Appendix I

AECOM

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

(April 2023 to March 2024)

Capital Regional District

Project number: 60631284

October 2024

Delivering a better world

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# Executive Summary

The CRD's Annual Monitoring Program provided an effective assessment of landfill performance and compliance with respect to groundwater, surface water, and leachate flow and quality. Based on our interpretation of historical data and the water/leachate quality data collected in 2023/24, we made the following interpretations:

## Quality Assurance and Quality Control

Upon review of the quality assurance and quality control data collected in 2023/24, the groundwater, surface water and leachate sampling and laboratory testing have produced reliable results that are acceptable for the purposes of this monitoring report, with the exception of the ammonia concentration results from 2023.

Throughout 2023 the CRD observed anomalously low ammonia concentrations in the North and South Purge Wells and anomalously high ammonia concentrations where concentrations are typically low. The CRD worked with ALS and BV labs to investigate the root cause of the anomalous ammonia concentrations, and they determined that a set of sample bottles contained too much of the sample preservative. The same type of sample bottles were used during all sampling events in 2023. Hence, ammonia data collected in Q1 of 2024 are the only data available from the 2023/24 monitoring period.

## Leachate Flow

Leachate flow patterns at Hartland were generally consistent with historical interpretations. The Phase 2 hydraulic trap was maintained throughout the monitoring year, and leachate mounding persisted in Phase 1. Leachate elevations in both areas of the landfill were generally stable, exhibiting 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 2024, leachate elevations in the upper portion of the refuse were generally below 155 m asl, reflecting an approximate 5 m decrease in elevation since closure of the Phase 1 landfill in 1997. The highest leachate elevations (155 to 157 m asl) were observed in the east/southeast area of the Phase 1, in an area with elevated topography and refuse heights.

In 2023/24, a total of 28,090.6 $m^3$ of leachate was collected from the South Purge Wells, which is approximately 8.1% less than in the previous monitoring year, 18.9% less than in 2021/22, and 24.3% less than in 2020/21. At the North Purge Wells, a total of 7,038.2 $m^3$ of leachate was collected, which was 51% less than in 2022/23 (14,277 $m^3$) and 61% less than in 2021/22 (18,140 $m^3$). The leachate quality and flow data suggest that both systems performed adequately throughout the 2023/24 monitoring period. However, the steady decline in leachate discharge volumes suggests pump performance is declining. Moreover, groundwater levels in 52-3-0, adjacent to P7, continued to increase, which likely reflects leachate mounding and/or diminishing pump performance at P7. The average total daily leachate discharge rate was 16.3 L/s, as compared to the historical average of approximately 12.3 L/s, which was likely influenced by expansion of the landfill into the Toutle Valley.

## Groundwater Flow

Groundwater flow patterns observed at Hartland were consistent with historical interpretations, with some changes observed in the North Ridge area. 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 footprint. 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. Around the North Ridge and Hartland North Pad, northwest of Phase 2, groundwater flows radially outward to the north, east and south from a topographic high situated north of Phase 2.

In 2023, continued blasting operations along the North Ridge resulted in lowering of the topography and a decline in groundwater elevations. Groundwater levels in the area continued to exhibit seasonal fluctuations, and the intensity of the fluctuations was more pronounced. It is suspected that quarrying impacted groundwater flow around the Highland Fault, potentially facilitating the drainage of eastward moving groundwater that was previously impeded by the fault. This is consistent with groundwater seepage observed at the base of Toutle Valley.

## Groundwater Quality

Relative magnitudes and trends in conductivity, ammonia, chloride, sulphate, and nitrate concentrations were compared to background concentrations to differentiate between 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 geological alteration zones.
- Leachate Impacts: 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.
- Aggregate Impacts: 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 and/or nitrate are present at concentrations above background levels of 0.1 mg/L. Elevated nitrate concentrations have been observed in the absence of elevated sulphate concentrations, so aggregate runoff impacts are interpreted on a case-by-case basis.
- Road Salt Impacts: Groundwater is considered impacted by road salt when both conductivity (>1,000 µS/cm) and chloride (>20 mg/L) are elevated above background levels and ammonia and its degradation products (primarily nitrate) are not elevated. Chloride (Cl) to sodium (Na) molar ratios are also used to assess the source of potential chloride sources.

The groundwater quality results from 2023/24 indicate that leachate-impacted groundwater was contained within the landfill property. At the north end of the landfill, leachate-impacted groundwater extended just north of the unlined Lower Leachate Lagoon and through the middle of the lined Upper Leachate Lagoon and did not extend off-site. South of the landfill, leachate-impacted groundwater did not extend off-site. Leachate related exceedances were confined to the landfill footprint on the east side of Phase 1 and are inferred to extend to the western extent of the Phase 2 waste footprint. The Leachate Collection System continued to function adequately, minimizing groundwater quality impacts.

Aggregate runoff impacts were observed across the landfill and were most common downgradient of the aggregate stockpiles. Nitrate exceedances to the CSR DW were observed at many groundwater wells, including boundary compliance wells GW-31-1-1 and GW-39-1-1, reflecting off-site migration of leached ammonium nitrate fuel oil (ANFO) residue and potentially some magnesium lignosulphonate. At this point, it is unclear how much ammonia, nitrate, nitrite, and sulphate that magnesium lignosulphate has contributed to the groundwater and surface water systems, but laboratory testing of the dust suppressant indicated that it is highly concentrated with ammonia and sulphate. Several groundwater wells exhibited highly elevated nitrate concentrations in the presence of low to moderate (i.e., <75 mg/L) sulphate concentrations, suggesting that sulphide oxidation does not always occur during ANFO leaching in the stockpiles.

All other Boundary Compliance Wells and off-site monitoring wells met CSR AW and DW standards, except for a boron concentration that exceeded the CSR AW at GW-20-1-2 in September 2023. For several years, elevated boron concentrations have persisted at this location without elevated leachate or aggregate runoff indicator parameters, hence the elevated boron concentrations may reflect a natural source. Ultimately, the source of the boron is not yet known. Overall, most exceedances occurred in groundwater wells near leachate purge wells and known leachate sources.

**North of the Landfill**

- Operation of the Phase 1 North Purge Well System continued to mitigate leachate impacts north of the landfill, as indicated by long-term stable or decreasing concentrations of leachate indicator parameters at monitoring locations 40, 20 and 21. Groundwater quality in these wells were generally stable in 2023/24.
- 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 that the groundwater quality was not affected by landfill leachate.

- Along the northern edge of the Phase 2 basin, groundwater quality was impacted by runoff from the Northwest Stockpile, with some wells exhibiting highly elevated conductivity, nitrate and sulphate concentrations.
- Groundwater quality between the Lower Leachate Lagoon and Willis Point Road continued to exhibit elevated boron concentrations around Boundary Compliance Station 20, which may reflect a natural source.
- Groundwater quality at Boundary Compliance Stations GW-31-1-1 and GW-31-1-2 exhibited elevated and non-compliant nitrate concentrations caused by off-site migration of aggregate runoff and potentially magnesium lignosulphonate.

**Hartland North Pad**

- Groundwater quality at the Hartland North Pad was impacted by aggregate runoff, with elevated conductivity, nitrate, and sulphate concentrations observed at several monitoring stations (e.g., 62, 77, 87, 88, 94).
- Groundwater quality at GW-91-1-1 and GW-92-1-1 was generally consistent with background conditions, except for elevated conductivity and sulphate concentrations. Nitrate concentrations remained low at both sites. The elevated sulphate may be associated with natural sulphide oxidation.

**South of the Landfill**

- Groundwater quality south of the landfill met all applicable CSR standards. Although ammonia concentrations in some wells south of the landfill were slightly elevated, they were within historical ranges and well below the applicable CSR standards.
- Water quality along the southern boundary of the Phase 1 landfill continued to show no evidence of landfill leachate impacts.
- Since 2020, chloride concentrations have been elevated at some monitoring stations in the area (e.g., stations 4, 16, 60, and 85), but the elevated chloride concentrations have not correlated with elevated ammonia concentrations. High Cl/Na molar ratios (>1) suggest there is additional source of chloride other than road salt, but the source of chloride is currently unknown.
- Elevated nitrate concentrations were observed at several wells, often in the absence of elevated sulphate concentrations. This trend might reflect impacts from magnesium lignosulphonate or aggregate runoff.

**East of the Landfill**

- Water quality along the east boundary of the Phase 1 landfill was not impacted by landfill leachate.
- Chloride and ammonia concentrations at monitoring locations 16, 17 and 18 were close to or below the detection limit on all sampling events, and groundwater parameters other than nitrate concentrations met all applicable CSR standards. Elevated conductivity, nitrate and sulphate concentrations observed at location 16 reflect aggregate runoff impacts.

## Domestic Well Water Quality

The CRD's groundwater quality monitoring program includes annual sampling of 20 residential wells, including 15 wells within a 2 km radius of the landfill and five domestic wells located north of the Hartland North Pad.

The domestic groundwater quality data was consistent with historical results, meeting all applicable federal and provincial drinking water quality guidelines other than a few manganese and iron Aesthetic Objective exceedances, one total manganese exceedance, and one total lead exceedance. The well that exhibited the total lead exceedance was resampled, and the lead concentration was below regulatory criteria. Overall, the results indicate that off-site domestic water wells continued to remain unimpacted by landfill leachate.

## Surface Water Quality

The primary causes of surface water quality degradation at the Site include landfill leachate, road salting, and aggregate runoff. Magnesium lignosulphonate has been used for dust suppression on gravel roads since 2014 and may impact the water quality. Surface water quality data collected at the landfill is interpreted with consideration for the following:

- 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/nitrate concentrations are typically below 0.01 mg/L, but occasionally exceed 0.1 mg/L in 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.
- Leachate: 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 of these parameters are typically observed during the dry summer and early fall months, when flows are low and there is limited dilution by precipitation.
- Aggregate: Surface water is considered impacted by 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). Note that in recent years, highly elevated nitrate concentrations have been observed at the landfill in the absence of sulphate concentrations exceeding 75 mg/L, so aggregate runoff impacts are interpreted on a case-by-case basis. Peak concentrations of these parameters 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, aggregate stockpiling or aggregate placement.
- Road Salt: 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 at monitoring points within the landfill, in the receiving environment immediately north of the landfill, and at compliance monitoring points at the south end of the landfill continued to show signs of water quality degradation related to aggregate runoff. Aggregate runoff impacts are a pervasive surface water quality issue at and around the landfill, and in many locations, they have persisted for several years. The water quality impacts were most prevalent in November and December 2023, following major precipitation events.

**North of the Landfill and Downstream of the North Pad**

- Surface water at Boundary Compliance Station SW-N-05 continued to exhibit elevated sulphate and nitrate concentrations, as well as total aluminum (1 sample), dissolved copper (2 samples), and total iron (1 sample) resulting in non-compliant water quality. Elevated nitrate and sulphate concentrations suggest that aggregate runoff impacted water quality at SW-N-05, but nitrate concentrations have decreased since their peak in 2022/23. Magnesium lignosulphonate may have also contributed to elevated nitrate and sulphate. The absence of paired ammonia and chloride concentrations suggest water quality was not affected by leachate. TSS, dissolved and total metals concentration exceedances observed at this location likely reflect turbid conditions at the time of sampling and weathering of the local bedrock.
- Surface water quality at Boundary Compliance Station Sw-N-16 was not impacted by leachate but continued to exhibit elevated conductivity, sulphate and nitrate concentrations caused by aggregate runoff. Similar impacts were observed at downstream at station Sw-N-17 and Sw-N-45. Aggregate runoff impacts were more severe at Sw-N-45.
- In the Hartland North Pad area, surface water quality at Boundary Compliance stations Sw-N-41s1 and Sw-N-42s1 met BCWQG-STA, except for TSS and total iron concentrations related to turbid conditions at the time of sampling. Leachate indicator parameters were low, indicating that the surface water was not impacted by landfill leachate or construction activities. Slightly elevated conductivity, nitrate and sulphate concentrations likely reflect minor impacts from aggregate runoff.
- Sw-S-52 has consistently shown no signs of landfill-related impacts, confirming that the water quality at this location continues to represent background conditions.
- Surface water quality in the area northwest of the landfill (Sw-N-41s3 and Sw-N-41s4) was not impacted by landfill activities.

- Nearby surface water bodies, including Tod Creek, Durrance Lake, and Killarney Lake were not impacted by landfill leachate or aggregate runoff. However, elevated nitrate concentrations were observed at monitoring locations 14, 63, and 65, indicating that Durrance Creek was impacted by aggregate runoff. High concentrations of nitrate were reported in Durrance Creek (location 63), which receives surface water from Heal Creek (Sw-N-14). Downstream of monitoring point 63, at monitoring point 65, nitrate concentrations were more dilute. Upstream of location 63, aggregate runoff impacts have been observed at Sw-N-14 for over five (5) years.

**South of the Landfill**

- Water quality at Boundary Compliance Station (Sw-S-04) exhibited trends that reflect dilute aggregate runoff impacts. Elevated chloride concentrations were observed at this location, as well as other monitoring locations south of the landfill, but low ammonia concentrations suggest that landfill leachate did not impact the water quality. The source of the anomalous chloride concentrations should be investigated.
- Surface water quality south of the recycling area (Sw-S-03, Sw-S-12) exhibited dissolved and total iron BCWQG-STA exceedances in May 2023 and March 2024. Surface water quality in this location was impacted by aggregate runoff and likely magnesium lignosulphonate, as indicated by elevated conductivity, nitrate and sulphate concentrations. Road salting of nearby paved surfaces likely influenced the elevated chloride concentrations, but this is not possible to determine without sodium concentration data.

## Leachate Quality

The leachate quality observed at the Hartland Valve Chamber was compliant with the Waste Discharge Authorization. The statistical trend analysis indicates that leachate quality has been relatively stable with minor improvements over the past five years. The average daily leachate flow was considerably higher than the long-term average, which may be related to the expansion of the Phase 2, Cell 4 quarry and the resultant increase in groundwater seepage to the quarry walls and floor. Overall, the leachate quality data in 2023/24 were comparable to historical data.

## Compliance with Operating Certificate and Waste Discharge Authorization

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

**Leachate**

The Hartland Valve Chamber is the Compliance Monitoring Station for the Waste Discharge Authorization. During the monitoring period, leachate discharges at the Hartland Valve Chamber were compliant with the Waste Discharge Authorization.

**Groundwater**

A total of 36 groundwater monitoring wells were identified as Boundary Compliance Monitoring Wells. Water quality data collected from these wells were compared to the CSR standards for the protection of freshwater aquatic life and drinking water to evaluate landfill compliance with the Operating Certificate and protect both current and future uses of the groundwater resource. Exceedances are summarized in Table ES-1.

Aggregate runoff impacts were observed across the landfill and were common downgradient of the aggregate stockpiles. Nitrate exceedances to the CSR DW were reported at Boundary Compliance Well 31, reflecting off-site migration of ANFO residue and potentially some magnesium lignosulphonate.

All other Boundary Compliance Wells and off-site monitoring wells met CSR AW and DW standards, except for a boron concentration that exceeded the CSR AW at GW-20-1-2 in September 2023. Elevated boron concentrations have persisted at this location for several years, and it may be linked to a natural source. However, the source of the boron is not yet known. Leachate and aggregate indicator parameters were present in low concentrations at the time of sampling.

**Table ES-1. Groundwater Quality Compliance at Boundary Compliance Stations**

| Station | General Parameters | Nutrients | Metals | Comments |
|---|---|---|---|---|
| **GW-20-1-2** | None | None | Boron (1) | • The boron exceedance may be associated with a natural source, given the presence of very low leachate and aggregate indicator parameters, but the source of boron is not yet known. |
| **GW-31-1-1** | None | Nitrate (2) | None | • Nitrate exceedances are associated with aggregate production and stockpiling at Hartland. The nitrate originates from leaching of ANFO residue left on the aggregate after blasting. |
| **GW-31-1-2** | None | Nitrate (3) | None | |

## Surface Water

A total of five (5) 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, downgradient of areas that have the potential to be impacted by leachate or landfill runoff. Water quality data collected from the Boundary Compliance stations were compared to the BCWQG-STA and BCWQG-LTC criteria to assess compliance with the Landfill Operational Certificate. Exceedances are summarized in Table ES-2.

Some of the water quality impacts were caused by sources other than landfill leachate or aggregate runoff, including turbid samples collected under low-flow conditions and ongoing construction activities. However, highly elevated conductivity, sulphate, and nitrate/ammonia concentrations consistent with aggregate runoff and potentially magnesium were observed at boundary compliance stations Sw-N-05 and Sw-N-16, indicating that surface water quality at these locations was not compliant with the Landfill Operational Certificate.

**Table ES-2. Surface Water Quality Compliance at Boundary Compliance Stations**

| Station | General Parameters | Nutrients | Metals | Comments |
|---|---|---|---|---|
| **Sw-N-05** | TSS (1) | Nitrate (4) | Total Aluminum (1), Total Iron (1), Dissolved Copper (1) | • Nitrate exceedances are associated with aggregate production and stockpiling at Hartland. The nitrate originates from leaching of ANFO residue left on the aggregate after blasting. The TSS and metal concentration exceedances are anticipated to be related to turbid flow conditions following a prolonged dry period. It is unlikely that the elevated TSS and metal concentrations were influenced by landfill activities. |
| **Sw-N-16** | TSS (1) | Nitrate (3) | Total Iron (1), Dissolved Copper (2) | |
| **Sw-N-41S1** | TSS (1) | None | Total Iron (1), Total Aluminum (2) | • The TSS and metal concentration exceedances are anticipated to be related to turbid flow conditions following a prolonged dry period. It is unlikely that the elevated TSS and metal concentrations were influenced by landfill activities. |
| **Sw-N-42S1** | TSS (1) | None | Dissolved Copper (1) | |
| **Sw-S-04** | None | None | Dissolved Copper (1) | |

## Recommendations

Based on the findings of this report, our recommendations are summarized in Table ES-3.

**Table ES-3. Summary of Recommendations**

| | Leachate Collection System | Status |
|---|---|---|
| **1** | Closely monitor water levels and leachate quality in the north purge wells to verify the effectiveness of the leachate collection system. Water levels in well 52-3-0, adjacent to 52-4-0-P7 have slowly increased since 2021/22 and may indicate diminished drawdown and leachate collection in this area. Water quality in this area is beginning to suggest changes in leachate capture. A step test should be conducted on each north purge well to measure the specific capacity, which is an indicator of well performance. The measurements should be compared to historical assessments to determine the need for well rehabilitation. | Ongoing |
| **2** | Closely monitor water levels and leachate quality in the south purge wells to verify the effectiveness of the leachate collection system and identify opportunities for improvements. These wells have not been rehabilitated since they were installed in 2001 and have likely accumulated sediment, diminishing their performance and/or requiring excessive maintenance. Pump failures were observed at P10, increased water levels above operational targets were observed in P1, and pump discharge rates have declined for multiple years. 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 |
| **3** | Periodically validate the pumping levels and the extent of the drawdown cones surrounding the north and south purge well systems (next assessment was to be conducted in 2024) to confirm the proper functioning of the purge 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** | Conduct a detailed assessment of the effectiveness of the hydraulic trap and leachate collection systems including the north purge wells and south purge wells based on the design of the Cell 4/5/6 quarry and liner system. This is required to confirm the landfill will perform as intended 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 suggests additional leachate containment or groundwater management measures need to be implemented to mitigate the potential for off-site leachate migration and non-compliant water quality at Sw-N-05. | Ongoing |
| | **Runoff and Infiltration Associated with Aggregate Stockpiles** | |
| **5** | Continue to characterize the aggregate runoff source term and thresholds for identifying aggregate runoff by performing geochemical testing. Elevated copper concentrations were observed in historical shake flask extraction testing leachate for several aggregate samples, indicating that aggregate may be the source of the copper exceedances in surface water and groundwater. | New |
| **6** | Minimize the spatial extent and volume of aggregate stockpiles outside of the leachate collection system. Where this is not feasible, stockpiles should be covered with low permeability temporary tarps as soon as practical to minimize sulphate, ammonia, nitrate and TSS impacts on downgradient groundwater and surface water quality. Direct runoff from aggregate stockpiles away from natural water courses as it is known to exceed BCWQ guidelines for sulphate and some nitrogenous compounds. This approach proved to be effective for mitigation of historical aggregate impacts at the Hartland North Pad. Aggregate run-off mitigation and control is currently underway by the CRD, and additional measures are being evaluated/planned as part of an overall aggregate management plan. | Ongoing |
| | **Groundwater Monitoring Program** | |
| **7** | Advance a network of boreholes into the bedrock slope west of the Phase 2 landfill to characterize the geology, hydrogeology and groundwater quality. This will also allow for establishment of a long-term groundwater monitoring network west and upslope of the Phase 2 landfill to support continued evaluations of hydraulic trap performance and monitor groundwater quality. This is required to monitor the lowering of the water table surrounding Phase 2 following completion of the Phase 2 Quarry. Water levels have dropped significantly over the past several years, and monitoring of the hydraulic trap is critical to confirming landfill performance. | Ongoing |
| **8** | Groundwater monitoring wells in proximity to the Phase 2 Basin and Northwest Sedimentation Pond should be monitored closely 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 groundwater flow system on the west side of the Highland Fault and the Phase 2 hydraulic trap, resulting in lowering of the surrounding groundwater levels and increased leachate generation. | Ongoing |
| **9** | Groundwater is no longer compliant north of the Lower Leachate Lagoon and the Northeast Stockpile. A Notice of Offsite Migration should be issued to downgradient property owner(s) pursuant to the requirements of the BC CSR. Additional groundwater monitoring wells should also be installed downgradient of the Northeast Stockpile to monitor groundwater quality on the north perimeter of the Site. This work is currently underway. | New |
| **10** | Elevated and non-compliant boron concentrations were observed at Boundary Compliance Station GW-20-1-2. The source of boron should be investigation by performing speciation/isotopic testing. | New |

| | | |
|---|---|---|
| **11** | The existing Groundwater, Surface Water and Leachate Monitoring Plan should be updated to ensure that it remains effective in monitoring the impacts current and future of landfill operations, including aggregate production, stockpiling, transport and use. This work is currently underway. | Ongoing |
| **12** | 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 |
| **13** | 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). This can be accomplished by drilling through the refuse to the base of the landfill and investigating leachate levels in new wells. It is important that new wells are drilled because the wells tend to shift and become damaged as the refuse pile shifts over time. | Ongoing |
| **14** | Conduct a 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 benefits from a complete understanding of the landfill design and operations over the next five years. The next review should be conducted in 2024 following completion of the Cell 4and design of Cell 5 and 6. | Ongoing |
| **15** | 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 Water Monitoring** | |
| **16** | Provide sodium concentration data. Analyzing sodium is required to help determine if elevated chloride concentrations originate from road salt application. | Ongoing |
| **17** | Investigate water quality impacts associated with the application of magnesium lignosulphonate and stop or limit the use this product as a dust suppressant. Use can be limited to unpaved roads within leachate containment. | New |
| **18** | Improve surface water flow monitoring upstream of Sw-N-05 in Heal Creek to ensure it provides an accurate measurement of surface water discharge from the landfill. Accurate flow measurements are important for evaluating environmental impacts and ensuring adequate collection and conveyance capacity. | Ongoing |
| **19** | Improve surface water management north of the Phase 2 landfill to minimize impacts of aggregate runoff on groundwater and surface water that is not captured by the leachate collection system. This may require lining of the NWSP and installation of an underdrain to allow for management of groundwater separately from surface water in the area. Additional sediment control measures and efforts to reduce the quantity of blasting residuals contained in aggregate stockpiles may help reduce impacts on water quality as quarry development becomes increasingly close to the northern property boundary and the water quality Boundary Compliance monitoring stations. | Ongoing |
| | **Leachate Monitoring** | |
| **20** | Characterize the chemistry of residual wastewater solids and stabilized biosolids (solids and leachate) to allow for establishment of indicator parameter thresholds and future evaluation of any impacts to leachate chemistry. This information may be available from pilot studies or operational monitoring programs. | Ongoing |
| **21** | Investigate the source of chloride in the south area of the landfill. 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 facility have been noted in the past. Changes in activities at the south end of the landfill and management of impacted surface runoff may play a role. | Ongoing |
| **22** | Resume leachate sampling from the Phase 2 Cleanout as soon as the sampling pump is replaced. This information will be important for tracking changes in leachate chemistry as Phase 2 Cell 4/5/6 are developed. This work is currently underway. | Ongoing |
| **23** | 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. Additionally, an updated list of emerging contaminants will be integrated into the monitoring program for the 2024/2025. | Ongoing |
| | **Construction Management** | |
| **24** | Future blasting and quarrying activities 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. This has been demonstrated to have important implications on groundwater elevations west of the Highland Fault and the volume of seepage reporting to the Phase 2 Basin as the base of the quarry has been lowered. In circumstances where blasting might induce substantial topographic alterations or changes to the elevation of the base of the Phase 2 quarry, consultation with a hydrogeologist is recommended to evaluate potential implications on the performance of the hydraulic trap and the leachate collection system. | Ongoing |
| **25** | 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** | |
| **26** | 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). Landfilling 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 at the landfill in 1983. Since 1988, annual monitoring reports have been prepared and issued by Gartner Lee and AECOM. The present Hartland Monitoring Program is part of an Amended Operational Certificate (#12659) that is required and approved by the BC Ministry of Environment and Climate Change Strategy (ENV) and was last amended January 27, 2010.

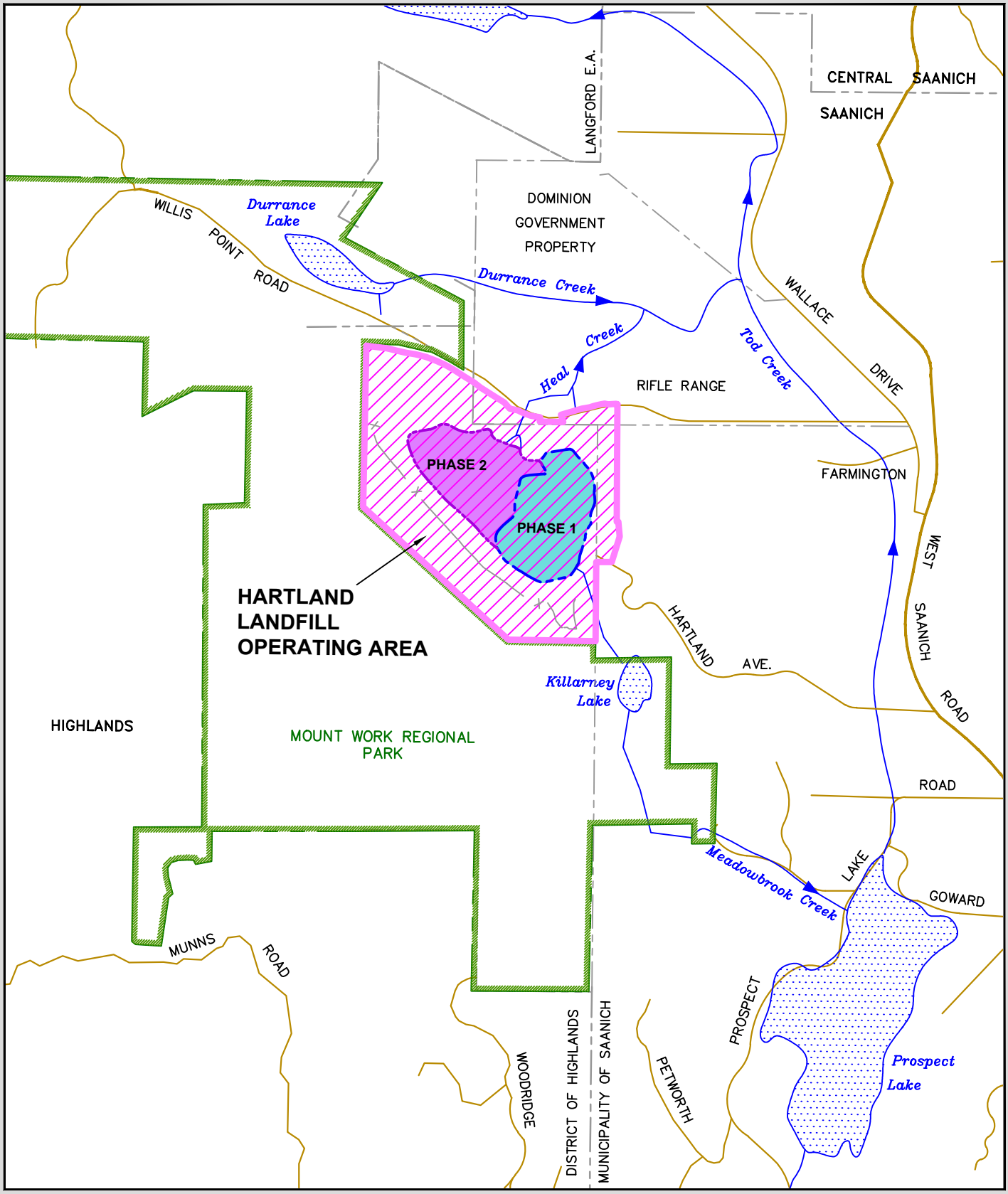
The Hartland Landfill is divided into two distinct areas referred to as Phase 1 and Phase 2. Initially, waste was deposited in Phase 1, which reached capacity in 1996 and was capped in 1997. Phase 2 receives waste actively and is engineered and operated as a ‘hydraulic trap” landfill with the maintenance of upward groundwater gradients below the base of the Phase 2 landfill providing leachate containment. Filling of Phase 2 Cell 1 was completed in 2004, and Cell 1 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. The Phase 2 Cell 4/5/6 quarry reached the maximum extents in September 2023, and the basal landfill liner system is presently under construction.

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 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 Authorization SC97.001, last amended on June 21, 2021, 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 2023 and March 2024 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

Project: Hartland Landfill Monitoring
Location: Saanich, BC

## Site Location Map

AECOM

**Figure 1-1**

Reviewed by: KJ
Date Issued: JULY 2024

Prepared by: SP
Project Number: 60631284

Date Plotted: 2023-08-15 File Location: C:\Users\susan.a.powell\Desktop\Desktop_WFH\60631284Hartland Landfill 2022-2023\900-CAD_GIS\910-CAD\20-SHEETS\CFIG1.1-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). 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.

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, and the formal switch from the leachate pipeline to the CRL occurred in March 2021.

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 veneer of glacial till composed of silty, gravelly sand, with interspersed cobbles and boulders overlies 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, the bedrock is mantled by a 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 the Hartland North area.

In 2022/23, AECOM supervised a drilling program at Hartland. During the drill program, a gully infilled with unconsolidated material was identified north of the Phase 2 landfill, between Phase 2 and the Northwest Sedimentation Pond (NWSP) (AECOM 2023). The subsurface materials consisted of dense, silty diamicton and till, with interspersed cobbles.

### 2.2.2 Bedrock Geology

The bedrock geology in the area surrounding the landfill is comprised of Wark Diorite Gneiss and Colquitz Gneiss, with Colquitz Gneiss outcropping in the northern and eastern margins of the landfill site. The Wark Diorite Gneiss is dark green to black in colour. It is competent, except 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 identified in this study

and further validated by a drill investigation in the fall of 2019 (AECOM 2019a). Permeability testing and water level measurements have determined that faults and shear zones behave as conduits and/or barriers to groundwater flow which imparts a degree of anisotropy in the hydrogeological properties of the bedrock (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 2023/24 are provided in Appendix C. The precipitation measured at Hartland Landfill from April 2023 to March 2024 was 962 mm, approximately 9% higher than the 30-year average reported for Victoria International Airport CS (882.9 mm/year), and 14.9% higher than the total precipitation recorded in 2022/23 at Victoria Hartland CS (837.4 mm). Precipitation during the 2023/24 wet season (i.e., October to February) was 752.5 mm, contributing over 78% of the total annual precipitation.

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 2023/24

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:

- Mounding Leachate/Groundwater in Leachate Collector (Sumpzilla): In late-May 2023, elevated groundwater levels were observed in the sump, which may reflect fine material accumulating in the sump and/or biofouling limiting infiltration into Phase 2. In March of 2024, an electric submersible pump was installed to lower water levels.
- Construction of the Cell 4 Liner: In late-May 2023, construction of the Cell 4 liner immediately north of the Highwall and south of the NWSP began. The liner has been designed to prevent downward migration of leachate when Cell 4 is filled with refuse.
- Completion of Blasting/Quarrying in the Cell 4 Area: In September 2023, blasting, quarrying, and grading in the Cell 4 area and west of the Contractors Shed reached completion. The blasting and quarrying activities led to considerable changes to the topography in this area that impacted groundwater elevations and the hydraulic trap.
- Clearance of Aggregate Stored on the Southern Area of Phase 1: In late-September 2023, aggregate stockpiles on the southern half of Phase 1 were cleared due to construction of the new Resource Recovery Area, which will store mattresses, asphalt shingles, and wooden debris. It was noted during clearing of the aggregate that the Phase 1 PVC cap was torn in some areas. These areas are scheduled to be repaired.
- Leachate Line Maintenance: In early-February 2024, leachate levels in the Upper Leachate Lagoon rose rapidly to 48% capacity in response to heavy precipitation. It was determined that fouling of the leachate line had occurred causing flow restriction. The line was pigged and flows returned to normal.
- Reactivation of Surface Water Monitoring Stations Downstream of the Northeast Stockpile: Surface water monitoring stations SW-N-55 and SW-N-56 were reactivated in 2023/24 to restore water quality monitoring infrastructure downstream of the Northeast Stockpile. These monitoring points aim to capture surface water quality leaving the Site north of the stockpile.

- Operation of Purge Well P11: Two purge wells, P11 and P12, were installed during the NWSP Investigation in2022. P12 is dry intermittently, but P11 has exhibited impacted water quality and sustained water levels. In May of 2023, P11 began operating, discharging approximately 0.75 L/min to the Upper Leachate Lagoon.
- Maintenance/Verification of North and South Purge Well Systems: Flow tests were regularly conducted at P1, P7 and P8 to monitor pump efficiency.

## 2.5 Applicable Regulatory Criteria

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 21, 2013.
- Waste Discharge Authorization SC97.001 issued by the CRD Regional Source Control Program, last amended on June 21, 2021, 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 came into force on February 1, 2021, and Stage 14 amendments came into effect on March 1, 2023. References to CSR standards in this report consider the latest amendments up to March 1, 2024.

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, and the review should be conducted every five years to ensure effectiveness and relevance. The review of 2018 to 2022 data is currently on-going. In consideration of the five-year review process, quarterly sample collection in 2022/23 for CEC was paused, and only one sample was collected in May 2023 for selected CECs.

### 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 14 amendments and amendments up to March 1, 2024.

### 2.5.2 Surface Water

Surface water quality data are compared to the *British Columbia Approved and Working Water Quality Guidelines* (BCWQG) for DW and the protection of AW 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. The approved and working BCWQGs were last updated in November 2023 and February 2021, respectively and the updated guidelines were considered when assessing data compliance in this report. Furthermore, there are two sets of BCWQG criteria for AW use:

- long-term chronic (LTC)
- Short-term acute (STA)

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

Short-term acute (STA) WQGs are established to protect the most sensitive species and life stages against short-term exposure (i.e., <96 hours). BCWQGs for STAs 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, pH and temperature data were compared to BCWQG AW criteria.

The approved BCWQG AW criteria for total aluminum, total arsenic and dissolved zinc were updated in November 2023 version, and the changes have been considered in this report.

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 and Willis Point Road. Both the BCWQG and CCME criteria are guidelines and do not have the same regulatory force as the CSR standards.

### 2.5.3 Leachate

Discharge from the leachate pipeline is subject to the CRD Regional Source Control Program (RSCP Waste Discharge Authorization (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 authorization was amended to reflect operation of the Centrate Return Line and decommissioning of the Markham Valve Chamber. Leachate sampling is conducted on monthly basis.

The Hartland Landfill leachate compliance monitoring location is the Hartland Valve Chamber, which is a flow detection chamber located near the Lower Lagoon. Discharge limits are identified within the authorization.

# 3. Methods and Quality Assurance

## 3.1 Field Techniques

All active leachate, surface water and groundwater sampling locations are shown on Figure 4-1. Boreholes and monitoring wells are identified using a standard system adopted by the CRD, consisting of and acronym and three numbers (e.g., GW-02-02-01). The acronym refers to the sample type; GW indicates groundwater samples, and SW indicated surface water samples. The first number refers to the monitoring site, the second number refers to the borehole at the monitoring site (in the case of multi-level groundwater wells, 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, nested installations). If the third number is a zero, it indicates an open borehole where no PVC monitoring well has been installed. Additionally, several leachate purge (collector) wells have been installed at the Site, which 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, with comments describing any problems associated with each monitoring well. Monitoring wells are categorized as active (fully functioning) or inactive (non-functioning, decommissioned, or destroyed). In 2023/24, there were 134 active groundwater monitoring wells at 83 locations at the Site; ten (10) are active purge wells and 13 are landfill gas wells that were used regularly to measure leachate levels in Phase 1.

The methods used to develop and sample each monitoring well are described in Appendix A.2. The Standard Operating Procedure (SOP) for groundwater sampling is updated periodically. A variety of sampling 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 in the deeper monitoring wells and open boreholes to facilitate more efficient sampling, resulting in improved data quality. Sampling events were scheduled to avoid heavy rainfall to avoid sample dilution.

In 2023/24, 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.

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

The CRD has adopted a continuous improvement and quality assurance program. The existing Leachate, Groundwater, and Surface Water Monitoring Plan for Hartland was established in 2016. Following a review, modifications were made to the groundwater, surface water, and leachate monitoring program, and these changes were implemented in the 2019/20 monitoring year. CRD regularly reviews and updates the program to ensure that it remains effective in monitoring the impacts of various landfill operations, including aggregate production, stockpiling, leachate discharge and on-going construction.

## 3.2 Quality Assurance

In 2023/24, 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 to assess the validity of the laboratory 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 22 surface water and 57 groundwater samples submitted in duplicate between March 2023 and April 2024. 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 sampling location and under the same conditions. In all cases, the field replicates were submitted 'blind' to the laboratory. This resulted in duplicate sampling frequencies of 16.3% (57/350 samples) for groundwater, 15.7% (22/140 samples) for surface water, 28.6% (4/14 samples) for the Hartland Valve Chamber compliance point, and 6.25% (4/64 samples) for the overall leachate sampling program. Overall, duplicate samples were collected at a frequency of approximately 15% (88/554), 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 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 to evaluate 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 exceeding the 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 RPDs

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 2023/24:

- A total of 57 duplicate samples were collected and analyzed for 57 parameters. Thirty-three (33) samples had RPD values greater than 30% when all concentrations were above the LOQ.
- RPD values for dissolved aluminum (17 samples), antimony (1 sample), arsenic (2 samples), cadmium (3 samples), cobalt (6 samples), copper (3 samples), iron (7 samples), lead (3 samples), manganese (3 samples), molybdenum (2 samples), ammonia (5 samples), nickel (9 samples), phosphorus (2 samples), selenium (1 sample), uranium (2 samples), vanadium (1 sample), zinc (7 samples), and conductivity (3 samples) were greater than the 30% target when all concentrations were above the LOQ.

Overall, the groundwater field replicates showed good precision for most parameters, and the majority of RPD values for the 2023/24 monitoring year were within the acceptable range. Therefore, for the purpose of this report, the precision of the groundwater quality data is acceptable. However, dissolved aluminum and zinc concentrations should be interpreted with caution, as these parameters exhibited a relatively high number of elevated RPD values above the alarm limit when all parameter concentrations were above the LOQ.

Table 3-2 indicates the following for surface water samples collected at the landfill in 2023/24:

- A total of 22 duplicate samples were collected and analyzed for 52 parameters. Twenty-two (22) samples had parameters with RPD values greater than 30% when all concentrations were above the LOQ.
- RPD values for total aluminum (1 sample), total arsenic (1 sample), total cobalt (1 sample), total copper (3 samples), total iron (1 sample), total manganese (1 sample), total molybdenum (1 sample), ammonia (2 samples), total nickel (6 samples), total zinc (3 samples), conductivity (4 samples), dissolved aluminum (6 samples), dissolved cadmium (1 sample), dissolved copper (1 sample), dissolved iron (4 samples), dissolved manganese (1 sample), dissolved nickel

(2 samples), and dissolved zinc (7 samples) were greater than the 30% target 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 2022/23 monitoring year were within the acceptable range. Some of the parameters that exhibited high RPD values (e.g., dissolved aluminum and zinc) may reflect the turbid conditions and should be interpreted with caution.

### 3.2.2 Leachate RPDs

Four (4) duplicate leachate samples were collected during the 2023/24 monitoring year and analyzed for 69 parameters (Table 3-3). Two (2) replicate samples and five (5) parameters had calculated RPD values that exceeded alarm limits when concentrations in both replicates were above the LOQ. A duplicate sample collected in August 2023 exhibited the most parameters exceeding the alarm limits, which may be related to issues with the filtration and collection process during sampling. Overall, the leachate field replicates showed good precision for most parameters and the quality of the data is acceptable for the purposes of this report.

### 3.2.3 Ammonia Concentrations

Throughout 2023 the CRD observed anomalously low ammonia concentrations in the North and South Purge Wells and anomalously high ammonia concentrations where concentrations are typically low. The CRD worked with ALS and BV labs to investigate the root cause of the anomalous ammonia concentrations, and they determined that a set of sample bottles contained too much of the sample preservative. The same type of sample bottles were used during all sampling events in 2023. Hence, ammonia data collected in Q1 of 2024 are the only reliable data available from the 2023/24 monitoring period, and the remaining data was not analyzed or interpreted.

## 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 2019 and March 2024. 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 95 groundwater monitoring wells (36 compliance and 59 routine), 10 purge wells, 33 surface water monitoring stations (5 compliance and 28 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.

# Hartland Landfill Groundwater, Surface Water and Leachate Monitoring Program Annual Report (April 2022 to March 2023)

## Table 3-1. Groundwater Quality QA/QC - Relative Percent Difference 2023-2024

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# Hartland Landfill Groundwater, Surface Water and Leachate Monitoring Program Annual Report (April 2022 to March 2023)

## Table 3-1. Groundwater Quality QA/QC - Relative Percent Difference 2023-2024

| | | | | | MAX Acceptable RPD | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Method Detection Limit (MDL) | 1 | 0.5 | 0.02 | 0.02 | 0.02 | 0.01 | 0.005 | 10 | 0.005 | 0.05 | 1 | 0.1 | 0.005 | 0.05 | 0.5 | 1 | 0.005 | 0.5 | 0.05 | 0.05 | 0.05 | 0.05 | 0.02 | 0.005 |
| | | | | | Limit of Quantitation (5 x MDL) | 5 | 2.5 | 0.1 | 0.1 | 0.1 | 0.05 | 0.025 | 50 | 0.025 | 0.25 | 5 | 0.5 | 0.025 | 0.25 | 2.5 | 5 | 0.025 | 2.5 | 0.25 | 0.25 | 0.25 | 0.075 | 0.025 |
| | | | | | Parameter | Alkalinity | Aluminum | Antimony | Arsenic | barium | beryllium | bismuth | boron | Cadmium | Calcium | Chloride | Chromium | Cobalt | Copper | rdness (As CaC0 | Iron | Lead | Lithium | Magnesium | Manganese | Molybdenum | Ammonia | Nitrite |
| | | | | | Fraction | TOT | DIS | DIS | 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 | mg/L | mg/L | µg/L | µg/L | µg/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 | | | | | | | | | | | | | | | | | | | | | | | | |
| 21-2-1 | FR1 | Y | 2024-02-08 | Yellow, low turbidity | | 150.00 | 1.31 | 0.02 | 1.26 | 17.60 | < 0.01 | < 0.01 | 797.00 | 0.01 | 47.50 | 52.00 | 0.25 | 0.97 | 0.20 | 159.00 | 921.00 | < 0.01 | < 0.50 | 9.72 | 1760.00 | 0.66 | 5.30 | < 0.01 |
| 21-2-1 | FR2 | Y | 2024-02-08 | Yellow, low turbidity | | 150.00 | 1.87 | 0.03 | 1.63 | 14.50 | < 0.01 | < 0.01 | 657.00 | 0.02 | 46.60 | 51.00 | 0.18 | 1.01 | 0.21 | 157.00 | 758.00 | 0.01 | < 0.50 | 9.92 | 1960.00 | 0.61 | 5.30 | < 0.01 |
| 21-2-1 | FRM | QA/QC | 2024-02-08 | Mean of duplicates | | 150.00 | 1.59 | 0.03 | 1.45 | 16.05 | < 0.01 | < 0.01 | 727.00 | 0.01 | 47.05 | 51.50 | 0.22 | 0.99 | 0.21 | 158.00 | 839.50 | 0.01 | < 0.50 | 9.82 | 1860.00 | 0.63 | 5.30 | < 0.01 |
| 21-2-1 | RPD | QA/QC | | RPD of duplicates | | 0.0% | 35.2% b | 8.0% | 25.6% | 19.3% | 0.0% | 0.0% | 19.3% | 113.6% b | 1.9% | 1.9% | 32.6% b | 4.0% | 7.3% | 1.3% | 19.4% | 37.4% b | 0.0% | 2.0% | 10.8% | 7.9% | 0.0% | 0.0% |
| 30-1-2 | FR1 | Y | 2023-05-19 | Clear and colourless | | 140. | 2.45 | 0.064 | 0.16 | 3.92 | < 0.01 | < 0.005 | 44. | 0.035 5 | 116. | 4. | < 0.1 | 0.189 | 0.712 | 329. | 4.6 | < 0.005 | < 0.5 | 9.33 | 41.5 | 0.777 | < 0.015 | < 0.005 |
| 30-1-2 | FR2 | Y | 2023-05-19 | Clear and colourless | | 140. | 1.45 | 0.056 | 0.163 | 3.73 | < 0.01 | < 0.005 | 44. | 0.034 | 113. | 3.9 | < 0.1 | 0.186 | 0.628 | 321. | 2.2 | < 0.005 | < 0.5 | 9.11 | 40.8 | 0.758 | < 0.015 | < 0.005 |
| 30-1-2 | FRM | QA/QC | 2023-05-19 | Mean of duplicates | | 140. | 1.95 | 0.06 | 0.161 5 | 3.825 | < 0.01 | < 0.005 | 44. | 0.034 75 | 114.5 | 3.95 | < 0.1 | 0.187 5 | 0.67 | 325. | 3.4 | < 0.005 | < 0.5 | 9.22 | 41.15 | 0.767 5 | < 0.015 | < 0.005 |
| 30-1-2 | RPD | QA/QC | | RPD of duplicates | | 0.0% | 51.3% b | 13.3% | 1.9% | 5.0% | 0.0% | 0.0% | 0.0% | 4.3% | 2.6% | 2.5% | 0.0% | 1.6% | 12.5% | 70.6% b | 0.0% | 0.0% | 0.0% | 2.4% | 1.7% | 2.5% | 0.0% | 0.0% |
| 30-1-2 | FR1 | Y | 2023-09-28 | Clear and colourless | | 130. | 10.3 | 0.104 | 0.305 | 11.2 | < 0.01 | < 0.005 | 274. | 0.068 | 71.8 | 88. | 0.15 | 0.069 | 0.974 | 210. | 15.4 | 0.019 | < 0.5 | 7.57 | 1.83 | 4.59 | 0.7 | < 0.005 |
| 30-1-2 | FR2 | Y | 2023-09-28 | Clear and colourless | | 130. | 19.9 | 0.116 | 0.299 | 11.5 | < 0.01 | < 0.005 | 273. | 0.065 | 73.2 | 88. | 0.77 | 0.087 | 1.25 | 214. | 42.2 | 0.03 | < 0.52 | 7.61 | 2.6 | 4.76 | 0.89 | < 0.005 |
| 30-1-2 | FRM | QA/QC | 2023-09-28 | Mean of duplicates | | 130. | 15.1 | 0.11 | 0.302 | 11.35 | < 0.01 | < 0.005 | 273.5 | 0.066 5 | 72.5 | 88. | 0.46 | 0.078 | 1.112 | 212. | 28.8 | 0.024 5 | < 0.51 | 7.59 | 2.215 | 4.675 | 0.795 | < 0.005 |
| 30-1-2 | RPD | QA/QC | | RPD of duplicates | | 0.0% | 63.6% a | 10.9% | 2.0% | 2.6% | 0.0% | 0.0% | 0.4% | 4.5% | 1.9% | 0.0% | 134.8% b | 23.1% | 24.8% | 1.9% | 93.1% a | 44.9% b | 3.9% | 0.5% | 34.8% a | 3.6% a | 23.9% | 0.0% |
| 30-1-2 | FR1 | Y | 2023-11-24 | Clear and colourless | | 66. | 4.77 | 0.024 | 0.177 | 9.81 | < 0.01 | < 0.005 | 119. | 0.124 | 38.6 | 72. | 0.23 | 0.051 9 | 0.642 | 115. | 2.5 | 0.007 6 | < 0.5 | 4.54 | 0.942 | 1.32 | < 0.005 | < 0.005 |
| 30-1-2 | FR2 | Y | 2023-11-24 | Clear and colourless | | 66. | 4.02 | 0.024 | 0.179 | 8.27 | < 0.01 | < 0.005 | 116. | 0.113 | 38.4 | 73. | 0.2 | 0.051 5 | 0.637 | 114. | 1.1 | < 0.005 | < 0.5 | 4.4 | 0.857 | 1.31 | 1.4 | < 0.005 |
| 30-1-2 | FRM | QA/QC | 2023-11-24 | Mean of duplicates | | 66. | 4.395 | 0.024 | 0.178 | 9.04 | < 0.01 | < 0.005 | 117.5 | 0.118 5 | 38.5 | 72.5 | 0.215 | 0.051 7 | 0.639 5 | 114.5 | 1.8 | 0.006 3 | < 0.5 | 4.47 | 0.899 5 | 1.315 | 1.165 | < 0.005 |
| 30-1-2 | RPD | QA/QC | | RPD of duplicates | | 0.0% | 17.1% | 0.0% | 1.1% | 17.0% | 0.0% | 0.0% | 2.6% | 9.3% | 0.5% | 1.4% | 14.0% | 0.8% | 0.8% | 0.9% | 77.8% b | 41.3% b | 0.0% | 3.1% | 9.4% | 0.8% | 40.3% a | 0.0% |
| 30-1-2 | FR1 | Y | 2024-02-28 | Yellow, low turbidity | | 39.00 | 7.25 | 0.03 | 0.14 | 5.59 | < 0.01 | < 0.01 | 39.00 | 0.15 | 20.40 | 45.00 | 0.21 | 0.04 | 0.73 | 61.90 | 3.80 | 0.01 | < 0.50 | 2.66 | 0.38 | 0.29 | < 0.02 | < 0.01 |
| 30-1-2 | FR2 | Y | 2024-08-28 | Yellow, low turbidity | | 38.00 | 7.19 | 0.04 | 0.13 | 5.55 | < 0.01 | < 0.01 | 34.00 | 0.15 | 20.40 | 45.00 | 0.11 | 0.04 | 0.72 | 61.90 | 3.60 | 0.01 | < 0.50 | 2.64 | 0.32 | 0.23 | < 0.02 | < 0.01 |
| 30-1-2 | FRM | QA/QC | 2024-08-28 | Mean of duplicates | | 38.50 | 7.22 | 0.03 | 0.13 | 5.57 | < 0.01 | < 0.01 | 36.50 | 0.15 | 20.40 | 45.00 | 0.16 | 0.04 | 0.73 | 61.90 | 3.70 | 0.01 | < 0.50 | 2.65 | 0.35 | 0.26 | < 0.02 | < 0.01 |
| 30-1-2 | RPD | QA/QC | | RPD of duplicates | | 2.6% | 0.8% | 41.2% b | 6.1% | 0.7% | 0.0% | 0.0% | 13.7% | 0.0% | 0.0% | 0.0% | 62.5% b | 5.6% | 0.4% | 0.0% | 5.4% | 18.2% | 0.0% | 0.8% | 15.8% | 22.1% | 0.0% | 0.0% |
| 31-1-1 | FR1 | Y | 2023-10-04 | Clear and colourless | | 160. | 4.26 | 0.057 | 0.138 | 4.63 | < 0.01 | < 0.005 | 52. | 0.043 2 | 125. | 15. | < 0.1 | 0.177 | 0.43 | 357. | 28.5 | 0.010 9 | < 0.5 | 10.7 | 34.3 | 0.827 | < 0.005 | < 0.005 |
| 31-1-1 | FR2 | Y | 2023-10-04 | Clear and colourless | | 160. | 1.77 | 0.052 | 0.138 | 4.6 | < 0.01 | < 0.005 | 54. | 0.034 7 | 126. | 15. | < 0.1 | 0.176 | 0.361 | 358. | 31. | < 0.005 | < 0.5 | 10.8 | 34. | 0.863 | 0.95 | < 0.005 |
| 31-1-1 | FRM | QA/QC | 2023-10-04 | Mean of duplicates | | 160. | 3.015 | 0.054 5 | 0.138 | 4.615 | < 0.01 | < 0.005 | 53. | 0.038 95 | 125.5 | 15. | < 0.1 | 0.176 5 | 0.395 5 | 357.5 | 29.75 | 0.007 95 | < 0.5 | 10.75 | 34.15 | 0.845 | 0.935 | < 0.005 |
| 31-1-1 | RPD | QA/QC | | RPD of duplicates | | 0.0% | 82.6% b | 9.2% | 0.0% | 0.7% | 0.0% | 0.0% | 3.8% | 21.8% | 0.8% | 0.0% | 0.0% | 0.6% | 17.4% | 0.3% | 8.4% | 74.2% b | 0.0% | 0.9% | 0.9% | 4.3% | 3.2% | 0.0% |
| 31-1-1 | FR1 | Y | 2023-11-24 | Clear and colourless | | 160. | 2.48 | 0.081 | 0.159 | 4.54 | < 0.01 | < 0.005 | 52. | 0.038 4 | 125. | 15. | < 0.1 | 0.177 | 0.403 | 354. | 1. | < 0.005 | < 0.5 | 10.1 | 32.1 | 0.8 | 0.63 | < 0.005 |
| 31-1-1 | FR2 | Y | 2023-11-24 | Clear and colourless | | 160. | 10.9 | 0.078 | 0.162 | 4.55 | < 0.01 | < 0.005 | 49. | 0.038 9 | 125. | 15. | < 0.1 | 0.19 | 0.479 | 354. | 1.6 | 0.006 5 | < 0.5 | 10.1 | 31.9 | 0.846 | 0.75 | < 0.005 |
| 31-1-1 | FRM | QA/QC | 2023-11-24 | Mean of duplicates | | 160. | 6.69 | 0.079 5 | 0.160 5 | 4.545 | < 0.01 | < 0.005 | 50.5 | 0.038 65 | 125. | 15. | < 0.1 | 0.183 5 | 0.441 | 354. | 1.3 | 0.005 75 | < 0.5 | 10.1 | 32. | 0.823 | 0.69 | < 0.005 |
| 31-1-1 | RPD | QA/QC | | RPD of duplicates | | 0.0% | 125.9% b | 3.8% | 1.9% | 0.2% | 0.0% | 0.0% | 5.9% | 1.3% | 0.0% | 0.0% | 0.0% | 7.1% | 17.2% | 0.0% | 46.2% b | 26.1% | 0.0% | 0.0% | 0.6% | 5.6% | 17.4% | 0.0% |
| 31-1-1 | FR1 | Y | 2024-08-28 | Yellow, low turbidity | | 150. | 2.56 | 0.085 | 0.184 | 4.9 | < 0.01 | < 0.005 | 47. | 0.040 3 | 140. | 14. | < 0.1 | 0.167 | 0.336 | 398. | 2.4 | 0.005 6 | < 0.5 | 11.9 | 31.9 | 0.686 | 0.056 | 0.068 5 |
| 31-1-1 | FR2 | Y | 2024-08-28 | Yellow, low turbidity | | 150. | 2.87 | 0.107 | 0.174 | 5. | < 0.01 | < 0.005 | 49. | 0.044 2 | 138. | 15. | < 0.1 | 0.168 | 0.345 | 394. | 5.5 | 0.007 3 | < 0.5 | 11.9 | 31.7 | 0.707 | 0.041 | 0.063 5 |
| 31-1-1 | FRM | QA/QC | 2024-08-28 | Mean of duplicates | | 150. | 2.715 | 0.096 | 0.179 | 4.95 | < 0.01 | < 0.005 | 48. | 0.042 25 | 139. | 14.5 | < 0.1 | 0.167 5 | 0.340 5 | 396. | 3.95 | 0.006 45 | < 0.5 | 11.9 | 31.8 | 0.696 5 | 0.048 5 | 0.066 |
| 31-1-1 | RPD | QA/QC | | RPD of duplicates | | 0.0% | 11.4% | 22.9% | 5.6% | 2.0% | 0.0% | 0.0% | 4.2% | 9.2% | 1.4% | 6.9% | 0.0% | 0.6% | 2.6% | 1.0% | 78.5% b | 26.4% | 0.0% | 0.0% | 0.6% | 3.0% | 30.9% b | 7.6% |
| 39-1-1 | FR1 | Y | 2023-05-12 | Clear and colourless | | 96. | 22.3 | 0.895 | 0.391 | 8.9 | < 0.01 | < 0.005 | 18. | 0.066 7 | 56.6 | 9.6 | 0.21 | 0.049 9 | 0.466 | 161. | 47.8 | 0.026 2 | < 0.5 | 4.66 | 0.941 | 2.47 | < 0.015 | 0.075 2 |
| 39-1-1 | FR2 | Y | 2023-05-12 | Clear and colourless | | 94. | 103. | 1.63 | 3.03 | 12. | 0.015 | 0.111 | 14. | 1.73 | 56.8 | 9.7 | 0.78 | 0.427 | 0.864 | 161. | 147. | 0.261 | < 0.5 | 4.7 | 3.81 | 3.4 | < 0.015 | 0.078 8 |
| 39-1-1 | FRM | QA/QC | 2023-05-12 | Mean of duplicates | | 95. | 62.65 | 1.262 5 | 1.710 5 | 10.45 | 0.012 5 | 0.058 | 16. | 0.898 35 | 56.7 | 9.65 | 0.495 | 0.238 45 | 0.665 | 161. | 97.4 | 0.143 6 | < 0.5 | 4.68 | 2.375 5 | 2.935 | < 0.015 | 0.077 |
| 39-1-1 | RPD | QA/QC | | RPD of duplicates | | 2.1% | 128.8% a | 58.2% a | 154.3% a | 29.7% | 40.0% b | 182.8% b | 25.0% | 185.2% a | 0.4% | 1.0% | 115.2% b | 158.1% a | 59.8% a | 0.0% | 101.8% a | 163.5% a | 0.0% | 0.9% | 120.8% a | 31.7% a | 0.0% | 0.0% |
| 39-1-1 | FR1 | Y | 2023-09-15 | Clear and colourless | | 95. | 9.11 | 0.88 | 0.398 | 9.54 | < 0.01 | < 0.005 | 17. | 0.019 4 | 56.5 | 8.8 | 0.25 | 0.031 9 | 0.342 | 161. | 15.4 | 0.009 2 | < 0.5 | 4.77 | 0.323 | 3.18 | < 0.015 | 0.015 6 |
| 39-1-1 | FR2 | Y | 2023-09-15 | Clear and colourless | | 95. | 7.47 | 0.87 | 0.396 | 8.3 | < 0.01 | < 0.005 | 15. | 0.019 6 | 53.8 | 8.6 | < 0.1 | 0.023 5 | 0.256 | 153. | 2.1 | < 0.005 | < 0.5 | 4.64 | 0.092 | 3.18 | < 0.015 | < 0.005 |
| 39-1-1 | FRM | QA/QC | 2023-09-15 | Mean of duplicates | | 95. | 8.29 | 0.875 | 0.397 | 8.92 | 0.01 | 0.005 | 16. | 0.019 5 | 55.15 | 8.7 | 0.175 | 0.027 7 | 0.299 | 157. | 8.75 | 0.007 1 | 0.5 | 4.705 | 0.207 5 | 3.18 | 0.015 | 0.010 3 |
| 39-1-1 | RPD | QA/QC | | RPD of duplicates | | 0.0% | 19.8% | 1.1% | 0.5% | 13.9% | 0.0% | 0.0% | 12.5% | 1.0% | 4.9% | 2.3% | 85.7% b | 30.3% b | 28.8% | 5.1% | 152.0% b | 59.2% b | 0.0% | 2.8% | 111.3% b | 0.0% | 0.0% | 102.9% b |
| 39-1-1 | FR1 | Y | 2023-11-14 | Clear and colourless | | 96. | 4.67 | 0.728 | 0.302 | 6.77 | 0.024 | < 0.005 | 11. | 0.010 4 | 54.1 | 8.6 | < 0.1 | 0.030 5 | 1.37 | 154. | 2.4 | 0.012 1 | < 0.5 | 4.63 | < 0.05 | 2.04 | 0.85 | < 0.005 |
| 39-1-1 | FR2 | Y | 2023-11-14 | Clear and colourless | | 96. | 2.85 | 0.717 | 0.31 | 6.72 | < 0.01 | < 0.005 | 12. | 0.011 7 | 54.2 | 8.6 | 0.15 | 0.028 5 | 0.192 | 154. | 1. | < 0.005 | < 0.5 | 4.53 | < 0.05 | 2.06 | 0.88 | < 0.005 |
| 39-1-1 | FRM | QA/QC | 2023-11-14 | Mean of duplicates | | 96. | 3.76 | 0.722 5 | 0.306 | 6.745 | 0.017 | < 0.005 | 11.5 | 0.011 05 | 54.15 | 8.6 | 0.125 | 0.029 5 | 0.781 | 154. | 1.7 | 0.008 55 | < 0.5 | 4.58 | < 0.05 | 2.05 | 0.865 | < 0.005 |
| 39-1-1 | RPD | QA/QC | | RPD of duplicates | | 0.0% | 48.4% a | 1.5% | 2.6% | 0.7% | 82.4% b | 0.0% | 8.7% | 11.8% | 0.2% | 0.0% | 40.0% b | 6.8% | 150.8% b | 0.0% | 82.4% b | 83.0% b | 0.0% | 2.2% | 0.0% | 1.0% | 3.5% | 0.0% |
| 39-1-1 | FR1 | Y | 2024-02-09 | Clear and colourless | | 93. | 5.18 | 0.759 | 0.331 | 9.51 | 0.01 | < 0.005 | 16. | 0.020 1 | 61.3 | 8.3 | < 0.1 | 0.039 1 | 0.219 | 174. | 2.4 | 0.009 1 | < 0.5 | 5.08 | 0.247 | 2.55 | < 0.015 | 0.009 4 |
| 39-1-1 | FR2 | Y | 2024-02-09 | Clear and colourless | | 92. | 5.4 | 0.748 | 0.329 | 7.95 | < 0.01 | < 0.005 | 17. | 0.017 4 | 62.1 | 8.4 | < 0.1 | 0.032 9 | 0.204 | 176. | 1. | < 0.005 | < 0.5 | 5.12 | 0.212 | 2.54 | < 0.015 | 0.009 4 |
| 39-1-1 | FRM | QA/QC | 2024-02-09 | Mean of duplicates | | 92.5 | 5.29 | 0.753 5 | 0.33 | 8.73 | 0.01 | < 0.005 | 16.5 | 0.018 75 | 61.7 | 8.35 | < 0.1 | 0.036 | 0.211 5 | 175. | 1.7 | 0.007 05 | < 0.5 | 5.1 | 0.229 5 | 2.545 | < 0.015 | 0.009 4 |
| 39-1-1 | RPD | QA/QC | | RPD of duplicates | | 1.1% | 4.2% | 1.5% | 0.6% | 17.9% | 0.0% | 0.0% | 6.1% | 14.4% | 1.3% | 1.2% | 0.0% | 17.2% | 7.1% | 1.1% | 82.4% b | 58.2% b | 0.0% | 0.8% | 15.3% | 0.4% | 0.0% | 0.0% |
| 41-1-1 | FR1 | Y | 2023-05-18 | Clear and colourless | | 140. | 3.42 | 0.059 | 2.43 | 2.64 | 0.01 | < 0.005 | 37. | 0.010 7 | 69.4 | 12. | 0.16 | 0.059 1 | 0.239 | 202. | 7.1 | < 0.005 | < 0.5 | 7.02 | 95.1 | 1.41 | 1.1 | < 0.005 |
| 41-1-1 | FR2 | Y | 2023-05-18 | Clear and colourless | | 150. | 70.6 | 0.07 | 2.18 | 3.25 | < 0.01 | < 0.005 | 34. | 0.016 | 68.7 | 11. | 0.2 | 0.123 | 0.302 | 200. | 189. | 0.035 7 | < 0.5 | 7.06 | 67.2 | 1.31 | 1.1 | < 0.005 |
| 41-1-1 | FRM | QA/QC | 2023-05-18 | Mean of duplicates | | 145. | 37.01 | 0.064 5 | 2.305 | 2.945 | 0.01 | < 0.005 | 35.5 | 0.013 35 | 69.05 | 11.5 | 0.18 | 0.091 05 | 0.270 5 | 201. | 98.05 | 0.020 35 | < 0.5 | 7.04 | 81.15 | 1.36 | 1.1 | < 0.005 |
| 41-1-1 | RPD | QA/QC | | RPD of duplicates | | 6.9% | 181.5% a | 17.1% | 10.8% | 20.7% | 0.0% | 0.0% | 8.5% | 39.7% b | 1.0% | 8.7% | 22.2% a | 70.2% a | 23.3% | 1.0% | 185.5% a | 150.9% b | 0.0% | 0.6% | 34.4% a | 7.4% | 0.0% | 0.0% |
| 41-1-1 | FR1 | COMPLIANCE | 2023-09-28 | Clear and colourless | | 160. | 6.92 | 0.054 | 4.46 | 1.22 | < 0.01 | < 0.005 | 32. | 0.021 | 66.5 | 5.5 | < 0.1 | 0.069 | 0.262 | 195. | 8.9 | 0.007 | < 0.5 | 7.09 | 187. | 2.08 | 0.94 | < 0.005 |
| 41-1-1 | FR2 | COMPLIANCE | 2023-09-28 | Clear and colourless | | 160. | 2.7 | 0.042 | 4.51 | 1.19 | < 0.01 | < 0.005 | 37. | 0.008 | 68.5 | 5.2 | < 0.1 | 0.061 | 0.231 | 201. | 4.8 | < 0.005 | < 0.5 | 7.21 | 185. | 2.02 | 0.9 | < 0.005 |
| 41-1-1 | FRM | QA/QC | 2023-09-28 | Mean of duplicates | | 160. | 4.81 | 0.048 | 4.485 | 1.205 | < 0.01 | < 0.005 | 34.5 | 0.014 5 | 67.5 | 5.35 | < 0.1 | 0.065 | 0.246 5 | 198. | 6.85 | 0.006 | < 0.5 | 7.15 | 186. | 2.05 | 0.92 | < 0.005 |
| 41-1-1 | RPD | QA/QC | | RPD of duplicates | | 0.0% | 87.7% a | 25.0% | 1.1% | 2.5% | 0.0% | 0.0% | 14.5% | 89.7% b | 3.0% | 5.6% | 0.0% | 12.3% | 12.6% | 3.0% | 59.9% b | 33.3% a | 0.0% | 1.7% | 1.1% | 2.9% | 4.3% | 0.0% |
| 41-1-1 | FR1 | Y | 2023-11-24 | Clear and colourless | | 150. | 2. | 0.084 | 1.54 | 1.56 | 0.026 | < 0.005 | 30. | < 0.005 | 65.7 | 5.8 | < 0.1 | 0.023 3 | 1.31 | 192. | 2.3 | 0.009 9 | < 0.5 | 6.72 | 30.1 | 1.2 | 0.89 | < 0.005 |
| 41-1-1 | FR2 | Y | 2023-11-24 | Clear and colourless | | 150. | 1.26 | 0.073 | 1.54 | 1.54 | < 0.01 | < 0.005 | 29. | < 0.005 | 65.4 | 5.4 | < 0.1 | 0.017 1 | 0.217 | 191. | 1.3 | < 0.005 | < 0.5 | 6.78 | 30. | 1.17 | 0.89 | < 0.005 |
| 41-1-1 | FRM | QA/QC | 2023-11-24 | Mean of duplicates | | 150. | 1.63 | 0.078 5 | 1.54 | 1.55 | 0.018 | < 0.005 | 29.5 | < 0.005 | 65.55 | 5.6 | < 0.1 | 0.020 2 | 0.763 5 | 191.5 | 1.8 | 0.007 45 | < 0.5 | 6.75 | 30.05 | 1.185 | 0.89 | < 0.005 |
| 41-1-1 | RPD | QA/QC | | RPD of duplicates | | 0.0% | 45.4% b | 14.0% | 0.0% | 1.3% | 88.9% b | 0.0% | 3.4% | 0.0% | 0.5% | 7.1% | 0.0% | 30.7% b | 143.2% b | 0.5% | 55.6% b | 65.8% b | 0.0% | 0.9% | 0.3% | 2.5% | 0.0% | 0.0% |
| 41-1-1 | FR1 | Y | 2024-02-28 | Clear, very slightly yellow | | 140. | 1.65 | 0.114 | 1.47 | 1.7 | < 0.01 | < 0.005 | 27. | < 0.005 | 67.3 | 12. | < 0.1 | 0.031 | 0.173 | 197. | 7.1 | < 0.005 | < 0.5 | 7.08 | 6.79 | 1.85 | 0.21 | < 0.005 |
| 41-1-1 | FR2 | Y | 2024-02-28 | Clear, very slightly yellow | | 140. | 1.74 | 0.121 | 1.44 | 1.66 | < 0.01 | < 0.005 | 27. | < 0.005 | 68.5 | 12. | < 0.1 | 0.032 | 0.177 | 200. | 5.9 | 0.005 | < 0.5 | 6.96 | 5.25 | 1.81 | 0.21 | < 0.005 |
| 41-1-1 | FRM | QA/QC | 2024-02-28 | Mean of duplicates | | 140. | 1.695 | 0.117 5 | 1.455 | 1.68 | < 0.01 | < 0.005 | 27. | < 0.005 | 67.9 | 12. | < 0.1 | 0.031 5 | 0.175 | 198.5 | 6.5 | 0.005 | < 0.5 | 7.02 | 6.02 | 1.83 | 0.21 | < 0.005 |
| 41-1-1 | RPD | QA/QC | | RPD of duplicates | | 0.0% | 5.3% | 6.0% | 2.1% | 2.4% | 0.0% | 0.0% | 0.0% | 0.0% | 1.8% | 0.0% | 0.0% | 3.2% | 2.3% | 1.5% | 18.5% | 0.0% | 0.0% | 1.7% | 25.6% | 2.2% | 0.0% | 0.0% |

# Hartland Landfill Groundwater, Surface Water and Leachate Monitoring Program Annual Report (April 2022 to March 2023)

## Table 3-1. Groundwater Quality QA/QC - Relative Percent Difference 2023-2024

| | | |

# Hartland Landfill Groundwater, Surface Water and Leachate Monitoring Program Annual Report (April 2022 to March 2023)

## Table 3-1. Groundwater Quality QA/QC - Relative Percent Difference 2023-2024

| | | | | | MAX Acceptable RPD | | 30% | | 30% | | 30%

# Hartland Landfill Groundwater, Surface Water and Leachate Monitoring Program Annual Report (April 2022 to March 2023)

## Table 3-1. Groundwater Quality QA/QC - Relative Percent Difference 2023-2024

| | | |

# Hartland Landfill Groundwater, Surface Water and Leachate Monitoring Program Annual Report (April 2022 to March 2023)

## Table 3-1. Groundwater Quality QA/QC - Relative Percent Difference 2023-2024

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# Hartland Landfill Groundwater, Surface Water and Leachate Monitoring Program Annual Report (April 2022 to March 2023)

## Table 3-2. Surface Water Quality QA/QC - Relative Percent Difference 2023-2024

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# Hartland Landfill Groundwater, Surface Water and Leachate Monitoring Program Annual Report (April 2022 to March 2023)

## Table 3-2. Surface Water Quality QA/QC - Relative Percent Difference 2023-2024

| | | |

# Hartland Landfill Groundwater, Surface Water and Leachate Monitoring Program Annual Report
# (April 2022 to March 2023)
## Table 3-2. Surface Water Quality QA/QC - Relative Percent Difference 2023-2024

| | | |

# Hartland Landfill Groundwater, Surface Water and Leachate Monitoring Program Annual Report
# (April 2022 to March 2023)
## Table 3-2. Surface Water Quality QA/QC - Relative Percent Difference 2023-2024

| | | |

# Hartland Landfill Groundwater, Surface Water and Leachate Monitoring Program Annual Report (April 2022 to March 2023)

## Table 3-2. Surface Water Quality QA/QC - Relative Percent Difference 2023-2024

| | | |

# Hartland Landfill Groundwater, Surface Water and Leachate Monitoring Program Annual Report (April 2022 to March 2023)

## Table 3-2. Surface Water Quality QA/QC - Relative Percent Difference 2023-2024

| | | |

AECOM

## Table 3-3. Hartland Valve Chamber Leachate Chemistry QA/QC - Relative Percent Difference 2023-2024

| State | Parameter | MDL | LOQ | Lab Units | Maximum Acceptable RPD | Hartland Valve Chamber FR1 13-Apr-2023 | | Hartland Valve Chamber FR2 13-Apr-2023 | | RPD % | | Hartland Valve Chamber FR1 24-Aug-2023 | | Hartland Valve Chamber FR2 24-Aug-2023 | | RPD % | | Hartland Valve Chamber FR1 09-Nov-2024 | | Hartland Valve Chamber FR2 09-Nov-2024 | | RPD % | | Hartland Valve Chamber FR1 24-Feb-2024 | | Hartland Valve Chamber FR2 24-Feb-2024 | | RPD % | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Conventionals** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| TOT | Total Sulphide | 0.001 8 | 0.009 | mg/L | 30% | < | 0.047 | < | 0.051 | 8.2% | | | 0.082 | | 0.033 | 85.2% | a | | 0.056 | | 0.026 | 73.7% | a | < | 0.009 | | 0.027 | 40.0% | b |
| DISS | Dissolved Sulphide | 0.009 | 0.045 | mg/L | 30% | < | 0.03 | < | 0.02 | 40.0% | b | | 0.048 | | 0.043 | 11.0% | | | 0.026 | | 0.024 | 8.0% | | | 0.022 | | 0.025 | 12.8% | |
| TOT | TSS | 1. | 5. | mg/L | 30% | | 73. | | 70. | 4.2% | | | 23. | | 21. | 9.1% | | | 14. | | 19. | 30.3% | a | | 15. | | 15. | --- | |
| TOT | BOD | 2. | 10. | mg/L | 30% | < | 40. | < | 42. | 4.9% | | | 45. | | 52. | 14.4% | | | 21. | | 18. | 15.4% | | | 23. | | 21. | 9.1% | |
| TOT | COD | 10. | 50. | mg/L | 30% | | 480. | | 521. | 8.2% | | | 553. | | 582. | 5.1% | | | 427. | | 454. | 6.1% | | | 251. | | 250. | 0.4% | |
| DISS | Chloride | 1. | 5. | mg/L | 30% | | 270. | | 280. | 3.6% | | | 390. | | 390. | --- | | | 260. | | 260. | --- | | | 170. | | 170. | --- | |
| DISS | Sulphate | 1. | 5. | mg/L | 30% | | 88. | < | 87. | 1.1% | | | 4. | | 5.2 | 26.1% | | | 220. | | 210. | 4.7% | | | 120. | | 120. | --- | |
| TOT | Oil & Grease, Total | 1. | 5. | mg/L | 30% | < | 1. | < | 1. | --- | | < | 1. | < | 1. | --- | | | 1. | | 1. | --- | | < | 1. | < | 1. | --- | |
| TOT | Oil & Grease, Mineral | 2. | 10. | mg/L | 45% | < | 2. | < | 2. | --- | | < | 2. | < | 2. | --- | | < | 2. | < | 2. | --- | | < | 2. | < | 2. | --- | |
| TOT | Cyanide - SAD (total) | 0.000 5 | 0.002 5 | mg/L | 30% | | 0.013 2 | | 0.014 2 | 7.3% | | < | 0.014 1 | | 0.015 5 | 9.5% | | < | 0.012 7 | | 0.011 8 | 7.3% | | < | 0.007 17 | | 0.007 99 | 10.8% | |
| TOT | Cyanide - WAD | 0.000 5 | 0.002 5 | mg/L | 30% | | 0.008 1 | | 0.009 4 | 14.9% | | | 0.005 2 | | 0.006 9 | 28.1% | | | 0.004 18 | | 0.004 81 | 14.0% | | < | 0.000 5 | < | 0.000 5 | --- | |
| TOT | Phenols | 0.015 | 0.075 | mg/L | 45% | < | 0.05 | < | 0.05 | --- | | | --- | | --- | --- | | | 0.015 | | 0.04 | 90.9% | b | < | 0.001 5 | | --- | --- | |
| TOT | Ammonia | 1.5 | 7.5 | mg/L | 30% | | 240. | | 230. | 4.3% | | | 290. | | 270. | 7.1% | | | 220. | | 220. | --- | | | 120. | | 120. | --- | |
| TOT | Nitrite | 0.005 | 0.025 | mg/L | 30% | | 1.31 | | 1.3 | 0.8% | | | 0.29 | | 0.323 | 10.8% | | | 1.08 | | 1.09 | 0.9% | | | 0.382 | | 0.375 | 1.8% | |
| TOT | Nitrate | 0.02 | 0.1 | mg/L | 30% | | 16.2 | | 16.2 | --- | | | 0.21 | < | 0.2 | 4.9% | | | 12.1 | | 12. | 0.8% | | | 12.8 | | 13. | 1.6% | |
| TOT | pH | 0.01 | 0.05 | pH | 30% | | 7.6 | | 7.6 | --- | | | 8.71 | | 8.71 | --- | | | 7.68 | | 7.68 | --- | | | 7.06 | | 7.06 | --- | |
| TOT | Conductivity | 0.1 | 0.5 | µS/cm | 30% | | 3 035. | | 3 035. | --- | | | 4 328. | | 4 328. | --- | | | 3 017. | | 3 017. | --- | | | 1 502. | | 1 502. | --- | |
| TOT | Temperature | 0.1 | 0.5 | °C | 30% | | 14.5 | | 14.5 | --- | | | 21.7 | | 21.7 | --- | | | 14.1 | | 14.1 | --- | | | 12.2 | | 12.2 | --- | |
| TOT | Dissolved Oxygen | 0.01 | 0.05 | mg/L | 30% | | 17.4 | | 17.4 | --- | | | 87.4 | | 87.4 | --- | | | 1.57 | | 1.57 | --- | | | 9.55 | | 9.55 | --- | |
| TOT | ORP | 1. | 5. | mV | 30% | | - 140.1 | | - 140.1 | --- | | | 18.4 | | 18.4 | --- | | | 72.1 | | 72.1 | --- | | | 80.3 | | 80.3 | --- | |
| **Total Metals** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| TOT | Arsenic | 0.04 | 0.2 | µg/L | 30% | | 5.06 | | 5.17 | 2.2% | | | 6.88 | | 6.78 | 1.5% | | | 4.87 | | 5.02 | 3.0% | | | 3.57 | | 3.41 | 4.6% | |
| TOT | Cadmium | 0.01 | 0.05 | µg/L | 30% | | 0.056 | | 0.062 | 10.2% | | | 0.093 | | 0.059 | 44.7% | a | | 0.048 2 | | 0.047 1 | 2.3% | | | 0.029 6 | | 0.024 | 20.9% | |
| TOT | Chromium | 0.2 | 1. | µg/L | 30% | | 35.7 | | 36.9 | 3.3% | | | 50.1 | | 49.6 | 1.0% | | | 35.4 | | 37. | 4.4% | | | 23.5 | | 23.7 | 0.8% | |
| TOT | Cobalt | 0.02 | 0.1 | µg/L | 30% | | 10.7 | | 10.8 | 0.9% | | | 14.1 | | 13.8 | 2.2% | | | 10.2 | | 10.6 | 3.8% | | | 6.03 | | 5.76 | 4.6% | |
| TOT | Copper | 0.2 | 1. | µg/L | 30% | | 14. | | 14.6 | 4.2% | | | 11.3 | | 10.6 | 6.4% | | | 19.6 | | 20.2 | 3.0% | | | 8.46 | | 7.3 | 14.7% | |
| TOT | Iron | 10. | 50. | µg/L | 30% | | 1 500. | | 1 810. | 18.7% | | | 3 260. | | 3 140. | 3.8% | | | 1 360. | | 1 390. | 2.2% | | | 894. | | 914. | 2.2% | |
| TOT | Lead | 0.04 | 0.2 | µg/L | 30% | | 0.488 | | 0.56 | 13.7% | | | 0.602 | | 0.53 | 12.7% | | | 0.596 | | 0.592 | 0.7% | | | 0.388 | | 0.388 | --- | |
| TOT | Manganese | 0.2 | 1. | µg/L | 30% | | 514. | | 525. | 2.1% | | | 546. | | 549. | 0.5% | | | 491. | | 508. | 3.4% | | | 286. | | 269. | 6.1% | |
| TOT | Mercury | 0.019 | 0.095 | µg/L | 30% | < | 0.038 | < | 0.038 | --- | | < | 0.019 | < | 0.019 | --- | | < | 0.038 | < | 0.038 | --- | | < | 0.019 | < | 0.019 | --- | |
| TOT | Molybdenum | 0.1 | 0.5 | µg/L | 30% | | 2.22 | | 2.17 | 2.3% | | | 3.23 | | 3.25 | 0.6% | | | 3.91 | | 4.13 | 5.5% | | | 1.82 | | 1.86 | 2.2% | |
| TOT | Nickel | 0.2 | 1. | µg/L | 30% | | 30.8 | | 30.7 | 0.3% | | | 40.5 | | 39.1 | 3.5% | | | 29.7 | | 30.7 | 3.3% | | | 16.6 | | 16.1 | 3.1% | |
| TOT | Selenium | 0.08 | 0.4 | µg/L | 30% | | 0.485 | | 0.495 | 2.0% | | | 0.863 | | 0.703 | 20.4% | | | 0.913 | | 0.922 | 1.0% | | | 0.57 | | 0.574 | 0.7% | |
| TOT | Sodium | 50. | 250. | µg/L | 30% | | 220. | | 222. | 0.9% | | | 294. | | 290. | 1.4% | | | 206. | | 214. | 3.8% | | | 128. | | 122. | 4.8% | |
| TOT | Silver | 0.02 | 0.1 | µg/L | 30% | < | 0.02 | < | 0.02 | --- | | | 0.034 | < | 0.02 | 51.9% | b | | 0.016 | | 0.015 | 6.5% | | < | 0.01 | < | 0.01 | --- | |
| TOT | Zinc | 2. | 10. | µg/L | 30% | | 14.3 | | 15.7 | 9.3% | | | 16.3 | | 7.8 | 70.5% | b | | 11. | | 10.6 | 3.7% | | | 8.7 | | 8.3 | 4.7% | |
| **BTEX** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| DISS | Benzene | 0.4 | 2. | µg/L | 45% | < | 0.4 | < | 0.4 | --- | | < | 0.4 | < | 0.4 | --- | | < | 0.4 | < | 0.4 | --- | | < | 0.4 | < | 0.4 | --- | |
| DISS | Toluene | 0.4 | 2. | µg/L | 45% | | 0.61 | | 0.61 | --- | | < | 0.4 | < | 0.4 | --- | | | 1.2 | | 1.1 | 8.7% | | | 0.56 | | 0.67 | 17.9% | |
| DISS | Ethylbenzene | 0.4 | 2. | µg/L | 45% | < | 0.4 | < | 0.4 | --- | | < | 0.4 | < | 0.4 | --- | | < | 0.4 | < | 0.4 | --- | | < | 0.4 | < | 0.4 | --- | |
| DISS | Xylenes | 0.4 | 2. | µg/L | 45% | < | 0.4 | < | 0.4 | --- | | < | 0.4 | < | 0.4 | --- | | | 0.43 | | 0.44 | 2.3% | | < | 0.4 | < | 0.4 | --- | |
| **PAH** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| TOT | Total PAH | 0.01 | 0.05 | µg/L | 45% | | 3.5 | | 3. | 15.4% | | | 3.2 | | 4.2 | 27.0% | | | 5.8 | | 5.3 | 9.0% | | | 2.4 | | 2.3 | 4.3% | |
| TOT | Acenaphthene | 0.01 | 0.05 | µg/L | 45% | | 0.46 | | 0.41 | 11.5% | | | 0.83 | | 1.1 | 28.0% | | | 2. | | 1.9 | 5.1% | | | 0.71 | | 0.7 | 1.4% | |
| TOT | Acenaphthylene | 0.01 | 0.05 | µg/L | 45% | | 0.06 | | 0.054 | 10.5% | | | 0.013 | | 0.015 | 14.3% | | | 0.024 | | 0.021 | 13.3% | | | 0.028 | | 0.028 | --- | |
| TOT | Anthracene | 0.01 | 0.05 | µg/L | 45% | | 0.82 | | 0.79 | 3.7% | | | 0.048 | | 0.057 | 17.1% | | | 0.15 | | 0.13 | 14.3% | | | 0.21 | | 0.2 | 4.9% | |
| TOT | Benzo(a)anthracene | 0.01 | 0.05 | µg/L | 45% | | 0.11 | | 0.093 | 16.7% | | | 0.04 | | 0.055 | 31.6% | b | | 0.073 | | 0.058 | 22.9% | | | 0.047 | | 0.05 | 6.2% | |
| TOT | Benzo(a)pyrene | 0.005 | 0.025 | µg/L | 45% | | 0.043 | | 0.034 | 23.4% | | | 0.012 | | 0.013 | 8.0% | | | 0.009 5 | | 0.008 5 | 11.1% | | | 0.009 8 | | 0.013 | 28.1% | |
| TOT | Benzo(b,j)fluoranthene | 0.01 | 0.05 | µg/L | 45% | | 0.061 | | 0.05 | 19.8% | | | 0.016 | | 0.021 | 27.0% | | | 0.014 | | 0.013 | 7.4% | | | 0.015 | | 0.017 | 12.5% | |
| TOT | Benzo(g,h,i)perylene | 0.02 | 0.1 | µg/L | 45% | < | 0.022 | < | 0.02 | 9.5% | | < | 0.02 | < | 0.02 | --- | | < | 0.02 | < | 0.02 | --- | | < | 0.02 | < | 0.02 | --- | |
| TOT | Benzo(k)fluoranthene | 0.01 | 0.05 | µg/L | 45% | < | 0.024 | < | 0.016 | 40.0% | b | < | 0.01 | < | 0.01 | --- | | < | 0.01 | < | 0.01 | --- | | < | 0.01 | < | 0.01 | --- | |
| TOT | Chrysene | 0.01 | 0.05 | µg/L | 45% | | 0.12 | | 0.1 | 18.2% | | | 0.032 | | 0.043 | 29.3% | | | 0.07 | | 0.056 | 22.2% | | | 0.05 | | 0.054 | 7.7% | |
| TOT | Dibenzo(a,h)anthracene | 0.02 | 0.1 | µg/L | 45% | < | 0.02 | < | 0.02 | --- | | < | 0.02 | < | 0.02 | --- | | < | 0.02 | < | 0.02 | --- | | < | 0.02 | < | 0.02 | --- | |
| TOT | Fluoranthene | 0.01 | 0.05 | µg/L | 45% | | 0.65 | | 0.51 | 24.1% | | | 0.37 | | 0.52 | 33.7% | a | | 0.75 | | 0.65 | 14.3% | | | 0.45 | | 0.42 | 6.9% | |
| TOT | Fluorene | 0.01 | 0.05 | µg/L | 45% | | 0.45 | | 0.4 | 16.9% | | | 0.37 | | 0.46 | 21.7% | | | 1.2 | | 1.1 | 8.7% | | | 0.36 | | 0.36 | --- | |
| TOT | Indeno(1,2,3-c,d)pyrene | 0.02 | 0.1 | µg/L | 45% | < | 0.02 | < | 0.02 | --- | | < | 0.02 | < | 0.02 | --- | | < | 0.02 | < | 0.02 | --- | | < | 0.02 | < | 0.02 | --- | |
| TOT | Naphthalene | 0.01 | 0.05 | µg/L | 45% | | 0.025 | | 0.029 | 14.8% | | | 0.82 | | 1.1 | 29.2% | | | 0.48 | | 0.44 | 8.7% | | | 0.052 | | 0.049 | 5.9% | |
| TOT | Phenanthrene | 0.01 | 0.05 | µg/L | 45% | | 0.05 | | 0.039 | 24.7% | | | 0.16 | | 0.2 | 22.2% | | | 0.22 | | 0.19 | 14.6% | | | 0.037 | | 0.03 | 20.9% | |
| TOT | Pyrene | 0.01 | 0.05 | µg/L | 45% | | 0.56 | | 0.44 | 24.0% | | | 0.27 | | 0.38 | 33.8% | a | | 0.51 | | 0.44 | 14.7% | | | 0.3 | | 0.27 | 10.5% | |
| **Chlorinated Phenols** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| TOT | Chlorinated phenols (total) | 0.41 | 2.05 | µg/L | 45% | < | 0.5 | | 0.5 | --- | | | --- | | --- | --- | | | --- | | --- | --- | | | --- | | --- | --- | |
| TOT | Total Dichlorophenols | 0.22 | 1.1 | µg/L | 45% | < | 0.5 | < | 0.5 | --- | | | --- | | --- | --- | | | --- | | --- | --- | | | --- | | --- | --- | |
| TOT | Total Monochlorophenols | 0.09 | 0.45 | µg/L | 45% | < | 0.4 | < | 0.4 | --- | | | --- | | --- | --- | | | --- | | --- | --- | | | --- | | --- | --- | |
| TOT | Total Nonchlorinated phenols | 1.6 | 8. | µg/L | 45% | | 50. | | 50. | --- | | | --- | | --- | --- | | | --- | | --- | --- | | | --- | | --- | --- | |
| TOT | Total Phenolic Compounds | 0.17 | 0.85 | µg/L | 45% | | 0.5 | | 0.5 | --- | | | --- | | --- | --- | | | --- | | --- | --- | | | --- | | --- | --- | |
| TOT | Total Tetrachlorophenols | 0.17 | 0.85 | µg/L | 45% | < | 0.5 | < | 0.5 | --- | | | --- | | --- | --- | | | --- | | --- | --- | | | --- | | --- | --- | |
| TOT | Total Trichlorophenols | 0.24 | 1.2 | µg/L | 45% | < | 0.4 | < | 0.4 | --- | | | --- | | --- | --- | | | --- | | --- | --- | | | --- | | --- | --- | |
| TOT | 2-Chlorophenol | 0.05 | 0.25 | µg/L | 45% | | 0.5 | | 0.5 | --- | | | --- | | --- | --- | | | --- | | --- | --- | | | --- | | --- | --- | |
| TOT | 2,4 + 2,5 Dichlorophenol | 0.1 | 0.5 | µg/L | 45% | < | 0.5 | < | 0.5 | --- | | | --- | | --- | --- | | | --- | | --- | --- | | | --- | | --- | --- | |
| TOT | 2,4,6-Trichlorophenol | 0.1 | 0.5 | µg/L | 45% | < | 0.5 | < | 0.5 | --- | | | --- | | --- | --- | | | --- | | --- | --- | | | --- | | --- | --- | |
| TOT | Pentachlorophenol | 0.1 | 0.5 | µg/L | 45% | < | 0.5 | < | 0.5 | --- | | | --- | | --- | --- | | | --- | | --- | --- | | | --- | | --- | --- | |
| TOT | 2,3,4,5-Tetrachlorophenol | 0.1 | 0.5 | µg/L | 45% | < | 0.5 | < | 0.5 | --- | | | --- | | --- | --- | | | --- | | --- | --- | | | --- | | --- | --- | |
| TOT | 2,3,4,6-Tetrachlorophenol | 0.1 | 0.5 | µg/L | 45% | | 0.5 | | 0.5 | --- | | | --- | | --- | --- | | | --- | | --- | --- | | | --- | | --- | --- | |

***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 30% for general inorganic parameters/metals and 45% for organic parameters and all replicates greater than the limit of quantitation.*
***b*** *- Relative Standard Difference greater than 30% for general inorganic parameters/metals and 45% for organic parameters, with some replicates less than the limit of quantitation.*

## 3.4 Summary

In summary, the 2023/24 quality assurance (QA) analysis indicates the following:

- Duplicate sampling frequencies of 16.3% (57/350 samples) for groundwater, 15.7% (22/140 samples) for surface water, 28.6% (4/14 samples) for the Hartland Valve Chamber compliance point, and 6.25% (4/64 samples) for the overall leachate sampling program. Overall, duplicate samples were collected at a frequency of approximately 15% (88/554), which exceeded the targeted duplicate sampling rate of 10%.
- Groundwater sampling and the laboratory analysis produced reliable results. The QA results indicated a total of 33 samples and 77 analytical results across 18 parameters exceeded the RPD alert limits when all parameter concentrations were above the LOQ. Notably, dissolved aluminum and zinc concentrations should be interpreted with caution, as these parameters exhibited a relatively high number of RPD values above the alarm limit (among 17 and 7 samples, respectively) when all parameter concentrations were above the LOQ. The relatively high number of elevated RPD values may reflect 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 22 samples and 45 analytical results across 18 parameters exceeded the RPD alert limits where all parameter concentrations were above the LOQ. Total nickel, dissolved aluminum, and dissolved zinc concentrations exhibited a relatively high number of elevated RPD results among 6-7 samples, so these parameters should be interpreted with caution for these samples.
- Leachate sampling and laboratory analysis have produced reliable results. A total of 2 samples and 5 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 to evaluate temporal trends in water quality at the landfill. The analysis is targeted at parameters that are known indicators of leachate and aggregate influences. Water quality data collected from 93 groundwater monitoring wells, 10 leachate purge wells, 26 surface water stations, and one (1) leachate compliance monitoring point were analyzed, and 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, and recommendations for modifications to the number, location and sampling frequency of compliance monitoring locations were implemented beginning in the 2016/17 monitoring year. The monitoring network and sampling program was reviewed again in 2023/24, with further adjustments to ensure the landfill monitoring program provides information to support the compliance monitoring program and management of the landfill. Groundwater elevations at the landfill are 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 installed in the Lower Leachate Lagoon, Upper Leachate Lagoon, Phase 2 basin (i.e., Heal Basin), wells GW-36-1-1 and GW-37-1-1, and one monitoring well located north of Phase 1 (GW-40-1-1).
- Continuous groundwater level monitoring using the SCADA system installed in five purge wells south of Phase 1 (P1, P2, P3, P4 and P10).
- Continuous water level monitoring in four monitoring wells east of Phase 1 (GW-17-1-1, GW-18-1-1, GW-54-1-1 and GW-76-1-1).
- Continuous groundwater level and flow monitoring using the SCADA system installed in or near three North Purge Wells (GW-80-1-0-P8, GW-81-1-0-P9 and GW-52-4-0-P7) and two monitoring wells located north of Phase 1 (GW-52-3-0 and GW-52-1-1).
- Continuous water level monitoring in 10 wells north of Phase 2 (GW-41-1-1, GW-43-1-1, GW-44-1-1, GW-62-1-1, GW-77-1-1, GW-78-1-1, GW-87-1-1, GW-87-2-1, GW-88-1-1 and GW-88-2-1).
- Continuous water level monitoring in four wells installed in the Hartland North Ridge area (GW-91-1-1, GW-92-1-1, GW-93-1-1 and GW-94-1-1).
- The presence and elevation of topography, refuse, engineered covers, temporary tarps, ditches, and surface water features.
- Daily precipitation data collected from the Hartland Climate Station (Victoria Hartland CS).

Manually measured groundwater elevations from 2023/24 are presented in Appendix A.3. Groundwater flow patterns were interpreted based on the groundwater elevations measured in September 2023. 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 Phase 1. 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. 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 systems.

In 2022/23, monitoring wells GW-93-1-1 and GW-27-1-2 were destroyed during blasting, and the pressure transducers installed in these wells could not be retrieved. In 2023/24, monitoring well GW-27-1-1 was decommissioned due to construction of Cell 4, and monitoring well GW-94-1-1 was damaged during blasting and subsequently decommissioned.

Monitoring wells GW-78-1-1 and GW-78-2-1 were decommissioned in Q1 of 2024 due to construction of a commercial road along the North Ridge. Monitoring groundwater levels in these wells is imperative to assess the structure of the hydraulic trap, and CRD staff is planning a drilling program to replace these wells during the summer of 2024.

Several of the monitoring wells (GW-99-1-1, GW-100-1-1, GW-101-1-1, GW-103-1-1, GW-105-1-1, GW-106-1-1, GW-107-1-1, GW-107-1-2 and GW-110-1-1) that were installed north/northwest of Phase 2 during the Northwest Sedimentation Pond (NWSP) Investigation (AECOM 2023) were decommissioned in Q1 of 2024 because they are spaced closely to other wells, were in the way of Cell 4 and 5 construction, and are no longer needed to monitor groundwater quality. Some of the wells, including wells GW-95-1-1, GW-96-1-1, GW-98-1-1, GW-104-1-1, GW-108-1-1, and GW-109-1-1 were left intact. Two purge wells, P11 and P12, were installed during the later stages of the NWSP Investigation, and P11 began operating in intermittently

in May 2023, with ongoing challenges related to the air compressor. The air compressor was fixed at the end of Q1 2024 and the pump is fully functional.

## 4.2 Regional Groundwater Flow in the Bedrock

Figure 4-1 presents an interpretation of regional groundwater flow patterns based on groundwater level measurements collected from wells completed in bedrock and deep wells completed in refuse, as observed in September 2023. Figure 4-2 is a cross-section that extends from north of the leachate lagoons to the south of Phase 1 and depicts groundwater flow in a north-south direction. Figure 4-3 shows groundwater flow in section along an east-west transect extending from the bedrock ridge northwest of Phase 2 to the eastern property boundary. Within the landfill footprint, several wells (GW-75-1-1, 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 GW-77-1-1 are shown in plan on Figure 4-1 and in cross section in Figure 4-2 and Figure 4-3. Measured groundwater elevations and hydrogeologic testing indicated that these structures influence local-scale groundwater flow patterns.

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

As shown on Figure 4-1, there is an inferred groundwater flow divide located near the south end of the landfill and a small portion of groundwater below the south portion Phase 1 flows toward the southeast. This flow divide trends roughly along 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 that was installed at the south end of the landfill in the 1980s, and by five purge wells (P1, P2, P3, P4 and P10) that began pumping leachate in 2001. Leachate collected by the south purge well network is pumped from the south pumping station to the Lower Leachate Lagoon.

Near the North Ridge and Hartland North Pad, northwest of Phase 2, groundwater flows radially from a topographic high. The water flows predominantly northeast towards Heal Creek and northward in the direction of Durrance Lake. East of the landfill, along the bedrock ridge trending roughly north-south between the Site and Kiowa Place Road, groundwater flows inward toward the northern portion of the Phase 1 landfill. Further east of the landfill boundary, the topography begins to slope eastward towards the Tod Creek valley, and the groundwater flow direction is likely eastward toward Tod Creek.

In 2023/24 groundwater flow patterns were consistent with previous years, with some differences caused by blasting and the construction of Cell 4 and lowering of the quarry floor, particularly along the North Ridge. Similar to the previous monitoring year, during the dry season, groundwater levels in wells GW-88-1-1 and GW-87-1-1 decreased by approximately 2-6 m. Compared to the 2021/22 monitoring year, groundwater levels in 87-1-1 have decreased by approximately 12.5 m, and groundwater levels in GW-88-1-1 have decreased by about 7.5 m. The same changes have been observed in other monitoring wells completed along the North Ridge (e.g., GW-94-1-1, GW-92-1-1, GW-77-1-1, GW-62-1-1), where groundwater levels have decreased by about 3-7.5 m since the 2021/22 monitoring year. In the wet season, groundwater levels along the North Ridge rebounded to historical levels in all wells except GW-88-1-1, GW-88-2-1, and GW-62-1-1. Ultimately, the declining groundwater levels and changes to the potentiometric surface are judged to be the result of landfill modifications, highlighting the extent of the drawdown influence of the quarry and the importance of closely monitoring the hydraulic trap north and west of the landfill. Throughout the 2023/24, inward hydraulic gradients toward Phase 2 were maintained.

In 2023/24, groundwater elevations around the Highland Fault continued to change. Historically, groundwater elevations have been about 7-10 m higher west of the Highland Fault than they are immediately east (as observed in wells 87 and 88), indicating that the fault is a barrier to west-east groundwater flow. Seasonal fluctuations in groundwater elevations have been observed in this area, but differences in groundwater levels across the fault have become less pronounced during the wet season and more pronounced in the dry season. Historically, groundwater levels in GW-88-1-1 and GW-87-1-1 differed by about 1-3 m, depending on the season, but groundwater levels in these wells differed by approximately 6 m in 2023/24. It is possible that quarry development removed some of the lower permeability material associated with the Highland Fault, allowing groundwater to drain to Phase 2 and lowering groundwater elevations upgradient (west) of the fault.

## 4.3 Leachate Elevations in Phase 1 and Phase 2

### 4.3.1 Phase 1

Groundwater monitoring wells installed at varying depths in Phase 1 allow for measurement of leachate levels and interpretation of flow directions within the refuse. In addition to the monitoring wells, groundwater 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 and leachate level measurements collected in September 2023. During the operating years of the Phase 1 landfill, the leachate mound within Phase 1 reached an elevation of approximately 160 m asl. A final cover that incorporated a geomembrane liner 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, and the hydraulic gradient is downward. The downward gradient in the central portion of the landfill reverse to upward gradients due to pumping at the leachate collection purge wells in the north and south areas of the landfill. In 2023/24, leachate elevations within Phase 1 were generally below 155 m asl, reflecting an approximate 5 m decrease in the elevation of the leachate mound since capping of the Phase 1 landfill.

Figure 4-5 presents leachate elevations in seven (7) landfill gas monitors in the Phase 1 landfill. Like previous years, leachate levels in the shallow landfill gas monitors typically showed minor (i.e., ±1 m) variability, as the refuse has a relatively high porosity and exhibits relatively consistent recharge and discharge patterns. The relatively high leachate elevations in other shallow gas wells screened in refuse (e.g., VLGW-21-D and VLGW-26-D) indicate downward vertical gradients from the refuse into the underlying bedrock.

In March 2019, a pressure transducer was installed in GW-89-2-1 to record leachate levels continuously. However, the pressure transducer malfunctioned in March 2022 and has not been replaced. Manual measurements were collected from GW-89-2-1 to provide information on leachate levels throughout the 2023/24 monitoring period. As shown on Figure 4-5, leachate elevations in GW-89-2-1 have been generally stable over time, ranging from approximately 150.2 to 152.5 m asl.

Like previous years, leachate levels in the deep gas monitors (VLGW-02-D, VLGW-03-D, VLGW-08-D, VLGW-15-D, VLGW-16-D and VLGW-17-D) fluctuated in response to seasonal variability in groundwater recharge, indicating that the lower portions of the Phase 1 landfill are connected hydraulically to the regional groundwater flow system. In November 2018, leachate monitoring well GW-89-1-1 was drilled and completed at the bottom of the refuse to facilitate monitoring of the leachate mound and replace the decommissioned well GW-74-1-1. In March 2019, a pressure transducer was installed in the well to monitor leachate levels continuously. In April 2023, the pressure transducer was damaged, and data from the 2022/23 monitoring period could not be retrieved. In September 2023, a pressure transducer was reinstalled in the well, but it malfunctioned again in December 2023. Leachate level measurements were collected manually from well GW-89-1-1 and indicate that leachate elevations were below 153 m asl over the 2023/24 monitoring period.

Well GW-75-1-1 is located on the north end of Phase 1, downgradient of wells GW-89-1-1 and GW-89-2-1 and is used to monitor the deep regional water table. Similar to previous years, in 2023/24, groundwater elevations in well GW-75-1-1 ranged from approximately 128 to 130 m asl (Figure 4-5). VLGW-21-D and VLGW-26-D were completed approximately 50 m upgradient of GW-75-1-1 and exhibited relatively high leachate elevations ranging from 144.27 to 154.25 m asl, indicating that strong, downward vertical gradients persisted throughout the 2023/24 monitoring period.

### 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, Cell 3 is active, and Cells 4 and 5 are under construction. Quarrying of the Toutle Valley to provide airspace for refuse in Cells 4 and5 was completed in 2023. Leachate from Cell 1 and Cell 2 is captured in a 350 mm diameter micro-tunnel by gravity and transported 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. Leachate from Cell 3 is captured via the Toutle Drain, which reports to the Upper Leachate Lagoon prior to 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. Groundwater levels north of Phase 2 must be higher than leachate levels inside the Phase 2 basin for the hydraulic trap to operate. Leachate elevations within the Phase 2 basin are typically around 113-114 m asl, or 8 to 10 m lower than groundwater elevations outside the basin (AECOM 2020b). Important groundwater level monitoring points north of Phase 2 include

locations 38, 39, 62, 77, and 78. In 2023/24, groundwater levels in GW-62-1-1 and GW-77-1-1 were lower than in previous years and exhibited greater variability in response to climate, but groundwater elevations in all monitoring wells north of Phase 2 exceeded leachate elevations within Phase 2, indicating that the leachate collection system functioned effectively. The declining groundwater levels in wells GW-62-1-1 and GW-77-1-1 reflect blasting along the North Ridge, lowering of the topography, and subsequent lowering of the potentiometric surface in the bedrock.

Leachate monitoring wells GW-82-1-1, GW-83-1-1, GW-90-1-1, and GW-90-2-1 were installed in the Phase 2 Basin to investigate and verify leachate capture and monitor leachate mounding. Drilling observations and long-term monitoring indicated that the waste mass was moist but largely unsaturated. In 2023/24, some relatively high (i.e., 143.6 to 148.9 m asl) leachate elevations were observed in GW-82-1-1, GW-90-1-1, and GW-90-2-1, with strong upward gradients observed at monitoring station 90 from May to September 2023 and strong downward gradients observed in late-January 2024. The relatively high leachate levels may be related to the presence of condensate, historical tarping, or low-permeability strata within the refuse. Except for the September 2023 monitoring event, leachate levels in GW-82-1-1 and GW-83-1-1 were consistent with historic levels. These wells should continue to be monitored closely to assess the severity of leachate mounding in Phase 2.

Historically, leachate elevations in Phase 2 were typically about 0.8 m below the elevation of the Lower Leachate Lagoon. In 2023/24, leachate elevations in the Lower Leachate Lagoon were slightly lower than historical values, reaching a maximum elevation of 114.86 m asl in late-April 2023, with an average of 114.01 m asl over the 2023/24 monitoring period (Figure 4-8). In January 2024, leachate in the Phase 2 Basin reached a maximum elevation of approximately 116.1 m asl, and the average leachate elevation over the 2023/24 monitoring period was 114.78 m asl.

Figure 4-8 shows a hydrograph of leachate elevations in the lined Upper Leachate Lagoon, based on pressure transducer readings recorded by the SCADA system. In 2023/24, the average leachate elevation in the Upper Leachate Lagoon was 125.4 m asl, and the maximum leachate elevation was 127.87 m asl (approximately 65% full), as observed in late-June 2023. In the summer, the CRD maintains relatively high leachate elevations intentionally for fire suppression. During other parts of year, fluctuations in leachate elevations in lagoons occurred in response to site maintenance.

As landfill development continues, it is imperative that leachate levels in each phase of the landfill are closely monitored to verify seismic stability, confirm that the Leachate Collection System and the Phase 2 hydraulic trap are functioning effectively, and determine if additional leachate containment measures should be implemented. AECOM previously recommended investigating leachate mounding in Phase 2 on a five-year basis, with the next investigation scheduled for 2025.

## 4.4 Groundwater Flow in the Bedrock Aquifer Near the Landfill

### 4.4.1 East of Phase 1

Figure 4-4 shows groundwater elevations at monitoring locations 17, 18, 54, and 76, which are situated on the bedrock ridge east of Phase 1. Dramatic changes in water levels at monitoring location 18 have occurred occasionally since 2001. In 2016/17, groundwater levels at monitoring location 18 increased by approximately 8 m relative to years prior, resulting in lower of westward hydraulic gradients. In 2018, groundwater levels at monitoring location 18 returned to historical values, indicating that westward hydraulic gradients restabilized. As per the 2018/19 annual monitoring report recommendations (AECOM 2019a), pressure transducers were installed in wells GW-18-1-1, GW-76-1-1, GW-17-1-1, and GW-54-1-1 to continuously monitor groundwater elevations and confirm groundwater flow toward the landfill.

In 2023/24, groundwater levels in GW-18-1-1 were approximately 6 to 7 m lower than those observed in GW-76-1-1. Groundwater levels at GW-54-1-1 were consistently higher than those in GW-17-1-1, confirming a westward component of groundwater flow at these locations. Like previous years, in 2023/24, groundwater levels at monitoring station 76 indicated strong downward hydraulic gradients, and groundwater levels at station 18 indicated a low downward to neutral gradient. Groundwater levels should continue to be monitored at these locations to verify that groundwater gradients are directed toward the landfill.

### 4.4.2 North of Phase 1

Groundwater quality data collected from wells downgradient of the North Purge Wells indicate that the purge well system prevents northward migration of leachate. In July 2016, monitoring well GW-81-1-0-P9 became operational in an ongoing effort to increase leachate collection capacity upgradient of well GW-40-1-1. The influence of pumping the North Purge Wells (GW-

80-1-0-P8, GW-52-4-0-P7, and GW-81-1-0-P9) on groundwater flow is illustrated in plan on Figure 4-1, with the 115 m and 120 m water table contours deflecting southward due to drawdown of the water table around the North Purge Wells.

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

In 2023/24, a total of 7,038.2 $m^3$ of leachate was removed by the North Purge Wells, which was considerably lower than in 2022/23 (14,277 $m^3$) and 2021/22 (18,140 $m^3$). The greatest leachate flow rate (70.2 $m^3$/day) was observed in June 2023, and the average daily leachate flow was approximately 20.2 $m^3$/day.

In late-2021, groundwater levels in GW-52-3-0 increased by approximately 2-3 m from historical levels. Since then, groundwater levels have in GW-52-3-0 have been consistent, exhibiting rapid fluctuations in response to precipitation events. In 2023/24, the average groundwater elevation in GW-52-3-0 was 116.82 m asl, about 0.3 m higher than in 2022/23. This may indicate a reduction in the extent of the drawdown cone surrounding GW-52-4-0-P7 and/or GW-80-1-0-P8 due to formation of a biofilm on the inside of the well bore, which has been observed several times historically. GW-52-3-0 should be investigated by conducting specific capacity tests on each of the North Purge wells and comparing the results to historical values to determine if well performance has degraded. If deemed to significantly impact well performance, the biofilm should be removed by rehabilitating the purge wells, which was last completed during expansion of the north purge well system between 2007 and 2010.

