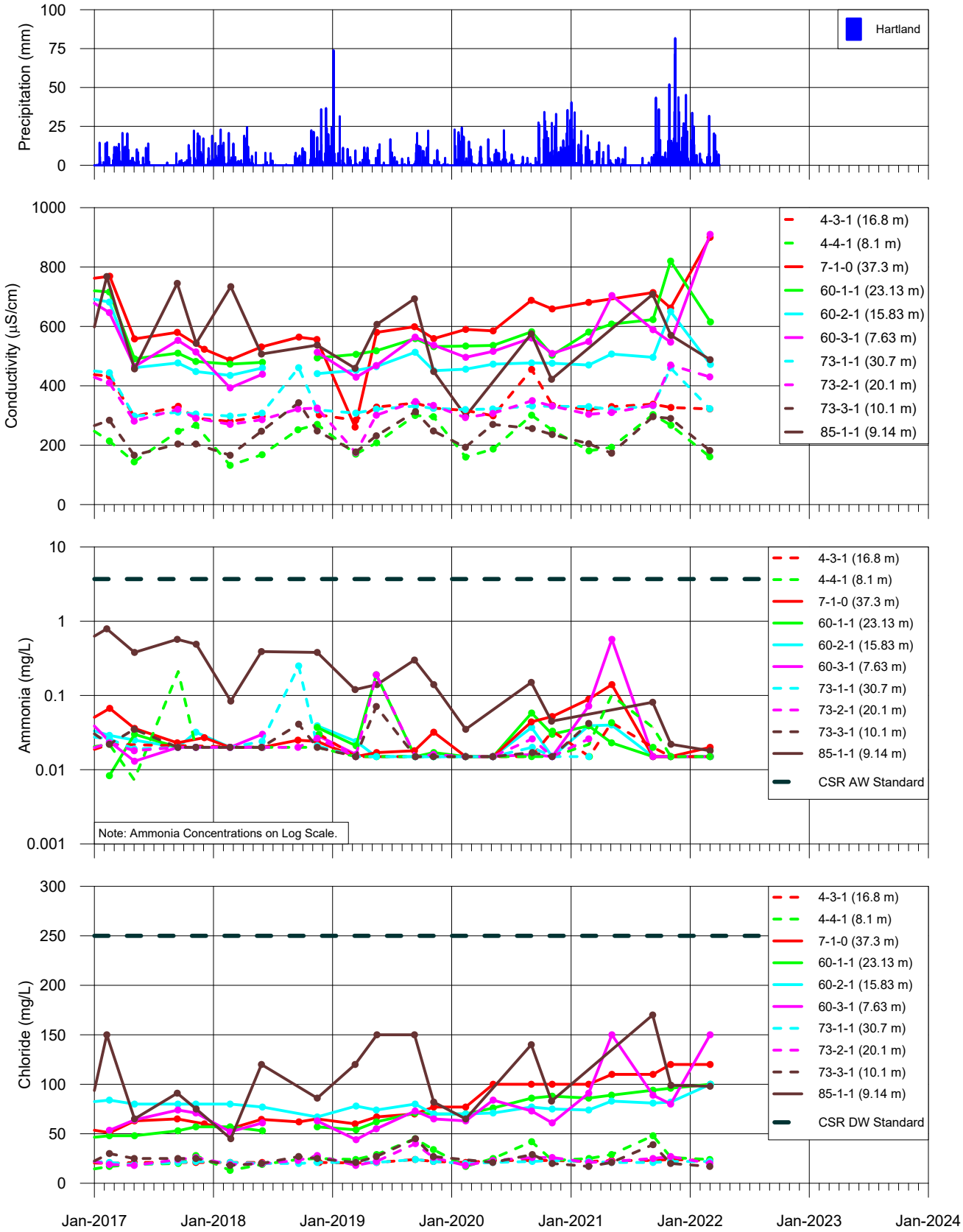


Figure 5-8. Groundwater Quality South of Landfill

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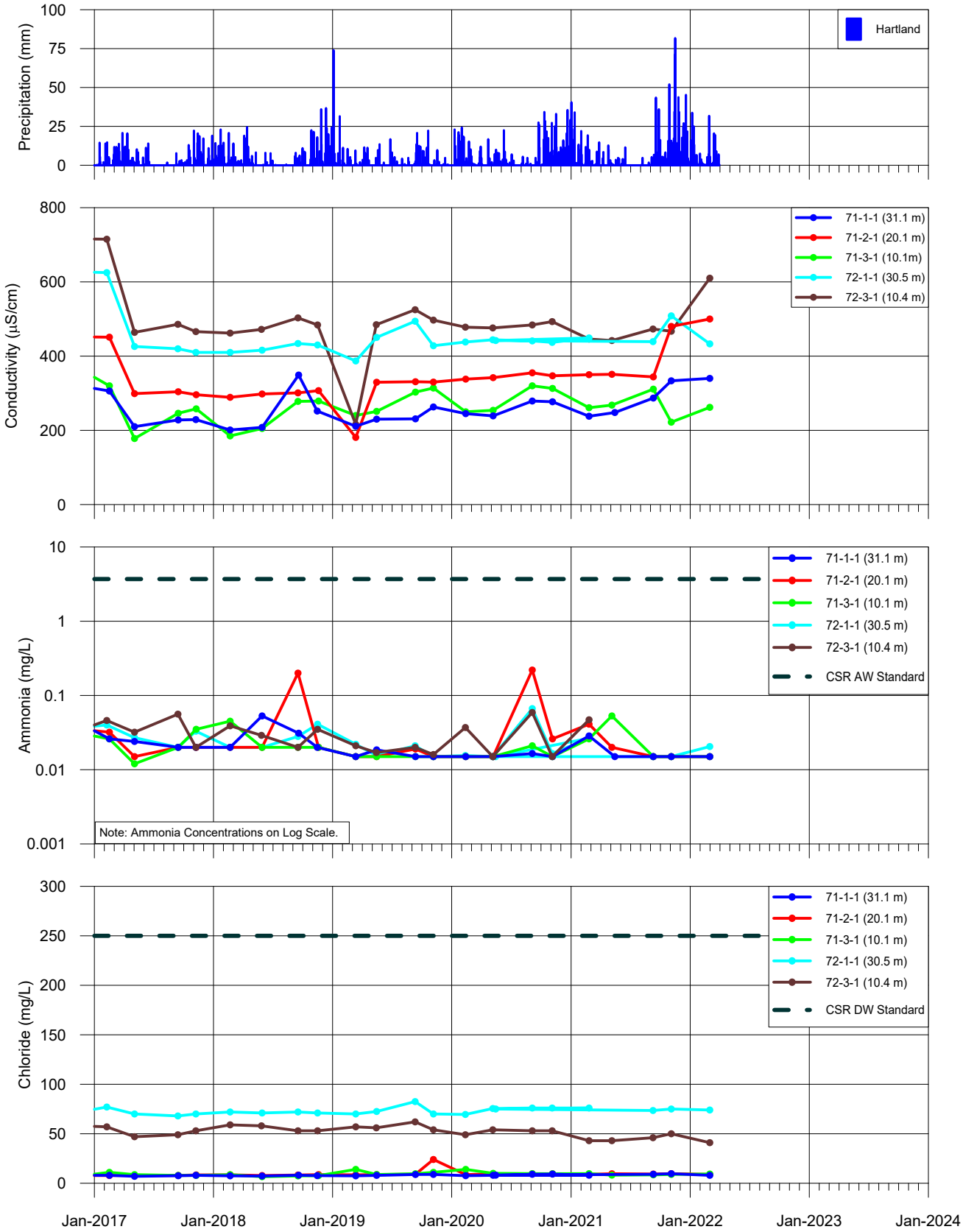


Figure 5-9. Groundwater Quality Southeast of Landfill

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5.7.6 Monitoring Site 04

Location 04 is the most southerly groundwater monitoring location at the landfill and is considered a Boundary Compliance Well. Groundwater sampling in the deepest monitoring well at location 04-2-1 was discontinued in 2016 due to extremely slow recharge and resultant challenges in collecting representative samples.

All concentrations observed in 04-3-1 and 04-4-1 met the applicable CSR standards in 2021/22. Groundwater quality in 04-4-1 continued to report slightly elevated concentrations of chloride in 2021/22, with a maximum concentration of 48 mg/L during September 2021 sampling event. Conductivity, nitrate and ammonia concentrations in both wells were generally consistent with background conditions, indicating water quality was not impacted by leachate.

A statistical analysis of data collected at location 04 over the past five years indicated statistically significant increasing trends in chloride in well 04-4-1 and increasing trends for chloride and sulphate in well 04-3-1. Overall, water quality in wells at location 04 has degraded slightly as a result of increased chloride concentrations. However, water quality was not likely impacted by leachate, due to low ammonia concentrations. Water quality should continue to be closely monitored for impacts due to leachate, road salt and aggregate placement.

5.7.7 Monitoring Site 19

Four monitoring wells are present at location 19: 19-1-1 (38 m), 19-1-2 (28 m), 19-2-1 (17 m) and 19-2-2 (9 m). These wells are not considered Boundary Compliance Wells. During 2021/22, all samples collected at location 19 met applicable CSR AW and DW standards. Similar to previous years, conductivity in all wells were below 500 µS/cm, ammonia and nitrate concentrations were generally close to detection limits, and sulphate concentrations were generally below 50 mg/L. Sulphate concentrations in wells 19-2-1 and 19-2-2 exhibited statistically significant decreasing trends.

Chloride concentrations in 19-1-1 were slightly elevated in 2019/20 but returned to the historical range of values since November 2020. Chloride concentrations in wells 19-2-1 and 19-2-2 exhibited statistically significant increasing trends but remained low (<22 mg/L). Similar to previous years, groundwater quality at location 19 was not impacted by leachate or aggregate placement.

5.8 Monitors East of the Phase 1 Landfill

Monitoring well locations 16, 17, 18, 50, 54 and 76 are situated along the east boundary of the Phase 1 landfill north of Hartland Avenue. Groundwater quality is no longer monitored at locations 50, 54 and 76 due to continued demonstration of groundwater flow toward the landfill and the presence of water quality reflective of background conditions.

5.8.1 Monitoring Sites 17 and 18

Figure 5-10 presents concentrations of leachate indicator parameters in wells at locations 17 and 18. In 2021/22, concentrations in wells at compliance locations 17 and 18 met applicable CSR standards for all parameters analyzed.

Groundwater quality data at location 18-1-1 indicated statistically significant increasing trends in ammonia and sulphate. However, concentrations of both parameters remained low and well below threshold limits, and water quality is not likely impacted by leachate. Ammonia concentrations generally remained below detection limits but was slightly elevated during the September 2021 sampling event.

In wells 18-2-1 and 18-2-2, sulphate and nitrate concentrations exhibited a statistically significant increasing trend, and sulphate concentrations have occasionally been above the background value of 50 mg/L since 2020. The concurrent increase in sulphate and nitrate concentrations were generally observed during the late fall and early winter sampling event (September to November) and may indicate dilute aggregate/runoff impacts. Groundwater samples have not been collected at 18-1-2 due to an obstruction in the well prior to 2010. Because the obstruction cannot be removed, the well should be decommissioned and replaced with a new well in accordance with the *Water Sustainability Act*.

In 2021/22, ammonia, chloride, sulphate and conductivity values in wells 17-1-1 and 17-1-2 remained below background values, indicating groundwater quality was relatively stable. In shallow well 17-1-3, conductivity reached to the peak value of 540 µS/cm during the November 2021 sampling event. Similar to previous years, nitrate concentrations at 17-1-3 were slightly elevated, but remained below 0.3 mg/L. Nitrate concentrations may be related to the oxidation of ammonia, which is associated with decaying organic matter. Based on field observations and experience at Hartland landfill, the occasionally elevated ammonia and nitrate concentrations generally occur during the winter, and this phenomenon has been attributed to

decaying organic matter, including reptiles that have entered wells in the past. At location 17, statistically significant decreasing trends were found in chloride in well 17-1-2, indicating generally stable groundwater quality. Similar to previous years, groundwater quality at location 17 and 18 was not impacted by leachate. Water quality at location 18 may be experiencing minor impacts from nearby aggregate placement or bedrock weathering.

5.8.2 Monitoring Site 16

At monitoring location 16 (not a Boundary Compliance Well) located northeast of Phase 1, concentrations of leachate indicator parameters were indicative of background conditions and applicable CSR standards were met for all parameters in 2021/22. Similar to previous years, nitrate concentrations in wells 16-1-2, 16-2-1 and 16-2-2 increased above background values during the winter and reached peak value of 1.39 mg/L. Conductivity and chloride in well 16-2-2 exhibited a statistically significant increasing trend, but concentrations remained below background values.

Overall, groundwater quality at location 16 was generally stable or slightly degraded in 2021/22. Low sulphate (<30 mg/L), chloride (<5 mg/L) and ammonia (<0.05 mg/L) concentrations indicate water quality is not likely impacted by aggregate or leachate.

5.9 Summary

The groundwater quality results for 2021/22 indicated that leachate-impacted groundwater is contained within the landfill property. At the north end of the landfill, leachate-affected groundwater extends just north of the unlined lower leachate lagoon and through the middle of the lined upper leachate lagoon but does not extend off-site. South of the landfill, leachate-affected groundwater does not extend off-site. Leachate related exceedances are confined to the landfill footprint on the east side of Phase 1 and are inferred to extend to the west side of the Phase 2 landfill.

In 2020/21, most groundwater wells exhibited slightly degraded groundwater quality compared to 2020/21, which may be related to the aggregate production and stockpiling on the bedrock ridge north of the Phase 2 landfill and the impacts of high intensity precipitation events during November 2021 that may have mobilized oxidation products from the unsaturated zone to the water table. Groundwater quality in Boundary Compliance location 31 remained slightly impacted by the pump #4 effluent release that occurred at the RTF on October 18, 2020.

Our review of the 2021/22 groundwater quality data revealed the following:

- Boundary Compliance Wells and off-site monitoring wells met CSR AW and DW standards, except for boron. During one sampling event, boron marginally exceeded the CSR DW standard of 5 mg/L in well 20-1-1.
- CSR exceedances in groundwater were observed in on-site monitoring wells in close proximity to leachate purge wells and known leachate sources as follows:
    - Similar to previous years, water quality in well 58-1-0 (within the landfill waste footprint) exceeded CSR AW standards for ammonia and cobalt on all four sampling dates. Chloride, cobalt, nickel, strontium and vanadium concentrations exceeded CSR DW on one or more sampling events. Sodium concentrations were above the CSR DW of 200 mg/L but well below the regional background concentration of 1,700 mg/L, and therefore sodium concentrations were in compliance with the CSR at this location.
    - Groundwater quality in well 52-1-1 (near the north purge wells) exceeded CSR AW standards for ammonia and CSR DW standards for strontium on all four sampling dates.
    - Groundwater quality in the north purge wells (52-4-0-P7 and 80-1-0-P8) and south purge wells (P1, P2, P3, P4 and P10) exceeded CSR AW standards for ammonia on one or more sampling dates. Chloride, arsenic, barium and nitrate concentrations occasionally exceeded CSR DW standards in some wells. Lithium and sodium concentrations in all wells were below regional background values, and therefore elevated concentrations were not considered CSR exceedances.
- Nitrate concentrations in some shallow groundwater wells (78-2-1, 87-2-1, 88-2-1) near the Hartland North Pad exceeded applicable CSR DW standard during Q4 2021 or Q1 2022 sampling events. Ammonia concentrations remained below detection limits. The nitrate exceedances were primarily attributed to the aggregate stockpiling on the bedrock ridge north of the Phase 2 landfill.

- Operation of the Phase 1 north purge well system continues to mitigate leachate impacts north of the landfill, as indicated by long-term stable or decreasing concentrations of leachate indicator parameters at locations 40, 20 and 21. Groundwater quality in well 20, 21 and 40 were generally stable or slightly improved in 2021/22.
- Groundwater quality between the lower leachate lagoon and Willis Point Road continued to show no indications of leachate impacts. However, conductivity, ammonia, sulphate and nitrate concentrations in Boundary Compliance Well 31 continued to show impacts from the wastewater residual spill event that occurred on October 18, 2020.
- During the monitoring timeframe between April 2021 and March 2022, groundwater quality in close proximity to the Phase 2 basin confirms the hydraulic trap leachate collection system is effectively containing leachate north of Phase 2, and no off-site exceedances were observed. Additional investigations are underway to further evaluate the root causes of the degraded groundwater and surface water quality north of Phase 2 during 2021/22. Groundwater quality 100 m north of Phase 2 continued to show low concentrations of leachate indicator parameters, indicating water quality is not affected by landfill leachate. The increase in nitrate and sulphate concentrations in groundwater is likely due to infiltration of blasting residuals and other constituents from aggregate stockpiles.
- Groundwater quality at the Hartland North Pad were consistent with background levels, except for higher sulphate, nitrate and conductivity during Q3 and Q4 2021 sampling events. The concurrent increase in conductivity, ammonia and nitrate concentrations may suggest that the background groundwater in 94-1-1 was temporally impacted by aggregate placement activities.
- Groundwater quality in 91-1-1, 92-1-1 and 93-1-1 was generally consistent with background conditions, except for elevated sulphate concentrations during November 2021 and February 2022 sampling events. The elevated conductivity and sulphate concentrations indicate that groundwater quality is likely impacted by on-going aggregate production, stockpiling and road construction activities.
- Water quality along the south boundary of the Phase 1 landfill is not impacted by leachate. Although ammonia concentrations in some wells south of the landfill were slightly elevated during the winter months, they were within historical ranges, and well below the applicable CSR standards. Therefore, the occasionally elevated ammonia concentrations are not interpreted to be related to leachate. Since 2020, chloride concentrations in some wells were occasionally elevated, and reached a new high in 2021/22. The high Cl/Na ratios (>1) suggested there is additional source of chloride other than road salt. The source of chloride is currently unknown, and not likely related to the application of herbicide as it was not applied in 2021/22.
- Water quality along the east boundary of the Phase 1 landfill remained similar to previous years and is not impacted by leachate. Although ammonia concentrations in wells 17 and 18 were slightly elevated during the winter months, they were generally below 0.1 mg/L, and well below the applicable CSR standards. Therefore, the occasionally elevated ammonia concentrations are not interpreted to be related to leachate. The concurrent increase in sulphate and nitrate concentrations were generally observed during the late fall and early winter sampling event (September to November), and may indicate dilute aggregate/runoff impacts.

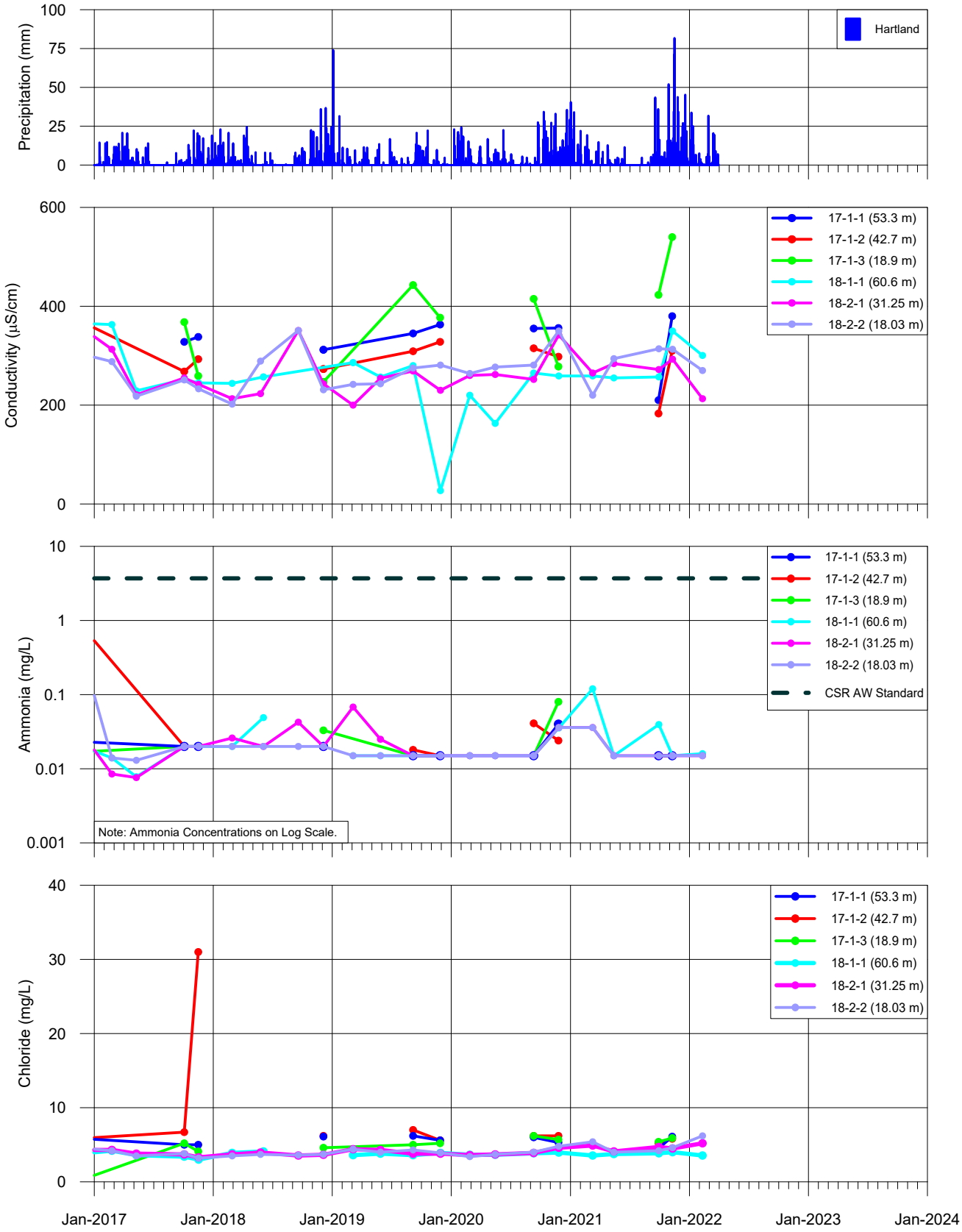


Figure 5-10. Groundwater Quality East of Landfill

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6 Groundwater Quality in Domestic Wells

6.1 Monitoring Locations

This section of the report summarizes our interpretation of water quality data collected from domestic wells around Hartland Landfill between May 31 and June 2, 2021. The sampling program included the following:

- Routine groundwater samples were collected in May/June 2021 from fourteen (14) selected domestic wells located within a 2 km radius of the landfill.
- Groundwater samples were collected from five (5) additional domestic wells located northwest of the Hartland North Pad and analyzed for selected parameters (sodium, chloride, ammonia, conductivity, and pH).

Since the 1980s, the CRD has performed routine sampling and analysis of domestic wells near the landfill that are used as a primary source of drinking water. The number of wells included in the program have been reduced gradually as municipal water became available and residents chose to connect to the municipal supply system. Most of the domestic wells near Hartland Landfill are situated southeast of the landfill as shown on Figure 6-1. The wells are primarily 0.15 m diameter drilled wells that penetrate between 30 m and 120 m of bedrock. Three of the wells are shallow dug wells completed in overburden. Well yields are generally low and substantial drawdown occurs during pumping, particularly during the dry summer months.

Routine groundwater samples collected in 2021 were analyzed for general water quality parameters and total metals. Tabulated results are presented in Appendix B.2. Results were compared to the *British Columbia Approved Source Drinking Water Quality Guidelines (SDWQGs)* where available and *Guidelines for Canadian Drinking Water Quality* (CDWQ). SDWQGs and CDWQ were updated in September 2020 and June 2019, respectively, with a number of parameters (e.g. sulphate, antimony, lead, cobalt, chromium, copper, manganese, nickel, etc.) added to the drinking water guidelines or updated.

6.2 Domestic Well Quality

Groundwater quality in the domestic wells was consistent with groundwater quality results reported since 2000. Although concentrations of some parameters have varied since the sampling program began, they are considered representative of natural conditions or influenced by household water filtration/treatment equipment.

At the 14 routine locations, the observed groundwater quality meets the applicable guidelines and standards in sampled wells, with some exceptions. Exceedances of the CDWQ guideline (aesthetic objectives) were noted at select locations as described below:

- Field pH values were below the CDWQ guideline of 7.0, in wells 24, 25, 61, 47, 50, 52, 53, 80, and 51.
- The manganese concentration observed in domestic well 38 (at the well head) exceeded the total manganese SWWQG (0.02 mg/L). The SDWQG for total manganese in drinking water is an aesthetic objective to protect against staining and unpleasant taste but such concentrations are not considered toxic.

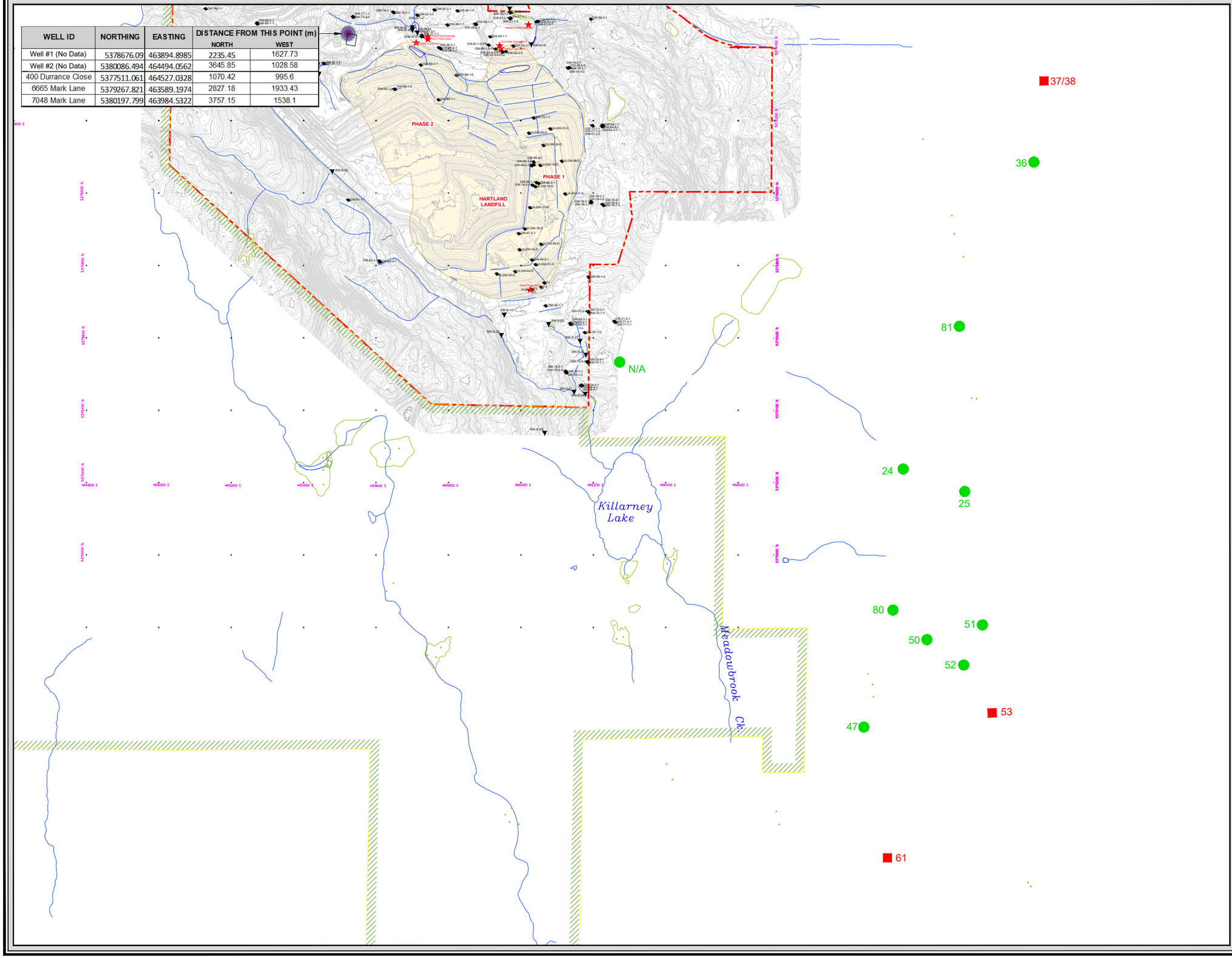
The five domestic wells located northwest of the landfill met CDWQ and SDWQG guidelines for leachate indicator parameters, indicating these wells were not impacted by leachate from Hartland Landfill.

Overall, the 2021 domestic well water quality results are consistent with historical data, and the data indicates that the wells have not been impacted by leachate from Hartland Landfill.

6.3 Summary

As part of the CRD's groundwater quality monitoring program, nineteen (19) domestic wells were sampled in 2021, including 14 routine locations and 5 new wells. Overall, the groundwater quality in the domestic wells sampled in 2021 was consistent with historical data, indicating landfill leachate from Hartland Landfill did not impact water quality in the sampled wells. Water quality in all domestic wells located northwest of the landfill near the end of Willis Point Road met CDWQ and SDWQG guidelines, indicating landfill leachate did not impact water quality in these wells.

WELL ID	NORTHING	EASTING	DISTANCE FROM THIS POINT (m)	
			NORTH	WEST
Well #1 (No Data)	5378676.09	463894.8985	2235.45	1627.73
Well #2 (No Data)	5380086.494	464494.0562	3645.85	1028.58
400 Durrance Close	5377511.061	464527.0328	1070.42	995.6
6665 Mark Lane	5379267.821	463589.1974	2827.18	1933.43
7048 Mark Lane	5380197.799	463984.5322	3757.15	1538.1



Legend

- BUILDING / STRUCTURE
- ROAD
- FENCE
- LEGAL LOT BOUNDARY
- INDEX CONTOUR (5m)
- INTERMEDIATE CONTOUR (1m)
- TREES/SHRUB/VEGETATION
- DITCH
- DRAINAGE
- PIPE
- EXISTING WASTE
- HARTLAND LANDFILL OPERATING AREA BOUNDARY
- 37 — DRILLED DOMESTIC WELL SAMPLED IN MAY-JUNE 2021
- 61 — DUG DOMESTIC WELL SAMPLED IN MAY-JUNE 2021
- Well #1 — NO DATA COLLECTED IN 2021

Map Sources / Notes:
- Contour interval 1.0 m
- Groundwater elevation data collected by CRD, September 2021.
- Contours based on 24-W542_2021_base.dwg provided by Adrian Betanzo of Capital Regional District, April 2022.
- Drainage information for years 2018-2019 obtained from Parks & Env. Services GIS technicians and have layers with the prefix "CRD19_GIS DRAINAGE" & "CRD19_GIS streams_Ditches".
- GPS pickup has been conducted by CRD Staff of creeks, wetlands, culverts located under tree canopied areas. This information (considered more accurate) has been added to the base (superceding some planimetric information) and is placed on layers indicating GPS pickup. An example of that layering system would be 'CRD19-wat-culvert_GPS pickup'.
- Surveyed points for monitoring sites (groundwater, gas wells, leachate, purge wells) were updated for 2019.
- The map is to NAD83 UTM coordinates. Vertical datum is to CGVD28.

N / W / E / S

0 50 100 200 300 400 m

1 : 10,000

UTM Zone 10N, NAD83

Reviewed by: KJ Prepared by: PCJ
Date Issued: October 2022 Project Number: 60631284

Making a difference...together

Project: Hartland Landfill Monitoring
Location: Saanich, BC

Domestic Well Locations

AECOM

Figure 6-1

File Location: \\NA.AECOMNET.COM\LFSVAMERIBURNABY-CABNY1\LEGACY\CABNY1FP001\PROD\PROJECTS\60631284\900-CAD_GIS\910-CAD\20-SHEETS\C433 - 2021-22 ANNUAL REPORT\FIG6.1-DOMESTIC WELLS-60631284-2022.DWG Date Plotted: October 17, 2022 Saved By:castlejanschp

7 Surface Water Quality near the Landfill

7.1 Compliance Monitoring Locations

Five surface water compliance monitoring stations (i.e., Boundary Compliance stations) surround Hartland Landfill. These stations are concentrated along the southern and northern property boundaries, downgradient of areas that could potentially be impacted by leachate or runoff from the landfill. The following Boundary Compliance stations are monitored to assess landfill compliance with the landfill operating permit:

South of the Landfill

- Sw-S-04

North of Phases 1 and 2

- Sw-N-05
- Sw-N-16

North of the Hartland North Pad

- Sw-N-41s1
- Sw-N-42s1

AECOM reviewed the surface water sampling program in early 2016 (AECOM 2016) and recommended adjusting the number of sampling sites, their locations and sampling frequency. Such recommendations were implemented in the 2016/17 monitoring year. In 2021/22, a total of 23 surface water stations were sampled. The 2021/22 surface water quality analytical results are presented in Appendix B.3.

7.1.1 Regulatory Comments

As discussed in Section 2.4.2, the results were compared to the BCWQG for the protection of freshwater AW. Exceedances of BCWQGs are noted in Table 7-1. Some parameters have variable guidelines, as noted below:

- For ammonia, there is no single value for the protection of freshwater AW. The toxicity of ammonia is related to the temperature and pH of the water, and the BCWQG includes values for acute and chronic effects. The appropriateness of the chronic (allowable 30-day average) concentration for the assessment of ongoing operations is currently being evaluated. Using surface water quality data, CRD staff calculated the allowable 30-day average concentration of ammonia for the protection of freshwater AW and the maximum allowable concentration (MAC) based on the pH and temperature of each sample (as discussed in the footnotes of Table 7-1), with exceedances highlighted based on BCWQG-MACs.
- The BCWQG-MAC for sulphate was calculated based on the hardness of each sample. A detailed description is presented in the footnotes of Appendix B.3.
- The BCWQG-MAC and 30-day average values for total suspended solids (TSS) reference a “change from the background value” and the flow conditions (i.e., clear or turbid waters). Water quality at stations Sw-N-CSs2 and Sw-N-14 are considered representative of background surface water quality north of the landfill. Water quality at station Sw-S-52 represents background surface water quality south of the landfill. In 2021/22, the background TSS values north and south of the landfill were both <1.0 mg/L, respectively.
- BCWQGs for cadmium, lead, nickel, manganese, sulphate, silver and zinc are hardness dependent. Total metal concentrations were compared to guidelines based on the hardness of each sample.
- The dissolved copper BCWQG varies with hardness, pH, dissolved organic carbon (DOC) and temperature, and is calculated using the Biotic Ligand Model (BLM).

Table 7-1 Surface Water Quality Exceedances 2021-2022

B.C. Water Quality Guidelines				BC WQG MAXIMUM (1)	---		5		---		---		600		110	
				BC WQG AVERAGE (1)	---		---		1200		---		150		4	
Station	Sample Type	Compliance Well (Y/N?)	Date Sampled	PARAMETER	Aluminum		Arsenic		Boron		Cadmium		Chloride		Cobalt	
				STATE	TOT		TOT		TOT		TOT		DIS		TOT	
				UNIT	µg/L		µg/L		µg/L		µg/L		mg/L		µg/L	
				Method Detection Limit (MDL)	0.5		0.02		10		0.005		1		0.01	
				Limit of Quantification (LOQ)	2.5		0.1		50		0.025		5		0.05	
					30%		30%		30%		30%		30%		30%	
				COMMENTS	RESULT		RESULT		RESULT		RESULT		RESULT		RESULT	
SW-N-05	FRM	Y	2021-04-26	Mean of duplicates	139.5		0.12		33.		0.007 2		4.5		0.183 5	
SW-N-05	FRM		2021-10-05	Mean of duplicates	229.		0.133		42.		0.029 15		7.05		0.351	
SW-N-05	FRM		2021-11-30	Mean of duplicates	182.5		0.182 5		89.5		0.068 25		9.4		0.443	
SW-N-05	FRM		2022-02-07	Mean of duplicates	49.05		0.215 5		135.		0.304 5		11.		0.624	
SW-N-16	FRM	Y	2021-04-26	Mean of duplicates	25.9		0.373 5		56.5		0.014 25		7.15		1.11	
SW-N-16	FRM		2021-10-04	Mean of duplicates	23.25		0.34		78.5		0.033 95		11.		0.532 5	
SW-N-16	FRM		2021-11-30	Mean of duplicates	42.85		0.244		53.		0.019 1		4.35		0.234 5	
SW-N-16	FRM		2022-02-08	Mean of duplicates	29.		0.214 5		46.		0.011 85		< 10.		0.276	
SW-N-17	SS		2021-04-29	Moderately low flow, clear and colourless	17.9		0.102		82.		< 0.005		13.		0.083	
SW-N-17	SS		2021-10-04	Moderately low flow, clear and colourless	14.6		0.11		106.		0.007 5		11.		0.122	
SW-N-17	SS		2022-02-07	Moderate flow, clear and colouress	12.5		0.086		106.		0.007 7		18.		0.129	
SW-N-18	SS		2021-04-26	Moderately low flow, clear and colourless	111.		0.12		16.		0.007 3		4.7		0.252	
SW-N-18	SS		2021-10-05	Moderately low flow, clear and colourless	41.1		0.092		17.		< 0.005		7.		0.104	
SW-N-18	SS		2021-11-30		11 400.		1.14		69.		0.042 9		9.3		8.57	b
SW-N-18	NS		2022-02-07	DRY - flow blocked off feeding into sample locatic	Null		Null		Null		Null		Null		Null	
SW-N-19	SS		2021-04-26	Moderately low flow, clear and moderately yellow	30.1		0.364		43.		0.013 8		7.1		1.39	
SW-N-19	SS		2021-11-30		38.4		0.265		42.		0.012		4.		0.261	
SW-N-19	SS		2022-02-08	Moderate flow, clear and slightly yellow	47.9		0.227		30.		0.010 8		6.9		0.258	
SW-N-41S1	FRM	Y	2021-04-26	Mean of duplicates	219.		0.452		18.		0.007 95		11.		0.374 5	
SW-N-41S1	FRM		2021-10-04	Mean of duplicates	7.185		0.314 5		18.		< 0.005		10.		0.247 5	
SW-N-41S3	SS		2021-04-26	Moderately low flow, clear and colourless	48.4		0.169		34.		0.006 3		11.		0.052	
SW-N-41S3	SS		2021-11-30		22.2		0.075		16.		< 0.005		6.		0.032 5	
SW-N-41S3	SS		2022-02-07	Moderately high flow, clear and colourless	11.7		0.077		21.		< 0.005		6.5		0.027 2	
SW-N-42S1	FRM	Y	2021-04-26	Mean of duplicates	63.15		0.122		48.		0.007		22.		0.159 5	
SW-N-42S1	FRM		2021-11-30	Mean of duplicates	37.35		0.068		61.		0.007 25		8.9		0.106 5	
SW-N-42S1	FRM		2022-02-07	Mean of duplicates	80.15		0.086 5		48.5		< 0.005 4		17.		0.123	
SW-N-45	SS		2021-04-29	Moderately low flow, clear and colourless	33.5		0.105		71.		0.005 4		8.8		0.099 8	
SW-N-45	SS		2021-10-04	Moderately low flow, clear and colourless	19.4		0.077		98.		< 0.005		9.1		0.117	
SW-N-45	SS		2022-02-07	Moderate flow, clear and colouress	7.68		0.09		128.		0.016 4		17.		0.234	
SW-N-50	SS		2021-04-27	Moderately low flow, clear and colourless	114.		0.076		< 10.		< 0.005		5.1		0.123	
SW-N-50	SS		2021-10-05	Moderately low flow, clear and colourless	119.		0.09		17.		< 0.005		6.6		0.156	
SW-N-50	SS		2021-11-30		35 300.		0.985		< 20.		0.123		5.1		29.1	b
SW-N-53	SS		2021-11-30		2 120.		0.383		62.		0.064		4.3		2.39	
SW-N-54	SS		2021-04-26	Low flow, clear and colourless	19.7		0.435		57.		0.012 5		1.6		0.433	
SW-N-54	SS		2021-10-05	Moderately low flow, clear and slightly yellow	20.4		0.693		67.		0.019 9		5.1		1.27	
SW-N-54	SS		2021-11-30		493.		0.351		62.		0.007 1		2.3		0.717	
SW-N-54	SS		2022-02-07	Moderately low flow, clear and slighlty yellow	174.		0.327		49.		< 0.005		3.9		0.334	
SW-N-CS2	SS		2021-11-30		40.5		0.038		< 10.		< 0.005		3.9		0.025 3	
SW-N-CS2	SS		2022-02-07	Moderate flow, clear and colourless	46.7		0.025		< 10.		< 0.005		2.4		0.041	
SW-S-03	SS		2021-04-27	Moderately low flow, clear and colourless	228.		0.194		53.		0.012		28.		0.383	
SW-S-03	SS		2021-10-05	Moderately low flow, clear and colourless, some g	89.2		0.286		58.		0.029 7		29.		1.52	
SW-S-03	SS		2021-12-01		65.6		0.186		70.		0.015 4		13.		0.415	
SW-S-03	SS		2022-02-08	Moderately high flow, moderately silty and very g	3 130.		0.516		64.		0.041 3		25.		2.7	
SW-S-04	FRM	Y	2021-04-27	Mean of duplicates	102.5		0.184 5		87.		0.016 45		36.		0.225 5	
SW-S-04	FRM		2021-10-05	Mean of duplicates	12.45		0.106		69.		0.014 5		36.		0.077 7	
SW-S-04	FRM		2021-12-01	Mean of duplicates	74.5		0.119		46.5		0.010 25		9.85		0.116	
SW-S-04	FRM		2022-02-08	Mean of duplicates	104.4		0.134		74.5		0.013 15		30.		0.218 5	
SW-S-12	SS		2021-04-27	Moderately low flow, clear and slightly yellow	59.1		0.252		66.		0.011 1		16.		0.48	
SW-S-12	SS		2021-10-05	Very low flow, clear and colourless, lots of vegeta	78.		0.495		34.		0.037 5		8.2		0.339	
SW-S-12	SS		2021-12-01		79.4		0.265		100.		0.028 5		11.		0.757	
SW-S-12	SS		2022-02-08	Moderately high flow, very silty and moderately g	1 010.		0.341		106.		0.018 8		17.		1.44	
SW-S-20	SS		2021-12-01		68.		0.099		16.		< 0.005		4.2		0.081	
SW-S-21	SS		2021-12-01		48.3		0.102		15.		< 0.005		4.		0.048 3	
SW-S-21	SS		2022-02-08	Moderate flow, clear and colourless	24.5		0.079		12.		< 0.005		4.7		0.027 9	
SW-S-24	SS		2021-04-27	Moderately low flow, clear and colourless	104.		0.171		86.		0.017 3		27.		0.255	
SW-S-24	SS		2021-10-05	Moderately low flow, clear and colourless	410.		0.229		86.		0.037 6		27.		0.574	
SW-S-24	SS		2021-12-01		258.		0.209		84.		0.026 3		27.		0.437	
SW-S-24	SS		2022-02-08	Moderately high flow, clear and colourless	163.		0.138		78.		0.009 2		27.		0.289	
SW-S-27	SS		2021-12-01		60.2		0.138		76.		0.049 8		9.1		0.14	
SW-S-27	SS		2022-02-08	Moderately low flow, clear and colourless	647.		0.245		70.		0.055 2		19.		0.819	

Notes:

na — *Not applicable.*

Null — *No sample collected.*

a — *Above Maximum allowable concentration (MAC) British Columbia Water Quality Guideline.*

b — *Above 30-day average British Columbia Water Quality Guideline.*

(1) — *British Columbia Approved Water Quality Guidelines (Criteria), 1998 Edition, Updated in August*

(2) — *Maximum acceptable concentration unless otherwise noted.*

(3) — *The ammonia guideline is pH and temperature (15°C assumed) dependant. All ammonia results were compared to standards based on the associated pH and temperature results for that sample.*

(4) — *The nitrite guidelines are chloride dependant. All nitrite results were compared to standards based on the associated chloride result for that sample.*

(5) — *This value is hardness dependent. All metals results were compared to standards based on the associated hardness result for a particular sample.*

(6) — *This value is the short-term daily for streams with unknown fish distribution.*

(7) — *The TSS guidelines are "change from background" and flow condition dependent. The background TSS in the North landfill are derived from stations SW-N-CSs2, SW-N-41s3 and SW-N-14.*

(8) — *Dissolved copper guideline varies with water hardness, temperature and dissolved organic carbon; Dissolved copper results were only compared with guidelines where DOC was analyzed.*

Table 7-1 Surface Water Quality Exceedances 2021-2022

B.C. Water Quality Guidelines				BC WQG MAXIMUM (1)	---		1000	3.28 - 416.7 (5)	815 - 3394 (5)	10000
				BC WQG AVERAGE (1)	---	---	---	3.43 - 19.57 (5)	767 - 2585 (5)	250
Station	Sample Type	Compliance Well (Y/N?)	Date Sampled	PARAMETER	Copper	Hardness (As Caco3)	Iron	Lead	Manganese	Molybdenum
				STATE	TOT	TOT	TOT	TOT	TOT	TOT
				UNIT	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
				Method Detection Limit (MDL)	0.1	0.5	1	0.005	0.1	0.05
				Limit of Quantification (LOQ)	0.5	2.5	5	0.025	0.5	0.25
					30%	30%	30%	30%	30%	30%
				COMMENTS	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT
SW-N-05	FRM	Y	2021-04-26	Mean of duplicates	10.815	158.	210.5	0.020 15	4.16	1.79
SW-N-05	FRM		2021-10-05	Mean of duplicates	2.485	231.	336.5	0.079	14.15	0.863 5
SW-N-05	FRM		2021-11-30	Mean of duplicates	5.395	340.	163.5	0.062	14.	1.43
SW-N-05	FRM		2022-02-07	Mean of duplicates	7.055	715.5	38.	0.025 35	85.25	2.37
SW-N-16	FRM	Y	2021-04-26	Mean of duplicates	5.565	164.	1 140. **a**	0.022 5	722.5	2.11
SW-N-16	FRM		2021-10-04	Mean of duplicates	6.285	211.	726.5	0.048 5	145.	1.14
SW-N-16	FRM		2021-11-30	Mean of duplicates	13.55	143.5	155.5	0.028 5	36.45	0.770 5
SW-N-16	FRM		2022-02-08	Mean of duplicates	8.585	132.	251.	0.026	98.25	0.752 5
SW-N-17	SS		2021-04-29	Moderately low flow, clear and colourless	0.665	155.	41.6	0.008 3	17.8	0.814
SW-N-17	SS		2021-10-04	Moderately low flow, clear and colourless	0.993	179.	22.8	0.006 4	12.9	0.89
SW-N-17	SS		2022-02-07	Moderate flow, clear and colouress	0.834	292.	13.9	0.007 6	6.	0.481
SW-N-18	SS		2021-04-26	Moderately low flow, clear and colourless	1.54	144.	204.	0.068 4	6.27	1.17
SW-N-18	SS		2021-10-05	Moderately low flow, clear and colourless	0.799	185.	46.2	0.029 9	1.81	0.52
SW-N-18	SS		2021-11-30		36.9	144.	14 500. **a**	2.32	276.	0.246
SW-N-18	NS		2022-02-07	DRY - flow blocked off feeding into sample locatic	Null	Null	Null	Null	Null	Null
SW-N-19	SS		2021-04-26	Moderately low flow, clear and moderately yellow	12.	184.	151.	0.038	66.7	1.21
SW-N-19	SS		2021-11-30		19.4	154.	52.4	< 0.02	6.91	0.857
SW-N-19	SS		2022-02-08	Moderate flow, clear and slightly yellow	18.2	143.	71.5	< 0.02	4.86	0.938
SW-N-41S1	FRM	Y	2021-04-26	Mean of duplicates	0.68	187.5	621.5	0.139 5	267.	0.352
SW-N-41S1	FRM		2021-10-04	Mean of duplicates	0.221	237.	188.	< 0.005	289.	0.394 5
SW-N-41S3	SS		2021-04-26	Moderately low flow, clear and colourless	0.57	124.	63.	0.072	6.65	0.485
SW-N-41S3	SS		2021-11-30		0.502	62.	15.2	0.018 4	1.63	0.201
SW-N-41S3	SS		2022-02-07	Moderately high flow, clear and colourless	0.399	83.3	9.7	0.012 5	1.91	0.262
SW-N-42S1	FRM	Y	2021-04-26	Mean of duplicates	0.635	205.	173.5	0.095	79.45	0.574 5
SW-N-42S1	FRM		2021-11-30	Mean of duplicates	0.955	146.5	58.05	0.057 5	23.85	0.374 5
SW-N-42S1	FRM		2022-02-07	Mean of duplicates	0.725	162.5	113.	0.095	33.75	0.532
SW-N-45	SS		2021-04-29	Moderately low flow, clear and colourless	1.	171.	45.	0.012 2	5.44	1.2
SW-N-45	SS		2021-10-04	Moderately low flow, clear and colourless	1.26	199.	19.8	0.008 7	6.97	1.05
SW-N-45	SS		2022-02-07	Moderate flow, clear and colouress	1.49	527.	6.3	< 0.005	8.72	0.709
SW-N-50	SS		2021-04-27	Moderately low flow, clear and colourless	0.536	142.	211.	0.026 8	3.26	0.464
SW-N-50	SS		2021-10-05	Moderately low flow, clear and colourless	1.09	181.	162.	0.025	3.31	0.477
SW-N-50	SS		2021-11-30		132.	176.	41 500. **a**	7.98	869.	< 0.1
SW-N-53	SS		2021-11-30		5.97	1 160.	3 590. **a**	0.515	81.2	1.1
SW-N-54	SS		2021-04-26	Low flow, clear and colourless	15.4	196.	63.4	0.008 8	151.	1.25
SW-N-54	SS		2021-10-05	Moderately low flow, clear and slightly yellow	18.9	334.	383.	0.038	559.	0.632
SW-N-54	SS		2021-11-30		19.9	152.	784.	0.108	40.1	0.399
SW-N-54	SS		2022-02-07	Moderately low flow, clear and slighlty yellow	16.	153.	287.	0.064	32.2	0.523
SW-N-CS2	SS		2021-11-30		0.405	42.	8.5	0.010 1	0.426	0.066
SW-N-CS2	SS		2022-02-07	Moderate flow, clear and colourless	0.36	59.7	41.4	0.064	2.66	0.082
SW-S-03	SS		2021-04-27	Moderately low flow, clear and colourless	7.95	111.	749.	0.25	45.3	0.25
SW-S-03	SS		2021-10-05	Moderately low flow, clear and colourless, some g	5.07	168.	892.	0.314	272.	0.338
SW-S-03	SS		2021-12-01		11.5	92.8	271.	0.04	158.	0.159
SW-S-03	SS		2022-02-08	Moderately high flow, moderately silty and very g	15.9	88.2	5 150. **a**	2.22	213.	0.344
SW-S-04	FRM	Y	2021-04-27	Mean of duplicates	3.19	125.5	177.	0.180 5	22.95	0.275 5
SW-S-04	FRM		2021-10-05	Mean of duplicates	1.33	136.5	6.1	0.008 55	1.015	0.104 5
SW-S-04	FRM		2021-12-01	Mean of duplicates	3.08	67.3	98.85	0.076 5	10.85	0.125
SW-S-04	FRM		2022-02-08	Mean of duplicates	3.485	98.6	200.	0.169 5	21.	0.152 5
SW-S-12	SS		2021-04-27	Moderately low flow, clear and slightly yellow	13.6	116.	1 320. **a**	0.023 3	230.	0.205
SW-S-12	SS		2021-10-05	Very low flow, clear and colourless, lots of vegeta	18.4	269.	170.	0.06	21.2	0.202
SW-S-12	SS		2021-12-01		17.7	114.	649.	0.042	342.	0.155
SW-S-12	SS		2022-02-08	Moderately high flow, very silty and moderately g	11.5	102.	3 330. **a**	0.621	395.	0.173
SW-S-20	SS		2021-12-01		1.24	40.8	74.3	0.027	12.8	0.071
SW-S-21	SS		2021-12-01		1.15	0.	29.3	0.009 3	0.956	0.076
SW-S-21	SS		2022-02-08	Moderate flow, clear and colourless	0.735	44.4	5.7	< 0.005	0.133	0.054
SW-S-24	SS		2021-04-27	Moderately low flow, clear and colourless	3.24	121.	210.	0.176	46.8	0.251
SW-S-24	SS		2021-10-05	Moderately low flow, clear and colourless	4.85	162.	664.	0.572	126.	0.114
SW-S-24	SS		2021-12-01		6.15	101.	476.	0.381	79.9	0.156
SW-S-24	SS		2022-02-08	Moderately high flow, clear and colourless	3.77	102.	314.	0.177	32.2	0.141
SW-S-27	SS		2021-12-01		1.91	0.	107.	0.26	18.4	0.13
SW-S-27	SS		2022-02-08	Moderately low flow, clear and colourless	2.87	92.5	907.	1.04	112.	0.123

Notes:

na — *Not applicable.*

Null — *No sample collected.*

a — *Above Maximum allowable concentration (MAC) British Columbia Water Quality Guideline.*

b — *Above 30-day average British Columbia Water Quality Guideline.*

(1) — *British Columbia Approved Water Quality Guidelines (Criteria), 1998 Edition, Updated in August*

(2) — *Maximum acceptable concentration unless otherwise noted.*

(3) — *The ammonia guideline is pH and temperature (15°C assumed) dependant. All ammonia results were compared to standards based on the associated pH and temperature results for that sample.*

(4) — *The nitrite guidelines are chloride dependant. All nitrite results were compared to standards based on the associated chloride result for that sample.*

(5) — *This value is hardness dependent. All metals results were compared to standards based on the associated hardness result for a particular sample.*

(6) — *This value is the short-term daily for streams with unknown fish distribution.*

(7) — *The TSS guidelines are "change from background" and flow condition dependent. The background TSS in the North landfill are derived from stations SW-N-CSs2, SW-N-41s3 and SW-N-14.*

(8) — *Dissolved copper guideline varies with water hardness, temperature and dissolved organic carbon; Dissolved copper results were only compared with guidelines where DOC was analyzed.*

Table 7-1 Surface Water Quality Exceedances 2021-2022

B.C. Water Quality Guidelines				BC WQG MAXIMUM (1)	1.9 - 24.9 (3)	0.06 - 0.6 (4)	32.8	---	---	0.05 - 1.5 (5)
				BC WQG AVERAGE (1)	0.135 - 1.77 (3)	0.02 - 0.2 (4)	3	---	2	0.1 - 3 (5)
Station	Sample Type	Compliance Well (Y/N?)	Date Sampled	PARAMETER	N - Nh3 (As N)	N - No2 (As N)	N - No3 (As N)	Nickel	Selenium	Silver
				STATE	TOT	DIS	DIS	TOT	TOT	TOT
				UNIT	mg/L	mg/L	mg/L	µg/L	µg/L	µg/L
				Method Detection Limit (MDL)	0.015	0.005	0.02	0.02	0.04	0.005
				Limit of Quantification (LOQ)	0.075	0.025	0.1	0.1	0.2	0.025
					30%	30%	30%	30%	30%	30%
				COMMENTS	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT
SW-N-05	FRM	Y	2021-04-26	Mean of duplicates	0.089	< 0.005	3.225 b	3.67	0.199	< 0.005
SW-N-05	FRM		2021-10-05	Mean of duplicates	0.066	< 0.005	3.4 b	0.765	0.491	< 0.01
SW-N-05	FRM		2021-11-30	Mean of duplicates	1.85 b	0.541 5 a b	26. b	1.76	0.695	< 0.01
SW-N-05	FRM		2022-02-07	Mean of duplicates	0.685	0.414 5 b	91.9 a b	2.98	1.82	< 0.005
SW-N-16	FRM	Y	2021-04-26	Mean of duplicates	0.087	< 0.005	0.191	6.4	0.122 5	< 0.005
SW-N-16	FRM		2021-10-04	Mean of duplicates	0.083 5	0.046 65	0.477 5	2.05	0.125	< 0.01
SW-N-16	FRM		2021-11-30	Mean of duplicates	0.016	0.012	3.9 b	1.7	0.142 5	< 0.01
SW-N-16	FRM		2022-02-08	Mean of duplicates	0.103	< 0.005 15	1.795	1.265	0.103	< 0.01
SW-N-17	SS		2021-04-29	Moderately low flow, clear and colourless	< 0.015	< 0.005	1.7	0.469	0.12	< 0.005
SW-N-17	SS		2021-10-04	Moderately low flow, clear and colourless	0.094	< 0.005	1.67	0.388	0.35	< 0.005
SW-N-17	SS		2022-02-07	Moderate flow, clear and colouress	0.97	< 0.005	30.5 b	0.374	0.513	< 0.005
SW-N-18	SS		2021-04-26	Moderately low flow, clear and colourless	< 0.015	< 0.005	1.77	3.37	0.152	< 0.005
SW-N-18	SS		2021-10-05	Moderately low flow, clear and colourless	0.016	< 0.005	3.14 b	0.193	0.235	< 0.005
SW-N-18	SS		2021-11-30		4. b	0.011 3	1.66	14.	0.166	0.031
SW-N-18	NS		2022-02-07	DRY - flow blocked off feeding into sample locatic	Null	Null	Null	Null	Null	Null
SW-N-19	SS		2021-04-26	Moderately low flow, clear and moderately yellow	0.074	< 0.005	0.101	3.35	0.192	0.014
SW-N-19	SS		2021-11-30		0.015	0.013 8	4.88 b	2.22	0.168	< 0.01
SW-N-19	SS		2022-02-08	Moderate flow, clear and slightly yellow	1.6	< 0.005	3.18 b	2.37	0.144	< 0.01
SW-N-41S1	FRM	Y	2021-04-26	Mean of duplicates	0.068	< 0.005	0.093	0.425	0.094 5	< 0.01
SW-N-41S1	FRM		2021-10-04	Mean of duplicates	< 0.015	< 0.005	0.258	0.182	0.11	< 0.005
SW-N-41S3	SS		2021-04-26	Moderately low flow, clear and colourless	0.068	< 0.005	0.031	0.64	0.075	< 0.01
SW-N-41S3	SS		2021-11-30		< 0.015	< 0.005	0.025	0.072	0.063	< 0.005
SW-N-41S3	SS		2022-02-07	Moderately high flow, clear and colourless	0.094	< 0.005	0.031	0.083	0.065	< 0.005
SW-N-42S1	FRM	Y	2021-04-26	Mean of duplicates	< 0.015	< 0.005	0.055 5	0.51	0.052	< 0.01
SW-N-42S1	FRM		2021-11-30	Mean of duplicates	< 0.015	< 0.005	0.241 5	0.15	0.051 5	< 0.01
SW-N-42S1	FRM		2022-02-07	Mean of duplicates	0.13	< 0.005	0.122	0.205	0.051 5	< 0.01
SW-N-45	SS		2021-04-29	Moderately low flow, clear and colourless	< 0.015	< 0.005	3.41 b	0.798	0.218	< 0.005
SW-N-45	SS		2021-10-04	Moderately low flow, clear and colourless	1.8	< 0.005	2.72	0.257	0.422	< 0.005
SW-N-45	SS		2022-02-07	Moderate flow, clear and colouress	1.7	< 0.005	72.8 a b	0.655	1.19	< 0.005
SW-N-50	SS		2021-04-27	Moderately low flow, clear and colourless	1.9 b	< 0.005	1.43	0.52	0.127	< 0.005
SW-N-50	SS		2021-10-05	Moderately low flow, clear and colourless	< 0.015	0.018 3	2.95	0.26	0.241	< 0.01
SW-N-50	SS		2021-11-30		0.073	0.009 8	1.59	42.4	0.199	0.135
SW-N-53	SS		2021-11-30		< 0.15	0.021 4	131. a b	14.3	2.83 b	< 0.02
SW-N-54	SS		2021-04-26	Low flow, clear and colourless	< 0.015	< 0.005	0.021	3.89	0.24	< 0.005
SW-N-54	SS		2021-10-05	Moderately low flow, clear and slightly yellow	1.2	0.013 2	0.189	2.31	0.319	0.011
SW-N-54	SS		2021-11-30		0.036	0.008 7	2.36	2.33	0.197	< 0.01
SW-N-54	SS		2022-02-07	Moderately low flow, clear and slighlty yellow	0.096	< 0.005	1.17	1.67	0.202	< 0.01
SW-N-CS2	SS		2021-11-30		< 0.015	< 0.005	< 0.02	0.03	0.059	< 0.005
SW-N-CS2	SS		2022-02-07	Moderate flow, clear and colourless	0.086	< 0.005	< 0.02	< 0.1	0.046	< 0.01
SW-S-03	SS		2021-04-27	Moderately low flow, clear and colourless	0.069	0.011 5	2.85	1.59	0.086	< 0.005
SW-S-03	SS		2021-10-05	Moderately low flow, clear and colourless, some g	0.066	0.019 4	4.21 b	1.33	0.127	< 0.01
SW-S-03	SS		2021-12-01		< 0.03	0.047 5	2.05	1.81	0.11	< 0.01
SW-S-03	SS		2022-02-08	Moderately high flow, moderately silty and very g	1.5	0.026 7	1.55	5.17	0.088	0.013
SW-S-04	FRM	Y	2021-04-27	Mean of duplicates	< 0.015	< 0.005	0.822 5	0.895	0.069	< 0.01
SW-S-04	FRM		2021-10-05	Mean of duplicates	1.029	< 0.005	1.51	0.302	0.073	< 0.005
SW-S-04	FRM		2021-12-01	Mean of duplicates	0.032 5	0.034 75	0.83	0.495	0.071	< 0.01
SW-S-04	FRM		2022-02-08	Mean of duplicates	0.165	< 0.005	1.845	0.698 5	0.064 5	< 0.007 5
SW-S-12	SS		2021-04-27	Moderately low flow, clear and slightly yellow	0.39	0.020 8	2.19	2.87	0.114	< 0.005
SW-S-12	SS		2021-10-05	Very low flow, clear and colourless, lots of vegeta	0.078	0.005 5	9.05 b	4.57	0.264	< 0.01
SW-S-12	SS		2021-12-01		2.1 b	0.024 9	2.32	2.92	0.133	< 0.01
SW-S-12	SS		2022-02-08	Moderately high flow, very silty and moderately g	0.79	0.017 1	1.66	3.09	0.089	< 0.01
SW-S-20	SS		2021-12-01		0.088	< 0.005	0.03	0.23	0.051	< 0.01
SW-S-21	SS		2021-12-01		0.076	< 0.005	0.107	0.181	0.051	< 0.005
SW-S-21	SS		2022-02-08	Moderate flow, clear and colourless	0.13	< 0.005	0.132	0.111	< 0.04	< 0.005
SW-S-24	SS		2021-04-27	Moderately low flow, clear and colourless	0.07	< 0.005	0.814	0.87	0.054	< 0.01
SW-S-24	SS		2021-10-05	Moderately low flow, clear and colourless	0.074	< 0.005	0.232	1.18	0.082	< 0.01
SW-S-24	SS		2021-12-01		0.097	0.074 1	1.48	1.19	0.103	< 0.01
SW-S-24	SS		2022-02-08	Moderately high flow, clear and colourless	< 0.15	< 0.005	1.84	0.75	0.067	< 0.01
SW-S-27	SS		2021-12-01		0.088	< 0.005	0.4	0.416	0.068	0.007
SW-S-27	SS		2022-02-08	Moderately low flow, clear and colourless	0.027	0.005 4	< 0.02	1.16	0.049	< 0.01

Notes:

na — *Not applicable.*

Null — *No sample collected.*

a — *Above Maximum allowable concentration (MAC) British Columbia Water Quality Guideline.*

b — *Above 30-day average British Columbia Water Quality Guideline.*

(1) — *British Columbia Approved Water Quality Guidelines (Criteria), 1998 Edition, Updated in August*

(2) — *Maximum acceptable concentration unless otherwise noted.*

(3) — *The ammonia guideline is pH and temperature (15°C assumed) dependant. All ammonia results were compared to standards based on the associated pH and temperature results for that sample.*

(4) — *The nitrite guidelines are chloride dependant. All nitrite results were compared to standards based on the associated chloride result for that sample.*

(5) — *This value is hardness dependent. All metals results were compared to standards based on the associated hardness result for a particular sample.*

(6) — *This value is the short-term daily for streams with unknown fish distribution.*

(7) — *The TSS guidelines are "change from background" and flow condition dependent. The background TSS in the North landfill are derived from stations SW-N-CSs2, SW-N-41s3 and SW-N-14.*

(8) — *Dissolved copper guideline varies with water hardness, temperature and dissolved organic carbon; Dissolved copper results were only compared with guidelines where DOC was analyzed.*

Table 7-1 Surface Water Quality Exceedances 2021-2022

B.C. Water Quality Guidelines				BC WQG MAXIMUM (1)	128 - 429 (5)		25		33 - 340.5 (5)		6.5 to 9.0		---		---	
				BC WQG AVERAGE (1)	---		5		7.5 - 187.5 (5)		---		---		---	
				PARAMETER	Sulphate		TSS		Zinc		pH		Conductivity		Temperature	
				STATE	DIS		TOT		TOT		TOT		TOT		TOT	
				UNIT	mg/L		mg/L		µg/L		pH		µS/cm		°C	
				Method Detection Limit (MDL)	1		1		1		0.1		1		0.1	
				Limit of Quantification (LOQ)	5		5		5		0.5		5		0.5	
					30%		30%		30%		30%		30%		30%	
Station	**Sample Type**	**Compliance Well (Y/N?)**	**Date Sampled**	**COMMENTS**	**RESULT**		**RESULT**		**RESULT**		**RESULT**		**RESULT**		**RESULT**	
SW-N-05	FRM	Y	2021-04-26	Mean of duplicates	87.	---	< 2.3		1.46		6.72	--- ---	247.	--- ---	10.	--- ---
SW-N-05	FRM		2021-10-05	Mean of duplicates	140.	---	< 1.		4.5		7.35	--- ---	45.	--- ---	13.	--- ---
SW-N-05	FRM		2021-11-30	Mean of duplicates	200.	---	< 1.		4.2		6.8	--- ---	510.	--- ---	10.4	--- ---
SW-N-05	FRM		2022-02-07	Mean of duplicates	405.	---	3.8		8.8		6.96	--- ---	979.	--- ---	8.7	--- ---
SW-N-16	FRM	Y	2021-04-26	Mean of duplicates	45.	---	3.4		4.415		6.52	--- ---	273.	--- ---	11.4	--- ---
SW-N-16	FRM		2021-10-04	Mean of duplicates	115.	---	6.6	**b**	17.35		7.12	--- ---	318.	--- ---	12.3	--- ---
SW-N-16	FRM		2021-11-30	Mean of duplicates	45.5	---	2.8		10.45		7.13	--- ---	218.	--- ---	10.6	--- ---
SW-N-16	FRM		2022-02-08	Mean of duplicates	39.5	---	< 1.		8.35		6.94	--- ---	280.	--- ---	5.4	--- ---
SW-N-17	SS		2021-04-29	Moderately low flow, clear and colourless	69.	---	< 1.		0.81		6.46	---	269.	--- ---	10.2	--- ---
SW-N-17	SS		2021-10-04	Moderately low flow, clear and colourless	110.	---	< 1.		4.		6.57	--- ---	309.	--- ---	11.7	--- ---
SW-N-17	SS		2022-02-07	Moderate flow, clear and colouress	160.	---	< 1.		2.37		7.34	--- ---	447.	--- ---	7.1	--- ---
SW-N-18	SS		2021-04-26	Moderately low flow, clear and colourless	61.	---	2.8		19.4		7.81	--- ---	316.	--- ---	11.1	--- ---
SW-N-18	SS		2021-10-05	Moderately low flow, clear and colourless	93.	---	< 1.		3.16		7.77	--- ---	315.	--- ---	12.9	--- ---
SW-N-18	SS		2021-11-30		50.	---	< 1.		23.5		7.31	--- ---	224.	--- ---	10.3	--- ---
SW-N-18	NS		2022-02-07	DRY - flow blocked off feeding into sample locatic	Null	---	Null		Null		Null	--- ---	Null	--- ---	Null	--- ---
SW-N-19	SS		2021-04-26	Moderately low flow, clear and moderately yellow	56.	---	4.		2.		7.55	--- ---	298.	--- ---	13.4	--- ---
SW-N-19	SS		2021-11-30		51.	---	28.	**a** **b**	4.4		7.32	--- ---	236.	--- ---	11.	--- ---
SW-N-19	SS		2022-02-08	Moderate flow, clear and slightly yellow	49.	---	< 1.		2.9		7.31	--- ---	193.	--- ---	5.9	--- ---
SW-N-41S1	FRM	Y	2021-04-26	Mean of duplicates	65.5	---	5.4	**b**	3.1		6.85	--- ---	295.	--- ---	9.5	--- ---
SW-N-41S1	FRM		2021-10-04	Mean of duplicates	97.	---	< 1.		1.06		7.43	--- ---	362.	--- ---	11.1	--- ---
SW-N-41S3	SS		2021-04-26	Moderately low flow, clear and colourless	23.	---	3.6		< 1.		6.76	--- ---	191.	--- ---	8.8	--- ---
SW-N-41S3	SS		2021-11-30		13.	---	6.	**b**	0.28		7.32	--- ---	101.	--- ---	9.2	--- ---
SW-N-41S3	SS		2022-02-07	Moderately high flow, clear and colourless	14.	---	2.8		0.55		7.02	--- ---	190.	--- ---	7.3	--- ---
SW-N-42S1	FRM	Y	2021-04-26	Mean of duplicates	79.5	---	5.8	**b**	< 1.		6.56	--- ---	319.	--- ---	9.7	--- ---
SW-N-42S1	FRM		2021-11-30	Mean of duplicates	73.	---	< 1.		< 1.		6.57	--- ---	238.	--- ---	9.8	--- ---
SW-N-42S1	FRM		2022-02-07	Mean of duplicates	66.5	---	< 8.5	**c**	1.2		7.415	--- ---	400.	--- ---	6.6	--- ---
SW-N-45	SS		2021-04-29	Moderately low flow, clear and colourless	89.	---	< 1.		0.64		6.16	---	276.	--- ---	9.5	--- ---
SW-N-45	SS		2021-10-04	Moderately low flow, clear and colourless	120.	---	< 1.		1.57		6.43	---	330.	--- ---	11.7	--- ---
SW-N-45	SS		2022-02-07	Moderate flow, clear and colouress	340.	---	< 1.		1.98		7.34	--- ---	768.	--- ---	7.7	--- ---
SW-N-50	SS		2021-04-27	Moderately low flow, clear and colourless	60.	---	21.	**b**	1.2		7.73	--- ---	219.	--- ---	10.2	--- ---
SW-N-50	SS		2021-10-05	Moderately low flow, clear and colourless	86.	---	< 1.		1.3		7.93	--- ---	277.	--- ---	11.4	--- ---
SW-N-50	SS		2021-11-30		38.	---	160.	**a** **b**	75.8		8.	--- ---	147.	--- ---	9.9	--- ---
SW-N-53	SS		2021-11-30		740.	--- **b**	35.	**a** **b**	68.5		8.35	--- ---	1 428.	--- ---	10.6	--- ---
SW-N-54	SS		2021-04-26	Low flow, clear and colourless	45.	---	< 1.		0.59		7.61	--- ---	309.	--- ---	12.8	--- ---
SW-N-54	SS		2021-10-05	Moderately low flow, clear and slightly yellow	190.	---	< 1.		1.8		7.45	--- ---	511.	--- ---	14.7	--- ---
SW-N-54	SS		2021-11-30		30.	---	14.	**b**	2.7		7.39	--- ---	209.	--- ---	10.4	--- ---
SW-N-54	SS		2022-02-07	Moderately low flow, clear and slighlty yellow	25.	---	1.6		1.9		6.91	--- ---	207.	--- ---	7.9	--- ---
SW-N-CS2	SS		2021-11-30		7.2	---	< 1.		< 0.1		7.41	--- ---	69.	--- ---	9.1	--- ---
SW-N-CS2	SS		2022-02-07	Moderate flow, clear and colourless	7.3	---	< 1.		< 1.		7.05	--- ---	130.	--- ---	7.2	--- ---
SW-S-03	SS		2021-04-27	Moderately low flow, clear and colourless	24.	---	2.8		6.55		6.6	--- ---	235.	--- ---	11.4	--- ---
SW-S-03	SS		2021-10-05	Moderately low flow, clear and colourless, some g	110.	---	1.6		14.7		7.53	--- ---	394.	--- ---	15.4	--- ---
SW-S-03	SS		2021-12-01		27.	---	1.6		5.3		6.94	--- ---	191.	--- ---	11.7	--- ---
SW-S-03	SS		2022-02-08	Moderately high flow, moderately silty and very g	14.	---	63.	**a** **b**	38.7	**a** **b**	6.75	--- ---	182.	--- ---	8.4	--- ---
SW-S-04	FRM	Y	2021-04-27	Mean of duplicates	25.5	---	3.2		3.9		7.66	--- ---	240.	--- ---	9.8	--- ---
SW-S-04	FRM		2021-10-05	Mean of duplicates	71.	---	< 1.		2.725		7.45	--- ---	288.	--- ---	11.5	--- ---
SW-S-04	FRM		2021-12-01	Mean of duplicates	21.	---	2.4		9.45	**b**	7.65	--- ---	122.	--- ---	10.1	--- ---
SW-S-04	FRM		2022-02-08	Mean of duplicates	29.5	---	< 2.5		5.06		7.455	--- ---	242.	--- ---	7.4	--- ---
SW-S-12	SS		2021-04-27	Moderately low flow, clear and slightly yellow	26.	---	1.6		2.9		7.4	--- ---	234.	--- ---	10.5	--- ---
SW-S-12	SS		2021-10-05	Very low flow, clear and colourless, lots of vegeta	200.	---	< 1.		9.1		7.45	--- ---	474.	--- ---	14.6	--- ---
SW-S-12	SS		2021-12-01		31.	---	2.8		6.5		6.59	--- ---	222.	--- ---	12.1	--- ---
SW-S-12	SS		2022-02-08	Moderately high flow, very silty and moderately g	16.	---	23.	**b**	11.4		6.64	--- ---	310.	--- ---	9.1	--- ---
SW-S-20	SS		2021-12-01		6.5	---	< 1.		22.9	**b**	7.44	--- ---	66.	--- ---	9.6	--- ---
SW-S-21	SS		2021-12-01		6.5	---	< 1.		11.7	**b**	7.76	--- ---	61.	--- ---	9.5	--- ---
SW-S-21	SS		2022-02-08	Moderate flow, clear and colourless	6.7	---	< 1.		5.94		6.98	--- ---	110.	--- ---	5.5	--- ---
SW-S-24	SS		2021-04-27	Moderately low flow, clear and colourless	27.	---	2.		4.4		7.14	--- ---	250.	--- ---	10.8	--- ---
SW-S-24	SS		2021-10-05	Moderately low flow, clear and colourless	96.	---	11.	**b**	11.9		7.14	--- ---	330.	--- ---	11.8	--- ---
SW-S-24	SS		2021-12-01		37.	---	< 1.		9.3		7.38	--- ---	183.	--- ---	10.9	--- ---
SW-S-24	SS		2022-02-08	Moderately high flow, clear and colourless	24.	---	2.4		4.8		6.78	--- ---	198.	--- ---	7.5	--- ---
SW-S-27	SS		2021-12-01		41.	---	< 1.		5.		6.92	--- ---	111.	--- ---	9.8	--- ---
SW-S-27	SS		2022-02-08	Moderately low flow, clear and colourless	27.	---	15.	**b**	8.8		7.25	--- ---	158.	--- ---	5.5	--- ---

Notes:

na — *Not applicable.*

Null — *No sample collected.*

a — *Above Maximum allowable concentration (MAC) British Columbia Water Quality Guideline.*

b — *Above 30-day average British Columbia Water Quality Guideline.*

(1) — *British Columbia Approved Water Quality Guidelines (Criteria), 1998 Edition, Updated in August*

(2) — *Maximum acceptable concentration unless otherwise noted.*

(3) — *The ammonia guideline is pH and temperature (15°C assumed) dependant. All ammonia results were compared to standards based on the associated pH and temperature results for that sample.*

(4) — *The nitrite guidelines are chloride dependant. All nitrite results were compared to standards based on the associated chloride result for that sample.*

(5) — *This value is hardness dependent. All metals results were compared to standards based on the associated hardness result for a particular sample.*

(6) — *This value is the short-term daily for streams with unknown fish distribution.*

(7) — *The TSS guidelines are "change from background" and flow condition dependent. The background TSS in the North landfill are derived from stations SW-N-CSs2, SW-N-41s3 and SW-N-14.*

(8) — *Dissolved copper guideline varies with water hardness, temperature and dissolved organic carbon; Dissolved copper results were only compared with guidelines where DOC was analyzed.*

Table 7-1 Surface Water Quality Exceedances 2021-2022

B.C. Water Quality Guidelines				BC WQG MAXIMUM (1)	100		---		---		0.038-2.8 (5)		---		BC BLM software (10)	
				BC WQG AVERAGE (1)	50		---		---		0.018-0.645 (5)		---		BC BLM software (10)	
Station	Sample Type	Compliance Well (Y/N?)	Date Sampled	PARAMETER	Aluminum		Arsenic		Boron		Cadmium		Cobalt		Copper	
				STATE	DIS		DIS		DIS		DIS		DIS		DIS	
				UNIT	µg/L		µg/L		µg/L		µg/L		µg/L		µg/L	
				Method Detection Limit (MDL)	0.5		0.02		10		0.005		0.005		0.05	
				Limit of Quantification (LOQ)	2.5		0.1		50		0.025		0.025		0.25	
					30%		30%		30%		30%		30%		30%	
				COMMENTS	RESULT		RESULT		RESULT		RESULT		RESULT		RESULT	
SW-N-05	FRM	Y	2021-04-26	Mean of duplicates	17.7		0.115 5	--- ---	32.5	--- ---	0.013 65		0.089 8	--- ---	1.935	a b
SW-N-05	FRM		2021-10-05	Mean of duplicates	2.705		0.105	--- ---	39.5	--- ---	0.176 4		0.088 05	--- ---	1.405	b
SW-N-05	FRM		2021-11-30	Mean of duplicates	44.45		0.197 5	--- ---	91.	--- ---	0.044 55		0.388 5	--- ---	4.815	a b
SW-N-05	FRM		2022-02-07	Mean of duplicates	30.		0.194 5	--- ---	137.	--- ---	0.084 3		0.625	--- ---	5.795	
SW-N-16	FRM	Y	2021-04-26	Mean of duplicates	9.79		0.303	--- ---	56.5	--- ---	0.014 7		1.07	--- ---	3.805	b
SW-N-16	FRM		2021-10-04	Mean of duplicates	9.655		0.297 5	--- ---	79.	--- ---	0.023 35		0.527 5	--- ---	4.89	b
SW-N-16	FRM		2021-11-30	Mean of duplicates	22.5		0.249 5	--- ---	50.5	--- ---	0.010 85		0.210 5	--- ---	12.8	b
SW-N-16	FRM		2022-02-08	Mean of duplicates	14.6		0.186 5	--- ---	42.5	--- ---	0.01		0.255 5	--- ---	7.205	b
SW-N-17	SS		2021-04-29	Moderately low flow, clear and colourless	5.54		0.077	--- ---	80.	--- ---	< 0.005		0.072 6	--- ---	0.641	b
SW-N-17	SS		2021-10-04	Moderately low flow, clear and colourless	7.82		0.116	--- ---	112.	--- ---	0.009 7		0.121	--- ---	1.	b
SW-N-17	SS		2022-02-07	Moderate flow, clear and colouress	6.03		0.086	--- ---	103.	--- ---	0.006		0.128	--- ---	0.815	
SW-N-18	SS		2021-04-26	Moderately low flow, clear and colourless	19.4		0.088	--- ---	14.	--- ---	< 0.005		0.092 4	--- ---	1.06	b
SW-N-18	SS		2021-10-05	Moderately low flow, clear and colourless	3.42		0.083	--- ---	16.	--- ---	0.005 1		0.063	--- ---	0.626	b
SW-N-18	SS		2021-11-30		463.	a b	0.283	--- ---	73.	--- ---	0.006 2		1.34	--- ---	3.8	
SW-N-18	NS		2022-02-07	DRY - flow blocked off feeding into sample locatic	Null		Null	--- ---	Null	--- ---	Null		Null	--- ---	Null	b
SW-N-19	SS		2021-04-26	Moderately low flow, clear and moderately yellow	14.		0.326	--- ---	39.	--- ---	0.017 3		1.18	--- ---	9.15	b
SW-N-19	SS		2021-11-30		24.9		0.255	--- ---	42.	--- ---	0.015 6		0.244	--- ---	18.1	b
SW-N-19	SS		2022-02-08	Moderate flow, clear and slightly yellow	18.8		0.202	--- ---	28.	--- ---	0.011 7		0.19	--- ---	15.7	b
SW-N-41S1	FRM	Y	2021-04-26	Mean of duplicates	97.5	b	0.36	--- ---	18.	--- ---	0.005 95		0.256 5	--- ---	0.447 5	a b
SW-N-41S1	FRM		2021-10-04	Mean of duplicates	3.91		0.306 5	--- ---	19.	--- ---	< 0.005		0.247	--- ---	0.257 5	a b
SW-N-41S3	SS		2021-04-26	Moderately low flow, clear and colourless	9.18		0.137	--- ---	32.	--- ---	0.007 5		0.030 6	--- ---	0.334	b
SW-N-41S3	SS		2021-11-30		9.07		0.062	--- ---	16.	--- ---	< 0.005		0.023 4	--- ---	0.46	
SW-N-41S3	SS		2022-02-07	Moderately high flow, clear and colourless	3.77		0.073	--- ---	22.	--- ---	< 0.005		0.023 7	--- ---	0.515	b
SW-N-42S1	FRM	Y	2021-04-26	Mean of duplicates	7.525		0.122	--- ---	44.	--- ---	< 0.006 05		0.084	--- ---	0.347	
SW-N-42S1	FRM		2021-11-30	Mean of duplicates	12.8		0.097	--- ---	64.	--- ---	< 0.005 05		0.067 4	--- ---	0.712 5	a b
SW-N-42S1	FRM		2022-02-07	Mean of duplicates	4.975		0.064 5	--- ---	45.5	--- ---	< 0.005		0.052 6	--- ---	0.464	
SW-N-45	SS		2021-04-29	Moderately low flow, clear and colourless	9.05		0.073	--- ---	69.	--- ---	0.007 2		0.075 5	--- ---	1.49	a b
SW-N-45	SS		2021-10-04	Moderately low flow, clear and colourless	4.76		0.069	--- ---	99.	--- ---	0.007 6		0.114	--- ---	1.16	b
SW-N-45	SS		2022-02-07	Moderate flow, clear and colouress	4.73		0.08	--- ---	131.	--- ---	0.016 8		0.248	--- ---	1.51	b
SW-N-50	SS		2021-04-27	Moderately low flow, clear and colourless	42.9		0.076	--- ---	11.	--- ---	< 0.005		0.074 7	--- ---	0.783	b
SW-N-50	SS		2021-10-05	Moderately low flow, clear and colourless	6.98		0.102	--- ---	15.	--- ---	0.015 1		0.066 7	--- ---	0.776	b
SW-N-50	SS		2021-11-30		283.	a b	0.151	--- ---	11.	--- ---	< 0.005		0.389	--- ---	1.69	b
SW-N-53	SS		2021-11-30		55.4	b	0.214	--- ---	60.	--- ---	0.058		0.401	--- ---	0.9	b
SW-N-54	SS		2021-04-26	Low flow, clear and colourless	6.69		0.39	--- ---	57.	--- ---	0.009 8		0.417	--- ---	13.3	b
SW-N-54	SS		2021-10-05	Moderately low flow, clear and slightly yellow	8.27		0.655	--- ---	64.	--- ---	0.024 3		1.23	--- ---	11.9	b
SW-N-54	SS		2021-11-30		34.8		0.329	--- ---	63.	--- ---	< 0.005		0.159	--- ---	16.6	b
SW-N-54	SS		2022-02-07	Moderately low flow, clear and slighlty yellow	8.19		0.268	--- ---	45.	--- ---	< 0.005		0.137	--- ---	14.3	a b
SW-N-CS2	SS		2021-11-30		7.91		0.034	--- ---	< 10.	--- ---	< 0.005		0.022 3	--- ---	0.605	b
SW-N-CS2	SS		2022-02-07	Moderate flow, clear and colourless	4.32		0.028	--- ---	< 10.	--- ---	< 0.005		0.020 2	--- ---	0.254	b
SW-S-03	SS		2021-04-27	Moderately low flow, clear and colourless	12.1		0.182	--- ---	55.	--- ---	0.008 4		0.252	--- ---	5.52	a b
SW-S-03	SS		2021-10-05	Moderately low flow, clear and colourless, some g	17.		0.285	--- ---	57.	--- ---	0.032 4		1.4	--- ---	3.59	b
SW-S-03	SS		2021-12-01		29.7		0.225	--- ---	75.	--- ---	0.015 9		0.418	--- ---	11.7	a b
SW-S-03	SS		2022-02-08	Moderately high flow, moderately silty and very g	22.6		0.155	--- ---	61.	--- ---	0.017 5		0.317	--- ---	5.93	a b
SW-S-04	FRM	Y	2021-04-27	Mean of duplicates	19.95		0.152 5	--- ---	80.	--- ---	0.007 95		0.12	--- ---	2.725	b
SW-S-04	FRM		2021-10-05	Mean of duplicates	11.23		0.105	--- ---	70.	--- ---	0.016 45		0.081 35	--- ---	1.375	b
SW-S-04	FRM		2021-12-01	Mean of duplicates	30.55		0.134	--- ---	46.5	--- ---	0.006 1		0.069 9	--- ---	2.695	b
SW-S-04	FRM		2022-02-08	Mean of duplicates	10.8		0.118	--- ---	71.5	--- ---	0.009 65		0.099 65	--- ---	2.82	b
SW-S-12	SS		2021-04-27	Moderately low flow, clear and slightly yellow	31.4		0.234	--- ---	65.	--- ---	0.012 7		0.433	--- ---	12.1	b
SW-S-12	SS		2021-10-05	Very low flow, clear and colourless, lots of vegeta	28.7		0.474	--- ---	32.	--- ---	0.030 8		0.293	--- ---	17.3	b
SW-S-12	SS		2021-12-01		41.		0.266	--- ---	95.	--- ---	0.028 1		0.734	--- ---	16.4	a b
SW-S-12	SS		2022-02-08	Moderately high flow, very silty and moderately g	29.3		0.213	--- ---	107.	--- ---	0.013		0.654	--- ---	7.78	a b
SW-S-20	SS		2021-12-01		29.4		0.098	--- ---	15.	--- ---	< 0.005		0.053 6	--- ---	1.05	b
SW-S-21	SS		2021-12-01		37.		0.103	--- ---	15.	--- ---	< 0.005		0.038 9	--- ---	1.27	
SW-S-21	SS		2022-02-08	Moderate flow, clear and colourless	20.8		0.07	--- ---	13.	--- ---	< 0.005		0.029 5	--- ---	0.78	b
SW-S-24	SS		2021-04-27	Moderately low flow, clear and colourless	17.2		0.157	--- ---	82.	--- ---	0.014 7		0.138	--- ---	2.61	b
SW-S-24	SS		2021-10-05	Moderately low flow, clear and colourless	6.68		0.156	--- ---	86.	--- ---	0.017 1		0.1	--- ---	2.69	b
SW-S-24	SS		2021-12-01		18.4		0.177	--- ---	82.	--- ---	0.010 6		0.116	--- ---	4.49	b
SW-S-24	SS		2022-02-08	Moderately high flow, clear and colourless	10.5		0.107	--- ---	73.	--- ---	0.008 1		0.117	--- ---	2.91	a b
SW-S-27	SS		2021-12-01		26.6		0.113	--- ---	73.	--- ---	0.033 3		0.087 1	--- ---	1.53	b
SW-S-27	SS		2022-02-08	Moderately low flow, clear and colourless	13.9		0.1	--- ---	65.	--- ---	0.023 8		0.141	--- ---	0.89	b

Notes:

na — *Not applicable.*

Null — *No sample collected.*

a — *Above Maximum allowable concentration (MAC) British Columbia Water Quality Guideline.*

b — *Above 30-day average British Columbia Water Quality Guideline.*

(1) — *British Columbia Approved Water Quality Guidelines (Criteria), 1998 Edition, Updated in August*

(2) — *Maximum acceptable concentration unless otherwise noted.*

(3) — *The ammonia guideline is pH and temperature (15°C assumed) dependant. All ammonia results were compared to standards based on the associated pH and temperature results for that sample.*

(4) — *The nitrite guidelines are chloride dependant. All nitrite results were compared to standards based on the associated chloride result for that sample.*

(5) — *This value is hardness dependent. All metals results were compared to standards based on the associated hardness result for a particular sample.*

(6) — *This value is the short-term daily for streams with unknown fish distribution.*

(7) — *The TSS guidelines are "change from background" and flow condition dependent. The background TSS in the North landfill are derived from stations SW-N-CSs2, SW-N-41s3 and SW-N-14.*

(8) — *Dissolved copper guideline varies with water hardness, temperature and dissolved organic carbon; Dissolved copper results were only compared with guidelines where DOC was analyzed.*

Table 7-1 Surface Water Quality Exceedances 2021-2022

B.C. Water Quality Guidelines				BC WQG MAXIMUM (1)	---			350			---			---			---		
				BC WQG AVERAGE (1)	---			---			---			---			---		
				PARAMETER	Hardness (As Caco3)			Iron			Lead			Manganese			Molybdenum		
				STATE	DIS			DIS			DIS			DIS			DIS		
				UNIT	mg/L			µg/L			µg/L			µg/L			µg/L		
Station	Sample Type	Compliance Well (Y/N?)	Date Sampled	Method Detection Limit (MDL)	0.5			1			0.005			0.05			0.05		
				Limit of Quantification (LOQ)	2.5			5			0.025			0.25			0.25		
					30%			30%			30%			30%			30%		
				COMMENTS	RESULT			RESULT			RESULT			RESULT			RESULT		
SW-N-05	FRM	Y	2021-04-26	Mean of duplicates	158.	---	---	19.7		---	<	0.005 15	---	---	0.576 5	---	---	0.986	---	---
SW-N-05	FRM		2021-10-05	Mean of duplicates	222.5	---	---	1.5		---	<	0.006 8	---	---	0.214 5	---	---	0.826	---	---
SW-N-05	FRM		2021-11-30	Mean of duplicates	326.	---	---	26.2		---		0.013	---	---	12.2	---	---	1.525	---	---
SW-N-05	FRM		2022-02-07	Mean of duplicates	717.5	---	---	18.05		---		0.006 8	---	---	84.45	---	---	2.3	---	---
SW-N-16	FRM	Y	2021-04-26	Mean of duplicates	163.5	---	---	562.	a	---		0.012 5	---	---	737.5	---	---	0.846	---	---
SW-N-16	FRM		2021-10-04	Mean of duplicates	216.	---	---	341.		---		0.016	---	---	140.	---	---	1.175	---	---
SW-N-16	FRM		2021-11-30	Mean of duplicates	138.5	---	---	82.35		---		0.007 6	---	---	26.	---	---	0.772 5	---	---
SW-N-16	FRM		2022-02-08	Mean of duplicates	127.	---	---	129.5		---		0.006 1	---	---	91.8	---	---	0.694	---	---
SW-N-17	SS		2021-04-29	Moderately low flow, clear and colourless	156.	---	---	22.		---	<	0.005	---	---	16.5	---	---	0.701	---	---
SW-N-17	SS		2021-10-04	Moderately low flow, clear and colourless	182.	---	---	11.8		---		0.005 7	---	---	12.3	---	---	0.904	---	---
SW-N-17	SS		2022-02-07	Moderate flow, clear and colouress	301.	---	---	4.6		---	<	0.005	---	---	5.44	---	---	0.512	---	---
SW-N-18	SS		2021-04-26	Moderately low flow, clear and colourless	131.	---	---	20.8		---		0.008 4	---	---	1.08	---	---	0.415	---	---
SW-N-18	SS		2021-10-05	Moderately low flow, clear and colourless	184.	---	---	2.6		---		0.005 6	---	---	0.486	---	---	0.496	---	---
SW-N-18	SS		2021-11-30		115.	---	---	859.	a	---		0.187	---	---	59.	---	---	0.433	---	---
SW-N-18	NS		2022-02-07	DRY - flow blocked off feeding into sample locatic	Null	---	---	Null		---		Null	---	---	Null	---	---	Null	---	---
SW-N-19	SS		2021-04-26	Moderately low flow, clear and moderately yellow	179.	---	---	80.5		---		0.021 2	---	---	55.5	---	---	1.01	---	---
SW-N-19	SS		2021-11-30		148.	---	---	29.6		---		0.007 9	---	---	6.13	---	---	0.863	---	---
SW-N-19	SS		2022-02-08	Moderate flow, clear and slightly yellow	138.	---	---	20.7		---	<	0.005	---	---	2.42	---	---	0.979	---	---
SW-N-41S1	FRM	Y	2021-04-26	Mean of duplicates	186.5	---	---	392.	a	---		0.090 75	---	---	216.	---	---	0.410 5	---	---
SW-N-41S1	FRM		2021-10-04	Mean of duplicates	240.	---	---	112.5		---		0.013 75	---	---	283.	---	---	0.381	---	---
SW-N-41S3	SS		2021-04-26	Moderately low flow, clear and colourless	120.	---	---	18.9		---		0.009 5	---	---	4.24	---	---	0.325	---	---
SW-N-41S3	SS		2021-11-30		63.8	---	---	4.9		---		0.010 1	---	---	0.59	---	---	0.211	---	---
SW-N-41S3	SS		2022-02-07	Moderately high flow, clear and colourless	84.5	---	---	3.6		---	<	0.005	---	---	0.973	---	---	0.399	---	---
SW-N-42S1	FRM	Y	2021-04-26	Mean of duplicates	193.5	---	---	33.3		---		0.009 65	---	---	43.05	---	---	0.455 5	---	---
SW-N-42S1	FRM		2021-11-30	Mean of duplicates	144.	---	---	19.4		---		0.016 15	---	---	11.2	---	---	0.387 5	---	---
SW-N-42S1	FRM		2022-02-07	Mean of duplicates	165.5	---	---	9.75		---	<	0.005 35	---	---	11.	---	---	0.509	---	---
SW-N-45	SS		2021-04-29	Moderately low flow, clear and colourless	172.	---	---	12.6		---		0.013 1	---	---	4.23	---	---	1.06	---	---
SW-N-45	SS		2021-10-04	Moderately low flow, clear and colourless	209.	---	---	6.		---	<	0.005	---	---	6.16	---	---	1.1	---	---
SW-N-45	SS		2022-02-07	Moderate flow, clear and colouress	556.	---	---	3.2		---	<	0.005	---	---	7.94	---	---	0.838	---	---
SW-N-50	SS		2021-04-27	Moderately low flow, clear and colourless	135.	---	---	70.9		---		0.020 7	---	---	1.6	---	---	0.398	---	---
SW-N-50	SS		2021-10-05	Moderately low flow, clear and colourless	175.	---	---	13.		---		0.010 3	---	---	0.618	---	---	0.483	---	---
SW-N-50	SS		2021-11-30		90.7	---	---	473.	a	---		0.134	---	---	18.6	---	---	0.368	---	---
SW-N-53	SS		2021-11-30		1 130.	---	---	55.6		---		0.019	---	---	15.4	---	---	1.1	---	---
SW-N-54	SS		2021-04-26	Low flow, clear and colourless	195.	---	---	26.3		---	<	0.005	---	---	148.	---	---	0.547	---	---
SW-N-54	SS		2021-10-05	Moderately low flow, clear and slightly yellow	330.	---	---	194.		---		0.014	---	---	549.	---	---	0.572	---	---
SW-N-54	SS		2021-11-30		140.	---	---	58.7		---		0.008 1	---	---	22.2	---	---	0.441	---	---
SW-N-54	SS		2022-02-07	Moderately low flow, clear and slighlty yellow	146.	---	---	16.6		---	<	0.005	---	---	20.4	---	---	0.469	---	---
SW-N-CS2	SS		2021-11-30		43.2	---	---	3.		---	<	0.005	---	---	0.075	---	---	0.057	---	---
SW-N-CS2	SS		2022-02-07	Moderate flow, clear and colourless	60.4	---	---	1.		---	<	0.005	---	---	< 0.05	---	---	0.082	---	---
SW-S-03	SS		2021-04-27	Moderately low flow, clear and colourless	105.	---	---	266.		---		0.014 8	---	---	56.3	---	---	0.217	---	---
SW-S-03	SS		2021-10-05	Moderately low flow, clear and colourless, some g	170.	---	---	640.	a	---		0.080 9	---	---	251.	---	---	0.385	---	---
SW-S-03	SS		2021-12-01		97.6	---	---	162.		---		0.012 3	---	---	174.	---	---	0.16	---	---
SW-S-03	SS		2022-02-08	Moderately high flow, moderately silty and very g	77.	---	---	147.		---		0.042 8	---	---	126.	---	---	0.375	---	---
SW-S-04	FRM	Y	2021-04-27	Mean of duplicates	116.5	---	---	27.7		---		0.022 95	---	---	3.335	---	---	0.197 5	---	---
SW-S-04	FRM		2021-10-05	Mean of duplicates	136.5	---	---	3.5		---	<	0.006	---	---	0.757	---	---	0.091 5	---	---
SW-S-04	FRM		2021-12-01	Mean of duplicates	65.55	---	---	24.55		---		0.013 35	---	---	2.335	---	---	0.107	---	---
SW-S-04	FRM		2022-02-08	Mean of duplicates	98.45	---	---	21.1		---		0.009 35	---	---	0.862	---	---	0.209	---	---
SW-S-12	SS		2021-04-27	Moderately low flow, clear and slightly yellow	111.	---	---	981.	a	---		0.008 5	---	---	219.	---	---	0.127	---	---
SW-S-12	SS		2021-10-05	Very low flow, clear and colourless, lots of vegeta	267.	---	---	51.		---		0.021 2	---	---	16.3	---	---	0.201	---	---
SW-S-12	SS		2021-12-01		111.	---	---	369.	a	---		0.009 7	---	---	329.	---	---	0.125	---	---
SW-S-12	SS		2022-02-08	Moderately high flow, very silty and moderately g	98.3	---	---	1 140.	a	---		0.033 7	---	---	374.	---	---	0.155	---	---
SW-S-20	SS		2021-12-01		38.1	---	---	19.3		---		0.007 9	---	---	11.2	---	---	0.059	---	---
SW-S-21	SS		2021-12-01		35.4	---	---	18.4		---		0.006 8	---	---	0.465	---	---	0.124	---	---
SW-S-21	SS		2022-02-08	Moderate flow, clear and colourless	46.1	---	---	4.7		---	<	0.005	---	---	0.065	---	---	0.097	---	---
SW-S-24	SS		2021-04-27	Moderately low flow, clear and colourless	118.	---	---	57.		---		0.022 7	---	---	25.8	---	---	0.206	---	---
SW-S-24	SS		2021-10-05	Moderately low flow, clear and colourless	156.	---	---	3.3		---		0.006 6	---	---	1.38	---	---	0.095	---	---
SW-S-24	SS		2021-12-01		97.	---	---	26.3		---		0.014 3	---	---	10.7	---	---	0.156	---	---
SW-S-24	SS		2022-02-08	Moderately high flow, clear and colourless	98.7	---	---	25.1		---		0.007 3	---	---	6.23	---	---	0.17	---	---
SW-S-27	SS		2021-12-01		82.2	---	---	40.8		---		0.090 2	---	---	11.3	---	---	0.137	---	---
SW-S-27	SS		2022-02-08	Moderately low flow, clear and colourless	89.8	---	---	48.2		---		0.034 1	---	---	36.7	---	---	0.121	---	---

Notes:

na — *Not applicable.*

Null — *No sample collected.*

a — *Above Maximum allowable concentration (MAC) British Columbia Water Quality Guideline.*

b — *Above 30-day average British Columbia Water Quality Guideline.*

(1) — *British Columbia Approved Water Quality Guidelines (Criteria), 1998 Edition, Updated in August*

(2) — *Maximum acceptable concentration unless otherwise noted.*

(3) — *The ammonia guideline is pH and temperature (15°C assumed) dependant. All ammonia results were compared to standards based on the associated pH and temperature results for that sample.*

(4) — *The nitrite guidelines are chloride dependant. All nitrite results were compared to standards based on the associated chloride result for that sample.*

(5) — *This value is hardness dependent. All metals results were compared to standards based on the associated hardness result for a particular sample.*

(6) — *This value is the short-term daily for streams with unknown fish distribution.*

(7) — *The TSS guidelines are "change from background" and flow condition dependent. The background TSS in the North landfill are derived from stations SW-N-CSs2, SW-N-41s3 and SW-N-14.*

(8) — *Dissolved copper guideline varies with water hardness, temperature and dissolved organic carbon; Dissolved copper results were only compared with guidelines where DOC was analyzed.*

Table 7-1 Surface Water Quality Exceedances 2021-2022

B.C. Water Quality Guidelines				BC WQG MAXIMUM (1)	---			---			---			---			---		
				BC WQG AVERAGE (1)	---			---			---			---			---		
Station	Sample Type	Compliance Well (Y/N?)	Date Sampled	PARAMETER	Nickel			Selenium			Silver			Zinc			Dissolved Organic Carbon		
				STATE	DIS			DIS			DIS			DIS			Dissolved		
				UNIT	µg/L			µg/L			µg/L			µg/L			µg/L		
				Method Detection Limit (MDL)	0.02			0.04			0.005			0.1			0.5		
				Limit of Quantification (LOQ)	0.1			0.2			0.025			0.5			2.5		
					30%			30%			30%			30%			30%		
				COMMENTS	RESULT			RESULT			RESULT			RESULT			RESULT		
SW-N-05	FRM	Y	2021-04-26	Mean of duplicates	0.419 5	---	---	0.188	---	---	< 0.005	---	---	1.4	---	---	1.7	---	---
SW-N-05	FRM		2021-10-05	Mean of duplicates	0.378	---	---	0.445 5	---	---	< 0.005	---	---	2.315	---	---	0.75	---	---
SW-N-05	FRM		2021-11-30	Mean of duplicates	1.63	---	---	0.676	---	---	< 0.005	---	---	3.595	---	---	4.4	---	---
SW-N-05	FRM		2022-02-07	Mean of duplicates	3.035	---	---	1.72	---	---	< 0.005	---	---	6.62	---	---	4.4	---	---
SW-N-16	FRM	Y	2021-04-26	Mean of duplicates	1.705	---	---	0.114	---	---	< 0.005	---	---	4.105	---	---	9.75	---	---
SW-N-16	FRM		2021-10-04	Mean of duplicates	1.945	---	---	0.122 5	---	---	< 0.005	---	---	15.75	---	---	10.	---	---
SW-N-16	FRM		2021-11-30	Mean of duplicates	1.75	---	---	0.132 5	---	---	< 0.005	---	---	8.23	---	---	10.4	---	---
SW-N-16	FRM		2022-02-08	Mean of duplicates	1.165	---	---	0.101 5	---	---	< 0.005	---	---	6.835	---	---	8.1	---	---
SW-N-17	SS		2021-04-29	Moderately low flow, clear and colourless	0.19	---	---	0.115	---	---	< 0.005	---	---	1.11	---	---	1.4	---	---
SW-N-17	SS		2021-10-04	Moderately low flow, clear and colourless	0.409	---	---	0.33	---	---	< 0.005	---	---	3.88	---	---	3.1	---	---
SW-N-17	SS		2022-02-07	Moderate flow, clear and colouress	0.343	---	---	0.485	---	---	< 0.005	---	---	1.67	---	---	2.7	---	---
SW-N-18	SS		2021-04-26	Moderately low flow, clear and colourless	0.243	---	---	0.143	---	---	< 0.005	---	---	17.	---	---	1.3	---	---
SW-N-18	SS		2021-10-05	Moderately low flow, clear and colourless	0.197	---	---	0.208	---	---	< 0.005	---	---	2.56	---	---	1.	---	---
SW-N-18	SS		2021-11-30		1.45	---	---	0.155	---	---	0.015 2	---	---	1.76	---	---	2.4	---	---
SW-N-18	NS		2022-02-07	DRY - flow blocked off feeding into sample locatic	Null	---	---	Null	---	---	Null	---	---	Null	---	---	Null	---	---
SW-N-19	SS		2021-04-26	Moderately low flow, clear and moderately yellow	2.7	---	---	0.176	---	---	0.005 5	---	---	3.89	---	---	11.	---	---
SW-N-19	SS		2021-11-30		2.21	---	---	0.16	---	---	< 0.005	---	---	4.08	---	---	12.	---	---
SW-N-19	SS		2022-02-08	Moderate flow, clear and slightly yellow	2.2	---	---	0.139	---	---	< 0.005	---	---	2.28	---	---	9.3	---	---
SW-N-41S1	FRM	Y	2021-04-26	Mean of duplicates	0.578 5	---	---	0.088	---	---	< 0.005	---	---	1.055	---	---	1.85	---	---
SW-N-41S1	FRM		2021-10-04	Mean of duplicates	0.224 5	---	---	0.104	---	---	< 0.005	---	---	1.145	---	---	1.75	---	---
SW-N-41S3	SS		2021-04-26	Moderately low flow, clear and colourless	0.125	---	---	0.083	---	---	< 0.005	---	---	0.64	---	---	1.6	---	---
SW-N-41S3	SS		2021-11-30		0.046	---	---	0.058	---	---	< 0.005	---	---	0.5	---	---	2.2	---	---
SW-N-41S3	SS		2022-02-07	Moderately high flow, clear and colourless	0.064	---	---	0.072	---	---	< 0.005	---	---	0.21	---	---	1.1	---	---
SW-N-42S1	FRM	Y	2021-04-26	Mean of duplicates	0.179	---	---	0.043 5	---	---	< 0.005	---	---	0.565	---	---	4.1	---	---
SW-N-42S1	FRM		2021-11-30	Mean of duplicates	0.148 5	---	---	0.05	---	---	< 0.005	---	---	1.2	---	---	3.8	---	---
SW-N-42S1	FRM		2022-02-07	Mean of duplicates	0.125	---	---	0.044 5	---	---	< 0.005	---	---	0.71	---	---	2.55	---	---
SW-N-45	SS		2021-04-29	Moderately low flow, clear and colourless	0.227	---	---	0.197	---	---	< 0.005	---	---	1.32	---	---	0.83	---	---
SW-N-45	SS		2021-10-04	Moderately low flow, clear and colourless	0.249	---	---	0.441	---	---	< 0.005	---	---	1.1	---	---	2.3	---	---
SW-N-45	SS		2022-02-07	Moderate flow, clear and colouress	0.659	---	---	1.24	---	---	< 0.005	---	---	1.35	---	---	2.2	---	---
SW-N-50	SS		2021-04-27	Moderately low flow, clear and colourless	0.15	---	---	0.142	---	---	< 0.005	---	---	1.46	---	---	1.2	---	---
SW-N-50	SS		2021-10-05	Moderately low flow, clear and colourless	0.161	---	---	0.236	---	---	< 0.005	---	---	1.86	---	---	1.1	---	---
SW-N-50	SS		2021-11-30		0.454	---	---	0.14	---	---	< 0.005	---	---	1.	---	---	1.3	---	---
SW-N-53	SS		2021-11-30		10.7	---	---	2.71	---	---	< 0.01	---	---	42.1	---	---	1.9	---	---
SW-N-54	SS		2021-04-26	Low flow, clear and colourless	1.47	---	---	0.227	---	---	< 0.005	---	---	0.77	---	---	7.7	---	---
SW-N-54	SS		2021-10-05	Moderately low flow, clear and slightly yellow	2.16	---	---	0.265	---	---	0.006 7	---	---	0.93	---	---	15.	---	---
SW-N-54	SS		2021-11-30		1.98	---	---	0.205	---	---	< 0.005	---	---	0.83	---	---	9.8	---	---
SW-N-54	SS		2022-02-07	Moderately low flow, clear and slighlty yellow	1.37	---	---	0.19	---	---	< 0.005	---	---	0.35	---	---	7.3	---	---
SW-N-CS2	SS		2021-11-30		0.047	---	---	0.048	---	---	< 0.005	---	---	0.67	---	---	1.8	---	---
SW-N-CS2	SS		2022-02-07	Moderate flow, clear and colourless	0.03	---	---	< 0.04	---	---	< 0.005	---	---	0.51	---	---	1.	---	---
SW-S-03	SS		2021-04-27	Moderately low flow, clear and colourless	0.966	---	---	0.083	---	---	< 0.005	---	---	3.3	---	---	4.7	---	---
SW-S-03	SS		2021-10-05	Moderately low flow, clear and colourless, some g	1.27	---	---	0.118	---	---	< 0.005	---	---	13.6	---	---	5.	---	---
SW-S-03	SS		2021-12-01		1.9	---	---	0.121	---	---	< 0.005	---	---	5.68	---	---	7.1	---	---
SW-S-03	SS		2022-02-08	Moderately high flow, moderately silty and very g	1.03	---	---	0.082	---	---	< 0.005	---	---	6.56	---	---	5.7	---	---
SW-S-04	FRM	Y	2021-04-27	Mean of duplicates	0.516 5	---	---	0.060 5	---	---	< 0.005	---	---	2.04	---	---	3.75	---	---
SW-S-04	FRM		2021-10-05	Mean of duplicates	0.370 5	---	---	0.063	---	---	< 0.005	---	---	2.68	---	---	3.45	---	---
SW-S-04	FRM		2021-12-01	Mean of duplicates	0.423 5	---	---	0.068	---	---	< 0.005	---	---	7.695	---	---	4.9	---	---
SW-S-04	FRM		2022-02-08	Mean of duplicates	0.511	---	---	0.062 5	---	---	< 0.005	---	---	2.29	---	---	3.65	---	---
SW-S-12	SS		2021-04-27	Moderately low flow, clear and slightly yellow	2.49	---	---	0.11	---	---	< 0.005	---	---	2.53	---	---	6.9	---	---
SW-S-12	SS		2021-10-05	Very low flow, clear and colourless, lots of vegeta	4.21	---	---	0.248	---	---	< 0.005	---	---	6.46	---	---	11.	---	---
SW-S-12	SS		2021-12-01		2.9	---	---	0.144	---	---	< 0.005	---	---	6.22	---	---	8.6	---	---
SW-S-12	SS		2022-02-08	Moderately high flow, very silty and moderately g	1.78	---	---	0.084	---	---	< 0.005	---	---	3.72	---	---	6.6	---	---
SW-S-20	SS		2021-12-01		0.149	---	---	0.052	---	---	< 0.005	---	---	20.2	---	---	4.2	---	---
SW-S-21	SS		2021-12-01		0.218	---	---	0.052	---	---	< 0.005	---	---	11.1	---	---	4.3	---	---
SW-S-21	SS		2022-02-08	Moderate flow, clear and colourless	0.106	---	---	< 0.04	---	---	< 0.005	---	---	7.28	---	---	2.5	---	---
SW-S-24	SS		2021-04-27	Moderately low flow, clear and colourless	0.678	---	---	0.059	---	---	< 0.005	---	---	2.68	---	---	4.2	---	---
SW-S-24	SS		2021-10-05	Moderately low flow, clear and colourless	0.5	---	---	0.064	---	---	< 0.005	---	---	4.53	---	---	5.1	---	---
SW-S-24	SS		2021-12-01		0.731	---	---	0.094	---	---	< 0.005	---	---	4.28	---	---	5.5	---	---
SW-S-24	SS		2022-02-08	Moderately high flow, clear and colourless	0.539	---	---	0.057	---	---	< 0.005	---	---	2.09	---	---	3.7	---	---
SW-S-27	SS		2021-12-01		0.419	---	---	0.065	---	---	< 0.005	---	---	5.23	---	---	3.5	---	---
SW-S-27	SS		2022-02-08	Moderately low flow, clear and colourless	0.371	---	---	< 0.04	---	---	< 0.005	---	---	3.41	---	---	2.9	---	---

Notes:

na — *Not applicable.*

Null — *No sample collected.*

a — *Above Maximum allowable concentration (MAC) British Columbia Water Quality Guideline.*

b — *Above 30-day average British Columbia Water Quality Guideline.*

(1) — *British Columbia Approved Water Quality Guidelines (Criteria), 1998 Edition, Updated in August*

(2) — *Maximum acceptable concentration unless otherwise noted.*

(3) — *The ammonia guideline is pH and temperature (15°C assumed) dependant. All ammonia results were compared to standards based on the associated pH and temperature results for that sample.*

(4) — *The nitrite guidelines are chloride dependant. All nitrite results were compared to standards based on the associated chloride result for that sample.*

(5) — *This value is hardness dependent. All metals results were compared to standards based on the associated hardness result for a particular sample.*

(6) — *This value is the short-term daily for streams with unknown fish distribution.*

(7) — *The TSS guidelines are "change from background" and flow condition dependent. The background TSS in the North landfill are derived from stations SW-N-CSs2, SW-N-41s3 and SW-N-14.*

(8) — *Dissolved copper guideline varies with water hardness, temperature and dissolved organic carbon; Dissolved copper results were only compared with guidelines where DOC was analyzed.*

7.6 Assessment of Surface Water Quality Impacts

The primary causes of any surface water quality degradation at the site include leachate, road salt, and crushed aggregate production, stockpiling and use. Ammonium lignosulphonate has been used for dust suppression on gravel roads since 2014. Background conductivity in surface water is typically below 200 µS/cm but has been observed at higher concentrations at some locations during periods of low flow, or after periods of prolonged dry weather. Background ammonia concentrations are typically below 0.01 mg/L, but occasionally exceed 0.1 mg/L downgradient of wetland areas. Background chloride concentrations are typically below 10 mg/L. Background sulphate concentrations are typically below 10 mg/L, but often increase in the downstream direction as streams receive groundwater discharge from underlying groundwater aquifers.

Surface water is considered impacted by leachate when electrical conductivity surpasses 500 µS/cm, ammonia concentrations exceed 0.5 mg/L and chloride concentrations exceed 20 mg/L. Peak concentrations at surface water monitoring stations are typically observed during the dry summer and early fall months, when flows are low and there is limited dilution by precipitation.

Surface water is considered impacted by aggregate (e.g., aggregate production, stockpiling or site construction works) when sulphate concentrations exceed 75 mg/L and ammonia or nitrate (from blasting residuals) are present at concentrations above background levels (0.1 mg/L). Peak concentrations are typically observed during the first sampling event following the onset of wet weather in the fall months, and in areas of active quarry development or aggregate placement.

Surface water is considered impacted by road salt when electrical conductivity and chloride concentrations exceed background levels (300 µS/cm and 20 mg/L, respectively), and concentrations of ammonia and its degradation products (primarily nitrate) are below background levels (0.1 mg/L). Sites that are judged to be impacted by road salt must also be located downstream (or downgradient) of surfaces and roadways where road salt was applied. Electrical conductivity and chloride concentrations typically peak following cold weather periods when de-icing salt is applied to roadways.

Surface water quality in natural and anthropogenically modified systems can be highly variable due to temporal variations in flow and chemical inputs, and professional judgement is used to determine the nature and degree of any impacts due to leachate, road salt and aggregate stockpiles. The authors are hydrogeologists and geochemists with considerable experience evaluating leachate and water quality impacts at other landfills and industrial facilities in coastal regions of British Columbia. If any surface water concentrations exceed BCWQG for the protection of freshwater AW at the property boundary, standard CSR protocols for notification of affected property owners should be followed.

7.7 Data

Hartland Landfill is located within the Tod Creek watershed on a drainage divide between the Heal Creek drainage basin to the north and the Killarney Creek basin to the south. Surface water from both the Heal Creek drainage basin and Killarney Creek basin flow into Tod Creek and ultimately discharge to Tod Inlet. Surface water sampling stations are shown on Figure 7-1. Surface water sampling stations have been established on the landfill property to monitor compliance at the property boundary and identify changes in surface water quality that could be related to landfill operations. Surface water stations are also located at numerous off-site locations to routinely monitor water quality.

Surface water quality interpretation was based on water quality data collected at eight (8) locations south and west of the landfill, 10 locations north of the Phase 1 and Phase 2 landfill areas, and four (4) locations northwest of the landfill (Hartland North Pad). Surface water samples are collected four times per year from property Boundary Compliance and other key stations. Surface water samples are collected twice per year from all other monitoring stations. Samples were not collected when watercourses were dry. In 2021/22, pre-existing surface water monitoring locations continued to be monitored for potential impacts.

Surface water sampling points utilized for the 2021/22 monitoring program are shown below:

South and West of the Landfill

- Sw-S-03
- Sw-S-04 - compliance
- Sw-S-12
- Sw-S-20
- Sw-S-21

North of Phase 1 and Phase 2

- Sw-N-05 - compliance
- Sw-N-16 - compliance
- Sw-N-17
- Sw-N-18
- Sw-N-19

- Sw-S-24
- Sw-S-27
- Sw-S-52

North of the Hartland North Pad

- Sw-N-41s1 - compliance
- Sw-N-41s3
- Sw-N-42s1 - compliance
- Sw-N-CS2
- Sw-N-45
- Sw-N-50
- Sw-N-51
- Sw-N-53
- Sw-N-54

7.8 Overview of Surface Water Exceedances

Surface water results were compared to the approved and working BCWQG AW criteria in Appendix B.3. A summary of surface water exceedances is presented in Table 7-1. In 2021/22, surface water quality data met the BCWQG-MAC for all parameters except for TSS, total and dissolved iron, nitrite, nitrate, zinc, aluminum and dissolved copper concentrations. Metal concentration exceedances mostly reflect low flow conditions and turbulent flow conditions, however, nutrient exceedances are interpreted to reflect impacts due to runoff from aggregate stockpiles located on the bedrock ridge north of the Phase 2 landfill and elsewhere. Elevated copper concentrations are interpreted to be the result of very low criteria derived using the BLM model driven primarily by naturally low pH and dissolved organic carbon concentrations in surface water.

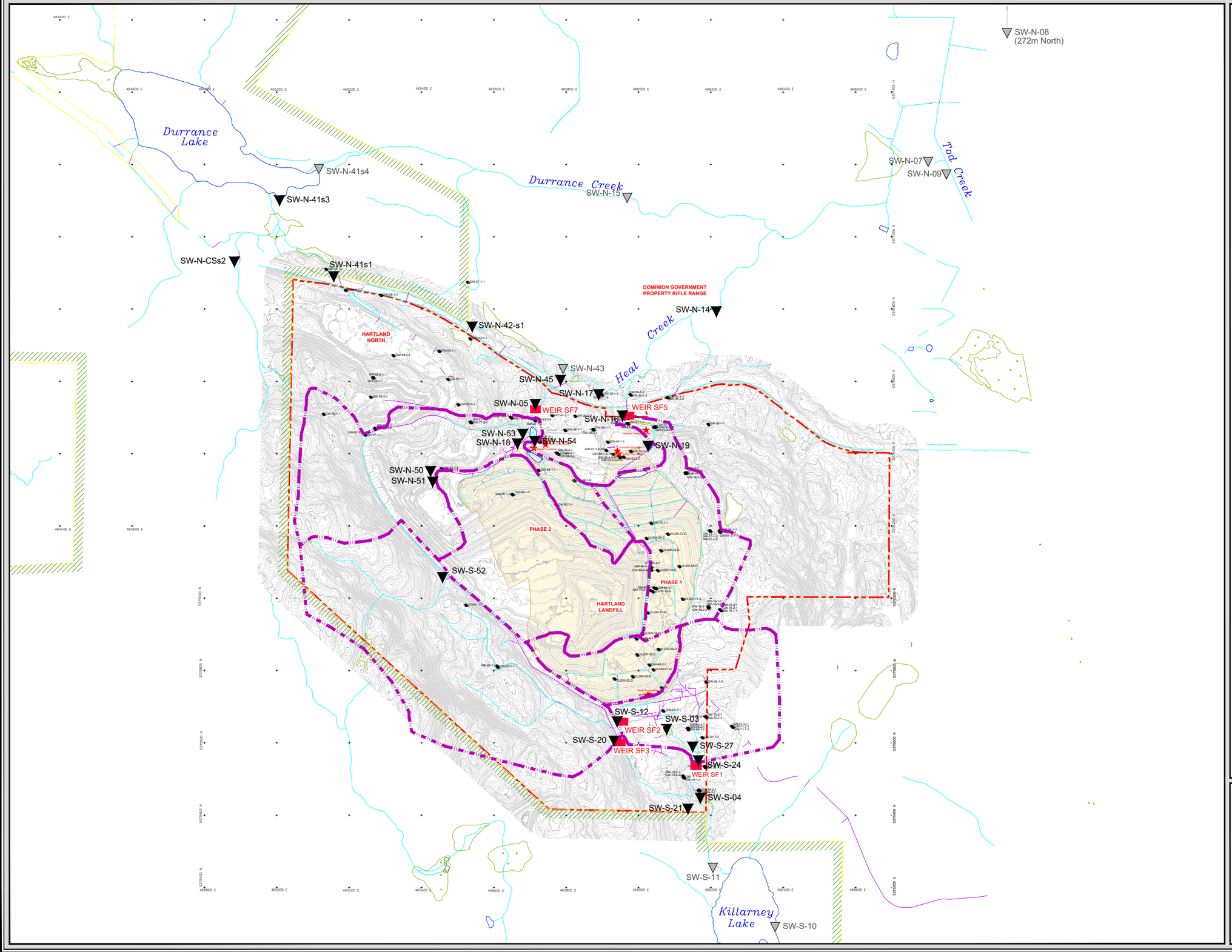
Since November 2021, surface water in the NWSP and compliance location (SW-N-05) has exhibited increased nutrient and metal concentrations, resulting in non-compliance conditions at SW-N-05. A subsurface investigation is actively underway to determine the source of the nutrient impacts and develop remedial solutions to restore water quality in this area. The aggregate stockpiles located in the Toutle Valley and atop the bedrock ridge north of the Phase 2 landfill are interpreted to be the primary source of nitrate and sulphate observed at Sw-N-05, but additional investigations are required to determine the source of ammonia reporting to the NWSP and Sw-N-05.

7.9 Surface Water Quality North of Phase 1

Clean runoff from the Phase 1 closure and the eastern perimeter of the landfill is directed to a lined NWSP and then into the wetland located north of the lower leachate lagoon. The wetland, in turn, discharges northward to Heal Creek. Heal Creek also receives drainage from the area north of Phase 2 (High Level Road ditch), and from a small stream draining a small wetland below the east end of the Hartland North Pad. Aggregate and piping was added to select sections of the High Level Road ditch in June 2018 to protect the ditch from nearby construction and mitigate ponding, which may contribute to elevated concentrations of sulphate in surface drainage over time.

Heal Creek flows north-easterly from the NWSP at the north end of the Phase 2 basin to the confluence with Durrance Creek, as shown in Figure 4-1. Durrance Creek discharges to Tod Creek, which in turn discharges to Tod Inlet, about 3 km north of the landfill. Heal Creek is a small creek with a watershed area of 128 ha. Heal Creek is mainly steep and rocky although the creek passes through a few small wetlands near the upper end. The creek dries up during the summer months except in the lower reaches where groundwater discharge maintains flow year-round.

Figure 7-2 presents conductivity, ammonia, chloride and sulphate concentrations in Heal Creek downstream of the landfill at stations Sw-N-05, Sw-N-14, Sw-N-16 and Sw-N-17. The distance of each station from the landfill boundary is shown in brackets in the legend. Sw-N-05 and Sw-N-16 are compliance monitoring stations. The plot shows that water quality continued to improve at Sw-N-16 but increases in key leachate parameters were observed at Sw-N-05 throughout 2021. As described, the water quality impacts observed at Sw-N-05 are linked to runoff from aggregate stockpiles and possible leachate inputs along the northern boundary of Phase 2. Similar water quality impacts were observed at Sw-N-17, where water quality degraded steadily throughout the monitoring year. No sample was collected at Sw-N-14. Like previous years, these sampling locations were periodically dry in 2021/22 due to arid summer conditions.



Legend

- BUILDING / STRUCTURE
- ROAD
- FENCE
- LEGAL LOT BOUNDARY
- INDEX CONTOUR (5m)
- INTERMEDIATE CONTOUR (1m)
- TREES/SHRUB/VEGETATION
- DITCH
- DRAINAGE
- PIPE
- EXISTING WASTE
- HARTLAND LANDFILL OPERATING AREA BOUNDARY
- SW-S-52 — ACTIVE SURFACE WATER SAMPLING LOCATION
- SW-N-15 — INACTIVE SURFACE WATER SAMPLING LOCATION
- SURFACE WATER DIVIDE
- WEIR SF1 — WEIR LOCATION

Map Sources / Notes:
- Contour interval 1.0 m
- Groundwater elevation data collected by CRD, September 2021.
- Contours based on 24-W542_2021_base.dwg provided by Adrian Betanzo of Capital Regional District, April 2022.
- Drainage information for years 2018-2019 obtained from Parks & Env. Services GIS technicians and have layers with the prefix "CRD19_GIS DRAINAGE" & "CRD19_GIS streams_Ditches".
- GPS pickup has been conducted by CRD Staff of creeks, wetlands, culverts located under tree canopied areas. This information (considered more accurate) has been added to the base (superceding some planimetric information) and is placed on layers indicating GPS pickup. An example of that layering system would be 'CRD19-wat-culvert_GPS pickup'.
- Surveyed points for monitoring sites (groundwater, gas wells, leachate, purge wells) were updated for 2019.
- The map is to NAD83 UTM coordinates. Vertical datum is to CGVD28.

N W E S

0 50 100 200 300 400 m

1 : 10,000

UTM Zone 10N, NAD83

Reviewed by:	KJ	Prepared by:	PCJ
Date Issued:	August 2022	Project Number:	60631284

CRD Making a difference...together

Project: Hartland Landfill Monitoring
Location: Saanich, BC

Surface Water Bodies and Sampling Locations

AECOM

Figure 7-1

File Location: \\NA.AECOMNET.COM\LFS\AMERBURNABY-CABNY1\LEGACY\CABNY1FP001\PROD\PROJECTS\60631284\900-CAD_GIS\910-CAD\20-SHEETS\C433 - 2021-22 ANNUAL REPORT\FIG7.1-SURFACE WATER & SAMPLE LOC-60631284-2022.DWG Date Plotted: August 9, 2022 Saved By:castlejanschp

7.9.1 Monitoring Site Sw-N-16

A small wetland is located just north of the lower leachate lagoon. Water flows from this wetland northwards through a weir (Sw-N-16 – Boundary Compliance Station) before discharging to a culvert under Willis Point Road and then to Heal Creek. Site Sw-N-16 is located on the landfill property and is the compliance point used to monitor the quality of the surface water leaving the landfill through this route.

In 2021/22, all parameters met BCWQG-MAC guidelines at Sw-N-16 except for dissolved and total iron concentrations during one sampling event. Like previous years, nitrate and sulphate concentrations were elevated during the wet season, whereas ammonia concentrations remained relatively low. Given the low ammonia and chloride concentrations, it is unlikely the surface water was impacted by leachate. The elevated nitrate and sulphate concentrations observed during the winter season suggest that the surface water may have been impacted by the prolonged dry summer season (i.e., less dilution), as well as nearby construction activities involving blasting, aggregate placement, or excavation of organic soils.

The iron exceedances in April 2021 are likely due to the disturbance of sediment during sampling, as indicated by the reported high TSS concentrations. Alternatively, elevated iron concentrations may be derived from the wetland located upgradient of Sw-N-16 or related to sediment accumulation at sampling locations. Dissolved copper concentrations were above the BCWQG 30-Day average guideline during all sampling events. Overall, water quality at Sw-N-16 is slightly improved from the previous monitoring year, with lower conductivity and sulphate concentrations, and fewer exceedances overall.

7.9.2 Monitoring Site Sw-N-05

The other route for surface water to leave the property to the north is through the main channel of Heal Creek located just north of Phase 2. In 2021/22, water quality samples were collected on all four sampling dates at Boundary Compliance station Sw-N-05.

Surface water quality at Sw-N-05 degraded throughout the monitoring year. Conductivity, sulphate, nitrate, dissolved copper, chloride and ammonia concentrations increased throughout the monitoring period (with ammonia concentrations decreasing slightly in February 2022). Nitrite and nitrate concentrations exceeded BCWQG-MAC in November 2021 and February 2022, respectively. Dissolved copper exceedances were observed in April and November 2021 sampling events. Nitrate concentrations exceeded the BCWQG 30-Day average guidelines on all sampling dates, with nitrite and ammonia exceedances in November 2021 and February 2022. Dissolved copper exceedances occurred in April and November 2021. Conductivity, sulphate and nitrate concentrations at Sw-N-05 have exhibited an increasing trend over the past five years, indicating water quality in Heal Creek has degraded due to aggregate production, stockpiling and placement, and possible localized leachate impacts.

As discussed above, surface water at compliance location SW-N-05 has exhibited increased nutrient and metal concentrations since November 2021, resulting in non-compliant water quality at SW-N-05. Following the identification of nutrient impacts, CRD initiated an expanded monitoring program to determine the source of the exceedances, evaluate temporal changes in water quality and develop and initiate mitigation measures. Additional water quality sampling events were completed by CRD between November 2021 and April 2022 at Sw-N-05 and other locations north of Phase 2. This supplemental monitoring program evolved over time in response to water quality results, and incorporated sampling from drive point piezometers and new groundwater wells following their installation. Preliminary review of the water quality results at Sw-N-05 indicated that dissolved copper, ammonia, nitrite and nitrate exceeded BCWQG-MAC during one or more sampling events. This investigation is ongoing and will be completed in late 2022.

7.9.3 Monitoring Sites Sw-N-14

This sampling location is off site along Heal Creek north of Willis Point Road, and within the Heals Rifle Range. Sw-N-14 is located on Heal Creek upstream of the confluence with Durrance Creek. In 2021/22, surface water samples from Sw-N-14 were not collected because it was inaccessible.

7.9.4 Monitoring Site Sw-N-19

Sw-N-19 is located within the landfill property below the northeast freshwater retention pond, and approximately 80 m east of the lower leachate lagoon. It is not a compliance monitoring station. It receives runoff primarily from the bedrock/refuse interface adjacent to Phase 1 and discharges to the wetland upstream of Sw-N-16. In 2021/22, water quality samples were collected in April and November 2021 and February 2022.

In 2021/22, all parameters were below BCWQG-MAC guidelines on all sampling dates, except for total suspended solids in November 2021. Like Sw-N-16, nitrate concentrations were elevated during the winter and were above BCWQG 30-day average. No statistically significant trends were detected in 2021/22, indicating water quality at this station remained stable over the last five years.

7.9.5 Monitoring Sites Sw-N-45 and Sw-N-17

Sw-N-45 is located north of Phase 2, and outside the landfill property boundary on the north side of Willis Point Road. During 2021/22, water quality at Sw-N-45 met BCWQG-MAC, except for nitrate and dissolved copper concentrations on separate sampling events. The copper exceedance was due to a relatively low pH (<6.5) reading that resulted in a relatively stringent guideline. Nitrate concentrations in Sw-N-45 exceeded the BCWQG 30-Day average in April 2021 and February 2022. Like previous years, conductivity, nitrate and sulphate concentrations were elevated, indicating surface water quality was impacted by aggregate stockpiling or nearby road works.

Sw-N-17 is located north of Willis Point Road and is downstream of Sw-N-45 and Sw-N-05. Water quality at Sw-N-17 met BCWQG-MAC guidelines on all sampling dates, but copper concentrations exceeded the BCWQG 30-Day average in April and October 2021, and a nitrate exceedance was observed in February 2022. Substantial increases in conductivity, sulphate, ammonia, chloride and nitrate concentrations were observed at Sw-N-17 in February 2022, which may be due to impacts from aggregate stockpiles and other sources of nutrients. Statistically significant increasing trends were observed for sulphate, nitrate and conductivity at Sw-N-45 and Sw-N-17, indicating water quality degradation that is interpreted to be primarily related to aggregate production, stockpiling and aggregate placement in 2021/22. Since Sw-N-17 is located downstream of Sw-N-05, the slight increase in ammonia and nitrate concentrations may also attributed to dilute impacts from aggregate stockpiles or leachate.

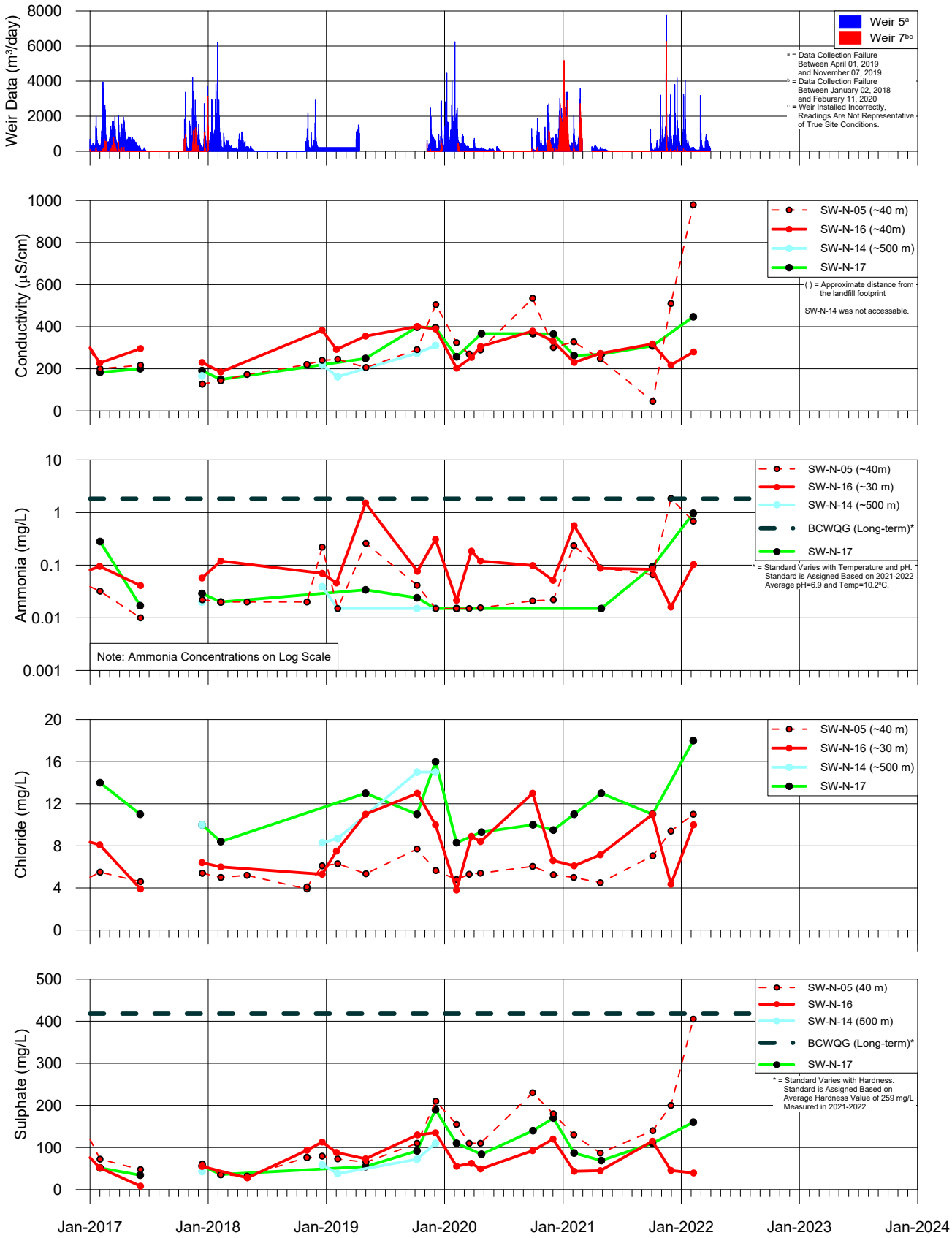


Figure 7-2. Surface Water Quality North of Phase 1

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7.10 Surface Water Quality North of Phase 2

7.10.1 Surface Water Quality in the Hartland North Pad Area

The Hartland North Pad is located northwest of the landfill as shown on Figure 7-1. Recent geologic mapping of the area (AECOM 2018) revealed an undulating bedrock surface with extensive deformation, fracturing and mineralization. This area continued to undergo significant changes with the construction of the RTF. Development in the vicinity of the RTF began in 2017 and the construction was completed in late 2020. The treatment process at the RTF turns residual solids from the McLoughlin Point Wastewater Treatment Plant into Class A biosolids.

The west side of the Hartland North Pad drains northward through an ephemeral channel that originates at the northwest corner of the Hartland North Pad. The water is carried through a culvert under Willis Point Road and into a drainage channel that eventually discharges into Durrance Lake approximately 450 m to the north. Flow through the channel only occurs during wet weather periods. During dry periods, several wetlands persist along the drainage course, but they are not connected by surface flows. In the downstream portions of the creek, flows increase due to groundwater discharge to the stream. Further downstream, a second creek of similar size joins the original creek. The “combined” creek has a well-defined channel in the area where it discharges to Durrance Lake.

7.10.1.1 Monitoring Sites Sw-N-41, Sw-N-42, and Sw-N-CSs2

Figure 7-4 presents conductivity, ammonia, chloride and sulphate concentrations at sampling locations located along the ephemeral channel at the northwest corner of the Hartland North Pad to the drainage channel discharging into Durrance Lake at stations Sw-N-41s1, Sw-N-41s3, Sw-N-42s1, and Sw-N-CSs2, which are off the landfill property. The sampling location Sw-N-CSs2 was periodically dry in 2021/22, so only two water samples were collected.

At surface water quality station Sw-N-41s1, located off the landfill property northwest of the Hartland North Pad, all parameters met the BCWQG-MAC, except for dissolved copper concentrations on both sampling dates and dissolved iron concentration in April 2021. The iron exceedance was likely due to turbid flow conditions. The Mann-Kendall analysis indicates a decreasing trend in nitrate and an increasing trend in chloride at station Sw-N-41s1.

Station Sw-N-41s3 is located downstream of Sw-N-41s1, where the drainage from the northwest portion of the Hartland North Pad flows into Durrance Lake. In 2021/22, all parameters met BCWQG-MAC. Like previous years, concentrations of leachate parameters remained low. Conductivity and sulphate concentrations at Sw-N-41s3 remained lower than those observed upstream at Sw-N-41s1, which may be the result of dilution from other tributaries. The Mann-Kendall analysis indicates a decreasing trend in nitrate concentration at station Sw-N-41s3, implying water quality has improved since the application of the temporary tarps over the aggregate stockpiles in 2012, and removal of the Hartland North aggregate stockpiles in 2017.

Station Sw-N-42s1 is located northeast of the Hartland North Pad along Willis Point Road. Concentrations of all parameters were below applicable BCWQG-MAC on all sampling dates in 2021/22. Like previous years, this site continued to report higher conductivity, ammonia and sulphate values than all other nearby stations except Sw-N-41s1. Chloride concentrations were higher than all other stations near the Hartland North Pad and exceeded 20 mg/L. Chloride concentrations were highest at Sw-N-42s1 during April and October 2021, decreased in November 2021 when precipitation was at an annual high, and increased again in February 2022. Ammonia concentrations increased substantially in February 2022. The Mann-Kendall analysis indicates an increasing trend in sulphate concentration and conductivity at Sw-N-42s1, indicating water quality at this location has been impacted by aggregate stockpiling or RTF construction activities over the past five years.

Water quality at background station Sw-N-CSs2 was relatively stable, and concentrations were below the applicable BCWQG-MAC. This sampling location was periodically dry in 2021/22 and was sampled on two out of three attempted sampling events. Ammonia concentrations at Sw-N-CSs2 increased substantially in February 2022, which is interpreted to be the result of natural processes and flushing of nutrients from upslope forest soils and localized organic deposits. No statistically significant trends have been observed at this sampling location over the past five years.

Overall, surface water quality at the Hartland North Pad and downstream area was generally consistent with historical results and exhibited continued minor impacts from aggregate stockpiling and placement.

7.10.2 Surface Water Quality in the Phase 2 Area

7.10.2.1 Monitoring Sites Sw-N-51 and Sw-N-50

Stations Sw-N-50 and Sw-N-51 are located near the northern boundary of the newly constructed Phase 2 Cell 3 and near the northwest diversion ditch near the Toutle Valley rock quarry and aggregate processing area. They are not Boundary Compliance stations.

Figure 7-3 presents conductivity, chloride, sulphate, and ammonia concentrations at stations Sw-N-50, Sw-N-05, Sw-N-54 and Sw-N-18. In 2021/22, water quality at Sw-N-50 met BCWQG-MAC, except exceedances in total and dissolved iron, dissolved aluminum, and total suspended solids were observed in February 2022. Concentrations of leachate parameters remained stable and low throughout 2021/22 indicating water was not impacted by leachate. However, ammonia concentrations marginally exceeded the BCWQG 30-Day average in April 2021. A cobalt exceedance occurred in November 2021, and dissolved copper concentration exceedances occurred on all sampling dates. A statistically significant trend was not observed for the past five years, indicating relatively stable water quality at this location.

Sw-N-51 is located immediately south of Sw-N-50. In 2021/22, a water sample could not be collected at station Sw-N-51 due to dry conditions.

7.10.2.2 Monitoring Sites Sw-N-54 and Sw-N-18

Sw-N-18 and Sw-N-54 are located adjacent to the Upper Leachate Lagoon. Station Sw-N-18 is located near the headwaters of Heal Creek and monitors the combined discharge from the Sw-N-50 and Sw-N-51 catchment areas. Sw-N-54 monitors discharge from the NW freshwater retention pond to Phase 2 Cell 1 NWSP. They are not Compliance Boundary stations. In December 2021, high turbidity and organic odours were observed at surface water station Sw-N-18. On January 18, 2022, the stormwater culvert upstream of SW-N-18 was plugged to prevent impacted runoff from reaching the NWSP and flowing to compliance location SW-N-05. Drainage from SW-N-18 was redirected to the Upper Leachate Lagoon.

All parameters measured at Sw-N-54 met BCWQG-MAC, except for dissolved copper in February 2022. The dissolved copper exceedance was due to a low pH reading that adjusted criteria. Compared to previous years, ammonia concentrations were elevated at Sw-N-54, and concentrations of sulphate and conductivity increased. Water quality at Sw-N-18 was consistent with previous years, but aluminum, total and dissolved iron, and dissolved copper concentrations exceeded BCWQG-MAC in November 2021. Additionally, nitrate concentration exceeded the BCWQG 30-Day average in October 2021, an ammonia concentration exceedance occurred in November 2021, and dissolved copper concentrations were elevated on all sampling dates. The elevated nitrate and sulphate concentrations at Sw-N-18 suggest water quality was impacted by quarrying or aggregate stockpiling, whereas elevated ammonia and dissolved copper concentrations indicate impacts from other sources. The concurrent elevated ammonia concentrations at Sw-N-05 and Sw-N-18 indicated that the water quality at Sw-N-05 was impacted by Sw-N-18 before the stormwater culvert was plugged. However, it is suspected that the impacted water at Sw-N-18 continues to discharge to the NWSP via surface water conveyance infrastructure (i.e., compromised pipeline) or other preferential pathways and flow below ground toward Sw-N-05. The ongoing investigation will be completed in late 2022. Statistical analysis indicated increasing trends in conductivity, nitrate and chloride concentrations at station Sw-N-18. Water quality at location Sw-N-54 should continue to be monitored for impacts from the aggregate stockpiling and blasting activities. CRD has initiated an investigation to determine the source of these impacts and restore water quality in the Toutle Valley and protect water quality downstream.

Historically, conductivity, sulphate, and nitrate concentrations have fluctuated at locations Sw-N-18, Sw-N-50 and Sw-N-05 due to varying stream discharge, dilute leachate, and ongoing quarrying activities. Mitigation measures have been implemented to manage water quality in the Toutle Valley. Temporary tarps were installed on a large portion of the Phase 2 landfill, and aggregate storage in the Toutle Valley was carefully managed. In 2021, aggregate was removed from Toutle Valley and placed in the cleared area south of the Hartland North Pad. A blasting program was initiated for Cell 4 preparation in October 2021. Given the sensitivity of surface water quality to blasting, quarrying and runoff from aggregate stockpiles at these locations, water quality at these locations should continue to be monitored closely. Careful surface water management planning is required for this area as the landfill develops to minimize impacts on groundwater and surface water that is not captured by the leachate collection system. Additional sediment control measures and efforts to reduce the quantity of blasting products may help reduce impairment to water quality as quarry development becomes increasingly close to the northern boundary of the landfill and these water quality monitoring stations.

7.10.2.3 Monitoring Site Sw-N-53

Sw-N-53 is discharges into the NWSP and conveys surface water from a shotcrete-lined ditch south of the Hartland North Pad. Historically, only few surface water samples have been collected from Sw-N-53, due to dry conditions. In 2021/22, only one

sample was collected during the November 2021 sampling event, and surface water quality exhibited highly elevated conductivity, nitrate and sulphate concentrations in comparison to previous monitoring years.

In November 2021, TSS, nitrate and total iron concentrations observed at Sw-N-53 exceeded the BCWQG-MAC. Additionally, selenium, sulphate, aluminum and dissolved copper concentrations exceeded the BCWQG 30-Day average. Water quality impacts observed at Sw-N-53 are consistent with runoff from aggregate stockpiles. It is also possible that elevated concentrations of parameters associated with aggregate runoff may reflect deposition of dust from nearby blasting, aggregate stockpiles and roads accumulating in the ditches connected to Sw-N-53.

7.11 Surface Water Quality South of the Landfill

An ephemeral stream drains the area to the south of the landfill and flows southward towards Killarney Lake, which subsequently drains to Prospect Lake. Surface water flow south of the landfill occurs mainly during periods of wet weather and groundwater seepage has been observed in the Killarney Creek channel during dry periods. Clean surface water runoff from the south slope of Phase 1 runs westward in a ditch to a culvert that discharges into a small wetland at Sw-S-03 and then into the ephemeral stream that flows south to Killarney Lake.

There are several surface water sampling stations located south of the landfill, listed from upstream to downstream, as follows:

- Sw-S-52 diversion ditch rerouted from north of the landfill, upstream of wheel wash facility
- Sw-S-20 flow monitoring weir along diversion ditch at south end of Phase 1
- Sw-S-12 flow monitoring weir upstream of the public weigh scale
- Sw-S-03 culvert emerging from southeast corner of recycling area immediately upstream of a small natural wetland
- Sw-S-27 Killarney Creek, north tributary
- Sw-S-24 Killarney Creek, downstream of confluence of north and west tributaries
- Sw-S-21 drainage ditch along road south of diversion ditch at south end of Phase 1
- Sw-S-04 Killarney Creek, on property boundary, 270 m south of the landfill

7.11.1 Upgradient Surface Water Quality

7.11.1.1 Monitoring Site Sw-S-52

Sw-S-52 is a background monitoring station. During 2021/22, surface water samples were collected on all sampling dates. Concentrations of all parameters were below the BCWQG-MAC. Like previous years, sulphate concentrations at Sw-S-52 were relatively stable and remained below 10 mg/L throughout the monitoring year. Ammonia concentrations increased substantially from previous years but remained below BCWQG-MAC. Similar to other stations draining natural areas, this may be related to the relatively dry summer followed by intense fall precipitation that flushed nutrients into nearby watercourses. No statistically significant trends have been observed at this sampling location over the past five years.

7.11.1.2 Monitoring Site Sw-S-20

At station Sw-S-20, samples were collected on only one (December 2021) out of three attempted sampling dates. Concentrations of all parameters remained below the BCWQG-MAC guidelines. Zinc and copper concentrations exceeded the BCWQG 30-day average. Slightly elevated metal concentrations during the wet season may be partially due to elevated TSS. No statistically significant trends have been observed at this sampling location over the past five years.

7.11.2 Surface Water Quality Near and South of the Recycling Area

Figure 7-5 presents water quality data for surface water sampling stations located south of the landfill, including Sw-S-03, Sw-S-04, and Sw-S-12. The distance of each station from the landfill boundary is shown in brackets in the legend. CRD's recycling area went into operation in January 2001 and is located near Sw-S-12.

7.11.2.1 Monitoring Site Sw-S-12

In 2021/22, surface water samples were collected at station Sw-S-12 during all sampling events. BCWQG-MAC exceedances were reported for dissolved iron (two sampling events), dissolved copper (two sampling events), and total iron (three sampling events). All three parameters exceeded BCWQG-MAC on February 2022, which may be related to turbid flow conditions associated with high TSS concentrations. Like previous years, ammonia concentrations generally remained low during the

summer and fall but increased above 2 mg/L in December 2021. Chloride concentrations show a similar trend, generally remained low but increased during wet seasons. Conductivity, nitrate and sulphate concentrations were slightly elevated in October 2021 but returned to baseline values in December 2021. Overall, the increase in conductivity, nitrate and sulphate concentrations during the drier months and early fall (i.e., April and October) may be due to runoff from paved areas surrounding the bin facility or dilute leachate. The elevated ammonia during the wet season may be derived from denitrification driven by decomposing organic matter. The temporal changes in ammonia concentrations following intense precipitation events were also consistent with that observed at background station Sw-S-52. Dissolved organic carbon concentrations at this location ranged from 7.3 to 14 mg/L, which is 2-3 times higher than that at other stations.

Due to low concentrations of leachate parameters, it is unlikely that surface water at station Sw-S-12 was impacted by leachate. Moreover, the Mann-Kendall analysis indicates no significant increase in any leachate parameters over the past five years. Surface water at this location should be monitored closely because ammonia is often the first parameter detected at the leading edge of an advancing leachate plume. High flows and a slightly orange/yellow color were previously reported. The source of the elevated concentrations of ammonia and nutrients should be investigated.

7.11.2.2 Monitoring Site Sw-S-03

Sw-S-03 is located on the landfill property in the main channel of Killarney Creek where the culvert discharges into a small wetland area. Sw-S-03 is not a compliance location. Historically, water quality at Sw-S-03 was affected by contaminated runoff from the south face of the landfill and the former truck wash area until the truck wash facility was relocated in the fall of 1997. Due to the proximity to the public drop-off and storage area, water quality in Sw-S-03 may be affected by runoff from the bin facility, heavy traffic, and industrial actives.

Conductivity, sulphate and nitrate concentrations were elevated during sampling dates in October 2021 and returned to normal ranges in the wet season. Ammonia concentrations exhibited decreasing pattern throughout 2021 but reached a peak value of 1.5 mg/L in February 2022. In 2021/22, dissolved iron, suspended solids, and dissolved copper, lead and zinc concentrations exceeded BCWQG-MAC on at least one sampling date. Nitrate concentrations exceeded the BCWQG 30-day average guideline in October 2021, and dissolved copper concentration exceedances occurred on all sampling dates. The elevated conductivity, sulphate and nitrate concentrations were likely due to upstream runoff from the area surrounding Sw-S-12, as discussed above. Mann-Kendall analysis indicates a statistically significant increasing trend in chloride concentrations over the past five years. Water quality should continue to be closely monitored for quarry and leachate impacts in the area downgradient of the bin facility and the south purge wells.

7.11.2.3 Monitoring Site Sw-S-04

Water quality at the property Boundary Compliance location (Sw-S-04) met the BCWQG-MAC values for all analytes in all samples collected during 2021/22. Copper concentrations were above the BCWQG 30-day average on all sampling dates, and a zinc exceedance was observed in December 2021.

Like upstream stations, conductivity, nitrate and sulphate concentrations were slightly elevated in October 2021. Ammonia concentrations were elevated in October 2021, and chloride was elevated in April and October 2021. The Mann-Kendall analysis indicates an increasing trend in ammonia concentration at Sw-S-04, which may reflect dilute impacts from landfill operations or dilute leachate.

7.11.2.4 Monitoring Sites Sw-S-24 and Sw-S-27

Stations Sw-S-24 and Sw-S-27 are located on the landfill property downgradient of Phase 1 of the landfill, the landfill administration area and mountain bike trails. These stations are not Compliance Boundary locations.

Water quality at Sw-S-24 met the BCWQG-MAC guidelines in 2021/22, except for dissolved copper concentrations in February 2022. Water quality at Sw-S-24 was consistent with data collected in previous years. Conductivity and sulphate concentrations were slightly elevated in October 2021, but other leachate indicator parameters were present in low concentrations. Dissolved copper concentrations exceeded the BCWQG 30-day average on all sampling dates, and a total dissolved solids exceedance was observed in October 2021.

At station Sw-S-27, water samples were collected on two out of four attempted sampling dates. Water quality remained below the BCWQG-MAC values on all sampling events. Dissolved copper concentrations exceeded the BCWQG 30-day average on all sampling events, and a total dissolved solids exceedance was observed in October 2021. Ammonia concentrations were slightly elevated in December 2021, but other leachate parameters were present in low concentrations.

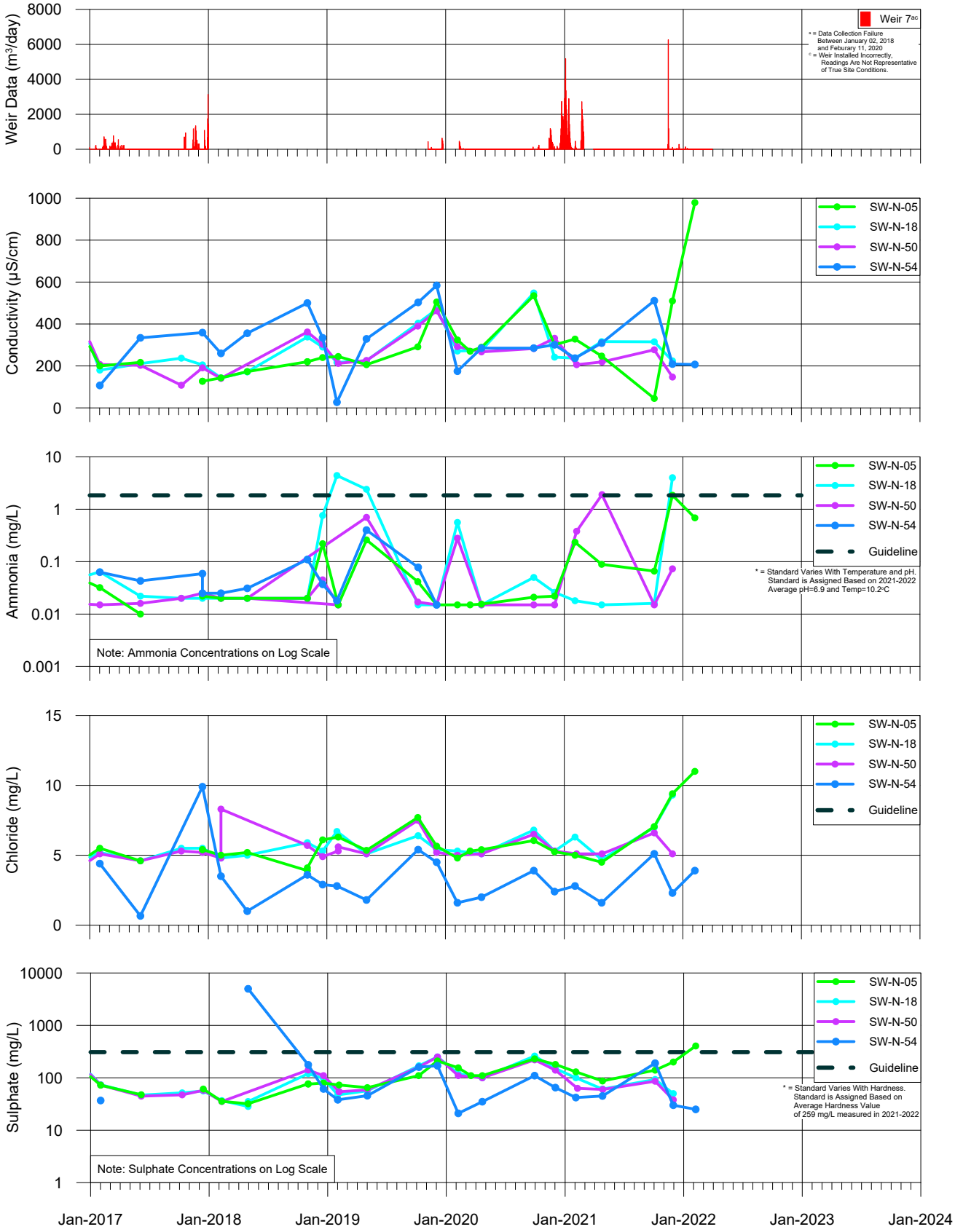


Figure 7-3. Surface Water Quality North of Phase 2

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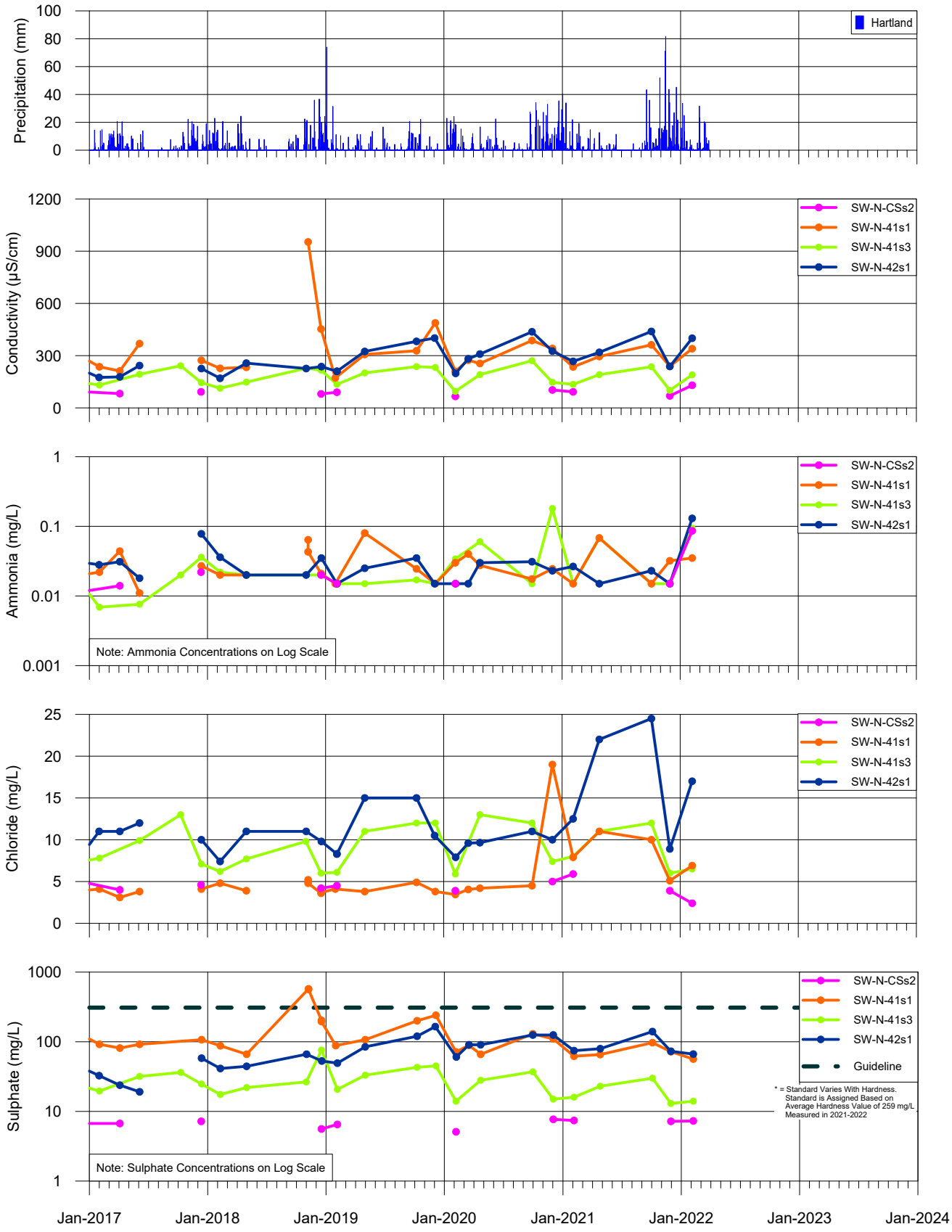


Figure 7-4. Surface Water Quality Downstream of the Hartland North Pad

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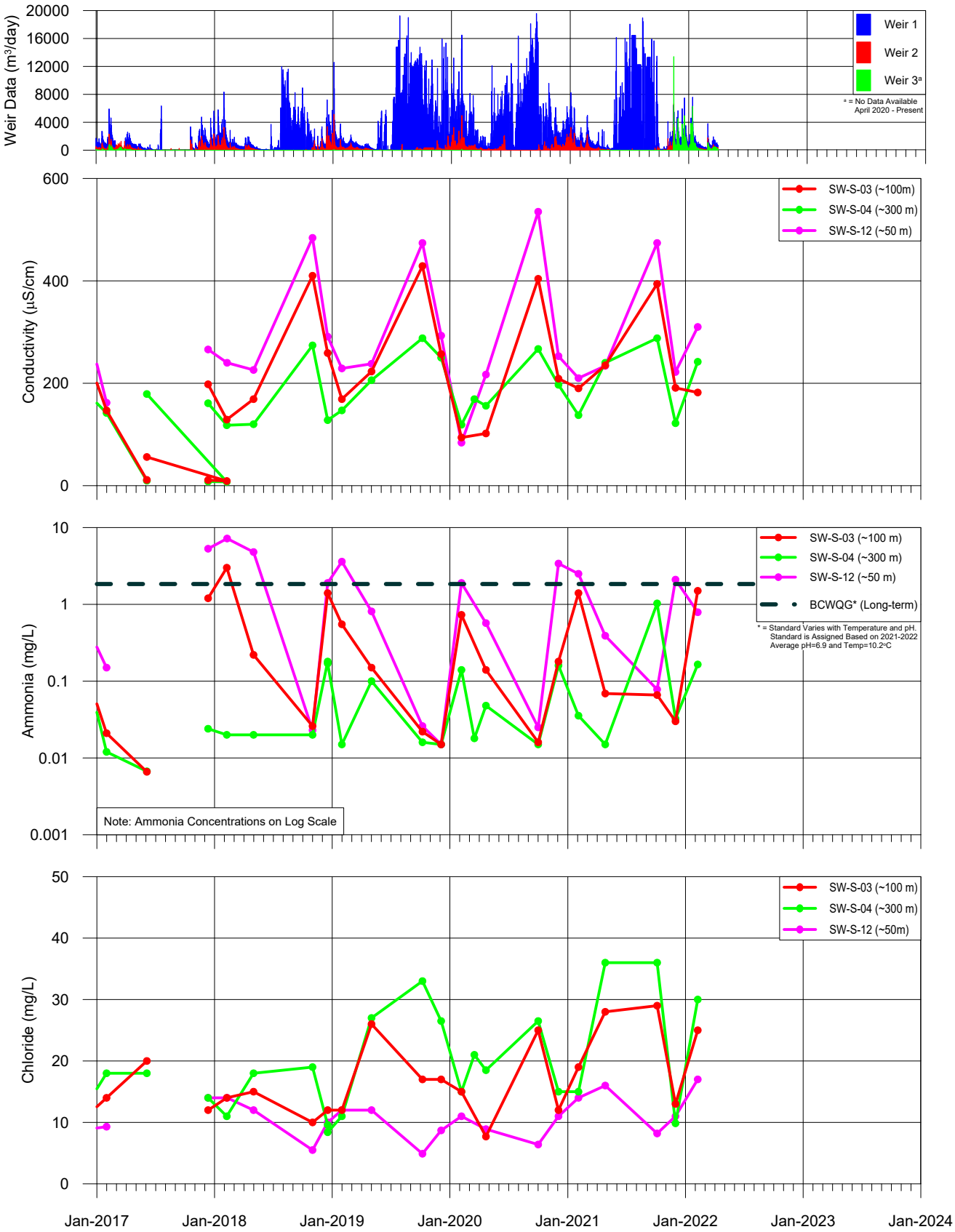


Figure 7-5. Surface Water Quality South of Landfill

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7.12 Summary

The surface water quality data collected in 2021/22 revealed that nearby surface water bodies, Tod Creek, Durrance Lake, Durrance Creek, and Killarney Lake were not impacted by leachate or other landfill activities. Surface water quality monitoring stations at the landfill show signs of water quality degradation, especially in the area northwest of Phase 2. Surface water quality in the Phase 2 area exhibited impacts related to runoff from the aggregate stockpiles located in the Phase 2 quarry and on the bedrock ridge north of the Phase 2 landfill and other sources of ammonia during wet weather.

- Surface water at Boundary Compliance location SW-N-05 has exhibited increased nutrient and metal concentrations since November 2021, resulting in non-compliance conditions. Nitrate, nitrite, and dissolved copper concentrations at Sw-N-05 exceeded BCWQG-MAC during the November 2021 and February 2022 sampling events. The cause for these exceedances is currently being investigated with a view to implementing remedial measures to restore water quality.
- Surface water quality at Boundary Compliance station Sw-N-16 met BCWQG-MAC in 2021/22, except for dissolved and total iron during one or more sampling events. Surface water quality at Sw-N-16 continued to improve from previous monitoring years. Similar to previous years, surface water was not impacted by leachate, but exhibited minor influence from nearby construction activities involving blasting, aggregate placement, or excavation of organic soils. Iron exceedances are likely due to the disturbance of sediment during the sampling, as indicated by high TSS concentrations.
- Surface water at Sw-N-18 exhibited an ammonia exceedance in November 2021, and CRD observed impacted runoff in the leachate ditch near Sw-N-18. On January 18, 2022, the stormwater culvert connecting the leachate ditch and SW-N-18 was plugged to prevent leachate-impacted water from reaching the NWSP and flowing to compliance location SW-N-05. Additional site investigation and remedial design efforts are underway to protect water quality at Sw-N-05.
- Water quality at Sw-N-53 was impacted by runoff from the aggregate stockpile, evident by exceptionally high nitrate, sulphate and conductivity during periods when the ditch was flowing.
- In the Hartland North Pad area, surface water quality at Boundary Compliance stations (Sw-N-41s1 and Sw-N-42s1) met BCWQG-MAC in 2021/22, except for dissolved copper, total iron and TSS. Leachate indicator parameters remained low in 2020/21, indicating surface water was not impacted by landfill leachate or construction activities. Water quality at Sw-N-42s1 station indicates slight impacts of aggregate stockpiling. Occasionally elevated ammonia concentrations are likely the result of natural drainage from the contributing catchment.
- Water quality at the Boundary Compliance location (Sw-S-04) met the BCWQG-MAC values for all analytes in all samples collected during 2021/22. Surface water quality along the south boundary is not impacted by leachate.
- Water quality at station Sw-S-52 (not a compliance location) is representative of background water quality. In 2021/22, concentrations of all parameters were below the BCWQG-MAC. Concentrations of leachate indicator parameters were consistent with previously reported values.
- Surface water quality south of the recycling area exhibited several BCWQG-MAC exceedances, including TSS, dissolved copper, iron, lead, and zinc during one or more sampling date. Elevated copper concentrations at these stations may be related to aggregate dust or surface water runoff from the truck wash and paved areas surrounding the bin facilities. Slightly elevated conductivity, sulphate and nitrate concentrations observed at Sw-S-12 and Sw-S-03 during drier months and early fall may be due to runoff from paved areas surrounding the bin facility or dilute leachate. The elevated ammonia during the wet season may be derived from nitrate reduction via decomposing organic matter.

8 Leachate

8.1 Compliance Monitoring Locations

Discharge from the leachate pipeline is subject to the CRD Regional Source Control Program (RSCP) Waste Discharge Permit (Waste Discharge Permit Number SC97.001). The compliance monitoring location for leachate at Hartland Landfill is the Hartland Valve Chamber (flow detection chamber) at the start of the leachate pipeline. Leachate compliance data is reported to the CRD RSCP on a quarterly basis.

8.2 Data

Our interpretation of the leachate chemistry data was based on samples collected at the following locations by CRD staff:

- Hartland Valve Chamber (leachate pipeline flow detection chamber and compliance point)
- Phase 1 North purge well system (combined discharge from 52-4-0-P7, 80-1-0-P8 and 81-1-0-P9)
- Phase 1 South purge well system (combined discharge from P1, P2, P3, P4 and P10)
- Controlled Waste drainage
- West Face drainage
- Cell 3 Pipe Outlet drainage

These locations were sampled and analyzed for conventional parameters, organic compounds and metals on a monthly basis in 2021/22. Additionally, Hartland Valve Chamber samples were analyzed quarterly for trace organic compounds including polycyclic aromatic hydrocarbons (PAHs), phthalate esters, ketones, aromatics, phenols, ethers, nitrosamines, alkanes, alkenes and other select organic compounds.

In 2021/22, eleven (11) leachate samples were collected at Cell 3 Pipe Outlet, and fifteen (15) leachate samples were collected from the Hartland Valve Chamber. A total of five (5) leachate samples were taken at the Markham Valve Chamber. Twelve (12) leachate samples were collected from the Controlled Waste Ditch, and twelve (12) leachate samples were collected from the South Purge Wells. Twelve (12) leachate samples were collected from the West Face drainage, where intermittent drainage patterns are attributed to precipitation, refuse settlement, and the increasing depth of waste cover over the toe drain. No leachate samples were collected at the Phase 2 cleanout in 2021/22, due to failure of the pump used for sampling.

8.3 Leachate Generation and Discharge

Leachate collected from the Phase 1 and Phase 2 landfill is discharged to the lower leachate lagoon. During wet winter months, leachate is pumped into the lined upper leachate lagoon to minimize head build-up in the unlined lower lagoon. Leachate from the lagoons is discharged from the site through an 8.6 km long pipeline that discharges to the Saanich sanitary sewer and ultimately to the Macaulay Point deep water outfall. The CRL was activated on December 30, 2020 and the formal switch from the leachate pipeline to the CRL occurred in March 2021, with flow rates ranging between 60 and 80 L/s.

Total monthly leachate flows discharged to sewer are provided in Appendix D. Average daily leachate flow in 2021/22 was 17.85 L/s, which is considerably higher than in 2020/21 (12.91 L/s). The highest monthly leachate flow recorded in 2021/22 was 115,487 m^3 (average monthly flow rate of 43.9 L/s) in November 2021, which was due to anomalous and prolonged intense precipitation events. Changes in leachate discharge rates throughout the year may be related to the increased capacity of the Centrate Return Line (CRL) from the RTF, variability in precipitation, biofouling within the line, or operational improvements aimed at minimizing leachate generation.

8.4 Leachate Quality

Sampling and testing of leachate quality have been carried out since the early 1970s. Since 2000, leachate samples have primarily been collected from the Hartland Valve Chamber, which represents the point of discharge for compliance with the RSCP Waste Discharge Permit.

The analytical results of the routine monthly leachate discharge samples are provided in Appendix B.4. Analysis of trace organics in the leachate discharge was conducted quarterly and is provided in Appendix B.5. The analytical results for samples collected from the leachate collection and conveyance network are presented in Appendices B.6., B.7., B.8., B.9., B.10, and B.11. Analysis of emerging contaminants at the Hartland Valve Chamber was conducted quarterly and is provided in Appendix B.12. In addition to the Sewer Use Bylaw Criteria, leachate quality results for trace organic compounds were screened against CSR standards for the protection of drinking water and aquatic life to support operational decisions regarding leachate containment.

8.4.1 Routine Monthly Leachate Analyses and Sewer Use Bylaw Comparison

The Hartland Valve Chamber is the compliance point for the Waste Discharge Permit. During 2021/22, all leachate quality samples. met RSCP Waste Discharge Permit criteria. It has been confirmed that the noted COD exceedances in February 2022 were due to use of compromised/expired preservatives supplied by the laboratory. Since COD concentrations measured in 2021/22 are unreliable and were not representative of leachate quality, COD values are not discussed below.

Although the Waste Discharge Permit criteria only apply to the combined discharge at the Hartland Valve Chamber, comparison of other leachate monitoring station results to these criteria allows for evaluation of individual leachate contributions to the combined leachate discharge. Concentrations above RSCP criteria at locations other than the Hartland Valve Chamber are not considered to be non-compliant, and the criteria are used for reference purposes only.

Figure 8-1 and Figure 8-2 present time series plots for selected parameters in leachate at the compliance point (Hartland Valve Chamber) and in Phases 1 and 2 for the past five years. Evaluation of this data allows for comparison of leachate from each landfill area. At all sampling locations, concentrations of inorganic parameters such as conductivity and chloride show a seasonal dilution effect whereby greater precipitation in the fall and winter months results in lower concentrations during the wet winter months. Higher concentrations occur during drier periods from May to October. Leachate discharge from the Phase 2 basin is significantly stronger than leachate generated in Phase 1, which was closed in 1996. The mixing of leachate from Phases 1 and 2 in the Hartland Valve Chamber results in a leachate that exhibits chemistry which is intermediate between the two primary sources.

Similar to previous years, leachate concentrations at the Hartland Valve Chamber were well above background concentrations observed in surface water and groundwater, with conductivity concentrations ranging from 2,378 µS/cm to 4,633 µS/cm, ammonia concentrations ranging from 220 mg/L to 310 mg/L, and chloride concentrations ranging from 270 mg/L to 520 mg/L. Overall, annual average leachate concentrations in 2021/22 were slightly less concentrated, with average conductivity values at the Hartland Valve Chamber slightly lower than those measured in 2020/21.

As shown in Figure 8-2, BOD concentrations at the Hartland Valve Chamber exhibited a pattern that was consistent with conductivity, ammonia and chloride values. BOD concentrations at Hartland remain relatively low for a large landfill, and were typically below 100 mg/L. In August 2018, BOD concentration reached to peak value of 160 mg/L, which was consistent with the elevated sulphide concentration (0.912 mg/L). The changes in quantity of biological organisms may be related to the elevated temperatures observed during summer months, or changes in leachate storage and management prior to sample collection. Since August 2018, BOD concentrations have fallen below 100 mg/L.

Total sulphide, dissolved sulphide and PAH concentrations at Hartland Valve Chamber did not exceed the Waste Discharge Permit criteria during any of the 2021/22 sampling events. Total and dissolved sulphide concentrations exceeded the Waste Discharge Permit criteria in January 2019 and remained well below standard of 1 mg/L since then. Infiltration through aggregate placed in the Phase 2 landfill during the winter months is known to be an important source of sulphate to the Phase 2 Cleanout. Sulphate can be reduced to sulphide by bacteria under reducing conditions in the absence of other reducing agents such as oxygen and nitrate.

Average conductivity concentrations were lower in 2021/22 than in 2020/21. Waste Discharge Permit criteria were not exceeded during any of the sampling events in 2021/22, and the long-term conductivity and chloride concentrations at the Hartland Valve Chamber revealed a decreasing trend in conductivity and ammonia and an increasing trend in nitrate and sulphate over the past five years. This indicates that leachate quality is relatively stable and slightly improving at this location. Concentrations of many parameters were several orders of magnitude below Waste Discharge Permit criteria.

8.4.1.1 Phase 2 Cleanout

In 2021/22, leachate samples were not collected from Phase 2 cleanout due to failure of the pump utilized for collection of leachate samples, and data were not available for evaluation

8.4.1.2 North Purge Wells

In 2021/22, data collected from the Phase 1 north purge wells (52-4-0-P7, 80-1-0-P8 and 81-1-0-P9) indicates that all parameters met the Waste Discharge Permit criteria. Total sulphide concentrations in the Phase 1 leachate remained low (≤ 0.39 mg/L) but were slightly higher than previous years.

8.4.1.3 South Purge Wells

Concentrations in combined effluent collected from the Phase 1 south purge wells (P1, P2, P3, P4 and P10) is presented in Appendix B.9. Leachate sampling at the south purge Wells commenced in November 2020 and is part of the monthly leachate sampling program. During the 2021/22 monitoring year, leachate samples from the south purge wells met Waste Discharge Permit criteria on all sampling dates except for total phenols and TSS collected on June 14, 2021. In 2021/22, total sulphide concentrations in the south purge wells ranged from 0.0018 to 0.025 mg/L and were well below Waste Discharge Permit criteria. BOD ranged from 3.0 to 180 mg/L, with a median of 5.3 mg/L.

Leachate quality in the south purge wells is characterized by moderately elevated conductivity (1,097 to 1,399 µS/cm), ammonia (3.8 to 60 mg/L), chloride (79-120 mg/L) and low sulphate (<10 mg/L). In 2021/22, all metal concentrations in the south purge wells met Waste Discharge Permit criteria.

8.4.1.4 Controlled Waste Drainage

Leachate collected by the Controlled Waste Drainage is not as concentrated as leachate collected from Phase 2 and the West Face Toe Drain. In 2021/22, all leachate parameters and metal concentrations in the Controlled Waste Drainage leachate met the Waste Discharge Permit criteria.

8.4.1.5 West Face Drainage

In 2021/22, leachate discharged from the West Face Closure Toe Drain throughout the year and was sampled monthly. Like previous years, the West Face Closure Toe Drain generally had the most concentrated leachate, with the highest BOD, ammonia, conductivity, and chloride concentrations.

In 2021/22, the average concentrations of conductivity, chloride and BOD were lower than those measured in 2020/21, and sulphide concentrations remained low and met Waste Discharge Permit criteria on all sampling dates. Total phenols exceeded the Waste Discharge Permit criteria on two sampling dates, and TSS exceeded the Waste Discharge Permit criteria on one sampling date.

Leachate from the West Face Closure Toe Drain is strongly reduced with high organic content. A weir and flow monitor have been installed at the West Face Closure Toe Drain to evaluate flow trends over time. Recent observations indicate that leachate flow from the West Face Closure Toe Drain has increased over time. Since leachate from the West Face Closure Toe Drain is contributing a relatively small volume of leachate to the leachate collection system, it does not appear to materially affect the quality of leachate at the Hartland Valve Chamber.

8.4.1.6 Cell 3 Pipe Outlet

Cell 3 includes new leachate containment (i.e., the Toutle Drain) and gravity flow conveyance infrastructure, which discharges directly into the upper leachate lagoon. Starting in 2016, the Cell 3 Pipe Outlet began discharging leachate, and leachate from this location is considered representative of newly deposited refuse. In 2021/22, samples were collected on 11 of 12 attempted sampling dates. Sampling from this station is challenging due to the intermittent flows observed at this location. In 2021/22, all parameters met Waste Discharge Permit criteria, except for one chloride concentration observed in July 2021.

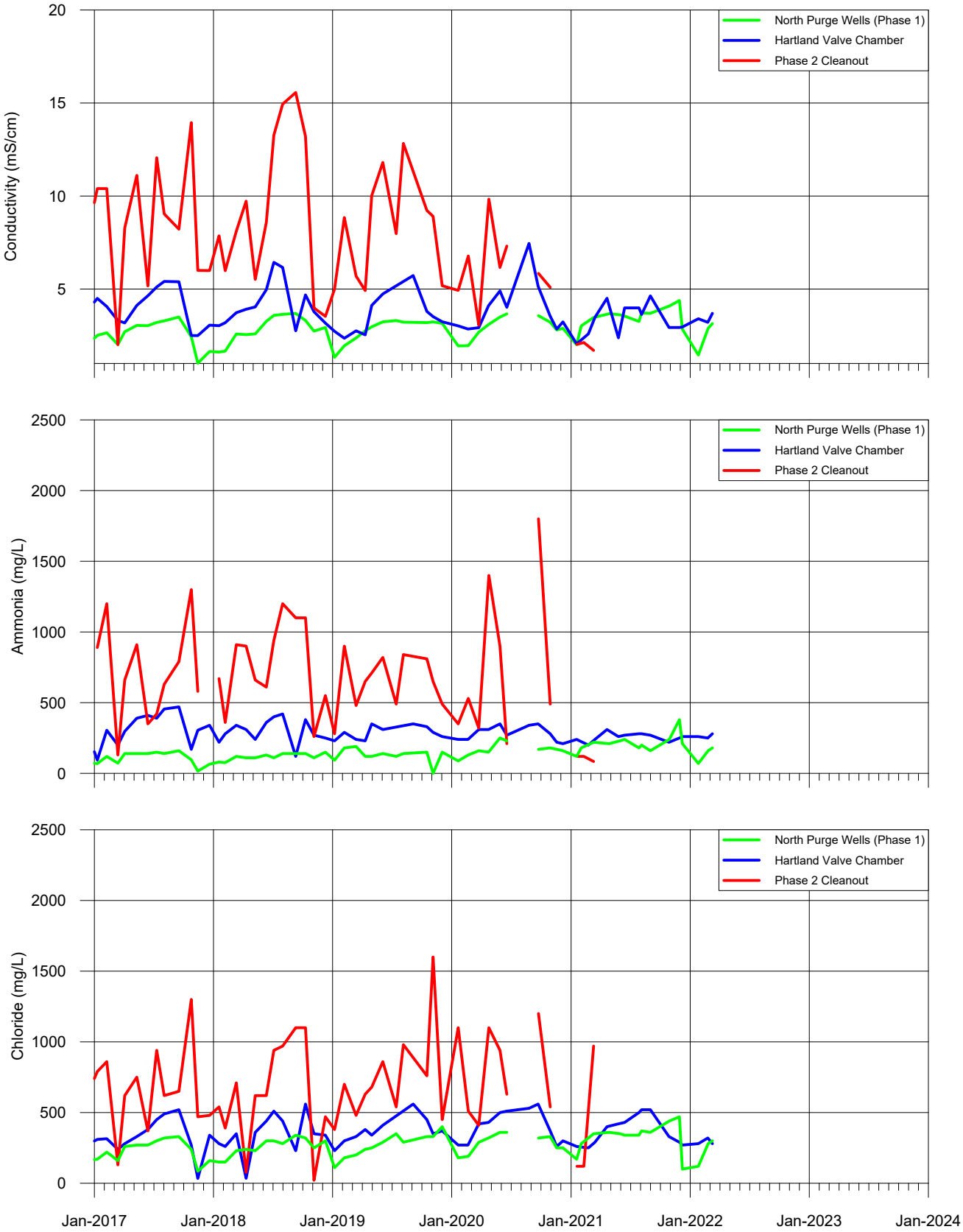


Figure 8-1. Hartland Valve Chamber Leachate Chemistry (Conductivity, Ammonia and Chloride)

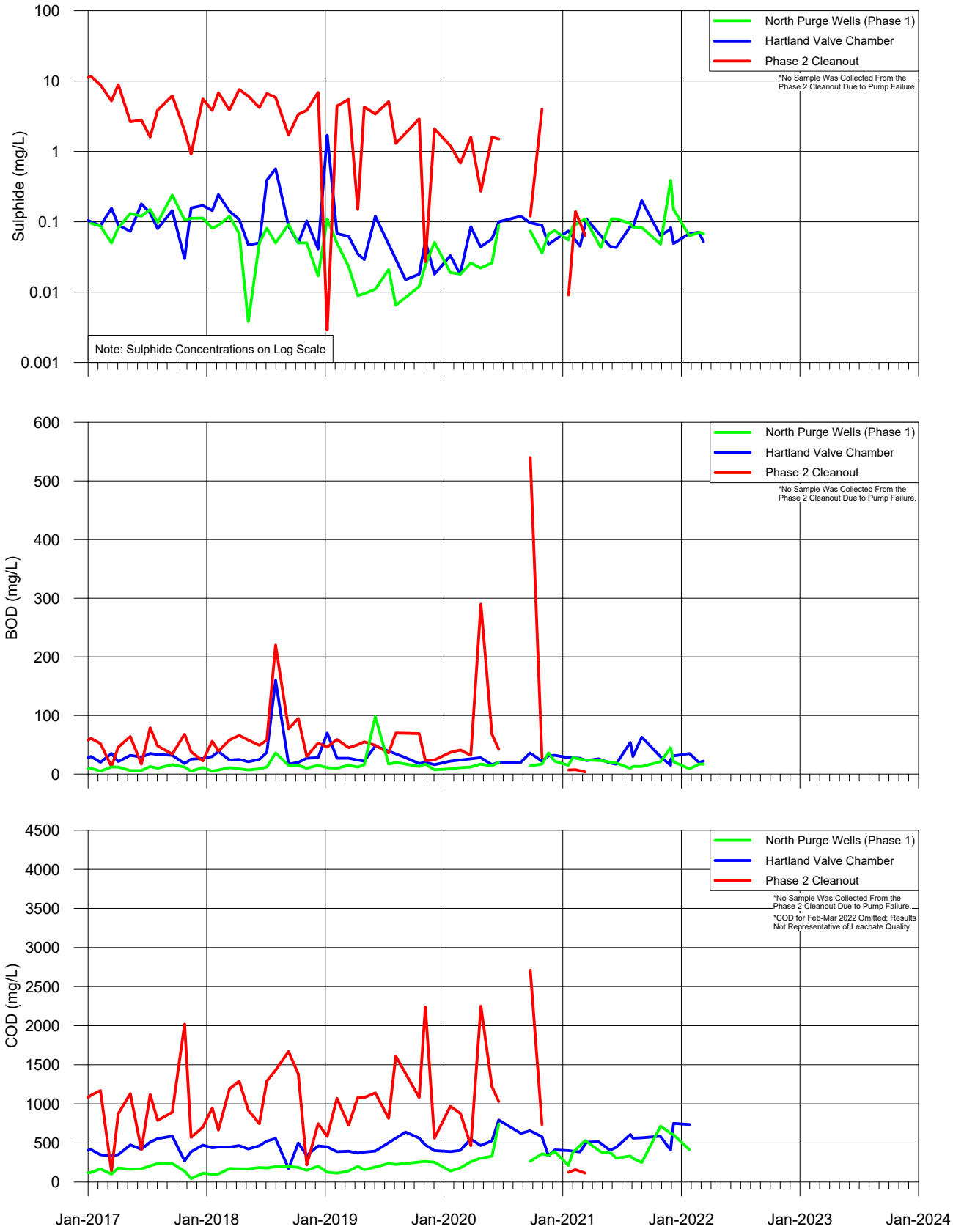


Figure 8-2. Hartland Valve Chamber Leachate Chemistry (Sulphide, BOD and COD)

AECOM

8.4.2 Quarterly Trace Organic Analysis at Hartland Valve Chamber

Trace volatile and semi-volatile organic analysis has been carried out quarterly since 1998 on leachate samples collected from the Hartland Valve Chamber. Trace organic compound analytical results for combined leachate in 2021/22 are presented in Appendix B.5.

A total of four (4) volatile and semi-volatile organic compounds were reported at detectable concentrations across all sampling dates. The detected compounds were found at concentrations that are low compared to those commonly found in leachate at municipal solid waste landfills of similar size. Of the trace organic compounds analyzed, none exceeded Waste Discharge Permit criteria. Like previous years, concentrations of volatile organic compounds in Phase 2 leachate (i.e., the West Face Drainage and Phase 2 cleanout) are exceedingly low and typically at concentrations on the order of 1% to 20% of Waste Discharge Permit criteria. Regular sampling and analysis for VOC concentrations in leachate sources should continue, but it is not warranted in groundwater at compliance monitoring locations at this time.

In 2021/22, all trace organic parameters were present at concentrations below 0.1 µg/L. Elevated concentrations (up to 100 µg/L) of methyl ethyl ketone and dimethyl ketone were reported in 2014/15, but concentrations were below detection limits in 2021/22. Phthalate esters were detected during the October 2016, April 2017, and October 2018 sampling events, but they were not detected in 2020/21. Dimethyl phthalate concentrations were slightly above the detection limit in 2017/18 but have been below detection limits since 2018/19.

In 2021/22, all phenolic compounds were present at or below detection limits. During 2017/18, two phenolic compounds (2,4-dimethylphenol, and 2,4 + 2,5 dichlorophenol) reported concentrations above detection limits. Phenol concentrations in leachate are lower than or similar to those found at other large landfills. Phenols are used in several manufacturing processes and occur naturally at low concentrations due to their presence in wood and other natural organic matter.

In 2021/22, all low-weight PAHs were detected in Hartland Landfill leachate, except for 2-chloronaphthalene and 2-methylnaphthalene (Appendix B.4). Total concentrations of low weight PAHs ranged from 0.30 to 14.1 µg/L, which was consistent with historical concentrations. Acenaphthene exhibited a maximum concentration of 5.3 µg/L in January 2021, slightly above the maximum value (5.2 µg/L) observed in 2020/21.

In 2021/22, high-weight PAHs, including benzo(a)anthracene, fluoranthene and pyrene continued to be detected in leachate with maximum concentrations of 0.091 µg/L, 0.87 µg/L, and 0.54 µg/L, respectively. Chrysene and benzo(a)pyrene have been marginally above detection limits since 2016. Overall, high-weight PAH concentrations were considerably lower than in 2020/21, ranging from 0.39 to 1.68 µg/L.

All volatile organic compounds were detected in 2021/22, except for methyl tertiary butyl ether, M & P xylenes, o-xylene and styrene. The highest concentrations were generally observed in January 2021 and coincided with low ORP values.

The CRD Environmental Protection division conducted high-resolution analyses of leachate quality between 2004 and 2007. The high-resolution analytes included polychlorinated biphenyls (PCBs), polybrominated diphenyl ethers (PBDEs), nonylphenols, and chlorobenzenes. Data collected revealed that nonylphenols and PBDEs are not present at levels of environmental concern, even in full strength leachate (Golder 2008). The aquatic risks of PCBs observed in leachate samples were also found to be negligible. In addition, concentrations of nonylphenols, PCBs, DDT and select PDBEs varied in comparison to CRD wastewater. At the time of the study, Hartland leachate contributed only 2% of the total wastewater discharge from the Macaulay Point outfall. The evaluation concluded that despite differences in the chemical profile of leachate and Macaulay Point wastewater, leachate had no observable impact on the chemical profile at Macaulay Point. Based on these findings, the high-resolution analyses were discontinued, although co-ordination between the CRD's Marine Monitoring and Environmental programs is on-going.

8.5 Summary

The leachate flow and quality data collected in 2020/21 indicates the following:

- The average daily leachate flow rate was 17.85 L/s, with a maximum monthly flow of 115,487 m^3 (43.9 L/s) in November 2021. The maximum leachate flow in November 2021 was considerably higher than the extreme flows (39.6 L/s) observed during 2006/07, due to the increased capacity of the CRL. The2021/22 daily average leachate flow was considerably higher than the long-term (1997 to 2021) average of approximately 12.0 L/s.