In 2023/24, groundwater elevations in P8 and P9 were consistent with the historical values, with annual averages of 113.38 and 118.31 m asl, respectively. Groundwater elevations in P7 were consistent historical values, with some fluctuations attributed to power outages and maintenance throughout the monitoring period. The rapid increases in groundwater levels can likely be attributed to pump malfunction or power outages. A rapid decrease in groundwater elevation observed in July 2023 was attributed to a pressure transducer malfunction. In 2023/24, the average groundwater elevation in P7 was 111.7 m asl. 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.

In August 2022, two purge wells (P11 and P12) were installed immediately south of the NWSP. P11 was completed in bedrock, and P12 was screened in overburden approximately 2 m above the upper surface of the bedrock. Groundwater levels in P11 and P12 are measured quarterly. In late-August/early-September, P11 was dry, but groundwater elevations measured during other parts of the year ranged from 126.58 to 128.22 m asl. Groundwater elevations in P12 ranged from 120.26 to 126.03 m asl. In May 2023, a pneumatic pump was installed in P11, and the well began discharging impacted groundwater to the Upper Leachate Lagoon, though challenges with the air compressor resulted in intermittent pumping cycles until the air compressor was repaired at the end of Q1 2024.

### 4.4.3 South of Phase 1

In August 2000, the CRD installed six leachate collection purge wells at the south end of the Phase 1 landfill to intercept leachate migrating south of the Phase 1 groundwater divide. Pneumatic pumps were installed in four of the wells (P1, P2, P3, and P4) and they began operating in 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 and outfitted with a pneumatic pump to augment pumping capacity south of the landfill. P1 has since been altered and outfitted with an electric submersible pump.

Groundwater elevations in the south purge wells have fluctuated since 2007. Although elevations have remained somewhat higher than the target pumping elevations, 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 produced approximately of 1.01 L/s of leachate. The replacement well was screened in refuse from 6.10 to 12.19 m below ground surface (bgs). 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 that could be achieved without overheating the pump.

Groundwater elevations in five of the South Purge Wells (P1, P2, P3, P4, and P10) are plotted on Figure 4-7. The on/off cycling of the pumps is evident, and groundwater elevations generally ranged from approximately 133 to 151 m asl. In 2023/24, groundwater levels in the South Purge Wells were within their normal ranges, with some exceptions. Early in the monitoring period, two pump failures or power outages may have occurred in P10, as indicated by sharp increases in groundwater elevations. In December 2023, a gradual decline and rapid increase in groundwater elevations in P2 reflect pump maintenance. In P4, fluctuations in groundwater elevations observed in October/November 2023 have been attributed to a pressure transducer malfunction. Groundwater levels in P1 were anomalously high at the beginning of the monitoring period, which may reflect a pumping delay and/or declining pump performance. In May/June 2023, in response to pump maintenance, groundwater elevations in P1 declined to typical values and fluctuated around historical levels for the remainder of the monitoring period.

In 2023/24, a total of 28,090.6 $m^3$ of leachate was collected from the South Purge Wells, which is approximately 8.1% less than in the previous monitoring year, 18.9% less than in 2021/22, and 24.3% less than in 2020/21. The average daily flow in 2023/24 was 76.8 $m^3$/day. The 2023/24 groundwater level data indicates that the South Purge Wells System functioned effectively, but the decreasing discharge rates may reflect declining pump performance and/or lesser amounts of precipitation infiltrating Phase 1. Ultimately, the performance of the South Purge Well System should be closely monitored to determine if pump performance is declining, or there is a need to rehabilitate the wells which has not been completed since they were installed in 2001.

### 4.4.4 North of Phase 2

A detailed assessment of hydrogeologic conditions below the North Ridge was conducted in 2016, culminating in a hydrogeological conceptual model (AECOM 2016). The report stated that subvertical strike-slip faults (e.g., the Highland Fault) near groundwater monitoring stations 87 and 88 and an inferred fault near station 77 behave as barriers to west-east groundwater flow, creating a compartmentalized groundwater flow system in the North Ridge area. Conversely, 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 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.

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 is expanding northward. Since 2006, ten (10) new wells have been installed at five (5) separate locations (groundwater monitoring stations 77, 78, 79, 87, and 88) north of High Level Road to monitor the groundwater divergence and direction of groundwater flow north of Phase 2. Continuous water levels have been recorded at monitoring locations GW-77-1-1, GW-78-1-1, GW-87-1-1, GW-87-2-1, GW-88-1-1, and GW-88-2-1 to better understand the temporal and spatial variability in groundwater elevations over time. In November 2019, four new groundwater monitoring wells (GW-91-1-1, GW-92-1-1, GW-93-1-1, and GW-94-1-1) were installed in the North Ridge area to increase the spatial coverage of the groundwater monitoring network and investigate the groundwater divergence. In 2022/23, well GW-93-1-1 was damaged due to the blasting activities and subsequently decommissioned. In Q1 of 2024, GW-78-1-1 and GW-78-2-1 were decommissioned due to road construction. Similarly, due to construction of Cell 4 and blasting, GW-27-1-1 ad GW-94-1-1 were decommissioned in Q1 of 2024.

In 2022, a total of 17 monitoring wells were installed north of Phase 2. Wells GW-96-1-1, GW-97-1-1, GW-98-1-1, GW-99-1-1, GW-103-1-1, GW-104-1-1, GW-105-1-1, GW-106-1-1, GW-107-1-1, GW-108-1-1, GW-109-1-1 and GW-110-1-1 were installed in bedrock, whereas monitoring wells GW-95-1-1, GW-100-1-1, GW-101-1-1, GW-102-1-1 and GW-107-1-2 were installed in overburden or across the overburden-bedrock contact. Well GW-102-1-1 was decommissioned shortly after installation. In Q1 of 2024, monitoring wells GW-99-1-1, GW-100-1-1, GW-101-1-1, GW-103-1-1, GW-105-1-1, GW-106-1-1, GW-107-1-1, GW-107-1-2 and GW-110-1-1 were decommissioned due to an overabundance of wells north of Phase 2 and the completion of the NWSP Investigation (AECOM 2023).

From 2021 to 2024, blasting performed in the Toutle Valley resulted in lowering of the bedrock surface and a decline in groundwater levels northwest of Phase 2. Historically, groundwater levels have been considerably higher to the west of the Highland Fault compared to the immediate east, particularly during the winter. However, similar to the previous monitoring year, in 2023/24, the difference in groundwater elevations across the fault became less distinct during the winter months and more distinct during the summer. In the summer, groundwater elevations beneath the North Ridge (as observed in wells GW-

62-1-1, GW-87-1-1, and GW-88-1-1) depicted a moderately sloping piezometric surface ranging between 153 to 159 m asl, or roughly 6 m lower than readings during the previous year, and approximately 8-10 m lower than in 2021/22. It is suspected that quarrying in the Toutle Valley impacted groundwater flow across the Highland Fault, potentially facilitating the drainage of eastward flowing groundwater that was previously impeded by the fault. This observation is consistent with groundwater seepage observed at the base of the Cell 4 quarry during site visits, relatively low groundwater elevations observed in the North Ridge area, and the ceasing of artesian conditions in groundwater well GW-27-1-1. Ultimately, these changes reflect expansion of the landfill, and despite the changes to the potentiometric surface in the bedrock and the impact to groundwater flow across the Highland Fault, the hydraulic trap remained intact throughout the 2023/24 monitoring period.

Modifications to site topography and/or the quarry floor have had a direct impact on the potentiometric structure of the hydraulic trap. Given the importance of maintaining the groundwater divergence for leachate containment, any modifications to the topography, bedrock, water management and leachate collection should involve consultation with a hydrogeologist.

## 4.5 Summary

### 4.5.1 Leachate Flow

In 2023/24 leachate flow patterns at Hartland were consistent with historical interpretations. Leachate mounding persisted in Phase 1, and leachate elevations were generally stable, exhibiting 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 2024, leachate elevations in the upper portion of the refuse were generally below 155 m asl, reflecting an approximate 5 m decrease in elevation since closure of the Phase 1 landfill in 1997. Based on historical data and the 2023/34 leachate flow data, AECOM has made the following interpretations:

- In December 2023, the pressure transducers in wells GW-89-1-1 and GW-89-2-1 (completed in Phase 1) were damaged, so most of the data recorded in 2023/24 could not be retrieved. Manual leachate elevation measurements from wells GW-89-1-1 and GW-89-2-1 were consistent with historical values.
- The highest leachate elevations (155 to 157 m asl) were typically observed in the east/southeast area of the Phase 1 (GW-46-2-1, VLGW-004D and VLGW-011S), an area with elevated topography and refuse heights.
- Leachate elevations observed at monitoring stations GW-82-1-1 and GW-83-1-1 (completed in Phase 2) were comparable to historical values, with a relatively large (~10 m) increase in leachate elevation observed at GW-82-1-1 in September 2023, which may reflect a data collection error or generation of a brief, strong upward hydraulic gradient.
- In 2023/24, a total of 28,090.6 $m^3$ of leachate was collected from the South Purge Wells, which is approximately 8.1% less than in the previous monitoring year, 18.9% less than in 2021/22, and 24.3% less than in 2020/21. The average daily flow in 2023/24 was 76.8 $m^3$/day. Leachate discharge volumes were consistent with previous years and have decreased steadily since 2020/21.
- In 2023/24, a total of 7,969.8 $m^3$ of leachate was removed by the North Purge Wells, which was considerably lower than in 2022/23 (14,277 $m^3$) and 2021/22 (18,140 $m^3$). The greatest leachate flow rate (223.2 $m^3$/day) was observed in late-June 2023, and the average daily leachate flow was approximately 21.8 $m^3$/day.
- Overall, standard leachate elevations observed in the North and South Purge wells indicate that the purge well systems performed adequately throughout the 2023/24 monitoring period. Groundwater levels in 52-3-0, adjacent to P7, continued to increase, which may reflect mounding or diminishing pump performance at P7.

### 4.5.2 Groundwater Flow

Regional groundwater flows northeast from Mount Work to the north-south trending valley underlying the northern portions of the Phase 1 and Phase 2 landfills. 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). Based on the 2023/24 groundwater flow data, AECOM has made the following interpretations:

- Groundwater monitors east of Phase 1 (e.g., GW-54-1-1, GW-76-1-1, GW-17-1-1, and GW-18-1-1) confirmed east-westward flow toward the landfill, suggesting there was no off-site migration to the east.

- Groundwater levels in GW-52-3-0 increased substantially in 2021/22 and remained elevated throughout 2022/23 and 2023/24. The increase in groundwater elevations at GW-52-3-0 may be related to overall lower leachate discharge rates in North Purge Wells or reduced well efficiency because of biofilm formation in wells GW-52-4-0-P7 or GW-80-1-0-P8. This should be investigated further to confirm the purge wells remain effective.
- 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 limited 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 generated by the South Purge Wells. In 2023/24, groundwater levels all of the South Purge Wells were consistent with historical levels, except for anomalous, rapid increases in P10, which were likely caused by power outages or pump delays, gradual decreases followed by rapid increases in P2, which were likely caused by pump/pressure transducer malfunctions, and fluctuations observed in P4, which were attributed to a pressure transducer malfunction. At the end of the 2022/23 monitoring period, a gradual increase in groundwater levels was observed in P1, which persisted into 2023/24. Elevated groundwater levels persisted in P1 until May/June 2023 when the CRD serviced the pump.
- In 2023/24, groundwater elevations on opposing sides of the Highland Fault continued to change. Historically, groundwater elevations have been about 7-10 m higher west of the Highland Fault than they are immediately east (as observed in wells 87 and 88) indicating that the fault is a barrier to west-east groundwater flow. Seasonal fluctuations in groundwater elevations have been observed in this area, but differences in groundwater levels across the fault have become less pronounced during the wet season and more pronounced in the dry season as a result of quarrying activities associated with landfill development to accommodate Cells 4 and5.
- Since 2021, quarrying and blasting activities performed northwest of Phase 2 and within the Toutle Valley have resulted in substantive changes to the topography and lowering of the Toutle Valley ground surface. These landscape alterations have resulted in changes to the potentiometric surface of the bedrock, as observed at monitoring locations 62, 77, 87, 88, 82, and 94. Compared to the previous monitoring period, groundwater elevations at monitoring locations 87 and 88 decreased by approximately 2-6 m. Compared to the 2021/22 monitoring period, groundwater elevations have decreased by approximately 7.5-12.5 m. Since 2022, the shallow wells at monitoring locations 87 and 88 have been going dry in the summer, and groundwater elevations in monitoring wells GW-94-1-1, GW-92-1-1, GW-77-1-1, GW-62-1-1 have decreased by about 3-7.5 m. Ultimately, the declining groundwater levels and changes to the potentiometric surface north of Phase 2 reflect expansion of the landfill. Overall, an inward hydraulic gradient toward the landfill were maintained throughout the 2023/24.

Durrance Lake

DURRANCE LAKE FAULT

HIGHLAND FAULT

INFERRED FAULT

Durrance Creek

Toad Cr

Heal Creek

DOMINION GOVERNMENT PROPERTY RIFLE RANGE

HARTLAND NORTH PAD

PHASE 2

PHASE 1

HARTLAND LANDFILL

Killarney Lake

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
- SW-S-21 SURFACE WATER SAMPLING LOCATION
- SW-S-21 INACTIVE SURFACE WATER SAMPLE
- P3 LEACHATE COLLECTION WELLS
- 95-1-1 ACTIVE GROUNDWATER WELL
- VLGW001D GAS WELL
- 86-1-1 DECOMMISSIONED WELL
- A A' CROSS SECTION LINE
- 158.90 GROUNDWATER LEVEL (m ASL) MEASURED ON SEPTEMBER 2021
- (D) D= DEEP MONITOR (~30m)
- (I) I= INTERMEDIATE MONITOR (~20m)
- (S) S= SHALLOW MONITOR (~10m)
- N/A NO GROUNDWATER LEVEL DATA AVAILABLE
- LG-11-S HIGHLIGHTED DATA INDICATES DATA WAS NOT USED IN BEDROCK GROUNDWATER FLOW ANALYSIS
- INFERRED GROUND WATER DIVIDE
- 150 INFERRED WATER TABLE CONTOUR
- INFERRED GROUNDWATER FLOW DIRECTION

Map Sources / Notes:
- Contour Interval 1.0 m
- Groundwater elevation data collected by CRD, January 2024.
- Contours based on 24-W542_2023 base.dwg Capital Regional District, April 2024.
- 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: MM Prepared by: SP
Date Issued: June 2024 Project Number: 60631284

Making a difference...together

Project: Hartland Landfill Monitoring
Location: Saanich, BC

**Groundwater Elevations and Flow Directions in Bedrock (September 2023)**

AECOM

**Figure 4-1**

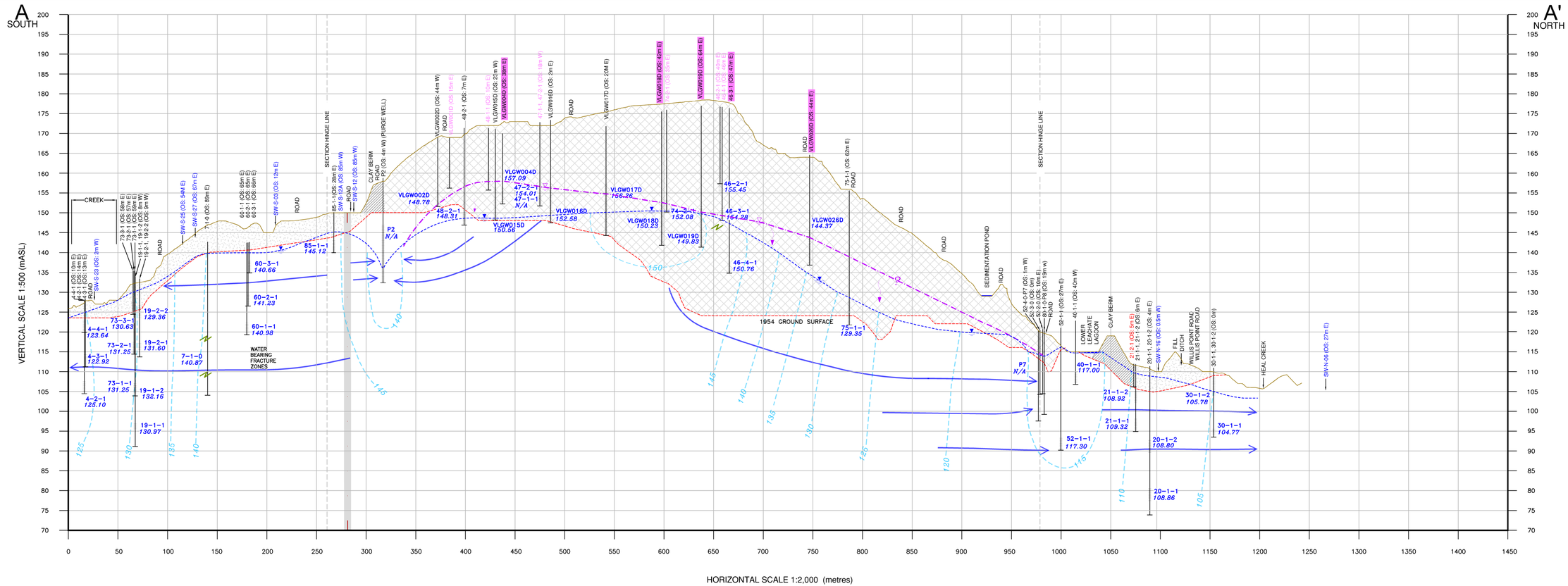
N

0 20 40 80 120 160 m

1 : 4000

UTM Zone 10N, NAD83

File Location: L:\LEGACY\CABNY1FP001\PROD\PROJECTS\60631284\900-CAD_GIS\910-CAD\20-SHEETS\C\435 - 2023-24 ANNUAL REPORT\FIG4.1_GW PLAN_60631284-2023_DWG Date Plotted: September 23, 2024 Saved By: amirin




## 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 - OCTOBER 2023
- 537.0 — LANDFILL GAS/MONITORING WELL WAS USED TO MEASURE LEACHATE ELEVATIONS.
- FAULT (MULLER, 1980)
- INFERRED FAULT (AECOM)
- SW-N/S-# — SURFACE WATER FEATURE NOT INCLUDED IN ANALYSIS

Map Sources / Notes:
- Contours based on 24WS42_2023 base dwg, provided by the Capital Regional District, April 2024.
- 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: MM
Date Issued: June 2024

Prepared by: SP
Project Number: 60631248

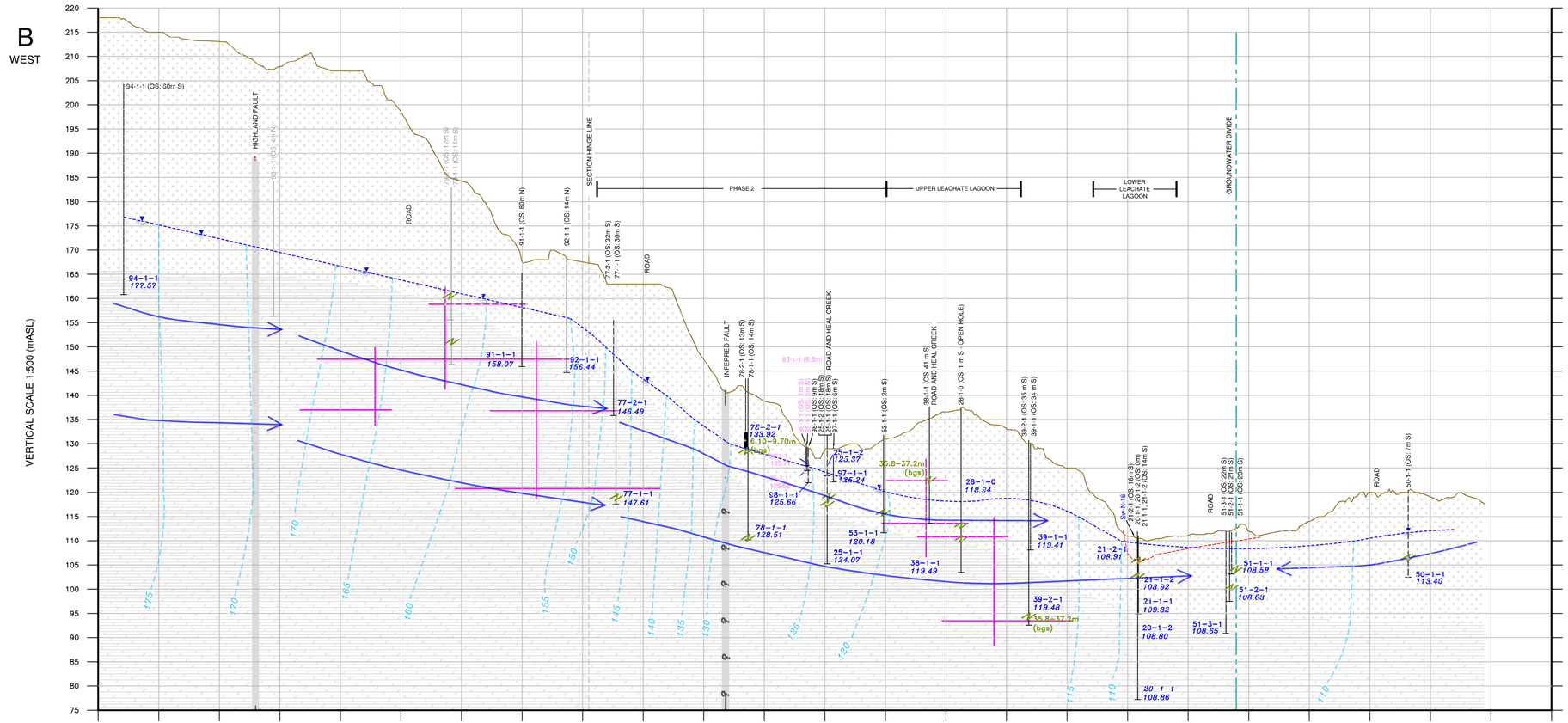
Making a difference...together

Project: Hartland Landfill Monitoring
Location: Saanich, BC

**Groundwater Flow in Cross Section A-A' (September 2023)**

AECOM

**Figure 4-2**




## 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
- OBSERVED FRACTURES ON DRILLED LOGS
- GROUND SURFACE
- LOCATION OF BEDROCK DERIVED FROM 1954 GROUND CONTOUR OR BEDROCK INTERSECTIONS IN BOREHOLES
- 95-1-1 — ACTIVE GROUNDWATER WELL
- 95-1-1 — DECOMMISSIONED GROUNDWATER WELL
- 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
- 112.50 — GROUNDWATER ELEVATION (mASL) SEPTEMBER 2023
- INFERRED HYDRAULIC CONNECTIONS
- GROUNDWATER DIVIDE
- FAULT (MULLER, 1980)
- INFERRED FAULT (AECOM)
- SW-N/S-# — SURFACE WATER FEATURE NOT INCLUDED IN ANALYSIS

Map Sources / Notes:
- Contours based on 24W542_2023 base.dwg, provided by the Capital Regional District, April 2024.
- 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: MM
Date Issued: June 2024

Prepared by: SP
Project Number: 60631284

Making a difference...together

Project: Hartland Landfill Monitoring
Location: Saanich, BC

**Groundwater Flow in Cross Section B-B' (September 2023)**

AECOM

**Figure 4-3**

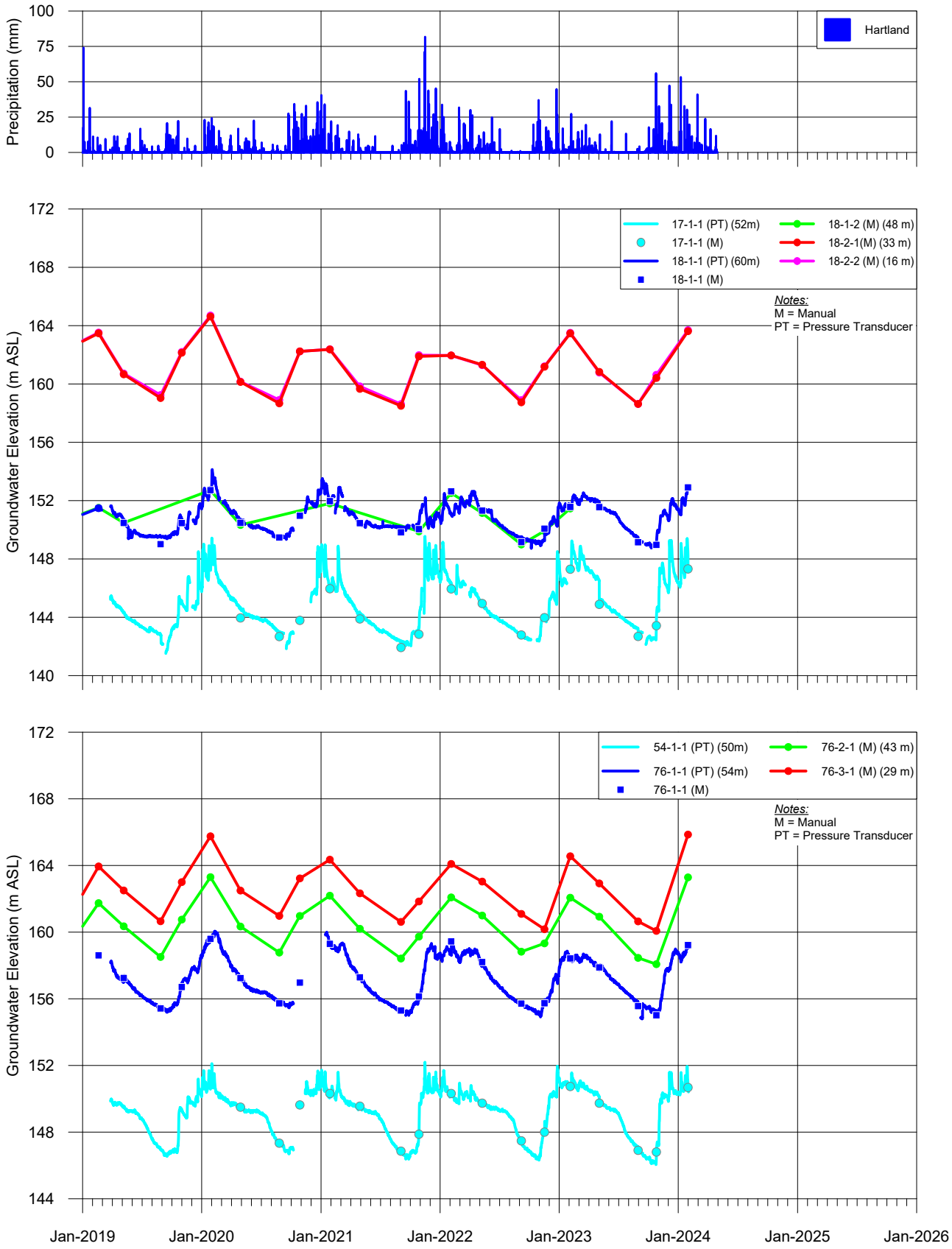



Figure 4-4. Groundwater Elevations East of Phase 1

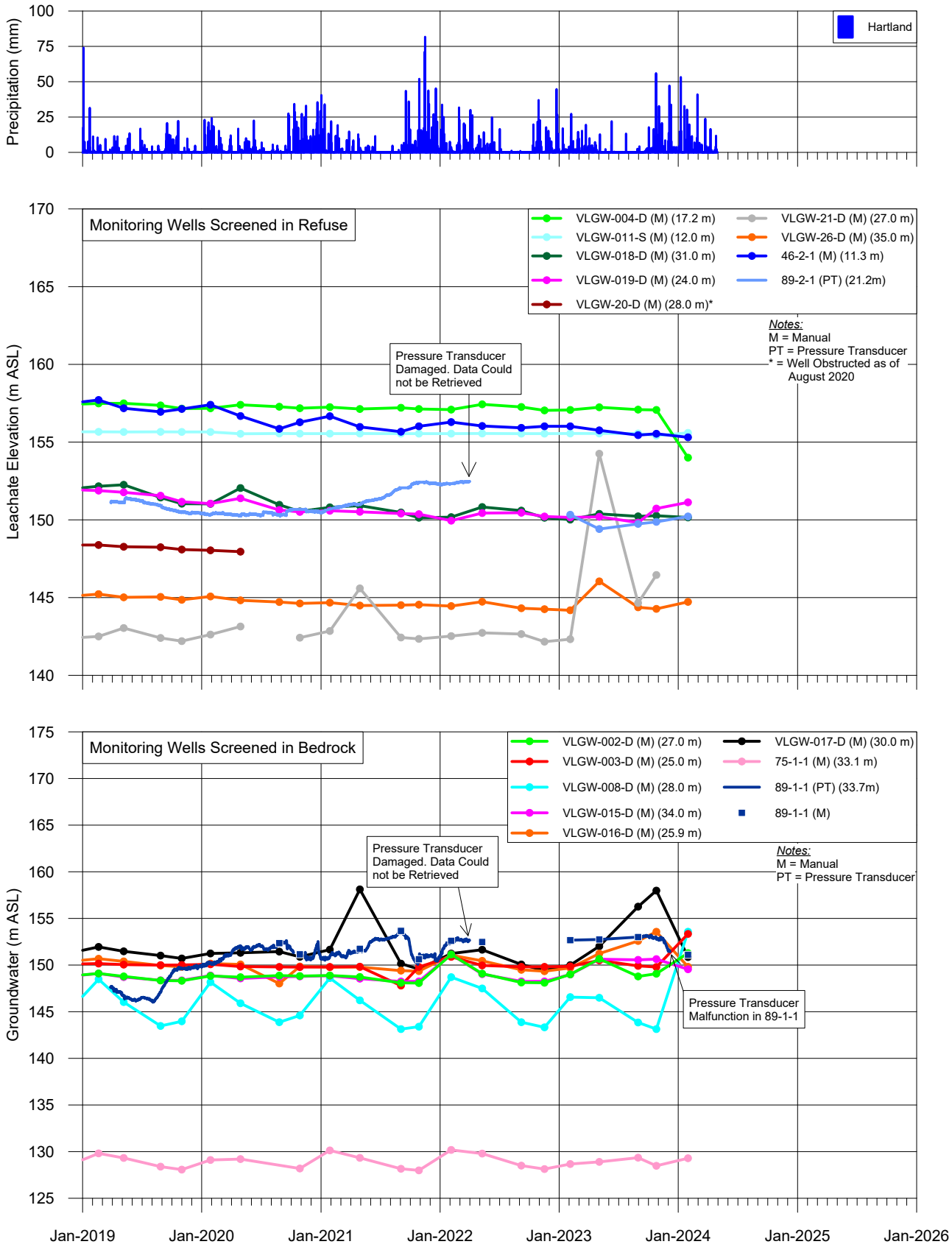



Figure 4-5. Leachate and Groundwater Elevations Within Phase 1

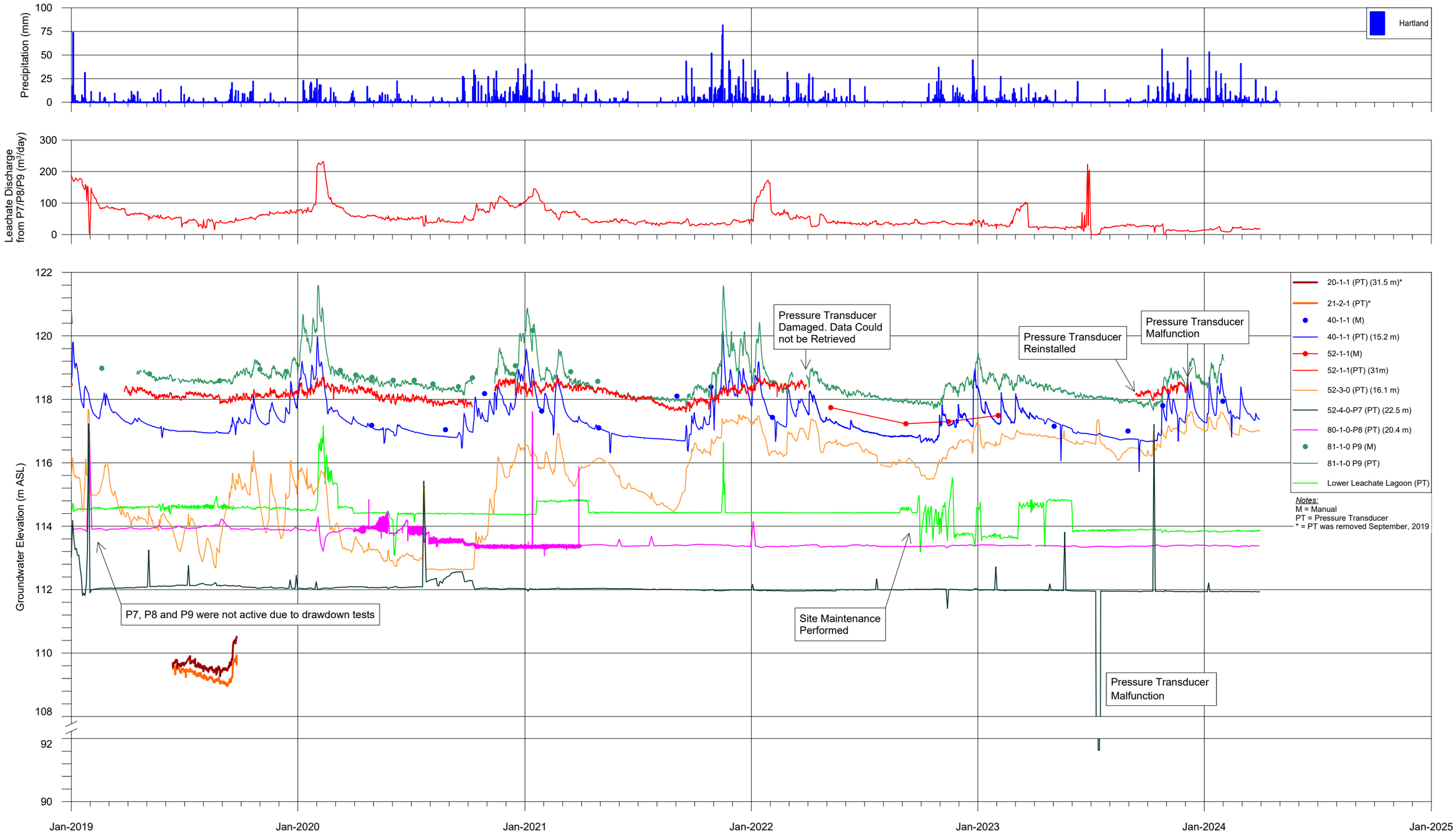



Figure 4-6. Groundwater Elevations Surrounding the North Purge Wells

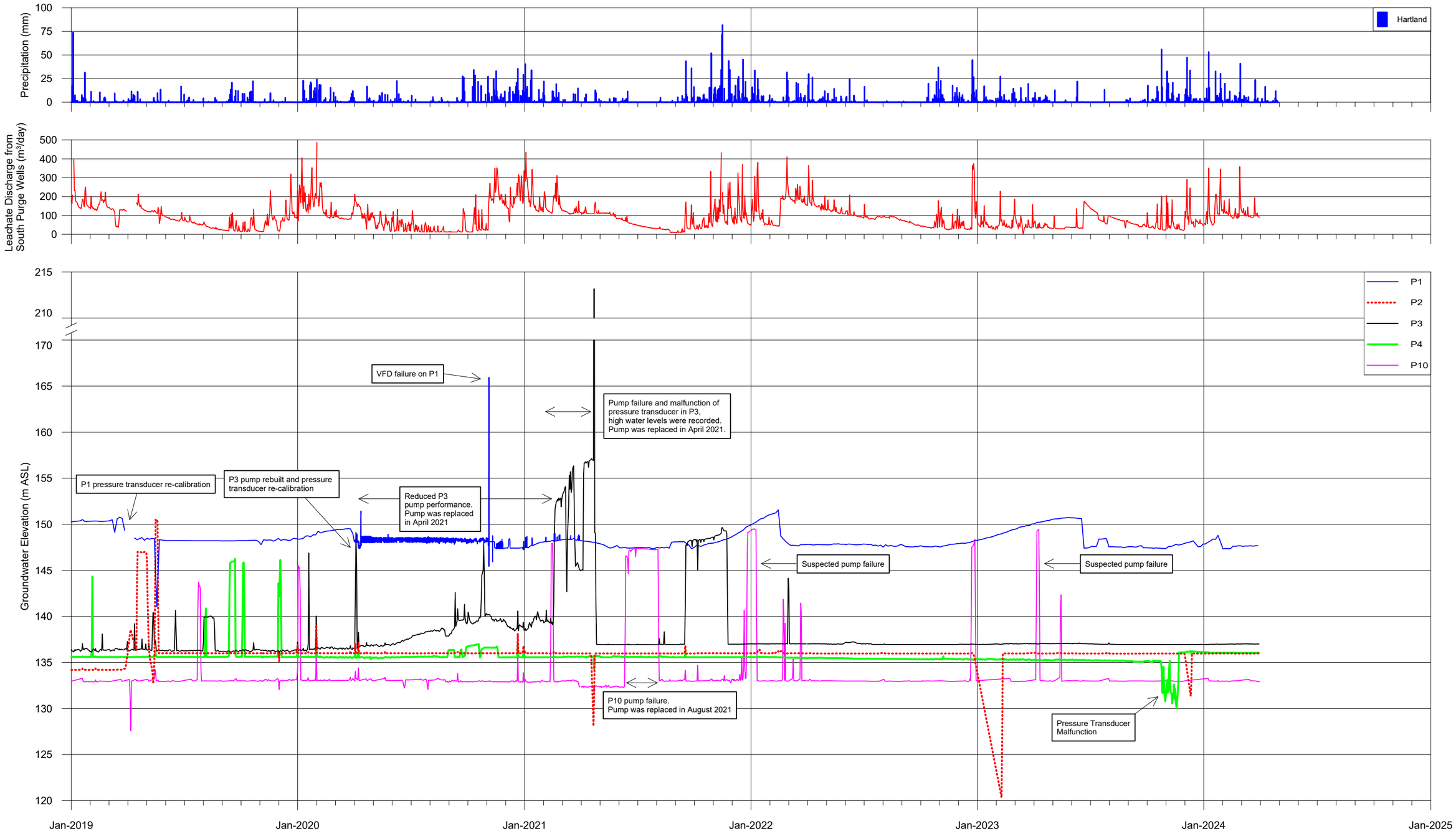



Figure 4-7. Groundwater Elevations in the South Purge Wels

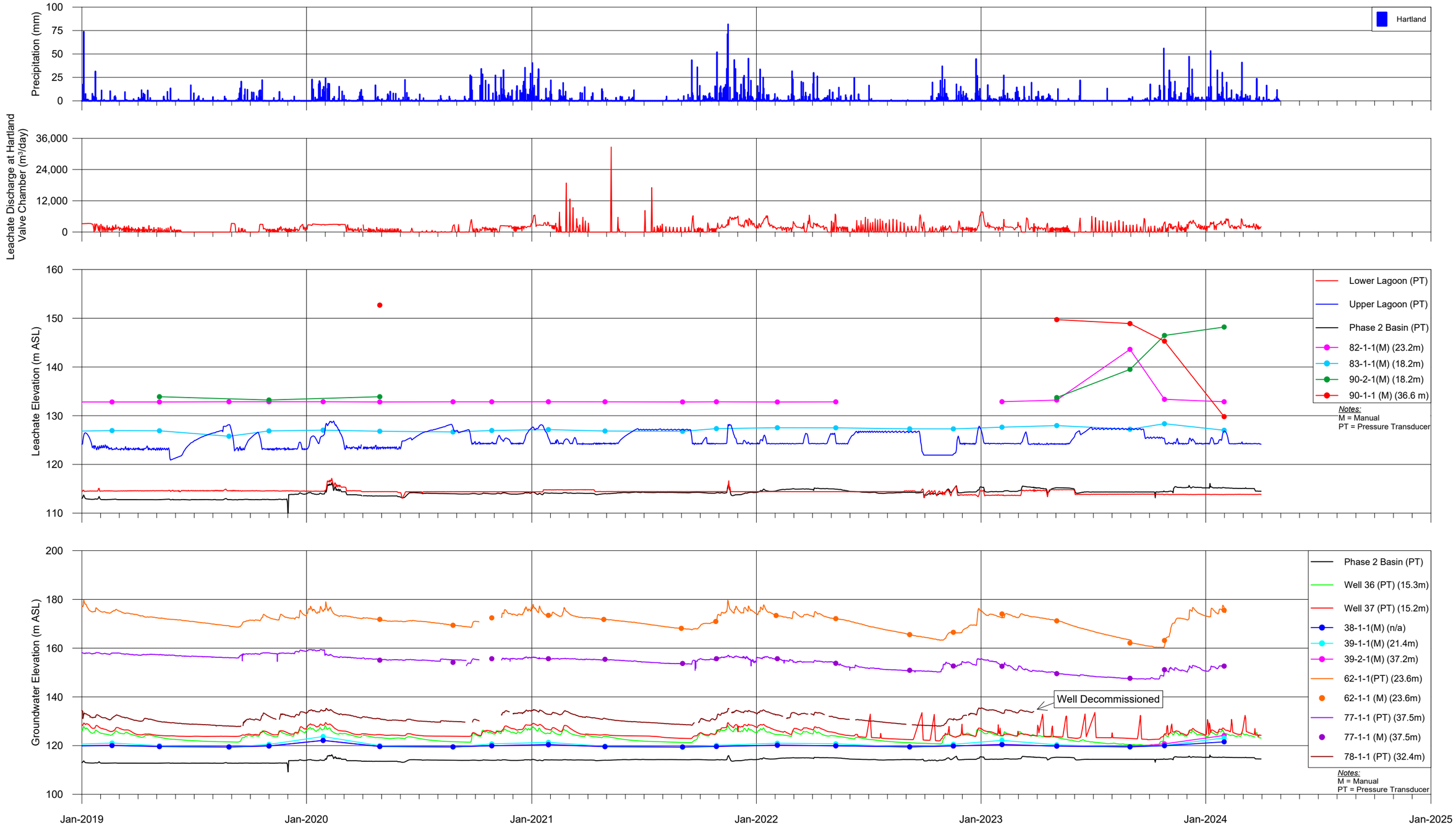



Figure 4-8. Water Elevations Within the Leachate Conveyance System and Surrounding the Phase 2 Basin

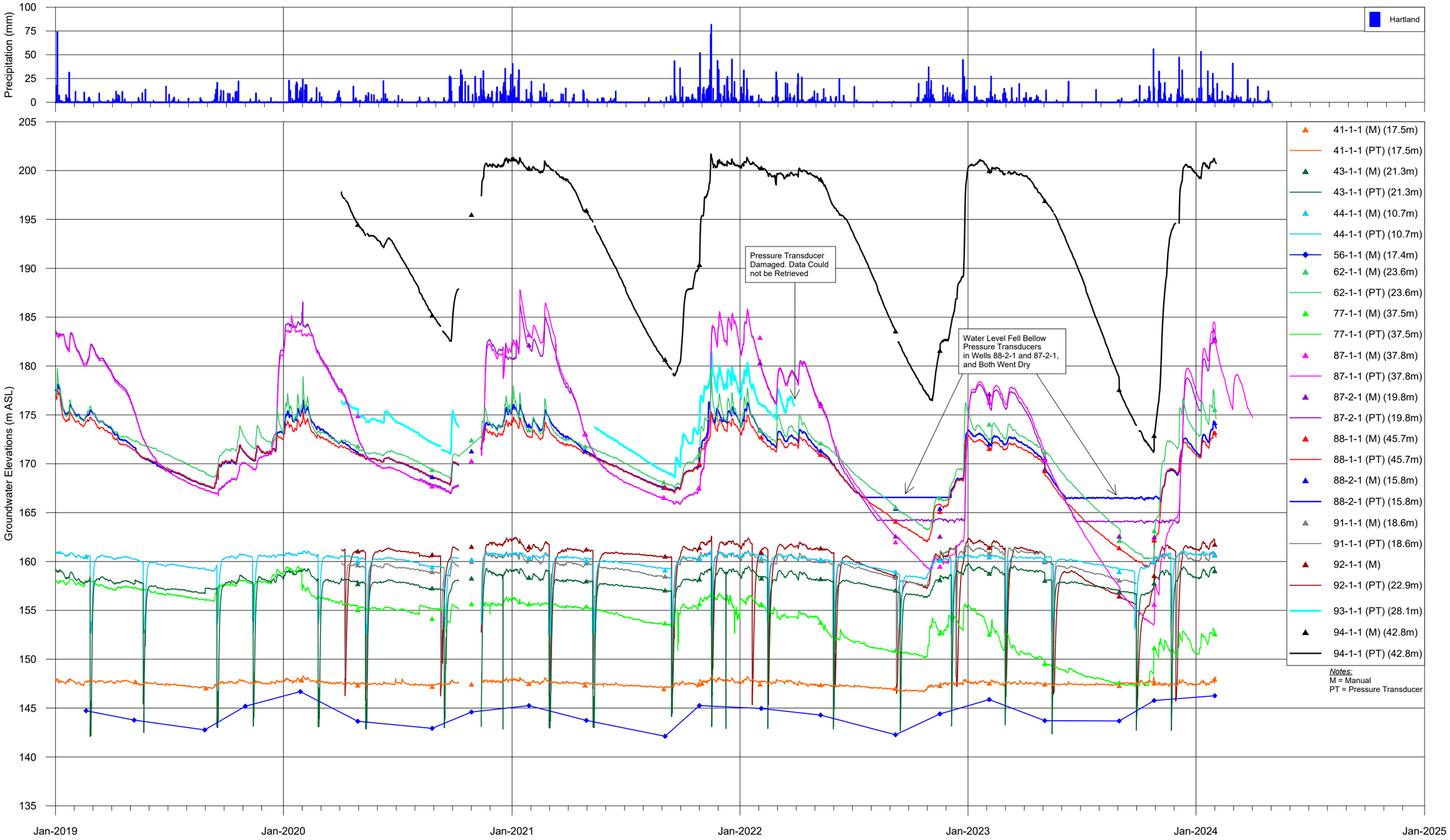



Figure 4-9. Groundwater Elevations in the North Ridge Area

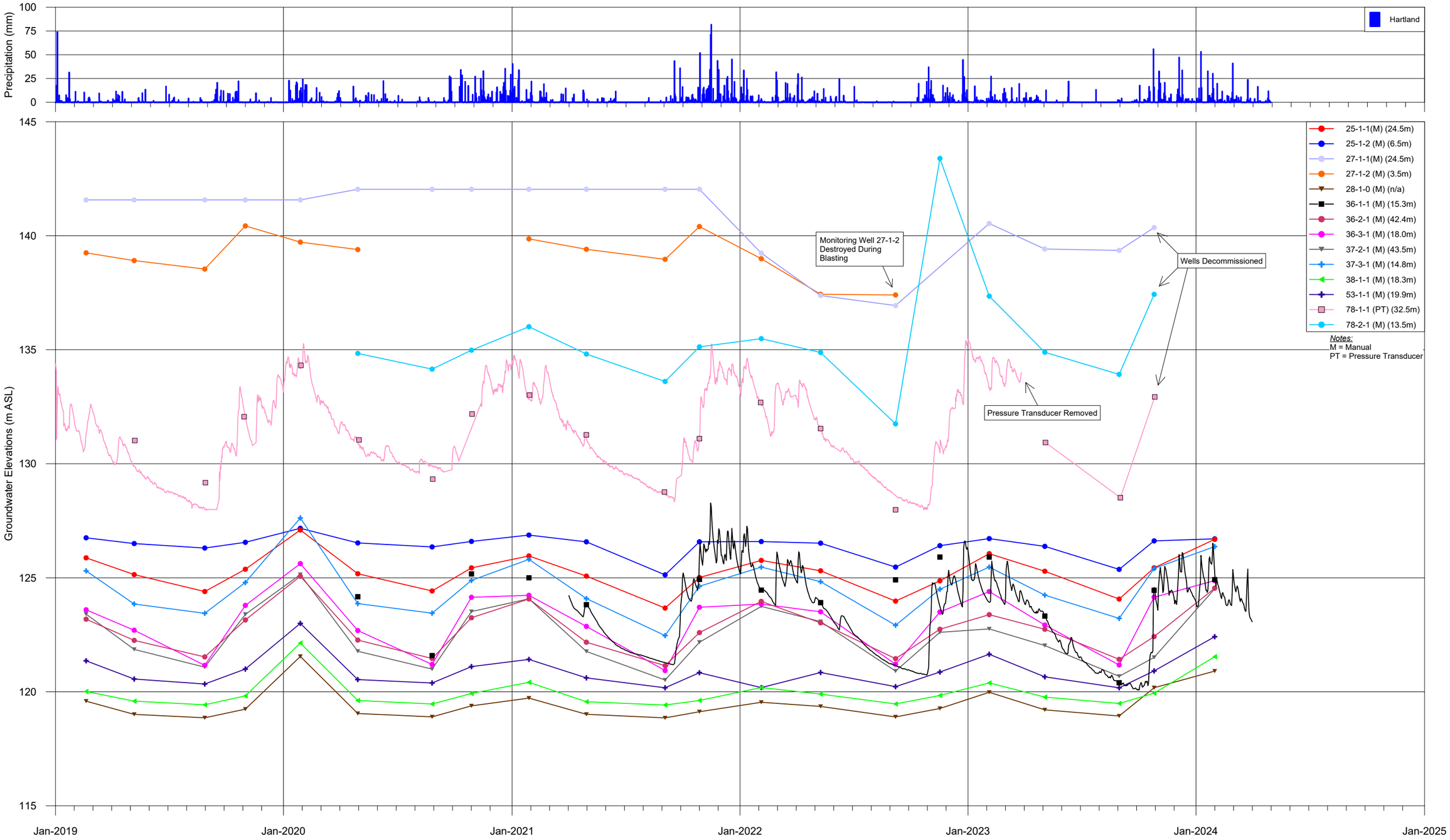



Figure 4-10. Groundwater Elevations North of the Phase 2 Landfill

# 5. Groundwater Quality Monitoring Wells

## 5.1 Compliance Groundwater Monitoring Locations

Thirty-four (34) boundary compliance monitoring wells have been established in 18 locations at the Hartland Landfill. These wells are concentrated along the south, east, and northern property boundaries, and downgradient of areas that have the potential to be impacted by leachate or runoff from the site. The monitoring wells listed below are considered boundary compliance wells. Quarterly monitoring conducted by the CRD includes both compliance wells and other non-compliance locations that contribute to a thorough understanding of landfill processes and the potential for environmental risks.

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
- 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

Groundwater quality compliance is assessed in Section 5.2. All data, including the applicable standards, are provided in Appendix B.1. Values that exceed CSR standards are noted with footnotes. Analytical results from groundwater samples collected from monitoring wells during 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 2023/24.

Monitoring location 39 consists of monitoring wells GW-39-1-1 and GW-39-2-1 and was considered a Boundary Compliance Station. Based on AECOM's review of the monitoring network (AECOM 2024), monitoring location 39 is no longer being used to assess landfill compliance because there are other compliance monitoring points in the same area.

As noted in Section 3.2.3, throughout 2023 the CRD observed anomalously low ammonia concentrations in the North and South Purge Wells and anomalously high ammonia concentrations where concentrations are typically low. The CRD worked with ALS and BV labs to investigate the root cause of the anomalous ammonia concentrations, and they determined that a set of sample bottles contained too much of the sample preservative. The same type of sample bottles were used during all sampling events in 2023. Hence, ammonia data collected in Q1 of 2024 are the only reliable data available from the 2023/24 monitoring period, and the remaining data was not analyzed or interpreted. Cells containing ammonia concentration data collected in 2023 are hatched in Appendix B1 and Table 5-1.

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. Due to low recharge rates, groundwater samples have not been collected at compliance monitoring wells GW-04-2-1 and GW-72-2-1 since 2016, so these wells are no longer considered compliance locations. AECOM has recently reviewed and provided recommendations for updates to the monitoring network and sampling program to ensure it remains effective in monitoring the impacts from landfill operations and changes to the monitoring program will be reflected in the 2024/2025 annual report.

## 5.2 Assessment of Groundwater Quality Impacts

The primary causes for any groundwater quality degradation at the site include leachate, road salt, aggregate runoff, and potentially magnesium lignosulphonate. Professional judgement is used to differentiate between different contaminant sources (leachate, road salt and aggregates) and assess the nature and severity of any impacts. The authors of this report 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. If concentrations exceed CSR AW or DW standards for groundwater quality at the property boundary, standard protocols for notification of the affected property owners should be followed. Note that, based on the Stage 8 Amendments to the CSR, DW and AW standards for iron and manganese are no longer applied to municipal landfills.

Relative magnitudes and trends in conductivity, ammonia, chloride, sulphate, and nitrate concentrations were compared to background concentrations to differentiate between 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 geological alteration zones.
- Leachate Impacts: 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.
- Aggregate Impacts: 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 and/or nitrate are present at concentrations above background levels of 0.1 mg/L. However, in recent years, elevated nitrate concentrations have been observed in the absence of elevated sulphate concentrations, so aggregate runoff impacts are interpreted on a case-by-case basis. Peak concentrations are typically observed during the first sampling event following the onset of wet weather in the fall months after recent blasting and aggregate stockpiling.
- Road Salt Impacts: Groundwater is considered impacted by road salt when both conductivity (>1,000 µS/cm) and chloride (>20 mg/L) are elevated above background levels and ammonia and its degradation products (primarily nitrate) are not elevated. Chloride (Cl) to sodium (Na) molar ratios are also used to assess the source of potential chloride sources. Cl/Na molar ratios in road salt are generally 1:1, assuming 100% compositional purity. Road salt-impacted sites must also be located downgradient (or downstream) of surfaces where road salt is known to be applied. Conductivity and chloride concentrations typically exhibit peaks following cold weather periods when de-icing salt is often applied to roadways.

The use of road salt for road de-icing and magnesium lignosulphonate for dust suppression confounds interpretation of groundwater quality data at and around Hartland landfill. An aqueous phase analysis of the magnesium lignosulphonate is provided in Appendix I. The results show that the compound is rich in ammonia and sulphur.

## 5.3 Electrical Conductivity

Figure 5-1 presents electrical conductivity values in plan, and figures 5-2 and 5-3 show north-south and east-west cross-sections through the landfill. All three figures show conductivity values collected from late-September through early-October, reflecting dry season conditions. 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 present. The highest conductivity values are typically observed during the dry season 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, in 2023/24, conductivity values in the North and South Purge Wells were generally above 1,000 µS/cm, except for GW-81-1-0-P9 (850 µS/cm). Among the North Purge Wells, conductivity values were highest in 80-1-0-P8, reaching 4,694 µS/cm in May 2023. In the South Purge Wells, conductivity values ranged from 876 to 2,500 µS/cm, with the highest conductivity observed in P3 in November 2023. Like previous years, the 1,000 µS/cm contour runs north of the North Purge Well System and Lower Leachate Lagoon, and south of the South Purge Well System. Conductivity values at new purge wells P11 and P12 were relatively low, ranging from 570 to 810 µS/cm.

The 500 µS/cm conductivity contour is considered indicative of background groundwater quality. In September/October 2023, the 500 µS/cm conductivity contour along the northern boundary of the landfill expanded beneath the Upper Leachate Lagoon, as indicated by monitoring wells GW-95-1-1 and GW-38-1-1. Additionally, the 500 µS/cm contour extended beyond the northern property boundary, as indicated by monitoring locations 29, 30, and 31, and represents a marked northward expansion relative to the past several decades. In November 2023, conductivity values at GW-31-1-1 and GW-31-1-2 increased to 800 and 880 µS/cm, respectively.

Unlike previous years, the 500 µS/cm contour extended north slightly beyond GW-25-1-1, but only in one location (GW-98-1-1) where conductivity ranged from 330 to 500 µS/cm throughout the monitoring period. Groundwater collected from monitoring well GW-36-3-1 exhibited conductivity ranging from 140 to 960 µS/cm, decreasing considerably from the previous monitoring year (805 to 1,348 µS/cm). This trend may reflect lesser amounts of magnesium lignosulphonate applied in the area of the NWSP and Contractor's Shed.

Along the North Ridge, elevated conductivity values were observed at GW-77-1-1, extending the 500 µS/cm contour toward the Northwest Stockpile. Additionally, elevated conductivity was observed in wells GW-88-1-1 and GW-88-2-1, ranging from 610 to 1,200 µS/cm throughout the monitoring period and extending the 500 µS/cm contour to the south end of the Northwest Stockpile. Groundwater conductivity was considerably lower on the west (upgradient) side of the Highland Fault, ranging from 311 to 340 µS/cm at monitoring station 87. At Hartland North Pad, elevated conductivity was observed in wells GW-43-1-1 (660 µS/cm).

Along the east boundary of the landfill, the 500 µS/cm contour terminated prior to GW-18-1-1. At the west boundary, groundwater conductivity was low (300 to 330 µS/cm), as indicated by wells GW-63-1-1 and GW-63-2-1. South of the landfill, the 500 µS/cm contour extended slightly further south than in previous monitoring years, as indicated by wells GW-72-3-1 (640 µS/cm), GW-4-4-1 (530 µS/cm), and GW-19-1-2 (560 µS/cm).

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

## 5.4 Overview of Groundwater Quality Exceedances

Groundwater quality data were compared to applicable BC CSR AW and DW standards, as shown in Appendix B-1. A summary of groundwater quality exceedances is presented in Table 5-1. Most CSR AW and DW groundwater quality exceedances were observed in groundwater samples collected from leachate collection wells or near leachate collection infrastructure. In 2023/24, groundwater samples collected from Boundary Compliance Stations met CSR AW and DW standards, except for the following:

- A boron concentration of 5.26 mg/L, measured at GW-20-1-2 in September 2023.
- Nitrate concentrations at several locations along the northern property boundary:
  - GW-31-1-1: 12.3 and 17.15 mg/L measured in November 2023 and February 2024, respectively.
  - GW-31-1-2: 11.4 to 19.2 mg/L, measured during three sampling events.

The boron concentration observed at Compliance Monitoring Station 20 correlated with very low conductivity (180 µS/cm) and low leachate and aggregate runoff parameters, suggesting it may originate from a natural source. However, the source of the boron is not yet known.

The elevated and non-compliant nitrate concentrations reported at Compliance Monitoring Station 31 prompted the CRD to submit a Notice of Offsite Contaminant Migration to the BC Ministry of Environment in 2023.

Several ammonia and nitrate concentration exceedances were reported at wells located downgradient of aggregate stockpiles (e.g., 62, 77, 78, 85, 88, 95, 96, 98, 105, 106, and 107), reflecting ongoing aggregate runoff impacts at the Site.

## 5.5 Monitoring Sites North of the Phase 1 Landfill

Figure 5-4 illustrates long-term groundwater quality trends north of the Phase 1 landfill.

### 5.5.1 Monitoring Site 58

Monitoring location 58 (not a Boundary Compliance Well) is located in the transition area between the Phase 1 and Phase 2 landfills, approximately 200 m from the property boundary. GW-58-1-0 is 19 m deep and screened in bedrock underlying

refuse. Well GW-58-1-0 has exhibited elevated concentrations of leachate indicator parameters since shortly after landfilling upslope of the well began in 2001. From 2004 to 2006, solute concentrations in well 58 decreased, then they were relatively consistent until 2021, with conductivity generally fluctuating between 5,000 and 6,000 µS/cm. Since 2021, conductivity has shown greater variability and higher magnitudes, reaching values over 6,400 µS/cm during four of the past five sampling events. Concentrations of key leachate indicator parameters (e.g., conductivity, ammonia, chloride, and nitrate) remain highly elevated, reflecting leachate-impacted groundwater flowing toward the Lower Leachate Lagoon and the North Purge Wells.

In 2023/24, four (4) groundwater sampling events were conducted at GW-58-1-0. Cobalt concentrations exceeded the CSR AW, and chloride, strontium, nickel, and vanadium concentrations exceeded the CS DW on all four sampling events. Sodium concentrations exceeded the CSR DW in May and September 2023 but were well-below the regional background concentration (1,700 mg/L) and therefore compliant with CSR standards.

At GW-58-1-Ammonia and nitrate concentrations were high (59 and 48 mg/L, respectively) in February 2024. Since Q1 2020, sulphate concentrations have risen progressively from approximately 60 mg/L to a maximum of 200 mg/L, increasing by about 100 mg/L from the previous wet season. The elevated nitrate and sulphate concentrations corresponding with elevated conductivity likely reflect aggregate runoff impacts. Continued water quality monitoring at this well is important because it provides an indication of the quality of impacted groundwater migrating toward the Lower Leachate Lagoon and the North Purge Well System.

### 5.5.2 Monitoring Sites 52 (GW-52-1-1 and 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 (GW-52-4-0-P7, GW-80-1-0-P8 and GW-81-1-0-P9). At these locations, groundwater quality has been impacted by leachate since monitoring began in the 1980's.

In 2023/24, four (4) groundwater samples were collected from well GW-52-1-1 (31 m deep), and four (4) leachate samples were collected from each of the North Purge Wells (GW-52-4-0-P7, GW-80-1-0-P8, and GW-81-1-0-P9). Prior to 2016/17, leachate samples had only been collected from the combined discharge at GW-52-4-0-P7 and GW-80-1-0-P8. In 2023/24, conductivity values measured at GW-52-4-0-P7, GW-80-1-0-P8, and GW-81-1-0-P9 were consistent with historical values. Leachate in GW-80-1-0-P8 was more concentrated than in GW-52-4-0-P7, with conductivity ranging from 2,774 to 4,680 µS/cm.

At monitoring well GW-52-1-1, chloride concentrations met the CSR DW standard of 250 mg/L during all sampling events in 2023/24. Ammonia concentrations were similar to historical values, exceeding the CSR AW standards on all sampling dates. Strontium concentrations exceeded the CSR DW standard on all sampling dates, and sodium concentrations exceeded the CSR DW but were below background levels. The average conductivity observed at GW-52-1-1 was 1,788 µS/cm. The Mann Kendall analysis detected statistically significant decreasing trends in ammonia and chloride concentrations at this location

At purge well GW-52-4-0-P7, chloride concentrations exceeded the CSR DW standard during all sampling events, with an average concentration of 325 mg/L. Ammonia concentrations exceeded the CSR AW and DW standards on all valid sampling events, with an average concentration of 153 mg/L. Sodium concentrations exceeded the CSR DW on three of four sampling events but were below regional background levels. Conductivity was similar to last year, ranging from 3,066 to 3,900 µS/cm. The Mann Kendall analysis detected a statistically significant decreasing trend in nitrate concentration at this location.

At purge well GW-80-1-0-P8, chloride concentrations exceeded the CSR DW standard during all sampling events, with an average concentration of 335 mg/L. Ammonia concentrations exceeded the CSR AW and DW standards in all representative samples, with an average concentration of 270 mg/L. Arsenic concentrations exceeded the CSR DW standard on three of four sampling events, and vanadium concentrations exceeded CSR DW standard on all four sampling events. The Mann Kendall detected statistically significant decreasing trends in nitrate and sulphate concentrations and increasing trends in conductivity and chloride concentrations at this location.

At purge well GW-81-1-0-P9, groundwater quality met all applicable CSR standards during all sampling events, and conductivity values were approximately equal to last year. The Mann Kendall analysis indicated that statistically significant decreasing trends in conductivity, chloride and sulphate concentrations have been observed at this location.

# Hartland Landfill Groundwater, Surface Water and Leachate Monitoring Program Annual Report (April 2022 to March 2023)

## Table 5-1. Groundwater Quality Exceedances 2023-2024

| Station | Sample Type | Compliance Well (Y/N?) | Date Sampled | 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) | | | (6) |
| | | | | 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 | Manganese |
| | | | | 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 | | µg/l | | µg/l | | µg/l | | µg/l | | µg/l | | µg/l | | mg/l | µg/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 | 0.05 |
| Gw-16-2-1 | SS | N | 2023-11-09 | Clear and colourless | 6.35 | 690 | 11.2 | 130 | 304 | 8.68 | | 0.074 | | 0.171 | | 17.3 | < | 0.01 | < | 0.005 | | 13. | | 0.060 6 | | 102. | | 28. | | 0.23 | | 0.185 | | 1.7 | | 5.8 | | 0.011 4 | < | 0.5 | 11.7 | 29. |
| Gw-16-2-2 | SS | N | 2023-11-09 | Clear and colourless | 6.32 | 490 | 11.7 | 93 | 377 | 15.1 | | 0.033 | | 0.133 | | 22.8 | | 0.017 | < | 0.005 | | 14. | | 0.113 | | 118. | | 47. | | 0.22 | | 0.536 | | 6.87 | | 3.6 | | 0.014 9 | < | 0.5 | 19.8 | 255. |
| Gw-20-1-2 | SS | Y | 2023-09-19 | Clear and colourless. Purged Dry and sampled same day. | 7.84 | 180 | 11.9 | 72 | 66.8 | 11.9 | < | 0.04 | | 0.076 | | 3.07 | < | 0.02 | < | 0.01 | | 5 260. | b | 0.034 | | 21.2 | | 3.9 | | 0.24 | | 0.044 | < | 0.1 | | 22.1 | | 0.02 | < | 1.5 | 3.38 | 11.9 |
| Gw-31-1-1 | FRM | Y | 2023-11-24 | Mean of duplicates, clear and colourless | 7.09 | 800 | 9.8 | 160 | 354 | 6.69 | | 0.079 5 | | 0.160 5 | | 4.545 | < | 0.01 | < | 0.005 | | 50.5 | | 0.038 65 | | 125. | | 15. | < | 0.1 | | 0.183 5 | | 0.441 | | 1.3 | | 0.005 75 | < | 0.5 | 10.1 | 32. |
| Gw-31-1-1 | FRM | Y | 2024-02-06 | Mean of duplicates, clear and colourless. Extra sample due to nitrate issue. | 7.48 | 604 | 9.5 | 150 | 396 | 2.715 | | 0.096 | | 0.179 | | 4.95 | < | 0.01 | < | 0.005 | | 48. | | 0.042 25 | | 139. | | 14.5 | < | 0.1 | | 0.167 5 | | 0.340 5 | | 3.95 | | 0.006 45 | < | 0.5 | 11.9 | 31.8 |
| Gw-31-1-2 | SS | Y | 2023-10-04 | Clear and colourless | 7.39 | 521 | 12.6 | 130 | 336 | 2.79 | | 0.023 | | 0.074 | | 3.65 | < | 0.01 | < | 0.005 | | 57. | | 0.030 5 | | 117. | | 17. | < | 0.1 | | 0.039 3 | | 0.85 | | 3.2 | | 0.005 3 | < | 0.5 | 10.8 | 0.964 |
| Gw-31-1-2 | SS | Y | 2023-11-24 | Clear and colourless | 6.91 | 880 | 10.9 | 120 | 390 | 2.46 | | 0.067 | | 0.12 | | 7.78 | < | 0.01 | < | 0.005 | | 44. | | 0.018 | | 136. | | 15. | < | 0.1 | | 0.075 9 | | 1.05 | | 2.8 | < | 0.005 | < | 0.5 | 12.4 | 0.226 |
| Gw-31-1-2 | SS | Y | 2024-02-28 | Clear Colourless. Extra sample due to nitrate issue | 7.19 | 218 | 9.1 | 110 | 329 | 8.35 | | 0.046 | | 0.123 | | 4.11 | < | 0.01 | < | 0.005 | | 44. | | 0.018 5 | | 113. | | 14. | < | 0.1 | | 0.076 1 | | 0.915 | | 32. | | 0.054 8 | < | 0.5 | 11.2 | 1.99 |
| Gw-39-1-1 | FRM | Y | 2023-05-12 | Mean of duplicates,clear and colourless | 7.78 | 308 | 14.7 | 95 | 161 | 62.65 | | 1.262 5 | | 1.710 5 | | 10.45 | | 0.012 5 | | 0.058 | | 16. | | 0.898 35 | | 56.7 | | 9.65 | | 0.495 | | 0.238 45 | | 0.665 | | 97.4 | | 0.143 6 | < | 0.5 | 4.68 | 2.375 5 |
| Gw-39-1-1 | FRM | Y | 2023-09-15 | Mean of duplicates | 8.035 | 405 | 12.6 | 95 | 157 | 8.29 | | 0.875 | | 0.397 | | 8.92 | | 0.01 | | 0.005 | | 16. | | 0.019 5 | | 55.15 | | 8.7 | | 0.175 | | 0.027 7 | | 0.299 | | 8.75 | | 0.007 1 | < | 0.5 | 4.705 | 0.207 5 |
| Gw-52-1-1 | SS | N | 2023-05-19 | Clear and colourless | 6.95 | 1682 | 14.4 | 860 | 485 | 4.8 | | 0.045 | | 0.286 | | 104. | | 0.043 | < | 0.01 | | 2 700. | | 0.053 | | 126. | | 190. | | 1.05 | | 2.08 | < | 0.1 | | 559. | | 0.019 | | 5.4 | 41.2 | 357. |
| Gw-52-1-1 | SS | N | 2023-09-20 | Clear and colourless | 7.64 | 1728 | 14.4 | 910 | 534 | 13. | < | 0.5 | < | 0.5 | | 118. | < | 0.25 | < | 0.13 | | 3 320. | < | 0.13 | | 141. | | 170. | < | 2.5 | | 2.33 | < | 1.3 | | 572. | | 1.53 | < | 13. | 44.3 | 395. |
| Gw-52-1-1 | SS | N | 2023-11-17 | Clear and colourless | 6.94 | 1642 | 12.6 | 880 | 497 | 2.9 | < | 0.1 | | 0.15 | | 109. | < | 0.05 | < | 0.025 | | 3 440. | < | 0.025 | | 131. | | 170. | < | 0.5 | | 2.24 | < | 0.25 | | 548. | < | 0.025 | | 4.1 | 41.1 | 362. |
| Gw-52-1-1 | SS | N | 2024-02-29 | Clear Colourless | 7.81 | 2100 | 8.1 | 810 | 534 | 22.4 | < | 0.08 | | 0.285 | | 118. | < | 0.04 | < | 0.02 | | 3 980. | < | 0.02 | | 142. | | 180. | | 1.04 | | 2.62 | < | 0.2 | | 672. | | 0.023 | | 5.3 | 43.4 | 425. |
| Gw-52-4-0 (P7) | SS | N | 2023-05-15 | Clear and very slightly yellow | 6.66 | 3535 | 19.6 | 1500 | 524 | 19.4 | | 0.093 | | 5.11 | | 455. | < | 0.02 | < | 0.01 | | 2 700. | < | 0.01 | | 116. | | 320. | b | 2.5 | | 5.5 | | 0.37 | | 19 400. | | 0.023 | | 2.1 | 57. | 1 130. |
| Gw-52-4-0 (P7) | SS | N | 2023-09-20 | Slightly turbid, slightly yellow | 7.37 | 3900 | 18.7 | 1600 | 579 | 14.3 | | 0.115 | | 5.63 | | 480. | < | 0.04 | < | 0.02 | | 2 940. | < | 0.02 | | 124. | | 340. | b | 2.36 | | 6.68 | | 0.45 | | 17 500. | | 0.067 | | 2.3 | 65.4 | 1 140. |
| Gw-52-4-0 (P7) | SS | N | 2023-11-17 | Clear, slightly yellow | 6.57 | 3261 | 15.3 | 1500 | 537 | 18.2 | | 0.217 | | 5.31 | | 442. | < | 0.02 | < | 0.01 | | 2 700. | < | 0.01 | | 119. | | 330. | b | 4.58 | | 6.31 | | 0.47 | | 18 200. | | 0.036 | | 1.3 | 58.1 | 1 180. |
| Gw-52-4-0 (P7) | SS | N | 2024-02-12 | Clear Colourless | 7.35 | 3066 | 15.4 | 1500 | 532 | 10.6 | | 0.124 | | 4.54 | | 454. | < | 0.02 | < | 0.01 | | 3 370. | < | 0.01 | | 117. | | 310. | b | 2.08 | | 5.46 | | 0.36 | | 17 300. | < | 0.01 | | 2.3 | 58.3 | 1 100. |
| Gw-58-1-0 | SS | N | 2023-05-16 | Clear, very yellow | 6.61 | 5857 | 20.3 | 1900 | 1470 | 13. | | 0.434 | | 2.19 | | 42.7 | < | 0.01 | < | 0.005 | | 3 690. | | 0.010 1 | | 378. | | 980. | b | 12.6 | | 49.3 | a | 2.42 | | 9 430. | | 0.183 | < | 0.5 | 127. | 5 940. |
| Gw-58-1-0 | SS | N | 2023-09-26 | Clear, moderately yellow | 7.2 | 6400 | 19 | 2000 | 1780 | 13.8 | | 0.46 | | 1.35 | | 34.2 | < | 0.05 | < | 0.025 | | 3 790. | | 0.066 | | 456. | | 1 000. | b | 10.6 | | 61.2 | a | 11.6 | | 777. | | 0.363 | < | 2.5 | 156. | 6 330. |
| Gw-58-1-0 | SS | N | 2023-11-16 | Clear, moderately yellow | 6.57 | 6500 | 17.7 | 2000 | 1520 | 15.1 | | 0.51 | | 1.39 | | 36.4 | < | 0.05 | < | 0.025 | | 4 010. | | 0.047 | | 389. | | 940. | b | 11.2 | | 57. | a | 7.32 | | 1 320. | | 0.195 | < | 2.5 | 133. | 6 040. |
| Gw-58-1-0 | SS | N | 2024-02-29 | No turbidity, moderately orange | 7.34 | 6600 | 12.1 | 1400 | 1630 | 14.5 | | 0.536 | | 1.55 | | 42.1 | < | 0.02 | < | 0.01 | | 4 810. | < | 0.01 | | 425. | | 1 200. | b | 13.3 | | 56.5 | a | 6.76 | | 1 390. | | 0.097 | < | 1. | 137. | 6 290. |
| Gw-62-1-1 | SS | N | 2023-11-24 | Clear and colourless | 7.15 | 364 | 8.7 | 100 | 223 | 1.67 | | 0.037 | | 0.113 | | 1.5 | < | 0.01 | < | 0.005 | | 24. | < | 0.005 | | 78.2 | | 2.5 | | 0.14 | | 0.067 9 | | 0.127 | < | 1. | < | 0.005 | < | 0.5 | 6.77 | < 0.05 |
| Gw-62-2-1 | SS | N | 2023-11-24 | Slightly turbid, slightly grey | 6.8 | 398 | 9.2 | 110 | 239 | 135. | | 0.092 | | 0.205 | | 11.6 | | 0.041 | | 0.022 6 | | 306. | | 0.027 9 | | 83.2 | | 3.1 | | 0.28 | | 0.272 4 | | 0.432 | | 246. | | 0.833 | | 0.5 | 54.4 | 28.5 |
| Gw-77-1-1 | SS | N | 2023-11-22 | Very slightly turbid, very very slightly grey | 7.76 | 370 | 10.7 | 150 | 170 | 737. | | 0.135 | | 0.222 | | 13.6 | | 0.04 | | 0.017 5 | | 232. | | 0.021 7 | | 51.3 | | 4.9 | | 1.04 | | 0.89 | | 1.63 | | 1 130. | | 0.445 | | 0.55 | 10.2 | 50.8 |
| Gw-78-1-1 | SS | N | 2023-09-26 | Clear and colourless | 7.88 | 376 | 12.7 | 210 | 218 | 304. | | 7.88 | b | 0.686 | | 31.2 | | 0.01 | < | 0.005 | | 316. | | 0.102 | | 61.6 | | 2.4 | | 0.88 | | 0.834 | | 3.25 | | 1 490. | | 0.585 | | 1.48 | 15.5 | 24.3 |
| Gw-80-1-0 (P8) | SS | N | 2023-05-15 | Clear and slightly orange | 7.26 | 4694 | 21.2 | 2000 | 436 | 96.7 | | 1.63 | | 11.4 | b | 116. | < | 0.02 | < | 0.01 | | 3 170. | | 0.032 | | 109. | | 360. | b | 29.5 | | 17.1 | | 6.18 | | 9 870. | | 0.144 | | 1.1 | 39.9 | 1 600. |
| Gw-80-1-0 (P8) | SS | N | 2023-09-20 | Moderatley turbid, moderately brown | 7.66 | 4680 | 18.7 | 2100 | 596 | 121. | | 1.55 | | 14.9 | b | 198. | < | 0.04 | < | 0.02 | | 3 410. | | 0.044 | | 134. | | 380. | b | 27.6 | | 17.7 | | 19.8 | | 18 600. | | 0.639 | < | 2. | 63.5 | 2 210. |
| Gw-80-1-0 (P8) | SS | N | 2023-11-17 | Clear, moderatley yellow | 7.22 | 4300 | 13.5 | 1700 | 416 | 82.6 | | 1.4 | | 11.1 | b | 96.9 | < | 0.02 | < | 0.01 | | 3 030. | | 0.033 | | 100. | | 310. | b | 28.7 | | 14.2 | | 5.28 | | 8 860. | | 0.676 | < | 1. | 40.4 | 1 360. |
| Gw-80-1-0 (P8) | SS | N | 2024-02-14 | Clear, moderately orange | 7.93 | 2774 | 11.6 | 1300 | 432 | 44.7 | | 1.17 | | 8.05 | | 79.3 | < | 0.02 | < | 0.01 | | 2 660. | | 0.022 | | 101. | | 290. | b | 17.8 | | 12.7 | | 3.94 | | 3 070. | | 0.51 | < | 1. | 43.3 | 1 450. |
| Gw-85-1-1 | SS | N | 2023-11-28 | Clear and colourless | 7.04 | 444 | 13.5 | 1 | 114 | 2.74 | | 0.137 | | 0.191 | | 3.86 | | 0.076 | < | 0.005 | | 140. | | 0.005 | | 34.7 | | 74. | | 0.15 | | 0.155 | | 8.43 | | 2. | < | 0.005 | < | 0.5 | 6.58 | 7.9 |
| Gw-88-1-1 | SS | N | 2023-09-26 | Clear and colourless | 7.72 | 610 | 10.8 | 120 | 284 | 1.76 | | 0.051 | | 0.136 | | 2.65 | < | 0.01 | < | 0.005 | | 24. | < | 0.005 | | 96.4 | | 2.8 | | 0.22 | | 0.080 4 | | 0.153 | | 2.1 | < | 0.005 | < | 0.5 | 10.5 | 0.354 |
| Gw-88-1-1 | SS | N | 2023-11-22 | Clear and colourless | 6.97 | 640 | 10.1 | 120 | 282 | 1.93 | | 0.038 | | 0.145 | | 3.8 | < | 0.01 | < | 0.005 | | 20. | < | 0.005 | | 96.4 | | 2.9 | < | 0.1 | | 0.062 3 | | 0.115 | | 3. | < | 0.005 | < | 0.5 | 10.1 | 0.596 |
| Gw-88-2-1 | SS | N | 2023-11-22 | Clear, moderately brown | 6.23 | 1200 | 10 | 45 | 622 | 4.75 | | 0.061 | | 0.211 | | 12.3 | < | 0.01 | < | 0.005 | | 46. | | 0.01 | | 211. | | 2. | | 0.17 | | 0.077 3 | | 0.635 | | 7.6 | | 0.013 2 | < | 0.5 | 23.3 | 1.4 |
| Gw-95-1-1 | FRM | N | 2024-02-09 | Mean of duplicates, very slightly turbid, very slightly grey | 7.575 | 626 | 9.9 | 170 | 453 | 3.345 | | 0.145 | | 0.125 | | 8.285 | < | 0.01 | < | 0.005 | | 352. | | 0.049 | | 160. | | 10. | < | 0.1 | | 0.291 | | 0.821 5 | | 3.7 | | 0.005 35 | < | 0.5 | 13. | 8.94 |
| Gw-96-1-1 | SS | N | 2023-11-15 | Very very slightly turbid, colourless | 6.82 | 477 | 12.1 | 75 | 290 | 6.23 | | 0.026 | | 0.098 | | 10.9 | < | 0.01 | < | 0.005 | | 96. | | 0.020 5 | | 92.5 | | 6.6 | | 0.29 | | 0.176 | | 0.421 | | 7.3 | | 0.005 4 | < | 0.5 | 14.3 | 7.38 |
| Gw-96-1-1 | SS | N | 2024-02-09 | Very slightly turbid, very slightly grey | 7.02 | 342 | 10.4 | 81 | 227 | 8.87 | | 0.038 | | 0.057 | | 4.18 | | 0.015 | < | 0.005 | | 109. | | 0.019 | | 72.7 | | 9.9 | | 0.19 | | 0.12 | | 0.483 | | 6.6 | < | 0.005 | < | 0.5 | 11.1 | 5.37 |
| Gw-98-1-1 | SS | N | 2023-11-14 | Moderately turbid, colourless | 6.62 | 487 | 11.8 | 91 | 316 | 26.9 | | 0.119 | | 0.075 | | 15.1 | < | 0.01 | < | 0.005 | | 120. | | 0.048 8 | | 103. | | 8.1 | | 0.44 | | 0.127 | | 0.508 | | 46.8 | | 0.020 2 | | 0.58 | 14.4 | 5.84 |
| Gw-98-1-1 | SS | N | 2024-02-09 | Moderately turbid, very slightly grey | 7.57 | 499 | 10.9 | 110 | 347 | 2.08 | | 0.246 | | 0.078 | | 3.78 | < | 0.01 | < | 0.005 | | 188. | | 0.239 | | 114. | | 5.6 | < | 0.1 | | 0.043 5 | | 0.32 | | 2.4 | < | 0.005 | < | 0.5 | 15.1 | 1.07 |
| Gw-104-1-1 | SS | N | 2023-09-26 | Very turbid, very brown. Purge water was brown/black and foamy. | 7.76 | 1678 | 13.3 | 510 | 1270 | 170. | | 0.7 | | 4.72 | | 57.3 | < | 0.05 | < | 0.025 | | 194. | | 0.055 | | 407. | | 170. | | 4.6 | | 120. | a | 326. | a | 4 660. | | 0.662 | < | 2.5 | 60.7 | 15 900. |
| Gw-104-1-1 | FRM | N | 2023-11-15 | Mean of duplicates, clear, moderately amber | 7.24 | 956 | 11.5 | 200 | 461 | 36. | | 0.301 | | 0.281 5 | | 10.53 | < | 0.01 | < | 0.005 | | 109.5 | | 0.124 | | 150. | | 65. | | 0.71 | | 65. | a | 210.5 | a | 317. | | 0.065 1 | < | 0.5 | 20.85 | 4 975. |
| Gw-105-1-1 | SS | N | 2023-05-09 | Clear and colourless. | 7.42 | 791 | 11.6 | 100 | 531 | 7.67 | | 4.37 | | 0.148 | | 43.6 | < | 0.01 | < | 0.005 | | 100. | | 0.008 5 | | 177. | | 96. | | 0.12 | | 0.075 1 | | 0.2 | | 8.2 | | 0.005 1 | | 1.04 | 21.7 | 1.73 |
| Gw-105-1-1 | SS | N | 2023-09-26 | Very slightly turbid, colourless | 7.8 | 795 | 12.4 | 130 | 493 | 55. | | 2.4 | | 0.187 | | 40.9 | < | 0.01 | < | 0.005 | | 95. | | 0.015 7 | | 160. | | 81. | | 0.81 | | 0.186 | | 1.52 | | 130. | | 0.017 8 | | 1.57 | 22.9 | 26.3 |
| Gw-106-1-1 | SS | N | 2023-05-10 | Slightly turbid, colourless. Purged two days in a row before taking a sample on the third day. | 7.24 | 830 | 15.3 | 140 | 422 | 9.62 | | 0.183 | | 0.207 | | 23.1 | < | 0.01 | < | 0.005 | | 179. | | 0.007 7 | | 134. | | 41. | | 0.23 | | 1.05 | | 2.72 | | 14.2 | | 0.011 8 | < | 0.5 | 20.9 | 275. |
| Gw-106-1-1 | FRM | N | 2023-01-12 | Mean of duplicates | 7.855 | 739 | 14.6 | 170 | 412 | 7.345 | | 0.172 5 | | 0.267 5 | | 18.75 | < | 0.01 | < | 0.005 | | 161. | | 0.016 55 | | 131. | | 33. | < | 0.1 | | 1.055 | | 2.995 | | 7.2 | | 0.006 55 | < | 0.5 | 20.7 | 182. |
| Gw-106-1-1 | FRM | N | 2024-01-12 | Mean of duplicates, clear and colourless | 7.23 | 829 | 14 | 150 | 390.5 | 6.645 | | 0.167 5 | | 0.241 | | 19.1 | < | 0.01 | < | 0.005 | | 139.5 | | 0.017 6 | | 124.5 | | 46. | | 0.205 | | 0.676 5 | | 3.53 | | 6.75 | | 0.008 95 | < | 0.5 | 19.35 | 117.5 |
| Gw-107-1-1 | SS | N | 2023-05-11 | Slightly turbid, colourless. Second sample which was collected on May 11. First one on May 9 rejected. | 7.53 | 844 | 16.5 | 130 | 453 | 461. | | 0.259 | | 0.253 | | 69.7 | < | 0.01 | < | 0.005 | | 144. | | 0.045 | | 145. | | 61. | | 1.25 | | 1.39 | | 2.48 | | 902. | | 0.068 2 | | 2.81 | 22. | 410. |
| Gw-109-1-1 | SS | N | 2023-09-26 | Very turbid, very grey. Purged Dry the following 4 days and water cleared up to slightly turbid, slightly grey. | 8.8 | 570 | 17.1 | 180 | 72 | 2 420. | | 0.633 | | 19.9 | b | 43.2 | | 1.72 | | 0.283 | | 284. | | 0.066 | | 17.3 | | 5.1 | | 5.66 | | 2.82 | | 4.1 | | 5 800. | | 12.7 | b | 10.1 | | 7.03 | 305. |
| Gw-P1 | SS | N | 2023-05-15 | Clear and colourless | 6.69 | 891 | 18.1 | 420 | 300 | 6.2 | | 0.127 | | 7.57 | | 1 350. | b | 0.02 | < | 0.01 | | 513. | < | 0.01 | | 95.8 | | 35. | | 0.55 | | 0.9 | | 0.49 | | 39 200. | | 0.232 | | 5.7 | 14.7 | 425. |
| Gw-P1 | SS | N | 2023-10-04 | Clear and colourless | 7.72 | 2000 | 16.6 | 760 | 286 | 4.7 | | 0.124 | | 7.3 | | 1 790. | b | 0.02 | < | 0.01 | | 2 640. | < | 0.01 | | 75.2 | | 140. | | 0.93 | | 3.08 | | 0.79 | | 10 400. | | 0.075 | | 21.5 | 24. | 83.4 |
| Gw-P1 | SS | N | 2023-11-30 | Slightly turbid, moderately orange | 7.01 | 1470 | 17.4 | 670 | 239 | 3.6 | | 0.637 | | 5.66 | | 1 380. | b | 0.02 | < | 0.01 | | 2 060. | | 0.03 | | 64.3 | | 110. | | 0.82 | | 2.53 | | 1.34 | | 7 380. | | 0.54 | | 18.7 | 19. | 103. |
| Gw-P1 | SS | N | 2024-02-29 | Clear Colourless | 7.8 | 990 | 14.6 | 420 | 268 | 5.8 | | 0.102 | | 7.52 | | 1 480. | b | 0.02 | < | 0.01 | | 982. | < | 0.01 | | 82.5 | | 52. | | 0.42 | | 1.12 | | 0.38 | | 27 400. | | 2.14 | | 9. | 15.2 | 204. |
| Gw-P2 | SS | N | 2023-05-15 | Clear and very slightly yellow | 6.87 | 954 | 18.6 | 650 | 256 | 7.95 | | 0.043 | | 0.854 | | 384. | < | 0.01 | < | 0.005 | | 1 770. | < | 0.005 | | 73.4 | | 65. | | 0.7 | | 2.32 | | 0.471 | | 615. | | 0.105 | | 2.76 | 17.7 | 324. |
| Gw-P2 | SS | N | 2023-10-04 | Very slightly turbid, colourless | 7.69 | 2100 | 16 | 810 | 303 | 4. | < | 0.04 | | 0.61 | | 390. | < | 0.02 | < | 0.01 | | 2 930. | < | 0.01 | | 72.9 | | 160. | | 0.86 | | 3.06 | | 0.71 | | 605. | | 0.035 | | 1.4 | 29.2 | 298. |
| Gw-P2 | SS | N | 2024-02-29 | Clear Colourless | 8 | 2000 | 14.2 | 780 | 260 | 8.8 | | 0.065 | | 1.28 | | 550. | < | 0.02 | < | 0.01 | | 3 090. | < | 0.01 | | 67.3 | | 150. | | 0.98 | | 3.9 | | 3.45 | | 613. | | 0.103 | | 4.7 | 22.4 | 303. |
| Gw-P3 | SS | N | 2023-05-15 | Clear and very slightly yellow | 6.93 | 959 | 17.7 | 640 | 245 | 4.53 | | 0.048 | | 1.51 | | 330. | < | 0.01 | < | 0.005 | | 1 740. | < | 0.005 | | 67.1 | | 70. | | 0.6 | | 1.77 | | 8.98 | | 628. | | 0.030 3 | | 3.17 | 18.7 | 532. |
| Gw-P3 | SS | N | 2023-10-04 | Very slightly turbid, very slightly yellow | 7.68 | 2400 | 15.3 | 910 | 282 | 4.8 | < | 0.04 | | 0.918 | | 560. | < | 0.02 | < | 0.01 | | 3 200. | < | 0.01 | | 66.8 | | 190. | | 0.82 | | 3.9 | | 0.67 | | 1 070. | | 0.014 | | 2.4 | 28. | 350. |
| Gw-P3 | SS | N | 2024-02-29 | Clear Colourless | 7.87 | 2300 | 14.6 | 850 | 335 | 4.4 | | 0.061 | | 0.989 | | 157. | < | 0.02 | < | 0.01 | | 3 020. | < | 0.01 | | 84.1 | | 180. | | 1. | | 3.79 | | 0.38 | | 2 940. | | 0.118 | < | 1. | 30.5 | 749. |
| Gw-P4 | SS | N | 2023-05-15 | Very slightly turbid and colourless | 6.86 | 1942 | 16.9 | 920 | 301 | 5.65 | | 0.039 | | 1.27 | | 139. | < | 0.01 | < | 0.005 | | 2 510. | < | 0.005 | | 72.6 | | 170. | | 0.93 | | 3.59 | | 0.571 | | 1 330. | | 0.012 9 | < | 0.5 | 29. | 644. |
| Gw-P4 | SS | N | 2023-10-04 | Very slightly turbid, very slightly yellow | 7.66 | 1936 | 15.2 | 900 | 360 | 3.8 | < | 0.04 | | 1.55 | | 220. | < | 0.02 | < | 0.01 | | 2 510. | < | 0.03 | | 90.4 | | 200. | | 0.87 | | 3.03 | | 0.29 | | 9 400. | | 0.081 | < | 1. | 32.6 | 705. |
| Gw-P4 | SS | N | 2024-02-29 | Clear Colourless | 7.86 | 2300 | 15.1 | 860 | 261 | 5.5 | | 0.086 | | 1.86 | | 666. | < | 0.02 | < | 0.01 | | 3 990. | < | 0.01 | | 63.4 | | 190. | | 1.09 | | 4.68 | | 2.19 | | 846. | | 0.053 | | 7.9 | 25. | 355. |
| Gw-P10 | SS | N | 2023-05-15 | Very slightly turbid and colourless | 6.74 | 876 | 16.5 | 480 | 280 | 2.57 | | 0.036 | | 0.875 | | 696. | < | 0.01 | < | 0.005 | | 832. | | 0.010 5 | | 86.3 | | 40. | | 0.42 | | 0.74 | | 0.434 | | 1 770. | | 0.031 9 | | 3.31 | 15.8 | 511. |
| Gw-P10 | SS | N | 2023-10-04 | Very slightly turbid, colourless | 7.72 | 1328 | 15.7 | 630 | 330 | 3.8 | | 0.04 | | 0.941 | | 852. | < | 0.02 | < | 0.01 | | 1 850. | | 0.01 | | 93.1 | | 120. | | 0.61 | | 1.92 | | 1.03 | | 312. | | 0.088 | | 4.3 | 23.7 | 492. |
| Gw-P10 | SS | N | 2024-02-29 | Very slightly turbid, slightly orange | 7.78 | 1100 | 14.2 | 470 | 301 | 3.99 | | 0.064 | | 0.471 | | 850. | < | 0.01 | < | 0.005 | | 1 550. | < | 0.005 | | 93.3 | | 58. | | 0.4 | | 1.48 | | 2.33 | | 906. | < | 0.005 | | 2.86 | 16.4 | 347. |
| Gw-P11 | SS | N | 2023-05-09 | Very slightly turbid, colourless | 6.91 | 617 | 12.5 | 95 | 371 | 282. | | 0.173 | | 0.157 | | 16.3 | | 0.011 | | 0.005 4 | | 124. | | 0.062 1 | | 122. | | 40. | | 0.59 | | 0.797 | | 3.14 | | 548. | | 0.188 | < | 0.5 | 16.3 | 42.6 |
| Gw-P11 | SS | N | 2023-11-15 | Clear and colourless | 6.69 | 810 | 12.1 | 92 | 353 | 4.68 | | 0.196 | | 0.089 | | 2.71 | < | 0.01 | < | 0.005 | | 134. | | 0.025 7 | | 116. | | 37. | | 0.18 | | 0.38 | | 4.25 | | 8.8 | | 0.006 | < | 0.5 | 15.3 | 24.5 |
| Gw-P12 | SS | N | 2023-11-15 | Clear and colourless | 7.26 | 690 | 12.3 | 100 | 294 | 9.98 | | 0.14 | | 0.24 | | 8.58 | < | 0.01 | < | 0.005 | | 68. | | 0.008 1 | | 98.4 | | 22. | | 0.22 | | 0.224 | | 13.1 | | 22.8 | < | 0.005 | < | 0.5 | 11.8 | 1.08 |
| Gw-P12 | SS | N | 2024-02-29 | Clear Colourless | 7.84 | 570 | 10.1 | 100 | 237 | 9.23 | | 0.152 | | 0.207 | | 9.16 | < | 0.01 | < | 0.005 | | 110. | | 0.008 9 | | 78.7 | | 22. | | 0.21 | | 0.317 | | 13.6 | | 31.5 | < | 0.005 | < | 0.5 | 9.78 | 3.35 |

**Notes:**

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|---|---|
| a | Above CSR Schedule 3.2 AW Standard. |
| b | Above CSR Schedule 3.2 DW Standard. |
| c | Detection Limits above Applicable Standards. |
| | Unreliable Ammonia Concentrations |
| 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. 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 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 |
| (9) | |

# Hartland Landfill Groundwater, Surface Water and Leachate Monitoring Program Annual Report (April 2022 to March 2023)

## Table 5-1. Groundwater Quality Exceedances 2023-2024

| 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) | | 1700 (9) | 2500 | 128-429 (5) | | 3 | | 1000 | 85 | | 75-2400 (5) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | b DW Maximum (2) | 250 | | 1 | 10 | 10 | 80 | | | | 10 | | 20 | | | | 500 | | | 2.5 | | | 20 | 20 | 3000 |
| Station | Sample Type | Compliance Well (Y/N?) | Date Sampled | Parameter | 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 | 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 | µg/l |
| | | | | Method Detection Limit | 0.05 | 0.015 | 0.005 | 0.02 | 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 | 0.1 |
| Gw-16-2-1 | SS | N | 2023-11-09 | Clear and colourless | 0.335 | 0.67 | 0.024 | 10.8 b | 10.8 b | 0.753 | 3.9 | 0.356 | 0.301 | 6 350. | < 0.005 | 6.04 | 401. | 120. | 37.8 | 0.004 5 | < 0.2 | < 0.5 | 0.105 | 0.79 | 2.15 | < 0.1 |
| Gw-16-2-2 | SS | N | 2023-11-09 | Clear and colourless | 0.087 | 0.67 | 0.040 5 | 14.2 b | 14.3 b | 1.97 | 2.6 | 0.322 | 0.325 | 6 140. | < 0.005 | 7.06 | 354. | 210. | 67.8 | 0.004 3 | < 0.2 | < 0.5 | 0.096 | 0.58 | 3.82 | < 0.1 |
| Gw-20-1-2 | SS | Y | 2023-09-19 | Clear and colourless. Purged Dry and sampled same day. | 0.43 | < 0.015 | < 0.005 | < 0.02 | < 0.02 | 0.34 | 13.8 | 0.26 | < 0.08 | 21 600. | < 0.01 | 10.3 | 420. | 12 | < 6. | < 0.004 | < 0.2 | < 1. | 0.018 6 | < 0.4 | 1.13 | < 0.2 |
| Gw-31-1-1 | FRM | Y | 2023-11-24 | Mean of duplicates, clear and colourless | 0.823 | 0.69 | < 0.005 | 12.3 b | 12.3 b | 0.254 | 3.9 | 0.698 5 | 0.237 5 | 5 520. | < 0.005 | 6.705 | 397. | 160. | 53. | < 0.002 | < 0.2 | < 0.5 | 0.373 | 0.275 | 0.335 | < 0.1 |
| Gw-31-1-1 | FRM | Y | 2024-02-06 | Mean of duplicates, clear and colourless. Extra sample due to nitrate issue. | 0.696 5 | 0.048 5 | 0.066 | 17.15 b | 17.2 b | 0.266 5 | 4.6 | 0.750 5 | 0.323 5 | 5 620. | < 0.005 | 7.515 | 444.5 | 180. | 61.75 | < 0.002 | < 0.2 | < 0.5 | 0.404 | 0.235 | 0.53 | < 0.1 |
| Gw-31-1-2 | SS | Y | 2023-10-04 | Clear and colourless | 0.448 | 0.87 | < 0.005 | 11.4 b | 11.4 b | 0.183 | 3. | 0.823 | 0.057 | 6 070. | < 0.005 | 7.4 | 337. | 140. | 49.4 | 0.002 4 | < 0.2 | < 0.5 | 0.429 | 0.36 | 1.66 | < 0.1 |
| Gw-31-1-2 | SS | Y | 2023-11-24 | Clear and colourless | 0.537 | 1.1 | < 0.005 | 19.2 b | 19.2 b | 0.172 | < 2. | 1. | 0.297 | 4 830. | < 0.005 | 7.43 | 375. | 210. | 67.2 | < 0.002 | < 0.2 | < 0.5 | 0.461 | 0.46 | 1.36 | < 0.1 |
| Gw-31-1-2 | SS | Y | 2024-02-28 | Clear Colourless. Extra sample due to nitrate issue | 0.474 | < 0.015 | < 0.005 | 15. b | 15. b | 0.157 | 2.1 | 0.741 | 0.31 | 5 010. | < 0.005 | 6.8 | 319. | 170. | 55.1 | 0.002 | < 0.2 | < 0.5 | 0.395 | 0.46 | 1.32 | < 0.1 |
| Gw-39-1-1 | FRM | Y | 2023-05-12 | Mean of duplicates,clear and colourless | 2.935 | < 0.015 | 0.077 | 13.5 b | 13.55 b | 0.946 | 158.7 | 0.325 | 0.577 | 5 570. | 0.119 15 | 5.055 | 359.5 | 31. | 11.65 | 0.056 7 | 0.54 | 14.245 | 0.228 | 2.19 | 4.39 | 0.27 |
| Gw-39-1-1 | FRM | Y | 2023-09-15 | Mean of duplicates | 3.18 | 0.015 | 0.010 3 | 12.95 b | 12.95 b | 0.250 5 | 3.4 | 0.313 5 | 0.432 5 | 5 200. | < 0.005 | 4.95 | 330.5 | 38. | 12.85 | 0.002 | < 0.2 | < 0.5 | 0.220 5 | 1.58 | 0.885 | 0.1 |
| Gw-52-1-1 | SS | N | 2023-05-19 | Clear and colourless | 0.49 | 26. a | < 0.005 | < 0.02 | < 0.02 | 10.7 | 30.5 | 13.8 | 0.44 | 37 700. | < 0.01 | 221. b | 3 190. b | < 1. | < 6. | < 0.004 | < 0.4 | < 1. | 0.005 7 | 0.77 | 0.76 | < 0.2 |
| Gw-52-1-1 | SS | N | 2023-09-20 | Clear and colourless | < 1.3 | 26. a | < 0.005 | < 0.02 | < 0.02 | 12.4 | < 50. | 15.3 | < 1. | 39 200. | < 0.13 | 241. b | 3 300. b | < 1. | < 75. | < 0.05 | < 5. | < 13. | < 0.05 | < 5. | < 2.5 | < 2.5 |
| Gw-52-1-1 | SS | N | 2023-11-17 | Clear and colourless | 0.46 | 0.88 | < 0.005 | < 0.02 | < 0.02 | 11.4 | 13. | 14.1 | 0.29 | 38 600. | < 0.025 | 218. b | 3 270. b | < 1. | < 15. | < 0.01 | < 1. | < 2.5 | < 0.01 | < 1. | < 0.5 | < 0.5 |
| Gw-52-1-1 | SS | N | 2024-02-29 | Clear Colourless | 0.49 | 26. a | < 0.005 | < 0.02 | < 0.02 | 12.9 | 23. | 15.8 | < 0.16 | 46 300. | < 0.02 | 244. | 3 480. b | < 1. | < 12. | < 0.008 | < 0.8 | < 2. | < 0.008 | 0.94 | 19. | < 0.4 |
| Gw-52-4-0 (P7) | SS | N | 2023-05-15 | Clear and very slightly yellow | 0.67 | 150. a | < 0.005 | < 0.02 | < 0.02 | 14.8 | 385. | 108. | 0.333 | 19 800. | < 0.01 | 296. b | 1 340. | 51. | < 6. | < 0.004 | < 0.6 | 2.1 | 0.024 4 | 2.79 | 18.1 | 0.66 |
| Gw-52-4-0 (P7) | SS | N | 2023-09-20 | Slightly turbid, slightly yellow | 0.81 | 140. a | < 0.005 | < 0.02 | < 0.02 | 18.3 | 55. | 121. | 0.2 | 20 700. | < 0.02 | 358. b | 1 380. | 21. | < 12. | < 0.008 | < 0.8 | 2.4 | 0.015 4 | 2.62 | 7.81 | 0.7 |
| Gw-52-4-0 (P7) | SS | N | 2023-11-17 | Clear, slightly yellow | 0.81 | 1.3 | < 0.005 | < 0.02 | < 0.02 | 17.4 | 361. | 110. | 0.311 | 19 100. | < 0.01 | 323. b | 1 390. | 21. | < 12. | < 0.004 | < 0.81 | 4.6 | 0.033 7 | 4.32 | 7.66 | 1.02 |
| Gw-52-4-0 (P7) | SS | N | 2024-02-12 | Clear Colourless | 0.56 | 170. a | < 0.005 | < 0.02 | < 0.02 | 15.8 | 194. | 117. | 0.104 | 19 200. | < 0.01 | 334. | 1 310. | 2.1 | < 6. | < 0.004 | 0.97 | 1.6 | 0.009 | 2.68 | 13. | 0.64 |
| Gw-58-1-0 | SS | N | 2023-05-16 | Clear, very yellow | 6.82 | 1.8 | < 0.005 | < 0.02 | < 0.02 | 88.9 b | 105. | 71.2 | 0.392 | 20 000. | < 0.005 | 557. b | 4 260. b | 81. | 30.3 | < 0.002 | 0.94 | 4.09 | 0.371 | 32.3 b | 3.05 | 2.8 |
| Gw-58-1-0 | SS | N | 2023-09-26 | Clear, moderately yellow | 6.62 | 1.3 | 0.136 | 2.68 | 2.82 | 96.5 b | 97. | 53.6 | 0.43 | 19 100. | < 0.025 | 561. b | 4 290. b | 100. | 29. | < 0.01 | < 1. | < 2.5 | 0.383 | 22. b | 5.26 | 2.41 |
| Gw-58-1-0 | SS | N | 2023-11-16 | Clear, moderately yellow | 5.03 | 0.96 | 0.030 6 | 1.12 | 1.15 | 93.2 b | 68. | 61.7 | 0.32 | 20 500. | < 0.025 | 586. | 4 330. b | 110. | 27. | < 0.01 | < 1. | 4.1 | 0.302 | 33.1 b | 3.62 | 3.06 |
| Gw-58-1-0 | SS | N | 2024-02-29 | No turbidity, moderately orange | 6.62 | 59. a | 0.009 5 | 48. b | 48. b | 95.2 b | 83.9 | 73.2 | 0.394 | 23 900. | < 0.01 | 627. | 4 620. b | 200. | 33.9 | < 0.004 | 1.05 | 6. | 0.356 | 37.7 b | 21.7 | 3.41 |
| Gw-62-1-1 | SS | N | 2023-11-24 | Clear and colourless | 0.175 | 0.9 | < 0.005 | 26.7 b | 26.7 b | 0.158 | < 2. | 0.186 | 0.608 | 6 260. | < 0.005 | 3.36 | 190. | 45. | 13.2 | < 0.002 | < 0.2 | 0.69 | 0.108 | 0.53 | 0.29 | < 0.1 |
| Gw-62-1-2 | SS | N | 2023-11-24 | Slightly turbid, slightly grey | 0.173 | 0.94 | < 0.005 | 31.3 b | 31.3 b | 0.566 | 12.5 | 0.34 | 0.621 | 7 900. | < 0.005 | 3.76 | 194. | 43. | 12.7 | < 0.006 2 | < 0.2 | 9.63 | 0.498 | 0.67 | 2.74 | 0.32 |
| Gw-77-1-1 | SS | N | 2023-11-22 | Very slightly turbid, very very slightly grey | 0.458 | 0.75 | < 0.005 | 10.6 b | 10.6 b | 1.25 | 33.2 | 0.321 | 0.09 | 12 700. | 0.010 2 | 4.09 | 196. | 26. | 8.1 | 0.013 7 | < 0.2 | 18.6 | 0.199 | 2.14 | 3.17 | 0.31 |
| Gw-78-1-1 | SS | N | 2023-09-26 | Clear and colourless | 1.99 | < 0.015 | < 0.005 | 0.113 | 0.113 | 1.5 | 71. | 0.777 | 0.689 | 15 000. | 0.012 1 | 19.4 | 405. | 58. | 18.3 | 0.020 9 | 0.5 | 17.6 | 0.823 | 1.88 | 5.27 | < 0.1 |
| Gw-80-1-0 (P8) | SS | N | 2023-05-15 | Clear and slightly orange | 1.39 | 320. a | < 0.05 | < 0.2 | < 0.2 | 38.4 | 1 210. | 116. | 0.381 | 17 000. | < 0.01 | 328. | 1 010. | 6.7 | 8.7 | 0.022 3 | 3.9 | 50.7 | 0.385 | 56.6 b | 32.7 | 12.1 |
| Gw-80-1-0 (P8) | SS | N | 2023-09-20 | Moderatley turbid, moderately brown | 1.2 | 300. a | 0.006 5 | < 0.02 | < 0.02 | 37.8 | 2 190. | 134. | 0.41 | 20 200. | < 0.02 | 380. | 1 190. | < 1. | < 12. | < 0.008 | 4.01 | 58.3 | 0.393 | 45.5 b | 8.63 | 8.84 |
| Gw-80-1-0 (P8) | SS | N | 2023-11-17 | Clear, moderatley yellow | 1.33 | 0.9 | 0.081 5 | 0.074 | 0.155 | 32. | 738. | 102. | 0.438 | 19 800. | < 0.01 | 299. | 1 000. | 67. | 17.1 | < 0.004 | 3.16 | 37.1 | 0.329 | 42.3 b | 8.53 | 4.81 |
| Gw-80-1-0 (P8) | SS | N | 2024-02-14 | Clear, moderately orange | 1.1 | 190. a | 0.037 7 | 0.057 | 0.095 | 26.7 | 230. | 91.3 | 0.296 | 21 600. | < 0.01 | 275. | 1 120. | 34. | 11.3 | < 0.004 | < 0.2 | 19.1 | 0.279 | 24.8 b | 5.11 | 5.04 |
| Gw-85-1-1 | SS | N | 2023-11-28 | Clear and colourless | 0.67 | 0.8 | < 0.005 | 341. b | 341. b | 0.616 | 7.5 | 5.27 | 0.434 | 5 880. | < 0.005 | 55.1 | 180. | 55. | 16.9 | 0.003 5 | < 0.2 | < 0.5 | 0.020 3 | 1.03 | < 0.1 | < 0.1 |
| Gw-88-1-1 | SS | N | 2023-09-26 | Clear and colourless | 0.338 | 0.8 | 0.012 9 | 17.3 b | 17.4 b | 0.251 | 3. | 0.187 | 0.793 | 5 670. | < 0.005 | 4.17 | 183. | 120. | 37.4 | 0.002 2 | < 0.2 | < 0.5 | 0.097 3 | 0.58 | 0.43 | < 0.1 |
| Gw-88-1-1 | SS | N | 2023-11-22 | Clear and colourless | 0.317 | 0.81 | 0.007 9 | 17.3 b | 17.3 b | 0.146 | 2.3 | 0.179 | 0.729 | 6 030. | < 0.005 | 3.95 | 193. | 120. | 36.5 | < 0.002 | < 0.2 | < 0.5 | 0.093 2 | 0.58 | 0.28 | < 0.1 |
| Gw-88-2-1 | SS | N | 2023-11-22 | Clear, moderately brown | < 0.05 | 0.73 | < 0.005 | 2.1 | 2.1 | 0.511 | 8. | 1.43 | 0.727 | 8 410. | < 0.005 | 9.95 | 499. | 550. b | 194. | < 0.002 | < 0.2 | < 0.5 | 0.078 1 | < 0.2 | 0.92 | < 0.1 |
| Gw-95-1-1 | FRM | N | 2024-02-09 | Mean of duplicates, very slightly turbid, very slightly grey | 0.721 | < 0.015 | < 0.005 | 24.35 b | 24.35 b | 1.655 | 2.75 | 0.296 5 | 0.625 5 | 9 005. | < 0.005 | 7.615 | 328.5 | 170. | 55.35 | 0.006 05 | < 0.2 | < 0.5 | 0.413 5 | 0.465 | 1.07 | < 0.1 |
| Gw-96-1-1 | SS | N | 2023-11-15 | Very very slightly turbid, colourless | 0.338 | 0.77 | < 0.005 | 38.4 b | 38.4 b | 0.565 | 6. | 0.274 | 0.765 | 8 330. | < 0.005 | 6.01 | 154. | 81. | 24.4 | < 0.005 1 | < 0.2 | 0.59 | 0.066 4 | 0.59 | 0.58 | < 0.1 |
| Gw-96-1-1 | SS | N | 2024-02-09 | Very slightly turbid, very slightly grey | 0.247 | < 0.015 | < 0.005 | 10.4 b | 10.4 b | 0.385 | 4.2 | 0.179 | 0.393 | 8 190. | < 0.005 | 7.03 | 112. | 100. | 30.1 | 0.003 8 | < 0.2 | < 0.5 | 0.047 5 | 0.52 | 0.39 | < 0.1 |
| Gw-98-1-1 | SS | N | 2023-11-14 | Moderately turbid, colourless | 0.758 | 0.69 | < 0.005 | 41.7 b | 41.7 b | 0.771 | 4.8 | 0.397 | 1.27 | 8 840. | < 0.005 | 10.5 | 195. | 120. | 36.1 | 0.009 8 | < 0.2 | 1.17 | 0.156 | 0.7 | 1.31 | < 0.1 |
| Gw-98-1-1 | SS | N | 2024-02-09 | Moderately turbid, very slightly grey | 1.04 | 0.064 | < 0.005 | 11. b | 11. b | 0.247 | 2.9 | 0.245 | 1.2 | 8 880. | < 0.005 | 5.47 | 192. | 190. | 62.8 | 0.004 7 | < 0.2 | < 0.5 | 0.376 | 0.58 | 0.84 | < 0.1 |
| Gw-104-1-1 | SS | N | 2023-09-26 | Very turbid, very brown. Purge water was brown/black and foamy. | 30.2 | 1. | 0.05 | 0.21 | 0.21 | 67.3 | 95. | 1.22 | 1.3 | 13 200. | 0.197 | 56.3 | 1 170. | 730. b | 317. | 0.031 | < 1. | 58.4 | 7.61 | 220. b | 5.48 | 6.55 |
| Gw-104-1-1 | FRM | N | 2023-11-15 | Mean of duplicates, clear, moderately amber | 9.77 | 0.094 5 | 0.184 5 | 6.365 | 6.545 | 16.4 | 16.4 | 0.621 | 0.823 | 6 650. | 0.162 5 | 31.25 | 439. | 285. | 98.05 | 0.025 | < 0.2 | 7.52 | 1.435 | 10.1 | 3.87 | 0.54 |
| Gw-105-1-1 | SS | N | 2023-05-09 | Clear and colourless. | 2.1 | < 0.015 | 0.010 6 | 20.3 b | 20.4 b | 0.372 | 3.8 | 1.53 | 1.34 | 6 420. | < 0.005 | 8.76 | 340. | 210. | 73.5 | 0.010 2 | < 0.2 | < 0.5 | 0.5 | 0.4 | 0.67 | < 0.1 |
| Gw-105-1-1 | SS | N | 2023-09-26 | Very slightly turbid, colourless | 5.49 | 0.062 | 0.047 8 | 12. b | 12.1 b | 1.21 | 7.6 | 1.89 | 0.553 | 5 760. | < 0.005 | 7.33 | 304. | 250. | 82.7 | 0.010 8 | < 0.2 | 2.18 | 0.807 | 0.6 | 1.77 | < 0.1 |
| Gw-106-1-1 | SS | N | 2023-05-10 | Slightly turbid, colourless. Purged two days in a row before taking a sample on the third day. | 5.43 | 1. | 0.103 | 18.6 b | 18.7 b | 1.67 | 10. | 1.62 | 0.064 | 5 970. | < 0.005 | 28.1 | 369. | 260. | 81.5 | 0.003 5 | < 0.2 | < 0.5 | 0.496 | 1.86 | 0.59 | < 0.1 |
| Gw-106-1-1 | FRM | N | 2023-01-12 | Mean of duplicates | 12.15 | 0.205 | 0.113 5 | 12.55 b | 12.7 b | 1.255 | 12.3 | 1.68 | 0.09 | 5 590. | < 0.005 | 16.5 | 316. | 210. | 70.45 | 0.006 4 | < 0.2 | < 0.5 | 0.532 | 1.965 | 0.28 | < 0.1 |
| Gw-106-1-1 | FRM | N | 2024-01-12 | Mean of duplicates, clear and colourless | 6.78 | 0.805 | 0.034 4 | 12.1 b | 12.1 b | 1.355 | 13.55 | 1.515 | 0.111 5 | 5 125. | < 0.005 | 16.2 | 319.5 | 195. | 58.85 | 0.005 8 | < 0.2 | 0.685 | 0.480 5 | 1.8 | 0.29 | < 0.1 |
| Gw-107-1-1 | SS | N | 2023-05-11 | Slightly turbid, colourless. Second sample which was collected on May 11. First one on May 9 rejected. | 8.69 | 0.035 | 0.043 5 | 15.8 b | 15.8 b | 3.33 | 11.9 | 1.09 | 0.321 | 6 180. | < 0.005 | 8.27 | 336. | 250. | 73.6 | 0.012 3 | < 0.2 | 17. | 0.399 | 2.61 | 1.97 | < 0.1 |
| Gw-109-1-1 | SS | N | 2023-09-26 | Very turbid, very grey. Purged Dry the following 4 days and water cleared up to slightly turbid, slightly grey. | 103. | 0.55 | 0.009 6 | 0.121 | 0.13 | 7.05 | 427. | 1.67 | 0.701 | 18 600. | < 0.01 | 105. | 261. | 92. | 28.6 | 0.042 7 | < 0.4 | 21.2 | 10.4 | 7.02 | 21.3 | 1.49 |
| Gw-P1 | SS | N | 2023-05-15 | Clear and colourless | 2.74 | 16. | < 0.005 | < 0.02 | < 0.02 | 5.94 | 63.9 | 15. | < 0.08 | 16 800. | < 0.01 | 33.4 | 894. | < 5. | < 6. | < 0.004 | < 0.4 | < 1. | 0.020 8 | < 0.4 | 13.1 | < 0.2 |
| Gw-P1 | SS | N | 2023-10-04 | Clear and colourless | 64. | 64. a | < 0.005 | < 0.02 | < 0.02 | 7.84 | 106. | 58.1 | 0.081 | 22 300. | < 0.01 | 202. | 1 070. | < 5. | < 6. | < 0.004 | < 0.52 | < 1. | 0.005 7 | 0.42 | 7.4 | < 0.2 |
| Gw-P1 | SS | N | 2023-11-30 | Slightly turbid, moderately orange | 12.9 | 1.3 | 0.104 | 0.061 | 0.165 | 12.1 | 56.7 | 47.9 | 0.174 | 20 300. | < 0.01 | 147. | 871. | 4.2 | < 6. | < 0.004 | < 0.4 | < 1. | 0.030 5 | < 0.4 | 40.8 | < 0.2 |
| Gw-P1 | SS | N | 2024-02-29 | Clear Colourless | 7.35 | 25. a | < 0.005 | < 0.02 | < 0.02 | 4.56 | 79.3 | 23.3 | < 0.08 | 20 100. | < 0.01 | 62.3 | 926. | < 1. | < 6. | < 0.004 | < 0.4 | < 1. | 0.016 | < 0.4 | 13.3 | < 0.2 |
| Gw-P2 | SS | N | 2023-05-15 | Clear and very slightly yellow | 8.43 | 44. a | < 0.005 | < 0.02 | < 0.02 | 4.52 | 13.2 | 39.8 | 0.085 | 12 500. | < 0.005 | 108. | 728. | < 1. | < 3. | < 0.002 | < 0.2 | < 0.5 | 0.012 6 | 1.59 | 0.99 | 0.15 |
| Gw-P2 | SS | N | 2023-10-04 | Very slightly turbid, colourless | 10.9 | 71. a | 0.010 7 | < 0.02 | 0.024 | 7.11 | 24.2 | 62.9 | 0.101 | 12 600. | < 0.01 | 200. | 1 000. | 5.2 | < 6. | < 0.004 | < 0.4 | < 1. | 0.013 7 | 1.59 | 1.7 | 0.21 |
| Gw-P2 | SS | N | 2024-02-29 | Clear Colourless | 14.7 | 65. a | 0.006 6 | 0.459 | 0.466 | 8.49 | 27.4 | 64. | 0.112 | 14 700. | < 0.01 | 212. | 936. | < 1. | < 6. | < 0.004 | < 0.4 | < 1. | < 0.004 | 2.12 | 5.04 | 0.24 |
| Gw-P3 | SS | N | 2023-05-15 | Clear and very slightly yellow | 7.65 | 48. a | < 0.005 | < 0.02 | < 0.02 | 3.51 | 9.7 | 44.7 | 0.068 | 13 100. | < 0.005 | 107. | 721. | < 1. | < 3. | < 0.002 | < 0.2 | < 0.5 | 0.002 4 | 1.45 | 2.73 | 0.12 |
| Gw-P3 | SS | N | 2023-10-04 | Very slightly turbid, very slightly yellow | 13.5 | 79. a | 0.034 3 | 0.052 | 0.086 | 8.35 | 25.4 | 71.7 | 0.107 | 14 200. | < 0.01 | 245. | 977. | < 1. | < 6. | < 0.004 | < 0.4 | < 1. | 0.007 6 | 1.62 | 1.21 | < 0.2 |
| Gw-P3 | SS | N | 2024-02-29 | Clear Colourless | 13.5 | 76. a | 0.007 6 | 0.022 | 0.029 | 8.41 | 30.8 | 68.7 | 0.094 | 14 900. | < 0.01 | 232. | 941. | 2.9 | < 6. | < 0.004 | < 0.4 | < 1. | < 0.004 | 2.5 | 21.8 | 0.21 |
| Gw-P4 | SS | N | 2023-05-15 | Very slightly turbid and colourless | 11.1 | 86. a | 0.007 8 | < 0.02 | < 0.02 | 6.92 | 18.2 | 67.3 | 0.139 | 10 300. | < 0.005 | 202. | 829. | 2.9 | < 3. | < 0.002 | < 0.2 | < 0.5 | 0.012 2 | 1.98 | 0.96 | 0.2 |
| Gw-P4 | SS | N | 2023-10-04 | Very slightly turbid, very slightly yellow | 15. | 76. a | 0.006 4 | 0.045 | 0.052 | 7.99 | 39.7 | 63. | 0.152 | 15 700. | < 0.01 | 235. | 981. | < 1. | < 6. | < 0.004 | < 0.4 | < 1. | 0.011 3 | 1.91 | 2.93 | < 0.2 |
| Gw-P4 | SS | N | 2024-02-29 | Clear Colourless | 20.5 | 78. a | 0.005 6 | 0.117 | 0.123 | 9.67 | 30.8 | 76.3 | < 0.08 | 18 100. | < 0.01 | 255. | 1 030. | < 1. | < 6. | < 0.004 | < 0.4 | < 1. | < 0.004 | 3.11 | 23.9 | 0.26 |
| Gw-P10 | SS | N | 2023-05-15 | Very slightly turbid and colourless | 2.44 | 26. a | 0.006 2 | 0.251 | 0.257 | 2.41 | 5.6 | 22.6 | 0.047 | 13 300. | < 0.005 | 52.2 | 872. | < 1. | < 3. | < 0.002 | < 0.2 | < 0.5 | 0.006 7 | 0.49 | 0.74 | < 0.1 |
| Gw-P10 | SS | N | 2023-10-04 | Very slightly turbid, colourless | 7.29 | 43. a | < 0.005 | 0.033 | 0.033 | 4.87 | 19.6 | 38.9 | < 0.08 | 15 100. | < 0.01 | 130. | 1 080. | < 1. | < 6. | < 0.004 | < 0.4 | < 1. | 0.008 4 | 0.57 | 3.4 | < 0.2 |
| Gw-P10 | SS | N | 2024-02-29 | Very slightly turbid, slightly orange | 4.38 | 31. a | 0.028 9 | 0.204 | 0.233 | 3.47 | 3.7 | 29.8 | 0.041 | 17 300. | < 0.005 | 88.3 | 892. | < 1. | < 3. | < 0.002 | < 0.2 | < 0.5 | < 0.002 | 0.67 | 2.12 | < 0.1 |
| Gw-P11 | SS | N | 2023-05-09 | Very slightly turbid, colourless | 1.15 | 0.16 | 0.082 5 | 26.8 b | 26.8 b | 1.03 | 19.7 | 1.38 | 0.42 | 6 580. | < 0.005 | 12.6 | 324. | 150. | 49.2 | 0.005 3 | < 0.2 | 13.2 | 0.328 | 1.96 | 2.39 | < 0.1 |
| Gw-P11 | SS | N | 2023-11-15 | Clear and colourless | 1.33 | 0.83 | 0.142 | 13.5 b | 13.6 b | 1.06 | 4.6 | 1.65 | 0.928 | 6 160. | < 0.005 | 13.2 | 315. | 200. | 60.9 | 0.004 5 | < 0.2 | < 0.5 | 0.332 | 0.85 | 3.69 | < 0.1 |
| Gw-P12 | SS | N | 2023-11-15 | Clear and colourless | 0.737 | 1.3 | < 0.005 | 18.8 b | 18.8 b | 1.79 | 13.2 | 1.99 | 0.289 | 5 160. | < 0.005 | 12. | 280. | 130. | 38.2 | 0.004 1 | < 0.2 | 0.96 | 0.079 6 | 1.24 | 0.42 | < 0.1 |
| Gw-P12 | SS | N | 2024-02-29 | Clear Colourless | 1.03 | < 0.015 | < 0.005 | 11.9 b | 11.9 b | 1.8 | 8.5 | 1.88 | 0.247 | 6 550. | < 0.005 | 11.6 | 219. | 91. | 29.5 | 0.006 1 | < 0.2 | < 0.5 | 0.071 9 | 0.96 | 0.5 | < 0.1 |

***Notes:***

***a*** *Above CSR Schedule 3.2 AW Standard.*

***b*** *Above CSR Schedule 3.2 DW Standard.*

***c*** *Detection Limits above Applicable Standards.*

*Unreliable Ammonia Concentrations*

*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. 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 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

DURRANCE LAKE FAULT

DURRANCE CREEK

HIGHLAND FAULT

INFERRED FAULT

DOMINION GOVERNMENT PROPERTY RIFLE RANGE

HARTLAND NORTH PAD

HEAL CR.

LOWER LEACHATE LAGOON

PHASE 2

PHASE 1

HARTLAND LANDFILL

KILLARNEY LAKE

A

A'

B

B'

500

1000

1500

2000

?

## 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
- A A' CROSS SECTION LINE
- 43-1-1 (784) Well (conductivity) GROUNDWATER ELECTRICAL CONDUCTIVITY (µS/cm) IN SEPT-OCT 2023 READINGS IN A SINGLE MONITORING WELL
- XXX ELECTRICAL CONDUCTIVITY DATA WAS NOT USED TO INTERPRET CONDUCTIVITY CONTOUR
- (N/A) GROUNDWATER SAMPLE WAS NOT COLLECTED IN SEPT-OCT 2023
- 500 INFERRED GROUNDWATER ELECTRICAL CONDUCTIVITY CONTOUR (µS/cm)

Map Sources / Notes:
- Contour Interval 1.0 m
- Groundwater electrical conductivity data collected by CRD, September 2022.
- Contours based on 24-W542_2023 base.dwg Capital regional District, April 2024.
- 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.

0 20 40 80 120 160 m

1 : 4000

UTM Zone 10N, NAD83

Reviewed by: MM Prepared by: SP
Date Issued: June 2024 Project Number: 60631284

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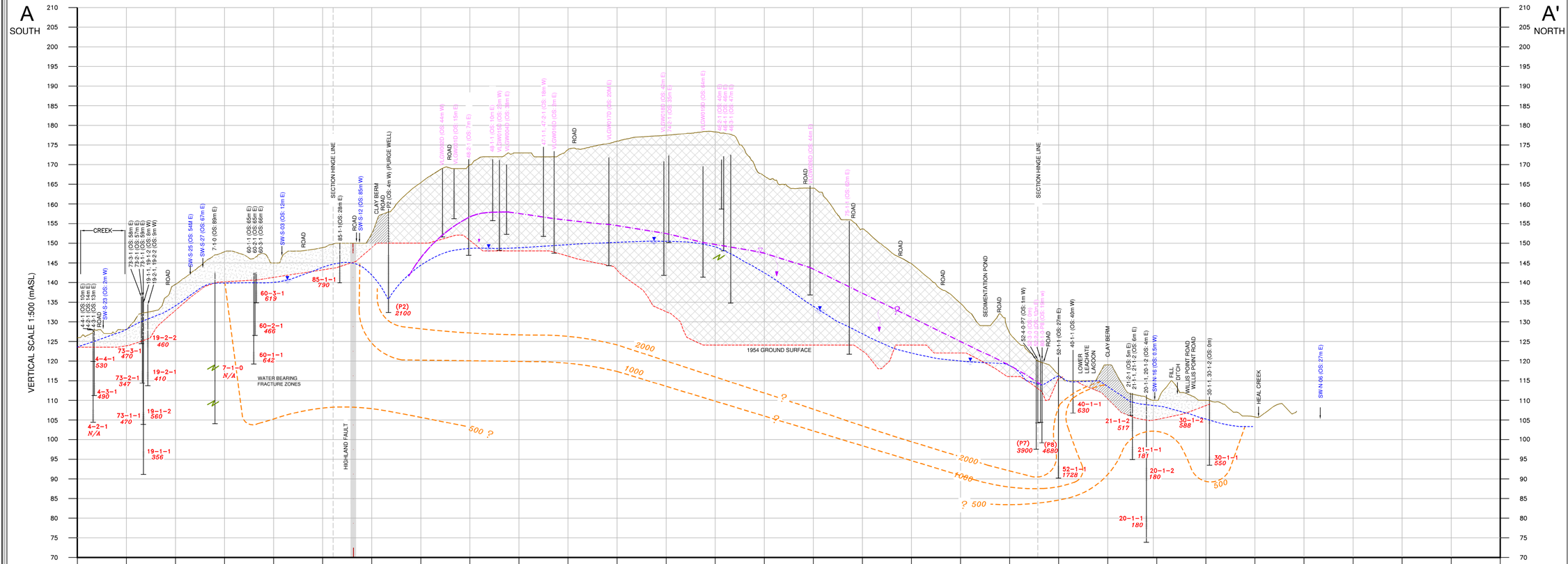
Project: Hartland Landfill Monitoring
Location: Saanich, BC

**Electrical Conductivity Plan (September - October 2023)**

AECOM

**Figure 5-1**

File Location: L:\LEGACY\CABNY1FP001\PROD\PROJECTS\60631284\900-CAD_GIS\910-CAD\20-SHEETS\C\435 - 2023-24 ANNUAL REPORT\FIG5.1_EC PLAN_60631284-2023.DWG Date Plotted: September 23, 2024 Saved By: amirin




## Legend

- MONITORING WELL (NUMBER) INDICATES DISTANCE WELL IS FROM PLANE OF SECTION. WHERE NOT INDICATED, DISTANCE IS LESS THAN 2 m.
- 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 (SEPTEMBER 2022)
- INTERPRETED LEACHATE MOUND
- INFERRED VERTICAL LEACHATE FLOW
- FAULT (MULLER 1980)
- INFERRED ELECTRICAL CONDUCTIVITY CONTOUR (SEPTEMBER 2022).
- 834.0 — ELECTRICAL CONDUCTIVITY SEPTEMBER-OCTOBER 2023 (µ S/cm)
- (N/A) — GROUNDWATER SAMPLE WAS NOT COLLECTED IN SEPTEMBER-OCTOBER 2023
- 537.0 — ELECTRICAL CONDUCTIVITY DATA WAS NOT USED TO INTERPRET CONDUCTIVITY CONTOUR
- SW-N/S-# — SURFACE WATER SAMPLING POINT (CONDUCTIVITY DATA NOT INCLUDED)

Map Sources / Notes:
- Contours based on 24W542_2023 base dwg, provided by the Capital Regional District, April 2024.
- Stratigraphy between boreholes is inferred and may vary from that shown

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

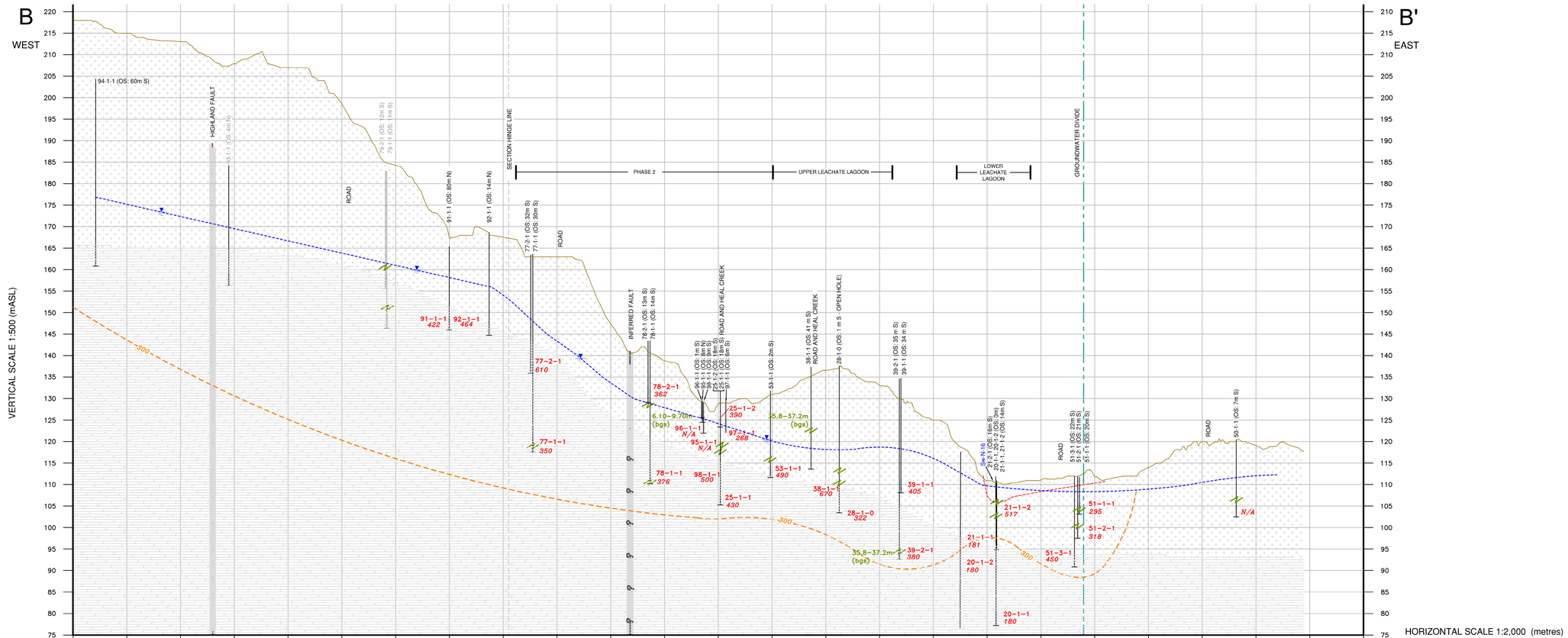
Reviewed by: MM
Date Issued: June 2024
Prepared by: SP
Project Number: 60631284

Making a difference...together
Project: Hartland Landfill Monitoring
Location: Saanich, BC

**Electrical Conductivity in Cross Section A-A'**
**(September - October 2023)**

AECOM

**Figure 5-2**




## Legend

- 85-1-1 (6.0m) — MONITORING WELL (NUMBER) INDICATES DISTANCE WELL IS FROM PLANE OF SECTION. WHERE NOT INDICATED, DISTANCE IS LESS THAN 2 m.
- 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 (SEPTEMBER 2022)
- INFERRED ELECTRICAL CONDUCTIVITY CONTOUR (SEPTEMBER 2022).
- 834.0 — ELECTRICAL CONDUCTIVITY SEPTEMBER-OCTOBER 2023 (µ S/cm)
- (N/A) — GROUNDWATER SAMPLE WAS NOT COLLECTED IN SEPTEMBER-OCTOBER 2023
- SW-N/S-# — SURFACE WATER SAMPLING POINT (CONDUCTIVITY DATA NOT INCLUDED)
- FAULT (MULLER, 1980)
- INFERRED FAULT (AECOM, 2017)

Map Sources / Notes:
- Contours based on 24W542_2023 base dwg, provided by the Capital Regional District, April 2024.
- 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: MM
Date Issued: June 2024

Prepared by: SP
Project Number: 60631248

Making a difference...together

Project: Hartland Landfill Monitoring
Location: Saanich, BC

**Electrical Conductivity in Cross Section B-B' (September - October 2023)**

AECOM

**Figure 5-3**

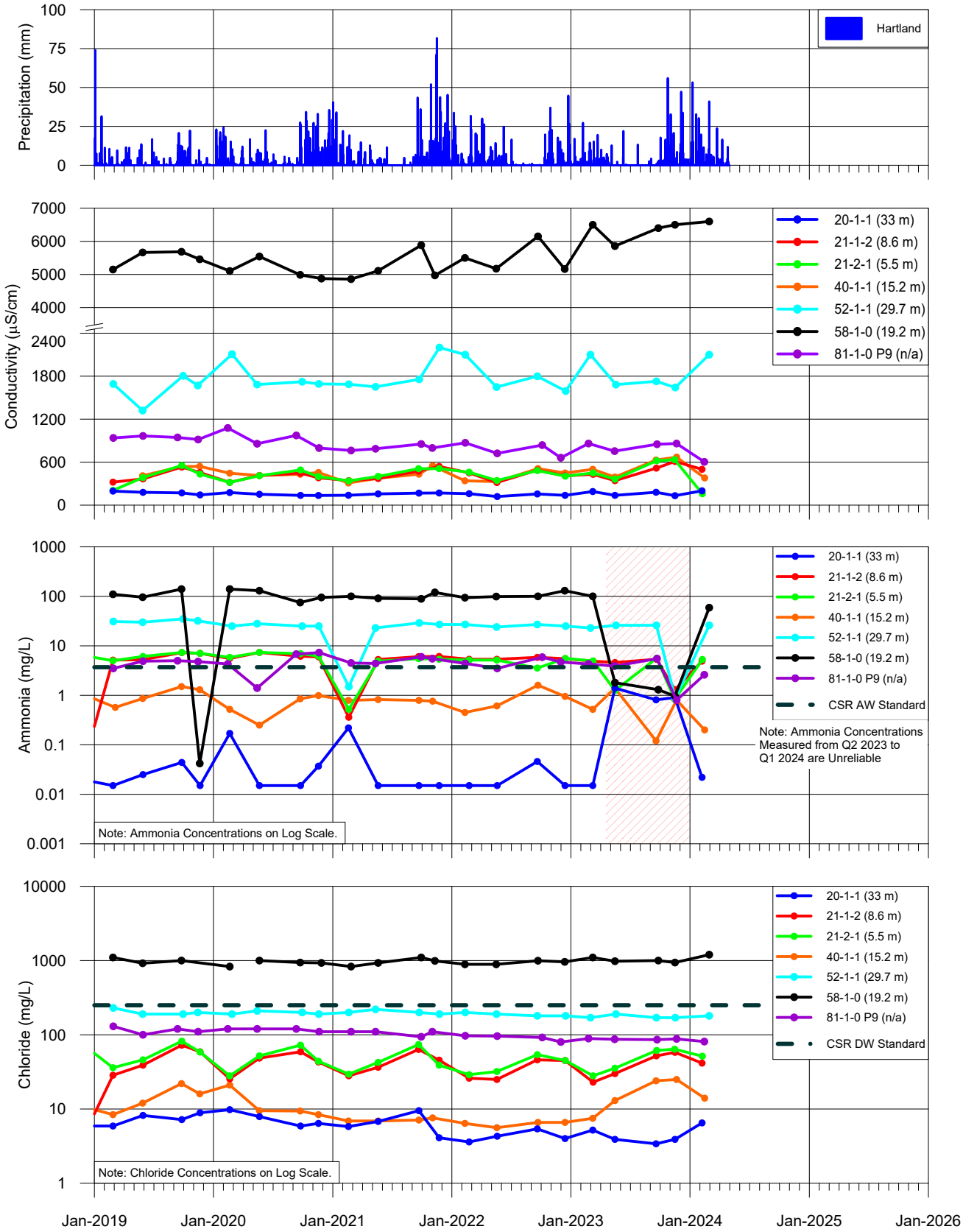



Figure 5-4. Groundwater Quality North of Phase 1

### 5.5.3 Monitoring Site 40

Monitoring well GW-40-1-1 is not a Boundary Compliance Well and was installed between the Upper and Lower Leachate Lagoons, approximately 70 m from the property boundary. Water quality impacts associated with leachate have been investigated at this location and were subject of a previous report (AECOM 2009a). In 2023/24, all parameters met the CSR AW and DW standards on all sampling dates, and conductivity values were below 670 µS/cm, with an average of 518 µS/cm. Conductivity at GW-40-1-1 exhibited a pattern that was consistent with the North Purge Wells, with the most elevated conductivity observed in November 2023.

Compared to the previous monitoring year, the average sulphate concentration observed at GW-40-1-1 increased from 41.5 to 48.75 mg/L, and the average nitrate concentration increased from 2.64 to 5.23 mg/L. Sulphate concentrations did not surpass 75 mg/L, but the elevated nitrate concentrations likely reflect aggregate runoff.

The Mann Kendall analysis did not detect any statistically significant increasing or decreasing trends in solute concentrations at GW-40-1-1, but the long-term decrease in key leachate indicator parameters suggests that groundwater quality has improved at this location due to consistent operation of the North Purge Wells. Groundwater quality at GW-40-1-1 should continue to be monitored closely to verify the effectiveness of leachate collection infrastructure north of the Phase 1 landfill and monitor impacts of aggregate runoff.

### 5.5.4 Monitoring Sites 20 and 21

Monitoring locations 20 and 21 are Boundary Compliance Stations located directly north of the Phase 1 landfill and the Lower Leachate Lagoon, approximately 5 to 15 m from the landfill property boundary. These monitors are in the most probable path of subsurface leachate migration below the unlined Lower Leachate Lagoon. The concentrations of leachate indicator parameters at locations 20 and 21 are plotted against time in Figure 5-4.

In 2023/24, groundwater quality at locations 20 and 21 met both CSR AW and DW standards, except for one boron concentration (5.26 mg/L) measured at GW-20-1-2 in September 2023. Conductivity values observed at both locations were comparable to historical values, with average conductivity ranging from 162.3 to 492.1 µS/cm and the highest values (i.e., >600 µS/cm) observed in wells GW-21-1-1 and GW-21-2-1. Chloride concentrations were low to elevated at location 21, ranging from 3.1 to 64 mg/L, with an average of 34.1 mg/L. Additionally, ammonia concentrations were elevated in both wells (4.9 to 5.3 mg/L) at monitoring location 21 in Q1 of 2024. Nitrate concentrations at both stations were generally below detection, and sulphate concentrations were low.

The Mann Kendall analysis revealed statistically significant decreasing trends in chloride concentrations at GW-20-1-1 and GW-20-1-2, and a statistically significant decreasing trend in nitrate concentration was detected at GW-20-1-1. Statistically significant decreasing trends in ammonia concentration were detected at GW-21-1-2 and GW-21-2-1, as well as statistically significant increasing trends in sulphate concentrations. Furthermore, a statistically significant increasing trend in conductivity was detected at GW-21-1-1.

The moderately elevated conductivity, ammonia and chloride concentrations observed at monitoring station likely reflect dilute leachate impacts, although the boron exceedance reported at GW-20-1-2 may reflect a natural source, given the presence of low leachate indicator parameters. Ultimately, the source of the boron is unknown. Groundwater quality at this station should continue to be monitored closely to identify leachate-impacted groundwater migrating offsite, and speciation/isotopic testing should be performed to determine the origin of the boron.

### 5.5.5 Monitoring Site 31

Monitoring location 31 is a Boundary Compliance Station located just inside the northern property boundary of the landfill, downgradient of the Northeast Stockpile, approximately 160 m northeast of the Lower Leachate Lagoon. The lowest groundwater elevations measured on site occur at this station.

In 2023/24, groundwater quality at location 31 met all applicable CSR standards, except nitrate concentrations exceeded the CSR DW guideline on two of three sampling events at GW-31-1-1, and during all sampling events at GW-31-1-2. Average conductivity values observed at these stations were elevated, ranging from 539 to 715 µS/cm, and sulphate concentrations consistently exceeded the aggregate runoff indicator threshold, with average concentrations ranging from 166.6 and 173.3 mg/L. Leachate indicator parameter concentrations were low. The Mann Kendall analysis revealed statistically significant increasing trends in nitrate concentration and conductivity at GW-31-1-1 over the past five years.

Compliance Monitoring Station 31 is located downgradient of the Northeast Stockpile and exhibited elevated conductivity, nitrate and sulphate concentrations, and groundwater quality was impacted by runoff from the Northeast Stockpile. The lack of groundwater monitoring infrastructure downgradient of the Northeast Stockpile precludes delineation of groundwater impacts, and CRD is in the process of expanding the monitoring network in this area. CRD is planning to install multi-level groundwater wells in two locations downgradient of the Northeast Stockpile to address this data gap. Ultimately, groundwater quality should continue to be monitored closely and more frequently at this location to delineate and evaluate the impacts of aggregate runoff in the receiving environment.

### 5.5.6 Monitoring Sites 29 and 30

Monitoring locations 29 and 30 are Boundary Compliance Stations located north of Willis Point Road. Long-term conductivity, ammonia, and chloride concentrations trends observed at these locations are displayed in Figure 5-5. In 2023/24, all groundwater quality parameters met applicable CSR standards at these locations.

At monitoring locations 29 and 30, elevated conductivity and chloride concentrations observed since 2007 likely reflect intermittent road salting 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 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, with maximum concentrations typically occurring in winter and early spring months.

Similar to last year, nitrate concentrations at Compliance Monitoring Stations 29 and 30 were moderate to elevated, with concentrations ranging from 0.323 to 2.63 mg/L and 0.02 to 2.61 mg/L, respectively. Average sulphate concentrations were low to moderate, ranging from 36 to 66 mg/L and 22.5 to 51 mg/L. Sulphate concentration reached a maximum value of 66 mg/L in well GW-29-1-2, which is close to the aggregate runoff indicator threshold of 75 mg/L. Average conductivity values ranged from approximately 310 to 588 µS/cm at both stations.

The Mann Kendall analysis revealed a statistically significant increasing trend in conductivity at GW-29-1-1, as well as increasing trends in conductivity and chloride concentrations at well GW-29-1-2. The elevated chloride concentration likely reflects road salting. The Mann Kendall analysis also detected statistically significant increasing trends in conductivity and sulphate concentration in well GW-30-1-1, as well as a decreasing trend in chloride concentrations.

Overall, the elevated conductivity, nitrate and sulphate concentrations observed at compliance monitoring stations 29 and 39 likely reflect dilute aggregate runoff impacts, and groundwater quality at these stations should continue to be monitored closely and more frequently to evaluate the impact of aggregate runoff in the receiving environment.

### 5.5.7 Monitoring Sites 28 and 39

Groundwater monitoring locations 28 and 39 are located between the Upper Leachate Lagoon and Willis Point Road. Wells at monitoring point 28 are considered Boundary Compliance Wells. In 2023/24, groundwater quality at sites 28 and 39 met all applicable CSR standards, except nitrate concentrations observed at GW-39-1-1 exceeded the CSR DW on two sampling events in May and September 2023.

At GW-28-1-0, chloride concentrations and conductivity were relatively low, with averages of 5.95 mg/L and 340 µS/cm, respectively. Nitrate and sulphate concentrations were low to moderate, and conductivity was moderate, ranging from 307 to 410 µS/cm. The Mann Kendall analysis detected statistically significant increasing trends in conductivity and nitrate concentration at this location.

Compared to the previous monitoring year, groundwater quality at station 39 declined considerably, with average nitrate concentrations increasing at locations GW-39-1-1 and GW-39-2-1 from 2.12 to 10.27 mg/L and from 0.55 to 1.45 mg/L, respectively over the past year. Similarly, average sulphate concentrations increased from 24.75 to 37.25 mg/L and from 22 to 27.75 mg/L. Ammonia and chloride concentrations were low, but average conductivity values (349.6 and 384.3 µS/cm, respectively) increased from the previous monitoring year, reflecting increases of 21.8 to 50.5%. The Mann Kendall analysis detected statistically significant increasing trends in conductivity, nitrate and sulphate concentrations in both wells at station 39. The water quality impacts observed at this location reflect aggregate runoff. Groundwater quality at this location should be monitored closely to evaluate the severity of aggregate runoff impacts.

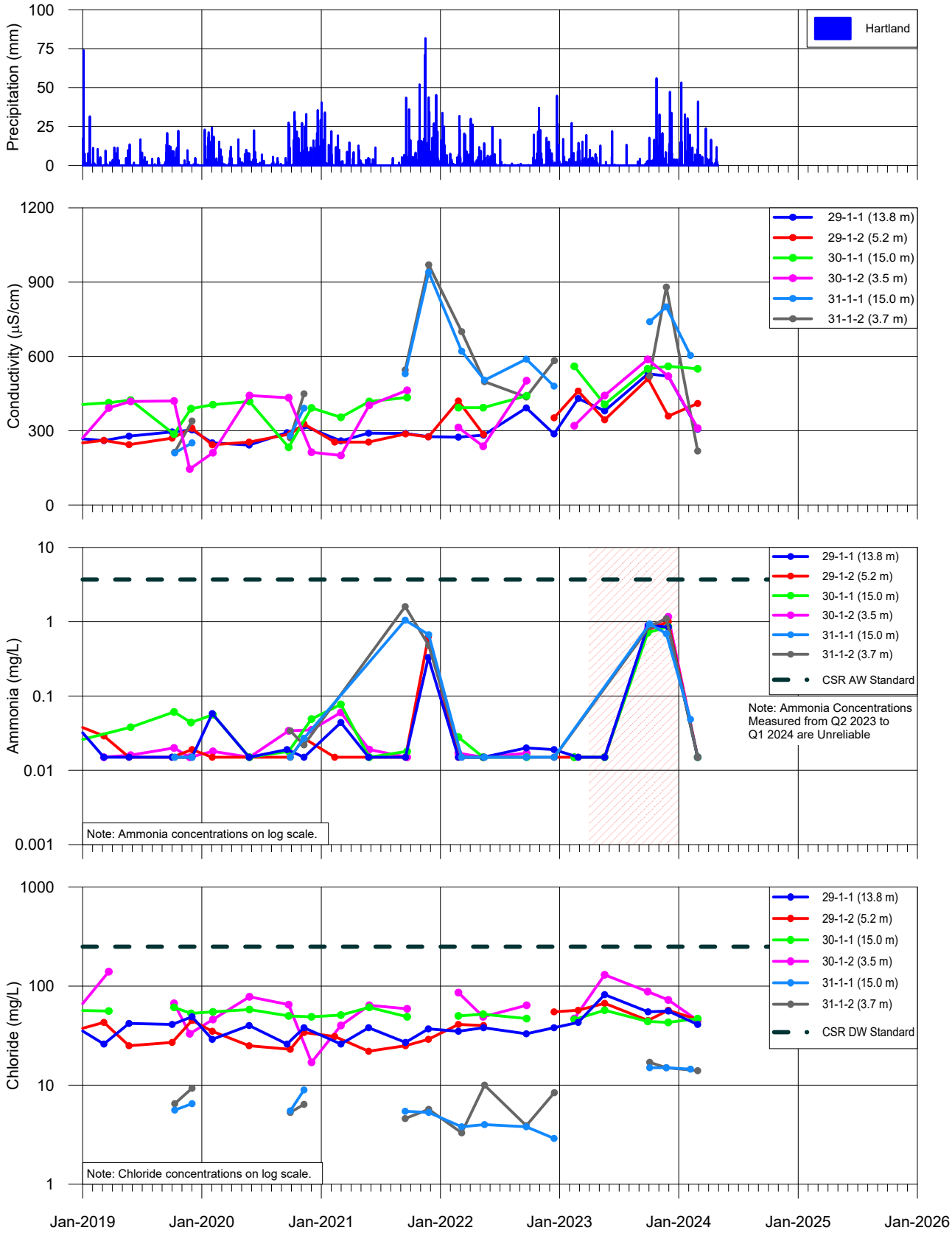



Figure 5-5. Groundwater Quality North of Willis Point Road

## 5.6 Monitors West and North of the Phase 2 Landfill

Background groundwater quality has been represented historically by monitoring location 63 (west of Phase 2) and six (6) monitoring locations (77, 78, 79, 87, 88, 94) north of Phase 2. Groundwater monitoring wells GW-79-1-1 and GW-79-2-1 were decommissioned in May 2018 to accommodate aggregate stockpiling, and monitoring station 78 was decommissioned in Q1 of 2024 due to road construction. In 2019/20, quarrying began in the North Pad area and east of the Toutle Valley Road, and since then, water quality data from locations 77, 78, 87 and 88 has not been considered representative of background conditions. In 2022/23, groundwater quality at well 94 was impacted by aggregate runoff and is no longer considered representative of background conditions.

Throughout July and September 2022, seven new monitoring wells (GW-104-1-1, GW-105-1-1, GW-106-1-1, GW-107-1-1, GW-108-1-1, GW-109-1-1, and GW-110-1-1) were installed North of Phase 2 near the Contractor's Shed to characterize hydrogeological conditions near the Northwest Sedimentation Pond (NWSP) and monitor impacts associated with landfill operations, construction, and aggregate storage. The site investigation results are summarized in AECOM (2023). Quarterly groundwater sampling at these locations commenced in September 2022, but the majority of wells installed during the investigation were decommissioned in Q1 of 2024.

Overall groundwater quality was monitored west and north of the Phase 2 landfill at two background locations (63 and 94), six locations north of the Phase 2 landfill near the Upper Leachate Lagoon (25, 27, 36, 37, 38 and 53), eight locations near the Hartland North Pad (41, 42, 43, 44, 55, 56, 57 and 62), and ten locations near the perimeter of the Phase 2 Basin, the NWSP, and Heal Creek (95, 96, 97, 98, 103, 104, 105, 106, 107, and 108).

### 5.6.1 Background Groundwater Quality

Monitoring well 63 is located at the western edge of the property, upgradient of the landfill, where groundwater quality is considered representative of background conditions. In 2023/24, groundwater quality at Site 63 was consistent with the previous monitoring year, and leachate/aggregate runoff indicator parameters including conductivity, chloride, ammonia, nitrate, and sulphate concentrations were low. Ultimately, groundwater quality at Site 63 shows no signs of landfill-related impacts.

### 5.6.2 Wells North of the Phase 2 Landfill

During the Northwest Sedimentation Pond Investigation (AECOM 2023), a total of 17 wells were drilled around the northern perimeter of Phase 2, the NWSP, and Heal Creek to investigate the groundwater quality. These new wells were sampled quarterly, and the data has been integrated into 2022/23 and 2023/24 annual monitoring reports. Figures 5-6, 5-7, and 5-8 illustrate groundwater quality with selected landfill and leachate indicator parameters. In Q1 of 2024, GW-99-1-1, GW-100-1-1, GW-101-1-1, GW-103-1-1, GW-105-1-1, GW-106-1-1, GW-107-1-1, GW-107-1-2 and GW-110-1-1 were decommissioned following the completion of the NWSP Investigation and to facilitate construction of Cell 4 and associated access roads.

#### 5.6.2.1 Monitoring Site 36

Monitoring location 36 is not a Boundary Compliance Well. It is located 20 m northeast and downgradient of the Phase 2 basin. In 2023/24, well GW-36-3-1 was sampled on a quarterly basis. Well GW-36-2-1 has not been monitored since 2016/17 due to well construction limitations. Well GW-36-3-1 was completed a metre below the elevation of the micro-tunnel (113 masl), so it is useful for assessing whether leachate is migrating beneath the clay liner along the north side of Phase 2. The bottom of the clay liner along the north side of the Phase 2 basin is at 114 m asl.

In 2023/24, groundwater quality in GW-36-3-1 exhibited some improvements, with conductivity and sulphate concentrations ranging from 140 to 960 µS/cm and 6.3 to 210 mg/L, respectively, as compared to values ranging from 805 to 1,348 µS/cm and 140 to 240 mg/L in 2022/23. Average ammonia concentration ranged from below detection to 0.2 mg/L, and chloride concentrations were low. The Mann Kendall analysis revealed a statistically significant decreasing trend in nitrate concentration at GW-36-3-1. Overall, the groundwater quality at station 36 was consistent to slightly improved from previous years, and the absence of elevated nitrate, ammonia, and chloride concentrations suggests any landfill-related impacts at this location are minor. Groundwater quality at this location should continue to be monitored closely to detect impacts related to leachate and aggregate runoff.

#### 5.6.2.2 Monitoring Site 37

Groundwater monitoring station 37 is not a Boundary Compliance Well, and it is located 25 m north of the Phase 2 basin. In 2023/24, well GW-37-3-1 was monitored routinely. Well GW-37-1-1 has been excluded from the monitoring program due to the

limited access. Sampling of GW-37-2-1 was discontinued in 2017 due to its low concentrations of leachate indicator parameters.

In 2023/24, groundwater quality parameters met all applicable CSR standards at GW37-3-1, but conductivity was elevated, ranging from 473 to 940 µS/cm, and the average chloride concentration increased from 13 to 67 mg/L. The highest chloride concentration (100 mg/L) was observed in September 2023, corresponding to a conductivity of 940 µS/cm and a moderate sodium concentration of 18.4 mg/L. Nitrate concentrations were below detection. The Mann Kendall analysis detected statistically significant increasing trends in conductivity and chloride concentration at this location.

Overall, the elevated conductivity, ammonia and chloride concentrations observed at location 37 may reflect dilute leachate impacts, and groundwater quality at this location should continue to be monitored closely. Consideration should be given to reinitiating sampling of GW-37-2-1.

#### 5.6.2.3 Purge Wells P11 and P12

Purge wells P11 and P12 were installed just north of Phase 2 during the NWSP Investigation (AECOM 2023). Since installation, the wells have been dry intermittently but have exhibited groundwater quality impacts related to aggregate runoff when groundwater sampling has been successful. In May of 2023, pumping of P11 began, with an average discharge rate of 0.75 L/min.

In 2023/24. groundwater samples were collected at P11 on three (3) sampling events. During all three (3) sampling events, conductivity was elevated, ranging from 617 to 810 µS/cm. Chloride concentrations were moderate, ranging from 37 to 47 mg/L, and nitrate concentrations were elevated, ranging from 3.23 to 26.8 mg/L, with an average of 14.51 mg/L. Nitrate concentrations exceeded the CSR DW during two sampling events, but all other groundwater parameters met CSR standards throughout the monitoring period. Ammonia concentrations were low, and sulphate concentrations were elevated, ranging from 150 to 230 mg/L.

At P12, groundwater samples were collected during two (2) sampling events. During both sampling events, conductivity was elevated, ranging from 570 to 690 µS/cm, and chloride concentrations were low. Nitrate concentrations were elevated and above the CSR DW on both sampling events, ranging from 11.9 to 18.8 mg/L. Sulphate concentrations were elevated, ranging from 91 to 130 mg/L.

Overall, the elevated conductivity, nitrate and sulphate concentrations observed in P11 and P12 reflect aggregate runoff impacts, but no evidence of landfill leachate was observed. Groundwater quality at these locations should continue to be monitored to observed how the aggregate runoff impacts progress. Moreover, pumping should continue at P11.

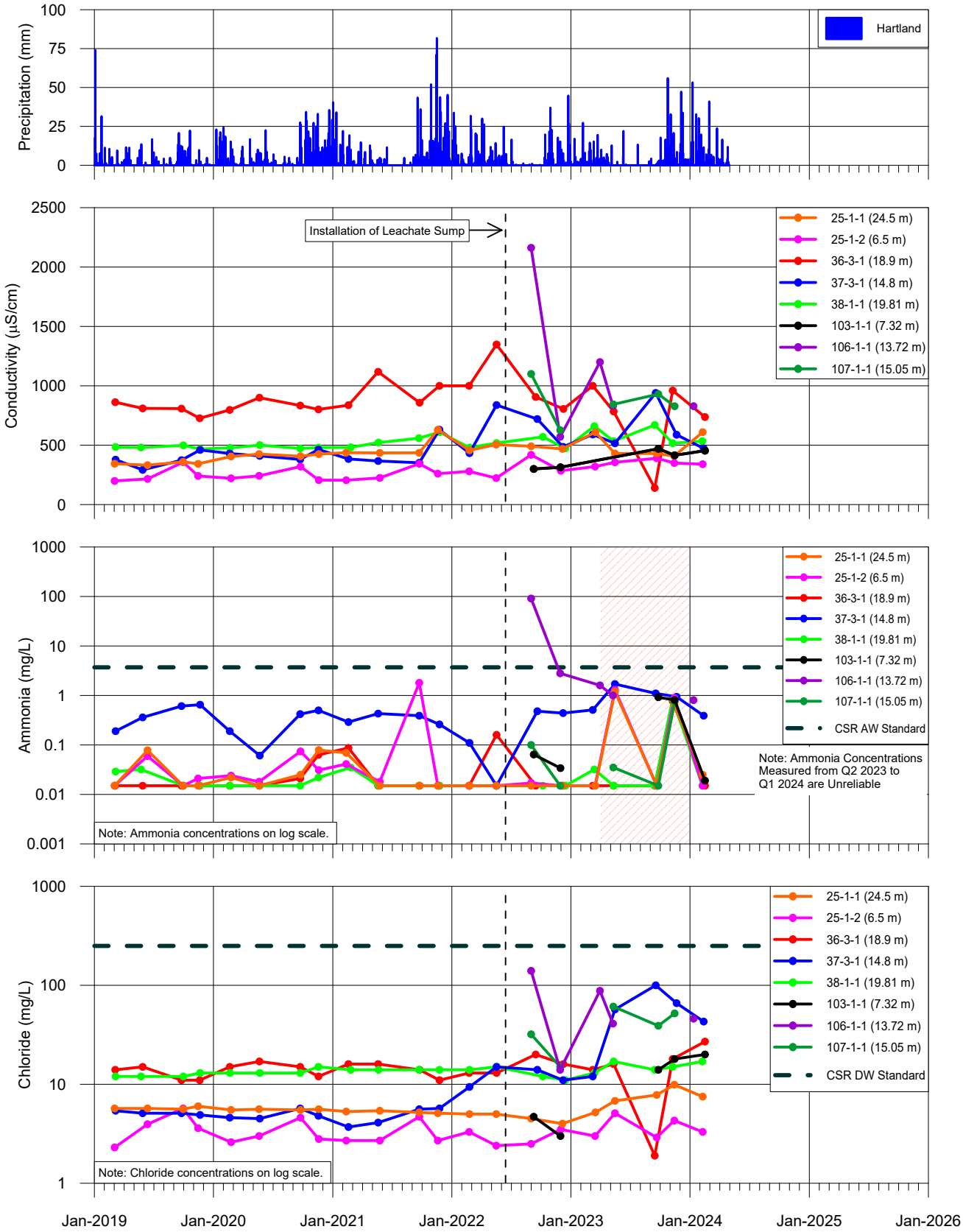



Figure 5-6. Groundwater Quality North of Phase 2 - Landfill Leachate Impacts

#### 5.6.2.4 Monitoring Site 38

Groundwater monitoring station 38 is not a Boundary Compliance Well. It is located roughly 80 m north of the Phase 2 basin immediately north of the Upper Leachate Lagoon. groundwater quality at this location met CSR standards for all parameters in 2023/24. Conductivity was elevated, ranging from 517 to 670 µS/cm, but chloride concentrations were low, and ammonia concentrations were consistently below detection. Nitrate concentrations were low and consistent with the previous monitoring year, ranging from 0.338 to 0.372 mg/L, and sulphate concentrations were moderate, ranging from 45 to 49 mg/L. The Mann Kendall analysis detected statistically significant increasing trends in conductivity and chloride concentration at this location.

The groundwater quality at location 38 showed some evidence of dilute aggregate runoff impacts, but no evidence of leachate impacts were observed. Groundwater quality at this station should continue to be monitored closely.

#### 5.6.2.5 Monitoring Sites 25 and 53

Wells GW-25-1-1, GW-25-1-2 (not Boundary Compliance Wells) and GW-53-1-1 (a Boundary Compliance Well) are located on an east-west trending ridge about 100 m north of the Phase 2 basin, close to the northern property boundary. These wells have exhibited good water quality in the past and remain unaffected by landfill leachate. However, evidence of aggregate runoff impacts began appearing at station 25 in 2022/23 and persisted into 2023/24. Groundwater quality at both stations met all applicable CSR standard in the 2023/24 monitoring period.

In 2023/24, at monitoring location 25, conductivity values ranged from 340 to 390 µS/cm in GW-25-1-2 and from 409 to 610 µS/cm in GW-25-1-1. Nitrate concentrations were elevated throughout most of the year, ranging from 0.062 to 6.99 mg/L and from 0.929 to 4.97 mg/L in GW-25-1-2 and GW-25-1-1, respectively. Sulphate concentrations were also elevated, particularly in the deep well (GW-25-1-1), ranging from 90 to 120 mg/L. In GW-25-1-2, sulphate concentrations ranged from 34 to 95 mg/L. Chloride concentrations in both wells were below 10 mg/L throughout the monitoring period. The Mann Kendall analysis indicated that statistically significant increasing trends in conductivity were observed in both monitoring wells over the past five years. Ultimately, the elevated conductivity, nitrate and ammonia concentrations observed at location 25 reflect aggregate runoff impacts

#### 5.6.2.6 Monitoring Site 27

Groundwater monitoring station 27 is located northwest of Phase 2 and downgradient of the Northwest Stockpile. Similar to previous years, groundwater quality in well GW-27-1-1 met all applicable CSR standards, and conductivity, nitrate, sulphate, ammonia, and chloride concentrations were low. In Q1 of 2024, GW-27-1-1 was decommissioned due to construction of Cell 4.

#### 5.6.2.7 Monitoring Sites Along the Northern Edge of the Phase 2 Basin

Five monitoring wells (GW-103-1-1, GW-104-1-1, GW-105-1-1, GW-106-1-1, and GW-107-1-1/GW-107-2-1) were installed just northwest of the Phase 2 Basin and have been monitored quarterly since 2022/23. The groundwater quality observed in these wells has varied, with some wells (GW-105-1-1 and GW-106-1-1) exhibiting evidence of landfill leachate impacts (in 2022/23), and other wells (GW-104-1-1, GW-105-1-1, and GW-107-1-1) exhibiting impacts related to aggregate runoff. In Q1 of 2024, all of these wells except GW-103-1-1 and GW-104-1-1 were decommissioned due to the completion of the NWSP Investigation (AECOM 2023).

In 2023/24, groundwater quality at GW-103-1-1 was impacted by aggregate runoff, as indicated by nitrate concentrations ranging from 3.54 to 8.92 mg/L, and sulphate concentrations ranging from 77 to 120 mg/L. Conductivity was moderate, ranging from 415 to 470 µS/cm, and ammonia and chloride concentrations were relatively low. Groundwater quality in this well met all applicable CSR standards throughout the monitoring period.

Since 2022/23, groundwater quality has worsened at GW-104-1-1, with conductivity values ranging from 493 µS/cm in the wet season to 1,678 µS/cm in May 2023. Chloride concentrations ranged from 38.5 mg/L to 170 mg/L, ammonia concentration was 0.2 mg/L in Q1 of 2024, and nitrate concentrations ranged from 0.21 to 6.37 mg/L. Sulphate concentrations were moderate to highly elevated, ranging from 140 to 730 mg/L, exceeding the CSR DW (along with cobalt and copper concentrations) in September 2023. Overall, the poor groundwater quality at GW-104-1-1 likely reflects a combination of magnesium lignosulphonate and aggregate runoff. The CRD reported observation of magnesium lignosulphonate puddles in the area of 104 at the time of sampling. Groundwater quality at this location should continue to be monitored closely to observed how the water quality impacts progress.

At GW-105-1-1, nitrate concentrations exceeded the CSR DW standards on two of three sampling events, ranging from 7.94 to 20.3 mg/L. Ammonia concentrations were low, and chloride concentrations ranged from 65 to 96 mg/L, corresponding to low sodium concentrations. Conductivity and sulphate concentrations were elevated, ranging from 791 to 796 µS/cm and from 210 to 260 mg/L, respectively. Overall, the elevated conductivity, nitrate and sulphate concentrations reflect aggregate runoff impacts.

At GW-106-1-1, groundwater quality impacts related to aggregate runoff were observed, as indicated by elevated and non-compliant (CSR DW) nitrate concentrations, ranging from 12.1 to 18.6 mg/L, and elevated sulphate concentrations, ranging from 195 to 260 mg/L. Ammonia concentrations were 0.805 mg/L in Q1 of 2024, and chloride concentrations were moderate, ranging from 33 to 46 mg/L. Conductivity was also elevated, ranging from 828 to 930 µS/cm throughout the monitoring period.

Similar groundwater quality impacts were observed at GW-107-1-1, where nitrate concentrations ranged from 6.17 to 15.8 mg/L, exceeding the CSR DW in May 2023. Sulphate concentrations were elevated and stable at 250 mg/L throughout the monitoring period. Ammonia concentrations were low, and chloride concentrations were moderate, ranging from 39 to 61 mg/L. Conductivity values ranged from 828 to 930 µS/cm. Groundwater quality at this location was clearly impacted by aggregate runoff.

#### 5.6.2.8 Monitoring Sites Near the Northwest Sedimentation Pond and Heal Creek

During the NWSP Investigation (AECOM 2023), five monitoring wells (GW-95-1-1, GW-96-1-1, GW-97-1-1, GW-98-1-1, and GW-108-1-1) were installed around the NWSP and Heal Creek to assess the groundwater quality on a local scale. These wells were sampled quarterly beginning in September 2022 and have continuously exhibited aggregate runoff impacts. In Q1 of 2024, GW-97-1-1 was decommissioned.

Wells GW-95-1-1 and GW-96-1-1 were installed meters apart, along the north edge of Heal Creek, east and downgradient of the NWSP. Both wells exhibited evidence of aggregate runoff impacts in 2022/23, which persisted in 2023/24. Conductivity in the wells ranged from 316 to 626 µS/cm, with the highest value observed at GW-95-1-1. During one sampling event, nitrate concentration exceeded the CSR DW standard at GW-95-1-1, reaching a maximum of 24.35 mg/L. At GW-96-1-1, nitrate concentration exceeded the CSR DW on two sampling dates, ranging from 10.4 to 38.4 mg/L. Average nitrate concentrations increased considerably from last year, increasing from 1.34 to 11 mg/L and from 8.68 to 17 mg/L at GW-95-1-1 and GW-96-1-1, respectively. Additionally, sulphate concentrations increased at GW-95-1-1, ranging from 33 to 170 mg/L. At GW-96-1-1, sulphate concentrations were similar to those observed in 2022/23, ranging from 51 to 100 mg/L. At both wells, ammonia and chloride concentrations were low.

Wells GW-97-1-1 and GW-98-1-1 were installed metres apart, just south of Heal Creek and north of the NWSP. Both wells exhibited evidence of aggregate runoff impacts in 2022/23, which persisted at well GW-98-1-1 throughout 2023/24. GW-97-1-1 exhibited relatively low sulphate concentrations, ranging from 17 to 35 mg/L, as well as low conductivity, ammonia and chloride concentrations. Additionally, nitrate concentrations were low, ranging from 0.034 to 0.341 mg/L. At GW-98-1-1 on the west side of Heal Creek, nitrate concentrations were considerably higher, ranging from 0.711 to 41.7 mg/L, exceeding the CSR DW on two sampling events. The two elevated nitrate concentrations (11.0 and 41.7 mg/L) observed at GW-98-1-1 corresponded with elevated sulphate concentrations, ranging from 120 to 190 mg/L, and conductivity ranging from 487 to 499 µS/cm. Ammonia and chloride concentrations were low.

In 2022/23, groundwater quality at GW-108-1-1 showed no evidence of aggregate runoff or leachate impacts, as nitrate, ammonia, and chloride concentrations were low. Conductivity and sulphate concentrations were elevated in this deep well, but these results likely reflect natural weathering of the bedrock. In 2023/24, the same trends persisted, with an average conductivity of 600 µS/cm, and an average sulphate concentration of approximately 236.7 mg/L. Ammonia concentrations were moderate (0.905 mg/L) during the January 2024 sampling event, nitrate concentration was generally below detection, and chloride concentrations stayed below 23 mg/L.

The elevated conductivity, nitrate and sulphate concentrations observed at wells GW-95-1-1, GW-96-1-1, and GW-98-1-1 point to worsening aggregate runoff impacts in this area of the landfill. Groundwater quality at these locations should continue to be monitored closely to track how these impacts progress. Moreover, groundwater quality at GW-108-1-1 should continue to be monitored closely to monitor for incipient groundwater quality impacts, which may have been detected in January 2024, given the elevated conductivity, ammonia and sulphate concentrations.

### 5.6.3 Wells near Hartland North Pad and the Northwest Stockpile

The Hartland North Pad has had a variety of uses including yard waste composting (1994 – 2004), aggregate stockpiling (2006 to 2018), and currently, it accommodates the north trailer and new north scale residuals facility. Aggregate is only stored on the ridge south of the North Pad. 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.

#### 5.6.3.1 Monitoring Sites 41, 42, 55, 56, and 57

Groundwater monitoring stations 41, 42, 55, 56 and 57 are considered Boundary Compliance Wells. Monitoring locations 41, 42, and 56 were installed on landfill property, and 55 and 57 are located in the receiving environment downgradient of the North Pad.

In 2023/24. Groundwater parameters at monitoring locations 41, 42, and 56 met all applicable CSR standards but showed some evidence of aggregate runoff impacts. Conductivity was moderate and consistent with historical values, and chloride and nitrate concentrations were generally low, except for concentrations ranging as high as 0.255 mg/L at location 41. Average sulphate concentrations were consistent with historical values, ranging from 36 to 76 mg/L. Ammonia concentrations was 0.21 mg/L in Q1 of 2024. Historically, ammonia concentrations have been below 0.01 mg/L. The Mann Kendall analysis revealed statistically significant increasing trends in chloride and nitrate concentrations at GW-41-1-1, as well as a decreasing trend in sulphate concentrations. Furthermore, increasing trends in conductivity and chloride concentrations were observed at GW-42-1-1, and a decreasing trend in sulphate concentration was observed at GW-56-1-1.

At monitoring locations 55 and 57, similar trends were observed, and all groundwater parameters met applicable CSR standards. Conductivity and sulphate concentrations were consistent with values observed in 2022/23, and similar to locations 41, 42, and 56, relatively high ammonia concentrations were observed at location 55 (0.93 to 1.0 mg/L). Nitrate and chloride concentrations were low at both locations and consistent with historical values. The Mann Kendall analysis revealed a statistically significant decreasing trend in sulphate concentration at location 55.

#### 5.6.3.2 Monitoring Sites 43, 44, and 62

Monitoring locations 43, 44 and 62 were installed adjacent to the Hartland North Pad and are not Boundary Compliance Wells. In 2023/24, groundwater quality at these locations declined, particularly at monitoring location 62, where nitrate concentrations exceeded the CSR DW on one sampling event. Nitrate concentrations ranged from 26.7 to 31.3 mg/L at GW-62-1-1 and GW-62-2-1, respectively, but groundwater samples were only collected during one sampling event (November 2023). The elevated nitrate concentrations corresponded with sulphate concentrations ranging from 43 to 45 mg/L. Ammonia concentrations were below detection at both locations 43 and 44 in Q1 of 2024. Sulphate concentrations were elevated at location 43 but were similar to historical values at both locations. Conductivity values were elevated, particularly at location 43, but conductivity at both locations was consistent with historical values.

The elevated conductivity, ammonia and sulphate concentrations observed at these locations suggest aggregate runoff impacted the groundwater quality in this area of the landfill. The Mann Kendall analysis detected statistically significant increasing trends in conductivity and chloride concentration at GW-62-1-1, as well as an increasing trend in nitrate concentration at location 44.

#### 5.6.3.3 Monitoring Sites 77 and 78

In 2023/24, concentrations of all parameters measured at monitoring stations 77 and 78 (not Boundary Compliance Wells) were below applicable CSR standards, except for an anomalous antimony concentration that exceeded the CSR DW at GW-78-1-1 in September 2023, and a nitrate concentration that exceeded the CSR DW at GW-77-1-1 in November 2023. Monitoring wells at location 78 were decommissioned in Q1 of 2024 due to road construction, and the CRD are currently planning a drilling program to replace them.

At monitoring locations 77 and 78, average conductivity values increased substantially from the previous monitoring period, ranging from 350 to 610 µS/cm and from 350 to 480 µS/cm, respectively. Chloride concentrations were generally low, except for two relatively high concentrations ranging from 68 to 70 mg/L, as observed at GW-77-2-1. Nitrate concentrations were elevated at GW-77-1-1 and GW-78-2-1 in November 2023, ranging from 6.83 to 10.6 mg/L, but they were otherwise low to moderate. Average sulphate concentrations at both locations ranged from 24 to 64 mg/L. The Mann Kendall analysis revealed statistically significant increasing trends in conductivity and sulphate concentration at well GW-77-2-1, as well as a decreasing trend in chloride concentration at GW-78-2-1. Ultimately, the groundwater quality data collected at these locations indicates aggregate runoff impacts are present in this area of the landfill, and the groundwater quality should continue to be monitored closely to evaluate how the aggregate runoff impacts progress.

#### 5.6.3.4 Monitoring Sites 87 and 88

Groundwater monitoring locations 87 and 88 are situated on either side of the Highland Fault, just south of the Northwest Stockpile. Groundwater quality at both locations declined considerably from the previous monitoring year, with nitrate concentrations (17.3 mg/L) exceeding the CSR DW at monitoring well GW-88-1-1 in September and November 2023. At GW-88-2-1, conductivity values ranged as high as 1,200 µS/cm, corresponding to a sulphate concentration of 550 mg/L, exceeding the CSR DW. Chloride concentrations at both monitoring locations were very low. At monitoring location 87, nitrate concentrations ranged from 0.032 to 3.69 mg/L. The Mann Kendall analysis revealed statistically significant increasing trends

in conductivity, sulphate and nitrate concentrations at GW-88-1-1, as well as a decreasing trend in chloride concentration. Additionally, a decreasing trend in chloride concentration was detected at GW-88-2-1. Aggregate runoff clearly impacted groundwater quality in this area of the landfill.

#### 5.6.3.5 Monitoring Sites 91, 92, and 94

Monitoring locations 91, 92, and 94 are located south of the RTF and are not considered Boundary Compliance Wells. In 2023/24 groundwater quality parameters measured at these locations met all applicable CSR standards. However, increases in average conductivity were observed at all three locations.

Since 2022/23, groundwater quality at well GW-94-1-1 has shown evidence of aggregate runoff impacts in the form of elevated conductivity, nitrate and sulphate concentrations. Similar results were observed in 2023/24, with slightly lower nitrate concentrations, ranging from 0.057 to 1.16 mg/L, and slightly higher sulphate concentrations, ranging from 36 to 76 mg/L. Conductivity ranged from 243 to 500 µS/cm.

At locations 91 and 92, average sulphate concentrations increased from 69.8 to 83.8 mg/L and from 117.5 to 133.3 mg/L at GW-91-1-1 and GW-92-1-1, respectively. Nitrate concentrations were generally low, ranging as high as 0.028 mg/L at GW-91-1-1 and 0.007 mg/L at GW-92-1-1. The Mann Kendall analysis detected a statistically significant increasing trends in conductivity and sulphate concentration at GW-91-1-1, as well as a decreasing trend in nitrate concentration. Overall, groundwater quality at locations 91, 92, and 94 exhibited evidence of aggregate runoff impacts and should continue to be monitored closely to evaluate how the impacts progress.

## 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 locations 4, 71, 72 and 73 are considered Boundary Compliance Monitoring Stations. Well GW-71-1-1 is located off site along Hartland Avenue. Wells at locations 4, 19, 60, 71, 72 and 73 were completed at multiple levels, and the well at location GW-7-1-1 is a 37 m deep, open borehole that was used for domestic water supply at the landfill until 1989. Wells at locations 71, 72 and 73 were installed in 2003. Well GW-85-1-1 was installed in 2009 to replace well GW-3-2-1, which was decommissioned to permit construction of the bin facility.

Figure 5-9 shows plots of leachate indicator parameters in wells located south and downgradient of the landfill, and Figure 5-10 shows leachate indicator parameters at wells located southeast of the landfill. Groundwater quality in these wells is sensitive to the performance of the South Purge Well System. When the system is functioning properly, concentrations of leachate indicator parameters have declined, and seasonal fluctuations have dampened. The reported concentrations indicate that the South Purge Well System mitigated southward migration of leachate successfully and leachate quality in Phase 1 may have improved in 2023/24.

### 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 P4) exhibited statistically significant decreasing trends in ammonia concentration, and a decreasing trend in chloride concentration was detected at P3 and P4. In 2023/24, the average conductivity of all groundwater samples collected from the South Purge Wells was 1,671 µS/cm, which was slightly lower than the average of 1,809 µS/cm observed in 2022/23. Similarly, the average chloride concentration decreased from 155 mg/L to 130 mg/L. These trends may reflect improvements in groundwater/leachate quality in the Phase 1 landfill or seasonal and interannual variability.

Throughout the monitoring period, ammonia concentrations in the South Purge Wells exceeded the CSR AW standard, except for monitoring event at P1. Additionally, barium concentrations exceeded the CSR DW at P1 during all sampling events. Among the South Purge Wells, ammonia concentrations ranged from 16 to 86 mg/L, and chloride concentrations ranged from 35 to 200 mg/L.

### 5.7.2 Monitoring Site 85

In 2023/24, at groundwater monitoring location 85 (not a Boundary Compliance Well), chloride concentrations remained elevated, ranging from 74 to 140 mg/L, and the average conductivity was 583.5 µS/cm. Nitrate concentrations were similar to historical values, ranging from 0.952 to 1.77 mg/L, and one nitrate concentration was reported as 341 mg/L, which was confirmed by the CRD as a laboratory reporting error. Sulphate concentrations were moderate, ranging from 36 to 56 mg/L, and ammonia concentrations were low to elevated, ranging from 0.02 to 1.4 mg/L. Sodium concentrations ranged from 55.1 to 72.4 mg/L. Given the relatively low ammonia concentrations and an average Cl/Na molar ratio of approximately 1.2, road

salting may have impacted the groundwater quality. However, the moderate sulphate concentrations and elevated nitrate may reflect aggregate runoff. The Mann Kendall did not detect any statistically significant trends at this location.

### 5.7.3 Monitoring Site 60

Three monitoring wells were installed at location 60: GW-60-1-1 (23 m bgs), GW-60-2-1 (16 m bgs), and GW-60-3-1 (7 m bgs). These wells are not considered Boundary Compliance Wells. In 2023/24, solute concentrations met applicable CSR standards in all three wells.

Groundwater quality at location 60 was comparable to last year, with average conductivity ranging from 554 to 662 µS/cm, and elevated chloride concentrations ranging from 64 to 120 mg/L. Nitrate concentrations were below detection in GW-60-2-1 and exceeded the detection limit on one sampling event at GW-60-1-1. During that sampling event (February 2024), nitrate concentrations were below detection in GW-60-3-1 despite being elevated (3.27 to 3.45 mg/L) during two of the other three sampling events. Sulphate concentrations were moderate to elevated, ranging from 38 to 72 mg/L, and ammonia concentrations were below detection in all three wells during Q1 of 2024.

The Mann Kendall analysis revealed statistically significant increasing trends in conductivity and chloride concentration at GW-60-1-1, as well as a decreasing trend in sulphate concentration. Moreover, a statistically significant decreasing trend in nitrate concentration was observed at GW-60-2-1, and an increasing trend in conductivity was highlighted at GW-60-3-1. Overall, groundwater quality at location 60 has degraded slowly over time and shown some evidence of aggregate runoff and potentially dilute leachate impacts. Groundwater at this location should continue to be monitored closely.

### 5.7.4 Monitoring Site 07

Monitoring wells at location GW-7-1-0 are considered Boundary Compliance Wells, but no groundwater samples could be collected at this location in 2023/24 because of a pump malfunction.

### 5.7.5 Monitoring Sites 71, 72, 73

Wells GW-71-1-1, GW-72-1-1, and GW-73-1-1 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 observed at monitoring stations 71, 72, and 73 are plotted in Figures 5-9 and 5-10. In 2023/24 all groundwater quality parameters measured at monitoring locations 71, 72, and 73 met applicable CSR standards.

At well monitoring location 71, groundwater quality was comparable to recent years, and ammonia concentrations were below detection during Q1 of 2024 in all three wells. Conductivity values were consistent with historical values, ranging from 243 to 500 µS/cm, and nitrate concentrations were below detection in GW-71-1-1 and GW-71-2-1, but were elevated in GW-71-3-1, with an average concentration of about 1.46 mg/L. Sulphate concentrations were generally low, exhibiting an average of 31.4 mg/L, and chloride concentrations were low. The Mann Kendall analysis highlighted statistically significant increasing trends in conductivity and sulphate concentrations in all three monitoring wells, as well as an increasing trend in nitrate concentration in well GW-71-3-1. Additionally, a statistically significant decreasing trend in chloride concentration was observed at GW-71-2-1.

At well monitoring location 72, groundwater quality was consistent with previous monitoring years, but increases in conductivity and ammonia concentration were observed. Average conductivity increased from 483 to 566 µS/cm, compared to the previous monitoring year, and the average ammonia concentration increased from nearly non-detectable values to 0.58 mg/L, with a maximum concentration of 1.55 mg/L observed at GW-72-1-1 in May 2023. The average sulphate and chloride concentrations were about the same as last year, at 54 and 53 mg/L, respectively. Nitrate concentrations were below detection at both wells throughout the monitoring period. The Mann Kendall analysis revealed statistically significant decreasing trends in chloride concentration at wells GW-72-1-1 and GW-72-3-1.

At monitoring location 73, groundwater quality was similar to last year, except for slightly higher ammonia and sulphate concentrations. Average conductivity was about 351.3 µS/cm, and ammonia concentrations were below detection during Q1 of 2024 in all three wells. In 2022/23, the average ammonia concentration at monitoring location 73 was 0.022 mg/L. Sulphate concentrations were moderate in all three monitoring wells at location 73, with an average value of 41.4 mg/L. Chloride concentrations were relatively low, ranging from 20 to 36 mg/L. The Mann Kendall analysis revealed statistically significant increasing trends in sulphate and nitrate concentrations in GW-73-1-1, as well as increasing trends in conductivity and sulphate concentration in GW-73-3-1. Additionally, an increasing trend in nitrate concentration was detected in GW-73-2-1.

Overall, groundwater quality at monitoring locations 71, 72, and 73 was consistent with previous years, except for occasionally elevated ammonia and nitrate concentrations, which may reflect aggregate runoff. Low chloride concentrations suggest no landfill leachate impacts occurred in this area of the landfill.

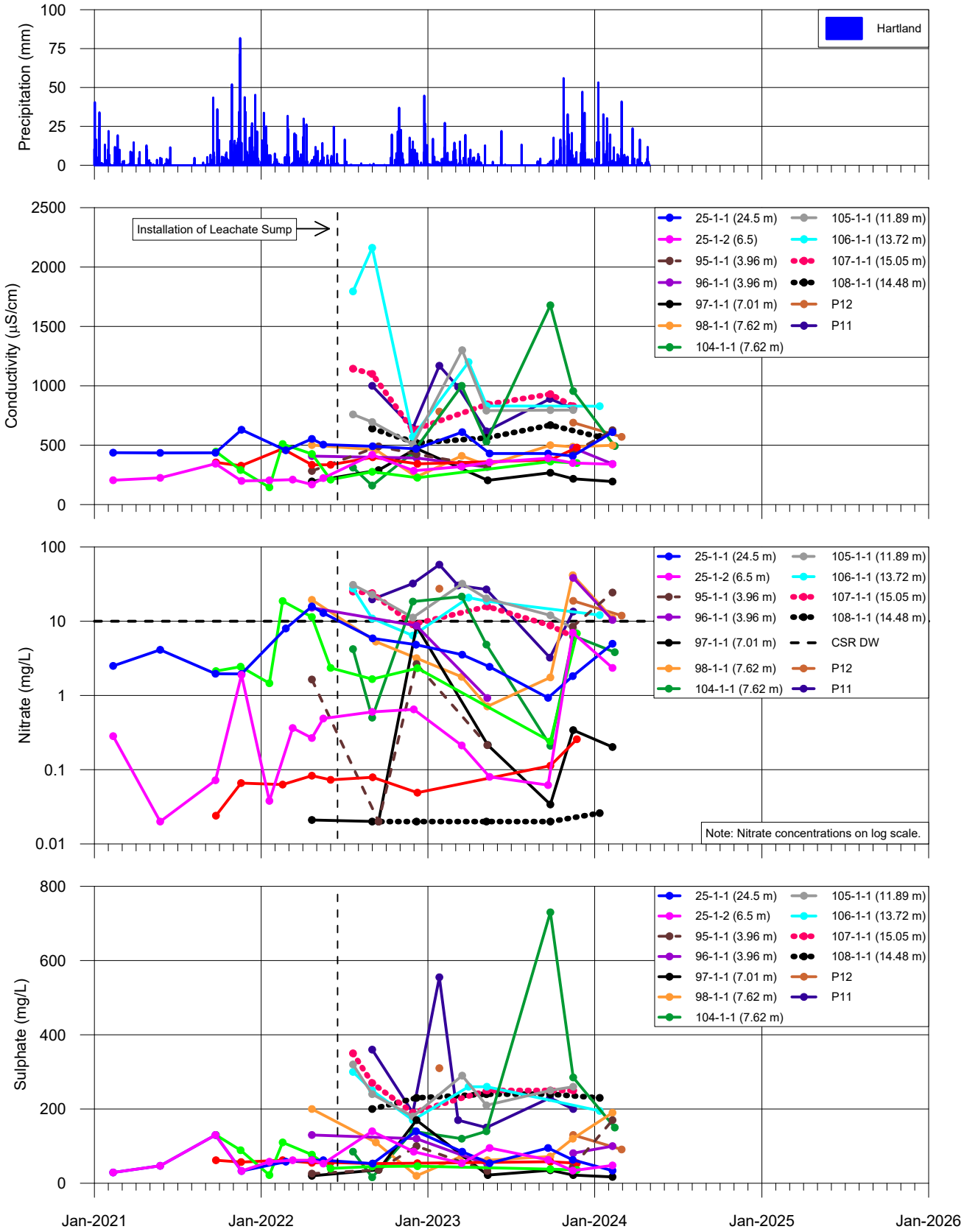



Figure 5-7. Groundwater Quality North of Phase 2 - Aggregate Impacts (2021 to Present)

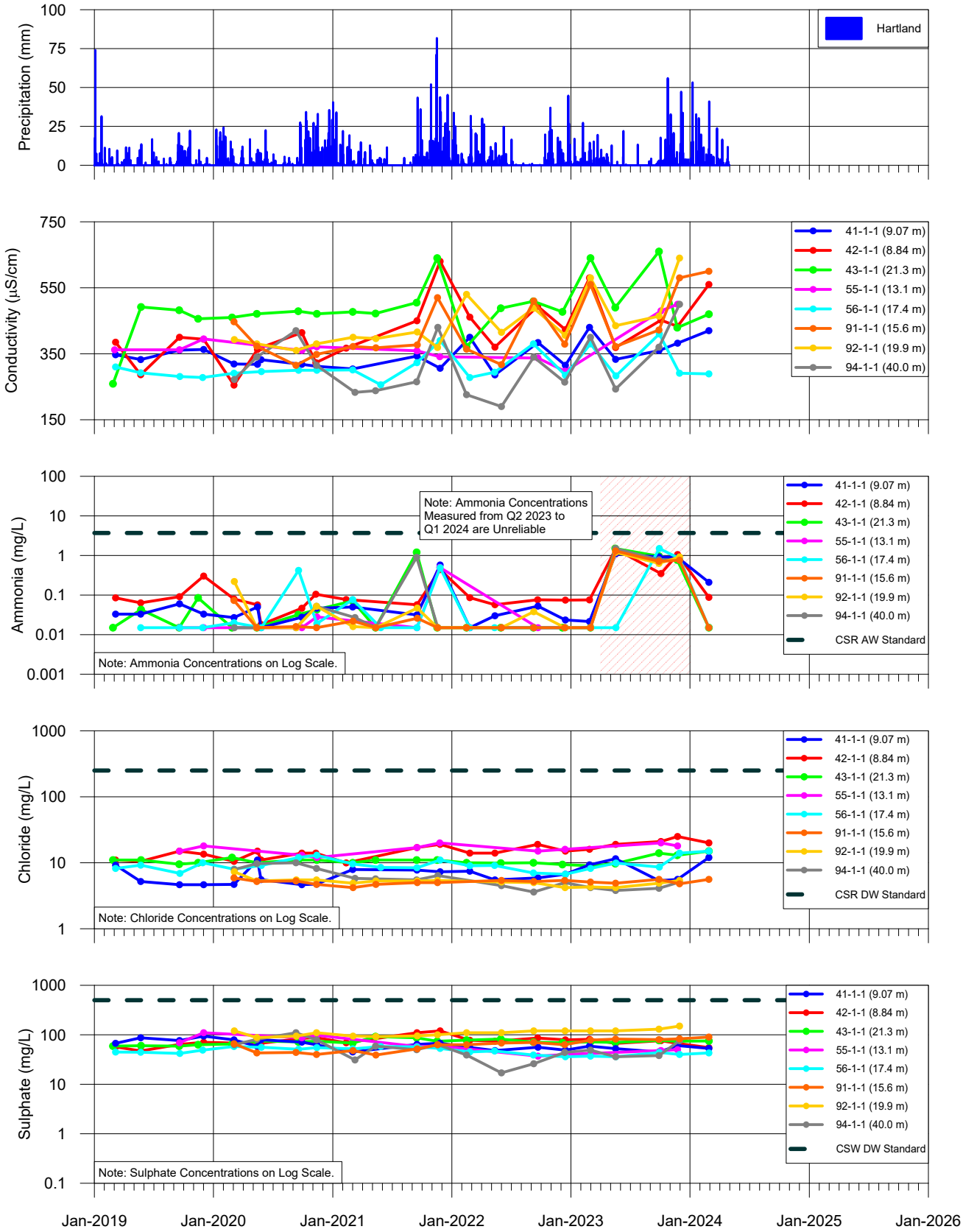



Figure 5-8. Groundwater Quality North of Hartland North Pad

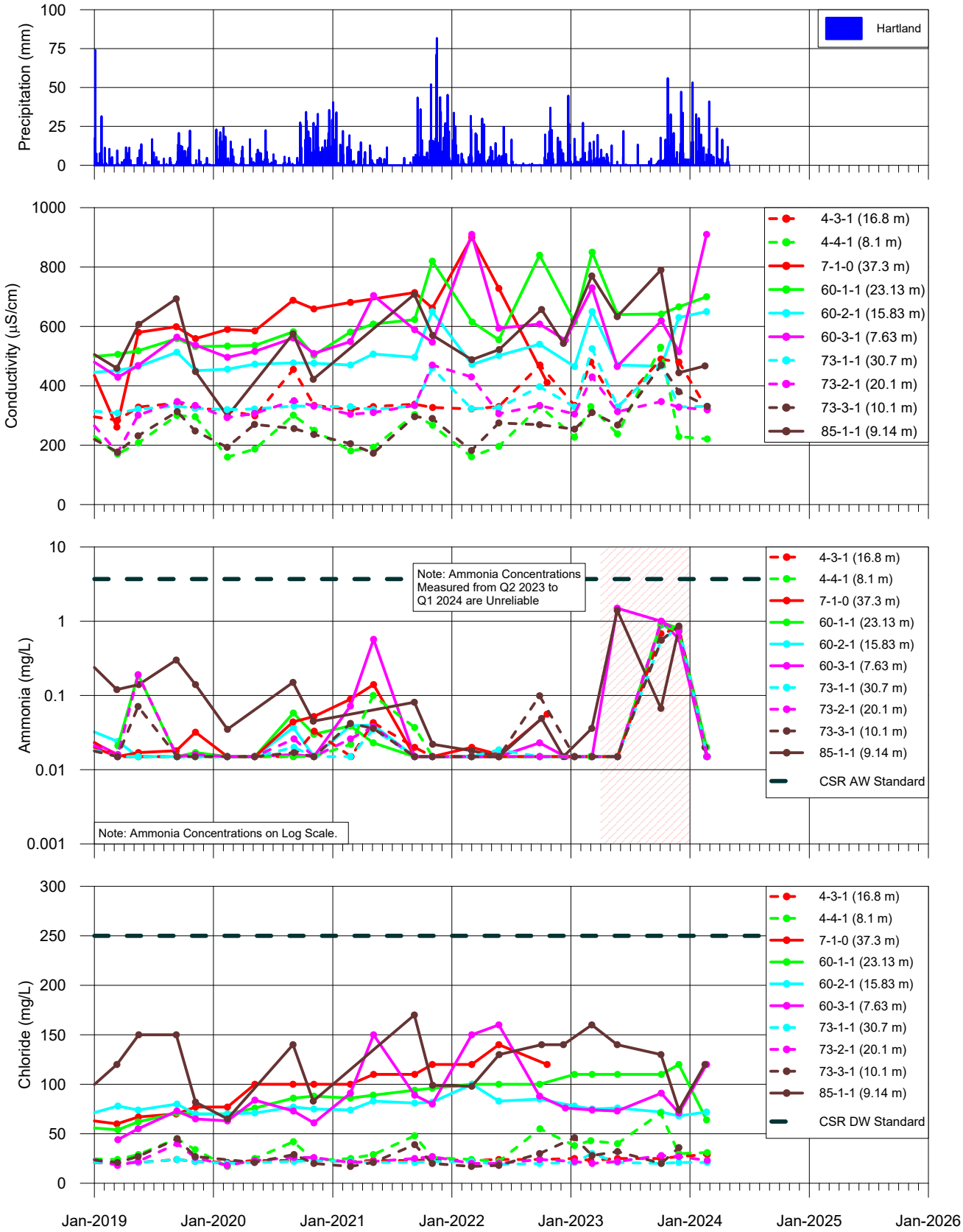



Figure 5-9. Groundwater Quality South of Landfill

### 5.7.6 Monitoring Site 04

Location 04 is the southernmost groundwater monitoring location at the landfill and is considered a Boundary Compliance Well. Groundwater sampling in the deepest monitoring well at Site 04 was discontinued in 2016 due to extremely slow recharge and challenges in collecting representative samples. In 2023/24 all groundwater quality parameters measured at monitoring location 4 met applicable CSR standards.

In 2023/24, groundwater quality at monitoring location was comparable to previous monitoring years, and ammonia concentrations were below detection in both wells during Q1 of 2024. Similar to in 2022/23, nitrate concentrations were low, except for seasonally elevated concentrations in GW-4-4-1 observed during the final two sampling events, when concentrations ranged from 1.03 to 1.43 mg/L. The average sulphate concentration was low to moderate, at 34.3 mg/L, and chloride concentrations ranged from 25 to 71 mg/L, corresponding to an average Cl/Na molar ratio of approximately 3.1. The average conductivity observed at monitoring station 4 was consistent with last year, at 355 µS/cm. The Mann Kendall analysis revealed statistically significant increasing trends in chloride and sulphate concentrations at GW-4-3-1, as well as an increasing trend in nitrate concentration at GW-4-4-1, and a decreasing trend in nitrate concentration at GW-4-3-1.

Overall, the groundwater quality at monitoring location 4 was mildly influenced by aggregate runoff, but most aggregate runoff indicators were below established thresholds. The source of the chloride remains uncertain but is likely linked to the same cause of water quality impacts at stations 07, 85 and 60.

### 5.7.7 Monitoring Site 19

Four monitoring wells were installed at monitoring station 19: GW-19-1-1 (38 m BGS), GW-19-1-2 (28 m BGS), GW-19-2-1 (17 m BGS), and GW-19-2-2 (9 m BGS). These wells are not considered Boundary Compliance Wells. In 2023/24, all groundwater parameters measured at location 19 met applicable CSR standards.

Similar to last year, conductivity in two wells (GW-19-1-1 and GW-19-1-2) surpassed 500 µS/cm, reaching a maximum conductivity of 560 µS/cm in November and October 2023, respectively. Ammonia and nitrate concentrations were generally close to detection limits, except for occasionally elevated concentrations that were generally as high as 0.86 mg/L in all four monitoring wells. The average ammonia concentration among these wells increased from 0.047 to 0.393 mg/L, compared to the previous monitoring year, and nitrate concentrations were consistently below detectible values. Sulphate and chloride concentrations were relatively low. The Mann Kendall analysis detected a statistically significant decreasing trend in sulphate concentration at GW-19-1-2. Similar to previous years, groundwater quality at monitoring station 19 was not impacted by landfill leachate or aggregate runoff.

## 5.8 Monitors East of the Phase 1 Landfill

Groundwater monitoring stations 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 stations 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 5-11 displays concentrations of leachate indicator parameters observed at groundwater monitoring stations 17 and 18. In 2023/24, solute concentrations in all wells at both sites met applicable CSR standards during all sampling events.

At both locations, the groundwater exhibited relatively low conductivity, with averages of 433 and 298 µS/cm at locations 17 and 18, respectively. Chloride and sulphate concentrations were low, as well as ammonia and nitrate concentrations, except for one sampling event at GW-17-1-3, when nitrate concentration was 1.91 mg/L. No ammonia data is available for location 17, but ammonia concentrations at location 18 were below detection in all three wells during Q1 of 2024. The average nitrate concentrations at locations 17 and 18 were 0.39 and 0.24 mg/L, respectively.

The Mann Kendall analysis highlighted a statistically significant increasing trend in conductivity at GW-17-1-1, as well as a decreasing trend in chloride concentration at GW-17-1-2. At monitoring location 18, the Mann Kendall analysis detected statistically significant increasing trends in conductivity and sulphate concentration at GW-18-1-1, as well as a decreasing trend in chloride concentration. Despite these trends, groundwater quality at monitoring stations 17 and 18 did not show any evidence of landfill leachate or aggregate runoff impacts.

### 5.8.2 Monitoring Site 16

Site 16 is located northeast of Phase 1 and is not considered a Boundary Compliance Station. In 2023/24, two groundwater samples were collected at Site 16 and all groundwater parameters met applicable CSR standards, except for nitrate concentrations on two sampling events in GW-16-2-1 and GW-16-2-2.

In 2023/24, conductivity values were typically low in all four wells at location 16, except for two elevated values (690 and 490 µS/cm) observed at GW-16-2-1 and GW-16-2-2 in November 2023. During these sampling events, nitrate concentrations ranged from 10.8 to 14.2 mg/L, exceeding the CSR DW. Ammonia concentrations were typically below the detection limit, and sulphate concentrations were elevated at all four wells in November 2023, ranging from 67 to 210 mg/L. Additionally, chloride concentrations were moderate to elevated in November, ranging from 12 to 47 mg/L. Sodium concentrations were low during all sampling events, ranging from 3.98 to 7.06 mg/L.

The Mann Kendall analysis highlighted a statistically significant increasing trend in conductivity at well GW-16-1-1, as well as increasing trends in chloride at wells GW-16-1-2, GW-16-2-1, and GW-16-2-2. The analysis also detected an increasing trend in nitrate concentration at GW-16-1-2. Overall, groundwater quality at monitoring location 16 showed evidence of aggregate runoff impacts, as well as similar anomalous chloride concentrations observed in other areas east and south of the Phase 1 landfill. Groundwater quality in these areas should continue to be monitored closely to monitor how these groundwater quality impacts progress.

## 5.9 Summary

Groundwater quality analytical results from 2023/24 indicate that leachate-impacted groundwater was contained within the landfill property boundary. At the north end of the landfill, leachate impacts extend just north of the unlined Lower Leachate Lagoon and through the middle of the lined Upper Leachate Lagoon, but they did not extend off-site. Similarly, south of the landfill, leachate-impacted groundwater did not extend off-site. Leachate-related exceedances were 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 2023/24, multiple wells exhibited groundwater quality impacts caused by aggregate stockpiling at Hartland, and the impacts were observed across a larger extent. Furthermore, several groundwater wells exhibited highly elevated nitrate concentrations in the absence of sulphate concentrations exceeding 75 mg/L, suggesting that sulphide oxidation (and sulphate release) does not always occur simultaneously with ANFO leaching in the stockpiles.

Based on review of the 2023/24 groundwater quality data, AECOM has made the following interpretations:

- Boundary Compliance Wells and off-site monitoring wells met CSR AW and DW standards, except for:
  - A boron concentration that exceeded the CSR AW at GW-20-1-2 in September 2023.
  - Nitrate concentrations that exceeded the CSR DW during at least two sampling events at monitoring locations 31 and 39.
- CSR exceedances were observed in on-site monitoring wells near the North and South Purge Wells and known leachate sources as follows:
  - Similar to previous years, water quality in well GW-58-1-0 (within the landfill waste footprint) exceeded CSR AW standards for cobalt on all four sampling dates. Additionally, chloride, nickel, strontium, and vanadium concentrations exceeded CSR DW during all four sampling events. Sodium concentrations were above the CSR DW during two sampling events but well below the regional background concentration of 1,700 mg/L and were therefore compliant with CSR standards. Nitrate concentrations exceeded the CSR DW during one sampling event.
  - Groundwater quality in well GW-52-1-1 (near the North Purge Wells) exceeded CSR AW standards for ammonia and CSR DW standards for strontium during all four sampling events. Sodium concentrations exceeded the CSR DW during three sampling events but were below regional background concentrations.
  - Groundwater quality in the North (GW-52-4-0-P7 and GW-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, sodium, chromium, arsenic and barium concentrations occasionally exceeded CSR DW standards in some wells. Sodium concentrations in all wells were below regional background concentrations.

- 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 stations 40, 20 and 21. Groundwater quality in wells GW-20-1-1, GW-21-1-1, and GW-40-1-1 were generally stable in 2023/24, but nitrate and sulphate concentrations were moderate to elevated at location 40, likely reflecting aggregate runoff impacts.
- Operation of Purge well P11 began in May 2023, with a sustained discharge rate of 0.75 L/min. Groundwater quality in both P11 and P12 exhibited aggregate runoff impacts, as indicated by elevated conductivity, nitrate and sulphate concentrations. P12 has not been put into operation because it is frequently dry.
- Groundwater quality in some shallow wells located along the North Ridge (e.g., monitoring stations 77, 78, 87, 88), near the Northwest Stockpile exhibited highly elevated conductivity, nitrate, and moderate to elevated sulphate concentrations, reflecting aggregate runoff impacts. Highly elevated nitrate concentrations did not always occur with elevated sulphate concentrations.
- Along the northern edge of the Phase 2 basin, groundwater quality was impacted by runoff from the Northwest Stockpile, with some wells (GW-106-1-1 and GW-105-1-1) exhibiting highly elevated conductivity, nitrate and sulphate concentrations. Additionally, GW-105-1-1 exhibited elevated chloride concentrations, but ammonia concentrations were generally low. In 2022/23, evidence of landfill leachate impacts was present at location 106 but chloride and ammonia concentrations subsided in 2023/24.
- Groundwater quality between the Lower Leachate Lagoon and Willis Point Road continued to show no indication of leachate impacts. However, the elevated conductivity, sulphate, and nitrate levels observed at Boundary Compliance Station 31 and monitoring point 21 are likely associated with local aggregate use and stockpiling to the northeast of the landfill.
- Water quality along the southern boundary of the Phase 1 landfill continued to show no evidence of landfill leachate impacts. Since 2020, chloride concentrations have been occasionally elevated at some monitoring stations in the area (e.g., stations 4, 16, 60, and 85), but the elevated chloride concentrations have not correlated with elevated ammonia concentrations. High Cl/Na molar ratios (>1) suggest there is additional source of chloride other than road salt, but the source of chloride is currently unknown. Additionally, elevated nitrate concentrations in the absence of sulphate concentrations exceeding 75 mg/L were observed in several of these wells, and the elevated nitrate was likely sourced from the Phase 1 Stockpile, dust originating from other stockpiles, or aggregate runoff that migrated or was tracked along paved surfaces.
- Water quality along the east boundary of the Phase 1 landfill was similar to previous years and was not impacted by leachate. Ammonia concentrations at monitoring stations 16, 17 and 18 were close to or below the detection limit on all sampling events, and groundwater parameters other than nitrate concentrations met all applicable CSR standards. Elevated conductivity, nitrate and sulphate concentrations observed at location 16 reflect aggregate runoff impacts.

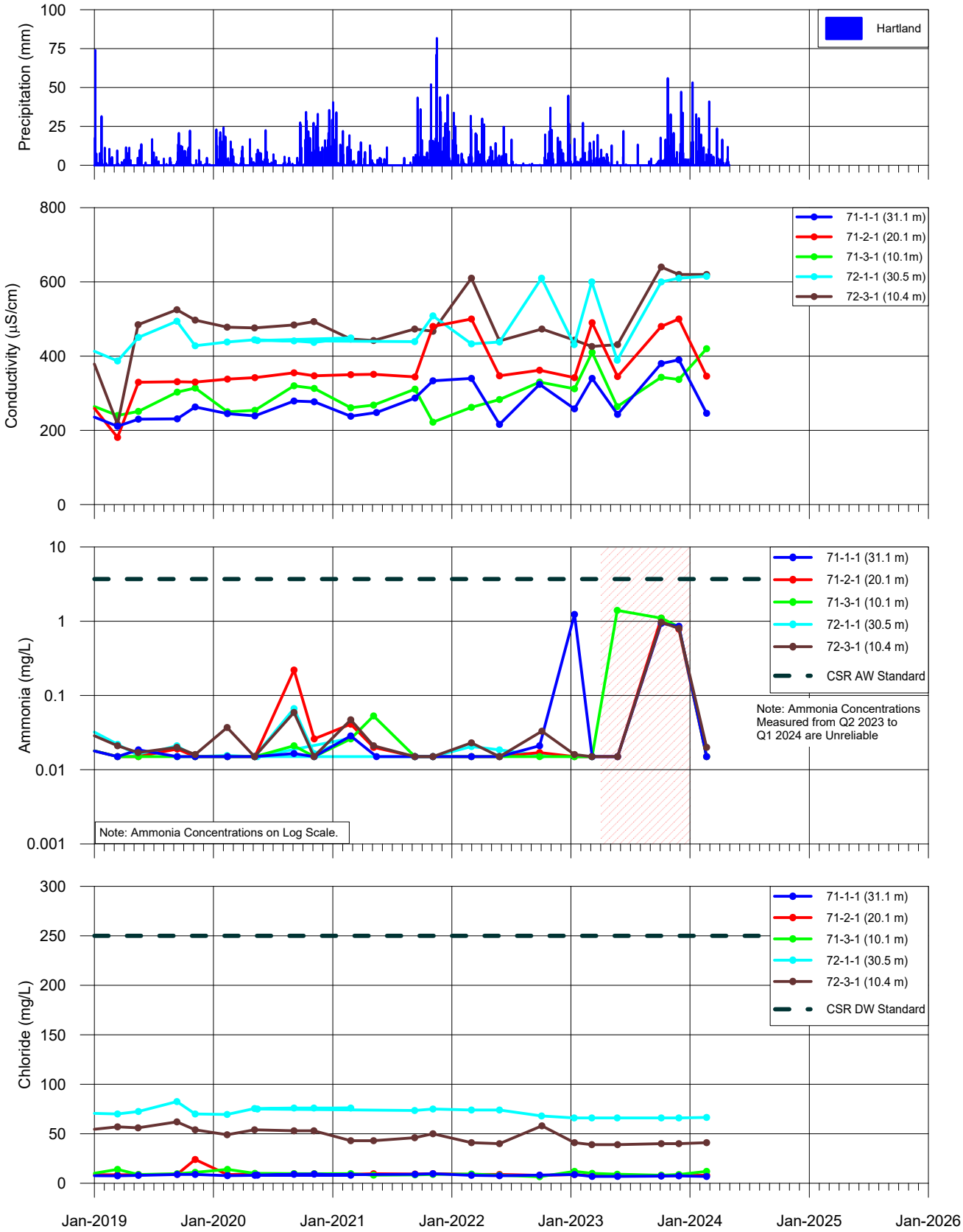



Figure 5-10. Groundwater Quality Southeast of Landfill

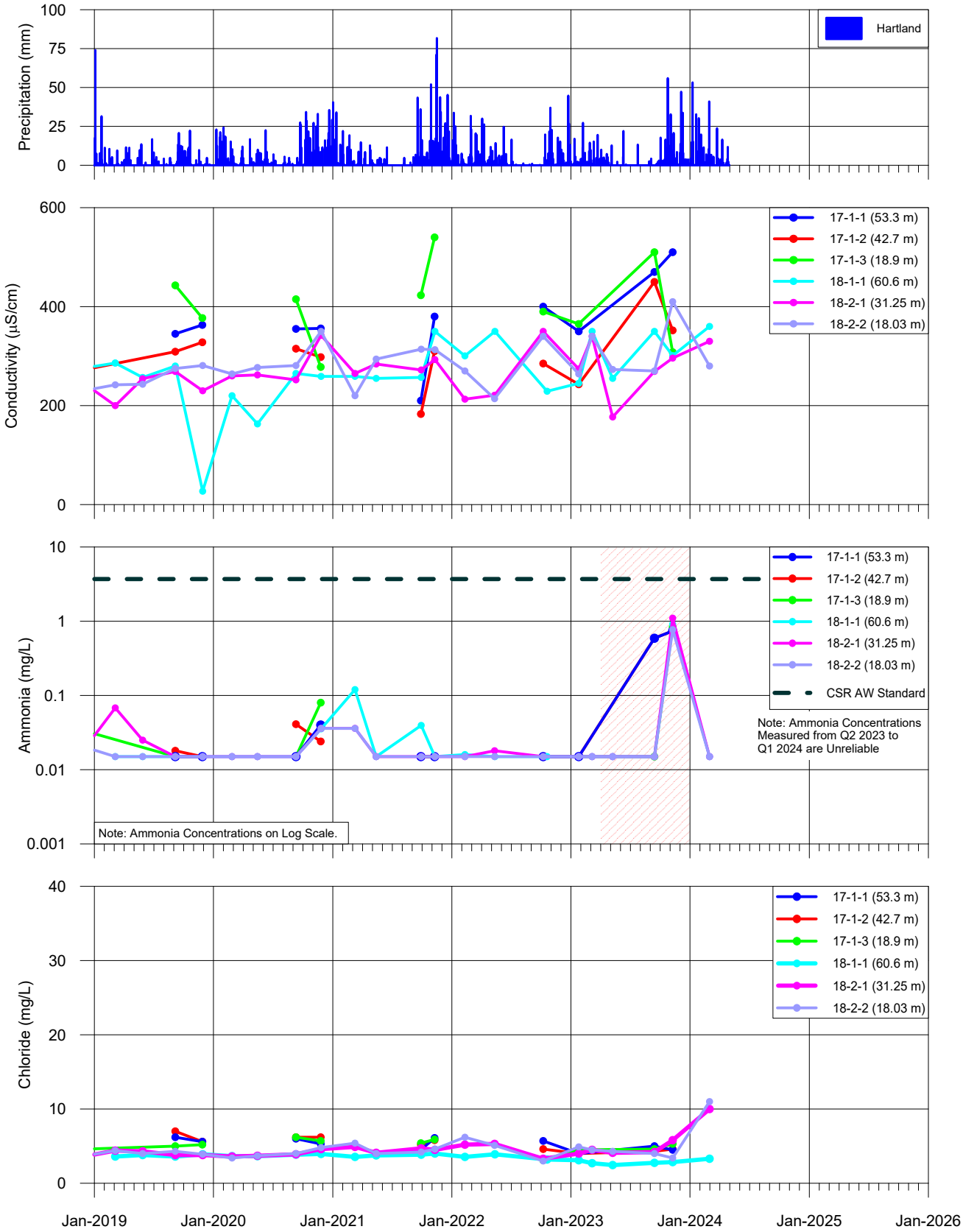



Figure 5-11. Groundwater Quality East of Landfill

# 6. Groundwater Quality in Domestic Wells

## 6.1 Monitoring Locations

This section of the report summarizes our interpretation of water quality data collected in from 20 domestic wells located within a 2 km radius of Hartland Landfill. The groundwater samples were collected in October 2023.

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 in diameter and penetrate between 30 m and 120 m into the underlying 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 2023 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* (GCDWQ). SDWQGs and GCDWQ were updated in September 2020 and March 2021, respectively, with several parameters (e.g., sulphate, antimony, lead, cobalt, chromium, copper, manganese, nickel, etc.) added to the drinking water guidelines and/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, and pH in some of the wells was less than circumneutral, the groundwater quality is considered representative of natural conditions.

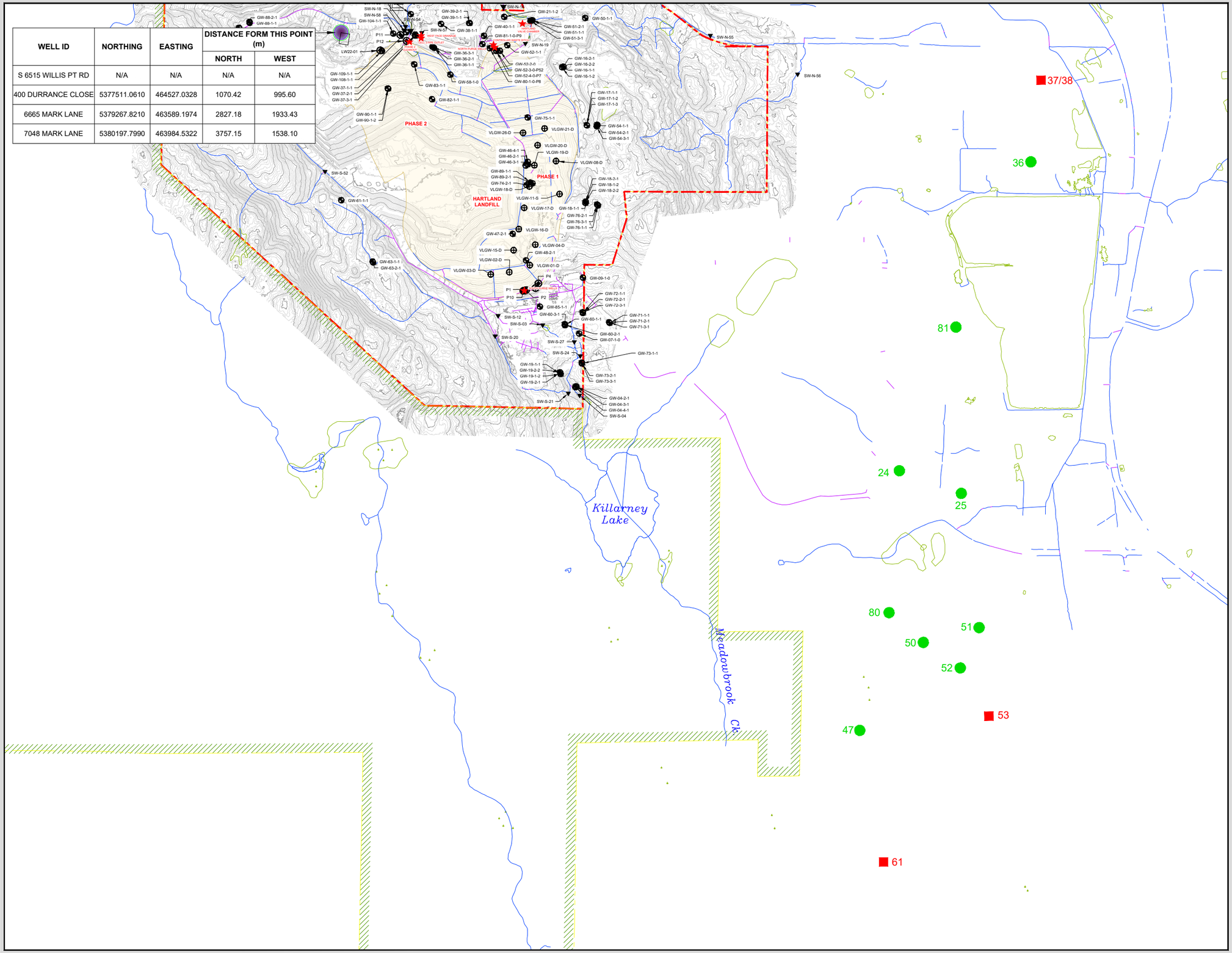
At all locations, the groundwater quality met applicable guidelines in all sampled wells, with some exceptions. Exceedances of the CDWQ guidelines were noted at select locations as described below:

- Field pH values were below the CDWQ guideline of 7.0, at monitoring stations 2, 3, 11, 14, 15, 16, and 17.
- Field temperature values were above the CDWQ aesthetic guideline of 15 °C at monitoring stations 16 and 18
- The total manganese concentrations observed at monitoring stations 1 and 17 exceeded the CDWQ aesthetic objective, and the total manganese concentration observed at monitoring station 11 exceeded the BC and CDWQGs.
- The total lead concentration observed at monitoring station 14 exceeded the BC and CDWQGs. This well was resampled in September 2023, and the lead concentration was below regulatory criteria.
- The total iron concentration observed at monitoring station 17 exceeded the CDWQ aesthetic objective

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

In summary, domestic well water quality results are consistent with historical data and show no evidence of landfill-related impacts.

| WELL ID | NORTHING | EASTING | DISTANCE FORM THIS POINT (m) | |
|---|---|---|---|---|
| | | | NORTH | WEST |
| S 6515 WILLIS PT RD | N/A | N/A | N/A | N/A |
| 400 DURRANCE CLOSE | 5377511.0610 | 464527.0328 | 1070.42 | 995.60 |
| 6665 MARK LANE | 5379267.8210 | 463589.1974 | 2827.18 | 1933.43 |
| 7048 MARK LANE | 5380197.7990 | 463984.5322 | 3757.15 | 1538.10 |




## 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 OCTOBER 2023
- 61 — DUG DOMESTIC WELL SAMPLED IN OCTOBER 2023
- Well #1 — NO DATA COLLECTED IN 2023

Map Sources / Notes:
- Contours based on 24-W542_2023_base.dwg April 2024.
- 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: MM Prepared by: SP
Date Issued: June 2024 Project Number: 60631284

Making a difference...together

Project: Hartland Landfill Monitoring
Location: Saanich, BC

# Domestic Well Locations

AECOM

**Figure 6-1**

File Location: L:\LEGACY\CABNY1FP001\PROD\PROJECTS\60631284\900-CAD_GIS\910-CAD\20-SHEETS\C\435 - 2023-24 ANNUAL REPORT\FIG6.1-DOMESTIC WELLS-60631284-2023.DWG
Date Plotted: September 23, 2024 Saved
By:AmiriN

# 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

In 2023/24, surface water samples were collected from 34 monitoring locations, including nine (9) locations that were established in 2022/23. Surface water quality analytical results are presented in Appendix B.3. These stations aim to monitor impacts on surface water quality due to various landfill activities, such as road construction, blasting, and aggregate stockpiling, as well as their impact on the downstream environment.

Surface water monitoring locations 55 and 56 are located downstream of the Northeast Stockpile and were reactivated in 2023/24. AECOM recommends considering these sampling locations as compliance monitoring points in 2024/25.

### 7.1.1 Regulatory Comments

As discussed in Section 2.5.2, the results were compared to the BCWQG for the protection of freshwater aquatic wildlife (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 LTC concentration of ammonia for the protection of freshwater AW and the short term acute (STA) based on the pH and temperature of each sample (as discussed in the footnotes of Table 7-1), with exceedances highlighted based on BCWQG-STAs.
- The BCWQG-STA 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-STA and LTC values for total suspended solids (TSS) reference a “change from the background value” and the flow conditions (i.e., clear/turbid waters). Due to influences from aggregate stockpiling and ongoing construction, the water quality at stations Sw-N-CSs2 and Sw-N-14 cannot be considered representative of background conditions north of the landfill. Sw-S-52 is the only background station at the landfill and was used to assess TSS criteria. In 2023/24, background TSS values observed at Sw-S-52 were less than 1.0 mg/L.
- BCWQGs for cadmium, lead, nickel, manganese, sulphate, and silver 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). The calculated BLM results were obtained from CRD.
- The total aluminum table was updated in the approved BCWQG version dated August 2023. The total aluminum guideline is dependent on pH, hardness, and DOC and is calculated using the BC Water Quality Guideline calculator for Aluminum in Freshwater Ecosystems.
- The total arsenic WQGs for freshwater and marine aquatic life were corrected in the approved BCWQG version from August 2023.
- The dissolved zinc table was updated in the approved BCWQG version from August 2023. The dissolved guideline is dependent on pH, hardness, and DOC.