- Leachate discharge remained in compliance with the requirements of the Waste Discharge Permit at the Hartland Valve Chamber. Statistical trend analysis indicates that leachate quality has been relatively stable to slightly improving over the past five years.
- The highest concentrations of leachate parameters at Hartland Valve Chamber were observed in August and September 2021, when precipitation (and dilution) was near the annual minimum.
- Phase 1 leachate exhibited the lowest average values of BOD and highest sulphide concentrations, compared to other leachate sampling locations.
- The West Face Closure Toe Drain exhibited the most concentrated leachate. Total phenols concentration exceeded the Waste Discharge Permit criteria on two sampling dates, and TSS exceeded the Waste Discharge Permit criteria on one sampling date.

9 Conclusions

Based on our review of historical data and interpretation of groundwater, surface water and leachate quality data collected between April 2021 and March 2022, the annual monitoring program provides an effective assessment of landfill performance and compliance related to groundwater, surface water and leachate flow and quality. The following conclusions are drawn based on our interpretation of the 2021/22 data.

9.1 Leachate Flow

Leachate elevation data collected in 2021/22 indicates that leachate mounding persists in the Phase 1 landfill. Leachate elevations in Phase 1 were generally stable and exhibited minor seasonal variations. The leachate mound in the upper portion of the refuse is interpreted as being ‘perched’ above the regional bedrock groundwater flow system, with relatively high water levels and strong downward hydraulic gradients.

Leachate elevations in the Phase 2 Basin rose above the leachate elevation in the Lower Lagoon in January 2022 and remained elevated for the rest of the monitoring period. Historically, the leachate elevation in Phase 2 has been considerably (approximately 1-2 m) lower than the elevation of the Lower Leachate Lagoon. The leachate levels in Phase 2 remained well below groundwater levels at locations 36 and 37, indicating the hydraulic trap was preserved throughout the year. However, confirmatory monitoring indicated that the increasing trend in leachate levels in the Phase 2 Basin was due to pressure transducer movement or instrument drift. The pressure transducer was recalibrated in April 2022 and leachate levels in the Phase 2 Basin are interpreted to have remained stable in 2021/22.

Daily, monthly, and annual leachate discharge rates for 2021/22 were higher than those observed in 2020/21. The total volume of leachate discharged in 2021/22 was 563,061 m^3, which is approximately 38% higher than in 2020/21. The relatively high leachate discharge volume was likely caused by higher precipitation, which increased by about 12.8% in 2021/22. The highest monthly leachate flow recorded in 2021/2022 was 115,487 m^3 (average monthly flow rate of 43.9 L/s) in November 2021 due to intense precipitation (“atmospheric river”) events and diversion of surface water from Sw-N-18 (runoff from Toutle Valley) to the Upper Leachate Lagoon between January and March 2022.

In 2021/22, a total of 18,140 m^3 of leachate was removed by the north purge wells, which was approximately 26.9% less than the volume of leachate removed 2020/21. The highest leachate extraction rate was observed in January 2022, with a peak flow of 173 m^3/day. A total of 35,252 m^3 leachate was removed by the south purge wells, which was approximately 5.2% less than the volume of leachate removed in 2020/21. The average daily flow in 2021/22 was 96.6 m^3/day, which was approximately 4.7% lower than in 2020/21. The lower volume of leachate may indicate the ongoing benefit of cover placement over the Phase 1 landfill in 1997, or possible influence of biofouling of the north purge wells. Ultimately, water levels in the north and south purge wells indicate that the leachate collection system is functioning effectively.

9.2 Groundwater Flow

Groundwater flow in 2021/22 generally followed previously established patterns. Regional groundwater flows from Mount Work northeast to the north-south trending valley that underlies the northern portions of the Phase 1 and Phase 2 landfill. Most of the northward groundwater flow in the bedrock below the landfill is captured by the Toutle Valley Underdrain, Phase 2 basin leachate collection system, springs discharging to the lower lagoon, and the north and south purge well systems. Groundwater

monitors east of Phase 1 confirm flow from east to west toward the landfill, preventing off-site migration to the east. Groundwater elevations in the North Ridge area exhibited strong seasonal fluctuations, and the Highland Fault continued to function as a barrier to groundwater moving in an easterly direction.

9.3 Groundwater Quality

The groundwater quality results for 2021/22 indicated that leachate-impacted groundwater is contained within the landfill property. At the north end of the landfill, leachate-affected groundwater extends just north of the unlined lower leachate lagoon and through the middle of the lined upper leachate lagoon but does not extend off-site. South of the landfill, leachate-affected groundwater does not extend off-site. Leachate related exceedances are confined to the landfill footprint on the east side of Phase 1 and are inferred to extend to the western extent of the waste footprint within the Phase 2 landfill. This indicates the leachate collection system continued to function as intended and minimized impacts to groundwater and surface water.

Boundary Compliance monitoring wells and off-site monitoring wells met CSR AW and DW standards, except for boron. Boron in Boundary Compliance well 20-1-1 marginally exceeded CSR DW standard of 5 mg/L during one sampling event. The majority of CSR exceedances in groundwater were observed in on-site monitoring wells that are located in close proximity to the waste footprint, known leachate sources, or leachate purge wells. In addition, nitrate concentrations in three (3) shallow groundwater wells (78-2-1, 87-2-1, 88-2-1) near the Hartland North Pad exceeded applicable CSR DW standard during Q4 2021 or Q1 2022 sampling events. The nitrate exceedances were primarily attributed to the aggregate stockpiling on the bedrock ridge north of the Phase 2 landfill.

In 2021/22, groundwater wells near the Hartland North Pad and north of Phase 2 exhibited slightly degraded water quality, primarily as a result of aggregate stockpiling on the bedrock ridge north of the Phase 2 landfill. South of the Phase 1 landfill, chloride concentrations in some wells continued to increase, but the source of chloride remains unknown. Present information suggests it is not likely from leachate, road salt or application of herbicide. The groundwater monitoring plan is presently being reviewed to ensure monitoring of groundwater along the northern boundary of the landfill is able to detect changes in groundwater quality now that the RTF is operational and to better characterize groundwater downgradient of the aggregate stockpiles and the NWSP.

North of the Landfill

- In 2021/22, annual average conductivity values in the north purge wells were generally higher than those in 2020/21, indicating more concentrated leachate quality. The overall deteriorated water quality in the north purge wells may reflect a change in the composition of leachate collected by the north purge wells from the Phase 1 landfill and the Lower Leachate Lagoon, or evaporitic concentration of leachate during relatively hot and dry weather.
- Operation of the Phase 1 north purge well system continues to mitigate leachate impacts north of the landfill, as indicated by long-term stable or decreasing concentrations of leachate indicator parameters at locations 40, 20 and 21. In 2021/22, groundwater quality in well 20, 21 and 40 was generally stable and comparable to previous results.
- Groundwater quality in proximity to the Phase 2 basin confirms the hydraulic trap leachate collection system is effectively containing leachate north of Phase 2. Groundwater quality 100 m north of Phase 2 continued to show low concentrations of leachate indicator parameters, indicating groundwater quality is not affected by landfill leachate. The increase in nitrate and sulphate concentrations in groundwater are likely associated with runoff from aggregate stockpiles.
- Groundwater quality in the shallow well at location 27 continued to be affected by ongoing aggregate production and blasting activity close to the Toutle Valley. However, the deep well at this location is not impacted at this time.
- Although groundwater quality at Boundary Compliance monitoring well 31 continued to be influenced by the effluent release from residual solids Pump Station 4 on October 18, 2020, groundwater quality met all applicable CSR AW and DW standards in 2021/22.

Hartland North Pad

- Groundwater quality at the Hartland North Pad was consistent with background concentrations, except for higher sulphate, nitrate and conductivity during Q3 and Q4 2021 sampling events. The concurrent increase in conductivity, sulphate and nitrate concentrations suggests that the background groundwater in 94-1-1 was temporally impacted by nearby aggregate placement.

- Groundwater quality in 91-1-1, 92-1-1 and 93-1-1 were generally consistent with background conditions, except for elevated sulphate concentrations during the November 2021 and February 2022 sampling events. The elevated conductivity and sulphate concentrations indicate that groundwater quality is impacted by on-going quarrying/blasting activities on-site.

South of the Landfill

- Water quality data from the south end of the landfill met the applicable CSR standards. Although ammonia concentrations in some of wells at south of landfill were slightly elevated during winter months, they were within historical ranges, and well below the applicable CSR standards.
- The application of road salt and herbicide continues to complicate interpretation of water quality data in this area. Since 2020, chloride concentrations in some wells were occasionally elevated, and reached a peak in 2021/22. The high molar Cl/Na ratios (>1) suggest there is an additional source of chloride other than road salt and leachate. The source of chloride is currently unknown, but it is not likely the result of herbicide application as records indicate it was not applied in 2021/22.
- Any long-term improvements in water quality south of the landfill are largely the result of leachate collection and containment measures instituted since 2001. However, the improvement in water quality in 2021/22 was slightly diminished, potentially due to pump failures at the south purge well station, and ongoing maintenance challenges. Ongoing improvements to operational and maintenance protocols should continue improving water quality south of the landfill. Groundwater quality in this area is known to be sensitive to changes in the operation of the south purge wells and should continue to be monitored closely.

East of the Landfill

- Water quality along the east boundary of the Phase 1 landfill remained similar or slightly improved to previous years and concentrations of all parameters remained below applicable CSR standards. The concurrent increase in sulphate and nitrate concentrations were generally observed during the late fall and early winter sampling events (September to November), and may indicate impacts from dilute runoff from aggregate placed on nearby access roads.

9.4 Domestic Well Water Quality

As part of the CRD's groundwater quality monitoring program, nineteen (19) domestic wells were sampled in 2021, including 14 routine locations located within a two-kilometre radius of the landfill and five new wells located north of the Hartland North Pad. The water quality monitoring program indicated that groundwater quality in the domestic wells was consistent with previous results and water quality in all five new domestic wells met applicable federal and provincial drinking water quality guidelines (CDWQ and SDWQG) indicating that offsite domestic water wells remain unimpacted by landfill leachate.

9.5 Surface Water Quality

Surface water quality data collected in 2021/22 confirmed that nearby surface water bodies, including Tod Creek, Durrance Lake and Durrance Creek and Killarney Lake continued to be unimpacted by landfill leachate. However, water quality at Boundary Compliance Sw-N-05 and downstream along Heal Creek diminished during 2021/22 due to runoff impacts from the aggregate stockpiles north of the Phase 2 landfill and landfill leachate. An ongoing investigation is being conducted to identify the source of water quality impacts. Upgrades to leachate collection and containment infrastructure are currently being implemented north of the Phase 2 Basin to address a possible preferential pathway along historical stormwater conveyance infrastructure and restore compliance at Sw-N-05. CRD is also investigating measures that can be implemented to minimize impacts of runoff and infiltration from aggregate stockpiles.

Water quality at background locations (Sw-S-52 and Sw-CS-s2) met BCWQG-MAC guidelines. Surface water in the vicinity of the landfill exhibited exceedances in TSS, total and dissolved iron, nitrite, nitrate, zinc, aluminum, and dissolved copper concentrations. Elevated TSS, iron, and aluminum concentrations were largely related to seasonal flow variability (high and turbid flow) or construction activities. Total iron concentrations exceeded BCWQG-MAC at seven (7) stations, five (5) of which exhibited dissolved iron concentration exceedances. Nitrite concentrations exceeded the BCWQG-MAC at one (1) sampling station, and nitrate exceedances were observed at three (3) sampling stations northwest of the Phase 2 landfill where there is active blasting, quarrying and aggregate stockpiling.

Dissolved copper concentrations exceeded BCWQG-MAC values at 13 stations. Copper exceedances are generally associated with variability in BCWQG due to relatively low pH, DOC or hardness. Some of the elevated metal concentrations occurred concurrently with high TSS, which may be related to construction and aggregate stockpiling activities.

North of the Landfill

- Surface water quality at the Sw-N-05 Boundary Compliance station degraded throughout the 2021/22 monitoring year, generally showing increases in electrical conductivity, sulphate, nitrate, dissolved copper, chloride and ammonia concentrations. Nitrite, nitrate and dissolved copper concentrations at Sw-N-05 exceeded the BCWQG-MAC during three sampling events, and the Mann-Kendall analysis indicates that Sw-N-05 has exhibited increasing trends in electrical conductivity, nitrate, sulphate and ammonia concentrations over the past five years. The water quality impacts observed at Sw-N-05 have also been observed downstream at offsite sampling stations Sw-N-45 and Sw-N-17, which have exhibited increasing trends in electrical conductivity, nitrate, and sulphate concentrations. Water quality impacts in Heal Creek are currently being investigated and are thought to be due to a combination of runoff from aggregate stockpiles and discharge of a relatively small volume of leachate primarily during wet winter months. CRD is presently implementing upgrades to the leachate containment and collection system to eliminate a possible preferential pathway associated with historically buried infrastructure.
- Surface water quality at the Sw-N-16 Boundary Compliance Station was consistent with historical data, exhibiting no signs of leachate impacts. All parameters met BCWQG-MAC guidelines in all sampling events at Sw-N-16, except for dissolved and total iron concentrations during one sampling event. The iron exceedances are likely due to the disturbance of sediment during sampling or the upgradient wetland. Overall, water quality at Sw-N-16 improved from the previous monitoring year, with lower electrical conductivity and sulphate concentrations, and fewer BCWQG-MAC exceedances.
- North of the landfill at Sw-N-45, dissolved copper concentrations exceeded BCWQC-MAC criteria during one sampling event. Dissolved copper concentrations at this location are generally low (<10 µg/L), and the exceedance was due to low pH (6.16) and a low DOC concentration (0.83 mg/L), reflecting natural background conditions.

Hartland North Pad

- In the Hartland North Pad area, surface water quality at Boundary Compliance stations (Sw-N-41s1 and Sw-N-42s1) met BCWQG-MAC in 2021/22, except for dissolved copper concentrations during two sampling events and dissolved iron concentrations during one sampling event. At Sw-N-41s1, leachate indicator parameters remained low in 2021/22, indicating that surface water was not impacted by leachate. Moreover, the Mann-Kendall analysis indicates that water quality at Sw-N-41s1 has exhibited a decreasing trend in nitrate over the past five years. At Sw-N-42s1, elevated chloride and ammonia concentrations were observed later in the monitoring year, and minor water quality impacts are evident and likely related to nearby aggregate stockpiling. Mann-Kendall statistical analysis indicates that water quality at Sw-N-42s1 has exhibited increasing trends in sulphate and electrical conductivity over the past five years.
- Station Sw-N-41s3 (not a Boundary Compliance location) is located downstream of Sw-N-41s1 where the drainage from the northwest portion of the Hartland North Pad flows into Durrance Lake. In 2021/22, all parameters met BCWQG-MAC, and water quality continued to improve from previous monitoring years.

South of the Landfill

- Water quality at Boundary Compliance location Sw-S-04 met BCWQG-MAC criteria for all analytes in all samples collected during 2021/22 and was not impacted by leachate.
- Water quality at station Sw-S-52 (not a Boundary Compliance location) is representative of background water quality. In 2021/22, concentrations of all parameters were below the BCWQG-MAC. Leachate parameter concentrations were consistent with previously reported values.
- Surface water quality south of Hartland Landfill was generally consistent with previous years and was not impacted by leachate. Slightly elevated conductivity, sulphate and nitrate concentrations observed at Sw-S-12 and Sw-S-03 during drier months and early fall may be due to runoff from paved areas surrounding the bin facility or dilute leachate. Elevated ammonia concentrations during the wet season may be derived from nitrate reduction via organic matter decomposition in nearby forest soils or wetlands.
- South of Hartland Landfill, dissolved copper concentrations at three (3) stations (none of which are Boundary Compliance locations) exceeded BCWQC-MAC criteria during one or more sampling events. Dissolved copper concentrations at these

locations generally remained low (<18 µg/L). Slightly elevated copper concentrations at Sw-S-03 and Sw-S-12 may be related to dust or surface water runoff from the truck wash facility and bin areas.

9.6 Leachate Quality

The leachate quality data collected in 2021/22 remained in compliance with the requirements of the Waste Discharge Permit at the Hartland Valve Chamber. Based on discussions with the analytical laboratory, CRD confirmed that the noted COD exceedances in February 2022 were due to the use of compromised/expired preservatives that were provided to CRD by the laboratory, and the exceedances do not likely reflect in-situ leachate quality. The compromised preservatives have since been disposed and COD concentrations have returned to historical values. Overall, annual average leachate concentrations in 2021/22 were generally comparable with those measured in 2020/21.

9.7 Quality Assurance and Quality Control

Upon review of the quality assurance and quality control data collected in 2021/22, groundwater, surface water and leachate sampling and laboratory analysis have produced reliable results that are acceptable for the purposes of this monitoring report.

9.8 Compliance with Operating Certificate and Waste Discharge Permit

Groundwater quality, surface water quality and leachate quality data were used to assess compliance with the Amended Operational Certificate and Waste Discharge Permit and are discussed individually below.

9.8.1 Groundwater

A total of 36 groundwater monitoring wells were identified as Boundary Compliance monitoring. Water quality information collected from these wells were compared to the CSR standards for freshwater aquatic life and drinking water to assess compliance with the landfill Operating Certificate and protect both current and future uses of the groundwater resource.

With respect to groundwater, Hartland Landfill remained in compliance with the Operational Certificate in 2021/22. The one (1) boron exceedance in Boundary Compliance well 20-2-1 is likely due to naturally elevated concentrations and seasonal variability and unrelated to landfill operations. All leachate indicator parameters in 20-1-1 remained low throughout 2021/22.

9.8.2 Surface Water

A total of five surface water monitoring stations have been identified as Boundary Compliance stations surrounding Hartland Landfill. These stations are concentrated along the southern and northern property boundaries and are located downgradient of areas that have the potential to be impacted by leachate or runoff from the site. Water quality data collected from these sites was compared to the BCWQG-MAC criteria and used to assess compliance with the landfill Operational Certificate. Some water quality impacts observed at the Boundary Compliance stations were caused by sources other than landfill leachate (e.g., low-flow sampling conditions, construction activities, spill events, blasting, aggregate stockpiling, etc.). Following the identification of nutrient impacts in November 2021, CRD initiated an expanded monitoring program to determine the source of the exceedances, evaluate temporal changes in water quality and develop and initiate mitigation measures. The investigation is underway and will be completed in late 2022.

In 2021/22, water quality was not compliant with BCWQG-MAC at Sw-N-05 and was impacted by nutrient concentrations that exceeded BCWQG-MAC for nitrite (November 2021) and nitrate (February 2022). With respect to surface water, the landfill was non-compliant with the Operational Certificate in 2021/22 due to nitrate and nitrite exceedances at Sw-N-05. Water quality exceedances at Sw-N-16 and Sw-N-41S1 are interpreted to be related to low-flow conditions or other non-leachate sources as noted in Table 9-1. The cause for the water quality impacts at Sw-N-05 is actively being investigated by CRD and remedial efforts are underway to restore water quality.

Table 9-1. Surface Water Quality Compliance at Property Boundary Stations

Station	General Parameters	Metals	Comments
North of the Landfill			
Sw-N-05	Nitrite (1) and Nitrate (1)	Dissolved Copper (2)	• Nitrate and nitrate exceedances are likely associated with the leachate and runoff from the aggregate stockpiles located in the Toutle Valley and on the bedrock ridge located north of the Phase 2 landfill. • Dissolved copper guidelines are dependent on pH, DOC and hardness values. Copper guidelines become more stringent under lower pH, hardness and DOC levels.
Sw-N-16	None	Total Iron (1), Dissolved Iron (1)	• Exceedances are anticipated to be related to turbid flow conditions following a prolonged dry period. Continued monitoring to assess these anomalous results.
Sw-N-41S1	None	Dissolved Copper (2) Dissolved Iron (1)	• Dissolved iron exceedances are anticipated to be related to turbid flow conditions following a prolonged dry period. Continued monitoring to assess these anomalous results. Refinement of the Standard Operating Procedure for surface water sampling may decrease the potential for artificially elevated concentrations of metals associated with suspended sediments. • Dissolved copper guidelines are dependent on pH, DOC and hardness values. Copper guidelines become more stringent under lower pH, hardness and DOC levels, which are typical of the natural background conditions at Hartland.

9.8.3 Leachate

The Hartland Valve Chamber is the compliance monitoring point for the Waste Discharge Permit. During the monitoring period, leachate discharges at the Hartland Valve Chamber were in compliance with the Waste Discharge Permit requirements.

10 Recommendations

Based on the findings of this report, our recommendations are summarized in Table 10-1:

Table 10-1. Summary of Recommendations

	Leachate Collection System	Status
1	Water levels and quality in the north purge wells should continue to be closely monitored to verify the effectiveness of the leachate collection system. Increased water levels were noticed in well 52-3-0 and P7. Options for maintaining lower leachate levels in P7 and P9 should be further investigated to continue improving groundwater quality west of the lower leachate lagoon.	New
2	Water levels and quality in the south purge wells should continue to be closely monitored to verify and improve the effectiveness of the leachate collection system. Several pump failures were reported for south purge wells P3 and P10 and P1.	New
3	Pumping levels and the extent of the drawdown cones surrounding the north and south purge well systems should continue to be validated periodically (next assessment in 2024) to confirm the proper functioning of the wells. All procedures should follow the Standard Operating Procedure (SOP) – North Purge Well Drawdown Cone Verification (AECOM 2016), with interpretation of results by a qualified professional. Water levels in purge wells and pump maintenance should be conducted regularly to confirm the efficiency of the purge wells.	Ongoing
4	Pumping elevations in the south purge wells (P2, P3, P4 and P10) should be maintained at elevations below 140 m asl. Pumping elevations in P1 should be maintained near the bottom of the screened interval around 146 m asl.	Ongoing
5	A detailed assessment of the effectiveness of the hydraulic trap and leachate collection systems including the north purge wells and south purge wells is required as the landfill extends further north and west, and as additional lifts are constructed. Recent groundwater and surface water characterization between the Phase 2 Basin and the Northwest Sedimentation Pond suggest additional leachate containment or groundwater management measures need to be implemented to mitigate the potential for off-site leachate migration. The role of historical buried utilities should be investigated as a possible subsurface conveyance pathway contributing to leachate impacts on the Northwest Sedimentation Pond and non-compliant water quality at Sw-N-05.	Ongoing
	Runoff and Infiltration Associated with Aggregate Stockpiles	
6	The location and volume of aggregate stockpiles should continue to be minimized outside of the leachate collection system. Stockpiles should be covered as soon as practical to minimize sulphate, ammonia, nitrate and TSS impacts on downgradient groundwater and surface water bodies. Direct runoff from aggregate stockpiles should be diverted away from natural water courses as it is known to exceed BCWQ guidelines for sulphate.	Ongoing
7	Within the footprint of the leachate collection system, progressive closure and temporary tarps and effective surface water diversion ditches/pipelines should continue to be implemented to minimize infiltration to the underlying leachate collection system and manage sulphide concentrations in leachate. The separation between clean runoff and leachate collection systems should be improved to minimize clean water inputs to the leachate collection system.	Ongoing
	Groundwater Monitoring Program	
8	Groundwater monitoring wells in proximity to the Phase 2 Basin and Northwest Sedimentation Pond should be closely monitored to confirm the hydraulic trap leachate collection system is effectively containing leachate north of Phase 2. Continued quarrying may result in greater connection between the flow system on the west side of the Highland Fault and the Phase 2 hydraulic trap, resulting in increased leachate generation. It will be important to establish monitoring wells west and upslope of the Phase 2 landfill to support continued evaluations of hydraulic trap performance and monitor groundwater quality. It is recommended that the CRD commence early planning for potential future shallow groundwater, surface water and leachate management in the Toutle Valley area to maximize diversion of clean water out of the leachate collection system.	New
9	The existing groundwater monitoring plan should be updated to ensure groundwater quality along northern boundary is closely monitored and confirm that impacted groundwater is retained within landfill.	New
10	Groundwater wells should be surveyed once every five years to verify well condition and ensure geodetic well elevations are accurate (i.e., next survey in 2025).	Ongoing
11	The elevation of the leachate mound in Phase 1 and 2 should be determined at least once every five years (i.e. next assessment in 2025).	Ongoing
12	Monitoring wells on the north ridge and at Hartland North should continue to be monitored to characterize daily groundwater level fluctuations, further define the groundwater divergence and monitor groundwater flow behavior over time as the extents of the quarry within Phase 2 migrate northward. These wells should be protected from site development activities and damage by heavy equipment.	Ongoing
13	There should be a routine review of the landfill development plan and filling plan every two years to ensure the existing monitoring network and monitoring program remain sufficient and interpretation of the data	Ongoing

	benefits from a complete understanding of the landfill design and operations over the next five years. The next review should be conducted in 2023.	
14	As required by the Amended Operational Certificate, the results of the annual monitoring program should continue to be reviewed and interpreted by a Qualified Professional experienced in assessing the impacts of landfill leachate at large municipal landfills similar to Hartland.	Ongoing
Surface and Leachate Monitoring Program		
15	Conduct a review of the monitoring program north of Phase 2 to monitor the effectiveness of remedial efforts to address nutrient impacts to groundwater and surface water observed north of the Phase 2 Basin. Any recommended changes should be implemented immediately. CRD should begin sampling and analysis of sodium in surface water, groundwater and leachate to allow for a more thorough evaluation of the source of chloride (e.g. road salt) in water quality in the future.	New
16	The chemistry of residual wastewater solids and stabilized biosolids (solids and leachate) should be characterized to allow for future evaluation of any impacts to leachate chemistry over time. This information may be available from pilot studies or operational monitoring programs.	Ongoing
17	Water quality north of the Phase 2 landfill should be closely monitored until water quality north of the Phase 2 Basin at Sw-N-05 has been restored.	New
18	The source of chloride, ammonia, dissolved copper and nitrate observed in surface water south of the Phase 1 landfill should be investigated further. Additional waste has been placed on the western and southern portions of Phase 2 over recent years and occasional leachate seeps and runoff from the truck wash have been noted in the past. A multilevel monitoring well cluster should be established west of the bin facility and well 85-1-1 to resolve whether the source of impacts to surface water are due to runoff or discharge of leachate impacted groundwater.	New/Ongoing
19	Leachate sampling from the Phase 2 cleanout should be resumed once the sampling pump is replaced.	New
20	In addition to the Sewer Use Criteria, leachate quality results for trace organic compounds should be compared to CSR standards for the protection of drinking water and aquatic life to allow for screening of data to identify parameters in leachate that exceed CSR standards, and guide any refinements to the monitoring program in future years.	Ongoing
Construction Management		
21	The placement of aggregate, road salt, dust suppressant and herbicides should be carefully considered and documented to help understand the causes of potential future concentrations of conductivity, ammonia, chloride, nitrate, sulphate and select metals at groundwater and surface water monitoring locations.	Ongoing
Quality Assurance and Quality Control		
22	Quality assurance for laboratory analyses should continue to be evaluated quarterly, and any discrepancies should be resolved with the laboratory and CRD sampling personnel within one month of receiving the laboratory results. The appropriate notation should be added to the data files to explain the reason for the low precision and the steps taken, if any, to improve the sampling or laboratory procedures.	Ongoing

11 Qualifications of the Authors

Matt Martinolich, M.Sc. is a hydrogeologist / Geochemist with one year experience collecting, analyzing and interpreting hydrogeochemical and hydrogeological data at AECOM in addition to a year of experience in exploration geology. He has been involved in several geological and geochemical investigations at Hartland landfill over the past year. Matt contributed to data analysis and authored several sections of this report.

Kun Jia, M.Sc., P.Geo. is a Hydrogeologist / Geochemist with over eight years of experience collecting, analyzing and interpreting hydrogeological and geochemistry data for waste management, mining and contaminated sites projects. Kun has contributed to and authored several monitoring reports at Hartland landfill since 2015. Kun was the primary author of this report.

Ryan Mills, M.Sc., P.Geo. is a Senior Hydrogeologist with over 20 years of experience interpreting and analyzing hydrogeological and water chemistry data for waste management, water resources and mining related projects. Ryan has authored several groundwater monitoring reports and conducted numerous site investigations involving drilling and hydrogeologic testing at Hartland Landfill since 2004. He has also undertaken site investigations at numerous other municipal, industrial and small rural landfills throughout British Columbia. Ryan oversaw and reviewed key aspects of the report.

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Appendix A

Monitoring Station and Groundwater Level Data

- A1. Monitoring Well Co-ordinates
- A2. Groundwater Monitoring Plan
- A3. Groundwater Elevations
- A4. Surface Water Station Details

A1. Monitoring Well Co-ordinates

Appendix A-1. Monitoring Well Co-ordinates 2021-2022

Station Name	Status	Location		Elevations					Depths				Survey Date	Monitor Class	Area of Landfill	Comments
		Northing (NAD 83)	Easting (NAD 83)	Ground Surface Elevation	Top of Casing Elevation	Top of Piezometer Elevation	Top of Screen Elevation	Bottom of Screen Elevation	Stickup	Borehole Depth Below Ground Surface	Depth to Top of Screen Below Ground Surface	Depth to Bottom of Screen Below Ground Surface		Shallow (S), Intermediate (I), Deep (D)		
		m	m	m ASL	m ASL	m ASL	m ASL	m ASL	m AGL	m BGS	m BGS	m BGS				
GW-04-3-1	Active	5375469.0	466167.8	127.11	128.20	128.09	114.26	111.21	1.05	15.90	12.85	15.90	2005 Mar	I	SP1	
GW-04-4-1	Active	5375466.8	466166.1	127.13	128.08	128.01	122.98	119.93	0.88	7.20	4.15	7.20	2005 Mar	S	SP1	
GW-07-1-0	Active	5375613.3	466177.0	140.60	142.69	142.29	N/A	N/A	1.69	No monitor	No monitor	No monitor	2005 Mar	D	SP1	
GW-09-1-0	Active	5375774.0	466187.0	148.96	150.14	150.14	N/A	N/A	1.18	No monitor	No monitor	No monitor	Historic	D	EP1	
GW-16-1-1	Active	5376345.6	466130.2	143.48	144.28	144.06	101.98	100.48	0.58	43.00	41.50	43.00	2005 Mar	D	EP1	
GW-16-1-2	Active	5376345.6	466130.1	143.48	144.28	144.00	110.98	109.48	0.52	34.00	32.50	34.00	2005 Mar	D	EP1	
GW-16-2-1	Active	5376347.1	466133.7	143.31	144.09	143.67	119.81	118.81	0.36	24.50	23.50	24.50	2005 Mar	I	EP1	
GW-16-2-2	Active	5376347.0	466133.7	143.31	144.09	143.72	129.81	126.81	0.41	16.50	13.50	16.50	2005 Mar	I	EP1	
GW-17-1-1	Active	5376186.4	466198.0	150.99	152.17	152.08	100.49	98.99	1.09	52.00	50.50	52.00	2005 Mar	D	EP1	
GW-17-1-2	Active	5376186.5	466198.0	150.99	152.17	152.11	110.99	109.49	1.12	41.50	40.00	41.50	2005 Mar	D	EP1	
GW-17-1-3	Active	5376186.5	466198.0	150.99	152.17	152.04	136.49	133.29	1.05	17.70	14.50	17.70	2005 Mar	I	EP1	
GW-18-1-1	Active	5375976.5	466194.8	168.81	169.48	168.82	110.64	109.14	0.19	59.67	58.17	59.67	2005 Mar	D	EP1	
GW-18-1-2	Active	5375976.5	466194.7	168.81	169.48	169.33	122.61	121.11	0.52	47.70	46.20	47.70	2005 Mar	D	EP1	
GW-18-2-1	Active	5375973.0	466193.8	168.92	169.68	169.16	138.42	136.92	0.24	32.00	30.50	32.00	2005 Mar	D	EP1	
GW-18-2-2	Active	5375973.0	466193.7	168.92	169.68	169.12	155.92	152.92	0.20	16.00	13.00	16.00	2005 Mar	I	EP1	
GW-19-1-1	Active	5375503.2	466125.3	132.89	133.86	133.85	96.89	95.39	0.96	37.50	36.00	37.50	2005 Mar	D	SP1	
GW-19-1-2	Active	5375503.2	466125.3	132.89	133.86	133.87	106.39	104.89	0.98	28.00	26.50	28.00	2005 Mar	I	SP1	
GW-19-2-1	Active	5375507.6	466124.1	132.60	133.37	133.26	117.10	115.60	0.66	17.00	15.50	17.00	2005 Mar	I	SP1	
GW-19-2-2	Active	5375507.6	466124.1	132.60	133.37	133.32	126.60	123.60	0.72	9.00	6.00	9.00	2005 Mar	S	SP1	
GW-20-1-1	Active	5376498.3	465971.1	110.46	111.32	111.17	80.46	77.46	1.20	33.00	30.00	33.00	2005 Mar	D	NP1	Deactivated in 2010.
GW-20-1-2	Active	5376498.4	465971.0	110.46	111.32	111.19	92.66	89.66	1.21	20.80	17.80	20.80	2005 Mar	I	NP1	
GW-21-1-1	Active	5376483.9	465970.8	110.92	111.79	111.69	98.02	94.92	1.25	16.00	12.90	16.00	2005 Mar	I	NP1	
GW-21-1-2	Active	5376483.9	465970.9	110.92	111.79	111.68	105.42	102.32	1.24	8.60	5.50	8.60	2005 Mar	S	NP1	
GW-21-2-1	Active	5376482.3	465970.0	111.10	111.87	111.80	No log	No log	0.70	NA	NA	NA	2005 Mar	S	NP1	
GW-25-1-1	Active	5376491.7	465713.9	129.91	130.89	130.77	106.91	105.41	0.86	24.50	23.00	24.50	2005 Mar	I	NP2	
GW-25-1-2	Active	5376491.7	465714.0	129.91	130.89	130.78	125.61	123.41	0.87	6.50	4.30	6.50	2005 Mar	S	NP2	
GW-27-1-1	Active	5376358.2	465455.8	141.09	141.91	141.57	118.09	116.59	0.48	24.50	23.00	24.50	2005 Mar	I	BKGND - WP2	
GW-27-1-2	Active	5376358.2	465455.7	141.09	141.91	141.56	140.59	137.59	0.47	3.50	0.50	3.50	2005 Mar	S	BKGND - WP2	
GW-28-1-0	Active	5376503.6	465825.1	136.25	137.07	136.52	N/A	N/A	0.27	NA	NA	NA	2005 Mar	D	NP1	

Notes:

Datum Description

m BGL	*metres below ground level*
m AGL	*metres above ground level*
m ASL	*metres above mean sea level*

Monitor Class

S	*Shallow well <15 m deep*
I	*Intermediate well between 15 and 30 m deep*
D	*Deep well >30 m deep*

Area of Landfill

SP1	*South of Phase 1 Landfill*
EP1	*East of Phase 1 Landfill*
NP1	*North of Phase 1 Landfill*
NP2	*North of Phase 2 Landfill*
BKGND - WP2	*Background Water Quality West of Phase 2*
HNP	*Hartland North Pad*
P1	*Phase 1*
P2	*Phase 2*

Appendix A-1. Monitoring Well Co-ordinates 2021-2022

Station Name	Status	Location		Elevations					Depths				Survey Date	Monitor Class	Area of Landfill	Comments
		Northing (NAD 83)	Easting (NAD 83)	Ground Surface Elevation	Top of Casing Elevation	Top of Piezometer Elevation	Top of Screen Elevation	Bottom of Screen Elevation	Stickup	Borehole Depth Below Ground Surface	Depth to Top of Screen Below Ground Surface	Depth to Bottom of Screen Below Ground Surface		Shallow (S), Intermediate (I), Deep (D)		
		m	m	m ASL	m ASL	m ASL	m ASL	m ASL	m AGL	m BGS	m BGS	m BGS				
GW-29-1-1	Active	5376563.3	465898.2	113.39	114.41	114.38	100.28	98.87	0.99	14.52	13.11	14.52	2005 Mar	S	NP1	
GW-29-1-2	Active	5376563.3	465898.3	113.39	114.41	114.39	110.39	105.96	1.00	7.43	3.00	7.43	2005 Mar	S	NP1	
GW-30-1-1	Active	5376562.2	465978.4	109.84	110.89	110.79	95.51	94.10	0.95	15.74	14.33	15.74	2005 Mar	I	NP1	
GW-30-1-2	Active	5376562.3	465978.5	109.84	110.89	110.79	108.56	104.07	0.95	5.77	1.28	5.77	2005 Mar	S	NP1	
GW-31-1-1	Active	5376555.2	466080.9	105.28	106.34	106.26	90.92	89.50	0.98	15.78	14.36	15.78	2005 Mar	I	NP1	
GW-31-1-2	Active	5376555.2	466080.9	105.28	106.34	106.26	103.84	99.41	0.98	5.87	1.44	5.87	2005 Mar	S	NP1	
GW-36-1-1	Active	5376398.9	465778.3	130.21	130.21	131.51	117.87	114.87	1.30	15.34	12.34	15.34	2005 Mar	I	NP2	
GW-36-2-1	Active	5376400.6	465776.5	130.00	131.11	131.07	90.68	87.63	1.07	42.37	39.32	42.37	2005 Mar	D	NP2	
GW-36-3-1	Active	5376401.7	465773.6	130.01	131.01	130.96	115.01	112.01	0.95	18.00	15.00	18.00	2005 Mar	I	NP2	
GW-37-1-1	Active	5376432.6	465725.6	129.59	130.12	129.98	117.35	114.35	0.39	15.24	12.24	15.24	2005 Mar	I	NP2	
GW-37-2-1	Active	5376432.5	465727.8	129.92	130.64	130.60	89.47	86.42	0.68	43.50	40.45	43.50	2005 Mar	D	NP2	
GW-37-3-1	Active	5376435.6	465726.8	129.95	130.75	130.63	119.72	115.15	0.68	14.80	10.23	14.80	2005 Mar	S	NP2	
GW-38-1-1	Active	5376464.6	465797.2	131.90	132.46	132.31	N/A	N/A	0.41	18.29	No monitor	18.29	2005 Mar	I	NP2	
GW-39-1-1	Active	5376467.2	465876.1	129.54	130.24	130.11	111.10	108.10	0.57	21.44	18.44	21.44	2005 Mar	I	NP2	
GW-39-2-1	Active	5376466.3	465874.7	129.75	130.72	130.58	95.56	92.56	0.83	37.19	34.19	37.19	2005 Mar	D	NP2	
GW-40-1-1	Active	5376432.1	465915.2	122.00	122.78	122.68	109.76	106.76	0.68	15.24	12.24	15.24	2005 Mar	I	NP1	
GW-41-1-1	Active	5376852.1	465190.4	149.48	150.30	150.16	143.41	140.41	0.68	9.07	6.07	9.07	2005 Mar	S	HNP	
GW-42-1-1	Active	5376717.6	465534.9	138.81	139.45	139.33	133.02	129.97	0.52	8.84	5.79	8.84	2005 Mar	S	HNP	
GW-43-1-1	Active	5376683.8	465448.7	162.60	163.05	163.10	144.31	141.26	0.50	21.34	18.29	21.34	2007 Apr	I	HNP	
GW-44-1-1	Active	5376671.5	465322.3	161.46	162.02	161.89	153.84	150.79	0.43	10.67	7.62	10.67	2005 Mar	S	HNP	
GW-46-2-1	Active	5376075.5	466029.9	169.97	171.25	171.70	161.69	158.69	1.73	11.28	8.28	11.28	2006 Apr	S	P1	
GW-46-3-1	Active	5376085.7	466035.7	169.83	172.46	172.38	137.83	134.78	2.55	35.05	32.00	35.05	2006 Apr	D	P1	Installed during 2005
GW-46-4-1	Active	5376078.5	466035.9	169.71	172.10	172.03	151.12	148.07	2.32	21.64	18.59	21.64	2006 Apr	I	P1	Installed during 2005
GW-47-2-1	Active	5375888.1	465996.7	171.84	174.46	174.40	154.78	151.73	2.55	20.11	17.06	20.11	2006 Apr	I	P1	Installed during 2005
GW-48-1-1	Active	5375840.5	466031.3	169.78	171.34	171.63	160.14	157.14	1.85	12.64	9.64	12.64	2006 Apr	S	P1	
GW-48-2-1	Active	537815.8	466031.6	168.87	171.28	171.22	149.97	146.92	2.35	21.95	18.90	21.95	2006 Apr	I	P1	Installed during 2005
GW-51-1-1	Active	5376475.1	466048.2	110.90	111.68	111.76	106.13	103.13	0.86	7.77	4.77	7.77	2005 Mar	S	NP1	
GW-51-2-1	Active	5376474.1	466045.6	110.90	111.83	111.89	100.49	97.49	0.99	13.41	10.41	13.41	2005 Mar	S	NP1	
GW-51-3-1	Active	5376473.3	466042.7	110.97	111.84	111.89	93.85	90.85	0.92	20.12	17.12	20.12	2005 Mar	I	NP1	
GW-52-1-1	Active	5376406.0	465979.1	119.91	120.94	120.90	93.19	90.19	0.99	29.72	26.72	29.72	Historic	I	NP1	
GW-52-2-0	Active	5376391.0	465959.0	119.99	120.65	120.65	N/A	N/A	0.66	NA	NA	NA	Historic	I	NP1	

Notes:

Datum Description

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m ASL	*metres above mean sea level*

Monitor Class

S	*Shallow well <15 m deep*
I	*Intermediate well between 15 and 30 m deep*
D	*Deep well >30 m deep*

Area of Landfill

SP1	*South of Phase 1 Landfill*
EP1	*East of Phase 1 Landfill*
NP1	*North of Phase 1 Landfill*
NP2	*North of Phase 2 Landfill*
BKGND - WP2	*Background Water Quality West of Phase 2*
HNP	*Hartland North Pad*
P1	*Phase 1*
P2	*Phase 2*

Appendix A-1. Monitoring Well Co-ordinates 2021-2022

Station Name	Status	Location		Elevations					Depths				Survey Date	Monitor Class	Area of Landfill	Comments
		Northing (NAD 83)	Easting (NAD 83)	Ground Surface Elevation	Top of Casing Elevation	Top of Piezometer Elevation	Top of Screen Elevation	Bottom of Screen Elevation	Stickup	Borehole Depth Below Ground Surface	Depth to Top of Screen Below Ground Surface	Depth to Bottom of Screen Below Ground Surface		Shallow (S), Intermediate (I), Deep (D)		
		m	m	m ASL	m ASL	m ASL	m ASL	m ASL	m AGL	m BGS	m BGS	m BGS				
GW-52-3-0	Active	5376389.9	465948.8	119.8	120.4	120.4	N/A	N/A	0.57	No monitor	No monitor	No monitor	Historic	I	NP1	
GW-52-4-0-P7	Active	5376388.0	465947.0	119.80	120.60	120.60	N/A	N/A	0.80	22.25	No monitor	No monitor	Historic	I	NP1	Purge well
GW-53-1-1	Active	5376506.2	465761.3	130.84	131.81	131.92	114.15	110.88	1.08	19.96	16.69	19.96	2005 Mar	I	NP2	
GW-54-1-1	Active	5376187.7	466226.9	154.63	155.58	155.65	107.91	104.91	1.02	49.72	46.72	49.72	2005 Mar	D	EP1	
GW-54-2-1	Active	5376185.6	466225.5	154.69	155.62	155.66	118.55	115.55	0.97	39.14	36.14	39.14	2005 Mar	D	EP1	
GW-54-3-1	Active	5376183.4	466224.7	154.66	155.50	155.53	138.05	135.05	0.87	19.61	16.61	19.61	2005 Mar	I	EP1	
GW-55-1-1	Active	5376910.6	465136.1	147.67	147.68	148.52	139.06	134.56	0.85	13.11	8.61	13.11	2005 Mar	S	HNP	
GW-56-1-1	Active	5376838.5	465287.8	148.67	149.69	149.61	139.92	131.29	0.94	17.38	8.75	17.38	2005 Mar	I	HNP	
GW-57-1-1	Active	5376873.9	465528.4	132.37	132.99	132.90	122.77	118.81	0.53	13.56	9.60	13.56	2005 Mar	S	HNP	
GW-58-1-0	Active	5376324.8	465822.9	137.17	138.30	138.23	N/A	N/A	1.06	19.20	No monitor	No monitor	2009 May	I	NP2	
GW-60-1-1	Active	5375636.9	466137.2	141.63	142.40	142.32	122.23	119.23	0.69	22.40	19.40	22.40	2005 Mar	I	SP1	
GW-60-2-1	Active	5375638.4	466137.4	141.61	142.46	142.40	129.51	126.51	0.79	15.10	12.10	15.10	2005 Mar	I	SP1	
GW-60-3-1	Active	5375640.0	466137.5	141.74	142.60	142.49	137.84	134.84	0.75	6.90	3.90	6.90	2005 Mar	S	SP1	
GW-61-1-1	Active	5375980.6	465523.1	212.00	213.06	212.95	146.40	143.40	0.95	68.60	65.60	68.60	2005 Mar	D	BKGND - WP2	
GW-62-1-1	Active	5376609.3	465265.5	183.44	184.25	184.25	161.32	159.82	N/A	23.70	22.12	23.62	2008 May	I	HNP	Survey elevations suspect.
GW-62-2-1	Active	5376610.5	465267.3	183.06	183.96	183.96	168.70	165.70	N/A	18.90	14.36	17.36	2008 May	I	HNP	Survey elevations suspect.
GW-63-1-1	Active	5375812.3	465609.5	197.24	198.18	198.09	168.44	165.44	0.85	31.80	28.80	31.80	2005 Mar	I	BKGND - WP2	
GW-63-2-1	Active	5375809.7	465610.5	197.21	198.11	198.03	186.71	183.71	0.82	13.50	10.50	13.50	2005 Mar	S	BKGND - WP2	
GW-71-1-1	Active	5375643.3	466260.6	144.04	144.93	144.82	116.61	113.56	0.81	31.24	27.43	30.48	2005 Mar	D	SP1	
GW-71-2-1	Active	5375644.1	466259.9	144.04	144.92	144.81	127.04	123.98	0.80	20.10	17.00	20.06	2005 Mar	I	SP1	
GW-71-3-1	Active	5375645.3	466259.1	144.05	144.95	144.90	137.04	134.00	0.85	10.10	7.01	10.05	2005 Mar	S	SP1	
GW-72-1-1	Active	5375670.6	466186.6	143.29	144.13	144.03	115.86	112.81	0.79	30.48	27.43	30.48	2005 Mar	D	SP1	
GW-72-2-1	Active	5375671.7	466186.7	143.32	144.09	144.04	126.56	123.20	0.72	20.12	16.76	20.12	2005 Mar	I	SP1	
GW-72-3-1	Active	5375672.7	466186.8	143.38	144.17	144.12	136.06	133.02	0.74	10.36	7.32	10.36	2005 Mar	S	SP1	
GW-73-1-1	Active	5375532.1	466184.1	134.52	135.47	135.31	106.91	103.86	0.86	30.66	27.61	30.66	2005 Mar	D	SP1	
GW-73-2-1	Active	5375533.2	466184.1	134.50	135.40	135.36	117.40	114.38	0.86	20.12	17.10	20.12	2005 Mar	I	SP1	
GW-73-3-1	Active	5375534.3	466184.1	134.48	135.37	135.31	127.46	124.42	0.83	10.06	7.02	10.06	2005 Mar	S	SP1	
GW-75-1-1	Active	5376207.5	466035.3	154.82	155.62	155.97	127.72	121.72	1.15	33.10	27.10	33.10	2007 Apr	D	P1	
GW-76-1-1	Active	5375966.0	466228.4	171.08	171.79	171.69	123.23	117.13	0.61	61.90	47.85	53.95	2005 Mar	D	EP1	
GW-76-2-1	Active	5375967.5	466227.1	171.00	171.77	171.66	133.81	127.72	0.66	43.60	37.19	43.28	2005 Mar	D	EP1	

Notes:

Datum Description

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m ASL	*metres above mean sea level*

Monitor Class

S	*Shallow well <15 m deep*
I	*Intermediate well between 15 and 30 m deep*
D	*Deep well >30 m deep*

Area of Landfill

SP1	*South of Phase 1 Landfill*
EP1	*East of Phase 1 Landfill*
NP1	*North of Phase 1 Landfill*
NP2	*North of Phase 2 Landfill*
BKGND - WP2	*Background Water Quality West of Phase 2*
HNP	*Hartland North Pad*
P1	*Phase 1*
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Appendix A-1. Monitoring Well Co-ordinates 2021-2022

Station Name	Status	Location		Elevations					Depths				Survey Date	Monitor Class	Area of Landfill	Comments
		Northing (NAD 83)	Easting (NAD 83)	Ground Surface Elevation	Top of Casing Elevation	Top of Piezometer Elevation	Top of Screen Elevation	Bottom of Screen Elevation	Stickup	Borehole Depth Below Ground Surface	Depth to Top of Screen Below Ground Surface	Depth to Bottom of Screen Below Ground Surface		Shallow (S), Intermediate (I), Deep (D)		
		m	m	m ASL	m ASL	m ASL	m ASL	m ASL	m AGL	m BGS	m BGS	m BGS				
GW-76-3-1	Active	466226.0	5375968.8	171.0	171.8	171.7	145.1	142.0	0.72	29.00	25.91	28.96	2005 Mar	I	EP1	
GW-77-1-1	Active	5376487.8	465536.8	155.04	155.66	155.63	120.60	117.55	0.59	40.26	34.44	37.49	2006 Apr	D	NP2	Installed in 2006
GW-77-2-1	Active	5376485.8	465536.2	154.90	155.51	155.45	139.16	135.87	0.55	20.67	15.74	19.03	2006 Apr	I	NP2	Installed in 2006
GW-78-1-1	Active	5376498.8	465648.8	142.66	143.46	143.38	113.46	110.18	0.72	33.79	29.20	32.48	2006 Apr	D	NP2	Installed in 2006
GW-78-2-1	Active	5376500.3	465646.7	142.59	143.40	143.36	132.42	129.14	0.77	14.11	10.17	13.45	2006 Apr	S	NP2	Installed in 2006
GW-80-1-0-P8	Active	5376397.4	465931.0	119.61	120.29	N/A	N/A	N/A	N/A	20.42	No monitor	No monitor	2008 May	I	NP1	Purge well
GW-81-1-0-P9	Active	5376409.0	465910.8	122.17	122.85	N/A	N/A	N/A	N/A	26.82	No monitor	No monitor	2008 May	I	NP1	Installed in 2007
GW-82-1-1	Active	5376257.5	465772.7	154.67	155.89	155.86	135.17	131.50	1.18	23.77	19.50	23.17	2009 May	I	P2	Installed in 2007
GW-83-1-1	Active	5376353.3	465723.8	140.09	141.40	141.44	124.97	121.92	1.35	18.90	15.12	18.17	2009 May	I	P2	Installed in 2007
GW-85-1-1	Active	5375688.3	466068.7	149.09	150.09	150.07	142.99	139.95	0.98	9.14	6.1	9.14	2009 May	S	SP1	Installed in March 2009
GW-87-1-1	Active	5376451.7	465243.4	182.32	183.22	183.16	147.62	144.52	0.84	37.80	34.70	37.80	2015 Feb	D	NP2	Installed in 2014
GW-87-2-1	Active	5376453.8	465242.8	182.36	183.26	183.24	165.56	162.56	0.88	21.90	16.80	19.80	2015 Feb	I	NP2	Installed in 2014
GW-88-1-1	Active	5376467.2	465271.7	181.47	182.24	182.16	138.77	135.77	0.69	45.70	42.70	45.70	2015 Feb	D	NP2	Installed in 2014
GW-88-2-1	Active	5376470.1	465271.9	181.29	182.16	182.10	168.49	165.49	0.81	16.80	12.80	15.80	2015 Feb	I	NP2	Installed in 2014
GW-89-1-1	Active	5376028.4	466043.4	169.25	169.45	169.45	138.62	135.57	0.19	30.18	30.63	33.68	2018 Dec	D	P1	Installed in 208
GW-89-2-1	Active	5376026.8	466048.7	169.141	169.34	169.34	149.48	146.43	0.20	19.05	19.66	22.71	2018 Dec	I	P1	Installed in 2018
GW-90-1-1	Active	5376286.6	465651.3	151.876	152.69	152.69	118.34	115.30	0.81	38.40	33.54	36.58	2019 Oct	D	P2	leachate mound monitoring well
GW-90-2-1	Active	5376286.8	465652.3	152.00	152.75	152.75	136.84	133.79	0.75	14.94	15.16	18.21	2018 Dec	I	P2	leachate mound monitoring well
GW-91-1-1	Active	5376604.9	465473.7	164.61	165.33	165.33	149.01	145.97	0.72	18.64	15.60	18.64	2019 Nov	I	HNP	Installed in 2019
GW-92-1-1	Active	5376535.4	465501.9	167.68	168.57	168.57	147.76	144.72	0.88	22.96	19.92	22.96	2019 Nov	I	HNP	Installed in 2019
GW-93-1-1	Active	5376556.5	465260.0	183.42	184.24	184.24	159.34	156.29	0.83	28.04	24.08	27.13	2019 Nov	D	HNP	Installed in 2019
GW-94-1-1	Active	5376508.8	465129.5	203.65	204.32	204.32	163.87	160.83	0.67	42.82	39.78	42.82	2019 Dec	D	HNP	Installed in 2019
GW95-1-1	Active	5376518.9	465698.3	128.44	129.36	129.36	126.00	124.48	0.92	4.84	2.44	3.96	2022 Apr	S	NP2	Installed in April 2022
GW96-1-1	Active	5376510.3	465695.6	129.49	130.45	130.45	127.05	125.53	0.95	4.43	2.44	3.96	2022 Apr	S	NP2	Installed in April 2022
GW97-1-1	Active	5376503.5	465719.6	129.12	130.00	130.00	125.16	122.11	0.88	7.95	3.96	7.01	2022 Apr	S	NP2	Installed in April 2022
GW98-1-1	Active	5376501	465698.7	130.41	131.30	131.30	125.84	122.79	0.90	8.54	4.57	7.62	2022 Apr	S	NP2	Installed in April 2022
GW99-1-1	Active	5376427.6	465668.9	135.40	135.30	135.30	132.96	131.44	-0.10	3.88	2.44	3.96	2022 Apr	S	NP2	Installed in April 2022
GW100-1-1	Active	5376419.7	465668.6	135.50	135.44	135.44	130.01	128.49	-0.06	7.02	5.49	7.01	2022 Apr	S	NP2	Installed in April 2022
GW101-1-1	Active	5376414	465669.1	135.46	135.33	135.33	129.97	126.93	-0.12	8.51	5.49	8.53	2022 Apr	S	NP2	Installed in April 2022
GW102-1-1	Active	5376399.4	465663.5	134.46	135.01	135.01	129.89	128.36	0.56	6.65	5.47	6.10	2022 Apr	S	NP2	Installed in April 2022
GW103-1-1	Active	5376400.9	465626.0	135.74	136.67	136.67	129.95	128.42	0.92	8.25	5.79	7.32	2022 Apr	S	NP2	Installed in April 2022
VLGW-02-D	Active	5375782.7	465984.2	168.58	168.93	168.79	155.58	151.58	0.21	22.00	13.00	17.00	2008 May	I	P1	Landfill gas well
VLGW-03-D	Active	5375776.6	465933.6	170.04	170.30	170.30	156.29	153.29	0.26	17.00	13.75	16.75	2014 Feb	I	P1	Landfill gas well
VLGW-04-D	Active	5375858.1	466056.5	169.24	169.95	169.90	156.24	152.24	0.65	19.00	13.00	17.00	2008 May	I	P1	Landfill gas well
VLGW-08-D	Active	5376088.1	466113.6	164.42	165.28	165.14	147.41	137.38	0.72	28.04	17.01	27.04	2008 May	I	P1	Landfill gas well
VLGW-11-S	Active	5375996.8	466122.6	166.06	166.53	166.48	160.42	155.78	0.42	11.28	5.64	10.28	2008 May	I	P1	Landfill gas well
VLGW-15-D	Active	5375842.9	465997.0	170.61	171.13	171.07	156.41	148.21	0.46	23.31	14.2	22.4	2008 May	D	P1	Landfill gas well
VLGW-16-D	Active	5375901.0	466011.3	172.47	173.38	173.31	157.02	147.48	0.84	25.90	15.45	24.99	2008 May	I	P1	Landfill gas well
VLGW-17-D	Active	5375959.1	466025.5	171.40	171.81	171.77	157.20	144.28	0.37	28.04	14.2	27.12	2008 May	D	P1	Landfill gas well

Notes:

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NP1	*North of Phase 1 Landfill*
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P1	*Phase 1*
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Appendix A-1. Monitoring Well Co-ordinates 2021-2022

Station Name	Status	Location		Elevations					Depths				Survey Date	Monitor Class	Area of Landfill	Comments
		Northing (NAD 83)	Easting (NAD 83)	Ground Surface Elevation	Top of Casing Elevation	Top of Piezometer Elevation	Top of Screen Elevation	Bottom of Screen Elevation	Stickup	Borehole Depth Below Ground Surface	Depth to Top of Screen Below Ground Surface	Depth to Bottom of Screen Below Ground Surface		Shallow (S), Intermediate (I), Deep (D)		
		m	m	m ASL	m ASL	m ASL	m ASL	m ASL	m AGL	m BGS	m BGS	m BGS				
VLGW-18-D	Active	5376017.5	466039.7	170.14	170.78	170.61	152.94	141.80	0.47	29.25	17.2	28.34	2008 May	D	P1	Landfill gas well
VLGW-19-D	Active	5376076.2	466054.1	168.80	169.53	169.21	151.60	141.37	0.42	28.34	17.2	27.43	2008 May	I	P1	Landfill gas well
VLGW-20-D	Active	5376131.2	466062.8	167.88	169.05	168.93	148.03	140.76	1.05	28.04	19.85	27.12	2008 May	I	P1	Landfill gas well
VLGW-21-D	Active	5376177.2	466082.0	164.81	165.40	165.30	147.89	140.43	0.49	25.93	16.92	24.38	2008 May	I	P1	Landfill gas well
VLGW-26-D	Active	5376165.6	466022.9	163.94	164.57	164.45	145.50	136.82	0.51	28.04	18.44	27.12	2008 May	D	P1	Landfill gas well
P1	Active	5375732.0	466026.0	157.60	158.17	158.17	151.50	145.41	0.57	12.50	6.10	12.19	2018 Dec	S	P1	Purge well, to replace the old well installed in 2005
P2	Active	5375733.3	466030.9	157.37	158.72	158.62	146.87	132.37	1.25	25.00	10.5	25	2005 Mar	I	P1	Purge well
P3	Active	5375739.0	466056.7	157.25	158.51	158.41	143.18	132.25	1.16	25.00	14.07	25	2005 Mar	I	P1	Purge well
P4	Active	5375751.7	466064.7	157.73	158.88	158.78	146.21	132.73	1.05	25.00	11.52	25	2005 Mar	I	P1	Purge well
P10	Active	5375731.5	466023.5	157.89	N/A	158.01	144.79	129.89	0.12	28.00	13.1	28	2010 October	I	P1	Purge well
VLGW-01-D	Inactive	5375802.0	466040.8	168.25	168.86	168.79	163.25	156.25	0.54	14.00	5.00	12.00	2008 May	I	P1	Landfill gas well
GW-01-1-1	Inactive	5375781.9	465852.0			168.56	-42.00	-44.50	168.56	55.54	42	44.5				
GW-01-1-2	Inactive	5375781.9	465852.0			168.53	-24.40	-24.80	168.53	40.10	24.4	24.8				
GW-01-1-3	Inactive	5375781.9	465852.0			168.53	-13.00	-14.75	168.53	29.53	13	14.75				
GW-01-2-1	Inactive	5375787.9	465859.0			168.25	-4.70	-5.10	168.25	20.50	4.7	5.1				
GW-01-3-1	Inactive	5375791.9	465851.0			167.81	-5.11	-5.91	167.81	21.02	5.11	5.91				
GW-02-1-1	Inactive	5375813.9	465996.0			166.90	-33.00	-33.50	166.90	48.58	33	33.5				
GW-02-1-2	Inactive	5375813.9	465996.0			166.90	-23.00	-24.60	166.90	39.29	23	24.6				
GW-02-1-3	Inactive	5375813.9	465996.0			166.90	-12.20	-13.80	166.90	28.79	12.2	13.8				
GW-02-2-1	Inactive	5375812.9	465990.0			167.14	-6.25	-7.50	167.14	22.53	6.25	7.5				
GW-03-1-1	Inactive	5375684.9	466042.0	147.41	148.21	148.05	122.91	122.21	0.64	26.03	24.5	25.2				
GW-03-1-2	Inactive	5375684.9	466042.0	147.41	148.21	148.05	134.11	133.61	0.64	16.33	13.3	13.8				
GW-03-1-3	Inactive	5375684.9	466042.0	147.41	148.21	148.05	143.41	141.61	0.64	7.03	4	5.8				
GW-03-2-1	Inactive	5375685.5	466037.7	149.20	150.01	149.28	145.15	142.10	0.08	7.10	4.05	7.1	2005 Mar	S	SP1	
GW-04-1-1	Inactive	5375464.0	466171.0	126.67	128.12	128.07	96.47	95.77	1.40	32.00	30.2	30.9				
GW-04-1-2	Inactive	5375464.0	466171.0	126.67	128.12	128.07	104.27	103.67	1.40	24.10	22.4	23				
GW-04-1-3	Inactive	5375464.0	466171.0	126.67	128.12	128.07	116.67	115.07	1.40	11.60	10	11.6				
GW-04-1-4	Inactive	5375464.0	466171.0	126.67	128.12	128.07	122.97	121.27	1.40	6.10	3.7	5.4				
GW-04-2-1	Inactive	5375468.5	466169.3	127.14	127.95	127.86	107.49	104.44	0.75	22.70	19.65	22.70	2005 Mar	I	SP1	Deactivated in 2016.
GW-05-1-1	Inactive	5376444.9	465813.9	126.29	127.49	127.49	112.59	110.59	1.20	16.90	13.7	15.7				
GW-05-1-2	Inactive	5376444.9	465813.9	126.29	127.49	127.49	118.69	116.69	1.20	10.80	7.6	9.6				

Notes:

Datum Description

m BGL	*metres below ground level*
m AGL	*metres above ground level*
m ASL	*metres above mean sea level*

Monitor Class

S	*Shallow well <15 m deep*
I	*Intermediate well between 15 and 30 m deep*
D	*Deep well >30 m deep*

Area of Landfill

SP1	*South of Phase 1 Landfill*
EP1	*East of Phase 1 Landfill*
NP1	*North of Phase 1 Landfill*
NP2	*North of Phase 2 Landfill*
BKGND - WP2	*Background Water Quality West of Phase 2*
HNP	*Hartland North Pad*
P1	*Phase 1*
P2	*Phase 2*

Appendix A-1. Monitoring Well Co-ordinates 2021-2022

Station Name	Status	Location		Elevations					Depths				Survey Date	Monitor Class	Area of Landfill	Comments
		Northing (NAD 83)	Easting (NAD 83)	Ground Surface Elevation	Top of Casing Elevation	Top of Piezometer Elevation	Top of Screen Elevation	Bottom of Screen Elevation	Stickup	Borehole Depth Below Ground Surface	Depth to Top of Screen Below Ground Surface	Depth to Bottom of Screen Below Ground Surface		Shallow (S), Intermediate (I), Deep (D)		
		m	m	m ASL	m ASL	m ASL	m ASL	m ASL	m AGL	m BGS	m BGS	m BGS				
GW-05-1-3	Inactive	5376444.9	465813.9	126.29	127.49	127.49	122.89	121.89	1.20	5.60	3.4	4.4				
GW-05-2-1	Inactive	5376426.9	465774.9	126.00	126.80	126.80	125.20	124.20	0.80	2.60	0.8	1.8				
GW-06-1-1	Inactive	5376148.9	465661.9	127.70	128.41	128.40	107.00	104.90	0.70	23.50	20.7	22.8				
GW-06-1-2	Inactive	5376148.9	465661.9	127.70	128.41	128.40	115.20	113.20	0.70	15.20	12.5	14.5				
GW-06-1-3	Inactive	5376148.9	465661.9	127.70	128.41	128.40	120.80	118.80	0.70	9.60	6.9	8.9				
GW-06-2-1	Inactive	5376151.9	465669.9	127.46	127.76	127.76	125.86	124.86	0.30	2.90	1.6	2.6				
GW-08-1-1	Inactive	5375867.9	465738.0	159.26	160.28	160.26	145.86	143.76	1.00	16.50	13.4	15.5				
GW-08-1-2	Inactive	5375867.9	465738.0	159.26	160.28	160.26	152.11	150.11	1.00	10.15	7.15	9.15				
GW-08-1-3	Inactive	5375867.9	465738.0	159.26	160.28	160.26	156.76	155.76	1.00	4.50	2.5	3.5				
GW-10-1-1	Inactive	5376108.9	465701.9	135.11	135.41	135.41	133.61	132.61	0.30	2.80	1.5	2.5				
GW-11-1-1	Inactive	5376254.9	465770.9	134.13	135.13	135.13	131.23	130.23	1.00	4.90	2.9	3.9				
GW-12-1-0	Inactive	5375701.0	466189.0	143.02	143.82	143.82	N/A	N/A	0.80	3.40	No monitor	No monitor	Historic	S	SP1	Dug well, deactivated in 2010
GW-13-1-1	Inactive	5376166.9	466031.9	150.43	152.73	152.73	121.93	118.93	2.30	33.80	28.5	31.5				
GW-13-1-2	Inactive	5376166.9	466031.9	150.43	152.73	152.73	126.83	125.33	2.30	27.40	23.6	25.1				
GW-14-1-1	Inactive	5375968.9	465969.9	158.73	160.22	160.22	138.53	135.53	1.49	24.69	20.2	23.2				
GW-15-1-1	Inactive	5375754.9	466007.0	159.78	160.82	160.82	145.68	143.38	1.04	17.44	14.1	16.4				
GW-22-1-1	Inactive	5376290.1	465751.7	138.54	138.81	139.86	111.22	109.69	1.32	28.09	27.32	28.85				
GW-23-1-1	Inactive	5376260.7	465718.7	128.37	129.52	129.50	111.51	110.09	1.13	17.57	16.86	18.28				
GW-23-1-2	Inactive	5376260.7	465718.7	128.37	129.52	129.49	124.67	121.80	1.12	5.14	3.7	6.57				
GW-24-1-1	Inactive	5376421.9	465753.0	127.77	128.88	128.88	109.91	108.51	1.11	18.56	17.86	19.26				
GW-24-1-2	Inactive	5376421.9	465753.0	127.77	128.88	128.87	124.10	121.26	1.10	5.09	3.67	6.51				
GW-26-1-1	Inactive	5376319.8	465596.6	128.22	129.16	129.12	109.79	111.20	0.90	17.73	18.43	17.02				
GW-26-1-2	Inactive	5376319.8	465596.6	128.22	129.16	129.12	124.36	121.52	0.90	5.28	3.86	6.7				
GW-32-1-1	Inactive	5376129.7	465569.9	165.41	166.44	166.34	123.85	122.44	0.93	42.27	41.56	42.97				
GW-32-1-2	Inactive	5376129.7	465569.9	165.41	166.44	166.37	157.93	152.04	0.96	10.43	7.48	13.37				
GW-33-1-1	Inactive	5376296.5	465627.4	124.55	123.43	124.54	111.11	109.69	-0.01	14.15	13.44	14.86				
GW-33-1-2	Inactive	5376296.5	465627.4	124.55	123.43		N/A	N/A	-124.55		no monitor	no monitor				
GW-34-1-1	Inactive	5376216.8	465668.4	119.47			104.64	101.64	-119.47		14.83	17.83				
GW-34-2-1	Inactive	5376214.9	465668.9	119.67			115.97	112.97	-119.67		3.7	6.7				
GW-35-1-1	Inactive	5376207.9	465677.3	120.19			108.29	105.29	-120.19		11.9	14.9				
GW-35-1-2	Inactive	5376207.0	465675.9	120.33			117.13	114.13	-120.33		3.2	6.2				

Notes:

Datum Description

m BGL	*metres below ground level*
m AGL	*metres above ground level*
m ASL	*metres above mean sea level*

Monitor Class

S	*Shallow well <15 m deep*
I	*Intermediate well between 15 and 30 m deep*
D	*Deep well >30 m deep*

Area of Landfill

SP1	*South of Phase 1 Landfill*
EP1	*East of Phase 1 Landfill*
NP1	*North of Phase 1 Landfill*
NP2	*North of Phase 2 Landfill*
BKGND - WP2	*Background Water Quality West of Phase 2*
HNP	*Hartland North Pad*
P1	*Phase 1*
P2	*Phase 2*

Appendix A-1. Monitoring Well Co-ordinates 2021-2022

Station Name	Status	Location		Elevations					Depths				Survey Date	Monitor Class	Area of Landfill	Comments
		Northing (NAD 83)	Easting (NAD 83)	Ground Surface Elevation	Top of Casing Elevation	Top of Piezometer Elevation	Top of Screen Elevation	Bottom of Screen Elevation	Stickup	Borehole Depth Below Ground Surface	Depth to Top of Screen Below Ground Surface	Depth to Bottom of Screen Below Ground Surface		Shallow (S), Intermediate (I), Deep (D)		
		m	m	m ASL	m ASL	m ASL	m ASL	m ASL	m AGL	m BGS	m BGS	m BGS				
GW-45-1-1	Inactive	5376163.1	466106.3	162.37			143.71	140.71	-162.37		18.66	21.66				
GW-46-1-1	Inactive	5376078.3	466029.2	170.48	171.65	171.96	140.68	134.68	1.48		29.8	35.8				
GW-47-1-1	Inactive	5375918.3	465992.6	174.85	177.24	177.37	155.09	152.09	2.52	22.55	19.76	22.758	2008 May	I	P1	
GW-49-1-0	Inactive	5376759.5	465218.7	160.00	159.81	159.81	N/A	N/A	-0.19	62.20						
GW-50-1-1	Inactive	5376480.9	466193.4	119.37	120.41	120.43	105.47	102.47	1.06	16.90	13.9	16.9	2005 Mar	I	EP1	
GW-59-1-1	Inactive	5376254.5	465636.2	125.62	126.40	126.40	113.72	112.22	0.78	13.40	11.9	13.4				
GW-64-1-1	Inactive	5375855.0	465849.0	172.00		172.78	156.20	154.50	0.78	17.50	15.8	17.5				
GW-65-1-1	Inactive	5375831.0	465820.0	172.09		172.79	159.79	153.69	0.70	18.40	12.3	18.4				
GW-66-1-1	Inactive	5376088.0	465902.0	164.23		165.08	157.03	150.93	0.85	13.30	7.2	13.3				
GW-67-1-1	Inactive	5376256.2	465774.0	155.85	N/A	157.55	133.95	127.85	1.70	28.00	21.90	28.00	2005 Mar	I	P2	Destroyed. Replaced by GW-82-1-1
GW-67-2-1	Inactive	5376256.2	465774.0	155.85		157.55	133.95	127.85	1.70	28.00	21.9	28	2005 Mar	I	P2	
GW-68-1-1	Inactive	5376353.0	465718.0	141.56		142.74	130.36	124.26	1.18	17.30	11.2	17.3				
GW-68-2-1	Inactive	5376353.0	465718.0	141.56	N/A	142.29	123.76	120.76	0.73	20.80	17.80	20.80	Historic	I	P2	Destroyed. Replaced by GW-83-1-1
GW-69-1-1	Inactive	5376267.6	465665.8	140.64		142.50	127.64	121.54	1.86	19.10	13	19.1	2005 Mar	I	P2	
GW-69-2-1	Inactive	5376269.9	465667.0	140.67		142.11	121.67	115.67	1.44	25.20	19	25	2005 Mar	I	P2	
GW-70-1-1	Inactive	5376019.0	465891.0	167.00		167.59	149.50	143.40	0.59	23.60	17.5	23.6				
GW-74-1-1	Inactive	5376013.4	466018.4	170.94	171.56	171.60	138.04	132.04	0.66	38.90	32.90	38.90	2007 Apr	D	P1	
GW-74-2-1	Inactive	5 376 021.6	466 032.5	170.29	172.25	172.40	153.19	150.19	2.11	20.10	17.10	20.10	2006 Apr	I	P1	Installed during 2005
GW-79-1-1	Inactive	5376522.5	465404.3	182.87	183.63	183.59	147.82	144.77	0.72	39.62	35.05	38.10	2007 Apr	D	NP2	Installed during 2007, decommissioned in May 2018
GW-79-2-1	Inactive	5376521.9	465403.1	182.96	183.69	183.59	157.05	154.00	0.64	30.48	25.91	28.96	2007 Apr	I	NP2	Installed during 2007, decommissioned in May 2018
GW-84-1-1	Inactive	5376225.9	465646.9	158.20	158.86	158.79	120.63	117.58	0.59	27.74	37.565889	40.615889	2009 Feb	I	P2	Installed during 2007
GW-84-2-1	Inactive	5376224.8	465648.5	158.43	159.06	161.36	133.14	130.09	2.93	15.24	25.289839	28.339839	2009 Feb	S	P2	Installed during 2007
GW-86-1-1	Inactive	5376228.4	465651.4	160.55	N/A	N/A	N/A	N/A	N/A	42.98	N/A	N/A	2010 October	D	P2	SG piezo - 42.42 mBGS
GW-86-1-2	Inactive	5376228.4	465651.4	160.55	N/A	N/A	N/A	N/A	N/A	42.98	N/A	N/A	2010 October	I	P2	SG piezo - 20.85 mBGS
GW-86-2-1	Inactive	5376224.8	465651.8	160.55	N/A	N/A	N/A	N/A	N/A	30.78	N/A	N/A	2010 October	D	P2	SG piezo - 29.69 mBGS
GW-86-2-2	Inactive	5376224.8	465651.8	160.55	N/A	N/A	N/A	N/A	N/A	30.78	N/A	N/A	2010 October	I	P2	SG piezo - 8.67 mBGS
P5	Inactive	5375775.2	466079.9	158.35	159.46	159.36	144.43	133.35	1.01	25.00	13.92	25	2005 Mar	I	P1	Purge well
P6	Inactive	5375803.6	466098.0	159.88	161.65	161.55	147.74	134.88	1.67	25.00	12.14	25	2005 Mar	I	P1	Purge well

Notes:

Datum Description

m BGL	*metres below ground level*
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m ASL	*metres above mean sea level*

Monitor Class

S	*Shallow well <15 m deep*
I	*Intermediate well between 15 and 30 m deep*
D	*Deep well >30 m deep*

Area of Landfill

SP1	*South of Phase 1 Landfill*
EP1	*East of Phase 1 Landfill*
NP1	*North of Phase 1 Landfill*
NP2	*North of Phase 2 Landfill*
BKGND - WP2	*Background Water Quality West of Phase 2*
HNP	*Hartland North Pad*
P1	*Phase 1*
P2	*Phase 2*

A2. Groundwater Monitoring Plan

Appendix A-2 - Groundwater Monitoring Plan 2021-2022

Station Name	Status	Pipe Diameter (mm)	Monitored in 2021-2022				Development Method	Sampling Method	Comments
			Groundwater Quality Samples		Groudwater Level Measurements				
			Quarterly (4/yr)	Bi-annual (2/yr)	Manual measurement (4/yr)	Pressure transducer (continuous)			
GW-04-2-1	Active	50			Y		NA	NA	Dedicated submersible pump installed January 2012. Well recharges very slowly since 2014, so it is no longer sampled.
GW-04-3-1	Active	50	Y		Y		footvalve	footvalve	Submersile pump removed. Sampled using waterra in from May 2019 onwards.
GW-04-4-1	Active	50	Y		Y		footvalve	footvalve	
GW-07-1-0	Active	220	Y		Y		well pump	well pump	
GW-09-1-0	Active	150			Y		NA	NA	Sampling discontinued in 2010 due to outdated pump and redundancy. Water levels only.
GW-16-1-1	Active	50		Y	Y		footvalve	footvalve	
GW-16-1-2	Active	50		Y	Y		footvalve	footvalve	
GW-16-2-1	Active	50		Y	Y		footvalve	footvalve	
GW-16-2-2	Active	50		Y	Y		footvalve	footvalve	16-2-2 often dry; difficult to develop and sample. Sometimes use bailer.
GW-17-1-1	Active	50		Y	Y	Y	footvalve	footvalve	Pressure transducer installed in March 2019.
GW-17-1-2	Active	50		Y	Y		footvalve	footvalve	
GW-17-1-3	Active	50		Y	Y		footvalve	footvalve	
GW-18-1-1	Active	50	Y		Y	Y	sample pump	sample pump / footvalve	Dedicated submersible pump installed May 2009. Pump failed in September and November 2018. Waterra tubing from Feb/Mar 2019 onwards. Pressure transducer installed in March 2019.
GW-18-1-2	Active	50			Y		sample pump	sample pump	Pump damaged and stuck in well since 2004. Not sampled, only water levels.
GW-18-2-1	Active	50	Y		Y		footvalve	footvalve	
GW-18-2-2	Active	50	Y		Y		footvalve	footvalve	
GW-19-1-1	Active	50	Y		Y		footvalve	footvalve	19-1-1 sometimes flows artesian.
GW-19-1-2	Active	50	Y		Y		footvalve	footvalve	19-1-2 sometimes flows artesian.
GW-19-2-1	Active	50	Y		Y		footvalve	footvalve	19-2-1 sometimes flows artesian.
GW-19-2-2	Active	50	Y		Y		footvalve	footvalve	
GW-20-1-1	Active	50	Y		Y		sample pump	footvalve	Dedicated submersible pump installed January 2012. Pump ceased functioning in Nov 2019, was removed for repair and is currently sampled using waterra.
GW-20-1-2	Active	50	Y		Y		sample pump	sample pump	Dedicated submersible pump installed January 2012.
GW-21-1-1	Active	50	Y		Y		sample pump	footvalve	Dedicated submersible pump installed January 2012. Pump replaced with waterra.
GW-21-1-2	Active	50	Y		Y		sample pump	sample pump	Dedicated submersible pump installed January 2012.
GW-21-2-1	Active	50	Y		Y		footvalve	footvalve	
GW-21-2-1	Active	50	Y		Y		sample pump	sample pump	Dedicated submersible pump installed January 2012.
GW-25-1-1	Active	50	Y		Y		footvalve	footvalve	
GW-25-1-2	Active	50	Y		Y		footvalve	footvalve	
GW-27-1-1	Active	50	Y		Y		not developed	footvalve	Artesian
GW-27-1-2	Active	50	Y		Y		footvalve	footvalve	27-1-2 almost dry in summer, bailer used occasionally. Went dry after blasting in the Teutle Valley.
GW-28-1-0	Active	150	Y		Y		sample pump	sample pump	Open borehole. Dedicated submersible pump installed January 2011.
GW-29-1-1	Active	50	Y		Y		footvalve	footvalve	
GW-29-1-2	Active	50	Y		Y		footvalve	footvalve	
GW-30-1-1	Active	50	Y		Y		footvalve	footvalve	
GW-30-1-2	Active	50	Y		Y		footvalve	footvalve	30-1-2 almost dry in summer, bailer used occasionally.
GW-31-1-1	Active	50		Y	Y		footvalve	footvalve	
GW-31-1-2	Active	50		Y	Y		footvalve	footvalve	
GW-36-1-1	Active	50				Y	NA	NA	Pressure transducer installed June 1997 records water levels continuously.
GW-36-2-1	Active	50			Y		footvalve	footvalve	
GW-36-3-1	Active	50	Y		Y		footvalve	footvalve	
GW-37-1-1	Active	50				Y	NA	NA	Pressure transducer installed June 1997 records water levels continuously.
GW-37-2-1	Active	50			Y		footvalve	footvalve	
GW-37-3-1	Active	50	Y		Y		footvalve	footvalve	
GW-38-1-1	Active	50	Y		Y		footvalve	footvalve	
GW-39-1-1	Active	50	Y		Y		footvalve	footvalve	
GW-39-2-1	Active	50	Y		Y		sample pump	sample pump	Dedicated submersible pump installed January 2011.
GW-40-1-1	Active	50	Y		Y	Y	footvalve	footvalve	Pressure transducer installed in September 2008 records water levels continuously. Can be removed as required for sampling.
GW-41-1-1	Active	50	Y		Y	Y	footvalve	footvalve	Pressure transducer installed in May 2018.
GW-42-1-1	Active	50	Y		Y		footvalve	footvalve	
GW-43-1-1	Active	50	Y		Y	Y	footvalve	footvalve	Pressure transducer installed in May 2018.
GW-44-1-1	Active	50	Y		Y	Y	footvalve	footvalve	Pressure transducer installed in May 2018.
GW-46-2-1	Active	50			Y		NA	NA	
GW-46-3-1	Active	50			Y		NA	NA	
GW-46-4-1	Active	50			Y		NA	NA	
GW-47-2-1	Active	50			Y		NA	NA	
GW-48-2-1	Active	50			Y		NA	NA	
GW-50-1-1	Active	50			Y		footvalve	NA	Deactivated in from sampling program September 2012 due to poor recharge. Now only monitored for water level.
GW-51-1-1	Active	50		Y	Y		footvalve	footvalve	
GW-51-2-1	Active	50		Y	Y		footvalve	footvalve	
GW-51-3-1	Active	50		Y	Y		footvalve	footvalve	
GW-52-1-1	Active	50	Y		Y	Y	footvalve	footvalve	Pressure transducer installed in 2018
GW-52-2-0	Active	150			Y		NA	NA	
GW-52-3-0 (P52)	Active	150				Y	NA	NA	Pressure transducer records water levels continuously.
GW-52-4-0 (P7)	Active	250	Y			Y	NA	spigot	Pressure transducer installed. Purge well in conjunction with 80-1-0-P8. Pressure transducer records water levels continuously. Sampling spigot installed in 2016.
GW-53-1-1	Active	50	Y		Y		footvalve	footvalve	
GW-54-1-1	Active	50			Y	Y	sample pump	sample pump	Dedicated submersible pump installed January 2012. Sampling discontinued in 2016. Water levels only. Pressure transducer installed in March 2019.
GW-54-2-1	Active	50			Y		footvalve	footvalve	Water levels only.
GW-54-3-1	Active	50			Y		footvalve	footvalve	Water levels only.
GW-55-1-1	Active	50		Y	Y		footvalve	footvalve	
GW-56-1-1	Active	50	Y		Y		footvalve	footvalve	
GW-57-1-1	Active	50		Y	Y		footvalve	footvalve	
GW-58-1-0	Active	150	Y		Y		sample pump	sample pump	Dedicated submersible pump reinstalled after Phase 2 Cell one closure in October 2012. This well is an 8" diameter borehole.
GW-60-1-1	Active	50	Y		Y		footvalve	footvalve	
GW-60-2-1	Active	50	Y		Y		footvalve	footvalve	
GW-60-3-1	Active	50	Y		Y		footvalve	footvalve	
GW-61-1-1	Active	150			Y		NA	NA	Borehole
GW-62-1-1	Active	50		Y	Y	Y	sample pump	sample pump	Portable pressure transducer installed January 2012 - records water levels every three hours. Dedicated submersible pump installed January 2012.
GW-62-2-1	Active	50		Y	Y		footvalve	footvalve	
GW-63-1-1	Active	50		Y	Y		sample pump	sample pump	Dedicated submersible pump installed January 2011.
GW-63-2-1	Active	50		Y	Y		footvalve	footvalve	

Notes:
Footvalves are 16 mm (5/8") unless otherwise noted.
NA - Not Available or Not Applicable.

Appendix A-2 - Groundwater Monitoring Plan 2021-2022

Station Name	Status	Pipe Diameter (mm)	Monitored in 2021-2022				Development Method	Sampling Method	Comments
			Groundwater Quality Samples		Groudwater Level Measurements				
			Quarterly (4/yr)	Bi-annual (2/yr)	Manual measurement (4/yr)	Pressure transducer (continuous)			
GW-71-1-1	Active	50	Y		Y		sample pump	sample pump	Dedicated submersible pump installed January 2012 has malfunctioned.
GW-71-2-1	Active	50	Y		Y		sample pump	footvalve	Dedicated submersible pump installed January 2012.
GW-71-3-1	Active	50	Y		Y		footvalve	footvalve	
GW-72-1-1	Active	50	Y		Y		sample pump	sample pump	Dedicated submersible pump installed January 2012.
GW-72-2-1	Active	50			Y		footvalve	footvalve	Well has been recharging very slowly since 2014, so it is no longer sampled. Water levels only.
GW-72-3-1	Active	50	Y		Y		footvalve	footvalve	
GW-73-1-1	Active	50	Y		Y		sample pump	sample pump	Dedicated submersible pump installed January 2012.
GW-73-2-1	Active	50	Y		Y		sample pump	sample pump	Dedicated submersible pump installed January 2012.
GW-73-3-1	Active	50	Y		Y		footvalve	footvalve	
GW-74-2-1	Active	50			Y		NA	NA	
GW-75-1-1	Active	50			Y		NA	NA	
GW-76-1-1	Active	50			Y	Y	sample pump	sample pump	Dedicated submersible pump installed January 2010. Sampling discontinued in 2016. Water levels only. Pressure transducer installed in March 2019.
GW-76-2-1	Active	50			Y		sample pump	sample pump	Sampling discontinued in 2016. Water levels only. Dedicated submersible pump installed January 2012.
GW-76-3-1	Active	50			Y		footvalve	footvalve	Sampling discontinued in 2016. Water levels only.
GW-77-1-1	Active	50		Y	Y	Y	footvalve	footvalve	Portable pressure transducer installed January 2012 - records water levels every three hours. Dedicated submersible pump installed. Pump failed in 2020, replaced by waterra tubing.
GW-77-2-1	Active	50		Y	Y		footvalve	footvalve	
GW-78-1-1	Active	50		Y	Y	Y	footvalve	footvalve	Portable pressure transducer installed January 2012 - records water levels every three hours.
GW-78-2-1	Active	50		Y	Y		footvalve	footvalve	
GW-80-1-0 (P8)	Active	NA	Y		Y	Y	sample pump	spigot	Pressure transducer installed. Purge well in conjunction with 52-4-0-P7. Pressure transducer records water levels continuously. Sampling spigot installed in 2016.
GW-81-1-0 (P9)	Active	NA	Y		Y	Y	NA	bailer	Borehole. Pressure transducer installed in 2018.
GW-82-1-1	Active	50			Y		NA	NA	
GW-83-1-1	Active	50			Y		NA	NA	
GW-85-1-1	Active	50	Y		Y		footvalve	footvalve	
GW-87-1-1	Active	50		Y	Y	Y	footvalve	sample pump	Well drilled in December 2014. Dedicated submersible pump (GeoTech) installed in February 2015. Pressure transducer installed March 2016.
GW-87-2-1	Active	50		Y	Y	Y	footvalve	waterra	Well drilled in December 2014. Pressure transducer installed in March 2016.
GW-88-1-1	Active	50		Y	Y	Y	footvalve	waterra	Well drilled in December 2014. Dedicated submersible pump (GeoTech) installed in February 2015 but replaced with waterra tubing after malfunctioning in 2016. Pressure transducer installed March 2016.
GW-88-2-1	Active	50		Y	Y	Y	footvalve	waterra	Well drilled in December 2014. Pressure transducer installed in March 2016.
GW-89-1-1	Active	50			Y	Y	NA	NA	Well drilled in Dec 2018. Pressure transducer installed in March 2019
GW-89-2-1	Active	50			Y	Y	NA	NA	Well drilled in Dec 2018. Pressure transducer installed in March 2019
GW-91-1-1	Active	50	Y		Y	Y	Waterra	Waterra	Well drilled in Dec 2019. Pressure transducer installed in March 2020
GW-92-1-1	Active	50	Y		Y	Y	Waterra	Waterra	Well drilled in Dec 2019. Pressure transducer installed in March 2020
GW-93-1-1	Active	50	Y		Y	Y	Waterra	Waterra	Well drilled in Dec 2019. Pressure transducer was installed in March 2020, and removed in Feb 2021. Well has been extended due to aggregate storage in the area.
GW-94-1-1	Active	50	Y		Y	Y	Waterra	Waterra	Well drilled in Dec 2019. Pressure transducer installed in March 2020
P1	Active	NA	Y			Y	NA	spigot	Pressure transducer installed. QED bladder pumps installed and pressure transducer records water levels continuously. Second bladder pump installed April 2013. Electric submersible pump installed 14-May-2015.
P10	Active	NA	Y			Y	NA	spigot	Pressure transducer installed. QED bladder pumps installed and pressure transducer records water levels continuously.
P2	Active	NA	Y			Y	NA	spigot	Pressure transducer installed. QED bladder pumps installed and pressure transducer records water levels continuously.
P3	Active	NA	Y			Y	NA	spigot	Pressure transducer installed. QED bladder pumps installed and pressure transducer records water levels continuously.
P4	Active	NA	Y			Y	NA	spigot	Pressure transducer installed. QED bladder pumps installed and pressure transducer records water levels continuously.
VLGW002D	Active	NA			Y		NA	NA	
VLGW003D	Active	NA			Y		NA	NA	
VLGW004D	Active	NA			Y		NA	NA	
VLGW008D	Active	NA			Y		NA	NA	
VLGW011S	Active	NA			Y		NA	NA	
VLGW015D	Active	NA			Y		NA	NA	
VLGW016D	Active	NA			Y		NA	NA	
VLGW017D	Active	NA			Y		NA	NA	
VLGW018D	Active	NA			Y		NA	NA	
VLGW019D	Active	NA			Y		NA	NA	
VLGW021D	Active	NA			Y		NA	NA	
VLGW026D	Active	NA			Y		NA	NA	
VLGW020D	Inactive	NA			Y		NA	NA	Became obstructed in 2021
GW-01-1-1	Inactive	20							Site destroyed.
GW-01-1-2	Inactive	20							
GW-01-1-3	Inactive	20							
GW-01-2-1	Inactive	20							
GW-01-3-1	Inactive	20							
GW-02-1-1	Inactive	20							Site destroyed
GW-02-1-2	Inactive	20							
GW-02-1-3	Inactive	20							
GW-02-2-1	Inactive	20							
GW-03-1-1	Inactive	20							Deactivated at end of 1998, replaced by well 60-1-1.
GW-03-1-2	Inactive	20							Deactivated at end of 1998, replaced by well 60-2-1.
GW-03-1-3	Inactive	20							Deactivated at end of 1998, replaced by well 60-3-1.
GW-03-2-1	Inactive	50							Destroyed and replaced with 85-1-1 in March 2009.
GW-04-1-1	Inactive	20							Deactivated at end of 1998, replaced by new 04-2-1.
GW-04-1-2	Inactive	20							Deactivated at end of 1998, replaced by well 04-3-1.
GW-04-1-3	Inactive	20							Deactivated at end of 1998, replaced by well 04-4-1.
GW-04-1-4	Inactive	40							Deactivated during 1998, failed to recharge after purging.
GW-04-2-1	Inactive	50	Y		Y		sample pump	sample pump	Dedicated submersible pump installed January 2012. Sampling discontinued due to very slow recharge rate.
GW-05-1-1	Inactive	20							Site destroyed during construction of Phase 2 lagoon
GW-05-1-2	Inactive	20							
GW-05-1-3	Inactive	20							
GW-05-2-1	Inactive	20							
GW-06-1-1	Inactive	20							Site destroyed during dike contruction in interim filling area.
GW-06-1-2	Inactive	20							
GW-06-1-3	Inactive	20							
GW-06-2-1	Inactive	20							
GW-08-1-1	Inactive	20							Site destroyed
GW-08-1-2	Inactive	20							
GW-08-1-3	Inactive	20							
GW-10-1-1	Inactive	20							Site destroyed
GW-11-1-1	Inactive	20							Site destroyed
GW-12-1-0	Inactive	220							Deactivated in 2010.

Notes:
Footvalves are 16 mm (5/8") unless otherwise noted.
NA - Not Available or Not Applicable.

Appendix A-2 - Groundwater Monitoring Plan 2021-2022

Station Name	Status	Pipe Diameter (mm)	Monitored in 2021-2022				Development Method	Sampling Method	Comments
			Groundwater Quality Samples		Groudwater Level Measurements				
			Quarterly (4/yr)	Bi-annual (2/yr)	Manual measurement (4/yr)	Pressure transducer (continuous)			
GW-13-1-1	Inactive	50							Site destroyed
GW-13-1-2	Inactive	50							
GW-14-1-1	Inactive	50							Site destroyed
GW-15-1-1	Inactive	50							Site destroyed
GW-22-1-1	Inactive	50							Destroyed during expansion of interim composting area.
GW-23-1-1	Inactive	50							Site destroyed in November 1994
GW-23-1-2	Inactive	50							
GW-24-1-1	Inactive	50							Site destroyed during construction of Phase 2 lagoon
GW-24-1-2	Inactive	50							
GW-26-1-1	Inactive	50							Site destroyed in August 1994
GW-26-1-2	Inactive	50							
GW-32-1-1	Inactive	50							Site destroyed in October 1997
GW-32-1-2	Inactive	50							Site destroyed in October 1997
GW-33-1-1	Inactive	50							Deactivated in August 1992.
GW-33-1-2	Inactive	50							
GW-34-1-1	Inactive	50							Site destroyed in August 1994
GW-34-2-1	Inactive	50							
GW-35-1-1	Inactive	50							Site destroyed in August 1994
GW-35-1-2	Inactive	50							
GW-45-1-1	Inactive	50							Site destroyed.
GW-46-1-1	Inactive	50							Deactivated in June 1999.
GW-47-1-1	Inactive	50							Deactivated in December 2012.
GW-48-1-1	Inactive	50					NA	NA	Obstructed. Unable to measure groundwater level.
GW-49-1-0	Inactive	50							Deactived in June 2005.
GW-59-1-1	Inactive	50							Destroyed Feb 2005 by Phase 2 construction.
GW-64-1-1	Inactive	50							Destroyed by interim fill area construction in 2003.
GW-65-1-1	Inactive	50							Destroyed by interim fill area construction in 2003.
GW-66-1-1	Inactive	50							Destroyed by interim fill area construction in 2003.
GW-67-1-1	Inactive	50							Destroyed. Replaced by GW-82-1-1
GW-67-2-1	Inactive	50							Destroyed. Replaced by GW-82-1-1
GW-68-1-1	Inactive	50							Destroyed. Replaced by GW-83-1-1
GW-68-2-1	Inactive	50							Destroyed. Replaced by GW-83-1-1
GW-69-1-1	Inactive	50							Destroyed July 2006 during construction on active face
GW-69-2-1	Inactive	50							Destroyed July 2006 during construction on active face
GW-70-1-1	Inactive	50							Destroyed by interim fill area construction in 2003.
GW-74-1-1	Inactive	50			Y		NA	NA	Decommissioned
GW-79-1-1	Inactive	50					sample pump	sample pump	Well decommissioned in May 2018 due to blasting in vicinity.
GW-79-2-1	Inactive	50					footvalve	footvalve	Well decommissioned in May 2018 due to blasting in vicinity.
GW-84-1-1	Inactive	50							Destroyed spring 2009. Recorded continuous water levels until April 2012. No longer functioning. Cannot be repaired because it's buried in garbage.
GW-84-2-1	Inactive	50							Destroyed spring 2009. Recorded continuous water levels until April 2012. No longer functioning. Cannot be repaired because it's buried in garbage.
GW-90-1-1	Inactive	50					NA	NA	Well drilled in Oct 2019. No water levels taken in well due to high landfill gas concentrations in area.
GW-90-2-1	Inactive	50					NA	NA	Well drilled in Dec 2018. No water levels taken in well since Oct 2019 due to high landfill gas concentrations in area.
T-86-1-1	Inactive	NA							
T-86-1-2	Inactive	NA			Y	Y	NA	NA	Pressure transducer installed October 2010. Well replaces GW-84-1-1 & GW-84-2-1. Pressure transducer records water levels continuously. No longer functioning.
T-86-2-1	Inactive	NA			Y	Y	NA	NA	Pressure transducer installed October 2010. Well replaces GW-84-1-1 & GW-84-2-1. Pressure transducer records water levels continuously. No longer functioning.
T-86-2-2	Inactive	NA			Y	Y	NA	NA	Pressure transducer installed October 2010. Well replaces GW-84-1-1 & GW-84-2-1. Pressure transducer records water levels continuously. No longer functioning.
VLGW001D	Inactive	NA					NA	NA	Well is obstructed. No water level measurements were taken in 2018-2019

Notes:
Footvalves are 16 mm (5/8") unless otherwise noted.
NA - Not Available or Not Applicable.