# Hartland Landfill Groundwater, Surface Water and Leachate Monitoring Program Annual Report (Apr 2023 to Mar 2024)

## Table 7-1. Surface Water Quality Exceedances 2023-2024

| B.C. Water Quality Guidelines | | | | BC WQG-STA (1) | --- | --- | --- | --- | 600 | 110 | --- | --- |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | BC WQG-LTC (1) | Variable (9) | 5 | 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 |
| | | | | Limit of Quantification (LOQ) | 2.5 | 0.1 | 50 | 0.025 | 5 | 0.05 | 0.5 | 2.5 |
| SW-N-05 | FRM | Y | 2023-02-05 | Mean of duplicates, very low flow, clear & colourless sample | 32.7 | 0.139 | 175. | 0.015 75 | 22. | 0.120 5 | 4.51 | 209. |
| SW-N-05 | FRM | Y | 2023-11-02 | Mean of duplicates, moderate flow, clear and colourless. | 841 b | 0.203 | 83 | 0.0161 | 28 | 1.04 | 10.1 | 223 |
| SW-N-05 | FRM | Y | 2023-12-19 | Mean of duplicates, low flow, clear and colourless | 112 | 0.210 | 163 | 0.0307 | 10 | 0.18 | 6.01 | 338 |
| SW-N-05 | FRM | Y | 2024-05-03 | Mean of duplicates, low-moderate flow. Clear and colourless sample. Used pump. | 116.50 | 0.19 | 133.00 | 0.02 | 11.00 | 0.19 | 4.11 | 289.00 |
| SW-N-14 | SS | N | 2023-06-26 | Extra sample date for Heals range access. Low flow, clear and colourless sample. | 443. b | 0.347 | 71. | 0.032 6 | 14. | 0.415 | 2.37 | 107. |
| SW-N-14 | SS | N | 2023-11-02 | Moderately high flow, clear and colourless. | 94.8 | 0.157 | 79. | 0.016 | 19. | 0.202 | 3.49 | 168 |
| SW-N-14 | SS | N | 2023-12-19 | Moderate High flow, clear and colourless | 38.1 | 0.094 | 85. | 0.005 7 | 17. | 0.092 8 | 1.25 | 194 |
| SW-N-14 | SS | N | 2024-02-27 | High flow. Clear and colourless sample. | 18.5 | 0.069 | 62. | < 0.005 | 19. | 0.075 | 1.06 | 144.00 |
| SW-N-15 | SS | N | 2023-08-17 | Extra sample for Heals range access. Very low flow, clear and colourless sample. | 46.1 | 0.127 | 35. | < 0.005 | 6.7 | 0.032 9 | 0.34 | 84.20 |
| SW-N-16 | FRM | Y | 2023-02-05 | Mean of duplicates, moderate flow, clear & colourless sample | 397.5 b | 0.211 | 71. | 0.019 95 | 29. | 0.690 5 | 6.175 | 179.5 |
| SW-N-16 | FRM | Y | 2023-11-02 | Mean of duplicates, high flow, clear and colourless. | 265.5 | 0.194 5 | 54. | 0.017 9 | 12.5 | 0.558 5 | 9.385 | 150 |
| SW-N-16 | FRM | Y | 2023-12-19 | Mean of duplicates, high flow, clear and colourless | 66.7 | 0.197 5 | 65. | 0.083 | 10. | 0.304 5 | 7.71 | 195 |
| SW-N-16 | FRM | Y | 2024-05-03 | Mean of duplicates, high flow, clear and colourless sample. | 53.2 | 0.2 | 59. | 0.017 | 10.45 | 0.328 5 | 12.25 | 134.00 |
| SW-N-17 | SS | N | 2023-06-26 | Extra sample for Heals range access. Very low flow, slightly turbid sample | 876. b | 0.41 | 118. | 0.018 | 41. | 1.39 | 2.39 | 216. |
| SW-N-17 | SS | N | 2023-11-02 | Moderate flow, clear and colourless. | 28.7 | 0.102 | 107. | 0.006 8 | 34. | 0.079 | 0.93 | 161 |
| SW-N-17 | SS | N | 2023-12-19 | Moderate flow, clear and colourless | 20.7 | 0.09 | 145. | < 0.005 | 21. | 0.098 3 | 0.879 | 241 |
| SW-N-17 | SS | N | 2024-02-27 | High flow. Very turbid, very slightly brown. | 414. b | 0.12 | 112. | 0.011 | 26. | 0.414 | 2.15 | 170.00 |
| SW-N-19 | SS | N | 2023-05-02 | Low flow, clear and colourless. | 24.1 | 0.193 | 47. | 0.023 | 29. | 0.401 | 13.3 | 183. |
| SW-N-19 | SS | N | 2023-11-07 | Moderate flow, Clear and very slightly yellow. Sample collection delayed due to logging in the ar | 38.6 | 0.248 | 42. | 0.012 3 | 7.6 | 0.331 | 10.2 | 153 |
| SW-N-19 | SS | N | 2023-12-19 | High flow, clear and colourless. | 23.2 | 0.203 | 37. | 0.012 9 | 8.2 | 0.377 | 12.1 | 183 |
| SW-N-19 | SS | N | 2024-03-05 | High flow, clear and colourless, slightly sudsy sample. | 90. | 0.202 | 53. | 0.024 | 9.3 | 0.407 | 17.5 | 138.00 |
| SW-N-41S1 | FRM | Y | 2023-12-18 | Mean of duplicates, low flow, clear colourless | 264.5 b | 0.415 | 24. | 0.009 4 | 4.25 | 0.286 | 0.85 | 177 |
| SW-N-41S1 | FRM | Y | 2024-05-03 | Mean of duplicates, moderate-low flow. Clear and colourless | 496. b | 0.632 | 17. | 0.019 5 | 9.1 | 0.658 | 1.62 | 156.00 |
| SW-N-42S1 | FRM | Y | 2023-05-02 | Mean of duplicates, low flow, clear and colourless. | 64.85 | 0.097 | 50. | < 0.005 15 | 34. | 0.138 5 | 0.52 | 205. |
| SW-N-42S1 | FRM | Y | 2024-05-03 | Mean of duplicates, high flow, clear and colourless | 23.95 | 0.07 | 55. | < 0.005 | 33.5 | 0.053 | 0.705 | 155.00 |
| SW-N-41S3 | SS | N | 2023-11-01 | Low flow, clear and colourless. | 1 350. b | 0.342 | 47. | 0.033 | 15. | 1.05 | 3. | 145 |
| SW-N-42S1 | FRM | Y | 2023-05-02 | Mean of duplicates, low flow, clear and colourless. | 64.85 | 0.097 | 50. | < 0.005 15 | 34. | 0.138 5 | 0.52 | 205. |
| SW-N-42S1 | FRM | Y | 2024-05-03 | Mean of duplicates, high flow, clear and colourless | 23.95 | 0.07 | 55. | < 0.005 | 33.5 | 0.053 | 0.705 | 155.00 |
| SW-N-45 | SS | N | 2023-11-02 | Moderately low flow, clear and colourless. | 33.1 | 0.089 | 196. | 0.008 7 | 38. | 0.125 | 1.54 | 191 |
| SW-N-45 | SS | N | 2023-12-19 | Low moderate flow, clear colourless | 14.4 | 0.098 | 192. | 0.008 4 | 19. | 0.137 | 1.61 | 252 |
| SW-N-45 | SS | N | 2024-02-27 | Low flow. Clear and colourless sample. | 21.7 | 0.06 | 180. | 0.005 | 22. | 0.109 | 1.16 | 200.00 |
| SW-N-54 | SS | N | 2023-05-02 | Very low flow, clear, very slightly yellow | 20.1 | 0.415 | 61. | 0.010 3 | 40. | 0.676 | 12.6 | 245. |
| SW-N-54 | SS | N | 2023-11-03 | Moderate flow, clear and slightly yellow sample. | 923. b | 0.391 | 48. | 0.009 3 | 25. | 1.33 | 16. | 263 |
| SW-N-54 | SS | N | 2023-12-20 | Low flow, clear colourless | 124. | 0.408 | 82. | 0.012 9 | 11. | 0.475 | 27.7 | 238 |
| SW-N-54 | SS | N | 2024-03-06 | Moderate flow. Clear, very slightly yellow. | 207. | 0.332 | 55. | 0.007 | 6.3 | 0.399 | 28. | 177.00 |
| SW-N-55 | SS | N | 2023-12-12 | Moderate flow, clear colourless. New station added | 36.2 | 0.087 | 11. | 0.067 8 | 13. | 0.126 | 0.63 | 273. |
| SW-N-55 | SS | N | 2024-03-06 | Moderate flow, clear and colourless sample. | 18.8 | 0.065 | < 10. | 0.107 | 15. | 0.141 | 0.64 | 323.00 |
| SW-N-56 | SS | N | 2023-12-12 | Moderate flow, clear colourless. New station added | 20.4 | 0.079 | 20. | < 0.005 | 12. | 0.045 6 | 0.657 | 78.1 |
| SW-N-56 | SS | N | 2024-03-06 | Moderate-high flow. Clear and colourless sample. | 22.7 | 0.075 | 17. | < 0.005 | 12. | 0.04 | 0.46 | 93.60 |
| SW-N-57 | SS | N | 2023-11-03 | Moderate flow, clear and colourless. | 230. b | 0.177 | 47. | 0.007 9 | 3.2 | 0.622 | 1.29 | 297 |
| SW-N-57 | SS | N | 2024-03-06 | High flow. Clear and colourless sample. | 57.8 | 0.159 | 27. | < 0.005 | 5.6 | 0.275 | 0.76 | 262.00 |
| SW-N-63 | SS | N | 2023-05-02 | Moderate high flow, clear and colourless | 35.2 | 0.206 | 42. | < 0.005 | 10. | 0.211 | 1.61 | 90.7 |
| SW-N-63 | SS | N | 2023-11-02 | Moderately low flow, clear and colourless. | 326. | 0.286 | 52. | 0.012 1 | 14. | 0.32 | 5.18 | 97.3 |
| SW-N-63 | SS | N | 2024-03-05 | High flow. Clear and colourless sample. | 129. | 0.153 | 30. | < 0.005 | 8.8 | 0.16 | 1.74 | 77.00 |
| SW-N-64 | SS | N | 2023-05-02 | Moderate flow, clear slightly yellow | 85. | 0.742 | 43. | 0.012 7 | 17. | 0.809 | 3.34 | 77.1 |
| SW-N-64 | SS | N | 2023-11-02 | Extra low flow, clear and very slightly yellow sample. | 338. b | 0.63 | 51. | 0.021 7 | 27. | 2.87 | 4.28 | 107 |
| SW-N-64 | SS | N | 2023-12-18 | Moderate flow, clear and colourless | 90.3 | 0.4 | 28. | 0.011 2 | 12. | 0.193 | 2.2 | 55 |
| SW-N-64 | SS | N | 2024-03-05 | High flow. Clear and colourless sample. | 96.2 | 0.271 | 21. | 0.006 | 12. | 0.185 | 1.57 | 44.90 |
| SW-N-65 | SS | N | 2023-05-02 | Moderate flow, clear slightly yellow | 80.6 | 0.543 | 38. | 0.009 2 | 16. | 0.606 | 2.76 | 74.1 |
| SW-N-65 | SS | N | 2023-11-02 | Moderately low flow, clear and slightly yellow sample. | 347. b | 0.508 | 51. | 0.018 4 | 21. | 1.87 | 5.08 | 105 |
| SW-N-65 | SS | N | 2023-12-18 | Moderate flow, clear and colourless | 78.4 | 0.324 | 31. | 0.009 1 | 11. | 0.164 | 2.06 | 67 |
| SW-N-CS2 | SS | N | 2023-12-18 | Moderate flow, clear colourless | 10.3 | 0.032 | < 10. | < 0.005 | 4.2 | 0.022 7 | 0.301 | 72 |
| SW-N-CS2 | SS | N | 2024-03-05 | High flow. Clear and colourless. Additional sample collected to coincide with new SW-N-66 static | 6.5 | 0.028 | < 10. | < 0.005 | 3.6 | 0.019 | 0.23 | 66.30 |

# Hartland Landfill Groundwater, Surface Water and Leachate Monitoring Program Annual Report (Apr 2023 to Mar 2024)
## Table 7-1. Surface Water Quality Exceedances 2023-2024

| B.C. Water Quality Guidelines | | | | BC WQG-STA (1) | --- | --- | --- | --- | 600 | 110 | --- | --- |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | BC WQG-LTC (1) | Variable (9) | 5 | 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 |
| | | | | Limit of Quantification (LOQ) | 2.5 | 0.1 | 50 | 0.025 | 5 | 0.05 | 0.5 | 2.5 |
| SW-S-03 | FRM | N | 2023-05-03 | Mean of duplicates, moderate low flow, clear & colourless | 257. b | 0.324 5 | 66.5 --- | 0.015 5 --- --- | 24. | 0.641 5 | 7.285 --- --- | 93.2 --- --- |
| SW-S-03 | SS | N | 2023-11-01 | Moderate flow, clear and colourless. | 94.3 | 0.618 | 60. --- | 0.008 --- --- | 34. | 0.21 | 3.64 --- --- | 141 --- --- |
| SW-S-03 | SS | N | 2023-12-15 | Moderate high flow, clear colourless | 48.4 | 0.162 | 56. --- | 0.012 9 --- --- | 13. | 0.484 | 4.95 --- --- | 95 --- --- |
| SW-S-03 | SS | N | 2024-03-07 | Moderate flow. Clear and colourless sample. Sampled from mini waterfall. | 48.3 | 0.108 | 37. --- | < 0.005 --- --- | 20. | 0.274 | 3.83 --- --- | 63.60 --- --- |
| SW-S-04 | FRM | Y | 2023-05-02 | Mean of duplicates, moderately low flow, clear & colourless | 28.4 | 0.075 | 66.5 --- | 0.012 2 --- --- | 38.5 | 0.091 5 | 1.235 --- --- | 103. --- --- |
| SW-S-04 | FRM | Y | 2023-11-01 | Mean of duplicates, moderate flow, clear and colourless. | 74.15 | 0.089 | 67.5 --- | 0.018 --- --- | 49.5 | 0.125 5 | 1.465 --- --- | 135 --- --- |
| SW-S-04 | FRM | Y | 2023-05-12 | Mean of duplicates, high flow, clear and colourless | 67.25 | 0.103 | 57.5 --- | 0.009 45 --- --- | 16. | 0.106 5 | 2.065 --- --- | 89 --- --- |
| SW-S-04 | FRM | Y | 2024-03-07 | Mean of duplicates, high flow, clear and colourless | 51.1 | 0.075 5 | 43.5 --- | < 0.005 --- --- | 24. | 0.083 5 | 1.55 --- --- | 70.75 --- --- |
| SW-S-12 | SS | N | 2023-05-02 | Moderate low flow, clear & colourless sample | 30.3 | 0.291 | 103. --- | 0.008 7 --- --- | 19. | 0.766 | 5.44 --- --- | 114. --- --- |
| SW-S-12 | FRM | N | 2023-11-02 | Mean of duplicates, high flow, clear and colourless. | 111. | 0.239 | 20. --- | 0.022 --- --- | 4.8 | 0.234 5 | 13.45 --- --- | 83.6 --- --- |
| SW-S-12 | FRM | N | 2023-12-15 | Mean of duplicates, high flow, clear colourless | 59.55 | 0.229 | 70. --- | 0.018 --- --- | 11. | 0.807 | 5.89 --- --- | 106.5 --- --- |
| SW-S-12 | FRM | N | 2024-03-07 | Mean of duplicates, moderate-high flow. Clear and colourless sample. Dunked bottles in wier | 66.85 | 0.159 | 55.5 --- | < 0.005 --- --- | 13. | 0.51 | 4.96 --- --- | 69.80 --- --- |
| SW-S-20 | SS | N | 2023-11-02 | Moderately low flow, clear and colourless. | 256. | 0.174 | 20. --- | 0.006 9 --- --- | 6.9 | 0.29 | 3.64 --- --- | 41.5 --- --- |
| SW-S-20 | SS | N | 2023-12-15 | High flow, clear colourless | 50.7 | 0.099 | 14. --- | < 0.005 --- --- | 5.9 | 0.084 1 | 1.33 --- --- | 49.7 --- --- |
| SW-S-21 | SS | N | 2023-12-15 | High flow, clear colourless | 39.4 | 0.084 | 12. --- | < 0.005 --- --- | 5.9 | 0.036 6 | 1.17 --- --- | 42.8 --- --- |
| SW-S-21 | SS | N | 2024-03-07 | Moderate-high flow. Clear and colourless sample. | 26.9 | 0.054 | < 10. --- | < 0.005 --- --- | 6.4 | 0.026 | 0.62 --- --- | 32.30 --- --- |
| SW-S-24 | SS | N | 2023-05-02 | Moderate low flow, clear & colourless sample | 36.5 | 0.128 | 99. --- | 0.011 8 --- --- | 38. | 0.132 | 2.03 --- --- | 125. --- --- |
| SW-S-24 | SS | N | 2023-11-01 | Moderate flow, clear and colourless. | 10. | 0.105 | 80. --- | 0.011 6 --- --- | 56. | 0.076 | 1.85 --- --- | 147 --- --- |
| SW-S-24 | SS | N | 2023-12-15 | High flow, clear colourless | 100. | 0.157 | 83. --- | 0.013 4 --- --- | 19. | 0.198 | 3.11 --- --- | 110 --- --- |
| SW-S-24 | SS | N | 2024-03-07 | Moderate-high flow. Clear and colourless sample. Dipped in weir | 74.5 | 0.089 | 56. --- | < 0.005 --- --- | 29. | 0.142 | 2.38 --- --- | 82.10 --- --- |
| SW-S-27 | SS | N | 2023-11-01 | Low flow, clear and colourless. | 70.5 | 0.142 | 45. --- | 0.009 1 --- --- | 43. | 0.173 | 2.53 --- --- | 118 --- --- |
| SW-S-27 | SS | N | 2023-12-15 | High flow, clear colourless | 140. | 0.181 | 55. --- | 0.014 3 --- --- | 15. | 0.286 | 4.64 --- --- | 95 --- --- |
| SW-S-27 | SS | N | 2024-03-07 | Moderate flow. Clear and colourless sample. Used pump to collect pumped sample. | 106. | 0.115 | 42. --- | < 0.005 --- --- | 27. | 0.198 | 3.84 --- --- | 72.40 --- --- |
| SW-S-52 | SS | N | 2023-12-18 | High flow, clear colourless | 9.52 | 0.046 | 17. --- | < 0.005 --- --- | 4.9 | 0.021 8 | 0.355 --- --- | 56.6 --- --- |

***Notes:***

| | |
|---|---|
| *na* | *Not applicable.* |
| *Null* | *No sample collected.* |
| **a** | *Above short-term acute (STA) British Columbia* |
| **b** | *Above long-term chronic (LTC) British Columbia Water Quality Guideline.* |
| | *Unreliable Ammonia Concentrations* |
| *BC CSR* | *CSR-Sch3.2: BC Contaminated Site Regulation - Schedule 3.2 - Generic Numerical Water Standards, effective on November 1, 2017.* |
| *(1)* | *British Columbia Approved Water Quality Guidelines (Criteria), 1998 Edition, Updated in August 2023. 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)* | *above STA 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 landfill are derived from stations Sw-S-52 .* |
| *(8)* | *Dissolved copper guideline varies with water hardness, temperature and DOC, and calcuated using BLM;* |
| *(9)* | *Total Aluminum guidance is pH, hardness, and DOC dependent and calculated based on BC Water Quality Guideline calculator for Aluminum in Freshwater. Due to anomalously high DOC concentrations resulting from the use of compromised laboratory-supplied preservatives, the aluminum guideline is based on the 2021/22 average DOC concentration of 4.5 mg/L across the landfill. Ecosystems.* |
| *(10)* | *Dissolved Zinc guidance is pH, hardness, and DOC dependent. Due to anomalously high DOC concentrations resulting from the use of compromised laboratory-supplied preservatives, the aluminum guideline is based on the 2021/22 average DOC concentration of 4.5 mg/L across the landfill.* |
| *(11)* | *Aquatic Life (AW) Freshwater, Column 3.* |
| *(12)* | *Drinking Water (DW), Column 6.* |

# Hartland Landfill Groundwater, Surface Water and Leachate Monitoring Program Annual Report (Apr 2023 to Mar 2024)

## Table 7-1. Surface Water Quality Exceedances 2023-2024

AECOM

| B.C. Water Quality Guidelines | | | | BC WQG-STA (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-LTC (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 |
| | | | | Limit of Quantification (LOQ) | 5 | 0.025 | 0.5 | 0.25 | 0.075 | 0.025 | 0.1 | 0.1 |
| SW-N-05 | FRM | Y | 2023-02-05 | Mean of duplicates, very low flow, clear & colourless sample | 28.65 --- | 0.02 | 8.735 | 2.98 | 0.015 | 0.005 | 10.35 b | 1.32 |
| SW-N-05 | FRM | Y | 2023-11-02 | Mean of duplicates, moderate flow, clear and colourless. | 1490 a b | 0.146 | 24.7 | 1.90 | < 0.233 | < 0.005 | 9.10 b | 2.24 |
| SW-N-05 | FRM | Y | 2023-12-19 | Mean of duplicates, low flow, clear and colourless | 92 | 0.012 | 4.4 | 3.33 | 0.755 | < 0.005 | 34.95 a b | 1.74 |
| SW-N-05 | FRM | Y | 2024-05-03 | Mean of duplicates, low-moderate flow. Clear and colourless sample. Used pump. | 129.00 --- | 0.03 | 4.35 | 3.01 | < 0.02 | < 0.01 | 14.30 b | 1.25 |
| SW-N-14 | SS | N | 2023-06-26 | Extra sample date for Heals range access. Low flow, clear and colourless sample. | 1 010. a b | 0.020 8 | 111. | 0.483 | 0.037 | < 0.005 | 0.143 | 0.99 |
| SW-N-14 | SS | N | 2023-11-02 | Moderately high flow, clear and colourless. | 168. --- | 0.055 | 8.65 | 0.463 | 0.79 | 0.052 2 | 7.23 b | 0.86 |
| SW-N-14 | SS | N | 2023-12-19 | Moderate High flow, clear and colourless | 74.8 --- | 0.028 4 | 5.42 | 0.439 | < 0.015 | < 0.005 | 7.61 b | 0.326 |
| SW-N-14 | SS | N | 2024-02-27 | High flow. Clear and colourless sample. | 24.6 --- | < 0.02 | 2.15 | 0.361 | < 0.015 | < 0.005 | 5.25 b | 0.35 |
| SW-N-15 | SS | N | 2023-08-17 | Extra sample for Heals range access. Very low flow, clear and colourless sample. | 39.8 | 0.005 6 | 4. | 0.339 | < 0.015 | < 0.005 | 0.197 | 0.077 |
| SW-N-16 | FRM | Y | 2023-02-05 | Mean of duplicates, moderate flow, clear & colourless sample | 902. --- | 0.044 5 | 117.5 | 0.877 5 | 0.038 5 | 0.013 4 | 1.165 | 2.17 |
| SW-N-16 | FRM | Y | 2023-11-02 | Mean of duplicates, high flow, clear and colourless. | 505.5 --- | 0.082 | 36.45 | 0.797 | 0.865 | 0.035 35 | 8.01 b | 1.96 |
| SW-N-16 | FRM | Y | 2023-12-19 | Mean of duplicates, high flow, clear and colourless | 165.5 | 0.022 05 | 80.35 | 0.701 | 0.081 | 0.189 5 | 13.75 b | 1.88 |
| SW-N-16 | FRM | Y | 2024-05-03 | Mean of duplicates, high flow, clear and colourless sample. | 117.5 --- | 0.04 | 30.6 | 0.705 5 | 0.027 | 0.009 4 | 8.16 b | 2.615 |
| SW-N-17 | SS | N | 2023-06-26 | Extra sample for Heals range access. Very low flow, slightly turbid sample | 1 340. a b | 0.009 9 | 310. | 0.64 | 0.095 | 0.010 9 | 0.191 | 1.56 |
| SW-N-17 | SS | N | 2023-11-02 | Moderate flow, clear and colourless. | 23.4 --- | < 0.02 | 3.59 | 0.427 | 0.88 | < 0.005 | 3.85 b | 0.34 |
| SW-N-17 | SS | N | 2023-12-19 | Moderate flow, clear and colourless | 24.5 --- | 0.015 6 | 4.04 | 0.551 | 0.85 | < 0.005 | 3.73 b | 0.244 |
| SW-N-17 | SS | N | 2024-02-27 | High flow. Very turbid, very slightly brown. | 464. --- | 0.326 | 24.9 | 0.419 | 0.017 | < 0.005 | 3.18 b | 0.7 |
| SW-N-19 | SS | N | 2023-05-02 | Low flow, clear and colourless. | 48.4 --- | < 0.02 | 34.9 | 1.08 | 0.016 | 0.014 4 | 3.79 b | 2.58 |
| SW-N-19 | SS | N | 2023-11-07 | Moderate flow, Clear and very slightly yellow. Sample collection delayed due to logging in the ar | 53.9 --- | 0.028 | 13.6 | 1.12 | 0.75 | 0.052 4 | 6.62 b | 2.38 |
| SW-N-19 | SS | N | 2023-12-19 | High flow, clear and colourless. | 38.1 | 0.008 7 | 16. | 0.678 | 0.032 | 0.037 5 | 6.44 b | 2.47 |
| SW-N-19 | SS | N | 2024-03-05 | High flow, clear and colourless, slightly sudsy sample. | 117. --- | 0.046 | 5.34 | 0.764 | < 0.015 | < 0.005 | 8.23 b | 3.54 |
| SW-N-41S1 | FRM | Y | 2023-12-18 | Mean of duplicates, low flow, clear colourless | 511.5 --- | 0.193 5 | 206. | 0.307 5 | < 0.015 | < 0.005 | 1.008 | 0.39 |
| SW-N-41S1 | FRM | Y | 2024-05-03 | Mean of duplicates, moderate-low flow. Clear and colourless | 1 021.5 a b | 0.392 | 381.5 | 0.240 5 | < 0.015 | < 0.005 | 0.835 5 | 0.655 |
| SW-N-42S1 | FRM | Y | 2023-05-02 | Mean of duplicates, low flow, clear and colourless. | 117.5 --- | 0.085 | 63.45 | 0.685 5 | < 0.016 5 | < 0.005 | 0.055 5 | 0.345 |
| SW-N-42S1 | FRM | Y | 2024-05-03 | Mean of duplicates, high flow, clear and colourless | 35.75 --- | 0.027 | 11.3 | 0.431 | < 0.015 | < 0.005 | 0.346 5 | 0.13 |
| SW-N-41S3 | SS | N | 2023-11-01 | Low flow, clear and colourless. | 1 320. a b | 0.705 | 54.2 | 0.319 | 0.92 | < 0.005 | 0.288 | 1.39 |
| SW-N-42S1 | FRM | Y | 2023-05-02 | Mean of duplicates, low flow, clear and colourless. | 117.5 --- | 0.085 | 63.45 | 0.685 5 | < 0.016 5 | < 0.005 | 0.055 5 | 0.345 |
| SW-N-42S1 | FRM | Y | 2024-05-03 | Mean of duplicates, high flow, clear and colourless | 35.75 --- | 0.027 | 11.3 | 0.431 | < 0.015 | < 0.005 | 0.346 5 | 0.13 |
| SW-N-45 | SS | N | 2023-11-02 | Moderately low flow, clear and colourless. | 22.6 --- | < 0.02 | 6.78 | 0.778 | 0.8 | 0.007 | 6.64 b | 0.43 |
| SW-N-45 | SS | N | 2023-12-19 | Low moderate flow, clear colourless | 18.6 --- | 0.006 4 | 6.62 | 1.02 | < 0.015 | 0.006 1 | 18.5 b | 0.37 |
| SW-N-45 | SS | N | 2024-02-27 | Low flow. Clear and colourless sample. | 24.4 --- | < 0.02 | 7.75 | 0.798 | < 0.015 | < 0.005 | 7.21 b | 0.26 |
| SW-N-54 | SS | N | 2023-05-02 | Very low flow, clear, very slightly yellow | 99.3 --- | 0.022 | 304. | 0.685 | 0.061 | 0.021 | 3.94 b | 2.88 |
| SW-N-54 | SS | N | 2023-11-03 | Moderate flow, clear and slightly yellow sample. | 1 700. a b | 0.249 | 109. | 0.783 | 0.62 | 0.126 | 12.4 b | 3.28 |
| SW-N-54 | SS | N | 2023-12-20 | Low flow, clear colourless | 180. --- | 0.045 9 | 58.5 | 0.768 | 1.3 | 0.114 | 17.2 b | 3.07 |
| SW-N-54 | SS | N | 2024-03-06 | Moderate flow. Clear, very slightly yellow. | 303. | 0.068 | 10.7 | 0.488 | 0.018 | 0.009 7 | 13. b | 2.56 |
| SW-N-55 | SS | N | 2023-12-12 | Moderate flow, clear colourless. New station added | 16.5 | 0.022 | 5.74 | 0.101 | 0.89 | 0.035 3 | 44.5 a b | 0.155 |
| SW-N-55 | SS | N | 2024-03-06 | Moderate flow, clear and colourless sample. | < 5. | < 0.02 | 5.39 | 0.121 | < 0.015 | 0.011 3 | 39.6 a b | 0.19 |
| SW-N-56 | SS | N | 2023-12-12 | Moderate flow, clear colourless. New station added | 8.1 | 0.005 | 0.452 | 0.124 | 0.94 | 0.005 | 3.16 b | 0.18 |
| SW-N-56 | SS | N | 2024-03-06 | Moderate-high flow. Clear and colourless sample. | 11.2 | < 0.02 | 0.3 | 0.098 | < 0.015 | < 0.005 | 3.4 b | 0.18 |
| SW-N-57 | SS | N | 2023-11-03 | Moderate flow, clear and colourless. | 458. | 0.046 | 17.2 | 4.96 | 0.8 | 0.15 a b | 11.8 b | 1.38 |
| SW-N-57 | SS | N | 2024-03-06 | High flow. Clear and colourless sample. | 103. | < 0.02 | 5.75 | 1.9 | 0.068 | 0.011 2 | 4.73 b | 0.98 |
| SW-N-63 | SS | N | 2023-05-02 | Moderate high flow, clear and colourless | 350. --- | 0.074 | 37.3 | 0.369 | < 0.015 | < 0.005 | 0.474 | 0.9 |
| SW-N-63 | SS | N | 2023-11-02 | Moderately low flow, clear and colourless. | 437. | 0.649 | 35.4 | 0.447 | < 0.015 | 0.009 8 | 3.55 b | 1.26 |
| SW-N-63 | SS | N | 2024-03-05 | High flow. Clear and colourless sample. | 258. --- | 0.326 | 18.8 | 0.273 | 0.016 | < 0.005 | 1.08 | 0.46 |
| SW-N-64 | SS | N | 2023-05-02 | Moderate flow, clear slightly yellow | 1 090. a b | 0.14 | 304. | 0.369 | 0.046 | 0.005 3 | 0.113 | 2.05 |
| SW-N-64 | SS | N | 2023-11-02 | Extra low flow, clear and very slightly yellow sample. | 1 620. a b | 0.31 | 321. | 0.4 | 0.6 | 0.012 3 | 1.25 | 2.25 |
| SW-N-64 | SS | N | 2023-12-18 | Moderate flow, clear and colourless | 257. | 0.222 | 17.1 | 0.31 | 1. | < 0.005 | 0.283 | 0.701 |
| SW-N-64 | SS | N | 2024-03-05 | High flow. Clear and colourless sample. | 271. --- | 0.31 | 19.6 | 0.249 | < 0.015 | < 0.005 | 0.221 | 0.58 |
| SW-N-65 | SS | N | 2023-05-02 | Moderate flow, clear slightly yellow | 836. --- | 0.113 | 212. | 0.385 | 0.037 | < 0.005 | 0.207 | 2.45 |
| SW-N-65 | SS | N | 2023-11-02 | Moderately low flow, clear and slightly yellow sample. | 1 220. a b | 0.469 | 207. | 0.435 | 0.64 | 0.011 | 2.48 | 1.93 |
| SW-N-65 | SS | N | 2023-12-18 | Moderate flow, clear and colourless | 209. | 0.191 | 15. | 0.34 | 0.053 | < 0.005 | 0.642 | 0.579 |
| SW-N-CS2 | SS | N | 2023-12-18 | Moderate flow, clear colourless | 7.1 --- | 0.006 9 | 0.412 | 0.078 | < 0.015 | < 0.005 | 1.19 | 0.046 |
| SW-N-CS2 | SS | N | 2024-03-05 | High flow. Clear and colourless. Additional sample collected to coincide with new SW-N-66 static | < 5. --- | < 0.02 | 0.13 | 0.093 | < 0.015 | < 0.005 | 0.846 | < 0.1 |

# Hartland Landfill Groundwater, Surface Water and Leachate Monitoring Program Annual Report (Apr 2023 to Mar 2024)

## Table 7-1. Surface Water Quality Exceedances 2023-2024

| B.C. Water Quality Guidelines | | | | BC WQG-STA (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-LTC (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 |
| | | | | Limit of Quantification (LOQ) | 5 | 0.025 | 0.5 | 0.25 | 0.075 | 0.025 | 0.1 | 0.1 |
| SW-S-03 | FRM | N | 2023-05-03 | Mean of duplicates, moderate low flow, clear & colourless | 1 135. | 0.781 | 112.5 | 0.366 | 1. | 0.064 2 | 2.29 | 1.9 |
| SW-S-03 | SS | N | 2023-11-01 | Moderate flow, clear and colourless. | 278. | 0.128 | 21.7 | 0.265 | < 0.015 | < 0.005 | 3.54 b | 0.61 |
| SW-S-03 | SS | N | 2023-12-15 | Moderate high flow, clear colourless | 377. | 0.046 8 | 193. | 0.119 | 1. | 0.048 5 | 2.39 | 1.12 |
| SW-S-03 | SS | N | 2024-03-07 | Moderate flow. Clear and colourless sample. Sampled from mini waterfall. | 349. | 0.036 | 103. | 0.101 | 0.96 | 0.019 | 1.77 | 0.83 |
| SW-S-04 | FRM | Y | 2023-05-02 | Mean of duplicates, moderately low flow, clear & colourless | 29.5 | 0.062 5 | 2.895 | 8.22 | 0.015 | 0.005 | 0.876 | 35.65 |
| SW-S-04 | FRM | Y | 2023-11-01 | Mean of duplicates, moderate flow, clear and colourless. | 84.25 | 0.135 5 | 6.89 | 0.107 | 1.17 | < 0.005 | 1.305 | 0.4 |
| SW-S-04 | FRM | Y | 2023-05-12 | Mean of duplicates, high flow, clear and colourless | 97.6 | 0.070 25 | 5.185 | 0.137 5 | 0.020 5 | 0.022 3 | 1.45 | 0.406 5 |
| SW-S-04 | FRM | Y | 2024-03-07 | Mean of duplicates, high flow, clear and colourless | 89.8 | 0.046 | 4.615 | 0.095 5 | < 0.015 | < 0.005 | 1.29 | 0.325 |
| SW-S-12 | SS | N | 2023-05-02 | Moderate low flow, clear & colourless sample | 1 800. a b | 0.041 | 410. | 0.119 | 4.6 b | 0.058 1 | 2.48 | 1.87 |
| SW-S-12 | FRM | N | 2023-11-02 | Mean of duplicates, high flow, clear and colourless. | 211. | 0.059 5 | 9.605 | 0.091 5 | 0.725 | 0.005 | 3.685 b | 2.4 |
| SW-S-12 | FRM | N | 2023-12-15 | Mean of duplicates, high flow, clear colourless | 757.5 | 0.049 7 | 336. | 0.066 5 | 1.8 | 0.022 65 | 2.88 | 1.675 |
| SW-S-12 | FRM | N | 2024-03-07 | Mean of duplicates, moderate-high flow. Clear and colourless sample. Dunked bottles in wier | 764.5 | 0.043 | 224.5 | 0.056 | 2. b | 0.011 1 | 2.455 | 1.275 |
| SW-S-20 | SS | N | 2023-11-02 | Moderately low flow, clear and colourless. | 357. | 0.207 | 23.4 | 0.063 | 0.68 | 0.005 6 | 1.32 | 0.58 |
| SW-S-20 | SS | N | 2023-12-15 | High flow, clear colourless | 65. | 0.023 3 | 16.9 | 0.058 | 0.12 | < 0.005 | 0.05 | 0.225 |
| SW-S-21 | SS | N | 2023-12-15 | High flow, clear colourless | 14. | 0.005 | 0.182 | 0.068 | < 0.015 | < 0.005 | 0.142 | 0.173 |
| SW-S-21 | SS | N | 2024-03-07 | Moderate-high flow. Clear and colourless sample. | 11.1 | 3.32 a | 0.35 | 0.053 | < 0.015 | < 0.005 | 0.069 | 0.16 |
| SW-S-24 | SS | N | 2023-05-02 | Moderate low flow, clear & colourless sample | 69.2 | 0.057 | 17.9 | 0.79 | 0.015 | 0.005 | 0.716 | 2.99 |
| SW-S-24 | SS | N | 2023-11-01 | Moderate flow, clear and colourless. | 8.6 | < 0.02 | 7.56 | 0.089 | 0.92 | < 0.005 | < 0.02 | 0.39 |
| SW-S-24 | SS | N | 2023-12-15 | High flow, clear colourless | 240. | 0.163 | 26. | 0.145 | 1.5 | 0.063 3 | 1.82 | 0.747 |
| SW-S-24 | SS | N | 2024-03-07 | Moderate-high flow. Clear and colourless sample. Dipped in weir | 176. | 0.099 | 17. | 0.106 | < 0.015 | < 0.005 | 1.66 | 0.53 |
| SW-S-27 | SS | N | 2023-11-01 | Low flow, clear and colourless. | 111. | 0.133 | 14.8 | 0.127 | 0.9 | < 0.005 | 0.039 | 0.45 |
| SW-S-27 | SS | N | 2023-12-15 | High flow, clear colourless | 358. | 0.208 | 51.5 | 0.141 | 0.31 | 0.125 | 2.49 | 0.966 |
| SW-S-27 | SS | N | 2024-03-07 | Moderate flow. Clear and colourless sample. Used pump to collect pumped sample. | 295. | 0.106 | 23.5 | 0.096 | 0.034 | 0.020 8 | 2.46 | 0.76 |
| SW-S-52 | SS | N | 2023-12-18 | High flow, clear colourless | 6.3 | 0.005 6 | 0.2 | < 0.05 | < 0.015 | < 0.005 | < 0.02 | 0.059 |

***Notes:***

*na* — *Not applicable.*
*Null* — *No sample collected.*
**a** — *Above short-term acute (STA) British Columbia*
**b** — *Above long-term chronic (LTC) British Columbia Water Quality Guideline.*
*Unreliable Ammonia Concentrations*
*BC CSR* — *CSR-Sch3.2: BC Contaminated Site Regulation - Schedule 3.2 - Generic Numerical Water Standards, effective on November 1, 2017.*
*(1)* — *British Columbia Approved Water Quality Guidelines (Criteria), 1998 Edition, Updated in August 2023. 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)* — *above STA 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 landfill are derived from stations Sw-S-52 .*
*(8)* — *Dissolved copper guideline varies with water hardness, temperature and DOC, and calcuated using BLM;*
*(9)* — *Total Aluminum guidance is pH, hardness, and DOC dependent and calculated based on BC Water Quality Guideline calculator for Aluminum in Freshwater. Due to anomalously high DOC concentrations resulting from the use of compromised laboratory-supplied preservatives, the aluminum guideline is based on the 2021/22 average DOC concentration of 4.5 mg/L across the landfill. Ecosystems.*
*(10)* — *Dissolved Zinc guidance is pH, hardness, and DOC dependent. Due to anomalously high DOC concentrations resulting from the use of compromised laboratory-supplied preservatives, the aluminum guideline is based on the 2021/22 average DOC concentration of 4.5 mg/L across the landfill.*
*(11)* — *Aquatic Life (AW) Freshwater, Column 3.*
*(12)* — *Drinking Water (DW), Column 6.*

# Hartland Landfill Groundwater, Surface Water and Leachate Monitoring Program Annual Report (Apr 2023 to Mar 2024)
## Table 7-1. Surface Water Quality Exceedances 2023-2024

| B.C. Water Quality Guidelines | | | | BC WQG-STA (1) | --- | 0.05 - 1.5 (5) | --- | 25 | --- | 6.5 to 9.0 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | BC WQG-LTC (1) | 2 | 0.1 - 3 (5) | 128 - 429 (5) | 5 | --- | --- |
| Station | Sample Type | Compliance Well (Y/N?) | Date Sampled | PARAMETER | Selenium | Silver | Sulphate | TSS | Zinc | pH |
| | | | | STATE | TOT | TOT | DIS | TOT | TOT | NoRS |
| | | | | UNIT | µg/L | µg/L | mg/L | mg/L | µg/L | pH |
| | | | | Method Detection Limit (MDL) | 0.04 | 0.005 | 1 | 1 | 1 | 0.1 |
| | | | | Limit of Quantification (LOQ) | 0.2 | 0.025 | 5 | 5 | 5 | 0.5 |
| SW-N-05 | FRM | Y | 2023-02-05 | Mean of duplicates, very low flow, clear & colourless sample | 0.234 5 --- | 0.01 | 110. --- | 1.2 | 3.5 | 6.51 --- |
| SW-N-05 | FRM | Y | 2023-11-02 | Mean of duplicates, moderate flow, clear and colourless. | 0.515 --- | < 0.01 | 145 --- | 5.8 b | 6.4 | 7.24 --- |
| SW-N-05 | FRM | Y | 2023-12-19 | Mean of duplicates, low flow, clear and colourless | 0.409 | < 0.01 | 170 | < 1.0 | 5.2 | 6.65 |
| SW-N-05 | FRM | Y | 2024-05-03 | Mean of duplicates, low-moderate flow. Clear and colourless sample. Used pump. | 0.41 --- | < 0.01 | 210.00 --- | < 1.10 | 3.85 | 7.28 --- |
| SW-N-14 | SS | N | 2023-06-26 | Extra sample date for Heals range access. Low flow, clear and colourless sample. | 0.054 --- | < 0.01 | 27. --- | 2.4 | 1.29 | 7.45 --- |
| SW-N-14 | SS | N | 2023-11-02 | Moderately high flow, clear and colourless. | 0.147 --- | < 0.01 | 90. --- | < 1. | 3.6 | 7.66 --- |
| SW-N-14 | SS | N | 2023-12-19 | Moderate High flow, clear and colourless | 0.114 --- | < 0.005 | 83. --- | 1.2 | 1.9 | 7.48 --- |
| SW-N-14 | SS | N | 2024-02-27 | High flow. Clear and colourless sample. | 0.074 --- | < 0.01 | 70. --- | < 1. | 1.2 | 6.7 --- |
| SW-N-15 | SS | N | 2023-08-17 | Extra sample for Heals range access. Very low flow, clear and colourless sample. | 0.05 | < 0.005 | 12. | 8. b | 0.39 | 7.76 |
| SW-N-16 | FRM | Y | 2023-02-05 | Mean of duplicates, moderate flow, clear & colourless sample | 0.073 --- | 0.01 | 49. --- | 6.8 b | 8.85 | 6.94 --- |
| SW-N-16 | FRM | Y | 2023-11-02 | Mean of duplicates, high flow, clear and colourless. | 0.136 --- | < 0.01 | 88. --- | 3.8 | 10.2 | 6.97 --- |
| SW-N-16 | FRM | Y | 2023-12-19 | Mean of duplicates, high flow, clear and colourless | 0.100 5 --- | < 0.005 | 59. --- | 1.8 | 12.7 | 7.16 --- |
| SW-N-16 | FRM | Y | 2024-05-03 | Mean of duplicates, high flow, clear and colourless sample. | 0.12 --- | < 0.01 | 45. --- | < 1.1 | 6.1 | 7.35 --- |
| SW-N-17 | SS | N | 2023-06-26 | Extra sample for Heals range access. Very low flow, slightly turbid sample | 0.063 --- | < 0.01 | 78. --- | < 1. | 4.19 | 7.19 --- |
| SW-N-17 | SS | N | 2023-11-02 | Moderate flow, clear and colourless. | 0.129 --- | < 0.01 | 97. --- | < 1. | 1.7 | 7.4 --- |
| SW-N-17 | SS | N | 2023-12-19 | Moderate flow, clear and colourless | 0.125 --- | < 0.005 | 120. --- | < 1. | 1.79 | 7.1 --- |
| SW-N-17 | SS | N | 2024-02-27 | High flow. Very turbid, very slightly brown. | 0.101 --- | < 0.01 | 110. --- | 20. b | 5.4 | 6.61 --- |
| SW-N-19 | SS | N | 2023-05-02 | Low flow, clear and colourless. | 0.105 --- | < 0.01 | 59. --- | < 1. | 2.6 | 8.08 --- |
| SW-N-19 | SS | N | 2023-11-07 | Moderate flow, Clear and very slightly yellow. Sample collection delayed due to logging in the ar | 0.166 --- | < 0.01 | 100. --- | < 1. | 2.85 | 7.62 --- |
| SW-N-19 | SS | N | 2023-12-19 | High flow, clear and colourless. | 0.118 | < 0.005 | 66. | < 1. | 2.77 | 7.57 |
| SW-N-19 | SS | N | 2024-03-05 | High flow, clear and colourless, slightly sudsy sample. | 0.147 --- | < 0.01 | 44. --- | < 1. | 4.1 | 7.43 --- |
| SW-N-41S1 | FRM | Y | 2023-12-18 | Mean of duplicates, low flow, clear colourless | 0.100 5 --- | < 0.01 | 67. --- | 16. b | 1.8 | 7.59 --- |
| SW-N-41S1 | FRM | Y | 2024-05-03 | Mean of duplicates, moderate-low flow. Clear and colourless | 0.129 --- | < 0.01 | 70. --- | 61. a b | 1.8 | 7.59 --- |
| SW-N-42S1 | FRM | Y | 2023-05-02 | Mean of duplicates, low flow, clear and colourless. | < 0.043 --- | < 0.01 | 79. --- | 5.8 b | < 1.05 | 7.1 --- |
| SW-N-42S1 | FRM | Y | 2024-05-03 | Mean of duplicates, high flow, clear and colourless | 0.056 5 --- | < 0.01 | 64.5 --- | 1.6 | < 1. | 7.28 --- |
| SW-N-41S3 | SS | N | 2023-11-01 | Low flow, clear and colourless. | 0.136 --- | < 0.01 | 25. --- | 5.2 b | 5.3 | 7.58 --- |
| SW-N-42S1 | FRM | Y | 2023-05-02 | Mean of duplicates, low flow, clear and colourless. | < 0.043 --- | < 0.01 | 79. --- | 5.8 b | < 1.05 | 7.1 --- |
| SW-N-42S1 | FRM | Y | 2024-05-03 | Mean of duplicates, high flow, clear and colourless | 0.056 5 --- | < 0.01 | 64.5 --- | 1.6 | < 1. | 7.28 --- |
| SW-N-45 | SS | N | 2023-11-02 | Moderately low flow, clear and colourless. | 0.504 --- | < 0.01 | 100. --- | < 1. | 1.3 | 7.35 --- |
| SW-N-45 | SS | N | 2023-12-19 | Low moderate flow, clear colourless | 0.285 --- | < 0.005 | 100. --- | 1.6 | 1.06 | 7.02 --- |
| SW-N-45 | SS | N | 2024-02-27 | Low flow. Clear and colourless sample. | 0.206 --- | < 0.01 | 120. --- | 1.2 | 1.5 | 6.45 --- |
| SW-N-54 | SS | N | 2023-05-02 | Very low flow, clear, very slightly yellow | 0.228 --- | 0.01 | 52. --- | 2.8 | 1. | 7.69 --- |
| SW-N-54 | SS | N | 2023-11-03 | Moderate flow, clear and slightly yellow sample. | 0.281 --- | < 0.01 | 120. --- | 11. b | 4.7 | 7.48 --- |
| SW-N-54 | SS | N | 2023-12-20 | Low flow, clear colourless | 0.358 --- | < 0.005 | 69. --- | 1.6 | 1.06 | 7.31 --- |
| SW-N-54 | SS | N | 2024-03-06 | Moderate flow. Clear, very slightly yellow. | 0.321 --- | < 0.01 | 50. --- | 1.6 | 1.2 | 7.3 --- |
| SW-N-55 | SS | N | 2023-12-12 | Moderate flow, clear colourless. New station added | 0.909 | 0.005 | 95. | 2. | 11. | 6.65 |
| SW-N-55 | SS | N | 2024-03-06 | Moderate flow, clear and colourless sample. | 0.816 | < 0.01 | 220. | < 1. | 22.8 | 6.8 |
| SW-N-56 | SS | N | 2023-12-12 | Moderate flow, clear colourless. New station added | 0.051 | 0.005 | 11. | 1. | 0.1 | 7.37 |
| SW-N-56 | SS | N | 2024-03-06 | Moderate-high flow. Clear and colourless sample. | 0.051 | < 0.01 | 29. | < 1. | < 1. | 7.38 |
| SW-N-57 | SS | N | 2023-11-03 | Moderate flow, clear and colourless. | 1.56 | < 0.01 | 200. | 4.6 | 3.1 | 7.7 |
| SW-N-57 | SS | N | 2024-03-06 | High flow. Clear and colourless sample. | 0.778 | < 0.01 | 150. | 2. | < 1. | 7.48 |
| SW-N-63 | SS | N | 2023-05-02 | Moderate high flow, clear and colourless | 0.091 --- | < 0.01 | 16. --- | 1.6 | 1.3 | 7.1 --- |
| SW-N-63 | SS | N | 2023-11-02 | Moderately low flow, clear and colourless. | 0.192 | < 0.01 | 45. | 2.8 | 4.1 | 7.27 |
| SW-N-63 | SS | N | 2024-03-05 | High flow. Clear and colourless sample. | 0.085 --- | < 0.01 | 22. --- | 4. | < 1. | 7.36 a b |
| SW-N-64 | SS | N | 2023-05-02 | Moderate flow, clear slightly yellow | 0.113 --- | < 0.01 | 19. --- | 3.2 | 2.8 | 6.73 --- |
| SW-N-64 | SS | N | 2023-11-02 | Extra low flow, clear and very slightly yellow sample. | 0.1 --- | 0.013 | 68. --- | 7.2 b | 8.2 | 6.77 --- |
| SW-N-64 | SS | N | 2023-12-18 | Moderate flow, clear and colourless | 0.063 | 0.008 8 | 10. | 1.6 | 3.28 | 7.04 |
| SW-N-64 | SS | N | 2024-03-05 | High flow. Clear and colourless sample. | 0.053 --- | < 0.01 | 9. --- | 2.4 | 1.8 | 7.34 a b |
| SW-N-65 | SS | N | 2023-05-02 | Moderate flow, clear slightly yellow | 0.091 --- | < 0.01 | 19. --- | 2.4 | 2.5 | 6.57 --- |
| SW-N-65 | SS | N | 2023-11-02 | Moderately low flow, clear and slightly yellow sample. | 0.136 --- | 0.012 | 60. --- | 7.2 b | 6.6 | 6.95 --- |
| SW-N-65 | SS | N | 2023-12-18 | Moderate flow, clear and colourless | 0.077 | 0.006 7 | 14. | 1.2 | 2.48 | 7.29 |
| SW-N-CS2 | SS | N | 2023-12-18 | Moderate flow, clear colourless | 0.073 --- | < 0.005 | 9.2 --- | < 1. | 0.22 | 7.29 --- |
| SW-N-CS2 | SS | N | 2024-03-05 | High flow. Clear and colourless. Additional sample collected to coincide with new SW-N-66 static | 0.076 --- | < 0.01 | 16. --- | < 1. | < 1. | 7.29 --- |

# Hartland Landfill Groundwater, Surface Water and Leachate Monitoring Program Annual Report (Apr 2023 to Mar 2024)
## Table 7-1. Surface Water Quality Exceedances 2023-2024

| B.C. Water Quality Guidelines | | | | BC WQG-STA (1) | --- | 0.05 - 1.5 (5) | --- | 25 | --- | 6.5 to 9.0 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | BC WQG-LTC (1) | 2 | 0.1 - 3 (5) | 128 - 429 (5) | 5 | --- | --- |
| Station | Sample Type | Compliance Well (Y/N?) | Date Sampled | PARAMETER | Selenium | Silver | Sulphate | TSS | Zinc | pH |
| | | | | STATE | TOT | TOT | DIS | TOT | TOT | NoRS |
| | | | | UNIT | µg/L | µg/L | mg/L | mg/L | µg/L | pH |
| | | | | Method Detection Limit (MDL) | 0.04 | 0.005 | 1 | 1 | 1 | 0.1 |
| | | | | Limit of Quantification (LOQ) | 0.2 | 0.025 | 5 | 5 | 5 | 0.5 |
| SW-S-03 | FRM | N | 2023-05-03 | Mean of duplicates, moderate low flow, clear & colourless | 0.055 5 | 0.01 | 19. | 6.8 | 16.2 | 7.02 |
| SW-S-03 | SS | N | 2023-11-01 | Moderate flow, clear and colourless. | 0.096 | < 0.01 | 54. | 2.4 | 5.7 | 7.28 |
| SW-S-03 | SS | N | 2023-12-15 | Moderate high flow, clear colourless | 0.07 | < 0.005 | 22. | 1.6 | 8.62 | 7.08 |
| SW-S-03 | SS | N | 2024-03-07 | Moderate flow. Clear and colourless sample. Sampled from mini waterfall. | 0.063 | < 0.01 | 14. | 1.2 | 2.9 | 7.22 |
| SW-S-04 | FRM | Y | 2023-05-02 | Mean of duplicates, moderately low flow, clear & colourless | 0.04 | 0.01 | 26. | 3.2 | 4.65 | 6.96 |
| SW-S-04 | FRM | Y | 2023-11-01 | Mean of duplicates, moderate flow, clear and colourless. | 0.064 | < 0.01 | 45.5 | < 1. | 2.8 | 6.62 |
| SW-S-04 | FRM | Y | 2023-05-12 | Mean of duplicates, high flow, clear and colourless | 0.056 5 | < 0.005 | 25. | < 1.1 | 3.335 | 7.45 |
| SW-S-04 | FRM | Y | 2024-03-07 | Mean of duplicates, high flow, clear and colourless | 0.082 5 | < 0.01 | 18. | 2.2 | 2.3 | 7.93 |
| SW-S-12 | SS | N | 2023-05-02 | Moderate low flow, clear & colourless sample | 0.045 | 0.01 | 21. | 2. | 3. | 6.7 |
| SW-S-12 | FRM | N | 2023-11-02 | Mean of duplicates, high flow, clear and colourless. | 0.134 | 0.011 5 | 47. | 3. | 4.65 | 6.94 |
| SW-S-12 | FRM | N | 2023-12-15 | Mean of duplicates, high flow, clear colourless | 0.061 5 | 0.005 | 24. | 1.8 | 4.495 | 6.57 |
| SW-S-12 | FRM | N | 2024-03-07 | Mean of duplicates, moderate-high flow. Clear and colourless sample. Dunked bottles in wier | 0.061 5 | < 0.01 | 14. | < 1.7 | 4.3 | 6.8 |
| SW-S-20 | SS | N | 2023-11-02 | Moderately low flow, clear and colourless. | 0.074 | < 0.01 | 9.6 | 12. b | 13. b | 7.39 |
| SW-S-20 | SS | N | 2023-12-15 | High flow, clear colourless | 0.055 | < 0.005 | 4.9 | < 1. | 7.9 b | 7.29 |
| SW-S-21 | SS | N | 2023-12-15 | High flow, clear colourless | 0.051 | < 0.005 | 5.3 | < 1. | 7.85 b | 7.64 |
| SW-S-21 | SS | N | 2024-03-07 | Moderate-high flow. Clear and colourless sample. | 0.055 | < 0.01 | 4.7 | < 1. | 5.4 | 7.89 |
| SW-S-24 | SS | N | 2023-05-02 | Moderate low flow, clear & colourless sample | 0.049 | 0.01 | 30. | 1. | 3. | 7.3 |
| SW-S-24 | SS | N | 2023-11-01 | Moderate flow, clear and colourless. | 0.051 | < 0.01 | 56. | < 1. | 3.1 | 6.93 |
| SW-S-24 | SS | N | 2023-12-15 | High flow, clear colourless | 0.074 | < 0.005 | 31. | 4. | 5.12 | 7.35 |
| SW-S-24 | SS | N | 2024-03-07 | Moderate-high flow. Clear and colourless sample. Dipped in weir | 0.053 | < 0.01 | 22. | 2.8 | 2.9 | 7.5 |
| SW-S-27 | SS | N | 2023-11-01 | Low flow, clear and colourless. | 0.049 | < 0.01 | 55. | 1.2 | 2.8 | 7.07 |
| SW-S-27 | SS | N | 2023-12-15 | High flow, clear colourless | 0.06 | < 0.005 | 23. | 2.4 | 7.93 | 7.42 |
| SW-S-27 | SS | N | 2024-03-07 | Moderate flow. Clear and colourless sample. Used pump to collect pumped sample. | 0.077 | < 0.01 | 14. | 16. b | 3.4 | 7.54 |
| SW-S-52 | SS | N | 2023-12-18 | High flow, clear colourless | 0.045 | < 0.005 | 5.7 | < 1. | 0.5 | 7.88 |

***Notes:***

*na* — *Not applicable.*
*Null* — *No sample collected.*
**a** — *Above short-term acute (STA) British Columbia*
**b** — *Above long-term chronic (LTC) British Columbia Water Quality Guideline.*
*Unreliable Ammonia Concentrations*
*BC CSR* — *CSR-Sch3.2: BC Contaminated Site Regulation - Schedule 3.2 - Generic Numerical Water Standards, effective on November 1, 2017.*
*(1)* — *British Columbia Approved Water Quality Guidelines (Criteria), 1998 Edition, Updated in August 2023. 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)* — *above STA 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 landfill are derived from stations Sw-S-52 .*
*(8)* — *Dissolved copper guideline varies with water hardness, temperature and DOC, and calcuated using BLM;*
*(9)* — *Total Aluminum guidance is pH, hardness, and DOC dependent and calculated based on BC Water Quality Guideline calculator for Aluminum in Freshwater. Due to anomalously high DOC concentrations resulting from the use of compromised laboratory-supplied preservatives, the aluminum guideline is based on the 2021/22 average DOC concentration of 4.5 mg/L across the landfill. Ecosystems.*
*(10)* — *Dissolved Zinc guidance is pH, hardness, and DOC dependent. Due to anomalously high DOC concentrations resulting from the use of compromised laboratory-supplied preservatives, the aluminum guideline is based on the 2021/22 average DOC concentration of 4.5 mg/L across the landfill.*
*(11)* — *Aquatic Life (AW) Freshwater, Column 3.*
*(12)* — *Drinking Water (DW), Column 6.*

| B.C. Water Quality Guidelines | | | | BC WQG-STA (1) | --- | --- | --- | --- | 0.038-2.8 (5) | --- |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | BC WQG-LTC (1) | --- | --- | --- | --- | 0.018-0.645 (5) | --- |
| Station | Sample Type | Compliance Well (Y/N?) | Date Sampled | PARAMETER | Conductivity | Temperature | Aluminum | Arsenic | Boron | Cadmium | Cobalt |
| | | | | STATE | TOT | TOT | DIS | DIS | DIS | DIS | DIS |
| | | | | UNIT | µS/cm | °C | µg/L | µg/L | µg/L | µg/L | µg/L |
| | | | | Method Detection Limit (MDL) | 1 | 0.1 | 0.5 | 0.02 | 10 | 0.005 | 0.005 |
| | | | | Limit of Quantification (LOQ) | 5 | 0.5 | 2.5 | 0.1 | 50 | 0.025 | 0.025 |
| SW-N-05 | FRM | Y | 2023-02-05 | Mean of duplicates, very low flow, clear & colourless sample | 408. | 11.7 | 21.85 | 0.179 | 196. | 0.014 3 | 0.089 9 |
| SW-N-05 | FRM | Y | 2023-11-02 | Mean of duplicates, moderate flow, clear and colourless. | 443 | 12.1 | 25.3 | 0.156 | 84 | 0.0088 | 0.154 |
| SW-N-05 | FRM | Y | 2023-12-19 | Mean of duplicates, low flow, clear and colourless | 522 | 9.4 | 58.0 | 0.222 | 133 | 0.1038 | 0.133 |
| SW-N-05 | FRM | Y | 2024-05-03 | Mean of duplicates, low-moderate flow. Clear and colourless sample. Used pump. | 577.00 | 7.80 | 39.95 | 0.18 | 149.00 | 0.02 | 0.13 |
| SW-N-14 | SS | N | 2023-06-26 | Extra sample date for Heals range access. Low flow, clear and colourless sample. | 253. | 12.8 | 9.93 | 0.128 | 53. | < 0.005 | 0.046 1 |
| SW-N-14 | SS | N | 2023-11-02 | Moderately high flow, clear and colourless. | 289. | 8.4 | 11.3 | 0.143 | 79. | 0.010 3 | 0.135 |
| SW-N-14 | SS | N | 2023-12-19 | Moderate High flow, clear and colourless | 302. | 7.6 | 7.22 | 0.109 | 71. | < 0.005 | 0.071 4 |
| SW-N-14 | SS | N | 2024-02-27 | High flow. Clear and colourless sample. | 257. | 5.2 | 5.74 | 0.085 | 72. | < 0.005 | 0.072 |
| SW-N-15 | SS | N | 2023-08-17 | Extra sample for Heals range access. Very low flow, clear and colourless sample. | --- | 7.2 | 2.46 | 0.135 | 31. | < 0.005 | 0.013 7 |
| SW-N-16 | FRM | Y | 2023-02-05 | Mean of duplicates, moderate flow, clear & colourless sample | 395. | 18.1 | 19.85 | 0.252 | 76. | 0.022 05 | 0.313 5 |
| SW-N-16 | FRM | Y | 2023-11-02 | Mean of duplicates, high flow, clear and colourless. | 294. | 10.1 | 13.05 | 0.183 | 48. | 0.017 45 | 0.289 5 |
| SW-N-16 | FRM | Y | 2023-12-19 | Mean of duplicates, high flow, clear and colourless | 301. | 7.7 | 14. | 0.200 5 | 59.5 | 0.074 3 | 0.24 |
| SW-N-16 | FRM | Y | 2024-05-03 | Mean of duplicates, high flow, clear and colourless sample. | 380. | 5.6 | 16. | 0.205 5 | 66.5 | 0.016 5 | 0.317 |
| SW-N-17 | SS | N | 2023-06-26 | Extra sample for Heals range access. Very low flow, slightly turbid sample | 413. | 15. | 11.2 | 0.261 | 129. | 0.006 4 | 0.742 |
| SW-N-17 | SS | N | 2023-11-02 | Moderate flow, clear and colourless. | 335. | 8.7 | 16.9 | 0.123 | 124. | < 0.005 | 0.097 7 |
| SW-N-17 | SS | N | 2023-12-19 | Moderate flow, clear and colourless | 373. | 8. | 35.5 | 0.115 | 126. | 0.006 8 | 0.116 |
| SW-N-17 | SS | N | 2024-02-27 | High flow. Very turbid, very slightly brown. | 325. | 6.2 | 6.4 | 0.084 | 131. | < 0.005 | 0.149 |
| SW-N-19 | SS | N | 2023-05-02 | Low flow, clear and colourless. | 385. | 13.5 | 11.1 | 0.252 | 53. | 0.025 4 | 0.42 |
| SW-N-19 | SS | N | 2023-11-07 | Moderate flow, Clear and very slightly yellow. Sample collection delayed due to logging in the are | 339. | 10.7 | 11.6 | 0.199 | 27. | 0.010 3 | 0.305 |
| SW-N-19 | SS | N | 2023-12-19 | High flow, clear and colourless. | 273. | 7.9 | 13.9 | 0.235 | 37. | 0.012 2 | 0.342 |
| SW-N-19 | SS | N | 2024-03-05 | High flow, clear and colourless, slightly sudsy sample. | 233. | 5.6 | 21.6 | 0.234 | 62. | 0.013 | 0.347 |
| SW-N-41S1 | FRM | Y | 2023-12-18 | Mean of duplicates, low flow, clear colourless | 380. | 9.1 | 5.935 | 0.148 5 | 17.5 | < 0.005 | 0.039 1 |
| SW-N-41S1 | FRM | Y | 2024-05-03 | Mean of duplicates, moderate-low flow. Clear and colourless | 318.5 | 9.1 | 4.05 | 0.120 5 | 20. | < 0.005 | 0.045 |
| SW-N-42S1 | FRM | Y | 2023-05-02 | Mean of duplicates, low flow, clear and colourless. | 515. | 12.4 | 7.27 | 0.114 5 | 51. | < 0.005 35 | 0.060 25 |
| SW-N-42S1 | FRM | Y | 2024-05-03 | Mean of duplicates, high flow, clear and colourless | 349. | 5.7 | 5.225 | 0.077 | 58. | < 0.005 | 0.039 5 |
| SW-N-41S3 | SS | N | 2023-11-01 | Low flow, clear and colourless. | 237. | 8.8 | 4.21 | 0.2 | 56. | < 0.005 | 0.016 1 |
| SW-N-42S1 | FRM | Y | 2023-05-02 | Mean of duplicates, low flow, clear and colourless. | 515. | 12.4 | 7.27 | 0.114 5 | 51. | < 0.005 35 | 0.060 25 |
| SW-N-42S1 | FRM | Y | 2024-05-03 | Mean of duplicates, high flow, clear and colourless | 349. | 5.7 | 5.225 | 0.077 | 58. | < 0.005 | 0.039 5 |
| SW-N-45 | SS | N | 2023-11-02 | Moderately low flow, clear and colourless. | 359. | 9.2 | 23.2 | 0.111 | 217. | 0.012 2 | 0.148 |
| SW-N-45 | SS | N | 2023-12-19 | Low moderate flow, clear colourless | 399. | 8.6 | 100. | 0.132 | 164. | 0.008 3 | 0.184 |
| SW-N-45 | SS | N | 2024-02-27 | Low flow. Clear and colourless sample. | 550. | 5.9 | 6.6 | 0.07 | 197. | 0.008 | 0.107 |
| SW-N-54 | SS | N | 2023-05-02 | Very low flow, clear, very slightly yellow | 453. | 13.4 | 7.31 | 0.451 | 58. | 0.013 1 | 0.719 |
| SW-N-54 | SS | N | 2023-11-03 | Moderate flow, clear and slightly yellow sample. | 456. | 10.9 | 9.53 | 0.327 | 40. | 0.006 5 | 0.383 |
| SW-N-54 | SS | N | 2023-12-20 | Low flow, clear colourless | 389. | 9.6 | 9.73 | 0.368 | 74. | 0.011 3 | 0.367 |
| SW-N-54 | SS | N | 2024-03-06 | Moderate flow. Clear, very slightly yellow. | 296. | 8.2 | 13.7 | 0.345 | 64. | 0.009 | 0.244 |
| SW-N-55 | SS | N | 2023-12-12 | Moderate flow, clear colourless. New station added | 497. | 8.6 | 22.4 | 0.072 | 10. | 0.069 7 | 0.121 |
| SW-N-55 | SS | N | 2024-03-06 | Moderate flow, clear and colourless sample. | 516. | 5.6 | 13.7 | 0.084 | 12. | 0.104 | 0.146 |
| SW-N-56 | SS | N | 2023-12-12 | Moderate flow, clear colourless. New station added | 141. | 7.9 | 18.6 | 0.075 | 17. | 0.005 | 0.042 3 |
| SW-N-56 | SS | N | 2024-03-06 | Moderate-high flow. Clear and colourless sample. | 171. | 4.9 | 11.1 | 0.076 | 21. | < 0.005 | 0.039 |
| SW-N-57 | SS | N | 2023-11-03 | Moderate flow, clear and colourless. | 519. | 11.5 | 8.18 | 0.183 | 41. | 0.007 3 | 0.324 |
| SW-N-57 | SS | N | 2024-03-06 | High flow. Clear and colourless sample. | 381. | --- | 9.27 | 0.192 | 30. | 0.005 | 0.209 |
| SW-N-63 | SS | N | 2023-05-02 | Moderate high flow, clear and colourless | 230. | 11.8 | 12.8 | 0.195 | 41. | < 0.005 | 0.199 |
| SW-N-63 | SS | N | 2023-11-02 | Moderately low flow, clear and colourless. | 195. | 9.1 | 45.9 | 0.261 | 54. | 0.009 9 | 0.272 |
| SW-N-63 | SS | N | 2024-03-05 | High flow. Clear and colourless sample. | 135. | 6.4 | 14.9 | 0.123 | 32. | < 0.005 | 0.096 |
| SW-N-64 | SS | N | 2023-05-02 | Moderate flow, clear slightly yellow | 172. | 12.5 | 43.3 | 0.715 | 48. | 0.011 1 | 0.876 |
| SW-N-64 | SS | N | 2023-11-02 | Extra low flow, clear and very slightly yellow sample. | 233. | 8.2 | 46.1 | 0.513 | 59. | 0.013 9 | 3.26 |
| SW-N-64 | SS | N | 2023-12-18 | Moderate flow, clear and colourless | 99.7 | 6.4 | 23. | 0.384 | 25. | 0.010 3 | 0.154 |
| SW-N-64 | SS | N | 2024-03-05 | High flow. Clear and colourless sample. | 92. | 5.3 | 27.1 | 0.278 | 24. | < 0.005 | 0.163 |
| SW-N-65 | SS | N | 2023-05-02 | Moderate flow, clear slightly yellow | 175. | 13. | 34. | 0.607 | 47. | 0.008 | 0.727 |
| SW-N-65 | SS | N | 2023-11-02 | Moderately low flow, clear and slightly yellow sample. | 213. | 8.4 | 43.8 | 0.419 | 60. | 0.014 4 | 2.02 |
| SW-N-65 | SS | N | 2023-12-18 | Moderate flow, clear and colourless | 180. | 6.5 | 19.7 | 0.3 | 27. | 0.008 | 0.13 |
| SW-N-CS2 | SS | N | 2023-12-18 | Moderate flow, clear colourless | 160. | 8.2 | 6.95 | 0.052 | 11. | < 0.005 | 0.018 1 |
| SW-N-CS2 | SS | N | 2024-03-05 | High flow. Clear and colourless. Additional sample collected to coincide with new SW-N-66 static | 102. | 8.2 | 6.37 | 0.046 | 11. | < 0.005 | 0.022 |

# Hartland Landfill Groundwater, Surface Water and Leachate Monitoring Program Annual Report (Apr 2023 to Mar 2024)
## Table 7-1. Surface Water Quality Exceedances 2023-2024

| B.C. Water Quality Guidelines | | | | BC WQG-STA (1) | --- | --- | --- | --- | --- | 0.038-2.8 (5) | --- |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | BC WQG-LTC (1) | --- | --- | --- | --- | --- | 0.018-0.645 (5) | --- |
| Station | Sample Type | Compliance Well (Y/N?) | Date Sampled | PARAMETER | Conductivity | Temperature | Aluminum | Arsenic | Boron | Cadmium | Cobalt |
| | | | | STATE | TOT | TOT | DIS | DIS | DIS | DIS | DIS |
| | | | | UNIT | µS/cm | °C | µg/L | µg/L | µg/L | µg/L | µg/L |
| | | | | Method Detection Limit (MDL) | 1 | 0.1 | 0.5 | 0.02 | 10 | 0.005 | 0.005 |
| | | | | Limit of Quantification (LOQ) | 5 | 0.5 | 2.5 | 0.1 | 50 | 0.025 | 0.025 |
| SW-S-03 | FRM | N | 2023-05-03 | Mean of duplicates, moderate low flow, clear & colourless | 300. | 11.3 | 7.7 | 0.244 5 | 66.5 | 0.016 15 | 0.363 5 |
| SW-S-03 | SS | N | 2023-11-01 | Moderate flow, clear and colourless. | 335. | 13.2 | 2.91 | 0.149 | 70. | 0.008 1 | 0.11 |
| SW-S-03 | SS | N | 2023-12-15 | Moderate high flow, clear colourless | 193. | 11.4 | 14.2 | 0.175 | 54. | 0.013 5 | 0.447 |
| SW-S-03 | SS | N | 2024-03-07 | Moderate flow. Clear and colourless sample. Sampled from mini waterfall. | 163. | 8.6 | 15.7 | 0.118 | 49. | < 0.005 | 0.309 |
| SW-S-04 | FRM | Y | 2023-05-02 | Mean of duplicates, moderately low flow, clear & colourless | 231. | 9. | 8.78 | 0.088 | 70. | 0.021 85 | 0.069 4 |
| SW-S-04 | FRM | Y | 2023-11-01 | Mean of duplicates, moderate flow, clear and colourless. | 269. | 9.4 | 13.775 | 0.105 5 | 74.5 | 0.015 95 | 0.073 45 |
| SW-S-04 | FRM | Y | 2023-05-12 | Mean of duplicates, high flow, clear and colourless | 172. | 8.7 | 16.45 | 0.128 5 | 57. | < 0.005 75 | 0.061 3 |
| SW-S-04 | FRM | Y | 2024-03-07 | Mean of duplicates, high flow, clear and colourless | 158. | 5.8 | 13.95 | 0.088 5 | 57. | < 0.007 5 | 0.054 |
| SW-S-12 | SS | N | 2023-05-02 | Moderate low flow, clear & colourless sample | 285. | 11.5 | 12.1 | 0.296 | 111. | 0.012 1 | 0.828 |
| SW-S-12 | FRM | N | 2023-11-02 | Mean of duplicates, high flow, clear and colourless. | 192. | 13.9 | 35.05 | 0.272 5 | 26.5 | 0.02 | 0.145 5 |
| SW-S-12 | FRM | N | 2023-12-15 | Mean of duplicates, high flow, clear colourless | 250.5 | 11.5 | 16.25 | 0.223 | 67.5 | 0.014 | 0.734 |
| SW-S-12 | FRM | N | 2024-03-07 | Mean of duplicates, moderate-high flow. Clear and colourless sample. Dunked bottles in wier | 170. | 9.1 | 20.75 | 0.165 | 64.5 | < 0.005 | 0.522 |
| SW-S-20 | SS | N | 2023-11-02 | Moderately low flow, clear and colourless. | 90. | 10.7 | 88. b | 0.168 | 24. | < 0.005 | 0.123 |
| SW-S-20 | SS | N | 2023-12-15 | High flow, clear colourless | 81. | 8.1 | 29.2 | 0.116 | 14. | < 0.005 | 0.057 8 |
| SW-S-21 | SS | N | 2023-12-15 | High flow, clear colourless | 110. | 7.7 | 35.5 | 0.108 | 12. | < 0.005 | 0.035 4 |
| SW-S-21 | SS | N | 2024-03-07 | Moderate-high flow. Clear and colourless sample. | 66. | 4.9 | 24.8 | 0.062 | 11. | < 0.005 | 0.036 |
| SW-S-24 | SS | N | 2023-05-02 | Moderate low flow, clear & colourless sample | 272. | 11.1 | 7.76 | 0.142 | 103. | 0.021 3 | 0.104 |
| SW-S-24 | SS | N | 2023-11-01 | Moderate flow, clear and colourless. | 323. | 9. | 6.5 | 0.124 | 91. | 0.014 4 | 0.083 5 |
| SW-S-24 | SS | N | 2023-12-15 | High flow, clear colourless | 209. | 9.7 | 11.2 | 0.158 | 82. | 0.010 2 | 0.081 2 |
| SW-S-24 | SS | N | 2024-03-07 | Moderate-high flow. Clear and colourless sample. Dipped in weir | 188. | 6.5 | 10.6 | 0.105 | 69. | 0.008 5 | 0.131 |
| SW-S-27 | SS | N | 2023-11-01 | Low flow, clear and colourless. | 282. | 8.5 | 5.39 | 0.162 | 50. | 0.005 8 | 0.095 5 |
| SW-S-27 | SS | N | 2023-12-15 | High flow, clear colourless | 190. | 10.7 | 12.5 | 0.163 | 55. | 0.009 7 | 0.11 |
| SW-S-27 | SS | N | 2024-03-07 | Moderate flow. Clear and colourless sample. Used pump to collect pumped sample. | 173. | 7.9 | 13.8 | 0.124 | 48. | 0.008 | 0.151 |
| SW-S-52 | SS | N | 2023-12-18 | High flow, clear colourless | 89. | 8. | 5.6 | 0.064 | 17. | < 0.005 | 0.022 6 |

***Notes:***

*na* — *Not applicable.*
*Null* — *No sample collected.*
**a** — *Above short-term acute (STA) British Columbia*
**b** — *Above long-term chronic (LTC) British Columbia Water Quality Guideline.*
*Unreliable Ammonia Concentrations*
*BC CSR* — *CSR-Sch3.2: BC Contaminated Site Regulation - Schedule 3.2 - Generic Numerical Water Standards, effective on November 1, 2017.*
*(1)* — *British Columbia Approved Water Quality Guidelines (Criteria), 1998 Edition, Updated in August 2023. 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)* — *above STA 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 landfill are derived from stations Sw-S-52 .*
*(8)* — *Dissolved copper guideline varies with water hardness, temperature and DOC, and calcuated using BLM;*
*(9)* — *Total Aluminum guidance is pH, hardness, and DOC dependent and calculated based on BC Water Quality Guideline calculator for Aluminum in Freshwater. Due to anomalously high DOC concentrations resulting from the use of compromised laboratory-supplied preservatives, the aluminum guideline is based on the 2021/22 average DOC concentration of 4.5 mg/L across the landfill. Ecosystems.*
*(10)* — *Dissolved Zinc guidance is pH, hardness, and DOC dependent. Due to anomalously high DOC concentrations resulting from the use of compromised laboratory-supplied preservatives, the aluminum guideline is based on the 2021/22 average DOC concentration of 4.5 mg/L across the landfill.*
*(11)* — *Aquatic Life (AW) Freshwater, Column 3.*
*(12)* — *Drinking Water (DW), Column 6.*

# Hartland Landfill Groundwater, Surface Water and Leachate Monitoring Program Annual Report (Apr 2023 to Mar 2024)
## Table 7-1. Surface Water Quality Exceedances 2023-2024

AECOM

| B.C. Water Quality Guidelines | | | | BC WQG-STA (1) | BC BLM (8) | | | --- | | 350 | | --- | | --- | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | BC WQG-LTC (1) | BC BLM (8) | | | --- | | --- | | --- | | --- | |
| Station | Sample Type | Compliance Well (Y/N?) | Date Sampled | PARAMETER | Copper | | | Hardness (As Caco3) | | Iron | | Lead | | Manganese | |
| | | | | STATE | DIS | | | DIS | | DIS | | DIS | | DIS | |
| | | | | UNIT | µg/L | | | mg/L | | µg/L | | µg/L | | µg/L | |
| | | | | Method Detection Limit (MDL) | 0.05 | | | 0.5 | | 1 | | 0.005 | | 0.05 | |
| | | | | Limit of Quantification (LOQ) | 0.25 | | | 2.5 | | 5 | | 0.025 | | 0.25 | |
| SW-N-05 | FRM | Y | 2023-02-05 | Mean of duplicates, very low flow, clear & colourless sample | 4.56 | a | b | 228. | --- --- | 13.85 | --- | 0.006 8 | --- --- | 0.639 5 | --- --- |
| SW-N-05 | FRM | Y | 2023-11-02 | Mean of duplicates, moderate flow, clear and colourless. | 7.535 | | b | 247 | --- --- | 43.6 | --- | < 0.006 | --- --- | 0.900 | --- --- |
| SW-N-05 | FRM | Y | 2023-12-19 | Mean of duplicates, low flow, clear and colourless | 5.55 | | b | 331 | --- --- | 26.2 | --- | < 0.026 | --- --- | 3.135 | --- --- |
| SW-N-05 | FRM | Y | 2024-05-03 | Mean of duplicates, low-moderate flow. Clear and colourless sample. Used pump. | 4.07 | | b | 318.00 | --- --- | 20.05 | --- | 0.02 | --- --- | 1.38 | --- --- |
| SW-N-14 | SS | N | 2023-06-26 | Extra sample date for Heals range access. Low flow, clear and colourless sample. | 0.679 | | | 116. | --- --- | 19.8 | --- | 0.425 | --- --- | 12.8 | --- --- |
| SW-N-14 | SS | N | 2023-11-02 | Moderately high flow, clear and colourless. | 3.11 | | | 180. | --- --- | 15.6 | --- | 0.024 2 | --- --- | 4.17 | --- --- |
| SW-N-14 | SS | N | 2023-12-19 | Moderate High flow, clear and colourless | 1.1 | | | 188. | --- --- | 5.4 | --- | < 0.005 | --- --- | 0.224 | --- --- |
| SW-N-14 | SS | N | 2024-02-27 | High flow. Clear and colourless sample. | 1.19 | | b | 163. | --- --- | 5.2 | --- | < 0.005 | --- --- | 0.222 | --- --- |
| SW-N-15 | SS | N | 2023-08-17 | Extra sample for Heals range access. Very low flow, clear and colourless sample. | 0.274 | | | 84.3 | --- --- | 2.9 | --- | 0.036 7 | --- --- | 2.96 | --- --- |
| SW-N-16 | FRM | Y | 2023-02-05 | Mean of duplicates, moderate flow, clear & colourless sample | 5.175 | | b | 189.5 | --- --- | 92.45 | --- | 0.019 1 | --- --- | 115. | --- --- |
| SW-N-16 | FRM | Y | 2023-11-02 | Mean of duplicates, high flow, clear and colourless. | 8.025 | | b | 164.5 | --- --- | 33.55 | --- | < 0.006 1 | --- --- | 28.1 | --- --- |
| SW-N-16 | FRM | Y | 2023-12-19 | Mean of duplicates, high flow, clear and colourless | 6.84 | | b | 187. | --- --- | 64.15 | --- | < 0.005 | --- --- | 75.4 | --- --- |
| SW-N-16 | FRM | Y | 2024-05-03 | Mean of duplicates, high flow, clear and colourless sample. | 11.65 | | b | 152.5 | --- --- | 58.15 | --- | 0.01 | --- --- | 30.9 | --- --- |
| SW-N-17 | SS | N | 2023-06-26 | Extra sample for Heals range access. Very low flow, slightly turbid sample | 0.442 | | | 192. | --- --- | 205. | --- | 0.41 | --- --- | 227. | --- --- |
| SW-N-17 | SS | N | 2023-11-02 | Moderate flow, clear and colourless. | 0.961 | | | 192. | --- --- | 19.1 | --- | < 0.005 | --- --- | 3.88 | --- --- |
| SW-N-17 | SS | N | 2023-12-19 | Moderate flow, clear and colourless | 0.905 | | | 230. | --- --- | 29.3 | --- | 0.033 9 | --- --- | 6.54 | --- --- |
| SW-N-17 | SS | N | 2024-02-27 | High flow. Very turbid, very slightly brown. | 0.634 | | b | 206. | --- --- | 9.2 | --- | < 0.005 | --- --- | 19.7 | --- --- |
| SW-N-19 | SS | N | 2023-05-02 | Low flow, clear and colourless. | 13.8 | | b | 209. | --- --- | 32. | --- | 0.012 4 | --- --- | 35.3 | --- --- |
| SW-N-19 | SS | N | 2023-11-07 | Moderate flow, Clear and very slightly yellow. Sample collection delayed due to logging in the ar | 11.7 | | b | 192. | --- --- | 97. | --- | 0.009 9 | --- --- | 11.6 | --- --- |
| SW-N-19 | SS | N | 2023-12-19 | High flow, clear and colourless. | 11.5 | | b | 184. | --- --- | 19.2 | --- | < 0.005 | --- --- | 15.6 | --- --- |
| SW-N-19 | SS | N | 2024-03-05 | High flow, clear and colourless, slightly sudsy sample. | 19.1 | | b | 153. | --- --- | 33.3 | --- | 0.021 | --- --- | 4. | --- --- |
| SW-N-41S1 | FRM | Y | 2023-12-18 | Mean of duplicates, low flow, clear colourless | 0.213 5 | | | 169. | --- --- | 15.2 | --- | < 0.005 | --- --- | 23.85 | --- --- |
| SW-N-41S1 | FRM | Y | 2024-05-03 | Mean of duplicates, moderate-low flow. Clear and colourless | 0.235 | | | 169. | --- --- | 14.05 | --- | 0.01 | --- --- | 20.4 | --- --- |
| SW-N-42S1 | FRM | Y | 2023-05-02 | Mean of duplicates, low flow, clear and colourless. | 0.428 | | | 212.5 | --- --- | 18.4 | --- | 0.020 05 | --- --- | 20.7 | --- --- |
| SW-N-42S1 | FRM | Y | 2024-05-03 | Mean of duplicates, high flow, clear and colourless | 0.927 | | b | 170. | --- --- | 13.95 | --- | 0.008 | --- --- | 7.92 | --- --- |
| SW-N-41S3 | SS | N | 2023-11-01 | Low flow, clear and colourless. | 0.21 | | | 157. | --- --- | 6.9 | --- | 0.006 9 | --- --- | 2.61 | --- --- |
| SW-N-42S1 | FRM | Y | 2023-05-02 | Mean of duplicates, low flow, clear and colourless. | 0.428 | | | 212.5 | --- --- | 18.4 | --- | 0.020 05 | --- --- | 20.7 | --- --- |
| SW-N-42S1 | FRM | Y | 2024-05-03 | Mean of duplicates, high flow, clear and colourless | 0.927 | | b | 170. | --- --- | 13.95 | --- | 0.008 | --- --- | 7.92 | --- --- |
| SW-N-45 | SS | N | 2023-11-02 | Moderately low flow, clear and colourless. | 1.73 | | | 212. | --- --- | 10. | --- | 0.075 2 | --- --- | 6.93 | --- --- |
| SW-N-45 | SS | N | 2023-12-19 | Low moderate flow, clear colourless | 1.64 | | b | 232. | --- --- | 112. | --- | 0.071 7 | --- --- | 10.7 | --- --- |
| SW-N-45 | SS | N | 2024-02-27 | Low flow. Clear and colourless sample. | 1.14 | | b | 227. | --- --- | 9.9 | --- | 0.005 | --- --- | 7.27 | --- --- |
| SW-N-54 | SS | N | 2023-05-02 | Very low flow, clear, very slightly yellow | 11.5 | | b | 254. | --- --- | 52.2 | --- | 0.007 5 | --- --- | 304. | --- --- |
| SW-N-54 | SS | N | 2023-11-03 | Moderate flow, clear and slightly yellow sample. | 12.1 | | b | 264. | --- --- | 45.6 | --- | 0.006 7 | --- --- | 84.2 | --- --- |
| SW-N-54 | SS | N | 2023-12-20 | Low flow, clear colourless | 26.7 | | b | 224. | --- --- | 14.4 | --- | 0.005 1 | --- --- | 51.7 | --- --- |
| SW-N-54 | SS | N | 2024-03-06 | Moderate flow. Clear, very slightly yellow. | 29.5 | | b | 200. | --- --- | 21.9 | --- | 0.011 | --- --- | 6.86 | --- --- |
| SW-N-55 | SS | N | 2023-12-12 | Moderate flow, clear colourless. New station added | 0.576 | | b | 276. | | 4. | | 0.005 | | 4.57 | |
| SW-N-55 | SS | N | 2024-03-06 | Moderate flow, clear and colourless sample. | 1.34 | | b | 317. | --- --- | 4.4 | --- | 0.01 | --- --- | 5.18 | --- --- |
| SW-N-56 | SS | N | 2023-12-12 | Moderate flow, clear colourless. New station added | 0.666 | | | 78.8 | | 6.2 | | 0.005 | | 0.065 | |
| SW-N-56 | SS | N | 2024-03-06 | Moderate-high flow. Clear and colourless sample. | 0.598 | | | 105. | --- --- | 6.4 | --- | < 0.005 | --- --- | 0.071 | --- --- |
| SW-N-57 | SS | N | 2023-11-03 | Moderate flow, clear and colourless. | 0.674 | | b | 333. | --- --- | 7. | --- | 0.005 6 | --- --- | 10.6 | --- --- |
| SW-N-57 | SS | N | 2024-03-06 | High flow. Clear and colourless sample. | 0.742 | | b | 285. | --- --- | 3.2 | --- | 0.005 | --- --- | 4.38 | --- --- |
| SW-N-63 | SS | N | 2023-05-02 | Moderate high flow, clear and colourless | 0.952 | | b | 93.5 | --- --- | 215. | --- | 0.036 3 | --- --- | 36.3 | --- --- |
| SW-N-63 | SS | N | 2023-11-02 | Moderately low flow, clear and colourless. | 4.73 | | b | 110. | --- --- | 160. | --- | 0.226 | --- --- | 36.4 | --- --- |
| SW-N-63 | SS | N | 2024-03-05 | High flow. Clear and colourless sample. | 1.25 | | b | 86. | --- --- | 77.3 | --- | 0.038 | --- --- | 15.1 | --- --- |
| SW-N-64 | SS | N | 2023-05-02 | Moderate flow, clear slightly yellow | 3.56 | | b | 80.8 | --- --- | 857. | a | b | 0.103 | --- --- | 318. | --- --- |
| SW-N-64 | SS | N | 2023-11-02 | Extra low flow, clear and very slightly yellow sample. | 3.34 | | b | 125. | --- --- | 863. | a | b | 0.096 2 | --- --- | 384. | --- --- |
| SW-N-64 | SS | N | 2023-12-18 | Moderate flow, clear and colourless | 1.86 | | b | 53.7 | --- --- | 143. | --- | 0.136 | --- --- | 15.6 | --- --- |
| SW-N-64 | SS | N | 2024-03-05 | High flow. Clear and colourless sample. | 1.36 | | | 51.9 | --- --- | 166. | --- | 0.094 | --- --- | 18.6 | --- --- |
| SW-N-65 | SS | N | 2023-05-02 | Moderate flow, clear slightly yellow | 2.26 | | b | 84.7 | --- --- | 688. | a | b | 0.073 4 | --- --- | 252. | --- --- |
| SW-N-65 | SS | N | 2023-11-02 | Moderately low flow, clear and slightly yellow sample. | 3.99 | | b | 117. | --- --- | 606. | a | b | 0.153 | --- --- | 222. | --- --- |
| SW-N-65 | SS | N | 2023-12-18 | Moderate flow, clear and colourless | 2.62 | | b | 65. | --- --- | 110. | --- | 0.094 8 | --- --- | 12.9 | --- --- |
| SW-N-CS2 | SS | N | 2023-12-18 | Moderate flow, clear colourless | 0.355 | | b | 69.6 | --- --- | 2.3 | --- | < 0.005 | --- --- | 0.166 | --- --- |
| SW-N-CS2 | SS | N | 2024-03-05 | High flow. Clear and colourless. Additional sample collected to coincide with new SW-N-66 static | 1.16 | | b | 66. | --- --- | 6.3 | --- | 0.009 | --- --- | < 0.05 | --- --- |

# Hartland Landfill Groundwater, Surface Water and Leachate Monitoring Program Annual Report (Apr 2023 to Mar 2024)
## Table 7-1. Surface Water Quality Exceedances 2023-2024

| B.C. Water Quality Guidelines | | | | BC WQG-STA (1) | BC BLM (8) | --- | 350 | --- | --- |
|---|---|---|---|---|---|---|---|---|---|
| | | | | BC WQG-LTC (1) | BC BLM (8) | --- | --- | --- | --- |
| Station | Sample Type | Compliance Well (Y/N?) | Date Sampled | PARAMETER | Copper | Hardness (As Caco3) | Iron | Lead | Manganese |
| | | | | STATE | DIS | DIS | DIS | DIS | DIS |
| | | | | UNIT | µg/L | mg/L | µg/L | µg/L | µg/L |
| | | | | Method Detection Limit (MDL) | 0.05 | 0.5 | 1 | 0.005 | 0.05 |
| | | | | Limit of Quantification (LOQ) | 0.25 | 2.5 | 5 | 0.025 | 0.25 |
| SW-S-03 | FRM | N | 2023-05-03 | Mean of duplicates, moderate low flow, clear & colourless | 2.75 b | 97.95 | 235.5 | 0.050 7 | 104. |
| SW-S-03 | SS | N | 2023-11-01 | Moderate flow, clear and colourless. | 3.46 | 160. | 10.6 | 0.005 6 | 12.8 |
| SW-S-03 | SS | N | 2023-12-15 | Moderate high flow, clear colourless | 4.41 b | 94. | 219. | 0.013 5 | 186. |
| SW-S-03 | SS | N | 2024-03-07 | Moderate flow. Clear and colourless sample. Sampled from mini waterfall. | 4.08 b | 74.6 | 208. | 0.009 | 120. |
| SW-S-04 | FRM | Y | 2023-05-02 | Mean of duplicates, moderately low flow, clear & colourless | 1.205 b | 111.5 | 3.75 | 0.023 6 | 0.649 |
| SW-S-04 | FRM | Y | 2023-11-01 | Mean of duplicates, moderate flow, clear and colourless. | 1.315 b | 147.5 | 8.35 | 0.030 5 | 1.149 |
| SW-S-04 | FRM | Y | 2023-05-12 | Mean of duplicates, high flow, clear and colourless | 1.815 b | 86.05 | 14.45 | 0.012 45 | 0.586 |
| SW-S-04 | FRM | Y | 2024-03-07 | Mean of duplicates, high flow, clear and colourless | 1.515 b | 84.7 | 12.5 | 0.011 | 0.647 5 |
| SW-S-12 | SS | N | 2023-05-02 | Moderate low flow, clear & colourless sample | 4.61 a b | 127. | 1 400. a b | 0.015 2 | 452. |
| SW-S-12 | FRM | N | 2023-11-02 | Mean of duplicates, high flow, clear and colourless. | 14.85 a b | 98.3 | 30.6 | 0.010 25 | 6.73 |
| SW-S-12 | FRM | N | 2023-12-15 | Mean of duplicates, high flow, clear colourless | 4.94 b | 102.5 | 513.5 | 0.032 4 | 315.5 |
| SW-S-12 | FRM | N | 2024-03-07 | Mean of duplicates, moderate-high flow. Clear and colourless sample. Dunked bottles in wier | 5.46 a b | 80.25 | 654.5 a b | 0.009 | 256. |
| SW-S-20 | SS | N | 2023-11-02 | Moderately low flow, clear and colourless. | 3.26 b | 44.7 | 85.3 | 0.025 | 14.6 |
| SW-S-20 | SS | N | 2023-12-15 | High flow, clear colourless | 2.1 b | 48. | 27.4 | 0.037 6 | 15.8 |
| SW-S-21 | SS | N | 2023-12-15 | High flow, clear colourless | 1.13 | 41.4 | 11.7 | 0.005 1 | 0.069 |
| SW-S-21 | SS | N | 2024-03-07 | Moderate-high flow. Clear and colourless sample. | 0.752 | 43.5 | 7.8 | < 0.005 | < 0.05 |
| SW-S-24 | SS | N | 2023-05-02 | Moderate low flow, clear & colourless sample | 1.76 b | 129. | 12.3 | 0.026 6 | 12.6 |
| SW-S-24 | SS | N | 2023-11-01 | Moderate flow, clear and colourless. | 2.06 b | 167. | 6.1 | 0.011 1 | 7.72 |
| SW-S-24 | SS | N | 2023-12-15 | High flow, clear colourless | 2.57 b | 105. | 29.6 | 0.019 7 | 7.93 |
| SW-S-24 | SS | N | 2024-03-07 | Moderate-high flow. Clear and colourless sample. Dipped in weir | 2.13 b | 97.2 | 29.7 | 0.016 | 7.4 |
| SW-S-27 | SS | N | 2023-11-01 | Low flow, clear and colourless. | 2.38 b | 133. | 2.8 | < 0.005 | 0.139 |
| SW-S-27 | SS | N | 2023-12-15 | High flow, clear colourless | 3.6 b | 90.9 | 45.4 | 0.026 1 | 27.6 |
| SW-S-27 | SS | N | 2024-03-07 | Moderate flow. Clear and colourless sample. Used pump to collect pumped sample. | 3.33 b | 78.4 | 47.4 | 0.017 | 12.7 |
| SW-S-52 | SS | N | 2023-12-18 | High flow, clear colourless | 1.31 b | 56.3 | 5.3 | 0.030 5 | 0.489 |

**Notes:**

| | |
|---|---|
| *na* | *Not applicable.* |
| *Null* | *No sample collected.* |
| **a** | *Above short-term acute (STA) British Columbia* |
| **b** | *Above long-term chronic (LTC) British Columbia Water Quality Guideline.* |
| | *Unreliable Ammonia Concentrations* |
| *BC CSR* | *CSR-Sch3.2: BC Contaminated Site Regulation - Schedule 3.2 - Generic Numerical Water Standards, effective on November 1, 2017.* |
| *(1)* | *British Columbia Approved Water Quality Guidelines (Criteria), 1998 Edition, Updated in August 2023. 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)* | *above STA 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 landfill are derived from stations Sw-S-52 .* |
| *(8)* | *Dissolved copper guideline varies with water hardness, temperature and DOC, and calcuated using BLM;* |
| *(9)* | *Total Aluminum guidance is pH, hardness, and DOC dependent and calculated based on BC Water Quality Guideline calculator for Aluminum in Freshwater. Due to anomalously high DOC concentrations resulting from the use of compromised laboratory-supplied preservatives, the aluminum guideline is based on the 2021/22 average DOC concentration of 4.5 mg/L across the landfill. Ecosystems.* |
| *(10)* | *Dissolved Zinc guidance is pH, hardness, and DOC dependent. Due to anomalously high DOC concentrations resulting from the use of compromised laboratory-supplied preservatives, the aluminum guideline is based on the 2021/22 average DOC concentration of 4.5 mg/L across the landfill.* |
| *(11)* | *Aquatic Life (AW) Freshwater, Column 3.* |
| *(12)* | *Drinking Water (DW), Column 6.* |

# Hartland Landfill Groundwater, Surface Water and Leachate Monitoring Program Annual Report(Apr 2023 to Mar 2024)

## Table 7-1. Surface Water Quality Exceedances 2023-2024

| B.C. Water Quality Guidelines | | | | BC WQG-STA (1) | --- | --- | --- | --- | variable (10) | --- |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | BC WQG-LTC (1) | --- | --- | --- | --- | variable (10) | --- |
| Station | Sample Type | Compliance Well (Y/N?) | Date Sampled | PARAMETER | Molybdenum | Nickel | Selenium | Silver | Zinc | Dissolved Organic Carbon |
| | | | | STATE | DIS | DIS | DIS | DIS | DIS | Dissolved |
| | | | | UNIT | µg/L | µg/L | µg/L | µg/L | µg/L | mg/L |
| | | | | Method Detection Limit (MDL) | 0.05 | 0.02 | 0.04 | 0.005 | 0.1 | 0.5 |
| | | | | Limit of Quantification (LOQ) | 0.25 | 0.1 | 0.2 | 0.025 | 0.5 | 2.5 |
| SW-N-05 | FRM | Y | 2023-02-05 | Mean of duplicates, very low flow, clear & colourless sample | 3.455 | 1.14 | 0.258 | 0.005 | 4.045 | 4.9 |
| SW-N-05 | FRM | Y | 2023-11-02 | Mean of duplicates, moderate flow, clear and colourless. | 2.11 | 1.03 | 0.525 | < 0.005 | 1.67 | 14 |
| SW-N-05 | FRM | Y | 2023-12-19 | Mean of duplicates, low flow, clear and colourless | 3.20 | 1.66 | 0.413 | < 0.005 | 6.38 | 9 |
| SW-N-05 | FRM | Y | 2024-05-03 | Mean of duplicates, low-moderate flow. Clear and colourless sample. Used pump. | 3.21 | 1.27 | 0.40 | < 0.01 | 3.97 | 6.30 |
| SW-N-14 | SS | N | 2023-06-26 | Extra sample date for Heals range access. Low flow, clear and colourless sample. | 0.38 | 0.134 | 0.076 | < 0.005 | 8.1 | 2.2 |
| SW-N-14 | SS | N | 2023-11-02 | Moderately high flow, clear and colourless. | 0.536 | 0.764 | 0.135 | < 0.005 | 2.26 | 8.3 |
| SW-N-14 | SS | N | 2023-12-19 | Moderate High flow, clear and colourless | 0.416 | 0.268 | 0.111 | < 0.005 | 1.44 | 4. |
| SW-N-14 | SS | N | 2024-02-27 | High flow. Clear and colourless sample. | 0.43 | 0.379 | 0.092 | < 0.005 | 1.04 | 3.5 |
| SW-N-15 | SS | N | 2023-08-17 | Extra sample for Heals range access. Very low flow, clear and colourless sample. | 0.339 | 0.126 | 0.051 | < 0.005 | 0.46 | 1.4 |
| SW-N-16 | FRM | Y | 2023-02-05 | Mean of duplicates, moderate flow, clear & colourless sample | 0.933 5 | 1.26 | 0.082 | 0.005 | 10. | 8.3 |
| SW-N-16 | FRM | Y | 2023-11-02 | Mean of duplicates, high flow, clear and colourless. | 0.837 | 1.46 | 0.134 5 | < 0.005 | 9.36 | 7.6 |
| SW-N-16 | FRM | Y | 2023-12-19 | Mean of duplicates, high flow, clear and colourless | 0.699 5 | 1.75 | 0.093 | < 0.005 | 12.05 | 8.15 |
| SW-N-16 | FRM | Y | 2024-05-03 | Mean of duplicates, high flow, clear and colourless sample. | 0.751 | 2.83 | 0.114 5 | < 0.005 | 6.335 | 9.85 |
| SW-N-17 | SS | N | 2023-06-26 | Extra sample for Heals range access. Very low flow, slightly turbid sample | 0.682 | 0.558 | 0.094 | < 0.005 | 14.7 | 4.4 |
| SW-N-17 | SS | N | 2023-11-02 | Moderate flow, clear and colourless. | 0.448 | 0.24 | 0.138 | < 0.005 | 1.88 | 6.1 |
| SW-N-17 | SS | N | 2023-12-19 | Moderate flow, clear and colourless | 0.562 | 0.276 | 0.13 | < 0.005 | 1.6 | 3.8 |
| SW-N-17 | SS | N | 2024-02-27 | High flow. Very turbid, very slightly brown. | 0.492 | 0.171 | 0.113 | < 0.005 | 1.46 | 2.9 |
| SW-N-19 | SS | N | 2023-05-02 | Low flow, clear and colourless. | 1.25 | 2.68 | 0.138 | < 0.005 | 2.06 | 9.9 |
| SW-N-19 | SS | N | 2023-11-07 | Moderate flow, Clear and very slightly yellow. Sample collection delayed due to logging in the ar | 0.77 | 1.95 | 0.134 | < 0.005 | 3.9 | 10. |
| SW-N-19 | SS | N | 2023-12-19 | High flow, clear and colourless. | 0.683 | 2.53 | 0.115 | < 0.005 | 3.21 | 9.6 |
| SW-N-19 | SS | N | 2024-03-05 | High flow, clear and colourless, slightly sudsy sample. | 0.845 | 3.72 | 0.138 | < 0.005 | 6.88 | 11. |
| SW-N-41S1 | FRM | Y | 2023-12-18 | Mean of duplicates, low flow, clear colourless | 0.261 5 | 0.103 5 | 0.08 | < 0.005 | 0.695 | 1.85 |
| SW-N-41S1 | FRM | Y | 2024-05-03 | Mean of duplicates, moderate-low flow. Clear and colourless | 0.288 | 0.048 | 0.1 | < 0.005 | 0.475 | 1.8 |
| SW-N-42S1 | FRM | Y | 2023-05-02 | Mean of duplicates, low flow, clear and colourless. | 0.690 5 | 0.135 5 | 0.058 5 | < 0.005 | 2.205 | 2.95 |
| SW-N-42S1 | FRM | Y | 2024-05-03 | Mean of duplicates, high flow, clear and colourless | 0.507 | 0.109 5 | 0.056 | < 0.005 | 0.8 | 2.85 |
| SW-N-41S3 | SS | N | 2023-11-01 | Low flow, clear and colourless. | 0.353 | 0.109 | 0.122 | < 0.005 | 0.26 | 1.6 |
| SW-N-42S1 | FRM | Y | 2023-05-02 | Mean of duplicates, low flow, clear and colourless. | 0.690 5 | 0.135 5 | 0.058 5 | < 0.005 | 2.205 | 2.95 |
| SW-N-42S1 | FRM | Y | 2024-05-03 | Mean of duplicates, high flow, clear and colourless | 0.507 | 0.109 5 | 0.056 | < 0.005 | 0.8 | 2.85 |
| SW-N-45 | SS | N | 2023-11-02 | Moderately low flow, clear and colourless. | 0.922 | 0.533 | 0.528 | < 0.005 | 2.64 | 6.5 |
| SW-N-45 | SS | N | 2023-12-19 | Low moderate flow, clear colourless | 0.962 | 0.385 | 0.251 | 0.01 | 2.02 | 3.9 |
| SW-N-45 | SS | N | 2024-02-27 | Low flow. Clear and colourless sample. | 0.916 | 0.257 | 0.258 | < 0.005 | 1.04 | 3. |
| SW-N-54 | SS | N | 2023-05-02 | Very low flow, clear, very slightly yellow | 0.702 | 2.6 | 0.248 | 0.005 | 0.56 | 14. |
| SW-N-54 | SS | N | 2023-11-03 | Moderate flow, clear and slightly yellow sample. | 0.768 | 1.75 | 0.266 | < 0.005 | 0.53 | 17. |
| SW-N-54 | SS | N | 2023-12-20 | Low flow, clear colourless | 0.747 | 2.84 | 0.341 | < 0.005 | 0.37 | 23. |
| SW-N-54 | SS | N | 2024-03-06 | Moderate flow. Clear, very slightly yellow. | 0.619 | 2.52 | 0.332 | < 0.005 | 3.31 | 19. |
| SW-N-55 | SS | N | 2023-12-12 | Moderate flow, clear colourless. New station added | 0.094 | 0.108 | 0.926 | 0.005 | 11.5 | 3.1 |
| SW-N-55 | SS | N | 2024-03-06 | Moderate flow, clear and colourless sample. | 0.207 | 0.147 | 0.757 | < 0.005 | 22. | 2.8 |
| SW-N-56 | SS | N | 2023-12-12 | Moderate flow, clear colourless. New station added | 0.125 | 0.16 | 0.061 | 0.005 | 0.21 | 3.9 |
| SW-N-56 | SS | N | 2024-03-06 | Moderate-high flow. Clear and colourless sample. | 0.134 | 0.148 | 0.041 | < 0.005 | < 0.1 | 3.2 |
| SW-N-57 | SS | N | 2023-11-03 | Moderate flow, clear and colourless. | 5.7 | 1.12 | 1.73 | < 0.005 | 2.07 | 0.67 |
| SW-N-57 | SS | N | 2024-03-06 | High flow. Clear and colourless sample. | 2.04 | 0.932 | 0.773 | < 0.005 | 0.49 | 1.1 |
| SW-N-63 | SS | N | 2023-05-02 | Moderate high flow, clear and colourless | 0.327 | 0.713 | 0.1 | < 0.005 | 0.58 | 4.1 |
| SW-N-63 | SS | N | 2023-11-02 | Moderately low flow, clear and colourless. | 0.49 | 1.01 | 0.199 | < 0.005 | 2.85 | 14. |
| SW-N-63 | SS | N | 2024-03-05 | High flow. Clear and colourless sample. | 0.304 | 0.351 | 0.071 | < 0.005 | 0.55 | 3.6 |
| SW-N-64 | SS | N | 2023-05-02 | Moderate flow, clear slightly yellow | 0.339 | 1.84 | 0.098 | 0.006 6 | 4.62 | 16. |
| SW-N-64 | SS | N | 2023-11-02 | Extra low flow, clear and very slightly yellow sample. | 0.484 | 2.3 | 0.105 | 0.005 6 | 8.03 | 13. |
| SW-N-64 | SS | N | 2023-12-18 | Moderate flow, clear and colourless | 0.302 | 0.597 | 0.046 | < 0.005 | 3.13 | 7.1 |
| SW-N-64 | SS | N | 2024-03-05 | High flow. Clear and colourless sample. | 0.263 | 0.578 | 0.054 | < 0.005 | 1.68 | 6.6 |
| SW-N-65 | SS | N | 2023-05-02 | Moderate flow, clear slightly yellow | 0.356 | 1.61 | 0.101 | 0.005 2 | 2.17 | 13. |
| SW-N-65 | SS | N | 2023-11-02 | Moderately low flow, clear and slightly yellow sample. | 0.472 | 1.69 | 0.154 | 0.008 3 | 5.77 | 13. |
| SW-N-65 | SS | N | 2023-12-18 | Moderate flow, clear and colourless | 0.33 | 0.781 | 0.06 | < 0.005 | 5.04 | 5.7 |
| SW-N-CS2 | SS | N | 2023-12-18 | Moderate flow, clear colourless | 0.089 | 0.052 | 0.067 | < 0.005 | 0.84 | 1.3 |
| SW-N-CS2 | SS | N | 2024-03-05 | High flow. Clear and colourless. Additional sample collected to coincide with new SW-N-66 static | 0.101 | < 0.02 | 0.07 | < 0.005 | 0.52 | 1.7 |

# Hartland Landfill Groundwater, Surface Water and Leachate Monitoring Program Annual Report (Apr 2023 to Mar 2024)
## Table 7-1. Surface Water Quality Exceedances 2023-2024

| B.C. Water Quality Guidelines | | | | BC WQG-STA (1) | --- | --- | --- | --- | --- |
|---|---|---|---|---|---|---|---|---|---|
| | | | | BC WQG-LTC (1) | --- | --- | --- | --- | variable (10) |
| Station | Sample Type | Compliance Well (Y/N?) | Date Sampled | PARAMETER | Molybdenum | Nickel | Selenium | Silver | Zinc |
| | | | | STATE | DIS | DIS | DIS | DIS | DIS |
| | | | | UNIT | µg/L | µg/L | µg/L | µg/L | µg/L |
| | | | | Method Detection Limit (MDL) | 0.05 | 0.02 | 0.04 | 0.005 | 0.1 |
| | | | | Limit of Quantification (LOQ) | 0.25 | 0.1 | 0.2 | 0.025 | 0.5 |
| SW-S-03 | FRM | N | 2023-05-03 | Mean of duplicates, moderate low flow, clear & colourless | 0.258 5 | 1.065 | 0.079 5 | 0.005 | 8.11 |
| SW-S-03 | SS | N | 2023-11-01 | Moderate flow, clear and colourless. | 0.302 | 0.468 | 0.141 | < 0.005 | 3.99 |
| SW-S-03 | SS | N | 2023-12-15 | Moderate high flow, clear colourless | 0.116 | 1.12 | 0.069 | < 0.005 | 8.17 |
| SW-S-03 | SS | N | 2024-03-07 | Moderate flow. Clear and colourless sample. Sampled from mini waterfall. | 0.103 | 0.846 | 0.066 | < 0.005 | 2.66 |
| SW-S-04 | FRM | Y | 2023-05-02 | Mean of duplicates, moderately low flow, clear & colourless | 0.145 | 0.303 | 0.062 5 | 0.005 | 1.525 |
| SW-S-04 | FRM | Y | 2023-11-01 | Mean of duplicates, moderate flow, clear and colourless. | 0.126 5 | 0.504 5 | 0.075 5 | < 0.005 | 2.615 |
| SW-S-04 | FRM | Y | 2023-05-12 | Mean of duplicates, high flow, clear and colourless | 0.139 | 0.41 | 0.064 | < 0.005 | 2.545 |
| SW-S-04 | FRM | Y | 2024-03-07 | Mean of duplicates, high flow, clear and colourless | 0.109 5 | 0.339 | 0.059 5 | < 0.005 | 2.09 |
| SW-S-12 | SS | N | 2023-05-02 | Moderate low flow, clear & colourless sample | 0.096 | 1.77 | 0.078 | 0.005 | 2.77 |
| SW-S-12 | FRM | N | 2023-11-02 | Mean of duplicates, high flow, clear and colourless. | 0.096 | 2.64 | 0.143 5 | 0.005 3 | 4.675 |
| SW-S-12 | FRM | N | 2023-12-15 | Mean of duplicates, high flow, clear colourless | 0.058 5 | 1.495 | 0.067 5 | 0.005 | 4.31 |
| SW-S-12 | FRM | N | 2024-03-07 | Mean of duplicates, moderate-high flow. Clear and colourless sample. Dunked bottles in wier | < 0.05 | 1.295 | 0.089 5 | < 0.005 | 3.7 |
| SW-S-20 | SS | N | 2023-11-02 | Moderately low flow, clear and colourless. | < 0.05 | 0.453 | 0.08 | 0.005 4 | 10.4 |
| SW-S-20 | SS | N | 2023-12-15 | High flow, clear colourless | 0.06 | 0.294 | 0.052 | < 0.005 | 8.69 |
| SW-S-21 | SS | N | 2023-12-15 | High flow, clear colourless | 0.07 | 0.185 | 0.055 | < 0.005 | 7.54 b |
| SW-S-21 | SS | N | 2024-03-07 | Moderate-high flow. Clear and colourless sample. | 0.075 | 0.115 | 0.054 | < 0.005 | 6.13 b |
| SW-S-24 | SS | N | 2023-05-02 | Moderate low flow, clear & colourless sample | 0.181 | 0.409 | 0.068 | 0.005 | 2.15 |
| SW-S-24 | SS | N | 2023-11-01 | Moderate flow, clear and colourless. | 0.113 | 0.462 | 0.061 | < 0.005 | 3.66 |
| SW-S-24 | SS | N | 2023-12-15 | High flow, clear colourless | 0.142 | 0.478 | 0.057 | < 0.005 | 3.33 |
| SW-S-24 | SS | N | 2024-03-07 | Moderate-high flow. Clear and colourless sample. Dipped in weir | 0.151 | 0.448 | 0.069 | < 0.005 | 2.09 |
| SW-S-27 | SS | N | 2023-11-01 | Low flow, clear and colourless. | 0.148 | 0.403 | 0.07 | < 0.005 | 1.59 |
| SW-S-27 | SS | N | 2023-12-15 | High flow, clear colourless | 0.132 | 0.75 | 0.053 | < 0.005 | 5.3 |
| SW-S-27 | SS | N | 2024-03-07 | Moderate flow. Clear and colourless sample. Used pump to collect pumped sample. | 0.126 | 0.654 | 0.053 | < 0.005 | 2.19 |
| SW-S-52 | SS | N | 2023-12-18 | High flow, clear colourless | < 0.05 | 0.17 | 0.046 | < 0.005 | 1.82 |

| B.C. Water Quality Guidelines | | | | BC WQG-STA (1) | --- | --- |
|---|---|---|---|---|---|---|
| | | | | BC WQG-LTC (1) | --- | --- |
| Station | Sample Type | Compliance Well (Y/N?) | Date Sampled | PARAMETER | Silver | Dissolved Organic Carbon |
| | | | | STATE | DIS | Dissolved |
| | | | | UNIT | µg/L | mg/L |
| | | | | Method Detection Limit (MDL) | 0.005 | 0.5 |
| | | | | Limit of Quantification (LOQ) | 0.025 | 2.5 |
| SW-S-03 | FRM | N | 2023-05-03 | Mean of duplicates, moderate low flow, clear & colourless | 0.005 | 5.15 |
| SW-S-03 | SS | N | 2023-11-01 | Moderate flow, clear and colourless. | < 0.005 | 24. |
| SW-S-03 | SS | N | 2023-12-15 | Moderate high flow, clear colourless | < 0.005 | 4.2 |
| SW-S-03 | SS | N | 2024-03-07 | Moderate flow. Clear and colourless sample. Sampled from mini waterfall. | < 0.005 | 3.8 |
| SW-S-04 | FRM | Y | 2023-05-02 | Mean of duplicates, moderately low flow, clear & colourless | 0.005 | 2.65 |
| SW-S-04 | FRM | Y | 2023-11-01 | Mean of duplicates, moderate flow, clear and colourless. | < 0.005 | 2.8 |
| SW-S-04 | FRM | Y | 2023-05-12 | Mean of duplicates, high flow, clear and colourless | < 0.005 | 4.1 |
| SW-S-04 | FRM | Y | 2024-03-07 | Mean of duplicates, high flow, clear and colourless | < 0.005 | 3. |
| SW-S-12 | SS | N | 2023-05-02 | Moderate low flow, clear & colourless sample | 0.005 | 5.8 |
| SW-S-12 | FRM | N | 2023-11-02 | Mean of duplicates, high flow, clear and colourless. | 0.005 3 | 5.05 |
| SW-S-12 | FRM | N | 2023-12-15 | Mean of duplicates, high flow, clear colourless | 0.005 | 87.65 |
| SW-S-12 | FRM | N | 2024-03-07 | Mean of duplicates, moderate-high flow. Clear and colourless sample. Dunked bottles in wier | < 0.005 | 4.45 |
| SW-S-20 | SS | N | 2023-11-02 | Moderately low flow, clear and colourless. | 0.005 4 | 7.9 |
| SW-S-20 | SS | N | 2023-12-15 | High flow, clear colourless | < 0.005 | 5.2 |
| SW-S-21 | SS | N | 2023-12-15 | High flow, clear colourless | < 0.005 | 4.6 |
| SW-S-21 | SS | N | 2024-03-07 | Moderate-high flow. Clear and colourless sample. | < 0.005 | 3.3 |
| SW-S-24 | SS | N | 2023-05-02 | Moderate low flow, clear & colourless sample | 0.005 | 3.7 |
| SW-S-24 | SS | N | 2023-11-01 | Moderate flow, clear and colourless. | < 0.005 | 3.8 |
| SW-S-24 | SS | N | 2023-12-15 | High flow, clear colourless | < 0.005 | 4.2 |
| SW-S-24 | SS | N | 2024-03-07 | Moderate-high flow. Clear and colourless sample. Dipped in weir | < 0.005 | 3.6 |
| SW-S-27 | SS | N | 2023-11-01 | Low flow, clear and colourless. | < 0.005 | 4.1 |
| SW-S-27 | SS | N | 2023-12-15 | High flow, clear colourless | < 0.005 | 4.2 |
| SW-S-27 | SS | N | 2024-03-07 | Moderate flow. Clear and colourless sample. Used pump to collect pumped sample. | < 0.005 | 3.9 |
| SW-S-52 | SS | N | 2023-12-18 | High flow, clear colourless | < 0.005 | 2.2 |

**Notes:**

| | |
|---|---|
| *na* | *Not applicable.* |
| *Null* | *No sample collected.* |
| **a** | *Above short-term acute (STA) British Columbia* |
| **b** | *Above long-term chronic (LTC) British Columbia Water Quality Guideline.* |
| | *Unreliable Ammonia Concentrations* |
| *BC CSR* | *CSR-Sch3.2: BC Contaminated Site Regulation - Schedule 3.2 - Generic Numerical Water Standards, effective on November 1, 2017.* |
| *(1)* | *British Columbia Approved Water Quality Guidelines (Criteria), 1998 Edition, Updated in August 2023. 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)* | *above STA 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 landfill are derived from stations Sw-S-52 .* |
| *(8)* | *Dissolved copper guideline varies with water hardness, temperature and DOC, and calcuated using BLM;* |
| *(9)* | *Total Aluminum guidance is pH, hardness, and DOC dependent and calculated based on BC Water Quality Guideline calculator for Aluminum in Freshwater. Due to anomalously high DOC concentrations resulting from the use of compromised laboratory-supplied preservatives, the aluminum guideline is based on the 2021/22 average DOC concentration of 4.5 mg/L across the landfill. Ecosystems.* |
| *(10)* | *Dissolved Zinc guidance is pH, hardness, and DOC dependent. Due to anomalously high DOC concentrations resulting from the use of compromised laboratory-supplied preservatives, the aluminum guideline is based on the 2021/22 average DOC concentration of 4.5 mg/L across the landfill.* |
| *(11)* | *Aquatic Life (AW) Freshwater, Column 3.* |
| *(12)* | *Drinking Water (DW), Column 6.* |

## 7.12 Assessment of Surface Water Quality Impacts

The primary causes of surface water quality degradation at the Site include landfill leachate, road salting, and aggregate runoff. Magnesium lignosulphonate has been used for dust suppression on gravel roads since 2014 and likely contributes sulphate, nitrate, nitrite, and/or ammonia to the surface water system (Appendix I). Surface water quality data collected at the landfill is interpreted with consideration for the following:

- 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/nitrate concentrations are typically below 0.01 mg/L, but occasionally exceed 0.1 mg/L in 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.
- Leachate: 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 of these parameters are typically observed during the dry summer and early fall months, when flows are low and there is limited dilution by precipitation.
- Aggregate: Surface water is considered impacted by 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). Note that in recent years, highly elevated nitrate concentrations have been observed at the landfill in the absence of sulphate concentrations exceeding 75 mg/L, so aggregate runoff impacts are interpreted on a case-by-case basis. Peak concentrations of these parameters 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, aggregate stockpiling or aggregate placement.
- Road Salt: 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.