A3. Groundwater Elevations

Appendix A-3 - Groundwater Elevations 2021-2022

Groundwater Level Elevations (mASL)				
Station	Q2	Q3	Q4	Q1
	April 28, 2021 to April 30, 2021	September 1, 2021 to September 3, 2021	October 27, 2021 to October 28, 2021	February 2, 2022 to February 4, 2022
04-2-1	126.79	124.97	126.57	127.24
04-3-1	124.31	122.62	124.53	124.56
04-4-1	125.23	123.64	125.72	125.41
07-1-0	141.49	140.66	141.60	141.70
09-1-0	146.14	143.74	147.09	146.44
16-1-1	129.47	126.22	131.48	131.82
16-1-2	129.74	126.46	131.85	132.16
16-2-1	130.29	128.28	132.28	132.68
16-2-2	130.19	128.22	132.27	132.67
17-1-1	143.89	141.92	142.83	145.95
17-1-2	143.89	141.93	142.84	145.95
17-1-3	145.03	142.92	144.79	146.32
18-1-1	150.46	148.83	150.05	152.64
18-1-2	---	---	149.89	152.52
18-2-1	159.66	158.50	161.89	161.96
18-2-2	159.84	158.62	161.98	161.96
19-1-1	132.65	130.80	133.54	133.54
19-1-2	133.24	131.68	133.66	133.66
19-2-1	133.19	131.56	133.19	133.19
19-2-2	132.74	129.66	132.69	132.84
20-1-1	109.72	108.76	109.86	109.93
20-1-2	109.60	108.66	109.73	109.70
21-1-1	110.35	109.24	110.56	110.34
21-1-2	109.81	108.83	109.97	109.94
21-2-1	109.82	108.83	109.98	109.97
25-1-1	125.07	123.67	125.01	125.76
25-1-2	126.58	125.13	126.58	126.59
27-1-1	142.04	142.04	142.04	139.24
27-1-2	139.41	138.96	140.40	138.99
28-1-0	119.01	118.86	119.13	119.54
29-1-1	112.08	110.88	112.61	112.20
29-1-2	112.18	110.97	112.63	112.28
30-1-1	105.78	104.33	---	106.20
30-1-2	106.52	105.77	---	107.21
31-1-1	104.39	103.13	104.79	104.80
31-1-2	104.23	103.15	104.93	104.64
36-1-1	123.82	124.82	124.93	124.46
36-2-1	122.17	121.15	122.60	123.97
36-3-1	122.87	120.93	123.71	123.85
37-1-1	124.49	125.49	124.81	126.05
37-2-1	121.77	120.52	122.17	123.75
37-3-1	124.09	122.47	124.63	125.47
38-1-1	119.56	119.42	119.62	120.19
39-1-1	119.72	119.31	120.07	120.97
39-2-1	119.56	119.42	119.68	120.08
40-1-1	117.10	118.10	118.39	117.43
41-1-1	147.34	146.96	147.43	147.43
42-1-1	137.67	137.00	137.73	137.79
43-1-1	157.99	157.05	158.19	158.28
44-1-1	160.11	159.11	160.25	160.32
46-2-1	155.98	155.67	156.02	156.29
46-3-1	154.03	151.68	151.67	152.11
46-4-1	---	---	149.36	---
47-2-1	151.99	151.98	151.90	152.19
48-2-1	149.10	148.25	148.30	151.22
50-1-1	115.62	112.41	113.46	118.41
51-1-1	109.95	108.48	110.17	110.08
51-2-1	110.08	108.53	110.41	110.30
51-3-1	110.13	108.54	110.49	110.38
52-1-1	117.59	117.00	117.36	117.72
52-2-0	118.00	117.33	117.89	118.14
52-3-0 (P52)	116.15	116.15	116.61	116.36
52-4-0 (P7)	112.04	112.04	111.0-113.0	111.97
53-1-1	120.61	120.18	120.84	120.18
54-1-1	149.56	146.86	147.87	150.32
54-2-1	149.10	146.58	147.45	149.86
54-3-1	149.11	147.00	147.71	150.05
55-1-1	142.11	140.22	141.74	143.14

Notes:

Bracketed data on bottom of well.

--- - Not measured

Appendix A-3 - Groundwater Elevations 2021-2022

Groundwater Level Elevations (mASL)				
Station	Q2	Q3	Q4	Q1
	April 28, 2021 to April 30, 2021	September 1, 2021 to September 3, 2021	October 27, 2021 to October 28, 2021	February 2, 2022 to February 4, 2022
56-1-1	143.74	142.12	145.26	144.96
57-1-1	129.35	124.79	129.40	129.86
58-1-0	127.32	125.35	128.40	128.57
60-1-1	141.56	140.76	141.58	141.76
60-2-1	141.58	140.82	141.60	141.82
60-3-1	141.20	140.31	141.59	141.34
61-1-1	183.89	182.98	184.68	184.84
62-1-1	171.77	168.11	170.94	173.39
62-2-1	171.76	168.11	170.93	173.38
63-1-1	190.57	188.60	190.87	192.09
63-2-1	191.84	190.44	192.95	193.83
71-1-1	141.47	140.29	141.44	141.88
71-2-1	141.63	140.49	141.72	142.02
71-3-1	141.65	140.48	141.74	142.03
72-1-1	141.43	140.56	141.59	141.67
72-2-1	141.67	140.92	141.46	141.88
72-3-1	141.57	140.84	141.89	141.86
73-1-1	133.18	130.97	133.31	133.96
73-2-1	133.24	131.04	133.40	134.01
73-3-1	132.73	130.61	132.87	133.00
74-2-1	152.29	152.23	152.13	152.10
75-1-1	129.33	128.16	127.99	130.18
76-1-1	157.29	155.30	156.14	159.44
76-2-1	160.20	158.42	159.73	162.08
76-3-1	162.33	160.61	161.84	164.09
77-1-1	155.41	153.70	155.66	155.66
77-2-1	154.13	152.48	154.47	154.40
78-1-1	131.27	128.76	131.10	132.69
78-2-1	134.81	133.61	135.13	135.49
80-1-0 (P8)	113.42	114.42	113.0-113.7	113.36
81-1-0 (P9)	116.09	115.78	116.23	116.40
82-1-1	132.85	132.82	132.85	132.81
83-1-1	126.86	126.80	127.36	127.54
85-1-1	145.34	144.86	145.68	145.54
87-1-1	173.01	166.56	167.53	182.91
87-2-1	173.08	166.54	167.49	180.32
88-1-1	171.21	167.63	169.98	172.72
88-2-1	171.32	167.57	169.87	173.45
89-1-1	151.74	153.66	150.63	152.60
89-2-1	150.20	149.67	149.66	149.48
90-1-1	---	---	---	---
90-2-1	---	---	---	---
91-1-1	159.84	158.47	160.38	160.07
92-1-1	161.24	160.53	161.41	160.93
93-1-1	174.57	175.57	154.32	156.24
94-1-1	195.93	180.66	190.36	200.27
LG-02-D	148.72	148.09	148.07	151.14
LG-03-D	149.82	147.80	149.80	150.88
LG-04-D	157.13	157.21	157.13	157.09
LG-08-D	146.22	143.13	143.39	148.70
LG-11-S	155.55	155.55	155.55	155.55
LG-15-D	148.54	148.24	148.25	151.14
LG-16-D	149.79	149.40	149.35	151.06
LG-17-D	158.11	150.15	149.56	151.23
LG-18-D	150.92	150.48	150.14	150.18
LG-19-D	150.52	150.41	150.37	149.95
LG-21-D	145.59	142.43	142.34	142.52
LG-26-D	144.49	144.51	144.54	144.45

Notes:

Bracketed data on bottom of well.

--- - Not measured

A4. Surface Water Station Details

Appendix A-4. Surface Water Station Details 2021-2022

Station Name	Location		Status	Parameter List		Comments
	Northing	Easting		Routine		
	UTM (NAD83)	UTM (NAD83)		(4/yr)	(2/yr)	
Sw-N-05	5 376 534.511	465 729.384	Active	Y		Heal Creek - 40m from perimeter fence line
Sw-N-14	5 376 795.252	466 228.944	Active		Y	Heal Creek 2/3 of the way from the Northeast Diversion Ditch to Durrance Creek.
Sw-N-16	5 376 506.808	465 968.695	Active	Y		North Wetland at dischage of Weir SF5 into North Wetland Creek, just above confluence with Heal Creek.
Sw-N-17	5 376 566.303	465 903.628	Active	Y		Heal Creek below confluence with 42 Creek and above confluence with North Wetland Creek.
Sw-N-18	5 376 429.846	465 679.709	Active	Y		Northwest Diversion Ditch at discharge to Northwest Sedimentation Pond.
Sw-N-19	5 376 423.322	466 040.279	Active	Y		Northeast Diversion Ditch below Northeast Sedimentation Pond, just above discharge into North Wetland.
Sw-N-41s1	5 376 892.202	465 171.078	Active	Y		41 Creek at north side of Willis Point Road, near source.
Sw-N-41s3	5 377 102.438	465 021.226	Active	Y		41 Creek just above discharge to Durrance Lake.
Sw-N-42s1	5 376 753.436	465 553.804	Active	Y		42 Creek at discharge from 42 Wetland below southeast end of Yardwaste Pad. Across Willis Point Road from Well 42.
Sw-N-45	5 376 605.647	465 797.403	Active	Y		Heal Creek just above confluence with 42 Creek.
Sw-N-50	5 376 353.361	465 438.872	Active	Y		Toutle Valley break out.
Sw-N-51	5 376 323.976	465 444.733	Active	Y		NW diversion ditch just above confluence with Toutle Valley break out.
Sw-N-53	5 376 456.000	465 693.000	Active	Y		Drainage from High Level Road North Diversion Ditch to Northwest Sedimentation Pond.
Sw-N-54	5 376 438.000	465 713.000	Active	Y		Runoff from northeast face of Phase 2 and Phase 2 Cell 1 closure into Northwest Sedimentation Pond. Replaced Sw-N-47.
Sw-N-CSs2	5 376 933.072	464 896.583	Active		Y	Control station on south side of Willis Point Rd at ephemeral stream and culvert 300 m west of Yardwaste gate.
Sw-S-03	5 375 637.813	466 077.533	Active	Y		Kilarney Creek at culvert discharging from underneath Recycle Road.
Sw-S-04	5 375 447.329	466 171.246	Active	Y		Kilarney Creek below confluence with Southwest Diversion Ditch.
Sw-S-12	5 375 661.074	465 954.884	Active	Y		At the discharge of Weir SF2, upstream of Killarney Creek.
Sw-S-20	5 375 607.030	465 945.921	Active		Y	At the discharge of Weir SF3, in the Southwest Diversion Ditch where it converges with the South High Level Road.
Sw-S-21	5 375 419.559	466 150.441	Active	Y		Southwest Diversion Ditch just above confluence with Kilarney Creek.
Sw-S-24	5 375 553.049	466 179.487	Active	Y		Kilarney Creek just above confluence with Bike Trail Kiosk Creek and below confluence with Southeast Storm Drain.
Sw-S-27	5 375 591.468	466 163.597	Active	Y		Southeast Storm Drain just above confluence with Kilarney Creek.
Sw-S-52	5 376 059.905	465 472.066	Active		Y	Creek from Mt. Work before entering culvert draining to South Diversion Ditch.
Sw-N-06	5 376 669.740	466 024.406	Inactive	n/a		Heal Creek - East side of access road approximately 600m from entrace of rifle range. Discontinued: same channel morphology and water quality as SW-14 (no additional inputs between the two stations.
Sw-N-07	5 377 209.377	466 814.510	Inactive	n/a		Durrance Creek - on private property approximately 100m due west of Wallace Drive, 1km north of Willis Pt Road intersection. DISCONTINUED IN JUNE 2015 DUE TO SAFETY HAZARD (dilapidated bridge).
Sw-N-07A	5 377 096.940	466 527.760	Inactive	n/a		Intended to replace 07 but water quality differed significantly so station discontinued.
Sw-N-08	5 377 837.095	467 019.461	Inactive	n/a		Todd Creek on west side of road approximately 2km north of Willis Pt Road intersection
Sw-N-09	5 377 174.427	466 865.131	Inactive	n/a		Todd Creek below confluence with Durrance Creek. Just below Durrance Road bridge.
Sw-N-15	5 377 109.531	465 982.354	Inactive	n/a		Durrance Creek well above confluence with Heal Creek.
Sw-N-41s0	5 376 810.000	465 232.000	Inactive	n/a		41 Creek at source where pipe dischages from Yardwaste Pad. Near gate on access road of Willis Point Road.
Sw-N-41s2	5 376 955.866	465 105.992	Inactive	n/a		41 Creek at discharge from wetland located part way down creek.
Sw-N-41s4	5 377 189.115	465 130.141	Inactive	Y		Discharge from Durrance Lake.
Sw-N-41s5	5 377 478.219	464 471.090	Inactive	n/a		West end of Durrance Lake near where stream enters west end of lake.
Sw-N-41s6	5 377 236.090	464 906.330	Inactive	n/a		Creek / culvert entering Durrance Lake from north side 1/3 of the way from the west end (linlet) to the east end (outlet). Discontinued due to high traffic area and liklihood of contamination from recreational activities.
Sw-N-41s7	5 377 416.510	464 790.110	Inactive	n/a		Creek / culvert entering Durrance Lake from north side near west end entrance of parking lot.
Sw-N-43	5 376 636.303	465 804.994	Inactive	n/a		42 Creek just above confluence with Heal Creek.
Sw-N-46	5 376 500.000	465 700.000	Inactive	n/a		Discharge channel from Northwest Sedimentation Pond.
SW-N-47	5 376 438.000	465 713.000	Inactive	n/a		Runoff from northeast face of Phase 2 into Northwest Sedimentation Pond. Replaced by Sw-N-54.
Sw-N-48	5 376 354.000	466 031.000	Inactive	n/a		Northeast Diversion Ditch at entry into Northeast Sedimentation Pond.
Sw-N-CSs1	5 377 280.000	464 570.000	Inactive	n/a		Control station at pond on north side of Willis Point Rd 800 m west of Yardwaste gate. Drains into southeast side of Durrrance Lake.
Sw-S-10	5 375 090.830	466 377.540	Inactive	n/a		Kilarney Lake, near outlet
Sw-S-11	5 375 258.558	466 213.279	Inactive	n/a		Kilarney Creek just above entrance into northwest end of Kilarney Lake.
Sw-S-13	5 375 660.000	466 060.000	Inactive	n/a		Old wash down area septic tank in current yardwaste drop off area.
Sw-S-22	5 375 307.180	466 327.650	Inactive	n/a		Stream entering northeast end of Kilarney Lake.
Sw-S-23	5 375 469.346	466 151.441	Inactive	n/a		Kilarney Creek just above confluence with Southwest Diversion Ditch. Discontinued due to water quality similarities to SW-S-25 and close proximity to SW-S-03
Sw-S-25	5 375 574.866	466 158.314	Inactive	n/a		Kilarney Creek just above confluence with Southeast Storm Drain. Discontinued due to proximity and simlarity to SW-S-23.
Sw-S-26	5 375 554.010	466 181.970	Inactive	n/a		Bike Trail Kiosk Creek just above confluence with Kilarney Creek.
Sw-S-28	5 375 626.640	466 172.100	Inactive	n/a		07 Creek just above confluence with Southeast Storm Drain.
Sw-S-29	5 375 645.480	466 159.040	Inactive	n/a		Southeast Storm Drain above confluence with 07 Creek, where culvert dischages after crossing under East Hydro Road near well site 60.
Sw-S-30	5 375 651.511	465 914.193	Inactive	n/a		Southwest Diversion Ditch just above confluence with High Level Road South Diversion Ditch.
Sw-S-31	5 375 887.490	465 662.951	Inactive	n/a		Base of High Level Road South Diversion Ditch, sampled at the grate.

AECOM

Appendix B

Water Quality Data

- B1. Groundwater Quality Data
- B2. Domestic Well Quality
- B3. Surface Water Quality
- B4. Monthly Leachate Quality Data – Hartland Valve Chamber
- B5. Quarterly Leachate Quality – Trace Organics
- B6. Monthly Leachate Quality – Phase 2 Cleanout
- B7. Monthly Leachate Quality – North Purge Well
- B8. Monthly Leachate Quality – Controlled Waste Drainage
- B9. Monthly Leachate Quality – South Purge Wells
- B10. Monthly Leachate Quality – West Face Drainage
- B11. Monthly Leachate Quality - Cell 3 Pipe Outlet
- B12. Monthly Leachate Quality Emerging Contaminant

B1. Groundwater Quality Data

BC CSR				a AW Maximum (1)	---	---	---	---		---	90	50	10000	2 (9)	---	12000	0.5-4 (5)	---	1500	90 (7)	40	20-90 (5)	---	40-160 (5)	---	---
				b DW Maximum (2)	---	---	---	---		9500	6	10	1000	8	---	5000	5	---	250	6000	14 (9)	1500	--- (6)	10	33 (9)	---
Station	Sample Type	Compliance Well (Y/N?)	Date Sampled	Parameter	PH (Field)	Specific Conductivity - 25°C (Field)	Temperature (Field)	Alkalinity	Hardness as CaCO3	Aluminum	Antimony	Arsenic	Barium	Beryllium	Bismuth	Boron	Cadmium	Calcium	Chloride	Chromium	Cobalt	Copper	Iron	Lead	Lithium	Magnesium
				Fraction	TOT	TOT	TOT	TOT	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS
				Unit	pH	µS/cm	°C	mg/L	mg/L	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	mg/L	mg/L	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	mg/l
				Method Detection Limit	0.1	1	0.1	1	0.5	0.5	0.02	0.02	0.02	0.01	0.005	10	0.005	0.05	1	0.1	0.005	0.05	1	0.005	0.5	0.05
04-3-1	SS	Y	2021-05-05	Clear and colourless	8.03	330	10.5	150	208	0.92	0.072	0.249	48.3	< 0.01	< 0.005	79.	0.029 2	68.4	23.	< 0.1	0.0448	0.366	< 1.	0.067 8	0.75	9.
04-3-1	SS		2021-09-09	Clear and colourless	7.82	338	10.6	170	210	4.67	0.079	0.225	33.	< 0.01	< 0.005	78.	0.028 7	70.1	23.	< 0.1	0.053 8	0.27	2.5	0.048 3	0.57	8.48
04-3-1	SS		2021-11-03	Clear and colourless	7.99	327	10	170	200	25.6	0.059	0.172	26.6	< 0.01	< 0.005	82.	0.034	67.5	24.	< 0.1	0.090 6	0.328	47.9	0.105	0.51	7.7
04-3-1	SS		2022-03-02	Clear and colourless	6.78	322	9	170	209	2.26	0.068	0.236	38.8	< 0.01	< 0.005	72.	0.028 1	69.8	23.	< 0.1	0.043 4	0.399	1.5	0.039 2	0.67	8.52
04-4-1	SS	Y	2021-05-05	Clear and colourless	7.24	193	8.9	67	92.5	8.03	0.05	0.072	6.75	< 0.01	< 0.005	64.	0.009 4	29.	29.	< 0.1	0.061	1.35	3.3	< 0.005	< 0.5	4.88
04-4-1	SS		2021-09-09	Clear and colourless	7.23	303	10.7	110	168	4.97	0.043	0.083	13.3	< 0.01	< 0.005	76.	0.013 7	54.8	48.	< 0.1	0.055 9	0.919	1.6	< 0.005	< 0.5	7.66
04-4-1	SS		2021-11-03	Clear and colourless	6.93	267	11.4	64	119	9.1	0.061	0.089	11.	< 0.01	< 0.005	76.	0.017	37.9	26.	0.16	0.079 5	2.09	3.9	0.016 4	< 0.5	5.89
04-4-1	SS		2022-03-02	Clear and colourless	5.88	161	8	52	73.8	11.8	0.048	0.069	5.64	< 0.01	< 0.005	47.	0.008 1	23.2	24.	0.11	0.050 1	1.58	3.9	< 0.005	< 0.5	3.83
07-1-0	SS		2021-05-06	Clear and colourless	7.96	0	0	260	384	1.99	0.047	0.502	13.4	< 0.01	< 0.005	160.	0.023 9	131.	110.	0.33	2.82	0.355	433.	0.007 7	< 0.5	13.5
07-1-0	SS		2021-09-09	Clear and colourless	7.84	714	14.8	250	389	1.13	0.042	1.45	12.9	< 0.01	< 0.005	213.	0.016 7	133.	110.	< 0.1	2.58	1.25	752.	0.022 8	< 0.5	13.5
07-1-0	SS		2021-11-02	Clear and colourless	7.93	682	12.5	250	359	1.06	0.054	0.404	13.	< 0.01	< 0.005	183.	0.032 6	123.	120.	< 0.1	2.72	0.46	305.	0.011 1	< 0.5	12.5
07-1-0	SS		2022-03-03	Clear and colourless	6.61	900	12.3	260	385	1.24	0.043	0.577	13.6	< 0.01	< 0.005	167.	0.014 3	133.	120.	< 0.1	2.91	0.344	499.	0.006 3	< 0.5	12.9
16-1-1	SS		2021-09-28	Clear and colourless	7.83	248	12.4	150	157	0.57	0.039	0.064	10.4	< 0.01	< 0.005	22.	0.008 6	51.9	3.3	< 0.1	0.030 2	0.448	< 1.	0.008 2	< 0.5	6.61
16-1-1	SS		2021-11-09	Clear and colourless	7.75	320	10.6	130	149	2.43	0.035	0.07	9.72	< 0.01	< 0.005	19.	0.009 8	49.2	3.8	< 0.1	0.026 1	0.609	1.4	0.012 2	< 0.5	6.39
16-1-1	SS		2022-02-11	Clear and colourless	7.21	240	10.7	100	114	7.36	0.028	0.061	5.63	< 0.01	< 0.005	16.	0.012 6	37.6	3.	0.23	0.051 2	0.612	9.	0.016 1	< 0.5	5.
16-1-2	SS		2021-09-28	Moderately silty and slightly grey	7.61	244	12.7	130	136	280.	0.065	0.15	29.6	0.026	0.013 7	17.	0.014 6	45.1	3.2	< 0.1	0.134	0.897	204.	0.468	< 0.5	5.72
16-1-2	SS		2021-11-09	Very silty and moderately grey	7.5	193	11.1	110	158	2 300.	0.157	1.05	60.1	1.13	0.052	< 20.	0.092	51.8	3.7	0.72	5.57	4.54	4 820.	14.5	b 1.7	6.95
16-1-2	SS		2022-02-10	Slightly silty and slightly grey	6.44	173	10.9	100	109	115.	0.038	0.12	18.7	< 0.01	< 0.005	16.	0.013 6	35.8	3.	< 0.1	0.13	0.722	124.	0.201	< 0.5	4.75
16-2-1	SS		2021-09-28	Clear and colourless	8.04	260	11.9	160	168	11.6	0.093	0.24	11.7	< 0.01	< 0.005	20.	0.011 1	57.2	3.4	< 0.1	0.045 9	0.48	9.2	0.052 2	0.83	6.12
16-2-1	SS		2021-11-09	Clear and colourless	7.75	340	11.1	150	159	2.23	0.082	0.257	11.2	< 0.01	< 0.005	22.	0.025 8	53.6	4.	< 0.1	0.028 2	0.431	1.8	0.008 2	0.89	6.14
16-2-1	SS		2022-02-10	Clear and colourless	6.9	213	10.4	140	152	1.18	0.06	0.181	9.11	< 0.01	< 0.005	21.	0.047 8	51.2	3.1	< 0.1	0.034 4	0.447	< 1.	0.007 7	0.55	5.79
16-2-2	NS		2021-09-28	Insufficient well volume for sampling; no sample collected.	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
16-2-2	SS		2021-11-09	Clear and colourless	7.49	270	9.9	110	127	4.36	0.04	0.09	8.22	< 0.01	< 0.005	15.	0.019 3	42.5	3.5	0.15	0.032 6	1.05	2.7	0.011 8	< 0.5	5.12
16-2-2	SS		2022-02-10	Clear and colourless	6.72	186	10.9	100	114	1.67	0.042	0.096	7.95	< 0.01	< 0.005	14.	0.012 2	37.7	3.3	0.14	0.027 8	0.718	< 1.	0.005 8	< 0.5	4.78
17-1-1	SS		2021-09-28	Moderately silty and slightly grey	7.44	210	12.2	110	118	315.	5.2	0.468	16.5	0.033	0.009 6	18.	0.018 5	36.2	4.5	0.19	0.279	2.88	174.	0.446	1.07	6.83
17-1-1	SS		2021-11-09	Clear and colourless	7.82	380	10.2	150	211	5.65	0.901	0.558	20.6	< 0.01	< 0.005	27.	0.037 4	66.6	6.1	< 0.1	0.048 8	1.2	3.5	0.013 8	1.23	10.8
17-1-2	SS		2021-09-28	Moderately silty and slightly grey	7.34	183	11.5	82	111	149.	0.112	0.329	34.8	0.013	0.005 1	14.	0.011 2	34.7	5.2	0.27	0.151	2.02	132.	0.22	< 0.5	5.83
17-1-2	SS		2021-11-09	Moderately silty and very grey	7.5	310	11	100	138	423.	0.156	0.461	25.1	0.057	0.022 7	21.	0.031 5	43.	5.8	0.13	0.343	4.02	301.	1.22	0.97	7.41
17-1-3	SS		2021-09-28	Slightly silty and slightly grey	8.04	423	11.6	270	296	13.	< 0.02	0.238	16.5	< 0.01	< 0.005	17.	0.009 6	90.3	5.4	0.22	0.124	0.528	8.5	0.032 4	< 0.5	17.2
17-1-3	SS		2021-11-09	Clear and colourless	8.01	540	11	250	181	12.9	0.033	0.176	10.1	< 0.01	< 0.005	16.	0.013 9	55.4	5.9	< 0.1	0.219	1.95	11.3	0.027 7	< 0.5	10.4
18-1-1	FRM	Y	2021-05-14	Mean of duplicates	8.165	255	11.5	160	174.5	2.66	0.604 5	1.95	12.25	< 0.01	< 0.005	24.	0.011 3	57.8	3.75	< 0.1	0.172	0.094 5	8.75	0.008 25	0.69	7.265
18-1-1	FRM		2021-09-29	Mean of duplicates	7.49	257	11.5	155	185	76.425	0.329 5	2.235	55.9	< 0.01	0.005 7	25.5	0.207	61.85	3.85	0.175	0.138	1.425	43.75	0.079 1	1.59	7.475
18-1-1	FRM		2021-11-10	Mean of duplicates	8.04	350	11.2	150	170.5	5.83	0.526	2.1	11.75	< 0.01	< 0.005	25.5	0.036 85	56.5	4.	< 0.1	0.795 5	0.277	3.65	0.019 8	1.055	7.15
18-1-1	FRM		2022-02-10	Mean of duplicates	7.6	301	10	150	165	4.04	0.293	2.825	12.05	< 0.01	< 0.005	25.	< 0.005	54.15	3.55	< 0.1	1.595	0.086 5	70.2	0.007 25	1.265	7.19
18-2-1	SS	Y	2021-05-14	Slightly silty and slightly brown	8	284	10.9	160	185	26.2	0.025	0.056	1.53	< 0.01	< 0.005	< 10.	0.035 8	62.9	4.1	< 0.1	0.031 6	1.05	12.1	0.050 4	< 0.5	6.78
18-2-1	SS		2021-09-29	Clear and colourless	7.01	272	12.4	130	183	41.3	0.046	0.053	22.9	< 0.01	< 0.005	< 10.	0.047 3	62.5	4.7	< 0.1	0.036 2	1.83	16.3	0.041 8	< 0.5	6.46
18-2-1	SS		2021-11-10	Clear and colourless	7.76	293	11.6	130	205	5.48	0.037	0.092	2.13	< 0.01	< 0.005	< 10.	0.081 1	70.1	4.5	< 0.1	0.025	1.45	1.7	0.011 8	< 0.5	7.25
18-2-1	SS		2022-02-10	Slightly silty and slightly grey	7.09	213	10.5	120	148	13.8	0.027	0.036	1.17	< 0.01	< 0.005	< 10.	0.028 4	50.1	5.2	< 0.1	0.021 2	1.12	4.	0.016	< 0.5	5.49
18-2-2	SS	Y	2021-05-14	Clear and colourless	8.05	294	10.9	170	198	5.44	0.024	0.07	6.24	< 0.01	< 0.005	< 10.	0.022 3	68.3	4.	< 0.1	0.048 1	0.884	5.	0.014 4	< 0.5	6.7
18-2-2	SS		2021-09-29	Clear and colourless	7.38	314	11.9	170	208	2.77	< 0.02	0.068	7.32	< 0.01	< 0.005	< 10.	0.012 5	71.3	4.2	< 0.1	0.041 1	1.13	5.7	< 0.005	< 0.5	7.35
18-2-2	SS		2021-11-10	Clear and colourless	7.76	313	11.3	160	221	3.97	0.025	0.092	14.7	< 0.01	< 0.005	< 10.	0.02	76.6	4.6	< 0.1	0.094 8	1.28	3.	0.010 1	< 0.5	7.3
18-2-2	SS		2022-02-10	Clear and colourless	7.11	270	10.4	86	137	2.94	0.028	0.026	4.35	< 0.01	< 0.005	< 10.	0.021 5	46.7	6.2	< 0.1	0.026 4	0.935	2.8	0.009 1	< 0.5	4.93
19-1-1	SS		2021-05-05	Clear and slightly orange	7.92	0	0	150	193	2.11	0.028	0.349	7.9	< 0.01	< 0.005	30.	0.005 1	61.	13.	< 0.1	0.548	0.079	178.	< 0.005	0.88	9.89
19-1-1	SS		2021-09-09	Slightly silty, moderately orange	7.68	282	11.3	150	182	12.	0.046	0.455	10.4	< 0.01	< 0.005	30.	< 0.005	56.9	13.	< 0.1	0.406	0.17	252.	0.018 9	0.83	9.7
19-1-1	SS		2021-11-02	Clear and moderately orange	7.93	440	10.2	170	201	11.9	0.022	0.431	5.22	< 0.01	< 0.005	28.	< 0.005	65.4	18.	< 0.1	0.961	0.172	577.	0.015 5	0.66	9.08
19-1-1	SS		2022-03-07	Clear and moderately yellow	6.74	420	9.7	160	200	0.62	< 0.02	1.68	3.12	< 0.01	< 0.005	17.	< 0.005	66.7	14.	< 0.1	1.62	< 0.05	4 390.	< 0.005	< 0.5	8.1
19-1-2	SS		2021-05-05	Moderately silty and slightly orange	7.77	303	10.5	160	199	1.01	< 0.02	0.896	3.77	< 0.01	< 0.005	23.	< 0.005	65.1	13.	< 0.1	0.851	< 0.05	1 780.	< 0.005	< 0.5	8.79
19-1-2	SS		2021-09-09	Clear and slightly yellow	7.46	294	11.3	180	202	12.4	< 0.02	0.755	3.17	< 0.01	< 0.005	16.	< 0.005	67.2	14.	< 0.1	0.86	< 0.05	2 540.	0.012 8	< 0.5	8.4
19-1-2	SS		2021-11-02	Clear and slightly orange	7.96	257	10.2	150	168	65.	< 0.02	0.86	3.15	< 0.01	< 0.005	24.	< 0.005	54.1	11.	< 0.1	0.445	1.82	1 590.	0.075 8	< 0.5	8.05
19-1-2	SS		2022-03-07	Clear and colourless	7.14	250	10	140	165	1.72	< 0.02	0.549	4.83	< 0.01	< 0.005	33.	< 0.005	51.6	8.7	< 0.1	0.153	< 0.05	518.	0.011 2	< 0.5	8.73
19-2-1	SS		2021-05-05	Clear and colourless	8.07	297	10.5	140	196	1.76	< 0.02	0.26	41.3	< 0.01	< 0.005	66.	< 0.005	59.8	16.	< 0.1	0.054	0.059	81.	0.005 2	< 0.5	11.3
19-2-1	SS		2021-09-09	Clear and colourless	7.7	332	12.4	160	218	3.16	0.02	0.22	43.	< 0.01	< 0.005	60.	< 0.005	67.2	17.	< 0.1	0.088 4	< 0.05	24.5	< 0.005	< 0.5	12.1
19-2-1	SS		2021-11-02	Clear and colourless	8.12	295	10.4	150	195	7.04	< 0.02	0.262	40.1	< 0.01	< 0.005	61.	< 0.005	59.9	15.	< 0.1	0.068	0.094	82.3	0.009 5	< 0.5	11.
19-2-1	SS		2022-03-07	Clear and colourless	7.31	286	9.9	140	194	2.21	< 0.02	0.247	40.	< 0.01	< 0.005	56.	< 0.005	60.3	15.	< 0.1	0.074 3	0.08	94.8	< 0.005	< 0.5	10.7
19-2-2	SS		2021-05-06	Clear and moderately brown	7.93	273	9.9	130	186	2.24	< 0.02	0.085	30.4	< 0.01	< 0.005	66.	0.034 3	54.7	16.	< 0.2	0.023 6	0.236	2.6	0.028 9	0.6	11.9
19-2-2	SS		2021-09-09	Slightly silty and slightly brown	7.55	375	12.7	160	223	6.09	< 0.02	0.119	16.5	< 0.01	< 0.005	48.	0.008	67.3	21.	< 0.1	0.069 1	0.14	103.	0.049 1	0.69	13.5
19-2-2	SS		2021-11-02	Clear and moderately brown	7.87	320	11	99	137	15.1	< 0.02	0.071	16.1	< 0.01	< 0.005	53.	0.005 5	40.9	16.	< 0.1	0.055 8	0.174	71.6	0.048 3	0.81	8.43
19-2-2	SS		2022-03-07	Slightly silty and slightly brown	6.99	250	8.8	120	160	1.49	0.026	0.067	15.3	< 0.01	< 0.005	56.	< 0.005	47.9	15.	< 0.1	0.014 2	0.094	4.	< 0.005	0.6	9.94
20-1-1	SS	Y	2021-05-20	Clear and colourless	7.92	157	12.2	84	78.2	8.7	< 0.04	0.176	9.93	< 0.02	< 0.01	4 510.	0.011	26.1	6.8	< 0.2	0.038	0.3	7.4	0.014	1.5	3.13
20-1-1	SS		2021-09-22	Clear and colourless	8.15	168	11.4	94	90.7	7.7	< 0.04	0.086	3.1	< 0.02	< 0.01	4 060.	< 0.01	29.2	9.5	< 0.2	0.074	< 0.1	< 2.	< 0.01	1.5	4.31
20-1-1	SS		2021-11-23	Clear and colourless	7.76	170	10.8	74	60.2	8.3	< 0.04	< 0.04	1.72	< 0.02	< 0.01	4 010.	< 0.01	19.3	4.1	< 0.2	0.014	28.9	11.6	0.016	1.1	2.91
20-1-1	SS		2022-02-23	Clear and colourless	7.39	160	10.4	66	65.4	4.6	< 0.1	< 0.1	2.16	< 0.05	< 0.025	5 080.	b < 0.025	21.2	3.6	< 0.5	< 0.025	11.3	< 5.	< 0.025	< 2.5	3.
20-1-2	SS	Y	2021-05-20	Clear and colourless	7.99	204	12.1	110	101	2.1	< 0.04	0.193	3.91	< 0.02	< 0.01	3 950.	< 0.01	31.4	11.	< 0.2	0.178	< 0.1	9.7	< 0.01	1.4	5.47
20-1-2	SS		2021-09-22	Clear and colourless	8.15	208	11.3	120	111	7.6	< 0.04	0.102	4.15	< 0.02	< 0.01	3 520.	< 0.01	34.3	12.	< 0.2	0.122	< 0.1	22.	< 0.01	1.6	6.26
20-1-2	SS		2021-11-23	Clear and colourless	7.79	200	11	83	72.1	3.1	< 0.04	0.09	2.69	< 0.02	< 0.01	3 810.	< 0.01	22.7	6.2	< 0.2	0.029	< 0.1	6.3	< 0.01	1.3	3.75
20-1-2	SS		2022-02-23	Clear and colourless	7.7	138	10.6	75	66.3	2.7	< 0.1	< 0.1	3.01	< 0.05	< 0.025	3 960.	< 0.025	20.9	6.1	< 0.5	< 0.025	< 0.25	< 5.	< 0.025	< 2.5	3.42
21-1-1	FRM	Y	2021-05-21	Mean of duplicates	7.875	143	14.3	70	64.95	5.55	< 0.04	4.55	2.055	< 0.02	< 0.01	4 205.	0.021	20.	4.	< 0.2	0.011	0.11	7.8	0.011 5	1.15	3.66
21-1-1	FRM		2021-09-22	Mean of duplicates	8.15	131	11.9	71	65.75	7.25	< 0.04	1.19	1.57	< 0.02	< 0.01	4 155.	< 0.01	20.5	3.7	< 0.2	< 0.01	< 0.1	2.2	< 0.01	1.15	3.535
21-1-1	FRM		2021-11-24	Mean of duplicates	7.705	170	10.8	77	65.05	19.15	< 0.1	0.96	1.545	< 0.05	< 0.025	3 730.	< 0.025	20.1	3.9	< 0.5	< 0.025	< 0.25	< 5.	< 0.025	< 2.5	3.605
21-1-1	FRM		2022-02-23	Mean of duplicates	7.17	148	10.5	67	66.95	2.7	< 0.1	1.1	1.61	< 0.05	< 0.025	4 115.	< 0.025	20.6	3.6	< 0.5	< 0.025	0.355	< 5.	< 0.025	< 2.5	3.775
21-1-2	FRM	Y	2021-05-20	Mean of duplicates	7.88	372	12.8	180	152.5	1.13	0.023 5	1.345	16.9	< 0.01	< 0.005	690.5	0.008 45	45.6	36.5	0.275	1.03	0.335 5	996.	0.009 3	< 0.5	9.465
21-1-2	FRM		2021-09-21	Mean of duplicates	7.52	475	11.7	210	200.5	1.26	< 0.02	1.39	21.35	< 0.01	< 0.005	710.5	0.005 5	59.9	63.5	0.225	1.205	0.242 5	1 325.	< 0.005	< 0.5	12.4
21-1-2	FRM		2021-11-23	Mean of duplicates	8.085	540	11.6	200	168.5	1.82	< 0.02	1.36	18.65	< 0.01	< 0.005	808.	0.010 05	50.15	45.5	0.25	1.21	0.33	1 070.	0.005 05	< 0.5	10.5
21-1-2	FRM		2022-02-23	Mean of duplicates	6.27	450	11.4	170	137	1.145	< 0.02	1.365	15.25	< 0.01	< 0.005	767.	0.007 1	40.75	26.	0.22	0.814 5	0.445	818.5	< 0.005	< 0.5	8.475
21-2-1	FRM	Y	2021-05-20	Mean of duplicates	7.815	401	13.5	180	164.5	1.285	0.022 5	1.96	15.35	< 0.01	< 0.005	634.	0.007 85	48.85	42.5	0.215	1.23	0.338	1 105.	0.008 95	< 0.5	10.35
21-2-1	FRM		2021-09-21	Mean of duplicates	7.365	509	12.7	215	221.5	1.74	0.02	1.685	21.6	< 0.01	< 0.005	710.5	0.006 5	66.5	74.	0.24	1.555	0.268 5	1 565.	0.054 5	< 0.5	13.45
21-2-1	FRM		2021-11-23	Mean of duplicates	8.04	510	11.2	190	147	2.635	< 0.02	1.66	14.4	< 0.01	< 0.005	702.5	0.012 4	43.85	39.	0.205	1.175	0.554	941.5	0.012 5	< 0.5	9.14
21-2-1	FRM		2022-02-23	Mean of duplicates	6.35	460	10.4	170	141	1.85	< 0.02	1.56	13.95	< 0.01	< 0.005	612.	0.007 4	41.95	29.	0.195	0.900 5	0.227	905.	0.005 7	< 0.5	8.76
25-1-1	SS		2021-05-25	Clear and colourless	7.84	435	10.8	140	307	0.79	0.137	0.318	8.52	< 0.01	< 0.005	221.	0.008	105.	5.4	< 0.1	0.142	0.176	9.1	0.006 5	< 0.5	11.
25-1-1	SS		2021-09-23	Clear and colourless	8.18	436	11.1	140	319	1.23	0.1	0.206	6.94	< 0.01	< 0.005	207.	0.006 2	110.	5.2	< 0.1	0.148	0.153	16.2	< 0.005	< 0.5	10.4
25-1-1	SS		2021-11-19	Clear and colourless	7.85	630	10.3	140	309	12.1	0.092	0.145	6.46	< 0.01	< 0.005	205.	0.006 2	105.	5.1	< 0.1	0.153	0.281	94.6	0.069 6	< 0.5	11.1
25-1-1	SS		2022-02-24	Clear and colourless	6.78	457	9.9	130	322	1.96	0.132	0.178	7.8	< 0.01	< 0.005	183.	0.006 4	111.	5.	< 0.1	0.078	0.227	3.2	< 0.005	< 0.5	11.1
25-1-2	SS		2021-05-25	Clear and colourless	7.84	225	11.7	110	150	1.49	0.044	0.337	3.86	< 0.01	< 0.005	68.	< 0.005	53.9	2.7	< 0.1	0.134	0.519	75.4	0.006 1	< 0.5	3.76
25-1-2	SS		2021-09-23	Clear and colourless	7.96	344	13.7	110	222	3.14	0.19	0.28	5.08	< 0.01	< 0.005	74.	< 0.005	79.8	4.7	< 0.1	0.194	0.438	64.2	0.005 6	< 0.5	5.4
25-1-2	SS		2021-11-19	Clear and colourless	7.32	260	12.1	97	116	9.65	0.108	0.167	3.79	< 0.01	< 0.005	69.	< 0.005	41.3	2.7	< 0.1	0.102	0.521	43.7	0.006 3	< 0.5	3.11
25-1-2	SS		2022-02-23	Clear and colourless	6.57	280	9.7	100	184	1.56	0.151	0.15	4.94	< 0.01	< 0.005	124.	< 0.005	65.6	3.3	0.12	0.090 1	0.516	25.5	< 0.005	< 0.5	4.82
27-1-1	SS		2021-05-13	Very silty and moderately grey	8.18	129	10.9	83	336	10 400.	b < 0.2	1.25	423.	5.34	a 0.224	325.	0.074	98.7	3.8	1.4	5.27	13.4	15 200.	36.4	b 6.9	21.8
27-1-1	SS		2021-09-17	Very silty and slightly grey	8.08	138	11.1	72	62	3.76	< 0.02	0.152	10.8	< 0.01	< 0.005	248.	< 0.005	17.1	3.7	< 0.1	0.02	0.123	15.	0.009 1	< 0.5	4.7
27-1-1	SS		2021-11-18	Moderately silty and moderately grey	7.69	180	9.9	80	59.8	373.	< 0.02	0.12	5.59	0.098	0.031	263.	< 0.005	17.9	2.7	< 0.1	0.064 1	0.678	357.	1.06	0.73	3.65
27-1-1	SS		2022-02-17	Moderately silty and slightly grey	7.39	180	9.3	73	74.6	6.44	< 0.02	0.321	3.33	< 0.01	< 0.005	260.	< 0.005	20.	4.4	< 0.1	0.041 9	0.083	4.4	0.015 2	< 0.5	6.
27-1-2	SS		2021-05-13	Clear and colourless	7.78	366	10.2	120	238	76.8	0.173	0.281	7.3	< 0.01	< 0.005	95.	0.010 9	77.7	4.7	0.23	0.238	2.04	244.	0.054 4	1.04	10.7
27-1-2	SS		2021-09-17	Moderately silty and slightly yellow	7.82	344	13.2	86	188	53.4	0.147	0.224	5.8	< 0.01	< 0.005	83.	0.011 3	61.4	7.9	0.22	0.12	3.79	25.4	0.007 6	0.57	8.43
27-1-2	SS		2021-11-18	Clear and colourless	7.21	400	10.6	63	153	6.57	0.07	0.084	4.15	< 0.01	< 0.005	58.	0.011 2	53.2	2.7	0.12	0.047 5	1.2	36.1	0.014 6	0.57	4.8
27-1-2	NS		2022-02-17	Dry after blas

BC CSR				a AW Maximum (1)	---	---	---	---		---		90	50	10000	2 (9)	---	12000	0.5-4 (5)	---	1500	90 (7)	40	20-90 (5)	---	40-160 (5)	---	---
				b DW Maximum (2)	---	---	---	---		9500		6	10	1000	8	---	5000	5	---	250	6000	14 (9)	1500	--- (6)	10	33 (9)	---
Station	Sample Type	Compliance Well (Y/N?)	Date Sampled	Parameter	PH (Field)	Specific Conductivity - 25°C (Field)	Temperature (Field)	Alkalinity	Hardness as CaCO3	Aluminum		Antimony	Arsenic	Barium	Beryllium	Bismuth	Boron	Cadmium	Calcium	Chloride	Chromium	Cobalt	Copper	Iron	Lead	Lithium	Magnesium
				Fraction	TOT	TOT	TOT	TOT	DIS	DIS		DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS
				Unit	pH	µS/cm	°C	mg/L	mg/L	µg/l		µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	mg/L	mg/L	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	mg/l
				Method Detection Limit	0.1	1	0.1	1	0.5	0.5		0.02	0.02	0.02	0.01	0.005	10	0.005	0.05	1	0.1	0.005	1	0.005	0.5	0.05
31-1-1	FRM	Y	2021-09-15	Mean of duplicates	7.715	530	10.9	160	367	3.875		0.060 5	0.207	4.33	< 0.01	< 0.005	51.5	0.039 55	130.5	5.45	< 0.1	0.248	0.481 5	29.6	0.013 35	< 0.5	10.15
31-1-1	FRM		2021-11-26	Mean of duplicates	7.67	940	10.2	160	459.5	1.615		0.058	0.282	5.81	0.011 5	< 0.005	46.	0.050 35	163.5	5.3	< 0.1	0.309 5	0.506 5	6.1	0.008 9	< 0.5	12.65
31-1-1	FRM		2022-03-07	Mean of duplicates	6.78	621	10.3	135	362	1.53		0.055 5	0.196	4.415	< 0.01	< 0.005	42.	0.031 15	128.	3.8	0.245	0.176	0.513	4.95	< 0.005	< 0.5	10.15
31-1-2	SS	Y	2021-09-15	Clear and colourless	7.46	545	12.2	140	364	1.94		0.032	0.109	4.19	< 0.01	< 0.005	51.	0.028 7	128.	4.6	< 0.1	0.067 8	0.852	1.	0.055 6	< 0.5	10.9
31-1-2	SS		2021-11-26	Clear and colourless	7.4	970	11	110	482	2.5		0.037	0.174	5.47	< 0.01	< 0.005	46.	0.031 3	168.	5.7	< 0.1	0.082	1.14	25.4	0.006 1	< 0.5	15.1
31-1-2	SS		2022-03-07	Clear and colourless	6.51	700	9.9	110	341	2.3		0.031	0.126	3.48	< 0.01	< 0.005	38.	0.017 9	119.	3.3	< 0.1	0.044 4	0.968	1.9	< 0.005	< 0.5	10.7
36-3-1	SS		2021-05-20	Clear and colourless	7.73	1118	14.4	330	582	1.06		0.075	0.329	46.1	< 0.01	< 0.005	83.	0.006 6	173.	16.	0.11	0.149	1.34	5.	0.005 2	0.67	36.7
36-3-1	SS		2021-09-24	Clear and colourless	7.92	858	13.6	340	602	3.57		0.074	0.282	44.5	< 0.01	< 0.005	74.	0.007 6	182.	14.	< 0.1	0.16	1.09	52.1	0.006 6	0.5	35.8
36-3-1	SS		2021-11-24	Clear and colourless	7.96	1000	12.8	340	565	3.61		0.065	0.268	36.	< 0.01	< 0.005	72.	0.007 5	173.	11.	0.12	0.155	1.01	6.5	0.014 6	< 0.5	32.
36-3-1	SS		2022-02-23	Clear and colourless	6.69	1000	12.4	330	550	1.19		0.075	0.29	32.2	< 0.01	< 0.005	69.	< 0.005	167.	13.	< 0.1	0.115	0.877	< 1.	< 0.005	< 0.5	32.3
37-3-1	SS		2021-05-20	Clear and colourless	7.71	367	12.7	150	232	0.9	<	0.02	0.207	15.2	< 0.01	< 0.005	317.	0.014 2	79.	4.1	< 0.1	0.245	0.096	690.	< 0.005	< 0.5	8.48
37-3-1	SS		2021-09-23	Clear and colourless	7.99	352	11.2	150	252	1.78	<	0.02	0.232	15.5	< 0.01	< 0.005	358.	0.014 5	85.8	5.6	< 0.1	0.257	0.076	1 050.	< 0.005	< 0.5	9.09
37-3-1	SS		2021-11-24	Clear and colourless	7.79	630	10.9	130	310	1.62		0.074	0.228	18.2	< 0.01	< 0.005	309.	0.013 4	105.	5.7	< 0.1	0.595	0.337	1 190.	< 0.005	< 0.5	11.6
37-3-1	SS		2022-02-24	Clear and colourless	6.79	433	10.7	130	304	1.43		0.066	0.12	15.8	< 0.01	< 0.005	398.	0.013 3	104.	9.4	< 0.1	0.81	0.282	90.5	0.011 3	< 0.5	11.
38-1-1	SS		2021-05-21	Clear and colourless	8.04	522	16.4	280	322	4.33		0.282	0.283	6.79	< 0.01	< 0.005	198.	0.026 8	101.	14.	< 0.1	0.079 3	0.755	7.4	0.014 6	0.63	17.1
38-1-1	SS		2021-09-22	Clear and colourless	7.93	559	15.3	290	330	5.48		0.246	0.395	7.39	< 0.01	< 0.005	194.	0.024 4	102.	14.	< 0.1	0.076 6	0.688	10.2	0.024 6	0.64	18.3
38-1-1	SS		2021-11-24	Clear and colourless	7.99	610	11.8	270	312	2.12		0.231	0.513	8.55	< 0.01	< 0.005	184.	0.023 8	93.9	14.	< 0.1	0.056 3	0.69	8.4	0.016 7	0.73	18.7
38-1-1	SS		2022-02-24	Clear and colourless	7	480	11.3	270	312	1.53		0.261	0.452	8.18	< 0.01	< 0.005	167.	0.028 1	93.2	14.	< 0.1	0.036	0.812	< 1.	0.034 9	0.81	19.1
39-1-1	FRM	Y	2020-05-15	Mean of duplicates	7.965	190	12.2	100	118	3.61		0.087	0.359 5	6.395	< 0.01	< 0.005	15.	0.137 5	41.2	2.15	< 0.1	0.037 5	0.651	1.9	0.012 9	< 0.5	3.645
39-1-1	FRM		2021-09-22	Mean of duplicates	8.065	192	11.5	105	122.5	6.635		0.086	0.318	6.035	< 0.01	< 0.005	12.5	0.016 7	42.95	2.	< 0.1	0.033 5	0.266 5	2.3	0.006 25	< 0.5	3.68
39-1-1	FRM		2021-11-24	Mean of duplicates	7.47	179	11	110	115	2.61		0.097	0.343 5	5.405	< 0.01	< 0.005	23.5	0.011 05	40.05	2.55	< 0.1	0.029 35	0.252	2.05	0.007 2	< 0.5	3.595
39-1-1	FRM		2022-02-24	Mean of duplicates	7.5	186	10.6	99	117.5	3.405		0.121	0.374 5	5.53	< 0.01	< 0.005	17.	0.014	41.2	2.4	< 0.1	0.029 65	0.227	1.4	0.008 85	< 0.5	3.55
39-2-1	SS	Y	2021-05-20	Clear and colourless	8.02	278	11.3	170	190	1.48		0.175	0.532	1.89	< 0.01	< 0.005	901.	< 0.005	65.4	4.5	< 0.13	0.021 3	0.296	3.6	< 0.005	< 0.5	6.55
39-2-1	SS		2021-09-22	Clear and colourless	8.15	251	11.4	150	176	1.62		0.152	0.571	1.75	< 0.01	< 0.005	1 140.	< 0.005	61.	4.1	< 0.1	0.024	0.23	1.	< 0.005	< 0.5	5.69
39-2-1	SS		2021-11-24	Clear and colourless	7.91	257	11.1	170	177	1.43		0.163	0.468	1.8	< 0.01	< 0.005	809.	< 0.005	60.8	4.7	< 0.1	0.021 4	0.269	< 1.	< 0.005	< 0.5	6.17
39-2-1	SS		2022-02-24	Clear and colourless	7.22	262	11.1	160	180	1.45		0.197	0.484	1.77	< 0.01	< 0.005	703.	< 0.005	62.	4.1	< 0.1	0.017 9	0.298	< 1.	0.006 1	< 0.5	6.
40-1-1	SS		2021-05-20	Clear and colourless	7.99	376	14.2	200	219	27.4		0.147	0.126	4.77	< 0.01	< 0.005	167.	0.010 8	74.7	6.9	0.21	0.366	2.49	30.5	0.044 5	< 0.5	7.81
40-1-1	SS		2021-09-22	Clear and colourless	7.77	432	14.4	220	259	2.78		0.144	0.062	5.51	< 0.01	< 0.005	189.	0.016 9	89.1	7.1	< 0.1	0.396	2.64	2.1	0.013 9	< 0.5	8.78
40-1-1	SS		2021-11-03	Clear and colourless	8	550	13.7	240	249	2.39		0.133	0.09	5.5	< 0.01	< 0.005	205.	0.015	85.6	7.6	< 0.1	0.34	2.28	2.1	0.009 9	< 0.5	8.51
40-1-1	SS		2022-02-10	Clear and colourless	6.87	340	12.7	170	183	5.73		0.201	0.07	5.15	< 0.01	< 0.005	132.	0.010 7	62.	6.4	< 0.12	0.256	1.77	2.3	0.021 4	0.83	6.74
41-1-1	FRM	Y	2020-05-15	Mean of duplicates	7.75	318	9.9	---	205	2.825		0.042	2.075	2.49	< 0.01	< 0.005	22.	0.005 2	69.1	11.	< 0.1	0.137	0.276	23.3	0.008 95	< 0.5	7.935
41-1-1	FRM		2021-09-16	Mean of duplicates	8.18	343	11.6	160	207	3.405		0.021 5	4.34	2.385	< 0.01	< 0.005	24.5	0.010 4	70.45	7.75	< 0.1	0.273	0.226 5	12.3	< 0.005	< 0.5	7.615
41-1-1	FRM		2021-11-26	Mean of duplicates	7.85	306	10.9	160	201.5	2.79		0.038 5	2.55	2.43	< 0.01	< 0.005	28.5	0.007 15	68.45	7.3	< 0.1	0.153	0.390 5	28.05	0.007 25	< 0.5	7.47
41-1-1	FRM		2022-02-25	Mean of duplicates	6.8	400	9.4	140	191	1.07		0.074 5	1.475	1.595	< 0.01	< 0.005	23.	< 0.005	65.15	7.45	< 0.1	0.028 9	0.272 5	4.65	< 0.005	< 0.5	6.895
42-1-1	FRM	Y	2020-05-15	Mean of duplicates	7.575	363	9	---	254	6.88	<	0.02	0.147	14.25	0.011	< 0.005	69.5	< 0.005	92.15	15.	0.13	0.079	0.205	711.5	0.007 25	< 0.5	5.815
42-1-1	FRM		2021-09-16	Mean of duplicates	8.07	450	10.7	200	295	4.58	<	0.02	0.199 5	14.95	< 0.01	< 0.005	63.5	< 0.005	107.5	17.	0.105	0.044 75	0.082	659.5	< 0.005	< 0.5	6.31
42-1-1	FRM		2021-11-26	Mean of duplicates	7.805	630	10.2	210	291	5.595	<	0.02	0.203 5	16.4	0.016 5	< 0.005	81.5	< 0.005	106.5	19.	0.215	0.078 8	0.086 5	790.	0.006 05	< 0.5	6.17
42-1-1	FRM		2022-02-25	Mean of duplicates	6.82	461	8.8	190	264.5	5.	<	0.02	0.156 5	13.25	0.01	< 0.005	64.5	< 0.005	96.85	14.	0.15	0.054	0.055 5	684.	< 0.005	< 0.5	5.545
43-1-1	SS		2021-05-12	Clear and colourless	8.01	472	11.4	250	320	3.27		0.19	0.28	8.57	< 0.01	< 0.005	683.	0.040 6	111.	11.	< 0.1	0.070 1	2.92	4.	0.009 7	0.71	10.4
43-1-1	SS		2021-09-15	Clear and colourless	7.99	505	13.6	250	333	2.41		0.292	0.221	7.95	< 0.01	< 0.005	590.	0.033 3	117.	11.	< 0.1	0.084 7	2.98	2.1	0.005 5	0.73	10.1
43-1-1	SS		2021-11-17	Clear and colourless	7.85	640	12.3	270	319	7.14		0.318	0.294	8.58	< 0.01	< 0.005	610.	0.027 8	111.	11.	0.19	0.107	2.76	32.7	0.012	0.75	10.2
43-1-1	SS		2022-02-15	Clear and colourless	7.77	371	11.1	250	330	5.68		0.27	0.282	8.03	< 0.01	< 0.005	618.	0.043 9	115.	10.	< 0.1	0.061 5	2.98	10.6	0.022 5	0.8	10.1
44-1-1	SS		2021-05-13	Clear and colourless	8.02	315	10.6	200	201	4.62		0.156	0.091	9.35	0.016	< 0.005	102.	0.034 1	72.4	6.3	< 0.1	0.058	0.577	20.1	0.075 6	0.56	4.84
44-1-1	SS		2021-09-15	Clear and colourless	8.01	341	11.3	210	223	2.37		0.265	0.048	11.2	< 0.01	< 0.005	94.	0.033 4	80.5	6.3	< 0.1	0.057 4	0.759	5.4	0.020 2	0.52	5.29
44-1-1	SS		2021-11-17	Clear and colourless	7.72	338	10.9	210	223	3.7		0.227	0.068	13.9	< 0.01	< 0.005	89.	0.019 2	80.6	6.4	< 0.1	0.036 5	0.435	4.6	0.028 6	< 0.5	5.28
44-1-1	SS		2022-02-15	Clear and colourless	7.84	258	10.2	200	226	2.32		0.299	0.043	9.95	< 0.01	< 0.005	88.	0.020 1	82.2	6.2	< 0.1	0.022 2	0.74	2.5	0.011 6	0.68	5.13
51-1-1	SS		2021-09-22	Clear and colourless	7.35	249	12.3	110	154	2.53		0.054	0.508	4.75	< 0.01	< 0.005	56.	0.011 3	53.1	6.	< 0.1	0.089 6	4.69	< 1.	< 0.005	< 0.5	5.16
51-1-1	SS		2021-11-23	Clear and colourless	7.68	310	11.4	120	141	1.67		0.043	0.519	3.83	< 0.01	< 0.005	63.	0.007 4	48.7	5.7	< 0.1	0.043 7	1.49	2.6	< 0.005	< 0.5	4.71
51-1-1	SS		2022-02-23	Clear and colourless	5.76	153	9.2	64	98.1	31.7		0.039	0.42	3.4	< 0.01	< 0.005	35.	0.009	33.5	4.3	0.13	0.065 5	1.89	42.1	0.017 4	< 0.5	3.49
51-2-1	SS		2021-09-22	Clear and colourless	8.11	326	11.2	140	193	1.61		0.189	0.85	34.	< 0.01	< 0.005	168.	0.020 1	54.8	24.	< 0.1	0.089 6	0.433	< 1.	0.071 1	1.18	13.5
51-2-1	SS		2021-11-23	Clear and colourless	7.68	430	10.4	150	188	2.34		0.185	0.844	33.6	< 0.01	< 0.005	171.	0.017 5	52.4	22.	< 0.1	0.076 2	0.417	< 1.	0.01	1.21	13.8
51-2-1	SS		2022-02-23	Clear and colourless	6.88	410	9.7	140	180	1.82		0.194	0.886	33.	< 0.01	< 0.005	177.	0.016 5	50.3	20.	< 0.1	0.048 3	0.442	< 1.	0.014 3	1.31	13.3
51-3-1	SS		2021-09-22	Slightly silty and slightly grey	8.03	343	11.1	130	216	39.6		0.12	0.389	21.7	< 0.01	< 0.005	247.	0.006 7	60.3	63.	< 0.1	0.092 7	0.79	37.2	0.205	1.28	15.8
51-3-1	SS		2021-11-23	Slightly silty and slightly grey	7.86	289	9.8	140	188	14.5		0.115	0.382	18.4	< 0.01	< 0.005	184.	0.005 2	52.1	35.	< 0.1	0.057 9	1.21	12.4	0.077 9	0.94	14.1
51-3-1	SS		2022-02-23	Slightly silty and slightly brown	6.98	390	9	120	171	1.5		0.125	0.401	20.3	< 0.01	< 0.005	214.	0.005 1	47.	33.	< 0.1	0.029 5	0.803	1.	0.065 3	1.15	13.1
52-1-1	SS		2021-05-12	Clear and slightly yellow	7.8	1651	14	840	494	1.7		0.044	0.218	109.	< 0.02	< 0.01	2 890.	< 0.01	131.	220.	1.09	2.39	0.11	518.	< 0.01	5.4	40.4
52-1-1	SS		2021-09-23	Clear and slightly yellow	7.74	1756	14.4	910	520	1.5		0.042	0.242	112.	< 0.02	< 0.01	2 690.	< 0.01	140.	200.	1.03	2.39	< 0.1	498.	< 0.01	5.2	41.7
52-1-1	SS		2021-11-24	Clear and colourless, sudsy	7.98	2200	13.7	890	496	2.6	<	0.04	0.218	108.	< 0.02	< 0.01	2 700.	< 0.01	133.	190.	0.99	2.17	0.32	493.	< 0.01	4.9	39.7
52-1-1	SS		2022-02-11	Clear and slightly yellow	7.37	2100	13.6	840	489	2.9	<	0.1	0.21	104.	< 0.05	< 0.025	3 230.	< 0.025	129.	200.	1.16	2.45	< 0.25	513.	< 0.025	5.2	40.3
52-4-0 (P7)	SS		2021-05-12	Slightly silty and moderately brown	7.51	3946	17.7	1800	495	63.7		1.36	10.2	b 381.	< 0.02	< 0.01	3 170.	0.021	111.	400.	b 19.9	8.59	0.41	17 200.	0.307	2.6	52.8
52-4-0 (P7)	SS		2021-09-29	Clear and very yellow	7.27	3416	18.6	1500	537	12.		0.246	6.68	392.	< 0.02	< 0.01	2 750.	< 0.01	120.	330.	b 3.78	6.27	2.07	13 900.	0.078	2.2	57.7
52-4-0 (P7)	SS		2021-11-01	Clear and slightly yellow	7.37	4000	17	1500	535	21.7		0.672	6.76	368.	< 0.02	< 0.01	2 780.	< 0.01	122.	350.	b 8.28	7.89	11.2	12 400.	0.38	2.1	56.
52-4-0 (P7)	SS		2022-02-11	Clear and slightly yellow	7.12	2929	16.6	1400	498	13.4		0.12	4.07	415.	< 0.02	< 0.01	2 720.	< 0.01	113.	290.	b 2.33	5.27	0.72	13 800.	0.049	1.9	52.6
53-1-1	SS	Y	2021-05-21	Clear and colourless	7.95	388	12	200	258	1.6	<	0.02	0.131	25.5	< 0.01	< 0.005	509.	0.014 7	90.1	7.9	< 0.1	0.515	0.073	298.	0.010 8	< 0.5	8.01
53-1-1	SS		2021-09-23	Clear and colourless	8.14	365	10.4	200	268	1.76	<	0.02	0.121	22.9	< 0.01	< 0.005	472.	0.011 8	94.	8.1	< 0.1	0.484	< 0.05	337.	< 0.005	< 0.5	7.97
53-1-1	SS		2021-11-19	Clear and colourless	7.99	490	10.1	210	250	1.45	<	0.02	0.11	22.	< 0.01	< 0.005	489.	0.013 2	87.4	7.5	< 0.1	0.422	< 0.05	323.	< 0.005	< 0.5	7.75
53-1-1	SS		2022-02-24	Clear and colourless	6.96	322	10	190	244	1.9	<	0.02	0.134	21.5	< 0.01	< 0.005	394.	0.013	85.6	6.8	< 0.1	0.529	0.069	277.	< 0.005	< 0.5	7.38
55-1-1	SS	Y	2021-09-16	Clear and colourless	8.04	359	11.6	170	215	1.69		0.119	0.166	4.43	< 0.01	< 0.005	16.	0.018 3	75.3	17.	< 0.1	0.027 2	0.269	2.4	< 0.005	< 0.5	6.59
55-1-1	SS		2021-11-25	Clear and colourless	7.74	341	10	180	222	1.67		0.109	0.159	4.41	< 0.01	< 0.005	24.	< 0.005	77.1	20.	0.15	0.029 4	0.249	1.4	< 0.005	< 0.5	7.02
56-1-1	SS	Y	2021-05-28	Clear and colourless	8.03	256	10.1	---	196	1.38		0.025	0.121	18.9	< 0.01	< 0.005	16.	0.030 2	69.5	8.5	< 0.1	0.013 8	0.1	2.4	< 0.005	< 0.5	5.52
56-1-1	SS		2021-09-16	Clear and colourless	8.21	323	10.9	150	204	2.88		0.045	0.159	34.6	< 0.01	< 0.005	16.	0.036 7	71.9	8.4	< 0.1	0.016 5	0.169	3.1	< 0.005	< 0.5	5.92
56-1-1	SS		2021-11-26	Clear and colourless	8.03	390	9.9	150	188	1.81		0.027	0.205	18.3	< 0.01	< 0.005	18.	0.014 9	66.8	11.	< 0.1	0.015 4	0.053	2.8	< 0.005	< 0.5	5.26
56-1-1	SS		2022-02-25	Clear and colourless	7.35	278	8.5	140	194	1.32		0.028	0.153	22.8	< 0.01	< 0.005	15.	0.012 1	68.7	9.	< 0.1	0.010 5	0.077	< 1.	< 0.005	< 0.5	5.49
57-1-1	SS	Y	2021-09-16	Clear and colourless	8.14	275	10.9	180	225	1.52		0.021	0.098	15.9	< 0.01	< 0.005	35.	0.005 5	81.	14.	< 0.1	0.039 7	0.75	15.4	< 0.005	< 0.5	5.58
57-1-1	SS		2021-11-24	Clear and colourless	8.02	530	9.8	170	232	2.4		0.031	0.074	10.1	< 0.01	< 0.005	44.	0.024 3	83.4	19.	< 0.1	0.040 8	0.157	4.5	0.007 1	< 0.5	5.8
58-1-0	SS		2021-05-20	Clear, very yellow	7.25	5110	19.8	1800	1600	10.2		0.398	1.37	31.2	< 0.01	< 0.01	3 650.	0.092	427.	930.	b 8.65	53.2	a 9.99	710.	0.227	< 1.	130.
58-1-0	SS		2021-09-29	Clear and very yellow	7.24	5883	21.7	1800	1450	13.4		0.55	1.36	34.8	< 0.05	< 0.025	4 100.	0.129	367.	1 100.	b 13.2	53.3	a 34.2	658.	< 0.025	< 2.5	129.
58-1-0	SS		2021-11-10	Clear and moderately brown	7.22	4972	18.1	1800	1510	12.5		0.52	1.67	33.4	< 0.05	< 0.025	4 130.	0.591	387.	990.	b 12.7	49.4	a 16.	1 320.	0.074	< 2.5	132.
58-1-0	SS		2022-02-10	Clear and moderately yellow brown	6.99	5500	19	1700	1380	9.9		0.398	1.31	28.3	< 0.02	< 0.01	3 410.	0.077	360.	890.	b 7.63	46.4	a 6.72	602.	0.084	< 1.	116.
60-1-1	SS		2021-05-05	Clear and colourless	7.96	608	11.2	190	369	1.79	<	0.02	0.334	23.4	< 0.01	< 0.005	189.	0.014	117.	89.	< 0.1	0.067 3	0.261	138.	0.006 6	0.59	18.4
60-1-1	SS		2021-09-09	Clear and colourless	7.73	623	11.4	250	385	1.41		0.024	0.334	23.6	< 0.01	< 0.005	207.	0.006 3	123.	94.	< 0.1	0.075 6	0.138	128.	0.005 8	0.58	19.
60-1-1	SS		2021-11-02	Clear and colourless	7.99	820	10.1	240	358	1.39	<	0.02	0.288	24.1	< 0.01	< 0.005	192.	0.008	114.	96.	< 0.1	0.064 5	0.163	95.7	0.006	0.54	17.8
60-1-1	SS		2022-03-04	Clear and colourless	6.64	615	11.1	240	365	1.71		0.02	0.294	21.6	< 0.01	< 0.005	202.	0.013 3	116.	100.	< 0.1	0.069 6	0.252	87.7	0.005 8	0.58	18.2
60-2-1	SS		2021-05-05	Clear and colourless	7.98	507	11.1	130	291	2.87		0.046	0.307	33.7	< 0.01	< 0.005	369.	0.029	90.9	83.	< 0.1	0.2	0.247	27.6	0.014 1	0.63	15.5
60-2-1	SS		2021-09-09	Clear and colourless	7.77	496	11.5	160	295	2.21		0.056	0.343	40.7	< 0.01	< 0.005	366.	0.012 7	92.6	81.	0.49	0.162	0.211	13.9	0.009 6	0.8	15.6
60-2-1	SS		2021-11-02	Clear and colourless	8.02	650	10.2	160	283	2.55		0.04	0.301	36.8	< 0.01	< 0.005	344.	0.014 8	89.1	82.	< 0.1	0.227	0.226	31.1	0.007 7	0.62	14.7
60-2-1	SS		2022-03-04	Clear and colourless	6.96	472	10.5	180	284	1.68		0.053	0.339	38.2	< 0.01	< 0.005	340.	0.019 3	90.	100.	< 0.1	0.173	0.38	18.4	0.012 3	0.67	14.4
60-3-1	SS		2021-05-06	Clear and colourless	8.04	704	11.4	170	360	1.87		0.057	0.15	18.	< 0.01	< 0.005	203.	0.154	121.	150.	1.48	0.182	1.47	1.2	< 0.005	< 0.5	14.
60-3-1	SS		2021-09-09	Slightly silty and slightly brown	7.93	589	12.1	200	312	1.41		0.065	0.176	15.4	< 0.01	< 0.005	372.	0.108	107.	89.	< 0.1	0.129	1.39	< 1.	< 0.005	< 0.5	11.1
60-3-1	SS		2021-11-02	Slightly silty and slightly black	7.92	547	11.1	200	303	1.5		0.053	0.187	15.1	< 0.01	< 0.005	336.	0.32	103.	80.	< 0.1	0.28	2.29	1.1	< 0.005	< 0.5	10.9
60-3-1	SS		2022-03-03	Slightly silty and very grey	6.57	910	9.8	150	341	1.15		0.053	0.148	16.7	< 0.01	< 0.005	192.	0.109	117.	150.	0.3	0.136	1.36	2.4	< 0.005	< 0.5	12.2
62-1-1	SS		2021-09-24	Clear and colourless	8.09	181	9.9	110	126	0.75		0.034	0.094	1.08	< 0.01	< 0.005	35.	< 0.005	43.9	2.9	0.24	0.034 9	0.196	2.4	< 0.005	< 0.5	4.03
62-1-1	SS		2021-11-25	Clear and colourless	7.73	170	9.6	120	118	1.33		0.026	0.093	0.953	< 0.01	< 0.005	26.	< 0.005	40.9	3.2	0.22	0.037 8	0.131	1.5	< 0.005	< 0.5	3.81
62-1-1	S

BC CSR			a AW Maximum (1)	---	---	---	---		---	90	50	10000	2 (9)	---	12000	0.5-4 (5)	---	1500	90 (7)	40	20-90 (5)	---	40-160 (5)	---	---
			b DW Maximum (2)	---	---	---	---		9500	6	10	1000	8	---	5000	5	---	250	6000	14 (9)	1500	--- (6)	10	33 (9)	---
Station	Sample Type	Compliance Well (Y/N?)	Date Sampled	Parameter	PH (Field)	Specific Conductivity - 25°C (Field)	Temperature (Field)	Alkalinity	Hardness as CaCO3	Aluminum	Antimony	Arsenic	Barium	Beryllium	Bismuth	Boron	Cadmium	Calcium	Chloride	Chromium	Cobalt	Copper	Iron	Lead	Lithium	Magnesium
				Fraction	TOT	TOT	TOT	TOT	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS
				Unit	pH	µS/cm	°C	mg/L	mg/L	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	mg/L	mg/L	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	mg/l
				Method Detection Limit	0.1	1	0.1	1	0.5	0.5	0.02	0.02	0.02	0.01	0.005	10	0.005	0.05	1	0.1	0.005	1	0.005	0.5	0.05
72-1-1	FRM	Y	2020-05-15	Mean of duplicates	8.13	442	10.9	160	275.5	1.585	< 0.03	0.13	12.65	< 0.015	< 0.007 5	1 705.	0.009 25	87.	75.	0.845	0.076 85	< 0.075	356.	< 0.007 5	0.77	14.2
72-1-1	FRM		2021-09-09	Mean of duplicates	7.91	439	10.7	160	278	1.655	< 0.02	0.158 5	12.8	< 0.01	< 0.005	1 785.	< 0.005	88.4	73.5	< 0.1	0.058 95	< 0.05	381.	< 0.005	0.54	13.9
72-1-1	FRM		2021-11-04	Mean of duplicates	7.99	509	10.6	160	264.5	1.38	< 0.02	0.148	12.4	< 0.01	< 0.005	1 725.	< 0.005	84.75	75.	0.105	0.121 9	< 0.05	356.	< 0.005	0.5	12.85
72-1-1	FRM		2022-03-02	Mean of duplicates	7.29	433	10.6	150	268	1.66	< 0.03	0.135 5	12.05	< 0.015	< 0.007 5	1 625.	0.019 1	84.85	74.	< 0.15	0.042 85	0.09	373.	0.013	0.755	13.65
72-3-1	SS	Y	2021-05-06	Clear and colourless	8.16	442	10.6	200	241	2.2	0.024	0.311	15.6	< 0.01	< 0.005	501.	0.018 6	84.2	43.	1.88	0.102	0.296	6.6	0.007 2	0.67	7.52
72-3-1	SS		2021-09-09	Clear and colourless	7.89	473	11.6	210	264	1.59	0.033	0.253	15.3	< 0.01	< 0.005	559.	0.012 6	93.1	46.	< 0.1	0.092 8	0.254	3.9	0.005 8	0.64	7.71
72-3-1	SS		2021-11-04	Clear and colourless	8.03	467	11.3	210	256	5.23	0.029	0.266	16.1	< 0.01	< 0.005	589.	0.023 9	90.5	50.	< 0.1	0.101	0.277	8.4	0.009	0.64	7.33
72-3-1	SS		2022-03-02	Clear and colourless	6.95	610	10.3	200	255	3.32	0.031	0.315	14.6	< 0.01	< 0.005	449.	0.027 1	89.7	41.	< 0.1	0.081 8	0.31	5.5	0.008 5	0.66	7.51
73-1-1	SS	Y	2021-05-05	Clear and colourless	8	320	10.3	160	215	2.07	0.021	0.183	12.8	< 0.01	< 0.005	112.	0.023 2	66.5	21.	< 0.1	0.276	0.419	6.6	0.017 3	< 0.5	12.
73-1-1	FRM		2021-09-09	Mean of duplicates	7.76	333	11	170	222.5	1.895	0.021 5	0.188	12.85	< 0.01	< 0.005	116.5	0.022 1	69.2	21.	< 0.1	0.199 5	0.149	< 1.	0.011 4	< 0.5	12.1
73-1-1	FRM		2021-11-02	Mean of duplicates	8.01	460	10.1	160	213	21.975	0.025 5	0.216 5	12.85	< 0.01	< 0.005	127.	0.017 05	66.05	22.	< 0.1	0.22	0.667	30.85	0.028 3	< 0.5	11.65
73-1-1	FRM		2022-03-02	Mean of duplicates	6.89	323	9.8	160	215	1.24	0.028 5	0.208	10.3	< 0.01	< 0.005	116.	0.013 25	67.35	22.	< 0.1	0.078 9	0.188 5	< 1.	< 0.005	< 0.5	11.35
73-2-1	SS	Y	2021-05-05	Clear and colourless	7.82	310	10.5	160	197	1.37	< 0.02	0.095	9.01	< 0.01	< 0.005	77.	0.009 5	62.	22.	< 0.1	0.104	0.657	12.9	0.006 3	< 0.5	10.2
73-2-1	SS		2021-09-09	Clear and colourless	7.67	334	10.4	160	229	1.35	< 0.02	0.125	10.6	< 0.01	< 0.005	97.	0.008 5	72.1	25.	< 0.1	0.126	0.781	16.1	< 0.005	< 0.5	11.8
73-2-1	SS		2021-11-02	Clear and colourless	7.91	470	10.2	150	210	1.26	< 0.02	0.121	10.2	< 0.01	< 0.005	92.	0.011 5	65.8	27.	< 0.1	0.114	0.52	16.4	< 0.005	< 0.5	11.2
73-2-1	SS		2022-03-02	Clear and colourless	6.62	430	10.2	150	194	1.18	< 0.02	0.096	8.71	< 0.01	< 0.005	67.	0.008 5	60.4	20.	< 0.1	0.081 8	0.388	9.4	< 0.005	< 0.5	10.4
73-3-1	SS	Y	2021-05-05	Moderately silty and moderately grey	7.14	173	10.2	63	74.9	13.6	0.038	0.138	12.8	< 0.01	< 0.005	46.	0.022	23.5	21.	< 0.1	0.033 2	0.311	4.7	0.012 4	1.36	3.96
73-3-1	SS		2021-09-09	Slightly silty and clear	7.04	296	11.5	110	143	3.44	0.032	0.157	21.6	< 0.01	< 0.005	96.	0.034	45.3	39.	< 0.1	0.046 3	0.376	1.7	0.011	1.31	7.36
73-3-1	SS		2021-11-02	Clear and colourless	7.22	290	10.8	86	94.7	7.76	0.032	0.153	16.	< 0.01	< 0.005	54.	0.025 4	29.4	20.	< 0.1	0.030 8	0.389	3.2	0.012	1.32	5.17
73-3-1	SS		2022-03-02	Slightly silty and slightly grey	6.19	182	9.9	69	83	11.	0.031	0.175	12.2	< 0.01	< 0.005	32.	0.023 1	26.	17.	< 0.1	0.032 4	0.382	3.8	0.012	1.01	4.39
77-1-1	SS		2021-09-24	Slightly silty and slightly grey	8.2	262	11.3	160	182	11.4	< 0.02	0.087	10.5	< 0.01	< 0.005	210.	< 0.005	55.9	5.8	< 0.1	0.073 1	0.055	62.3	0.007 4	< 0.5	10.4
77-1-1	SS		2021-11-17	Moderately silty and moderately grey	7.82	350	10.7	160	173	68.8	< 0.02	0.099	7.97	< 0.01	< 0.005	213.	0.029 8	52.4	6.1	< 0.1	0.103	0.192	188.	0.059 7	< 0.5	10.2
77-1-1	SS		2022-02-17	Slightly silty and slightly grey	7.43	254	10.4	160	179	3.02	0.023	0.067	6.07	< 0.01	< 0.005	209.	0.010 5	55.	6.1	< 0.1	0.051 7	0.076	10.7	0.006 1	< 0.5	10.
77-2-1	SS		2021-09-24	Clear and colourless	8.29	291	11.6	170	202	27.7	0.057	0.791	40.7	< 0.01	< 0.005	184.	0.009 5	56.3	7.1	< 0.1	0.025 2	0.22	5.7	0.011	0.64	14.9
77-2-1	SS		2021-11-18	Clear and colourless	8	277	10.7	170	163	2.06	0.031	0.593	17.8	< 0.01	< 0.005	200.	< 0.005	48.2	6.5	< 0.1	< 0.005	0.13	2.4	< 0.005	0.85	10.4
77-2-1	SS		2022-02-17	Clear and colourless	7.5	380	11.1	160	192	9.94	0.034	0.677	18.3	< 0.01	< 0.005	175.	0.006 7	52.7	7.2	< 0.1	0.059	0.176	23.	0.006 6	0.73	14.6
78-1-1	SS		2021-09-24	Clear and colourless	8.28	355	11.1	190	231	12.6	0.681	0.484	40.2	< 0.01	< 0.005	328.	0.019 8	66.	3.5	< 0.1	0.030 3	0.336	13.1	0.016 4	1.18	16.1
78-1-1	SS		2021-11-18	Clear and colourless	8.08	327	10.6	200	194	1.81	0.659	0.449	27.5	< 0.01	< 0.005	366.	0.017 2	59.5	3.8	< 0.1	< 0.005	0.235	9.3	< 0.005	1.53	11.2
78-1-1	SS		2022-02-17	Clear and colourless	7.55	470	11.2	190	225	27.4	1.37	0.531	29.7	< 0.01	< 0.005	323.	0.019 1	64.1	5.4	0.19	0.033 7	0.914	54.6	0.008 5	1.26	15.8
78-2-1	SS		2021-09-24	Clear and colourless	8.1	446	12.9	180	297	15.7	0.188	0.435	29.5	< 0.01	< 0.005	351.	0.433	98.	2.8	0.22	0.247	0.419	47.9	0.016 1	0.96	12.7
78-2-1	SS		2021-11-17	Clear and colourless	7.31	410	10.5	120	95.1	101.	0.067	0.274	8.59	0.021	< 0.005	200.	0.477	30.5	3.9	0.41	0.18	1.06	168.	0.139	1.	4.57
78-2-1	SS		2022-02-17	Clear and colourless	7.17	510	11.7	76	245	42.	0.106	0.232	16.6	< 0.01	< 0.005	219.	0.341	80.4	3.2	0.21	0.217	0.374	95.6	0.017 4	1.06	10.7
80-1-0 (P8)	SS		2021-05-12	Slightly silty and very black	7.94	4673	14.7	2400	476	126.	4.76	21.3 b	60.4	< 0.05	< 0.025	4 070.	0.033	128.	410. b	55.5	22. b	8.33	10 500.	0.564	3.9	38.
80-1-0 (P8)	SS		2021-09-29	Slightly silty and very brown	7.56	2	15.9	1900	539	60.8	3.36	6.71	114.	< 0.02	< 0.01	3 190.	0.107	149.	380. b	28.2	19.5 b	32.1	3 370.	0.5	2.	40.7
80-1-0 (P8)	SS		2021-11-01	Clear and moderately brown	7.71	4456	15	1800	536	37.7	2.34	5.03	103.	0.027	< 0.01	2 920.	0.082	149.	410. b	22.	17.9 b	14.7	3 300.	0.254	1.5	39.7
80-1-0 (P8)	SS		2022-02-11	Clear and moderately brown	7.39	2433	13.5	1200	364	47.5	1.29	8.56	68.7	< 0.02	< 0.01	2 150.	0.018	92.	230.	20.6	9.86	3.35	5 490.	0.172	1.6	32.5
81-1-0 (P9)	SS		2021-05-12	Slightly silty and slightly yellow	7.93	787	14.1	280	391	1.28	0.061	0.15	47.6	< 0.01	< 0.005	868.	< 0.005	94.4	110.	0.67	1.15	0.198	55.8	0.006 1	0.81	37.6
81-1-0 (P9)	SS		2021-09-29	Clear and slightly brown	7.77	853	16.5	250	395	3.69	0.061	0.225	50.1	< 0.01	< 0.005	878.	< 0.005	95.8	94.	0.69	37.5	0.267	40.9	< 0.005	0.83	37.9
81-1-0 (P9)	SS		2021-11-02	Clear and slightly yellow	8.08	798	15.9	280	340	3.44	0.072	0.253	43.4	< 0.01	< 0.005	795.	0.007 1	83.	110.	0.6	0.86	8.8	72.7	0.469	0.75	32.1
81-1-0 (P9)	SS		2022-02-11	Clear and colourless	8.05	870	12.7	230	335	3.11	0.08	0.125	38.7	< 0.01	< 0.005	794.	< 0.005	80.3	97.	0.53	0.912	0.22	21.	< 0.005	0.66	32.6
85-1-1	SS		2021-09-08	Clear and colourless	6.9	708	15.4	92	224	1.46	0.045	0.198	5.3	< 0.01	< 0.005	159.	0.121	67.	170.	< 0.1	0.228	5.73	< 1.	< 0.005	< 0.5	13.7
85-1-1	SS		2021-11-03	Clear and slighlty orange	7.06	570	15.2	65	118	2.44	0.095	0.148	2.98	< 0.01	< 0.005	131.	0.011 3	35.3	99.	< 0.1	0.161	9.6	2.3	0.192	< 0.5	7.3
85-1-1	SS		2022-03-03	Clear and colourless	6.64	488	14.2	97	136	1.65	0.091	0.201	3.19	< 0.01	< 0.005	157.	0.007 6	40.6	98.	< 0.1	0.139	4.29	1.1	< 0.005	< 0.5	8.41
87-1-1	SS		2021-09-15	Clear and colourless	8.09	274	11.3	170	171	7.61	0.135	0.387	27.6	< 0.01	< 0.005	21.	0.023 9	53.1	5.2	< 0.1	0.286	0.263	7.7	0.041 2	< 0.5	9.35
87-1-1	SS		2021-11-17	Clear and colourless	7.77	350	9.9	160	170	87.	0.034	0.613	20.9	< 0.01	< 0.005	17.	0.017 4	52.8	5.5	0.24	0.145	0.182	176.	0.037 9	< 0.5	9.26
87-1-1	SS		2022-02-17	Clear and colourless	7.12	245	9.1	160	172	4.11	0.126	0.624	16.9	< 0.01	< 0.005	16.	0.011 4	54.3	7.7	< 0.1	0.022	0.472	2.7	0.005 1	< 0.5	8.86
87-2-1	SS		2021-09-15	Clear and colourless	7.11	168	11.7	96	99.3	1.99	< 0.02	< 0.02	0.954	< 0.01	< 0.005	12.	< 0.005	32.1	4.3	< 0.1	0.020 1	0.175	2.7	0.006 7	< 0.5	4.68
87-2-1	SS		2021-11-17	Clear and colourless	6.78	640	9.2	69	265	1.54	< 0.02	0.053	1.89	< 0.01	< 0.005	10.	< 0.005	85.5	4.8	< 0.1	0.112	0.096	3.5	< 0.005	< 0.5	12.5
87-2-1	SS		2022-02-17	Clear and colourless	6.39	190	9.1	73	87.4	2.33	< 0.02	0.043	0.697	< 0.01	< 0.005	< 10.	< 0.005	28.1	4.3	< 0.1	0.019 2	0.167	2.9	< 0.005	< 0.5	4.16
88-1-1	SS		2021-09-15	Clear and colourless	7.56	227	11.4	140	144	1.78	0.022	0.051	2.19	< 0.01	< 0.005	14.	< 0.005	48.5	4.3	< 0.1	0.039 6	0.13	1.3	< 0.005	< 0.5	5.65
88-1-1	SS		2021-11-17	Clear and colourless	7.24	330	9.7	120	157	7.47	0.021	0.085	7.74	< 0.01	< 0.005	13.	< 0.005	52.4	4.2	0.13	0.043	0.146	2.	0.006 8	< 0.5	6.27
88-1-1	SS		2022-02-17	Clear and colourless	6.7	320	9.7	96	150	2.45	0.024	0.062	0.941	< 0.01	< 0.005	12.	< 0.005	50.4	4.	0.14	0.144	0.201	4.6	< 0.005	< 0.5	5.98
88-2-1	SS		2021-09-15	Moderately silty and very brown	7.54	268	11.1	130	174	2.18	0.046	0.095	5.28	< 0.01	< 0.005	23.	0.006	59.	4.1	< 0.1	0.045 3	0.401	3.2	0.013 8	< 0.5	6.38
88-2-1	SS		2021-11-17	Clear and colourless	6.69	700	9.7	67	336	92.9	0.115	0.191	75.7	< 0.01	< 0.005	26.	0.095 5	114.	4.1	0.14	0.889	1.06	103.	0.044	< 0.5	12.2
88-2-1	SS		2022-02-17	Moderately silty and very brown	6.29	242	10.2	55	148	5.74	0.05	0.069	3.19	< 0.01	< 0.005	16.	< 0.005	49.9	3.8	< 0.1	0.108	0.368	10.1	0.01	< 0.5	5.63
91-1-1	SS		2021-05-13		8.1	368	11.4	220	245	133.	0.266	0.618	46.5	0.051	0.010 3	83.	0.025 2	80.3	4.7	0.41	0.245	0.445	252.	0.236	2.95	10.9
91-1-1	SS		2021-09-17		8.19	377	11.9	210	237	4.81	0.223	0.452	41.5	< 0.01	< 0.005	72.	0.014 8	78.	5.	< 0.1	0.027	0.248	6.9	0.011 1	2.53	10.2
91-1-1	SS		2021-11-18		8.09	520	9.4	220	234	13.9	0.203	0.397	45.8	< 0.01	< 0.005	81.	0.009 6	80.4	5.	< 0.1	0.087 8	0.325	31.8	0.041 9	4.05	8.05
91-1-1	SS		2022-02-15		7.99	364	10.6	210	266	3.65	0.21	0.402	45.5	< 0.01	< 0.005	67.	0.013 6	88.4	5.	< 0.1	0.022 2	0.37	4.	0.007 1	2.96	11.
92-1-1	SS		2021-05-13		7.97	396	11.4	180	256	149.	0.102	0.684	36.7	0.038	0.005 3	429.	0.027	81.3	5.3	0.24	0.198	0.331	261.	0.137	3.22	12.8
92-1-1	SS		2021-09-17		8.22	416	12.3	180	249	6.79	0.08	0.647	31.4	< 0.01	< 0.005	423.	0.044 9	78.9	5.3	< 0.1	0.041 7	0.397	10.5	0.023 4	1.87	12.6
92-1-1	SS		2021-11-18		8.08	369	9.4	180	225	17.4	0.08	0.53	32.6	< 0.01	< 0.005	459.	0.035	74.5	5.4	< 0.1	0.064 1	1.01	41.	0.051 3	2.43	9.47
92-1-1	SS		2022-02-15		8.1	530	10	180	262	4.37	0.089	0.567	34.2	< 0.01	< 0.005	433.	0.016 5	83.4	5.3	< 0.1	0.029 6	0.64	4.6	0.029 2	2.07	13.1
93-1-1	NS		2021-05-13	No sample. Not accessible due to construction.	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
93-1-1	NS		2021-09-17	Well inaccessible due to aggregate storage; no sample collected.	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
93-1-1	NS		2021-11-18		---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
93-1-1	NS		2022-02-15		---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
94-1-1	SS		2021-05-12		7.97	238	8.5	140	174	35.2	0.115	0.276	26.4	0.02	< 0.005	30.	0.023 8	56.7	5.7	< 0.1	0.15	0.264	19.3	0.039 9	0.95	7.87
94-1-1	SS		2021-09-15		7.92	265	8.9	150	170	13.9	0.147	0.235	31.8	< 0.01	< 0.005	22.	0.034 8	55.5	5.5	< 0.1	0.085 1	0.351	9.	0.012 2	1.24	7.55
94-1-1	SS		2021-11-19		8.11	430	8.4	160	173	1.95	0.209	0.236	29.8	< 0.01	< 0.005	19.	0.043 5	55.6	6.4	< 0.1	0.278	0.252	< 1.	0.006 2	1.06	8.26
94-1-1	SS		2022-02-15		8.19	226	8.2	150	169	2.5	0.135	0.308	25.9	< 0.01	< 0.005	20.	0.015 8	54.7	5.	< 0.1	0.201	0.171	< 1.	< 0.005	1.25	7.89
P1	SS		2021-05-07	Clear and slighlty orange	8.06	1470	16.9	700	289	7.1	0.089	9.76	1 650. b	< 0.02	< 0.01	2 350.	0.076	78.5	130.	0.73	2.56	< 0.1	14 900.	0.075	19.5	22.6
P1	SS		2021-09-29	Clear and slighlty orange	7.62	1816	18.4	810	274	26.8	0.174	5.64	1 710. b	< 0.02	< 0.01	2 490.	< 0.01	74.5	170.	1.05	3.7	0.24	9 570.	0.019	19.	21.4
P1	SS		2021-11-03	Clear and colourless	8.05	2000	17.7	790	279	4.5	0.803	10.1 b	1 420. b	< 0.02	< 0.01	2 690.	0.025	77.5	170.	1.08	6.64	0.74	10 900.	0.659	21.7	20.7
P1	SS		2022-03-07	Clear and colourless	6.68	1100	15.3	490	295	5.2	0.159	8.39	1 040. b	< 0.02	< 0.01	889.	< 0.01	93.5	62.	0.57	1.07	0.17	27 100.	0.298	9.	14.9
P2	SS		2021-05-07	Clear and slighlty orange	8.1	2067	16.4	980	311	7.3	0.062	1.03	638.	< 0.02	< 0.01	3 450.	< 0.01	78.6	190.	1.27	4.7	0.57	889.	0.04	2.9	27.8
P2	SS		2021-09-10	Clear and slighlty yellow	7.95	2208	18	990	320	5.8	0.07	0.967	525.	< 0.02	< 0.01	3 270.	< 0.01	84.6	180.	1.28	4.64	< 0.1	1 100.	0.017	1.4	26.5
P2	SS		2021-11-03	Clear and slighlty yellow	8.2	2500	15.2	1000	309	5.	0.061	0.93	504.	< 0.02	< 0.01	3 290.	0.018	81.6	200.	1.37	4.76	2.24	1 170.	0.198	1.4	25.5
P2	SS		2022-03-07	Clear and slighlty orange	6.9	1600	16.2	660	276	3.7	0.053	0.794	445.	< 0.02	< 0.01	2 110.	< 0.01	77.2	89.	0.74	2.57	0.2	597.	0.033	3.4	20.3
P3	SS		2021-05-07	Clear and slighlty orange	8.16	2369	16.4	1100	298	8.9	< 0.1	2.05	801.	< 0.05	< 0.025	4 240.	< 0.025	64.6	220.	1.1	3.33	4.66	0.27	1 020.	0.035	5.5	33.1
P3	SS		2021-09-10	Clear and slighlty yellow	7.99	2223	16.1	1000	313	5.2	0.042	1.78	539.	< 0.02	< 0.01	3 670.	< 0.01	77.8	200.	1.07	4.61	0.12	3 260.	0.017	1.5	28.9
P3	SS		2021-11-26	Clear and slighlty yellow	8.09	1832	14	960	275	4.1	0.041	1.11	803.	< 0.02	< 0.01	1 190.	< 0.01	81.2	190.	0.48	1.68	1.04	309.	0.071	5.8	17.7
P3	SS		2022-03-07	Clear and slighlty orange	6.75	1345	16.9	660	305	4.2	0.042	1.25	374.	< 0.02	< 0.01	1 790.	< 0.01	85.5	98.	0.59	1.52	0.21	1 560.	0.019	3.6	22.2
P4	SS		2021-05-07	Clear and slighlty orange	8.01	1888	14.4	980	324	5.7	0.05	1.79	159.	< 0.02	< 0.01	2 570.	< 0.01	79.2	180.	1.	3.11	0.26	3 210.	0.04	< 1.	30.7
P4	SS		2021-09-10	Clear and slighlty yellow	7.93	1971	16.7	950	322	5.2	< 0.04	2.32	162.	< 0.02	< 0.01	2 620.	< 0.01	84.1	180.	0.95	3.04	< 0.1	6 620.	0.012	< 1.	27.2
P4	SS		2021-11-03	Clear and slighlty yellow	8.04	2300	14.5	940	307	4.9	< 0.04	2.58	164.	< 0.02	< 0.01	2 530.	< 0.01	79.7	180.	0.87	3.18	0.2	6 810.	0.018	< 1.	26.3
P4	SS		2022-03-07	Clear and slighlty orange	6.84	1784	14.7	870	303	3.8	0.048	1.37	150.	< 0.02	< 0.01	2 520.	< 0.01	75.	160.	0.82	3.06	0.13	2 120.	< 0.01	< 1.	28.
P10	SS		2021-05-07	Slighlty silty and moderately orange	8.03	1154	15.8	600	306	3.6	< 0.04	1.43	865.	< 0.02	< 0.01	1 490.	< 0.01	89.2	95.	0.53	1.48	< 0.1	1 150.	0.012	5.9	20.3
P10	SS		2021-09-10	Clear and slighlty yellow	8.03	1546	17.6	700	341	3.44	0.068	1.8	1 150. b	< 0.01	< 0.005	1 980.	< 0.005	99.7	140.	0.74	2.54	0.326	186.	0.141	7.64	22.5
P10	SS		2021-11-26	Clear and slighlty yellow	8.01	1400	15.3	610	282	2.74	0.04	1.07	789.	< 0.01	< 0.005	1 200.	< 0.005	84.1	89.	0.54	1.67	1.01	300.	0.066 1	5.87	17.4
P10	SS		2022-03-07	Clear and very orange	6.67	1100	14.8	470	302	3.1	< 0.04	0.626	599.	< 0.02	< 0.01	883.	0.018	93.1	43.	0.32	0.796	0.53	381.	0.019	2.5	16.9

Notes:

a	*Above CSR Schedule 3.2 AW Standard.*
b	*Above CSR Schedule 3.2 DW Standard.*
c	*Detection Limits above Applicable Standards.*
SS	*Single sample.*
FR1, FR2	*Field replicates.*
BC CSR	*CSR-Sch3.2: BC Contaminated Site Regulation - Schedule 3.2 - Generic Numerical Water Standards, be in effective on November 1, 2017.*
(1)	*Aquatic Life (AW) Freshwater, Column 3.*
(2)	*Drinking Water (DW), Column 6.*
(3)	*Standard varies with pH. Every ammonia result was compared to a standard based on the associated pH result for that sample.*
(4)	*Standard varies with chloride. Every nitrite result was compared to a standard based on the associated chloride result for that sample.*
(5)	*Standard varies with hardness. Every result was compared to a standard that was based on the associated hardness result for that sample.*
(6)	*BC CSR Schedule 3.2 criterion for iron and manganese were not applied as directed by the Stage 8 CSR Amendments.*
(7)	*Standard is based on the trivalent (Cr(III)) species.*
(8)	*Interim standard used.*
(9)	*CSR Stage 13 amendments, protocol 9, background concentration is higher than the applicable CSR DW and/or most stringent CSR a standard. A concentration above the CSR DW or most stringent CSR AW stanadard but below the regional background concentration (South Vancouver Island Region). Is not considered contaminated and is not highlighted as a CSR DW or AW exceedance*

BC CSR				a AW Maximum (1)	---		10000		1.31-18.4 (3)		0.2-2 (4)		400		400	250-1500 (5)		---		---		20		---		0.5-15 (5)		---		---		128-429 (5)		---		3		---		1000		85		---		75-2400 (5)		---
				b DW Maximum (2)	--- (6)		250		---		1		10		10	80		---		---		10		---		20		1700 (9)		2500		500		---		---		2.5		---		20		20		3000		---
Station	Sample Type	Compliance Well (Y/N?)	Date Sampled	Parameter	Manganese		Molybdenum		Nitrogen - ammonia		Nitrogen - nitrite		Nitrogen - nitrate		Nitrogen - nitrate plus nitrite	Nickel		Phosphorus		Potassium		Selenium		Silicon		Silver		Sodium		Strontium		Sulphate		Sulphur		Thallium		Tin		Titanium		Uranium		Vanadium		Zinc		Zirconium
				Fraction	DIS		DIS		DIS		DIS		DIS		DIS	DIS		DIS		DIS		DIS		DIS		DIS		DIS		DIS		DIS		DIS		DIS		DIS		DIS		DIS		DIS		DIS
				Unit	µg/l		µg/l		mg/l		mg/l		mg/l		mg/l	µg/l		µg/l		µg/l		µg/l		µg/l		µg/l		mg/L		µg/l		mg/L		µg/l		µg/l		µg/l		µg/l		µg/l		µg/l		µg/l
				Method Detection Limit	0.05		0.05		0.015		0.005		0.02		0.02	2		0.05		0.04		50		0.005		0.05		0.05		1		3		0.002		0.2		0.5		0.002		0.2		0.1		0.2		0.1
04-3-1	SS	Y	2021-05-05	Clear and colourless	0.205		2.87		0.043	<	0.005		0.025		0.025	0.394		10.6		0.767		0.199		9 060.	<	0.005		12.3		197.		38.		12.1		0.003 1	<	0.2	<	0.5		0.584	<	0.2		0.33	<	0.1
04-3-1	SS		2021-09-09	Clear and colourless	0.129		2.63		0.02	<	0.005		0.027		0.027	0.368		7.7		0.551		0.143		9 340.	<	0.005		11.9		179.		41.		11.2		0.004	<	0.2	<	0.5		0.642	<	0.2		0.88		0.72
04-3-1	SS		2021-11-03	Clear and colourless	3.22		2.18	<	0.015	<	0.005	<	0.02	<	0.02	0.377		7.2		0.525		0.119		8 910.	<	0.005		10.9		170.		41.		10.2		0.003 4	<	0.2	<	0.5		0.538	<	0.2		0.91	<	0.1
04-3-1	SS		2022-03-02	Clear and colourless	0.054		3.25	<	0.015	<	0.005		0.036		0.036	0.336		7.5		0.628		0.188		8 950.	<	0.005		12.8		182.		37.		11.8		0.002 8	<	0.2	<	0.5		0.788	<	0.2		0.51	<	0.1
04-4-1	SS	Y	2021-05-05	Clear and colourless	1.28		0.101		0.1	<	0.005		0.314		0.314	0.33		6.1		1.31	<	0.04		5 720.	<	0.005		14.2		93.7		24.		7.	<	0.002	<	0.2	<	0.5		0.009 8		0.44	<	0.1	<	0.1
04-4-1	SS		2021-09-09	Clear and colourless	4.31		0.159		0.037	<	0.005		0.249		0.249	0.408		3.3		1.62		0.041		6 430.	<	0.005		15.4		148.		38.		10.1		0.003 7	<	0.2	<	0.5		0.038		0.42		0.37	<	0.1
04-4-1	SS		2021-11-03	Clear and colourless	3.86		0.116	<	0.015	<	0.005		1.91		1.91	0.412		2.7		1.48		0.058		5 790.	<	0.005		15.5		112.		67.		18.4		0.002 4	<	0.2	<	0.5		0.012 6		0.38		0.29	<	0.1
04-4-1	SS		2022-03-02	Clear and colourless	1.12		0.11	<	0.015	<	0.005		1.14		1.14	0.292		2.1		1.14		0.046		5 110.	<	0.005		13.		74.5		20.		6.3	<	0.002	<	0.2	<	0.5		0.006 7		0.47		0.14	<	0.1
07-1-0	SS		2021-05-06	Clear and colourless	1 980.		0.617		0.14	<	0.005	<	0.02	<	0.02	4.78		3.		1.27		0.063		8 490.	<	0.005		24.1		301.		45.		13.	<	0.002	<	0.2	<	0.5		0.301	<	0.2		12.8	<	0.1
07-1-0	SS		2021-09-09	Clear and colourless	1 850.		0.271	<	0.015	<	0.005	<	0.02	<	0.02	3.73		2.4		1.48	<	0.04		8 390.	<	0.005		26.6		288.		45.		15.	<	0.002	<	0.2	<	0.5		0.346	<	0.2		28.2	<	0.1
07-1-0	SS		2021-11-02	Clear and colourless	1 800.		0.279	<	0.015	<	0.005	<	0.02	<	0.02	3.25		2.4		1.33		0.068		7 690.	<	0.005		26.		295.		44.		13.5	<	0.002	<	0.2	<	0.5		0.322	<	0.2		7.66	<	0.1
07-1-0	SS		2022-03-03	Clear and colourless	2 040.		0.249		0.02	<	0.005	<	0.02	<	0.02	3.52	<	2.		1.31		0.047		8 270.	<	0.005		26.1		303.		41.		12.5	<	0.002	<	0.2	<	0.5		0.294	<	0.2		11.5	<	0.1
16-1-1	SS		2021-09-28	Clear and colourless	0.122		0.576	<	0.015	<	0.005		0.044		0.044	0.184		2.2		0.194	<	0.04		7 090.	<	0.005		4.44		181.		17.		5.4	<	0.002	<	0.2	<	0.5		0.177		0.62		0.59	<	0.1
16-1-1	SS		2021-11-09	Clear and colourless	0.062		0.419	<	0.015	<	0.005		0.735		0.735	0.221	<	2.		0.181		0.054		7 030.	<	0.005		3.97		174.		22.		6.5	<	0.002	<	0.2	<	0.5		0.122		0.6		0.97	<	0.1
16-1-1	SS		2022-02-11	Clear and colourless	0.569		0.339	<	0.015		0.010 3		0.714		0.724	0.22		2.		0.153		0.062		6 340.	<	0.005		3.44		124.		15.		4.3	<	0.002	<	0.2	<	0.5		0.064 4		0.62		2.73	<	0.1
16-1-2	SS		2021-09-28	Moderately silty and slightly grey	8.		0.405	<	0.015	<	0.005		0.142		0.142	0.299		8.5		0.259		0.061		7 290.	<	0.005		4.48		152.		16.		5.3	<	0.006 6	<	0.2		7.5		0.286		0.59		6.5		0.32
16-1-2	SS		2021-11-09	Very silty and moderately grey	418.		0.32	<	0.045		0.018 7		1.39		1.41	3.49		123.		0.57	<	0.08		9 650.	<	0.01		3.98		182.		20.	<	6.		0.049 8		0.41		43.1		2.77		4.04		38.4		1.31
16-1-2	SS		2022-02-10	Slightly silty and slightly grey	9.19		0.299	<	0.015		0.125		0.764		0.889	0.312		6.2		0.177		0.05		5 960.	<	0.005		3.57		122.		15.		4.8		0.003 3	<	0.2		2.8		0.123		0.7		1.86	<	0.1
16-2-1	SS		2021-09-28	Clear and colourless	0.494		0.853		0.21	<	0.005		0.127		0.127	0.245		4.6		0.33		0.115		7 220.	<	0.005		5.51		242.		17.		6.1		0.002 3	<	0.2	<	0.5		0.261		0.88		0.87	<	0.1
16-2-1	SS		2021-11-09	Clear and colourless	0.115		0.689		0.064		0.008 7		0.214		0.223	0.34		5.8		0.334		0.059		6 920.	<	0.005		5.16		238.		20.		5.7	<	0.002	<	0.2	<	0.5		0.217		1.09		0.51	<	0.1
16-2-1	SS		2022-02-10	Clear and colourless	0.178		0.653		0.043		0.005 6		0.48		0.486	0.226		4.5		0.291		0.073		6 430.	<	0.005		4.74		204.		16.		4.7		0.002 7	<	0.2	<	0.5		0.131		0.87		0.89	<	0.1
16-2-2	NS		2021-09-28	Insufficient well volume for sampling; no sample collected.	---		---		---		---		---		---	---		---		---		---		---		---		---		---		---		---		---		---		---		---		---		---		---		---
16-2-2	SS		2021-11-09	Clear and colourless	0.231		0.27	<	0.015	<	0.005		1.05		1.05	0.487		3.4		0.201		0.088		6 090.	<	0.005		3.74		142.		22.		7.		0.002 2	<	0.2	<	0.5		0.101		0.47		1.02	<	0.1
16-2-2	SS		2022-02-10	Clear and colourless	0.173		0.386	<	0.015		0.011 4		0.655		0.666	0.504		5.7		0.216		0.053		5 920.	<	0.005		3.8		134.		18.		5.		0.002 3	<	0.2	<	0.5		0.083		0.53		0.91	<	0.1
17-1-1	SS		2021-09-28	Moderately silty and slightly grey	19.1		0.43	<	0.015	<	0.005		0.658		0.658	0.709		8.1		0.642		0.078		12 100.	<	0.005		8.62		244.		28.		9.1		0.004 5	<	0.2		4.68		0.402		1.35		4.01		0.45
17-1-1	SS		2021-11-09	Clear and colourless	18.2		0.641	<	0.015		0.011 5		0.749		0.761	0.962		3.7		0.655		0.077		14 800.	<	0.005		10.3		443.		38.		11.6		0.003 2	<	0.2	<	0.5		0.398		1.92		1.69	<	0.1
17-1-2	SS		2021-09-28	Moderately silty and slightly grey	14.7		0.119	<	0.015	<	0.005		0.758		0.758	0.208		8.6		0.537		0.077		8 450.	<	0.005		4.36		154.		36.		9.3		0.003 4	<	0.2		3.57		0.113		0.81		0.11		0.25
17-1-2	SS		2021-11-09	Moderately silty and very grey	30.5		0.31	<	0.015		0.041 8		3.76		3.8	0.63		10.2		0.672		0.166		12 900.	<	0.005		7.05		289.		36.		9.		0.007 4	<	0.2		7.95		0.419		1.22		5.68		0.74
17-1-3	SS		2021-09-28	Slightly silty and slightly grey	3.24		0.353	<	0.015	<	0.005		0.073		0.073	0.901		4.1		0.356		0.053		9 890.	<	0.005		4.42		487.		42.		12.6		0.002 1	<	0.2		0.55		0.177		2.05		1.3	<	0.1
17-1-3	SS		2021-11-09	Clear and colourless	2.4		0.12	<	0.015		0.007 2		0.245		0.252	1.37		3.		0.385		0.117		8 220.	<	0.005		3.64		268.		43.		10.4		0.002 2	<	0.2	<	0.5		0.035 8		1.36		0.6		0.34
18-1-1	FRM	Y	2021-05-14	Mean of duplicates	48.25		0.394	<	0.015	<	0.005	<	0.02	<	0.02	0.32		5.5		0.203	<	0.04		8 075.	<	0.005		4.125		88.45		23.5		6.9	<	0.002	<	0.2	<	0.5		0.125 5		0.825		1.48	<	0.1
18-1-1	FRM		2021-09-29	Mean of duplicates	37.25		0.606		0.039 5	<	0.005	<	0.02	<	0.02	0.562 5		24.2		0.351 5	<	0.04		8 365.	<	0.005		5.09		97.25		23.5		7.45		0.003 1	<	0.2		0.95		0.137 5		0.61		42.02	<	0.1
18-1-1	FRM		2021-11-10	Mean of duplicates	173.		0.581 5	<	0.015	<	0.005	<	0.02	<	0.02	0.611 5		5.15		0.231	<	0.04		8 515.	<	0.005		4.7		90.75		25.		7.75	<	0.002	<	0.2	<	0.5		0.137 5		0.525		1.81	<	0.1
18-1-1	FRM		2022-02-10	Mean of duplicates	270.		0.617 5		0.016	<	0.005	<	0.02	<	0.02	0.997 5		8.2		0.264 5	<	0.04		8 185.	<	0.005		4.935		85.95		26.		7.65	<	0.002	<	0.2	<	0.5		0.142		0.315		0.26	<	0.1
18-2-1	SS	Y	2021-05-14	Slightly silty and slightly brown	0.543	<	0.05	<	0.015	<	0.005		0.116		0.116	0.08		2.4		0.096		0.35		6 910.	<	0.005		3.33		72.8		36.		11.5	<	0.002	<	0.2	<	0.5		0.046 1		0.7		0.8	<	0.1
18-2-1	SS		2021-09-29	Clear and colourless	0.527	<	0.05	<	0.015		0.008 3		0.37		0.379	0.534		10.8		0.131		0.932		6 920.	<	0.005		3.73		70.9		52.		14.8	<	0.002	<	0.2	<	0.5		0.049 5		0.59		23.2	<	0.1
18-2-1	SS		2021-11-10	Clear and colourless	0.116		0.058	<	0.015		0.009 9		0.557		0.567	0.255		2.		0.122		0.943		7 040.	<	0.005		4.02		79.9		75.		21.2	<	0.002	<	0.2	<	0.5		0.070 5		0.61		1.39	<	0.1
18-2-1	SS		2022-02-10	Slightly silty and slightly grey	0.138	<	0.05	<	0.015		0.023 4		0.198		0.221	0.082		3.8		0.098		0.441		7 050.	<	0.005		3.26		54.1		27.		9.2	<	0.002	<	0.2	<	0.5		0.027 2		0.59		0.64	<	0.1
18-2-2	SS	Y	2021-05-14	Clear and colourless	0.582		0.061	<	0.015	<	0.005		0.083		0.083	0.099	<	2.		0.153		0.375		6 740.	<	0.005		3.39		77.4		36.		12.2	<	0.002	<	0.2	<	0.5		0.069 3		0.64		0.36	<	0.1
18-2-2	SS		2021-09-29	Clear and colourless	0.196		0.052	<	0.015	<	0.005		0.121		0.121	0.103		2.6		0.154		0.447		6 680.	<	0.005		3.62		82.		45.		13.2	<	0.002	<	0.2	<	0.5		0.061 4		0.78		0.36	<	0.1
18-2-2	SS		2021-11-10	Clear and colourless	0.172	<	0.05	<	0.015	<	0.005		0.862		0.862	0.164		2.2		0.231		0.585		7 160.	<	0.005		3.7		94.5		110.		24.7		0.002 5	<	0.2	<	0.5		0.1		0.92		0.49		0.46
18-2-2	SS		2022-02-10	Clear and colourless	0.16		0.054	<	0.015	<	0.005		0.251		0.251	0.116		3.1		0.134		0.28		7 330.	<	0.005		3.12		51.4		29.		9.4	<	0.002	<	0.2	<	0.5		0.026		0.54		0.63	<	0.1
19-1-1	SS		2021-05-05	Clear and slightly orange	1 420.		1.22		0.03	<	0.005	<	0.02	<	0.02	0.536		2.		0.207	<	0.04		12 900.	<	0.005		8.3		160.		40.		11.1	<	0.002	<	0.2	<	0.5		0.17	<	0.2	<	0.1	<	0.1
19-1-1	SS		2021-09-09	Slightly silty, moderately orange	1 220.		5.02		0.036	<	0.005	<	0.02	<	0.02	0.415		2.2		0.198	<	0.04		12 700.	<	0.005		7.59		155.		37.		10.2	<	0.002	<	0.2	<	0.5		0.217	<	0.2		0.31	<	0.1
19-1-1	SS		2021-11-02	Clear and moderately orange	2 090.		0.606		0.03	<	0.005	<	0.02	<	0.02	0.573		2.5		0.216		0.137		11 300.	<	0.005		8.49		169.		30.		10.7	<	0.002	<	0.2	<	0.5		0.128	<	0.2		0.42	<	0.1
19-1-1	SS		2022-03-07	Clear and moderately yellow	2 670.		0.474		0.16	<	0.005	<	0.02	<	0.02	0.67		2.7		0.203	<	0.04		11 200.	<	0.005		5.98		173.		36.		11.8	<	0.002	<	0.2	<	0.5		0.012 2	<	0.2		0.19	<	0.1
19-1-2	SS		2021-05-05	Moderately silty and slightly orange	1 800.		0.406		0.067	<	0.005	<	0.02	<	0.02	0.529		3.9		0.179		0.054		11 100.	<	0.005		5.94		165.		37.		10.7	<	0.002	<	0.2	<	0.5		0.022 6	<	0.2	<	0.1	<	0.1
19-1-2	SS		2021-09-09	Clear and slightly yellow	2 000.		0.389		0.039	<	0.005		0.02	<	0.02	0.475		2.1		0.182	<	0.04		10 900.	<	0.005		6.02		165.		29.		8.5	<	0.002	<	0.2	<	0.5		0.043 2	<	0.2		0.15	<	0.1
19-1-2	SS		2021-11-02	Clear and slightly orange	816.		0.26		0.018	<	0.005	<	0.02	<	0.02	0.297		3.8		0.143		0.055		9 030.	<	0.005		4.92		146.		23.		7.3	<	0.002	<	0.2		1.23		0.064	<	0.2		0.25		0.11
19-1-2	SS		2022-03-07	Clear and colourless	294.		0.37		0.015	<	0.005	<	0.02	<	0.02	0.203		2.2		0.121	<	0.04		10 900.	<	0.005		4.45		147.		31.		9.5	<	0.002	<	0.2	<	0.5		0.034	<	0.2		0.24	<	0.1
19-2-1	SS		2021-05-05	Clear and colourless	79.7		0.592		0.086	<	0.005	<	0.02	<	0.02	0.157		3.7		0.145	<	0.04		12 800.	<	0.005		5.13		167.		45.		14.8	<	0.002	<	0.2	<	0.5		0.088 8	<	0.2	<	0.1	<	0.1
19-2-1	SS		2021-09-09	Clear and colourless	86.3		0.62		0.026	<	0.005	<	0.02	<	0.02	0.211		2.6		0.152	<	0.04		13 100.	<	0.005		5.09		187.		48.		13.3	<	0.002	<	0.2	<	0.5		0.126	<	0.2		0.4	<	0.1
19-2-1	SS		2021-11-02	Clear and colourless	83.3		0.5	<	0.015	<	0.005	<	0.02	<	0.02	0.2		3.2		0.144	<	0.04		12 100.	<	0.005		4.76		173.		41.		12.8	<	0.002	<	0.2		0.67		0.106	<	0.2		0.22		0.19
19-2-1	SS		2022-03-07	Clear and colourless	91.3		0.587	<	0.015	<	0.005	<	0.02	<	0.02	0.323		2.6		0.144	<	0.04		12 200.	<	0.005		4.7		170.		53.		13.7	<	0.002	<	0.2	<	0.5		0.085 7	<	0.2		0.17	<	0.1
19-2-2	SS		2021-05-06	Clear and moderately brown	229.		1.45	<	0.015	<	0.005	<	0.02	<	0.02	2.51		3.2		0.238	<	0.04		8 920.	<	0.005		5.22		178.		46.		15.	<	0.002	<	0.2	<	0.5		0.412	<	0.2		1.38	<	0.1
19-2-2	SS		2021-09-09	Slightly silty and slightly brown	86.9		0.399		0.024	<	0.005	<	0.02	<	0.02	0.273		3.		0.241	<	0.04		10 600.	<	0.005		5.86		205.		44.		12.6	<	0.002	<	0.2	<	0.5		0.245	<	0.2		0.45	<	0.1
19-2-2	SS		2021-11-02	Clear and moderately brown	93.2		0.363	<	0.015	<	0.005	<	0.02	<	0.02	0.265		2.5		0.247	<	0.04		7 800.	<	0.005		5.84		135.		41.		12.4	<	0.002	<	0.2	<	0.5		0.06	<	0.2		0.46	<	0.1
19-2-2	SS		2022-03-07	Slightly silty and slightly brown	4.88		0.488	<	0.015		0.005 4	<	0.02	<	0.02	0.14	<	2.		0.205	<	0.04		8 980.	<	0.005		5.04		159.		51.		13.6	<	0.002	<	0.2	<	0.5		0.068	<	0.2		0.17	<	0.1
20-1-1	SS	Y	2021-05-20	Clear and colourless	4.63		0.44	<	0.015	<	0.005	<	0.02	<	0.02	0.322		6.3		0.31	<	0.08		19 900.	<	0.01		11.4		493.		14.	<	6.	<	0.004	<	0.4	<	1.		0.027 1		0.51		8.48	<	0.2
20-1-1	SS		2021-09-22	Clear and colourless	17.8		0.48	<	0.015	<	0.005	<	0.02	<	0.02	0.489		4.3		0.31	<	0.08		20 700.	<	0.01		12.1		583.		15.	<	6.	<	0.004	<	0.4	<	1.		0.018 1	<	0.4		1.57	<	0.2
20-1-1	SS		2021-11-23	Clear and colourless	3.67		0.6	<	0.015	<	0.005	<	0.02	<	0.02	0.255	<	4.		0.21	<	0.08		19 900.	<	0.01		8.39		412.		14.	<	6.	<	0.004		11.4	<	1.		0.009 7	<	0.4		1.04	<	0.2
20-1-1	SS		2022-02-23	Clear and colourless	2.86		0.41	<	0.015	<	0.005	<	0.02	<	0.02	0.27	<	10.	<	0.25	<	0.2		21 900.	<	0.025		10.5		413.		12.	<	15.	<	0.01	<	1.	<	2.5		0.02	<	1.	<	0.5	<	0.5
20-1-2	SS	Y	2021-05-20	Clear and colourless	27.9		0.61		0.24	<	0.005	<	0.02	<	0.02	0.807	<	4.		0.48	<	0.08		20 600.	<	0.01		15.8		632.		15.	<	6.	<	0.004	<	0.4	<	1.		0.020 6	<	0.4		1.16	<	0.2
20-1-2	SS		2021-09-22	Clear and colourless	29.5		0.57		0.12	<	0.005	<	0.02	<	0.02	0.382		8.7		0.46	<	0.08		20 700.	<	0.01		16.4		709.		16.	<	6.	<	0.004	<	0.4	<	1.		0.019 3	<	0.4		1.2	<	0.2
20-1-2	SS		2021-11-23	Clear and colourless	12.2		0.45	<	0.015	<	0.005	<	0.02	<	0.02	0.1	<	4.		0.3	<	0.08		20 400.	<	0.01		9.48		490.		14.	<	6.	<	0.004	<	0.4	<	1.		0.009	<	0.4		1.12	<	0.2
20-1-2	SS		2022-02-23	Clear and colourless	7.65		0.43		0.02	<	0.005	<	0.02	<	0.02	0.13	<	10.	<	0.25	<	0.2		19 000.	<	0.025		8.94		420.		13.	<	15.	<	0.01	<	1.	<	2.5	<	0.01	<	1.		1.14	<	0.5
21-1-1	FRM	Y	2021-05-21	Mean of duplicates	5.755		0.5		0.028 5	<	0.005	<	0.02	<	0.02	0.14		4.1		0.205	<	0.08		19 350.	<	0.01		9.135		466.5		12.	<	6.	<	0.004	<	0.4	<	1.		0.028 9	<	0.4		0.95	<	0.2
21-1-1	FRM		2021-09-22	Mean of duplicates	5.51		0.54	<	0.015	<	0.005	<	0.02	<	0.02	0.04		4.9		0.195	<	0.08		19 600.	<	0.01		8.555		489.		12.	<	6.	<	0.004	<	0.4	<	1.		0.016 25	<	0.4		1.4	<	0.2
21-1-1	FRM		2021-11-24	Mean of duplicates	7.28		0.44		0.018	<	0.005	<	0.02	<	0.02	0.1	<	10.	<	0.25	<	0.2		20 200.	<	0.025		8.515		457.5		11.	<	15.	<	0.01	<	1.	<	2.5		0.010 5	<	1.		16.67	<	0.5
21-1-1	FRM		2022-02-23	Mean of duplicates	5.655		0.515		0.052 5	<	0.005		0.042 5		0.042 5	0.1	<	10.	<	0.25	<	0.2		20 800.	<	0.025		8.85		483.5		12.	<	15.	<	0.01	<	1.	<	2.5		0.022 5	<	1.	<	0.5	<	0.5
21-1-2	FRM	Y	2021-05-20	Mean of duplicates	1 830.		0.849		5.3	<	0.005	<	0.02	<	0.02	1.52		4.1		6.165	<	0.04		13 100.	<	0.005		26.5		441.5		19.		6.15		0.003 3	<	0.2	<	0.5		0.070 15		0.33		1.405	<	0.1
21-1-2	FRM		2021-09-21	Mean of duplicates	2 410.		0.673		6.05	<	0.005	<	0.02	<	0.02	2.26		7.15		7.09	<	0.04		13 200.	<	0.005		29.75		571.5		15.		5.		0.003 35	<	0.2	<	0.5		0.100 5		0.29		0.245	<	0.1
21-1-2	FRM		2021-11-23	Mean of duplicates	2 025.		0.757 5		6.1	<	0.005	<	0.02	<	0.02	2.255		6.15		6.54	<	0.04		13 500.	<	0.005		27.7		511.		17.		5.35		0.003 5	<	0.2	<	0.5		0.074 65		0.355		0.745	<	0.1
21-1-2	FRM		2022-02-23	Mean of duplicates	1 620.		0.853		5.35	<	0.005	<	0.02	<	0.02	1.405		6.5		5.75	<	0.04		13 300.		0.012 7		24.75		419.		20.		5.85		0.004 55	<	0.2	<	0.5		0.056 65		0.28		0.395	<	0.1
21-2-1	FRM	Y	2021-05-20	Mean of duplicates	2 180.		0.706		4.9		0.005 6		0.083 5		0.086 5	1.82		4.9		6.345	<	0.04		12 800.	<	0.005		26.85		458.5		20.		6.15		0.004 3	<	0.2	<	0.5		0.075 85		0.38		1.35	<	0.1
21-2-1	FRM		2021-09-21	Mean of duplicates	2 835.		0.635 5		5.5	<	0.005	<	0.02	<	0.02	2.95		7.85		7.585	<	0.04		13 200.	<	0.005		34.6		606.5		15.		5.15		0.002 95	<	0.2	<	0.5		0.121		0.315		3.

BC CSR				a AW Maximum (1)	---		10000		1.31-18.4 (3)		0.2-2 (4)		400		400		250-1500 (5)		---		---		20		---		0.5-15 (5)		---		---		128-429 (5)		---		3		---		1000		85		---		75-2400 (5)		---	
				b DW Maximum (2)	--- (6)		250		---		1		10		10		80		---		---		10		---		20		1700 (9)		2500		500		---		---		2.5		---		20		20		3000		---	
Station	Sample Type	Compliance Well (Y/N?)	Date Sampled	Parameter	Manganese		Molybdenum		Nitrogen - ammonia		Nitrogen - nitrite		Nitrogen - nitrate		Nitrogen - nitrate plus nitrite		Nickel		Phosphorus		Potassium		Selenium		Silicon		Silver		Sodium		Strontium		Sulphate		Sulphur		Thallium		Tin		Titanium		Uranium		Vanadium		Zinc		Zirconium	
				Fraction	DIS		DIS		DIS		DIS		DIS		DIS		DIS		DIS		DIS		DIS		DIS		DIS		DIS		DIS		DIS		DIS		DIS		DIS		DIS		DIS		DIS	
				Unit	µg/l		µg/l		mg/l		mg/l		mg/l		mg/l		µg/l		µg/l		µg/l		µg/l		µg/l		µg/l		mg/L		µg/l		mg/L		µg/l		µg/l		µg/l		µg/l		µg/l		µg/l		µg/l	
				Method Detection Limit	0.05		0.05		0.015		0.005		0.02		0.02		0.02		2		50		0.04		0.05		0.005		0.05		1		3		0.002		0.2		0.5		0.002		0.2		0.1		0.1	
31-1-1	FRM	Y	2021-09-15	Mean of duplicates	46.5		0.885		1.05	<	0.005		0.075 5		0.077		0.329		6.55		0.685 5	<	0.04		5 805.	<	0.005		7.395		399.		190.		73.1	<	0.002	<	0.2	<	0.5		0.391 5	<	0.2		0.56	<	0.1	
31-1-1	FRM		2021-11-26	Mean of duplicates	65.2		0.741		0.67	<	0.005		0.694 5		0.694 5		0.362 5		5.65		0.721 5		0.084 5	<	0.005		7.685		535.		370.		102.		0.002 55	<	0.2	<	0.5		0.464		0.24		1.065	<	0.1	
31-1-1	FRM		2022-03-07	Mean of duplicates	35.8		0.725 5	<	0.015	<	0.005		0.257 5		0.257 5		0.321		4.25		0.669		0.046		5 460.	<	0.005		6.985		413.		295.		77.	<	0.002	<	0.2	<	0.5		0.306 5		0.255		0.375	<	0.1	
31-1-2	SS	Y	2021-09-15	Clear and colourless	2.51		0.359		1.6	<	0.005		0.174		0.174		0.304		2.9		0.683	<	0.04		5 900.	<	0.005		8.17		371.		250.		81.3		0.002 3	<	0.2	<	0.5		0.454		0.4		5.31	<	0.1	
31-1-2	SS		2021-11-26	Clear and colourless	0.461		0.447		0.48	<	0.005		0.649		0.649		0.242	<	2.		0.812		0.112		4 490.	<	0.005		8.34		525.		460.		126.	<	0.002	<	0.2	<	0.5		0.56		0.43		2.72	<	0.1	
31-1-2	SS		2022-03-07	Clear and colourless	0.225		0.479	<	0.015	<	0.005		0.506		0.506		0.178	<	2.		0.694		0.066		4 800.	<	0.005		6.48		332.		320.		78.	<	0.002	<	0.2	<	0.5		0.396		0.41		1.36	<	0.1	
36-3-1	SS		2021-05-20	Clear and colourless	0.219		0.379	<	0.015		0.010 6		0.599		0.609		0.377		10.		0.744		0.09		13 700.	<	0.005		11.6		490.		280.		88.9		0.006 1	<	0.2	<	0.5		0.33		0.45		1.54	<	0.1	
36-3-1	SS		2021-09-24	Clear and colourless	4.16		0.274	<	0.015	<	0.005		0.575		0.575		0.355		10.5		0.717		0.109		12 200.	<	0.005		10.2		449.		200.		80.4		0.004	<	0.2	<	0.5		0.351		0.26		3.22	<	0.1	
36-3-1	SS		2021-11-24	Clear and colourless	12.6		0.216	<	0.015	<	0.005		1.08		1.08		0.329		7.7		0.691		0.079		10 900.	<	0.005		9.44		418.		310.		77.3		0.003 4	<	0.2	<	0.5		0.262	<	0.2		3.09	<	0.1	
36-3-1	SS		2022-02-23	Clear and colourless	0.384		0.209	<	0.015		0.005 2		0.937		0.942		0.232		7.5		0.692		0.122		11 000.	<	0.005		10.2		423.		200.		72.3		0.003 7	<	0.2	<	0.5		0.283	<	0.2		0.49	<	0.1	
37-3-1	SS		2021-05-20	Clear and colourless	356.		0.292		0.43	<	0.005	<	0.02	<	0.02		0.542		6.3		0.319	<	0.04		10 100.	<	0.005		4.26		177.		85.		26.8		0.014 3	<	0.2	<	0.5		0.063 2		0.4		1.15	<	0.1	
37-3-1	SS		2021-09-23	Clear and colourless	369.		0.471		0.39	<	0.005	<	0.02	<	0.02		0.483		7.3		0.321	<	0.04		10 000.	<	0.005		4.44		182.		100.		31.7		0.010 8	<	0.2	<	0.5		0.082 8		0.81		0.37	<	0.1	
37-3-1	SS		2021-11-24	Clear and colourless	404.		0.214		0.26		0.015 1		0.301		0.316		1.97		5.2		0.32	<	0.04		9 770.	<	0.005		4.57		235.		190.		63.6		0.006 6	<	0.2	<	0.5		0.041 9		0.23		0.52	<	0.1	
37-3-1	SS		2022-02-24	Clear and colourless	228.		0.634		0.11	<	0.005		0.045		0.045		2.79		2.6		0.553	<	0.04		9 280.	<	0.005		5.05		215.		180.		52.2		0.007 5	<	0.2	<	0.5		0.358		0.27		0.5	<	0.1	
38-1-1	SS		2021-05-21	Clear and colourless	0.485		2.23	<	0.015	<	0.005		0.231		0.231		4.23		5.5		0.366		0.404		13 400.	<	0.005		11.1		533.		53.		14.3		0.002 1	<	0.2	<	0.5		0.583		1.61		1.44	<	0.1	
38-1-1	SS		2021-09-22	Clear and colourless	1.68		2.68	<	0.015	<	0.005		0.154		0.154		4.13		6.8		0.365		0.28		14 400.	<	0.005		13.1		577.		51.		14.7	<	0.002	<	0.2	<	0.5		0.587		1.87		1.42	<	0.1	
38-1-1	SS		2021-11-24	Clear and colourless	0.152		2.34	<	0.015	<	0.005		0.298		0.298		3.71		5.4		0.359		0.412		13 600.	<	0.005		10.6		555.		44.		13.5	<	0.002	<	0.2	<	0.5		0.514		2.01		1.47	<	0.1	
38-1-1	SS		2022-02-24	Clear and colourless	0.072		2.47	<	0.015	<	0.005		0.439		0.439		4.04		4.		0.368		0.45		12 900.	<	0.005		11.4		559.		46.		14.6	<	0.002	<	0.2	<	0.5		0.633		2.01		1.71	<	0.1	
39-1-1	FRM	Y	2020-05-15	Mean of duplicates	0.645		1.925		0.034 5	<	0.005		0.067 5		0.067 5		0.269 5		3.2		0.309 5		0.09		6 155.	<	0.005		4.555		252.		21.		6.95	<	0.002	<	0.2	<	0.5		0.126 5		2.01		4.09	<	0.1	
39-1-1	FRM		2021-09-22	Mean of duplicates	< 0.05		2.12		0.029	<	0.005		0.054 5		0.054 5		0.126		3.3		0.257 5		0.085 5		5 885.	<	0.005		4.39		266.5		23.5		7.5	<	0.002	<	0.2	<	0.5		0.138		1.91		0.645	<	0.1	
39-1-1	FRM		2021-11-24	Mean of duplicates	< 0.05		1.865	<	0.015	<	0.005		0.355		0.355		0.113 5		3.55		0.24		0.144 5		5 665.	<	0.005		3.91		248.		21.		6.75	<	0.002	<	0.2	<	0.5		0.107		1.87		0.58		0.12	
39-1-1	FRM		2022-02-24	Mean of duplicates	0.112 5		2.075	<	0.015	<	0.005		0.274 5		0.274 5		0.145 5	<	2.		0.246		0.147		5 610.	<	0.005		4.16		241.		23.		7.35	<	0.002	<	0.2	<	0.5		0.132 5		1.935		1.015	<	0.1	
39-2-1	SS	Y	2021-05-20	Clear and colourless	1.39		1.12	<	0.015	<	0.005		0.052		0.052		0.102		2.4		0.208		0.139		8 190.	<	0.005		3.67		334.		24.		6.8	<	0.002	<	0.2	<	0.5		0.176		1.26		1.26	<	0.1	
39-2-1	SS		2021-09-22	Clear and colourless	2.01		1.31	<	0.015	<	0.005		0.038		0.038		0.074		2.8		0.197		0.056		9 210.	<	0.005		3.84		300.		21.		6.3	<	0.002	<	0.2	<	0.5		0.15		1.29	<	0.1	<	0.1	
39-2-1	SS		2021-11-24	Clear and colourless	1.75		1.17	<	0.015	<	0.005		0.174		0.174		0.111	<	2.		0.198		0.175		8 110.	<	0.005		3.51		304.		23.		7.2	<	0.002	<	0.2	<	0.5		0.163		1.18	<	0.1	<	0.1	
39-2-1	SS		2022-02-24	Clear and colourless	1.78		1.24	<	0.015	<	0.005		0.088		0.088		0.132	<	2.		0.197		0.334		7 980.	<	0.005		3.35		303.		21.		7.2	<	0.002	<	0.2	<	0.5		0.173		1.11		0.13	<	0.1	
40-1-1	SS		2021-05-20	Clear and colourless	57.5		0.946		0.82		0.011 4		1.08		1.09		0.874		4.7		3.97		0.047		7 220.	<	0.005		10.5		384.		40.		11.8		0.003 5	<	0.2	<	0.5		1.24		0.537		0.43		3.46	<	0.1	
40-1-1	SS		2021-09-22	Clear and colourless	119.		1.12		0.79		0.012 4		0.954		0.967		1.04		3.3		4.15		0.045		7 550.	<	0.005		10.9		460.		57.		16.6		0.004 6	<	0.2	<	0.5		0.747		0.26		1.63	<	0.1	
40-1-1	SS		2021-11-03	Clear and colourless	84.4		1.01		0.76		0.010 5		0.943		0.953		0.876	<	2.		3.93		0.046		7 090.	<	0.005		10.		457.		66.		15.9		0.005 6	<	0.2	<	0.5		0.78		0.26		1.55	<	0.1	
40-1-1	SS		2022-02-10	Clear and colourless	3.76		0.901		0.45		0.015 9		1.6		1.62		0.761		3.2		3.59		0.054		7 270.	<	0.005		10.4		317.		41.		11.8		0.003 2	<	0.2	<	0.5		0.464		0.27		2.01	<	0.1	
41-1-1	FRM	Y	2020-05-15	Mean of duplicates	265.		1.375		0.05	<	0.005		0.028 5		0.028 5		0.132 5	<	2.		1.445		0.06		6 890.	<	0.005		6.715		207.		58.		20.65		0.002 25	<	0.2	<	0.5		0.244	<	0.2		0.54	<	0.1	
41-1-1	FRM		2021-09-16	Mean of duplicates	767.		2.655		0.031 5	<	0.005	<	0.02	<	0.02		0.164 5		2.6		0.904	<	0.04		7 630.	<	0.005		4.76		212.5		64.		17.8	<	0.002 5	<	0.2	<	0.5		0.293	<	0.2		0.21		0.405	
41-1-1	FRM		2021-11-26	Mean of duplicates	459.		2.055		0.575		0.007 15		0.183		0.19		0.233 5		3.6		1.135		0.056		6 305.	<	0.005		5.865		214.		67.5		19.45		0.003 45	<	0.2	<	0.5		0.281 5	<	0.2		0.97	<	0.1	
41-1-1	FRM		2022-02-25	Mean of duplicates	26.95		1.03	<	0.015	<	0.005		0.055 5		0.055 5		0.062 5	<	2.		1.055		0.072 5		7 025.	<	0.005		5.56		188.		55.5		16.7	<	0.002	<	0.2	<	0.5		0.194	<	0.2		0.105	<	0.1	
42-1-1	FRM	Y	2020-05-15	Mean of duplicates	170.		0.184 5		0.056 5	<	0.005	<	0.02	<	0.02		0.151		5.		1.095	<	0.04		5 950.	<	0.005		9.27		365.5		70.		21.4	<	0.002	<	0.2	<	0.5		0.046 45		0.765		0.57	<	0.1	
42-1-1	FRM		2021-09-16	Mean of duplicates	167.		0.386 5		0.057	<	0.005	<	0.02	<	0.02		0.112 5		5.65		0.884 5	<	0.04		6 680.	<	0.005		10.15		403.		110.		31.5	<	0.002	<	0.2	<	0.5		0.108		0.555		0.175	<	0.1	
42-1-1	FRM		2021-11-26	Mean of duplicates	171.5		0.231		0.44		0.005 45	<	0.02	<	0.02		0.164 5		6.1		0.944 5	<	0.04		6 150.	<	0.005		9.615		423.5		120.		31.1	<	0.002	<	0.2	<	0.5		0.060 2		1.		0.865	<	0.1	
42-1-1	FRM		2022-02-25	Mean of duplicates	155.		0.215		0.086	<	0.005	<	0.02	<	0.02		0.136		5.25		0.859	<	0.04		6 455.	<	0.005		8.92		360.5		77.5		24.45	<	0.002	<	0.2	<	0.5		0.050 65		0.76		0.115	<	0.1	
43-1-1	SS		2021-05-12	Clear and colourless	3.93		0.81	<	0.015	<	0.005	<	0.02	<	0.02		0.528		5.3		0.48		0.049		12 500.	<	0.005		9.88		488.		92.		25.9	<	0.002	<	0.2	<	0.5		0.108		0.94		2.16	<	0.1	
43-1-1	SS		2021-09-15	Clear and colourless	3.73		0.741		1.2	<	0.005		0.034		0.034		0.624		4.1		0.448	<	0.04		11 800.	<	0.005		9.31		462.		87.		23.9	<	0.002	<	0.2	<	0.5		0.138		0.96		1.93	<	0.1	
43-1-1	SS		2021-11-17	Clear and colourless	3.96		0.779	<	0.015	<	0.005		0.097		0.097		0.641		6.7		0.48		0.082		12 200.	<	0.005		9.72		475.		74.		22.7	<	0.002	<	0.2	<	0.5		0.134		1.25		1.26	<	0.1	
43-1-1	SS		2022-02-15	Clear and colourless	3.4		0.736	<	0.015	<	0.005		0.038		0.038		0.77		4.4		0.469		0.047		12 900.	<	0.005		9.32		463.		78.		23.	<	0.002	<	0.2	<	0.5		0.137		1.04		2.84	<	0.1	
44-1-1	SS		2021-05-13	Clear and colourless	2.58		1.41	<	0.015	<	0.005	<	0.02	<	0.02		0.39		8.7		0.361	<	0.04		7 560.	<	0.005		7.89		192.		23.		7.4		0.003 2	<	0.2	<	0.5		0.251		0.39		1.56	<	0.1	
44-1-1	SS		2021-09-15	Clear and colourless	6.51		1.09	<	0.015	<	0.005		0.022		0.022		0.607		6.4		0.412	<	0.04		7 820.	<	0.005		6.87		199.		41.		11.	<	0.002	<	0.2	<	0.5		0.204		0.21		2.52	<	0.1	
44-1-1	SS		2021-11-17	Clear and colourless	2.01		1.01	<	0.015	<	0.005		0.021		0.021		0.379		9.3		0.407		0.049		7 810.	<	0.005		6.95		208.		40.		10.7	<	0.002	<	0.2	<	0.5		0.199		0.34		4.74	<	0.1	
44-1-1	SS		2022-02-15	Clear and colourless	0.615		0.989		0.015	<	0.005		0.038		0.038		0.257		5.3		0.394	<	0.04		8 080.	<	0.005		6.87		198.		37.		10.2	<	0.002	<	0.2	<	0.5		0.204		0.29		1.19	<	0.1	
51-1-1	SS		2021-09-22	Clear and colourless	3.91		0.234	<	0.015	<	0.005		1.29		1.3		0.609		5.6		0.555		0.062		5 720.	<	0.005		4.33		205.		52.		14.9		0.004 7	<	0.2	<	0.5		0.044 3		0.26		0.15	<	0.1	
51-1-1	SS		2021-11-23	Clear and colourless	3.38		0.323	<	0.015	<	0.005		0.51		0.51		0.325		3.1		0.344		0.07		6 140.	<	0.005		4.06		198.		41.		11.4		0.003 1	<	0.2	<	0.5		0.055		0.33		0.18	<	0.1	
51-1-1	SS		2022-02-23	Clear and colourless	3.09		0.124	<	0.015	<	0.005		1.18		1.18		0.413		4.3		0.3	<	0.04		5 130.	<	0.005		3.43		138.		29.		9.4	<	0.002	<	0.2		0.67		0.01		0.32		0.85	<	0.1	
51-2-1	SS		2021-09-22	Clear and colourless	16.4		1.36	<	0.015	<	0.005	<	0.02	<	0.02		0.96		7.9		0.396		0.1		13 200.	<	0.005		11.1		670.		40.		15.1		0.007 5	<	0.2	<	0.5		0.379		0.49		3.46	<	0.1	
51-2-1	SS		2021-11-23	Clear and colourless	10.5		1.44	<	0.015	<	0.005	<	0.02	<	0.02		0.817		8.7		0.414		0.154		13 700.	<	0.005		11.2		667.		48.		13.7		0.007 1	<	0.2	<	0.5		0.479		0.44		0.69	<	0.1	
51-2-1	SS		2022-02-23	Clear and colourless	5.62		1.41	<	0.015	<	0.005	<	0.02	<	0.02		0.743		7.4		0.403		0.146		13 300.	<	0.005		10.7		653.		46.		14.2		0.005 3	<	0.2	<	0.5		0.442		0.49		0.64	<	0.1	
51-3-1	SS		2021-09-22	Slightly silty and slightly grey	1.9		0.543	<	0.015	<	0.005	<	0.02	<	0.02		1.38		4.7		0.332		0.044		15 400.	<	0.005		8.12		872.		20.		5.9		0.002 9	<	0.2		1.06		0.105	<	0.2		0.58	<	0.1	
51-3-1	SS		2021-11-23	Slightly silty and slightly grey	0.512		0.512	<	0.015		0.024 1		0.325		0.349		0.761		2.6		0.294	<	0.04		14 200.	<	0.005		7.15		765.		34.		9.2		0.003 1	<	0.2	<	0.5		0.086 6		0.22		0.45	<	0.1	
51-3-1	SS		2022-02-23	Slightly silty and slightly brown	0.206		0.535	<	0.015		0.048 8		0.16		0.208		0.675		3.4		0.303		0.043		14 900.	<	0.005		7.15		713.		20.		7.		0.002 5	<	0.2	<	0.5		0.061 2		0.24		0.33	<	0.1	
52-1-1	SS		2021-05-12	Clear and slightly yellow	378.		0.29		23.	a	0.005	<	0.02	<	0.02		11.9		22.4		13.1		0.176		36 400.	<	0.01		229.		3 340.	b	1.	<	6.	<	0.004	<	0.4	<	1.	<	0.004		0.84		0.62	<	0.2	
52-1-1	SS		2021-09-23	Clear and colourless	403.		0.33		29.	a	0.005	<	0.02	<	0.02		11.		14.		13.4		0.113		36 700.	<	0.01		230.		3 280.	b	1.	<	6.		0.004 7	<	0.4	<	1.	<	0.004		0.72		0.72	<	0.2	
52-1-1	SS		2021-11-24	Clear and colourless, sudsy	369.		0.37		27.	a	0.005	<	0.02	<	0.02		10.4		12.8		13.1		0.256		36 900.	<	0.01		220.		3 340.	b	1.	<	6.	<	0.004	<	0.4	<	1.	<	0.004		0.79		0.45	<	0.2	
52-1-1	SS		2022-02-11	Clear and slightly yellow	355.		0.27		27.	a	0.005	<	0.02	<	0.02		11.7		44.		13.3	<	0.2		38 400.	<	0.025		228.		2 930.	b	17.	<	15.	<	0.01	<	1.	<	2.5	<	0.01		1.		1.76	<	0.5	
52-4-0 (P7)	SS		2021-05-12	Slightly silty and moderately brown	1 010.		1.32		230.	a	0.05	<	0.2	<	0.2		22.7		1 890.		126.		0.517		20 400.	<	0.01		344.		1 220.		2.7	<	6.		0.008 5		3.84		29.3		0.053 2		15.2		24.5		4.79	
52-4-0 (P7)	SS		2021-09-29	Clear and very yellow	1 040.		0.98		180.	a	0.016 5		0.05		0.067		15.8		362.		107.		0.213		21 500.	<	0.01		320.		1 460.		8.9	<	6.		0.005 4		0.83		3.3		0.03		4.12		20.5		1.14	
52-4-0 (P7)	SS		2021-11-01	Clear and slightly yellow	1 080.		1.47		180.	a	0.05	<	0.2	<	0.2		20.		335.		117.		0.206		20 900.	<	0.01		329.		1 390.		34.		7.4		0.005 4		1.81		9.4		0.113		6.63		38.8		2.41	
52-4-0 (P7)	SS		2022-02-11	Slightly silty and slightly yellow	949.		0.88		140.	a	0.05	<	0.2	<	0.2		13.1		356.		111.		0.152		19 200.	<	0.01		305.		1 130.		33.	<	6.		0.004 1		0.64		2.5		0.041 9		2.66		7.19		0.6	
53-1-1	SS	Y	2021-05-21	Clear and colourless	226.		0.588	<	0.015	<	0.005	<	0.02	<	0.02		0.687		4.1		0.273	<	0.04		12 100.	<	0.005		3.89		362.		58.		18.4		0.013 3	<	0.2	<	0.5		0.086 1	<	0.2		0.57	<	0.1	
53-1-1	SS		2021-09-23	Clear and colourless	224.		0.539	<	0.015	<	0.005	<	0.02	<	0.02		0.603		3.4		0.26	<	0.04		12 100.	<	0.005		3.89		345.		62.		17.4		0.011 5	<	0.2	<	0.5		0.087 3	<	0.2		0.21	<	0.1	
53-1-1	SS		2021-11-19	Clear and colourless	197.		0.557	<	0.015	<	0.005	<	0.02	<	0.02		0.528		2.1		0.256	<	0.04		11 800.	<	0.005		3.71		350.		53.		15.1		0.011 3	<	0.2	<	0.5		0.084	<	0.2		0.36	<	0.1	
53-1-1	SS		2022-02-24	Clear and colourless	205.		0.548		0.024	<	0.005		0.038		0.038		0.612	<	2.		0.329	<	0.04		11 200.	<	0.005		3.72		325.		50.		15.4		0.012 7	<	0.2	<	0.5		0.079 6	<	0.2		0.41	<	0.1	
55-1-1	SS	Y	2021-09-16	Clear and colourless	9.05		0.395	<	0.015	<	0.005		0.166		0.166		0.196		2.3		1.43		0.163		5 740.	<	0.005		12.4		222.		58.		17.1		0.002	<	0.2	<	0.5		0.255		0.21		0.51	<	0.1	
55-1-1	SS		2021-11-25	Clear and colourless	3.06		0.326	<	0.015	<	0.005		0.506		0.506		0.114		3.8		1.58	<	0.04		9 550.	<	0.005		12.3		231.		59.		17.		0.002 4	<	0.2	<	0.5		0.303		0.29		0.27	<	0.1	
56-1-1	SS	Y	2021-05-28	Clear and colourless	0.158		1.04	<	0.015	<	0.005	<	0.02	<	0.02		0.093		4.5		0.271	<	0.04		6 350.	<	0.005		4.18		258.		58.		18.		0.005 9	<	0.2	<	0.5		0.098 8	<	0.2		0.66	<	0.1	
56-1-1	SS		2021-09-16	Clear and colourless	0.186		1.	<	0.015	<	0.005	<	0.02	<	0.02		0.088		5.4		0.373	<	0.04		6 180.	<	0.005		4.07		265.		57.		16.9		0.004	<	0.2	<	0.5		0.112	<	0.2		0.53	<	0.1	
56-1-1	SS		2021-11-26	Clear and colourless	0.194		1.11		0.49	<	0.005	<	0.02	<	0.02		0.09		6.9		0.258	<	0.04		5 560.	<	0.005		3.97		268.		53.		14.4		0.006	<	0.2	<	0.5		0.094 2	<	0.2		0.88	<	0.1	
56-1-1	SS		2022-02-25	Clear and colourless	< 0.05		1.09	<	0.015	<	0.005	<	0.02	<	0.02		0.075		4.7		0.302	<	0.04		6 450.	<	0.005		3.91		258.		45.		14.2		0.004	<	0.2	<	0.5		0.093 1	<	0.2		0.34	<	0.1	
57-1-1	SS	Y	2021-09-16	Clear and colourless	6.67		0.279	<	0.015	<	0.005	<	0.02	<	0.02		0.161		2.5		0.41	<	0.04		8 070.	<	0.005		8.95		217.		62.		18.2		0.002 2		7.62	<	0.5		0.033 4	<	0.2		0.16	<	0.1	
57-1-1	SS		2021-11-24	Clear and colourless	5.		0.289		0.16	<	0.005	<	0.02	<	0.02		0.308		6.6		0.411	<	0.04		6 250.	<	0.005		9.05		235.	<	1.		21.	<	0.002	<	0.2	<	0.5		0.027 7	<	0.2		2.13	<	0.1	
58-1-0	SS		2021-05-20	Clear, very yellow	6 880.		7.26		91.	a

BC CSR				a AW Maximum (1)	---		10000		1.31-18.4 (3)		0.2-2 (4)		400		400		250-1500 (5)		---		---		20		---		0.5-15 (5)		---		---		128-429 (5)		---		3		---		1000		85		---		75-2400 (5)		---
				b DW Maximum (2)	--- (6)		250		---		1		10		10		80		---		---		10		---		20		1700 (9)		2500		500		---		---		2.5		---		20		20		3000		---
Station	Sample Type	Compliance Well (Y/N?)	Date Sampled	Parameter	Manganese		Molybdenum		Nitrogen - ammonia		Nitrogen - nitrite		Nitrogen - nitrate		Nitrogen - nitrate plus nitrite		Nickel		Phosphorus		Potassium		Selenium		Silicon		Silver		Sodium		Strontium		Sulphate		Sulphur		Thallium		Tin		Titanium		Uranium		Vanadium		Zinc		Zirconium	
				Fraction	DIS		DIS		DIS		DIS		DIS		DIS		DIS		DIS		DIS		DIS		DIS		DIS		DIS		DIS		DIS		DIS		DIS		DIS		DIS		DIS		DIS	
				Unit	µg/l		µg/l		mg/l		mg/l		mg/l		mg/l		µg/l		µg/l		µg/l		µg/l		µg/l		µg/l		mg/L		µg/l		mg/L		µg/l		µg/l		µg/l		µg/l		µg/l		µg/l		µg/l	
				Method Detection Limit	0.05		0.05		0.015		0.005		0.02		0.02		0.02		2		50		0.05		0.04		0.005		0.05		0.05		1		3		0.002		0.2		0.5		0.002		0.2		0.1		0.1	
72-1-1	FRM	Y	2020-05-15	Mean of duplicates	111.		1.725	<	0.015	<	0.005	<	0.02	<	0.02		5.505		9.45		0.252 5	<	0.06		20 950.	<	0.007 5		8.65		304.		46.5		15.8	<	0.003	<	0.3	<	0.75		0.019 35	<	0.3		0.37	<	0.15	
72-1-1	FRM		2021-09-09	Mean of duplicates	123.5		0.671	<	0.015	<	0.005	<	0.02	<	0.02		1.66		10.55		0.239	<	0.04		21 050.	<	0.005		8.945		285.5		51.5		15.1	<	0.002	<	0.2	<	0.5		0.020 2	<	0.2		0.145	<	0.1	
72-1-1	FRM		2021-11-04	Mean of duplicates	113.5		0.684 5	<	0.015	<	0.005	<	0.02	<	0.02		1.675		7.55		0.241 5	<	0.04		19 200.	<	0.005		8.395		293.		48.5		13.85	<	0.002	<	0.2	<	0.5		0.017 65	<	0.2	<	0.1		0.105	
72-1-1	FRM		2022-03-02	Mean of duplicates	113.5		0.679 5		0.020 5	<	0.005	<	0.02	<	0.02		1.665		8.25		0.241 5	<	0.06		19 700.	<	0.007 5		8.575		282.5		48.5		15.25	<	0.003	<	0.3	<	0.75		0.016 9	<	0.3		0.22	<	0.15	
72-3-1	SS	Y	2021-05-06	Clear and colourless	40.9		2.87		0.021	<	0.005	<	0.02	<	0.02		9.1		9.8		0.935	<	0.04		8 710.	<	0.005		28.		189.		58.		18.9		0.01	<	0.2	<	0.5		0.186	<	0.2		0.27	<	0.1	
72-3-1	SS		2021-09-09	Clear and colourless	44.9		0.65	<	0.015	<	0.005		0.021		0.021		0.899		8.6		0.988	<	0.04		9 100.	<	0.005		28.5		194.		66.		18.7		0.006 7	<	0.2	<	0.5		0.211	<	0.2		0.24	<	0.1	
72-3-1	SS		2021-11-04	Clear and colourless	39.5		0.656	<	0.015		0.007 4	<	0.02		0.021		0.9		8.9		0.921		0.047		8 520.	<	0.005		26.8		185.		62.		19.		0.005 4	<	0.2	<	0.5		0.213	<	0.2		0.32	<	0.1	
72-3-1	SS		2022-03-02	Clear and colourless	30.6		0.745		0.023	<	0.005	<	0.02	<	0.02		0.752		9.8		0.969	<	0.04		8 920.	<	0.005		28.2		184.		56.		19.7		0.006 9	<	0.2	<	0.5		0.196	<	0.2		1.98	<	0.1	
73-1-1	SS	Y	2021-05-05	Clear and colourless	79.8		0.884		0.035		0.006 2		0.131		0.137		0.778		11.8		0.384	<	0.04		9 660.	<	0.005		6.84		197.		43.		12.		0.005 4	<	0.2	<	0.5		0.243		0.42		0.5	<	0.1	
73-1-1	FRM		2021-09-09	Mean of duplicates	82.45		0.88	<	0.015	<	0.005		0.095 5		0.095 5		0.788		12.15		0.405 5	<	0.04		10 150.	<	0.005		6.835		203.		44.		13.25		0.006 65	<	0.2	<	0.5		0.25		0.435		0.535	<	0.1	
73-1-1	FRM		2021-11-02	Mean of duplicates	78.9		0.875 5	<	0.015	<	0.005		0.053 5		0.053 5		0.778		12.4		0.423	<	0.04		9 450.	<	0.005		6.52		200.5		46.5		13.4		0.006 2	<	0.2		0.52		0.257		0.69		0.53	<	0.1	
73-1-1	FRM		2022-03-02	Mean of duplicates	1.64		1.255	<	0.015	<	0.005		0.047 5		0.047 5		0.369 5		9.85		0.434	<	0.04		9 790.	<	0.005		6.4		199.		45.		13.9		0.003 75	<	0.2	<	0.5		0.255		0.425		0.365	<	0.1	
73-2-1	SS	Y	2021-05-05	Clear and colourless	47.9		1.04		0.038	<	0.005		0.183		0.183		0.365		5.		0.346	<	0.04		8 610.	<	0.005		6.76		162.		33.		10.6	<	0.002	<	0.2	<	0.5		0.236		0.64		0.12	<	0.1	
73-2-1	SS		2021-09-09	Clear and colourless	52.9		1.27	<	0.015	<	0.005		0.057		0.057		0.39		4.9		0.373	<	0.04		9 900.	<	0.005		7.13		186.		52.		15.6		0.002 7	<	0.2	<	0.5		0.295		0.59		0.14	<	0.1	
73-2-1	SS		2021-11-02	Clear and colourless	54.8		1.11	<	0.015	<	0.005		0.094		0.094		0.351		5.8		0.371	<	0.04		9 170.	<	0.005		6.98		171.		45.		13.9		0.002 5	<	0.2	<	0.5		0.251		0.69		0.14	<	0.1	
73-2-1	SS		2022-03-02	Clear and colourless	45.8		0.924	<	0.015	<	0.005		0.229		0.229		0.319		3.2		0.339	<	0.04		8 590.	<	0.005		6.35		160.		33.		10.2		0.002 2	<	0.2	<	0.5		0.238		0.61		0.15	<	0.1	
73-3-1	SS	Y	2021-05-05	Moderately silty and moderately grey	0.319		0.289		0.036		0.020 8		0.237		0.257		0.384		15.3		0.492		0.045		6 960.	<	0.005		16.7		56.6		23.		6.8		0.006 3	<	0.2	<	0.5		0.033 3		0.3		0.64	<	0.1	
73-3-1	SS		2021-09-09	Slightly silty and clear	0.237		0.327	<	0.015	<	0.005		0.086		0.086		0.61		14.8		0.625		0.06		7 370.	<	0.005		16.6		114.		28.		8.1		0.009 3	<	0.2	<	0.5		0.060 3		0.32		1.38	<	0.1	
73-3-1	SS		2021-11-02	Clear and colourless	0.231		0.335	<	0.015	<	0.005		1.24		1.24		0.458		16.8		0.552		0.057		7 380.	<	0.005		16.4		77.4		28.		7.5		0.007 6	<	0.2	<	0.5		0.043 1		0.45		1.16		0.29	
73-3-1	SS		2022-03-02	Slightly silty and slightly grey	0.242		0.429	<	0.015		0.015 8		0.331		0.347		0.336		14.7		0.5		0.051		6 950.	<	0.005		14.8		64.2		25.		8.1		0.005 9	<	0.2	<	0.5		0.045 1		0.46		0.69	<	0.1	
77-1-1	SS		2021-09-24	Slightly silty and slightly grey	39.8		0.37		0.018	<	0.005	<	0.02	<	0.02		0.127		7.4		0.233	<	0.04		11 500.	<	0.005		4.31		195.		20.		6.	<	0.002	<	0.2	<	0.5		0.027 2	<	0.2		3.79	<	0.1	
77-1-1	SS		2021-11-17	Moderately silty and moderately grey	38.1		0.353	<	0.015		0.020 7		0.076		0.097		0.171		9.7		0.242	<	0.04		11 500.	<	0.005		4.15		194.		19.		6.4		0.002 1	<	0.2	<	0.5		0.056 4	<	0.2		2.45	<	0.1	
77-1-1	SS		2022-02-17	Slightly silty and slightly grey	32.8		0.405	<	0.015	<	0.005	<	0.02	<	0.02		0.118		3.7		0.228	<	0.04		12 000.	<	0.005		4.1		201.		21.		6.		0.002 3	<	0.2	<	0.5		0.031 6		0.85	<	0.1	<	0.1	
77-2-1	SS		2021-09-24	Clear and colourless	6.25		0.872	<	0.015	<	0.005		0.022		0.022		0.382		51.1		0.457		0.107		15 200.	<	0.005		6.06		524.		41.		10.		0.006 4	<	0.2	<	0.5		0.178		0.47		19.4	<	0.1	
77-2-1	SS		2021-11-18	Clear and colourless	1.32		0.803	<	0.015	<	0.005	<	0.02	<	0.02		0.321		33.2		0.364		0.097		10 900.	<	0.005		4.72		532.		32.		5.5		0.006 4	<	0.2	<	0.5		0.158	<	0.2	<	0.1	<	0.1	
77-2-1	SS		2022-02-17	Clear and colourless	2.72		0.829	<	0.015	<	0.005	<	0.02	<	0.02		0.359		37.3		0.443		0.081		15 200.	<	0.005		5.83		532.		35.		10.4		0.005 5	<	0.2		0.56		0.161		0.45		0.38	<	0.1	
78-1-1	SS		2021-09-24	Clear and colourless	0.517		1.74	<	0.015	<	0.005		0.024		0.024		0.547		47.7		0.607		0.235		16 900.	<	0.005		10.4		401.		62.		16.7		0.010 8	<	0.2	<	0.5		0.466		0.68		0.72		0.1	
78-1-1	SS		2021-11-18	Clear and colourless	< 0.05		1.67	<	0.015	<	0.005		0.066		0.066		0.361		35.7		0.52		0.366		11 700.	<	0.005		10.7		428.		57.		10.4		0.012 1	<	0.2	<	0.5		0.486		0.44		0.15	<	0.1	
78-1-1	SS		2022-02-17	Clear and colourless	0.739		1.81	<	0.015	<	0.005		0.063		0.063		0.466		47.2		0.669		0.321		16 100.	<	0.005		10.7		415.		62.		16.		0.012 5	<	0.2		0.51		0.587		0.8		0.66	<	0.1	
78-2-1	SS		2021-09-24	Clear and colourless	4.62		2.34	<	0.015		0.006 7		2.13		2.13		5.		37.2		0.544		1.07		13 300.	<	0.005		4.23		175.		130.		36.		0.016 6	<	0.2		0.85		0.846		0.79		171.	<	0.1	
78-2-1	SS		2021-11-17	Clear and colourless	4.11		1.03	<	0.015		0.022 7		2.44		2.46		2.33		24.6		0.229		0.312		13 600.	<	0.005		3.23		52.		89.		6.5		0.013 4	<	0.2		4.71		0.1		0.84		171.	a	0.24	
78-2-1	SS		2022-02-17	Clear and colourless	3.51		1.25	<	0.015	<	0.005		18.7	b	18.7	b	5.41		19.3		0.376		0.72		13 300.	<	0.005		4.08		145.		110.		28.3		0.016 2	<	0.2		2.1		0.104		0.71		239.	<	0.1	
80-1-0 (P8)	SS		2021-05-12	Slightly silty and very black	863.		2.47		440.	a	0.05	<	0.2	<	0.2		54.		2 890.		154.		0.65		19 300.	<	0.025		396.		715.		31.		26.	<	0.01		8.6		68.3		0.615		58.4	b	16.		14.1	
80-1-0 (P8)	SS		2021-09-29	Slightly silty and very brown	1 120.		3.02		360.	a	0.058		3.53		3.58		40.2		589.		118.		0.625		18 100.		0.018		324.		980.		72.		27.2		0.011		4.97		27.1		1.34		28.6	b	19.9		11.3	
80-1-0 (P8)	SS		2021-11-01	Clear and moderately brown	969.		2.76		490.	a	0.05	<	0.2	<	0.2		36.5		342.		101.		0.587		18 600.	<	0.01		301.		1 080.		140.		19.6		0.005 4		4.02		19.		1.18		23.	b	6.69		9.03	
80-1-0 (P8)	SS		2022-02-11	Clear and moderately brown	766.		1.18		180.	a	0.05		0.39		0.39		20.3		1 330.		77.		0.245		14 600.	<	0.01		217.		573.		180.		13.2		0.004 4		3.		25.6		0.207		15.1		5.92		4.16	
81-1-0 (P9)	SS		2021-05-12	Slightly silty and slightly yellow	324.		0.366		4.4		0.006 3	<	0.02		0.021		7.71		46.4		2.95	<	0.04		20 400.	<	0.005		43.		1 360.		100.		32.2	<	0.002		0.43	<	0.5		0.046	<	0.2		0.87	<	0.1	
81-1-0 (P9)	SS		2021-09-29	Clear and slightly brown	303.		0.139		6.		0.119		0.193		0.312		7.2		219.		3.1		10.7	b	21 000.	<	0.005		41.9		1 370.		85.		43.8		0.003 3		0.66	<	0.5		0.037 3		0.23		3.17	<	0.1	
81-1-0 (P9)	SS		2021-11-02	Clear and slightly yellow	224.		0.198		5.5		0.006	<	0.02	<	0.02		6.57		250.		2.65		6.13		18 000.	<	0.005		36.5		1 180.		86.		42.4		0.007 3		1.14		0.68		0.034 6		0.42		5.89	<	0.1	
81-1-0 (P9)	SS		2022-02-11	Clear and colourless	247.		0.292		4.4		0.005 5		0.05		0.055		6.85		76.2		2.66	<	0.04		17 700.	<	0.005		38.8		1 080.		89.		27.2	<	0.002		0.49	<	0.5		0.037 2		0.25		1.68	<	0.1	
85-1-1	SS		2021-09-08	Clear and colourless	289.		1.03		0.081	<	0.005		0.712		0.714		1.16		8.		8.1		0.114		5 840.	<	0.005		69.2		367.		45.		13.		0.010 4	<	0.2	<	0.5		0.039 9		1.08		0.66	<	0.1	
85-1-1	SS		2021-11-03	Clear and slightly orange	6.14		0.449		0.022	<	0.005		3.05		3.05		0.531		4.2		6.03		0.545		5 310.	<	0.005		52.3		189.		72.		18.1		0.004 8	<	0.2	<	0.5		0.012 6		1.11		3.15	<	0.1	
85-1-1	SS		2022-03-03	Clear and colourless	10.4		0.59		0.018	<	0.005		2.2		2.2		0.605		7.1		5.49		0.22		5 970.	<	0.005		52.5		215.		39.		10.9		0.003 8	<	0.2	<	0.5		0.031	<	0.1	<	0.1	<	0.1	
87-1-1	SS		2021-09-15	Clear and colourless	202.		1.12		1.8	<	0.005	<	0.02	<	0.02		1.01		32.3		0.919		0.111		7 430.	<	0.005		9.57		157.		22.		7.2		0.018 6	<	0.2	<	0.5		1.04		0.32		0.73	<	0.1	
87-1-1	SS		2021-11-17	Clear and colourless	37.7		0.734	<	0.015		0.005 9	<	0.02	<	0.02		0.63		20.8		0.513		0.084		7 940.	<	0.005		6.12		170.		22.		7.1		0.029 8	<	0.2		8.21		0.35		0.45		0.46	<	0.1	
87-1-1	SS		2022-02-17	Clear and colourless	5.41		0.765		0.022		0.009		0.023		0.032		0.423		14.5		0.381		0.043		7 870.	<	0.005		5.12		165.		26.		7.1		0.012 3	<	0.2	<	0.5		0.26	<	0.2		0.27	<	0.1	
87-2-1	SS		2021-09-15	Clear and colourless	0.126		0.089		1.3	<	0.005		0.355		0.355		0.079		4.3		0.138		0.085		6 360.	<	0.005		3.27		49.8		17.		4.8	<	0.002	<	0.2	<	0.5		0.036 7		0.53		0.31	<	0.1	
87-2-1	SS		2021-11-17	Clear and colourless	0.173		0.057	<	0.015		0.012 1		47.4	b	47.4	b	0.081		3.7		0.208		0.036		6 330.	<	0.005		5.09		151.		55.		16.5	<	0.002	<	0.2	<	0.5		0.053 1		0.46		0.18	<	0.1	
87-2-1	SS		2022-02-17	Clear and colourless	0.307		0.086	<	0.015	<	0.005		0.552		0.552		0.051		2.9		0.129		0.068		6 440.	<	0.005		3.		44.3		18.		5.	<	0.002	<	0.2	<	0.5		0.027		0.59	<	0.1	<	0.1	
88-1-1	SS		2021-09-15	Clear and colourless	0.531		0.209		1.7	<	0.005		0.346		0.346		0.171		3.2		0.149		0.14		6 290.	<	0.005		3.28		89.3		22.		6.5	<	0.002	<	0.2	<	0.5		0.048 5		0.48		0.33	<	0.1	
88-1-1	SS		2021-11-17	Clear and colourless	0.655		0.193		0.079	<	0.005		5.09		5.09		0.19		5.8		0.159		0.22		6 240.	<	0.005		3.55		103.		24.		7.6		0.002 1	<	0.2	<	0.5		0.045 4		0.59		5.37	<	0.1	
88-1-1	SS		2022-02-17	Clear and colourless	0.153		0.156	<	0.015		0.006		5.66		5.67		0.26	<	2.		0.142		0.395		6 530.	<	0.005		3.35		92.4		40.		12.	<	0.002	<	0.2	<	0.5		0.030 5		0.63		0.4	<	0.1	
88-2-1	SS		2021-09-15	Moderately silty and very brown	10.8	<	0.05		1.7	<	0.005		5.08		5.08		0.414		8.6	<	0.04		6 950.	<	0.005		5.82		144.		100.		30.	<	0.002	<	0.2	<	0.5		0.074 9	<	0.2		1.07	<	0.1	
88-2-1	SS		2021-11-17	Clear and colourless	722.	<	0.05	<	0.015		0.008 4		42.4	b	42.4	b	1.18		30.8		1.24		0.342		7 430.		0.008 4		7.93		295.		130.		43.2		0.007 2	<	0.2		2.79		0.075 2		0.39		47.4	<	0.1	
88-2-1	SS		2022-02-17	Moderately silty and very brown	24.3	<	0.05	<	0.015	<	0.005		7.81		7.81		0.141		5.		0.731		0.403		6 950.	<	0.005		4.78		121.		71.		21.8	<	0.002	<	0.2	<	0.5		0.031 9	<	0.2		0.14	<	0.1	
91-1-1	SS		2021-05-13		19.5		1.46	<	0.015		0.006 5		0.07		0.076		0.789		26.9		1.64		0.234		8 320.	<	0.005		6.52		421.		39.		13.5		0.019		0.22		5.79		1.76		0.34		1.69		0.1	
91-1-1	SS		2021-09-17		1.45		1.1		0.026	<	0.005		0.074		0.074		0.546		15.3		1.53		0.152		8 020.	<	0.005		5.27		392.		52.		13.6		0.012 3	<	0.2	<	0.5		1.42	<	0.2		0.68	<	0.1	
91-1-1	SS		2021-11-18		5.48		1.13	<	0.015		0.006 4		0.072		0.079		0.584		16.5		1.53		0.307		6 280.	<	0.005		5.16		460.		63.		9.3		0.017	<	0.2	<	0.5		1.75	<	0.2	<	0.1	<	0.1	
91-1-1	SS		2022-02-15		4.01		1.07	<	0.015	<	0.005		0.091		0.091		0.438		15.8		1.73		0.147		8 520.	<	0.005		5.94		427.		63.		17.		0.016 1	<	0.2	<	0.5		1.58	<	0.2		0.68	<	0.1	
92-1-1	SS		2021-05-13		42.8		3.8	<	0.015		0.017 5		0.045		0.063		0.797		17.9		2.		0.22		9 850.	<	0.005		12.8		279.		92.		29.8		0.026 8	<	0.2		6.08		1.63		0.35		2.29		0.1	
92-1-1	SS		2021-09-17		31.5		3.01		0.047	<	0.005		0.051		0.051		0.644		13.9		1.52		0.138		9 690.	<	0.005		8.01		250.		95.		29.6		0.018 5	<	0.2	<	0.5		1.02	<	0.2		2.14	<	0.1	
92-1-1	SS		2021-11-18		28.		3.27	<	0.015		0.008 8		0.024		0.033		1.04		12.7		1.34		0.228		7 740.	<	0.005		6.09		249.		100.		17.		0.020 4	<	0.2		0.91		0.917	<	0.2		3.21	<	0.1	
92-1-1	SS		2022-02-15		13.5		3.67	<	0.015	<	0.005		0.065		0.065		0.541		12.		1.54		0.166		10 200.	<	0.005		7.29		261.		110.		29.4		0.021 8	<	0.2	<	0.5		1.03	<	0.2		0.53	<	0.1	
93-1-1	NS		2021-05-13	No sample. Not accessible due to construction.	---		---		---		---		---		---		---		---		---		---		---		---		---		---		---		---		---		---		---		---		---		---		---		0.1	
93-1-1	NS		2021-09-17	Well inaccessible due to aggregate storage; no sample collected.	---		---		---		---		---		---		---		---		---		---		---		---		---		---		---		---		---		---		---		---		---		---		---		---		0.1	
93-1-1	NS		2021-11-18		---		---		---		---		---		---		---		---		---		---		---		---		---		---		---		---		---		---		---		---		---		---		---		---		0.1	
93-1-1	NS		2022-02-15		---		---		---		---		---		---		---		---		---		---		---		---		---		---		---		---		---		---		---		---		---		---		---		---		0.1	
94-1-1	SS		2021-05-12		7.74		0.704	<	0.015	<	0.005	<	0.02	<	0.02		3.08		8.3		0.66		0.108		6 730.	<	0.005		9.25		182.		59.		16.1		0.016 1	<	0.2		1.4		0.724		0.4		0.75	<	0.1	
94-1-1	SS		2021-09-15		16.1		0.795		0.9	<	0.005	<	0.02	<	0.02		1.51		7.3		0.879		0.062		6 750.	<	0.005		10.2		165.		50.		13.3		0.015 1	<	0.2		0.58		1.15	<	0.2		1.34	<	0.1	
94-1-1	SS		2021-11-19		28.8		0.661	<	0.015		0.007 7		0.197		0.205		1.65		3.9		0.781		0.127		6 580.	<	0.005		10.8		178.		63.		16.1		0.010 8	<	0.2	<	0.5		1.		0.23		1.51	<	0.1	
94-1-1	SS		2022-02-15		60.		0.825	<	0.015	<	0.005	<	0.02	<	0.02		1.7		4.7		0.791		0.087		6 930.	<	0.005		7.78		159.		39.		11.6		0.011 2	<	0.2	<	0.5		0.798		0.27		0.59	<	0.1	
P1	SS		2021-05-07	Clear and slightly orange	131.		17.7		56.	a	0.005	<	0.02	<	0.02		6.62		131.		48.8		0.102		22 300.	<	0.01		154.		1 020.	<	1.	<	6.	<	0.004		0.46	<	1.		0.011 7	<	0.4		5.91		0.1	
P1	SS		2021-09-29	Clear and slightly orange	68.7		13.8		72.	a	0.005	<	0.02	<	0.02		8.42		67.8		53.9		0.434		19 800.	<	0.01		191.		1 130.	<	10.	<	6.	<	0.004		0.42	<	1.		0.011		0.42		2.8		0.1	
P1	SS		2021-11-03	Clear and colourless	150.		21.5		64.	a	0.009 1	<	0.02		0.022		44.8		77.8		54.5		0.136		19 200.	<	0.01		182.		1 060.		27.		8.	<	0.004		0.46	<	1.		0.203	<	0.4		182.		0.1	
P1	SS		2022-03-07	Clear and colourless	494.		7.24		24.	a	0.005	<	0.02	<	0.02		7.88		72.9		22.5	<	0.08		16 400.	<	0.01		69.3		834.		7.4	<	6.		0.004 7	<	0.4	<	1.		0.046 7		0.42		31.1	<	0.1	
P2	SS		2021-05-07	Clear and slightly orange	310.		22.6		82.	a	0.009 7		0.072		0.082		10.1		22.		76.8		0.16		13 600.	<	0.01		267.		1 200.	<	1.	<	6.	<	0.004	<	0.4	<	1.		0.010 9		2.56		1.98		0.1	
P2	SS		2021-09-10	Clear and slightly yellow	318.		18.7		82.	a	0.018 1		0.115		0.133		9.85		20.6		71.9		0.133		13 400.	<	0.01		257.		1 210.		2.2	<	6.	<	0.004	<	0.4	<	1.		0.024 3		2.81		3.15		0.1	
P2	SS		2021-11-03	Clear and slightly yellow	311.		18.6		82.	a	0.011 8		0.053		0.065

B2. Domestic Well Quality

Parameters	Criteria		Well Number	Site #2	Site #3	BFD of Site #3	Site #11	Site # 12	Site #13	Site #10	Site #9
				Kiowa Ave	Spotts Close	Spotts Close	Farmington Rd	Wallace Dr	Wallace Dr	Meadowbrook	Wildview Cres
	Canadian	British Columbia		24	25	25	36	37 (at House)	38 (at Well Head)	61	47
	DWQ Guidelines [1]	SDWQ Guidelines [2]	Sample Date	1-Jun-2021	1-Jun-2021	1-Jun-2021	1-Jun-2021	1-Jun-2021	1-Jun-2021	31-May-2021	31-May-2021
Metals											
Aluminum, total	0.1 ‡	9.5	mg/L	0.00064	0.0198	0.0018	0.00158	0.00528	0.00200	0.00699	0.01610
Antimony, total	0.006	0.006	mg/L	< 0.00002	0.000031	0.000038	< 0.00002	0.000074	0.000087	< 0.00002	< 0.00002
Arsenic, total	0.010	0.010	mg/L	< 0.00002	< 0.00002	< 0.00002	< 0.00002	0.00153	0.00162	< 0.00002	< 0.00002
Barium, total	2	n/a	mg/L	0.000236	0.00227	0.00226	0.00016	0.00676	0.00737	0.000891	0.00415
Beryllium, total	n/a	n/a	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001	0.000015
Bismuth, total	n/a	n/a	mg/L	< 0.000005	< 0.000005	< 0.000005	< 0.000005	< 0.000005	< 0.000005	< 0.000005	< 0.000005
Boron, total	5	5	mg/L	0.176	0.188	0.181	0.67	0.228	0.234	< 0.01	< 0.01
Cadmium, total	0.007	0.005	mg/L	0.0000061	0.0000075	0.0000057	< 0.000005	< 0.000005	< 0.00001	0.000008	0.0000174
Calcium, total	n/a	n/a	mg/L	20.1	59.5	57.1	10.1	32.4	35.9	19.3	13.1
Chromium, total	0.05	0.05	mg/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	0.00014	< 0.0001
Cobalt, total	n/a	0.001	mg/L	0.0000153	0.0000354	0.0000332	0.0000066	0.0000276	0.0000473	0.0000234	0.0000279
Copper, total	2 [1] and 1 †	2 [2] and 1 †	mg/L	0.00719	0.0575	0.0572	0.000254	0.00394	0.00101	0.063	0.0762
Iron, total	0.3 †	0.3 †	mg/L	0.0022	0.0023	0.0017	0.008	0.0010	0.0022	0.0045	0.0126
Lead, total	0.005	0.005	mg/L	0.000102	0.000987	0.00101	0.0000247	0.000147	0.000197	0.000889	0.00094
Lithium, total	n/a	n/a	mg/L	< 0.0005	< 0.0005	< 0.0005	0.00109	0.00095	0.00094	< 0.0005	< 0.0005
Magnesium, total	n/a	n/a	mg/L	1.5	6.61	6.65	3.2	7.75	7.93	5.47	2.49
Manganese, total	0.12 [1] and 0.02 †	0.12 [2] and 0.02 †	mg/L	0.000267	0.000511	0.000497	0.00395	0.0168	**0.0434**	0.000172	0.0158
Mercury, total	0.001	0.001	mg/L	< 0.0000019	< 0.0000019	< 0.0000019	< 0.0000019	< 0.0000019	< 0.0000019	< 0.0000019	0.0000042
Molybdenum, total	n/a	0.088	mg/L	0.000084	0.000124	0.000134	0.00104	0.000888	0.000905	0.000055	< 0.00005
Nickel, total	n/a	0.08	mg/L	0.000049	0.00024	0.000268	0.000034	0.000242	0.0003	0.000151	0.000115
Phosphorus, total	n/a	n/a	mg/L	0.0031	0.0047	0.0041	0.0064	0.0366	0.04	0.0088	0.0087
Potassium, total	n/a	n/a	mg/L	0.346	1.83	1.71	0.52	1.12	1.14	0.232	0.36
Selenium, total	0.05	0.01	mg/L	< 0.00004	0.000052	0.000049	0.000831	< 0.00004	< 0.00004	0.000093	< 0.00004
Silicon, total	n/a	n/a	mg/L	9.12	9.3	8.76	8.64	7.81	8.58	9.35	7.69
Silver, total	n/a	n/a	mg/L	< 0.000005	< 0.000005	< 0.000005	< 0.000005	< 0.000005	< 0.000005	< 0.000005	< 0.000005
Sodium, total	200 †	n/a	mg/L	71.3	10.2	10	36	17.5	17.7	6.51	9.13
Strontium, total	7.0	7.0	mg/L	0.0199	0.0821	0.0814	0.026	0.121	0.123	0.0399	0.0349
Sulphur, total	n/a	n/a	mg/L	4.3	6.8	6.9	5.7	8.5	9.3	< 3	< 3
Thallium, total	n/a	n/a	mg/L	< 0.000002	0.0000024	0.0000023	0.0000046	< 0.000002	< 0.000002	< 0.000002	< 0.000002
Tin, total	n/a	n/a	mg/L	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Titanium, total	n/a	n/a	mg/L	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Uranium, total	0.02	0.02	mg/L	0.000116	0.00028	0.000272	< 0.000002	0.000221	0.000227	0.0000067	0.0000617
Vanadium, total	n/a	n/a	mg/L	0.00053	0.00093	0.00093	< 0.0002	0.00034	0.00038	0.00055	< 0.0002
Zinc, total	5 †	3 [2] and 5 †	mg/L	0.00238	0.0188	0.0185	0.00178	0.00348	0.00283	0.00426	0.00447
Zirconium, total	n/a	n/a	mg/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Conventionals											
Hardness (as CaCO3)	n/a	n/a	mg/L	56.4	176	170	38.5	113	122	71	43
Chloride, dissolved	250 †	250 †	mg/L	18	29	29	10	16	16	12	10
Total dissolved solids	500 †	n/a	mg/L	270	250	250	160	220	230	120	88
Specific Conductivity (Lab)	n/a	n/a	µS/cm	430	420	420	240	330	330	190	150
Conductivity (Field)	n/a	n/a	µS/cm	350	326	326	183	259	260	142	103
pH (lab)	7.0 to 10.5 †	n/a	pH	7.58	7.65	7.14	8.4	8.1	8.08	7.14	7.22
pH (field)	7.0 to 10.5 †	n/a	pH	**6.23**	**5.91**	**5.91**	8	7.4	7.4	**5.22**	**5.17**
Temperature (field)	15 †	15 †	°C	14.9	12.9	12.9	12.9	13.3	13.4	11.9	10.5
Ammonia	n/a	n/a	mg/L	---	---	---	---	---	---	---	---

Notes:

1) Health Canada (updated in September 2020 version). Guidelines for Canadian Drinking Water Quality—Summary Table.

(2) British Columbia Approved Source Drinking Water Quality Guideline (SDWQGs) (2020 edition).

‡ Limit for this parameter is an operational guideline (OG) only.

† Limit for this parameter is an aesthetic objective (AO), not a human health objective.

 # Limit for this guideline is an iterim value.

BOLD *Sample concentrations expressed in bold exceed AO drinking water quality guidelines.*

Sample concentrations highlighted in yellow exceed drinking water quality guidelines.

n/a - no drinking water quality guideline is available for this parameter.

Parameters	Criteria		Well Number	Site #4	Site #6	BFD of Site #6	Site #7	Site #8	Site #16	Site #5	Site #14
				Lohr Road	Lohr Road	Lohr Road	Lohr Road	Lohr Road	Spotts Close	Lohr Road	Hartland Ave
	Canadian	British Columbia		50	52	52	53	80	81	51	n/a
	DWQ Guidelines [1]	SDWQ Guidelines [2]	Sample Date	31-May-2021	31-May-2021	31-May-2021	31-May-2021	31-May-2021	1-Jun-2021	31-May-2021	1-Jun-2021
Metals											
Aluminum, total	0.1 ‡	9.5	mg/L	0.0111	0.00337	0.00371	0.00480	0.00152	0.00420	0.00146	0.00900
Antimony, total	0.006	0.006	mg/L	0.000025	< 0.00002	< 0.00002	< 0.00002	< 0.00002	< 0.00004	< 0.00002	< 0.00002
Arsenic, total	0.010	0.010	mg/L	< 0.00002	< 0.00002	< 0.00002	< 0.00002	< 0.00002	< 0.00004	< 0.00002	< 0.00002
Barium, total	2	n/a	mg/L	0.00698	0.00823	0.00803	0.00186	0.006	0.00158	0.016	0.00177
Beryllium, total	n/a	n/a	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00002	< 0.00001	0.000016
Bismuth, total	n/a	n/a	mg/L	< 0.000005	< 0.000005	< 0.000005	< 0.000005	< 0.000005	< 0.00001	< 0.000005	< 0.000005
Boron, total	5	5	mg/L	0.08	0.058	0.058	< 0.01	< 0.01	0.913	0.041	0.012
Cadmium, total	0.007	0.005	mg/L	0.0000123	< 0.000005	< 0.000005	< 0.000005	< 0.000005	< 0.000010	< 0.000005	0.000009
Calcium, total	n/a	n/a	mg/L	16.6	38.8	40.6	17.2	37.2	4.51	50	13.6
Chromium, total	0.05	0.05	mg/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0002	< 0.0001	< 0.0001
Cobalt, total	n/a	0.001	mg/L	0.0000882	0.0000306	0.000027	0.0000181	0.000013	< 0.00001	0.0000207	0.0000372
Copper, total	2 [1] and 1 †	2 [2] and 1 †	mg/L	0.0669	0.00448	0.00422	0.000099	0.0105	0.00013	0.00744	0.00217
Iron, total	0.3 †	0.3 †	mg/L	0.0283	0.0023	0.0029	0.0045	< 0.001	0.0106	0.0062	0.0852
Lead, total	0.005	0.005	mg/L	0.0028	0.000378	0.000379	0.0000061	0.000376	0.000154	0.000565	0.000285
Lithium, total	n/a	n/a	mg/L	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	0.0012	< 0.0005	< 0.0005
Magnesium, total	n/a	n/a	mg/L	3.07	5.46	5.37	2.58	2.94	0.48	6.22	3.28
Manganese, total	0.12[1] and 0.02 †	0.12[2] and 0.02 †	mg/L	0.00119	0.000132	0.00013	0.000251	0.000372	0.0006	0.0002	0.0020
Mercury, total	0.001	0.001	mg/L	0.0000019	< 0.0000019	< 0.0000019	< 0.0000019	< 0.0000019	< 0.000002	< 0.0000019	< 0.0000019
Molybdenum, total	n/a	0.088	mg/L	0.000255	0.000561	0.000591	0.000436	0.000404	0.00195	0.000954	0.000267
Nickel, total	n/a	0.08	mg/L	0.000187	0.00015	0.000147	0.000028	0.000034	0.000052	0.000674	0.000029
Phosphorus, total	n/a	n/a	mg/L	0.0044	0.0057	0.0046	0.009	0.0045	< 0.004	0.0031	0.0054
Potassium, total	n/a	n/a	mg/L	0.345	0.53	0.529	0.268	0.286	0.2	0.379	0.307
Selenium, total	0.05	0.01	mg/L	0.000041	0.000094	0.000101	0.000053	0.00007	< 0.00008	0.000187	< 0.00004
Silicon, total	n/a	n/a	mg/L	6.23	6.66	6.91	7.19	7.29	11.2	7.48	6.55
Silver, total	n/a	n/a	mg/L	0.0000105	< 0.000005	< 0.000005	< 0.000005	< 0.000005	< 0.00001	< 0.000005	< 0.000005
Sodium, total	200 †	n/a	mg/L	7.36	5.7	5.57	4.37	4.3	40.3	6.08	15
Strontium, total	7.0	7.0	mg/L	0.045	0.0835	0.0821	0.0351	0.0672	0.0358	0.122	0.0333
Sulphur, total	n/a	n/a	mg/L	< 3	< 3	< 3	< 3	< 3	< 6	< 3	6.2
Thallium, total	n/a	n/a	mg/L	< 0.000002	< 0.000002	< 0.000002	0.000002	< 0.000002	< 0.000004	< 0.000002	< 0.000002
Tin, total	n/a	n/a	mg/L	0.00022	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0004	< 0.0002	< 0.0002
Titanium, total	n/a	n/a	mg/L	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0010	< 0.0005	< 0.0005
Uranium, total	0.02	0.02	mg/L	0.0000182	0.000487	0.000474	0.0000975	0.000551	< 0.000004	0.000575	0.0000218
Vanadium, total	n/a	n/a	mg/L	0.00042	0.00051	0.00053	0.00041	< 0.0002	< 0.0004	0.00045	0.00033
Zinc, total	5 †	3[2] and 5 †	mg/L	0.0254	0.00261	0.00286	0.0012	0.00407	0.01070	0.00332	0.00455
Zirconium, total	n/a	n/a	mg/L	<	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0002	< 0.0001	< 0.0001
Conventionals											
Hardness (as CaCO3)	n/a	n/a	mg/L	54.1	119	123	53.6	105	13	150	48
Chloride, dissolved	250 †	250 †	mg/L	12	13	13	6.5	9.2	16	16	20
Total dissolved solids	500 †	n/a	mg/L	140	170	190	110	180	140	220	140
Specific Conductivity (Lab)	n/a	n/a	µS/cm	160	300	290	140	240	220	340	190
Conductivity (Field)	n/a	n/a	µS/cm	121	222	222	107	188	165	249	144
pH (lab)	7.0 to 10.5 †	n/a	pH	**6.99**	7.73	7.77	7.1	7.6	8.79	7.81	**6.64**
pH (field)	7.0 to 10.5 †	n/a	pH	**5**	**5.93**	**5.93**	**4.98**	**5.78**	8.44	**6.3**	**5.05**
Temperature (field)	15 †	15 †	°C	10.7	11.8	11.8	10	12.7	11.2	11	10.6
Ammonia	n/a	n/a	mg/L	---	---	---	---	---	---	---	---

Notes:

1) Health Canada (updated in June 2019 version). Guidelines for Canadian Drinking Water Quality—Summary Table.