As noted in Section 3.2.3, throughout 2023 the CRD observed anomalously low ammonia concentrations in the North and South Purge Wells and anomalously high ammonia concentrations where concentrations are typically low. The CRD worked with ALS and BV labs to investigate the root cause of the anomalous ammonia concentrations, and they determined that a set of sample bottles contained too much of the sample preservative. The same type of sample bottles were used during all sampling events in 2023. Hence, ammonia data collected in Q1 of 2024 are the only reliable data available from the 2023/24 monitoring period, and the remaining data was not analyzed or interpreted. Cells containing ammonia concentration data collected in 2023 are hatched in Appendix B-3 and Table 7-1.

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 at the property boundary, standard CSR protocols for notification of affected property owners should be followed.

## 7.13 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, which discharges 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 quality monitoring stations located off-site are used to monitor surface water quality

around the landfill. Surface water quality data was collected at eight (8) locations south and west of the landfill, 21 locations north of the Phase 1 and Phase 2 landfill areas, five (5) locations northwest of the landfill (Hartland North Pad). Surface water samples are collected four times per year from Boundary Compliance Stations and other key locations and twice per year from all other monitoring stations. Samples cannot be collected when watercourses are dry.

In December 2022, a total of five (5) surface water stations (SW-N-57, SW-N-58, SW-N-59, SW-N-60, SW-N-61 and SW-N-62) were established within the footprint of the Phase 2 landfill and quarry. These stations aim to monitor surface water quality impacts related to landfill activities. In 2023/24, many of these stations were either dry or only yielded a single set of data.

In February 2023, SW-N-63, SW-N-64, and SW-N-65 were established near the confluence of Durrance Creek and Heal Creek to assess and delineate any water quality impacts related to aggregate in the receiving environment.

In 2023/24, two surface water monitoring locations (SW-N-55 and SW-N-56) were reactivated to monitor water quality downstream of the Northeast Stockpile. These stations are utilized to monitor water quality impacts related to aggregate runoff.

Surface water sampling points utilized in the 2023/24 monitoring program include:

South and West of the Landfill

- Sw-S-03
- Sw-S-04 - compliance
- Sw-S-12
- Sw-S-20
- Sw-S-21
- Sw-S-24
- Sw-S-27
- Sw-S-52

North of the Hartland North Pad

- Sw-N-41s1 - compliance
- Sw-N-41s3
- Sw-N-41s4
- Sw-N-42s1 - compliance
- Sw-N-CS2

North of Phase 1 and Phase 2

- Sw-N-05 - compliance
- Sw-N-14
- Sw-N-15
- Sw-N-16 - compliance
- Sw-N-17
- Sw-N-18
- Sw-N-19
- Sw-N-45
- Sw-N-53
- Sw-N-54
- Sw-N-55
- Sw-N-56
- Sw-N-57
- Sw-N-58
- Sw-N-59

North of Phase 1 and Phase 2

- Sw-N-60
- Sw-N-61
- Sw-N-62
- Sw-N-63
- Sw-N-64
- Sw-N-65

## 7.14 Overview of Surface Water Exceedances

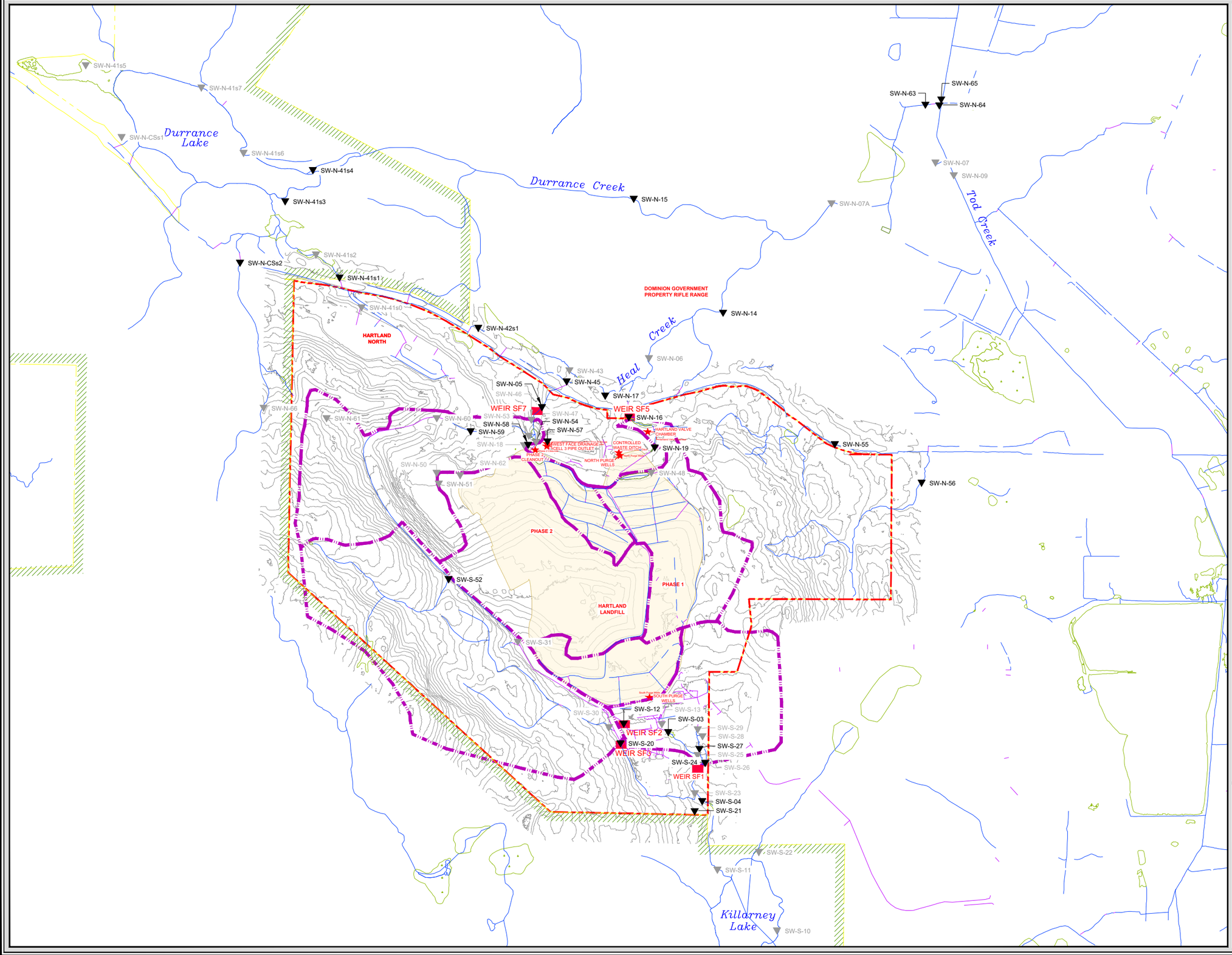
Surface water analytical results were compared to the approved and working BCWQG AW criteria in Appendix B.3. A summary of surface water exceedances is presented in Table 7-1. In 2023/24, surface water quality data met the BCWQG-STA for all parameters except TSS, total iron, total lead, nitrite, nitrate, and dissolved copper and iron concentrations. The TSS, iron, copper, and aluminum exceedances likely reflect natural mineral dissolution or low flow/turbulent sampling conditions, whereas nutrient exceedances are interpreted to reflect impacts due to runoff from the aggregate stockpiles. Dissolved copper concentration exceedances are often reported at background monitoring locations and sampling locations with no water quality impacts associated with landfill operations. Magnesium lignosulphonate may have contributed to the elevated conductivity, sulphate, ammonia, and nitrate concentrations. Overall, elevated solute concentrations were most apparent in November 2023 and thereafter, following major precipitation events.

## 7.15 Surface Water Quality North of Phase 1

Clean runoff from the Phase 1 closure and the eastern perimeter of the landfill is directed to the NWSP and then into the wetland located north of the Lower Leachate Lagoon. The wetland 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 were 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 northeast from just north of the NWSP to the confluence with Durrance Creek, as shown in Figure 4-1. Durrance Creek discharges to Tod Creek, which 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. The creek dries up during the summer months except in the lower reaches where groundwater discharge maintains flow year-round.

Figures 7-2 and 7-3 present solute concentration and conductivity trends observed at surface water monitoring stations in the north area of the landfill and beyond the northern property boundary. In Figure 7-2, the distance of each station from the landfill boundary is shown in brackets in the legend.




## 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
- Contours based on 24-W542_2023_base.dwg, April 2024.
- 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: | MM | Prepared by: | SP |
| Date Issued: | June 2024 | Project Number: | 60631284 |

CRD
Making a difference...together

Project: Hartland Landfill Monitoring
Location: Saanich, BC

# Surface Water Bodies and Sampling Locations (September 2023)

AECOM

**Figure 7-1**

File Location: L:\LEGACY\CABNY1FP001\PROD\PROJECTS\60631284\900-CAD_GIS\910-CAD\20-SHEETS\C435 - 2023-24 ANNUAL REPORT\FIG7.1-SURFACE WATER & SAMPLE LOC-60631284-2023.DWG Date
Plotted: September 23, 2024 Saved By:AmiriN

### 7.15.1 Monitoring Site Sw-N-16

A small wetland is located just north of the Lower Leachate Lagoon. In this wetland, surface water flows north and through a weir at Sw-N-16 (Boundary Compliance Station) before discharging into a culvert under Willis Point Road and then to Heal Creek. Sw-N-16 is located on landfill property and is the compliance point used to monitor the quality of surface water leaving the landfill through this route. In 2023/24, surface water samples were collected from Sw-N-16 during four (4) sampling events.

In 2023/24, surface water parameters met all BCWQGs at Sw-N-16 except for TSS, total aluminum, nitrate, and dissolved copper concentrations, which all surpassed the BCWQG LTC. Nitrate concentrations were elevated, ranging from 1.165 to 13.75 mg/L, with an average of 7.77 mg/L. Ammonia concentrations were low to moderate for a wetland area, ranging from 0.027 to 0.865 mg/L. Chloride concentrations were above background levels, ranging from 10 to 29 mg/L, but peak chloride concentrations correlated with relatively low ammonia concentrations. TSS ranged from <1.1 to 6.8 mg/L, exceeding the BCWQG LTC during one sampling event. Dissolved copper concentrations ranged from 5.175 to 11.65 µg/L, exceeding the BCWQG LTC on all four (4) sampling events. Conductivity at Sw-N-16 was consistently elevated, ranging from 294 to 395 µS/cm, with an average of 342.5 µS/cm. Additionally, sulphate concentrations were elevated, ranging from 45 to 88 mg/L. The Mann Kendall analysis detected a statistically significant increasing trend in nitrate concentration and a decreasing trend in ammonia concentration at this location.

The surface water quality at Sw-N-16 continued to be impacted by aggregate runoff. Magnesium lignosulphonate may also have contributed to these water quality impacts. Water quality at this location should continue to be monitored to observe how these impacts progress.

### 7.15.2 Monitoring Site Sw-N-05

Another 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 at Sw-N-05 (Boundary Compliance Station). During a hydrogeochemical site investigation in 2022, surface water quality was evaluated at location Sw-N-05 and the NWSP, and AECOM determined that elevated metal and nutrient concentrations observed at Sw-N-05 were influenced by aggregate production/stockpiling and dilute leachate potentially from the northwest corner of Phase 2 (AECOM 2023). In 2023/24, surface water samples were collected from Sw-N-05 during four (4) sampling events.

Throughout the monitoring year, surface water quality at Sw-N-05 exhibited elevated and non-compliant nitrate concentrations, exceeding the BCWQG LTC during all sampling events and exceeding the BCWQG STA on one sampling event. Nitrate concentrations ranged from 9.1 to 34.95 mg/L, with an average of 17.17 mg/L. TSS exceeded the BCWQG LTC during one sampling event, and dissolved copper concentrations exceeded the BCWQG STA in February 2023 (4.56 µg/L) and exceeded the LTC during all other sampling events. Moreover, total aluminum exceeded the BCWQG LTC on one sampling event, and total iron concentration exceeded the BCWQG STA on one sampling event.

Throughout 2023/24, sulphate concentrations at Sw-N-05 were highly elevated, ranging from 110 to 210 mg/L. Ammonia concentration was below detection during Q1 of 2024, and chloride concentrations were moderate to elevated, ranging from 10 to 28 mg/L. Conductivity was elevated consistently, ranging from 408 to 577 µS/cm. The Mann Kendall analysis detected statistically significant increasing trends conductivity, chloride and nitrate concentrations at this location.

The elevated and non-compliant total iron and aluminum concentrations observed at Sw-N-05 likely reflect low-flow conditions at the time of sampling, as indicated by the CRD's field notes. The elevated conductivity, nitrate and sulphate concentrations observed at monitoring location Sw-N-05 reflect ongoing aggregate runoff impacts, which have persisted at this location for over five (5) years. Magnesium lignosulphonate may also have contributed to these water quality impacts. Despite the elevated conductivity, ammonia and chloride concentrations, there was no indication of landfill leachate impacts because chloride concentrations were low when ammonia concentrations were elevated, and vice-versa. Water quality at this location should continue to be monitored to observe how these impacts progress. Efforts to address this non-compliant water quality should be progressed to restore compliance.

### 7.15.3 Monitoring Sites Sw-N-14

Surface water monitoring location Sw-N-14 is located offsite, north of Willis Point Road and within the Heals Rifle Range. Sw-N-14 is part of Heal Creek, upstream of the confluence with Durrance Creek. In 2023/24, surface water samples were collected at Sw-N-14 during four (4) sampling events.

At Sw-N-14, surface water quality exceedances to the BCWQG LTC were reported for total aluminum, total iron, nitrate, and dissolved copper concentrations. From November 2023 onward, Nitrate concentrations were elevated, exceeding the BCWQG LTC, with concentrations ranging from 5.25 to 7.23 mg/L. Throughout the monitoring period, ammonia concentrations were generally below detection, and sulphate concentrations were elevated, ranging from 27 to 90 mg/L. Chloride concentrations were slightly elevated from background levels, with an average of 15.6 mg/L. Conductivity was also elevated, ranging from 253 to 310 µS/cm.

The elevated and non-compliant total iron and aluminum concentrations could reflect turbid conditions at the time of sampling, but the elevated conductivity, nitrate and sulphate concentrations observed at monitoring location Sw-N-14 reflect ongoing aggregate runoff impacts, which have persisted at this location for over five (5) years. Water quality at this location should continue to be monitored to observed how these impacts progress and guide efforts to restore water quality north of the landfill.

### 7.15.4 Monitoring Site Sw-N-19

Sw-N-19 is located within the landfill property below the northeast freshwater retention pond, approximately 80 m east of the Lower Leachate Lagoon. Sw-N-19 is not a compliance monitoring point. This monitoring point receives runoff primarily from the bedrock/refuse interface adjacent to Phase 1 and discharges into the wetland upstream of Sw-N-16. Surface water samples were collected from Sw-N-19 during four (4) sampling events.

In 2023/24, all surface parameters were below BCWQGs, except for nitrate and dissolved copper concentrations. Nitrate concentrations exceeded the BCWQG LTC on all sampling events, with concentrations ranging from 3.79 to 8.43 mg/L. Dissolved copper concentrations exceeded the BCWQG LTC during two sampling events, with concentrations of 11.5 and 19.1 µg/L. Sulphate concentrations were elevated, ranging from 44 to 100 mg/L, and ammonia and chloride concentrations were low, except for one chloride concentration (29 mg/L) measured in May 2023. The Mann Kendall analysis detected a statistically significant decreasing trend in sulphate concentration at this location.

The elevated conductivity, nitrate and sulphate concentrations observed at monitoring location Sw-N-19 reflect ongoing aggregate runoff impacts, which have persisted at this location for over five (5) years. The dissolved copper concentration exceedances likely reflect natural bedrock mineral dissolution. Water quality at this location should continue to be monitored to observed how these impacts progress.

### 7.15.5 Monitoring Sites Sw-N-45 and Sw-N-17

Sw-N-45 is located north of Phase 2, outside the landfill property boundary and on the north side of Willis Point Road. In 2023/24, surface water was sampled from Sw-N-45 during three (3) sampling events.

Surface water quality parameters at SW-N-45 met all applicable BCWQGs, except for nitrate and dissolved copper concentrations. Nitrate concentration exceeded the BCWQG LTC on all sampling events, with concentrations ranging from 6.64 to 18.5 mg/L, and dissolved copper concentrations exceeded the BCWQG LTC during two sampling events, with concentrations of 1.14 to 1.64 µg/L. Sulphate concentrations were elevated, ranging from 100 to 120 mg/L, as well as conductivity, which ranged from 359 to 550 µS/cm. Ammonia concentrations were below detection during Q1 of 2024, and chloride concentrations were elevated, ranging from 19 to 38 mg/L. The Mann Kendall analysis detected a statistically significant increasing trend in chloride concentration at this location.

Sw-N-17 is located north of Willis Point Road and downstream of Sw-N-45 (and Sw-N-05). At this location, surface water quality exceedances to the BCWQG LTC were reported for TSS (1), total aluminum (2), nitrate (3), and dissolved copper concentrations (1). Moreover, total iron concentration (1.34 mg/L) exceeded the BCWQG STA during one sampling event. Throughout 2023/24, conductivity and sulphate concentrations at Sw-N-17 were elevated, ranging from 325 to 423 µS/cm and 78 to 120 mg/L, respectively. Nitrate concentrations ranged from 0.191 to 3.85 mg/L, with an average of 2.74 mg/L. Ammonia concentration was low (0.017 mg/L) during Q1 of 2024, and chloride concentrations were elevated, ranging from 21 to 41 mg/L. The Mann Kendall analysis detected a statistically significant increasing trend in chloride concentration at this location.

The elevated conductivity, nitrate and sulphate concentrations observed at monitoring locations Sw-N-17 and Sw-N-45 reflect ongoing aggregate runoff impacts in the receiving environment downstream of the landfill, which have persisted for over five (5) years. Magnesium lignosulphonate may also have contributed to these water quality impacts. The dissolved copper concentrations likely reflect natural bedrock mineral dissolution. Water quality at these locations should continue to be monitored to observed how these impacts progress. The increasing chloride concentration trends likely reflect road salting.

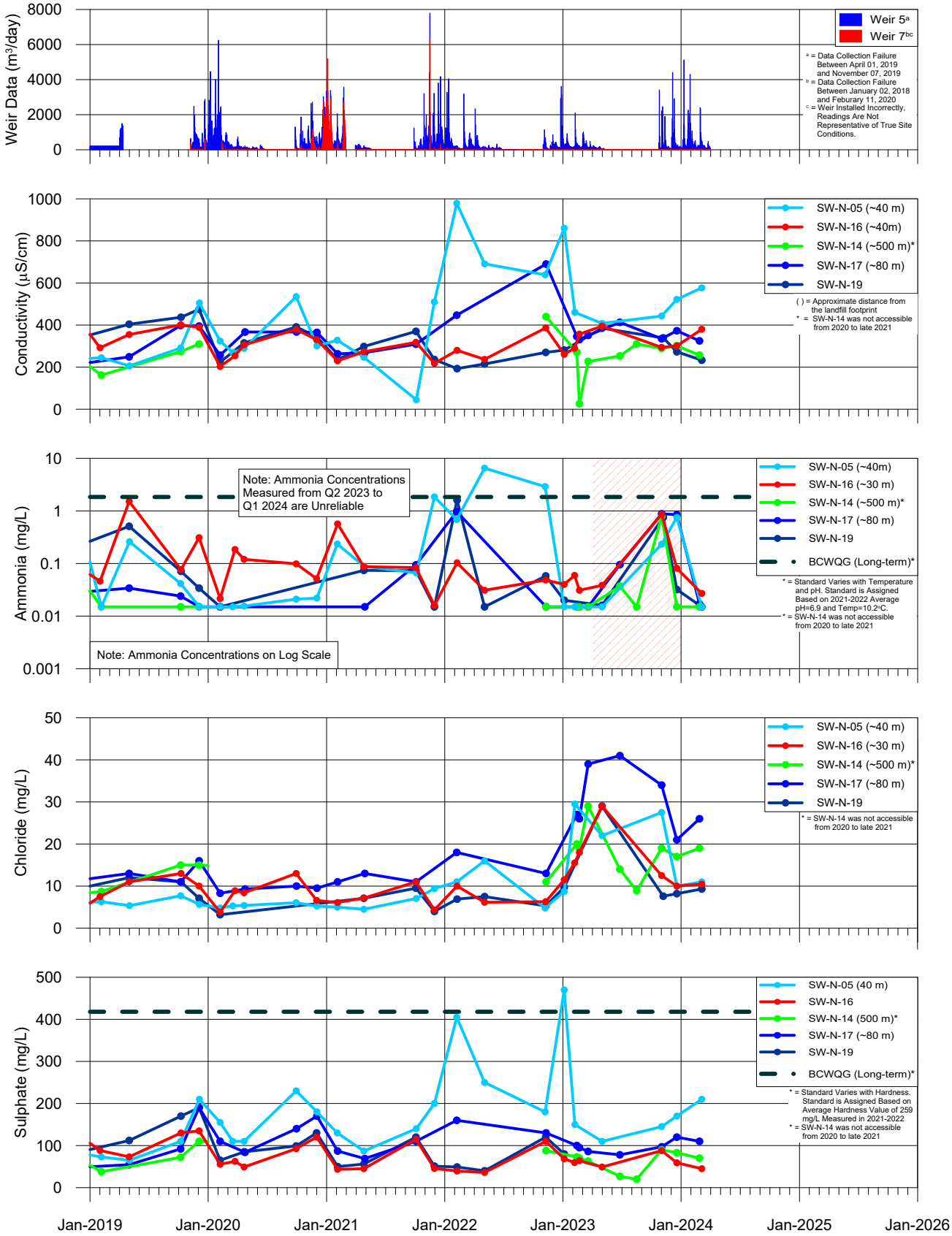



Figure 7-2. Surface Water Quality North of Phase 1

## 7.16 Surface Water Quality North of Phase 2

### 7.16.1 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 ridge to the south of the North Pad (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 Residuals Treatment Facility (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 anaerobically digests 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.

#### 7.16.1.1 Monitoring Sites Sw-N-41s1, Sw-N-41s3, Sw-N-41s4, Sw-N-42s1, and Sw-N-CSs2

Figure 7-5 presents conductivity, ammonia, chloride, and sulphate concentrations at sampling locations along the ephemeral channel at the northwest corner of the Hartland North Pad and the drainage channel discharging into Durrance Lake at stations Sw-N-41s1, Sw-N-41s3, Sw-N-41s4, Sw-N-42s1, and Sw-N-CSs2, which are located off-site. Sw-N-41s1 and Sw-N-42s1 are Boundary Compliance Stations.

At Sw-N-41s1, surface water quality parameters met all applicable BCWQGs, except for TSS, total aluminum, and total iron concentrations. TSS and total iron concentrations exceeded the BCWQG STA on one sampling event, with concentrations of 61 and 1.021 mg/L, respectively. Total aluminum concentration exceeded the BCWQG LTC during two sampling events, with concentrations of 0.264 and 0.496 mg/L. Average conductivity was elevated, at 329.4 µS/cm, as well as sulphate concentrations, which ranged from 59 to 97.5 mg/L. Nitrate concentrations were elevated, ranging from 0.529 to 1.008 mg/L, with an average of 0.789 mg/L. Chloride and ammonia concentrations, ranged from low to non-detectable values. The Mann Kendall analysis detected a statistically significant decreasing trend in sulphate concentration at this location.

At Sw-N-41s3, surface water quality parameters met all applicable BCWQGs, except for TSS, total aluminum, and total iron concentrations. TSS and total aluminum concentrations exceeded the BCWQG LTC during one sampling event, with concentrations of 5.2 and 1.35 mg/L, respectively. Total iron concentration exceeded the BCWQG STA on one sampling event, with a concentration of 1.32 mg/L. Conductivity was elevated slightly, with an average of 212.7 µS/cm. Sulphate concentrations were low, with an average of 18.5 mg/L, and nitrate concentrations were elevated, ranging from 0.288 to 0.898 mg/L, with an average of 0.585 mg/L. Chloride and ammonia concentrations ranged from low to non-detectable values.

At Sw-N-41s4, surface water quality parameters met all applicable BCWQGs during all sampling events. Ammonia concentration was below detection during Q1 of 2024, and nitrate concentrations were low to elevated, ranging from 0.02 to 0.213 mg/L, with an average of 0.118 mg/L. Conductivity, sulphate and chloride concentration were low to moderate.

At Sw-N-42s1, surface water quality parameters met all applicable BCWQGs, except for TSS (5.8 mg/L) and dissolved copper concentration (0.927 µg/L), which exceeded the BCWQG LTC during one sampling event. Conductivity was elevated, ranging from 286 to 515 µS/cm, with an average of 367 µS/cm. Ammonia concentration was below detection during Q1 of 2024, and nitrate concentrations were elevated, with an average of 0.188 mg/L. Sulphate and chloride concentrations were also elevated, with averages of 72.88 mg/L and 26.38 mg/L, respectively. Elevated chloride concentrations did not correlate with elevated ammonia concentrations and were highest during winter months, suggesting possible road salt impacts. The Mann Kendall analysis detected a statistically significant decreasing trend in chloride concentration at this location.

Historically, Sw-N-CSs2 was used to monitor background surface water quality. In 2023/24, surface water samples were collected during two (2) sampling events. All surface water parameters met BCWQGs except dissolved copper concentration on both sampling events. Dissolved copper concentrations ranged from 0.355 to 1.16 µg/L. Sulphate and chloride concentrations were low, and nitrate concentrations were moderate to elevated, ranging from 0.846 to 1.19 mg/L. Ammonia concentrations were below detection, and conductivity was low to moderate, ranging from 102 to 160 µS/cm. The Mann

Kendall analysis detected a statistically significant increasing trend in nitrate concentration at this location. Due to elevated nitrate concentrations, this location can no longer be used to monitor background surface water quality.

Overall, surface water quality downstream of the Hartland North Pad exhibited evidence of aggregate runoff impacts at both compliance monitoring points Sw-N-41s1 and Sw-N-42s1. Additionally, elevated nitrate concentrations observed at monitoring points Sw-N-41s3, Sw-N-41s4, and Sw-N-CSs2 may reflect dilute aggregate runoff impacts, although sulphate concentrations were generally low. Chloride concentrations have generally increased in this area of the receiving environment, which likely reflects the impact of road salting, given the relatively low to non-detectable ammonia concentrations. However, it is not possible to determine if road salting caused the elevated chloride concentrations because sodium concentrations have not been included in the surface water quality analytical suite. Surface water quality in the receiving environment downstream of the Hartland North Pad should continue to be monitored closely to confirm the function of environmental protection measures associated with the RTF and Hartland North Pad.

### 7.16.2 Surface Water Quality in the Phase 2 Area

Due to the dilute leachate impacts and ongoing quarrying activities in the Phase 2 area, the CRD has implemented mitigation measures to manage water quality, particularly in the Toutle Valley and around the NWSP. 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.

#### 7.16.2.1 Monitoring Sites Sw-N-54 and Sw-N-57

Sw-N-54 and Sw-N-57 (not Boundary Compliance stations) are located adjacent to the Upper Leachate Lagoon. Sw-N-54 monitors discharge from the northwest freshwater retention pond to Phase 2 Cell 1 and the NWSP. Sw-N-57 is a pipe outlet at the west end of Upper Lagoon that collects surface water runoff from Shane's Pond and the Toutle Valley. Sw-N-57 was implemented to capture surface flow in the Toutle Valley and some runoff from the Northwest Stockpile to mitigate aggregate runoff impacts in the receiving environment.

At Sw-N-57, surface water samples were collected during two sampling events, and all surface water quality parameters met applicable BCWQGs, except for total aluminum, nitrite, and nitrate concentrations. Nitrite concentrations exceeded the BCWQG STA during one sampling event, with a concentration of 0.15 mg/L, and nitrate exceeded the BCWQG LTA on both sampling events, with concentrations ranging from 4.73 to 11.8 mg/L. Sulphate concentrations were elevated during both sampling events, ranging from 150 to 200 mg/L, and ammonia concentrations were low. Chloride concentrations were low, and conductivity was elevated, ranging from 381 to 519 µS/cm.

At Sw-N-54, surface water parameters met applicable BCWQGs, except for TSS, total aluminum, total iron, dissolved copper, and nitrate concentrations. TSS (11 mg/L) and total aluminum (0.923 mg/L) concentrations exceeded the BCWQG LTC on one sampling event, while total iron concentration (1.7 mg/L) exceeded the BCWQG STA. Dissolved copper concentrations exceeded the BCWQG LTC during two sampling events, ranging from 26.7 to 29.5 µg/L, and nitrate concentration exceeded the BCWQG LTC during all sampling events, with concentrations ranging from 3.94 to 17.2 mg/L, and an average of 11.6 mg/L. Ammonia concentrations were low (0.018 mg/L) during Q1 of 2024, and nitrate concentrations were low to elevated, ranging from 0.0097 to 0.126 mg/L. Additionally, conductivity and sulphate concentrations were elevated, with averages of 398.5 µS/cm and 72.8 mg/L, respectively The Mann Kendall Analysis detected statistically significant increasing trends in chloride and nitrate concentrations at this location.

Overall, surface water quality in the Phase 2 area (Sw-N-54 and Sw-N-57) continued to exhibit aggregate runoff impacts in the form of elevated conductivity, nitrate, sulphate, and occasionally ammonia and nitrite concentrations. Additionally, magnesium lignosulphonate may have impacted the water quality. The elevated TSS, total iron, total aluminum, and dissolved copper concentration exceedances likely reflect low-flow sampling conditions and natural bedrock mineral dissolution. Water quality in this area of the landfill should continue to be monitored to observed how these impacts progress.

## 7.17 Surface Water Quality Further North of the Landfill

Since 2022/23, surface water samples have been collected at three locations (SW-N-63, SW-N-64, and SW-N-65), approximately 900 m northeast of Hartland, at the confluence of Durrance and Tod creeks. These stations are not boundary compliance monitoring stations. In 2023/24, surface water quality at these locations met applicable BCWQGs, except for TSS,

total aluminum, total iron, dissolved iron, dissolved copper, and a single nitrate concentration. At each of these locations, solute concentrations and conductivity tended to be highest in November 2023 after heavy precipitation events.

At Sw-N-63, nitrate concentrations were moderate to elevated, ranging from 0.474 to 3.55 mg/L, exceeding the BCWQG LTC during one sampling event. Ammonia concentrations were just above the detection limit (0.016 mg/L) during Q1 of 2024, and chloride concentrations were moderate to elevated, ranging from 8.6 to 14 mg/L. Sulphate concentrations were moderate, with an average of 25.8 mg/L, and conductivity was elevated, with an average of 195 µS/cm.

At Sw-N-64, total aluminum concentration exceeded the BCWQG LTC during one sampling event, while total and dissolved iron concentrations exceeded the BCWQG STA during two sampling events, with concentrations ranging from 1.09 to 1.62 mg/L and 0.857 to 0.863 mg/L, respectively. TSS exceeded the BCWQG LTC during one sampling event, with a concentration of 7.2 mg/L, and dissolved copper concentration (1.86 µg/L) exceeded the BCWQG LTC on one sampling event. Ammonia concentrations were below the detection limit during Q1 of 2024, and nitrate concentrations were moderate to elevated, ranging from 0.113 to 1.25 mg/L. Similarly, conductivity and sulphate concentration were low to elevated, ranging from 92 to 233 µS/cm and 9 to 68 mg/L, respectively.

At Sw-N-65, total aluminum (0.347 mg/L) and iron concentrations (1.22 mg/L) exceeded the BCWQG LTC and STA during one sampling event, respectively. During that sampling event (November 2023), TSS exceeded the BCWQG TLC, with a concentration of 7.2 mg/L. Dissolved copper concentration (2.62 µg/L) exceeded the BCWQG LTC during one sampling event, and dissolved iron concentration exceeded the BCWQG LTC during two sampling events, with concentrations ranging from 0.606 to 0.688 mg/L. Ammonia and chloride concentrations were low throughout the monitoring period, and nitrate concentrations were moderate to elevated, ranging from 0.207 to 2.48 mg/L, with the highest concentration observed in November 2023, corresponding to an elevated sulphate concentration of 60 mg/L. Other than during the November 2023 sampling event, sulphate concentrations were generally low, ranging from 5.8 to 19.0 mg/L. Conductivity was low to elevated, ranging from 83 to 213 µS/cm.

Surface water quality in this area was likely impacted by aggregate runoff from the landfill, as indicated by elevated nitrate and sulphate concentrations. Comparing samples collected from locations 63 and 64, higher nitrate concentrations were observed at location 63, where the water quality is impacted upstream by the landfill. Downstream of the confluence of Durrance and Tod creeks (location 65), surface water quality exhibited intermediate nitrate concentrations, reflecting mixing of the two streams. The nitrate may have originated from local agriculture, as nitrate is commonly used as fertilizer. Moreover, the elevated TSS, sulphate, iron, copper, and aluminum concentrations may reflect natural weathering of the bedrock. Surface water quality at these locations should continue to be monitored to assess how the impacts progress.

## 7.18 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 into 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 toward 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 (background station).
- 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.

## 7.18.1 Upgradient Surface Water Quality

### 7.18.1.1 Monitoring Site Sw-S-52

Sw-S-52 is a background monitoring location that was sampled twice in 2023/24. At this location, all surface water parameters met applicable BCWQGs, except for one dissolved copper concentration (1.31 µg/L) that exceeded the BCWQG LTC during one sampling event.

Throughout the monitoring period, solute concentrations and average conductivity (108 µS/cm) at Sw-S-52 were low, with average sulphate and chloride concentrations of 9.35 and 7.95 mg/L, respectively. Ammonia concentrations were non-detectable, and nitrate concentrations ranged from non-detectable values to 0.4 mg/L. The Mann Kendall analysis detected a statistically significant increasing trend in nitrate concentration at this location, however, it is unlikely that aggregate runoff has impacted the water quality. There is potential for aggregate dust to be transported into this area and leached by precipitation, but it is AECOM's interpretation that surface water quality at this location continued to reflect background conditions, with no definitive evidence of landfill-related impacts.

### 7.18.1.2 Monitoring Site Sw-S-20

Sw-S-20 is a surface water quality monitoring location upgradient of the Recycling Centre and south landfill entrance. Surface water samples were collected at Sw-S-20 during two sampling events. Concentrations of all parameters were below the BCWQG-STA, but TSS, total zinc, dissolved aluminum, and dissolved copper concentrations exceeded the BCWQG LTC on at least one sampling event.

In November 2023, TSS at Sw-S-20 exceeded the BCWQG LTC, with a concentration of 12 mg/L, as well as dissolved aluminum, with a concentration of 0.088 mg/L. Total zinc concentration (10.4 µg/L) exceeded the BCWQG LTC in November 2023, and dissolved copper concentrations (2.1 to 3.26 µg/L) exceeded the BCWQG LTC on both sampling events. Throughout the monitoring period, conductivity was low, with an average of 85.5 µS/cm, and sulphate and chloride concentrations were low, with average concentrations of 7.25 and 6.4 mg/L, respectively. Ammonia concentration was low, and nitrate concentration was elevated in November 2023, at 1.32 mg/L. The elevated nitrate concentration was likely influenced by aggregate runoff because it is too high to reflect background processes, which typically result in nitrate/ammonia concentrations of <0.1 mg/L, whereas the elevated TSS, zinc, copper, and aluminum concentrations can likely be attributed to natural weathering of the bedrock or turbid/low-flow conditions at the time of sampling. Solute concentrations were highest in November 2023.

## 7.18.2 Surface Water Quality Near and South of the Recycling Area

Figure 7-6 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 from each station to the landfill boundary is shown in brackets in the legend. CRD's recycling area began operation in January 2001 and Sw-S-12 is the nearest surface water monitoring location.

### 7.18.2.1 Monitoring Site Sw-S-12

In 2023/24, surface water quality parameters at Sw-S-12 met all applicable BCWGs, except for total aluminum, nitrate, and dissolved copper concentrations. Total aluminum concentration (0.257 mg/L) exceeded the BCWQG LTC during one sampling event, and dissolved copper concentration exceeded the BCWQG LTC during two sampling events, with concentrations ranging from 4.08 to 4.41 µg/L. Throughout the monitoring period, nitrate concentrations were elevated, ranging from 2.455 to 3.685 mg/L, with an average of approximately 2.86 mg/L. Ammonia and sulphate concentrations were low to moderate, ranging from 0.96 to 1.0 mg/L and 14 to 54 mg/L, respectively. The most elevated sulphate concentration correlated with the highest nitrate concentration in November 2023. Conductivity and chloride concentrations were moderate to elevated, ranging from 163 to 335 µS/cm and from 13 to 34 mg/L, respectively. The Mann Kendall analysis detected a statistically significant decreasing trend in sulphate concentration at this location.

Surface water quality at this location was likely impacted by aggregate runoff, given the relatively high conductivity, ammonia, nitrate and sulphate concentrations. Additionally, magnesium lignosulphate may have contributed to these water quality Impacts. Similar to previous years, elevated chloride concentrations persisted in this area of the landfill. The source of the elevated chloride should be investigated, as well as sodium concentrations at this location. Surface water quality in this area should continue to be monitored to observe how the likely aggregate runoff impacts progress and confirm the effectiveness of any corrective measures.

### 7.18.2.2 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 activities.

In 2023/24, surface water quality parameters at Sw-S-03 met all applicable BCWGs, except for total aluminum, nitrate, and dissolved copper concentrations. Total aluminum concentration (0.257 mg/L) exceeded the BCWQG LTC during one sampling event, and dissolved copper concentration exceeded the BCWQG LTC during two sampling events, with concentrations ranging from 4.08 to 4.41 µg/L. Throughout the monitoring period, nitrate concentrations were elevated, ranging from 1.77 to 3.54 mg/L, with an average of 2.5 mg/L. Sulphate concentrations were low to moderate, ranging from 14 to 54 mg/L, and ammonia concentration was moderate (0.96 mg/L) during Q1 of 2024. The most elevated sulphate concentration correlated with the highest nitrate concentration, in November 2023. During that sampling event, conductivity was elevated, at 335 µS/cm, and was moderate to elevated during other sampling events, ranging from 163 to 300 µS/cm. Chloride concentration was also elevated, ranging from 13 to 34 mg/L.

Surface water quality at this location was likely impacted by aggregate runoff, given the relatively high conductivity, ammonia, nitrate and sulphate concentrations. Additionally, magnesium lignosulphonate may have contributed to these water quality Impacts. Similar to previous years, elevated chloride concentrations persisted in this area of the landfill. The source of the elevated chloride should be investigated, and surface water quality in this area should continue to be monitored.

#### 7.18.2.3 Monitoring Site Sw-S-04

Sw-S-04 is the southernmost Boundary Compliance Station at Hartland. In 2023/24, surface water quality at station Sw-S-04 met all BCWQGs, except dissolved copper concentrations, which exceeded the BCWQG LTC on two sampling events, with concentrations ranging from 1.515 to 1.815 µg/L. Throughout 2023/24, conductivity was elevated, ranging from 158 to 269 µS/cm, with an average of 207.5 µS/cm. Ammonia concentrations were low, and nitrate concentrations were moderate to elevated, ranging from 0.876 to 1.45 mg/L with an average of 1.23 mg/L. Sulphate concentrations were moderate, ranging from 18 to 45.5 mg/L, with an average of 28.6 mg/L, and chloride concentrations were elevated, ranging from 16 to 49.5 mg/L. The Mann Kendall analysis revealed a statistically significant increasing trend in nitrate concentration at this location.

Surface water quality at this Boundary Compliance Station was likely impacted by aggregate runoff, given the consistently elevated conductivity, sulphate and nitrate concentrations. Additionally, magnesium lignosulphonate may have contributed to these water quality Impacts. The elevated chloride concentrations may reflect road salting but that cannot be determined without sodium concentration data. The cause of the elevated chloride concentrations in this area of the landfill should be investigated, and surface water quality in this area should continue to be monitored closely. It is also possible that runoff from the bin facility is affecting water quality in this area.

#### 7.18.2.4 Monitoring Sites Sw-S-24 and Sw-S-27

Stations Sw-S-24 and Sw-S-27 (not Boundary Compliance stations) are located on the landfill property downgradient of the Phase 1 landfill, the landfill administration area and parking lots, and near the mountain bike trails. In 2023/24, surface water quality at both stations met applicable BCWQGs for all parameters except TSS, which exceeded the BCWQG LTC during one sampling event at Sw-S-27, and dissolved copper concentration, which exceeded the BCWQG LTC at both stations during the December 2023 and March 2024 sampling events.

At Sw-S-24, surface water samples were collected during four (4) sampling events. conductivity was consistently elevated, ranging from 188 to 323 µS/cm, with an average of 248 µS/cm. Additionally, nitrate and chloride concentrations were elevated, ranging from 0.716 to 1.82 mg/L and 19 to 56 mg/L, respectively. Sulphate concentrations were low to moderate, ranging from 22 to 56 mg/L. Ammonia concentrations were below the detection limit during Q1 of 2024.

At Sw-S-27, surface water samples were collected during three (3) sampling events, and similar water quality trends were observed. Nitrate concentrations were typically higher than at Sw-S-24, ranging from 0.039 to 2.49 mg/L, with an average of 1.66 mg/L. Sulphate concentrations were low to moderate, ranging from 14 to 55 mg/L, and conductivity moderate to elevated, ranging from 173 to 282 µS/cm, with an average of 215 µS/cm. Chloride concentrations were low to moderate, ranging from 15 to 43 mg/L, and ammonia concentrations were very low (0.034 mg/L) during Q1 of 2024.

Surface water quality at Sw-S-24 and Sw-S-27 was likely impacted by aggregate runoff, given the relatively high conductivity, ammonia, nitrate and occasionally sulphate concentrations. Additionally, magnesium lignosulphonate may have contributed to these water quality Impacts. The elevated chloride concentrations observed at these locations may reflect road salting but that cannot be determined without sodium concentration data. The cause of the elevated chloride concentrations in this area of the

landfill should be investigated, and surface water quality in this area of the landfill should continue to be monitored to observe how the water quality impacts progress.

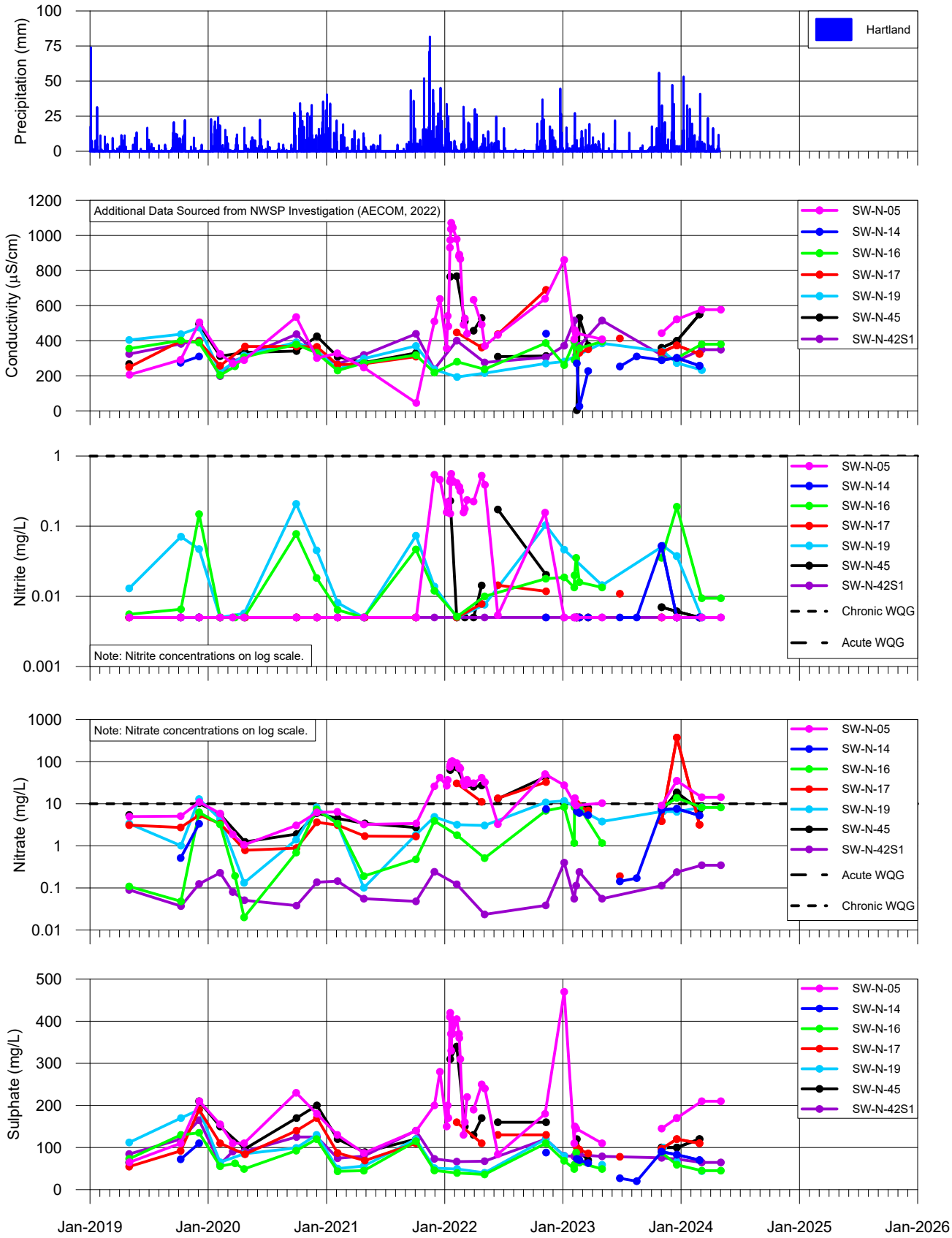



Figure 7-3. Surface Water Quality North of Phase 1 - Aggregate Impacts

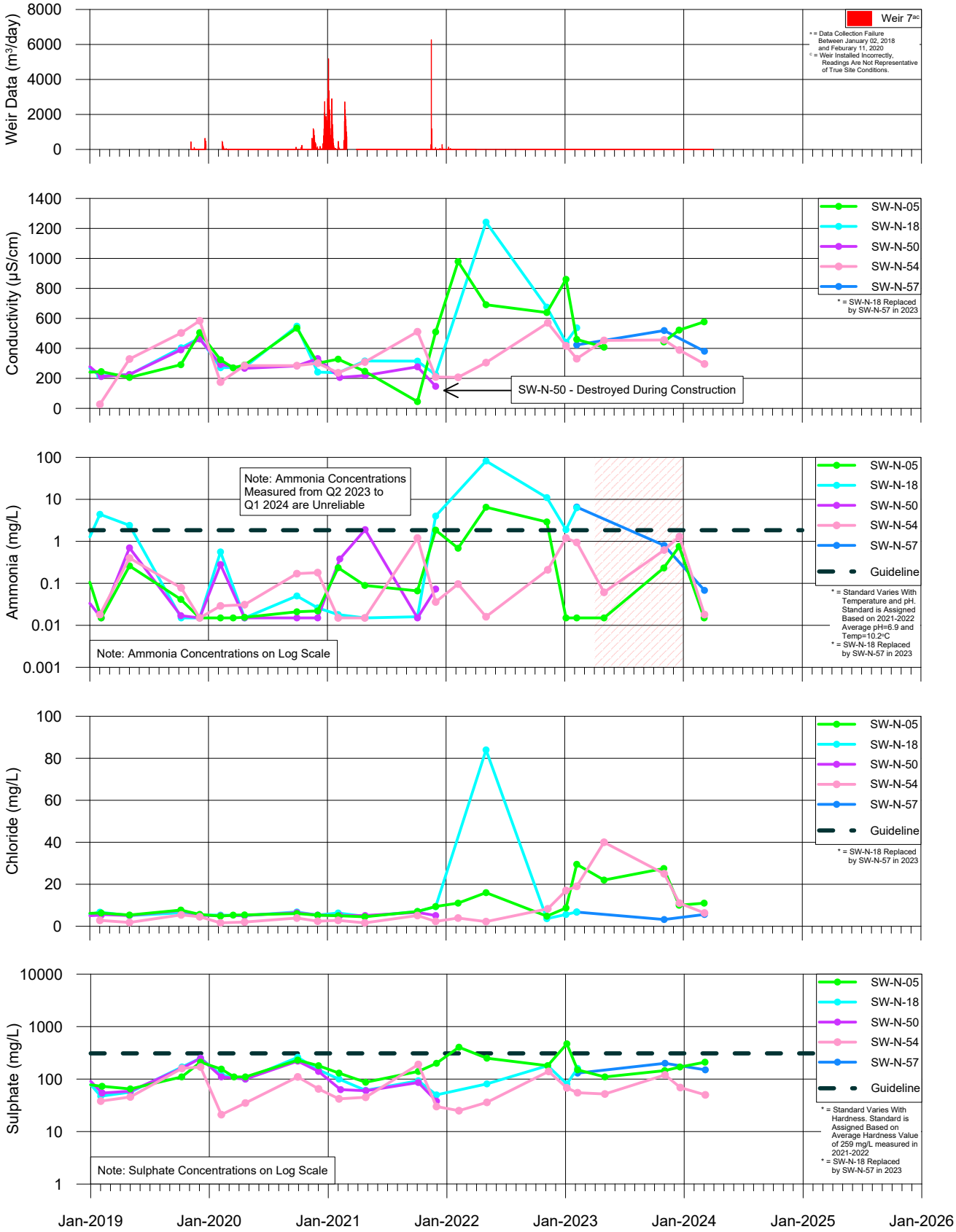



Figure 7-4. Surface Water Quality North of Phase 2

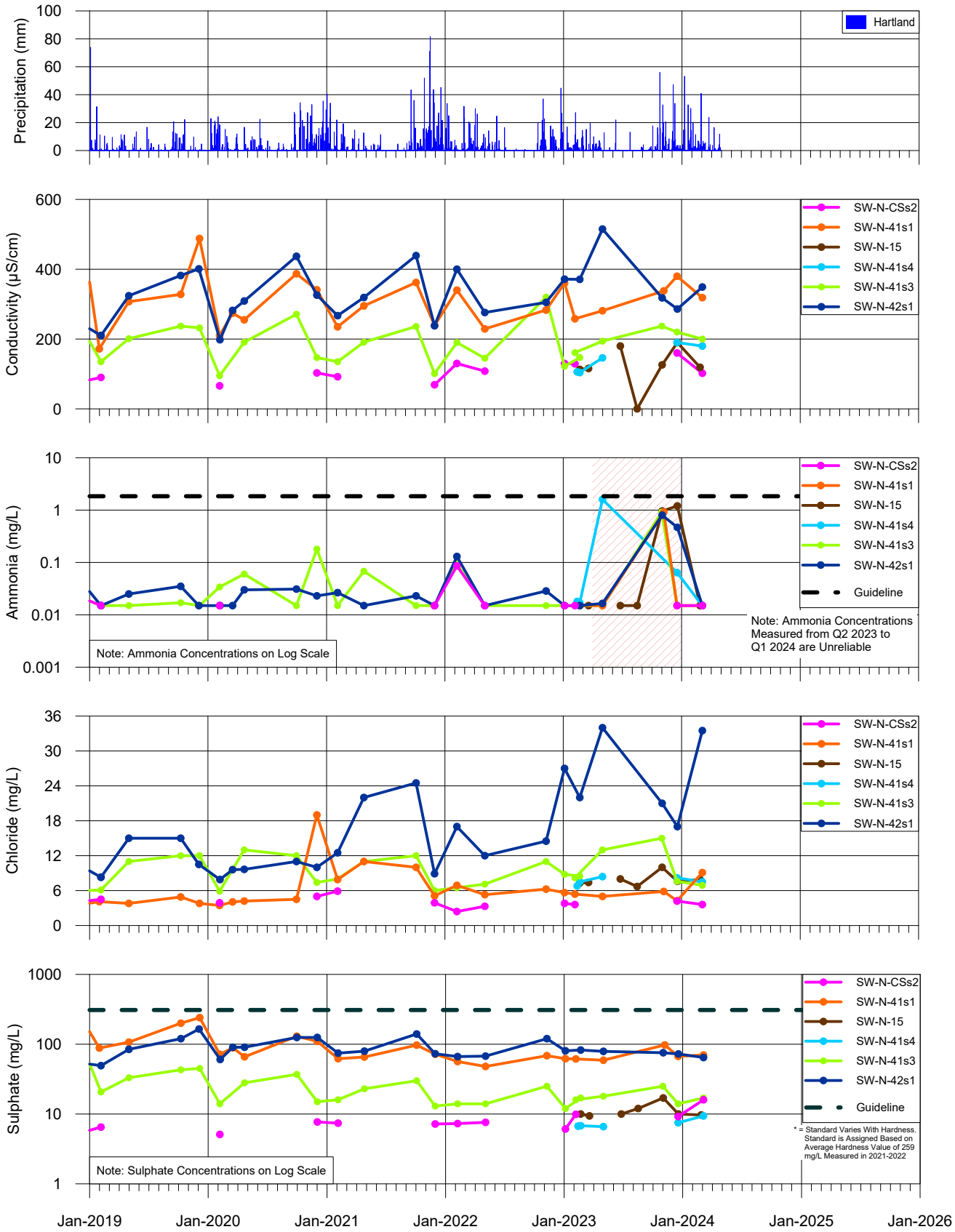



Figure 7-5. Surface Water Quality Downstream of the Hartland North Pad

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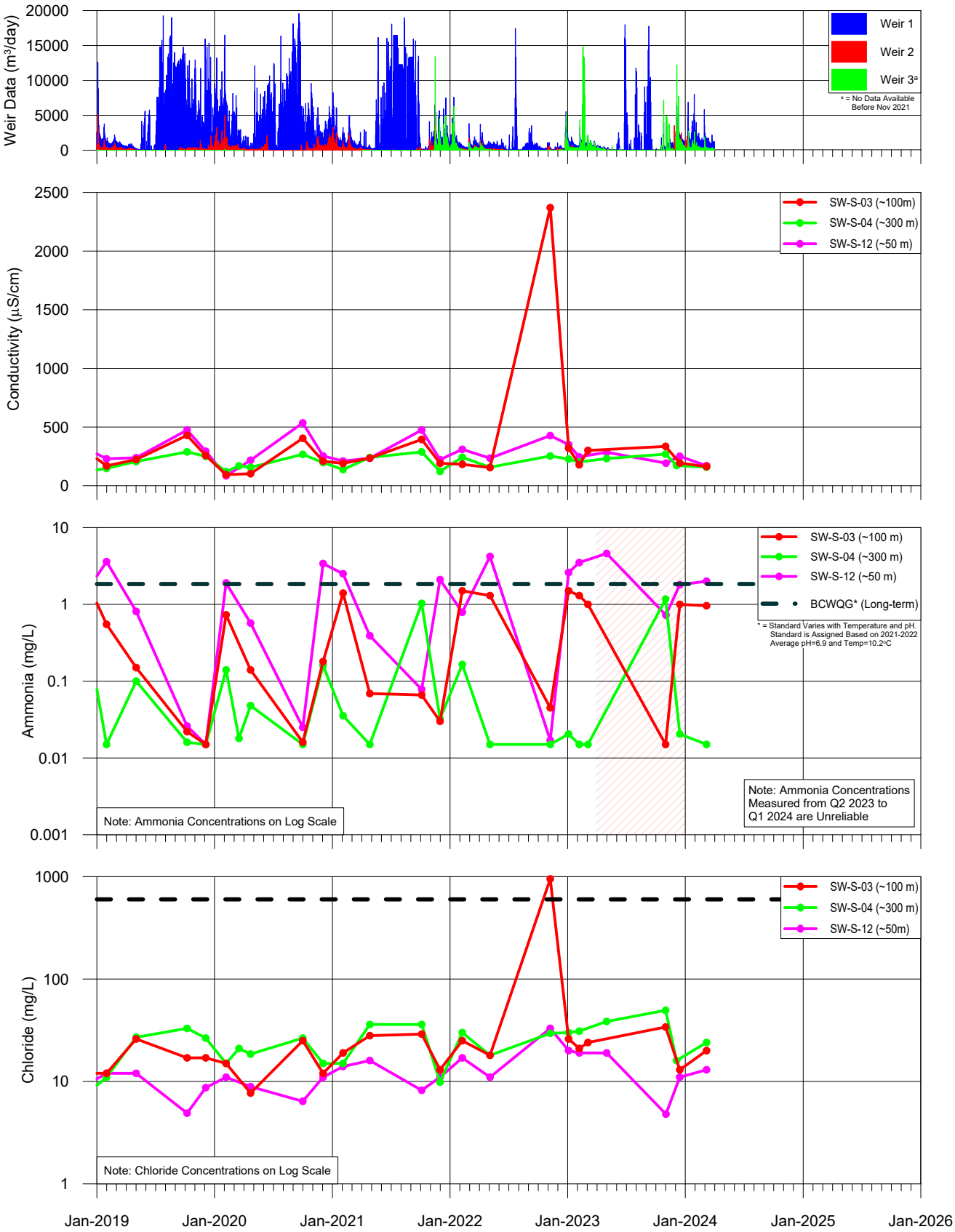



Figure 7-6. Surface Water Quality South of Landfill

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## 7.19 Summary

The surface water quality data collected at and around the landfill in 2023/24 indicated that nearby surface water bodies, including Tod Creek, Durrance Lake, and Killarney Lake were not impacted by landfill leachate or aggregate runoff. However, elevated nitrate concentrations were observed at monitoring locations 14, 63, and 65, indicating that Durrance Creek water quality was impacted by aggregate runoff. Additionally, the surface water at monitoring points within the landfill, in the receiving environment immediately north of the landfill, and at compliance monitoring points at the south end of the landfill continued to show signs of water quality degradation related to aggregate runoff. Magnesium lignosulphonate, which is the primary dust suppressant used at Hartland, may have contributed to the water quality impacts, but impacts related to the dust suppressant would likely be contained largely within the landfill footprint and show up seasonally (reflecting dry season application) in the water quality. Ultimately, aggregate runoff impacts are a pervasive surface water quality issue at and around the landfill, and in many locations, they have persisted for several years. In 2023/24, the water quality impacts were most prevalent in November and December 2023, following major precipitation events.

In addition to the aggregate runoff impacts, elevated chloride concentrations were observed at several monitoring points in the south area of the landfill, and it is unclear whether the chloride impacts were caused by road salting because there is no sodium concentration data to interpret. The source of elevated chloride concentrations in the south area of the landfill should be investigated. Based on historical data and the 2023/24 surface water quality data provided by the CRD, AECOM has summarized the following points:

- Surface water at Boundary Compliance Station SW-N-05 continued to exhibit elevated sulphate and nitrate concentrations, as well as some total and dissolved metal concentrations, resulting in non-compliant water quality at this location. The elevated nitrate and sulphate concentrations suggest that the water quality was impacted by aggregate production and stockpiling, and Magnesium lignosulphonate may have contributed to these water quality impacts. The absence of paired ammonia and chloride concentrations suggest water quality was not affected by leachate. TSS, dissolved and total metals concentration exceedances observed at this location likely reflect turbid conditions at the time of sampling and weathering of the local bedrock.
- Surface water quality at Boundary Compliance Station Sw-N-16 was not impacted by landfill leachate, but continued to exhibit water quality impacts related to aggregate production and runoff from the Northeast Stockpile. Similar aggregate runoff impacts were observed at downstream at station Sw-N-17 and Sw-N-45, where runoff from the Toutle Valley and Northwest Stockpile is received. Aggregate runoff impacts were more severe at Sw-N-45, as indicated by higher nitrate and sulphate concentrations. TSS, dissolved and total metal concentration exceedances were reported at these locations, but they likely reflect turbid conditions at the time of sampling and natural weathering of the bedrock.
- In the Hartland North Pad area, surface water quality at Boundary Compliance stations (Sw-N-41s1 and Sw-N-42s1) met BCWQG-STA in 2023/24, except for TSS and total iron concentrations at Sw-N-41s1. Leachate indicator parameters were low, indicating that the surface water was not impacted by landfill leachate. Slightly elevated conductivity, nitrate and sulphate concentrations likely reflect minor impacts from aggregate runoff. Dissolved and total metal concentration exceedances reported at these locations likely reflect turbid conditions at the time of sampling and natural weathering of the bedrock.
- Historically, surface water monitoring location Sw-N-CS2 was used to monitor background conditions north of the landfill, but elevated conductivity, nitrate, and sulphate concentrations observed in 2022/23 indicated that surface water quality at this station has been impacted by aggregate runoff. Sw-S-52 has consistently shown no signs landfill-related impacts, confirming that the water quality at this location continues to represent background conditions.
- Surface water quality in the area northwest of the landfill (Sw-N-41s3 and Sw-N-41s4) exhibited a few dissolved and total metal concentration exceedances that likely reflect weathering of the bedrock and turbid conditions at the time of sampling. Nitrate concentrations were low to moderate, and sulphate concentrations at both locations were low. Overall, surface water quality in this area was similar to last year, with slightly higher conductivity, and slightly lower nitrate concentrations. The surface water in this area was likely not impacted by landfill activities.
- At the confluence of Durrance Creek and Tod Creek (Sw-N-63, Sw-N-64, and Sw-N-65), the surface water exhibited a few dissolved and total metal concentration exceedances that likely reflect weathering of the bedrock and turbid conditions at the time of sampling. Elevated nitrate concentrations were also observed, with higher concentrations reported in Durrance Creek (location 63), which receives surface water upstream from the landfill. Upstream of

location 63 (e.g., Sw-N-14), aggregate runoff impacts have been observed for over five (5) years, so it is likely that the surface water in this location has been impacted by aggregate runoff.

- Water quality at the Boundary Compliance location (Sw-S-04) exhibited trends that reflect dilute aggregate runoff impacts. Elevated chloride concentrations were observed at this location, as well as other locations south of the landfill, but low ammonia concentrations suggest that landfill leachate did not impact the water quality.
- Surface water quality south of the recycling area (Sw-S-03, Sw-S-12) exhibited dissolved and total iron BCWQG-STA exceedances in May 2023 and March 2024. However, the total and dissolved metal concentrations likely reflect turbid conditions at the time of sampling and natural weathering of the bedrock. Surface water quality in this location was impacted by aggregate runoff and likely magnesium lignosulphonate, as indicated by elevated conductivity, nitrate and sulphate concentrations. Road salting of nearby paved surfaces likely influenced the elevated chloride concentrations, but this is not possible to determine without sodium concentration data.

# 8. Leachate

## 8.1 Compliance Monitoring Locations

Discharge from the leachate pipeline is subject to the CRD Regional Source Control Program (RSCP) Waste Discharge Authorization (Waste Discharge Authorization 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 2023/24. 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.

Leachate samples are collected from each location monthly, unless the monitoring point is dry. In 2023/24, eight (8) leachate samples were collected at Cell 3 Pipe Outlet, and sixteen (12) leachate samples were collected from the Hartland Valve Chamber. Ten (10) leachate samples were collected from the Controlled Waste Drainage, and twelve (12) leachate samples were collected from the South Purge Wells. Nine (9) leachate samples were collected from the West Face Drainage.. In 2032/24, no leachate samples were collected from the Phase 2 Cleanout because of ongoing site maintenance.

## 8.3 Leachate Generation and Discharge

Leachate collected from the Phase 1 and Phase 2 landfill is discharged to the Lower Leachate Lagoon. 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 the 19.3 km Centrate Return Line that discharges to the CRD trunk sewer system and ultimately to the McLoughlin Point Wastewater Treatment Plant. The Centrate Return Line (CRL) was activated on December 30, 2020, and the formal switch from the previous leachate discharge line 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 monthly leachate flow in 2023/24 was 16.8 L/s and slightly higher than in 2022/23 (16.5 L/s). The highest monthly leachate flow was observed in January (83,858 $m^3$), in response to intense winter precipitation events. Changes in leachate discharge rates throughout the year may be related to the increased capacity of the 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 been collected primarily from the Hartland Valve Chamber, which represents the point of discharge for compliance with the RSCP Waste Discharge Authorization.

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.7, B.8, B.9, B.10, and B.11.

### 8.4.1 Routine Monthly Leachate Analyses and Sewer Use Bylaw Comparison

The Hartland Valve Chamber is the compliance point for the Waste Discharge Authorization. In 2023/24, all leachate quality samples met RSCP Waste Discharge Authorization criteria during all sampling events.

Although the Waste Discharge Authorization 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 monitoring point (Hartland Valve Chamber) and in phases 1 and 2. Evaluation of this data allows for comparison of leachate quality from each landfill area. At all sampling locations, concentrations of inorganic parameters such as conductivity and chloride show a seasonal dilution effect when greater amounts of precipitation in the fall and winter months result in lower concentrations. Higher concentrations occur during drier periods from May to October. Leachate discharge from the Phase 2 Basin has been significantly more concentrated than leachate generated in Phase 1, which was closed in 1996. Leachate samples have not been collected from Phase 2 Basin since 2021 due to troubles with the sampling pump. The CRD confirmed that the pump is functional but not recovering leachate, and there is an ongoing investigation to determine why leachate samples cannot be recovered. Mixing of leachate from Phases 1 and 2 in the Hartland Valve Chamber results in a leachate that exhibits chemistry that is intermediate of the two sources.

Similar to previous years, leachate concentrations at the Hartland Valve Chamber were well above concentrations observed in surface water and groundwater and considerably lower than 2022/23, with conductivity concentrations ranging from 611 µS/cm to 4,471 µS/cm, and an average of 3,093 µS/cm. Ammonia concentrations ranging from 37 mg/L to 290 mg/L, and chloride concentrations ranging from 47 mg/L to 390 mg/L. Overall, average leachate concentrations in 2023/24 were much lower than in 2022/23.

Figure 8-2 shows BOD concentrations at the Hartland Valve Chamber. BOD concentrations at Hartland are relatively low for a large landfill were generally below 50 mg/L in 2023/24. Changes in BOD may be related to the elevated temperatures observed during summer months, or changes in leachate storage and management prior to sample collection.

Total sulphide, dissolved sulphide, and PAH concentrations did not exceed the Waste Discharge Authorization criteria at Hartland Valve Chamber during any of the 2023/24 sampling events. Total and dissolved sulphide concentrations exceeded the Waste Discharge Authorization criteria in January 2019 but have since remained well below the standard of 1 mg/L. Infiltration through aggregate placed on the Phase 2 landfill 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.

Overall, leachate quality at the Hartland Valve Chamber was consistent with previous years, with concentrations of many parameters several orders of magnitude below Waste Discharge Authorization criteria. Over the past five years, statistically significant decreasing trends in ammonia and chloride concentrations have been observed in the leachate.

#### 8.4.1.1 Phase 2 Cleanout

Leachate samples have not been collected from Phase 2 Basin since 2021 due to troubles with the sampling pump. The CRD confirmed that the pump is functional but not recovering leachate, and there is an ongoing investigation to determine why leachate samples cannot be recovered.

#### 8.4.1.2 North Purge Wells

In 2022/23, leachate samples collected from the North Purge Wells (52-4-0-P7, 80-1-0-P8 and 81-1-0-P9) met all Waste Discharge Authorization criteria during all sampling events. Total sulphide concentrations in the Phase 1 leachate were low (<0.98 mg/L).

#### 8.4.1.3 South Purge Wells

Leachate quality data from combined effluent samples collected from the South Purge Wells (P1, P2, P3, P4 and P10) is provided in Appendix B.9. Leachate sampling at the South Purge Wells began in November 2020 and is now part of the monthly leachate sampling program. During the 2023/24 monitoring year, leachate samples collected from the South Purge Wells met all Waste Discharge Authorization criteria. Total sulphide concentrations ranged from 0.006 to 0.062 mg/L and were well-below the Waste Discharge Authorization criteria. BOD ranged from 2.0 to 11.0 mg/L, with a median of 4.8 mg/L.

Leachate quality in the South Purge Wells was characterized by moderately elevated conductivity (976 to 1,755 µS/cm), and relatively low ammonia (32 to 67 mg/L), chloride (59 to 150 mg/L), and sulphate concentrations (<2.0 mg/L). In 2023/24, all metal concentrations in the South Purge Wells met Waste Discharge Authorization 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 Cleanout and the West Face Drainage. In 2023/24, all leachate parameters and metal concentrations in the Controlled Waste Drainage leachate met Waste Discharge Authorization criteria, except for one COD concentration (1,450 mg/L) observed May 2023. Additionally, total iron concentration nearly exceeded the Waste Discharge Authorization criteria in October 2023.

#### 8.4.1.5 West Face Drainage

In 2023/24, leachate discharged from the West Face Drainage was sampled 9 out of 12 sampling events due to periodically dry conditions. Like previous years, the West Face Closure Toe Drain generally had the most concentrated leachate, with the highest BOD, ammonia, conductivity, and chloride concentrations. All leachate quality parameters met Waste Discharge Authorization criteria, except for COD concentrations in April and June 2023.

Leachate from the West Face Drainage is strongly reduced with abundant organic content. A weir and flow monitor have been installed at the West Face Drainage to evaluate seasonal trends in flows. Because leachate from the West Face Drainage is contributing a relatively small volume of leachate to the leachate collection system, it does not noticeably affect the quality of leachate at the Hartland Valve Chamber.

#### 8.4.1.6 Cell 3 Pipe Outlet

Cell 3 includes new leachate containment and gravity flow conveyance infrastructure (i.e., the Toutle Drain), which discharges directly into the Upper Leachate Lagoon. Beginning in 2016, the Cell 3 Pipe Outlet began discharging leachate, and leachate from this location is considered representative of newly deposited refuse. In 2023/24, leachate samples were collected on eight of 12 sampling dates due to periodically dry conditions. Sampling from this station is challenging due to the intermittent flows. In 2023/24, all parameters except COD concentration met Waste Discharge Authorization criteria during all sampling events. COD concentrations exceeded the Waste Discharge Authorization during all sampling events.

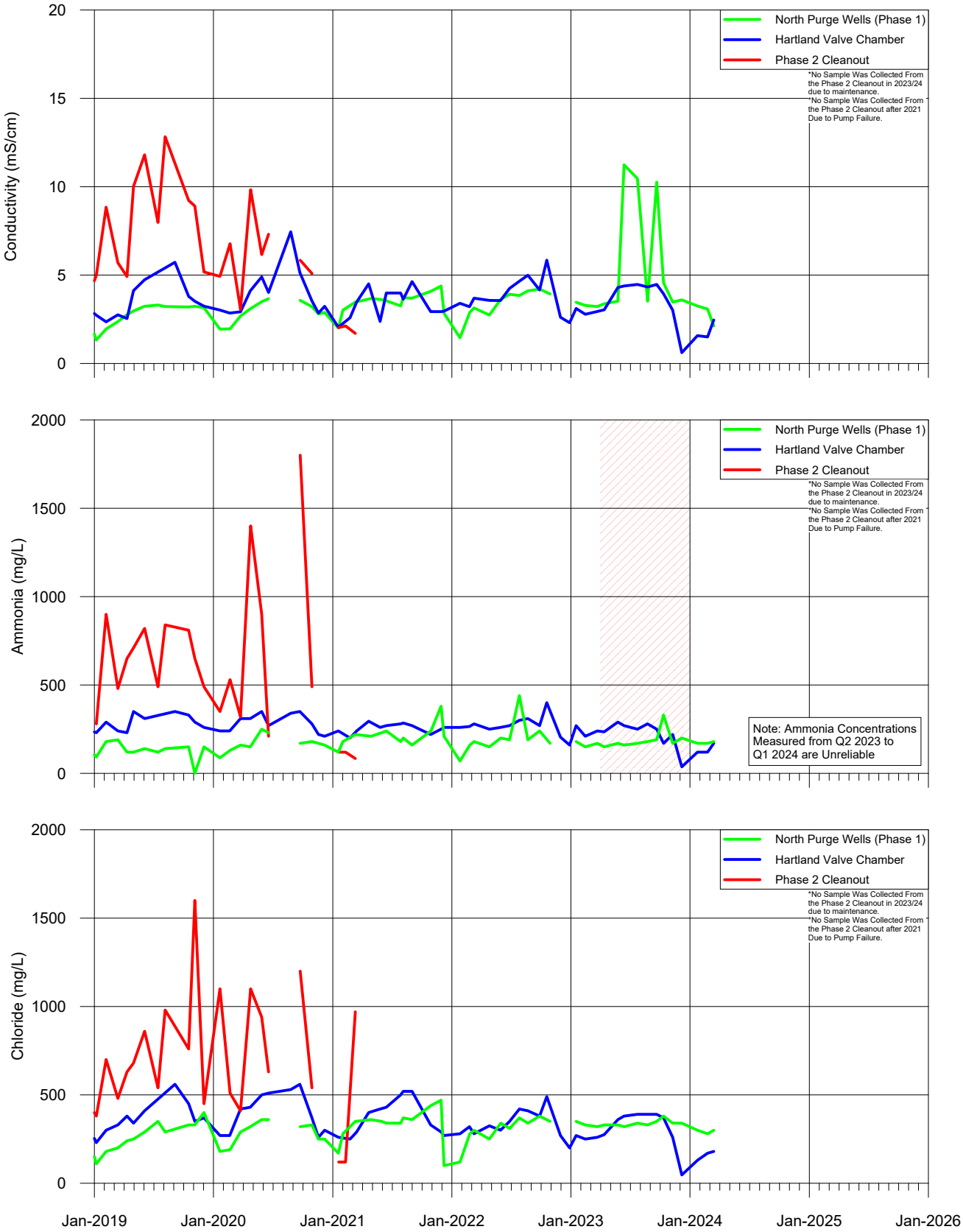



Figure 8-1. Hartland Valve Chamber Leachate Chemistry (Conductivity, Ammonia and Chloride)

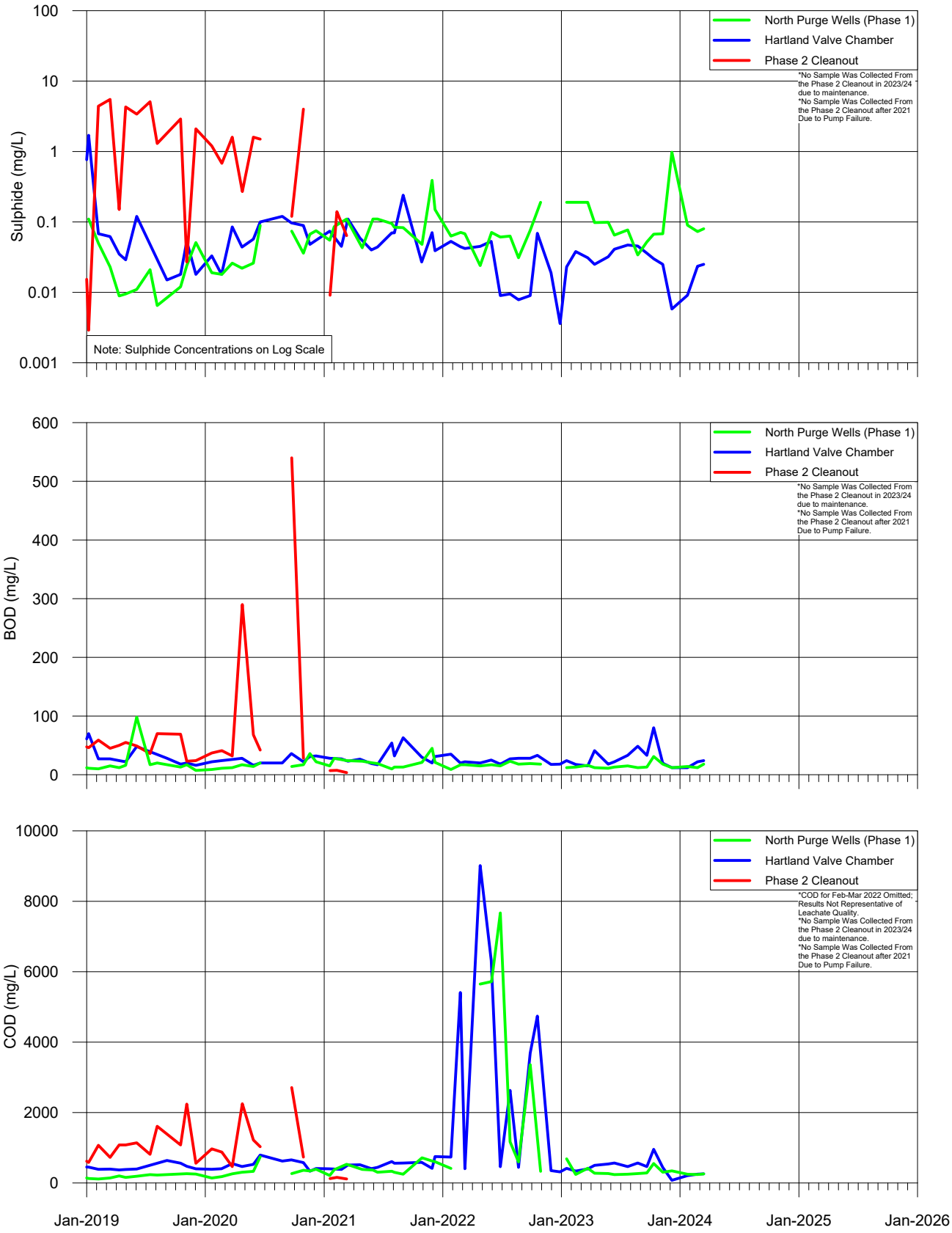



Figure 8-2. Hartland Valve Chamber Leachate Chemistry (Sulphide, BOD and COD)

### 8.4.2 Quarterly Trace Organic Analysis at Hartland Valve Chamber

Since 1998, trace volatile and semi-volatile organic analyses have been carried out quarterly on leachate samples collected from the Hartland Valve Chamber. Chlorinated phenol compound analytical results for combined leachate in 2023/24 are presented in Appendix B.5.

A total of five (5) 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. None of the trace organics exceeded Waste Discharge Authorization 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 Authorization criteria. Regular sampling and analysis for VOC concentrations in leachate sources should continue, but it is not warranted in groundwater or surface water at compliance monitoring locations at this time.

In 2023/24, one phenolic compound was above detection limits (2,3,4,6-tetrachlorophenol). However, the phenol concentrations in leachate at Hartland are lower than or similar to those found at other large municipal solid waste 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 2023/24, six of nine low-weight PAHs were detected in Hartland Landfill leachate. Total concentrations of low-weight PAHs ranged from 0.01 to 2.0 µg/L, which was lower than historical concentrations. Acenaphthene exhibited a maximum concentration of 2.0 µg/L in November 2023. High-weight PAHs, including benzo(a)anthracene, fluoranthene, and pyrene were detected at maximum concentrations of 0.17 µg/L, 1.0 µg/L, and 0.74 µg/L, respectively. Chrysene and benzo(a)pyrene have been marginally above detection limits since 2016. Overall, high-weight PAH concentrations were lower than in 2022/23, ranging from 0.005 to 1.0 µg/L.

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. Additionally, 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. 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 2023/24 indicated the following:

- The average daily leachate flow rate was 16.8 L/s, with a maximum monthly discharge of 83,858 $m^3$ in January 2024. The average flow was considerably higher than the long-term (1997 to 2023) average of approximately 12.3 L/s, which may be related to the expansion of the Phase 2, Cell 4 quarry.
- Several COD concentrations exceeded the Waste Discharge Authorization criteria at multiple locations, including the Cell 3 Pipe Outlet (8), West Face Drainage (2), and the Controlled Waste Ditch (1).
- 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.
- At the Hartland Valve Chamber, leachate quality was compliant with the Waste Discharge Authorization. Statistical trend analysis indicates that leachate quality has been relatively stable with minor improvements over the past five years. The highest concentrations of leachate parameters were observed in September 2023, when precipitation was near the annual minimum.

# 9. Conclusions

The following conclusions were drawn based on our interpretation of historical data and groundwater, surface water and leachate flow and quality data collected in 2023/24.

## 9.1 Leachate Flow

Leachate flow patterns at Hartland were consistent with historical interpretations. The Phase 2 hydraulic trap was maintained throughout the monitoring year, and leachate mounding persisted in Phase 1. Leachate elevations in both areas of the landfill were generally stable, exhibiting 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 2024, leachate elevations in the upper portion of the refuse were generally below 155 m asl, reflecting an approximate 5 m decrease in elevation since closure of the Phase 1 landfill in 1997. The highest leachate elevations (155 to 157 m asl) were observed in the east/southeast area of the Phase 1, in an area with elevated topography and refuse heights.

In 2023/24, a total of 28,090.6 $m^3$ of leachate was collected from the South Purge Wells, which is approximately 8.1% less than in the previous monitoring year, 18.9% less than in 2021/22, and 24.3% less than in 2020/21. At the North Purge Wells, a total of 7,969.8 $m^3$ of leachate was collected, which was considerably lower than in 2022/23 (14,277 $m^3$) and 2021/22 (18,140 $m^3$). The leachate quality and flow data suggest that both systems performed adequately throughout the 2023/24 monitoring period. However, groundwater levels in 52-3-0, adjacent to P7, continued to increase, which may reflect mounding or diminishing pump performance at P7. Furthermore, subtle changes in groundwater quality in this area suggest the drawdown cones associated with P7 and P8 have recently changed, perhaps in response to fouling of P7. The average total daily leachate discharge rate was 16.8 L/s, as compared to the historical average of approximately 12.3 L/s, which was likely influenced by expansion of the landfill into the Toutle Valley.

## 9.2 Groundwater Flow

Groundwater flow patterns observed at Hartland were consistent with historical interpretations, with some changes observed in the North Ridge area. 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 footprint. 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. Around the North Ridge and Hartland North Pad, northwest of Phase 2, groundwater flows radially outward to the north, east and south from a topographic high situated north of Phase 2.

In 2023, continued blasting operations along the North Ridge resulted in lowering of the topography and a decline in groundwater elevations. Groundwater levels in the area continued to exhibit seasonal fluctuations, but the intensity of the fluctuations was less pronounced. It is suspected that quarrying impacted groundwater flow around the Highland Fault, potentially facilitating the drainage of eastward moving groundwater that was previously impeded by the fault. This is consistent with groundwater seepage observed at the base of quarry. The CRD has also observed seepage emanating from the northwest corner of the Cell 4 well, in the area of the Highland Fault, and has since installed a pressure relief system to collect the seepage and transport it into the surface water collection system.

## 9.3 Groundwater Quality

The groundwater quality results from 2023/24 indicate that leachate-impacted groundwater was contained within the landfill property. At the north end of the landfill, leachate-impacted groundwater extended just north of the unlined Lower Leachate Lagoon and through the middle of the lined Upper Leachate Lagoon and did not extend off-site. Elevated boron concentrations persisted at the northern property boundary at Boundary Compliance Station 20, which may reflect a natural source. It is unlikely that the boron reflects a leachate impact due to low leachate indicator parameters and higher boron concentrations than what was observed in the North Purge Wells. Ultimately, the source of the boron is not yet known. South of the landfill, leachate-impacted groundwater did not extend off-site. Leachate related exceedances were confined to the landfill footprint on the east side of Phase 1 and are inferred to extend to the western extent of the Phase 2 waste footprint. The Leachate Collection System continued to function adequately, minimizing groundwater quality impacts. However, persistent water quality impacts downgradient of the south purge wells within the landfill footprint indicates there may be continued bypass of a small amount of leachate.

The CRD indicated that ammonia concentration data collected in 2023 is unreliable because of a set of over-preserved sample bottles. Based on AECOM's interpretation of the data and correspondence with the CRD, all ammonia concentration data collected in 2023 is unreliable, and the ammonia from Q1 of 2024 is sound.

Aggregate runoff impacts were observed across the landfill and were most common downgradient of the aggregate stockpiles. Nitrate exceedances to the CSR DW were observed at many groundwater wells, including boundary compliance wells 31 and 39, reflecting off-site migration of ANFO residue. At this point, it is unclear what impact the use of ammonium lignosulphate has on the water quality. Several groundwater wells exhibited highly elevated nitrate concentrations in the presence of low to moderate (i.e., <75 mg/L) sulphate concentrations, suggesting that sulphide oxidation does not always occur during ANFO leaching in the stockpiles.

All other Boundary Compliance Wells and off-site monitoring wells met CSR AW and DW standards, except for a boron concentration that exceeded the CSR AW at GW-20-1-2 in September 2023, and two nitrate concentrations that exceeded the CSR DW at GW-31-1 in November 2023 and February 2024. Elevated boron concentrations have persisted at this location for several years. Overall, most exceedances occurred in groundwater wells near leachate purge wells and known leachate sources.

**North of the Landfill**

- Operation of the Phase 1 North Purge Well System continued to mitigate leachate impacts north of the landfill, as indicated by long-term stable or decreasing concentrations of leachate indicator parameters at stations 40, 20 and 21. Groundwater quality in wells GW-20-1-1, GW-21-1-1, and GW-40-1-1 were generally stable in 2023/24, but nitrate and sulphate concentrations were moderate to elevated at location 40, likely reflecting aggregate runoff impacts.
- 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 that the groundwater quality was not affected by landfill leachate. The increase in nitrate and sulphate concentrations in groundwater is interpreted to be due to runoff from aggregate stockpiles and roads constructed with aggregate.
- Along the northern edge of the Phase 2 Basin, groundwater quality was impacted by runoff and infiltration from the Northwest Stockpile, with some wells (GW-106-1-1 and GW-105-1-1) exhibiting highly elevated conductivity, nitrate and sulphate concentrations. Additionally, GW-105-1-1 exhibited elevated chloride concentrations, but ammonia concentrations were generally low. In 2022/23, evidence of landfill leachate impacts was present at location 106 but chloride and ammonia concentrations subsided in 2023/24.
- Groundwater quality between the Lower Leachate Lagoon and Willis Point Road continued to exhibit elevated boron concentrations around monitoring location 20, which may reflect a natural source.
- Groundwater quality at Boundary Compliance Station 31 and monitoring point 21 exhibited elevated and non-compliant nitrate concentrations caused by aggregate runoff.

**Hartland North Pad**

- Groundwater quality at the Hartland North Pad was impacted by aggregate runoff, with elevated conductivity, nitrate, and sulphate concentrations observed at several monitoring stations (e.g., 44, 62, 77, 87, 88, 94).
- Groundwater quality at GW-91-1-1 and GW-92-1-1 was generally consistent with background conditions, except for elevated conductivity and sulphate concentrations. Nitrate concentrations remained low at both sites. The elevated sulphate may be associated with natural sulphide oxidation.

**South of the Landfill**

- Groundwater quality south of the landfill met all applicable CSR standards.
- Water quality along the southern boundary of the Phase 1 landfill continued to show no evidence of landfill leachate impacts.
- Since 2020, chloride concentrations have been elevated at some monitoring stations in the area, but the elevated chloride concentrations have not correlated with elevated ammonia concentrations, and the origin of the chloride is currently unknown.

- Elevated nitrate concentrations were observed at several wells, and often in the absence of elevated sulphate concentrations. This trend might reflect impacts from magnesium lignosulphonate or runoff from paved surfaces.

**East of the Landfill**

- Water quality along the east boundary of the Phase 1 landfill was not impacted by landfill leachate.
- Ammonia concentrations at monitoring stations 16, 17 and 18 were close to or below the detection limit on all sampling events, and groundwater parameters other than nitrate concentrations met all applicable CSR standards. Elevated conductivity, nitrate and sulphate concentrations observed at location 16 reflect aggregate runoff impacts.

## 9.4 Domestic Well Water Quality

The CRD's groundwater quality monitoring program includes annual sampling of 20 residential wells, including 15 wells within a 2 km radius of the landfill and five (5) domestic wells located north of the Hartland North Pad.

The domestic groundwater quality data was consistent with historical results, meeting all applicable federal and provincial drinking water quality guidelines other than a few manganese and iron Aesthetic Objective exceedances, one total lead exceedance, and one total manganese exceedance. The well that exhibited the total lead exceedance was later resampled, and the lead concentration was below regulatory criteria. Overall, the results indicate that off-site domestic water wells continued to remain unimpacted by landfill leachate.

## 9.5 Surface Water Quality

The surface water quality data indicated that nearby surface water bodies, including Tod Creek, Durrance Lake, and Killarney Lake were not impacted by landfill leachate or aggregate runoff. However, elevated nitrate concentrations were observed at monitoring locations 14, 63, and 65, suggesting that Durrance Creek was impacted by aggregate runoff.

Surface water at monitoring points within the landfill, in the receiving environment immediately north of the landfill, and at compliance monitoring points at the south end of the landfill continued to show signs of water quality degradation related to aggregate runoff. Use of magnesium lignosulphonate may have contributed to the water quality impacts. Aggregate runoff impacts are a pervasive surface water quality issue at and around the landfill. In many locations, they have persisted for several years. The water quality impacts were most prevalent in November and December 2023, following major precipitation events.

The CRD indicated that ammonia concentration data collected in 2023 is unreliable because of a set of over-preserved sample bottles. Based on AECOM's interpretation of the data, the ammonia concentrations measured in surface water samples collected in November 2023 are unreliable, and the rest of the ammonia concentration data may be interpreted with caution.

**North of the Landfill and Downstream of the North Pad**

- Surface water at Boundary Compliance Station SW-N-05 continued to exhibit elevated sulphate and nitrate concentrations, as well as some total and dissolved metal concentrations, resulting in non-compliant water quality. The elevated nitrate and sulphate concentrations suggest that the water quality was impacted aggregate runoff, and magnesium lignosulphonate may have also contributed to these water quality impacts. The absence of paired ammonia and chloride concentrations suggest water quality was not affected by leachate. TSS, dissolved and total metals concentration exceedances observed at this location likely reflect turbid conditions at the time of sampling and weathering of the local bedrock.
- Surface water quality at Boundary Compliance Station Sw-N-16 was not impacted by leachate but continued to exhibit water quality impacts related to aggregate runoff. Similar impacts were observed at downstream at station Sw-N-17 and Sw-N-45. Aggregate runoff impacts were more distinctive at Sw-N-45.
- In the Hartland North Pad area, surface water quality at Boundary Compliance stations Sw-N-41s1 and Sw-N-42s1 met BCWQG-STA, except for TSS and total iron concentrations. Leachate indicator parameters were low, indicating that the surface water was not impacted by landfill leachate. Slightly elevated conductivity, nitrate and sulphate concentrations likely reflect minor impacts from aggregate runoff and road salt.
- Sw-S-52 has consistently shown no signs of landfill-related impacts, confirming that the water quality at this location continues to represent background conditions.

- Surface water quality in the area northwest of the landfill (Sw-N-41s3 and Sw-N-41s4) exhibited a few dissolved and total metal concentration exceedances that likely reflect weathering of the bedrock and turbid conditions at the time of sampling. Nitrate concentrations were low to moderate, and one ammonia concentration observed in May 2023 was high. Sulphate concentrations at both locations were low. Overall, surface water quality in this area was similar to 2022/23, with slightly higher conductivity, and slightly lower nitrate concentrations. The surface water in this area was likely not impacted by landfill activities.
- At the confluence of Durrance Creek and Tod Creek (Sw-N-63, Sw-N-64, and Sw-N-65), the surface water exhibited a few dissolved and total metal concentration exceedances that likely reflect weathering of the bedrock and turbid conditions at the time of sampling, or potentially some runoff/contamination from the Heal's Shooting Range. Elevated nitrate concentrations were also observed, with higher concentrations reported in Durrance Creek (location 63), which receives surface water from the landfill. Upstream of location 63 (e.g., Sw-N-14), aggregate runoff impacts have been observed for over five (5) years, so it is likely that the surface water in this location has been impacted by aggregate runoff.

**South of the Landfill**

- Water quality at Boundary Compliance Station (Sw-S-04) exhibited trends that reflect dilute aggregate runoff impacts. Elevated chloride concentrations were observed at this location, as well as other monitoring locations south of the landfill, but low ammonia concentrations suggest that landfill leachate did not impact the water quality. The source of the anomalous chloride concentrations should be investigated.
- Surface water quality south of the recycling area (Sw-S-03, Sw-S-12) exhibited dissolved and total iron BCWQG-STA exceedances in May 2023 and March 2024. However, the total and dissolved metal concentrations likely reflect turbid conditions at the time of sampling and natural weathering of the bedrock. Surface water quality in this location was impacted by aggregate runoff, as indicated by elevated conductivity, nitrate and sulphate concentrations. Road salting of nearby paved surfaces likely influenced the elevated chloride concentrations, but this is not possible to determine without sodium concentration data.

## 9.6 Leachate Quality

The leachate quality observed at the Hartland Valve Chamber was compliant with the Waste Discharge Authorization. The statistical trend analysis indicates that leachate quality has been relatively stable with minor improvements over the past five years. The average daily leachate flow was considerably higher than the long-term average, which may be related to the expansion of the Phase 2, Cell 4 quarry and the resultant increase in groundwater discharge to the quarry walls and floor. Overall, the leachate quality data in 2023/24 were comparable to historical data.

## 9.7 Quality Assurance and Quality Control

Upon review of the quality assurance and quality control data collected in 2023/24, groundwater, surface water and leachate sampling and laboratory analysis have produced reliable results that are acceptable for the purposes of this monitoring report with the exception of ammonia concentrations in November 2023 as discussed throughout the report.

## 9.8 Compliance with Operating Certificate and Waste Discharge Authorization

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

### 9.8.1 Leachate

The Hartland Valve Chamber is the Compliance Monitoring Station for the Waste Discharge Authorization. During the monitoring period, leachate discharges at the Hartland Valve Chamber were compliant with the Waste Discharge Authorization during all sampling events.

### 9.8.2 Groundwater

A total of 36 groundwater monitoring wells were identified as Boundary Compliance Monitoring Wells. Water quality data collected from these wells were compared to the CSR standards for the protection of freshwater aquatic life and drinking water to evaluate landfill compliance with the Operating Certificate and protect both current and future uses of the groundwater resource. Groundwater quality exceedances reported at Boundary Compliance Stations are summarized in Table 9-1.

Aggregate runoff impacts were observed across the landfill and were common downgradient of the aggregate stockpiles. Nitrate exceedances to the CSR DW were reported at boundary compliance wells 31 and 39, reflecting off-site migration of ANFO residue and potentially some magnesium lignosulphonate.

All other Boundary Compliance Wells and off-site monitoring wells met CSR AW and DW standards, except for a boron concentration that exceeded the CSR AW at GW-20-1-2 in September 2023. Elevated boron concentrations have persisted at this location for several years.

**Table 9-1. Groundwater Quality Compliance at Boundary Compliance Stations**

| Station | General Parameters | Nutrients | Metals | Comments |
|---|---|---|---|---|
| **GW-20-1-2** | None | None | Boron (1) | • The boron exceedance may be associated with a natural source or spill, given the presence of very low leachate and aggregate indicator parameters. Ultimately, the source of the boron is not yet known. |
| **GW-31-1-1** | None | Nitrate (2) | None | • Nitrate exceedances are associated with aggregate production and stockpiling at Hartland. The nitrate originates from leaching of ANFO residue left on the aggregate after blasting. |
| **GW-31-1-2** | None | Nitrate (3) | None | |

## 9.8.3 Surface Water

A total of five (5) 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, downgradient of areas that have the potential to be impacted by leachate or landfill runoff. Water quality data collected from the Boundary Compliance stations were compared to the BCWQG-STA and BCWQG-LTC criteria to assess compliance with the Landfill Operational Certificate, and the results are summarized in Table 9-2.

Some of the water quality impacts were caused by sources other than landfill leachate or aggregate runoff, including turbid samples collected under low-flow conditions and ongoing construction activities. However, highly elevated conductivity, sulphate, and nitrate/ammonia concentrations consistent with aggregate runoff and potentially magnesium lignosulphonate were observed at Boundary Compliance stations Sw-N-05 and Sw-N-16, indicating that surface water quality at these locations was not compliant with the Landfill Operational Certificate.

**Table 9-2. Surface Water Quality Compliance at Property Boundary Stations**

| Station | General Parameters | Nutrients | Metals | Comments |
|---|---|---|---|---|
| **Sw-N-05** | TSS (1) | Nitrate (4) | Total Aluminum (1), Total Iron (1), Dissolved Copper (1) | • Nitrate exceedances are associated with aggregate production and stockpiling at Hartland. The nitrate originates from leaching of ANFO residue left on the aggregate after blasting. The TSS and metal concentration exceedances are anticipated to be related to turbid flow conditions following a prolonged dry period. It is unlikely that the elevated TSS and metal concentrations were influenced by landfill activities. |
| **Sw-N-16** | TSS (1) | Nitrate (3) | Total Iron (1), Dissolved Copper (2) | |
| **Sw-N-41S1** | TSS (1) | None | Total Iron (1), Total Aluminum (2) | • The TSS and metal concentration exceedances are anticipated to be related to turbid flow conditions following a prolonged dry period. It is unlikely that the elevated TSS and metal concentrations were influenced by landfill activities. |
| **Sw-N-42S1** | TSS (1) | None | Dissolved Copper (1) | |
| **Sw-S-04** | None | None | Dissolved Copper (1) | |

# 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** | Closely monitor water levels and leachate quality in the north purge wells to verify the effectiveness of the leachate collection system. Water levels in well 52-3-0, adjacent to 52-4-0-P7 have slowly increased since 2021/22 and may indicate diminished drawdown and leachate collection in this area. Water quality in this area is beginning to suggest changes in leachate capture. A step test should be conducted on each north purge well to measure the specific capacity, which is an indicator of well performance. The measurements should be compared to historical assessments to determine the need for well rehabilitation. | Ongoing |
| **2** | Closely monitor water levels and leachate quality in the south purge wells to verify the effectiveness of the leachate collection system and identify opportunities for improvements. These wells have not been rehabilitated since they were installed in 2001 and have likely accumulated sediment, diminishing their performance and/or requiring excessive maintenance. Pump failures were observed at P10, increased water levels above operational targets were observed in P1, and pump discharge rates have declined for multiple years. 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 |
| **3** | Periodically validate the pumping levels and the extent of the drawdown cones surrounding the north and south purge well systems (next assessment was to be conducted in 2024) to confirm the proper functioning of the purge 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** | Conduct a detailed assessment of the effectiveness of the hydraulic trap and leachate collection systems including the north purge wells and south purge wells based on the design of the Cell 4/5/6 quarry and liner system. This is required to confirm the landfill will perform as intended 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 suggests additional leachate containment or groundwater management measures need to be implemented to mitigate the potential for off-site leachate migration and non-compliant water quality at Sw-N-05. | Ongoing |
| | **Runoff and Infiltration Associated with Aggregate Stockpiles** | |
| **5** | Continue to characterize the aggregate runoff source term and thresholds for identifying aggregate runoff by performing geochemical testing. Elevated copper concentrations were observed in historical shake flask extraction testing leachate for several aggregate samples, indicating that aggregate may be the source of the copper exceedances in surface water and groundwater. | New |
| **6** | Minimize the spatial extent and volume of aggregate stockpiles outside of the leachate collection system. Where this is not feasible, stockpiles should be covered with low permeability temporary tarps as soon as practical to minimize sulphate, ammonia, nitrate and TSS impacts on downgradient groundwater and surface water quality. Direct runoff from aggregate stockpiles away from natural water courses as it is known to exceed BCWQ guidelines for sulphate and some nitrogenous compounds. This approach proved to be effective for mitigation of historical aggregate impacts at the Hartland North Pad. Aggregate run-off mitigation and control is currently underway by the CRD, and additional measures are being evaluated/planned as part of an overall aggregate management plan. | Ongoing |
| | **Groundwater Monitoring Program** | |
| **7** | Advance a network of boreholes into the bedrock slope west of the Phase 2 landfill to characterize the geology, hydrogeology and groundwater quality. This will also allow for establishment of a long-term groundwater monitoring network west and upslope of the Phase 2 landfill to support continued evaluations of hydraulic trap performance and monitor groundwater quality. This is required to monitor the lowering of the water table surrounding Phase 2 following completion of the Phase 2 Quarry. Water levels have dropped significantly over the past several years, and monitoring of the hydraulic trap is critical to confirming landfill performance. | Ongoing |
| **8** | Groundwater monitoring wells in proximity to the Phase 2 Basin and Northwest Sedimentation Pond should be monitored closely 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 groundwater flow system on the west side of the Highland Fault and the Phase 2 hydraulic trap, resulting in lowering of the surrounding groundwater levels and increased leachate generation. | Ongoing |
| **9** | Groundwater is no longer compliant north of the Lower Leachate Lagoon and the Northeast Stockpile. A Notice of Offsite Migration should be issued to downgradient property owner(s) pursuant to the requirements of the BC CSR. Additional groundwater monitoring wells should also be installed downgradient of the Northeast Stockpile to monitor groundwater quality on the north perimeter of the Site. This work is currently underway. | New |
| **10** | Elevated and non-compliant boron concentrations were observed at Boundary Compliance Station GW-20-1-2. The source of boron should be investigation by performing speciation/isotopic testing. | New |

| | | |
|---|---|---|
| **11** | The existing Groundwater, Surface Water and Leachate Monitoring Plan should be updated to ensure that it remains effective in monitoring the impacts current and future of landfill operations, including aggregate production, stockpiling, transport and use. This work is currently underway. | Ongoing |
| **12** | 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 |
| **13** | 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). This can be accomplished by drilling through the refuse to the base of the landfill and investigating leachate levels in new wells. It is important that new wells are drilled because the wells tend to shift and become damaged as the refuse pile shifts over time. | Ongoing |
| **14** | Conduct a 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 benefits from a complete understanding of the landfill design and operations over the next five years. The next review should be conducted in 2024 following completion of the Cell 4and design of Cell 5 and 6. | Ongoing |
| **15** | 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 Water Monitoring** | | |
| **16** | Provide sodium concentration data. Analyzing sodium is required to help determine if elevated chloride concentrations originate from road salt application. | Ongoing |
| **17** | Investigate water quality impacts associated with the application of magnesium lignosulphonate and stop or limit the use this product as a dust suppressant. Use should be limited to unpaved roads within leachate containment. | New |
| **18** | Improve surface water flow monitoring upstream of Sw-N-05 in Heal Creek to ensure it provides an accurate measurement of surface water discharge from the landfill. Accurate flow measurements are important for evaluating environmental impacts and ensuring adequate collection and conveyance capacity. | Ongoing |
| **19** | Improve surface water management north of the Phase 2 landfill to minimize impacts of aggregate runoff on groundwater and surface water that is not captured by the leachate collection system. This may require lining of the NWSP and installation of an underdrain to allow for management of groundwater separately from surface water in the area. Additional sediment control measures and efforts to reduce the quantity of blasting residuals contained in aggregate stockpiles may help reduce impacts on water quality as quarry development becomes increasingly close to the northern property boundary and the water quality Boundary Compliance monitoring stations. | Ongoing |
| **Leachate Monitoring** | | |
| **20** | Characterize the chemistry of residual wastewater solids and stabilized biosolids (solids and leachate) to allow for establishment of indicator parameter thresholds and future evaluation of any impacts to leachate chemistry. This information may be available from pilot studies or operational monitoring programs. | Ongoing |
| **21** | Investigate the source of chloride in the south area of the landfill. 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 facility have been noted in the past. Changes in activities at the south end of the landfill and management of impacted surface runoff may play a role. | Ongoing |
| **22** | Resume leachate sampling from the Phase 2 Cleanout as soon as the sampling pump is replaced. This information will be important for tracking changes in leachate chemistry as Phase 2 Cell 4/5/6 are developed. This work is currently underway. | Ongoing |
| **23** | 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. Additionally, an updated list of emerging contaminants will be integrated into the monitoring program for the 2024/2025. | Ongoing |
| **Construction Management** | | |
| **24** | Future blasting and quarrying activities 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. This has been demonstrated to have important implications on groundwater elevations west of the Highland Fault and the volume of seepage reporting to the Phase 2 Basin as the base of the quarry has been lowered. In circumstances where blasting might induce substantial topographic alterations or changes to the elevation of the base of the Phase 2 quarry, consultation with a hydrogeologist is recommended to evaluate potential implications on the performance of the hydraulic trap and the leachate collection system. | Ongoing |
| **25** | 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** | | |
| **26** | 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., G.I.T.** is a Hydrogeologist / Geochemist with about 4.5 years of experience working at AECOM, conducting research at Simon Fraser University, and working in mineral exploration. He has been involved in several hydrogeological and geochemical investigations at Hartland landfill over the past three years. Matt contributed to data analysis and was the lead author of this report.