(2) British Columbia Approved Source Drinking Water Quality Guideline (SDWQGs) (2020 edition).

‡ Limit for this parameter is an operational guideline (OG) only.

† Limit for this parameter is an aesthetic objective (AO), not a human health objective.

 # Limit for this guideline is an iterim value.

BOLD *Sample concentrations expressed in bold exceed AO drinking water quality guidelines.*

Sample concentrations highlighted in yellow exceed drinking water quality guidelines.

n/a - no drinking water quality guideline is available for this parameter.

Parameters	Criteria		Well Number	Site #18	Site #20	BFD of Site #20	Site #21	Site #17
				Willis Pt Rd	Mark Lane	Mark Lane	Mark Lane	Durrance Close
	Canadian	British Columbia		n/a	n/a	n/a	n/a	n/a
	DWQ Guidelines [1]	SDWQ Guidelines [2]	Sample Date	2-Jun-2021	2-Jun-2021	2-Jun-2021	2-Jun-2021	1-Jun-2021
Metals								
Aluminum, total	0.1 ‡	9.5	mg/L					
Antimony, total	0.006	0.006	mg/L					
Arsenic, total	0.010	0.010	mg/L					
Barium, total	2	n/a	mg/L					
Beryllium, total	n/a	n/a	mg/L					
Bismuth, total	n/a	n/a	mg/L					
Boron, total	5	5	mg/L					
Cadmium, total	0.007	0.005	mg/L					
Calcium, total	n/a	n/a	mg/L					
Chromium, total	0.05	0.05	mg/L					
Cobalt, total	n/a	0.001	mg/L					
Copper, total	2 [1] and 1 †	2 [2] and 1 †	mg/L					
Iron, total	0.3 †	0.3 †	mg/L					
Lead, total	0.005	0.005	mg/L					
Lithium, total	n/a	n/a	mg/L					
Magnesium, total	n/a	n/a	mg/L					
Manganese, total	0.12[1] and 0.02 †	0.12[2] and 0.02 †	mg/L					
Mercury, total	0.001	0.001	mg/L					
Molybdenum, total	n/a	0.088	mg/L					
Nickel, total	n/a	0.08	mg/L					
Phosphorus, total	n/a	n/a	mg/L					
Potassium, total	n/a	n/a	mg/L					
Selenium, total	0.05	0.01	mg/L					
Silicon, total	n/a	n/a	mg/L					
Silver, total	n/a	n/a	mg/L					
Sodium, total	200 †	n/a	mg/L	13.3	17.4	17.4	11	6.28
Strontium, total	7.0	7.0	mg/L					
Sulphur, total	n/a	n/a	mg/L					
Thallium, total	n/a	n/a	mg/L					
Tin, total	n/a	n/a	mg/L					
Titanium, total	n/a	n/a	mg/L					
Uranium, total	0.02	0.02	mg/L					
Vanadium, total	n/a	n/a	mg/L					
Zinc, total	5 †	3[2] and 5 †	mg/L					
Zirconium, total	n/a	n/a	mg/L					
Conventionals								
Hardness (as CaCO3)	n/a	n/a	mg/L					
Chloride, dissolved	250 †	250 †	mg/L	3.8	35	37	26	5.2
Total dissolved solids	500 †	n/a	mg/L					
Specific Conductivity (Lab)	n/a	n/a	µS/cm	200	420	420	540	380
Conductivity (Field)	n/a	n/a	µS/cm	147	303	303	391	285.0
pH (lab)	7.0 to 10.5 †	n/a	pH	8.02	7.98	7.98	7.78	7.79
pH (field)	7.0 to 10.5 †	n/a	pH	7.76	7.17	7.17	**6.7**	**6.80**
Temperature (field)	15 †	15 †	°C	10.10	11.5	11.5	11.5	11.0
Ammonia	n/a	n/a	mg/L	< 0.015	< 0.015	< 0.015	< 0.015	< 0.015

Notes:

1) Health Canada (updated in June 2019 version). Guidelines for Canadian Drinking Water Quality—Summary Table.

(2) British Columbia Approved Source Drinking Water Quality Guideline (SDWQGs) (2020 edition).

‡ Limit for this parameter is an operational guideline (OG) only.

† Limit for this parameter is an aesthetic objective (AO), not a human health objective.

 # Limit for this guideline is an iterim value.

BOLD *Sample concentrations expressed in bold exceed AO drinking water quality guidelines.*

Sample concentrations highlighted in yellow exceed drinking water quality guidelines.

n/a - no drinking water quality guideline is available for this parameter.

B3. Surface Water Quality

AECOM

B.C. Water Quality Guidelines				BC WQG MAXIMUM (1)	---			5			---			---			600			110			---			---		
				BC WQG AVERAGE (1)	---			---			1200			---			150			4			---			---		
Station	Sample Type	Compliance Well (Y/N?)	Date Sampled	PARAMETER	Aluminum			Arsenic			Boron			Cadmium			Chloride			Cobalt			Copper			Hardness (As Caco3)		
				STATE	TOT			TOT			TOT			TOT			DIS			TOT			TOT			TOT		
				UNIT	µg/L			µg/L			µg/L			µg/L			mg/L			µg/L			µg/L			mg/L		
				Method Detection Limit (MDL)	0.5			0.02			10			0.005			1			0.01			0.1			0.5		
SW-N-05	FRM	Y	2021-04-26	Mean of duplicates	139.5	---	---	0.12	---		33.	---		0.007 2	---	---	4.5			0.183 5			10.815	---	---	158.	---	---
SW-N-05	FRM		2021-10-05	Mean of duplicates	229.	---	---	0.133	---		42.	---		0.029 15	---	---	7.05			0.351			2.485	---	---	231.	---	---
SW-N-05	FRM		2021-11-30	Mean of duplicates	182.5	---	---	0.182 5	---		89.5	---		0.068 25	---	---	9.4			0.443			5.395	---	---	340.	---	---
SW-N-05	FRM		2022-02-07	Mean of duplicates	49.05	---	---	0.215 5	---		135.	---		0.304 5	---	---	11.			0.624			7.055	---	---	715.5	---	---
SW-N-14	NS		2021-04-29		Null	---	---	Null	---		Null	---		Null	---	---	Null			Null			Null	---	---	Null	---	---
SW-N-14	NS		2021-10-04	Not Accesible, active shooting	Null	---	---	Null	---		Null	---		Null	---	---	Null			Null			Null	---	---	Null	---	---
SW-N-14	NS		2021-11-30		Null	---	---	Null	---		Null	---		Null	---	---	Null			Null			Null	---	---	Null	---	---
SW-N-14	NS		2022-02-07	Couldn't access due to active firing	Null	---	---	Null	---		Null	---		Null	---	---	Null			Null			Null	---	---	Null	---	---
SW-N-16	FRM	Y	2021-04-26	Mean of duplicates	25.9	---	---	0.373 5	---		56.5	---		0.014 25	---	---	7.15			1.11			5.565	---	---	164.	---	---
SW-N-16	FRM		2021-10-04	Mean of duplicates	23.25	---	---	0.34	---		78.5	---		0.033 95	---	---	11.			0.532 5			6.285	---	---	211.	---	---
SW-N-16	FRM		2021-11-30	Mean of duplicates	42.85	---	---	0.244	---		53.	---		0.019 1	---	---	4.35			0.234 5			13.55	---	---	143.5	---	---
SW-N-16	FRM		2022-02-08	Mean of duplicates	29.	---	---	0.214 5	---		46.	---		0.011 85	---	---	< 10.			0.276			8.585	---	---	132.	---	---
SW-N-17	SS		2021-04-29	Moderately low flow, clear and colourless	17.9	---	---	0.102	---		82.	---		< 0.005	---	---	13.			0.083			0.665	---	---	155.	---	---
SW-N-17	SS		2021-10-04	Moderately low flow, clear and colourless	14.6	---	---	0.11	---		106.	---		0.007 5	---	---	11.			0.122			0.993	---	---	179.	---	---
SW-N-17	NS		2021-11-30		Null	---	---	Null	---		Null	---		Null	---	---	Null			Null			Null	---	---	Null	---	---
SW-N-17	SS		2022-02-07	Moderate flow, clear and colouress	12.5	---	---	0.086	---		106.	---		0.007 7	---	---	18.			0.129			0.834	---	---	292.	---	---
SW-N-18	SS		2021-04-26	Moderately low flow, clear and colourless	111.	---	---	0.12	---		16.	---		0.007 3	---	---	4.7			0.252			1.54	---	---	144.	---	---
SW-N-18	SS		2021-10-05	Moderately low flow, clear and colourless	41.1	---	---	0.092	---		17.	---		< 0.005	---	---	7.			0.104			0.799	---	---	185.	---	---
SW-N-18	SS		2021-11-30		11 400.	---	---	1.14	---		69.	---		0.042 9	---	---	9.3			8.57		**b**	36.9	---	---	144.	---	---
SW-N-18	NS		2022-02-07	DRY - flow blocked off feeding into sample location	Null	---	---	Null	---		Null	---		Null	---	---	Null			Null			Null	---	---	Null	---	---
SW-N-19	SS		2021-04-26	Moderately low flow, clear and moderately yellow	30.1	---	---	0.364	---		43.	---		0.013 8	---	---	7.1			1.39			12.	---	---	184.	---	---
SW-N-19	SS		2021-10-04	Moderately low flow, clear and slightly yellow	13.	---	---	0.25	---		55.	---		0.010 1	---	---	9.5			1.48			6.49	---	---	210.	---	---
SW-N-19	SS		2021-11-30		38.4	---	---	0.265	---		42.	---		0.012	---	---	4.			0.261			19.4	---	---	154.	---	---
SW-N-19	SS		2022-02-08	Moderate flow, clear and slightly yellow	47.9	---	---	0.227	---		30.	---		0.010 8	---	---	6.9			0.258			18.2	---	---	143.	---	---
SW-N-41S1	FRM	Y	2021-04-26	Mean of duplicates	219.	---	---	0.452	---		18.	---		0.007 95	---	---	11.			0.374 5			0.68	---	---	187.5	---	---
SW-N-41S1	FRM		2021-10-04	Mean of duplicates	7.185	---	---	0.314 5	---		18.	---		< 0.005	---	---	10.			0.247 5			0.221	---	---	237.	---	---
SW-N-41S1	FRM		2021-11-30	Mean of duplicates	29.25	---	---	0.19	---		19.	---		< 0.005	---	---	5.1			0.086 8			0.410 5	---	---	153.5	---	---
SW-N-41S1	FRM		2022-02-07	Mean of duplicates	39.45	---	---	0.192 5	---		18.5	---		< 0.005	---	---	6.9			0.116			0.315	---	---	157.5	---	---
SW-N-41S3	SS		2021-04-26	Moderately low flow, clear and colourless	48.4	---	---	0.169	---		34.	---		0.006 3	---	---	11.			0.052			0.57	---	---	124.	---	---
SW-N-41S3	SS		2021-10-04	Moderately low flow, clear and colourless	15.8	---	---	0.185	---		53.	---		< 0.005	---	---	12.			0.037 4			0.296	---	---	150.	---	---
SW-N-41S3	SS		2021-11-30		22.2	---	---	0.075	---		16.	---		< 0.005	---	---	6.			0.032 5			0.502	---	---	62.	---	---
SW-N-41S3	SS		2022-02-07	Moderately high flow, clear and colourless	11.7	---	---	0.077	---		21.	---		< 0.005	---	---	6.5			0.027 2			0.399	---	---	83.3	---	---
SW-N-42S1	FRM	Y	2021-04-26	Mean of duplicates	63.15	---	---	0.122	---		48.	---		0.007	---	---	22.			0.159 5			0.635	---	---	205.	---	---
SW-N-42S1	FRM		2021-10-04	Mean of duplicates	60.95	---	---	0.194 5	---		72.5	---		0.008 3	---	---	24.5			0.197			1.475	---	---	275.	---	---
SW-N-42S1	FRM		2021-11-30	Mean of duplicates	37.35	---	---	0.068	---		61.	---		0.007 25	---	---	8.9			0.106 5			0.955	---	---	146.5	---	---
SW-N-42S1	FRM		2022-02-07	Mean of duplicates	80.15	---	---	0.086 5	---		48.5	---		< 0.005 4	---	---	17.			0.123			0.725	---	---	162.5	---	---
SW-N-45	SS		2021-04-29	Moderately low flow, clear and colourless	33.5	---	---	0.105	---		71.	---		0.005 4	---	---	8.8			0.099 8			1.	---	---	171.	---	---
SW-N-45	SS		2021-10-04	Moderately low flow, clear and colourless	19.4	---	---	0.077	---		98.	---		< 0.005	---	---	9.1			0.117			1.26	---	---	199.	---	---
SW-N-45	NS		2021-11-30		Null	---	---	Null	---		Null	---		Null	---	---	Null			Null			Null	---	---	Null	---	---
SW-N-45	SS		2022-02-07	Moderate flow, clear and colouress	7.68	---	---	0.09	---		128.	---		0.016 4	---	---	17.			0.234			1.49	---	---	527.	---	---
SW-N-50	SS		2021-04-27	Moderately low flow, clear and colourless	114.	---	---	0.076	---	<	10.	---	<	0.005	---	---	5.1			0.123			0.536	---	---	142.	---	---
SW-N-50	SS		2021-10-05	Moderately low flow, clear and colourless	119.	---	---	0.09	---		17.	---	<	0.005	---	---	6.6			0.156			1.09	---	---	181.	---	---
SW-N-50	SS		2021-11-30		35 300.	---	---	0.985	---	<	20.	---		0.123	---	---	5.1			29.1		**b**	132.	---	---	176.	---	---
SW-N-50	NS		2022-02-07	DRY	Null	---	---	Null	---		Null	---		Null	---	---	Null			Null			Null	---	---	Null	---	---
SW-N-51	NS		2021-04-26	Dry, no sample collected	Null	---	---	Null	---		Null	---		Null	---	---	Null			Null			Null	---	---	Null	---	---
SW-N-51	NS		2021-10-05	Dry, insufficient volume to sample	Null	---	---	Null	---		Null	---		Null	---	---	Null			Null			Null	---	---	Null	---	---
SW-N-51	NS		2021-11-30		Null	---	---	Null	---		Null	---		Null	---	---	Null			Null			Null	---	---	Null	---	---
SW-N-51	NS		2022-02-07	DRY - sample location no longer exists	Null	---	---	Null	---		Null	---		Null	---	---	Null			Null			Null	---	---	Null	---	---
SW-N-53	NS		2021-04-26	Dry, no sample collected	Null	---	---	Null	---		Null	---		Null	---	---	Null			Null			Null	---	---	Null	---	---
SW-N-53	NS		2021-10-05	Dry, insufficient volume to sample	Null	---	---	Null	---		Null	---		Null	---	---	Null			Null			Null	---	---	Null	---	---
SW-N-53	SS		2021-11-30		2 120.	---	---	0.383	---		62.	---		0.064	---	---	4.3			2.39			5.97	---	---	1 160.	---	---
SW-N-53	NS		2022-02-07	DRY	Null	---	---	Null	---		Null	---		Null	---	---	Null			Null			Null	---	---	Null	---	---
SW-N-54	SS		2021-04-26	Low flow, clear and colourless	19.7	---	---	0.435	---		57.	---		0.012 5	---	---	1.6			0.433			15.4	---	---	196.	---	---
SW-N-54	SS		2021-10-05	Moderately low flow, clear and slightly yellow	20.4	---	---	0.693	---		67.	---		0.019 9	---	---	5.1			1.27			18.9	---	---	334.	---	---
SW-N-54	SS		2021-11-30		493.	---	---	0.351	---		62.	---		0.007 1	---	---	2.3			0.717			19.9	---	---	152.	---	---
SW-N-54	SS		2022-02-07	Moderately low flow, clear and slighlty yellow	174.	---	---	0.327	---		49.	---		< 0.005	---	---	3.9			0.334			16.	---	---	153.	---	---
SW-N-CS2	NS		2021-04-26	Dry, no sample collected	Null	---	---	Null	---		Null	---		Null	---	---	Null			Null			Null	---	---	Null	---	---
SW-N-CS2	NS		2021-10-05	Dry, insufficient volume to sample	Null	---	---	Null	---		Null	---		Null	---	---	Null			Null			Null	---	---	Null	---	---
SW-N-CS2	SS		2021-11-30		40.5	---	---	0.038	---	<	10.	---	<	0.005	---	---	3.9			0.025 3			0.405	---	---	42.	---	---
SW-N-CS2	SS		2022-02-07	Moderate flow, clear and colourless	46.7	---	---	0.025	---	<	10.	---	<	0.005	---	---	2.4			0.041			0.36	---	---	59.7	---	---
SW-S-03	SS		2021-04-27	Moderately low flow, clear and colourless	228.	---	---	0.194	---		53.	---		0.012	---	---	28.			0.383			7.95	---	---	111.	---	---
SW-S-03	SS		2021-10-05	Moderately low flow, clear and colourless, some garbage upstre	89.2	---	---	0.286	---		58.	---		0.029 7	---	---	29.			1.52			5.07	---	---	168.	---	---
SW-S-03	SS		2021-12-01		65.6	---	---	0.186	---		70.	---		0.015 4	---	---	13.			0.415			11.5	---	---	92.8	---	---
SW-S-03	SS		2022-02-08	Moderately high flow, moderately silty and very grey	3 130.	---	---	0.516	---		64.	---		0.041 3	---	---	25.			2.7			15.9	---	---	88.2	---	---
SW-S-04	FRM	Y	2021-04-27	Mean of duplicates	102.5	---	---	0.184 5	---		87.	---		0.016 45	---	---	36.			0.225 5			3.19	---	---	125.5	---	---
SW-S-04	FRM		2021-10-05	Mean of duplicates	12.45	---	---	0.106	---		69.	---		0.014 5	---	---	36.			0.077 7			1.33	---	---	136.5	---	---
SW-S-04	FRM		2021-12-01	Mean of duplicates	74.5	---	---	0.119	---		46.5	---		0.010 25	---	---	9.85			0.116			3.08	---	---	67.3	---	---
SW-S-04	FRM		2022-02-08	Mean of duplicates	104.4	---	---	0.134	---		74.5	---		0.013 15	---	---	30.			0.218 5			3.485	---	---	98.6	---	---
SW-S-12	SS		2021-04-27	Moderately low flow, clear and slightly yellow	59.1	---	---	0.252	---		66.	---		0.011 1	---	---	16.			0.48			13.6	---	---	116.	---	---
SW-S-12	SS		2021-10-05	Very low flow, clear and colourless, lots of vegetation debris an	78.	---	---	0.495	---		34.	---		0.037 5	---	---	8.2			0.339			18.4	---	---	269.	---	---
SW-S-12	SS		2021-12-01		79.4	---	---	0.265	---		100.	---		0.028 5	---	---	11.			0.757			17.7	---	---	114.	---	---
SW-S-12	SS		2022-02-08	Moderately high flow, very silty and moderately green	1 010.	---	---	0.341	---		106.	---		0.018 8	---	---	17.			1.44			11.5	---	---	102.	---	---
SW-S-20	NS		2021-04-27	Dry, no sample collected	Null	---	---	Null	---		Null	---		Null	---	---	Null			Null			Null	---	---	Null	---	---
SW-S-20	NS		2021-10-05	Dry, insufficient volume to sample	Null	---	---	Null	---		Null	---		Null	---	---	Null			Null			Null	---	---	Null	---	---
SW-S-20	SS		2021-12-01		68.	---	---	0.099	---		16.	---		< 0.005	---	---	4.2			0.081			1.24	---	---	40.8	---	---
SW-S-21	NS		2021-04-27	Dry, no sample collected	Null	---	---	Null	---		Null	---		Null	---	---	Null			Null			Null	---	---	Null	---	---
SW-S-21	NS		2021-10-05	Dry, insufficient volume to sample	Null	---	---	Null	---		Null	---		Null	---	---	Null			Null			Null	---	---	Null	---	---
SW-S-21	SS		2021-12-01		48.3	---	---	0.102	---		15.	---		< 0.005	---	---	4.			0.048 3			1.15	---	---		---	---
SW-S-21	SS		2022-02-08	Moderate flow, clear and colourless	24.5	---	---	0.079	---		12.	---		< 0.005	---	---	4.7			0.027 9			0.735	---	---	44.4	---	---
SW-S-24	SS		2021-04-27	Moderately low flow, clear and colourless	104.	---	---	0.171	---		86.	---		0.017 3	---	---	27.			0.255			3.24	---	---	121.	---	---
SW-S-24	SS		2021-10-05	Moderately low flow, clear and colourless	410.	---	---	0.229	---		86.	---		0.037 6	---	---	27.			0.574			4.85	---	---	162.	---	---
SW-S-24	SS		2021-12-01		258.	---	---	0.209	---		84.	---		0.026 3	---	---	27.			0.437			6.15	---	---	101.	---	---
SW-S-24	SS		2022-02-08	Moderately high flow, clear and colourless	163.	---	---	0.138	---		78.	---		0.009 2	---	---	27.			0.289			3.77	---	---	102.	---	---
SW-S-27	NS		2021-04-27	Dry, no sample collected	Null	---	---	Null	---		Null	---		Null	---	---	Null			Null			Null	---	---	Null	---	---
SW-S-27	NS		2021-10-05	Dry, insufficient volume to sample	Null	---	---	Null	---		Null	---		Null	---	---	Null			Null			Null	---	---	Null	---	---
SW-S-27	SS		2021-12-01		60.2	---	---	0.138	---		76.	---		0.049 8	---	---	9.1			0.14			1.91	---	---		---	---
SW-S-27	SS		2022-02-08	Moderately low flow, clear and colourless	647.	---	---	0.245	---		70.	---		0.055 2	---	---	19.			0.819			2.87	---	---	92.5	---	---
SW-S-52	SS		2021-04-27	Moderately low flow, clear and colourless	8.11	---	---	0.042	---		12.	---		< 0.005	---	---	4.2			0.019 3			0.246	---	---	69.2	---	---
SW-S-52	NS		2021-10-05	Dry, insufficient volume to sample	Null	---	---	Null	---		Null	---		Null	---	---	Null			Null			Null	---	---	Null	---	---
SW-S-52	SS		2021-12-01		19.4	---	---	0.073	---		18.	---		< 0.005	---	---	4.1			0.039 3			0.513	---	---		---	---
SW-S-52	SS		2022-02-08	Moderately high flow, clear and colourless	7.99	---	---	0.038	---		16.	---		< 0.005	---	---	3.8			0.024 8			0.309	---	---	57.8	---	---

Notes:

na Not applicable.

Null No sample collected.

a Above maximum allowable concentration (MAC) British Columbia Water Quality Guideline.

b Above 30-day average British Columbia Water Quality Guideline.

c Detection Limits above Applicable Standards.

(1) British Columbia Approved Water Quality Guidelines (Criteria), 1998 Edition, Updated in 2021. British Columbia Ministry of Environment and a Compendium of Working Water Quality Guidelines for British Columbia, 1998 Edition, Updated in Feb 2021. British Columbia Ministry of Environment. The Guidelines cited specific to protection of freshwater aquatic life unless otherwise noted.

(2) Maximum acceptable concentration unless otherwise noted.

(3) The ammonia guideline is pH and temperature (15°C assumed) dependant. All ammonia results were compared to standards based on the associated pH and temperature results for that sample.

(4) The nitrite guidelines are chloride dependant. All nitrite results were compared to standards based on the associated chloride result for that sample.

(5) This value is hardness dependent. All metals results were compared to standards based on the associated hardness result for a particular sample.

(6) This value is the short-term daily for streams with unknown fish distribution.

(7) The TSS guidelines are "change from background" and flow condition dependent. The background TSS in the North landfill are derived from stations SW-N-CSs2, SW-N-41s3 and SW-N-14.

(8) Dissolved copper guideline varies with water hardness, temperature and dissolved organic carbon; Dissolved copper results were only compared with guidelines where DOC was analyzed.

B.C. Water Quality Guidelines				BC WQG MAXIMUM (1)	1000		3.28 - 416.7 (5)		815 - 3394 (5)		46000		1.9 - 24.9 (3)		0.06 - 0.6 (4)		32.8		---		
				BC WQG AVERAGE (1)	---		3.43 - 19.57 (5)		767 - 2585 (5)		7600		0.135 - 1.77 (3)		0.02 - 0.2 (4)		3		---		
Station	Sample Type	Compliance Well (Y/N?)	Date Sampled	PARAMETER	Iron		Lead		Manganese		Molybdenum		N - Nh3 (As N)		N - No2 (As N)		N - No3 (As N)		Nickel		
				STATE	TOT		TOT		TOT		TOT		TOT		DIS		DIS		TOT		
				UNIT	µg/L		µg/L		µg/L		µg/L		mg/L		mg/L		mg/L		µg/L		
				Method Detection Limit (MDL)	1		0.005		0.1		0.05		0.015		0.005		0.02		0.02		
SW-N-05	FRM	Y	2021-04-26	Mean of duplicates	210.5	---	0.020 15		4.16		1.79		0.089		< 0.005		3.225	b	3.67	---	---
SW-N-05	FRM		2021-10-05	Mean of duplicates	336.5	---	0.079		14.15		0.863 5		0.066		< 0.005		3.4	b	0.765	---	---
SW-N-05	FRM		2021-11-30	Mean of duplicates	163.5	---	0.062		14.		1.43		1.85	b	0.541 5	a b	26.	b	1.76	---	---
SW-N-05	FRM		2022-02-07	Mean of duplicates	38.	---	0.025 35		85.25		2.37		0.685		0.414 5	b	91.9	a b	2.98	---	---
SW-N-14	NS		2021-04-29		Null	---	Null		Null		Null		Null		Null		Null		Null	---	---
SW-N-14	NS		2021-10-04	Not Accesible, active shooting	Null	---	Null		Null		Null		Null		Null		Null		Null	---	---
SW-N-14	NS		2021-11-30		Null	---	Null		Null		Null		Null		Null		Null		Null	---	---
SW-N-14	NS		2022-02-07	Couldn't access due to active firing	Null	---	Null		Null		Null		Null		Null		Null		Null	---	---
SW-N-16	FRM	Y	2021-04-26	Mean of duplicates	1 140.	a ---	0.022 5		722.5		2.11		0.087		< 0.005		0.191		6.4	---	---
SW-N-16	FRM		2021-10-04	Mean of duplicates	726.5	---	0.048 5		145.		1.14		0.083 5		0.046 65		0.477 5		2.05	---	---
SW-N-16	FRM		2021-11-30	Mean of duplicates	155.5	---	0.028 5		36.45		0.770 5		0.016		0.012		3.9	b	1.7	---	---
SW-N-16	FRM		2022-02-08	Mean of duplicates	251.	---	0.026		98.25		0.752 5		0.103		< 0.005 15		1.795		1.265	---	---
SW-N-17	SS		2021-04-29	Moderately low flow, clear and colourless	41.6	---	0.008 3		17.8		0.814		< 0.015		< 0.005		1.7		0.469	---	---
SW-N-17	SS		2021-10-04	Moderately low flow, clear and colourless	22.8	---	0.006 4		12.9		0.89		0.094		< 0.005		1.67		0.388	---	---
SW-N-17	NS		2021-11-30		Null	---	Null		Null		Null		Null		Null		Null		Null	---	---
SW-N-17	SS		2022-02-07	Moderate flow, clear and colouress	13.9	---	0.007 6		6.		0.481		0.97		< 0.005		30.5	b	0.374	---	---
SW-N-18	SS		2021-04-26	Moderately low flow, clear and colourless	204.	---	0.068 4		6.27		1.17		< 0.015		< 0.005		1.77		3.37	---	---
SW-N-18	SS		2021-10-05	Moderately low flow, clear and colourless	46.2	---	0.029 9		1.81		0.52		0.016		< 0.005		3.14	b	0.193	---	---
SW-N-18	SS		2021-11-30		14 500.	a ---	2.32		276.		0.246		4.	b	0.011 3		1.66		14.	---	---
SW-N-18	NS		2022-02-07	DRY - flow blocked off feeding into sample location	Null	---	Null		Null		Null		Null		Null		Null		Null	---	---
SW-N-19	SS		2021-04-26	Moderately low flow, clear and moderately yellow	151.	---	0.038		66.7		1.21		0.074		< 0.005		0.101		3.35	---	---
SW-N-19	SS		2021-10-04	Moderately low flow, clear and slightly yellow	211.	---	0.034		84.4		1.05		0.073		0.073 2		1.84		2.58	---	---
SW-N-19	SS		2021-11-30		52.4	---	< 0.02		6.91		0.857		0.015		0.013 8		4.88	b	2.22	---	---
SW-N-19	SS		2022-02-08	Moderate flow, clear and slightly yellow	71.5	---	< 0.02		4.86		0.938		1.6		< 0.005		3.18	b	2.37	---	---
SW-N-41S1	FRM	Y	2021-04-26	Mean of duplicates	621.5	---	0.139 5		267.		0.352		0.068		< 0.005		0.093		0.425	---	---
SW-N-41S1	FRM		2021-10-04	Mean of duplicates	188.	---	< 0.005		289.		0.394 5		< 0.015		< 0.005		0.258		0.182	---	---
SW-N-41S1	FRM		2021-11-30	Mean of duplicates	78.35	---	0.020 95		52.95		0.263 5		< 0.032		< 0.005		0.471		0.149 5	---	---
SW-N-41S1	FRM		2022-02-07	Mean of duplicates	128.	---	0.04		107.5		0.275 5		0.035		< 0.005		0.122		0.16	---	---
SW-N-41S3	SS		2021-04-26	Moderately low flow, clear and colourless	63.	---	0.072		6.65		0.485		0.068		< 0.005		0.031		0.64	---	---
SW-N-41S3	SS		2021-10-04	Moderately low flow, clear and colourless	22.1	---	0.023 9		5.49		0.436		< 0.015		< 0.005		0.072		0.093	---	---
SW-N-41S3	SS		2021-11-30		15.2	---	0.018 4		1.63		0.201		< 0.015		< 0.005		0.025		0.072	---	---
SW-N-41S3	SS		2022-02-07	Moderately high flow, clear and colourless	9.7	---	0.012 5		1.91		0.262		0.094		< 0.005		0.031		0.083	---	---
SW-N-42S1	FRM	Y	2021-04-26	Mean of duplicates	173.5	---	0.095		79.45		0.574 5		< 0.015		< 0.005		0.055 5		0.51	---	---
SW-N-42S1	FRM		2021-10-04	Mean of duplicates	132.65	---	0.092 5		135.7		0.687		< 0.023		< 0.005		0.048		0.29	---	---
SW-N-42S1	FRM		2021-11-30	Mean of duplicates	58.05	---	0.057 5		23.85		0.374 5		< 0.015		< 0.005		0.241 5		0.15	---	---
SW-N-42S1	FRM		2022-02-07	Mean of duplicates	113.	---	0.095		33.75		0.532		0.13		< 0.005		0.122		0.205	---	---
SW-N-45	SS		2021-04-29	Moderately low flow, clear and colourless	45.	---	0.012 2		5.44		1.2		< 0.015		< 0.005		3.41	b	0.798	---	---
SW-N-45	SS		2021-10-04	Moderately low flow, clear and colourless	19.8	---	0.008 7		6.97		1.05		1.8		< 0.005		2.72		0.257	---	---
SW-N-45	NS		2021-11-30		Null	---	Null		Null		Null		Null		Null		Null		Null	---	---
SW-N-45	SS		2022-02-07	Moderate flow, clear and colouress	6.3	---	< 0.005		8.72		0.709		1.7		< 0.005		72.8	a b	0.655	---	---
SW-N-50	SS		2021-04-27	Moderately low flow, clear and colourless	211.	---	0.026 8		3.26		0.464		1.9	b	< 0.005		1.43		0.52	---	---
SW-N-50	SS		2021-10-05	Moderately low flow, clear and colourless	162.	---	0.025		3.31		0.477		< 0.015		0.018 3		2.95		0.26	---	---
SW-N-50	SS		2021-11-30		41 500.	a ---	7.98		869.		< 0.1		0.073		0.009 8		1.59		42.4	---	---
SW-N-50	NS		2022-02-07	DRY	Null	---	Null		Null		Null		Null		Null		Null		Null	---	---
SW-N-51	NS		2021-04-26	Dry, no sample collected	Null	---	Null		Null		Null		Null		Null		Null		Null	---	---
SW-N-51	NS		2021-10-05	Dry, insufficient volume to sample	Null	---	Null		Null		Null		Null		Null		Null		Null	---	---
SW-N-51	NS		2021-11-30		Null	---	Null		Null		Null		Null		Null		Null		Null	---	---
SW-N-51	NS		2022-02-07	DRY - sample location no longer exists	Null	---	Null		Null		Null		Null		Null		Null		Null	---	---
SW-N-53	NS		2021-04-26	Dry, no sample collected	Null	---	Null		Null		Null		Null		Null		Null		Null	---	---
SW-N-53	NS		2021-10-05	Dry, insufficient volume to sample	Null	---	Null		Null		Null		Null		Null		Null		Null	---	---
SW-N-53	SS		2021-11-30		3 590.	a ---	0.515		81.2		1.1		< 0.15		0.021 4		131.	a b	14.3	---	---
SW-N-53	NS		2022-02-07	DRY	Null	---	Null		Null		Null		Null		Null		Null		Null	---	---
SW-N-54	SS		2021-04-26	Low flow, clear and colourless	63.4	---	0.008 8		151.		1.25		< 0.015		< 0.005		0.021		3.89	---	---
SW-N-54	SS		2021-10-05	Moderately low flow, clear and slightly yellow	383.	---	0.038		559.		0.632		1.2		0.013 2		0.189		2.31	---	---
SW-N-54	SS		2021-11-30		784.	---	0.108		40.1		0.399		0.036		0.008 7		2.36		2.33	---	---
SW-N-54	SS		2022-02-07	Moderately low flow, clear and slighlty yellow	287.	---	0.064		32.2		0.523		0.096		< 0.005		1.17		1.67	---	---
SW-N-CS2	NS		2021-04-26	Dry, no sample collected	Null	---	Null		Null		Null		Null		Null		Null		Null	---	---
SW-N-CS2	NS		2021-10-05	Dry, insufficient volume to sample	Null	---	Null		Null		Null		Null		Null		Null		Null	---	---
SW-N-CS2	SS		2021-11-30		8.5	---	0.010 1		0.426		0.066		< 0.015		< 0.005		< 0.02		0.03	---	---
SW-N-CS2	SS		2022-02-07	Moderate flow, clear and colourless	41.4	---	0.064		2.66		0.082		0.086		< 0.005		< 0.02		< 0.1	---	---
SW-S-03	SS		2021-04-27	Moderately low flow, clear and colourless	749.	---	0.25		45.3		0.25		0.069		0.011 5		2.85		1.59	---	---
SW-S-03	SS		2021-10-05	Moderately low flow, clear and colourless, some garbage upstre	892.	---	0.314		272.		0.338		0.066		0.019 4		4.21	b	1.33	---	---
SW-S-03	SS		2021-12-01		271.	---	0.04		158.		0.159		< 0.03		0.047 5		2.05		1.81	---	---
SW-S-03	SS		2022-02-08	Moderately high flow, moderately silty and very grey	5 150.	a ---	2.22		213.		0.344		1.5		0.026 7		1.55		5.17	---	---
SW-S-04	FRM	Y	2021-04-27	Mean of duplicates	177.	---	0.180 5		22.95		0.275 5		< 0.015		< 0.005		0.822 5		0.895	---	---
SW-S-04	FRM		2021-10-05	Mean of duplicates	6.1	---	0.008 55		1.015		0.104 5		1.029		< 0.005		1.51		0.302	---	---
SW-S-04	FRM		2021-12-01	Mean of duplicates	98.85	---	0.076 5		10.85		0.125		0.032 5		0.034 75		0.83		0.495	---	---
SW-S-04	FRM		2022-02-08	Mean of duplicates	200.	---	0.169 5		21.		0.152 5		0.165		< 0.005		1.845		0.698 5	---	---
SW-S-12	SS		2021-04-27	Moderately low flow, clear and slightly yellow	1 320.	a ---	0.023 3		230.		0.205		0.39		0.020 8		2.19		2.87	---	---
SW-S-12	SS		2021-10-05	Very low flow, clear and colourless, lots of vegetation debris an	170.	---	0.06		21.2		0.202		0.078		0.005 5		9.05	b	4.57	---	---
SW-S-12	SS		2021-12-01		649.	---	0.042		342.		0.155		2.1	b	0.024 9		2.32		2.92	---	---
SW-S-12	SS		2022-02-08	Moderately high flow, very silty and moderately green	3 330.	a ---	0.621		395.		0.173		0.79		0.017 1		1.66		3.09	---	---
SW-S-20	NS		2021-04-27	Dry, no sample collected	Null	---	Null		Null		Null		Null		Null		Null		Null	---	---
SW-S-20	NS		2021-10-05	Dry, insufficient volume to sample	Null	---	Null		Null		Null		Null		Null		Null		Null	---	---
SW-S-20	SS		2021-12-01		74.3	---	0.027		12.8		0.071		0.088		< 0.005		0.03		0.23	---	---
SW-S-21	NS		2021-04-27	Dry, no sample collected	Null	---	Null		Null		Null		Null		Null		Null		Null	---	---
SW-S-21	NS		2021-10-05	Dry, insufficient volume to sample	Null	---	Null		Null		Null		Null		Null		Null		Null	---	---
SW-S-21	SS		2021-12-01		29.3	---	0.009 3		0.956		0.076		0.076		< 0.005		0.107		0.181	---	---
SW-S-21	SS		2022-02-08	Moderate flow, clear and colourless	5.7	---	< 0.005		0.133		0.054		0.13		< 0.005		0.132		0.111	---	---
SW-S-24	SS		2021-04-27	Moderately low flow, clear and colourless	210.	---	0.176		46.8		0.251		0.07		< 0.005		0.814		0.87	---	---
SW-S-24	SS		2021-10-05	Moderately low flow, clear and colourless	664.	---	0.572		126.		0.114		0.074		< 0.005		0.232		1.18	---	---
SW-S-24	SS		2021-12-01		476.	---	0.381		79.9		0.156		0.097		0.074 1		1.48		1.19	---	---
SW-S-24	SS		2022-02-08	Moderately high flow, clear and colourless	314.	---	0.177		32.2		0.141		< 0.15		< 0.005		1.84		0.75	---	---
SW-S-27	NS		2021-04-27	Dry, no sample collected	Null	---	Null		Null		Null		Null		Null		Null		Null	---	---
SW-S-27	NS		2021-10-05	Dry, insufficient volume to sample	Null	---	Null		Null		Null		Null		Null		Null		Null	---	---
SW-S-27	SS		2021-12-01		107.	---	0.26		18.4		0.13		0.088		< 0.005		0.4		0.416	---	---
SW-S-27	SS		2022-02-08	Moderately low flow, clear and colourless	907.	---	1.04		112.		0.123		0.027		0.005 4		< 0.02		1.16	---	---
SW-S-52	SS		2021-04-27	Moderately low flow, clear and colourless	6.8	---	< 0.005		0.292		0.089		0.086		< 0.005		< 0.02		0.309	---	---
SW-S-52	NS		2021-10-05	Dry, insufficient volume to sample	Null	---	Null		Null		Null		Null		Null		Null		Null	---	---
SW-S-52	SS		2021-12-01		15.3	---	0.007 1		0.666		< 0.05		0.12		< 0.005		< 0.02		0.059	---	---
SW-S-52	SS		2022-02-08	Moderately high flow, clear and colourless	4.2	---	< 0.005		0.226		< 0.05		0.18		< 0.005		< 0.02		0.04	---	---

Notes:

na Not applicable.

Null No sample collected.

a Above maximum allowable concentration (MAC) British Columbia Water Quality Guideline.

b Above 30-day average British Columbia Water Quality Guideline.

c Detection Limits above Applicable Standards.

(1) British Columbia Approved Water Quality Guidelines (Criteria), 1998 Edition, Updated in 2021. British Columbia Ministry of Environment and a Compendium of Working Water Quality Guidelines for British Columbia, 1998 Edition, Updated in Feb 2021. British Columbia Ministry of Environment. The Guidelines cited specific to protection of freshwater aquatic life unless otherwise noted.

(2) Maximum acceptable concentration unless otherwise noted.

(3) The ammonia guideline is pH and temperature (15°C assumed) dependant. All ammonia results were compared to standards based on the associated pH and temperature results for that sample.

(4) The nitrite guidelines are chloride dependant. All nitrite results were compared to standards based on the associated chloride result for that sample.

(5) This value is hardness dependent. All metals results were compared to standards based on the associated hardness result for a particular sample.

(6) This value is the short-term daily for streams with unknown fish distribution.

(7) The TSS guidelines are "change from background" and flow condition dependent. The background TSS in the North landfill are derived from stations SW-N-CSs2, SW-N-41s3 and SW-N-14.

(8) Dissolved copper guideline varies with water hardness, temperature and dissolved organic carbon; Dissolved copper results were only compared with guidelines where DOC was analyzed.

B.C. Water Quality Guidelines				BC WQG MAXIMUM (1)	---		0.05 - 1.5 (5)		128 - 429 (5)		25		33 - 340.5 (5)		6.5 to 9.0		---		---		100	
				BC WQG AVERAGE (1)	2		0.1 - 3 (5)		---		5		7.5 - 187.5 (5)		---		---		---		50	
				PARAMETER	Selenium		Silver		Sulphate		TSS		Zinc		pH		Conductivity		Temperature		Aluminum	
				STATE	TOT		TOT		DIS		TOT		TOT		TOT		TOT		TOT		DIS	
				UNIT	µg/L		µg/L		mg/L		mg/L		µg/L		pH		µS/cm		°C		µg/L	
Station	Sample Type	Compliance Well (Y/N?)	Date Sampled	Method Detection Limit (MDL)	0.04		0.005		1		1		1		0.1		1		0.1		0.5	
SW-N-05	FRM	Y	2021-04-26	Mean of duplicates	0.199		< 0.005		87.		< 2.3		1.46		6.72		247.		10.		17.7	
SW-N-05	FRM		2021-10-05	Mean of duplicates	0.491		< 0.01		140.		< 1.		4.5		7.35		45.		13.		2.705	
SW-N-05	FRM		2021-11-30	Mean of duplicates	0.695		< 0.01		200.		< 1.		4.2		6.8		510.		10.4		44.45	
SW-N-05	FRM		2022-02-07	Mean of duplicates	1.82		< 0.005		405.		3.8		8.8		6.96		979.		8.7		30.	
SW-N-14	NS		2021-04-29		Null		Null		Null		Null		Null		Null		Null		Null		Null	
SW-N-14	NS		2021-10-04	Not Accesible, active shooting	Null		Null		Null		Null		Null		Null		Null		Null		Null	
SW-N-14	NS		2021-11-30		Null		Null		Null		Null		Null		Null		Null		Null		Null	
SW-N-14	NS		2022-02-07	Couldn't access due to active firing	Null		Null		Null		Null		Null		Null		Null		Null		Null	
SW-N-16	FRM	Y	2021-04-26	Mean of duplicates	0.122 5		< 0.005		45.		3.4		4.415		6.52		273.		11.4		9.79	
SW-N-16	FRM		2021-10-04	Mean of duplicates	0.125		< 0.01		115.		6.6 b		17.35		7.12		318.		12.3		9.655	
SW-N-16	FRM		2021-11-30	Mean of duplicates	0.142 5		< 0.01		45.5		2.8		10.45		7.13		218.		10.6		22.5	
SW-N-16	FRM		2022-02-08	Mean of duplicates	0.103		< 0.01		39.5		< 1.		8.35		6.94		280.		5.4		14.6	
SW-N-17	SS		2021-04-29	Moderately low flow, clear and colourless	0.12		< 0.005		69.		< 1.		0.81		6.46		269.		10.2		5.54	
SW-N-17	SS		2021-10-04	Moderately low flow, clear and colourless	0.35		< 0.005		110.		< 1.		4.		6.57		309.		11.7		7.82	
SW-N-17	NS		2021-11-30		Null		Null		Null		Null		Null		Null		Null		Null		Null	
SW-N-17	SS		2022-02-07	Moderate flow, clear and colouress	0.513		< 0.005		160.		< 1.		2.37		7.34		447.		7.1		6.03	
SW-N-18	SS		2021-04-26	Moderately low flow, clear and colourless	0.152		< 0.005		61.		2.8		19.4		7.81		316.		11.1		19.4	
SW-N-18	SS		2021-10-05	Moderately low flow, clear and colourless	0.235		< 0.005		93.		< 1.		3.16		7.77		315.		12.9		3.42	
SW-N-18	SS		2021-11-30		0.166		0.031		50.		< 1.		23.5		7.31		224.		10.3		463. a b	
SW-N-18	NS		2022-02-07	DRY - flow blocked off feeding into sample location	Null		Null		Null		Null		Null		Null		Null		Null		Null	
SW-N-19	SS		2021-04-26	Moderately low flow, clear and moderately yellow	0.192		0.014		56.		4.		2.		7.55		298.		13.4		14.	
SW-N-19	SS		2021-10-04	Moderately low flow, clear and slightly yellow	0.147		< 0.01		120.		< 1.		2.7		7.74		370.		13.1		9.13	
SW-N-19	SS		2021-11-30		0.168		< 0.01		51.		28. a b		4.4		7.32		236.		11.		24.9	
SW-N-19	SS		2022-02-08	Moderate flow, clear and slightly yellow	0.144		< 0.01		49.		< 1.		2.9		7.31		193.		5.9		18.8	
SW-N-41S1	FRM	Y	2021-04-26	Mean of duplicates	0.094 5		< 0.01		65.5		5.4 b		3.1		6.85		295.		9.5		97.5 b	
SW-N-41S1	FRM		2021-10-04	Mean of duplicates	0.11		< 0.005		97.		< 1.		1.06		7.43		362.		11.1		3.91	
SW-N-41S1	FRM		2021-11-30	Mean of duplicates	0.082 5		< 0.005		72.		< 1.7		1.31		7.05		239.		10.5		14.25	
SW-N-41S1	FRM		2022-02-07	Mean of duplicates	0.067 5		< 0.01		56.5		< 1.5		1.2		7.37		340.		7.9		4.5	
SW-N-41S3	SS		2021-04-26	Moderately low flow, clear and colourless	0.075		< 0.01		23.		3.6		< 1.		6.76		191.		8.8		9.18	
SW-N-41S3	SS		2021-10-04	Moderately low flow, clear and colourless	0.085		< 0.005		30.		2.4		0.69		7.32		236.		10.		6.47	
SW-N-41S3	SS		2021-11-30		0.063		< 0.005		13.		6. b		0.28		7.32		101.		9.2		9.07	
SW-N-41S3	SS		2022-02-07	Moderately high flow, clear and colourless	0.065		< 0.005		14.		2.8		0.55		7.02		190.		7.3		3.77	
SW-N-42S1	FRM	Y	2021-04-26	Mean of duplicates	0.052		< 0.01		79.5		5.8 b		< 1.		6.56		319.		9.7		7.525	
SW-N-42S1	FRM		2021-10-04	Mean of duplicates	0.052 5		< 0.01		140.		< 1.7		2.6		7.22		439.		10.7		8.33	
SW-N-42S1	FRM		2021-11-30	Mean of duplicates	0.051 5		< 0.01		73.		< 1.		< 1.		6.57		238.		9.8		12.8	
SW-N-42S1	FRM		2022-02-07	Mean of duplicates	0.051 5		< 0.01		66.5		< 8.5 c		1.2		7.415		400.		6.6		4.975	
SW-N-45	SS		2021-04-29	Moderately low flow, clear and colourless	0.218		< 0.005		89.		< 1.		0.64		6.16		276.		9.5		9.05	
SW-N-45	SS		2021-10-04	Moderately low flow, clear and colourless	0.422		< 0.005		120.		< 1.		1.57		6.43		330.		11.7		4.76	
SW-N-45	NS		2021-11-30		Null		Null		Null		Null		Null		Null		Null		Null		Null	
SW-N-45	SS		2022-02-07	Moderate flow, clear and colouress	1.19		< 0.005		340.		< 1.		1.98		7.34		768.		7.7		4.73	
SW-N-50	SS		2021-04-27	Moderately low flow, clear and colourless	0.127		< 0.005		60.		21. b		1.2		7.73		219.		10.2		42.9	
SW-N-50	SS		2021-10-05	Moderately low flow, clear and colourless	0.241		< 0.01		86.		< 1.		1.3		7.93		277.		11.4		6.98	
SW-N-50	SS		2021-11-30		0.199		0.135		38.		160. a b		75.8		8.		147.		9.9		283. a b	
SW-N-50	NS		2022-02-07	DRY	Null		Null		Null		Null		Null		Null		Null		Null		Null	
SW-N-51	NS		2021-04-26	Dry, no sample collected	Null		Null		Null		Null		Null		Null		Null		Null		Null	
SW-N-51	NS		2021-10-05	Dry, insufficient volume to sample	Null		Null		Null		Null		Null		Null		Null		Null		Null	
SW-N-51	NS		2021-11-30		Null		Null		Null		Null		Null		Null		Null		Null		Null	
SW-N-51	NS		2022-02-07	DRY - sample location no longer exists	Null		Null		Null		Null		Null		Null		Null		Null		Null	
SW-N-53	NS		2021-04-26	Dry, no sample collected	Null		Null		Null		Null		Null		Null		Null		Null		Null	
SW-N-53	NS		2021-10-05	Dry, insufficient volume to sample	Null		Null		Null		Null		Null		Null		Null		Null		Null	
SW-N-53	SS		2021-11-30		2.83 b		< 0.02		740. b		35. a b		68.5		8.35		#######		10.6		55.4 b	
SW-N-53	NS		2022-02-07	DRY	Null		Null		Null		Null		Null		Null		Null		Null		Null	
SW-N-54	SS		2021-04-26	Low flow, clear and colourless	0.24		< 0.005		45.		< 1.		0.59		7.61		309.		12.8		6.69	
SW-N-54	SS		2021-10-05	Moderately low flow, clear and slightly yellow	0.319		0.011		190.		< 1.		1.8		7.45		511.		14.7		8.27	
SW-N-54	SS		2021-11-30		0.197		< 0.01		30.		14. b		2.7		7.39		209.		10.4		34.8	
SW-N-54	SS		2022-02-07	Moderately low flow, clear and slighlty yellow	0.202		< 0.01		25.		1.6		1.9		6.91		207.		7.9		8.19	
SW-N-CS2	NS		2021-04-26	Dry, no sample collected	Null		Null		Null		Null		Null		Null		Null		Null		Null	
SW-N-CS2	NS		2021-10-05	Dry, insufficient volume to sample	Null		Null		Null		Null		Null		Null		Null		Null		Null	
SW-N-CS2	SS		2021-11-30		0.059		< 0.005		7.2		< 1.		< 0.1		7.41		69.		9.1		7.91	
SW-N-CS2	SS		2022-02-07	Moderate flow, clear and colourless	0.046		< 0.01		7.3		< 1.		< 1.		7.05		130.		7.2		4.32	
SW-S-03	SS		2021-04-27	Moderately low flow, clear and colourless	0.086		< 0.005		24.		2.8		6.55		6.6		235.		11.4		12.1	
SW-S-03	SS		2021-10-05	Moderately low flow, clear and colourless, some garbage upstre	0.127		< 0.01		110.		1.6		14.7		7.53		394.		15.4		17.	
SW-S-03	SS		2021-12-01		0.11		< 0.01		27.		1.6		5.3		6.94		191.		11.7		29.7	
SW-S-03	SS		2022-02-08	Moderately high flow, moderately silty and very grey	0.088		0.013		14.		63. a b		38.7 a b		6.75		182.		8.4		22.6	
SW-S-04	FRM	Y	2021-04-27	Mean of duplicates	0.069		< 0.01		25.5		3.2		3.9		7.66		240.		9.8		19.95	
SW-S-04	FRM		2021-10-05	Mean of duplicates	0.073		< 0.005		71.		< 1.		2.725		7.45		288.		11.5		11.23	
SW-S-04	FRM		2021-12-01	Mean of duplicates	0.071		< 0.01		21.		2.4		9.45 b		7.65		122.		10.1		30.55	
SW-S-04	FRM		2022-02-08	Mean of duplicates	0.064 5		< 0.007 5		29.5		< 2.5		5.06		7.455		242.		7.4		10.8	
SW-S-12	SS		2021-04-27	Moderately low flow, clear and slightly yellow	0.114		< 0.005		26.		1.6		2.9		7.4		234.		10.5		31.4	
SW-S-12	SS		2021-10-05	Very low flow, clear and colourless, lots of vegetation debris an	0.264		< 0.01		200.		< 1.		9.1		7.45		474.		14.6		28.7	
SW-S-12	SS		2021-12-01		0.133		< 0.01		31.		2.8		6.5		6.59		222.		12.1		41.	
SW-S-12	SS		2022-02-08	Moderately high flow, very silty and moderately green	0.089		< 0.01		16.		23. b		11.4		6.64		310.		9.1		29.3	
SW-S-20	NS		2021-04-27	Dry, no sample collected	Null		Null		Null		Null		Null		Null		Null		Null		Null	
SW-S-20	NS		2021-10-05	Dry, insufficient volume to sample	Null		Null		Null		Null		Null		Null		Null		Null		Null	
SW-S-20	SS		2021-12-01		0.051		< 0.01		6.5		< 1.		22.9 b		7.44		66.		9.6		29.4	
SW-S-21	NS		2021-04-27	Dry, no sample collected	Null		Null		Null		Null		Null		Null		Null		Null		Null	
SW-S-21	NS		2021-10-05	Dry, insufficient volume to sample	Null		Null		Null		Null		Null		Null		Null		Null		Null	
SW-S-21	SS		2021-12-01		0.051		< 0.005		6.5		< 1.		11.7 b		7.76		61.		9.5		37.	
SW-S-21	SS		2022-02-08	Moderate flow, clear and colourless	< 0.04		< 0.005		6.7		< 1.		5.94		6.98		110.		5.5		20.8	
SW-S-24	SS		2021-04-27	Moderately low flow, clear and colourless	0.054		< 0.01		27.		2.		4.4		7.14		250.		10.8		17.2	
SW-S-24	SS		2021-10-05	Moderately low flow, clear and colourless	0.082		< 0.01		96.		11. b		11.9		7.14		330.		11.8		6.68	
SW-S-24	SS		2021-12-01		0.103		< 0.01		37.		< 1.		9.3		7.38		183.		10.9		18.4	
SW-S-24	SS		2022-02-08	Moderately high flow, clear and colourless	0.067		< 0.01		24.		2.4		4.8		6.78		198.		7.5		10.5	
SW-S-27	NS		2021-04-27	Dry, no sample collected	Null		Null		Null		Null		Null		Null		Null		Null		Null	
SW-S-27	NS		2021-10-05	Dry, insufficient volume to sample	Null		Null		Null		Null		Null		Null		Null		Null		Null	
SW-S-27	SS		2021-12-01		0.068		0.007		41.		< 1.		5.		6.92		111.		9.8		26.6	
SW-S-27	SS		2022-02-08	Moderately low flow, clear and colourless	0.049		< 0.01		27.		15. b		8.8		7.25		158.		5.5		13.9	
SW-S-52	SS		2021-04-27	Moderately low flow, clear and colourless	< 0.04		< 0.005		6.1		< 1.		1.56		7.47		112.		9.7		4.47	
SW-S-52	NS		2021-10-05	Dry, insufficient volume to sample	Null		Null		Null		Null		Null		Null		Null		Null		Null	
SW-S-52	SS		2021-12-01		0.043		< 0.005		6.6		< 1.		0.96		7.64		69.		9.2		10.	
SW-S-52	SS		2022-02-08	Moderately high flow, clear and colourless	< 0.04		< 0.005		6.8		< 1.		1.2		7.41		76.		7.1		5.56	

Notes:

na Not applicable.

Null No sample collected.

a Above maximum allowable concentration (MAC) British Columbia Water Quality Guideline.

b Above 30-day average British Columbia Water Quality Guideline.

c Detection Limits above Applicable Standards.

(1) British Columbia Approved Water Quality Guidelines (Criteria), 1998 Edition, Updated in 2021. British Columbia Ministry of Environment and a Compendium of Working Water Quality Guidelines for British Columbia, 1998 Edition, Updated in Feb 2021. British Columbia Ministry of Environment. The Guidelines cited specific to protection of freshwater aquatic life unless otherwise noted.

(2) Maximum acceptable concentration unless otherwise noted.

(3) The ammonia guideline is pH and temperature (15°C assumed) dependant. All ammonia results were compared to standards based on the associated pH and temperature results for that sample.

(4) The nitrite guidelines are chloride dependant. All nitrite results were compared to standards based on the associated chloride result for that sample.

(5) This value is hardness dependent. All metals results were compared to standards based on the associated hardness result for a particular sample.

(6) This value is the short-term daily for streams with unknown fish distribution.

(7) The TSS guidelines are "change from background" and flow condition dependent. The background TSS in the North landfill are derived from stations SW-N-CSs2, SW-N-41s3 and SW-N-14.

(8) Dissolved copper guideline varies with water hardness, temperature and dissolved organic carbon; Dissolved copper results were only compared with guidelines where DOC was analyzed.

B.C. Water Quality Guidelines				BC WQG MAXIMUM (1)	---			0.038-2.8 (5)		---		BC BLM (10)		---		350		---	
				BC WQG AVERAGE (1)	---			0.018-0.645 (5)		---		BC BLM (10)		---		---		---	
Station	Sample Type	Compliance Well (Y/N?)	Date Sampled	PARAMETER	Arsenic			Cadmium		Cobalt		Copper		Hardness (As Caco3)		Iron		Lead	
				STATE	DIS			DIS		DIS		DIS		DIS		DIS		DIS	
				UNIT	µg/L			µg/L		µg/L		µg/L		mg/L		µg/L		µg/L	
				Method Detection Limit (MDL)	0.02			0.005		0.005		0.05		0.5		1		0.005	
SW-N-05	FRM	Y	2021-04-26	Mean of duplicates	0.115 5	---	---	0.013 65		0.089 8	--- ---	1.935	a b	158.	--- ---	19.7	---	< 0.005 15	--- ---
SW-N-05	FRM		2021-10-05	Mean of duplicates	0.105	---	---	0.176 4		0.088 05	--- ---	1.405	b	222.5	--- ---	1.5	---	< 0.006 8	--- ---
SW-N-05	FRM		2021-11-30	Mean of duplicates	0.197 5	---	---	0.044 55		0.388 5	--- ---	4.815	a b	326.	--- ---	26.2	---	0.013	--- ---
SW-N-05	FRM		2022-02-07	Mean of duplicates	0.194 5	---	---	0.084 3		0.625	--- ---	5.795	b	717.5	--- ---	18.05	---	0.006 8	--- ---
SW-N-14	NS		2021-04-29		Null	---	---	Null		Null	--- ---	Null		Null	--- ---	Null	---	Null	--- ---
SW-N-14	NS		2021-10-04	Not Accesible, active shooting	Null	---	---	Null		Null	--- ---	Null		Null	--- ---	Null	---	Null	--- ---
SW-N-14	NS		2021-11-30		Null	---	---	Null		Null	--- ---	Null		Null	--- ---	Null	---	Null	--- ---
SW-N-14	NS		2022-02-07	Couldn't access due to active firing	Null	---	---	Null		Null	--- ---	Null		Null	--- ---	Null	---	Null	--- ---
SW-N-16	FRM	Y	2021-04-26	Mean of duplicates	0.303	---	---	56.5	--- ---	0.014 7		1.07	--- ---	3.805	b	163.5	--- ---	562.	a ---
SW-N-16	FRM		2021-10-04	Mean of duplicates	0.297 5	---	---	79.	--- ---	0.023 35		0.527 5	--- ---	4.89	b	216.	--- ---	341.	--- ---
SW-N-16	FRM		2021-11-30	Mean of duplicates	0.249 5	---	---	50.5	--- ---	0.010 85		0.210 5	--- ---	12.8	b	138.5	--- ---	82.35	--- ---
SW-N-16	FRM		2022-02-08	Mean of duplicates	0.186 5	---	---	42.5	--- ---	0.01		0.255 5	--- ---	7.205	b	127.	--- ---	129.5	--- ---
SW-N-17	SS		2021-04-29	Moderately low flow, clear and colourless	0.077	---	---	80.	--- ---	< 0.005		0.072 6	--- ---	0.641	b	156.	--- ---	22.	--- ---
SW-N-17	SS		2021-10-04	Moderately low flow, clear and colourless	0.116	---	---	112.	--- ---	0.009 7		0.121	--- ---	1.	b	182.	--- ---	11.8	--- ---
SW-N-17	NS		2021-11-30		Null	---	---	Null	--- ---	Null		Null	--- ---	Null		Null	--- ---	Null	--- ---
SW-N-17	SS		2022-02-07	Moderate flow, clear and colouress	0.086	---	---	103.	--- ---	0.006		0.128	--- ---	0.815		301.	--- ---	4.6	--- ---
SW-N-18	SS		2021-04-26	Moderately low flow, clear and colourless	0.088	---	---	14.	--- ---	< 0.005		0.092 4	--- ---	1.06	b	131.	--- ---	20.8	--- ---
SW-N-18	SS		2021-10-05	Moderately low flow, clear and colourless	0.083	---	---	16.	--- ---	0.005 1		0.063	--- ---	0.626	b	184.	--- ---	2.6	--- ---
SW-N-18	SS		2021-11-30		0.283	---	---	73.	--- ---	0.006 2		1.34	--- ---	3.8		115.	--- ---	859.	a ---
SW-N-18	NS		2022-02-07	DRY - flow blocked off feeding into sample location	Null	---	---	Null	--- ---	Null		Null	--- ---	Null	b	Null	--- ---	Null	--- ---
SW-N-19	SS		2021-04-26	Moderately low flow, clear and moderately yellow	0.326	---	---	39.	--- ---	0.017 3		1.18	--- ---	9.15	b	179.	--- ---	80.5	--- ---
SW-N-19	SS		2021-10-04	Moderately low flow, clear and slightly yellow	0.266	---	---	55.	--- ---	0.007 5		1.48	--- ---	4.87		213.	--- ---	165.	--- ---
SW-N-19	SS		2021-11-30		0.255	---	---	42.	--- ---	0.015 6		0.244	--- ---	18.1	b	148.	--- ---	29.6	--- ---
SW-N-19	SS		2022-02-08	Moderate flow, clear and slightly yellow	0.202	---	---	28.	--- ---	0.011 7		0.19	--- ---	15.7	b	138.	--- ---	20.7	--- ---
SW-N-41S1	FRM	Y	2021-04-26	Mean of duplicates	0.36	---	---	18.	--- ---	0.005 95		0.256 5	--- ---	0.447 5	a b	186.5	--- ---	392.	a ---
SW-N-41S1	FRM		2021-10-04	Mean of duplicates	0.306 5	---	---	19.	--- ---	< 0.005		0.247	--- ---	0.257 5	a b	240.	--- ---	112.5	--- ---
SW-N-41S1	FRM		2021-11-30	Mean of duplicates	0.149 5	---	---	19.	--- ---	< 0.005		0.069	--- ---	0.409		160.	--- ---	33.75	--- ---
SW-N-41S1	FRM		2022-02-07	Mean of duplicates	0.161 5	---	---	17.5	--- ---	< 0.005		0.085 45	--- ---	0.204		158.5	--- ---	51.1	--- ---
SW-N-41S3	SS		2021-04-26	Moderately low flow, clear and colourless	0.137	---	---	32.	--- ---	0.007 5		0.030 6	--- ---	0.334	b	120.	--- ---	18.9	--- ---
SW-N-41S3	SS		2021-10-04	Moderately low flow, clear and colourless	0.185	---	---	54.	--- ---	0.005 1		0.033 9	--- ---	0.302		153.	--- ---	8.3	--- ---
SW-N-41S3	SS		2021-11-30		0.062	---	---	16.	--- ---	< 0.005		0.023 4	--- ---	0.46		63.8	--- ---	4.9	--- ---
SW-N-41S3	SS		2022-02-07	Moderately high flow, clear and colourless	0.073	---	---	22.	--- ---	< 0.005		0.023 7	--- ---	0.515	b	84.5	--- ---	3.6	--- ---
SW-N-42S1	FRM	Y	2021-04-26	Mean of duplicates	0.122	---	---	44.	--- ---	< 0.006 05		0.084	--- ---	0.347		193.5	--- ---	33.3	--- ---
SW-N-42S1	FRM		2021-10-04	Mean of duplicates	0.159 5	---	---	74.5	--- ---	0.008 75		0.088 45	--- ---	0.521		279.5	--- ---	18.75	--- ---
SW-N-42S1	FRM		2021-11-30	Mean of duplicates	0.097	---	---	64.	--- ---	< 0.005 05		0.067 4	--- ---	0.712 5	a b	144.	--- ---	19.4	--- ---
SW-N-42S1	FRM		2022-02-07	Mean of duplicates	0.064 5	---	---	45.5	--- ---	< 0.005		0.052 6	--- ---	0.464		165.5	--- ---	9.75	--- ---
SW-N-45	SS		2021-04-29	Moderately low flow, clear and colourless	0.073	---	---	69.	--- ---	0.007 2		0.075 5	--- ---	1.49	a b	172.	--- ---	12.6	--- ---
SW-N-45	SS		2021-10-04	Moderately low flow, clear and colourless	0.069	---	---	99.	--- ---	0.007 6		0.114	--- ---	1.16	b	209.	--- ---	6.	--- ---
SW-N-45	NS		2021-11-30		Null	---	---	Null	--- ---	Null		Null	--- ---	Null		Null	--- ---	Null	--- ---
SW-N-45	SS		2022-02-07	Moderate flow, clear and colouress	0.08	---	---	131.	--- ---	0.016 8		0.248	--- ---	1.51	b	556.	--- ---	3.2	--- ---
SW-N-50	SS		2021-04-27	Moderately low flow, clear and colourless	0.076	---	---	11.	--- ---	< 0.005		0.074 7	--- ---	0.783	b	135.	--- ---	70.9	--- ---
SW-N-50	SS		2021-10-05	Moderately low flow, clear and colourless	0.102	---	---	15.	--- ---	0.015 1		0.066 7	--- ---	0.776	b	175.	--- ---	13.	--- ---
SW-N-50	SS		2021-11-30		0.151	---	---	11.	--- ---	< 0.005		0.389	--- ---	1.69	b	90.7	--- ---	473.	a ---
SW-N-50	NS		2022-02-07	DRY	Null	---	---	Null	--- ---	Null		Null	--- ---	Null		Null	--- ---	Null	--- ---
SW-N-51	NS		2021-04-26	Dry, no sample collected	Null	---	---	Null	--- ---	Null		Null	--- ---	Null		Null	--- ---	Null	--- ---
SW-N-51	NS		2021-10-05	Dry, insufficient volume to sample	Null	---	---	Null	--- ---	Null		Null	--- ---	Null		Null	--- ---	Null	--- ---
SW-N-51	NS		2021-11-30		Null	---	---	Null	--- ---	Null		Null	--- ---	Null		Null	--- ---	Null	--- ---
SW-N-51	NS		2022-02-07	DRY - sample location no longer exists	Null	---	---	Null	--- ---	Null		Null	--- ---	Null		Null	--- ---	Null	--- ---
SW-N-53	NS		2021-04-26	Dry, no sample collected	Null	---	---	Null	--- ---	Null		Null	--- ---	Null		Null	--- ---	Null	--- ---
SW-N-53	NS		2021-10-05	Dry, insufficient volume to sample	Null	---	---	Null	--- ---	Null		Null	--- ---	Null		Null	--- ---	Null	--- ---
SW-N-53	SS		2021-11-30		0.214	---	---	60.	--- ---	0.058		0.401	--- ---	0.9	b	1 130.	--- ---	55.6	--- ---
SW-N-53	NS		2022-02-07	DRY	Null	---	---	Null	--- ---	Null		Null	--- ---	Null		Null	--- ---	Null	--- ---
SW-N-54	SS		2021-04-26	Low flow, clear and colourless	0.39	---	---	57.	--- ---	0.009 8		0.417	--- ---	13.3	b	195.	--- ---	26.3	--- ---
SW-N-54	SS		2021-10-05	Moderately low flow, clear and slightly yellow	0.655	---	---	64.	--- ---	0.024 3		1.23	--- ---	11.9	b	330.	--- ---	194.	--- ---
SW-N-54	SS		2021-11-30		0.329	---	---	63.	--- ---	< 0.005		0.159	--- ---	16.6	b	140.	--- ---	58.7	--- ---
SW-N-54	SS		2022-02-07	Moderately low flow, clear and slighlty yellow	0.268	---	---	45.	--- ---	< 0.005		0.137	--- ---	14.3	a b	146.	--- ---	16.6	--- ---
SW-N-CS2	NS		2021-04-26	Dry, no sample collected	Null	---	---	Null	--- ---	Null		Null	--- ---	Null		Null	--- ---	Null	--- ---
SW-N-CS2	NS		2021-10-05	Dry, insufficient volume to sample	Null	---	---	Null	--- ---	Null		Null	--- ---	Null		Null	--- ---	Null	--- ---
SW-N-CS2	SS		2021-11-30		0.034	---	---	< 10.	--- ---	< 0.005		0.022 3	--- ---	0.605	b	43.2	--- ---	3.	--- ---
SW-N-CS2	SS		2022-02-07	Moderate flow, clear and colourless	0.028	---	---	< 10.	--- ---	< 0.005		0.020 2	--- ---	0.254	b	60.4	--- ---	< 1.	--- ---
SW-S-03	SS		2021-04-27	Moderately low flow, clear and colourless	0.182	---	---	55.	--- ---	0.008 4		0.252	--- ---	5.52	a b	105.	--- ---	266.	--- ---
SW-S-03	SS		2021-10-05	Moderately low flow, clear and colourless, some garbage upstre	0.285	---	---	57.	--- ---	0.032 4		1.4	--- ---	3.59	b	170.	--- ---	640.	a ---
SW-S-03	SS		2021-12-01		0.225	---	---	75.	--- ---	0.015 9		0.418	--- ---	11.7	a b	97.6	--- ---	162.	--- ---
SW-S-03	SS		2022-02-08	Moderately high flow, moderately silty and very grey	0.155	---	---	61.	--- ---	0.017 5		0.317	--- ---	5.93	a b	77.	--- ---	147.	--- ---
SW-S-04	FRM	Y	2021-04-27	Mean of duplicates	0.152 5	---	---	80.	--- ---	0.007 95		0.12	--- ---	2.725	b	116.5	--- ---	27.7	--- ---
SW-S-04	FRM		2021-10-05	Mean of duplicates	0.105	---	---	70.	--- ---	0.016 45		0.081 35	--- ---	1.375	b	136.5	--- ---	3.5	--- ---
SW-S-04	FRM		2021-12-01	Mean of duplicates	0.134	---	---	46.5	--- ---	0.006 1		0.069 9	--- ---	2.695	b	65.55	--- ---	24.55	--- ---
SW-S-04	FRM		2022-02-08	Mean of duplicates	0.118	---	---	71.5	--- ---	0.009 65		0.099 65	--- ---	2.82	b	98.45	--- ---	21.1	--- ---
SW-S-12	SS		2021-04-27	Moderately low flow, clear and slightly yellow	0.234	---	---	65.	--- ---	0.012 7		0.433	--- ---	12.1	b	111.	--- ---	981.	a ---
SW-S-12	SS		2021-10-05	Very low flow, clear and colourless, lots of vegetation debris an	0.474	---	---	32.	--- ---	0.030 8		0.293	--- ---	17.3	b	267.	--- ---	51.	--- ---
SW-S-12	SS		2021-12-01		0.266	---	---	95.	--- ---	0.028 1		0.734	--- ---	16.4	a b	111.	--- ---	369.	a ---
SW-S-12	SS		2022-02-08	Moderately high flow, very silty and moderately green	0.213	---	---	107.	--- ---	0.013		0.654	--- ---	7.78	a b	98.3	--- ---	1 140.	a ---
SW-S-20	NS		2021-04-27	Dry, no sample collected	Null	---	---	Null	--- ---	Null		Null	--- ---	Null		Null	--- ---	Null	--- ---
SW-S-20	NS		2021-10-05	Dry, insufficient volume to sample	Null	---	---	Null	--- ---	Null		Null	--- ---	Null		Null	--- ---	Null	--- ---
SW-S-20	SS		2021-12-01		0.098	---	---	15.	--- ---	< 0.005		0.053 6	--- ---	1.05	b	38.1	--- ---	19.3	--- ---
SW-S-21	NS		2021-04-27	Dry, no sample collected	Null	---	---	Null	--- ---	Null		Null	--- ---	Null		Null	--- ---	Null	--- ---
SW-S-21	NS		2021-10-05	Dry, insufficient volume to sample	Null	---	---	Null	--- ---	Null		Null	--- ---	Null		Null	--- ---	Null	--- ---
SW-S-21	SS		2021-12-01		0.103	---	---	15.	--- ---	< 0.005		0.038 9	--- ---	1.27		35.4	--- ---	18.4	--- ---
SW-S-21	SS		2022-02-08	Moderate flow, clear and colourless	0.07	---	---	13.	--- ---	< 0.005		0.029 5	--- ---	0.78	b	46.1	--- ---	4.7	--- ---
SW-S-24	SS		2021-04-27	Moderately low flow, clear and colourless	0.157	---	---	82.	--- ---	0.014 7		0.138	--- ---	2.61	b	118.	--- ---	57.	--- ---
SW-S-24	SS		2021-10-05	Moderately low flow, clear and colourless	0.156	---	---	86.	--- ---	0.017 1		0.1	--- ---	2.69	b	156.	--- ---	3.3	--- ---
SW-S-24	SS		2021-12-01		0.177	---	---	82.	--- ---	0.010 6		0.116	--- ---	4.49	b	97.	--- ---	26.3	--- ---
SW-S-24	SS		2022-02-08	Moderately high flow, clear and colourless	0.107	---	---	73.	--- ---	0.008 1		0.117	--- ---	2.91	a b	98.7	--- ---	25.1	--- ---
SW-S-27	NS		2021-04-27	Dry, no sample collected	Null	---	---	Null	--- ---	Null		Null	--- ---	Null		Null	--- ---	Null	--- ---
SW-S-27	NS		2021-10-05	Dry, insufficient volume to sample	Null	---	---	Null	--- ---	Null		Null	--- ---	Null		Null	--- ---	Null	--- ---
SW-S-27	SS		2021-12-01		0.113	---	---	73.	--- ---	0.033 3		0.087 1	--- ---	1.53	b	82.2	--- ---	40.8	--- ---
SW-S-27	SS		2022-02-08	Moderately low flow, clear and colourless	0.1	---	---	65.	--- ---	0.023 8		0.141	--- ---	0.89	b	89.8	--- ---	48.2	--- ---
SW-S-52	SS		2021-04-27	Moderately low flow, clear and colourless	0.04	---	---	16.	--- ---	< 0.005		0.019 4	--- ---	0.339		67.7	--- ---	2.3	--- ---
SW-S-52	NS		2021-10-05	Dry, insufficient volume to sample	Null	---	---	Null	--- ---	Null		Null	--- ---	Null		Null	--- ---	Null	--- ---
SW-S-52	SS		2021-12-01		0.057	---	---	17.	--- ---	< 0.005		0.030 7	--- ---	0.545		41.9	--- ---	4.5	--- ---
SW-S-52	SS		2022-02-08	Moderately high flow, clear and colourless	0.048	---	---	16.	--- ---	< 0.005		0.022 3	--- ---	0.301		58.1	--- ---	2.4	--- ---

Notes:

na Not applicable.

Null No sample collected.

a Above maximum allowable concentration (MAC) British Columbia Water Quality Guideline.

b Above 30-day average British Columbia Water Quality Guideline.

c Detection Limits above Applicable Standards.

(1) British Columbia Approved Water Quality Guidelines (Criteria), 1998 Edition, Updated in 2021. British Columbia Ministry of Environment and a Compendium of Working Water Quality Guidelines for British Columbia, 1998 Edition, Updated in Feb 2021. British Columbia Ministry of Environment. The Guidelines cited specific to protection of freshwater aquatic life unless otherwise noted.

(2) Maximum acceptable concentration unless otherwise noted.

(3) The ammonia guideline is pH and temperature (15°C assumed) dependant. All ammonia results were compared to standards based on the associated pH and temperature results for that sample.

(4) The nitrite guidelines are chloride dependant. All nitrite results were compared to standards based on the associated chloride result for that sample.

(5) This value is hardness dependent. All metals results were compared to standards based on the associated hardness result for a particular sample.

(6) This value is the short-term daily for streams with unknown fish distribution.

(7) The TSS guidelines are "change from background" and flow condition dependent. The background TSS in the North landfill are derived from stations SW-N-CSs2, SW-N-41s3 and SW-N-14.

(8) Dissolved copper guideline varies with water hardness, temperature and dissolved organic carbon; Dissolved copper results were only compared with guidelines where DOC was analyzed.

| B.C. Water Quality Guidelines | | | | BC WQG MAXIMUM (1) | --- | --- | ---

B4. Monthly Leachate Quality Data – Hartland Valve Chamber

Appendix B-4. Monthly Leachate Quality Data - Hartland Valve Chamber 2021-2022

AECOM

State	Parameter	Unit	Sewer Use Criteria		Hartland Valve Chamber FR1 21-Apr-2021	Hartland Valve Chamber FR2 21-Apr-2021	Hartland Valve Chamber FRM 21-Apr-2021	Hartland Valve Chamber SS 26-May-2021	Hartland Valve Chamber SS 14-Jun-2021	Hartland Valve Chamber SS 28-Jun-2021	Hartland Valve Chamber FR1 5-Aug-2021
			min	max							
CONVENTIONALS											
Total	Alkalinity - Total - Ph 4.5	mg/L	---	---	---	---	---	---	---	---	---
Total	BOD	mg/L	---	500	26	27	27	19.	17.	54.	30.
Total	CBOD	mg/L	---	---	---	---	---	---	---	---	---
Total	Chloride	mg/L	---	1500	400	400	400	420.	430.	500.	520.
Total	COD	mg/L	---	1000	516	519	518	407.	443.	608.	561.
Total	Conductivity	µS/cm	---	---	4506	4506	4506	2 378.	3 987.	3 987.	3 633.
Total	Cyanide SAD	mg/L	---	1	0.0188	0.0183	0.019	0.027	0.012	0.018	0.012
Total	Cyanide WAD	mg/L	---	1	0.0064	0.0063	0.006	0.015	< 0.005	< 0.013	0.008 1
Total	Dissolved Oxygen	mg/L	---	---	1.99	1.99	1.99	2.05	2.34	2.3	1.57
Total	Fecal Coliforms	CFU/100 mL	---	---	---	---	---	---	---	---	---
Total	N - Ammonia (As N)	mg/L	---	---	310	280	295	260.	270.	280.	280.
Total	N - Nitrite (As N)	mg/L	---	---	1.76	1.77	1.765	1.24	0.834	0.799	< 0.5
Total	N - Nitrate (As N)	mg/L	---	---	9	9	9	10.9	6.55	< 0.05	< 2.00
Total	N - Nitrite+Nitrite (As N)	mg/L	---	---	---	---	---	---	---	---	---
Total	N - TKN (As N)	mg/L	---	---	---	---	---	---	---	---	---
Total	N - Total (As N)	mg/L	---	---	---	---	---	---	---	---	---
Total	Oil & Grease, Mineral	mg/L	---	15	< 2	< 2	< 2.	2.6	< 2.	< 2.	< 2.
Total	Oil & grease, total	mg/L	---	100	< 1	< 1	< 1.	< 1.	< 1.	< 1.	< 1.
Total	ORP	mV	---	---	76.0	76.0	76	- 15.	- 65.	64.	49.
Total	pH	pH	5.5	11	---	---	---	7.58	7.99	7.99	8.14
Dissolved	Sulphide	mg/L	---	1	0.06	0.058	0.0590	0.04	0.044	0.07	0.075
Total	Sulphide	mg/L	---	1	0.069	0.053	0.0610	0.045	0.043	0.086	0.085
Dissolved	Sulphate	mg/L	---	1500	36	34	35	28.	32.	29.	17.
	Temperature	°C	---	---	20.8	20.8	20.8	16.9	18.7	18.2	24.6
Total	TOC	mg/L	---	---	---	---	---	---	---	---	---
Total	Total Phenols	mg/L	---	1	0.16	0.033	0.10	0.15	0.037	0.054	0.007 6
Total	TSS	mg/L	---	350	32	32	32	31.	23.	29.	20.

Appendix B-4. Monthly Leachate Quality Data - Hartland Valve Chamber 2021-2022

AECOM

State	Parameter	Unit	Sewer Use Criteria		Hartland Valve Chamber FR1 21-Apr-2021	Hartland Valve Chamber FR2 21-Apr-2021	Hartland Valve Chamber FRM 21-Apr-2021	Hartland Valve Chamber SS 26-May-2021	Hartland Valve Chamber SS 14-Jun-2021	Hartland Valve Chamber SS 28-Jun-2021	Hartland Valve Chamber FR1 5-Aug-2021
			min	max							
METALS											
Total	Aluminum	µg/L	---	---	---	---	---	---	---	---	---
Total	Antimony	µg/L	---	---	---	---	---	---	---	---	---
Total	Arsenic	µg/L	---	0.4	7.87	8.24	8.055	6.7	6.47	9.14	9.34
Total	Barium	µg/L	---	---	---	---	---	---	---	---	---
Total	Beryllium	µg/L	---	---	---	---	---	---	---	---	---
Total	Bismuth	µg/L	---	---	---	---	---	---	---	---	---
Total	Boron	µg/L	---	---	---	---	---	---	---	---	---
Total	Cadmium	µg/L	---	0.3	0.058	0.059	0.0585	0.052	0.088	0.053	0.053
Total	Calcium	µg/L	---	---	---	---	---	---	---	---	---
Total	Chromium	µg/L	---	4	49.3	50.1	49.70	42.7	43.3	57.3	57.4
Total	Chromium III	µg/L	---	---	---	---	---	---	---	---	---
Total	Chromium Vi	µg/L	---	---	---	---	---	---	---	---	---
Total	Cobalt	µg/L	---	5	14.5	14.5	14.5	14.7	14.4	19	18.8
Total	Copper	µg/L	---	1	9.86	9.4	9.63	10.3	13.9	14.3	11.8
Total	Hardness (As Caco3)	µg/L	---	---	---	---	---	---	---	---	---
Total	Iron	µg/L	---	50	2110	2140	2125	2930	2100	3150	3010
Total	Lead	µg/L	---	1	1	1.06	1.03	0.82	0.633	0.71	0.72
Total	Lithium	µg/L	---	---	---	---	---	---	---	---	---
Total	Magnesium	µg/L	---	---	---	---	---	---	---	---	---
Total	Manganese	µg/L	---	5	626	627	627	778	634	749	751
Total	Mercury	µg/L	---	0.02	< 0.038	< 0.038	< 0.04	< 0.038	< 0.038	< 0.038	< 0.038
Total	Molybdenum	µg/L	---	5	3.03	3.31	3.17	3.43	4.21	4.46	4.04
Total	Nickel	µg/L	---	3	42.8	42.5	42.65	41.9	37.7	54.6	53.1
Total	Phosphorus	µg/L	---	---	---	---	---	---	---	---	---
Total	Potassium	µg/L	---	---	---	---	---	---	---	---	---
Total	Selenium	µg/L	---	0.3	0.418	0.463	0.4405	0.38	0.391	0.52	0.48
Total	Silicon	µg/L	---	---	---	---	---	---	---	---	---
Total	Silver	µg/L	---	0.5	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.05	< 0.05
Total	Sodium	µg/L	---	---	---	---	---	---	---	---	---
Total	Strontium	µg/L	---	---	---	---	---	---	---	---	---
Total	Sulphur	µg/L	---	---	---	---	---	---	---	---	---
Total	Thallium	µg/L	---	---	---	---	---	---	---	---	---
Total	Tin	µg/L	---	---	---	---	---	---	---	---	---
Total	Titanium	µg/L	---	---	---	---	---	---	---	---	---
Total	Uranium	µg/L	---	---	---	---	---	---	---	---	---
Total	Vanadium	µg/L	---	---	---	---	---	---	---	---	---
Total	Zinc	µg/L	---	3	15.4	16.6	16	18.3	17.2	15.9	15.2
Total	Zirconium	µg/L	---	---	---	---	---	---	---	---	---

Appendix B-4. Monthly Leachate Quality Data - Hartland Valve Chamber 2021-2022

State	Parameter	Unit	Sewer Use Criteria		Hartland Valve Chamber FR1 21-Apr-2021	Hartland Valve Chamber FR2 21-Apr-2021	Hartland Valve Chamber FRM 21-Apr-2021	Hartland Valve Chamber SS 26-May-2021	Hartland Valve Chamber SS 14-Jun-2021	Hartland Valve Chamber SS 28-Jun-2021	Hartland Valve Chamber FR1 5-Aug-2021
			min	max							
POLYCYCLIC AROMATIC HYDROCARBONS											
Total	Total PAHs	µg/L		0.05	5.90	6.60	6.25	2.80	1.70	3.40	3.70
LOW WEIGHT											
Total	2-Chloronaphthalene	µg/L	---	---	---	---	---	---	---	---	---
Total	2-Methylnaphthalene	µg/L	---	---	---	---	---	---	---	---	---
Total	Acenaphthene	µg/L	---	---	1.9	2.2	2.050	0.41	0.24	0.62	0.86
Total	Acenaphthylene	µg/L	---	---	0.043	0.049	0.046	0.018	0.018	0.051	0.024
Total	Anthracene	µg/L	---	---	0.59	0.66	0.625	0.087	0.057	0.067	0.047
Total	Fluorene	µg/L	---	---	1.4	1.6	1.500	0.41	0.27	0.15	0.41
Total	Naphthalene	µg/L	---	---	0.36	0.44	0.400	0.18	0.28	0.5	0.8
Total	Phenanthrene	µg/L	---	---	0.24	0.33	0.285	0.047	0.027	0.94	0.14
Total	Total Lmw-Pah'S	µg/L	---	---	---	---	---	---	---	---	---
HIGH WEIGHT											
Total	Benzo(A)Anthracene	µg/L	---	---	0.05	0.049	0.049 5	0.051	0.046	0.046	0.013
Total	Benzo(A)Pyrene	µg/L	---	---	0.009 2	0.011	0.010 1	0.009 3	0.008 2	0.009 3	< 0.005
Total	Benzo(B)Fluoranthene + Benzo(J)Fluoranthene	µg/L	---	---	0.012	0.014	0.013	0.015	0.013	0.017	< 0.01
Total	Benzo(G,H,I)Perylene	µg/L	---	---	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Total	Benzo(K)Fluoranthene	µg/L	---	---	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Total	Chrysene	µg/L	---	---	0.053	0.054	0.053 5	0.054	0.078	0.043	0.017
Total	Dibenzo(A,H)Anthracene	µg/L	---	---	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Total	Fluoranthene	µg/L	---	---	0.48	0.47	0.475	0.42	0.27	0.26	0.16
Total	Indeno(1,2,3-C,D)Pyrene	µg/L	---	---	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Total	Pyrene	µg/L	---	---	0.34	0.33	0.335	0.34	0.3	0.24	0.12
Total	Total Hmw-Pah'S	µg/L	---	---	---	---	---	---	---	---	---
VOLATILE ORGANICS											
Dissolved	Benzene	µg/L	---	100	0.59	0.54	0.57	0.47	< 0.4	< 0.4	0.48
Dissolved	Ethylbenzene	µg/L	---	200	0.99	0.97	0.98	< 0.4	< 0.4	< 0.4	0.85
Total	M & P Xylenes	µg/L	---	---	---	---	---	---	---	---	---
Total	Methyl Tertiary Butyl Ether	µg/L	---	---	---	---	---	---	---	---	---
Total	O-Xylene	µg/L	---	---	---	---	---	---	---	---	---
Total	Styrene	µg/L	---	---	---	---	---	---	---	---	---
Dissolved	Toluene	µg/L	---	200	0.55	0.46	0.51	0.93	< 0.4	< 0.4	< 0.4
Dissolved	Xylenes	µg/L	---	200	1.9	1.9	1.90	1.1	< 0.4	< 0.4	1.6

Notes:

a *- Exceeded maximum allowable value specified in CRD Sewer Use Bylaw 2922.*

b *- Exceeded minimum allowable value specified in CRD Sewer Use Bylaw 2922.*

* *- Exceedances are due to compromised/expired preservatives, and results are not representative*

--- = Not available.

FR1 - Field replicate 1.

FR2 - Field replicate 2.

FR3 - Field replicate 3.

FRM - Mean of field replicates.

SS - Single Sample

NS- Not sampled

Appendix B-4. Monthly Leachate Quality Data - Hartland Valve Chamber 2021-2022

State	Parameter	Unit	Sewer Use Criteria		Hartland Valve Chamber FR2 5-Aug-2021	Hartland Valve Chamber FRM 5-Aug-2021	Hartland Valve Chamber SS 1-Sep-2021	Hartland Valve Chamber SS 28-Oct-2021	Hartland Valve Chamber FR1 29-Nov-2021	Hartland Valve Chamber FR2 29-Nov-2021
			min	max						
CONVENTIONALS										
Total	Alkalinity - Total - Ph 4.5	mg/L	---	---	---	---	---	---	---	---
Total	BOD	mg/L	---	500	34.	32.	63	30.	< 15.	25.
Total	CBOD	mg/L	---	---	---	---	---	---	---	---
Total	Chloride	mg/L	---	1500	520.	520.	520	330.	290.	290.
Total	COD	mg/L	---	1000	560.	560.5	566	586.	409.	421.
Total	Conductivity	µS/cm	---	---	3 633.	3 633.	4633	2 934.	2 934.	2 934.
Total	Cyanide SAD	mg/L	---	1	0.010 6	0.011 3	0.0119	0.016	0.012	0.024 5
Total	Cyanide WAD	mg/L	---	1	0.003 6	0.005 85	< 0.005	< 0.005	< 0.005	0.006 4
Total	Dissolved Oxygen	mg/L	---	---	1.57	1.57	3.46	2.76	2.76	2.76
Total	Fecal Coliforms	CFU/100 mL	---	---	---	---	---	---	---	---
Total	N - Ammonia (As N)	mg/L	---	---	290.	285.	270	220.	250.	250.
Total	N - Nitrite (As N)	mg/L	---	---	< 0.5	< 0.5	0.81	4.21	0.501	0.496
Total	N - Nitrate (As N)	mg/L	---	---	< 2.	< 2.0	< 2	24.6	2.74	2.7
Total	N - Nitrite+Nitrite (As N)	mg/L	---	---	---	---	---	---	---	---
Total	N - TKN (As N)	mg/L	---	---	---	---	---	---	---	---
Total	N - Total (As N)	mg/L	---	---	---	---	---	---	---	---
Total	Oil & Grease, Mineral	mg/L	---	15	< 2.	< 2.	< 2	< 2.	< 2.	< 2.
Total	Oil & grease, total	mg/L	---	100	< 1.	< 1.	1.2	1.5	< 1.	< 1.
Total	ORP	mV	---	---	49.	49.	73.0	93.	93.	93.
Total	pH	pH	5.5	11	8.14	8.14	7.91	7.58	7.58	7.58
Dissolved	Sulphide	mg/L	---	1	0.065	0.07	0.24	0.027	0.068	0.073
Total	Sulphide	mg/L	---	1	0.06	0.072 5	0.2	0.064	0.078	0.083
Dissolved	Sulphate	mg/L	---	1500	20.	18.5	170	82.	110.	< 100.
	Temperature	°C	---	---	24.6	24.6	17.8	15.1	15.1	15.1
Total	TOC	mg/L	---	---	---	---	---	---	---	---
Total	Total Phenols	mg/L	---	1	0.008 2	0.007 9	< 0.03	0.11	< 0.015	< 0.015
Total	TSS	mg/L	---	350	22.	21.	16	24.	26.	22.