**Ryan Mills, M.Sc., P.Geo.** is a Senior Hydrogeologist with over 22 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 was the senior reviewer of this 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

# Hartland Landfill Groundwater, Surface Water and Leachate Monitoring Program Annual Report (Apr 2023 to Mar 2024)
## Appendix A-1. Monitoring Well Co-ordinates 2023-2024

| 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-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 | |
| 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 | |

***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* |

# Hartland Landfill Groundwater, Surface Water and Leachate Monitoring Program Annual Report (Apr 2023 to Mar 2024)
## Appendix A-1. Monitoring Well Co-ordinates 2023-2024

| 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-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 | |
| 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 | |

***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* |

# Hartland Landfill Groundwater, Surface Water and Leachate Monitoring Program Annual Report (Apr 2023 to Mar 2024)
## Appendix A-1. Monitoring Well Co-ordinates 2023-2024

| 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-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 | |
| 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-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-95-1-1 | 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 |

***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 2023-2024

| 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-96-1-1 | 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 |
| GW-98-1-1 | 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 |
| GW-103-1-1 | 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 |
| GW-104-1-1 | Active | 5376438.121 | 465666.3 | 135.52 | 135.46 | 135.46 | 129.36 | 127.84 | -0.06 | 7.62 | 6.10 | 7.62 | 2022 Aug | S | NP2 | Installed in August 2022 |
| GW-108-1-1 | Active | 5376441.45 | 465701.6 | 129.80 | 130.69 | 130.69 | 119.26 | 116.21 | 0.89 | 15.24 | 11.43 | 14.48 | 2022 Aug | D | NP2 | Installed in August 2022 |
| GW-109-1-1 | Active | 5376390.117 | 465635.3 | 134.14 | 134.91 | 134.91 | 123.94 | 122.41 | 0.77 | 13.11 | 10.97 | 12.50 | 2022 Aug | S | NP2 | Installed in August 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 |
| 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 |
| P11 | Active | 5376434.0 | 465685.9 | 135.01 | 135.69 | 135.69 | 134.33 | 117.94 | 0.68 | 17.07 | 13.87 | 16.51 | 2022 Aug | D | NP2 | Installed in August 2022 |
| P12 | Active | 5376418.0 | 465702.6 | 135.22 | 135.86 | 135.86 | 134.58 | 116.47 | 0.64 | 18.75 | 13.56 | 14.78 | 2022 Aug | D | NP2 | Installed in August 2022 |
| 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 | | | | 55.54 | 42 | 44.5 | | | | |
| GW-01-1-2 | Inactive | 5375781.9 | 465852.0 | | | 168.53 | | | | 40.10 | 24.4 | 24.8 | | | | |
| GW-01-1-3 | Inactive | 5375781.9 | 465852.0 | | | 168.53 | | | | 29.53 | 13 | 14.75 | | | | |
| GW-01-2-1 | Inactive | 5375787.9 | 465859.0 | | | 168.25 | | | | 20.50 | 4.7 | 5.1 | | | | |
| GW-01-3-1 | Inactive | 5375791.9 | 465851.0 | | | 167.81 | | | | 21.02 | 5.11 | 5.91 | | | | |
| GW-02-1-1 | Inactive | 5375813.9 | 465996.0 | | | 166.90 | | | | 48.58 | 33 | 33.5 | | | | |
| GW-02-1-2 | Inactive | 5375813.9 | 465996.0 | | | 166.90 | | | | 39.29 | 23 | 24.6 | | | | |
| GW-02-1-3 | Inactive | 5375813.9 | 465996.0 | | | 166.90 | | | | 28.79 | 12.2 | 13.8 | | | | |
| GW-02-2-1 | Inactive | 5375812.9 | 465990.0 | | | 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 | | | | |

***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 2023-2024

| 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-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 | |
| 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 | | | | |
| 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-27-1-1 | Inactive | 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 | Inactive | 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 | Destoryed in summer 2022 |
| 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 2023-2024

| 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-78-1-1 | Inactive | 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 | Inactive | 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-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 |
| GW-93-1-1 | Inactive | 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 | Inactive | 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 |
| GW-97-1-1 | Inactive | 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 |
| GW-99-1-1 | Inactive | 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 |
| GW-100-1-1 | Inactive | 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 |
| GW-101-1-1 | Inactive | 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 |
| GW-102-1-1 | Inactive | 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, decomissioned in Q3 2022 |
| GW-105-1-1 | Inactive | 5376431.992 | 465673.0 | 135.51 | 135.42 | 135.42 | 126.58 | 123.53 | -0.09 | 12.19 | 8.84 | 11.89 | 2022 Aug | I | NP2 | Installed in August 2022 |
| GW-106-1-1 | Inactive | 5376423.369 | 465679.7 | 135.43 | 135.34 | 135.34 | 123.15 | 121.62 | -0.09 | 13.72 | 12.19 | 13.72 | 2022 Aug | I | NP2 | Installed in August 2022 |
| GW-107-1-1 | Inactive | 5376417.266 | 465684.4 | 135.54 | 135.40 | 135.40 | 121.88 | 120.35 | -0.14 | 16.76 | 13.52 | 15.05 | 2022 Aug | D | NP2 | Installed in August 2022 |
| GW-107-1-2 | Inactive | 5376417.266 | 465684.4 | 135.54 | 135.43 | 135.43 | 129.33 | 128.27 | -0.11 | 16.76 | 6.10 | 7.16 | 2022 Aug | S | NP2 | Installed in August 2022 |
| GW-110-1-1 | Inactive | 5376365.13 | 465593.6 | 137.61 | 138.32 | 138.32 | 134.21 | 132.68 | 0.71 | 5.94 | 4.11 | 5.64 | 2022 Aug | S | NP2 | Installed in August 2022 |
| 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* |
| *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* |

# A2. Groundwater Monitoring Plan

# Hartland Landfill Groundwater, Surface Water and Leachate Monitoring Program Annual Report (Apr 2023 to Mar 2024)
# Appendix A-2. Groundwater Monitoring Plan 2023-2024

| Station Name | Status | Pipe Diameter (mm) | Monitored in 2023-2024 | | | | 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-04-3-1 | Active | 50 | Y | | Y | | footvalve | footvalve | Submersile pump removed. Sampled using waterra from May 2019 onwards. |
| GW-04-4-1 | Active | 50 | Y | | Y | | footvalve | footvalve | |
| 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 | |
| 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. Recharges in minutes |
| GW-20-1-2 | Active | 50 | Y | | Y | | sample pump | sample pump | Dedicated submersible pump installed January 2012. Recharges completely in under 1 hour |
| 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-25-1-1 | Active | 50 | Y | | Y | | footvalve | footvalve | |
| GW-25-1-2 | Active | 50 | Y | | Y | | footvalve | footvalve | |
| 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 | Recharges very slowly, 48 hours required after purging to sample. |
| 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 | | Y | | footvalve | footvalve | Reactivated to sampling plan in Q1 of 2024 due to Nitrate issues stemming from NE Stockpile |
| 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 | |

***Notes:***

*Footvalves are 16 mm (5/8") unless otherwise noted.*

*NA - Not Available or Not Applicable.*

| Station Name | Status | Pipe Diameter (mm) | Monitored in 2023-2024 | | | | 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-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 | |
| 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-94-1-1 | Active | 50 | Y | | Y | Y | Waterra | Waterra | Well drilled in Dec 2019. Pressure transducer installed in March 2020 |
| GW-95-1-1 | Active | 50 | | Y | Y | | Waterra | Waterra | Well drilled April 14 2022 |
| GW-96-1-1 | Active | 50 | | Y | Y | | Waterra | Waterra | Well drilled April 14 2022 |
| GW-97-1-1 | Active | 50 | | Y | Y | | Waterra | Waterra | Well drilled April 14 2022 |
| GW-98-1-1 | Active | 50 | Y | | Y | | Waterra | Waterra | Well drilled April 18 2022 |
| GW-99-1-1 | Active | 50 | | Y | Y | | Waterra | Waterra | Well drilled April 18 2022. Dry at the time of drilling. Dry during the wet season in 2022 |
| GW-100-1-1 | Active | 50 | Y | | Y | | Waterra | Waterra | Well drilled April 18 2022. Dry at the time of drilling. Not enough volume to sample during the wet season in 2022 |
| GW-101-1-1 | Active | 50 | | Y | Y | | Waterra | Waterra | Well drilled April 18 2022. Dry during the wet season in 2022 |

***Notes:***

*Footvalves are 16 mm (5/8") unless otherwise noted.*

*NA - Not Available or Not Applicable.*

| Station Name | Status | Pipe Diameter (mm) | Monitored in 2023-2024 | | | | 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-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 | |
| 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-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-94-1-1 | Active | 50 | Y | | Y | Y | Waterra | Waterra | Well drilled in Dec 2019. Pressure transducer installed in March 2020 |
| GW-95-1-1 | Active | 50 | | Y | Y | | Waterra | Waterra | Well drilled April 14 2022 |
| GW-96-1-1 | Active | 50 | | Y | Y | | Waterra | Waterra | Well drilled April 14 2022 |
| GW-98-1-1 | Active | 50 | Y | | Y | | Waterra | Waterra | Well drilled April 18 2022 |

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

| Station Name | Status | Pipe Diameter (mm) | Monitored in 2023-2024 | | | | 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 103-1-1 | Active | 50 | | Y | Y | | Waterra | Waterra | Well drilled April 18 2022 |
| GW 104-1-1 | Active | 50 | Y | | Y | | Waterra | Waterra | Well drilled July 11 2022 |
| GW 108-1-1 | Active | 50 | | Y | Y | | Waterra | Waterra | Well drilled August 2 2022 |
| GW 109-1-1 | Active | 50 | | | Y | | Waterra | Waterra | Well drilled August 9 2022. Deep well. |
| P11 | Active | 101.6 | Y | | Y | | Waterra | Waterra | Submersible pump installed and functional in Q2 of 2024 |
| P12 | Active | 101.6 | Y | | Y | | Waterra | Waterra | Well drilled August 5 2022. 4" diameter borehole |
| 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 | | 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-07-1-0 | Inactive | 220 | | | Y | | well pump | well pump | Several maintenance issues (electrical panel, spigot connection, power) resulted in station not sampled in the last year |
| 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 |

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

| Station Name | Status | Pipe Diameter (mm) | Monitored in 2023-2024 | | | | 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-11-1-1 | Inactive | 20 | | | | | | | Site destroyed |
| GW-12-1-0 | Inactive | 220 | | | | | | | Deactivated in 2010. |
| 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-27-1-1 | Inactive | 50 | | | | | footvalve | footvalve | Sampled in Q2, Q3, and Q4 of 2023. Decomissioned in Q1 of 2024 due to construction of cell 4 |
| GW-27-1-2 | Inactive | 50 | | | | | footvalve | footvalve | Destroyed in summer 2022. No longer exists. |
| 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-78-1-1 | Inactive | 50 | | | | | NA | NA | Sampled in Q2, Q3, and Q4 of 2023. Decomissioned in Q1 of 2024 due to construction of new commercial road |
| GW-78-2-1 | Inactive | 50 | | | | | NA | NA | Sampled in Q2, Q3, and Q4 of 2023. Decomissioned in Q1 of 2024 due to construction of new commercial road |
| 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. |
| GW-93-1-1 | Inactive | 50 | | | | | Waterra | Waterra | Destroyed September 2022 due to aggregate stockpiling |
| GW-97-1-1 | Inactive | 50 | | | | | Waterra | Waterra | Decommissioned in 2024 Q1 |
| GW-99-1-1 | Inactive | 50 | | Y | Y | | Waterra | Waterra | Decommissioned in 2024 Q1 |
| GW-100-1-1 | Inactive | 50 | Y | | Y | | Waterra | Waterra | Decommissioned in 2024 Q1 |
| GW 101-1-1 | Inactive | 50 | | Y | Y | | Waterra | Waterra | Decommissioned in 2024 Q1 |
| GW 105-1-1 | Inactive | 50 | Y | | Y | | Waterra | Waterra | Decommissioned in 2024 Q1 |
| GW 106-1-1 | Inactive | 50 | Y | | Y | | Waterra | Waterra | Decommissioned in 2024 Q1 |
| GW 107-1-1 | Inactive | 50 | | Y | Y | | Waterra | Waterra | Decommissioned in 2024 Q1 |
| GW 110-1-1 | Inactive | 50 | | | Y | | Waterra | Waterra | Decommissioned in 2024 Q1 |
| 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

# Hartland Landfill Groundwater, Surface Water and Leachate Monitoring Program Annual Report (Apr 2023 to Mar 2024)
## Appendix A-3 - Groundwater Elevations 2023-2024

| Groundwater Level Elevations (mASL) | | | | |
|---|---|---|---|---|
| Station | Q2 | Q3 | Q4 | Q1 |
| | May 4, 2023 to May 5, 2023 | August 31, 2023 to September 2, 2023 | October 26, 2023 to October 27, 2023 | January 31, 2024 to February 3, 2024 |
| 04-2-1 | 125.10 | 125.10 | 125.34 | 125.46 |
| 04-3-1 | 127.24 | 122.92 | 125.69 | 127.60 |
| 04-4-1 | 125.32 | 123.64 | 124.10 | 124.93 |
| 07-1-0 | 141.42 | 140.87 | 141.15 | 141.71 |
| 09-1-0 | 146.27 | 143.89 | 147.11 | 147.22 |
| 16-1-1 | 127.01 | 122.96 | 123.83 | 130.99 |
| 16-1-2 | 127.96 | 123.97 | 124.04 | 131.64 |
| 16-2-1 | 129.12 | 126.09 | 125.89 | 133.06 |
| 16-2-2 | 128.89 | 126.13 | 125.68 | 132.98 |
| 17-1-1 | 144.89 | 142.69 | 143.43 | 147.32 |
| 17-1-2 | 144.96 | 142.71 | 143.52 | 147.41 |
| 17-1-3 | 145.06 | 142.94 | 143.92 | 147.53 |
| 18-1-1 | 151.56 | 149.15 | 148.97 | 152.91 |
| 18-2-1 | 160.83 | 158.63 | 160.41 | 163.62 |
| 18-2-2 | 160.78 | 158.63 | 160.63 | 163.69 |
| 19-1-1 | 133.01 | 130.79 | 133.54 | 133.54 |
| 19-1-2 | 133.66 | 132.16 | 133.66 | 133.66 |
| 19-2-1 | 133.19 | 131.60 | 133.19 | 133.19 |
| 19-2-2 | 133.28 | 129.36 | 130.75 | 132.20 |
| 20-1-1 | 109.84 | 108.86 | 109.98 | 110.13 |
| 20-1-2 | 109.65 | 108.80 | 109.71 | 109.92 |
| 21-1-1 | 110.19 | 109.32 | 110.26 | 110.67 |
| 21-1-2 | 109.84 | 108.92 | 109.93 | 110.16 |
| 21-2-1 | 109.83 | 108.91 | 109.93 | 110.18 |
| 25-1-1 | 125.29 | 124.07 | 125.44 | 126.69 |
| 25-1-2 | 126.38 | 125.37 | 126.62 | 126.71 |
| 27-1-1 | 139.42 | 139.36 | 140.36 | Decommissioned |
| 28-1-0 | 119.21 | 118.94 | 120.18 | 120.91 |
| 29-1-1 | 112.07 | 110.81 | 112.22 | 112.38 |
| 29-1-2 | 112.18 | 110.88 | 112.28 | 112.35 |
| 30-1-1 | 108.58 | 104.77 | 105.67 | 106.55 |
| 30-1-2 | 108.84 | 105.78 | 106.70 | 107.66 |
| 31-1-1 | 104.53 | 103.28 | 104.33 | 104.96 |
| 31-1-2 | 104.33 | 103.30 | 104.49 | 104.82 |
| 36-1-1 | 123.32 | 120.40 | 124.45 | 124.92 |
| 36-2-1 | 122.74 | 121.42 | 122.42 | 124.54 |
| 36-3-1 | 122.93 | 121.18 | 124.15 | 124.88 |
| 37-1-1 | 123.64 | 122.91 | 124.87 | 126.65 |
| 37-2-1 | 122.03 | 120.68 | 121.51 | 124.52 |
| 37-3-1 | 124.24 | 123.22 | 125.41 | 126.37 |
| 38-1-1 | 119.77 | 119.49 | 119.94 | 121.54 |
| 39-1-1 | 120.31 | 119.41 | 120.03 | 123.15 |
| 39-2-1 | 119.77 | 119.48 | 120.70 | 124.16 |
| 40-1-1 | 117.15 | 117.00 | 117.80 | 117.94 |
| 41-1-1 | 147.44 | 147.29 | 147.54 | 147.93 |
| 42-1-1 | 137.75 | 137.39 | 137.72 | 138.09 |
| 43-1-1 | 158.05 | 156.90 | 157.78 | 159.04 |
| 44-1-1 | 160.14 | 158.95 | 159.94 | 160.61 |
| 46-2-1 | 155.76 | 155.45 | 155.54 | 155.31 |
| 46-3-1 | 151.48 | 154.28 | 154.27 | 150.61 |
| 46-4-1 | 154.34 | 150.76 | 157.22 | 154.26 |
| 47-2-1 | 152.34 | 154.01 | 152.33 | 154.79 |
| 48-2-1 | 150.77 | 148.31 | 148.77 | 150.94 |
| 50-1-1 | 116.54 | 113.40 | 114.35 | 118.47 |
| 51-1-1 | 109.73 | 108.58 | 110.16 | 110.18 |
| 51-2-1 | 109.84 | 108.63 | 110.32 | 110.53 |
| 51-3-1 | 109.95 | 108.65 | 110.38 | 110.66 |
| 52-1-1 | 117.48 | 117.30 | 117.22 | 117.66 |
| 52-2-0 | 118.11 | 117.76 | 118.09 | 118.12 |
| 52-3-0 (P52) | 116.77 | 116.40 | 117.13 | 117.40 |
| 52-4-0 (P7) | 111.40 | 111.93 | 113.00 | 111.97 |
| 53-1-1 | 120.66 | 120.18 | 120.92 | 122.42 |
| 54-1-1 | 149.74 | 146.91 | 146.81 | 150.68 |
| 54-2-1 | 149.27 | 146.57 | 146.47 | 150.35 |
| 54-3-1 | 149.32 | 147.01 | 146.81 | 150.53 |
| 55-1-1 | 142.32 | 140.53 | 142.17 | 143.53 |
| 56-1-1 | 143.71 | 143.68 | 145.77 | 146.26 |
| 57-1-1 | 129.53 | 129.42 | 129.69 | 129.85 |
| 58-1-0 | No reading | 128.06 | 128.23 | No Access |
| 60-1-1 | 141.63 | 140.98 | 141.32 | 141.89 |
| 60-2-1 | 141.65 | 141.23 | 141.29 | 141.92 |
| 60-3-1 | 141.25 | 140.66 | 141.44 | 141.43 |
| 61-1-1 | 184.89 | 183.34 | 184.17 | 186.29 |
| 62-1-1 | 171.18 | 162.11 | 163.13 | 175.53 |
| 62-2-1 | 171.16 | 166.39 | 165.73 | 175.50 |
| 63-1-1 | 191.01 | 188.66 | 189.45 | 192.51 |
| 63-2-1 | 192.03 | 190.39 | 192.68 | 193.95 |
| 71-1-1 | 141.58 | 140.51 | 141.22 | 142.18 |
| 71-2-1 | 141.71 | 140.68 | 141.37 | 142.28 |
| 71-3-1 | 141.72 | 140.69 | 141.38 | 142.30 |
| 72-1-1 | 141.49 | 140.78 | 141.27 | 141.78 |
| 72-2-1 | 141.69 | 141.02 | 141.12 | 141.87 |
| 72-3-1 | 141.68 | 140.95 | 141.65 | 141.97 |
| 73-1-1 | 133.51 | 131.25 | 133.05 | 135.26 |
| 73-2-1 | 132.70 | 131.25 | 133.07 | 135.21 |
| 73-3-1 | 132.71 | 130.63 | 132.75 | 134.35 |
| 74-2-1 | 152.25 | 152.08 | 152.19 | 152.43 |
| 75-1-1 | 128.90 | 129.35 | 128.48 | 129.29 |
| 76-1-1 | 157.88 | 155.56 | 155.01 | 159.22 |
| 76-2-1 | 160.93 | 158.46 | 158.08 | 163.29 |
| 76-3-1 | 162.92 | 160.64 | 160.07 | 165.85 |
| 77-1-1 | 149.53 | 147.61 | 151.15 | 152.61 |

| Groundwater Level Elevations (mASL) | | | | |
|---|---|---|---|---|
| Station | Q2 | Q3 | Q4 | Q1 |
| | May 4, 2023 to May 5, 2023 | August 31, 2023 to September 2, 2023 | October 26, 2023 to October 27, 2023 | January 31, 2024 to February 3, 2024 |
| 77-2-1 | 148.90 | 146.49 | 150.09 | 151.64 |
| 78-1-1 | 130.93 | 128.51 | 132.93 | Decommissioned |
| 78-2-1 | 134.89 | 133.92 | 137.43 | Decommissioned |
| 80-1-0 (P8) | 113.29 | 113.57 | 113.09 | 113.14 |
| 81-1-0 (P9) | 116.26 | 116.41 | 116.28 | 117.34 |
| 82-1-1 | 133.20 | 143.61 | 133.36 | 132.86 |
| 83-1-1 | 127.98 | 127.23 | 128.36 | 127.02 |
| 85-1-1 | 145.35 | 145.12 | 145.79 | 145.88 |
| 87-1-1 | 170.39 | 156.82 | 155.60 | 182.55 |
| 87-2-1 | 170.54 | 162.57 | 162.48 | 182.77 |
| 88-1-1 | 169.27 | 161.39 | 162.19 | 173.18 |
| 88-2-1 | 169.42 | Dry | Dry | 174.18 |
| 89-1-1 | 152.74 | 153.00 | 152.98 | 151.10 |
| 89-2-1 | 149.41 | 149.74 | 149.87 | 150.22 |
| 90-1-1 | 149.72 | 148.91 | 145.30 | 129.81 |
| 90-2-1 | 133.73 | 139.51 | 146.47 | 148.20 |
| 91-1-1 | 159.94 | 158.07 | 159.97 | 160.71 |
| 92-1-1 | 160.07 | 156.44 | 158.55 | 161.75 |
| 94-1-1 | 196.91 | 177.57 | 172.88 | Destroyed |
| LG-02-D | 150.66 | 148.78 | 149.07 | 151.28 |
| LG-03-D | 150.50 | 149.91 | 149.79 | 153.34 |
| LG-04-D | 157.24 | 157.09 | 157.07 | 154.00 |
| LG-08-D | 146.49 | 143.84 | 143.13 | 153.57 |
| LG-11-S | 155.56 | 155.56 | 155.42 | 155.60 |
| LG-15-D | 150.63 | 150.56 | 150.64 | 149.55 |
| LG-16-D | 151.23 | 152.58 | 153.57 | 149.81 |
| LG-17-D | 152.01 | 156.26 | 157.98 | 150.85 |
| LG-18-D | 150.39 | 150.23 | 150.27 | 150.16 |
| LG-19-D | 150.20 | 149.83 | 150.73 | 151.13 |
| LG-21-D | 154.25 | 144.65 | 146.45 | Destroyed |
| LG-26-D | 146.04 | 144.37 | 144.27 | 144.72 |
| 95-1-1 | 126.99 | 125.68 | 126.85 | 128.01 |
| 96-1-1 | 127.03 | 125.71 | 127.88 | 128.18 |
| 97-1-1 | 126.44 | 125.24 | 127.00 | 127.65 |
| 98-1-1 | 126.91 | 125.66 | 127.52 | 127.86 |
| 99-1-1 | Dry | Dry | 132.08 | Decommissioned |
| 100-1-1 | 128.49 | Dry | 129.01 | Decommissioned |
| 101-1-1 | 128.94 | Dry | 128.51 | Decommissioned |
| 103-1-1 | 132.17 | 131.43 | 131.97 | Decommissioned |
| 104-1-1 | 131.31 | 129.34 | 131.90 | 132.66 |
| 105-1-1 | 128.62 | 127.35 | 129.20 | Decommissioned |
| 106-1-1 | 128.33 | 127.22 | 128.89 | Decommissioned |
| 107-1-1 | 124.43 | 123.31 | 124.32 | Decommissioned |
| 107-1-2 | Dry | Dry | Dry | Decommissioned |
| 108-1-1 | 124.41 | 121.94 | 124.10 | 125.99 |
| 109-1-1 | 128.23 | 127.79 | 128.00 | 130.29 |
| 110-1-1 | 133.92 | 132.03 | 133.20 | Decommissioned |
| P-11 | 126.58 | Dry | 128.22 | 127.84 |
| P-12 | 120.91 | 120.26 | 123.25 | 126.03 |

***Notes:***

*Bracketed data on bottom of well.*

*--- Not measured*

# A4. Surface Water Station Details

# Hartland Landfill Groundwater, Surface Water and Leachate Monitoring Program Annual Report (Apr 2023 to Mar 2024)
## Appendix A-4. Surface Water Station Details 2023-2024

| 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 north of sedimentation pond - 40m north of 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 downstream of confluence with 42, 17 and 16. Creek and above confluence with North Wetland Creek. |
| SW-N-18 | 5 376 429.846 | 465 679.709 | Active | Y | | Manhole 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. Catchment area includes north pad/RTF. Discharges to Durrance Lake |
| SW-N-41s3 | 5 377 102.438 | 465 021.226 | Active | Y | | 41 Creek just upstream of discharge to Durrance Lake. |
| SW-N-42s1 | 5 376 753.436 | 465 553.804 | Active | Y | | 42 Creek at discharge from 42-1-1 Wetland below southeast end of Yardwaste Pad. Across Willis Point Road from GW-N-42. |
| SW-N-45 | 5 376 605.647 | 465 797.403 | Active | Y | | Heal Creek just upstream of 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 | Station on south side of Willis Point Rd at ephemeral stream and culvert 300 m west of Yardwaste gate.Was previously the background station, but may be impacted by aggregate stockpiling in NW; new background station is SW-N-66 |
| 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 east side of Mt. Work. Discharges to culvert and drains to South Diversion Ditch. |
| SW-N-55 | 5 376 432.480 | 466 536.890 | Active | Y | | Stream located on the South side of Willis Point Road, captures surface water run off from the NE aggregate stockpiles area. |
| SW-N-56 | 5 376 326.240 | 466 776.380 | Active | Y | | Stream located on the North East perimeter of the landfill, North of Kiowa Road. Captures surfacewater flow from the southern extent of the NE aggregate stockpile area and flows towards Willis Point Road |
| SW-N-57 | 5 376 439.917 | 465 744.608 | Active | Y | | Added December 5 2022. Green pipe outlet at West end of upper lagoon. Collects directed surface water runoff from Shane's pond and the Toutle Valley. Has valve to discharge to the sedimentation pond, or upper lagoon depending on water quality. Currently discahrging to upper lagoon. |
| SW-N-58 | 5 376 430.529 | 465 691.127 | Active | Y | | Added December 5 2022. Manhole near P11, collecting from black pipe in ditch along High Level Road and groundwater pumped out of P11. |
| SW-N-59 | 5 376 468.163 | 465 532.662 | Active | Y | | Added December 5 2022. Manhole near GW 77, collecting surfacewater from the kitcen scraps pad (not yet bult as of May 25 2023). |
| SW-N-60 | 5 376 504.232 | 465 439.352 | Active | Y | | Added December 5 2022. Manhole, smaller channel within the manhole collecting directed surfacewater runoff from Shane's pond. |
| SW-N-61 | 5 376 504.346 | 465 135.424 | Active | Y | | Added December 5 2022. Manhole on the West side of the road collected surfacewater drainage from Shane's pond. On the East side of the road there is a pipe at the base of a block wall which feeds into this manhole. It is the beginning of the collection point which reports to SW-N-57. |
| SW-N-62 | 5 376 346.869 | 465 503.734 | Active | Y | | Added December 5 2022. Culvert at the outlet of ditch in Toutle valley. |
| SW-N-63 | 5 377 369.181 | 466 786.923 | Active | Y | | Added February 8 2023. Sampling point on Durrance creek downstream of confluence with Heal creek. Located adjacent to a culvert that runs under the road on private property. |
| SW-N-64 | 5 377 367.064 | 466 825.288 | Active | Y | | Added February 8 2023. Sampling point on Todd Creek upstream of the Durrance Creek confluence. |
| SW-N-65 | 5 377 383.733 | 466 830.580 | Active | Y | | Added February 8 2023. Sampling point on Todd Creek downstream of confluence with Durrance Creek. |

# Appendix B

## Water Quality Data

- B1. Groundwater Quality
- 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 (not sampled in 2024)
- B7. Monthly Leachate Quality – North Purge Wells
- B8. Monthly Leachate Quality – Controlled Waste Drainage
- B9. Monthly Leachate Quality – South Purge Well
- B10. Monthly Leachate Quality – West Face Drainage
- B11. Monthly Leachate Quality - Cell 3 Pipe Outlet

# B1. Groundwater Quality

**Hartland Landfill Groundwater, Surface Water and Leachate Monitoring Program Annual Report**
**(Apr 2023 to Mar 2024)**
**Appendix B-1. Groundwater Quality Data 2023-2024**

| | | | | 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 |
| 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 |
| | | | | Fraction | TOT | TOT | TOT | TOT | 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 | µg/l | mg/L | mg/L | µg/l | µg/l | µg/l | µg/l | | µg/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 |
| Gw-04-3-1 | SS | Y | 2023-05-24 | Clear and colourless | 7.42 | 328 | 9.6 | 180 | 208 | 3.08 | 0.077 | 0.216 | 38.3 | < 0.01 | < 0.005 | 94. | 0.044 9 | 69.4 | 25. | 0.15 | 0.0362 | 0.382 | 7. | | 0.035 |
| Gw-04-3-1 | SS | Y | 2023-10-04 | Clear and colourless | 7.88 | 490 | 10.2 | 170 | 223 | 2.93 | 0.063 | 0.201 | 40.8 | < 0.01 | < 0.005 | 82. | 0.033 7 | 73.6 | 25. | < 0.1 | 0.033 3 | 0.492 | 2.1 | | 0.032 1 |
| Gw-04-3-1 | SS | Y | 2023-11-28 | Clear and colourless | 7.54 | 480 | 8.4 | 160 | 204 | 5.48 | 0.094 | 0.2 | 36.6 | < 0.01 | < 0.005 | 72. | 0.108 | 68.7 | 27. | < 0.1 | 0.038 1 | 0.709 | 8.9 | | 0.059 8 |
| Gw-04-3-1 | SS | Y | 2024-02-23 | Clear Colourless | 8.06 | 321 | 9.2 | 160 | 213 | 6.71 | 0.119 | 0.282 | 36.2 | < 0.01 | < 0.005 | 78. | 0.078 6 | 70.5 | 29. | < 0.1 | 0.035 5 | 0.533 | 3.1 | | 0.035 9 |
| Gw-04-4-1 | SS | Y | 2023-05-24 | Clear and colourless | 6.69 | 238 | 9.3 | 71 | 108 | 21.3 | 0.055 | 0.081 | 9.4 | < 0.01 | < 0.005 | 96. | 0.011 1 | 34.2 | 40. | 0.94 | 0.174 | 1.82 | 30.6 | | 0.024 7 |
| Gw-04-4-1 | SS | Y | 2023-10-03 | Clear and colourless | 6.68 | 530 | 10.8 | 110 | 190 | 3.95 | 0.02 | 0.045 | 16.8 | < 0.01 | < 0.005 | 71. | 0.156 | 62.2 | 71. | < 0.1 | 0.057 5 | 1.18 | 2.2 | < | 0.005 |
| Gw-04-4-1 | SS | Y | 2023-11-28 | Clear and colourless | 6.99 | 229 | 10.1 | 66 | 99.5 | 6.69 | 0.07 | 0.085 | 8.2 | < 0.01 | < 0.005 | 68. | 0.035 9 | 32.2 | 30. | < 0.1 | 0.057 9 | 1.83 | 3.9 | < | 0.005 |
| Gw-04-4-1 | SS | Y | 2024-02-23 | Clear Colourless | 7.61 | 221 | 8.6 | 61 | 92.7 | 8.16 | 0.081 | 0.075 | 7.15 | < 0.01 | < 0.005 | 67. | 0.016 3 | 29.1 | 31. | 0.13 | 0.059 3 | 1.7 | 5.7 | | 0.006 7 |
| Gw-07-1-0 | NS | N | 2023-05-24 | Not operational - electrical malfunction | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | --- |
| Gw-07-1-0 | NS | N | 2023-09-12 | Not operational - electrical malfunction | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | --- |
| Gw-16-1-1 | SS | N | 2023-09-12 | Clear and colourless sample. Pressure caps were not on very tight. | 8 | 380 | 12.1 | 160 | 179 | 7.96 | 0.095 | 0.077 | 6.44 | < 0.01 | < 0.005 | 27. | 0.025 | 58.3 | 5. | 0.1 | 0.019 | 0.505 | 8.7 | | 0.009 |
| Gw-16-1-1 | SS | N | 2023-11-09 | Clear and colourless | 6.89 | 270 | 11.1 | 150 | 236 | 1.42 | 0.124 | 0.088 | 7.95 | < 0.01 | < 0.005 | 18. | 0.012 6 | 77.1 | 13. | < 0.1 | 0.065 2 | 0.732 | 1.5 | | 0.006 1 |
| Gw-16-1-2 | SS | N | 2023-09-12 | Slightly turbid, clear | 7.72 | 370 | 11.8 | 130 | 162 | 19.2 | 0.077 | 0.094 | 18.3 | < 0.01 | < 0.005 | < 10. | 0.019 | 53.8 | 8. | < 0.1 | 0.032 | 0.449 | 13.7 | | 0.039 |
| Gw-16-1-2 | SS | N | 2023-11-09 | Slightly turbid, colourless | 6.56 | 315 | 11.2 | 120 | 188 | 1.41 | 0.06 | 0.12 | 24.2 | < 0.01 | < 0.005 | 10. | 0.019 | 61.8 | 12. | 0.1 | 0.043 9 | 0.451 | 1.5 | | 0.008 7 |
| Gw-16-2-1 | SS | N | 2023-09-12 | Very slightly turbid, clear sample. Casings were extended, bottom well depth measured. | 7.96 | 320 | 11.9 | 170 | 193 | 28.6 | 0.066 | 0.161 | 10.3 | < 0.01 | < 0.005 | 13. | 0.047 | 65.6 | 4.5 | 0.18 | 0.066 | 0.472 | 70.1 | < | 0.005 |
| Gw-16-2-1 | SS | N | 2023-11-09 | Clear and colourless | 6.35 | 690 | 11.2 | 130 | 304 | 8.68 | 0.074 | 0.171 | 17.3 | < 0.01 | < 0.005 | 13. | 0.060 6 | 102. | 28. | 0.23 | 0.185 | 1.7 | 5.8 | | 0.011 4 |
| Gw-16-2-2 | NS | N | 2023-09-12 | Dry - Not enough water to sample. | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | --- |
| Gw-16-2-2 | SS | N | 2023-11-09 | Clear and colourless | 6.32 | 490 | 11.7 | 93 | 377 | 15.1 | 0.033 | 0.133 | 22.8 | 0.017 | < 0.005 | 14. | 0.113 | 118. | 47. | 0.22 | 0.536 | 6.87 | 3.6 | | 0.014 9 |
| Gw-17-1-1 | SS | Y | 2023-09-14 | Moderaterly turbid, clear | 7.99 | 470 | 12.6 | 210 | 188 | 3.41 | 0.227 | 1.04 | 16.6 | < 0.01 | < 0.005 | 15. | 0.012 2 | 56. | 5. | 0.18 | 0.011 2 | 0.637 | 7.5 | | 0.012 1 |
| Gw-17-1-1 | SS | Y | 2023-11-09 | Clear and colourless | 7.18 | 510 | 10.8 | 220 | 237 | 1.33 | 0.324 | 0.474 | 13.5 | < 0.01 | < 0.005 | 10. | 0.008 6 | 72.6 | 4.5 | 0.17 | 0.010 8 | 0.568 | < 1. | < | 0.005 |
| Gw-17-1-2 | SS | Y | 2023-09-14 | Clear and colourless | 7.92 | 450 | 12.1 | 200 | 191 | 2.19 | 0.195 | 0.552 | 35.5 | < 0.01 | < 0.005 | 18. | 0.018 9 | 58.4 | 4.3 | 0.14 | 0.012 1 | 0.822 | 6.2 | | 0.007 9 |
| Gw-17-1-2 | SS | Y | 2023-11-09 | Clear and colourless | 7.12 | 352 | 11.2 | 200 | 205 | 1.23 | 0.197 | 0.495 | 34.2 | < 0.01 | < 0.005 | 15. | 0.008 6 | 63.4 | 4.6 | 0.15 | 0.011 3 | 0.823 | 2. | < | 0.005 |
| Gw-17-1-3 | SS | Y | 2023-09-14 | Clear and colourless | 8 | 510 | 11.8 | 240 | 251 | 3.56 | 0.022 | 0.272 | 13.6 | < 0.01 | < 0.005 | 14. | 0.018 8 | 76.3 | 4.6 | 0.16 | 0.017 3 | 0.509 | 3.2 | | 0.009 7 |
| Gw-17-1-3 | SS | Y | 2023-11-09 | Clear and colourless | 6.82 | 308 | 11.1 | 120 | 135 | 8.91 | 0.029 | 0.107 | 3.26 | < 0.01 | < 0.005 | < 10. | 0.015 | 43.2 | 5.3 | 0.11 | 0.124 | 2.18 | 2.7 | < | 0.005 |
| Gw-18-1-1 | FRM | Y | 2023-05-09 | Mean of duplicates, clear and colourless | 7.53 | 255 | 11.7 | 150 | 174.5 | 13.45 | 0.558 | 2.685 | 13.2 | < 0.01 | < 0.005 | 31.5 | 0.051 1 | 57.6 | 2.45 | < 0.1 | 0.167 | 0.675 5 | 26.35 | | 0.095 55 |
| Gw-18-1-1 | FRM | Y | 2023-09-14 | Mean of duplicates, clear and colourless | 8.11 | 350 | 12.6 | 150 | 155.5 | 36.9 | 1.025 | 2.32 | 13.55 | < 0.01 | < 0.005 | 24.5 | 0.251 5 | 51.5 | 2.75 | 0.165 | 0.182 | 1.42 | 92.55 | | 0.145 |
| Gw-18-1-1 | FRM | Y | 2023-11-09 | Mean of duplicates, clear and colourless | 7.5 | 301 | 10.6 | 140 | 158 | 3.165 | 0.661 5 | 2.22 | 11.85 | < 0.01 | < 0.005 | 21.5 | 0.006 95 | 52.25 | 2.85 | 0.195 | 0.125 | 0.081 5 | 5.05 | < | 0.005 |
| Gw-18-1-1 | FRM | Y | 2024-03-01 | Mean of duplicates, clear and colourless | 8.14 | 360 | 8 | 140 | 178 | 19.95 | 1.075 | 2.765 | 16.45 | < 0.01 | < 0.005 | 194. | 0.797 | 58.6 | 3.3 | < 0.1 | 0.050 5 | 0.485 5 | 4.05 | < | 0.005 |
| Gw-18-2-1 | SS | Y | 2023-09-14 | Clear and colourless | 7.97 | 269 | 11.6 | 140 | 171 | 20.4 | 0.024 | 0.044 | 1.42 | < 0.01 | < 0.005 | < 10. | 0.034 5 | 58.7 | 4.2 | 0.17 | 0.024 4 | 1.34 | 12.6 | | 0.040 6 |
| Gw-18-2-1 | SS | Y | 2023-11-09 | Clear and colourless | 7.1 | 296 | 10.8 | 140 | 185 | 56. | 0.035 | 0.052 | 1.74 | < 0.01 | < 0.005 | < 10. | 0.031 1 | 62.8 | 5.8 | 0.13 | 0.063 8 | 1.69 | 30.8 | | 0.144 |
| Gw-18-2-1 | SS | Y | 2023-05-09 | Clear and colourless | 7.05 | 177 | 10.1 | 89 | 129 | 2.87 | 0.035 | 0.049 | 2.28 | < 0.01 | < 0.005 | 10. | 0.085 9 | 43.9 | 4.1 | < 0.1 | 0.018 7 | 1.29 | 2.1 | | 0.015 5 |
| Gw-18-2-1 | SS | Y | 2024-03-01 | Clear Colourless | 8.07 | 330 | 5 | 120 | 168 | 2.48 | 0.034 | 0.041 | 3.39 | < 0.01 | < 0.005 | 129. | 0.047 | 57.7 | 10. | < 0.1 | 0.028 | 1.27 | 3.9 | < | 0.005 |
| Gw-18-2-2 | SS | Y | 2023-09-14 | Clear and colourless sample. Purge started at 11:50, stopped at 13:10. | 7.83 | 270 | 13.4 | 140 | 159 | 3.1 | 0.023 | 0.064 | 5.2 | < 0.01 | < 0.005 | < 10. | 0.044 6 | 55.3 | 4. | < 0.1 | 0.030 8 | 0.846 | 4.8 | | 0.009 7 |
| Gw-18-2-2 | SS | Y | 2023-11-09 | Clear and colourless | 6.92 | 410 | 10.7 | 110 | 179 | 2.78 | 0.038 | 0.068 | 5.94 | < 0.01 | < 0.005 | < 10. | 0.024 6 | 61.9 | 3.4 | < 0.1 | 0.257 | 0.624 | 3.5 | < | 0.005 |
| Gw-18-2-2 | SS | Y | 2023-05-09 | Clear and colourless | 6.95 | 273 | 10.7 | 150 | 205 | 2.21 | 0.033 | 0.082 | 9.81 | < 0.01 | < 0.005 | 11. | 0.023 2 | 71.1 | 4.3 | < 0.1 | 0.7 | 1.09 | 4.6 | | 0.074 6 |
| Gw-18-2-2 | SS | Y | 2024-03-01 | Clear Colourless | 7.68 | 280 | 6 | 97 | 166 | 13.5 | 0.071 | 0.166 | 9.57 | < 0.01 | < 0.005 | 113. | < 0.005 | 57.9 | 11. | < 0.1 | 3.38 | 0.295 | 44.3 | | 0.005 |
| Gw-19-1-1 | SS | N | 2023-05-24 | Well dry on purge day. Slightly turbid, moderately yellow-brown | 6.99 | 362 | 10.4 | 220 | 227 | 1.75 | 0.093 | 0.88 | 19.9 | < 0.01 | < 0.005 | 44. | < 0.005 | 72.6 | 20. | 0.1 | 0.91 | 0.09 | 1 940. | < | 0.005 |
| Gw-19-1-1 | SS | N | 2023-10-04 | Clear, very slightly yellow | 7.7 | 356 | 10.9 | 200 | 227 | 1.87 | 0.061 | 1.1 | 15.1 | < 0.01 | < 0.005 | 34. | < 0.005 | 71.8 | 22. | < 0.1 | 0.367 | < 0.05 | 2 510. | < | 0.005 |
| Gw-19-1-1 | SS | N | 2023-11-28 | Clear and colourless | 6.76 | 560 | 9.5 | 230 | 247 | 2.19 | 0.043 | 1.03 | 11.7 | < 0.01 | < 0.005 | 22. | 0.012 3 | 80.4 | 31. | 0.1 | 0.359 | 0.128 | 3 730. | | 0.007 4 |
| Gw-19-1-1 | SS | N | 2024-02-23 | Clear Colourless | 7.79 | 372 | 9.4 | 200 | 243 | 1.82 | 0.038 | 3.05 | 6.89 | < 0.01 | < 0.005 | 30. | < 0.005 | 78.8 | 26. | 0.16 | 0.208 | < 0.05 | 8 140. | < | 0.005 |
| Gw-19-1-2 | SS | N | 2023-05-23 | Purged until well was flowing as a trickle and then sampled. Clear and colourless | 7.06 | 279 | 11 | 180 | 187 | 4.34 | < 0.02 | 1.43 | 4.48 | < 0.01 | < 0.005 | 62. | < 0.005 | 101. | 13. | 0.14 | 0.074 3 | 0.052 | 5 290. | | 0.005 4 |
| Gw-19-1-2 | SS | N | 2023-10-04 | Very slightly turbid, colourless | 7.61 | 560 | 10.6 | 240 | 272 | 3.46 | < 0.02 | 3.95 | 4.4 | < 0.022 | < 0.005 | 21. | 0.010 8 | 88.8 | 28. | 0.16 | 0.177 | 0.056 | 11 900. | | 0.033 |
| Gw-19-1-2 | SS | N | 2023-11-28 | Clear and colourless | 6.88 | 343 | 9.5 | 200 | 207 | 2.34 | 0.034 | 2.11 | 3.75 | < 0.01 | < 0.005 | 15. | 0.027 7 | 68.3 | 23. | < 0.1 | 0.135 | 0.051 | 6 790. | | 0.021 1 |
| Gw-19-1-2 | SS | N | 2024-02-23 | Clear Colourless | 7.89 | 420 | 9.6 | 170 | 197 | 2.11 | < 0.02 | 1.57 | 3.17 | < 0.01 | < 0.005 | 27. | 0.040 5 | 63.3 | 15. | < 0.1 | 0.125 | 0.075 | 4 360. | | 0.005 2 |
| Gw-19-2-1 | SS | N | 2023-05-23 | colourless | 7.82 | 317 | 11.6 | 150 | 186 | 1.27 | < 0.02 | 0.237 | 39.4 | < 0.01 | < 0.005 | 98. | < 0.005 | 57.4 | 15. | 0.13 | 0.067 1 | < 0.05 | 88.2 | < | 0.005 |
| Gw-19-2-1 | SS | N | 2023-10-03 | Clear and colourless. GW well ran. | 7.86 | 410 | 11.6 | 150 | 195 | 1.53 | < 0.02 | 0.196 | 40.9 | < 0.01 | < 0.005 | 59. | < 0.005 | 60.6 | 14. | < 0.1 | 0.089 | 0.056 | 66.9 | | 0.005 2 |
| Gw-19-2-1 | SS | N | 2023-11-28 | Clear and colourless | 7.34 | 309 | 9.9 | 160 | 198 | 1.58 | 0.022 | 0.229 | 40.8 | < 0.01 | < 0.005 | 59. | < 0.005 | 61.8 | 17. | < 0.1 | 0.081 5 | < 0.05 | 74.8 | < | 0.005 |
| Gw-19-2-1 | SS | N | 2024-02-23 | Clear Colourless | 8.14 | 450 | 9.8 | 160 | 211 | 3.96 | < 0.02 | 0.248 | 41.4 | < 0.01 | < 0.005 | 66. | < 0.005 | 65. | 19. | < 0.1 | 0.186 | 0.241 | 112. | | 0.008 1 |
| Gw-19-2-2 | SS | N | 2023-05-24 | Slightly turbid, moderately tan | 7.36 | 254 | 10.1 | 120 | 159 | 1.74 | < 0.02 | 0.047 | 14.4 | < 0.01 | < 0.005 | 62. | 0.008 4 | 48. | 15. | < 0.1 | 0.009 4 | 0.184 | 4.5 | < | 0.005 |
| Gw-19-2-2 | SS | N | 2023-10-04 | Clear, very slightly yellow | 7.83 | 460 | 11.3 | 180 | 220 | 19.8 | < 0.02 | 0.122 | 21.4 | < 0.01 | < 0.005 | 63. | 0.129 | 65.5 | 22. | < 0.1 | 0.016 1 | 0.527 | 21.8 | | 0.029 3 |
| Gw-19-2-2 | SS | N | 2023-11-28 | Clear, very slightly yellow. | 7.34 | 350 | 10.5 | 120 | 153 | 3.09 | 0.029 | 0.047 | 18.2 | < 0.01 | < 0.005 | 51. | < 0.005 | 46.2 | 16. | < 0.1 | 0.006 3 | 0.12 | 3.2 | < | 0.005 |
| Gw-19-2-2 | SS | N | 2024-02-23 | Clear, slightly yellow in colour | 7.94 | 410 | 9.6 | 130 | 180 | 2.85 | < 0.02 | 0.051 | 11.3 | < 0.01 | < 0.005 | 64. | 0.008 8 | 51.8 | 19. | < 0.1 | 0.012 4 | 0.198 | 6.6 | | 0.006 |
| Gw-20-1-1 | SS | Y | 2023-05-16 | Very slightly turbid, clear | 8.26 | 137 | 11.1 | 70 | 61.5 | 4.2 | < 0.1 | < 0.1 | 2.51 | < 0.05 | < 0.025 | 4 110. | < 0.025 | 19.6 | 3.9 | < 0.5 | < 0.025 | < 0.25 | < 5. | < | 0.025 |
| Gw-20-1-1 | SS | Y | 2023-09-19 | Clear and colourless. Purged Dry and sampled same day. | 7.84 | 180 | 11.7 | 73 | 69 | 18.8 | < 0.04 | 0.089 | 2.06 | < 0.01 | < 0.005 | 4 640. | < 0.025 | 22. | 3.4 | < 0.2 | 0.033 | 0.17 | < 24.2 | | 0.052 |
| Gw-20-1-1 | SS | Y | 2023-11-16 | Clear and colourless | 8.21 | 132 | 11 | 69 | 61.6 | 4.6 | < 0.1 | < 0.1 | 1.69 | < 0.05 | < 0.025 | 4 210. | < 0.025 | 19.3 | 3.9 | < 0.5 | < 0.025 | 0.82 | < 5. | | 0.043 |
| Gw-20-1-1 | SS | Y | 2024-02-07 | Clear Colourless | 7.97 | 200 | 10.7 | 76 | 71.6 | 6.3 | < 0.1 | < 0.1 | 2.83 | < 0.05 | < 0.025 | 3 990. | < 0.025 | 22.7 | 6.5 | < 0.5 | < 0.025 | < 0.25 | < 5. | | 0.037 |
| Gw-20-1-2 | SS | Y | 2023-05-16 | Clear and colourless | 8.26 | 147 | 11.5 | 75 | 135 | 4.59 | < 0.02 | 1.25 | 15. | < 0.01 | < 0.005 | 691. | < 0.005 | 40. | 5.1 | 0.26 | 0.916 | 0.309 | 867. | | 0.008 1 |
| Gw-20-1-2 | SS | Y | 2023-09-19 | Clear and colourless. Purged Dry and sampled same day. | 7.84 | 180 | 11.9 | 72 | 66.8 | 11.9 | < 0.04 | 0.076 | 3.07 | < 0.02 | < 0.01 | 5 260. b | 0.034 | 21.2 | 3.9 | 0.24 | 0.044 | < 0.1 | 22.1 | | 0.02 |
| Gw-20-1-2 | SS | Y | 2023-11-16 | Clear and colourless | 8.13 | 154 | 11.1 | 82 | 78.8 | 9.2 | < 0.1 | < 0.1 | 4.54 | < 0.05 | < 0.025 | 4 110. | < 0.025 | 24.9 | 6.1 | < 0.5 | 0.043 | < 0.25 | 25.8 | | 0.054 |
| Gw-20-1-2 | SS | Y | 2024-02-07 | Clear Colourless | 7.95 | 220 | 11.4 | 87 | 79.6 | 4.4 | < 0.1 | < 0.1 | 3.54 | < 0.05 | < 0.025 | 4 000. | < 0.025 | 24.5 | 7.9 | < 0.5 | 0.031 | < 0.25 | < 5. | | 1.65 |
| Gw-21-1-1 | FRM | Y | 2023-05-16 | Mean of duplicates, clear and colourless | 8.38 | 130 | 11.9 | 70 | 63.5 | 35.8 | < 0.1 | 1.52 | 3.23 | < 0.05 | < 0.025 | 3 840. | 0.04 | 19.55 | 3.3 | < 0.5 | 0.136 | 0.285 | 75.7 | | 0.125 5 |
| Gw-21-1-1 | FRM | Y | 2023-09-21 | Mean of duplicates, clear and colourless | 7.78 | 181 | 12 | 79 | 76.55 | 11.45 | < 0.1 | 0.185 | 2.69 | < 0.05 | < 0.025 | 4 345. | < 0.025 | 24.3 | 5.85 | < 0.5 | 0.03 | < 0.25 | 16.7 | | 0.027 5 |
| Gw-21-1-1 | FRM | Y | 2023-11-17 | Mean of duplicates | 8.34 | 148 | 11 | 67.5 | 63 | 3.75 | < 0.1 | 1.305 | 1.515 | < 0.05 | < 0.025 | 3 960. | < 0.025 | 19.7 | 3.1 | < 0.5 | < 0.025 | 0.325 | < 5. | < | 0.025 |
| Gw-21-1-1 | FRM | Y | 2024-02-07 | Mean of duplicates, clear and colourless | 8.09 | 391 | 11.1 | 68.5 | 61.15 | 3.6 | < 0.1 | 0.76 | 1.615 | < 0.05 | < 0.025 | 3 850. | < 0.025 | 18.75 | 3.15 | < 0.5 | < 0.025 | < 0.25 | < 5. | | 1.359 5 |
| Gw-21-1-2 | FRM | Y | 2023-05-16 | Mean of duplicates, clear and colourless | 6.8 | 342 | 12 | 160 | 133 | 7.52 | 0.022 5 | 1.185 | 14.2 | < 0.01 | < 0.005 | 683. | 0.006 55 | 39.65 | 30. | 0.375 | 0.89 | 0.304 | 861. | | 0.006 9 |
| Gw-21-1-2 | FRM | Y | 2023-09-20 | Mean of duplicates, clear and colourless | 7.185 | 517 | 12.6 | 180 | 192.5 | 2.82 | 0.025 5 | 1.365 | 19.7 | < 0.01 | < 0.005 | 947.5 | 0.005 65 | 57.4 | 52. | 0.305 | 1.13 | 0.255 5 | 1 195. | | 0.009 65 |
| Gw-21-1-2 | FRM | Y | 2023-11-16 | Mean of duplicates, clear and colourless | 6.65 | 610 | 11.2 | 190 | 193.5 | 5.16 | < 0.02 | 1.27 | 19.55 | < 0.01 | < 0.005 | 836. | 0.005 45 | 57.35 | 58. | 0.12 | 1.245 | 0.293 5 | 1 250. | | 0.010 1 |
| Gw-21-1-2 | FRM | Y | 2024-02-07 | Mean of duplicates, clear and colourless | 7.465 | 500 | 10.7 | 150 | 157 | 1.865 | 0.031 5 | 1.46 | 15.15 | < 0.01 | < 0.005 | 733. | 0.012 25 | 46.6 | 41.5 | 0.18 | 0.996 | 0.226 5 | 856.5 | | 0.005 8 |
| Gw-21-2-1 | FRM | Y | 2023-05-16 | Mean of duplicates, clear, very slightly yellow. | 6.84 | 363 | 12.7 | 160 | 141 | 14.455 | < 0.02 | 1.94 | 13.85 | < 0.01 | < 0.005 | 580. | 0.009 85 | 41.95 | 35.5 | 1.465 | 1.02 | 0.261 5 | 1 155. | | 0.008 7 |
| Gw-21-2-1 | FRM | Y | 2023-09-21 | Mean of duplicates, clear and slightly orange | 7.575 | 620 | 12.3 | 190 | 196 | 3.01 | 0.022 5 | 1.515 | 18.2 | < 0.01 | < 0.005 | 682.5 | 0.013 | 58.65 | 61.5 | 0.2 | 1.28 | 0.473 | 984.5 | | 0.007 65 |
| Gw-21-2-1 | FRM | Y | 2023-11-15 | Mean of duplicates, clear and colourless | 6.85 | 635 | 11.2 | 185 | 184 | 2.305 | < 0.02 | 1.425 | 17.5 | < 0.01 | < 0.005 | 726. | 0.006 25 | 54.65 | 64. | 0.215 | 1.27 | 0.342 5 | 1 080. | | 0.008 4 |
| Gw-21-2-1 | FRM | Y | 2024-02-08 | Mean of duplicates, clear and colourless | 7.49 | 159 | 9.9 | 150 | 158 | 1.59 | 0.025 | 1.445 | 16.05 | < 0.01 | < 0.005 | 727. | 0.011 8 | 47.05 | 51.5 | 0.215 | 0.99 | 0.206 5 | 839.5 | | 0.006 15 |
| Gw-25-1-1 | SS | N | 2023-05-16 | Clear and colourless | 7.26 | 430 | 12 | 160 | 272 | 41.5 | 0.194 | 0.144 | 5.93 | < 0.01 | < 0.005 | 237. | 0.007 8 | 92.5 | 6.8 | 2.05 | 0.14 | 0.342 | 135. | | 0.089 3 |
| Gw-25-1-1 | SS | N | 2023-09-21 | Clear and colourless | 7.75 | 430 | 13.7 | 170 | 268 | 2.67 | 0.167 | 0.218 | 5.31 | < 0.01 | < 0.005 | 261. | 0.007 1 | 91.9 | 7.8 | < 0.1 | 0.081 9 | 0.326 | 9.9 | | 0.012 8 |
| Gw-25-1-1 | SS | N | 2023-11-14 | Clear and colourless | 6.97 | 409 | 10.8 | 160 | 267 | 9. | 0.153 | 0.14 | 5.34 | < 0.01 | < 0.005 | 253. | 0.007 7 | 91.2 | 9.9 | < 0.1 | 0.095 6 | 0.355 | 6.7 | | 0.013 5 |
| Gw-25-1-1 | SS | N | 2024-02-09 | Clear Colourless | 7.84 | 610 | 10.2 | 170 | 278 | 8.84 | 0.183 | 0.288 | 18.8 | < 0.01 | < 0.005 | 304. | 0.013 3 | 95.3 | 7.5 | < 0.1 | 0.097 6 | 0.363 | 11.3 | | 0.024 8 |
| Gw-25-1-2 | SS | N | 2023-05-16 | transducer out. | 7.22 | 356 | 13.8 | 110 | 202 | 165. | 0.17 | 0.161 | 6.87 | < 0.01 | < 0.005 | 138. | 0.014 7 | 71.8 | 5.1 | 0.7 | 0.284 | 1.2 | 288. | | 0.080 5 |
| Gw-25-1-2 | SS | N | 2023-09-21 | Clear and colourless | 7.69 | 390 | 15.3 | 130 | 199 | 18.4 | 0.144 | 0.21 | 6.41 | < 0.01 | < 0.005 | 119. | 0.011 2 | 70.8 | 2.9 | 0.13 | 0.124 | 4. | 82.3 | | 0.037 1 |
| Gw-25-1-2 | SS | N | 2023-11-14 | Clear and colourless | 6.79 | 350 | 12.4 | 98 | 156 | 3.67 | 0.184 | 0.105 | 4.69 | < 0.01 | < 0.005 | 110. | 0.005 2 | 55.6 | 4.3 | 0.19 | 0.104 | 0.556 | 7.7 | < | 0.005 |
| Gw-25-1-2 | SS | N | 2024-02-09 | Clear Colourless | 7.65 | 340 | 11 | 110 | 172 | 3.42 | 0.243 | 0.12 | 4.16 | < 0.01 | < 0.005 | 143. | 0.012 6 | 61. | 3.3 | < 0.1 | 0.228 | 0.574 | 3.9 | | 0.007 3 |
| Gw-27-1-1 | SS | N | 2023-09-28 | Moderately turbid, slightly grey | 7.62 | 250 | 12.5 | 71 | 94.4 | 23.5 | 0.025 | 0.174 | 8.12 | < 0.01 | < 0.005 | 251. | < 0.005 | 25.8 | 2.8 | < 0.1 | 0.037 | 0.08 | 29.7 | | 0.036 |
| Gw-27-1-1 | SS | N | 2023-11-29 | Clear and colourless | 8.13 | 260 | 10.1 | 69 | 87.8 | 48.1 | < 0.02 | 0.187 | 9.25 | < 0.01 | < 0.005 | 232. | < 0.005 | 24.3 | 3. | 0.11 | 0.047 8 | 0.094 | 71.5 | | 0.033 9 |

| | | | | BC CSR | | | |

| | | | | 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 |
| 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 | |
| | | | | Fraction | TOT | TOT | TOT | TOT | 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 | |
| | | | | 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 | |
| Gw-53-1-1 | SS | Y | 2023-09-22 | Clear and colourless | 8 | 490 | 10.9 | 200 | 249 | 1.77 | < | 0.02 | | 0.111 | | 17.6 | < | 0.01 | < | 0.005 | | 582. | | 0.014 | | 87.3 | 6.2 | < | 0.1 | | 0.347 | | 0.09 | | 345. | | | 0.013 2 | |
| Gw-53-1-1 | SS | Y | 2023-11-21 | Clear and colourless | 7.4 | 500 | 10.5 | 190 | 254 | 1.57 | < | 0.02 | | 0.114 | | 17. | < | 0.01 | < | 0.005 | | 487. | | 0.014 8 | | 88.9 | 6. | < | 0.1 | | 0.336 | < | 0.05 | | 319. | < | | 0.005 | |
| Gw-53-1-1 | SS | Y | 2024-02-29 | Clear Colourless | 8.09 | 490 | 8.5 | 180 | 257 | 8.86 | | 0.032 | | 0.142 | | 19.9 | < | 0.01 | < | 0.005 | | 730. | | 0.007 | | 89.7 | 7.2 | < | 0.1 | | 0.382 | | 0.099 | | 345. | < | | 0.005 | |
| Gw-55-1-1 | SS | Y | 2023-10-04 | Clear and colourless | 7.73 | 480 | 10.3 | 160 | 213 | 2.39 | | 0.09 | | 0.116 | | 4.58 | < | 0.01 | < | 0.005 | | 20. | < | 0.005 | | 73.9 | 20. | < | 0.1 | | 0.013 6 | | 0.25 | | 1.2 | < | | 0.005 | |
| Gw-55-1-1 | SS | Y | 2023-11-24 | Clear and colourless | 7.14 | 500 | 9.6 | 170 | 202 | 5.2 | | 0.112 | | 0.155 | | 4.56 | < | 0.01 | < | 0.005 | | 15. | < | 0.005 | | 70.6 | 18. | | 0.17 | | 0.016 1 | | 0.244 | | 11.1 | | | 0.01 | |
| Gw-56-1-1 | SS | Y | 2023-05-19 | Clear and colourless | 7.57 | 283 | 10.4 | 150 | 185 | 3.01 | | 0.054 | | 0.187 | | 30. | < | 0.01 | < | 0.005 | | 24. | | 0.034 7 | | 65.6 | 9.9 | | 0.11 | | 0.007 | | 0.146 | | 2.2 | | | 0.005 1 | |
| Gw-56-1-1 | SS | Y | 2023-09-29 | Clear and colourless | 8.14 | 410 | 10.4 | 150 | 207 | 2.34 | | 0.052 | | 0.176 | | 41.8 | < | 0.01 | < | 0.005 | | 18. | | 0.009 | | 72.6 | 8.6 | < | 0.1 | < | 0.005 | | 0.136 | | 2.8 | | | 0.007 | |
| Gw-56-1-1 | SS | Y | 2023-11-30 | Clear and colourless | 7.63 | 291 | 10.1 | 140 | 188 | 3.75 | | 0.028 | | 0.155 | | 27.5 | < | 0.01 | < | 0.005 | | 27. | | 0.014 4 | | 66.1 | 14. | | 0.1 | < | 0.005 | | 0.105 | | 1. | | < | 0.005 | |
| Gw-56-1-1 | SS | Y | 2024-02-28 | Clear Colourless | 7.93 | 289 | 9.8 | 150 | 193 | 2.78 | | 0.057 | | 0.158 | | 35.8 | < | 0.01 | < | 0.005 | | 21. | | 0.032 | | 67.5 | 15. | < | 0.1 | < | 0.005 | | 0.123 | | 1.6 | < | | 0.005 | |
| Gw-57-1-1 | SS | Y | 2023-09-29 | Clear and colourless | 8.09 | 510 | 12.7 | 170 | 251 | 2.06 | | 0.021 | | 0.102 | | 11.9 | < | 0.01 | < | 0.005 | | 36. | | 0.011 | | 90.5 | 18. | < | 0.1 | | 0.085 | | 0.132 | | 34.7 | | | 0.007 | |
| Gw-57-1-1 | SS | Y | 2023-11-17 | Clear and colourless | 7.55 | 490 | 10 | 170 | 231 | 4.04 | < | 0.02 | | 0.073 | | 10.1 | < | 0.01 | < | 0.005 | | 76. | | 0.006 4 | | 83.4 | 15. | | 0.86 | | 0.061 8 | | 0.217 | | 30.1 | | | 0.017 6 | |
| Gw-58-1-0 | SS | N | 2023-05-16 | Clear, very yellow | 6.61 | 5857 | 20.3 | 1900 | 1470 | 13. | | 0.434 | | 2.19 | | 42.7 | < | 0.01 | < | 0.005 | | 3 690. | | 0.010 1 | | 378. | 980. | b | 12.6 | | 49.3 | a | 2.42 | | 9 430. | | | 0.183 | |
| Gw-58-1-0 | SS | N | 2023-09-26 | Clear, moderately yellow | 7.2 | 6400 | 19 | 2000 | 1780 | 13.8 | | 0.46 | | 1.35 | | 34.2 | < | 0.05 | < | 0.025 | | 3 790. | | 0.066 | | 456. | 1 000. | b | 10.6 | | 61.2 | a | 11.6 | | 777. | | | 0.363 | |
| Gw-58-1-0 | SS | N | 2023-11-16 | Clear, moderately yellow | 6.57 | 6500 | 17.7 | 2000 | 1520 | 15.1 | | 0.51 | | 1.39 | | 36.4 | < | 0.05 | < | 0.025 | | 4 010. | | 0.047 | | 389. | 940. | b | 11.2 | | 57. | a | 7.32 | | 1 320. | | | 0.195 | |
| Gw-58-1-0 | SS | N | 2024-02-29 | No turbidity, moderately orange | 7.34 | 6600 | 12.1 | 1400 | 1630 | 14.5 | | 0.536 | | 1.55 | | 42.1 | < | 0.02 | < | 0.01 | < | 4 810. | < | 0.01 | | 425. | 1 200. | b | 13.3 | | 56.5 | a | 6.76 | | 1 390. | | | 0.097 | |
| Gw-60-1-1 | SS | N | 2023-05-24 | Clear and colourless | 7.15 | 640 | 10.6 | 250 | 372 | 1.61 | | 0.021 | | 0.265 | | 21.7 | < | 0.01 | < | 0.005 | | 188. | | 0.009 9 | | 119. | 110 | | 0.16 | | 0.047 2 | | 0.251 | | 193. | | | 0.006 2 | |
| Gw-60-1-1 | SS | N | 2023-10-05 | Clear and colourless | 7.9 | 642 | 10.7 | 240 | 392 | 2.73 | < | 0.02 | | 0.249 | | 22.4 | < | 0.01 | < | 0.005 | | 178. | | 0.010 5 | | 125. | 110. | < | 0.1 | | 0.066 8 | | 0.309 | | 98.6 | | | 0.009 6 | |
| Gw-60-1-1 | SS | N | 2023-11-28 | Clear and colourless | 7.14 | 666 | 10.1 | 240 | 373 | 1.5 | | 0.024 | | 0.276 | | 18.3 | | 0.025 | < | 0.005 | | 183. | | 0.011 7 | | 121. | 120. | < | 0.1 | | 0.045 3 | | 0.871 | | 268. | < | | 0.005 | |
| Gw-60-1-1 | SS | N | 2024-02-21 | Clear Colourless | 7.89 | 700 | 9.8 | 150 | 284 | 1.91 | | 0.071 | | 0.152 | | 14.5 | < | 0.01 | < | 0.005 | | 316. | | 0.052 6 | | 97.1 | 64. | < | 0.1 | | 0.129 | | 1.56 | | 2.4 | < | | 0.005 | |
| Gw-60-2-1 | SS | N | 2023-05-24 | Clear and colourless | 7.43 | 470 | 10.6 | 160 | 277 | 0.81 | | 0.045 | | 0.282 | | 35.1 | < | 0.01 | < | 0.005 | | 330. | | 0.018 1 | | 88.1 | 76. | | 0.32 | | 0.281 | | 0.228 | | 26.1 | | | 0.010 4 | |
| Gw-60-2-1 | SS | N | 2023-10-05 | Clear and colourless | 7.93 | 466 | 10.6 | 150 | 279 | 3.02 | | 0.051 | | 0.289 | | 36.3 | < | 0.01 | < | 0.005 | | 315. | | 0.018 4 | | 87.6 | 72. | < | 0.1 | | 0.19 | | 0.282 | | 23.4 | | | 0.008 6 | |
| Gw-60-2-1 | SS | N | 2023-11-28 | Clear and colourless | 7.41 | 630 | 10.3 | 150 | 263 | 1.33 | | 0.046 | | 0.266 | | 35.2 | < | 0.01 | < | 0.005 | | 265. | | 0.012 3 | | 84. | 68. | < | 0.1 | | 0.146 | | 0.232 | | 7.6 | | | 0.005 | |
| Gw-60-2-1 | SS | N | 2024-02-21 | Clear Colourless | 8.04 | 650 | 10.1 | 140 | 298 | 1.7 | | 0.079 | | 0.324 | | 35.2 | < | 0.01 | < | 0.005 | | 408. | | 0.016 6 | | 92.7 | 72. | < | 0.1 | | 0.155 | | 0.349 | | 10.3 | | | 0.006 8 | |
| Gw-60-3-1 | SS | N | 2023-05-23 | Clear and colourless | 7.03 | 465 | 10.6 | 170 | 276 | 2.48 | | 0.061 | | 0.132 | | 14.9 | < | 0.01 | < | 0.005 | | 204. | | 0.023 9 | | 94.1 | 73. | | 0.49 | | 0.072 7 | | 1.08 | | 6.5 | < | | 0.005 | |
| Gw-60-3-1 | SS | N | 2023-10-05 | Clear and colourless | 7.86 | 619 | 11.4 | 200 | 310 | 1.64 | | 0.057 | | 0.17 | | 15.3 | < | 0.01 | < | 0.005 | | 361. | | 0.043 1 | | 106. | 91. | | 0.1 | | 0.090 5 | | 1.41 | | 1.2 | < | | 0.005 | |
| Gw-60-3-1 | SS | N | 2023-11-28 | Very slightly turbid, colourless | 7.05 | 515 | 10.8 | 200 | 298 | 2.86 | | 0.057 | | 0.135 | | 15. | < | 0.01 | < | 0.005 | | 366. | | 0.111 | | 103. | 71. | < | 0.1 | | 0.111 | | 1.7 | | 3.4 | | | 0.009 7 | |
| Gw-60-3-1 | SS | N | 2024-02-21 | Clear Colourless | 7.98 | 910 | 10.2 | 220 | 417 | 3.13 | < | 0.02 | | 0.362 | | 27.1 | < | 0.01 | < | 0.005 | | 261. | | 0.010 7 | | 132. | 120. | < | 0.1 | | 0.067 3 | | 0.304 | | 145. | | | 0.109 | |
| Gw-62-1-1 | NS | N | 2023-09-22 | Dry | --- | --- | --- | --- | --- | --- | | --- | | --- | | --- | | --- | | --- | | --- | | --- | | --- | --- | | --- | | --- | | --- | | --- | | | --- | |
| Gw-62-1-1 | SS | N | 2023-11-24 | Clear and colourless | 7.15 | 364 | 8.7 | 100 | 223 | 1.67 | | 0.037 | | 0.113 | | 1.5 | < | 0.01 | < | 0.005 | | 24. | < | 0.005 | | 78.2 | 2.5 | | 0.14 | | 0.067 9 | | 0.127 | < | 1. | < | | 0.005 | |
| Gw-62-2-1 | NS | N | 2023-09-22 | Dry - not enough water to sample. | --- | --- | --- | --- | --- | --- | | --- | | --- | | --- | | --- | | --- | | --- | | --- | | --- | --- | | --- | | --- | | --- | | --- | | | --- | |
| Gw-62-2-1 | SS | N | 2023-11-24 | Slightly turbid, slightly grey | 6.8 | 398 | 9.2 | 110 | 239 | 135. | | 0.092 | | 0.205 | | 11.6 | | 0.041 | | 0.022 6 | | 306. | | 0.027 9 | | 83.2 | 3.1 | | 0.28 | | 0.274 | | 0.432 | | 246. | | | 0.833 | |
| Gw-63-1-1 | SS | N | 2023-10-04 | Clear and colourless | 7.84 | 300 | 11.1 | 140 | 155 | 1.78 | < | 0.02 | < | 0.02 | | 8.26 | < | 0.01 | < | 0.005 | | 13. | < | 0.005 | | 48.9 | 4.3 | < | 0.1 | | 0.060 8 | < | 0.05 | | 26.5 | < | | 0.005 | |
| Gw-63-1-1 | SS | N | 2023-11-28 | Clear and colourless | 7.68 | 222 | 9.9 | 140 | 154 | 0.79 | < | 0.02 | | 0.041 | | 7.08 | < | 0.01 | < | 0.005 | | 16. | < | 0.005 | | 50.1 | 3.7 | < | 0.1 | | 0.054 7 | < | 0.05 | | 24.7 | < | | 0.005 | |
| Gw-63-2-1 | SS | N | 2023-10-04 | Clear and colourless | 7.88 | 330 | 10.6 | 150 | 160 | 2.51 | < | 0.02 | | 0.114 | | 18. | < | 0.01 | < | 0.005 | | 11. | | 0.008 1 | | 55.2 | 4.1 | < | 0.1 | | 0.009 | | 0.198 | | 1.3 | < | | 0.005 | |
| Gw-63-2-1 | SS | N | 2023-11-28 | Clear and colourless | 7.6 | 340 | 9.5 | 150 | 163 | 2.18 | | 0.023 | | 0.137 | | 19.7 | < | 0.01 | < | 0.005 | < | 10. | | 0.006 1 | | 57.4 | 4. | < | 0.1 | | 0.009 4 | | 0.232 | | 2.6 | < | | 0.005 | |
| Gw-71-1-1 | FRM | Y | 2023-05-24 | Mean of duplicates, clear and colourless | 7.56 | 243 | 10.3 | 140 | 147 | 2.535 | | 0.049 5 | | 0.425 | | 7.87 | < | 0.01 | < | 0.005 | | 536. | | 0.008 25 | | 48.15 | 6.9 | | 0.28 | | 0.092 25 | | 0.056 5 | | 33.1 | | | 0.006 | |
| Gw-71-1-1 | FRM | Y | 2023-10-05 | Mean of duplicates, clear and colourless | 8.015 | 380 | 10.4 | 160 | 182 | 2.865 | | 0.059 5 | | 0.359 | | 6.975 | < | 0.01 | < | 0.005 | | 462. | | 0.587 6 | | 59.85 | 7.2 | | 0.115 | | 0.101 35 | | 0.140 5 | | 29.05 | | | 0.009 2 | |
| Gw-71-1-1 | FRM | Y | 2023-11-28 | Mean of duplicates, clear and colourless | 7.55 | 390 | 9.4 | 165 | 174 | 1.735 | | 0.058 | | 0.330 5 | | 7.785 | < | 0.01 | < | 0.005 | | 429.5 | | 0.005 5 | | 58.05 | 7.45 | < | 0.1 | | 0.108 5 | | 0.098 5 | | 15.3 | < | | 0.005 | |
| Gw-71-1-1 | FRM | Y | 2024-02-21 | Mean of duplicates, clear and colourless | 8.005 | 246 | 9.5 | 135 | 164 | 9.685 | | 0.057 5 | | 0.448 | | 8.05 | < | 0.01 | < | 0.005 | | 562.5 | | 0.029 75 | | 53.6 | 6.85 | < | 0.1 | | 0.113 | | 0.124 | | 36.1 | | | 0.014 8 | |
| Gw-71-2-1 | SS | Y | 2023-05-24 | Clear and colourless | 7.38 | 345 | 10.2 | 210 | 230 | 6.08 | | 0.034 | | 0.242 | | 23.7 | < | 0.01 | < | 0.005 | | 311. | | 0.041 1 | | 79.4 | 8.3 | | 0.69 | | 0.181 | | 0.299 | | 11.7 | | | 0.050 9 | |
| Gw-71-2-1 | SS | Y | 2023-10-05 | Clear and colourless | 8.04 | 480 | 11 | 200 | 242 | 4.03 | | 0.029 | | 0.373 | | 28.4 | < | 0.01 | < | 0.005 | | 314. | | 0.059 1 | | 83.3 | 7.9 | < | 0.1 | | 0.168 | | 0.178 | | 86.4 | | | 0.045 1 | |
| Gw-71-2-1 | SS | Y | 2023-11-28 | Clear and colourless | 7.39 | 500 | 9.7 | 210 | 235 | 2.39 | | 0.041 | | 0.291 | | 26.9 | < | 0.01 | < | 0.005 | | 276. | | 0.032 | | 81.1 | 7.9 | | 0.18 | | 0.23 | | 0.188 | | 3. | | | 0.043 6 | |
| Gw-71-2-1 | SS | Y | 2024-02-21 | Clear Colourless | 7.82 | 346 | 10.1 | 190 | 248 | 8.12 | | 0.046 | | 0.242 | | 28.4 | < | 0.01 | < | 0.005 | | 347. | | 0.063 5 | | 85.2 | 8.1 | < | 0.1 | | 0.143 | | 0.256 | | 10.5 | | | 0.057 7 | |
| Gw-71-3-1 | SS | Y | 2023-05-23 | Clear and colourless | 6.86 | 264 | 10.9 | 160 | 195 | 133. | | 0.033 | | 0.116 | | 8.44 | | 0.021 | | 0.005 7 | | 230. | | 0.040 4 | | 70.7 | 9.1 | | 0.16 | | 0.612 | | 2.35 | | 527. | | | 0.197 | |
| Gw-71-3-1 | SS | Y | 2023-10-05 | Clear and colourless | 7.51 | 343 | 11.4 | 180 | 222 | 2.49 | | 0.026 | | 0.092 | | 11.3 | < | 0.01 | < | 0.005 | | 456. | | 0.037 | | 79.1 | 8.1 | | 0.12 | | 0.043 2 | | 0.842 | | 2.9 | | | 0.009 | |
| Gw-71-3-1 | SS | Y | 2023-11-28 | Clear and colourless | 6.86 | 337 | 10.5 | 150 | 214 | 1.94 | | 0.025 | | 0.044 | | 7.7 | < | 0.01 | < | 0.005 | | 390. | | 0.033 9 | | 76.9 | 8.8 | < | 0.1 | | 0.034 2 | | 0.856 | | 2.4 | < | | 0.005 | |
| Gw-71-3-1 | SS | Y | 2024-02-21 | Clear Colourless | 7.72 | 420 | 9.9 | 150 | 203 | 2.72 | | 0.035 | | 0.058 | | 6.4 | < | 0.01 | < | 0.005 | | 340. | | 0.034 1 | | 72.7 | 12. | < | 0.1 | | 0.04 | | 1.11 | | 3.6 | | | 0.011 5 | |
| Gw-72-1-1 | FRM | Y | 2023-05-23 | Mean of duplicates, clear and colourless | 7.49 | 389 | 11.5 | 150 | 261.5 | 4.98 | < | 0.02 | | 0.128 | | 12.8 | < | 0.01 | < | 0.005 | | 1 665. | | 0.012 05 | | 83.35 | 66. | | 0.425 | | 0.064 05 | | 0.097 5 | | 377.5 | | | 0.006 1 | |
| Gw-72-1-1 | FRM | Y | 2023-10-05 | Mean of duplicates, clear and colourless | 7.99 | 600 | 11.7 | 150 | 268.5 | 12. | | 0.035 5 | | 0.112 | | 12.1 | < | 0.015 | < | 0.007 5 | | 1 760. | | 0.016 35 | | 85.35 | 66. | | 0.165 | | 0.069 15 | | 0.181 | | 380.5 | | | 0.012 25 | |
| Gw-72-1-1 | FRM | Y | 2023-11-28 | Mean of duplicates, clear and colourless | 7.63 | 610 | 10.3 | 150 | 255.5 | 2.035 | < | 0.02 | | 0.115 | | 12.35 | < | 0.01 | < | 0.005 | < | 1 650. | < | 0.005 | | 82.7 | 66. | < | 0.1 | | 0.037 75 | | 0.054 | | 364. | < | | 0.005 | |
| Gw-72-1-1 | FRM | Y | 2024-02-21 | Mean of duplicates, clear and colourless | 8.075 | 615 | 10.5 | 150 | 289.5 | 2.695 | < | 0.02 | | 0.128 | | 12.45 | < | 0.01 | < | 0.005 | | 1 805. | | 0.005 9 | | 91.6 | 66.5 | < | 0.1 | | 0.036 | | 0.062 5 | | 406.5 | | | 0.005 45 | |
| Gw-72-3-1 | SS | Y | 2023-05-24 | Clear and colourless | 7.33 | 431 | 10.4 | 190 | 235 | 0.92 | | 0.028 | | 0.264 | | 15. | < | 0.01 | < | 0.005 | | 470. | | 0.017 7 | | 82.8 | 39. | | 0.11 | | 0.064 9 | | 0.291 | | 3.3 | < | | 0.005 | |
| Gw-72-3-1 | SS | Y | 2023-10-05 | Clear and colourless | 7.97 | 640 | 11.3 | 200 | 257 | 2.04 | | 0.033 | | 0.278 | | 18. | < | 0.01 | < | 0.005 | | 535. | | 0.015 7 | | 90.5 | 40. | | 0.16 | | 0.08 | | 0.354 | | 5. | | | 0.008 5 | |
| Gw-72-3-1 | SS | Y | 2023-11-28 | Clear and colourless | 7.37 | 620 | 10.8 | 190 | 244 | 2.01 | | 0.025 | | 0.263 | | 14.4 | < | 0.01 | < | 0.005 | | 567. | | 0.033 6 | | 86.7 | 40. | < | 0.1 | | 0.073 3 | | 0.609 | | 7.6 | | | 0.006 2 | |
| Gw-72-3-1 | SS | Y | 2024-02-21 | Clear Colourless | 8.03 | 620 | 10.4 | 180 | 253 | 6.54 | | 0.048 | | 0.303 | | 14.4 | < | 0.01 | < | 0.005 | | 577. | | 0.024 5 | | 89. | 41. | < | 0.1 | | 0.086 8 | | 0.323 | | 13.3 | | | 0.009 | |
| Gw-73-1-1 | FRM | Y | 2023-05-24 | Mean of duplicates, clear and colourless | 7.3 | 329 | 10.1 | 160 | 208.5 | 1.245 | | 0.025 5 | | 0.209 | | 13.65 | < | 0.01 | | 0.007 75 | | 143.5 | | 0.049 | | 64.75 | 21. | | 0.355 | | 0.248 5 | | 0.46 | | 5.3 | | | 0.009 4 | |
| Gw-73-1-1 | FRM | Y | 2023-10-05 | Mean of duplicates, clear and colourless | 7.93 | 470 | 10.6 | 160 | 221 | 1.21 | | 0.032 | | 0.227 5 | | 14.2 | < | 0.01 | < | 0.005 | | 160. | | 0.058 65 | | 68.4 | 20. | | 0.1 | | 0.383 | | 0.337 5 | | 1.3 | | | 0.008 9 | |
| Gw-73-1-1 | FRM | Y | 2023-11-28 | Mean of duplicates, clear and colourless | 7.22 | 329 | 9.8 | 160 | 210.5 | 1.15 | | 0.035 | | 0.189 | | 13.8 | < | 0.01 | < | 0.005 | | 171.5 | | 0.056 3 | | 66.75 | 21. | < | 0.1 | | 0.315 | | 0.313 5 | | 4.65 | | | 0.006 6 | |
| Gw-73-1-1 | FRM | Y | 2024-02-23 | Mean of duplicates, clear and colourless | 8.015 | 331 | 10.1 | 155 | 211 | 1.635 | | 0.049 | | 0.194 | | 12.85 | < | 0.01 | < | 0.005 | | 113. | | 0.093 8 | | 65.65 | 21. | < | 0.1 | | 0.283 | | 0.418 | | 4.3 | | | 0.006 2 | |
| Gw-73-2-1 | SS | Y | 2023-05-24 | Clear and colourless | 7.05 | 313 | 10.4 | 150 | 195 | 2.78 | < | 0.02 | | 0.11 | | 11.9 | < | 0.01 | < | 0.005 | | 95. | | 0.008 3 | | 61.5 | 22. | | 0.28 | | 0.135 | | 0.377 | | 22.2 | < | | 0.005 | |
| Gw-73-2-1 | SS | Y | 2023-10-05 | Clear and colourless | 7.86 | 347 | 10.8 | 160 | 230 | 1.53 | < | 0.02 | | 0.116 | | 10.8 | < | 0.01 | < | 0.005 | | 114. | | 0.008 1 | | 72.5 | 28. | | 0.12 | | 0.294 | | 0.558 | | 10.4 | < | | 0.005 | |
| Gw-73-2-1 | SS | Y | 2023-11-28 | Clear and colourless | 7.01 | 328 | 10.4 | 150 | 202 | 2.26 | < | 0.02 | | 0.086 | | 9.27 | < | 0.01 | < | 0.005 | | 115. | | 0.006 3 | | 64.9 | 27. | < | 0.1 | | 0.089 1 | | 0.323 | | 8.3 | < | | 0.005 | |
| Gw-73-2-1 | SS | Y | 2024-02-23 | Clear Colourless | 7.95 | 319 | 10.4 | 150 | 202 | 1.92 | < | 0.02 | | 0.063 | | 9. | < | 0.01 | < | 0.005 | | 79. | | 0.029 7 | | 63.8 | 23. | < | 0.1 | | 0.103 | | 0.284 | | 7. | < | | 0.005 | |
| Gw-73-3-1 | SS | Y | 2023-05-24 | Clear and colourless | 6.85 | 268 | 10.6 | 94 | 110 | 3.88 | | 0.034 | | 0.141 | | 16.7 | < | 0.01 | < | 0.005 | | 79. | | 0.141 | | 34.6 | 32. | | 0.14 | | 0.029 3 | | 0.331 | | 12. | | | 0.007 4 | |
| Gw-73-3-1 | FRM | Y | 2023-10-05 | Mean of duplicates, clear and colourless | 7.93 | 470 | 10.6 | 160 | 221 | 1.21 | | 0.032 | | 0.227 5 | | 14.2 | < | 0.01 | < | 0.005 | | 160. | | 0.058 65 | | 68.4 | 20. | | 0.1 | | 0.383 | | 0.337 5 | | 1.3 | | | 0.008 9 | |
| Gw-73-3-1 | SS | Y | 2023-11-28 | Clear and colourless | 6.88 | 380 | 10.7 | 91 | 125 | 8.99 | | 0.043 | | 0.158 | | 17.7 | < | 0.01 | < | 0.005 | | 57. | | 0.19 | | 39.9 | 36. | | 0.17 | | 0.028 8 | | 0.425 | | 8.8 | | | 0.019 8 | |
| Gw-73-3-1 | FRM | Y | 2024-02-23 | Mean of duplicates, clear and colourless | 8.015 | 331 | 10.1 | 155 | 211 | 1.635 | | 0.049 | | 0.194 | | 12.85 | < | 0.01 | < | 0.005 | | 113. | | 0.093 8 | | 65.65 | 21. | < | 0.1 | | 0.283 | | 0.418 | | 4.3 | | | 0.006 2 | |
| Gw-77-1-1 | SS | N | 2023-09-25 | Clear and colourless | 8.05 | 350 | 13.3 | 150 | 161 | 6.87 | | 0.059 | | 0.136 | | 9.16 | < | 0.01 | < | 0.005 | | 227. | | 0.027 8 | | 49. | 4.5 | | 0.48 | | 0.073 1 | | 0.374 | | 20.8 | | | 0.009 9 | |
| Gw-77-1-1 | SS | N | 2023-11-22 | Very slightly turbid, very very slightly grey | 7.76 | 370 | 10.7 | 150 | 170 | 737. | | 0.135 | | 0.222 | | 13.6 | | 0.04 | | 0.017 5 | | 232. | | 0.021 7 | | 51.3 | 4.9 | | 1.04 | | 0.89 | | 1.63 | | 1 130. | | | 0.445 | |
| Gw-77-2-1 | SS | N | 2023-09-26 | Clear and colourless | 7.91 | 610 | 11.9 | 130 | 262 | 3.45 | | 0.028 | | 0.874 | | 23.6 | < | 0.01 | < | 0.005 | | 174. | | 0.054 2 | | 70.9 | 68. | < | 0.1 | | 0.033 1 | | 0.171 | | 4.5 | < | | 0.005 | |
| Gw-77-2-1 | SS | N | 2023-11-22 | Clear and colourless | 7.74 | 436 | 10.1 | 130 | 265 | 3.49 | | 0.031 | | 0.725 | | 22.8 | < | 0.01 | < | 0.005 | | 177. | | 0.020 6 | | 72.8 | 70. | < | 0.1 | | 0.013 2 | | 0.264 | | 6.4 | | | 0.011 8 | |
| Gw-78-1-1 | SS | N | 2023-09-26 | Clear and colourless | 7.88 | 376 | 12.7 | 210 | 218 | 304. | | 7.88 | b | 0.686 | | 31.2 | | 0.01 | < | 0.005 | | 316. | | 0.102 | | 61.6 | 2.4 | | 0.88 | | 0.834 | | 3.25 | | 1 490. | | | 0.585 | |
| Gw-78-1-1 | SS | N | 2023-11-23 | Clear and colourless | 7.2 | 480 | 11.1 | 190 | 209 | 6.17 | | 1.3 | | 0.429 | | 24.3 | < | 0.01 | < | 0.005 | | 321. | | 0.033 5 | | 59.8 | 2.5 | | 0.2 | | 0.006 1 | | 0.323 | | 4.8 | < | | 0.005 | |
| Gw-78-2-1 | SS | N | 2023-09-26 | Clear and colourless | 7.83 | 362 | 16 | 190 | 221 | 119. | | 0.247 | | 0.519 | | 16.9 | < | 0.01 | < | 0.005 | | 386. | | 0.114 | | 73.2 | 1.6 | | 0.22 | | 0.913 | | 0.627 | | 8.7 | | | 0.016 6 | |
| Gw-78-2-1 | SS | N | 2023-11-23 | Clear and colourless | 6.94 | 350 | 12.1 | 98 | 148 | 2.19 | | 0.165 | | 0.257 | | 11.4 | < | 0.01 | < | 0.005 | | 233. | | 0.402 | | 49.8 | 2.6 | | 0.34 | | 0.043 1 | | 0.345 | | 3.1 | | | 0.005 9 | |
| Gw-80-1-0 (PS | SS | N | 2023-05-15 | Clear and slightly orange | 7.26 | 4694 | 21.2 | 2000 | 436 | 96.7 | | 1.63 | | 11.4 | b | 116. | < | 0.02 | < | 0.01 | | 3 170. | | 0.032 | | 109. | 360. | b | 29.5 | | 17.1 | | 6.18 | | 9 870. | | | 0.144 | |
| Gw-80-1-0 (PS | SS | N | 2023-09-20 | Moderatley turbid, moderately brown | 7.66 | 4680 | 18.7 | 2100 | 596 | 121. | | 1.55 | | 14.9 | b | 198. | < | 0.04 | < | 0.02 | | 3 410. | | 0.044 | | 134. | 380. | b | 27.6 | | 17.7 | | 19.8 | | 18 600. | | | 0.639 | |
| Gw-80-1-0 (PS | SS | N | 2023-11-17 | Clear, moderately yellow | 7.22 | 4300 | 13.5 | 1700 | 416 | 82.6 | | 1.4 | | 11.1 | b | 96.9 | < | 0.02 | < | 0.01 | | 3 030. | | 0.033 | | 100. | 310. | b | 28.7 | | 14.2 | | 5.28 | | 8 860. | | | 0.676 | |
| Gw-80-1-0 (PS | SS | N | 2024-02-14 | Clear, moderately orange | 7.93 | 2774 | 11.6 | 1300 | 432 | 44.7 | | 1.17 | | 8.05 | | 79.3 | < | 0.02 | < | 0.01 | | 2 660. | | 0.022 | | 101. | 290. | b | 17.8 | | 12.7 | | 3.94 | | 3 070. | | | 0.51 | |
| Gw-81-1-0 (PS | SS | N | 2023-05-15 | Clear and colourless | 7.63 | 754 | 15.2 | 220 | 310 | 3.49 | | 0.162 | | 0.194 | | 36.1 | < | 0.01 | < | 0.005 | | 686. | < | 0.005 | | 75.7 | 87. | | 0.56 | | 0.71 | | 0.946 | | 15.5 | | | 0.023 9 | |
| Gw-81-1-0 (PS | SS | N | 2023-09-22 | Clear and colourless | 7.97 | 850 | 16.2 | 220 | 316 | 6.62 | | 0.094 | | 0.289 | | 38.5 | < | 0.01 | < | 0.005 | | 848. | < | 0.005 | | 76.2 | 86. | | 0.61 | | 0.667 | | 0.12 | | 117. | | | 0.022 2 | |
| Gw-81-1-0 (PS | SS | N | 2023-11-21 | Clear and colourless | 7.54 | 860 | 9.4 | 210 | 333 | 14.7 | | 0.109 | | 0.204 | | 34.4 | < | 0.01 | < | 0.005 | | 752. | < | 0.005 | | 80.1 | 88. | | 0.53 | | 0.786 | | 0.612 | | 43.4 | | | 0.019 8 | |
| Gw-81-1-0 (PS | SS | N | 2024-02-14 | Clear Colourless | 8.18 | 604 | 11.2 | 190 | 303 | 3.1 | | 0.201 | | 0.195 | | 35.5 | < | 0.01 | < | 0.005 | | 716. | | 0.006 8 | | 72.8 | 81. | | 0.44 | | 0.685 | | 0.974 | | 22.7 | | | 0.134 | |
| Gw-85-1-1 | SS | N | 2023-05-23 | Moderately silty, moderately grey | 7.18 | 633 | 14.2 | 85 | 185 | 1 100. | | 0.11 | | 1.16 | | 18.5 | | 0.181 | < | 0.025 | | 162. | | 0.06 | | 55.5 | 140. | | 1.5 | | 3.83 | | 13.4 | | 2 030. | | | 1.78 | |
| Gw-85-1-1 | SS | N | 2023-10-04 | Moderately turbid, yellow | 7.55 | 790 | 15.5 | 120 | 197 | 6.75 | | 0.061 | | 0.207 | | 7.68 | < | 0.01 | < | 0.005 | | 202. | | 0.056 9 | | 58.1 | 130. | < | 0.1 | | 0.223 | | 5.66 | | 12.5 | | | 0.008 | |
| Gw-85-1-1 | SS | N | 2023-11-28 | Clear and colourless | 7.04 | 444 | 13.5 | 1 | 114 | 2.74 | | 0.137 | | 0.191 | | 3.86 | | 0.076 | < | 0.005 | | 140. | | 0.005 | | 34.7 | 74. | | 0.15 | | 0.155 | | 8.43 | | 2. | < | | 0.005 | |
| Gw-85-1-1 | SS | N | 2024-02-16 | Clear Colourless | 7.66 | 467 | 13.5 | 65 | 121 | 2.42 | | 0.125 | | 0.182 | | 3.27 | < | 0.01 | < | 0.005 | | 127. | | 0.010 1 | | 36.2 | 120. | < | 0.1 | | 0.118 | | 3.5 | | 3.1 | < | | 0.005 | |
| Gw-87-1-1 | SS | N | 2023-09-25 | Clear and colourless | 8.02 | 340 | 10.3 | 150 | 150 | 39.8 | | 0.061 | | 0.447 | | 18.8 | < | 0.01 | < | 0.005 | | 15. | | 0.014 6 | | 46.7 | 3.8 | < | 0.1 | | 0.317 | | 0.272 | | 55.7 | | | 0.042 2 | |
| Gw-87-1-1 | SS | N | 2023-11-23 | Clear and colourless | 7.58 | 311 | 9.4 | 130 | 203 | 11.2 | | 0.721 | | 0.322 | | 14.5 | < | 0.01 | < | 0.005 | | 31. | | 0.012 3 | | 64.2 | 3.2 | < | 0.1 | | 0.053 1 | | 0.094 | | 4.2 | | | 0.005 4 | |
| Gw-87-2-1 | NS | N | 2023-09-25 | Dry | --- | --- | --- | --- | --- | --- | | --- | | --- | | --- | | --- | | --- | | --- | | ---

| | 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 |
| 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 | |
| | | | | Fraction | TOT | TOT | TOT | TOT | 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 | | DIS | µg/l | | µg/l | | mg/L | mg/L | | µg/l | | µg/l | | µg/l | | µg/l | | | µg/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 | |
| Gw-88-1-1 | SS | N | 2023-09-26 | Clear and colourless | 7.72 | 610 | 10.8 | 120 | 284 | 1.76 | 0.051 | | 0.136 | | 2.65 | < | 0.01 | < | 0.005 | 24. | < | 0.005 | | 96.4 | 2.8 | | 0.22 | | 0.080 4 | | 0.153 | | 2.1 | < | | 0.005 | |
| Gw-88-1-1 | SS | N | 2023-11-22 | Clear and colourless | 6.97 | 640 | 10.1 | 120 | 282 | 1.93 | 0.038 | | 0.145 | | 3.8 | < | 0.01 | < | 0.005 | 20. | < | 0.005 | | 96.4 | 2.9 | < | 0.1 | | 0.062 3 | | 0.115 | | 3. | < | | 0.005 | |
| Gw-88-2-1 | NS | N | 2023-09-26 | Dry | --- | --- | --- | --- | --- | --- | --- | | --- | | --- | | --- | | --- | --- | | --- | | --- | --- | | --- | | --- | | --- | | --- | | | --- | |
| Gw-88-2-1 | SS | N | 2023-11-22 | Clear, moderately brown | 6.23 | 1200 | 10 | 45 | 622 | 4.75 | 0.061 | | 0.211 | | 12.3 | < | 0.01 | < | 0.005 | 46. | | 0.01 | | 211. | 2 | | 0.17 | | 0.077 3 | | 0.635 | | 7.6 | | | 0.013 2 | |
| Gw-91-1-1 | SS | N | 2023-05-18 | Clear and colourless | 7.42 | 372 | 11.8 | 200 | 266 | 6.98 | 0.161 | | 0.35 | | 41.7 | < | 0.01 | < | 0.005 | 61. | | 0.011 7 | | 89.2 | 4.9 | | 0.19 | | 0.017 8 | | 0.203 | | 17.7 | | | 0.006 9 | |
| Gw-91-1-1 | SS | N | 2023-09-28 | Clear and colourless | 7.86 | 422 | 11.5 | 210 | 286 | 3.52 | 0.161 | | 0.344 | | 43.1 | < | 0.01 | < | 0.005 | 79. | | 0.007 | | 94.2 | 5.6 | | 0.46 | | 0.018 | | 0.239 | | 6. | < | | 0.005 | |
| Gw-91-1-1 | SS | N | 2023-11-30 | Clear and colourless | 7.36 | 580 | 10.6 | 200 | 275 | 5.02 | 0.146 | | 0.335 | | 41.2 | < | 0.01 | < | 0.005 | 71. | | 0.007 2 | | 91.3 | 4.8 | | 0.17 | | 0.011 7 | | 0.197 | | 7.5 | < | | 0.005 | |
| Gw-91-1-1 | SS | N | 2024-02-28 | Clear Colourless | 7.85 | 600 | 10 | 210 | 292 | 1.76 | 0.158 | | 0.367 | | 46.1 | < | 0.01 | < | 0.005 | 70. | | 0.006 | | 96.7 | 5.6 | < | 0.1 | | 0.02 | | 0.29 | | 2.1 | | | 0.005 | |
| Gw-92-1-1 | SS | N | 2023-05-18 | Clear and colourless | 7.61 | 435 | 12.3 | 170 | 255 | 2.17 | 0.147 | | 0.463 | | 34.4 | | 0.017 | < | 0.005 | 379. | | 0.018 3 | | 81.6 | 4.2 | | 0.6 | | 0.018 2 | | 0.251 | | 5.6 | < | | 0.005 | |
| Gw-92-1-1 | SS | N | 2023-09-28 | Very slightly turbid, colourless | 7.92 | 464 | 12.1 | 170 | 285 | 32.1 | 0.152 | | 0.442 | | 39.7 | < | 0.01 | < | 0.005 | 470. | | 0.009 | | 90. | 4.9 | | 0.1 | | 0.061 | | 0.282 | | 48.4 | | | 0.025 | |
| Gw-92-1-1 | SS | N | 2023-11-30 | Clear and colourless | 7.56 | 640 | 10.7 | 160 | 285 | 3.38 | 0.088 | | 0.475 | | 34.1 | < | 0.01 | < | 0.005 | 396. | | 0.008 7 | | 90.9 | 5.4 | | 0.14 | | 0.015 2 | | 0.234 | | 1.5 | < | | 0.005 | |
| Gw-92-1-1 | NS | N | 2024-02-16 | Dry - Not enough water to sample. | --- | --- | --- | --- | --- | --- | --- | | --- | | --- | | --- | | --- | --- | | --- | | --- | --- | | --- | | --- | | --- | | --- | | | --- | |
| Gw-94-1-1 | SS | N | 2023-05-18 | Clear and colourless | 7.64 | 243 | 10.5 | 130 | 173 | 12.8 | 0.695 | | 0.227 | | 32.9 | < | 0.01 | < | 0.005 | 38. | | 0.012 9 | | 57.6 | 3.8 | | 0.14 | | 0.052 5 | | 0.227 | | 19. | | | 0.008 1 | |
| Gw-94-1-1 | SS | N | 2023-09-28 | Slightly turbid, very slightly grey | 7.93 | 370 | 9.4 | 150 | 178 | 14.5 | 0.563 | | 0.226 | | 36.2 | < | 0.01 | < | 0.005 | 21. | | 0.008 | | 58.9 | 4.1 | < | 0.1 | | 0.067 | | 1.07 | | 13.9 | | | 0.013 | |
| Gw-94-1-1 | SS | N | 2023-11-30 | Clear and colourless | 7.73 | 500 | 8.1 | 150 | 185 | 12.3 | 0.435 | | 0.27 | | 33.4 | | 0.014 | < | 0.005 | 37. | | 0.011 4 | | 60.3 | 5.1 | | 0.14 | | 0.175 | | 0.802 | | 14.4 | | | 0.007 5 | |
| Gw-94-1-1 | NS | N | 2024-02-16 | Removed from the sampling program | --- | --- | --- | --- | --- | --- | --- | | --- | | --- | | --- | | --- | --- | | --- | | --- | --- | | --- | | --- | | --- | | --- | | | --- | |
| Gw-95-1-1 | SS | N | 2023-05-11 | Very silty, moderately grey | 6.82 | 320 | 10.4 | 220 | 239 | 10.4 | 0.134 | | 1.2 | | 13.1 | < | 0.01 | < | 0.005 | 288. | | 0.019 5 | | 85.9 | 7.1 | | 0.15 | | 0.719 | | 0.407 | | 67.8 | | | 0.005 2 | |
| Gw-95-1-1 | NS | N | 2023-09-22 | Dry, not enough water to sample | --- | --- | --- | --- | --- | --- | --- | | --- | | --- | | --- | | --- | --- | | --- | | --- | --- | | --- | | --- | | --- | | --- | | | --- | |
| Gw-95-1-1 | FRM | N | 2023-11-14 | Mean of duplicates, high-moderate turbidity, moderately grey | 6.71 | 436 | 11.4 | 170 | 209.5 | 3.4 | 0.209 | | 2.62 | | 8.1 | < | 0.01 | < | 0.005 | 256.5 | | 0.030 55 | | 73.6 | 9.25 | | 0.495 | | 0.472 5 | | 0.617 5 | | 23.65 | | | 0.006 65 | |
| Gw-95-1-1 | FRM | N | 2024-02-09 | Mean of duplicates, very slightly turbid, very slightly grey | 7.575 | 626 | 9.9 | 170 | 453 | 3.345 | 0.145 | | 0.125 | | 8.285 | < | 0.01 | < | 0.005 | 352. | | 0.049 | | 160. | 10. | < | 0.1 | | 0.291 | | 0.821 5 | | 3.7 | | | 0.005 35 | |
| Gw-96-1-1 | SS | N | 2023-05-11 | Very silty, moderately grey | 7.19 | 316 | 11.5 | 140 | 183 | 62.3 | 0.054 | | 0.066 | | 8.27 | < | 0.01 | < | 0.005 | 104. | | 0.007 | | 60.3 | 4.1 | | 0.41 | | 0.116 | | 0.505 | | 108. | | | 0.018 1 | |
| Gw-96-1-1 | NS | N | 2023-09-22 | Dry, not enough water to sample | --- | --- | --- | --- | --- | --- | --- | | --- | | --- | | --- | | --- | --- | | --- | | --- | --- | | --- | | --- | | --- | | --- | | | --- | |
| Gw-96-1-1 | SS | N | 2023-11-15 | Very very slightly turbid, colourless | 6.82 | 477 | 12.1 | 75 | 290 | 6.23 | 0.026 | | 0.098 | | 10.9 | < | 0.01 | < | 0.005 | 96. | | 0.020 5 | | 92.5 | 6.6 | | 0.29 | | 0.176 | | 0.421 | | 7.3 | | | 0.005 4 | |
| Gw-96-1-1 | SS | N | 2024-02-09 | Very slightly turbid, very slightly grey | 7.02 | 342 | 10.4 | 81 | 227 | 8.87 | 0.038 | | 0.057 | | 4.18 | | 0.015 | < | 0.005 | 109. | | 0.019 | | 72.7 | 9.9 | | 0.19 | | 0.12 | | 0.483 | | 6.6 | < | | 0.005 | |
| Gw-97-1-1 | SS | N | 2023-05-12 | Clear and colourless | 7.89 | 204 | 10.6 | 110 | 128 | 23.2 | 0.94 | | 0.216 | | 20.9 | | 0.011 | < | 0.005 | 64. | | 0.021 4 | | 47.3 | 3.3 | | 0.14 | | 0.049 8 | | 0.288 | | 43. | | | 0.013 5 | |
| Gw-97-1-1 | SS | N | 2023-09-26 | Clear and colourless | 7.86 | 268 | 13.1 | 130 | 159 | 13.1 | 0.812 | | 0.279 | | 32.9 | < | 0.01 | < | 0.005 | 57. | < | 0.005 | | 77.3 | 1.9 | | 0.24 | | 0.025 3 | | 0.332 | | 14.3 | | | 0.005 6 | |
| Gw-97-1-1 | SS | N | 2023-11-15 | Clear and colourless | 7.82 | 217 | 12.5 | 100 | 124 | 12.9 | 0.786 | | 0.191 | | 15.6 | < | 0.01 | < | 0.005 | 68. | | 0.013 9 | | 46.1 | 3.6 | | 0.16 | | 0.046 6 | | 0.336 | | 15.6 | | | 0.007 3 | |
| Gw-97-1-1 | SS | N | 2024-02-09 | Clear Colourless | 8.04 | 194 | 10.6 | 110 | 139 | 173. | 0.581 | | 0.235 | | 19.1 | < | 0.01 | < | 0.005 | 49. | | 0.013 3 | | 51.5 | 1.6 | | 0.43 | | 0.282 | | 0.526 | | 278. | | | 0.085 9 | |
| Gw-98-1-1 | SS | N | 2023-05-11 | Moderatey silty, moderately grey | 7.23 | 330 | 11.8 | 140 | 195 | 32.6 | 0.167 | | 0.089 | | 9.35 | < | 0.01 | < | 0.005 | 127. | | 0.007 2 | | 65.5 | 4.1 | | 0.11 | | 0.054 6 | | 0.33 | | 61.8 | | | 0.010 9 | |
| Gw-98-1-1 | SS | N | 2023-09-26 | Very slightly turbid, very slightly grey | 7.73 | 500 | 12.3 | 170 | 253 | 14.6 | 0.256 | | 0.165 | | 17.6 | < | 0.01 | < | 0.005 | 157. | | 0.021 9 | | 84.2 | 3.9 | < | 0.1 | | 0.058 5 | | 0.421 | | 25.7 | | | 0.014 8 | |
| Gw-98-1-1 | SS | N | 2023-11-14 | Moderately turbid, colourless | 6.62 | 487 | 11.8 | 91 | 316 | 26.9 | 0.119 | | 0.075 | | 15.1 | < | 0.01 | < | 0.005 | 120. | | 0.048 8 | | 103. | 8.1 | | 0.44 | | 0.127 | | 0.508 | | 46.8 | | | 0.020 2 | |
| Gw-98-1-1 | SS | N | 2024-02-09 | Moderately turbid, very slightly grey | 7.57 | 499 | 10.9 | 110 | 347 | 2.08 | 0.246 | | 0.078 | | 3.78 | < | 0.01 | < | 0.005 | 188. | | 0.239 | | 114. | 5.6 | < | 0.1 | | 0.043 5 | | 0.32 | | 2.4 | < | | 0.005 | |
| Gw-99-1-1 | NS | N | 2023-05-08 | Removed from routine sampling | --- | --- | --- | --- | --- | --- | --- | | --- | | --- | | --- | | --- | --- | | --- | | --- | --- | | --- | | --- | | --- | | --- | | | --- | |
| Gw-99-1-1 | NS | N | 2023-09-22 | Dry | --- | --- | --- | --- | --- | --- | --- | | --- | | --- | | --- | | --- | --- | | --- | | --- | --- | | --- | | --- | | --- | | --- | | | --- | |
| Gw-99-1-1 | NS | N | 2023-11-14 | Dry | --- | --- | --- | --- | --- | --- | --- | | --- | | --- | | --- | | --- | --- | | --- | | --- | --- | | --- | | --- | | --- | | --- | | | --- | |
| Gw-100-1-1 | NS | N | 2023-05-08 | Not required to sample this round. | --- | --- | --- | --- | --- | --- | --- | | --- | | --- | | --- | | --- | --- | | --- | | --- | --- | | --- | | --- | | --- | | --- | | | --- | |
| Gw-100-1-1 | NS | N | 2023-09-22 | Dry | --- | --- | --- | --- | --- | --- | --- | | --- | | --- | | --- | | --- | --- | | --- | | --- | --- | | --- | | --- | | --- | | --- | | | --- | |
| Gw-100-1-1 | NS | N | 2023-11-14 | Dry - not enough water to sample | --- | --- | --- | --- | --- | --- | --- | | --- | | --- | | --- | | --- | --- | | --- | | --- | --- | | --- | | --- | | --- | | --- | | | --- | |
| Gw-101-1-1 | NS | N | 2023-05-08 | Removed from routine sampling | --- | --- | --- | --- | --- | --- | --- | | --- | | --- | | --- | | --- | --- | | --- | | --- | --- | | --- | | --- | | --- | | --- | | | --- | |
| Gw-101-1-1 | NS | N | 2023-09-22 | Dry | --- | --- | --- | --- | --- | --- | --- | | --- | | --- | | --- | | --- | --- | | --- | | --- | --- | | --- | | --- | | --- | | --- | | | --- | |
| Gw-101-1-1 | NS | N | 2023-11-14 | Well jammed/buried with rocks | --- | --- | --- | --- | --- | --- | --- | | --- | | --- | | --- | | --- | --- | | --- | | --- | --- | | --- | | --- | | --- | | --- | | | --- | |
| Gw-103-1-1 | SS | N | 2023-09-26 | Very turbid, very grey | 8.04 | 470 | 16.4 | 130 | 214 | 11.2 | 0.334 | | 1.88 | | 45.4 | < | 0.01 | < | 0.005 | 102. | < | 0.005 | | 61.4 | 14. | | 1.02 | | 0.080 1 | | 0.662 | | 21.8 | | | 0.017 1 | |
| Gw-103-1-1 | SS | N | 2023-11-15 | Clear and colourless | 7.81 | 415 | 14 | 110 | 240 | 545. | 0.361 | | 1.51 | | 48.2 | < | 0.01 | < | 0.005 | 114. | | 0.015 3 | | 70.2 | 18. | | 1.44 | | 0.388 | | 1.05 | | 927. | | | 0.072 2 | |
| Gw-103-1-1 | SS | N | 2024-02-16 | Slightly turbid, very slightly grey | 8.07 | 454 | 12 | 110 | 264 | 327. | 0.44 | | 1.96 | | 55.1 | < | 0.01 | < | 0.005 | 110. | | 0.009 9 | | 77.8 | 20. | | 0.99 | | 0.258 | | 0.849 | | 537. | | | 0.058 3 | |
| Gw-104-1-1 | SS | N | 2023-05-09 | Very slightly rubid, colourless. | 7.49 | 530 | 10.9 | 110 | 311 | 6.36 | 0.237 | | 0.095 | | 4.28 | < | 0.01 | < | 0.005 | 98. | | 0.007 6 | | 104. | 62. | < | 0.1 | | 0.049 6 | | 1.7 | | 9.9 | | | 0.006 9 | |
| Gw-104-1-1 | SS | N | 2023-09-26 | Very turbid, very brown. Purge water was brown/black and foamy. | 7.76 | 1678 | 13.3 | 510 | 1270 | 170. | 0.7 | | 4.72 | | 57.3 | < | 0.05 | < | 0.025 | 194. | | 0.055 | | 407. | 170. | | 4.6 | | 120. | a | 326. | a | 4 660. | | | 0.662 | |
| Gw-104-1-1 | FRM | N | 2023-11-15 | Mean of duplicates, clear, moderately amber | 7.24 | 956 | 11.5 | 200 | 461 | 36. | 0.301 | | 0.281 5 | | 10.53 | < | 0.01 | < | 0.005 | 109.5 | | 0.124 | | 150. | 65. | | 0.71 | | 65. | a | 210.5 | a | 317. | | | 0.065 1 | |
| Gw-104-1-1 | FRM | N | 2024-02-14 | Mean of duplicates, clear, moderately yellow | 8.08 | 493 | 10 | 160 | 288 | 43.35 | 0.224 | | 0.178 | | 5.385 | < | 0.01 | < | 0.005 | 78.5 | | 0.070 5 | | 93.8 | 38.5 | | 0.315 | | 34.3 | | 86.75 | | 157.5 | | | 0.042 85 | |
| Gw-105-1-1 | SS | N | 2023-05-09 | Clear and colourless. | 7.42 | 791 | 11.6 | 100 | 531 | 7.67 | 4.37 | | 0.148 | | 43.6 | < | 0.01 | < | 0.005 | 100. | | 0.008 5 | | 177. | 96. | | 0.12 | | 0.075 1 | | 0.2 | | 8.2 | | | 0.005 1 | |
| Gw-105-1-1 | SS | N | 2023-09-26 | Very slightly turbid, colourless | 7.8 | 795 | 12.4 | 130 | 493 | 55. | 2.4 | | 0.187 | | 40.9 | < | 0.01 | < | 0.005 | 95. | | 0.015 7 | | 160. | 81. | | 0.81 | | 0.186 | | 1.52 | | 130. | | | 0.017 8 | |
| Gw-105-1-1 | SS | N | 2023-11-15 | Clear and colourless | 7.23 | 796 | 12.8 | 140 | 491 | 5.12 | 1.8 | | 0.186 | | 37.8 | < | 0.01 | < | 0.005 | 92. | | 0.020 4 | | 163. | 65. | < | 0.1 | | 0.101 | | 2.9 | | 4.6 | | | 0.005 3 | |
| Gw-106-1-1 | SS | N | 2023-05-10 | day. | 7.24 | 830 | 15.3 | 140 | 422 | 9.62 | 0.183 | | 0.207 | | 23.1 | < | 0.01 | < | 0.005 | 179. | | 0.007 7 | | 134. | 41. | | 0.23 | | 1.05 | | 2.72 | | 14.2 | | | 0.011 8 | |
| Gw-106-1-1 | FRM | N | 2023-01-12 | Mean of duplicates | 7.855 | 739 | 14.6 | 170 | 412 | 7.345 | 0.172 5 | | 0.267 5 | | 18.75 | < | 0.01 | < | 0.005 | 161. | | 0.016 55 | | 131. | 33. | < | 0.1 | | 1.055 | | 2.995 | | 7.2 | | | 0.006 55 | |
| Gw-106-1-1 | FRM | N | 2024-01-12 | Mean of duplicates, clear and colourless | 7.23 | 829 | 14 | 150 | 390.5 | 6.645 | 0.167 5 | | 0.241 | | 19.1 | < | 0.01 | < | 0.005 | 139.5 | | 0.017 6 | | 124.5 | 46. | | 0.205 | | 0.676 5 | | 3.53 | | 6.75 | | | 0.008 95 | |
| Gw-107-1-1 | SS | N | 2023-05-11 | Slightly turbid, colourless. Second sample which was collected on May 11. First one on May 9 rejected. | 7.53 | 844 | 16.5 | 130 | 453 | 461. | 0.259 | | 0.253 | | 69.7 | < | 0.01 | < | 0.005 | 144. | | 0.045 | | 145. | 61. | | 1.25 | | 1.39 | | 2.48 | | 902. | | | 0.068 2 | |
| Gw-107-1-1 | SS | N | 2023-09-26 | Moderatley turbid, colourless | 7.87 | 930 | 19.6 | 150 | 444 | 10.3 | 0.25 | | 0.243 | | 54.4 | < | 0.01 | < | 0.005 | 146. | | 0.017 7 | | 141. | 39. | | 0.16 | | 0.35 | | 2.17 | | 15. | | | 0.009 3 | |
| Gw-107-1-1 | SS | N | 2023-11-15 | Clear and colourless | 7.25 | 828 | 15.3 | 170 | 476 | 23.9 | 0.3 | | 0.265 | | 83.2 | < | 0.01 | < | 0.005 | 142. | | 0.028 2 | | 152. | 52. | | 0.23 | | 0.644 | | 2.23 | | 36.8 | | | 0.012 5 | |
| Gw-108-1-1 | SS | N | 2023-05-09 | Slightly turbid, colourless. | 7.85 | 561 | 11.3 | 130 | 388 | 28. | 0.104 | | 0.595 | | 70.5 | < | 0.01 | < | 0.005 | 142. | | 0.040 5 | | 103. | 10. | | 0.11 | | 0.352 | | 0.661 | | 55.1 | | | 0.035 2 | |
| Gw-108-1-1 | FRM | N | 2023-09-26 | Mean of duplicates | 7.89 | 669 | 11.9 | 125 | 368.5 | 3.99 | 0.068 5 | | 0.427 | | 67. | < | 0.01 | < | 0.005 | 115. | | 0.015 15 | | 97.35 | 19.5 | | 2.215 | | 0.164 | | 0.32 | | 16.05 | | | 0.005 8 | |
| Gw-108-1-1 | FRM | N | 2024-01-12 | Mean of duplicates, clear and colourless | 7.61 | 569 | 11.3 | 120 | 378.5 | 6.07 | 0.056 5 | | 0.351 | | 64.8 | < | 0.01 | < | 0.005 | 121. | | 0.011 85 | | 100.8 | 23. | | 0.215 | | 0.073 65 | | 0.51 | | 8.95 | | | 0.011 95 | |
| Gw-109-1-1 | NS | N | 2023-05-08 | Not required to sample this round. | --- | --- | --- | --- | --- | --- | --- | | --- | | --- | | --- | | --- | --- | | --- | | --- | --- | | --- | | --- | | --- | | --- | | | --- | |
| Gw-109-1-1 | SS | N | 2023-09-26 | Very turbid, very grey. Purged Dry the following 4 days and water cleared up to slightly turbid, slightly grey. | 8.8 | 570 | 17.1 | 180 | 72 | 2 420. | 0.633 | b | 19.9 | b | 43.2 | | 1.72 | | 0.283 | 284. | | 0.066 | | 17.3 | 5.1 | | 5.66 | | 2.82 | | 4.1 | | 5 800. | | | 12.7 | b |
| Gw-109-1-1 | FRM | N | 2023-11-15 | Mean of duplicates, slightly turbid, very slightly grey | 8.99 | 344 | 15.4 | 140 | 52.4 | 16.15 | 0.321 | | 6.83 | | 7.17 | < | 0.01 | < | 0.005 | 202. | < | 0.005 | | 12.85 | 3.85 | | 0.36 | | 0.036 05 | | 0.390 5 | | 27.05 | | | 0.027 35 | |
| Gw-109-1-1 | FRM | N | 2024-02-16 | Mean of duplicates, moderately turbid, moderately grey | 8.79 | 355 | 14 | 145 | 30.6 | 53.55 | 0.443 5 | | 9.735 | | 5.415 | < | 0.01 | | 0.005 45 | 259. | < | 0.005 | | 7.445 | 5.85 | | 0.12 | | 0.048 55 | | 0.246 5 | | 80.05 | | | 0.101 35 | |
| Gw-110-1-1 | NS | N | 2023-05-08 | Not required to sample this round. | --- | --- | --- | --- | --- | --- | --- | | --- | | --- | | --- | | --- | --- | | --- | | --- | --- | | --- | | --- | | --- | | --- | | | --- | |
| Gw-110-1-1 | NS | N | 2023-09-25 | Dry | --- | --- | --- | --- | --- | --- | --- | | --- | | --- | | --- | | --- | --- | | --- | | --- | --- | | --- | | --- | | --- | | --- | | | --- | |
| Gw-P1 | SS | N | 2023-05-15 | Clear and colourless | 6.69 | 891 | 18.1 | 420 | 300 | 6.2 | 0.127 | | 7.57 | | 1 350. | b | 0.02 | < | 0.01 | 513. | < | 0.01 | | 95.8 | 35. | | 0.55 | | 0.9 | | 0.49 | | 39 200. | | | 0.232 | |
| Gw-P1 | SS | N | 2023-10-04 | Clear and colourless | 7.72 | 2000 | 16.6 | 760 | 286 | 4.7 | 0.124 | | 7.3 | | 1 790. | b | 0.02 | < | 0.01 | 2 640. | < | 0.01 | | 75.2 | 140. | | 0.93 | | 3.08 | | 0.79 | | 10 400. | | | 0.075 | |
| Gw-P1 | SS | N | 2023-11-30 | Slightly turbid, moderately orange | 7.01 | 1470 | 17.4 | 670 | 239 | 3.6 | 0.637 | | 5.66 | | 1 380. | b | 0.02 | < | 0.01 | 2 060. | | 0.03 | | 64.3 | 110. | | 0.82 | | 2.53 | | 1.34 | | 7 380. | | | 0.54 | |
| Gw-P1 | SS | N | 2024-02-29 | Clear Colourless | 7.8 | 990 | 14.6 | 420 | 268 | 5.8 | 0.102 | | 7.52 | | 1 480. | b | 0.02 | < | 0.01 | 982. | < | 0.01 | | 82.5 | 52. | | 0.42 | | 1.12 | | 0.38 | | 27 400. | | | 2.14 | |
| Gw-P2 | SS | N | 2023-05-15 | Clear and very slightly yellow | 6.87 | 954 | 18.6 | 650 | 256 | 7.95 | 0.043 | | 0.854 | | 384. | < | 0.01 | < | 0.005 | 1 770. | < | 0.005 | | 73.4 | 65. | | 0.7 | | 2.32 | | 0.471 | | 615. | | | 0.105 | |
| Gw-P2 | SS | N | 2023-10-04 | Very slightly turbid, colourless | 7.69 | 2100 | 16 | 810 | 303 | 4. | 0.04 | < | 0.61 | | 390. | < | 0.02 | < | 0.01 | 2 930. | < | 0.01 | | 72.9 | 160. | | 0.86 | | 3.06 | | 0.71 | | 605. | | | 0.035 | |
| Gw-P2 | SS | N | 2023-11-30 | Clear, slightly yellow | 7.13 | 2300 | 13.5 | 870 | 316 | 15.3 | 0.057 | | 0.701 | | 422. | < | 0.02 | < | 0.01 | 2 800. | | 0.026 | | 78.7 | 170. | | 1.21 | | 3.46 | | 0.58 | | 851. | | | 0.342 | |
| Gw-P2 | SS | N | 2024-02-29 | Clear Colourless | 8 | 2000 | 14.2 | 780 | 260 | 8.8 | 0.065 | | 1.28 | | 550. | < | 0.02 | < | 0.01 | 3 090. | < | 0.01 | | 67.3 | 150. | | 0.98 | | 3.9 | | 3.45 | | 613. | | | 0.103 | |
| Gw-P3 | SS | N | 2023-05-15 | Clear and very slightly yellow | 6.93 | 959 | 17.7 | 640 | 245 | 4.53 | 0.048 | | 1.51 | | 330. | < | 0.01 | < | 0.005 | 1 740. | < | 0.005 | | 67.1 | 70. | | 0.6 | | 1.77 | | 8.98 | | 628. | | | 0.030 3 | |
| Gw-P3 | SS | N | 2023-10-04 | Very slightly turbid, very slightly yellow | 7.68 | 2400 | 15.3 | 910 | 282 | 4.8 | 0.04 | < | 0.918 | | 560. | < | 0.02 | < | 0.01 | 3 200. | < | 0.01 | | 66.8 | 190. | | 0.82 | | 3.9 | | 0.67 | | 1 070. | | | 0.014 | |
| Gw-P3 | SS | N | 2023-11-30 | Clear, slightly yellow | 7.01 | 2500 | 13.8 | 910 | 288 | 4.4 | 0.04 | < | 1.02 | | 504. | < | 0.02 | | 0.012 | 3 060. | | 0.011 | | 69.2 | 190. | | 1.23 | | 3.97 | | 0.32 | | 1 380. | | | 0.053 | |
| Gw-P3 | SS | N | 2024-02-29 | Clear Colourless | 7.87 | 2300 | 14.6 | 850 | 335 | 4.4 | 0.061 | | 0.989 | | 157. | < | 0.02 | < | 0.01 | 3 020. | < | 0.01 | | 84.1 | 180. | | 1. | | 3.79 | | 0.38 | | 2 940. | | | 0.118 | |
| Gw-P4 | SS | N | 2023-05-15 | Very slightly turbid and colourless | 6.86 | 1942 | 16.9 | 920 | 301 | 5.65 | 0.039 | | 1.27 | | 139. | < | 0.01 | < | 0.005 | 2 510. | < | 0.005 | | 72.6 | 170. | | 0.93 | | 3.59 | | 0.571 | | 1 330. | | | 0.012 9 | |
| Gw-P4 | SS | N | 2023-10-04 | Very slightly turbid, very slightly yellow | 7.66 | 1936 | 15.2 | 900 | 360 | 3.8 | 0.04 | < | 1.55 | | 220. | < | 0.02 | < | 0.01 | 2 510. | | 0.03 | | 90.4 | 200. | | 0.87 | | 3.03 | | 0.29 | | 9 400. | | | 0.081 | |
| Gw-P4 | SS | N | 2023-11-30 | Clear, slightly yellow | 6.95 | 1820 | 12.6 | 880 | 344 | 3.9 | 0.04 | < | 1.93 | | 178. | < | 0.02 | < | 0.01 | 2 320. | | 0.014 | | 88.3 | 190. | | 0.97 | | 3.03 | | 0.27 | | 9 080. | | | 0.017 | |
| Gw-P4 | SS | N | 2024-02-29 | Clear Colourless | 7.86 | 2300 | 15.1 | 860 | 261 | 5.5 | 0.086 | | 1.86 | | 666. | < | 0.02 | < | 0.01 | 3 990. | < | 0.01 | | 63.4 | 190. | | 1.09 | | 4.68 | | 2.19 | | 846. | | | 0.053 | |
| Gw-P10 | SS | N | 2023-05-15 | Very slightly turbid and colourless | 6.74 | 876 | 16.5 | 480 | 280 | 2.57 | 0.036 | | 0.875 | | 696. | < | 0.01 | < | 0.005 | 832. | | 0.010 5 | | 86.3 | 40. | | 0.42 | | 0.74 | | 0.434 | | 1 770. | | | 0.031 9 | |
| Gw-P10 | SS | N | 2023-10-04 | Very slightly turbid, colourless | 7.72 | 1328 | 15.7 | 630 | 330 | 3.8 | 0.04 | | 0.941 | | 852. | < | 0.02 | < | 0.01 | 1 850. | | 0.01 | | 93.1 | 120. | | 0.61 | | 1.92 | | 1.03 | | 312. | | | 0.088 | |
| Gw-P10 | SS | N | 2023-11-30 | Clear, slightly yellow | 6.96 | 1250 | 12.7 | 630 | 307 | 4. | 0.04 | < | 0.895 | | 946. | < | 0.02 | < | 0.01 | 1 760. | < | 0.01 | | 89. | 120. | | 0.73 | | 1.93 | | 1.33 | | 2 610. | | | 0.12 | |
| Gw-P10 | SS | N | 2024-02-29 | Very slightly turbid, slightly orange | 7.78 | 1100 | 14.2 | 470 | 301 | 3.99 | 0.064 | | 0.471 | | 850. | < | 0.01 | < | 0.005 | 1 550. | < | 0.005 | | 93.3 | 58. | | 0.4 | | 1.48 | | 2.33 | | 906. | < | | 0.005 | |
| Gw-P11 | SS | N | 2023-05-09 | Very slightly turbid, colourless | 6.91 | 617 | 12.5 | 95 | 371 | 282. | 0.173 | | 0.157 | | 16.3 | | 0.011 | | 0.005 4 | 124. | | 0.062 1 | | 122. | 40. | | 0.59 | | 0.797 | | 3.14 | | 548. | | | 0.188 | |
| Gw-P11 | SS | N | 2023-09-25 | Clear and colourless | 7.7 | 890 | 14.2 | 140 | 417 | 13.4 | 1.22 | | 0.985 | | 13.2 | < | 0.01 | < | 0.005 | 222. | | 0.18 | | 120. | 47. | | 0.11 | | 0.189 | | 2.34 | | 25.3 | | | 0.074 6 | |
| Gw-P11 | SS | N | 2023-11-15 | Clear and colourless | 6.69 | 810 | 12.1 | 92 | 353 | 4.68 | 0.196 | | 0.089 | | 2.71 | < | 0.01 | < | 0.005 | 134. | | 0.025 7 | | 116. | 37. | | 0.18 | | 0.38 | | 4.25 | | 8.8 | | | 0.006 | |
| Gw-P11 | NS | N | 2024-02-06 | Not functioning | --- | --- | --- | --- | --- | --- | --- | | --- | | --- | | --- | | --- | --- | | --- | | --- | --- | | --- | | --- | | --- | | --- | | | --- | |
| Gw-P12 | NS | N | 2023-05-16 | Several days of purging, slightly yellow | --- | --- | --- | --- | --- | --- | --- | | --- | | --- | | --- | | --- | --- | | --- | | --- | --- | | --- | | --- | | --- | | --- | | | --- | |
| Gw-P12 | NS | N | 2023-09-25 | Dry | --- | --- | --- | --- | --- | --- | --- | | --- | | --- | | --- | | --- | --- | | --- | | --- | --- | | --- | | --- | | --- | | --- | | | --- | |
| Gw-P12 | SS | N | 2023-11-15 | Clear and colourless | 7.26 | 690 | 12.3 | 100 | 294 | 9.98 | 0.14 | | 0.24 | | 8.58 | < | 0.01 | < | 0.005 | 68. | | 0.008 1 | | 98.4 | 22. | | 0.22 | | 0.224 | | 13.1 | | 22.8 | < | | 0.005 | |
| Gw-P12 | SS | N | 2024-02-29 | Clear Colourless | 7.84 | 570 | 10.1 | 100 | 237 | 9.23 | 0.152 | | 0.207 | | 9.16 | < | 0.01 | < | 0.005 | 110. | | 0.008 9 | | 78.7 | 22. | | 0.21 | | 0.317 | | 13.6 | | 31.5 | < | | 0.005 | |

***Notes:***

***a*** *Above CSR Schedule 3.2 AW Standard.*
***b*** *Above CSR Schedule 3.2 DW Standard.*
***c*** *Detection Limits above Applicable Standards.*
*Unreliable Ammonia Concentrations*
*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. CSR stage 13 amendments, protocol v, 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*

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| | | |

| | | | | a AW Maximum (1) | | | | | | | 10000 | | 1.31-18.4 (3) | | 0.2-2 (4) | | 400 | | 400 | | 250-1500 (5) | | | | | | 20 | | | 0.5-15 (5) | | | | 3 | | | 1000 | | 85 | | | 75-2400 (5) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | BC CSR | | b DW Maximum (2) | | | 33 (9) | | | | 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 | | | Lithium | | Magnesium | | 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 | |
| | | | | Unit | | | µg/l | | mg/l | | µg/l | | µg/l | | mg/l | | mg/l | | mg/l | | mg/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 | |
| | | | | Method Detection Limit | | | 0.5 | | 0.05 | | 0.05 | | 0.05 | | 0.015 | | 0.005 | | 0.02 | | 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 | | 0.1 |
| Gw-53-1-1 | SS | Y | 2023-09-22 | Clear and colourless | < | 0.5 | | 7.54 | | 171. | | 0.58 | < | 0.015 | < | 0.005 | < | 0.02 | < | 0.02 | | 0.535 | | 3.1 | | 0.247 | < | 0.04 | | 11 900. | < | 0.005 | | 3.8 | | 336. | | 53. | | 18.1 | | 0.011 1 | < | 0.2 | < | 0.5 | | 0.076 4 | < | 0.2 | | 0.28 | < | 0.1 |
| Gw-53-1-1 | SS | Y | 2023-11-21 | Clear and colourless | < | 0.5 | | 7.84 | | 157. | | 0.55 | | 0.79 | < | 0.005 | < | 0.02 | < | 0.02 | | 0.37 | | 3.1 | | 0.257 | < | 0.04 | | 12 200. | < | 0.005 | | 3.92 | | 318. | | 52. | | 17.4 | | 0.011 1 | < | 0.2 | < | 0.5 | | 0.097 | < | 0.2 | < | 0.1 | < | 0.1 |
| Gw-53-1-1 | SS | Y | 2024-02-29 | Clear Colourless | < | 0.5 | | 8.08 | | 187. | | 0.626 | < | 0.015 | < | 0.005 | < | 0.02 | < | 0.02 | | 0.595 | | 2.9 | | 0.479 | < | 0.04 | | 14 100. | < | 0.005 | | 7.11 | | 382. | | 48. | | 16.7 | | 0.011 | < | 0.2 | < | 0.5 | | 0.075 | < | 0.2 | | 0.64 | < | 0.1 |
| Gw-55-1-1 | SS | Y | 2023-10-04 | Clear and colourless | < | 0.5 | | 6.9 | | 0.433 | | 0.389 | | 0.93 | < | 0.005 | | 0.308 | | 0.308 | | 0.104 | | 2.1 | | 1.66 | | 6 260. | < | 0.005 | | 14.7 | | 225. | | 48. | | 17. | < | 0.002 | < | 0.2 | < | 0.5 | | 0.252 | < | 0.2 | | 0.14 | < | 0.1 |
| Gw-55-1-1 | SS | Y | 2023-11-24 | Clear and colourless | < | 0.5 | | 6.23 | | 2.96 | | 0.334 | | 1. | < | 0.005 | | 0.343 | | 0.343 | | 0.123 | | 2.2 | | 1.57 | | 0.225 | | 5 870. | < | 0.005 | | 12.9 | | 219. | | 50. | | 15.8 | < | 0.002 | < | 0.2 | | 1.05 | | 0.261 | | 0.26 | | 0.15 | < | 0.1 |
| Gw-56-1-1 | SS | Y | 2023-05-19 | Clear and colourless | < | 0.5 | | 5.25 | | 0.123 | | 1.02 | < | 0.015 | < | 0.005 | < | 0.02 | < | 0.02 | | 0.111 | | 9.1 | | 0.343 | | 0.178 | | 6 480. | | 0.006 2 | | 3.61 | | 264. | | 36. | | 11.6 | | 0.003 5 | < | 0.2 | < | 0.5 | | 0.087 8 | < | 0.2 | | 0.45 | < | 0.1 |
| Gw-56-1-1 | SS | Y | 2023-09-29 | Clear and colourless | | 0.5 | | 6.35 | | 0.165 | | 1.04 | | 1.5 | < | 0.005 | < | 0.02 | < | 0.02 | | 0.081 | | 4.7 | | 0.46 | | 0.088 | | 6 370. | < | 0.005 | | 4.03 | | 275. | | 44. | | 13.9 | | 0.003 | < | 0.2 | < | 0.5 | | 0.114 | < | 0.2 | | 0.63 | < | 0.1 |
| Gw-56-1-1 | SS | Y | 2023-11-30 | Clear and colourless | < | 0.5 | | 5.5 | | 0.109 | | 0.998 | | 0.84 | < | 0.005 | < | 0.02 | < | 0.02 | | 0.064 | | 5.9 | | 0.325 | | 0.064 | | 6 880. | < | 0.005 | | 3.8 | | 263. | | 40. | | 12.6 | | 0.003 3 | < | 0.2 | < | 0.5 | | 0.088 1 | < | 0.2 | | 0.15 | < | 0.1 |
| Gw-56-1-1 | SS | Y | 2024-02-28 | Clear Colourless | < | 0.5 | | 5.96 | | 0.107 | | 0.961 | < | 0.015 | < | 0.005 | < | 0.02 | < | 0.02 | | 0.088 | | 5.8 | | 0.394 | | 0.06 | | 6 050. | < | 0.005 | | 3.86 | | 259. | | 43. | | 12. | | 0.004 | < | 0.2 | < | 0.5 | | 0.105 | < | 0.2 | | 0.33 | < | 0.1 |
| Gw-57-1-1 | SS | Y | 2023-09-29 | Clear and colourless | < | 0.5 | | 6.19 | | 22.8 | | 0.258 | < | 0.015 | < | 0.005 | < | 0.02 | < | 0.02 | | 0.249 | | 2.2 | | 0.485 | < | 0.04 | | 6 480. | < | 0.005 | | 9.93 | | 236. | | 57. | | 19.6 | | 0.002 | < | 0.2 | < | 0.5 | | 0.026 | < | 0.2 | | 0.31 | < | 0.1 |
| Gw-57-1-1 | SS | Y | 2023-11-17 | Clear and colourless | < | 0.5 | | 5.52 | | 15.1 | | 0.262 | | 1.3 | < | 0.005 | < | 0.02 | < | 0.02 | | 0.652 | | 4.3 | | 0.428 | < | 0.04 | | 6 310. | < | 0.005 | | 8.92 | | 240. | | 54. | | 17.1 | | 0.002 9 | < | 0.2 | < | 0.5 | | 0.023 2 | < | 0.2 | | 0.77 | < | 0.1 |
| Gw-58-1-0 | SS | N | 2023-05-16 | Clear, very yellow | < | 0.5 | | 127. | | 5 940. | | 6.82 | | 1.8 | < | 0.005 | < | 0.02 | < | 0.02 | | 88.9 | b | 105. | | 71.2 | | 0.392 | | 20 000. | < | 0.005 | | 557. | b | 4 260. | b | 81. | | 30.3 | < | 0.002 | | 4.09 | | 0.371 | | 32.3 | b | 3.05 | | 2.8 |
| Gw-58-1-0 | SS | N | 2023-09-26 | Clear, moderately yellow | < | 2.5 | | 156. | | 6 330. | | 6.62 | | 1.3 | | 0.136 | | 2.68 | | 2.82 | | 96.5 | b | 97. | | 53.6 | | 0.43 | | 19 100. | < | 0.025 | | 561. | b | 4 290. | b | 100. | | 29. | < | 0.01 | < | 1. | < | 2.5 | | 0.383 | | 22. | b | 5.26 | | 2.41 |
| Gw-58-1-0 | SS | N | 2023-11-16 | Clear, moderately yellow | < | 2.5 | | 133. | | 6 040. | | 5.03 | | 0.96 | | 0.030 6 | | 1.12 | | 1.15 | | 93.2 | b | 68. | | 61.7 | | 0.32 | | 20 500. | < | 0.025 | | 586. | | 4 330. | b | 110. | | 27. | < | 0.01 | < | 1. | | 4.1 | | 0.302 | | 33.1 | b | 3.62 | | 3.06 |
| Gw-58-1-0 | SS | N | 2024-02-29 | No turbidity, moderately orange | < | 1. | | 137. | | 6 290. | | 6.62 | | 59. | a | 0.009 5 | | 48. | b | 48. | b | 95.2 | b | 83.9 | | 73.2 | | 0.394 | | 23 900. | < | 0.01 | | 627. | | 4 620. | b | 200. | | 33.9 | < | 0.004 | | 1.05 | | 6. | | 0.356 | | 37.7 | b | 21.7 | | 3.41 |
| Gw-60-1-1 | SS | N | 2023-05-24 | Clear and colourless | < | 0.5 | | 18.3 | | 140. | | 0.324 | < | 0.015 | < | 0.005 | < | 0.02 | < | 0.02 | | 0.675 | | 2.5 | | 0.272 | < | 0.04 | | 12 600. | < | 0.005 | | 16.8 | | 445. | | 39. | | 11.5 | | 0.002 5 | < | 0.2 | < | 0.5 | | 0.15 | < | 0.2 | | 0.45 | < | 0.1 |
| Gw-60-1-1 | SS | N | 2023-10-05 | Clear and colourless | | 0.64 | | 19.6 | | 117. | | 0.359 | | 0.97 | < | 0.005 | < | 0.02 | < | 0.02 | | 0.793 | | 4.2 | | 0.299 | < | 0.04 | | 12 800. | < | 0.005 | | 17.7 | | 427. | | 38. | | 12. | | 0.007 2 | < | 0.2 | < | 0.5 | | 0.166 | < | 0.2 | | 0.25 | < | 0.1 |
| Gw-60-1-1 | SS | N | 2023-11-28 | Clear and colourless | | 0.54 | | 17.3 | | 181. | | 0.287 | | 0.8 | < | 0.005 | < | 0.02 | < | 0.02 | | 0.619 | < | 2. | | 0.238 | < | 0.04 | | 11 900. | < | 0.005 | | 16.3 | | 421. | | 37. | | 11.1 | | 0.003 6 | < | 0.2 | < | 0.5 | | 0.093 8 | < | 0.2 | | 0.19 | < | 0.1 |
| Gw-60-1-1 | SS | N | 2024-02-21 | Clear Colourless | < | 0.5 | | 9.99 | | 55.3 | | 0.371 | < | 0.02 | < | 0.005 | | 2.92 | | 2.92 | | 0.696 | | 3.2 | | 2.47 | | 0.322 | | 8 460. | < | 0.005 | | 28.2 | | 236. | | 72. | | 24.4 | < | 0.002 | < | 0.2 | < | 0.5 | | 0.055 4 | < | 0.2 | | 0.11 | < | 0.1 |
| Gw-60-2-1 | SS | N | 2023-05-24 | Clear and colourless | | 0.51 | | 14. | | 145. | | 1.42 | < | 0.015 | < | 0.005 | < | 0.02 | < | 0.02 | | 2.44 | | 5. | | 0.362 | < | 0.04 | | 12 700. | < | 0.005 | | 10.8 | | 290. | | 56. | | 17.3 | | 0.010 8 | < | 0.2 | < | 0.5 | | 0.139 | < | 0.2 | | 0.38 | < | 0.1 |
| Gw-60-2-1 | SS | N | 2023-10-05 | Clear and colourless | | 0.74 | | 14.6 | | 98.8 | | 1.65 | | 0.89 | < | 0.005 | < | 0.02 | < | 0.02 | | 2.22 | | 7.8 | | 0.433 | | 0.065 | | 12 500. | < | 0.005 | | 10.8 | | 265. | | 53. | | 17.4 | | 0.010 3 | < | 0.2 | | 0.55 | | 0.184 | | 0.22 | | 0.51 | < | 0.1 |
| Gw-60-2-1 | SS | N | 2023-11-28 | Clear and colourless | | 0.61 | | 12.9 | | 64.4 | | 1.6 | | 0.73 | < | 0.005 | < | 0.02 | < | 0.02 | | 1.84 | | 6.7 | | 0.351 | | 0.059 | | 11 400. | < | 0.005 | | 10.2 | | 259. | | 53. | | 16.1 | | 0.006 3 | < | 0.2 | < | 0.5 | | 0.169 | < | 0.2 | | 0.42 | < | 0.1 |
| Gw-60-2-1 | SS | N | 2024-02-21 | Clear Colourless | | 0.69 | | 16. | | 75.6 | | 2.21 | < | 0.015 | < | 0.005 | < | 0.02 | < | 0.02 | | 2.28 | | 8.2 | | 0.425 | | 0.089 | | 15 100. | < | 0.005 | | 12.1 | | 285. | | 58. | | 19.8 | | 0.009 2 | < | 0.2 | < | 0.5 | | 0.271 | < | 0.2 | < | 0.1 | < | 0.1 |
| Gw-60-3-1 | SS | N | 2023-05-23 | Clear and colourless | < | 0.5 | | 9.83 | | 2.2 | | 0.323 | | 1.5 | < | 0.005 | | 3.45 | | 3.45 | | 0.756 | | 3.4 | | 2.41 | | 0.226 | | 6 820. | < | 0.005 | | 28.9 | | 248. | | 68. | | 21.3 | < | 0.002 | < | 0.2 | < | 0.5 | | 0.051 9 | < | 0.2 | | 0.48 | < | 0.1 |
| Gw-60-3-1 | SS | N | 2023-10-05 | Clear and colourless | < | 0.5 | | 10.8 | | 3.44 | | 0.396 | | 1. | < | 0.005 | < | 10. | b | 10. | b | 0.735 | | 3.5 | | 2.78 | | 0.07 | | 7 570. | < | 0.005 | | 35.2 | | 259. | | 60. | | 19.3 | | 0.002 | < | 0.2 | < | 0.5 | | 0.075 | | 0.34 | | 0.41 | < | 0.1 |
| Gw-60-3-1 | SS | N | 2023-11-28 | Very slightly turbid, colourless | < | 0.5 | | 10. | | 57.1 | | 0.407 | | 0.58 | < | 0.005 | | 3.27 | | 3.27 | | 0.979 | | 2.3 | | 2.56 | | 0.128 | | 7 160. | < | 0.005 | | 30.3 | | 255. | | 65. | | 20.1 | < | 0.002 | < | 0.2 | < | 0.5 | | 0.074 4 | | 0.22 | | 0.64 | < | 0.1 |
| Gw-60-3-1 | SS | N | 2024-02-21 | Clear Colourless | | 0.59 | | 21.5 | | 153. | | 0.426 | < | 0.015 | < | 0.005 | < | 0.02 | < | 0.02 | | 0.986 | | 4.5 | | 0.322 | < | 0.04 | | 14 800. | < | 0.005 | | 18.9 | | 471. | | 38. | | 12.8 | | 0.006 3 | < | 0.2 | < | 0.5 | | 0.195 | | 0.2 | | 0.14 | < | 0.1 |
| Gw-62-1-1 | NS | N | 2023-09-22 | Dry | | --- | | --- | | --- | | --- | | --- | | --- | | --- | | --- | | --- | | --- | | --- | | --- | | --- | | --- | | --- | | --- | | --- | | --- | | --- | | --- | | --- | | --- | | --- | | --- | | --- | | --- | | --- | | --- | | --- |
| Gw-62-1-1 | SS | N | 2023-11-24 | Clear and colourless | < | 0.5 | | 6.77 | < | 0.05 | | 0.175 | | 0.9 | < | 0.005 | | 26.7 | b | 26.7 | b | 0.158 | < | 2. | | 0.186 | | 0.608 | | 6 260. | < | 0.005 | | 3.36 | | 190. | | 45. | | 13.2 | < | 0.002 | < | 0.2 | | 0.69 | | 0.108 | | 0.53 | | 0.29 | < | 0.1 |
| Gw-62-2-1 | NS | N | 2023-09-22 | Dry - not enough water to sample. | | --- | | --- | | --- | | --- | | --- | | --- | | --- | | --- | | --- | | --- | | --- | | --- | | --- | | --- | | --- | | --- | | --- | | --- | | --- | | --- | | --- | | --- | | --- | | --- | | --- | | --- | | --- | | --- | | --- |
| Gw-62-2-1 | SS | N | 2023-11-24 | Slightly turbid, slightly grey | | 0.54 | | 7.62 | | 28.5 | | 0.173 | | 0.94 | < | 0.005 | | 31.3 | b | 31.3 | b | 0.566 | | 12.5 | | 0.34 | | 0.621 | | 7 900. | < | 0.005 | | 3.76 | | 194. | | 43. | | 12.7 | < | 0.006 2 | < | 0.2 | | 9.63 | | 0.498 | | 0.67 | | 2.74 | | 0.32 |
| Gw-63-1-1 | SS | N | 2023-10-04 | Clear and colourless | < | 0.5 | | 8.09 | | 31.6 | | 0.112 | | 0.93 | < | 0.005 | < | 0.02 | < | 0.02 | | 0.186 | < | 2.8 | < | 0.5 | | 0.05 | | 9 140. | < | 0.005 | | 3.67 | | 91.4 | | 8.6 | | 3.2 | < | 0.003 4 | < | 0.2 | < | 0.5 | | 0.009 4 | < | 0.2 | | 0.13 | < | 0.1 |
| Gw-63-1-1 | SS | N | 2023-11-28 | Clear and colourless | < | 0.5 | | 7.07 | | 30.8 | | 0.097 | | 0.87 | < | 0.005 | < | 0.02 | < | 0.02 | | 0.121 | < | 2. | < | 0.05 | < | 0.04 | | 7 990. | < | 0.005 | | 3.45 | | 87.8 | | 8.5 | < | 3. | < | 0.002 | < | 0.2 | < | 0.5 | | 0.007 3 | < | 0.2 | < | 0.1 | < | 0.1 |
| Gw-63-2-1 | SS | N | 2023-10-04 | Clear and colourless | < | 0.5 | | 5.47 | | 1.96 | | 0.189 | | 0.89 | < | 0.005 | < | 0.02 | < | 0.02 | | 0.091 | | 6.6 | | 0.094 | | 0.048 | | 6 910. | < | 0.005 | | 3.29 | | 68.5 | | 11. | | 3.6 | < | 0.002 5 | < | 0.2 | < | 0.5 | | 0.028 2 | | 0.22 | | 0.26 | < | 0.1 |
| Gw-63-2-1 | SS | N | 2023-11-28 | Clear and colourless | < | 0.5 | | 4.69 | | 0.996 | | 0.219 | | 0.85 | < | 0.005 | < | 0.02 | < | 0.02 | | 0.08 | | 4.8 | | 0.079 | | 0.051 | | 5 820. | < | 0.005 | | 3.13 | | 60.9 | | 13. | | 3.7 | < | 0.002 | < | 0.2 | < | 0.5 | | 0.024 4 | | 0.37 | | 0.78 | < | 0.1 |
| Gw-71-1-1 | FRM | Y | 2023-05-24 | Mean of duplicates, clear and colourless | < | 0.5 | | 6.495 | | 119.5 | | 0.524 5 | < | 0.015 | < | 0.005 | < | 0.02 | < | 0.02 | | 0.379 5 | | 14.25 | | 0.268 | < | 0.04 | | 12 350. | < | 0.005 | | 8.075 | | 130.5 | | 23. | | 7.2 | | 0.004 5 | < | 0.2 | < | 0.5 | | 0.247 5 | | 0.325 | | 0.585 | < | 0.1 |
| Gw-71-1-1 | FRM | Y | 2023-10-05 | Mean of duplicates, clear and colourless | | 0.565 | | 7.985 | | 99.35 | | 0.412 | | 0.935 | < | 0.005 | < | 0.02 | < | 0.02 | | 0.424 5 | | 15.5 | | 0.280 5 | < | 0.04 | | 12 700. | < | 0.005 | | 7.965 | | 158. | | 22.5 | | 7.7 | | 0.006 1 | < | 0.2 | < | 0.5 | | 0.274 | | 0.395 | | 0.265 | < | 0.1 |
| Gw-71-1-1 | FRM | Y | 2023-11-28 | Mean of duplicates, clear and colourless | | 0.54 | | 7.145 | | 117. | | 0.452 | | 0.855 | < | 0.005 | < | 0.02 | < | 0.02 | | 0.588 | | 11.75 | | 0.245 5 | < | 0.04 | | 11 300. | < | 0.005 | | 7.025 | | 156.5 | | 24. | | 7.05 | | 0.003 65 | < | 0.2 | < | 0.5 | | 0.265 | | 0.33 | | 0.34 | < | 0.1 |
| Gw-71-1-1 | FRM | Y | 2024-02-21 | Mean of duplicates, clear and colourless | < | 0.5 | | 7.315 | | 137.5 | | 0.522 | < | 0.015 | < | 0.005 | < | 0.02 | < | 0.02 | | 0.442 | | 14.55 | | 0.281 5 | < | 0.04 | | 14 900. | < | 0.005 | | 8.06 | | 147. | | 22.5 | | 7.75 | | 0.006 65 | < | 0.2 | < | 0.5 | | 0.257 5 | | 0.36 | | 0.81 | < | 0.1 |
| Gw-71-2-1 | SS | Y | 2023-05-24 | Clear and colourless | < | 0.5 | | 7.71 | | 66.2 | | 0.248 | < | 0.015 | < | 0.005 | < | 0.02 | < | 0.02 | | 0.781 | | 7.9 | | 0.376 | < | 0.04 | | 9 070. | < | 0.005 | | 7.18 | | 200. | | 34. | | 10. | | 0.006 8 | < | 0.2 | < | 0.5 | | 0.142 | < | 0.2 | | 0.42 | < | 0.1 |
| Gw-71-2-1 | SS | Y | 2023-10-05 | Clear and colourless | | 0.65 | | 8.19 | | 69.2 | | 0.248 | | 1.1 | < | 0.005 | < | 0.02 | < | 0.02 | | 0.463 | | 14.2 | | 0.531 | | 0.041 | | 9 460. | < | 0.005 | | 7.91 | | 204. | | 35. | | 11.5 | | 0.016 4 | < | 0.2 | < | 0.5 | | 0.198 | < | 0.2 | | 0.54 | < | 0.1 |
| Gw-71-2-1 | SS | Y | 2023-11-28 | Clear and colourless | < | 0.5 | | 7.9 | | 57.4 | | 0.258 | | 0.78 | < | 0.005 | < | 0.02 | < | 0.02 | | 0.468 | | 8.1 | | 0.503 | | 0.098 | | 9 160. | < | 0.005 | | 7.31 | | 205. | | 36. | | 11. | | 0.016 4 | < | 0.2 | < | 0.5 | | 0.212 | < | 0.2 | | 0.22 | < | 0.1 |
| Gw-71-2-1 | SS | Y | 2024-02-21 | Clear Colourless | | 0.52 | | 8.58 | | 38.9 | | 0.291 | < | 0.015 | < | 0.005 | < | 0.02 | < | 0.02 | | 0.546 | | 12.8 | | 0.537 | | 0.063 | | 10 600. | < | 0.005 | | 8.13 | | 215. | | 38. | | 12.4 | | 0.018 2 | < | 0.2 | < | 0.5 | | 0.239 | | 0.21 | | 0.62 | < | 0.1 |
| Gw-71-3-1 | SS | Y | 2023-05-23 | Clear and colourless | < | 0.5 | | 4.37 | | 16.7 | | 0.147 | | 1.4 | | 0.011 5 | | 1.6 | | 1.61 | | 0.554 | | 12.1 | | 0.235 | | 0.173 | | 7 870. | < | 0.005 | | 6.39 | | 87.7 | | 36. | | 10.1 | | 0.003 7 | < | 0.2 | < | 0.5 | | 0.201 | | 1.21 | | 1.44 | | 0.13 |
| Gw-71-3-1 | SS | Y | 2023-10-05 | Clear and colourless | < | 0.5 | | 6. | | 0.333 | | 0.159 | | 1.1 | < | 0.005 | < | 10. | < | 10. | | 0.471 | | 8. | | 0.263 | | 0.106 | | 8 230. | < | 0.005 | | 7.69 | | 106. | | 37. | | 11.3 | | 0.004 9 | < | 0.2 | < | 0.5 | | 0.281 | | 0.53 | | 0.69 | < | 0.1 |
| Gw-71-3-1 | SS | Y | 2023-11-28 | Clear and colourless | < | 0.5 | | 5.23 | | 0.237 | | 0.135 | | 0.84 | < | 0.005 | | 1.52 | | 1.52 | | 0.282 | | 5. | | 0.225 | | 0.123 | | 7 350. | < | 0.005 | | 7.21 | | 106. | | 37. | | 11.2 | < | 0.002 | < | 0.2 | < | 0.5 | | 0.248 | | 0.45 | | 0.36 | < | 0.1 |
| Gw-71-3-1 | SS | Y | 2024-02-21 | Clear Colourless | < | 0.5 | | 5.19 | | 0.243 | | 0.17 | < | 0.015 | < | 0.005 | | 1.26 | | 1.26 | | 0.271 | | 5.8 | | 0.231 | | 0.159 | | 9 180. | < | 0.005 | | 7.28 | | 105. | | 32. | | 10.3 | | 0.003 9 | < | 0.2 | < | 0.5 | | 0.188 | | 0.5 | < | 0.1 | < | 0.1 |
| Gw-72-1-1 | FRM | Y | 2023-05-23 | Mean of duplicates, clear and colourless | < | 0.5 | | 12.95 | | 112.5 | | 0.656 5 | | 1.55 | < | 0.005 | < | 0.02 | < | 0.02 | | 1.87 | | 7.95 | | 0.23 | < | 0.04 | | 20 000. | < | 0.005 | | 8.335 | | 296.5 | | 47.5 | | 14.6 | < | 0.002 | < | 0.2 | < | 0.5 | | 0.015 35 | < | 0.2 | | 0.45 | < | 0.1 |
| Gw-72-1-1 | FRM | Y | 2023-10-05 | Mean of duplicates, clear and colourless | | 0.77 | | 13.35 | | 109. | | 0.665 | | 0.895 | < | 0.005 | < | 1.01 | < | 1.01 | | 1.68 | | 23.05 | | 0.234 5 | < | 0.06 | | 20 500. | < | 0.007 5 | | 8.525 | | 278.5 | | 45. | | 14.75 | < | 0.003 | < | 0.3 | | 0.785 | | 0.017 4 | | 0.3 | | 0.95 | < | 0.15 |
| Gw-72-1-1 | FRM | Y | 2023-11-28 | Mean of duplicates, clear and colourless | < | 0.5 | | 11.85 | | 111.5 | | 0.605 | | 0.91 | < | 0.005 | < | 0.02 | < | 0.02 | | 1.555 | | 4.9 | | 0.209 5 | < | 0.04 | | 17 500. | < | 0.005 | | 7.81 | | 269. | | 44. | | 13.35 | < | 0.002 | < | 0.2 | < | 0.5 | | 0.012 45 | < | 0.2 | | 0.275 | < | 0.1 |
| Gw-72-1-1 | FRM | Y | 2024-02-21 | Mean of duplicates, clear and colourless | < | 0.5 | | 14.65 | | 125. | | 0.719 5 | < | 0.015 | < | 0.005 | < | 0.02 | < | 0.02 | | 1.755 | | 6.4 | | 0.240 5 | < | 0.04 | | 24 150. | < | 0.005 | | 9.055 | | 305.5 | | 46.5 | | 16.2 | < | 0.002 | < | 0.2 | < | 0.5 | | 0.016 55 | < | 0.2 | < | 0.1 | < | 0.1 |
| Gw-72-3-1 | SS | Y | 2023-05-24 | Clear and colourless | | 0.54 | | 6.82 | | 28.9 | | 0.68 | < | 0.015 | | 0.002 5 | < | 0.02 | < | 0.02 | | 0.64 | | 11.1 | | 0.835 | < | 0.04 | | 8 350. | < | 0.005 | | 26.2 | | 166. | | 61. | | 18.6 | | 0.002 7 | < | 0.2 | < | 0.5 | | 0.192 | < | 0.2 | | 0.34 | < | 0.1 |
| Gw-72-3-1 | SS | Y | 2023-10-05 | Clear and colourless | | 0.67 | | 7.52 | | 28.7 | | 0.638 | | 0.97 | | 0.002 5 | < | 0.02 | < | 0.02 | | 0.819 | | 14.3 | | 0.956 | < | 0.04 | | 8 650. | < | 0.005 | | 26.9 | | 181. | | 66. | | 22. | | 0.006 1 | < | 0.2 | < | 0.5 | | 0.215 | | 0.29 | | 0.25 | < | 0.1 |
| Gw-72-3-1 | SS | Y | 2023-11-28 | Clear and colourless | | 0.63 | | 6.64 | | 59.9 | | 0.633 | | 0.8 | | 0.002 5 | < | 0.02 | < | 0.02 | | 1.15 | | 7.9 | | 0.888 | < | 0.04 | | 7 990. | < | 0.005 | | 25.8 | | 175. | | 58. | | 18.1 | | 0.003 4 | < | 0.2 | < | 0.5 | | 0.166 | < | 0.2 | | 0.45 | < | 0.1 |
| Gw-72-3-1 | SS | Y | 2024-02-21 | Clear Colourless | | 0.65 | | 7.59 | | 27.2 | | 0.718 | | 0.02 | | 0.002 5 | < | 0.02 | < | 0.02 | | 0.662 | | 14.1 | | 0.98 | | 0.051 | | 10 000. | < | 0.005 | | 28.3 | | 186. | | 63. | | 21.5 | | 0.006 7 | < | 0.2 | < | 0.5 | | 0.218 | < | 0.2 | < | 0.1 | < | 0.1 |
| Gw-73-1-1 | FRM | Y | 2023-05-24 | Mean of duplicates, clear and colourless | < | 0.5 | | 11.25 | | 69.95 | | 0.916 5 | < | 0.015 | | 0.007 8 | | 0.106 5 | | 0.114 | | 0.980 5 | | 12.65 | | 0.430 5 | < | 0.04 | | 9 795. | < | 0.005 | | 6.705 | | 193.5 | | 46. | | 14.15 | | 0.002 | < | 0.2 | < | 0.5 | | 0.231 5 | | 0.54 | | 1.13 | < | 0.1 |
| Gw-73-1-1 | FRM | Y | 2023-10-05 | Mean of duplicates, clear and colourless | | 0.51 | | 12.2 | | 126.5 | | 0.992 5 | | 0.555 | < | 0.005 | | 0.046 | | 0.046 | | 1.08 | | 15.35 | | 0.513 | < | 0.04 | | 10 300. | < | 0.005 | | 6.91 | | 201. | | 48.5 | | 15.8 | | 0.005 45 | < | 0.2 | < | 0.5 | | 0.244 5 | | 0.665 | | 1.245 | < | 0.1 |
| Gw-73-1-1 | FRM | Y | 2023-11-28 | Mean of duplicates, clear and colourless | < | 0.5 | | 10.6 | | 93.2 | | 0.922 | | 0.835 | < | 0.005 | | 0.072 5 | | 0.072 5 | | 1.17 | | 10.55 | | 0.406 | < | 0.04 | | 9 040. | < | 0.005 | | 8.35 | | 197. | | 46. | | 13.9 | | 0.002 15 | < | 0.2 | < | 0.5 | | 0.223 5 | | 0.555 | | 0.86 | < | 0.1 |
| Gw-73-1-1 | FRM | Y | 2024-02-23 | Mean of duplicates, clear and colourless | < | 0.5 | | 11.4 | | 71.3 | | 1.035 | < | 0.015 | < | 0.005 | | 0.138 | | 0.138 | | 1.24 | | 11.95 | | 0.421 | < | 0.04 | | 10 950. | < | 0.005 | | 6.375 | | 195. | | 45.5 | | 13.45 | | 0.003 4 | < | 0.2 | < | 0.5 | | 0.238 5 | | 0.48 | | 1.025 | < | 0.1 |
| Gw-73-3-1 | FRM | Y | 2023-10-05 | Mean of duplicates, clear and colourless | | 0.51 | | 12.2 | | 126.5 | | 0.992 5 | | 0.555 | < | 0.005 | | 0.046 | | 0.046 | | 1.08 | | 15.35 | | 0.513 | < | 0.04 | | 10 300. | < | 0.005 | | 6.91 | | 201. | | 48.5 | | 15.8 | | 0.005 45 | < | 0.2 | < | 0.5 | | 0.244 5 | | 0.665 | | 1.245 | < | 0.1 |
| Gw-73-3-1 | SS | Y | 2023-11-28 | Clear and colourless | | 1.11 | | 6.1 | | 0.298 | | 0.481 | | 0.86 | < | 0.005 | | 1.19 | | 1.19 | | 0.45 | | 14.5 | | 0.602 | | 0.07 | | 7 910. | < | 0.005 | | 17.5 | | 99.7 | | 33. | | 9.2 | | 0.006 4 | < | 0.2 | < | 0.5 | | 0.12 | | 0.35 | | 1.23 | < | 0.1 |
| Gw-73-3-1 | FRM | Y | 2024-02-23 | Mean of duplicates, clear and colourless | < | 0.5 | | 11.4 | | 71.3 | | 1.035 | < | 0.015 | < | 0.005 | | 0.138 | | 0.138 | | 1.24 | | 11.95 | | 0.421 | < | 0.04 | | 10 950. | < | 0.005 | | 6.375 | | 195. | | 45.5 | | 13.45 | | 0.003 4 | < | 0.2 | < | 0.5 | | 0.238 5 | | 0.48 | | 1.025 | < | 0.1 |
| Gw-77-1-1 | SS | N | 2023-09-25 | Clear and colourless | < | 0.5 | | 9.32 | | 33. | | 0.43 | < | 0.015 | < | 0.005 | < | 0.02 | < | 0.02 | | 0.497 | | 6.5 | | 0.284 | < | 0.04 | | 10 400. | < | 0.005 | | 4.41 | | 177. | | 22. | | 6.6 | | 0.002 8 | < | 0.2 | < | 0.5 | | 0.056 9 | | 0.42 | | 2.57 | < | 0.1 |
| Gw-77-1-1 | SS | N | 2023-11-22 | Very slightly turbid, very very slightly grey | | 0.55 | | 10.2 | | 50.8 | | 0.458 | | 0.75 | < | 0.005 | | 10.6 | b | 10.6 | b | 1.25 | | 33.2 | | 0.321 | | 0.09 | | 12 700. | | 0.010 2 | | 4.09 | | 196. | | 26. | | 8.1 | | 0.013 7 | < | 0.2 | | 18.6 | | 0.199 | | 2.14 | | 3.17 | | 0.31 |
| Gw-77-2-1 | SS | N | 2023-09-26 | Clear and colourless | | 0.62 | | 20.7 | | 59. | | 0.618 | | 0.26 | < | 0.005 | < | 0.02 | < | 0.02 | | 1.74 | | 45.6 | | 0.432 | | 0.063 | | 14 600. | < | 0.005 | | 6.7 | | 748. | | 63. | | 20.1 | | 0.008 6 | < | 0.2 | < | 0.5 | | 0.102 | | 0.5 | | 0.77 | < | 0.1 |
| Gw-77-2-1 | SS | N | 2023-11-22 | Clear and colourless | | 0.9 | | 20.3 | | 12.1 | | 0.544 | | 0.83 | < | 0.005 | | 0.187 | | 0.187 | | 0.389 | | 34.6 | | 0.398 | | 0.06 | | 15 400. | < | 0.005 | | 6.57 | | 783. | | 65. | | 20.7 | | 0.005 7 | < | 0.2 | | 0.59 | | 0.099 9 | | 0.39 | | 0.49 | < | 0.1 |
| Gw-78-1-1 | SS | N | 2023-09-26 | Clear and colourless | | 1.48 | | 15.5 | | 24.3 | | 1.99 | < | 0.015 | < | 0.005 | | 0.113 | | 0.113 | | 1.5 | | 71. | | 0.777 | | 0.689 | | 15 000. | | 0.012 1 | | 19.4 | | 405. | | 58. | | 18.3 | | 0.020 9 | | 0.5 | | 17.6 | | 0.823 | | 1.88 | | 5.27 | < | 0.1 |
| Gw-78-1-1 | SS | N | 2023-11-23 | Clear and colourless | | 1.29 | | 14.6 | | 0.12 | | 1.77 | | 0.8 | < | 0.005 | | 0.257 | | 0.257 | | 0.605 | | 35.8 | | 0.53 | | 0.297 | | 16 700. | < | 0.005 | | 9.89 | | 381. | | 54. | | 16.5 | | 0.009 3 | < | 0.2 | | 0.6 | | 0.438 | | 0.78 | | 1. | < | 0.1 |
| Gw-78-2-1 | SS | N | 2023-09-26 | Clear and colourless | | 0.78 | | 9.19 | | 33.3 | | 3.53 | | 0.87 | < | 0.005 | | 0.241 | | 0.241 | | 3.83 | | 38.4 | | 0.433 | | 1.06 | |

**Hartland Landfill Groundwater, Surface Water and Leachate Monitoring Program Annual Report**
**(Apr 2023 to Mar 2024)**
**Appendix B-1. Groundwater Quality Data 2023-2024**

AECOM

| | | |

# B2. Domestic Well Quality

| Parameters | Criteria | | Well Number | Site # 1 | | Site #2 | | BFD of Site #2 | | Site #3 | | Site #11 | | Site #12 | | Site #13 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 5100 Wildview Crescent | | 237 Meadowbrook Road | | 160 Lohr Road | | 176 Lohr Road | | 184 Lohr Road | | 187 Lohr Road | | 200 Lohr Road | |
| | Canadian | British Columbia | | 99 | | 24 | | 24 | | 25 | | 36 | | 37 (at house) | | 38 (at well head) | |
| | DWQ Guidelines [1] | SDWQ Guidelines [2] | Sample Date | 2023-10-18 | | 2023-10-17 | | 2023-10-17 | | 2023-10-17 | | 2023-10-17 | | 2023-10-17 | | 2023-10-17 | |
| **Total Metals** | | | | | | | | | | | | | | | | | |
| Aluminum, total | 0.1 ‡ | 9.5 | mg/L | | 0.0196 | | 0.0156 | | 0.00253 | | 0.0103 | | 0.00179 | | 0.00156 | | 0.00114 |
| Antimony, total | 0.006 | 0.006 | mg/L | | 0.000081 | < | 0.00002 | | 0.000027 | < | 0.00002 | < | 0.00002 | < | 0.00002 | | 0.000021 |
| Arsenic, total | 0.010 | 0.010 | mg/L | | 0.000116 | | 0.000048 | | 0.000059 | | 0.000047 | | 0.000056 | | 0.000044 | | 0.000067 |
| Barium, total | 2 | n/a | mg/L | | 0.0109 | | 0.00101 | | 0.000831 | | 0.00784 | | 0.00974 | | 0.00224 | | 0.0172 |
| Beryllium, total | n/a | n/a | mg/L | < | 0.00001 | < | 0.00001 | < | 0.00001 | < | 0.00001 | < | 0.00001 | < | 0.00001 | < | 0.00001 |
| Bismuth, total | n/a | n/a | mg/L | < | 0.000005 | < | 0.000005 | < | 0.000005 | | 0.00001 | < | 0.000005 | < | 0.000005 | < | 0.000005 |
| Boron, total | 5 | 5 | mg/L | | 0.018 | | 0.01 | < | 0.01 | | 0.162 | | 0.057 | | 0.013 | | 0.043 |
| Cadmium, total | 0.007 | 0.005 | mg/L | | 0.000012 | | 0.000009 | < | 0.000005 | | 0.000012 | < | 0.000005 | | 0.000005 | < | 0.000005 |
| Calcium, total | n/a | n/a | mg/L | | 0.0518 | | 0.0212 | | 0.00501 | | 0.0249 | | 0.0505 | | 0.021 | | 0.0528 |
| Chromium, total | 0.05 | 0.05 | mg/L | | 0.00017 | | 0.00012 | < | 0.0001 | | 0.00019 | < | 0.0001 | | 0.00167 | < | 0.0001 |
| Cobalt, total | n/a | 0.001 | mg/L | | 0.000017 | | 0.000015 | | 0.000007 | | 0.000049 | | 0.000012 | | 0.000034 | | 0.00001 |
| Copper, total | 2 [1] and 1 † | 2 [2] and 1 † | mg/L | | 0.0505 | | 0.062 | | 0.0129 | | 0.111 | | 0.0104 | | 0.0059 | | 0.00725 |
| Iron, total | 0.3 † | 0.3 † | mg/L | | 0.255 | | 0.0181 | | 0.0426 | | 0.191 | < | 0.001 | | 0.0145 | | 0.0064 |
| Lead, total | 0.005 | 0.005 | mg/L | | 0.00285 | | 0.00114 | | 0.000295 | | 0.00223 | | 0.000273 | | 0.000086 | | 0.000213 |
| Lithium, total | n/a | n/a | mg/L | < | 0.0005 | < | 0.0005 | < | 0.0005 | < | 0.0005 | < | 0.0005 | < | 0.0005 | < | 0.0005 |
| Magnesium, total | n/a | n/a | mg/L | | 6.26 | | 6.2 | | 0.362 | | 4.28 | | 6.66 | | 2.88 | | 6.68 |
| Manganese, total | 0.12[1] and 0.02 † | 0.12[2] and 0.02 † | mg/L | | **0.03143** | | 0.000351 | | 0.000224 | | 0.00142 | | 0.000108 | | 0.000356 | | 0.000272 |
| Mercury, total | 0.001 | 0.001 | mg/L | < | 0.0000019 | < | 0.0000019 | | 0.0000026 | | 0.0000031 | | 0.0000022 | < | 0.0000019 | < | 0.0000019 |
| Molybdenum, total | n/a | 0.088 | mg/L | | 0.000623 | | 0.000058 | | 0.000351 | | 0.000497 | | 0.000698 | | 0.0005 | | 0.00117 |
| Nickel, total | n/a | 0.08 | mg/L | | 0.000196 | | 0.000198 | | 0.000111 | | 0.000249 | | 0.000134 | | 0.00113 | | 0.000585 |
| Phosphorus, total | n/a | n/a | mg/L | | 0.0086 | | 0.0072 | | 0.0027 | | 0.0048 | < | 0.002 | | 0.0177 | < | 0.002 |
| Potassium, total | n/a | n/a | mg/L | | 0.415 | | 0.243 | | 0.073 | | 0.049 | | 0.568 | | 0.356 | | 0.415 |
| Selenium, total | 0.05 | 0.01 | mg/L | | 0.000087 | | 0.000055 | | 0.0001 | < | 0.00004 | | 0.000127 | < | 0.00004 | | 0.00016 |
| Silicon, total | n/a | n/a | mg/L | | 10.3 | | 10.5 | | 8 | | 7.52 | | 7.42 | | 8.17 | | 7.7 |
| Silver, total | n/a | n/a | mg/L | < | 0.000005 | < | 0.000005 | < | 0.000005 | < | 0.000005 | < | 0.000005 | < | 0.000005 | < | 0.000005 |
| Sodium, total | 200 † | n/a | mg/L | | 6.47 | | 7.43 | | 68.1 | | 7.91 | | 6.25 | | 4.85 | | 6.6 |
| Strontium, total | 7.0 | 7.0 | mg/L | | 0.119 | | 0.045 | | 0.00934 | | 0.059 | | 0.109 | | 0.0425 | | 0.134 |
| Sulphur, total | n/a | n/a | mg/L | < | 3 | < | 3 | | 3.3 | < | 3 | < | 3 | < | 3 | < | 3 |
| Thallium, total | n/a | n/a | mg/L | < | 0.000002 | < | 0.000002 | < | 0.000002 | | 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 |
| Titanium, total | n/a | n/a | mg/L | < | 0.0005 | < | 0.0005 | < | 0.0005 | < | 0.0005 | < | 0.0005 | < | 0.0005 | < | 0.0005 |
| Uranium, total | 0.02 | 0.02 | mg/L | | 0.000897 | | 0.000009 | | 0.000352 | | 0.000027 | | 0.000665 | | 0.000123 | | 0.000671 |
| Vanadium, total | n/a | n/a | mg/L | | 0.00043 | | 0.00063 | < | 0.0002 | | 0.00122 | | 0.00058 | | 0.00049 | | 0.0005 |
| Zinc, total | 5 † | 3[2] and 5 † | mg/L | | 0.00792 | | 0.0518 | | 0.00842 | | 0.0584 | | 0.00647 | | 0.00713 | | 0.00279 |
| Zirconium, total | n/a | n/a | mg/L | < | 0.0001 | < | 0.0001 | < | 0.0001 | < | 0.0001 | < | 0.0001 | < | 0.0001 | < | 0.0001 |
| **Conventionals** | | | | | | | | | | | | | | | | | |
| Hardness (as CaCO3) | n/a | n/a | mg/L | | 155 | | 78.6 | | 14 | | 79.9 | | 153 | | 64.3 | | 159 |
| Chloride, dissolved | 250 † | 250 † | mg/L | | 5.3 | | 9.2 | | 19 | | 12 | | 13 | | 5.5 | | 15 |
| Total dissolved solids | 500 † | n/a | mg/L | | 210 | | 100 | | 180 | | 120 | | 180 | | 90 | | 180 |
| Specific Conductivity (Lab) | n/a | n/a | µS/cm | | 330 | | 190 | | 330 | | 200 | | 330 | | 150 | | 350 |
| Conductivity (Field) | n/a | n/a | µS/cm | | 236 | | 150 | | 259 | | 151 | | 241 | | 113 | | 247 |
| pH (lab) | 7.0 to 10.5 † | n/a | pH | | | | | | | | | | | | | | |
| pH (field) | 7.0 to 10.5 † | n/a | pH | | 7.48 | | 7.8 | | **6.94** | | **6.43** | | **6.78** | | 7.39 | | 7.03 |
| Temperature (field) | 15 † | 15 † | °C | | 11.1 | | 11.8 | | 14.5 | | 11.3 | | 12 | | 11.5 | | 10.7 |
| Ammonia | n/a | n/a | mg/L | | | | | | | | | | | | | | |

***Notes:***

*(1) Health Canada (March 2021). Guidelines for Canadian Drinking Water Quality—Summary Table.*

*(2) British Columbia Approved Source Drinking Water Quality Guidelines (SDWQGs) (September 2020).*

‡ *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.*

**Hartland Landfill Groundwater, Surface Water and Leachate Monitoring Program Annual Report**
**(Apr 2023 to Mar 2024)**
**Appendix B-2. Domestic Well Quality - 2023 to 2024**

| Parameters | Criteria | | Well Number | Site #10 | | Site #11 | | Site #12 | | Site #13 | | Site #14 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Canadian | British Columbia | | 5648 Wallace Drive Treated | | 5648 Wallace Drive | | 255 Farmington Road | | 5455 Spotts Close | | 5436 Spotts Close | |
| | DWQ Guidelines [1] | SDWQ Guidelines [2] | Sample Date | 61 | 2023-10-18 | 62 | 2023-10-18 | 63 | 2023-10-17 | 64 | 2023-10-17 | 65 | 2023-10-17 |
| **Total Metals** | | | | | | | | | | | | | |
| Aluminum, total | 0.1 ‡ | 9.5 | mg/L | | 0.00101 | | 0.00209 | | 0.00206 | | 0.0023 | | 0.00149 |
| Antimony, total | 0.006 | 0.006 | mg/L | | 0.000092 | | 0.00009 | < | 0.00002 | < | 0.00004 | | 0.00007 |
| Arsenic, total | 0.010 | 0.010 | mg/L | | 0.00174 | | 0.00172 | | 0.00002 | < | 0.00004 | | 0.000067 |
| Barium, total | 2 | n/a | mg/L | | 0.00837 | | 0.0127 | | 0.000124 | | 0.00238 | | 0.0021 |
| Beryllium, total | n/a | n/a | mg/L | < | 0.00001 | < | 0.00001 | < | 0.00001 | < | 0.00002 | < | 0.00001 |
| Bismuth, total | n/a | n/a | mg/L | | 0.000017 | < | 0.000005 | < | 0.000005 | < | 0.00001 | | 0.000017 |
| Boron, total | 5 | 5 | mg/L | | 0.247 | | 0.257 | | 0.691 | | 1.07 | | 0.253 |
| Cadmium, total | 0.007 | 0.005 | mg/L | | 0.000008 | < | 0.000005 | < | 0.000005 | < | 0.00001 | | 0.000008 |
| Calcium, total | n/a | n/a | mg/L | | 0.0383 | | 0.0386 | | 0.0117 | | 0.00598 | | 0.0692 |
| Chromium, total | 0.05 | 0.05 | mg/L | < | 0.0001 | < | 0.0001 | | 0.00011 | < | 0.0002 | < | 0.0001 |
| Cobalt, total | n/a | 0.001 | mg/L | | 0.000029 | | 0.000117 | | 0.000007 | | 0.000012 | | 0.000026 |
| Copper, total | 2 [1] and 1 † | 2 [2] and 1 † | mg/L | | 0.0166 | | 0.0133 | | 0.000128 | | 0.00154 | | 0.0714 |
| Iron, total | 0.3 † | 0.3 † | mg/L | | 0.0029 (a) | | 0.0174 | | 0.0111 | | 0.0188 | | 0.0214 |
| Lead, total | 0.005 | 0.005 | mg/L | | 0.00141 | | 0.000437 | | 0.000033 | | 0.000294 | | **0.00527** |
| Lithium, total | n/a | n/a | mg/L | | 0.00132 | | 0.00133 | | 0.00126 | | 0.0014 | < | 0.0005 |
| Magnesium, total | n/a | n/a | mg/L | | 8.27 | | 8.53 | | 3.26 | | 0.81 | | 7.16 |
| Manganese, total | 0.12[1] and 0.02 † | 0.12[2] and 0.02 † | mg/L | | 0.0166 | | **0.211** | | 0.0045 | | 0.00197 | | 0.000729 |
| Mercury, total | 0.001 | 0.001 | mg/L | < | 0.0000019 | < | 0.0000019 | < | 0.0000019 | < | 0.0000019 | < | 0.0000019 |
| Molybdenum, total | n/a | 0.088 | mg/L | | 0.00091 | | 0.000598 | | 0.0012 | | 0.0021 | | 0.000102 |
| Nickel, total | n/a | 0.08 | mg/L | | 0.000393 | | 0.000821 | | 0.000117 | | 0.000257 | | 0.000265 |
| Phosphorus, total | n/a | n/a | mg/L | | 0.0372 | | 0.0347 | | 0.004 | | 0.0192 | | 0.0021 |
| Potassium, total | n/a | n/a | mg/L | | 1.29 | | 1.27 | | 0.559 | | 0.22 | | 2.33 |
| Selenium, total | 0.05 | 0.01 | mg/L | < | 0.00004 | < | 0.00004 | < | 0.00004 | < | 0.00008 | < | 0.00004 |
| Silicon, total | n/a | n/a | mg/L | | 9.27 | | 9.27 | | 9.58 | | 12.3 | | 9.77 |
| Silver, total | n/a | n/a | mg/L | < | 0.000005 | < | 0.000005 | < | 0.000005 | | 0.000033 | | 0.000039 |
| Sodium, total | 200 † | n/a | mg/L | | 19.5 | | 19.8 | | 39.9 | | 43 | | 14.6 |
| Strontium, total | 7.0 | 7.0 | mg/L | | 0.139 | | 0.14 | | 0.0299 | | 0.0535 | | 0.0905 |
| Sulphur, total | n/a | n/a | mg/L | | 8.8 | | 8.3 | | 4.8 | < | 6 | | 4 |
| Thallium, total | n/a | n/a | mg/L | < | 0.000002 | < | 0.000002 | < | 0.000002 | < | 0.000004 | | 0.000002 |
| Tin, total | n/a | n/a | mg/L | < | 0.0002 | < | 0.0002 | < | 0.0002 | < | 0.0004 | | 0.0169 |
| Titanium, total | n/a | n/a | mg/L | < | 0.0005 | < | 0.0005 | < | 0.0005 | < | 0.001 | < | 0.0005 |
| Uranium, total | 0.02 | 0.02 | mg/L | | 0.00026 | | 0.000261 | | 0.000004 | | 0.000005 | | 0.000185 |
| Vanadium, total | n/a | n/a | mg/L | | 0.00053 | | 0.0006 | < | 0.0002 | < | 0.0004 | | 0.00088 |
| Zinc, total | 5 † | 3[2] and 5 † | mg/L | | 0.00869 | | 0.00417 | | 0.00077 | | 0.00843 | | 0.025 |
| Zirconium, total | n/a | n/a | mg/L | < | 0.0001 | < | 0.0001 | < | 0.0001 | < | 0.0002 | < | 0.0001 |
| **Conventionals** | | | | | | | | | | | | | |
| Hardness (as CaCO3) | n/a | n/a | mg/L | | 130 | | 131 | | 42.8 | | 18.3 | | 202 |
| Chloride, dissolved | 250 † | 250 † | mg/L | | 14 | | 13 | | 9.1 | | 15 | | 52 |
| Total dissolved solids | 500 † | n/a | mg/L | | 210 | | 210 | | 140 | | 140 | | 310 |
| Specific Conductivity (Lab) | n/a | n/a | µS/cm | | 340 | | 350 | | 250 | | 230 | | 500 |
| Conductivity (Field) | n/a | n/a | µS/cm | | 263 | | 254 | | 162 | | 167 | | 388 |
| pH (lab) | 7.0 to 10.5 † | n/a | pH | | | | | | | | | | |
| pH (field) | 7.0 to 10.5 † | n/a | pH | | 7.95 | | 7.97 | | 8.37 | | 8.93 | | **6.36** |
| Temperature (field) | 15 † | 15 † | °C | | 13.8 | | 12.2 | | 11.5 | | 11.4 | | 14.1 |
| Ammonia | n/a | n/a | mg/L | | | | | | | | | | |

***Notes:***

*(1) Health Canada (March 2021). Guidelines for Canadian Drinking Water Quality—Summary Table.*

*(2) British Columbia Approved Source Drinking Water Quality Guidelines (SDWQGs) (September 2020).*

‡ *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.*

**Hartland Landfill Groundwater, Surface Water and Leachate Monitoring Program Annual Report**
**(Apr 2023 to Mar 2024)**
**Appendix B-2. Domestic Well Quality - 2023 to 2024**

AECOM

| Parameters | Criteria | | Well Number | Site #15 | | Site #16 | | Site #17 | | Site #18 | | Site #19 | | Site #20 | | Site #21 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 5436 Spotts Close | | 5435 Kiowa Avenue | | 27 Hartland Avenue | | 1 Hartland Avenue | | 400 Durrance Close | | 7048 Mark Lane | | 7048 Mark Lane | |
| | Canadian | British Columbia | | 66 | | 67 | | 68 | | 69 | | 70 | | 71 | | 72 | |
| | DWQ Guidelines [1] | SDWQ Guidelines [2] | Sample Date | 2023-10-17 | | 2023-10-17 | | 2023-10-17 | | 2023-10-17 | | 2023-10-19 | | 2023-11-23 | | 2023-11-23 | |
| **Total Metals** | | | | | | | | | | | | | | | | | |
| Aluminum, total | 0.1 ‡ | 9.5 | mg/L | | 0.00174 | | 0.00705 | | 0.0142 | | 0.00576 | | | | | | |
| Antimony, total | 0.006 | 0.006 | mg/L | | 0.000031 | < | 0.00002 | | 0.000021 | < | 0.00002 | | | | | | |
| Arsenic, total | 0.010 | 0.010 | mg/L | | 0.000083 | | 0.000038 | | 0.000075 | | 0.00007 | | | | | | |
| Barium, total | 2 | n/a | mg/L | | 0.00211 | | 0.000646 | | 0.00243 | | 0.00379 | | | | | | |
| Beryllium, total | n/a | n/a | mg/L | | 0.000012 | < | 0.00001 | | 0.000017 | < | 0.00001 | | | | | | |
| Bismuth, total | n/a | n/a | mg/L | | 0.000075 | < | 0.000005 | < | 0.00001 | < | 0.000005 | | | | | | |
| Boron, total | 5 | 5 | mg/L | | 0.269 | | 0.239 | | 0.017 | < | 0.01 | | | | | | |
| Cadmium, total | 0.007 | 0.005 | mg/L | | 0.000009 | | 0.000041 | | 0.000031 | < | 0.000005 | | | | | | |
| Calcium, total | n/a | n/a | mg/L | | 0.0695 | | 0.0866 | | 0.0239 | | 0.00556 | | | | | | |
| Chromium, total | 0.05 | 0.05 | mg/L | | 0.00083 | < | 0.0001 | | 0.00023 | | 0.00012 | | | | | | |
| Cobalt, total | n/a | 0.001 | mg/L | | 0.000042 | | 0.000014 | | 0.000063 | | 0.000018 | | | | | | |
| Copper, total | 2 [1] and 1 † | 2 [2] and 1 † | mg/L | | 0.0626 | | 0.021 | | 0.00725 | | 0.0107 | | | | | | |
| Iron, total | 0.3 † | 0.3 † | mg/L | | 0.0391 | | 0.0029 | | **4.707** | | 0.0359 | | | | | | |
| Lead, total | 0.005 | 0.005 | mg/L | | 0.00156 | | 0.000129 | | 0.000039 | | 0.0005 | | | | | | |
| Lithium, total | n/a | n/a | mg/L | < | 0.0005 | < | 0.0005 | < | 0.0005 | < | 0.0005 | | | | | | |
| Magnesium, total | n/a | n/a | mg/L | | 7.09 | | 6.63 | | 5.33 | | 1.28 | | | | | | |
| Manganese, total | 0.12[1] and 0.02 † | 0.12[2] and 0.02 † | mg/L | | 0.000834 | | 0.000538 | | **0.0548** | | 0.00351 | | | | | | |
| Mercury, total | 0.001 | 0.001 | mg/L | < | 0.0000019 | | 0.0000025 | < | 0.0000019 | < | 0.0000019 | | | | | | |
| Molybdenum, total | n/a | 0.088 | mg/L | | 0.000131 | | 0.000083 | | 0.000773 | | 0.000065 | | | | | | |
| Nickel, total | n/a | 0.08 | mg/L | | 0.000832 | | 0.000202 | | 0.00024 | | 0.000268 | | | | | | |
| Phosphorus, total | n/a | n/a | mg/L | < | 0.002 | < | 0.002 | | 0.0229 | | 0.0027 | | | | | | |
| Potassium, total | n/a | n/a | mg/L | | 2.26 | | 0.789 | | 0.38 | | 0.15 | | | | | | |
| Selenium, total | 0.05 | 0.01 | mg/L | < | 0.00004 | < | 0.00004 | < | 0.00004 | < | 0.00004 | | | | | | |
| Silicon, total | n/a | n/a | mg/L | | 9.99 | | 10.1 | | 7.06 | | 1.85 | | | | | | |
| Silver, total | n/a | n/a | mg/L | < | 0.000005 | < | 0.000005 | | 0.000017 | < | 0.000005 | | | | | | |
| Sodium, total | 200 † | n/a | mg/L | | 14.5 | | 15 | | 18.4 | | 3.99 | | 7.11 | | 10.2 | | 11.3 |
| Strontium, total | 7.0 | 7.0 | mg/L | | 0.091 | | 0.0847 | | 0.0563 | | 0.0169 | | | | | | |
| Sulphur, total | n/a | n/a | mg/L | | 6.6 | | 4 | | 6.8 | < | 3 | | | | | | |
| Thallium, total | n/a | n/a | mg/L | | 0.000002 | < | 0.000002 | < | 0.000002 | < | 0.000002 | | | | | | |
| Tin, total | n/a | n/a | mg/L | | 0.00044 | < | 0.0002 | < | 0.0002 | < | 0.0002 | | | | | | |
| Titanium, total | n/a | n/a | mg/L | < | 0.0005 | < | 0.0005 | < | 0.002 | < | 0.0005 | | | | | | |
| Uranium, total | 0.02 | 0.02 | mg/L | | 0.000199 | | 0.000174 | | 0.000063 | | 0.00001 | | | | | | |
| Vanadium, total | n/a | n/a | mg/L | | 0.00088 | | 0.00063 | | 0.00234 | < | 0.0002 | | | | | | |
| Zinc, total | 5 † | 3[2] and 5 † | mg/L | | 0.0249 | | 0.0091 | | 0.0144 | | 0.00639 | | | | | | |
| Zirconium, total | n/a | n/a | mg/L | < | 0.0001 | < | 0.0001 | < | 0.0001 | < | 0.0001 | | | | | | |
| **Conventionals** | | | | | | | | | | | | | | | | | |
| Hardness (as CaCO3) | n/a | n/a | mg/L | | 203 | | 244 | | 81.6 | | 19.2 | | | | | | |
| Chloride, dissolved | 250 † | 250 † | mg/L | | 54 | | 29 | | 44 | | 3.9 | | 4.2 | | 41 | | 41 |
| Total dissolved solids | 500 † | n/a | mg/L | | 290 | | 290 | | 170 | | 42 | | | | | | |
| Specific Conductivity (Lab) | n/a | n/a | µS/cm | | 490 | | 530 | | 290 | | 59 | | 420 | | | | |
| Conductivity (Field) | n/a | n/a | µS/cm | | 388 | | 448 | | 212 | | 53 | | 319 | | 427 | | 427 |
| pH (lab) | 7.0 to 10.5 † | n/a | pH | | | | | | | | | | | | | | |
| pH (field) | 7.0 to 10.5 † | n/a | pH | | **6.36** | | **6.55** | | **6** | | 7.44 | | 7.54 | | 7.29 | | 7.29 |
| Temperature (field) | 15 † | 15 † | °C | | 14.1 | | **15.5** | | 11.2 | | **15.8** | | 14.1 | | 10.1 | | 10.1 |
| Ammonia | n/a | n/a | mg/L | | | | | | | | | | | | | | |

***Notes:***

*(1) Health Canada (March 2021). Guidelines for Canadian Drinking Water Quality—Summary Table.*

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

‡ *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.*

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**Appendix B-2. Domestic Well Quality - 2023 to 2024**

| Parameters | Criteria | | Well Number | Site #22 | | Site #23 | |
|---|---|---|---|---|---|---|---|
| | | | | 6665 Mark Lane | | S. 6515 Willis Pt Rd | |
| | Canadian | British Columbia | | 73 | | 74 | |
| | DWQ Guidelines [1] | SDWQ Guidelines [2] | Sample Date | 2023-10-18 | | 2023-11-16 | |
| **Total 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 | | 15.5 | | 11.9 |
| 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 | | 27 | | 2.5 |
| Total dissolved solids | 500 † | n/a | mg/L | | | | |
| Specific Conductivity (Lab) | n/a | n/a | µS/cm | | 410 | | |
| Conductivity (Field) | n/a | n/a | µS/cm | | 321 | | 146.5 |
| pH (lab) | 7.0 to 10.5 † | n/a | pH | | | | |
| pH (field) | 7.0 to 10.5 † | n/a | pH | | 7.63 | | 8.06 |
| Temperature (field) | 15 † | 15 † | °C | | 12.9 | | 9.2 |
| Ammonia | n/a | n/a | mg/L | | | | |

***Notes:***

*(1) Health Canada (March 2021). Guidelines for Canadian Drinking Water Quality—Summary Table.*

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

‡ *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

| Station | Sample Type | Compliance Well (Y/N?) | Date Sampled | | Aluminum | Arsenic | Boron | Cadmium | Chloride | Cobalt | Copper | Hardness (As Caco3) | Iron | Lead | Manganese | Molybdenum | N - Nh3 (As N) | N - No2 (As N) | N - No3 (As N) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **B.C. Water Quality Guidelines** | | | | **BC WQG-STA (1)** | --- | --- | --- | --- | 600 | 110 | --- | --- | 1000 | 3.28 - 416.7 (5) | 815 - 3394 (5) | 46000 | 1.9 - 24.9 (3) | 0.06 - 0.6 (4) | 32.8 |
| | | | | **BC WQG-LTC (1)** | Variable (9) | 5 | 1200 | --- | 150 | 4 | --- | --- | --- | 3.43 - 19.57 (5) | 767 - 2585 (5) | 7600 | 0.135 - 1.77 (3) | 0.02 - 0.2 (4) | 3 |
| | | | | **PARAMETER** | Aluminum | Arsenic | Boron | Cadmium | Chloride | Cobalt | Copper | Hardness (As Caco3) | Iron | Lead | Manganese | Molybdenum | N - Nh3 (As N) | N - No2 (As N) | N - No3 (As N) |
| | | | | **STATE** | TOT | TOT | TOT | TOT | DIS | TOT | TOT | TOT | TOT | TOT | TOT | TOT | TOT | DIS | DIS |
| | | | | **UNIT** | µg/L | µg/L | µg/L | µg/L | mg/L | µg/L | µg/L | mg/L | µg/L | µg/L | µg/L | µg/L | mg/L | mg/L | mg/L |
| | | | | **Method Detection Limit (MDL)** | 0.5 | 0.02 | 10 | 0.005 | 1 | 0.01 | 0.1 | 0.5 | 1 | 0.005 | 0.1 | 0.05 | 0.015 | 0.005 | 0.02 |
| | | | | **Limit of Quantification (LOQ)** | 2.5 | 0.1 | 50 | 0.025 | 5 | 0.05 | 0.5 | 2.5 | 5 | 0.025 | 0.5 | 0.25 | 0.075 | 0.025 | 0.1 |
| SW-N-05 | FRM | Y | 2023-02-05 | Mean of duplicates, very low flow, clear & colourless sample | 32.7 | 0.139 | 175. | 0.015 75 | 22. | 0.120 5 | 4.51 | 209. | 28.65 | 0.02 | 8.735 | 2.98 | 0.015 | 0.005 | 10.35 b |
| SW-N-05 | NS | Y | 2023-08-17 | Dry. Checked to coincide with Heals Range sample | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-05 | FRM | Y | 2023-11-02 | Mean of duplicates, moderate flow, clear and colourless. | 841 b | 0.203 | 83 | 0.0161 | 28 | 1.04 | 10.1 | 223 | 1490 a b | 0.146 | 24.7 | 1.90 | < 0.233 | < 0.005 | 9.10 b |
| SW-N-05 | FRM | Y | 2023-12-19 | Mean of duplicates, low flow, clear and colourless | 112 | 0.210 | 163 | 0.0307 | 10 | 0.18 | 6.01 | 338 | 92 | 0.012 | 4.4 | 3.33 | 0.755 | < 0.005 | 34.95 a b |
| SW-N-05 | FRM | Y | 2024-05-03 | Mean of duplicates, low-moderate flow. Clear and colourless sample. Used pump. | 116.50 | 0.19 | 133.00 | 0.02 | 11.00 | 0.19 | 4.11 | 289.00 | 129.00 | 0.03 | 4.35 | 3.01 | < 0.02 | < 0.01 | 14.30 b |
| SW-N-14 | NS | N | 2023-05-02 | On the Heals Range - no access this month. | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-14 | SS | N | 2023-06-26 | Extra sample date for Heals range access. Low flow, clear and colourless sample. | 443. b | 0.347 | 71. | 0.032 6 | 14. | 0.415 | 2.37 | 107. | 1 010. a b | 0.020 8 | 111. | 0.483 | 0.037 | < 0.005 | 0.143 |
| SW-N-14 | SS | N | 2023-08-17 | Extra sample date for Heals range access. Very low flow, clear and colourless sample. | 30.2 | 0.174 | 77. | 0.005 8 | 8.9 | 0.107 | 0.612 | 123. | 87.8 | 0.016 6 | 30.8 | 0.502 | < 0.015 | < 0.005 | 0.171 |
| SW-N-14 | SS | N | 2023-11-02 | Moderately high flow, clear and colourless. | 94.8 | 0.157 | 79. | 0.016 | 19. | 0.202 | 3.49 | 168 | 168. | 0.055 | 8.65 | 0.463 | 0.79 | 0.052 2 | 7.23 b |
| SW-N-14 | SS | N | 2023-12-19 | Moderate High flow, clear and colourless | 38.1 | 0.094 | 85. | 0.005 7 | 17. | 0.092 8 | 1.25 | 194 | 74.8 | 0.028 4 | 5.42 | 0.439 | < 0.015 | < 0.005 | 7.61 b |
| SW-N-14 | SS | N | 2024-02-27 | High flow. Clear and colourless sample. | 18.5 | 0.069 | 62. | < 0.005 | 19. | 0.075 | 1.06 | 144.00 | 24.6 | < 0.02 | 2.15 | 0.361 | < 0.015 | < 0.005 | 5.25 b |
| SW-N-15 | NS | N | 2023-05-02 | Reinstated for regular sampling in June | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-15 | SS | N | 2023-06-26 | Extra sample for Heals range access. Moderate flow, clear and colourless sample. | 5. | 0.085 | 33. | < 0.005 | 8. | 0.013 | 0.16 | 90.2 | < 5. | 0.015 3 | 0.37 | 0.277 | < 0.015 | < 0.005 | 0.173 |
| SW-N-15 | SS | N | 2023-08-17 | Extra sample for Heals range access. Very low flow, clear and colourless sample. | 46.1 | 0.127 | 35. | < 0.005 | 6.7 | 0.032 9 | 0.34 | 84.20 | 39.8 | 0.005 6 | 4. | 0.339 | < 0.015 | < 0.005 | 0.197 |
| SW-N-15 | SS | N | 2023-11-02 | Moderate flow, clear and colourless. | 45.1 | 0.112 | 36. | < 0.005 | 10. | 0.029 | 0.78 | 81.5 | 35.1 | 0.031 | 1.54 | 0.213 | 0.96 | < 0.005 | 0.509 |
| SW-N-15 | SS | N | 2023-12-19 | High flow, clear and colourless | 9.71 | 0.091 | 32. | < 0.005 | 7.6 | 0.017 6 | 0.374 | 78.7 | 10.6 | 0.009 | 1.7 | 0.238 | 1.2 | < 0.005 | 0.191 |
| SW-N-15 | SS | N | 2024-02-27 | High flow. Clear and colourless sample. | 4.5 | 0.052 | 24. | 0.005 | 7.9 | < 0.01 | 0.23 | 67.10 | < 5. | < 0.02 | 0.49 | 0.216 | < 0.015 | < 0.005 | 0.153 |
| SW-N-16 | FRM | Y | 2023-02-05 | Mean of duplicates, moderate flow, clear & colourless sample | 397.5 b | 0.211 | 71. | 0.019 95 | 29. | 0.690 5 | 6.175 | 179.5 | 902. | 0.044 5 | 117.5 | 0.877 5 | 0.038 5 | 0.013 4 | 1.165 |
| SW-N-16 | NS | Y | 2023-08-17 | Dry. Checked to coincide with Heals Range sample | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-16 | FRM | Y | 2023-11-02 | Mean of duplicates, high flow, clear and colourless. | 265.5 | 0.194 5 | 54. | 0.017 9 | 12.5 | 0.558 5 | 9.385 | 150 | 505.5 | 0.082 | 36.45 | 0.797 | 0.865 | 0.035 35 | 8.01 b |
| SW-N-16 | FRM | Y | 2023-12-19 | Mean of duplicates, high flow, clear and colourless | 66.7 | 0.197 5 | 65. | 0.083 | 10. | 0.304 5 | 7.71 | 195 | 165.5 | 0.022 05 | 80.35 | 0.701 | 0.081 | 0.189 5 | 13.75 b |
| SW-N-16 | FRM | Y | 2024-05-03 | Mean of duplicates, high flow, clear and colourless sample. | 53.2 | 0.2 | 59. | 0.017 | 10.45 | 0.328 5 | 12.25 | 134.00 | 117.5 | 0.04 | 30.6 | 0.705 5 | 0.027 | 0.009 4 | 8.16 b |
| SW-N-17 | NS | N | 2023-02-05 | On the Heals Range - no access this month. | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-17 | SS | N | 2023-06-26 | Extra sample for Heals range access. Very low flow, slightly turbid sample | 876. b | 0.41 | 118. | 0.018 | 41. | 1.39 | 2.39 | 216. | 1 340. a b | 0.009 9 | 310. | 0.64 | 0.095 | 0.010 9 | 0.191 |
| SW-N-17 | NS | N | 2023-08-17 | Extra sample date for Heals range access. Station dry | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-17 | SS | N | 2023-11-02 | Moderate flow, clear and colourless. | 28.7 | 0.102 | 107. | 0.006 8 | 34. | 0.079 | 0.93 | 161 | 23.4 | < 0.02 | 3.59 | 0.427 | 0.88 | < 0.005 | 3.85 b |
| SW-N-17 | SS | N | 2023-12-19 | Moderate flow, clear and colourless | 20.7 | 0.09 | 145. | < 0.005 | 21. | 0.098 3 | 0.879 | 241 | 24.5 | 0.015 6 | 4.04 | 0.551 | 0.85 | < 0.005 | 3.73 b |
| SW-N-17 | SS | N | 2024-02-27 | High flow. Very turbid, very slightly brown. | 414. b | 0.12 | 112. | 0.011 | 26. | 0.414 | 2.15 | 170.00 | 464. | 0.326 | 24.9 | 0.419 | 0.017 | < 0.005 | 3.18 b |
| SW-N-18 | NS | N | 2023-02-05 | Dry - No Flow from pipe. | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-18 | NS | N | 2023-11-02 | Eliminated - now 57. | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-18 | NS | N | 2023-12-20 | Eliminated - now 57. | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-18 | NS | N | 2024-03-05 | Eliminated - now 57. | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-19 | SS | N | 2023-05-02 | Low flow, clear and colourless. | 24.1 | 0.193 | 47. | 0.023 | 29. | 0.401 | 13.3 | 183. | 48.4 | < 0.02 | 34.9 | 1.08 | 0.016 | 0.014 4 | 3.79 b |
| SW-N-19 | SS | N | 2023-11-07 | Moderate flow, Clear and very slightly yellow. Sample collection delayed due to logging in the area | 38.6 | 0.248 | 42. | 0.012 3 | 7.6 | 0.331 | 10.2 | 153 | 53.9 | 0.028 | 13.6 | 1.12 | 0.75 | 0.052 4 | 6.62 b |
| SW-N-19 | SS | N | 2023-12-19 | High flow, clear and colourless. | 23.2 | 0.203 | 37. | 0.012 9 | 8.2 | 0.377 | 12.1 | 183 | 38.1 | 0.008 7 | 16. | 0.678 | 0.032 | 0.037 5 | 6.44 b |
| SW-N-19 | SS | N | 2024-03-05 | High flow, clear and colourless, slightly sudsy sample. | 90. | 0.202 | 53. | 0.024 | 9.3 | 0.407 | 17.5 | 138.00 | 117. | 0.046 | 5.34 | 0.764 | < 0.015 | < 0.005 | 8.23 b |
| SW-N-41S1 | FRM | Y | 2023-05-02 | Mean of duplicates, low flow, clear & colourless sample | 45.95 | 0.207 | 22. | 0.005 | 5. | 0.078 | 0.255 | 169. | 115. | 0.033 | 52.8 | 0.471 | 0.015 | 0.005 | 0.528 5 |
| SW-N-41S1 | FRM | Y | 2023-11-01 | Mean of duplicates, low flow, clear and colourless. | 36.7 | 0.200 5 | 21. | < 0.005 | 5.85 | 0.101 5 | 0.535 | 212 | 106.5 | 0.032 5 | 69.55 | 0.339 | 0.915 | < 0.005 | 0.784 |
| SW-N-41S1 | FRM | Y | 2023-12-18 | Mean of duplicates, low flow, clear colourless | 264.5 b | 0.415 | 24. | 0.009 4 | 4.25 | 0.286 | 0.85 | 177 | 511.5 | 0.193 5 | 206. | 0.307 5 | < 0.015 | < 0.005 | 1.008 |
| SW-N-41S1 | FRM | Y | 2024-05-03 | Mean of duplicates, moderate-low flow. Clear and colourless | 496. b | 0.632 | 17. | 0.019 5 | 9.1 | 0.658 | 1.62 | 156.00 | 1 021.5 a b | 0.392 | 381.5 | 0.240 5 | < 0.015 | < 0.005 | 0.835 5 |
| SW-N-42S1 | FRM | Y | 2023-05-02 | Mean of duplicates, low flow, clear and colourless. | 64.85 | 0.097 | 50. | < 0.005 15 | 34. | 0.138 5 | 0.52 | 205. | 117.5 | 0.085 | 63.45 | 0.685 5 | < 0.016 5 | < 0.005 | 0.055 5 |
| SW-N-42S1 | FRM | Y | 2023-11-02 | Mean of duplicates, moderate flow, clear and colourless. | 34.1 | 0.09 | 42.5 | < 0.005 | 21. | 0.114 | 0.62 | 177 | 178.5 | 0.252 | 40. | 0.606 5 | 0.8 | < 0.005 | 0.113 5 |
| SW-N-42S1 | FRM | Y | 2023-12-19 | Mean of duplicates, low moderate flow, clear and colourless | 18. | 0.08 | 69. | < 0.007 8 | 17. | 0.071 5 | 0.57 | 181 | 40.3 | 0.031 | 20.2 | 0.492 | 0.468 | < 0.005 | 0.237 |
| SW-N-42S1 | FRM | Y | 2024-05-03 | Mean of duplicates, high flow, clear and colourless | 23.95 | 0.07 | 55. | < 0.005 | 33.5 | 0.053 | 0.705 | 155.00 | 35.75 | 0.027 | 11.3 | 0.431 | < 0.015 | < 0.005 | 0.346 5 |
| SW-N-41S3 | SS | N | 2023-05-02 | Moderate flow, clear & colourless sample | 15.8 | 0.112 | 35. | 0.005 | 13. | 0.015 | 0.28 | 116. | 13.7 | 0.02 | 2.39 | 0.327 | 0.015 | 0.005 | 0.898 |
| SW-N-41S3 | SS | N | 2023-11-01 | Low flow, clear and colourless. | 1 350. b | 0.342 | 47. | 0.033 | 15. | 1.05 | 3. | 145 | 1 320. a b | 0.705 | 54.2 | 0.319 | 0.92 | < 0.005 | 0.288 |
| SW-N-41S3 | SS | N | 2023-12-18 | Moderately high flow, clear colourless | 21.3 | 0.066 | 22. | 0.005 | 7.6 | 0.03 | 0.488 | 90 | 50.2 | 0.016 3 | 2.78 | 0.323 | < 0.015 | < 0.005 | 0.604 |
| SW-N-41S3 | SS | N | 2024-03-05 | High flow. Clear and colourless sample. | 16.3 | 0.06 | 19. | < 0.005 | 6.9 | 0.022 | 0.35 | 75.20 | 12.7 | 0.044 | 1.87 | 0.272 | < 0.015 | < 0.005 | 0.549 |
| SW-N-41S4 | SS | N | 2023-05-02 | Moderate low flow, clear & colourless sample | 7.1 | 0.106 | 40. | 0.009 1 | 8.4 | 0.021 | 0.26 | 73.1 | 49.3 | 0.022 | 11.8 | 0.391 | 1.6 | 0.005 | 0.02 |
| SW-N-41S4 | NS | N | 2023-11-01 | Dry | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-41S4 | SS | N | 2023-12-18 | Moderately high flow, clear colourless | 8.33 | 0.112 | 37. | < 0.005 | 8.2 | 0.029 1 | 0.274 | 80.3 | 38.1 | 0.012 | 36.4 | 0.189 | 0.064 | < 0.005 | 0.122 |
| SW-N-41S4 | SS | N | 2024-03-05 | Moderate-high flow. Clear and colourless sample. | 7.9 | 0.079 | 32. | < 0.005 | 7.5 | 0.024 | 0.27 | 66.90 | 28.2 | < 0.02 | 15.5 | 0.173 | < 0.015 | < 0.005 | 0.213 |
| SW-N-42S1 | FRM | Y | 2023-05-02 | Mean of duplicates, low flow, clear and colourless. | 64.85 | 0.097 | 50. | < 0.005 15 | 34. | 0.138 5 | 0.52 | 205. | 117.5 | 0.085 | 63.45 | 0.685 5 | < 0.016 5 | < 0.005 | 0.055 5 |
| SW-N-42S1 | FRM | Y | 2023-11-02 | Mean of duplicates, moderate flow, clear and colourless. | 34.1 | 0.09 | 42.5 | < 0.005 | 21. | 0.114 | 0.62 | 177 | 178.5 | 0.252 | 40. | 0.606 5 | 0.8 | < 0.005 | 0.113 5 |
| SW-N-42S1 | FRM | Y | 2023-12-19 | Mean of duplicates, low moderate flow, clear and colourless | 18. | 0.08 | 69. | < 0.007 8 | 17. | 0.071 5 | 0.57 | 181 | 40.3 | 0.031 | 20.2 | 0.492 | 0.468 | < 0.005 | 0.237 |
| SW-N-42S1 | FRM | Y | 2024-05-03 | Mean of duplicates, high flow, clear and colourless | 23.95 | 0.07 | 55. | < 0.005 | 33.5 | 0.053 | 0.705 | 155.00 | 35.75 | 0.027 | 11.3 | 0.431 | < 0.015 | < 0.005 | 0.346 5 |
| SW-N-45 | NS | N | 2023-05-02 | On the Heals Range - no access this month. | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-45 | NS | N | 2023-06-26 | Extra sample date for Heals range access. Station dry | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-45 | NS | N | 2023-08-17 | Extra sample date for Heals range access. Station dry | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-45 | SS | N | 2023-11-02 | Moderately low flow, clear and colourless. | 33.1 | 0.089 | 196. | 0.008 7 | 38. | 0.125 | 1.54 | 191 | 22.6 | < 0.02 | 6.78 | 0.778 | 0.8 | 0.007 | 6.64 b |
| SW-N-45 | SS | N | 2023-12-19 | Low moderate flow, clear colourless | 14.4 | 0.098 | 192. | 0.008 4 | 19. | 0.137 | 1.61 | 252 | 18.6 | 0.006 4 | 6.62 | 1.02 | < 0.015 | 0.006 1 | 18.5 b |
| SW-N-45 | SS | N | 2024-02-27 | Low flow. Clear and colourless sample. | 21.7 | 0.06 | 180. | 0.005 | 22. | 0.109 | 1.16 | 200.00 | 24.4 | < 0.02 | 7.75 | 0.798 | < 0.015 | < 0.005 | 7.21 b |
| SW-N-53 | NS | N | 2023-05-02 | Dry | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-53 | NS | N | 2023-11-03 | Dry | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-53 | NS | N | 2023-12-20 | Dry | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-53 | NS | N | 2024-03-06 | No longer in the sampling program - geology in the area has changed. | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-54 | SS | N | 2023-05-02 | Very low flow, clear, very slightly yellow | 20.1 | 0.415 | 61. | 0.010 3 | 40. | 0.676 | 12.6 | 245. | 99.3 | 0.022 | 304. | 0.685 | 0.061 | 0.021 | 3.94 b |
| SW-N-54 | SS | N | 2023-11-03 | Moderate flow, clear and slightly yellow sample. | 923. b | 0.391 | 48. | 0.009 3 | 25. | 1.33 a | 16. | 263 | 1 700. a b | 0.249 | 109. | 0.783 | 0.62 | 0.126 | 12.4 b |
| SW-N-54 | SS | N | 2023-12-20 | Low flow, clear colourless | 124. | 0.408 | 82. | 0.012 9 | 11. | 0.475 | 27.7 | 238 | 180. | 0.045 9 | 58.5 | 0.768 | 1.3 | 0.114 | 17.2 b |
| SW-N-54 | SS | N | 2024-03-06 | Moderate flow. Clear, very slightly yellow. | 207. | 0.332 | 55. | 0.007 | 6.3 | 0.399 | 28. | 177.00 | 303. | 0.068 | 10.7 | 0.488 | 0.018 | 0.009 7 | 13. b |
| SW-N-55 | SS | N | 2023-12-12 | Moderate flow, clear colourless. New station added | 36.2 | 0.087 | 11. | 0.067 8 | 13. | 0.126 | 0.63 | 273. | 16.5 | 0.022 | 5.74 | 0.101 | 0.89 | 0.035 3 | 44.5 a b |
| SW-N-55 | SS | N | 2024-03-06 | Moderate flow, clear and colourless sample. | 18.8 | 0.065 | < 10. | 0.107 | 15. | 0.141 | 0.64 | 323.00 | < 5. | < 0.02 | 5.39 | 0.121 | < 0.015 | 0.011 3 | 39.6 a b |
| SW-N-56 | SS | N | 2023-12-12 | Moderate flow, clear colourless. New station added | 20.4 | 0.079 | 20. | < 0.005 | 12. | 0.045 6 | 0.657 | 78.1 | 8.1 | 0.005 | 0.452 | 0.124 | 0.94 | 0.005 | 3.16 b |
| SW-N-56 | SS | N | 2024-03-06 | Moderate-high flow. Clear and colourless sample. | 22.7 | 0.075 | 17. | < 0.005 | 12. | 0.04 | 0.46 | 93.60 | 11.2 | < 0.02 | 0.3 | 0.098 | < 0.015 | < 0.005 | 3.4 b |
| SW-N-57 | NS | N | 2023-05-02 | Dry - No Flow | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-57 | SS | N | 2023-11-03 | Moderate flow, clear and colourless. | 230. b | 0.177 | 47. | 0.007 9 | 3.2 | 0.622 | 1.29 | 297 | 458. | 0.046 | 17.2 a b | 4.96 | 0.8 | 0.15 | 11.8 b |
| SW-N-57 | NS | N | 2023-12-20 | Dry | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-57 | SS | N | 2024-03-06 | High flow. Clear and colourless sample. | 57.8 | 0.159 | 27. | < 0.005 | 5.6 | 0.275 | 0.76 | 262.00 | 103. | < 0.02 | 5.75 | 1.9 | 0.068 | 0.011 2 | 4.73 b |

# Hartland Landfill Groundwater, Surface Water and Leachate Monitoring Program Annual Report (Mar 2023 to Apr 2024)
## Appendix B-3. Surface Water Quality - 2023-2024