Appendix B-4. Monthly Leachate Quality Data - Hartland Valve Chamber 2021-2022

State	Parameter	Unit	Sewer Use Criteria		Hartland Valve Chamber FR2 5-Aug-2021	Hartland Valve Chamber FRM 5-Aug-2021	Hartland Valve Chamber SS 1-Sep-2021	Hartland Valve Chamber SS 28-Oct-2021	Hartland Valve Chamber FR1 29-Nov-2021	Hartland Valve Chamber FR2 29-Nov-2021
			min	max						
METALS										
Total	Aluminum	µg/L	---	---	---	---	---	---	---	---
Total	Antimony	µg/L	---	---	---	---	---	---	---	---
Total	Arsenic	µg/L	---	0.4	9.45	9.395	10.40	7.12	10.6	10.9
Total	Barium	µg/L	---	---	---	---	---	---	---	---
Total	Beryllium	µg/L	---	---	---	---	---	---	---	---
Total	Bismuth	µg/L	---	---	---	---	---	---	---	---
Total	Boron	µg/L	---	---	---	---	---	---	---	---
Total	Cadmium	µg/L	---	0.3	0.06	0.0565	0.04	0.059	0.079	0.123
Total	Calcium	µg/L	---	---	---	---	---	---	---	---
Total	Chromium	µg/L	---	4	59.2	58.3	58.30	40.8	43.8	45
Total	Chromium III	µg/L	---	---	---	---	---	---	---	---
Total	Chromium Vi	µg/L	---	---	---	---	---	---	---	---
Total	Cobalt	µg/L	---	5	19.7	19.25	18.30	13.6	12.5	12.5
Total	Copper	µg/L	---	1	12.3	12.05	8.60	17.6	25.5	39.5
Total	Hardness (As Caco3)	µg/L	---	---	---	---	---	---	---	---
Total	Iron	µg/L	---	50	3100	3055	2,860.00	2430	2240	2310
Total	Lead	µg/L	---	1	0.87	0.795	0.72	1.13	1.55	7.53
Total	Lithium	µg/L	---	---	---	---	---	---	---	---
Total	Magnesium	µg/L	---	---	---	---	---	---	---	---
Total	Manganese	µg/L	---	5	753	752	705.00	565	506	500
Total	Mercury	µg/L	---	0.02	< 0.038	< 0.038	< 0.04	< 0.038	< 0.038	< 0.038
Total	Molybdenum	µg/L	---	5	4.24	4.14	3.56	2.44	2.65	2.7
Total	Nickel	µg/L	---	3	54.6	53.85	52.50	36.1	35.8	37.3
Total	Phosphorus	µg/L	---	---	---	---	---	---	---	---
Total	Potassium	µg/L	---	---	---	---		---	---	---
Total	Selenium	µg/L	---	0.3	0.56	0.52	---	0.432	0.561	0.577
Total	Silicon	µg/L	---	---	---	---	---	---	---	---
Total	Silver	µg/L	---	0.5	< 0.05	< 0.05	< 0.05	< 0.02	0.03	0.03
Total	Sodium	µg/L	---	---	---	---	---	---	---	---
Total	Strontium	µg/L	---	---	---	---	---	---	---	---
Total	Sulphur	µg/L	---	---	---	---	---	---	---	---
Total	Thallium	µg/L	---	---	---	---	---	---	---	---
Total	Tin	µg/L	---	---	---	---	---	---	---	---
Total	Titanium	µg/L	---	---	---	---	---	---	---	---
Total	Uranium	µg/L	---	---	---	---	---	---	---	---
Total	Vanadium	µg/L	---	---	---	---	---	---	---	---
Total	Zinc	µg/L	---	3	15.1	15.15	11.90	19.3	27.5	65.1
Total	Zirconium	µg/L	---	---	---	---	---	---	---	---

Appendix B-4. Monthly Leachate Quality Data - Hartland Valve Chamber 2021-2022

State	Parameter	Unit	Sewer Use Criteria		Hartland Valve Chamber FR2 5-Aug-2021	Hartland Valve Chamber FRM 5-Aug-2021	Hartland Valve Chamber SS 1-Sep-2021	Hartland Valve Chamber SS 28-Oct-2021	Hartland Valve Chamber FR1 29-Nov-2021	Hartland Valve Chamber FR2 29-Nov-2021
			min	max						
POLYCYCLIC AROMATIC HYDROCARBONS										
Total	Total PAHs	µg/L		0.05	4.60	4.15	12.00	0.87	8.70	8.30
LOW WEIGHT										
Total	2-Chloronaphthalene	µg/L	---	---	---	---	---	---	---	---
Total	2-Methylnaphthalene	µg/L	---	---	---	---	---	---	---	---
Total	Acenaphthene	µg/L	---	---	0.91	0.885	1.50	0.045	2.7	2.6
Total	Acenaphthylene	µg/L	---	---	0.021	0.0225	0.02	< 0.01	0.027	0.025
Total	Anthracene	µg/L	---	---	0.056	0.0515	0.06	< 0.06	0.29	0.28
Total	Fluorene	µg/L	---	---	0.45	0.43	0.56	0.099	1.7	1.7
Total	Naphthalene	µg/L	---	---	1.5	1.15	0.36	0.05	0.52	0.37
Total	Phenanthrene	µg/L	---	---	0.16	0.15	0.21	0.036	0.3	0.38
Total	Total Lmw-Pah'S	µg/L	---	---	---	---	---	---	---	---
HIGH WEIGHT										
Total	Benzo(A)Anthracene	µg/L	---	---	0.019	0.016	0.03	0.034	0.077	0.091
Total	Benzo(A)Pyrene	µg/L	---	---	0.007 2	0.0061	0.01	0.007	0.015	0.025
Total	Benzo(B)Fluoranthene + Benzo(J)Fluoranthene	µg/L	---	---	0.013	0.0115	0.01	< 0.01	0.021	0.047
Total	Benzo(G,H,I)Perylene	µg/L	---	---	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Total	Benzo(K)Fluoranthene	µg/L	---	---	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.016
Total	Chrysene	µg/L	---	---	0.023	0.02	0.04	0.03	0.075	0.089
Total	Dibenzo(A,H)Anthracene	µg/L	---	---	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Total	Fluoranthene	µg/L	---	---	0.19	0.175	0.35	0.31	0.87	0.82
Total	Indeno(1,2,3-C,D)Pyrene	µg/L	---	---	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Total	Pyrene	µg/L	---	---	0.14	0.13	0.25	0.23	0.54	0.53
Total	Total Hmw-Pah'S	µg/L	---	---	---	---	---	---	---	---
VOLATILE ORGANICS										
Dissolved	Benzene	µg/L	---	100	< 0.4	0.44	< 0.40	< 0.4	0.66	0.66
Dissolved	Ethylbenzene	µg/L	---	200	0.48	0.665	0.57	< 0.4	0.75	0.62
Total	M & P Xylenes	µg/L	---	---	---	---	---	---	---	---
Total	Methyl Tertiary Butyl Ether	µg/L	---	---	---	---	---	---	---	---
Total	O-Xylene	µg/L	---	---	---	---	---	---	---	---
Total	Styrene	µg/L	---	---	---	---	---	---	---	---
Dissolved	Toluene	µg/L	---	200	< 0.4	< 0.4	0.84	0.9	1.6	1
Dissolved	Xylenes	µg/L	---	200	1.3	1.45	1.40	2.6	3.2	2.6

Notes:

a *- Exceeded maximum allowable value specified in CRD Sewer Use Bylaw 2922.*

b *- Exceeded minimum allowable value specified in CRD Sewer Use Bylaw 2922.*

* *- Exceedances are due to compromised/expired preservatives, and results are not representativ*

--- = Not available.

FR1 - Field replicate 1.

FR2 - Field replicate 2.

FR3 - Field replicate 3.

FRM - Mean of field replicates.

SS - Single Sample

NS- Not sampled

Appendix B-4. Monthly Leachate Quality Data - Hartland Valve Chamber 2021-2022

State	Parameter	Unit	Sewer Use Criteria		Hartland Valve Chamber FRM 29-Nov-2021	Hartland Valve Chamber SS 8-Dec-2021	Hartland Valve Chamber SS 26-Jan-2021	Hartland Valve Chamber FR1 24-Feb-2021	Hartland Valve Chamber FR2 24-Feb-2021	Hartland Valve Chamber FRM 24-Feb-2021	Hartland Valve Chamber SS 10-Mar-2021
			min	max							
CONVENTIONALS											
Total	Alkalinity - Total - Ph 4.5	mg/L	---	---	---	---	---	---	---	---	---
Total	BOD	mg/L	---	500	20.	31.	35.	20.	20.	20.	22.
Total	CBOD	mg/L	---	---	---	---	---	---	---	---	---
Total	Chloride	mg/L	---	1500	290.	270.	280.	320.	320.	320.	280.
Total	COD	mg/L	---	1000	415.	750.	736.	5470 *a**	5 350. *a**	5 410. *a**	405.
Total	Conductivity	µS/cm	---	---	2 934.	2 961.	3 405.	3 211.	3 211.	3 211.	3 694.
Total	Cyanide SAD	mg/L	---	1	0.018 25	0.013 5	< 0.005	0.010 3	0.010 4	0.010 35	0.007 6
Total	Cyanide WAD	mg/L	---	1	0.005 7	0.004 98	< 0.005	0.003 27	0.003 71	0.003 49	< 0.002 5
Total	Dissolved Oxygen	mg/L	---	---	2.76	2.8	1.77	0.6	0.6	0.6	1.15
Total	Fecal Coliforms	CFU/100 mL	---	---	---	---	---	---	---	---	---
Total	N - Ammonia (As N)	mg/L	---	---	250.	260.	260.	250.	280.	265.	280.
Total	N - Nitrite (As N)	mg/L	---	---	0.498 5	0.971	0.013 4	0.896	1.05	0.973	1.24
Total	N - Nitrate (As N)	mg/L	---	---	2.72	7.35	0.069	8.08	8.43	8.255	11.5
Total	N - Nitrite+Nitrite (As N)	mg/L	---	---	---	---	---	---	---	---	---
Total	N - TKN (As N)	mg/L	---	---	---	---	---	---	---	---	---
Total	N - Total (As N)	mg/L	---	---	---	---	---	---	---	---	---
Total	Oil & Grease, Mineral	mg/L	---	15	< 2.	< 2.	< 2.	2.3	< 2.	2.15	< 2.
Total	Oil & grease, total	mg/L	---	100	< 1.	< 1.	< 1.	7.1	4.3	5.7	2.
Total	ORP	mV	---	---	93.	127.	3.	196.	196.	196.	5.
Total	pH	pH	5.5	11	7.58	7.41	7.88	7.16	7.16	7.16	7.48
Dissolved	Sulphide	mg/L	---	1	0.070 5	0.039	0.053	0.034	0.055	0.044 5	0.042
Total	Sulphide	mg/L	---	1	0.080 5	0.049	0.068	0.071	0.058	0.064 5	0.052
Dissolved	Sulphate	mg/L	---	1500	105.	< 100.	< 100.	52.	48.	50.	67.
	Temperature	°C	---	---	15.1	11.8	13.8	11.5	11.5	11.5	13.2
Total	TOC	mg/L	---	---	---	---	---	---	---	---	---
Total	Total Phenols	mg/L	---	1	< 0.015	0.008 2	< 0.015	< 0.015	< 0.015	< 0.015	< 0.015
Total	TSS	mg/L	---	350	24.	30.	23.	24.	18.	21.	14.

Appendix B-4. Monthly Leachate Quality Data - Hartland Valve Chamber 2021-2022

State	Parameter	Unit	Sewer Use Criteria		Hartland Valve Chamber FRM 29-Nov-2021	Hartland Valve Chamber SS 8-Dec-2021	Hartland Valve Chamber SS 26-Jan-2021	Hartland Valve Chamber FR1 24-Feb-2021	Hartland Valve Chamber FR2 24-Feb-2021	Hartland Valve Chamber FRM 24-Feb-2021	Hartland Valve Chamber SS 10-Mar-2021
			min	max							
METALS											
Total	Aluminum	µg/L	---	---	---	---	---	---	---	---	---
Total	Antimony	µg/L	---	---	---	---	---	---	---	---	---
Total	Arsenic	µg/L	---	0.4	10.75	10	7.28	6.4	6.43	6.415	6.82
Total	Barium	µg/L	---	---	---	---	---	---	---	---	---
Total	Beryllium	µg/L	---	---	---	---	---	---	---	---	---
Total	Bismuth	µg/L	---	---	---	---	---	---	---	---	---
Total	Boron	µg/L	---	---	---	---	---	---	---	---	---
Total	Cadmium	µg/L	---	0.3	0.101	0.09	0.063	0.047	0.051	0.049	0.048
Total	Calcium	µg/L	---	---	---	---	---	---	---	---	---
Total	Chromium	µg/L	---	4	44.4	51.6	53.9	0	41.8	20.9	36.7
Total	Chromium III	µg/L	---	---	---	---	---	---	---	---	---
Total	Chromium Vi	µg/L	---	---	---	---	---	---	---	---	---
Total	Cobalt	µg/L	---	5	12.5	14.2	12.5	12	12.3	12.15	12.4
Total	Copper	µg/L	---	1	32.5	18.8	15	10.7	10.5	10.6	13.9
Total	Hardness (As Caco3)	µg/L	---	---	---	---	---	---	---	---	---
Total	Iron	µg/L	---	50	2275	2350	1640	1540	1570	1555	1270
Total	Lead	µg/L	---	1	4.54	1.55	1.01	0.761	0.786	0.7735	0.638
Total	Lithium	µg/L	---	---	---	---	---	---	---	---	---
Total	Magnesium	µg/L	---	---	---	---	---	---	---	---	---
Total	Manganese	µg/L	---	5	503	598	681	636	653	644.5	588
Total	Mercury	µg/L	---	0.02	< 0.038	< 0.038	0.038	< 0.038	< 0.038	< 0.038	< 0.019
Total	Molybdenum	µg/L	---	5	2.675	3.35	2.68	2.79	2.77	2.78	2.75
Total	Nickel	µg/L	---	3	36.55	41.3	38.9	34.9	36.3	35.6	35.1
Total	Phosphorus	µg/L	---	---	---	---	---	---	---	---	---
Total	Potassium	µg/L	---	---	---	---	---	---	---	---	---
Total	Selenium	µg/L	---	0.3	0.569	0.544	0.491	0.5	0.482	0.491	0.502
Total	Silicon	µg/L	---	---	---	---	---	---	---	---	---
Total	Silver	µg/L	---	0.5	0.03	0.029	0.026	< 0.02	< 0.02	< 0.02	< 0.02
Total	Sodium	µg/L	---	---	---	---	---	---	---	---	---
Total	Strontium	µg/L	---	---	---	---	---	---	---	---	---
Total	Sulphur	µg/L	---	---	---	---	---	---	---	---	---
Total	Thallium	µg/L	---	---	---	---	---	---	---	---	---
Total	Tin	µg/L	---	---	---	---	---	---	---	---	---
Total	Titanium	µg/L	---	---	---	---	---	---	---	---	---
Total	Uranium	µg/L	---	---	---	---	---	---	---	---	---
Total	Vanadium	µg/L	---	---	---	---	---	---	---	---	---
Total	Zinc	µg/L	---	3	46.3	23.4	18.3	24	14.7	19.35	15.5
Total	Zirconium	µg/L	---	---	---	---	---	---	---	---	---

Appendix B-4. Monthly Leachate Quality Data - Hartland Valve Chamber 2021-2022

AECOM

State	Parameter	Unit	Sewer Use Criteria		Hartland Valve Chamber FRM 29-Nov-2021	Hartland Valve Chamber SS 8-Dec-2021	Hartland Valve Chamber SS 26-Jan-2021	Hartland Valve Chamber FR1 24-Feb-2021	Hartland Valve Chamber FR2 24-Feb-2021	Hartland Valve Chamber FRM 24-Feb-2021	Hartland Valve Chamber SS 10-Mar-2021
			min	max							
POLYCYCLIC AROMATIC HYDROCARBONS											
Total	Total PAHs	µg/L		0.05	8.50	18.00	19.00	2.60	2.50	2.55	4.40
LOW WEIGHT											
Total	2-Chloronaphthalene	µg/L	---	---	---	---	---	---	---	---	---
Total	2-Methylnaphthalene	µg/L	---	---	---	---	---	---	---	---	---
Total	Acenaphthene	µg/L	---	---	2.65	3.4	5.3	1.2	1.2	1.2	1.8
Total	Acenaphthylene	µg/L	---	---	0.026	0.033	0.04	0.066	0.054	0.06	0.1
Total	Anthracene	µg/L	---	---	0.285	0.25	0.33	0.085	0.081	0.083	0.098
Total	Fluorene	µg/L	---	---	1.7	1.8	3	0.68	0.69	0.685	0.85
Total	Naphthalene	µg/L	---	---	0.445	7.8	3.4	0.026	0.017	0.0215	0.42
Total	Phenanthrene	µg/L	---	---	0.34	0.84	1.8	0.079	0.085	0.082	0.1
Total	Total Lmw-Pah'S	µg/L	---	---	---	---	---	---	---	---	---
HIGH WEIGHT											
Total	Benzo(A)Anthracene	µg/L	---	---	0.084	0.019	0.04	< 0.01	< 0.01	< 0.01	0.013
Total	Benzo(A)Pyrene	µg/L	---	---	0.02	< 0.005	0.008	< 0.005	< 0.005	< 0.005	< 0.005
Total	Benzo(B)Fluoranthene + Benzo(J)Fluoranthene	µg/L	---	---	0.034	< 0.01	0.011	< 0.01	< 0.01	< 0.01	< 0.01
Total	Benzo(G,H,I)Perylene	µg/L	---	---	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Total	Benzo(K)Fluoranthene	µg/L	---	---	0.013	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Total	Chrysene	µg/L	---	---	0.082	0.018	0.032	< 0.01	0.011	0.0105	0.013
Total	Dibenzo(A,H)Anthracene	µg/L	---	---	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Total	Fluoranthene	µg/L	---	---	0.845	0.37	0.5	0.19	0.18	0.185	0.32
Total	Indeno(1,2,3-C,D)Pyrene	µg/L	---	---	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Total	Pyrene	µg/L	---	---	0.535	0.21	0.3	0.11	0.1	0.105	0.19
Total	Total Hmw-Pah'S	µg/L	---	---	---	---	---	---	---	---	---
VOLATILE ORGANICS											
Dissolved	Benzene	µg/L	---	100	0.66	0.69	1.6	0.81	0.8	0.805	0.69
Dissolved	Ethylbenzene	µg/L	---	200	0.685	1.3	1.5	0.66	0.62	0.64	0.56
Total	M & P Xylenes	µg/L	---	---	---	---	---	---	---	---	---
Total	Methyl Tertiary Butyl Ether	µg/L	---	---	---	---	---	---	---	---	---
Total	O-Xylene	µg/L	---	---	---	---	---	---	---	---	---
Total	Styrene	µg/L	---	---	---	---	---	---	---	---	---
Dissolved	Toluene	µg/L	---	200	1.3	2.3	3	1.2	0.51	0.855	0.63
Dissolved	Xylenes	µg/L	---	200	2.9	3.9	4.4	2	1.8	1.9	2.4

Notes:

a *- Exceeded maximum allowable value specified in CRD Sewer Use Bylaw 2922.*

b *- Exceeded minimum allowable value specified in CRD Sewer Use Bylaw 2922.*

* *- Exceedances are due to compromised/expired preservatives, and results are not representativ*

--- = Not available.

FR1 - Field replicate 1.

FR2 - Field replicate 2.

FR3 - Field replicate 3.

FRM - Mean of field replicates.

SS - Single Sample

NS- Not sampled

B5. Quarterly Leachate Quality – Trace Organics

Appendix B-5. Quarterly Leachate Quality - Trace Organics - 2021-2022

AECOM

Sate	Parameters	Unit	Sewer Use Criteria		Hartland Valve Chamber FR1 21-Apr-2021	Hartland Valve Chamber FR2 21-Apr-2021	Hartland Valve Chamber FRM 21-Apr-2021	Hartland Valve Chamber SS 28-Jul-2021	Hartland Valve Chamber FR1 ---	Hartland Valve Chamber FR2 ---	Hartland Valve Chamber FRM ---	Hartland Valve Chamber BLF ---	Hartland Valve Chamber BLT ---	Hartland Valve Chamber SS 28-Oct-2021	Hartland Valve Chamber SS 26-Jan-2021
			min	max											
PHTHALATE ESTERS															
TOT	Bis(2-Ethylhexyl)Phthalate	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
NA	N-Butylbenzyl Phthalate	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
PHENOLS - HALOGENATED															
TOT	2,4 + 2,5 Dichlorophenol	µg/L	---	---	< 0.1	< 0.1	< 0.1	< 0.1	---	---	---	---	---	< 0.1	< 0.1
TOT	2,4,6-trichlorophenol	µg/L	---	---	< 0.1	< 0.1	< 0.1	< 0.1	---	---	---	---	---	< 0.1	< 0.1
TOT	2-Chlorophenol	µg/L	---	---	< 0.05	< 0.05	< 0.05	< 0.1	---	---	---	---	---	0 0.11	0 0.15
NA	Pentachlorophenol	µg/L	---	---	< 0.1	< 0.1	< 0.1	< 0.1	---	---	---	---	---	< 0.1	< 0.1
PHENOLS - NON-HALOGENATED															
TOT	2-Methyl-4,6-Dinitrophenol	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	Phenol	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOTAL CHLORINATED PHENOLIC COMPOUNDS															
TOT	Chlorinated phenols (total)	µg/L	---	---	< 0.41	< 0.41	< 0.41	< 0.41	---	---	---	---	---	< 2.9	15
TOT	Total Dichlorophenols	µg/L	---	---	< 0.22	< 0.22	< 0.22	< 0.22	---	---	---	---	---	< 0.33	0.3
TOT	Total Monochlorophenols	µg/L	---	---	< 0.09	< 0.09	< 0.09	< 0.09	---	---	---	---	---	< 2.8	< 0.09
TOT	Total Nonchlorinated phenols	µg/L	---	---	4.1	4.6	4.35	80	---	---	---	---	---	< 1.6	3.9
TOT	Total Tetrachlorophenols	µg/L	---	---	< 0.17	< 0.17	< 0.17	< 0.24	---	---	---	---	---	< 0.24	< 0.24
TOT	Total Trichlorophenols	µg/L	---	---	< 0.24	< 0.24	< 0.24	< 0.05	---	---	---	---	---	0 2.8	< 0.05
TOT	Total Phenolic Compounds	µg/L	---	---	---	---	---	< 0.17	---	---	---	---	---	< 0.17	< 0.17
ETHERS - HALOGENATED															
TOT	4-Bromophenyl Phenyl Ether	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	Bis(2-Chloroethoxy)Methane	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	Bis(2-Chloroethyl)Ether	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	Bis(2-Chloroisopropyl)Ether	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	N-Nitrosodimethylamine	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	N-Nitrosodi-N-Propylamine	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	N-Nitrosodiphenylamine	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	1,2-diphenylhydrazine	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	3,3-dichlorobenzidine	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	Alpha-Terpineol	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	Hexachlorobutadiene	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	Hexachlorocyclopentadiene	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	Isophorone	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
ALKANES - HALOGENATED															
TOT	Hexachloroethane	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
OTHER ORGANICS															
TOT	1,1,1,2-Tetrachloroethane	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	1,1,1-trichloroethane	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	1,1,2,2-tetrachloroethane	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	1,1,2Trichloro-1,2,2Trifluoroethane	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	1,1,2-trichloroethane	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	1,1-dichloroethane	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	1,1-dichloroethene	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	1,2,3-Trichlorobenzene	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	1,2,4-trichlorobenzene	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	1,2-dichlorobenzene	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	1,2-dichloroethane	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	1,2-dichloropropane	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	1,3,5-trimethylbenzene	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	1,3-Butadiene	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	1,3-dichlorobenzene	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	1,3-dichloropropane	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	1,4-dichlorobenzene	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	1-Methylnaphthalene	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	2,3,4,5-tetrachlorophenol	µg/L	---	---	< 0.1	< 0.1	< 0.1	< 0.1	---	---	---	---	---	< 0.1	< 0.1
TOT	2,3,4,6-tetrachlorophenol	µg/L	---	---	< 0.1	< 0.1	< 0.1	0 0.1	---	---	---	---	---	< 0.1	< 0.1
TOT	2,3,5,6-tetrachlorophenol	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	2,4-dimethylphenol	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	2,4-dinitrophenol	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	2,4-dinitrotoluene	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	2,6-dinitrotoluene	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	2-Nitrophenol	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
NA	4,6-dinitro-2-methylphenol	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	4-Chloro-3-Methylphenol	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	4-Chlorophenyl Phenyl Ether	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	4-Methyl-2-Pentanone	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	4-Nitrophenol	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	Acridine	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	Acrolein	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	Acrylonitrile	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	Benzidine	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	Bromobenzene	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	Bromodichloromethane	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	Bromomethane	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	Butylbenzyl Phthalate	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
NA	Carbon Tetrachloride	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	Chlorobenzene	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	Chlorodibromomethane	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	Chloroethane	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	Chloroethene	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
NA	Chloroform	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	Chloromethane	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	Cis-1,2-Dichloroethene	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	cis-1,3-dichloropropene	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	Csr Vph C6-C10 (Vh Minus Btex)	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	Dibromoethane	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
NA	Dibromomethane	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	Dichlorodifluoromethane	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	Dichloromethane	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	Diethyl Phthalate	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	Dimethyl Ketone	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	Dimethyl Phthalate	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	Di-N-Butyl Phthalate	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	Di-N-Octyl Phthalate	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	Isopropylbenzene	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	Methyl Ethyl Ketone	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	Nitrobenzene	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	PCP	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	Quinoline	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	Sulfolane	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	Tetrabromomethane	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	Tetrachloroethene	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	Tetrachloromethane	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	Trans-1,2-Dichloroethene	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	trans-1,3-dichloropropene	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	Tribromomethane	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	Trichloroethene	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	Trichlorofluoromethane	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	Trichloromethane	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOT	VH C6-C10	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
NA	Vinyl Chloride	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---

Notes:

a *- Exceeded maximum allowable value specified in CRD Sewer Use Bylaw 2922*

b *- Exceeded minimum allowable value specified in CRD Sewer Use Bylaw 2922.*

FR1 - Field replicate 1.
FR2 - Field replicate 2.
FRM - Mean of field replicates.
NS- Not sampled
SS- Single sample

B6. Monthly Leachate Quality – Phase 2 Cleanout

Appendix B-6. Monthly Leachate Quality - Phase 2 Cleanout - 2021-2022

State	Parameter	Units	Sewer Use Criteria		Phase 2 Cleanout	Phase 2 Cleanout	Phase 2 Cleanout	Phase 2 Cleanout	Phase 2 Cleanout	Phase 2 Cleanout	Phase 2 Cleanout	Phase 2 Cleanout	Phase 2 Cleanout	Phase 2 Cleanout	Phase 2 Cleanout	Phase 2 Cleanout
					SS	SS	SS	NS	NS	SS	SS	NS	NS	SS	SS	SS
			min	max	---	---	---	---	---	---	---	---	---	---	---	---
CONVENTIONALS																
Total	Alkalinity - Total - Ph 4.5	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	BOD	mg/L	---	500	---	---	---	---	---	---	---	---	---	---	---	---
Total	CBOD	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
DIS	Chloride	mg/L	---	1500	---	---	---	---	---	---	---	---	---	---	---	---
Total	COD	mg/L	---	1000	---	---	---	---	---	---	---	---	---	---	---	---
Total	Conductivity	µS/cm	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Cyanide SAD	mg/L	---	1	---	---	---	---	---	---	---	---	---	---	---	---
Total	Cyanide WAD	mg/L	---	1	---	---	---	---	---	---	---	---	---	---	---	---
Total	Dissolved Oxygen	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Fecal Coliforms	CFU/100 mL	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	N - NH3 (As N)	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	N - NO2 (As N)	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	N - NO3 (As N)	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	N - NO3 + NO2 (As N)	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	N - Tkn (As N)	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	N - Total (As N)	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Oil & Grease, Mineral	mg/L	---	15	---	---	---	---	---	---	---	---	---	---	---	---
Total	Oil & grease, total	mg/L	---	100	---	---	---	---	---	---	---	---	---	---	---	---
Total	ORP	mV	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	pH	pH	5.5	11	---	---	---	---	---	---	---	---	---	---	---	---
Dissolved	Sulphide	mg/L	---	1	---	---	---	---	---	---	---	---	---	---	---	---
Total	Sulphide	mg/L	---	1	---	---	---	---	---	---	---	---	---	---	---	---
Dissolved	Sulphate	mg/L	---	1500	---	---	---	---	---	---	---	---	---	---	---	---
Total	Temperature	°C	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	TOC	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Total Phenols	mg/L	---	1	---	---	---	---	---	---	---	---	---	---	---	---
Total	TSS	mg/L	---	350	---	---	---	---	---	---	---	---	---	---	---	---
METALS																
Total	Aluminum	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Antimony	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Arsenic	µg/L	---	400	---	---	---	---	---	---	---	---	---	---	---	---
Total	Barium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Beryllium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Bismuth	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Boron	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Cadmium	µg/L	---	300	---	---	---	---	---	---	---	---	---	---	---	---
Total	Calcium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Chromium	µg/L	---	4000	---	---	---	---	---	---	---	---	---	---	---	---
Total	Chromium III	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Chromium Vi	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Cobalt	µg/L	---	5000	---	---	---	---	---	---	---	---	---	---	---	---
Total	Copper	µg/L	---	1000	---	---	---	---	---	---	---	---	---	---	---	---
Total	Hardness (As Caco3)	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Iron	µg/L	---	50000	---	---	---	---	---	---	---	---	---	---	---	---
Total	Lead	µg/L	---	1000	---	---	---	---	---	---	---	---	---	---	---	---
Total	Lithium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Magnesium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Manganese	µg/L	---	5000	---	---	---	---	---	---	---	---	---	---	---	---
Total	Mercury	µg/L	---	20	---	---	---	---	---	---	---	---	---	---	---	---
Total	Molybdenum	µg/L	---	5000	---	---	---	---	---	---	---	---	---	---	---	---
Total	Nickel	µg/L	---	3000	---	---	---	---	---	---	---	---	---	---	---	---
Total	Phosphorus	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Potassium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Selenium	µg/L	---	300	---	---	---	---	---	---	---	---	---	---	---	---
Total	Silicon	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Silver	µg/L	---	500	---	---	---	---	---	---	---	---	---	---	---	---
Total	Sodium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Strontium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Sulphur	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Thallium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Tin	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Titanium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Uranium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Vanadium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Zinc	µg/L	---	3000	---	---	---	---	---	---	---	---	---	---	---	---
Total	Zirconium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
VOLATILE ORGANICS																
Dissolved	Benzene	µg/L	---	100	---	---	---	---	---	---	---	---	---	---	---	---
Dissolved	Ethylbenzene	µg/L	---	200	---	---	---	---	---	---	---	---	---	---	---	---
Total	M & P Xylenes	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Methyl Tertiary Butyl Ether	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	O-Xylene	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Styrene	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Dissolved	Toluene	µg/L	---	200	---	---	---	---	---	---	---	---	---	---	---	---
Dissolved	Xylenes	µg/L	---	200	---	---	---	---	---	---	---	---	---	---	---	---

Notes:

a - Exceeded maximum allowable value specified in CRD Sewer Use Bylaw 2922.

b - Exceeded minimum allowable value specified in CRD Sewer Use Bylaw 2922.

--- = Not available.

SS - Single Sample

NS - Not sampled

B7. Monthly Leachate Quality – North Purge Well

Appendix B-7. Monthly Leachate Quality - North Purge Well 2021-2022

State	Parameters	Unit	Sewer Use Criteria		North Purge Well System SS	North Purge Well System SS	North Purge Well System SS	North Purge Well System SS	North Purge Well System SS	North Purge Well System SS	North Purge Well System SS	North Purge Well System SS	North Purge Well System SS	North Purge Well System SS	North Purge Well System SS	North Purge Well System SS
			min	max	28-Apr-2021	31-May-2021	14-Jun-2021	28-Jul-2021	5-Aug-2021	1-Sep-2021	29-Oct-2021	29-Nov-2021	8-Dec-2021	26-Jan-2022	25-Feb-2022	10-Mar-2022
CONVENTIONALS																
Total	Alkalinity - Total - Ph 4.5	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	BOD	mg/L	---	500	23	20	19	9.8	13	13	21	45	21	8.9	17	17
Total	CBOD	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Chloride	mg/L	---	1500	360	350	340	340	370	360	440	470	< 100	120	280	300
Total	COD	mg/L	---	1000	385	367	305	333	303	249	715	624	604	413	5840 a*	6570 a*
Total	Conductivity	µS/cm	---	---	3676	3616	3548	3258	3716	3697	4087	4385	2843	1455	2891	3144
Total	Cyanide SAD	mg/L	---	1	0.00806	0.00675	0.00651	0.00485	0.0027	0.00481	0.0098	0.0091	0.00622	0.00136	0.00539	< 0.0025
Total	Cyanide WAD	mg/L	---	1	0.00272	0.00106	0.00113	0.00068	0.0091	0.00156	< 0.0025	< 0.005	0.00107	< 0.0005	0.00111	< 0.0025
Total	Dissolved Oxygen	mg/L	---	---	4.99	0.22	0.22	0.22	0.19	5.01	0.14	0.08	0.94	0.28	0.25	0.23
Total	Fecal Coliforms	CFU/100 mL	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	N - Nh3 (As N)	mg/L	---	---	210	230	240	180	200	160	240	380	210	70	160	180
Total	N - No2 (As N)	mg/L	---	---	< 0.05	< 0.05	< 0.05	0.258	< 0.05	< 0.005	< 0.05	0.052	0.068	< 0.005	< 0.05	< 0.05
Total	N - No3 (As N)	mg/L	---	---	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.02	< 0.2	< 0.2	< 0.2	0.358	0.23	< 0.2
Total	N - No3 + No2 (As N)	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	N - Tkn (As N)	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	N - Total (As N)	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Oil & Grease, Mineral	mg/L	---	15	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Total	Oil & grease, total	mg/L	---	100	< 1	1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Total	ORP	mV	---	---	347	-113	-11	-135	-128	-59	-63	-161	-92	-105	-120	-122
Total	pH	pH	5.5	11	---	6.98	7.03	7.03	7.23	6.74	7.23	7.05	6.93	6.94	6.96	6.84
Dissolved	Sulphide	mg/L	---	1	---	---	---	---	---	---	---	---	---	---	---	---
Total	Sulphide	mg/L	---	1	0.043	0.11	0.11	0.095	0.084	0.083	0.048	0.39	0.15	0.063	0.071	0.068
Dissolved	Sulphate	mg/L	---	1500	10	< 10	17	16	15	9.6	31	< 100	< 100	40	15	< 10
Total	Temperature	°C	---	---	17	17.5	17.6	18.7	19.9	18.9	18	17	16	13.4	14.6	15.6
Total	TOC	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Total Phenols	mg/L	---	1	0.078	0.19	0.062	< 0.015	0.0076	< 0.0075	0.059	< 0.015	0.018	0.0025	< 0.015	< 0.0075
Total	TSS	mg/L	---	350	43	56	64	45	60	59	14	12	11	10	17	20
METALS																
Total	Aluminum	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Antimony	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Arsenic	µg/L	---	400	10.4	9.75	10.8	10.4	10	8.67	9.89	22.1	10.6	2.98	8.13	8.32
Total	Barium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Beryllium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Bismuth	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Boron	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Cadmium	µg/L	---	300	0.018	0.017	0.013	0.01	< 0.025	< 0.01	0.025	0.124	0.0381	0.0156	0.021	0.026
Total	Calcium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Chromium	µg/L	---	4 000.	24.9	20.4	17.6	11.3	12.6	6.93	24.3	60.3	33	5.62	17.1	18.9
Total	Chromium III	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Chromium Vi	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Cobalt	µg/L	---	5000	9.16	9.26	8.72	8.94	8.48	7	11.4	15.7	9.56	3.47	8.69	8.7
Total	Copper	µg/L	---	1000	2.81	3	2.57	2.34	1.82	0.93	8.83	24	8.08	5.21	4.74	4.28
Total	Hardness (As Caco3)	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Iron	µg/L	---	50 000.	16600	16900	16300	23000	20000	18500	10100	17500	12900	5220	9620	13400
Total	Lead	µg/L	---	1 000.	0.361	0.356	0.308	0.195	0.23	0.099	0.504	1.83	0.683	0.126	0.38	0.336
Total	Lithium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Magnesium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Manganese	µg/L	---	5000	1030	1080	1020	1240	1160	1130	949	1040	773	389	927	984
Total	Mercury	µg/L	---	20	< 0.038	< 0.019	< 0.038	< 0.038	< 0.038	< 0.038	< 0.0019	< 0.038	< 0.038	< 0.038	< 0.038	< 0.019
Total	Molybdenum	µg/L	---	5000	1.85	1.56	1.75	1.63	1.4	1.15	2.26	1.8	1.86	1.21	1.45	1.28
Total	Nickel	µg/L	---	3000	24.4	23.8	20.7	21	21.1	16.7	27.5	39.1	21.6	7.81	19.1	19.1
Total	Phosphorus	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Potassium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Selenium	µg/L	---	300	0.252	0.242	0.226	0.223	0.22	0.207	0.303	0.55	0.32	0.16	0.259	0.258
Total	Silicon	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Silver	µg/L	---	500	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.02	< 0.05	0.013	< 0.01	< 0.02	< 0.02
Total	Sodium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Strontium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Sulphur	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Thallium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Tin	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Titanium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Uranium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Vanadium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Zinc	µg/L	---	3000	6.4	7.9	5	5.5	6.2	3.6	7	26.6	23.5	3.4	6.1	7.5
Total	Zirconium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
VOLATILE ORGANICS																
Dissolved	Benzene	µg/L	---	100	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	0.75	< 0.4	< 0.4	< 0.4	< 0.4
Dissolved	Ethylbenzene	µg/L	---	200	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	2.1	0.61	< 0.4	< 0.4	< 0.4
Total	M & P Xylenes	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Methyl Tertiary Butyl Ether	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	O-Xylene	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Styrene	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Dissolved	Toluene	µg/L	---	200	0.47	0.45	< 0.4	< 0.4	0.41	< 0.4	0.48	5.2	1.1	< 0.4	0.66	< 0.4
Dissolved	Xylenes	µg/L	---	200	0.93	0.52	< 0.4	< 0.4	< 0.4	< 0.4	0.9	6.1	1.9	< 0.4	1.1	0.41

Notes:

a - Exceeded maximum allowable value specified in CRD Sewer Use Bylaw 2922.

b - Exceeded minimum allowable value specified in CRD Sewer Use Bylaw 2922.

** - Exceedances are due to compromised/expired preservatives, and results are not representative*

SS - Single Sample

NS - Not Sampled

B8. Monthly Leachate Quality – Controlled Waste Drainage

Appendix B-8. Monthly Leachate Quality - Controlled Waste Drainage 2021-2022

States	Parameter	Units	Sewer Use Criteria		Controlled Waste Ditch SS 28-Apr-2021	Controlled Waste Ditch SS 31-May-2021	Controlled Waste Ditch SS 14-Jun-2021	Controlled Waste Ditch NS 28-Jul-2021	Controlled Waste Ditch NS 5-Aug-2021	Controlled Waste Ditch SS 1-Sep-2021	Controlled Waste Ditch SS 29-Oct-2021	Controlled Waste Ditch SS 29-Nov-2021	Controlled Waste Ditch SS 8-Dec-2021	Controlled Waste Ditch SS 26-Jan-2022	Controlled Waste Ditch SS 25-Feb-2022	Controlled Waste Ditch SS 10-Mar-2022
			min	max												
CONVENTIONALS																
Total	Alkalinity - Total - Ph 4.5	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	BOD	mg/L	---	500	63	62	73	59	15	39	23	64	40	81	40	87
Total	CBOD	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Dissolved	Chloride	mg/L	---	1500	540	630	640	700	710	750	240	250	270	310	460	410
Total	COD	mg/L	---	1000	568	671	565	699	682	738	216	487	590	649	5600 a*	5680 a*
Total	Conductivity	µS/cm	---	---	5068	6047	5854	6833	6992	6703	2522	2729	2870	3607	2859	4029
Total	Cyanide SAD	mg/L	---	1	0.0129	0.029	0.0159	0.019	0.0788	0.0163	0.0131	0.0115	0.00934	0.0033	0.0109	0.0075
Total	Cyanide WAD	mg/L	---	1	0.00347	< 0.013	< 0.005	< 0.013	0.0054	< 0.005	0.0049	0.0059	0.00279	< 0.0025	0.00269	< 0.0025
Total	Dissolved Oxygen	mg/L	---	---	6.63	2.42	2.48	1.63	1.7	6.01	6.06	5.36	5.9	5.52	7.78	5.88
Total	Fecal Coliforms	CFU/100 mL	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	N - NH3 (As N)	mg/L	---	---	380	520	530	650	530	500	130	190	210	260	300	310
Total	N - NO2 (As N)	mg/L	---	---	4.74	3.79	5.41	11.1	7.13	9.45	4.63	1.6	2.72	4.92	5.74	5.93
Total	N - NO3 (As N)	mg/L	---	---	3.76	1.11	1.12	0.82	< 2	2.88	14.1	6.91	18.1	16.1	10.6	13.1
Total	N - NO3 + NO2 (As N)	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	N - Tkn (As N)	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	N - Total (As N)	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Oil & Grease, Mineral	mg/L	---	15	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Total	Oil & grease, total	mg/L	---	100	< 1	< 1	< 1	< 1	< 1	< 1	2.1	< 1	< 1	< 1	< 1	1.2
Total	ORP	mV	---	---	407.0	53.0	29.0	-39.0	23.0	133.0	-8.0	27.0	95.0	-3.0	18.0	-41.0
Total	pH	pH	5.5	11	---	8.54	8.67	8.44	8.63	8.41	8.36	8.04	8.06	8.22	8.32	8.36
Dissolved	Sulphide	mg/L	---	1	---	---	---	---	---	---	---	---	---	---	---	---
Total	Sulphide	mg/L	---	1	0.027	0.055	0.033	< 0.018	0.043	< 0.009	0.018	< 0.009	0.037	0.022	0.042	0.02
Dissolved	Sulphate	mg/L	---	1500	< 10	< 10	< 10	< 10	< 10	180	61	< 100	< 100	< 100	< 10	12
Total	Temperature	°C	---	---	16.4	19	18.4	21.9	22.8	18.7	17.2	17.8	15.3	14.9	14.3	15.2
Total	TOC	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Total Phenols	mg/L	---	1	0.034	0.038	0.088	< 0.03	0.01	< 0.03	0.018	0.0079	< 0.0075	< 0.015	< 0.015	< 0.015
Total	TSS	mg/L	---	350	6	8.8	31	16	11	3.6	7.2	5.6	9.2	9.6	9.6	7.2
METALS																
Total	Aluminum	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Antimony	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Arsenic	µg/L	---	400	5.52	5.3	5.74	5.98	6.31	8.35	3.43	3.73	4.11	4.27	5.4	4.57
Total	Barium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Beryllium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Bismuth	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Boron	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Cadmium	µg/L	---	300	0.038	0.027	0.026	< 0.025	0.061	< 0.025	0.065	0.074	0.0785	0.087	0.05	0.088
Total	Calcium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Chromium	µg/L	---	4000	44.6	38.2	40.3	49.5	49.7	59.1	19.1	19.3	25.7	28.2	31.1	29.3
Total	Chromium III	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Chromium VI	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Cobalt	µg/L	---	5000	21.8	21.9	21	25.9	26.3	33.1	12.4	10.1	12.4	14.1	16.6	16.2
Total	Copper	µg/L	---	1000	5.14	1.23	0.74	1.47	0.99	1	21	11.7	12.6	10.4	5.96	9.24
Total	Hardness (As Caco3)	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Iron	µg/L	---	50000	3230	2610	2440	2700	2350	2710	1580	1380	1820	2310	2850	2090
Total	Lead	µg/L	---	1000	0.19	0.145	0.159	0.19	0.19	0.17	0.252	0.292	0.323	0.397	0.31	0.19
Total	Lithium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Magnesium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Manganese	µg/L	---	5000	1250	212	177	162	177	117	1010	1430	1610	1930	602	1690
Total	Mercury	µg/L	---	20	< 0.038	< 0.019	< 0.038	< 0.038	< 0.038	< 0.038	0.0066	< 0.038	< 0.038	< 0.038	< 0.038	< 0.019
Total	Molybdenum	µg/L	---	5000	1.57	1.33	1.65	1.66	1.84	2.34	1.85	1.34	1.49	1.23	1.32	1.27
Total	Nickel	µg/L	---	3000	46.7	41.4	38.4	53.1	53.5	66.6	30.7	26.4	31.5	33.8	37.7	36.4
Total	Phosphorus	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Potassium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Selenium	µg/L	---	300	0.65	0.56	0.562	0.68	0.67	0.93	0.379	0.325	0.352	0.387	0.56	0.59
Total	Silicon	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Silver	µg/L	---	500	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	0.037	< 0.02	0.023	< 0.02	< 0.05	< 0.05
Total	Sodium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Strontium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Sulphur	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Thallium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Tin	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Titanium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Uranium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Vanadium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Zinc	µg/L	---	3000	52.5	50.7	48.3	62.8	66.3	78.2	25.9	25.2	30.9	42.4	33.7	50.4
Total	Zirconium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
VOLATILE ORGANICS																
Dissolved	Benzene	µg/L	---	100	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Dissolved	Ethylbenzene	µg/L	---	200	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Total	M & P Xylenes	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Methyl Tertiary Butyl Ether	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	O-Xylene	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Styrene	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Dissolved	Toluene	µg/L	---	200	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	0.45	< 0.4	0.71	< 0.4	< 0.4	< 0.4
Dissolved	Xylenes	µg/L	---	200	< 0.4	< 0.4	0.53	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4

Notes:

a - Exceeded maximum allowable value specified in CRD Sewer Use Bylaw 2922.

b - Exceeded minimum allowable value specified in CRD Sewer Use Bylaw 2922.

** - Exceedances are due to compromised/expired preservatives, and results are not representative*

SS - Single Sample

NS - Not Sampled

B9. Monthly Leachate Quality – South Purge Wells

Appendix B-9. Leachate Quality - South Purge Wells - 2021-2022

State	Parameter	Units	Sewer Use Criteria		South Purge Wells SS 21-Apr-2021	South Purge Wells SS 26-May-2021	South Purge Wells SS 14-Jun-2021	South Purge Wells SS 28-Jul-2021	South Purge Wells SS 5-Aug-2021	South Purge Wells SS 1-Sep-2021	South Purge Wells SS 28-Oct-2021	South Purge Wells SS 29-Nov-2021	South Purge Wells SS 8-Dec-2021	South Purge Wells SS 27-Jan-2022	South Purge Wells SS 25-Feb-2022	South Purge Wells SS 10-Mar-2022
			min	max												
CONVENTIONALS																
Total	Alkalinity - Total - Ph 4.5	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	BOD	mg/L	---	500	4.3	9.1	180	8.7	6.3	6.5	8.1	3.8	3	4.1	4	3.3
Total	CBOD	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Chloride	mg/L	---	1500	130	150	1200	170	170	170	170	97	95	91	50	72
Total	COD	mg/L	---	1000	75	90	1480 a	126	110	95	409	366	362	398	4890 a*	55
Total	Conductivity	µS/cm	---	---	1496	1221	13591	1552	1936	1602	1655	1100	986	1133	721	1000
Total	Cyanide SAD	mg/L	---	1	0.00181	0.0024	0.029	0.0019	0.00248	0.00225	0.00371	0.00216	0.00136	0.00084	< 0.0005	0.00069
Total	Cyanide WAD	mg/L	---	1	0.00057	< 0.0005	< 0.013	< 0.0005	0.00145	0.00078	0.00156	0.0006	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Total	Dissolved Oxygen	mg/L	---	---	3.54	3.56	0.8	1.92	1.54	3.47	4.93	5.61	4.48	4.21	3.97	4.39
Total	Fecal Coliforms	CFU/100 mL	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	N - NH3 (As N)	mg/L	---	---	55	63	1400	69	60	63	61	55	1.9	37	22	29
Total	N - NO2 (As N)	mg/L	---	---	< 0.005	< 0.005	< 0.5	< 0.005	< 0.05	0.0091	0.0146	0.0058	0.0055	< 0.005	< 0.005	< 0.05
Total	N - NO3 (As N)	mg/L	---	---	< 0.02	< 0.02	< 2	< 0.02	< 0.2	0.026	0.05	0.029	0.026	< 0.02	< 0.02	< 0.2
Total	N - NO3 + NO2 (As N)	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	N - Tkn (As N)	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	N - Total (As N)	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Oil & Grease, Mineral	mg/L	---	15	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Total	Oil & grease, total	mg/L	---	100	< 1	< 1	2.2	< 1	< 1	< 1	13	< 1	< 1	< 1	< 1	< 1
Total	ORP	mV	---	---	208	-63	33	-106	-80	43	-40	-63.0	-47.0	-69	-75	-102
Total	pH	pH	5.5	11	---	7.41	8.1	7.71	7.7	7.25	7.71	7.17	7.12	7.01	6.91	7.04
Dissolved	Sulphide	mg/L	---	1	---	---	---	---	---	---	---	---	---	---	---	---
Total	Sulphide	mg/L	---	1	0.015	0.0075	0.025	0.018	0.017	< 0.0018	0.0046	0.0063	0.0024	0.0097	0.016	< 0.009
Dissolved	Sulphate	mg/L	---	1500	1.1	< 1	< 100	< 1	< 1	13	7.7	15	12	60	17	11
Total	Temperature	°C	---	---	17.5	18.1	19.6	20.5	21.3	18.8	16	15.8	14.0	14.1	13	14.8
Total	TOC	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Total Phenols	mg/L	---	1	0.005	0.012	1.2 a	< 0.0075	0.0026	0.0028	0.0079	0.002	< 0.0015	< 0.0015	< 0.0015	< 0.0015
Total	TSS	mg/L	---	350	38	22	380 a	24	36	5.2	19	23	30	34	19	49
METALS																
Total	Aluminum	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Antimony	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Arsenic	µg/L	---	400	8.44	8.9	50.2	6.49	7.13	2.68	5.84	6.08	7.23	5.11	8.64	7.88
Total	Barium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Beryllium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Bismuth	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Boron	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Cadmium	µg/L	---	300	< 0.01	< 0.025	0.29	< 0.025	0.035	< 0.01	< 0.01	0.131	0.027	0.0407	0.015	< 0.01
Total	Calcium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Chromium	µg/L	---	4000	0.86	1.07	228	1.3	1.48	1.45	1.09	0.63	0.61	0.69	0.53	0.63
Total	Chromium III	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Chromium Vi	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Cobalt	µg/L	---	5000	2.41	3.12	32	4.27	3.48	4.99	4.5	3.17	3.08	2.33	1.45	1.73
Total	Copper	µg/L	---	1000	< 0.2	< 0.5	12	1.03	< 0.5	0.69	0.58	1.16	0.96	1.67	1.26	0.78
Total	Hardness (As Caco3)	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Iron	µg/L	---	50000	14600	11900	2750	11300	16400	5800	8850	9450	11800	12400	26700	22900
Total	Lead	µg/L	---	1000	0.175	0.12	4.29	< 0.1	0.2	0.493	0.622	1.21	1.34	1.8	2.21	1.59
Total	Lithium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Magnesium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Manganese	µg/L	---	5000	161	149	306	126	144	585	196	311	304	669	573	465
Total	Mercury	µg/L	---	20	< 0.038	< 0.0019	< 0.038	< 0.0019	< 0.038	< 0.0019	< 0.0019	< 0.038	< 0.0019	0.003	< 0.0019	< 0.019
Total	Molybdenum	µg/L	---	5000	16.5	20.4	1.8	20.3	17.4	22.7	16.7	11.9	9.92	6.91	4.9	8
Total	Nickel	µg/L	---	3000	5.98	7.37	92.6	9.06	7.93	14.8	20.9	19.9	18.1	9.32	8.95	7.39
Total	Phosphorus	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Potassium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Selenium	µg/L	---	300	< 0.08	< 0.2	0.84	< 0.2	< 0.2	0.174	0.103	0.101	0.086	0.087	< 0.08	< 0.08
Total	Silicon	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Silver	µg/L	---	500	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02
Total	Sodium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Strontium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Sulphur	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Thallium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Tin	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Titanium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Uranium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Vanadium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Zinc	µg/L	---	3000	3.8	< 5	91.9	< 5	< 5	9.4	53.5	75	65.5	33.7	62.1	29.5
Total	Zirconium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
VOLATILE ORGANICS																
Total	Benzene	µg/L	---	100	0.42	0.5	0.97	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Total	Ethylbenzene	µg/L	---	200	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Total	M & P Xylenes	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Methyl Tertiary Butyl Ether	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	O-Xylene	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Styrene	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Toluene	µg/L	---	200	< 0.4	< 0.4	7.1	< 0.4	0.41	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Total	Xylenes	µg/L	---	200	< 0.4	< 0.4	20	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4

Notes:

a - Exceeded maximum allowable value specified in CRD Sewer Use Bylaw 2922.

b - Exceeded minimum allowable value specified in CRD Sewer Use Bylaw 2922.

** - Exceedances are due to compromised/expired preservatives, and results are not representative*

--- = Not available.

B10. Monthly Leachate Quality – West Face Drainage

Appendix B-10. Monthly Leachate Quality - West Face Drainage 2021-2022

State	Parameter	Units	Sewer Use Criteria		West Face Drainage SS 21-Apr-2021	West Face Drainage SS 31-May-2021	West Face Drainage SS 14-Jun-2021	West Face Drainage SS 28-Jul-2021	West Face Drainage SS 6-Aug-2021	West Face Drainage SS 1-Sep-2021	West Face Drainage SS 29-Oct-2021	West Face Drainage SS 29-Nov-2021	West Face Drainage SS 8-Dec-2021	West Face Drainage SS 26-Jan-2022	West Face Drainage SS 25-Feb-2022	West Face Drainage SS 11-Mar-2021
			min	max												
CONVENTIONALS																
Total	Alkalinity - Total - Ph 4.5	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	BOD	mg/L	---	500	100	210	56	220	240	230	42	62	83	75	77	37
Total	CBOD	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Dissolved	Chloride	mg/L	---	1500	1100	1200	1300	1200	910	1200	520	610	780	650	870	420
Total	COD	mg/L	---	1000	1880 a	2490 a	1620 a	2880 a	2340 a	2400 a	1180 a	1160 a	1350 a	1380 a	1490 a*	728
Total	Conductivity	µS/cm	---	---	13800	6280	9168	16158	16296	16940	10393	8885	11154	9366	11133	6105
Total	Cyanide SAD	mg/L	---	1	0.038	0.049	0.585	0.039	< 0.05	0.041	0.039	0.0233	0.0365	< 0.01	0.011	< 0.01
Total	Cyanide WAD	mg/L	---	1	< 0.013	< 0.025	0.018	< 0.025	< 0.05	< 0.013	< 0.01	< 0.005	0.0095	0.01	< 0.01	< 0.01
Total	Dissolved Oxygen	mg/L	---	---	0.19	3.03	0.47	0.5	0.34	1.51	0.91	0.81	2.44	2.97	0.98	0.1
Total	Fecal Coliforms	CFU/100 mL	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	N - Nh3 (As N)	mg/L	---	---	1200	1500	630	1600	1600	1500	360	540	740	810	540	440
Total	N - No2 (As N)	mg/L	---	---	< 0.5	< 0.5	133	0.555	< 5	0.9	12.3	< 0.5	0.521	< 0.005	< 0.5	0.227
Total	N - No3 (As N)	mg/L	---	---	< 2	< 2	105	< 0.2	< 20	< 2	31.9	2.7	6.73	< 0.02	3.6	12.1
Total	N - No3 + No2 (As N)	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	N - Tkn (As N)	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	N - Total (As N)	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Oil & Grease, Mineral	mg/L	---	15	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Total	Oil & grease, total	mg/L	---	100	3.3	< 1	< 1	< 1	1.8	7.1	< 1	< 1	1.2	< 1	< 1	4.2
Total	ORP	mV	---	---	-110	14	37	-7	-23	53	64	-530	20	-37	59.0	-37.0
Total	pH	pH	5.5	11	---	8.68	8.96	8.15	8.26	7.99	7.95	7.5	7.64	7.57	7.74	7.52
Dissolved	Sulphide	mg/L	---	1	---	---	---	---	---	---	---	---	---	---	---	---
Total	Sulphide	mg/L	---	1	< 0.18	0.2	0.058	< 0.18	< 0.09	< 0.018	0.041	0.068	0.049	0.078	0.087	0.073
Dissolved	Sulphate	mg/L	---	1500	< 100	< 100	< 100	< 100	< 50	350	230	< 100	110	< 100	22	100
Total	Temperature	°C	---	---	22.6	16.8	17.6	24.3	23.6	23	33.5	34.8	35.6	27.5	24.6	25
Total	TOC	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Total Phenols	mg/L	---	1	1.5 a	2.5 a	0.1	0.23	0.27	0.2	0.096	0.077	0.09	0.062	0.074	0.0
Total	TSS	mg/L	---	350	110	31	32	60	1700 a	20	15	16	21	11	15	5.6
METALS																
Total	Aluminum	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Antimony	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Arsenic	µg/L	---	400	58.2	49.3	60.1	61.8	69.6	90.6	28.4	28.7	33.4	24.7	40.4	15.7
Total	Barium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Beryllium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Bismuth	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Boron	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Cadmium	µg/L	---	300	0.37	0.298	0.419	0.363	0.392	0.357	0.267	0.177	0.261	0.143	0.271	0.118
Total	Calcium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Chromium	µg/L	---	4000	278	245	246	295	321	326	109	102	133	131	123	74.1
Total	Chromium III	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Chromium Vi	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Cobalt	µg/L	---	5000	42.7	34.6	57.8	43.1	46	49.2	30.5	25.2	33.2	28.6	35.8	19.9
Total	Copper	µg/L	---	1000	47	3.92	93.1	13.3	15.1	8.9	118	50.8	73.5	33.6	38.1	30.1
Total	Hardness (As Caco3)	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Iron	µg/L	---	50000	3050	2980	3820	3610	3760	3420	1960	2280	2710	3520	3350	1470
Total	Lead	µg/L	---	1000	5.39	5.14	5.29	5.68	5.96	6.26	2.67	2.69	3.45	2.64	3.56	1.52
Total	Lithium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Magnesium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Manganese	µg/L	---	5000	302	322	509	437	440	433	239	234	269	494	400	335
Total	Mercury	µg/L	---	20	< 0.038	0.032	< 0.038	< 0.038	0.039	< 0.038	0.012	< 0.038	< 0.038	< 0.038	< 0.038	< 0.019
Total	Molybdenum	µg/L	---	5000	5.88	1.94	5.98	1.11	3.03	2.45	5.22	1.92	1.77	3.64	1.86	1.97
Total	Nickel	µg/L	---	3000	125	111	150	127	140	149	71.4	72.6	90.3	89.4	106	55.4
Total	Phosphorus	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Potassium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Selenium	µg/L	---	300	1.24	0.92	2.02	1	0.97	1.3	2.02	0.83	0.91	0.86	1.13	0.83
Total	Silicon	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Silver	µg/L	---	500	0.074	< 0.05	0.06	< 0.1	< 0.1	< 0.1	0.084	< 0.05	0.066	< 0.05	< 0.1	< 0.05
Total	Sodium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Strontium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Sulphur	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Thallium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Tin	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Titanium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Uranium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Vanadium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Zinc	µg/L	---	3000	112	97	102	135	140	146	51.2	46.6	88	41.1	85	39.4
Total	Zirconium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
VOLATILE ORGANICS																
Total	Benzene	µg/L	---	100	2.4	1.5	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	1.6	1.4	1.9	2.5	1.2
Total	Ethylbenzene	µg/L	---	200	5.6	2.2	< 0.4	< 0.4	< 0.4	0.41	< 0.4	7.3	5	6.2	11	2.4
Total	M & P Xylenes	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Methyl Tertiary Butyl Ether	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	O-Xylene	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Styrene	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Toluene	µg/L	---	200	14	18	0.45	1.9	1.9	1.2	< 0.4	11	10	9.5	8.6	3.7
Total	Xylenes	µg/L	---	200	33	34	< 0.4	6.7	5.7	4.9	< 0.4	18	16	16	29	9.7

Notes:

a - Exceeded maximum allowable value specified in CRD Sewer Use Bylaw 2922.

b - Exceeded minimum allowable value specified in CRD Sewer Use Bylaw 2922.

** - Exceedances may be due to compromised/expired preservatives, and results may not be representative*

SS - Single Sample

NS - Not Sampled

B11. Monthly Leachate Quality - Cell 3 Pipe Outlet

Appendix B-11. Monthly Leachate Quality - Cell 3 Pipe Outlet 2021-2022

State	Parameter	Units	Sewer Use Criteria		Cell 3 Pipe Outlet SS 21-Apr-2021	Cell 3 Pipe Outlet SS 31-May-2021	Cell 3 Pipe Outlet SS 14-Jun-2021	Cell 3 Pipe Outlet SS 28-Jul-2021	Cell 3 Pipe Outlet SS 6-Aug-2021	Cell 3 Pipe Outlet SS 1-Sep-2021	Cell 3 Pipe Outlet SS 29-Oct-2021	Cell 3 Pipe Outlet SS 29-Nov-2021	Cell 3 Pipe Outlet SS 8-Dec-2021	Cell 3 Pipe Outlet SS 26-Jan-2022	Cell 3 Pipe Outlet SS 25-Feb-2022	Cell 3 Pipe Outlet SS 10-Mar-2022
			min	max												
CONVENTIONALS																
Total	Alkalinity - Total - Ph 4.5	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	BOD	mg/L	---	500	< 30	71	6	100	71	54	48	73	79	16	---	52
Total	CBOD	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Dissolved	Chloride	mg/L	---	1500	1000	730	160	1700 a	1300	1400	680	530	790	240	---	470
Total	COD	mg/L	---	1000	1430 a	1120 a	118	2460 a	2280 a	1860 a	942	1260 a	1360 a	974	---	7520 a*
Total	Conductivity	µS/cm	---	---	---	14586	1974	12978	12885	11757	4711	5650	7254	2884	---	4123
Total	Cyanide SAD	mg/L	---	1	0.156	0.148	0.00238	0.545	0.072	0.709	0.045	0.0182	0.0308	0.0386	---	0.059
Total	Cyanide WAD	mg/L	---	1	0.016	0.031	< 0.0005	< 0.025	0.072	0.034	0.027	< 0.005	0.0032	0.014	---	0.015
Total	Dissolved Oxygen	mg/L	---	---	---	0.18	2.33	1.47	0.91	1.16	2.18	0.06	0.67	4.98	---	0.5
Total	Fecal Coliforms	CFU/100 mL	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	N - NH3 (As N)	mg/L	---	---	650	370	64	880	770	550	600	500	650	250	---	310
Total	N - NO2 (As N)	mg/L	---	---	51.5	73.1	< 0.005	174	228	197	< 0.5	0.78	4.97	0.0787	---	32.4
Total	N - NO3 (As N)	mg/L	---	---	79.4	98	0.04	89	111	74.5	73.3	< 2	5.75	0.588	---	50.8
Total	N - No3 + No2 (As N)	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	N - Tkn (As N)	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	N - Total (As N)	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Oil & Grease, Mineral	mg/L	---	15	< 2	< 2	0	< 2	< 2	< 2	< 2	< 2	< 2	< 2	---	3.6
Total	Oil & grease, total	mg/L	---	100	< 1	< 1	0	< 1	< 1	< 1	1.3	1.6	1.8	1.6	---	16
Total	ORP	mV	---	---	---	-107	-60	32	3	62	41	-120	16	-23	---	-1143
Total	pH	pH	5.5	11	---	7.63	7.57	8.67	8.85	8.52	8.86	8.27	8.37	8.58	---	8.6
Dissolved	Sulphide	mg/L	---	1	---	---	---	---	---	---	---	---	---	---	---	---
Total	Sulphide	mg/L	---	1	< 0.18	0.04	0.014	< 0.18	< 0.09	< 0.018	0.048	0.14	0.11	0.088	---	0.062
Dissolved	Sulphate	mg/L	---	1500	< 100	150	< 1	200	290	160	98	< 100	< 100	< 100	---	120
Total	Temperature	°C	---	---	---	19.7	18.8	24.3	23.1	21.1	20.4	21.3	18.8	15.1	---	14.6
Total	TOC	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Total Phenols	mg/L	---	1	0.084	0.068	0.0084	< 0.038	< 0.15	< 0.03	0.96	0.04	0.023	< 0.015	---	< 0.03
Total	TSS	mg/L	---	350	18	11	26	61	46	22	16	18	21	82	---	15
METALS																
Total	Aluminum	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Antimony	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Arsenic	µg/L	---	400	48.9	31.2	7.54	74.9	82	90.1	31.8	34.1	42.9	17.8	---	33.8
Total	Barium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Beryllium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Bismuth	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Boron	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Cadmium	µg/L	---	300	0.332	0.269	< 0.01	0.631	0.67	0.648	0.177	0.178	0.267	0.151	---	0.291
Total	Calcium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Chromium	µg/L	---	4000	233	145	0.96	321	309	381	91.6	118	185	90.7	---	137
Total	Chromium III	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Chromium Vi	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Cobalt	µg/L	---	5000	47.6	36	3	83.2	81.4	85.3	25	27	38.1	21.2	---	32
Total	Copper	µg/L	---	1000	74.6	63.9	< 0.2	125	116	133	55.9	40.8	60.2	54.3	---	90
Total	Hardness (As Caco3)	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Iron	µg/L	---	50000	3590	2320	9920	5480	5440	5960	1500	3120	3860	6310	---	2770
Total	Lead	µg/L	---	1000	4.99	3.42	0.12	7.27	7.06	7.66	2.07	3.72	5.54	2.4	---	2.79
Total	Lithium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Magnesium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Manganese	µg/L	---	5000	488	310	105	723	740	659	256	486	491	329	---	316
Total	Mercury	µg/L	---	20	< 0.038	0.032	< 0.0019	< 0.038	< 0.038	< 0.038	0.0032	< 0.038	< 0.038	< 0.038	---	0.024
Total	Molybdenum	µg/L	---	5000	5.72	3.16	18.6	7.39	6.73	9.07	1.59	1.62	3.53	2.56	---	3.41
Total	Nickel	µg/L	---	3000	133	99.5	6.62	225	226	226	62.2	68.6	102	46.7	---	70.5
Total	Phosphorus	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Potassium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Selenium	µg/L	---	300	1.99	1.16	0.086	2.8	2.82	3.77	0.643	1.1	1.45	1.16	---	1.65
Total	Silicon	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Silver	µg/L	---	500	0.076	< 0.05	< 0.02	< 0.1	0.12	< 0.1	0.032	< 0.05	0.058	0.106	---	0.053
Total	Sodium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Strontium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Sulphur	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Thallium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Tin	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Titanium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Uranium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Vanadium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Zinc	µg/L	---	3000	90.4	67.2	4.6	143	147	143	37.5	63.3	89.7	36.4	---	60.7
Total	Zirconium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
VOLATILE ORGANICS																
Dissolved	Benzene	µg/L	---	100	< 0.4	0.65	0.5	< 0.4	< 0.4	< 0.4	2.2	< 0.4	< 0.4	1.6	---	< 0.4
Dissolved	Ethylbenzene	µg/L	---	200	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	9.3	0.49	< 0.4	0.48	---	< 0.4
Total	M & P Xylenes	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Methyl Tertiary Butyl Ether	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	O-Xylene	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Styrene	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Dissolved	Toluene	µg/L	---	200	< 0.4	0.52	< 0.4	0.51	0.56	0.53	18	1	< 0.4	1.7	---	< 0.4
Dissolved	Xylenes	µg/L	---	200	< 0.4	0.47	< 0.4	< 0.4	< 0.4	< 0.4	25	1.7	0.5	2.2	---	< 0.4

Notes:

a - Exceeded maximum allowable value specified in CRD Sewer Use Bylaw 2922.

b - Exceeded minimum allowable value specified in CRD Sewer Use Bylaw 2922.

** - Exceedances are due to compromised/expired preservatives, and results are not representative*

SS - Single sample

NS - Not sampled

B12. Monthly Leachate Quality Emerging Contaminant

Appendix B-12. Monthly Leachate Quality - Emerging Contaminant 2021-2022

State	Parameter	Units	Sewer Use Criteria		Hartland Valve Chamber SS 26-May-2021	Hartland Valve Chamber BLF 26-Sep-2021	Hartland Valve Chamber SS 1-Sep-2021	Hartland Valve Chamber BLF 1-Sep-2021	Hartland Valve Chamber BLT 1-Sep-2021	Hartland Valve Chamber SS 28-Oct-2021	Hartland Valve Chamber FR1 29-Nov-2021	Hartland Valve Chamber FR2 29-Nov-2021	Hartland Valve Chamber FRM 29-Nov-2021	Hartland Valve Chamber FR2 24-Feb-2022	Hartland Valve Chamber FRM 24-Feb-2022
			min	max											
EMERGING CONTAMINANTS															
Total	Perfluorobutanesulfonic acid	µg/L	---	---	0.43	< 0.02	0.70	< 0.02	< 0.02	0.54	0.37	0.38	0.375	---	---
Total	Perfluorodecanesulfonic acid (PFDS)	µg/L	---	---	< 0.02	< 0.02	< 0.20	< 0.02	< 0.02	0.59	0.37	0.41	0.39	---	---
Total	Perfluoroheptanesulfonic acid	µg/L	---	---	< 0.02	< 0.02	< 0.20	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	---	---
Total	Perfluorohexanesulfonic acid	µg/L	---	---	0.5	< 0.02	0.75	< 0.02	< 0.02	0.061	0.054	0.056	0.055	---	---
Total	Perfluorononanesulfonic acid	µg/L	---	---	< 0.02	< 0.02	< 0.20	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	---	---
Total	Perfluorooctanesulfonic acid	µg/L	---	---	0.14	< 0.02	0.22	< 0.02	< 0.02	0.26	0.21	0.23	0.22	---	---
Total	Perfluorooctanoic acid (PFOA)	µg/L	---	---	0.52	< 0.02	0.81	< 0.02	< 0.02	1.3	1.1	1.3	1.2	---	---
Total	Perfluoropentanesulfonic acid	µg/L	---	---	< 0.02	< 0.02	< 0.20	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	---	---
Total	PF3A	µg/L	---	---	< 0.02	< 0.02	< 0.20	< 0.02	< 0.02	0.037	0.04	0.044	0.042	---	---
Total	PF4A	µg/L	---	---	< 0.02	< 0.02	< 0.20	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	---	---
Total	PFBoA	µg/L	---	---	0.5	< 0.02	0.68	< 0.02	< 0.02	0.2	0.13	0.15	0.14	---	---
Total	PFDA	µg/L	---	---	0.03	< 0.02	< 0.20	< 0.02	< 0.02	0.74	0.74	0.83	0.785	---	---
Total	PFDoA	µg/L	---	---	< 0.02	< 0.02	< 0.20	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	---	---
Total	PFHpA	µg/L	---	---	0.19	< 0.02	0.30	< 0.02	< 0.02	0.59	0.45	0.51	0.48	---	---
Total	PFHxA	µg/L	---	---	1.2	< 0.02	1.50	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	---	---
Total	PFNA	µg/L	---	---	0.026	< 0.02	< 0.20	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	---	---
Total	PFOSA	µg/L	---	---	< 0.02	< 0.02	< 0.20	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	---	---
Total	PFPeA	µg/L	---	---	0.39	< 0.02	0.66	< 0.02	< 0.02	0.52	0.39	0.42	0.405	---	---
Total	PFUA	µg/L	---	---	< 0.02	< 0.02	< 0.20	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	---	---
Total	1,4-Dioxane	µg/L	---	---			11.00			11.	9.2	7.7	8.45	13.	13.5

Notes:

a *- Exceeded maximum allowable value specified in CRD Sewer Use Bylaw 2922.*

b *- Exceeded minimum allowable value specified in CRD Sewer Use Bylaw 2922.*

Appendix C

Climate Data

- C1. Daily Rainfall Data:
  Hartland Landfill Weather Station
- C2. Monthly Rainfall Data:
  Hartland Landfill Weather Station

C1. Daily Rainfall Data: Hartland Landfill Weather Station

AECOM

Appendix C-1. Daily Rainfall Data: Hartland Landfill Weather Station

Date		Daily Rainfall (mm)																								
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
January	1	2.4	11.6	0	7.6	0	8	5.4	0	11	5	35	0	22.2	22	0	0	3	2	0	0	0	0	0	0	10.5	2.25
January	2	0	0	0	0	0	2.6	32.6	0	0	0.8	64.4	11.2	0	1.3	0.0	0.8	0.0	1.5	0.0	0.0	0.0	0.0	0	0	40.5	0
January	3	0	0.2	0	16.8	4.6	2.6	6.8	5.8	0	1.6	7.8	1.6	0.2	0.0	0.0	5.5	0.0	10.5	4.3	0.0	0.0	0.0	17.75	0	7.5	16
January	4	0	16.2	0	11.2	13	0.2	15	0	0	1.4	9.6	0.4	20.4	40.0	4.3	8.3	5.3	0.0	3.5	0.5	0.0	0.8	74	0	13.75	5.75
January	5	0	20.8	0	0	30.2	0	0	0	0	23.8	57.4	11	2.8	5.8	21.8	22.8	1.8	0.0	31.5	2.0	0.0	4.0	1.5	0	16.5	8.75
January	6	0	20.4	0.4	6.4	0	10.2	0	9.8	3	11.4	2.6	0	21	0.0	23.8	8.5	3.8	0.0	26.0	2.5	0.0	0.0	0.5	0	0.75	0
January	7	0	1	0	1.8	0	44.4	0	16.4	14.2	6	55.8	0	28.6	0	11	1	9	0	0	0	0	14	7.5	0	0.25	33.75
January	8	0	0	0	7.6	0.2	21.8	0	2.2	12.8	1.8	4.2	8.2	2.2	15.0	0.0	1.8	6.0	9.0	0.3	0.0	0.0	6.5	0	0	5	0.75
January	9	0	0	19.6	19.8	0	0	0	2	0	16.4	10.8	0.6	0.2	2.0	0.3	0.5	6.8	7.5	0.3	0.0	0.3	1.5	1.5	0	1.5	1.25
January	10	0	0	21	3	0	0.4	0	1.2	0	42.4	12	36.6	17.2	1.5	0.0	0.3	2.3	5.0	2.3	0.0	0.0	2.5	1.5	23	3.25	0
January	11	0	0	1	1.2	0	0.4	0	1.6	0.6	14.2	0.6	3.4	0.8	27.8	0.0	0.0	0.0	2.5	3.0	0.0	0.0	4.0	1.5	2	23.5	7
January	12	0	0	0.2	4.2	0	7.8	7	0	0	17	0	1.8	0	4	3	0	1	4	1	6	0	5	0	12.5	34	25
January	13	0	17.2	0	0.6	3.2	0	0.4	2.2	0	8.4	0	0	0	2.5	16.3	0.0	0.0	2.3	0.3	12.5	0.0	3.8	0	0	0.75	13.25
January	14	0	20.4	65.6	6	0	n/a	2.2	2.2	0	0	0	12	0	22	14	1	0	0	0	2	0	0	0	0	0	2.25
January	15	0	22.8	0.2	10.8	0	0	0	2	3.6	0	0	0	0	21	15	6	1	0	0	0	0	0	0	3.75	0	0.75
January	16	0	13.4	10.2	6.4	0	0.8	0	0	8.6	36	5.6	0	0	0	11	0	0	0	3	2	1	0	0	0	0.75	0.25
January	17	0	16.4	8.6	2.2	0.4	0.8	0	0	54.4	1.4	0	0	0	1.3	0.3	0.5	0.0	0.0	0.0	12.0	14.5	12.5	0	0	1.5	0
January	18	0	0.2	20.6	0	10.2	1.8	0	5.4	18.4	0	12.4	0.4	0	2	0	0	0	0	21	6	6	4	7.75	1.75	0.25	6.5
January	19	0	0.4	3.2	0	2.6	8.6	0	2.6	15.4	3.6	5.4	2.8	0	0.0	0.0	0.0	0.3	0.3	37.0	0.5	2.3	4.0	5.25	1.5	0	3.75
January	20	0	0	2.8	5.4	0.4	11.6	0.6	0	10	6	0	0	0	0	8	0	0	0	1	0	0	3	4.5	1.75	0	5
January	21	0	0.4	1	10	21.4	10.8	9.4	0	0.4	2.2	2	0	0	0.0	8.8	19.5	0.0	0.0	0.0	7.8	0.5	12.0	0.25	18	0.75	6.5
January	22	0	1	1.6	0	0	4	27.6	0	42.2	0	18.2	0	0	0	0	5	0	0	1	34	0	12	0	21.25	0	0
January	23	0	16	0.4	0.4	0	4.4	10	8.6	0.2	0.2	8.8	0	0	0.0	5.0	4.3	0.0	0.0	8.8	2.5	0.0	23.0	31.5	19.5	0.75	0
January	24	0	6.2	0	0	1.2	22.8	9.4	0.6	0	0	0	0	0	4	10	1	4	0	14	0	0	1	3.5	3.25	13.25	0.25
January	25	0	0.4	0.4	0.8	1	20.4	0.6	0	0	0	0.2	0	0	1	0	20	6	0	4	0	0	4	0.25	3.75	3.5	0
January	26	0	6.6	2	0	0	3	24.4	3.6	0	18.6	0	1	0	0.0	0.0	21.5	0.3	0.0	0.0	0.0	0.0	6.5	0	3	0.5	0
January	27	0	4	7.4	0	0	6.2	6.2	4.4	0	3	0	0.2	6	0	0	0	3	0	0	10	0	6	0	12	2	0
January	28	0	1.2	19.2	0	0	0	0	16.8	0.2	11.2	0	0.4	0	0.0	5.0	0.0	0.0	1.5	0.3	0.5	0.0	3.0	0	8.5	3.25	0.75
January	29	0	0	88.2	0	5.8	0	7.4	13.4	0	33.2	0	8.2	0	0.5	6.0	1.5	0.0	1.3	0.0	1.3	2.0	2.8	0	15.25	0	0
January	30	0	3.2	2.2	0	5.2	16	2.8	18.6	11.4	10.8	0	4.2	0	6.5	0.0	21.8	0.5	21.3	0.0	8.8	0.0	13.0	0	9.5	0	2.25
January	31	0	0	5	1	0	3.6	38	0.4	3.8	1	0	2.8	0	0	0	1	1	2	0	4	0	5	0	6.25	10.25	7.5
Total Monthly Rainfall		***2.4***	***200***	***280.8***	***123.2***	***99.4***	***213.2***	***205.8***	***119.8***	***210.2***	***277.4***	***312.8***	***106.8***	***121.6***	***180.5***	***161.75***	***150.75***	***53.75***	***70.25***	***162.6***	***114.9***	***26.6***	***153.5***	***158.75***	***166.5***	***194.5***	***149.5***
Maximum Daily Rainfall		***2.4***	***22.8***	***88.2***	***19.8***	***30.2***	***44.4***	***38***	***18.6***	***54.4***	***42.4***	***64.4***	***36.6***	***28.6***	***40***	***23.75***	***22.75***	***8.5***	***21.25***	***37***	***34***	***14.5***	***23***	***74***	***23***	***40.5***	***33.75***

Appendix C-1. Daily Rainfall Data: Hartland Landfill Weather Station

Date		Daily Rainfall (mm)																								
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
February	1	0	0	28.8	26.4	0	0.8	0.2	6	0	10.2	0	0	1.4	3.0	0.0	4.8	0.5	0.0	1.0	7.5	0.0	14.50	1.0	24.25	22	0
February	2	0	0	45.4	0.4	9.4	0	0.2	8	0	11	0	0.2	4.6	2	0	5	0	0	3	1	0	5.50	11.3	0.25	7	0
February	3	0	0.4	3.2	0	3.2	0.4	0	1.2	1.6	5.6	1.6	0	0	1.0	2.0	0.0	0.0	0.0	3.5	0.3	0.0	1.50	0.0	0	0	2
February	4	0	0	6.2	0	9.2	0	0	2.2	10.6	32.6	6.6	0.2	0	0.5	9.8	0.0	1.8	0.0	1.0	1.8	14.0	1.3	0.3	13	0.75	3.75
February	5	0	0	0.6	0	4	2.6	0	0	0	0	0	12.8	0	1	0	0	0	0	4	0	3	0.0	0.0	18.5	0.25	2.25
February	6	0	0	17.6	0.4	0.4	11.8	0	6.4	25.4	0	0	14	4.4	0	9	0	10	0	28	0	0	0.8	1.3	17.75	0	0
February	7	0	0	5.4	0.4	0	8.2	0	0	0	0.2	4	13	0	2.8	0.3	0.0	6.8	0.0	17.3	0.0	0.3	0.3	0.3	18.25	0	0
February	8	0	1	11.4	5.4	13.4	0.2	0	0	0	0.4	1	1.8	0	0.5	0.0	0.0	0.0	0.0	10.8	0.0	0.0	0.3	0.0	0.25	0	0
February	9	0	1.6	1.6	1.8	0	0	0	0	0	0	1.4	3.4	0	0	0	6	0	0	5	0	15	0.0	0.0	0	0	1
February	10	0	0.8	2.2	0	0	0.6	0	0	0	0	0.4	5.8	12.2	0	0	15	0	0	11	0	4	0.0	0.0	0	0	0.5
February	11	0	0	0	0	0	4	0	0	0	0	1.2	3.4	1.4	3	1	2	0	17	2	4	1	0.0	0.0	0	0	0
February	12	0	13.8	0	0	0	0	0	0	0.6	0	0.8	0	0	4	23	1	0	7	0	15	0	0.0	0.0	0	0	0
February	13	0	11.8	2.4	0	0	0	0	0	0	5.8	1	0	0	2.0	1.8	4.0	1.0	5.8	5.8	10.5	0.0	1.3	0.0	2.5	0	0
February	14	0	0.2	0	0	0	0	0	1	0	0	14.6	0	0	4	12	1	0	2	4	12	5	1.0	0.0	0.25	1.5	0
February	15	0	0.6	0	0.6	0.6	0	1.2	3.8	0	0	10.8	3.4	0	1	0	0	9	10	0	8	5	1.0	0.0	4.5	11.75	0.5
February	16	0	0	4.8	0.2	10.8	7.8	2.4	2.8	0	0	0.8	0	0	5	7	0	1	18	0	74	0	6.0	10.5	0	11.25	0
February	17	0	0	12.8	0	0.4	0.6	5.4	3	0	0	2.8	0	0	0	0	7	0	3	0	0	0	20.8	0.5	0	0	0
February	18	0	0.6	10.6	0	3.4	0	1.6	8	0	0	1.6	0	0	0	0	9	0	13	0	15	0	0.5	0.0	0	5.25	0
February	19	0	3.2	9.6	0	0	4.8	2.4	0	0	0	22.2	0	0	0	0	28	6	18	0	6	0	0.0	0.0	0	3.25	0
February	20	0	0	0	0	0	0.4	10.2	0	0	0	16	2.2	0	0	0	0	0	11	2	1	0	0.0	0.8	0	4	0
February	21	0	3.2	3.8	1.4	0	65.8	2.4	0	0	0	1.2	0	0	0	1	3	1	3	0	3	0	0.0	0.3	0	19.25	0.5
February	22	0	3	24.4	1.4	4.4	38.2	0.8	0	0	0	0.6	0	2.4	0	0	2	1	0	0	1	0	2.8	0.0	2.5	1.25	5.25
February	23	0	2.6	10.6	4	0	14.4	0.2	0	0	1.2	0	0	1.6	2.3	0.0	0.0	21.3	4.0	0	11	0	3.3	4.5	15.25	5	0
February	24	0	0	54.2	0	0	0	0	0	0	0	5.4	0	1.8	10	0	1	0	0	0	0	0	3.5	5.3	0	0	0
February	25	0	1.8	1.6	0	0	0	0	4.2	0	0	0	0	13.4	1	0	28	2	4	0	0	0	5.0	3.5	0.25	10	1.25
February	26	0	0	0.2	5.8	0	0	0	3.8	0	12	0	0	0	5	0	6	6	16	1	0	0	0.0	0.0	0.25	1	0
February	27	0	1	21.6	16.8	0	0	0	1.8	0	0.2	0	1.2	0	3.0	2.5	0.0	1.3	0.0	15.0	0.3	0.0	0.8	0.0	0	0.75	7.25
February	28	0	13	7.4	1	0	0	2	0	1	0	0	0	0.6	0	4	2	0	0	20	1	4	0.3	0.0	10.25	0.5	31.75
February	29	n/a	n/a	n/a	13.6	n/a	n/a	n/a	0.8	n/a	n/a	n/a	1.6	n/a	n/a	n/a	0	n/a	n/a	n/a	3.25	n/a	n/a	n/a	1	n/a	n/a
Total Monthly Rainfall		***0***	***58.6***	***286.4***	***79.6***	***59.2***	***160.6***	***29***	***53***	***39.2***	***79.2***	***94***	***63***	***43.8***	***50.25***	***72.5***	***122.5***	***67.3***	***130.0***	***133.0***	***176.0***	***51.3***	***70.0***	***39.3***	***129.0***	***104.8***	***56.0***
Maximum Daily Rainfall		***0***	***13.8***	***54.2***	***26.4***	***13.4***	***65.8***	***10.2***	***8***	***25.4***	***32.6***	***22.2***	***14***	***13.4***	***9.75***	***22.5***	***27.5***	***21.25***	***18.25***	***27.75***	***74***	***15***	***20.75***	***11.25***	***24.25***	***22***	***31.75***

Appendix C-1. Daily Rainfall Data: Hartland Landfill Weather Station

Date		Daily Rainfall (mm)																								
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
March	1	0	11.8	9.8	0.4	6.6	0	0	0	6.6	0	0	2.8	0	0	4.25	5.00	18.00	0.00	0.00	3.00	1.75	0.25	0.00	0.75	0.25	23.25
March	2	0	1	3.6	2.6	11.2	0	1.2	0	0.2	0	5.4	1.6	0.2	2	6.5	0.0	3.3	0.0	4.0	22.5	7.0	14.0	0.0	5.75	0	5.75
March	3	0	2	32	6.2	2.2	0	1.4	2.2	0	0	2.4	4.6	0	0	1.75	5.75	6.25	13.00	0.25	5.50	11.75	0.75	0.00	0	0	5
March	4	2.2	0	9	5.8	0	0	0	0.2	0	0	0.2	0.2	0	0	7.25	0.00	0.00	4.00	0.00	7.50	0.00	0.00	0.00	0.75	2.5	0
March	5	0.8	0	0	0	0	0	0.4	11	0	0	1.2	0	0	0	5.5	4.8	0.0	14.0	0.0	0.0	4.0	0.0	0.0	1.25	0	0
March	6	0	0	0	0	0	0	0.4	0	0	2.2	0	0	0	0	0.25	12.25	3.75	2.5	0	0	1.75	0	0	0	0.75	0
March	7	0.2	0	0	0	0	0.2	4.8	43.8	0.6	0.4	2.8	2.2	0	1.5	0	0	6.5	14.75	0	7.75	10.25	0	0	0	2.75	0
March	8	0	2.6	0	0	5.2	2.8	0.8	0	1.6	15.8	8.8	0	1	0	0	0	1.5	0	0	11.75	7.75	5.25	0.25	0	0	0
March	9	8.8	8.2	0	1	2.8	1.2	20.4	0.2	3.4	5.4	1.6	4.4	0	0.25	7	0	0	2.5	0	1.75	11.75	0.25	0	0	0	1
March	10	0	5.8	0.6	0.2	0	3.4	3	0	0	0.8	12	0	0	2.25	15.75	15.5	0	0	0	6.25	0.25	0	0	0.75	0	0
March	11	0	0.4	0	4.6	0	44.8	13.6	0	0	3.8	65.8	0	0	11	2.75	5.5	0.25	2.75	0.25	38.5	7.5	0	0	0	0	1
March	12	0	1.2	2	0.6	0	18	17.4	0	0	0	3.4	0	0	13.25	1	0.75	6.25	0	3	1.5	2.25	0	9.5	0.5	0	1.75
March	13	0	2.8	3.6	1.8	3	16.6	17.6	0	0	0	1.2	0	0	1	1	7.25	2.5	0	0.75	0.25	9	2	1.25	0.25	0	0.25
March	14	0.6	0	7	14.4	0.2	0	6.8	0	0	0.4	3.2	10	0	5.75	2.75	0.75	13.25	3	1	8.5	11.25	0.25	0	0	0.25	0.25
March	15	0	0.6	0.4	0	4.6	1.6	0	0	0	0	6.4	24	0	2.5	19.25	3.5	9.5	6.25	16	2.5	1.75	0	1	0	0	20.5
March	16	0	0	8	3	0.6	15	0	0	4.6	1	6	15	0	1.5	8	19	2.5	22.25	36.25	0	2.5	0	0.25	0	0	4.5
March	17	0	0	0	5.8	0	0	1.2	0	1	0.8	9.8	3.8	2.2	0.25	4	1.75	0	0.75	0	0	13.75	2.75	0	0	0	0.5
March	18	1	0	0	4	5.4	8.6	0.8	6.6	0	0	0	2	0	0	0.25	1.25	0	0	0.75	0	9	0	0	0	0	19.5
March	19	0	0	0.6	5.2	7.2	2.2	3	15.8	11	0	6	4.6	0	0	1.25	0.25	8.5	0.75	0	0	0	0	0	0	1	0.75
March	20	0	0	0	1	0.8	13.4	0	0	4	0	1.4	2.2	0	0	0.5	0	3.25	1.25	17.25	0	0.25	0	0	0	0.5	0.75
March	21	0.2	2.2	4.6	0	0	1.6	8.6	0	0.4	0	0.4	0	0	0.75	0	15	5.75	0	7.25	2.25	2.75	0.5	0	0	8.75	4.75
March	22	0	7	0	7.6	0	0	27.4	0	0	1.4	4.4	0	0	0	4.75	0.25	0	0	13	1.25	0.75	2.5	0	0	0.75	9
March	23	0	8.8	1	0	0	0	6.2	0.2	0	0	9.6	0.8	0	0	0.25	0	0	1	0.5	0	1.5	0	0	0	0	5
March	24	0.8	3.4	0	0	0	0	1	7.8	0	2.6	8.4	0	0	0	0	0	0	0	1.5	4.5	2	0.25	0	1.25	8.25	0.25
March	25	0	1.4	0	0	8.4	0	0.4	2.4	0	0	0	0.2	0	5.25	0.5	0	0	0	0.5	1.5	1.25	0	0	0	0.75	0
March	26	1.6	0.4	15.2	0	5	2.2	6.4	1.6	34.8	1	0	0	0	0.5	1.5	0	0	8	6.75	0	2	3.25	2	0.75	0	0
March	27	7.6	0	0	0.2	5.6	0.6	3.6	0.2	4	0	0	0.6	0	0	0	1.75	0	2.75	0	3.25	1.75	0.25	0.5	5	0	4.5
March	28	0	4	0.4	0	7.6	3.6	0.4	0	4.4	0.6	0	4.6	0	2.75	0	0	0	0.5	1.25	7	20.75	0	0	9.25	14.75	0.75
March	29	0.2	0	5.4	0	1.8	0	0	0	3.8	0	0	0	0.2	40	0	2	0	7	0.25	0	11.75	0.75	0	1.25	0	7
March	30	0	3	6.8	0	0.8	0	0.6	2.2	0	0.4	0.4	0.6	0	1	2	16.5	0	5	11.75	0	0	0	0	12	0	0
March	31	0.6	6.2	0	0	2	0	2.2	2.8	5.6	0	1.4	15	0	0	10.25	10.75	0	0.5	0.25	0	0	0	0	0.25	0	0.5
Total Monthly Rainfall		***24.6***	***72.8***	***110***	***64.4***	***81***	***135.8***	***149.6***	***97***	***86***	***36.6***	***162.2***	***99.2***	***3.6***	***92***	***108***	***130***	***91***	***113***	***123***	***137***	***158***	***33***	***15***	***40***	***41***	***117***
Maximum Daily Rainfall		***8.8***	***11.8***	***32***	***14.4***	***11.2***	***44.8***	***27.4***	***43.8***	***34.8***	***15.8***	***65.8***	***24***	***2.2***	***40***	***19.25***	***19***	***18***	***22.25***	***36.25***	***38.5***	***20.75***	***14***	***9.5***	***12***	***14.75***	***23.25***

Appendix C-1. Daily Rainfall Data: Hartland Landfill Weather Station

Date		Daily Rainfall (mm)																								
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
April	1	9	0	0	0	1.2	0	0	0	7.6	13.4	0.4	0	18.6	0	4.25	2.25	0.00	0.00	0.25	0.00	4.50	0.0	0	4.75	0.00	
April	2	0	0	1.4	0	0	0	0	0	0.6	0	0	0	18.2	16	16	3	0	0	1	0	0	0.0	0.5	0	0	
April	3	0	0	1.2	0	0	0	0.4	0	2.2	5.6	0	0	0	3.5	16.5	0.0	0.0	0.0	1.0	4.8	0.0	0.0	3.5	0.8	0.0	
April	4	0	0	0	0	0	0	4.6	0	0	0	0	5	0	0	0.25	1.00	0.00	0.50	0.00	0.25	4.00	0.0	0	0.00	0.00	
April	5	0	0	0	0	3	0	0	0	9.2	0	0.2	0	0	0	15	0	11	0	0	1	12	19.0	1	0	0	
April	6	0	0	0	3.4	2.4	0	1.8	0	1.6	0	0	0.4	0	0.5	10.75	0.75	2.50	3.50	0.00	0.00	3.00	17.8	2	0.00	0.00	
April	7	0	0	2.2	0	6.4	2	3.8	0	4.6	0	4.6	4.6	0	8	2.75	6.75	3.75	0.00	0.00	0.00	10.50	1.3	0	0.00	0.00	
April	8	0	0.6	0.6	0	0	0	2.6	0	0	3.6	6	1.4	0	5.75	0	0	12	0	0	0	3	12.0	11.5	0	5	
April	9	0	0	0.2	0	0	2.4	1.8	0	0	5.6	2	0	n/a	0.5	0	0	0	12	0	0	0	3.0	3.5	0	0	
April	10	0	1.6	0	0	4	1	0	0	0.4	4.2	1.2	0	0	0	0	0	1	0	0	0	1	0.0	2	0	9	
April	11	0	1	0	0	0	0	0	0	1	0	0	0	0	0	4.5	0.0	14.8	0.0	4.5	0.0	0.0	0.5	8	0.0	0.5	
April	12	0	0.8	0.4	0	1.2	0.2	1	0	0.4	0.2	0	0	17.4	0	0.75	4.50	0.25	0.00	8.50	4.25	20.50	1.0	0.25	0.00	0.00	
April	13	0	0	0	1.6	0.6	11.2	13.6	0	0.6	4.8	1.4	0.2	3.6	0	1.75	2.25	5.50	0.00	0.25	0.00	6.25	0.5	6.75	0.00	0.00	
April	14	0	0	0	0.8	0	32	0.2	0	0	8.6	0.4	10.8	31.4	0	1.25	0.00	6.50	0.00	1.00	2.50	0.00	24.5	0	0.00	0.00	
April	15	0	0	0	0.4	0	9	0.8	2.2	8	0.4	0	0	n/a	0.5	7.5	0.0	0.8	0.0	1.5	0.0	10.0	3.5	0	0.0	0.0	
April	16	0.8	0	0	0	0	3.2	0.8	0	5	0	3.4	0	0	0	1.25	0.00	3.00	4.25	0.00	0.00	0.00	1.3	0	0.00	0.00	
April	17	1.2	0	0	0	12.2	0.6	0.6	0	0.2	2.4	0.8	0	4.4	3.25	0	9	1	7	0	0	1	12.0	0	0	0	
April	18	3.2	0.6	0	0	2.2	0	0.2	0	1.6	0.2	1	6.6	0	0	0	1	0	11	0	0	1	1.0	11.25	0	0	
April	19	2.8	0	4.4	0	0	0	2.8	0	0	0	0	22.6	0	3	0	1	1	0	0	0	0	0.0	0.75	0	0	
April	20	21.8	0	2.4	0	0	0	0	0	0	0.4	0	0	0	11.25	1.25	12.25	6.50	2.00	0.00	0.00	0.50	0.0	0	0.00	0.00	
April	21	0	1	0	0	0	0.2	1.4	0	0	1.2	0	8	0	0.5	1.5	0.3	0.8	1.0	0.0	0.0	0.0	3.8	0	0.0	0.0	
April	22	0	0	4.4	4.4	3	0	0	0	0	0	0.8	0	1	0	0	0	0	3	0	0	3	2.0	3.25	17	0	
April	23	4	0	0	1	3.6	0	1	0	0	0	0	1.4	0	7.25	0	0	0	2	0	1	1	0.0	0	0	0	
April	24	1.6	0.2	0	0	0	0	7.6	0	0.6	0	3.8	0	0	3.75	0	0	0	7	2	0	0	0.0	0	0	0	
April	25	0.8	0	0	0	0	0	0	0	0	0	0.8	0	0	0	2	5	0	11	12	0	0	0.0	0	3	13	
April	26	0.6	0	1.2	0	0	9.4	0	0	0	0	2.6	0	0	0	8.25	3.25	0.00	0.25	0.75	0.00	0.25	0.0	0	4.50	10.00	
April	27	1	0	0	0.4	0	0.6	1.2	2.2	0	0	11.4	3	0	1	0	0	0	1	0	0	5	0.0	0	1	1	
April	28	4.2	0	0	0	2	0	0	0.4	0	0	0	6.4	0	2.25	10.75	0.00	0.00	2.25	2.25	0.00	0.00	0.0	0	1.25	0.00	
April	29	1.8	0	0	0.2	1.4	0	0	0	0	5	0	0	0	0	3.5	0.0	0.8	0.0	0.5	0.0	4.8	6.0	0	0.8	0.0	
April	30	2	0	0	0.2	4.4	0	0	0	0	0	0	0	0	0.75	0	2	1	0	0	0	0	0.0	0	0	0	
Total Monthly Rainfall		***54.8***	***5.8***	***18.4***	***12.4***	***47.6***	***71.8***	***46.2***	***4.8***	***43.6***	***55.6***	***40.8***	***70.4***	***94.6***	***67.75***	***109.75***	***53.5***	***70.5***	***66***	***35.5***	***13.8***	***90.75***	***109.05***	***54.25***	***32.75***	***37.25***	***0***	
Maximum Daily Rainfall		***21.8***	***1.6***	***4.4***	***4.4***	***12.2***	***32***	***13.6***	***2.2***	***9.2***	***13.4***	***11.4***	***22.6***	***31.4***	***16***	***16.5***	***12.25***	***14.75***	***11.75***	***12.00***	***4.80***	***20.50***	***24.50***	***11.50***	***16.75***	***12.75***	***0***	

Appendix C-1. Daily Rainfall Data: Hartland Landfill Weather Station

Date		Daily Rainfall (mm)																								
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
May	1	0.8	0	0.4	2.2	3.6	0	0	0	0	0	0	0	0	0.75	0	4.25	0	0	0	0	2.5	1.5	0	0	3.25	
May	2	0	0	5.2	0	0	0	0	0.2	2	0	2.8	0.4	4	15.75	0	0.75	0	0	0	0	2	0	0	1.75	0	
May	3	0	0	0.2	2	0	0	1.4	1	0	0	2.2	2.8	0	8.25	9.75	0	0	0	0	0.75	2	0	0	2	0	
May	4	0.6	0	2	3	2.2	0	11.4	0.6	0.4	0	0.2	0	3.2	6.75	0	10.75	0	1.75	0	0.25	0	0	0	0	1.5	
May	5	15.8	0	0	2	4	1	4.4	0.6	0	0	0.2	0	8.6	0	0	0	0	15	0	0	0	0	0	0	0	
May	6	3.6	0	0	1.6	1	0	0	0	0	0.8	1	0	11.8	2.75	2	0	0	5	3.5	0	0.25	0	0	0	0	
May	7	0	0	0.4	0	0	0	0	1	0	3.6	0	0	0	0	4.75	0	0	0	0	0	0	0	0	0	0	
May	8	0	0	3.4	1.6	0	0	0	0.2	0.8	0	0	0	0	0	1.5	0	0	0	0	0	0	0	0	0	0.25	
May	9	0	0	1.4	0	0	0	0	0	0.8	0	0	0	0	0	0	0	0	9.5	0	0	0	0	0	0	0	
May	10	0	0	0.4	11	0	0	0	1	0	0	0	0.2	3.6	2.25	0	0	0	0	0	0	0	0.75	0	0	0.5	
May	11	0	0.2	1.4	0.4	0	0	0	0.6	0	0	0	0.2	2.8	0	0.5	0	0	0	0	0	10.25	8.25	0	1.75	0	
May	12	0	0.8	0	0	0	0	0	0	0	0	0	0	0.4	0	5.75	0	2.5	0	0	0	1.25	0	0	7.25	0	
May	13	0	0	0.4	0	0	1	0	0	0.2	0	0	5.2	10.2	0	0	0	5.5	0	0	0	6.75	0	0	5.75	0	
May	14	0	3.6	0.2	0	6	0.2	1.4	0	0.2	0	0	0.2	9	0	0	0	3.25	0	0	0	0	0	4.75	0	0	
May	15	0	1	0	0	1	0	0.2	0	0.8	0	0	0	0	0	9.75	0	0	0	0.5	0	8.25	0	1.75	0	0	
May	16	0	0	0.2	0	5.2	0	0	0	0.2	0	0	0	0	0	20.75	0	1.75	0	0	0	2.75	0	0	10	0	
May	17	0	0	9.4	0	0	6.2	0	0	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.75	0	
May	18	0	0	1.8	0	0	0	0	0	0.4	0	0	0	7.8	4.5	0	0	3	0	0	0	0	0	0	0	3.5	
May	19	0	0	0	7.2	0	0	2.4	0	1.6	0	1.6	1.8	0	1.5	0	0	1	0	0	0	0	0	0	0	0	
May	20	0	0	0	0	0	1.8	0.6	0	0	0	10.4	0.2	0	7.25	0	0	0	0	0	0.75	0	0	9.75	0	0	
May	21	3	0.6	0	4.4	0	0.4	0.4	0	0.4	2.6	0	4.6	n/a	0	0	0.5	4.75	0	0	0	0	0	1.25	8	0	
May	22	1	0	0	0	0	0	2	9.4	0.4	17.4	0	0	0	1	1.5	5.75	6.75	0	0	0	0	0	0	0	0	
May	23	3.6	0	0	0	0	0	1	1.2	0.4	0	0	0	0	0	0.25	0	8	0	0	0.25	0	0	0	0	0	
May	24	0	0.4	0	0	0	0	0	0	0	0.2	0	0	0	0	0	0	1.25	3.25	0	0	0	0	0	0	0	
May	25	0	6.8	0	0	0	2.6	0	1.2	0	3	0	0	0	1.5	0	1.25	0	0	0	0	0	0	13.5	7.75	4.75	
May	26	0	1.8	0	9.6	0	2.4	0	0.6	0	6.2	0	0.2	1.2	7	2.25	0	0.25	2	0	0	0	0	0.25	0	4	
May	27	0.4	22.8	0	7.2	0	0	0.2	9	0	0.4	0	0	0	0	0	0	3.5	0.75	0	0	0	0	0	0	0	
May	28	4.8	2.4	0	0.8	3.2	2.4	0	3.2	0	0	0	0	n/a	6.25	2.5	0	5.25	3	0	9.75	0	0	0	0	4.25	
May	29	6	0	0	0	0	1.4	0	7.6	0	0	0	0	0	0.75	0.5	0.25	1.5	0	0	0	0	0	0	0	0	
May	30	5.2	0	0	6.2	1.2	0	0	1	0	0	0	0	0	3.75	0	0	4.25	0	0	0	5	0	0	2.5	0	
May	31	14	0	0	0.8	0	0	0	0	0.4	0	0	0	0	6.5	0	8.5	1	0	0	0	0.25	0	0	0	0	
Total Monthly Rainfall		***58.8***	***40.4***	***26.8***	***60***	***27.4***	***19.4***	***25.4***	***38.4***	***9.2***	***34.2***	***18.4***	***15.8***	***62.6***	***76.5***	***61.75***	***32***	***53.5***	***40.25***	***4***	***11.75***	***41.25***	***10.5***	***31.25***	***47.5***	***22***	***0***
Maximum Daily Rainfall		***15.8***	***22.8***	***9.4***	***11***	***6***	***6.2***	***11.4***	***9.4***	***2***	***17.4***	***10.4***	***5.2***	***11.8***	***15.75***	***20.75***	***10.75***	***8***	***15***	***3.5***	***9.75***	***10.25***	***8.25***	***13.5***	***10***	***4.75***	***0***

Appendix C-1. Daily Rainfall Data: Hartland Landfill Weather Station

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Date		Daily Rainfall (mm)																								
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
June	1	0.2	0	0.6	0	8.4	0	0	0	0.4	5.4	0	0	0	0	0	1.75	0.5	0	0	7.5	0	0	0	0	0	
June	2	0.4	0	0	0	2.8	0	0	0	0	0.6	0	0.4	0	0	0	5.25	0.25	0	0.25	0.25	0.75	0.25	0	0.75	0	
June	3	8.2	0	0	0	0.8	0	0	0	0	0	1.4	4.4	0	0	1	0	0	0	0.25	0	0	0.25	0	0	0	
June	4	0.4	0	0	0	0	0	0	0	0	0	1.4	0.4	0	0	0	0	0	0	0	0	0	0	0	0.75	0	
June	5	0	0	4	1.6	0	2.4	0	4.8	0	0	0.8	2.8	0	0	0	0	0	0	0	0	0	0	0.25	0	1	
June	6	0	0	0.4	3.6	0.6	0	0	1	0	0	0.8	5.8	0	0	0	0	0	0	0	0	0	0	0.25	3.75	1	
June	7	0.6	0	1.6	0.4	0	0	0	0.2	0	6.2	0	0	0	0	0	0	0	0	0	0	0	0	1.75	0.25	0.5	
June	8	0	0	0.6	0	0	0	0	0	0.4	16.8	0	0	0	0	0	15	0.25	0	0	0	11.25	0	0	0	4	
June	9	0	0	0	0	10	0	0	5	0	0	9	10.2	0	0	0	0.25	0	0	0	0	0	8	0	22.5	0	
June	10	0	10.8	0	2.4	1.4	0	0	0	0	0	0	0.2	0	0	0	0	0	0	0	0	5.5	0.5	0	0.75	1	
June	11	3	0	0	2.6	1.4	0	0	0	0	0	0	0	0	0	0	0	0	0.25	0	0	0	0	0	0	0	
June	12	0.2	0	0	15.8	1.2	0	0	0.4	0	0	0.2	0	0	0	0	0	0	0	0	0	0	0	0	8.75	2.25	
June	13	0	0	0.2	0	0	0	0.6	8.4	0.2	0	0	0	0	0	0	0	12	0	0	0	0	0	0	0.25	1.25	
June	14	0	0	0	0.2	0	0	0	0	0	0	0	0	0	0	0	0	1.5	1	0	3	0	2	0	0	3.75	
June	15	0	1	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	4.25	14	0	0	3.75	0	
June	16	1.2	3.6	2.4	0	0	0	0	0	0.2	0.8	0	0	0	0	1	0	0	0	0	11.75	0	0	0	0.25	11.5	
June	17	13.4	0	0	0	0.4	2.6	0	0	0	0.6	0	0	1.4	0.35	0	1	0	6.25	0	0	0.25	0	0	0	0	
June	18	0	0	0	0	0	0.4	0	0	0	0	0	0	0	0	0	0	1	0	0	0.25	2.25	0	0	0	0	
June	19	0	0	0	0.2	0	0	0	0	0	0	0	0	0	0	2.25	1.75	0.25	0	2.75	0	0	0	0	0.5	0	
June	20	0.4	0	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	3.25	0	0.25	0	0	0	0	1	0	
June	21	11.8	0	1.6	0	0	0	0	0	0.4	0	5.8	0	1.4	0.35	0	0	2.5	0	0	0	0	0	0	0	0	
June	22	0	0	0.2	0	0	0	0	0	0	0	1.4	0	0	0	0	0	0	0	0	8.5	0	0	0	0	0	
June	23	2.2	0	6.2	0	0	0	0	0	0	0	0	0	0	0	0	13	0	0	0	4.75	0	0	0	0	0	
June	24	0	7.8	7.6	0	0	0	0	0	0	0	3.2	0	2.8	0.7	0	4.25	1.25	0.75	0	1.25	0	0	0	0	0	
June	25	0.8	0	0.4	0	0	0	0	0.4	0	0	0	0	0.2	0.05	3	0	2	0	0	0	0	7.75	0	0	0	
June	26	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	
June	27	0.6	0	0	0	0.8	1	0	0	0	0	0	0	1.4	0.35	0	0	1.5	0	0	0	0	0	16.75	1.75	0	
June	28	0	0	7.4	0	0.2	6.6	0	0	0	0	4	0	0	0	0.25	0	3	2	0	0	0	0	0	0.25	0	
June	29	27.4	0	0	0	0	5	0	0	0	0	4.4	0	0	0	0	2.5	0	1.75	0	0	0	0	0	0	0	
June	30	0	0	3.6	0.8	0	0	1.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5	0	0	0	
Total Monthly Rainfall		***73.8***	***23.2***	***37***	***27.6***	***28***	***18***	***2***	***20.2***	***1.6***	***30.4***	***34.4***	***24.2***	***7.2***	***1.8***	***7.5***	***44.75***	***30.25***	***12***	***3.5***	***41.5***	***34***	***19.25***	***19***	***45.25***	***26.25***	***0***
Maximum Daily Rainfall		***27.4***	***10.8***	***7.6***	***15.8***	***10***	***6.6***	***1.4***	***8.4***	***0.4***	***16.8***	***9***	***10.2***	***2.8***	***0.7***	***3***	***15***	***12***	***6.25***	***2.75***	***11.75***	***14***	***8***	***16.75***	***22.5***	***11.5***	***0***

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Date		Daily Rainfall (mm)																								
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
July	1	0	0	0	0	0	0	1.2	0	0	0	0	0	0	0	0	3	0	0	0	0.5	0	3	0	0	0	
July	2	0	0	3.2	0.2	0	0	0	3.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8.25	0	0	
July	3	0	20.6	3.2	1.8	0	0	0	0	0	0	0	2.2	0	0	0.25	5.5	0	0	0	0	0	0	0	7	0	
July	4	0	1.8	0	0	0	0	0	0	0	0	0	0	0	0	0	4.25	0	0	0	0	0	0	0	0	0	
July	5	2.4	0	0	1	0	0	0	0	0	0	0	0.4	0	0	0	0	0	0.25	0	0.25	0	0	0	0	0	
July	6	4.8	0	0	0	0	0	0	3.4	0.4	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	
July	7	0	0	0	0	0	0	0	0	0	0	0	0	1.6	0.4	0	0	0	1	0	3.5	0	0	1.75	0	0	
July	8	23	0	0	0	0	7.4	0	0	0.6	0	0	0	6	1.5	0	0	0	0	0	0.75	0	0	0	0.25	0	
July	9	2.4	0	0	0	0	0	0	21	0	0	0	0	0	0	0	0	0	0	0	11.5	0	0	4	3	0	
July	10	0	0	0	0	0	0	0	0.8	0	1.8	0	0	0	0	0	0	0	0	0	0	0	0.25	5.25	0	0	
July	11	0	0	0	0	0	0	0	2.6	0.2	0	0	0	0	0	0	0	0	0	0	0.25	0	0	0.5	0	0	
July	12	0	0.2	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0.25	0	0	0	0	0	0	
July	13	0	0	0	0	n/a	0	3	0	0	0	0	0	0	0	2.25	0	0	0	0	0	0	0	0	0	0	
July	14	0	1.8	0.6	0	n/a	0	4.2	0	0	0	0	0	0	0	0.25	1.25	0	0	0	0	0	0	0	0	0	
July	15	0	9.2	0	0	n/a	0	0	0	0	0	0	0	0	0	9.75	0	0	0	0	0	0	0	0	0	0	
July	16	0	0	0.8	0	n/a	0	0	0	0	0	0	0	0	0	0.75	3	0	0	0	0	0	0	0	0	0	
July	17	0	0	0.6	0	n/a	0	0	0	0	0	5.6	0	0	0	12.75	0	0	0	0	0	0	0	2.5	0	0	
July	18	0	0	0	0	0	0	0	0	0	0	14.45	0	0	0	0.25	0	0	0	0	0	0	0	0	0	0	
July	19	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
July	20	0	0	0	0	0	0	0.4	0	0	0	3.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
July	21	2.4	0	0	0	0	0	0	0	0	0	9.2	0	0	0	0	4	0	0	0	0	0	0	0	0	0	
July	22	0	0	0	0	0	0	0	0	0	0	7.8	0	0	0	0	0	0	0	0	1.5	0	0	0	0	0	
July	23	0	0	0	0	0	0	0	0	0	0	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
July	24	0	0	0.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.25	0	0	0	0	0	0	0	
July	25	0	0	0	0	0	0	0	0	0	0	0	0	3	0.75	0	0	0	3	7.75	0	0	0	0	0	0	
July	26	0	0	0	0	0	0	0	0	0	0	0	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	
July	27	0	0	0	3.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9.5	0	0	0	0	0	0	
July	28	0	0	0	10.2	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.25	0	0	0	0	0	
July	29	0	0	0.4	0	0	0	0	0	0	0	0	3.8	0	0	0	0	0	0	0	0	0	0	0	0	0	
July	30	0	0	0	0	0	0	0	0	0	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
July	31	0	0.8	0	0	0	0	0	0	0	0	0	0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	
Total Monthly Rainfall		***35***	***34.4***	***9.6***	***16.6***	***10***	***7.4***	***11.8***	***31***	***1.2***	***2***	***41.65***	***7***	***10.6***	***2.65***	***26.25***	***21***	***0***	***6.5***	***17.5***	***18.5***	***0***	***3.25***	***22.25***	***10.25***	***0***	***0***
Maximum Daily Rainfall		***23***	***20.6***	***3.2***	***10.2***	***10***	***7.4***	***4.2***	***21***	***0.6***	***1.8***	***14.45***	***3.8***	***6***	***1.5***	***12.75***	***5.5***	***0***	***3***	***9.5***	***11.5***	***0***	***3***	***8.25***	***7***	***0***	***0***

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Date		Daily Rainfall (mm)																								
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
August	1	0	0	0	0	0	0	0	0	0	0	0	1.6	0	0	0	0	0	0	0	0	0	0	0.5	0	0	
August	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.25	0	0	
August	3	0	0	0.2	0	13.6	0	0	0.4	0	0	0	0	0	0	0	0	2.75	0	0	0	0	0	0	1.25	0	
August	4	0	0	0.2	0	5.4	0	0	0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
August	5	0	0	7.8	0	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
August	6	5.4	0	0	0	2.4	0	0	25.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5.5	0	
August	7	0	0	0	0	0	0	0	0.2	0	0	0	0	0	12.25	0	0	0	0	0	0	0	0	0	2.25	1.25	
August	8	0	0	0	0	0	0	0.6	0	0	0	0	0	0	0.25	0	2	0	0	0	0	0	0	0	0.25	4.75	
August	9	0	0	0	0	0	0	0	0	0	0	0	4.4	2	1.25	0	0.25	0	0	1	0	0	0	0	0	0	
August	10	0	0	0	0	0	0	0	0	0	0.8	0	0	12	0	0	0	0	0	0	0.5	0	0	0.75	0	0	
August	11	0	0	0	0	0	0	0	0	0	0.2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	
August	12	0	0	0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0.25	0	0	0	1.75	0.5	0	0	0	
August	13	0	0	0.2	0	0	0	0	0	0	0	0	0	7.2	0	0	0	0	0	0	0	1.5	0	0	0	0	
August	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10.75	0	0	0	0	0	0	0	
August	15	0	0	8.2	0	0	0	0	0	0	0	1.4	0	0	0	0	0	0	1.75	0	0	0	0	0	0	0	
August	16	0	5.4	3.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.25	0	0	0	0	0	1	0	
August	17	0	0	0	0	0	0.8	0	0	2.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
August	18	0	0.2	0	3.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
August	19	0	0	0	0	0	0	0	0	0	0	12.2	5.8	0	0	0	0	0	0	0	0	0	0	0	0	0	
August	20	0.2	0	0	0	0	0	0	0	0	0	0.8	4.8	0	0	0	0	0	0	0	0	0	0	0	4.75	0	
August	21	5.4	0	0	0	2.2	0	0	11.2	0	0	7.6	0.4	0	0	0	0	0	0	0	0	0	0	4.75	2.5	0	
August	22	0	0	0	0	11.2	0	0	3.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
August	23	0.2	0	0	0	6.4	0	0	0	0	0	0	0	0	0	16.5	0	0	0	0	0	0	0	2.25	0	0	
August	24	0.2	0	0	0	1.8	0	0	30	0	0	0	15	0	0	0	0	0	0	0	0	0	0	0.25	0.25	0	
August	25	3.4	0	0	0	0	0	0	31.6	0	0	0	0.6	0	0	0	0	0	0	0	0	0	0	0	0	0	
August	26	5	0	0	0	0	0	0	0.8	0	0	0	4.6	0	0	0	0	0	0	0	0	0	0	0	0	0	
August	27	7.2	0	0	0	0	0	0	2.6	0	0	0	5.2	0	0.5	0	0	0	0	0	0	0	0	0	0	1.75	
August	28	0	0	0	0	0	0	0	0	0	2.4	0	1.2	0	0	0	0	0	0	0.25	0.5	0	0	0	0	0	
August	29	0	0	3.8	4.8	0	0	0	0	0.4	0	0	0	0	0	0	0	0	0	6.25	0	0	0	0	0	0	
August	30	0	0	0	1.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6.75	0	0	0	0	1	0	
August	31	0	0	0	0	0	0	0	0	0	0	1.2	0	0	12	0	0	0	0	1.25	1.75	0	0	0	0	0	
Total Monthly Rainfall		***27***	***5.6***	***24.4***	***9.6***	***43.2***	***0.8***	***0.6***	***106.2***	***2.8***	***3.4***	***23.2***	***43.6***	***22.2***	***26.25***	***16.5***	***2.25***	***3***	***12.75***	***15.5***	***2.75***	***3.25***	***0.5***	***12.75***	***18.75***	***7.75***	***0***
Maximum Daily Rainfall		***27***	***5.4***	***8.2***	***4.8***	***13.6***	***0.8***	***0.6***	***31.6***	***2.4***	***2.4***	***12.2***	***15***	***12***	***12.25***	***16.5***	***2***	***2.75***	***10.75***	***6.75***	***1.75***	***1.75***	***0.5***	***4.75***	***5.5***	***4.75***	***0***

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		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
September	1	0	0	0	0	5.2	0	0	2	0	0	0	0	0	0	0	0	0	0	8.5	3.5	0	0	0	0	0.25	
September	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	11.25	0	0	0	0	0	
September	3	0	0	0	0	1.6	0	0	0	0	0	5.6	0	1.6	0	0	0	0	19	12.25	0	0	0	0	0	0	
September	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8.5	0	0	0	0	0	0	
September	5	0.4	0	2	0.2	0	0	0	0	0	0	0	0	1.4	0	0	0	0	0	0	2.5	0	0	0	0	5.25	
September	6	0	0	0.4	0	0	0	1.2	0	0	0	0	0	13.8	10.25	0	0	0	0	4.5	2	0	0	0	0	0.25	
September	7	0	0	0	0.4	0	0	7.6	0	0	0	0	0	5.4	7	0	0	0	0	15.25	2.5	0	0	0	0	0	
September	8	0	1.2	0	6	0	0	0	2.2	0	0	0	0	0	2.5	0	0	0	0	0	0	0.5	6	0	0	0	
September	9	0	0	0	0	0	0	0	0	0	11.6	0	0	12.2	0.25	0	0	0	0	0	0	7.75	1.5	1	0	0.75	
September	10	0	0	0	0	0	0	1.6	0	0	0	0	0	0	0.25	0	0.5	0	1	0	0	0	8	0	0	0	
September	11	0	0	0	0	0	0	0.8	21.4	0	0	0	0	0	1.25	0	0	0	0	0	0	0	0	0	0	0	
September	12	0.2	0	0	0	0	0	0	0.2	0	0	0	0	0	14.25	0	0	3.75	0	0	0	0	2.5	2.5	0	6.75	
September	13	0	0	0	0	0	0	0	11.4	0	0.6	0	0	0	8	0	0	0	0	0	0	0	0.5	0	0	0.5	
September	14	6.4	0	0	0	0	0	0.8	0.8	0	0.6	0	0	0	0.25	0	0	0	0	0	0	0	0	8.25	4.75	0	
September	15	3	0	0	0	0	0	0	17.2	0	0.2	0	0	0	1.25	0	0	0	0	3	0	0	0	13.5	2	3.5	
September	16	9.6	0	0	0	0	0	10	2.2	0	0	5.2	0	5.4	2.75	0	0	3	0	0	0	0	4.5	0.75	0.25	0	
September	17	9.6	0	0	0	0	0	0	6.8	0	3.2	0	0	0	13.25	0	0	0	0	1.25	13.25	1	4	20.75	0	0	
September	18	5.4	0.2	0	0	0	n/a	8	5.8	0	4.4	2.4	0	0	18	0.25	0	0	0.25	1.25	0	1.25	0	1.25	0	43.5	
September	19	0	0	0	0	0	n/a	4.6	7.6	0	1.2	0	0	6.2	10.75	2.25	0	0	0.75	0.25	5	2.75	0	0.5	0	8.5	
September	20	0	0	0	3.2	0	n/a	0	0	0	10	1	0.2	0	0.5	0	0	0	0	0.75	0	0.25	0	0	0	5.75	
September	21	0	0	0	0	5.8	n/a	0	0	0	0	0.6	0	0	0	0	0	8.75	0	4.5	0	0	5.25	0	2.25	0	
September	22	0	0	0	0	0	n/a	0	1.4	0	0	0.6	0	0	0	1.75	0	0.25	0	0	0	0	6.25	6.25	0	0	
September	23	0	0	0.4	0	0	n/a	0	4.2	0	0	0	0	0	10.5	11.5	0	12.5	0	0	2	0	2	12.5	27.5	0	
September	24	0	0	0	0	0	n/a	0	0	0	0	1	11.6	0	1.5	0	0	3.5	12.5	0	0.5	0	0	0.25	20	0	
September	25	0	2.2	6.2	0	0	n/a	0	0	0	0	0.4	8.4	0	7.75	0	0	9.25	3	4.5	0.25	3.25	0	0	26	0	
September	26	23	0	0.8	0	14.6	n/a	0	0	0	0	0	1.2	0	17.5	3	0	4.75	1.25	2.75	0	0	0	0.5	11.5	0	
September	27	12.4	0	0	0	0	n/a	0	0	0	0	0	0	0	6	24	0	0	12	0.25	0	0	0	12	0	36	
September	28	8.6	0	0	0	0.6	n/a	0	0	0	0	0.6	0	0.8	0	1	0	6.5	0	0	0	0	0	0.25	0	4.25	
September	29	0	0	0	15.6	0.8	n/a	0	0	0.4	0	1	0	8	0	0	0	4.75	0	0	0	1	0	0	0	3	
September	30	11	0	0	1.4	0	n/a	0	0	0	0	8.8	0	0	0	0	0	3.25	1.5	0	0	1.5	0	0	0	5.5	
Total Monthly Rainfall		***89.6***	***3.6***	***9.8***	***26.8***	***28.6***	***0***	***34.6***	***83.2***	***0.4***	***31.8***	***27.2***	***21.4***	***54.8***	***133.75***	***43.75***	***0.5***	***60.25***	***51.25***	***76.5***	***42.75***	***19.25***	***40.5***	***80.25***	***94.25***	***123.75***	***0***
Maximum Daily Rainfall		***23***	***2.2***	***6.2***	***15.6***	***14.6***	***0***	***10***	***21.4***	***0.4***	***11.6***	***8.8***	***11.6***	***13.8***	***18***	***24***	***0.5***	***12.5***	***19***	***15.25***	***13.25***	***7.75***	***8***	***20.75***	***27.5***	***43.5***	***0***

Appendix C-1. Daily Rainfall Data: Hartland Landfill Weather Station

AECOM

Date		Daily Rainfall (mm)																								
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
October	1	3	0	0	0	0	n/a	0	0	0	0	0	0	3.4	0	0	0	9.25	0	0	0.5	0	11	0	0	16.25	
October	2	0.4	9.6	0	0	0	n/a	0	0	0	0	10.2	2	0	0	0	0	7	0	0	0.5	0	3	0.75	0	0	
October	3	12	2.6	0	0	0	n/a	0	0	0	0	1	13.4	0	0	0.5	0	5.75	0	2.25	4.25	0	0.5	0.25	0.25	0	
October	4	15	0.4	0	0	0	n/a	0	0	0	0	1	6.4	0	0	0.25	0	0	0	0	1	0	0	9.25	0.25	0	
October	5	1	0	21	0	0	0	0	4.8	0.4	0	0	1.8	0	0	0	0	0	0	0	0.25	0	0	2.5	0.5	0	
October	6	0	0	0	0	0	0	4.6	5.2	0	1.6	9	1.8	0	0	2	0	0	0	0	8	2	8.75	0	0	1.25	
October	7	8	0	9.2	0	0	0	8.2	3.6	0.4	0	10.4	2.4	0	0	0	0	0	0	0	12.25	0	0	9	0.25	5.5	
October	8	13.6	3.4	23.6	1.4	2	0	7.4	19.2	0	5.2	0	0	0	2.75	0.5	0	1.75	0	11.75	5	0	8.5	0.75	0.25	0	
October	9	0.2	1.8	1	5.2	0	0	7.6	3.4	0	0	0.4	0.6	0	23	0.5	0	0	0	0	0.25	0	5.25	0	16.5	0	
October	10	12.2	0	0	3	16.2	0	2.8	0	0.4	0	0	0	0	3.5	0.5	0	0	0	0	0	0	0.25	0	6.5	5.25	
October	11	0.8	0	0	0	0	0	1.6	0	0	0	0	0	0	2.25	8	0.25	0.25	1.25	12.75	0	0.25	0	0	34.25	4.25	
October	12	2.2	13.2	3.2	0	7	0	24	0	0	0	0	0	0	0.5	15.75	0	0	4.25	0	4.5	3.25	0	5	2	0.25	
October	13	2.4	3	7.8	0	0	0	0	0	0	0	n/a	8.2	0.8	0	2.5	3.5	4	1	6.75	3.25	1.75	0	0	28.5	2	
October	14	6.6	14.2	0	0	7.4	0	0	0	0	5	0	0	3.2	0	0	17.75	0	7	0	2.5	0	0	0	0	0.75	
October	15	2	0	0	0	0	0	8	0	0	10	0	7.6	3.2	0	0	3	0	0	0.25	9.25	0	0	3.25	0	2.5	
October	16	0	0	0	8	0.4	0	100	0	0	1.6	0.2	7	14.2	0	0	14.25	0	3	0	2.75	0.5	0	10.5	0	7.25	
October	17	0.8	7.6	0	24.8	0	0	104.4	27.2	0	0	1.2	0	48.6	0	0	0	0	0.75	0	2.25	13	0	11.25	0.75	8.25	
October	18	0	0	0	5.8	1.2	0	0.6	5.2	0	11.8	22.6	0	0	0	0	0	0	4.5	0	3.75	5.75	0	11.5	21.75	4.5	
October	19	0	0	0	0.2	3.2	1.6	12.8	10.2	0	8.2	27.4	0	0	0	0	19.75	0.5	0.25	0	6.5	9.75	0	2.5	0	0.25	
October	20	0	0	0	19.2	0	1.2	85.4	3.2	0	0	9.8	1.8	0	0	0.25	1	0.5	6.25	0.25	23	2	0	4.5	0	0	
October	21	0	0	0	0	14.4	0	13.6	0	0	0	1.6	0	4.4	0	0	0.75	0	4.5	0.25	11.5	2.5	0	22.25	0	3	
October	22	0.2	0	0	0	10.4	0	1.6	1.6	0	0	5.6	0	1.4	0.25	5.25	0	0.25	2	0.25	0.25	5	0	0	0	3.25	
October	23	0	0	0	0	9.6	0	1.8	0	0	0	0	0	34.8	2.25	16.25	5.75	0.5	25.75	0.25	1.5	0	0	0	17.5	1.5	
October	24	0	0	3.2	0	0.4	0	0	0	0	3	0	0	0	17.75	0	3	0	8.75	0	0	0	0.25	0	0	0.25	
October	25	0	0	0.4	0	21.4	0	0	7.2	3	0.4	0	0	10	22.75	0	3.75	0	1.5	0.5	0.25	0	1	0.5	0	1.25	
October	26	6.8	0	0	0	9.2	0	0	0	0	0.2	0	0	7.6	3.25	0	0	0.25	22.75	14.5	14.25	0	4	0	0.75	15.75	
October	27	0	0	1.2	0	1.6	1.8	0	0	0	0	0	0	0	0	1.75	9.75	0	9.75	2.25	4.75	0	6.25	0	0	4.75	
October	28	4.2	0	20	4.6	0	0	0	1.6	11	0	0	0	8.4	2.75	4.25	21.25	0	5.25	0	0.25	0	22.5	0	0.75	3.5	
October	29	21	0	8	0	0	0	0	0.2	3.2	1	0	0	13.4	0.5	15	1.25	0	14.75	12.5	0.5	0	8.75	0	0	52	
October	30	47.2	0	44.4	0	6.4	0	0	12.6	12	0	0	0.6	14.4	0.5	0	22.5	0	2.75	0.75	6	0	3.5	0	8.25	0	
October	31	7.8	1.8	27.4	1.8	13.6	0	0	0	17.8	0	0	2.4	3	4.25	7	3.75	0.25	11.25	15.75	6	0	6	0	0	0	
Total Monthly Rainfall		***167.4***	***57.6***	***170.4***	***74***	***124.4***	***4.6***	***384.4***	***105.2***	***48.2***	***48***	***100.4***	***56***	***170.8***	***86.25***	***80.25***	***131.25***	***30.25***	***137.25***	***81***	***135***	***45.75***	***89.5***	***93.75***	***139***	***143.5***	***0***	
Maximum Daily Rainfall		***47.2***	***14.2***	***44.4***	***24.8***	***21.4***	***1.8***	***104.4***	***27.2***	***17.8***	***11.8***	***27.4***	***13.4***	***48.6***	***23***	***16.25***	***22.5***	***9.25***	***25.75***	***15.75***	***23***	***13***	***22.5***	***22.25***	***34.25***	***52***	***0***	

Appendix C-1. Daily Rainfall Data: Hartland Landfill Weather Station

Date		Daily Rainfall (mm)																								
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
November	1	0.8	1	0	0	0.6	0	0	15.4	5.6	0	0	0	0	2.75	0	10	1.5	3	48.5	14.5	0	2.25	0	0	0	
November	2	0	19.4	0	0	0	0	0.6	36.4	12.6	16.6	0	1.4	0.8	0.25	0	1.25	4	0	16	14.5	22.25	20	0	0	8.5	
November	3	9.4	0	0.8	0	0	0	0	0	2.2	15.6	4	3.4	0	0	7.75	3	3	1.75	0	0.25	3.5	7	0	27.25	14	
November	4	0	7.4	1.2	9.8	5	0	0	n/a	10.2	21.4	0.2	6.4	0	0	1	5.75	0	21.25	0	2.25	4.75	21.5	0	9.75	15.75	
November	5	0.4	13	0	1.4	0.8	0	0	n/a	21.2	26.2	0	0	19.4	9	0	11	2.25	5	0.25	19	0.5	9.25	0	5	8.5	
November	6	3.2	0	14	7.8	0	4.2	0	n/a	2.2	88	2.6	66	17	2.75	0	0	5.75	8.25	0.5	0.5	0	0	0	0	1.5	
November	7	3.6	0	0	0	0	2.8	0	n/a	0	4.2	2	36.6	18.6	0.25	0	3.75	3.25	10.25	4.25	2.75	0	0	0	0	3.25	
November	8	0	0	2.8	11.8	0	4	0	n/a	2.4	17.6	7.4	2.2	0.8	0	0.75	0.25	11.75	0	15	1.75	3	0	0.75	0	12.75	
November	9	0	0	1.4	4	0	7	0	n/a	0.8	1	2	3	6.4	1	2.75	0	0	0	0.5	8.25	1.75	0	3.25	6	0.25	
November	10	0	0.2	6.2	0	0	4	0	n/a	3.4	18.2	4.2	2.2	8.2	0	0	0	0	3.25	2.5	0	0	4.25	0	0	14.5	
November	11	0	0	18.8	0	0	7.6	0	n/a	27.8	1.2	1.6	12	0.6	3.25	0	0	0	0	6.25	0	3.25	0.25	0	0	4	
November	12	0	22.2	14.6	0	4.8	11.6	0	n/a	0	42.2	22.6	22	0	0	9.5	24.5	0	0	0.5	0.75	2.5	0	0	25	17.25	
November	13	0	53.6	7.8	1.4	4.6	5.6	0	n/a	14	18	1.8	0	6.4	6.25	8.25	4	3.75	0	44.5	7	14.5	0	0	13	2.75	
November	14	0	22.2	4.4	0	25.8	4	0	n/a	0	0.6	2	0.8	0	2.25	0.25	3	0.5	0	23.25	0	20.5	9	0	2.5	34.5	
November	15	0	33.6	2.6	0	18.4	0	2.2	n/a	0	39.8	14.2	0.2	17	1.5	0	0.25	0	0	13	5.25	10.5	18	0	6.75	71.25	
November	16	0	27	10.6	0	6.4	11	22.6	n/a	0.6	0	4.6	0	58.4	0	0	0	3	0	3.75	6.5	2.5	0	0.75	33	81.75	
November	17	2.4	0	3.8	0	0	0	1.2	n/a	0	12.8	5.4	0	15	12.75	11.75	0.5	0	0	7	0	0.25	0.25	0.25	11.75	0	
November	18	0	0	0	0	0	15.2	68	14.4	0	6.8	1	0	16.4	2	6.5	4.5	5	0	49	0	0.25	0	9.75	5.5	0	
November	19	1.2	3.6	1	0	15.2	21.8	27.4	0	0	7.8	1.6	0	42.2	0.75	0	7	24	0	0	0	18.75	0	0.25	3.5	14.5	
November	20	8.4	35.2	9.4	0	6.8	1	0	0	0	14.4	0	3.4	7.2	0	0.25	3.75	0	0	0	1.25	7.75	0	0	1.25	0.75	
November	21	0.2	28.8	4	0	7.6	0	0	0	0	35.2	0	7.2	1	0	0	10.75	0	2.25	0	0	2.75	0	0	0.25	0	
November	22	1.4	19.6	3.4	0	7.2	0	0	1.2	0	1.8	0	0	17.6	0	5.75	14	0	17.75	0	16	7.75	9	0	2.5	0	
November	23	0.8	3.8	4.8	6.6	0.8	0	10.6	5.6	0	10.2	0	0	10.2	0	58	0.25	0	1.5	0	0.5	8.5	6.5	2.25	6	2	
November	24	3.2	28.2	18.4	0	0	0	5	13.4	0.8	1.4	0	0	2.6	0	15	10.25	0	18	8	11	2	8.75	0.5	8.5	2.25	
November	25	2.2	43.2	7.2	9	0.6	0	8	2.8	20.4	14.4	0	0	17.2	4.5	9.75	0.25	0	9.75	0.75	8.25	5.25	0	0	0.25	0	
November	26	0	10.8	0	25.6	2	0	0	1.6	0	32	10.6	0	9.4	14.25	0	0	0	27.75	0	6.5	6.5	3	0	1	43.75	
November	27	8	0.8	0.4	3.8	6.8	0	0.2	0.8	0	17.8	0	0	0	0.25	1.25	0	0	5.75	0	5.75	0.75	36	0	5	1.25	
November	28	16.8	0	0.4	0	33	0	66.8	0	5.2	0.8	10.4	2.2	8.2	0	24.25	0	0	7.25	0	0	2.25	13.5	0	0	34.25	
November	29	1.8	0.6	0	2	8.8	0	2.6	1.2	12	17.4	0.2	6	7	8	0	5.5	0	3.25	0	1.5	0.5	2	0	0	9.25	
November	30	9.4	1.2	2.8	4.4	2.4	0	0	5.6	0.2	2	0	0.6	1	17.75	7	0.5	7.75	0.25	0.25	0.25	7.5	0.25	0	11.5	1	
Total Monthly Rainfall		***73.2***	***375.4***	***140.8***	***87.6***	***157.6***	***99.8***	***215.2***	***98.4***	***141.6***	***485.4***	***98.4***	***175.6***	***308.6***	***89.5***	***169.75***	***124***	***75.5***	***146.25***	***243.75***	***134.25***	***160.25***	***170.75***	***17.75***	***185.25***	***399.5***	***0***
Maximum Daily Rainfall		***16.8***	***53.6***	***18.8***	***25.6***	***33***	***21.8***	***68***	***36.4***	***27.8***	***88***	***22.6***	***66***	***58.4***	***17.75***	***58***	***24.5***	***24***	***27.75***	***49***	***19***	***22.25***	***36***	***9.75***	***33***	***81.75***	***0***

Appendix C-1. Daily Rainfall Data: Hartland Landfill Weather Station

Date		Daily Rainfall (mm)																								
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
December	1	0	5.2	9.4	0	8.2	0	0	0	2.6	0	15.2	1.8	0	0.25	0.25	16	6.75	0.25	0.25	1	17.25	2.5	0	0	8.5	
December	2	0	19.4	16.4	12.4	12.8	0	1.4	0.2	0	0	46.4	0	0	0.25	0	23.25	5.75	0	9.5	0	2.5	1	0	0	0	
December	3	0	3.6	0	0	0	0	9	0.2	0	0	100.4	0	0	0.25	0	10.25	0	0.25	2.25	4.5	0	0	0	0	0	
December	4	0	0	0	0	6	3.2	0	16.6	0	3.6	18	0	0	0	0	13	0	0	7.75	0	0	0	0	0	0	
December	5	0	2.4	4.8	0	4.6	0	6.6	1.4	0	0.4	0.2	0	0	0	0	10.75	0	2	2.25	5	0	0	0	0.75	6.5	
December	6	0	0.4	16.2	0	5.2	0	9.8	12.4	0	0	0	4.2	0	0	0	8.5	0	1	17.5	0.25	0	0	0.25	0	0.25	
December	7	0.4	3	0	0	0	0	10.8	6	0	0.2	0	0.4	0	7	0	11	0	5.25	9.75	0	0	0	0.75	10.5	17.75	
December	8	1	2.8	1	0	12.4	0	0	16.2	0	0.2	0	0	0	4.25	1.75	7	0	0	5.75	0	0	0	0	16	2.75	
December	9	2.6	2.8	2.6	1.6	0	0	0	22	0	0.6	3.4	9.6	0	18.25	0	0	0	19.75	43	0	0.25	0	0	0	0.5	
December	10	1.8	8.4	3.2	0.8	5.4	4.4	9.2	38.4	0	1.4	0.2	3.8	0	0	0	9.25	0	13.75	15.25	8.25	0	8	0	0	0.5	
December	11	0	2.8	2.2	0	2.8	6.2	2	0	0	19.2	0.4	0	0	3.75	0	0.25	0	38.25	8	1.5	0	4.25	0	0.5	25	
December	12	0	11.4	28.8	0	8.4	20	4.4	0	0.2	17	0	22.2	0	5	0	6	0	6	0	0.25	0	36.75	4.75	0.25	27	
December	13	0	33.2	7.2	0	32.4	0.4	3.4	3	0	29.4	2.2	4.2	0	0.5	0	0	2	1.25	19	0	0	22.25	0.5	11.25	12	
December	14	1.6	0	22.6	1.2	15	21.4	18.6	14.4	0	31.8	9	1.6	10.4	3.25	0	7.75	2	0	10.25	0	0	24	0	2	4.25	
December	15	2.8	10	63	4.2	3.6	5	0	0.8	0	6.4	16.2	0	25.75	2	2.25	1.5	2.5	0	0	0	3	2.25	0	8.25	0.5	
December	16	47.6	7	0	49.2	61.8	5.8	8.4	0.6	0	0	0	0	14.25	0	1.25	0.75	4.5	0	0.25	0	4.5	0.75	0	8.5	0	
December	17	24.6	1	9.8	5.6	29.8	0.2	1.6	3.8	0	0	1.8	5.8	9.5	0	0.75	24.75	0	0.25	0	0	11	7	0.25	6.5	1	
December	18	2.2	0	3.8	0	1.6	0.2	0	1.8	0	1.8	6.2	3.4	4	0.75	0.75	10.75	0	2	25.75	1	6.5	13.5	0	16.5	9.25	
December	19	9.8	0	2.4	1.2	6	0.2	0	0	2	10	15.2	0	4.75	0.75	0.5	1.75	0	3.25	15.25	4	3	20	0	20.75	45.25	
December	20	7.8	0	1	3.8	0	0	0.6	0	15.2	6.2	0	0	11	1.5	0	22.75	0	3.75	0	1.25	0.75	5.5	0.5	0	0	
December	21	0.6	6.6	0	1.2	0	0	0.4	0	6.4	15.8	0	27.4	4.75	0	0	7.25	10.75	23.5	9	0	2.25	11.25	0.25	35.5	0	
December	22	0	0	0	4.8	0	0.4	0	0	10.6	1	19.4	13.2	0	0	0	0	2.5	3	9.25	0.25	0.75	0	0	12.5	5.25	
December	23	7	0.6	0	3.2	0	0	0	0	11.8	17.2	12.6	0.4	0	7	0.25	2.5	7.25	0	2.5	1.5	0	10.75	0	0.25	21.75	
December	24	0.2	18.2	0	4.6	0	1.2	4.8	0.8	15.4	23	0.2	21.8	0	5.25	1.25	4.25	6.75	11.75	8.25	0.25	0	12.25	0	0	1.25	
December	25	0	17.6	0	7.6	0	14.6	5.2	9.4	12.8	3.4	0	1.8	0	1	5.75	2	0	0.75	0	0	2.75	0	0	7	4.5	
December	26	7.4	21.8	0	2.4	0	12.2	0	4.4	0.4	4.8	0	7.8	0	8	3.5	22.25	0	0	0	0	0	0.5	0	4.75	3.25	
December	27	4.6	17	0	4.8	0	22.4	3.6	0	6.2	0	4.2	5	0	10.75	5.25	10	0	1.5	1	1	0.25	5.5	0	6.5	0	
December	28	10.6	15.4	0	0	2	1	1.8	0	13.8	0	7.6	0.6	0.25	0.5	30.75	0.75	2.5	6.25	12.25	0.25	19	1	0	0	0	
December	29	0.2	46.4	0.2	0	0	0	0	5.6	0.2	0.6	4.2	12.6	0	0	19.75	3	0	0.25	0	2.75	2.75	24.25	0	12.5	0	
December	30	0	0	0.2	3	0	4.2	0.2	0.6	5.6	0	1.8	1.6	3.5	0	5.25	3	0	0	0	0	4	19.5	0	29.25	0	
December	31	0	0.8	11.6	3.6	6.4	0	4.6	3.2	16.2	0	0	3	16.25	0	3.75	0	0.25	0	0	0.25	0	0	0	9.75	0	
Total Monthly Rainfall		***132.8***	***257.8***	***206.4***	***115.2***	***224.4***	***123***	***106.4***	***161.8***	***119.4***	***194***	***284.8***	***152.2***	***104.4***	***80.25***	***83***	***240.25***	***53.5***	***144***	***234***	***33.25***	***80.5***	***232.75***	***7.25***	***219.75***	***197***	***0***
Maximum Daily Rainfall		***47.6***	***46.4***	***63***	***49.2***	***61.8***	***22.4***	***18.6***	***38.4***	***16.2***	***31.8***	***100.4***	***27.4***	***25.75***	***18.25***	***30.75***	***24.75***	***10.75***	***38.25***	***43***	***8.25***	***19***	***36.75***	***4.75***	***35.5***	***45.25***	***0***

C2. Monthly Rainfall Data: Hartland Landfill Weather Station

AECOM

Appendix C-2. Monthly Rainfall Data: Hartland Landfill Weather Station

Month	Monthly Rainfall (mm)																					
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Avg
January	213.2	205.8	119.8	210.2	277.4	312.4	106.8	121.6	180.5	161.8	150.75	53.75	70.25	160.8	114.5	26	153.5	158.8	166.5	194.5	149.5	154.4
February	160.6	29	53	39.2	79.2	94	63	43.8	50.25	72.5	122.5	67.3	130	133	172.8	50	70	39.3	129.0	104.8	56.0	86.3
March	135.8	149.6	97	86	36.6	162.2	71.4	99.2	92	108	129.5	91	113	123	137	158	132	15.0	40.0	41.3	117.0	95.6
April	71.8	46.2	4.8	43.6	55.6	40.8	70.4	94.6	67.75	109.75	53.5	70.5	66	35	14	90.75	108	54.3	32.8	37.3		52.3
May	19.4	25.4	38.4	9.2	34.2	18.4	15.8	62.6	76.5	61.75	32	53.5	40.25	4	11.8	41.25	10.5	31.3	47.5	22.0		34.8
June	18	2	20.2	1.6	30.4	34.4	24.2	7.2	1.8	7.5	44.75	30.25	12	3.5	41.5	34	19.3	19.0	45.3	26.3		24.5
July	7.4	11.8	31	1.2	2	41.7	7	10.6	2.65	26.25	21	0	6.5	17.5	18.5	0	3.3	22.3	10.3	0.0		13.9
August	0.8	0.6	106.2	2.8	3.4	23.2	43.6	22.2	26.25	16.5	2.25	3	12.75	15.5	2.8	3.25	0.5	12.8	18.8	7.8		17.4
September	0	34.6	83.2	0.4	31.8	27.2	21.4	54.8	133.75	43.75	0.5	60.25	51.25	76.5	42.8	19.25	40.5	80.3	94.3	123.8		47.1
October	4.6	384.4	105.2	48.2	48	100.4	56	170.8	86.25	80.25	131.25	30.25	137.25	81	135	45.75	89.5	93.8	139.0	143.5		108.2
November	99.8	215.2	98.4	141.6	485	98.4	175.6	308.6	89.5	169.75	124	75.5	146.25	243.8	134.3	160.25	170.8	17.8	185.3	399.5		175.0
December	123	106.4	161.8	119.4	194	284.8	152.2	104.4	80.25	83	240.25	53.5	144	234	33.3	80.5	232.8	7.3	219.8	197.0		151.5
Total Yearly Rainfall	***854***	***1211***	***919***	***703***	***1278***	***1238***	***807***	***1100***	***887***	***941***	***1052***	***589***	***929***	***1127***	***858***	***709***	***1031***	***552***	***1128***	***1298***		***961***

Note:

No weather data was collected from Nov 4 - 17, 2004

Weather data collected in 2009 is unreliable due to equipment failure

Appendix D

Leachate Pipeline Flow Data

Appendix D. Leachate Pipeline Flow Data

Hartland Leachate System Monthly Flow Data					
	Days Without Flow	*Maximum Daily Flow in M^3*	*Minimum Daily Flow in M^3*	*Average Daily Flow in M^3*	*Monthly Total Flow in M^3*
Jan-1997	13	2148	0	2148	40816
Feb-1997	0	2700	732	2226	62334
Mar-1997	0	2759	2412	2696	83557
Apr-1997	0	2655	214	2545	78899
May-1997	4	2654	0	956	29561
Jun-1997	11	1563	0	546	17503
Jul-1997	17	2452	0	525	16090
Aug-1997	15	1608	0	386	11606
Sep-1997	21	2662	0	456	14159
Oct-1997	6	2782	0	1233	36996
Nov-1997	4	2533	0	1437	44565
Dec-1997	2	2408	0	1695	52547
TOTAL	93	2782	0	1404	488633

Hartland Leachate System Monthly Flow Data					
	Days Without Flow	*Maximum Daily Flow in M^3*	*Minimum Daily Flow in M^3*	*Average Daily Flow in M^3*	*Monthly Total Flow in M^3*
Jan-1998	0	2603	879	2187	65977
Feb-1998	3	2603	0	1624	43531
Mar-1998	3	2419	0	n/a	35275
Apr-1998	10	1542	0	542	16675
May-1998	13	1890	0	423	12574
Jun-1998	17	1241	0	239	7239
Jul-1998	21	1919	0	240	7645
Aug-1998	31	0	0	0	0
Sep-1998	27	1020	0	58	1821
Oct-1998	19	2379	0	511	14962
Nov-1998	7	2462	0	1538	45248
Dec-1998	0	2619	n/a	n/a	76518
TOTAL	151	2619	0	736	327465

Hartland Leachate System Monthly Flow Data					
	Days Without Flow	*Maximum Daily Flow in M^3*	*Minimum Daily Flow in M^3*	*Average Daily Flow in M^3*	*Monthly Total Flow in M^3*
Jan-1999	0	n/a	n/a	n/a	69000
Feb-1999	0	2970	1966	2681	74930
Mar-1999	0	2970	2539	2875	92028
Apr-1999	5	2894	0	1812	57986
May-1999	11	2889	0	660	20656
Jun-1999	18	1215	0	257	7480
Jul-1999	18	2772	0	365	11687
Aug-1999	30	n/a	n/a	n/a	1000
Sep-1999	4	1193	0	148	4597
Oct-1999	19	1473	0	163	4719
Nov-1999	4	2840	0	1497	43972
Dec-1999	4	3480		n/a	67907
TOTAL	113	3480	0	1162	455962

Appendix D. Leachate Pipeline Flow Data

Hartland Leachate System Monthly Flow Data					
	Days Without Flow	*Maximum Daily Flow in M^3*	*Minimum Daily Flow in M^3*	*Average Daily Flow in M^3*	*Monthly Total Flow in M^3*
Jan-2000	3	2791	0	n/a	55088
Feb-2000	7	2235	0	n/a	29318
Mar-2000	7	2211	0	n/a	37258
Apr-2000	8	1737	0	n/a	21289
May-2000	19	2772	0	501	15547
Jun-2000	19	2685	0	396	11902
Jul-2000	22	1086	0	155	4831
Aug-2000	26	907	0	116	3619
Sep-2000	21	2640	0	354	10623
Oct-2000	n/a	n/a	n/a	n/a	8572
Nov-2000	n/a	n/a	n/a	n/a	11737
Dec-2000	12	2926	0	943	29235
TOTAL	144	2926	0	411	239019

Hartland Leachate System Monthly Flow Data					
	Days Without Flow	*Maximum Daily Flow in M^3*	*Minimum Daily Flow in M^3*	*Average Daily Flow in M^3*	*Monthly Total Flow in M^3*
Jan-2001					38089
Feb-2001					30154
Mar-2001					24565
Apr-2001	15	2622	0	646	18746
May-2001	16	1647	0	400	12407
Jun-2001	22	2026	0	295	8862
Jul-2001	22	1521	0	244	7576
Aug-2001	24	2873	0	291	9047
Sep-2001	23	1633	0	157	4723
Oct-2001	15	2631	0	552	17112
Nov-2001	7	2899	0	993	29819
Dec-2001	0	3397	58	2241	69492
TOTAL	144	3397	0	647	270592

Hartland Leachate System Monthly Flow Data					
	Days Without Flow	*Maximum Daily Flow in M^3*	*Minimum Daily Flow in M^3*	*Average Daily Flow in M^3*	*Monthly Total Flow in M^3*
Jan-2002	1	2892	0	1946	60342
Feb-2002	1	3395	0	1946	54497
Mar-2002	2	3412	0	2200	68224
Apr-2002	6	2444	0	1022	29651
May-2002	13	2118	0	578	17928
Jun-2002	16	1683	0	381	11435
Jul-2002	20	2330	0	330	10231
Aug-2002	23	1521	0	253	7848
Sep-2002	28	1154	0	72	2160
Oct-2002	26	1356	0	143	4450
Nov-2002	14	2477	0	618	18555
Dec-2002	9	2896	0	987	30615
TOTAL	159	3412	0	873	315936

Appendix D. Leachate Pipeline Flow Data

Hartland Leachate System Monthly Flow Data					
	Days Without Flow	*Maximum Daily Flow in M^3*	*Minimum Daily Flow in M^3*	*Average Daily Flow in M^3*	*Monthly Total Flow in M^3*
Jan-2003	5	4880	0	1569	48664
Feb-2003	4	2819	0	1354	37921
Mar-2003	3	2849	0	1533	47546
Apr-2003	6	2185	0	846	24562
May-2003	18	1892	0	514	15962
Jun-2003	15	1397	0	340	10224
Jul-2003	20	1126	0	282	8768
Aug-2003	21	1140	0	214	6658
Sep-2003	23	1147	0	222	6671
Oct-2003	15	3869	0	1621	50260
Nov-2003	4	3681	0	2546	76397
Dec-2003	0	3587	96	2218	68773
TOTAL	134	4880	0	1105	402406

Hartland Leachate System Monthly Flow Data					
	Days Without Flow	*Maximum Daily Flow in M^3*	*Minimum Daily Flow in M^3*	*Average Daily Flow in M^3*	*Monthly Total Flow in M^3*
Jan-2004	0	2859	99	1597	49509
Feb-2004	0	2833	2	1536	44551
Mar-2004	2	2792	0	1170	36288
Apr-2004	22	1675	0	319	9272
May-2004	31	0	0	0	0
Jun-2004	13	3565	0	1104	33135
Jul-2004	30	63	0	2	63
Aug-2004	23	3007	0	601	18636
Sep-2004	24	2998	0	454	13640
Oct-2004	14	3668	0	1138	35284
Nov-2004	2	2889	0	1631	48938
Dec-2004	4	3659	0	2191	67947
TOTAL	165	3668	0	979	357263

Hartland Leachate System Monthly Flow Data					
	Days Without Flow	*Maximum Daily Flow in M^3*	*Minimum Daily Flow in M^3*	*Average Daily Flow in M^3*	*Monthly Total Flow in M^3*
Jan-2005	7	3671	0	2247	69680
Feb-2005	2	3662	0	2571	72002
Mar-2005	11	2484	0	824	25551
Apr-2005	4	2800	0	1041	30206
May-2005	18	2840	0	691	21437
Jun-2005	16	1800	0	431	12946
Jul-2005	18	1301	0	274	8512
Aug-2005	22	2771	0	417	12927
Sep-2005	19	1301	0	274	8512
Oct-2005	24	3025	0	432	13393
Nov-2005	5	2999	0	1347	40421
Dec-2005	5	2916	0	1180	36601
TOTAL	151	3671	0	977	352188

Appendix D. Leachate Pipeline Flow Data

Hartland Leachate System Monthly Flow Data					
	Days Without Flow	*Maximum Daily Flow in M^3*	*Minimum Daily Flow in M^3*	*Average Daily Flow in M^3*	*Monthly Total Flow in M^3*
Jan-2006	0	3415	1123	3075	95329
Feb-2006	2	3435	0	2206	61795
Mar-2006	8	2926	0	846	26247
Apr-2006	14	2141	0	558	16762
May-2006	19	2058	0	464	14402
Jun-2006	21	2175	0	359	10795
Jul-2006	28	1996	0	105	3277
Aug-2006	23	1991	0	327	10148
Sep-2006	22	1770	0	255	7654
Oct-2006	23	2043	0	304	9427
Nov-2006	2	3677	0	2872	86167
Dec-2006	0	3563	3130	3425	106180
TOTAL	162	3677	0	1233	448183

Hartland Leachate System Monthly Flow Data					
	Days Without Flow	*Maximum Daily Flow in M^3*	*Minimum Daily Flow in M^3*	*Average Daily Flow in M^3*	*Monthly Total Flow in M^3*
Jan-2007	0	3657	3272	3464	107411
Feb-2007	0	3619	815	2398	67168
Mar-2007	0	3442	38	2130	66034
Apr-2007	6	1929	0	872	26177
May-2007	14	2120	0	572	17740
Jun-2007	18	2127	0	477	14331
Jul-2007	22	2157	0	387	12019
Aug-2007	28	1730	0	92	2859
Sep-2007	29	76	0	2	76
Oct-2007	14	3288	0	945	29316
Nov-2007	11	2306	0	793	23813
Dec-2007	1	3715	0	2549	79041
TOTAL	143	3715	0	1223	445985

Hartland Leachate System Monthly Flow Data					
	Days Without Flow	*Maximum Daily Flow in M^3*	*Minimum Daily Flow in M^3*	*Average Daily Flow in M^3*	*Monthly Total Flow in M^3*
Jan-2008	0	2949	260	1644	50970
Feb-2008	2	2927	0	1322	38343
Mar-2008	0	1874	0	901	27953
Apr-2008	7	1849	0	845	25364
May-2008	18	2946	0	537	16670
Jun-2008	25	2695	0	286	8594
Jul-2008					0
Aug-2008					0
Sep-2008					28892
Oct-2008					29892
Nov-2008					17433
Dec-2008					37620
TOTAL	52	2949	0	923	281731

Appendix D. Leachate Pipeline Flow Data

Hartland Leachate System Monthly Flow Data					
	Days Without Flow	*Maximum Daily Flow in M^3*	*Minimum Daily Flow in M^3*	*Average Daily Flow in M^3*	*Monthly Total Flow in M^3*
Jan-2009	0	3522	799	2400.13	74404
Feb-2009	2	1551	0	866.54	24263
Mar-2009	0	2388	42	1040.23	32247
Apr-2009	5	2838	0	1056.40	31692
May-2009	11	2292	0	760.94	23589
Jun-2009	18	1839	0	426.58	13224
Jul-2009	9	2880	0	804.66	25749
Aug-2009	0	2871	402	942.19	29208
Sep-2009	18	2847	0	313.20	9396
Oct-2009	7	2838	0	814.52	25250
Nov-2009	0	3345	210	2426.10	72783
Dec-2009	0	3246	1125	2169.39	67251
TOTAL	70	3522	0	1168	429056

Hartland Leachate System Monthly Flow Data					
	Days Without Flow	*Maximum Daily Flow in M^3*	*Minimum Daily Flow in M^3*	*Average Daily Flow in M^3*	*Monthly Total Flow in M^3*
Jan-2010	0	3438	1080	2460.58	76278
Feb-2010	0	1824	387	1013.46	28377
Mar-2010	10	1617	0	629.32	19509
Apr-2010	10	2853	0	1280.63	38419
May-2010	11	1989	0	704.32	21834
Jun-2010	16	1776	0	498.70	14961
Jul-2010	17	1815	0	399.87	12396
Aug-2010	18	2481	0	391.84	12147
Sep-2010	13	1752	0	647.50	19425
Oct-2010	7	1719	0	791.61	24540
Nov-2010	1	2034	0	1107.90	33237
Dec-2010	1	3462	0	2673.97	82893
TOTAL	104	3462	0	1050	384016

Hartland Leachate System Monthly Flow Data					
	Days Without Flow	*Maximum Daily Flow in M^3*	*Minimum Daily Flow in M^3*	*Average Daily Flow in M^3*	*Monthly Total Flow in M^3*
Jan-2011	1	3324	0	2521.00	75630
Feb-2011	5	2823	0	1544.10	46323
Mar-2011	2	2832	0	1762.00	52860
Apr-2011	5	2715	0	1429.70	42891
May-2011	7	2847	0	894.68	27735
Jun-2011	13	1563	0	534.80	16044
Jul-2011	15	1428	0	441.19	13677
Aug-2011	13	1434	0	338.06	10818
Sep-2011	8	2604	0	454.94	14103
Oct-2011	20	1932	0	359.61	11148
Nov-2011	8	3288	0	1020.30	30609
Dec-2011	6	2589	0	1011.77	31365
TOTAL	103	3324	0	1026	373203

Appendix D. Leachate Pipeline Flow Data

Hartland Leachate System Monthly Flow Data					
	Days Without Flow	*Maximum Daily Flow in M^3*	*Minimum Daily Flow in M^3*	*Average Daily Flow in M^3*	*Monthly Total Flow in M^3*
Jan-2012	0	2556	156	1693.94	52512
Feb-2012	1	2742	0	1634.28	47394
Mar-2012	1	2472	0	1518.68	47079
Apr-2012	3	2121	0	914.60	27438
May-2012	11	1671	0	563.16	17458
Jun-2012	16	1848	0	449.77	13493
Jul-2012	10	2979	0	606.97	18816
Aug-2012	20	1266	0	205.55	6372
Sep-2012	9	1410	0	460.90	13827
Oct-2012	15	2688	0	641.03	19872
Nov-2012	3	2847	0	1601.70	48051
Dec-2012	0	2610	779	2346.68	72747
TOTAL	89	2979	0	1053	385059

Hartland Leachate System Monthly Flow Data					
	Days Without Flow	*Maximum Daily Flow in M^3*	*Minimum Daily Flow in M^3*	*Average Daily Flow in M^3*	*Monthly Total Flow in M^3*
Jan-2013	0	2526	43	1615.94	50094
Feb-2013	2	1986	0	1017.00	28476
Mar-2013	3	2694	0	1750.26	54258
Apr-2013	5	2136	0	997.30	29919
May-2013	10	1840	0	627.00	19437
Jun-2013	12	2515	0	594.30	17829
Jul-2013	14	1390	0	379.26	11757
Aug-2013	16	1590	0	355.55	11022
Sep-2013	9	2199	0	523.50	15705
Oct-2013	6	2448	0	772.81	23957
Nov-2013	6	2418	0	844.87	25346
Dec-2013	7	1848	0	708.74	21971
TOTAL	90	2694	0	849	309771

Hartland Leachate System Monthly Flow Data					
	Days Without Flow	*Maximum Daily Flow in M^3*	*Minimum Daily Flow in M^3*	*Average Daily Flow in M^3*	*Monthly Total Flow in M^3*
Jan-2014	1	2316	0	1348.52	41804
Feb-2014	2	3366	0	1951.21	54634
Mar-2014	0	3387	150	2252.39	69824
Apr-2014	2	2535	0	1004.27	30128
May-2014	7	2562	0	796.90	24704
Jun-2014	5	1677	0	473.77	14213
Jul-2014	18	2517	0	485.68	15056
Aug-2014	14	911	0	302.55	9379
Sep-2014	16	959	0	305.43	9163
Oct-2014	16	2163	0	447.48	13872
Nov-2014	8	2808	0	1420.00	42601
Dec-2014	0	2589	600	1814.42	56247
TOTAL	89	3387	0	1050	381625

Appendix D. Leachate Pipeline Flow Data

Hartland Leachate System Monthly Flow Data					
	Days Without Flow	*Maximum Daily Flow in M^3*	*Minimum Daily Flow in M^3*	*Average Daily Flow in M^3*	*Monthly Total Flow in M^3*
Jan-2015	0	2472	460	1976.13	61260
Feb-2015	0	2508	312	1750.36	49008
Mar-2015	0	2481	45	1493.71	46305
Apr-2015	1	2763	0	1118.30	33549
May-2015	15	2078	0	519.23	16096
Jun-2015	17	1744	0	449.57	13487
Jul-2015	23	1758	0	267.19	8283
Aug-2015	19	2595	0	376.71	11678
Sep-2015	15	1679	0	454.97	13649
Oct-2015	15	2251	0	460.35	14271
Nov-2015	3	3186	0	2154.30	64629
Dec-2015	0	3350	386	2693.29	83492
TOTAL	108	3350	0	1143	415707

Hartland Leachate System Monthly Flow Data					
	Days Without Flow	*Maximum Daily Flow in M^3*	*Minimum Daily Flow in M^3*	*Average Daily Flow in M^3*	*Monthly Total Flow in M^3*
Jan-2016	1	3240	0	1836.23	56923
Feb-2016	1	3267	0	2639.38	76542
Mar-2016	1	3099	0	1818.87	56385
Apr-2016	8	3096	0	784.40	23532
May-2016	16	3098	0	540.00	16740
Jun-2016	10	1251	0	454.73	13642
Jul-2016	16	1222	0	340.00	10540
Aug-2016	16	1553	0	330.42	10243
Sep-2016	19	1707	0	324.00	9720
Oct-2016	7	2610	0	1328.81	41193
Nov-2016	0	3228	603	2038.40	61152
Dec-2016	0	3378	774	2344.35	72675
TOTAL	95	3378	0	1232	449287

Hartland Leachate System Monthly Flow Data					
	Days Without Flow	*Maximum Daily Flow in M^3*	*Minimum Daily Flow in M^3*	*Average Daily Flow in M^3*	*Monthly Total Flow in M^3*
Jan-2017	1	2436	0	1390.29	43099
Feb-2017	2	3234	0	2049.18	57377
Mar-2017	0	3192	384	2050.16	63555
Apr-2017	0	2328	111	1547.40	46422
May-2017	11	3312	0	758.90	23526
Jun-2017	21	1410	0	291.60	8748
Jul-2017	7	882	0	356.03	11037
Aug-2017	15	2790	0	494.32	15324
Sep-2017	17	3375	0	494.00	14820
Oct-2017	23	2028	0	290.32	9000
Nov-2017	3	3324	0	1850.90	55527
Dec-2017	5	3276	0	1763.90	54681
TOTAL	105	3375	0	1111	403116

Appendix D. Leachate Pipeline Flow Data

Hartland Leachate System Monthly Flow Data					
	Days Without Flow	*Maximum Daily Flow in M^3*	*Minimum Daily Flow in M^3*	*Average Daily Flow in M^3*	*Monthly Total Flow in M^3*
Jan-2018	2	3213	0	2401.16	74436
Feb-2018	1	3438	0	2097.71	58736
Mar-2018	9	27775	0	1048.97	32518
Apr-2018	11	3111	0	1023.00	30690
May-2018	17	2892	0	629.00	19497
Jun-2018	17	2184	0	482.00	14473
Jul-2018	11	1608	0	385.00	11942
Aug-2018	21	1593	0	158.00	4908
Sep-2018	18	1286	0	234.00	7026
Oct-2018	8	1692	0	520.00	16127
Nov-2018	1	2676	0	1157.00	35865
Dec-2018	1	3234	0	2428.00	75255
TOTAL	117	27775	0	1047	381473

Hartland Leachate System Monthly Flow Data					
	Days Without Flow	*Maximum Daily Flow in M^3*	*Minimum Daily Flow in M^3*	*Average Daily Flow in M^3*	*Monthly Total Flow in M^3*
Jan-2019	2	3300	0	2607.00	80823
Feb-2019	3	2787	0	1302.00	36442
Mar-2019	5	2439	0	1013.00	31393
Apr-2019	8	2526	0	769.00	23078
May-2019	11	2172	0	595.00	18437
Jun-2019	21	802	0	152.00	4546
Jul-2019	29	14	0	1.00	19
Aug-2019	25	3320	0	158.00	4888
Sep-2019	12	3298	0	858.00	25725
Oct-2019	14	3010	0	897.00	27803
Nov-2019	7	2114	0	785.00	23560
Dec-2019	2	2196	0	1196.00	37091
TOTAL	139	3320	0	861	313805

Hartland Leachate System Monthly Flow Data					
	Days Without Flow	*Maximum Daily Flow in M^3*	*Minimum Daily Flow in M^3*	*Average Daily Flow in M^3*	*Monthly Total Flow in M^3*
Jan-2020	0	3108	1092	2793.00	86573
Feb-2020	0	2990	2608	2910.00	84399
Mar-2020	3	2892	0	1117.00	34616
Apr-2020	6	2772	0	711.00	21319
May-2020	13	1342	0	483.00	14962
Jun-2020	26	1502	0	126.00	3791
Jul-2020	21	692	0	68.00	2107
Aug-2020	15	2840	0	356.00	11031
Sep-2020	17	4804	0	710.00	21298
Oct-2020	4	1956	0	976.00	30254
Nov-2020	4	2474	0	1749.00	52828
Dec-2020	0	3396	274	1767.00	54774
TOTAL	109	4804	0	1147	417952

Appendix D. Leachate Pipeline Flow Data

Hartland Leachate System Monthly Flow Data					
	Days Without Flow	*Maximum Daily Flow in M^3*	*Minimum Daily Flow in M^3*	*Average Daily Flow in M^3*	*Monthly Total Flow in M^3*
Jan-2021	0	6558	2122	3284.00	101810
Feb-2021	15	18835	0	1722.00	48208
Mar-2021	20	12720	0	1444.00	44771
Apr-2021	29	3446	0	114.00	3446
May-2021	25	32661	0	1297.00	40133
Jun-2021	30	0	0	0.00	0
Jul-2021	21	17081	0	1158.00	37060
Aug-2021	25	2067	0	318.00	9846
Sep-2021	7	6273	0	954.00	28633
Oct-2021	9	3532	0	894.00	27700
Nov-2021	0	6133	1496	3850.00	115487
Dec-2021	0	5258	1377	3079.00	95452
TOTAL	181	32661	0	1510	552546
Hartland Leachate System Monthly Flow Data					
	Days Without Flow	*Maximum Daily Flow in M^3*	*Minimum Daily Flow in M^3*	*Average Daily Flow in M^3*	*Monthly Total Flow in M^3*
Jan-2022	0	6256	1303	3202.00	99263
Feb-2022	2	4019	0	1443.00	40395
Mar-2022	3	6506	0	2118.00	65646
Apr-2022					
May-2022					
Jun-2022					
Jul-2022					
Aug-2022					
Sep-2022					
Oct-2022					
Nov-2022					
Dec-2022					
TOTAL	5	6506	0	2254	205304

Appendix E

Hartland Landfill Site Plan and Sampling Locations

- E1. Hartland Landfill Site Plan
- E2. Groundwater Level Monitoring Locations
- E3. Groundwater Quality Monitoring Locations
- E4. Surface Water Quality Monitoring Locations
- E5. Leachate Quality Monitoring Locations

E1. Hartland Landfill Site Plan

CRD - Facilities Management & Engineering Services - Jun 07, 2021 - Technologist: jpbezeau - Map Document: HartlandSiteFacilitiesPhases2021.mxd

HARTLAND LANDFILL SITE PLAN

Mount Work Regional Park
Juan de Fuca Electoral Area
District of Saanich
Hartland North Site
Compost Access Road
Leachate Pipeline
Hartland Valve Chamber (compliance point)
Northwest Sedimentation Pond (fresh water)
West Face Leachate
Upper Leachate Lagoon
C3PO
Lower Leachate Lagoon
PS
Aggregate Stockpile
Microtunnel
Gas Utilization Facility
Sedimentation Pond (fresh water)
Quarry Access Road
Future Landfill Extent
Phase 2, Cell 1 North Face Closure (2011)
Toutle Leachate Underdrain
Perimeter East Road
Phase 2, Cell 3 (Active)
Phase 1 Closure (1997)
Phase 2, Cell 2 (2016)
Phase 1 Crest Road
South West Progressive Closure (2008)
South Leachate Pump Station
Entrance
Main Access Road
Bin Drop-off
Parking
Hartland Ave
Recycling Area
Mount Work Regional Park

Making a difference...together

Metres
0 50 100 200
Projection: UTM ZONE 10N NAD 83

Important This map is for general information purposes only. The Capital Regional District (**CRD**) makes no representations or warranties regarding the accuracy or completeness of this map or the suitability of the map for any purpose. **This map is not for navigation.** The CRD **will not be liable** for any damage, loss or injury resulting from the use of the map or information on the map and the map may be changed by the CRD at any time.

- Observation Chamber
- Pump Station
- Residual Solids & Centrate Return Line
- Hartland Leachate Line

Contours (5m interval)
- Index
- Index-Depression

- Cell Phases
- Lot Lines
- Regional Park

E2. Groundwater Level Monitoring Locations

HARTLAND LANDFILL
GROUNDWATER LEVEL MONITORING LOCATIONS



Making a difference...together

Metres

0 25 50 100 150

Projection: UTM ZONE 10N NAD 83

Important This map is for general information purposes only. The Capital Regional District (**CRD**) makes no representations or warranties regarding the accuracy or completeness of this map or the suitability of the map for any purpose. **This map is not for navigation.** The CRD **will not be liable** for any damage, loss or injury resulting from the use of the map or information on the map and the map may be changed by the CRD at any time.

Groundwater Level Monitoring Locations

Monitoring Frequency (# times per year)

- 4
- Continuous

Roads

Contours (5m interval)

E3. Groundwater Quality Monitoring Locations

HARTLAND LANDFILL
GROUNDWATER QUALITY MONITORING LOCATIONS



Making a difference...together

Metres

0 25 50 100 150

Projection: UTM ZONE 10N NAD 83

- Groundwater Monitoring Location – Non-Compliance Well
- Groundwater Monitoring Location – Compliance Well
- Roads
- Contours (5m interval)

Important This map is for general information purposes only. The Capital Regional District (**CRD**) makes no representations or warranties regarding the accuracy or completeness of this map or the suitability of the map for any purpose. **This map is not for navigation.** The CRD **will not be liable** for any damage, loss or injury resulting from the use of the map or information on the map and the map may be changed by the CRD at any time.

E4. Surface Water Quality Monitoring Locations

HARTLAND LANDFILL
SURFACE WATER QUALITY MONITORING LOCATIONS



Making a difference...together

Metres

0 50 100 200

Projection: UTM ZONE 10N NAD 83

Surface Water Monitoring Location – Compliance Station

Surface Water Monitoring Location – Non-compliance Station

Road

Important This map is for general information purposes only. The Capital Regional District (**CRD**) makes no representations or warranties regarding the accuracy or completeness of this map or the suitability of the map for any purpose. **This map is not for navigation.** The CRD **will not be liable** for any damage, loss or injury resulting from the use of the map or information on the map and the map may be changed by the CRD at any time.

E5. Leachate Quality Monitoring Locations

CRD - Parks & Environmental Services - Facilities Management & Engineering Services - Apr 12, 2022 - Technologist: jpbezeau - Map Document: HartlandLeachateQuality2022.mxd

HARTLAND LANDFILL
LEACHATE QUALITY MONITORING LOCATIONS



Making a difference...together

Metres

0 25 50 100 150

Projection: UTM ZONE 10N NAD 83

★ Leachate Quality Monitoring Locations

Roads

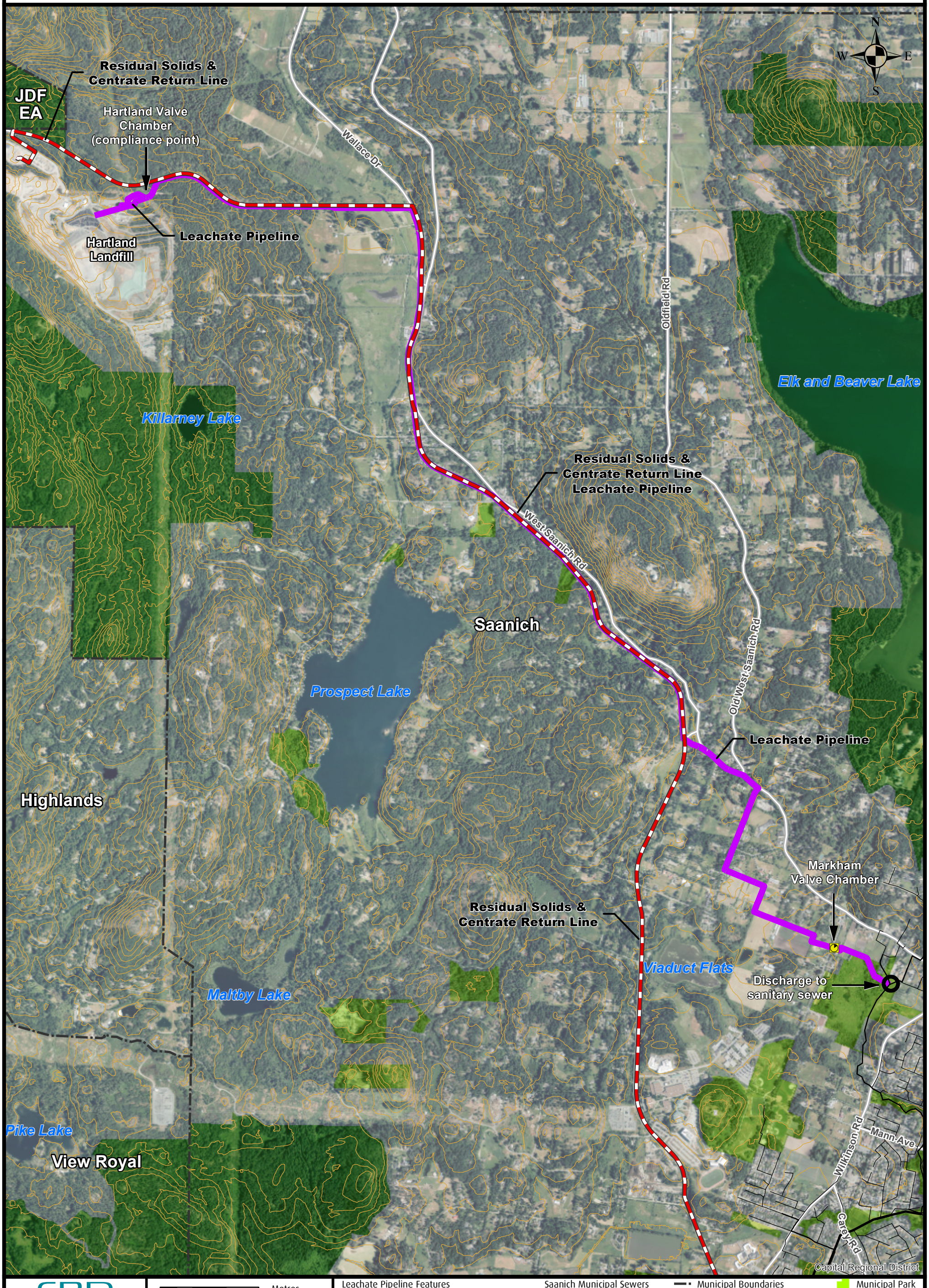
Important This map is for general information purposes only. The Capital Regional District (**CRD**) makes no representations or warranties regarding the accuracy or completeness of this map or the suitability of the map for any purpose. **This map is not for navigation.** The CRD **will not be liable** for any damage, loss or injury resulting from the use of the map or information on the map and the map may be changed by the CRD at any time.

Appendix F

Hartland Landfill Leachate Pipeline Plan

CRD - Facilities Management & Engineering Services - Jun 08, 2021 - Technologist: jpbezeau - Map Document: Hartland_Leachate_Line.mxd

HARTLAND LANDFILL - LEACHATE PIPELINE PLAN



Making a difference...together

Metres

0 100 200 400 600

Projection: UTM ZONE 10N NAD 83

Important This map is for general information purposes only. The Capital Regional District (**CRD**) makes no representations or warranties regarding the accuracy or completeness of this map or the suitability of the map for any purpose. **This map is not for navigation.** The CRD **will not be liable** for any damage, loss or injury resulting from the use of the map or information on the map and the map may be changed by the CRD at any time.

Leachate Pipeline Features
- Metering Chamber
- Observation Chamber
- Pump Station (PS)
- Residual Solids & Centrate Return Line
- Leachate Pipeline

Saanich Municipal Sewers
- 0 - 200 mm
- 201 - 599 mm
- 600 - 899 mm
- > 900 mm

- Municipal Boundaries
- Major Roads

Contours (10m Interval)
- Major Contour
- Major Contour - Depression

- Municipal Park
- Regional Park

Orthophoto flown in 2019

Appendix G

Results of Statistical Analysis

- G1. Groundwater
- G2. Surface Water
- G3. Leachate

G1. Groundwater

Appendix G-1. Results of Statistical Analysis - Groundwater

Station	Time Period	Parameter									
		Conductivity		Ammonia		Chloride		Sulphate		Nitrate	
		Increasing	Decreasing	Increasing	Decreasing	Increasing	Decreasing	Increasing	Decreasing	Increasing	Decreasing
		Y/N	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N
Boundary Compliance Monitoring Wells											
Gw-04-3-1	2017-2022	N	N	N	N	Y	N	Y	N	N	Y
Gw-04-4-1	2017-2022	N	N	N	N	Y	N	N	N	N	N
Gw-17-1-1	2017-2022	N	N	N	N	N	N	N	N	N	N
Gw-17-1-2	2017-2022	N	N	N	N	N	Y	N	N	N	N
Gw-17-1-3	2017-2022	N	N	N	N	Y	N	N	N	N	N
Gw-18-1-1	2017-2022	N	N	Y	N	N	N	Y	N	N	N
Gw-18-2-1	2017-2022	Y	N	N	N	Y	N	Y	N	Y	N
Gw-18-2-2	2017-2022	N	N	N	Y	N	N	Y	N	Y	N
Gw-20-1-1	2017-2022	N	N	N	Y	N	N	N	N	N	N
Gw-20-1-2	2017-2022	N	N	N	Y	N	Y	N	N	N	N
Gw-21-1-1	2017-2022	N	N	N	N	N	N	N	Y	N	N
Gw-21-1-2	2017-2022	N	N	N	N	N	N	N	N	N	N
Gw-21-2-1	2017-2022	Y	N	N	N	N	N	N	N	N	N
Gw-28-1-0	2017-2022	Y	N	N	N	N	N	N	N	Y	N
Gw-29-1-1	2017-2022	N	N	N	N	N	N	Y	N	Y	N
Gw-29-1-2	2017-2022	N	Y	N	N	N	Y	Y	N	Y	N
Gw-30-1-1	2017-2022	N	N	N	N	N	Y	N	N	N	N
Gw-30-1-2	2017-2022	N	N	N	N	N	N	Y	N	N	N
Gw-31-1-1	2017-2022	Y	N	N	N	N	N	Y	N	N	N
Gw-31-1-2	2017-2022	Y	N	N	N	N	N	Y	N	N	N
Gw-39-1-1	2017-2022	N	N	N	N	N	N	N	N	N	N
Gw-39-2-1	2017-2022	N	N	N	N	N	N	N	N	N	N
Gw-41-1-1	2017-2022	N	N	N	N	Y	N	N	Y	N	N
Gw-42-1-1	2017-2022	N	N	N	N	Y	N	Y	N	N	N
Gw-53-1-1	2017-2022	Y	N	N	N	N	Y	Y	N	N	N
Gw-55-1-1	2017-2022	N	N	N	N	N	N	N	N	N	N
Gw-56-1-1	2017-2022	Y	N	N	N	Y	N	N	N	N	N
Gw-57-1-1	2017-2022	Y	N	N	N	N	N	Y	N	N	N
Gw-71-1-1	2017-2022	Y	N	N	Y	Y	N	Y	N	N	N
Gw-71-2-1	2017-2022	Y	N	N	N	Y	N	Y	N	N	N
Gw-71-3-1	2017-2022	N	N	N	N	N	N	Y	N	Y	N
Gw-72-1-1	2017-2022	N	N	N	N	N	N	N	N	N	Y
Gw-72-3-1	2017-2022	N	N	N	N	N	Y	N	N	N	Y
Gw-73-1-1	2017-2022	Y	N	N	Y	N	N	N	N	Y	N
Gw-73-2-1	2017-2022	Y	N	N	Y	N	N	Y	N	Y	N
Gw-73-3-1	2017-2022	N	N	N	N	N	N	Y	N	Y	N

Notes:

NA indicates the analysis is unable to run due to insufficient dataset or over 80% of values were under detection limits

N - No Trend

Green highlights indicate decreasing trends

Red highlights indicate increasing trends

Appendix G-1. Results of Statistical Analysis - Groundwater

Additional Monitoring Wells											
Gw-07-1-0	2017-2022	Y	N	N	N	Y	N	N	N	N	N
Gw-16-1-1	2017-2022	N	N	N	N	N	N	N	N	N	N
Gw-16-1-2	2017-2022	N	N	N	N	N	N	N	Y	N	N
Gw-16-2-1	2017-2022	N	N	Y	N	N	N	N	Y	N	N
Gw-16-2-2	2017-2022	Y	N	N	N	Y	N	N	N	N	N
Gw-19-1-1	2017-2022	N	N	N	N	N	N	N	N	N	N
Gw-19-1-2	2017-2022	N	N	N	N	N	N	N	N	N	N
Gw-19-2-1	2017-2022	Y	N	N	N	Y	N	N	Y	N	N
Gw-19-2-2	2017-2022	N	N	N	N	Y	N	N	Y	N	Y
Gw-25-1-1	2017-2022	Y	N	N	N	N	Y	Y	N	Y	N
Gw-25-1-2	2017-2022	N	N	N	N	N	N	Y	N	N	N
Gw-27-1-1	2017-2022	N	N	N	N	Y	N	Y	N	N	N
Gw-27-1-2	2017-2022	Y	N	N	N	Y	N	N	N	Y	N
Gw-36-2-1	2017	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Gw-36-3-1	2017-2022	Y	N	N	N	N	N	N	N	N	N
Gw-37-2-1	2017-2021	N	N	N	N	N	N	N	N	N	N
Gw-37-3-1	2017-2022	N	N	N	N	N	N	Y	N	N	N
Gw-38-1-1	2017-2022	N	N	N	Y	N	N	N	N	N	N
Gw-40-1-1	2017-2022	N	N	N	Y	N	N	N	N	N	N
Gw-43-1-1	2017-2022	N	N	N	N	N	Y	Y	N	N	N
Gw-44-1-1	2017-2022	N	N	N	Y	Y	N	N	N	N	N
Gw-51-1-1	2017-2022	N	N	N	Y	N	Y	N	N	N	N
Gw-51-2-1	2017-2022	Y	N	N	Y	N	Y	Y	N	N	N
Gw-51-3-1	2017-2022	N	N	N	N	N	N	N	N	N	N
Gw-52-1-1	2017-2022	N	N	N	N	N	N	N	N	N	N
Gw-52-4-0 (P7)	2017-2022	Y	N	Y	N	Y	N	N	N	N	N
Gw-58-1-0	2017-2022	N	N	N	N	N	N	Y	N	N	N
Gw-60-1-1	2017-2022	Y	N	N	N	Y	N	N	Y	N	N
Gw-60-2-1	2017-2022	Y	N	N	N	N	N	N	N	N	N
Gw-60-3-1	2017-2022	Y	N	N	N	Y	N	Y	N	N	Y
Gw-62-1-1	2017-2022	N	Y	N	N	N	Y	N	N	Y	N
Gw-62-2-1	2017-2022	N	N	NA	NA	N	N	N	N	NA	NA
Gw-63-1-1	2017-2022	N	N	N	N	N	N	N	N	N	N
Gw-63-2-1	2017-2022	Y	N	N	N	N	N	N	N	N	N
Gw-77-1-1	2017-2022	N	N	N	N	Y	N	N	N	N	N
Gw-77-2-1	2017-2022	N	N	N	N	Y	N	Y	N	N	N
Gw-78-1-1	2017-2022	N	N	N	N	Y	N	Y	N	N	N
Gw-78-2-1	2017-2022	N	N	N	N	N	N	Y	N	Y	N
Gw-85-1-1	2017-2022	N	Y	N	Y	N	N	N	N	N	Y
Gw-87-1-1	2017-2022	Y	N	N	N	N	N	Y	N	N	N
Gw-87-2-1	2017-2022	N	N	N	N	N	N	Y	N	Y	N
Gw-88-1-1	2017-2022	N	N	N	N	N	Y	Y	N	Y	N
Gw-88-2-1	2017-2022	N	N	N	Y	N	Y	Y	N	N	N
GW-91-1-1	2020-2022	N	N	N	N	N	N	Y	N	N	N
GW-92-1-1	2020-2022	N	N	N	N	N	N	N	N	N	N
GW-93-1-1	2020-2022	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GW-94-1-1	2020-2022	N	N	N	N	N	Y	N	Y	N	N
Gw-P1	2017-2022	Y	N	N	N	Y	N	Y	N	N	N
Gw-P2	2017-2022	Y	N	N	N	N	N	Y	N	Y	N
Gw-P3	2017-2022	Y	N	N	N	N	N	Y	N	N	N
Gw-P4	2017-2022	N	N	N	N	N	N	N	N	N	N
Gw-80-1-0 (P8)	2017-2022	Y	N	Y	N	Y	N	N	N	N	N
Gw-81-1-0 (P9)	2017-2022	N	N	N	N	N	N	N	N	N	Y
Gw-P10	2017-2022	Y	N	Y	N	Y	N	N	N	N	N

Notes:

NA indicates the analysis is unable to run due to insufficient dataset or over 80% of values were under detection limits

N - No Trend

Green highlights indicate decreasing trends

Red highlights indicate increasing trends

G2. Surface Water

Appendix G-2. Results of Statistical Analysis - Surface Water

AECOM

Station	Time Period	Parameter									
		Conductivity		Ammonia		Chloride		Sulphate		Nitrate	
		Increasing Y/N	Decreasing Y/N	Increasing Y/N	Decreasing Y/N	Increasing Y/N	Decreasing Y/N	Increasing Y/N	Decreasing Y/N	Increasing Y/N	Decreasing Y/N
Boundary Surface Water Quality Location											
SW-S-04	2017-2022	N	N	Y	N	N	N	N	N	N	N
SW-N-05	2017-2022	Y	N	Y	N	N	N	Y	N	Y	N
SW-N-16	2017-2022	N	N	N	N	N	N	N	N	N	N
SW-N-41s1	2017-2022	N	N	N	N	Y	N	N	N	N	Y
SW-N-42s1	2017-2022	Y	N	N	N	N	N	Y	N	N	N
Routine Surface Water Quality Location											
SW-S-03	2017-2022	N	N	N	N	Y	N	N	N	N	N
SW-N-CSs2	2017-2022	N	N	N	N	N	N	N	N	N	N
SW-S-12	2017-2022	N	N	N	N	N	N	N	N	N	N
SW-N-14	2017-2022	N	N	NA	NA	N	N	N	N	N	N
SW-N-17	2017-2022	Y	N	N	N	N	N	Y	N	Y	N
SW-N-18	2017-2022	Y	N	N	N	Y	N	N	N	Y	N
SW-N-19	2017-2022	N	N	N	N	N	N	N	N	N	Y
SW-S-20	2017-2022	N	N	N	N	N	N	N	N	N	N
SW-S-21	2017-2022	N	N	N	N	N	N	N	N	N	N
SW-S-24	2017-2022	N	N	N	N	Y	N	N	N	N	N
SW-S-27	2017-2022	N	N	N	N	N	Y	N	N	N	Y
SW-S-52	2017-2022	N	N	N	N	N	N	N	N	N	N
SW-N-41s3	2017-2022	N	N	N	N	N	N	N	N	N	Y
SW-N-45	2017-2022	Y	N	N	N	N	N	Y	N	Y	N
SW-N-50	2017-2021	N	N	N	N	N	N	N	N	N	N
SW-N-51	2018, 2020	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SW-N-53	2018, 2021	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SW-N-54	2017-2022	N	N	N	N	N	N	N	N	N	N

Notes:

NA indicates the analysis is unable to run due to insufficient dataset or over 80% of values were under detection limits

Green highlights indicate decreasing trends

Red highlights indicate increasing trends

G3. Leachate

Appendix G-3. Results of Statistical Analysis - Leachate

Station	Time Period	Parameter									
		Conductivity		Ammonia		Chloride		Sulphate		Nitrate	
		Increasing Y/N	Decreasing Y/N	Increasing Y/N	Decreasing Y/N	Increasing Y/N	Decreasing Y/N	Increasing Y/N	Decreasing Y/N	Increasing Y/N	Decreasing Y/N
Hartland Valve Chamber	2017-2022	N	N	N	N	N	N	N	N	N	N

Notes:

Green highlights indicate decreasing trends

Red highlights indicate increasing trends

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