AECOM

| B.C. Water Quality Guidelines | | | | BC WQG-STA (1) | --- | 5 | 1200 | --- | 600 | 110 | --- | --- | 1000 | 3.28 - 416.7 (5) | 815 - 3394 (5) | 46000 | 1.9 - 24.9 (3) | 0.06 - 0.6 (4) | 32.8 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | BC WQG-LTC (1) | Variable (9) | 150 | 4 | --- | --- | --- | --- | --- | --- | 3.43 - 19.57 (5) | 767 - 2585 (5) | 7600 | 0.135 - 1.77 (3) | 0.02 - 0.2 (4) | 3 |
| | | | | PARAMETER | Aluminum | Arsenic | Boron | Cadmium | Chloride | Cobalt | Copper | Hardness (As Caco3) | Iron | Lead | Manganese | Molybdenum | N - Nh3 (As N) | N - No2 (As N) | N - No3 (As N) |
| | Sample | Compliance Well | | STATE | TOT | TOT | TOT | TOT | DIS | TOT | TOT | TOT | TOT | TOT | TOT | TOT | TOT | DIS | DIS |
| SW-N-58 | NS | N | 2023-05-02 | Could not locate | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-58 | NS | N | 2023-11-02 | Dry | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-58 | NS | N | 2023-12-18 | Dry | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-58 | NS | N | 2024-03-05 | Dry | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-59 | NS | N | 2023-05-02 | Not set up | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-59 | NS | N | 2023-11-02 | Dry | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-59 | NS | N | 2023-12-18 | Dry | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-59 | NS | N | 2024-03-05 | Dry | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-60 | NS | N | 2023-05-02 | Dry | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-60 | NS | N | 2023-11-02 | Dry | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-60 | NS | N | 2023-12-18 | Dry | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-60 | NS | N | 2024-03-05 | Dry | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-61 | NS | N | 2023-05-02 | Dry | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-61 | NS | N | 2023-11-02 | Dry | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-61 | NS | N | 2023-12-18 | Dry | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-61 | NS | N | 2024-03-05 | Dry | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-62 | NS | N | 2023-05-02 | Dry - No Flow | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-62 | NS | N | 2023-11-02 | Dry | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-62 | NS | N | 2023-12-18 | Dry | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-62 | NS | N | 2024-03-05 | Removed from sampling program. | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-63 | SS | N | 2023-05-02 | Moderate high flow, clear and colourless | 35.2 | 0.206 | 42. | < 0.005 | 10. | 0.211 | 1.61 | 90.7 | 350. | 0.074 | 37.3 | 0.369 | < 0.015 | < 0.005 | 0.474 |
| SW-N-63 | NS | N | 2023-06-26 | Extra sample date to coincide with Heals range access. Station dry | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-63 | SS | N | 2023-11-02 | Moderately low flow, clear and colourless. | 326. | 0.286 | 52. | 0.012 1 | 14. | 0.32 | 5.18 | 97.3 | 437. | 0.649 | 35.4 | 0.447 | < 0.015 | 0.009 8 | 3.55 b |
| SW-N-63 | SS | N | 2023-12-18 | Moderate flow, clear and colourless | 59.1 | 0.145 | 36. | < 0.005 | 8.6 | 0.096 | 1.69 | 91.9 | 121. | 0.083 4 | 8.14 | 0.326 | 0.9 | < 0.005 | 1.3 |
| SW-N-63 | SS | N | 2024-03-05 | High flow. Clear and colourless sample. | 129. | 0.153 | 30. | < 0.005 | 8.8 | 0.16 | 1.74 | 77.00 | 258. | 0.326 | 18.8 | 0.273 | 0.016 | < 0.005 | 1.08 |
| SW-N-64 | SS | N | 2023-05-02 | Moderate flow, clear slightly yellow | 85. | 0.742 | 43. | 0.012 7 | 17. | 0.809 | 3.34 | 77.1 | 1 090. a b | 0.14 | 304. | 0.369 | 0.046 | 0.005 3 | 0.113 |
| SW-N-64 | SS | N | 2023-11-02 | Extra low flow, clear and very slightly yellow sample. | 338. b | 0.63 | 51. | 0.021 7 | 27. | 2.87 a b | 4.28 | 107 | 1 620. a b | 0.31 | 321. | 0.4 | 0.6 | 0.012 3 | 1.25 |
| SW-N-64 | SS | N | 2023-12-18 | Moderate flow, clear and colourless | 90.3 | 0.4 | 28. | 0.011 2 | 12. | 0.193 | 2.2 | 55 | 257. | 0.222 | 17.1 | 0.31 | 1. | < 0.005 | 0.283 |
| SW-N-64 | SS | N | 2024-03-05 | High flow. Clear and colourless sample. | 96.2 | 0.271 | 21. | 0.006 | 12. | 0.185 | 1.57 | 44.90 | 271. | 0.31 | 19.6 | 0.249 | < 0.015 | < 0.005 | 0.221 |
| SW-N-65 | SS | N | 2023-05-02 | Moderate flow, clear slightly yellow | 80.6 | 0.543 | 38. | 0.009 2 | 16. | 0.606 | 2.76 | 74.1 | 836. | 0.113 | 212. | 0.385 | 0.037 | < 0.005 | 0.207 |
| SW-N-65 | SS | N | 2023-11-02 | Moderately low flow, clear and slightly yellow sample. | 347. b | 0.508 | 51. | 0.018 4 | 21. | 1.87 | 5.08 | 105 | 1 220. a b | 0.469 | 207. | 0.435 | 0.64 | 0.011 | 2.48 |
| SW-N-65 | SS | N | 2023-12-18 | Moderate flow, clear and colourless | 78.4 | 0.324 | 31. | 0.009 1 | 11. | 0.164 | 2.06 | 67 | 209. | 0.191 | 15. | 0.34 | 0.053 | < 0.005 | 0.642 |
| SW-N-65 | SS | N | 2024-03-05 | High flow. Clear and colourless sample. | 93.9 | 0.22 | 25. | 0.007 | 11. | 0.158 | 1.65 | 58.80 | 238. | 0.218 | 18.6 | 0.263 | < 0.015 | < 0.005 | 0.631 |
| SW-N-66 | SS | N | 2024-03-05 | Moderate-low flow. Clear and colourless sample. | 17.9 | 0.034 | < 10. | < 0.005 | 3.6 | 0.02 | 0.41 | 42.70 | 7.2 | < 0.02 | 0.39 | 0.064 | < 0.015 | < 0.005 | 0.043 |
| SW-N-CS2 | NS | N | 2023-11-02 | Dry | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-CS2 | SS | N | 2023-12-18 | Moderate flow, clear colourless | 10.3 | 0.032 | < 10. | < 0.005 | 4.2 | 0.022 7 | 0.301 | 72 | 7.1 | 0.006 9 | 0.412 | 0.078 | < 0.015 | < 0.005 | 1.19 |
| SW-N-CS2 | SS | N | 2024-03-05 | High flow. Clear and colourless. Additional sample collected to coincide with new SW-N-66 station | 6.5 | 0.028 | < 10. | < 0.005 | 3.6 | 0.019 | 0.23 | 66.30 | < 5. | < 0.02 | 0.13 | 0.093 | < 0.015 | < 0.005 | 0.846 |
| SW-S-03 | FRM | N | 2023-05-03 | Mean of duplicates, moderate low flow, clear & colourless | 257. b | 0.324 5 | 66.5 | 0.015 5 | 24. | 0.641 5 | 7.285 | 93.2 | 1 135. | 0.781 | 112.5 | 0.366 | 1. | 0.064 2 | 2.29 |
| SW-S-03 | SS | N | 2023-11-01 | Moderate flow, clear and colourless. | 94.3 | 0.618 | 60. | 0.008 | 34. | 0.21 | 3.64 | 141 | 278. | 0.128 | 21.7 | 0.265 | < 0.015 | < 0.005 | 3.54 b |
| SW-S-03 | SS | N | 2023-12-15 | Moderate high flow, clear colourless | 48.4 | 0.162 | 56. | 0.012 9 | 13. | 0.484 | 4.95 | 95 | 377. | 0.046 8 | 193. | 0.119 | 1. | 0.048 5 | 2.39 |
| SW-S-03 | SS | N | 2024-03-07 | Moderate flow. Clear and colourless sample. Sampled from mini waterfall. | 48.3 | 0.108 | 37. | < 0.005 | 20. | 0.274 | 3.83 | 63.60 | 349. | 0.036 | 103. | 0.101 | 0.96 | 0.019 | 1.77 |
| SW-S-04 | FRM | Y | 2023-05-02 | Mean of duplicates, moderately low flow, clear & colourless | 28.4 | 0.075 | 66.5 | 0.012 2 | 38.5 | 0.091 5 | 1.235 | 103. | 29.5 | 0.062 5 | 2.895 | 8.22 | 0.015 | 0.005 | 0.876 |
| SW-S-04 | FRM | Y | 2023-11-01 | Mean of duplicates, moderate flow, clear and colourless. | 74.15 | 0.089 | 67.5 | 0.018 | 49.5 | 0.125 5 | 1.465 | 135 | 84.25 | 0.135 5 | 6.89 | 0.107 | 1.17 | < 0.005 | 1.305 |
| SW-S-04 | FRM | Y | 2023-05-12 | Mean of duplicates, high flow, clear and colourless | 67.25 | 0.103 | 57.5 | 0.009 45 | 16. | 0.106 5 | 2.065 | 89 | 97.6 | 0.070 25 | 5.185 | 0.137 5 | 0.020 5 | 0.022 3 | 1.45 |
| SW-S-04 | FRM | Y | 2024-03-07 | Mean of duplicates, high flow, clear and colourless | 51.1 | 0.075 5 | 43.5 | < 0.005 | 24. | 0.083 5 | 1.55 | 70.75 | 89.8 | 0.046 | 4.615 | 0.095 5 | < 0.015 | < 0.005 | 1.29 |
| SW-S-12 | SS | N | 2023-05-02 | Moderate low flow, clear & colourless sample | 30.3 | 0.291 | 103. | 0.008 7 | 19. | 0.766 | 5.44 | 114. | 1 800. a b | 0.041 | 410. | 0.119 | 4.6 b | 0.058 1 | 2.48 |
| SW-S-12 | FRM | N | 2023-11-02 | Mean of duplicates, high flow, clear and colourless. | 111. | 0.239 | 20. | 0.022 | 4.8 | 0.234 5 | 13.45 | 83.6 | 211. | 0.059 5 | 9.605 | 0.091 5 | 0.725 | 0.005 | 3.685 b |
| SW-S-12 | FRM | N | 2023-12-15 | Mean of duplicates, high flow, clear colourless | 59.55 | 0.229 | 70. | 0.018 | 11. | 0.807 | 5.89 | 106.5 | 757.5 | 0.049 7 | 336. | 0.066 5 | 1.8 | 0.022 65 | 2.88 |
| SW-S-12 | FRM | N | 2024-03-07 | Mean of duplicates, moderate-high flow. Clear and colourless sample. Dunked bottles in wier | 66.85 | 0.159 | 55.5 | < 0.005 | 13. | 0.51 | 4.96 | 69.80 | 764.5 | 0.043 | 224.5 | 0.056 | 2. b | 0.011 1 | 2.455 |
| SW-S-20 | SS | N | 2023-11-02 | Moderately low flow, clear and colourless. | 256. | 0.174 | 20. | 0.006 9 | 6.9 | 0.29 | 3.64 | 41.5 | 357. | 0.207 | 23.4 | 0.063 | 0.68 | 0.005 6 | 1.32 |
| SW-S-20 | SS | N | 2023-12-15 | High flow, clear colourless | 50.7 | 0.099 | 14. | < 0.005 | 5.9 | 0.084 1 | 1.33 | 49.7 | 65. | 0.023 3 | 16.9 | 0.058 | 0.12 | < 0.005 | 0.05 |
| SW-S-21 | NS | N | 2023-05-02 | Dry | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-S-21 | NS | N | 2023-11-01 | Dry | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-S-21 | SS | N | 2023-12-15 | High flow, clear colourless | 39.4 | 0.084 | 12. | < 0.005 | 5.9 | 0.036 6 | 1.17 | 42.8 | 14. | 0.005 | 0.182 | 0.068 | < 0.015 | < 0.005 | 0.142 |
| SW-S-21 | SS | N | 2024-03-07 | Moderate-high flow. Clear and colourless sample. | 26.9 | 0.054 | < 10. | < 0.005 | 6.4 | 0.026 | 0.62 | 32.30 | 11.1 | 3.32 a | 0.35 | 0.053 | < 0.015 | < 0.005 | 0.069 |
| SW-S-24 | SS | N | 2023-05-02 | Moderate low flow, clear & colourless sample | 36.5 | 0.128 | 99. | 0.011 8 | 38. | 0.132 | 2.03 | 125. | 69.2 | 0.057 | 17.9 | 0.79 | 0.015 | 0.005 | 0.716 |
| SW-S-24 | SS | N | 2023-11-01 | Moderate flow, clear and colourless. | 10. | 0.105 | 80. | 0.011 6 | 56. | 0.076 | 1.85 | 147 | 8.6 | < 0.02 | 7.56 | 0.089 | 0.92 | < 0.005 | < 0.02 |
| SW-S-24 | SS | N | 2023-12-15 | High flow, clear colourless | 100. | 0.157 | 83. | 0.013 4 | 19. | 0.198 | 3.11 | 110 | 240. | 0.163 | 26. | 0.145 | 1.5 | 0.063 3 | 1.82 |
| SW-S-24 | SS | N | 2024-03-07 | Moderate-high flow. Clear and colourless sample. Dipped in weir | 74.5 | 0.089 | 56. | < 0.005 | 29. | 0.142 | 2.38 | 82.10 | 176. | 0.099 | 17. | 0.106 | < 0.015 | < 0.005 | 1.66 |
| SW-S-27 | NS | N | 2023-05-02 | Needs to be cleared to have access | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-S-27 | SS | N | 2023-11-01 | Low flow, clear and colourless. | 70.5 | 0.142 | 45. | 0.009 1 | 43. | 0.173 | 2.53 | 118 | 111. | 0.133 | 14.8 | 0.127 | 0.9 | < 0.005 | 0.039 |
| SW-S-27 | SS | N | 2023-12-15 | High flow, clear colourless | 140. | 0.181 | 55. | 0.014 3 | 15. | 0.286 | 4.64 | 95 | 358. | 0.208 | 51.5 | 0.141 | 0.31 | 0.125 | 2.49 |
| SW-S-27 | SS | N | 2024-03-07 | Moderate flow. Clear and colourless sample. Used pump to collect pumped sample. | 106. | 0.115 | 42. | < 0.005 | 27. | 0.198 | 3.84 | 72.40 | 295. | 0.106 | 23.5 | 0.096 | 0.034 | 0.020 8 | 2.46 |
| SW-S-52 | SS | N | 2023-11-02 | Moderately high flow, clear and colourless. | 13.9 | 0.089 | 12. | < 0.005 | 11. | 0.045 | 0.73 | 72.8 | 19.3 | < 0.02 | 1.69 | < 0.05 | 0.6 | < 0.005 | 0.4 |
| SW-S-52 | SS | N | 2023-12-18 | High flow, clear colourless | 9.52 | 0.046 | 17. | < 0.005 | 4.9 | 0.021 8 | 0.355 | 56.6 | 6.3 | 0.005 6 | 0.2 | < 0.05 | < 0.015 | < 0.005 | < 0.02 |
| SW-S-52 | NS | N | 2024-03-07 | Removed from the sample program | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-FB | FB | N | 2024-03-06 | Batch # 01122024-0112. Decanted on the tailgate of the lightning on Willis Point Road | 1.52 | < 0.02 | < 10. | < 0.005 | < 1. | < 0.005 | < 0.05 | < 0.50 | 2.9 | < 0.005 | < 0.05 | < 0.05 | < 0.015 | < 0.005 | < 0.02 |
| SW-TB | TB | N | 2024-03-06 | Sealed bottles. Blank Water Batch # C3a4454_23 12.27.120P | 1.67 | < 0.02 | < 10. | < 0.005 | < 1. | < 0.005 | < 0.05 | < 0.50 | < 1. | < 0.005 | < 0.05 | < 0.05 | < 0.015 | < 0.005 | < 0.02 |

**Notes:**

**a** *Above short-term acute (STA) British Columbia*

**b** *Above long-term chronic (LTC) British Columbia Water Quality Guideline.*

*Unreliable Ammonia Concentrations*

*BC CSR* *CSR-Sch3.2: BC Contaminated Site Regulation - Schedule 3.2 - Generic Numerical Water Standards, effective on November 1, 2017.*

*(1)* *British Columbia Approved Water Quality Guidelines (Criteria), 1998 Edition, Updated in August 2023. British Columbia Ministry of Environment and*

*(2)* *above STA 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*

*(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 landfill are derived from stations Sw-*

*(8)* *Dissolved copper guideline varies with water hardness, temperature and DOC, and calcuated using BLM;*

*(9)* *Total Aluminum guidance is pH, hardness, and DOC dependent and calculated based on BC Water Quality Guideline calculator for Aluminum in*

*(10)* *Dissolved Zinc guidance is pH, hardness, and DOC dependent. Due to anomalously high DOC concentrations resulting from the use of*

*(11)* *Aquatic Life (AW) Freshwater, Column 3.*

*(12)* *Drinking Water (DW), Column 6.*

# Hartland Landfill Groundwater, Surface Water and Leachate Monitoring Program Annual Report (Mar 2023 to Apr 2024)
## Appendix B-3. Surface Water Quality - 2023-2024

| B.C. Water Quality Guidelines | | | | BC WQG-STA (1) | --- | --- | 0.05 - 1.5 (5) | --- | 25 | --- | 6.5 to 9.0 | --- | --- |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | BC WQG-LTC (1) | --- | 2 | 0.1 - 3 (5) | 128 - 429 (5) | 5 | --- | --- | --- | --- |
| Station | Sample Type | Compliance Well (Y/N?) | Date Sampled | PARAMETER | Nickel | Selenium | Silver | Sulphate | TSS | Zinc | pH | Conductivity | Temperature |
| | | | | STATE | TOT | TOT | TOT | DIS | TOT | TOT | NoRS | TOT | TOT |
| | | | | UNIT | µg/L | µg/L | µg/L | mg/L | mg/L | µg/L | pH | µS/cm | °C |
| | | | | Method Detection Limit (MDL) | 0.02 | 0.04 | 0.005 | 1 | 1 | 1 | 0.1 | 1 | 0.1 |
| | | | | Limit of Quantification (LOQ) | 0.1 | 0.2 | 0.025 | 5 | 5 | 5 | 0.5 | 5 | 0.5 |
| SW-N-05 | FRM | Y | 2023-02-05 | Mean of duplicates, very low flow, clear & colourless sample | 1.32 | 0.234 5 --- | 0.01 | 110. --- | 1.2 | 3.5 | 6.51 --- | 408. --- --- | 11.7 |
| SW-N-05 | NS | Y | 2023-08-17 | Dry. Checked to coincide with Heals Range sample | --- | --- --- | --- | --- --- | --- | --- | --- --- | --- --- --- | --- |
| SW-N-05 | FRM | Y | 2023-11-02 | Mean of duplicates, moderate flow, clear and colourless. | 2.24 | 0.515 --- | < 0.01 | 145 --- | 5.8 b | 6.4 | 7.24 --- | 443 --- --- | 12.1 |
| SW-N-05 | FRM | Y | 2023-12-19 | Mean of duplicates, low flow, clear and colourless | 1.74 | 0.409 | < 0.01 | 170 | < 1.0 | 5.2 | 6.65 | 522 | 9.4 |
| SW-N-05 | FRM | Y | 2024-05-03 | Mean of duplicates, low-moderate flow. Clear and colourless sample. Used pump. | 1.25 | 0.41 --- | < 0.01 | 210.00 --- | < 1.10 | 3.85 | 7.28 --- | 577.00 --- --- | 7.80 |
| SW-N-14 | NS | N | 2023-05-02 | On the Heals Range - no access this month. | --- | --- --- | --- | --- --- | --- | --- | --- --- | --- --- --- | --- |
| SW-N-14 | SS | N | 2023-06-26 | Extra sample date for Heals range access. Low flow, clear and colourless sample. | 0.99 | 0.054 --- | < 0.01 | 27. --- | 2.4 | 1.29 | 7.45 --- | 253. --- --- | 12.8 |
| SW-N-14 | SS | N | 2023-08-17 | Extra sample date for Heals range access. Very low flow, clear and colourless sample. | 0.322 | 0.041 --- | < 0.005 | 20. --- | 2. | 1.79 | --- --- | 310. --- --- | --- |
| SW-N-14 | SS | N | 2023-11-02 | Moderately high flow, clear and colourless. | 0.86 | 0.147 --- | < 0.01 | 90. --- | < 1. | 3.6 | 7.66 --- | 289. --- --- | 8.4 |
| SW-N-14 | SS | N | 2023-12-19 | Moderate High flow, clear and colourless | 0.326 | 0.114 --- | < 0.005 | 83. --- | 1.2 | 1.9 | 7.48 --- | 302. --- --- | 7.6 |
| SW-N-14 | SS | N | 2024-02-27 | High flow. Clear and colourless sample. | 0.35 | 0.074 --- | < 0.01 | 70. --- | < 1. | 1.2 | 6.7 --- | 257. --- --- | 5.2 |
| SW-N-15 | NS | N | 2023-05-02 | Reinstated for regular sampling in June | --- | --- --- | --- | --- --- | --- | --- | --- --- | --- --- --- | --- |
| SW-N-15 | SS | N | 2023-06-26 | Extra sample for Heals range access. Moderate flow, clear and colourless sample. | 0.3 | 0.113 | < 0.01 | 10. | 3.2 | 0.77 | 7.76 | 180. | 7.2 |
| SW-N-15 | SS | N | 2023-08-17 | Extra sample for Heals range access. Very low flow, clear and colourless sample. | 0.077 | 0.05 | < 0.005 | 12. | 8. b | 0.39 | 7.76 | --- | 7.2 |
| SW-N-15 | SS | N | 2023-11-02 | Moderate flow, clear and colourless. | 0.24 | 0.119 | < 0.01 | 17. | < 1. | < 1. | 7.87 | 126. | 9.1 |
| SW-N-15 | SS | N | 2023-12-19 | High flow, clear and colourless | 0.085 | 0.049 | < 0.005 | 10. | < 1. | 0.42 | 7.76 | 190. | 7.2 |
| SW-N-15 | SS | N | 2024-02-27 | High flow. Clear and colourless sample. | < 0.1 | < 0.04 --- | < 0.01 | 9.7 --- | < 1. | < 1. | 7.76 --- | 119. --- --- | 7.2 |
| SW-N-16 | FRM | Y | 2023-02-05 | Mean of duplicates, moderate flow, clear & colourless sample | 2.17 | 0.073 --- | 0.01 | 49. --- | 6.8 b | 8.85 | 6.94 --- | 395. --- --- | 18.1 |
| SW-N-16 | NS | Y | 2023-08-17 | Dry. Checked to coincide with Heals Range sample | --- | --- --- | --- | --- --- | --- | --- | --- --- | --- --- --- | --- |
| SW-N-16 | FRM | Y | 2023-11-02 | Mean of duplicates, high flow, clear and colourless. | 1.96 | 0.136 --- | < 0.01 | 88. --- | 3.8 | 10.2 | 6.97 --- | 294. --- --- | 10.1 |
| SW-N-16 | FRM | Y | 2023-12-19 | Mean of duplicates, high flow, clear and colourless | 1.88 | 0.100 5 --- | < 0.005 | 59. --- | 1.8 | 12.7 | 7.16 --- | 301. --- --- | 7.7 |
| SW-N-16 | FRM | Y | 2024-05-03 | Mean of duplicates, high flow, clear and colourless sample. | 2.615 | 0.12 --- | < 0.01 | 45. --- | < 1.1 | 6.1 | 7.35 --- | 380. --- --- | 5.6 |
| SW-N-17 | NS | N | 2023-02-05 | On the Heals Range - no access this month. | --- | --- --- | --- | --- --- | --- | --- | --- --- | --- --- --- | --- |
| SW-N-17 | SS | N | 2023-06-26 | Extra sample for Heals range access. Very low flow, slightly turbid sample | 1.56 | 0.063 --- | < 0.01 | 78. --- | < 1. | 4.19 | 7.19 --- | 413. --- --- | 15. |
| SW-N-17 | NS | N | 2023-08-17 | Extra sample date for Heals range access. Station dry | --- | --- --- | --- | --- --- | --- | --- | --- --- | --- --- --- | --- |
| SW-N-17 | SS | N | 2023-11-02 | Moderate flow, clear and colourless. | 0.34 | 0.129 --- | < 0.01 | 97. --- | < 1. | 1.7 | 7.4 --- | 335. --- --- | 8.7 |
| SW-N-17 | SS | N | 2023-12-19 | Moderate flow, clear and colourless | 0.244 | 0.125 --- | < 0.005 | 120. --- | < 1. | 1.79 | 7.1 --- | 373. --- --- | 8. |
| SW-N-17 | SS | N | 2024-02-27 | High flow. Very turbid, very slightly brown. | 0.7 | 0.101 --- | < 0.01 | 110. --- | 20. b | 5.4 | 6.61 --- | 325. --- --- | 6.2 |
| SW-N-18 | NS | N | 2023-02-05 | Dry - No Flow from pipe. | --- | --- --- | --- | --- --- | --- | --- | --- --- | --- --- --- | --- |
| SW-N-18 | NS | N | 2023-11-02 | Eliminated - now 57. | --- | --- --- | --- | --- --- | --- | --- | --- --- | --- --- --- | --- |
| SW-N-18 | NS | N | 2023-12-20 | Eliminated - now 57. | --- | --- --- | --- | --- --- | --- | --- | --- --- | --- --- --- | --- |
| SW-N-18 | NS | N | 2024-03-05 | Eliminated - now 57. | --- | --- --- | --- | --- --- | --- | --- | --- --- | --- --- --- | --- |
| SW-N-19 | SS | N | 2023-05-02 | Low flow, clear and colourless. | 2.58 | 0.105 --- | < 0.01 | 59. --- | < 1. | 2.6 | 8.08 --- | 385. --- --- | 13.5 |
| SW-N-19 | SS | N | 2023-11-07 | Moderate flow, Clear and very slightly yellow. Sample collection delayed due to logging in the area | 2.38 | 0.166 --- | < 0.01 | 100. --- | < 1. | 2.85 | 7.62 --- | 339. --- --- | 10.7 |
| SW-N-19 | SS | N | 2023-12-19 | High flow, clear and colourless. | 2.47 | 0.118 | < 0.005 | 66. | < 1. | 2.77 | 7.57 | 273. | 7.9 |
| SW-N-19 | SS | N | 2024-03-05 | High flow, clear and colourless, slightly sudsy sample. | 3.54 | 0.147 --- | < 0.01 | 44. --- | < 1. | 4.1 | 7.43 --- | 233. --- --- | 5.6 |
| SW-N-41S1 | FRM | Y | 2023-05-02 | Mean of duplicates, low flow, clear & colourless sample | 0.955 | 0.07 --- | 0.01 | 59. --- | 2.2 | 2.65 | 7.97 --- | 281. --- --- | 11.4 |
| SW-N-41S1 | FRM | Y | 2023-11-01 | Mean of duplicates, low flow, clear and colourless. | 0.21 | 0.140 5 --- | < 0.01 | 97.5 --- | 4. | < 1. | 7.91 --- | 338. --- --- | 9.7 |
| SW-N-41S1 | FRM | Y | 2023-12-18 | Mean of duplicates, low flow, clear colourless | 0.39 | 0.100 5 --- | < 0.01 | 67. --- | 16. b | 1.8 | 7.59 --- | 380. --- --- | 9.1 |
| SW-N-41S1 | FRM | Y | 2024-05-03 | Mean of duplicates, moderate-low flow. Clear and colourless | 0.655 | 0.129 --- | < 0.01 | 70. --- | 61. a b | 1.8 | 7.59 --- | 318.5 --- --- | 9.1 |
| SW-N-42S1 | FRM | Y | 2023-05-02 | Mean of duplicates, low flow, clear and colourless. | 0.345 | < 0.043 --- | < 0.01 | 79. --- | 5.8 b | < 1.05 | 7.1 --- | 515. --- --- | 12.4 |
| SW-N-42S1 | FRM | Y | 2023-11-02 | Mean of duplicates, moderate flow, clear and colourless. | 0.265 | 0.07 --- | < 0.01 | 75.5 --- | 1.6 | < 1. | 7.04 --- | 318. --- --- | 9.4 |
| SW-N-42S1 | FRM | Y | 2023-12-19 | Mean of duplicates, low moderate flow, clear and colourless | 0.16 | 0.058 5 --- | < 0.01 | 72.5 --- | 1.6 | 2. | 7.02 --- | 286. --- --- | 8. |
| SW-N-42S1 | FRM | Y | 2024-05-03 | Mean of duplicates, high flow, clear and colourless | 0.13 | 0.056 5 --- | < 0.01 | 64.5 --- | 1.6 | < 1. | 7.28 --- | 349. --- --- | 5.7 |
| SW-N-41S3 | SS | N | 2023-05-02 | Moderate flow, clear & colourless sample | 0.19 | 0.088 --- | 0.01 | 18. --- | 1.2 | 1. | 7.55 --- | 193.9 --- --- | 8.7 |
| SW-N-41S3 | SS | N | 2023-11-01 | Low flow, clear and colourless. | 1.39 | 0.136 --- | < 0.01 | 25. --- | 5.2 b | 5.3 | 7.58 --- | 237. --- --- | 8.8 |
| SW-N-41S3 | SS | N | 2023-12-18 | Moderately high flow, clear colourless | 0.113 | 0.078 --- | < 0.005 | 14. --- | 2. | 0.37 | 7.35 --- | 220. --- --- | 8.3 |
| SW-N-41S3 | SS | N | 2024-03-05 | High flow. Clear and colourless sample. | 0.12 | 0.068 --- | < 0.01 | 17. --- | < 1. | < 1. | 7.35 --- | 200. --- --- | 8.3 |
| SW-N-41S4 | SS | N | 2023-05-02 | Moderate low flow, clear & colourless sample | 1.05 | 0.04 --- | 0.01 | 6.6 --- | 2. | 1.8 | 7.5 --- | 146. --- --- | 14.9 |
| SW-N-41S4 | NS | N | 2023-11-01 | Dry | --- | --- --- | --- | --- --- | --- | --- | --- --- | --- --- --- | --- |
| SW-N-41S4 | SS | N | 2023-12-18 | Moderately high flow, clear colourless | 0.114 | 0.042 | < 0.005 | 7.5 | < 1. | 0.44 | 7.3 | 190. | 6.8 |
| SW-N-41S4 | SS | N | 2024-03-05 | Moderate-high flow. Clear and colourless sample. | < 0.1 | 0.048 --- | < 0.01 | 9.4 --- | < 1. | < 1. | 7.3 --- | 180. --- --- | 6.8 |
| SW-N-42S1 | FRM | Y | 2023-05-02 | Mean of duplicates, low flow, clear and colourless. | 0.345 | < 0.043 --- | < 0.01 | 79. --- | 5.8 b | < 1.05 | 7.1 --- | 515. --- --- | 12.4 |
| SW-N-42S1 | FRM | Y | 2023-11-02 | Mean of duplicates, moderate flow, clear and colourless. | 0.265 | 0.07 --- | < 0.01 | 75.5 --- | 1.6 | < 1. | 7.04 --- | 318. --- --- | 9.4 |
| SW-N-42S1 | FRM | Y | 2023-12-19 | Mean of duplicates, low moderate flow, clear and colourless | 0.16 | 0.058 5 --- | < 0.01 | 72.5 --- | 1.6 | 2. | 7.02 --- | 286. --- --- | 8. |
| SW-N-42S1 | FRM | Y | 2024-05-03 | Mean of duplicates, high flow, clear and colourless | 0.13 | 0.056 5 --- | < 0.01 | 64.5 --- | 1.6 | < 1. | 7.28 --- | 349. --- --- | 5.7 |
| SW-N-45 | NS | N | 2023-05-02 | On the Heals Range - no access this month. | --- | --- --- | --- | --- --- | --- | --- | --- --- | --- --- --- | --- |
| SW-N-45 | NS | N | 2023-06-26 | Extra sample date for Heals range access. Station dry | --- | --- --- | --- | --- --- | --- | --- | --- --- | --- --- --- | --- |
| SW-N-45 | NS | N | 2023-08-17 | Extra sample date for Heals range access. Station dry | --- | --- --- | --- | --- --- | --- | --- | --- --- | --- --- --- | --- |
| SW-N-45 | SS | N | 2023-11-02 | Moderately low flow, clear and colourless. | 0.43 | 0.504 --- | < 0.01 | 100. --- | < 1. | 1.3 | 7.35 --- | 359. --- --- | 9.2 |
| SW-N-45 | SS | N | 2023-12-19 | Low moderate flow, clear colourless | 0.37 | 0.285 --- | < 0.005 | 100. --- | 1.6 | 1.06 | 7.02 --- | 399. --- --- | 8.6 |
| SW-N-45 | SS | N | 2024-02-27 | Low flow. Clear and colourless sample. | 0.26 | 0.206 --- | < 0.01 | 120. --- | 1.2 | 1.5 | 6.45 --- | 550. --- --- | 5.9 |
| SW-N-53 | NS | N | 2023-05-02 | Dry | --- | --- --- | --- | --- --- | --- | --- | --- --- | --- --- --- | --- |
| SW-N-53 | NS | N | 2023-11-03 | Dry | --- | --- --- | --- | --- --- | --- | --- | --- --- | --- --- --- | --- |
| SW-N-53 | NS | N | 2023-12-20 | Dry | --- | --- --- | --- | --- --- | --- | --- | --- --- | --- --- --- | --- |
| SW-N-53 | NS | N | 2024-03-06 | No longer in the sampling program - geology in the area has changed. | --- | --- --- | --- | --- --- | --- | --- | --- --- | --- --- --- | --- |
| SW-N-54 | SS | N | 2023-05-02 | Very low flow, clear, very slightly yellow | 2.88 | 0.228 --- | 0.01 | 52. --- | 2.8 | 1. | 7.69 --- | 453. --- --- | 13.4 |
| SW-N-54 | SS | N | 2023-11-03 | Moderate flow, clear and slightly yellow sample. | 3.28 | 0.281 --- | < 0.01 | 120. --- | 11. b | 4.7 | 7.48 --- | 456. --- --- | 10.9 |
| SW-N-54 | SS | N | 2023-12-20 | Low flow, clear colourless | 3.07 | 0.358 --- | < 0.005 | 69. --- | 1.6 | 1.06 | 7.31 --- | 389. --- --- | 9.6 |
| SW-N-54 | SS | N | 2024-03-06 | Moderate flow. Clear, very slightly yellow. | 2.56 | 0.321 --- | < 0.01 | 50. --- | 1.6 | 1.2 | 7.3 --- | 296. --- --- | 8.2 |
| SW-N-55 | SS | N | 2023-12-12 | Moderate flow, clear colourless. New station added | 0.155 | 0.909 | 0.005 | 95. | 2. | 11. | 6.65 | 497. | 8.6 |
| SW-N-55 | SS | N | 2024-03-06 | Moderate flow, clear and colourless sample. | 0.19 | 0.816 | < 0.01 | 220. | < 1. | 22.8 | 6.8 | 516. | 5.6 |
| SW-N-56 | SS | N | 2023-12-12 | Moderate flow, clear colourless. New station added | 0.18 | 0.051 | 0.005 | 11. | 1. | 0.1 | 7.37 | 141. | 7.9 |
| SW-N-56 | SS | N | 2024-03-06 | Moderate-high flow. Clear and colourless sample. | 0.18 | 0.051 | < 0.01 | 29. | < 1. | < 1. | 7.38 | 171. | 4.9 |
| SW-N-57 | NS | N | 2023-05-02 | Dry - No Flow | --- | --- --- | --- | --- --- | --- | --- | --- --- | --- --- --- | --- |
| SW-N-57 | SS | N | 2023-11-03 | Moderate flow, clear and colourless. | 1.38 | 1.56 | < 0.01 | 200. | 4.6 | 3.1 | 7.7 | 519. | 11.5 |
| SW-N-57 | NS | N | 2023-12-20 | Dry | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-57 | SS | N | 2024-03-06 | High flow. Clear and colourless sample. | 0.98 | 0.778 | < 0.01 | 150. | 2. | < 1. | 7.48 | 381. | --- |

| B.C. Water Quality Guidelines | | | | BC WQG-STA (1) | --- | --- | 0.05 - 1.5 (5) | --- | 25 | --- | 6.5 to 9.0 | --- | --- |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | BC WQG-LTC (1) | --- | 2 | 0.1 - 3 (5) | 128 - 429 (5) | 5 | --- | --- | --- | --- |
| | Sample | Compliance Well | | PARAMETER | Nickel | Selenium | Silver | Sulphate | TSS | Zinc | pH | Conductivity | Temperature |
| | | | | STATE | TOT | TOT | TOT | DIS | TOT | TOT | NoRS | TOT | TOT |
| SW-N-58 | NS | N | 2023-05-02 | Could not locate | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-58 | NS | N | 2023-11-02 | Dry | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-58 | NS | N | 2023-12-18 | Dry | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-58 | NS | N | 2024-03-05 | Dry | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-59 | NS | N | 2023-05-02 | Not set up | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-59 | NS | N | 2023-11-02 | Dry | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-59 | NS | N | 2023-12-18 | Dry | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-59 | NS | N | 2024-03-05 | Dry | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-60 | NS | N | 2023-05-02 | Dry | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-60 | NS | N | 2023-11-02 | Dry | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-60 | NS | N | 2023-12-18 | Dry | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-60 | NS | N | 2024-03-05 | Dry | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-61 | NS | N | 2023-05-02 | Dry | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-61 | NS | N | 2023-11-02 | Dry | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-61 | NS | N | 2023-12-18 | Dry | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-61 | NS | N | 2024-03-05 | Dry | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-62 | NS | N | 2023-05-02 | Dry - No Flow | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-62 | NS | N | 2023-11-02 | Dry | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-62 | NS | N | 2023-12-18 | Dry | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-62 | NS | N | 2024-03-05 | Removed from sampling program. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-63 | SS | N | 2023-05-02 | Moderate high flow, clear and colourless | 0.9 | 0.091 --- | < 0.01 | 16. --- | 1.6 | 1.3 | 7.1 --- | 230. --- --- | 11.8 |
| SW-N-63 | NS | N | 2023-06-26 | Extra sample date to coincide with Heals range access. Station dry | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-63 | SS | N | 2023-11-02 | Moderately low flow, clear and colourless. | 1.26 | 0.192 | < 0.01 | 45. | 2.8 | 4.1 | 7.27 | 195. | 9.1 |
| SW-N-63 | SS | N | 2023-12-18 | Moderate flow, clear and colourless | 0.429 | 0.09 | < 0.005 | 20. | 1.2 | 1.28 | 7.17 | 220. | 7.2 |
| SW-N-63 | SS | N | 2024-03-05 | High flow. Clear and colourless sample. | 0.46 | 0.085 --- | < 0.01 | 22. --- | 4. | < 1. | 7.36 a b | 135. --- --- | 6.4 |
| SW-N-64 | SS | N | 2023-05-02 | Moderate flow, clear slightly yellow | 2.05 | 0.113 --- | < 0.01 | 19. --- | 3.2 | 2.8 | 6.73 --- | 172. --- --- | 12.5 |
| SW-N-64 | SS | N | 2023-11-02 | Extra low flow, clear and very slightly yellow sample. | 2.25 | 0.1 --- | 0.013 | 68. --- | 7.2 b | 8.2 | 6.77 --- | 233. --- --- | 8.2 |
| SW-N-64 | SS | N | 2023-12-18 | Moderate flow, clear and colourless | 0.701 | 0.063 | 0.008 8 | 10. | 1.6 | 3.28 | 7.04 | 99.7 | 6.4 |
| SW-N-64 | SS | N | 2024-03-05 | High flow. Clear and colourless sample. | 0.58 | 0.053 --- | < 0.01 | 9. --- | 2.4 | 1.8 | 7.34 a b | 92. --- --- | 5.3 |
| SW-N-65 | SS | N | 2023-05-02 | Moderate flow, clear slightly yellow | 2.45 | 0.091 --- | < 0.01 | 19. --- | 2.4 | 2.5 | 6.57 --- | 175. --- --- | 13. |
| SW-N-65 | SS | N | 2023-11-02 | Moderately low flow, clear and slightly yellow sample. | 1.93 | 0.136 --- | 0.012 | 60. --- | 7.2 b | 6.6 | 6.95 --- | 213. --- --- | 8.4 |
| SW-N-65 | SS | N | 2023-12-18 | Moderate flow, clear and colourless | 0.579 | 0.077 | 0.006 7 | 14. | 1.2 | 2.48 | 7.29 | 180. | 6.5 |
| SW-N-65 | SS | N | 2024-03-05 | High flow. Clear and colourless sample. | 0.54 | 0.071 --- | < 0.01 | 15. --- | 3.2 | 1.4 | 7.36 --- | 109. --- --- | 5.8 |
| SW-N-66 | SS | N | 2024-03-05 | Moderate-low flow. Clear and colourless sample. | < 0.1 | 0.041 | < 0.01 | 5.8 | < 1. | < 1. | 7.61 | 83. | 7.3 |
| SW-N-CS2 | NS | N | 2023-11-02 | Dry | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-CS2 | SS | N | 2023-12-18 | Moderate flow, clear colourless | 0.046 | 0.073 --- | < 0.005 | 9.2 --- | < 1. | 0.22 | 7.29 --- | 160. --- --- | 8.2 |
| SW-N-CS2 | SS | N | 2024-03-05 | High flow. Clear and colourless. Additional sample collected to coincide with new SW-N-66 station | < 0.1 | 0.076 --- | < 0.01 | 16. --- | < 1. | < 1. | 7.29 --- | 102. --- --- | 8.2 |
| SW-S-03 | FRM | N | 2023-05-03 | Mean of duplicates, moderate low flow, clear & colourless | 1.9 | 0.055 5 --- | 0.01 | 19. --- | 6.8 | 16.2 | 7.02 --- | 300. --- --- | 11.3 |
| SW-S-03 | SS | N | 2023-11-01 | Moderate flow, clear and colourless. | 0.61 | 0.096 --- | < 0.01 | 54. --- | 2.4 | 5.7 | 7.28 --- | 335. --- --- | 13.2 |
| SW-S-03 | SS | N | 2023-12-15 | Moderate high flow, clear colourless | 1.12 | 0.07 --- | < 0.005 | 22. --- | 1.6 | 8.62 | 7.08 --- | 193. --- --- | 11.4 |
| SW-S-03 | SS | N | 2024-03-07 | Moderate flow. Clear and colourless sample. Sampled from mini waterfall. | 0.83 | 0.063 --- | < 0.01 | 14. --- | 1.2 | 2.9 | 7.22 --- | 163. --- --- | 8.6 |
| SW-S-04 | FRM | Y | 2023-05-02 | Mean of duplicates, moderately low flow, clear & colourless | 35.65 | 0.04 --- | 0.01 | 26. --- | 3.2 | 4.65 | 6.96 --- | 231. --- --- | 9. |
| SW-S-04 | FRM | Y | 2023-11-01 | Mean of duplicates, moderate flow, clear and colourless. | 0.4 | 0.064 --- | < 0.01 | 45.5 --- | < 1. | 2.8 | 6.62 --- | 269. --- --- | 9.4 |
| SW-S-04 | FRM | Y | 2023-05-12 | Mean of duplicates, high flow, clear and colourless | 0.406 5 | 0.056 5 --- | < 0.005 | 25. --- | < 1.1 | 3.335 | 7.45 --- | 172. --- --- | 8.7 |
| SW-S-04 | FRM | Y | 2024-03-07 | Mean of duplicates, high flow, clear and colourless | 0.325 | 0.082 5 --- | < 0.01 | 18. --- | 2.2 | 2.3 | 7.93 --- | 158. --- --- | 5.8 |
| SW-S-12 | SS | N | 2023-05-02 | Moderate low flow, clear & colourless sample | 1.87 | 0.045 --- | 0.01 | 21. --- | 2. | 3. | 6.7 --- | 285. --- --- | 11.5 |
| SW-S-12 | FRM | N | 2023-11-02 | Mean of duplicates, high flow, clear and colourless. | 2.4 | 0.134 --- | 0.011 5 | 47. --- | 3. | 4.65 | 6.94 --- | 192. --- --- | 13.9 |
| SW-S-12 | FRM | N | 2023-12-15 | Mean of duplicates, high flow, clear colourless | 1.675 | 0.061 5 --- | 0.005 | 24. --- | 1.8 | 4.495 | 6.57 --- | 250.5 --- --- | 11.5 |
| SW-S-12 | FRM | N | 2024-03-07 | Mean of duplicates, moderate-high flow. Clear and colourless sample. Dunked bottles in wier | 1.275 | 0.061 5 --- | < 0.01 | 14. --- | < 1.7 | 4.3 | 6.8 --- | 170. --- --- | 9.1 |
| SW-S-20 | SS | N | 2023-11-02 | Moderately low flow, clear and colourless. | 0.58 | 0.074 --- | < 0.01 | 9.6 --- | 12. b | 13. b | 7.39 --- | 90. --- --- | 10.7 |
| SW-S-20 | SS | N | 2023-12-15 | High flow, clear colourless | 0.225 | 0.055 --- | < 0.005 | 4.9 --- | < 1. | 7.9 b | 7.29 --- | 81. --- --- | 8.1 |
| SW-S-21 | NS | N | 2023-05-02 | Dry | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-S-21 | NS | N | 2023-11-01 | Dry | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-S-21 | SS | N | 2023-12-15 | High flow, clear colourless | 0.173 | 0.051 --- | < 0.005 | 5.3 --- | < 1. | 7.85 b | 7.64 --- | 110. --- --- | 7.7 |
| SW-S-21 | SS | N | 2024-03-07 | Moderate-high flow. Clear and colourless sample. | 0.16 | 0.055 --- | < 0.01 | 4.7 --- | < 1. | 5.4 | 7.89 --- | 66. --- --- | 4.9 |
| SW-S-24 | SS | N | 2023-05-02 | Moderate low flow, clear & colourless sample | 2.99 | 0.049 --- | 0.01 | 30. --- | 1. | 3. | 7.3 --- | 272. --- --- | 11.1 |
| SW-S-24 | SS | N | 2023-11-01 | Moderate flow, clear and colourless. | 0.39 | 0.051 --- | < 0.01 | 56. --- | < 1. | 3.1 | 6.93 --- | 323. --- --- | 9. |
| SW-S-24 | SS | N | 2023-12-15 | High flow, clear colourless | 0.747 | 0.074 --- | < 0.005 | 31. --- | 4. | 5.12 | 7.35 --- | 209. --- --- | 9.7 |
| SW-S-24 | SS | N | 2024-03-07 | Moderate-high flow. Clear and colourless sample. Dipped in weir | 0.53 | 0.053 --- | < 0.01 | 22. --- | 2.8 | 2.9 | 7.5 --- | 188. --- --- | 6.5 |
| SW-S-27 | NS | N | 2023-05-02 | Needs to be cleared to have access | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-S-27 | SS | N | 2023-11-01 | Low flow, clear and colourless. | 0.45 | 0.049 --- | < 0.01 | 55. --- | 1.2 | 2.8 | 7.07 --- | 282. --- --- | 8.5 |
| SW-S-27 | SS | N | 2023-12-15 | High flow, clear colourless | 0.966 | 0.06 --- | < 0.005 | 23. --- | 2.4 | 7.93 | 7.42 --- | 190. --- --- | 10.7 |
| SW-S-27 | SS | N | 2024-03-07 | Moderate flow. Clear and colourless sample. Used pump to collect pumped sample. | 0.76 | 0.077 --- | < 0.01 | 14. --- | 16. b | 3.4 | 7.54 --- | 173. --- --- | 7.9 |
| SW-S-52 | SS | N | 2023-11-02 | Moderately high flow, clear and colourless. | 0.11 | 0.071 --- | < 0.01 | 13. --- | < 1. | 4.4 | 7.65 --- | 128. --- --- | 11.1 |
| SW-S-52 | SS | N | 2023-12-18 | High flow, clear colourless | 0.059 | 0.045 --- | < 0.005 | 5.7 --- | < 1. | 0.5 | 7.88 --- | 89. --- --- | 8. |
| SW-S-52 | NS | N | 2024-03-07 | Removed from the sample program | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-FB | FB | N | 2024-03-06 | Batch # 01122024-0112. Decanted on the tailgate of the lightning on Willis Point Road | 0.093 | < 0.04 | < 0.005 | < 1. | < 1. | < 0.1 | 7.29 | 10. | 4.2 |
| SW-TB | TB | N | 2024-03-06 | Sealed bottles. Blank Water Batch # C3a4454_23 12.27.120P | < 0.02 | < 0.04 | < 0.005 | < 1. | < 1. | < 0.1 | --- | --- | --- |

***Notes:***

**a** *Above short-term acute (STA) British Columbia*

**b** *Above long-term chronic (LTC) British Columbia Water Quality Guideline.*

*Unreliable Ammonia Concentrations*

*BC CSR* *CSR-Sch3.2: BC Contaminated Site Regulation - Schedule 3.2 - Generic Numerical Water Standards, effective on November 1, 2017.*

*(1)* *British Columbia Approved Water Quality Guidelines (Criteria), 1998 Edition, Updated in August 2023. British Columbia Ministry of Environment and above STA 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*

*(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 landfill are derived from stations Sw-*

*(8)* *Dissolved copper guideline varies with water hardness, temperature and DOC, and calcuated using BLM;*

*(9)* *Total Aluminum guidance is pH, hardness, and DOC dependent and calculated based on BC Water Quality Guideline calculator for Aluminum in*

*(10)* *Dissolved Zinc guidance is pH, hardness, and DOC dependent. Due to anomalously high DOC concentrations resulting from the use of*

*(11)* *Aquatic Life (AW) Freshwater, Column 3.*

*(12)* *Drinking Water (DW), Column 6.*

| Station | Sample Type | Compliance Well (Y/N?) | Date Sampled | | |

# Hartland Landfill Groundwater, Surface Water and Leachate Monitoring Program Annual Report (Mar 2023 to Apr 2024)
## Appendix B-3. Surface Water Quality - 2023-2024

| B.C. Water Quality Guidelines | | | | BC WQG-STA (1) | --- | | 0.038-2.8 (5) | | BC BLM (8) | | 350 | | | | | | variable (10) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | BC WQG-LTC (1) | --- | | 0.018-0.645 (5) | | BC BLM (8) | | --- | | | | | | variable (10) | |
| | | | | PARAMETER | Aluminum | Arsenic | Boron | Cadmium | Cobalt | Copper | Hardness (As Caco3) | Iron | Lead | Manganese | Molybdenum | Nickel | Selenium | Silver | Zinc | Dissolved Organic Carbon |
| | | | | STATE | DIS | DIS | DIS | DIS | DIS | DIS | DIS | DIS | DIS | DIS | DIS | DIS | DIS | DIS | DIS | Dissolved |
| | Sample | Compliance Well | | | | | | | | | | | | | | | | | | |
| SW-N-58 | NS | N | 2023-05-02 | Could not locate | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-58 | NS | N | 2023-11-02 | Dry | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-58 | NS | N | 2023-12-18 | Dry | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-58 | NS | N | 2024-03-05 | Dry | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-59 | NS | N | 2023-05-02 | Not set up | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-59 | NS | N | 2023-11-02 | Dry | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-59 | NS | N | 2023-12-18 | Dry | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-59 | NS | N | 2024-03-05 | Dry | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-60 | NS | N | 2023-05-02 | Dry | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-60 | NS | N | 2023-11-02 | Dry | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-60 | NS | N | 2023-12-18 | Dry | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-60 | NS | N | 2024-03-05 | Dry | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-61 | NS | N | 2023-05-02 | Dry | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-61 | NS | N | 2023-11-02 | Dry | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-61 | NS | N | 2023-12-18 | Dry | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-61 | NS | N | 2024-03-05 | Dry | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-62 | NS | N | 2023-05-02 | Dry - No Flow | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-62 | NS | N | 2023-11-02 | Dry | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-62 | NS | N | 2023-12-18 | Dry | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-62 | NS | N | 2024-03-05 | Removed from sampling program. | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-63 | SS | N | 2023-05-02 | Moderate high flow, clear and colourless | 12.8 | 0.195 | 41. | < 0.005 | 0.199 | 0.952 b | 93.5 | 215. | 0.036 3 | 36.3 | 0.327 | 0.713 | 0.1 | < 0.005 | 0.58 | 4.1 |
| SW-N-63 | NS | N | 2023-06-26 | Extra sample date to coincide with Heals range access. Station dry | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-63 | SS | N | 2023-11-02 | Moderately low flow, clear and colourless. | 45.9 | 0.261 | 54. | 0.009 9 | 0.272 | 4.73 b | 110. | 160. | 0.226 | 36.4 | 0.49 | 1.01 | 0.199 | < 0.005 | 2.85 | 14. |
| SW-N-63 | SS | N | 2023-12-18 | Moderate flow, clear and colourless | 10.5 | 0.141 | 32. | < 0.005 | 0.066 8 | 1.17 | 88.1 | 51.4 | 0.016 3 | 6.96 | 0.321 | 0.385 | 0.09 | < 0.005 | 0.81 | 250. |
| SW-N-63 | SS | N | 2024-03-05 | High flow. Clear and colourless sample. | 14.9 | 0.123 | 32. | < 0.005 | 0.096 | 1.25 b | 86. | 77.3 | 0.038 | 15.1 | 0.304 | 0.351 | 0.071 | < 0.005 | 0.55 | 3.6 |
| SW-N-64 | SS | N | 2023-05-02 | Moderate flow, clear slightly yellow | 43.3 | 0.715 | 48. | 0.011 1 | 0.876 | 3.56 b | 80.8 | 857. a b | 0.103 | 318. | 0.339 | 1.84 | 0.098 | 0.006 6 | 4.62 | 16. |
| SW-N-64 | SS | N | 2023-11-02 | Extra low flow, clear and very slightly yellow sample. | 46.1 | 0.513 | 59. | 0.013 9 | 3.26 | 3.34 b | 125. | 863. a b | 0.096 2 | 384. | 0.484 | 2.3 | 0.105 | 0.005 6 | 8.03 | 13. |
| SW-N-64 | SS | N | 2023-12-18 | Moderate flow, clear and colourless | 23. | 0.384 | 25. | 0.010 3 | 0.154 | 1.86 b | 53.7 | 143. | 0.136 | 15.6 | 0.302 | 0.597 | 0.046 | < 0.005 | 3.13 | 7.1 |
| SW-N-64 | SS | N | 2024-03-05 | High flow. Clear and colourless sample. | 27.1 | 0.278 | 24. | < 0.005 | 0.163 | 1.36 | 51.9 | 166. | 0.094 | 18.6 | 0.263 | 0.578 | 0.054 | < 0.005 | 1.68 | 6.6 |
| SW-N-65 | SS | N | 2023-05-02 | Moderate flow, clear slightly yellow | 34. | 0.607 | 47. | 0.008 | 0.727 | 2.26 b | 84.7 | 688. a b | 0.073 4 | 252. | 0.356 | 1.61 | 0.101 | 0.005 2 | 2.17 | 13. |
| SW-N-65 | SS | N | 2023-11-02 | Moderately low flow, clear and slightly yellow sample. | 43.8 | 0.419 | 60. | 0.014 4 | 2.02 | 3.99 b | 117. | 606. a b | 0.153 | 222. | 0.472 | 1.69 | 0.154 | 0.008 3 | 5.77 | 13. |
| SW-N-65 | SS | N | 2023-12-18 | Moderate flow, clear and colourless | 19.7 | 0.3 | 27. | 0.008 | 0.13 | 2.62 b | 65. | 110. | 0.094 8 | 12.9 | 0.33 | 0.781 | 0.06 | < 0.005 | 5.04 | 5.7 |
| SW-N-65 | SS | N | 2024-03-05 | High flow. Clear and colourless sample. | 21.4 | 0.241 | 27. | 0.005 | 0.133 | 1.28 | 65.3 | 120. | 0.075 | 15.8 | 0.291 | 0.479 | 0.057 | < 0.005 | 0.91 | 6.2 |
| SW-N-66 | SS | N | 2024-03-05 | Moderate-low flow. Clear and colourless sample. | 9.16 | 0.045 | < 10. | < 0.005 | 0.02 | 0.588 | 46.4 | 4.8 | 0.009 | 0.053 | 0.081 | 0.026 | 0.056 | < 0.005 | 0.91 | 2.2 |
| SW-N-CS2 | NS | N | 2023-11-02 | Dry | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-N-CS2 | SS | N | 2023-12-18 | Moderate flow, clear colourless | 6.95 | 0.052 | 11. | < 0.005 | 0.018 1 | 0.355 b | 69.6 | 2.3 | < 0.005 | 0.166 | 0.089 | 0.052 | 0.067 | < 0.005 | 0.84 | 1.3 |
| SW-N-CS2 | SS | N | 2024-03-05 | High flow. Clear and colourless. Additional sample collected to coincide with new SW-N-66 station | 6.37 | 0.046 | 11. | < 0.005 | 0.022 | 1.16 b | 66. | 6.3 | 0.009 | < 0.05 | 0.101 | < 0.02 | 0.07 | < 0.005 | 0.52 | 1.7 |
| SW-S-03 | FRM | N | 2023-05-03 | Mean of duplicates, moderate low flow, clear & colourless | 7.7 | 0.244 5 | 66.5 | 0.016 15 | 0.363 5 | 2.75 b | 97.95 | 235.5 | 0.050 7 | 104. | 0.258 5 | 1.065 | 0.079 5 | < 0.005 | 8.11 | 5.15 |
| SW-S-03 | SS | N | 2023-11-01 | Moderate flow, clear and colourless. | 2.91 | 0.149 | 70. | 0.008 1 | 0.11 | 3.46 | 160. | 10.6 | 0.005 6 | 12.8 | 0.302 | 0.468 | 0.141 | < 0.005 | 3.99 | 24. |
| SW-S-03 | SS | N | 2023-12-15 | Moderate high flow, clear colourless | 14.2 | 0.175 | 54. | 0.013 5 | 0.447 | 4.41 b | 94. | 219. | 0.013 5 | 186. | 0.116 | 1.12 | 0.069 | < 0.005 | 8.17 | 4.2 |
| SW-S-03 | SS | N | 2024-03-07 | Moderate flow. Clear and colourless sample. Sampled from mini waterfall. | 15.7 | 0.118 | 49. | < 0.005 | 0.309 | 4.08 b | 74.6 | 208. | 0.009 | 120. | 0.103 | 0.846 | 0.066 | < 0.005 | 2.66 | 3.8 |
| SW-S-04 | FRM | Y | 2023-05-02 | Mean of duplicates, moderately low flow, clear & colourless | 8.78 | 0.088 | 70. | 0.021 85 | 0.069 4 | 1.205 b | 111.5 | 3.75 | 0.023 6 | 0.649 | 0.145 | 0.303 | 0.062 5 | < 0.005 | 1.525 | 2.65 |
| SW-S-04 | FRM | Y | 2023-11-01 | Mean of duplicates, moderate flow, clear and colourless. | 13.775 | 0.105 5 | 74.5 | 0.015 95 | 0.073 45 | 1.315 b | 147.5 | 8.35 | 0.030 5 | 1.149 | 0.126 5 | 0.504 5 | 0.075 5 | < 0.005 | 2.615 | 2.8 |
| SW-S-04 | FRM | Y | 2023-05-12 | Mean of duplicates, high flow, clear and colourless | 16.45 | 0.128 5 | 57. | < 0.005 75 | 0.061 3 | 1.815 b | 86.05 | 14.45 | 0.012 45 | 0.586 | 0.139 | 0.41 | 0.064 | < 0.005 | 2.545 | 4.1 |
| SW-S-04 | FRM | Y | 2024-03-07 | Mean of duplicates, high flow, clear and colourless | 13.95 | 0.088 5 | 57. | < 0.007 5 | 0.054 | 1.515 b | 84.7 | 12.5 | 0.011 | 0.647 5 | 0.109 5 | 0.339 | 0.059 5 | < 0.005 | 2.09 | 3. |
| SW-S-12 | SS | N | 2023-05-02 | Moderate low flow, clear & colourless sample | 12.1 | 0.296 | 111. | 0.012 1 | 0.828 | 4.61 a b | 127. | 1 400. a b | 0.015 2 | 452. | 0.096 | 1.77 | 0.078 | 0.005 | 2.77 | 5.8 |
| SW-S-12 | FRM | N | 2023-11-02 | Mean of duplicates, high flow, clear and colourless. | 35.05 | 0.272 5 | 26.5 | 0.02 | 0.145 5 | 14.85 a b | 98.3 | 30.6 | 0.010 25 | 6.73 | 0.096 | 2.64 | 0.143 5 | 0.005 3 | 4.675 | 5.05 |
| SW-S-12 | FRM | N | 2023-12-15 | Mean of duplicates, high flow, clear colourless | 16.25 | 0.223 | 67.5 | 0.014 | 0.734 | 4.94 b | 102.5 | 513.5 | 0.032 4 | 315.5 | 0.058 5 | 1.495 | 0.067 5 | 0.005 | 4.31 | 87.65 |
| SW-S-12 | FRM | N | 2024-03-07 | Mean of duplicates, moderate-high flow. Clear and colourless sample. Dunked bottles in wier | 20.75 | 0.165 | 64.5 | < 0.005 | 0.522 | 5.46 a b | 80.25 | 654.5 a b | 0.009 | 256. | < 0.05 | 1.295 | 0.089 5 | < 0.005 | 3.7 | 4.45 |
| SW-S-20 | SS | N | 2023-11-02 | Moderately low flow, clear and colourless. | 88. b | 0.168 | 24. | < 0.005 | 0.123 | 3.26 b | 44.7 | 85.3 | 0.025 | 14.6 | < 0.05 | 0.453 | 0.08 | 0.005 4 | 10.4 | 7.9 |
| SW-S-20 | SS | N | 2023-12-15 | High flow, clear colourless | 29.2 | 0.116 | 14. | < 0.005 | 0.057 8 | 2.1 b | 48. | 27.4 | 0.037 6 | 15.8 | 0.06 | 0.294 | 0.052 | < 0.005 | 8.69 | 5.2 |
| SW-S-21 | NS | N | 2023-05-02 | Dry | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-S-21 | NS | N | 2023-11-01 | Dry | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-S-21 | SS | N | 2023-12-15 | High flow, clear colourless | 35.5 | 0.108 | 12. | < 0.005 | 0.035 4 | 1.13 | 41.4 | 11.7 | 0.005 1 | 0.069 | 0.07 | 0.185 | 0.055 | < 0.005 | 7.54 | 4.6 |
| SW-S-21 | SS | N | 2024-03-07 | Moderate-high flow. Clear and colourless sample. | 24.8 | 0.062 | 11. | < 0.005 | 0.036 | 0.752 | 43.5 | 7.8 | < 0.005 | < 0.05 | 0.075 | 0.115 | 0.054 | < 0.005 | 6.13 | 3.3 |
| SW-S-24 | SS | N | 2023-05-02 | Moderate low flow, clear & colourless sample | 7.76 | 0.142 | 103. | 0.021 3 | 0.104 | 1.76 b | 129. | 12.3 | 0.026 6 | 12.6 | 0.181 | 0.409 | 0.068 | < 0.005 | 2.15 | 3.7 |
| SW-S-24 | SS | N | 2023-11-01 | Moderate flow, clear and colourless. | 6.5 | 0.124 | 91. | 0.014 4 | 0.083 5 | 2.06 b | 167. | 6.1 | 0.011 1 | 7.72 | 0.113 | 0.462 | 0.061 | < 0.005 | 3.66 | 3.8 |
| SW-S-24 | SS | N | 2023-12-15 | High flow, clear colourless | 11.2 | 0.158 | 82. | 0.010 2 | 0.081 2 | 2.57 b | 105. | 29.6 | 0.019 7 | 7.93 | 0.142 | 0.478 | 0.057 | < 0.005 | 3.33 | 4.2 |
| SW-S-24 | SS | N | 2024-03-07 | Moderate-high flow. Clear and colourless sample. Dipped in weir | 10.6 | 0.105 | 69. | 0.008 5 | 0.131 | 2.13 b | 97.2 | 29.7 | 0.016 | 7.4 | 0.151 | 0.448 | 0.069 | < 0.005 | 2.09 | 3.6 |
| SW-S-27 | NS | N | 2023-05-02 | Needs to be cleared to have access | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-S-27 | SS | N | 2023-11-01 | Low flow, clear and colourless. | 5.39 | 0.162 | 50. | 0.005 8 | 0.095 5 | 2.38 b | 133. | 2.8 | < 0.005 | 0.139 | 0.148 | 0.403 | 0.07 | < 0.005 | 1.59 | 4.1 |
| SW-S-27 | SS | N | 2023-12-15 | High flow, clear colourless | 12.5 | 0.163 | 55. | 0.009 7 | 0.11 | 3.6 b | 90.9 | 45.4 | 0.026 1 | 27.6 | 0.132 | 0.75 | 0.053 | < 0.005 | 5.3 | 4.2 |
| SW-S-27 | SS | N | 2024-03-07 | Moderate flow. Clear and colourless sample. Used pump to collect pumped sample. | 13.8 | 0.124 | 48. | 0.008 | 0.151 | 3.33 b | 78.4 | 47.4 | 0.017 | 12.7 | 0.126 | 0.654 | 0.053 | < 0.005 | 2.19 | 3.9 |
| SW-S-52 | SS | N | 2023-11-02 | Moderately high flow, clear and colourless. | 10.8 | 0.098 | 19. | < 0.005 | 0.041 3 | 0.845 | 85.9 | 9.4 | 0.006 1 | 1.69 | < 0.05 | 0.104 | 0.083 | < 0.005 | 5.07 | 5.7 |
| SW-S-52 | SS | N | 2023-12-18 | High flow, clear colourless | 5.6 | 0.064 | 17. | < 0.005 | 0.022 6 | 1.31 b | 56.3 | 5.3 | 0.030 5 | 0.489 | < 0.05 | 0.17 | 0.046 | < 0.005 | 1.82 | 2.2 |
| SW-S-52 | NS | N | 2024-03-07 | Removed from the sample program | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SW-FB | FB | N | 2024-03-06 | Batch # 01122024-0112. Decanted on the tailgate of the lightning on Willis Point Road | 1.42 | < 0.02 | < 10. | < 0.005 | < 0.005 | 0.181 | < 0.5 | 22.8 | < 0.005 | < 0.176 | 0.287 | < 0.02 | < 0.04 | < 0.005 | < 0.1 | 0.6 |
| SW-TB | TB | N | 2024-03-06 | Sealed bottles. Blank Water Batch # C3a4454 23 12.27.120P | 1.92 | < 0.02 | < 10. | < 0.005 | < 0.005 | < 0.05 | < 0.5 | < 1. | < 0.005 | < 0.05 | < 0.05 | < 0.02 | < 0.04 | < 0.005 | < 0.1 | < 0.5 |

***Notes:***

**a** *Above short-term acute (STA) British Columbia*

**b** *Above long-term chronic (LTC) British Columbia Water Quality Guideline.*
*Unreliable Ammonia Concentrations*

*BC CSR* *CSR-Sch3.2: BC Contaminated Site Regulation - Schedule 3.2 - Generic Numerical Water Standards, effective on November 1, 2017.*

*(1)* *British Columbia Approved Water Quality Guidelines (Criteria), 1998 Edition, Updated in August 2023. British Columbia Ministry of Environment and*

*(2)* *above STA 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*

*(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 landfill are derived from stations Sw-*

*(8)* *Dissolved copper guideline varies with water hardness, temperature and DOC, and calcuated using BLM;*

*(9)* *Total Aluminum guidance is pH, hardness, and DOC dependent and calculated based on BC Water Quality Guideline calculator for Aluminum in*

*(10)* *Dissolved Zinc guidance is pH, hardness, and DOC dependent. Due to anomalously high DOC concentrations resulting from the use of*

*(11)* *Aquatic Life (AW) Freshwater, Column 3.*

*(12)* *Drinking Water (DW), Column 6.*

# B4. Monthly Leachate Quality Data – Hartland Valve Chamber

| State | Parameter | Units | Sewer Use Criteria | | Hartland Valve Chamber | Hartland Valve Chamber | Hartland Valve Chamber | Hartland Valve Chamber | Hartland Valve Chamber | Hartland Valve Chamber | Hartland Valve Chamber | Hartland Valve Chamber | Hartland Valve Chamber | Hartland Valve Chamber | Hartland Valve Chamber | Hartland Valve Chamber | Hartland Valve Chamber | Hartland Valve Chamber | Hartland Valve Chamber | Hartland Valve Chamber | Hartland Valve Chamber | Hartland Valve Chamber | Hartland Valve Chamber | Hartland Valve Chamber | Hartland Valve Chamber |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | FR1 | FR2 | FRM | SS | SS | SS | FR1 | FR2 | FRM | SS | SS | FR1 | FR2 | FRM | SS | SS | FR1 | FR2 | FRM | SS |
| | | | min | max | 13-Apr-2023 | 13-Apr-2023 | 13-Apr-2023 | 25-May-2023 | 13-Jun-2023 | 24-Jul-2023 | 24-Aug-2023 | 24-Aug-2023 | 24-Aug-2023 | 21-Sep-2023 | 12-Oct-2023 | 09-Nov-2023 | 09-Nov-2023 | 09-Nov-2023 | 07-Dec-2023 | 24-Jan-2024 | 24-Feb-2024 | 24-Feb-2024 | 24-Feb-2024 | 14-Mar-2024 |
| **CONVENTIONALS** | | | | | | | | | | | | | | | | | | | | | | | | |
| Total | Alkalinity - Total - Ph 4.5 | mg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | BOD | mg/L | --- | 500 | < 40 | < 42 | 41 | 18. | 22. | 33. | 45. | 52. | 48.5 | 33 | 80. | 21. | 18. | 19.5 | 12. | 12. | 23. | 21. | 22. | 24. |
| Total | CBOD | mg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Chloride | mg/L | --- | 1500 | 270 | 280 | 275 | 360. | 380. | 390. | 390. | 390. | 390. | 390 | 370. | 260. | 260. | 260. | 47. | 130. | 170. | 170. | 170. | 180. |
| Total | COD | mg/L | --- | 1000 | 480 | 521 | 501 | 539. | 567. | 465. | 553. | 582. | 567.5 | 465 | 956. | 427. | 454. | 440.5 | 76. | 209. | 251. | 250. | 250.5 | 260. |
| Total | Conductivity | µS/cm | --- | --- | 3035 | 3035 | 3035 | 4 300. | 4 385. | 4 471. | 4 328. | 4 328. | 4 328. | 4471 | 3 942. | 3 017. | 3 017. | 3 017. | 611. | 1 575. | 1 502. | 1 502. | 1 502. | 2 463. |
| Total | Cyanide - SAD | mg/L | --- | 1 | 0.0132 | 0.0142 | 0 | 0.021 4 | 0.019 1 | 0.002 03 | 0.014 1 | 0.015 5 | 0.014 8 | 0.00203 | 0.009 8 | 0.012 7 | 0.011 8 | 0.012 25 | < 0.002 5 | 0.008 4 | 0.007 17 | 0.007 99 | 0.007 58 | 0.012 4 |
| Total | Cyanide - WAD | mg/L | --- | 1 | 0.0081 | 0.0094 | 0 | 0.008 9 | 0.002 5 | < 0.000 5 | 0.005 2 | 0.006 9 | 0.006 05 | < 0.0005 | 0.002 5 | 0.004 18 | 0.004 81 | 0.004 495 | < 0.002 5 | 0.003 1 | < 0.000 5 | < 0.000 5 | < 0.000 5 | 0.009 2 |
| Total | Dissolved Oxygen | mg/L | --- | --- | 17.4 | 17.4 | 17 | 1.31 | 0.84 | 0.8 | --- 87.4 | 87.4 | 87.4 | 0.8 | 2.63 | --- 1.57 | 1.57 | 1.57 | 6.44 | 2.75 | 9.55 | 9.55 | 9.55 | 1.12 |
| Total | Fecal Coliforms | CFU/100 mL | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Ammonia | mg/L | --- | --- | 240 | 230 | 235 | 290. | 270. | 250. | 290. | 270. | 280. | 250 | 170. | 220. | 220. | 220. | 37. | 120. | 120. | 120. | 120. | 170. |
| Total | Nitrite | mg/L | --- | --- | 1.31 | 1.3 | 1 | 0.569 | 0.446 | 1.26 | 0.29 | 0.323 | 0.306 5 | 1.26 | 6.15 | 1.08 | 1.09 | 1.085 | 0.189 | 0.372 | 0.382 | 0.375 | 0.378 5 | 0.826 |
| Total | Nitrate | mg/L | --- | --- | 16.2 | 16.2 | 16 | 15.2 | 4.01 | 0.46 | 0.21 | < 0.2 | 0.205 | 0.46 | 18.9 | 12.1 | 12. | 12.05 | 7.48 | 6.49 | 12.8 | 13. | 12.9 | 13.3 |
| 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. | < 2. | < 2. | < 2. | < 2 | < 2. | < 2. | < 2. | < 2. | 2. | < 2. | < 2. | < 2. | < 2. | < 2. |
| Total | Oil & Grease, Total | mg/L | --- | 100 | < 1 | < 1 | < 1 | < 1. | < 2.3 | 2.5 | < 1. | < 1. | < 1. | 2.5 | < 2. | 1. | 1. | 1. | 1.3 | 1.1 | < 1. | < 1. | < 1. | < 1. |
| Total | ORP | mV | --- | --- | -140.1 | -140.1 | -140 | 126.8 | 111.8 | 109.7 | 18.4 | 18.4 | 18.4 | 109.7 | 94.4 | 72.1 | 72.1 | 72.1 | 59.4 | 104.1 | 80.3 | 80.3 | 80.3 | 128.2 |
| Total | pH | pH | 5.5 | 11 | 7.6 | 7.6 | 8 | 7.36 | 7.89 | 7.69 | 8.71 | 8.71 | 8.71 | 7.69 | 8.87 | 7.68 | 7.68 | 7.68 | 7.49 | 7.57 | 7.06 | 7.06 | 7.06 | 8.12 |
| Dissolved | Dissolved Sulphide | mg/L | --- | 1 | < 0.03 | < 0.02 | 0 | 0.032 | 0.041 | 0.047 | 0.048 | 0.043 | 0.045 5 | < 0.036 | 0.03 | 0.026 | 0.024 | 0.025 | 0.005 8 | 0.009 1 | 0.022 | 0.025 | 0.023 5 | 0.025 |
| Total | Total Sulphide | mg/L | --- | 1 | < 0.047 | < 0.051 | 0 | 0.05 | 0.053 | 0.041 | 0.082 | 0.033 | 0.057 5 | 0.056 | 0.08 | 0.056 | 0.026 | 0.041 | 0.006 3 | 0.023 | < 0.009 | 0.027 | 0.018 | 0.03 |
| Dissolved | Sulphate | mg/L | --- | 1500 | 88 | < 87 | 88 | 81. | 82. | 71. | 4. | 5.2 | 4.6 | 71 | 68. | 220. | 210. | 215. | 140. | 120. | 120. | 120. | 120. | 130. |
| | Temperature | °C | --- | --- | 14.5 | 14.5 | 15 | 19.8 | 21.1 | 18.3 | 21.7 | 21.7 | 21.7 | 18.3 | 16. | 14.1 | 14.1 | 14.1 | 7.7 | 16.8 | 12.2 | 12.2 | 12.2 | 13.8 |
| Total | TOC | mg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Phenols | mg/L | --- | 1 | < 0.05 | < 0.05 | < 0 | | | < 0.015 | | | | 0.005 | 0.007 5 | 0.015 | 0.04 | 0.025 | < 0.003 8 | < 0.5 | < 0.001 5 | | | |
| Total | TSS | mg/L | --- | 350 | 73 | 70 | 72 | 19. | 16. | 9.2 | 23. | 21. | 22. | 9.2 | 250. | 14. | 19. | 16.5 | 22. | 9.2 | 15. | 15. | 15. | 23. |
| **METALS** | | | | | | | | | | | | | | | | | | | | | | | | |
| Total | Aluminum | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Antimony | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Arsenic | µg/L | --- | 400 | 5.06 | 5.17 | 5 | 6.96 | 5.25 | 5.92 | 6.88 | 6.78 | 6.83 | 5.92 | 9.03 | 4.87 | 5.02 | 4.945 | 1.47 | 3.28 | 3.57 | 3.41 | 3.49 | 4.75 |
| Total | Barium | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Beryllium | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Bismuth | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Boron | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Cadmium | µg/L | --- | 300 | 0.056 | 0.062 | 0 | 0.084 | 0.075 | 0.06 | 0.093 | 0.059 | 0.076 | 0.06 | 0.121 | 0.048 2 | 0.047 1 | 0.047 65 | 0.027 | 0.025 2 | 0.029 6 | 0.024 | 0.026 8 | 0.035 9 |
| Total | Calcium | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Chromium | µg/L | --- | 4000 | 35.7 | 36.9 | 36 | 56.6 | 51.6 | 49.6 | 50.1 | 49.6 | 49.85 | 49.6 | 57.1 | 35.4 | 37. | 36.2 | 12.9 | 20.9 | 23.5 | 23.7 | 23.6 | 32.4 |
| Total | Chromium III | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Chromium Vi | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Cobalt | µg/L | --- | 5000 | 10.7 | 10.8 | 11 | 15.1 | 15. | 14.4 | 14.1 | 13.8 | 13.95 | 14.4 | 16.6 | 10.2 | 10.6 | 10.4 | 3.89 | 5.55 | 6.03 | 5.76 | 5.895 | 7.34 |
| Total | Copper | µg/L | --- | 1000 | 14 | 14.6 | 14 | 25.5 | 24.2 | 17.9 | 11.3 | 10.6 | 10.95 | 17.9 | 19.8 | 19.6 | 20.2 | 19.9 | 8.94 | 6.54 | 8.46 | 7.3 | 7.88 | 5.86 |
| Total | Hardness (As Caco3) | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Iron | µg/L | --- | 50000 | 1500 | 1810 | 1655 | 4 150. | 3 120. | 2 860. | 3 260. | 3 140. | 3 200. | 2860 | 4 850. | 1 360. | 1 390. | 1 375. | 2 830. | 895. | 894. | 914. | 904. | 1 390. |
| Total | Lead | µg/L | --- | 1000 | 0.488 | 0.56 | 1 | 0.843 | 0.607 | 0.513 | 0.602 | 0.53 | 0.566 | 0.513 | 1.62 | 0.596 | 0.592 | 0.594 | 1.04 | 0.348 | 0.388 | 0.388 | 0.388 | 0.588 |
| Total | Lithium | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Magnesium | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Manganese | µg/L | --- | 5000 | 514 | 525 | 520 | 718. | 521. | 517. | 546. | 549. | 547.5 | 517 | 851. | 491. | 508. | 499.5 | 178. | 263. | 286. | 269. | 277.5 | 274. |
| Total | Mercury | µg/L | --- | 20 | < 0.038 | < 0.038 | < 0 | < 0.001 9 | < 0.038 | 0.002 | < 0.019 | < 0.019 | < 0.019 | 0.002 | 0.038 | < 0.038 | < 0.038 | < 0.038 | < 0.038 | | < 0.019 | < 0.019 | < 0.019 | 0.016 |
| Total | Molybdenum | µg/L | --- | 5000 | 2.22 | 2.17 | 2 | 3.28 | 3.48 | 3.62 | 3.23 | 3.25 | 3.24 | 3.62 | 3.14 | 3.91 | 4.13 | 4.02 | 2.96 | 1.81 | 1.82 | 1.86 | 1.84 | 2.15 |
| Total | Nickel | µg/L | --- | 3000 | 30.8 | 30.7 | 31 | 44.6 | 41.7 | 40.7 | 40.5 | 39.1 | 39.8 | 40.7 | 45. | 29.7 | 30.7 | 30.2 | 8.88 | 15.4 | 16.6 | 16.1 | 16.35 | 19.1 |
| Total | Phosphorus | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Potassium | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Selenium | µg/L | --- | 300 | 0.485 | 0.495 | 0 | 0.559 | 0.539 | 0.481 | 0.863 | 0.703 | 0.783 | 0.481 | 0.546 | 0.913 | 0.922 | 0.917 5 | 0.943 | 0.553 | 0.57 | 0.574 | 0.572 | |
| Total | Silicon | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Sodium | µg/L | --- | --- | 220 | 222 | 221 | 320. | 283. | 278. | 294. | 290. | 292. | 270 | 342. | 206. | 214. | 210. | 49.3 | 113. | 128. | 122. | 125. | 148. |
| Total | Silver | µg/L | --- | 500 | < 0.02 | < 0.02 | < 0 | < 0.02 | < 0.02 | < 0.02 | 0.034 | < 0.02 | 0.027 | < 0.02 | < 0.02 | 0.016 | 0.015 | 0.015 5 | 0.012 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Total | Sodium | µg/L | --- | --- | 220 | 222 | 221 | 320. | 283. | 278. | 294. | 290. | 292. | 270 | 342. | 206. | 214. | 210. | 49.3 | 113. | 128. | 122. | 125. | 148. |
| 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 | 14.3 | 15.7 | 15 | 19.7 | 13.3 | 10.3 | 16.3 | 7.8 | 12.05 | 10.3 | 49. | 11. | 10.6 | 10.8 | 10.4 | 8.4 | 8.7 | 8.3 | 8.5 | 10.9 |
| Total | Zirconium | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |

| | | | Sewer Use Criteria | | Hartland Valve Chamber | Hartland Valve Chamber | Hartland Valve Chamber | Hartland Valve Chamber | Hartland Valve Chamber | Hartland Valve Chamber | Hartland Valve Chamber | Hartland Valve Chamber | Hartland Valve Chamber | Hartland Valve Chamber | Hartland Valve Chamber | Hartland Valve Chamber | Hartland Valve Chamber | Hartland Valve Chamber | Hartland Valve Chamber | Hartland Valve Chamber | Hartland Valve Chamber | Hartland Valve Chamber | Hartland Valve Chamber | Hartland Valve Chamber |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **POLYCYCLIC AROMATIC HYDROCARBONS** | | | | | | | | | | | | | | | | | | | | | | | | |
| Total | Total PAHs | µg/L | --- | 50. | 3.5 | 3. | 3.25 | 6.2 | 3. | 1.6 | 3.2 | 4.2 | 3.7 | 1.6 | 3.8 | 5.8 | 5.3 | 5.55 | 2.1 | Lab Error | 2.4 | 2.3 | 2.35 | 4.9 |
| *LOW WEIGHT* | | | | | | | | | | | | | | | | | | | | | | | | |
| Total | 2-Chloronaphthalene | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | 2-Methylnaphthalene | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Acenaphthene | µg/L | --- | --- | 0.46 | 0.41 | 0 | 1.3 | 0.7 | 0.31 | 0.83 | 1.1 | 0.965 | 0.31 | 0.5 | 2. | 1.9 | 1.95 | 0.37 | Lab Error | 0.71 | 0.7 | 0.705 | 1.2 |
| Total | Acenaphthylene | µg/L | --- | --- | 0.06 | 0.054 | 0 | 0.05 | 0.019 | 0.013 | 0.013 | 0.015 | 0.014 | 0.013 | 0.018 | 0.024 | 0.021 | 0.022 5 | 0.01 | Lab Error | 0.028 | 0.028 | 0.028 | 0.017 |
| Total | Anthracene | µg/L | --- | --- | 0.82 | 0.79 | 1 | 0.12 | < 0.071 | 0.11 | 0.048 | 0.057 | 0.052 5 | 0.11 | 0.1 | 0.15 | 0.13 | 0.14 | < 0.041 | Lab Error | 0.21 | 0.2 | 0.205 | 0.15 |
| Total | Fluorene | µg/L | --- | --- | 0.45 | 0.38 | 0 | 0.88 | 0.31 | 0.17 | 0.37 | 0.46 | 0.415 | 0.17 | 0.41 | 1.2 | 1.1 | 1.15 | 0.24 | Lab Error | 0.36 | 0.36 | 0.36 | 0.9 |
| Total | Naphthalene | µg/L | --- | --- | 0.025 | 0.029 | 0 | 1.4 | 0.19 | 0.13 | 0.82 | 1.1 | 0.96 | 0.13 | 0.19 | 0.48 | 0.44 | 0.46 | < 0.046 | Lab Error | 0.052 | 0.049 | 0.050 5 | 0.15 |
| Total | Phenanthrene | µg/L | --- | --- | 0.05 | 0.039 | 0 | 0.34 | 0.082 | 0.053 | 0.16 | 0.2 | 0.18 | 0.053 | 0.13 | 0.22 | 0.19 | 0.205 | 0.096 | Lab Error | 0.037 | 0.03 | 0.033 5 | 0.57 |
| Total | Total Lmw-Pah'S | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *HIGH WEIGHT* | | | | | | | | | | | | | | | | | | | | | | | | |
| Total | Benzo(a)anthracene | µg/L | --- | --- | 0.11 | 0.093 | 0 | 0.11 | 0.12 | 0.057 | 0.04 | 0.055 | 0.047 5 | 0.057 | 0.17 | 0.073 | 0.058 | 0.065 5 | 0.031 | Lab Error | 0.047 | 0.05 | 0.048 5 | 0.077 |
| Total | Benzo(a)pyrene | µg/L | --- | --- | 0.043 | 0.034 | 0 | 0.025 | < 0.023 | 0.023 | 0.012 | 0.013 | 0.012 5 | 0.023 | 0.051 | 0.009 5 | 0.008 5 | 0.009 | 0.005 | Lab Error | 0.009 8 | 0.013 | 0.011 4 | 0.029 |
| Total | Benzo(b,j)fluoranthene | µg/L | --- | --- | 0.061 | 0.05 | 0 | 0.057 | < 0.039 | 0.038 | 0.016 | 0.021 | 0.018 5 | 0.038 | 0.1 | 0.014 | 0.013 | 0.013 5 | < 0.01 | Lab Error | 0.015 | 0.017 | 0.016 | 0.022 |
| Total | Benzo(g,h,i)perylene | µg/L | --- | --- | < 0.022 | < 0.02 | < 0 | 0.1 | < 0.02 | < 0.02 | < 0.02 | < 0.02 | < 0.02 | < 0.02 | 0.025 | < 0.02 | < 0.02 | < 0.02 | < 0.02 | Lab Error | < 0.02 | < 0.02 | < 0.02 | < 0.02 |
| Total | Benzo(k)fluoranthene | µg/L | --- | --- | < 0.024 | < 0.016 | < 0 | 0.05 | < 0.014 | < 0.011 | < 0.01 | < 0.01 | < 0.01 | 0.011 | 0.037 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | Lab Error | < 0.01 | < 0.01 | < 0.01 | 0.022 |
| Total | Chrysene | µg/L | --- | --- | 0.12 | 0.1 | 0 | 0.11 | 0.11 | 0.06 | 0.032 | 0.043 | 0.037 5 | 0.06 | 0.21 | 0.07 | 0.056 | 0.063 | < 0.033 | Lab Error | 0.05 | 0.054 | 0.052 | 0.077 |
| Total | Dibenzo(a,h)anthracene | µg/L | --- | --- | < 0.02 | < 0.02 | < 0 | 0.1 | < 0.02 | < 0.02 | < 0.02 | < 0.02 | < 0.02 | < 0.02 | < 0.02 | < 0.02 | < 0.02 | < 0.02 | 0.02 | Lab Error | < 0.02 | < 0.02 | < 0.02 | < 0.02 |
| Total | Fluoranthene | µg/L | --- | --- | 0.65 | 0.51 | 1 | 0.64 | 0.65 | 0.29 | 0.37 | 0.52 | 0.445 | 0.29 | 1. | 0.75 | 0.65 | 0.7 | < 0.23 | Lab Error | 0.45 | 0.42 | 0.435 | 0.7 |
| Total | Indeno(1,2,3-c,d)pyrene | µg/L | --- | --- | < 0.02 | < 0.02 | < 0 | 0.1 | < 0.02 | < 0.02 | < 0.02 | < 0.02 | < 0.02 | < 0.02 | < 0.02 | < 0.02 | < 0.02 | < 0.02 | 0.02 | Lab Error | < 0.02 | < 0.02 | < 0.02 | < 0.02 |
| Total | Pyrene | µg/L | --- | --- | 0.56 | 0.44 | 1 | 0.5 | 0.48 | 0.25 | 0.27 | 0.38 | 0.325 | 0.25 | 0.74 | 0.51 | 0.44 | 0.475 | 0.096 | Lab Error | 0.3 | 0.27 | 0.285 | 0.45 |
| Total | Total Hmw-Pah'S | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **VOLATILE ORGANICS** | | | | | | | | | | | | | | | | | | | | | | | | |
| Dissolved | Benzene | µg/L | --- | 100 | < 0.4 | < 0.4 | < 0 | 0.4 | < 0.4 | < 0.4 | < 0.4 | < 0.4 | < 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 | 0.4 | < 0.4 | < 0.4 | < 0.4 | < 0.4 | < 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 | 0.61 | 0.61 | 1 | 0.74 | < 0.4 | < 0.4 | < 0.4 | < 0.4 | < 0.4 | < 0.4 | 0.4 | 1.2 | 1.1 | 1.15 | < 0.4 | 0.62 | 0.56 | 0.67 | 0.615 | 0.87 |
| Dissolved | Xylenes | µg/L | --- | 200 | < 0.4 | < 0.4 | < 0.40 | 0.48 | < 0.4 | < 0.4 | < 0.4 | < 0.4 | < 0.4 | < 0.40 | 0.4 | 0.43 | 0.44 | 0.435 | < 0.4 | < 0.4 | < 0.4 | < 0.4 | < 0.4 | 0.49 |

***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.
*FR1 - Field replicate 1.*
*FR2 - Field replicate 2.*
*FR3 - Field replicate 3.*
*FRM - Mean of field replicates.*
*SS - Single Sample*
*NS- Not sampled*
*NS- Not sampled*

# B5. Quarterly Leachate Quality – Trace Organics

| State | Parameter | Unit | Sewer Use Criteria | | | Hartland Valve Chamber | | Hartland Valve Chamber | | Hartland Valve Chamber | | Hartland Valve Chamber | | Hartland Valve Chamber | | Hartland Valve Chamber |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | FR1 | | FR2 | | FRM | | SS | | SS | | SS |
| | | | min | max | | 13-Apr-2023 | | 13-Apr-2023 | | 13-Apr-2023 | | 24-Jul-2023 | | 19-Oct-2022 | | 24-Jan-2024 |
| **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 | **---** | **---** | < | 0.5 | < | 0.5 | < | 0.5 | < | 0.1 | < | 0.1 | < | 0.1 |
| TOT | 2,4,6-Trichlorophenol | µg/L | **---** | **---** | < | 0.5 | < | 0.5 | < | 0.5 | < | 2. | | 0.1 | < | 0.1 |
| TOT | 2-Chlorophenol | µg/L | **---** | **---** | | 0.5 | | 0.5 | | 0.5 | < | 0.1 | < | 0.1 | < | 0.1 |
| NA | Pentachlorophenol | µg/L | **---** | **---** | < | 0.5 | < | 0.5 | < | 0.5 | < | 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 | **---** | 50 | < | 0.5 | | 0.5 | | 0.5 | < | 2. | < | 0.1 | < | 0.1 |
| TOT | Total Dichlorophenols | µg/L | **---** | **---** | < | 0.5 | < | 0.5 | < | 0.5 | < | 0.1 | < | 0.1 | < | 0.1 |
| TOT | Total Monochlorophenols | µg/L | **---** | **---** | < | 0.4 | < | 0.4 | < | 0.4 | < | 0.08 | < | 0.8 | < | 0.08 |
| TOT | Total Nonchlorinated phenols | µg/L | **---** | **---** | | 50. | | 50. | | 50. | < | 10. | | 0.1 | < | 10. |
| TOT | Total Tetrachlorophenols | µg/L | **---** | **---** | < | 0.5 | < | 0.5 | < | 0.5 | < | 0.1 | < | 0.1 | < | 0.1 |
| TOT | Total Trichlorophenols | µg/L | **---** | **---** | < | 0.4 | < | 0.4 | < | 0.4 | < | 0.08 | < | 0.08 | < | 0.08 |
| TOT | Total Phenolic Compounds | µg/L | **---** | **---** | | 0.5 | | 0.5 | | 0.5 | < | 0.1 | | 0.1 | < | 0.1 |
| **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 | --- | --- | < | 0.5 | < | 0.5 | < | 0.5 | < | 0.1 | < | 0.1 | < | 0.1 |
| TOT | 2,3,4,6-Tetrachlorophenol | µg/L | --- | --- | | 0.5 | | 0.5 | | 0.5 | | 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 (not sampled in 2024)

# B7. Monthly Leachate Quality – North Purge Wells

| State | Parameter | Unit | Sewer Use Criteria | | North Purge Wells | North Purge Wells | North Purge Wells | North Purge Wells | North Purge Wells | North Purge Wells | North Purge Wells | North Purge Wells | North Purge Wells | North Purge Wells | North Purge Wells | North Purge Wells |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | SS | SS | SS | SS | SS | SS | SS | SS | SS | SS | SS | SS |
| | | | min | max | 13-Apr-2023 | 25-May-2023 | 13-Jun-2023 | 24-Jul-2023 | 24-Aug-2023 | 21-Sep-2023 | 12-Oct-2023 | 9-Nov-2023 | 7-Dec-2023 | 24-Jan-2024 | 24-Feb-2024 | 14-Mar-2024 |
| **CONVENTIONALS** | | | | | | | | | | | | | | | | |
| Total | Alkalinity - Total - Ph 4.5 | mg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | BOD | mg/L | --- | 500 | 12 | 11 | 13 | 15 | 12 | 13 | 31 | 18 | 12 | 14 | 12 | 18 |
| Total | CBOD | mg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Chloride | mg/L | --- | 1500 | 330 | 330 | 320 | 340 | 330 | 350 | 380 | 340 | 340 | 300 | 280 | 300 |
| Total | COD | mg/L | --- | 1000 | 277 | 268 | 238 | 249 | 267 | 285 | 553 | 305 | 344 | 248 | 240 | 257 |
| Total | Conductivity | µS/cm | --- | --- | 3378 | 3524 | 11240 | 10461 | 3525 | 10261 | 4565 | 3473 | 3597 | 3253 | 3079 | 2122 |
| Total | Cyanide - SAD (total) | mg/L | --- | 1 | 0.00365 | 0.00397 | 0.00304 | 0.00415 | 0.0045 | 0.00399 | 0.0107 | 0.0057 | 0.0055 | 0.0052 | < 0.0025 | 0.0092 |
| Total | Cyanide - WAD | mg/L | --- | 1 | 0.00086 | 0.00077 | < 0.0005 | < 0.0005 | < 0.0025 | 0.00133 | < 0.0025 | < 0.0005 | < 0.0025 | < 0.0025 | < 0.0025 | 0.0072 |
| Total | Dissolved Oxygen | mg/L | --- | --- | 3.57 | 0.95 | 2.34 | 2.56 | 19.5 | 2.66 | 6.5 | 1.53 | 17.4 | 1.68 | 2.68 | 1.25 |
| Total | Fecal Coliforms | CFU/100 mL | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Ammonia | mg/L | --- | --- | 150 | 170 | 160 | 170 | 180 | 190 | 330 | 170 | 200 | 170 | 170 | 180 |
| Total | Nitrite | mg/L | --- | --- | < 0.005 | < 0.005 | 0.0084 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | 0.0197 | < 0.005 |
| Total | Nitrate | mg/L | --- | --- | < 0.02 | < 0.02 | 0.032 | < 0.02 | < 0.02 | < 0.02 | < 0.02 | 0.035 | 0.03 | 0.02 | 0.24 | < 0.02 |
| 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 | 3.2 | < 1 | 1 | < 1 | < 1 | < 1 | < 1 | < 1 |
| Total | ORP | mV | --- | --- | -254.9 | 93.3 | 138.2 | 125.2 | 35.1 | 124.1 | 65.9 | 77.1 | 80.1 | 113.1 | 130.2 | 69.2 |
| Total | pH | pH | 5.5 | 11 | 6.74 | 7.42 | 8.26 | 8.15 | 7.21 | 8.18 | 8.43 | 8.19 | 8.01 | 6.9 | 7.18 | 7.88 |
| Dissolved | Total Sulphide | mg/L | --- | 1 | 0.098 | < 0.099 | 0.065 | 0.077 | 0.034 | 0.052 | 0.067 | 0.068 | 0.98 | 0.09 | 0.073 | 0.08 |
| Total | Sulphide | mg/L | 1 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Dissolved | Sulphate | mg/L | --- | 1500 | < 1 | < 1 | 4.2 | < 1 | < 1 | < 1 | 3.1 | 16 | 12 | 9.8 | 21 | 4 |
| Total | Temperature | °C | --- | --- | 17.5 | 18.5 | 24.2 | 19.2 | 19.5 | 19.8 | 14.8 | 17.3 | 15.6 | 16.4 | 16.9 | 16.5 |
| Total | TOC | mg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Phenols | mg/L | --- | 1 | 0.5 | 0.0049 | 0.004 | < 0.0075 | 0.5 | 0.0034 | 0.008 | < 0.0075 | 0.5 | < 0.0075 | 0.012 | 0.012 |
| Total | TSS | mg/L | --- | 350 | 50 | 53 | 47 | 58 | 74 | 71 | 19 | 52 | 50 | 55 | 30 | 41 |
| **METALS** | | | | | | | | | | | | | | | | |
| Total | Aluminum | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Antimony | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Arsenic | µg/L | --- | 400 | 5.02 | 4.83 | 4.4 | 5.15 | 11.6 | 6.27 | 15.3 | 6.51 | 9.94 | 6.7 | 4.75 | 5.31 |
| Total | Barium | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Beryllium | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Bismuth | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Boron | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Cadmium | µg/L | --- | 300 | < 0.01 | < 0.01 | < 0.005 | 0.017 | 0.034 | < 0.01 | 0.052 | 0.0064 | 0.02 | 0.0082 | < 0.01 | 0.018 |
| Total | Calcium | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Chromium | µg/L | --- | 4000 | 3.48 | 5.81 | 3.68 | 4.85 | 11.2 | 6.67 | 46.5 | 7.08 | 24.5 | 8.25 | 9.12 | 9.88 |
| Total | Chromium III | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Chromium Vi | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Cobalt | µg/L | --- | 5000 | 5.15 | 5.52 | 5.57 | 5.97 | 8.08 | 6.78 | 20.7 | 5.98 | 10.7 | 6.22 | 6.71 | 6.28 |
| Total | Copper | µg/L | --- | 1000 | 0.4 | 1.5 | 1.23 | 1.17 | 4.09 | 1.13 | 15.6 | 4.38 | 5.18 | 2.52 | 4.21 | 2.79 |
| Total | Hardness (As Caco3) | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Iron | µg/L | --- | 50000 | 16900 | 15500 | 15600 | 18300 | 49000 | 18300 | 17300 | 15500 | 20100 | 16200 | 12600 | 14900 |
| Total | Lead | µg/L | --- | 1000 | < 0.04 | 0.071 | 0.063 | 0.087 | 0.229 | 0.369 | 0.644 | 0.216 | 0.512 | 0.229 | 0.258 | 0.202 |
| Total | Lithium | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Magnesium | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Manganese | µg/L | --- | 5000 | 984 | 951 | 993 | 1070 | 1220 | 1040 | 2180 | 1020 | 1330 | 1130 | 1010 | 921 |
| Total | Mercury | µg/L | --- | 20 | < 0.0019 | < 0.0019 | < 0.0019 | < 0.0019 | < 0.019 | < 0.038 | < 0.038 | < 0.038 | < 0.038 | < 0.038 | < 0.019 | 0.0134 |
| Total | Molybdenum | µg/L | --- | 5000 | 0.75 | 0.81 | 0.857 | 0.74 | 0.94 | 0.67 | 2.23 | 0.798 | 1.25 | 0.864 | 0.76 | 0.76 |
| Total | Nickel | µg/L | --- | 3000 | 14.2 | 14.2 | 13.9 | 14.7 | 17.3 | 15.6 | 41 | 15.9 | 27.8 | 16.6 | 16.3 | 14.8 |
| Total | Phosphorus | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Potassium | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Selenium | µg/L | --- | 300 | 0.129 | 0.169 | 0.147 | 0.13 | 0.442 | 0.132 | 0.494 | 0.184 | 0.277 | 0.192 | 0.156 | 0.136 |
| Total | Silicon | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Silver | µg/L | --- | 500 | < 0.02 | < 0.02 | < 0.01 | < 0.02 | < 0.02 | < 0.02 | < 0.02 | < 0.01 | < 0.02 | < 0.01 | < 0.02 | < 0.02 |
| Total | Sodium | µg/L | --- | --- | 288 | 261 | 265 | 263 | 295 | 273 | 400 | 285 | 402 | 300 | 263 | 264 |
| 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 | < 2 | < 2 | 1.2 | < 2 | 4.4 | < 2 | 5.9 | 2 | 5 | 1.9 | 3.1 | 2.7 |
| Total | Zirconium | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **VOLATILE ORGANICS** | | | | | | | | | | | | | | | | |
| Dissolved | Benzene | µg/L | --- | 100 | < 0.4 | < 0.4 | < 0.4 | < 0.4 | < 0.4 | 1.2 | < 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 | 0.49 | < 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 | 0.44 | < 0.4 | < 0.4 | < 0.4 | < 0.4 | 0.47 | < 0.4 | < 0.4 | 0.47 | < 0.4 | < 0.4 |
| Dissolved | Xylenes | µg/L | --- | 200 | < 0.4 | < 0.4 | < 0.4 | < 0.4 | < 0.4 | < 0.4 | 0.42 | < 0.4 | < 0.4 | 0.42 | < 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*

# B8. Monthly Leachate Quality – Controlled Waste Drainage

| State | Parameter | Units | Sewer Use Criteria | | Controlled Waste Ditch | Controlled Waste Ditch | Controlled Waste Ditch | Controlled Waste Ditch | Controlled Waste Ditch | Controlled Waste Ditch | Controlled Waste Ditch | Controlled Waste Ditch | Controlled Waste Ditch | Controlled Waste Ditch | Controlled Waste Ditch | Controlled Waste Ditch |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | SS | SS | SS | SS | SS | SS | SS | SS | SS | SS | SS | SS |
| | | | min | max | 13-Apr-2023 | 25-May-2023 | 13-Jun-2023 | 24-Jul-2023 | 24-Aug-2023 | 21-Sep-2023 | 12-Oct-2023 | 9-Nov-2023 | 7-Dec-2023 | 24-Jan-2024 | 24-Feb-2024 | 14-Mar-2024 |
| **CONVENTIONALS** | | | | | | | | | | | | | | | | |
| Total | Alkalinity - Total - Ph 4.5 | mg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | BOD | mg/L | --- | 500 | 12 | 13 | 45 | 20 | Dry | Dry | 87 | 58 | 12 | 44 | 64 | 73 |
| Total | CBOD | mg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Dissolved | Chloride | mg/L | --- | 1500 | 460 | 510 | 550 | 640 | Dry | Dry | 280 | 430 | 180 | 260 | 270 | 340 |
| Total | COD | mg/L | --- | 1000 | 514 | 1450 a | 571 | 639 | Dry | Dry | 897 | 464 | 211 | 275 | 296 | 361 |
| Total | Conductivity | µS/cm | --- | --- | 4696 | 5672 | 5928 | 5621 | Dry | Dry | 6051 | 3548 | 2325 | 3245 | 1972 | 5126 |
| Total | Cyanide SAD | mg/L | --- | 1 | 0.0145 | 0.0171 | 0.0162 | 0.00217 | Dry | Dry | 0.0162 | 0.0114 | 0.0052 | 0.0088 | 0.006 | 0.0138 |
| Total | Cyanide WAD | mg/L | --- | 1 | 0.0074 | 0.0039 | < 0.0025 | < 0.0005 | Dry | Dry | < 0.0025 | 0.00181 | < 0.0025 | 0.0037 | < 0.0025 | 0.0056 |
| Total | Dissolved Oxygen | mg/L | --- | --- | 78.1 | 5.14 | 5.57 | 4.98 | Dry | Dry | 0.88 | 4.68 | 69.6 | 3.95 | 6.97 | 1.88 |
| Total | Fecal Coliforms | CFU/100 mL | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | N - NH3 (As N) | mg/L | --- | --- | 380 | 450 | 450 | 530 | Dry | Dry | 570 | 350 | 130 | 220 | 230 | 300 |
| Total | N - NO2 (As N) | mg/L | --- | --- | 3.77 | 2.25 | 2.49 | 3.43 | Dry | Dry | 10 | 7.35 | 1.24 | 1.22 | 4.69 | 4.16 |
| Total | N - NO3 (As N) | mg/L | --- | --- | 8.07 | 0.99 | 0.98 | 0.9 | Dry | Dry | 1.47 | 3.11 | 11.6 | 6.11 | 31 | 11.3 |
| 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 | Dry | Dry | < 2 | < 2 | < 2 | < 2 | < 2 | < 2 |
| Total | Oil & grease, total | mg/L | --- | 100 | < 1 | 1.3 | < 1 | 1.3 | Dry | Dry | < 1 | 1.3 | 1 | < 1 | < 1 | < 1 |
| Total | ORP | mV | --- | --- | -170.4 | 129.4 | 127.3 | 28.1 | Dry | Dry | 115.1 | 74.8 | 97.3 | 120.1 | 80.0 | 98.1 |
| Total | pH | pH | 5.5 | 11 | 8.43 | 8.33 | 8.35 | 8.12 | Dry | Dry | 8.65 | 8.42 | 8.47 | 7.45 | 8.29 | 7.81 |
| Dissolved | Sulphide | mg/L | 1 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Sulphide | mg/L | --- | 1 | 0.019 | 0.029 | < 0.03 | < 0.034 | | < | < 0.12 | 0.053 | 0.016 | 0.017 | < 0.0018 | < 0.0018 |
| Dissolved | Sulphate | mg/L | --- | 1500 | < 1 | < 1 | 4.7 | < 1 | Dry | Dry | < 1 | < 1 | 33 | 20 | 22 | < 1 |
| Total | Temperature | °C | --- | --- | 16.3 | 20.4 | 20.5 | 17.3 | Dry | Dry | 14.3 | 14.4 | 16.6 | 16.9 | 13.8 | 15.8 |
| Total | TOC | mg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Total Phenols | mg/L | --- | 1 | 0.5 | < 0.0075 | < 0.0075 | < 0.03 | Dry | Dry | < 0.0075 | < 0.0075 | 0.5 | 0.0078 | 0.0092 | 0.0098 |
| Total | TSS | mg/L | --- | 350 | 66 | 5.2 | 5.6 | 17 | Dry | Dry | 14 | 9.2 | 6 | 16 | 6.4 | 7.2 |
| **METALS** | | | | | | | | | | | | | | | | |
| Total | Aluminum | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Antimony | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| TOT | Arsenic | µg/L | --- | 400 | 4.17 | 5.01 | 5.13 | 5.84 | Dry | Dry | 12.7 | 3.88 | 2.42 | 3 | 2.5 | 3.21 |
| Total | Barium | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Beryllium | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Bismuth | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Boron | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| TOT | Cadmium | µg/L | --- | 300 | 0.036 | < 0.025 | < 0.01 | < 0.025 | Dry | Dry | 0.132 | 0.013 | 0.0409 | 0.0379 | 0.044 | 0.03 |
| Total | Calcium | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| TOT | Chromium | µg/L | --- | 4000 | 26.9 | 30.5 | 31.7 | 38.5 | Dry | Dry | 95.7 | 22.7 | 13.6 | 15.7 | 18.1 | 20.8 |
| Total | Chromium III | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Chromium Vi | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| TOT | Cobalt | µg/L | --- | 5000 | 19.3 | 16.5 | 18.7 | 23.6 | Dry | Dry | 27.2 | 15.6 | 9.85 | 11.4 | 11.3 | 13.1 |
| TOT | Copper | µg/L | --- | 1000 | 12.8 | 10.7 | 0.81 | < 0.5 | Dry | Dry | 13.3 | 3.7 | 13.6 | 9.41 | 11.2 | 5.58 |
| Total | Hardness (As Caco3) | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| TOT | Iron | µg/L | --- | 50000 | 1980 | 2580 | 2550 | 2800 | Dry | Dry | 48800 | 2020 | 1150 | 1540 | 1140 | 1190 |
| TOT | Lead | µg/L | --- | 1000 | 0.13 | < 0.1 | 0.116 | 0.11 | Dry | Dry | 2.67 | 0.088 | 0.34 | 0.124 | 0.236 | 0.153 |
| Total | Lithium | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Magnesium | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| TOT | Manganese | µg/L | --- | 5000 | 1020 | 268 | 383 | 132 | Dry | Dry | 2960 | 470 | 1070 | 1710 | 1180 | 1350 |
| TOT | Mercury | µg/L | --- | 20 | < 0.038 | < 0.0019 | < 0.038 | < 0.0019 | Dry | Dry | 0.038 | < 0.038 | < 0.038 | < 0.038 | < 0.019 | 0.0258 |
| TOT | Molybdenum | µg/L | --- | 5000 | 1.29 | 1.36 | 1.37 | 1.5 | Dry | Dry | 2.53 | 1.24 | 1.05 | 1.09 | 0.95 | 1.03 |
| TOT | Nickel | µg/L | --- | 3000 | 35.1 | 40.4 | 39.4 | 52.4 | Dry | Dry | 59.9 | 33.1 | 24.5 | 26.2 | 28.7 | 28.7 |
| Total | Phosphorus | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Potassium | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| TOT | Selenium | µg/L | --- | 300 | 0.61 | 0.49 | 0.492 | 0.58 | Dry | Dry | 0.854 | 0.464 | 0.348 | 0.352 | 0.315 | 0.308 |
| Total | Silicon | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| TOT | Silver | µg/L | --- | 500 | < 0.05 | < 0.05 | < 0.02 | < 0.05 | Dry | Dry | 0.04 | < 0.02 | 0.02 | 0.01 | < 0.02 | < 0.02 |
| TOT | Sodium | mg/L | --- | --- | 355 | 443 | 432 | 492 | Dry | Dry | 542 | 338 | 190 | 226 | 224 | 276 |
| 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 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| TOT | Zinc | µg/L | --- | 3000 | 43.9 | 27.7 | 14.3 | 23.3 | Dry | Dry | 1100 | 37.7 | 48.8 | 74 | 54.7 | 62.1 |
| Total | Zirconium | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **VOLATILE ORGANICS** | | | | | | | | | | | | | | | | |
| Dissolved | Benzene | µg/L | --- | 100 | < 0.4 | < 0.4 | < 0.4 | < 0.4 | Dry | Dry | < 0.4 | < 0.4 | < 0.4 | 0.64 | < 0.4 | < 0.4 |
| Dissolved | Ethylbenzene | µg/L | --- | 200 | < 0.4 | < 0.4 | < 0.4 | < 0.4 | Dry | Dry | < 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 | Dry | Dry | < 0.4 | < 0.4 | 0.88 | 1.5 | 0.52 | < 0.4 |
| Dissolved | Xylenes | µg/L | --- | 200 | < 0.4 | < 0.4 | < 0.4 | < 0.4 | Dry | Dry | < 0.4 | < 0.4 | < 0.4 | 0.78 | < 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 – Markham Valve Chamber

| State | Parameter | Units | Sewer Use Criteria | | South Purge Wells | South Purge Wells | South Purge Wells | South Purge Wells | South Purge Wells | South Purge Wells | South Purge Wells | South Purge Wells | South Purge Wells | South Purge Wells | South Purge Wells | South Purge Wells |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | SS | SS | SS | SS | SS | SS | SS | SS | SS | SS | SS | SS |
| | | | min | max | 13-Apr-2023 | 25-May-2023 | 13-Jun-2023 | 24-Jul-2023 | 24-Aug-2023 | 21-Sep-2023 | 12-Oct-2023 | 9-Nov-2023 | 7-Dec-2023 | 24-Jan-2024 | 24-Feb-2024 | 14-Mar-2024 |
| **CONVENTIONALS** | | | | | | | | | | | | | | | | |
| Total | Alkalinity - Total - Ph 4.5 | mg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | BOD | mg/L | --- | 500 | 3.1 | < 3 | < 2 | 5.1 | 9.9 | 9.6 | 11 | 7.1 | 5.2 | 2.1 | 2.8 | 4.5 |
| Total | CBOD | mg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Chloride | mg/L | --- | 1500 | 71 | 61 | 59 | 99 | 140 | 140 | 150 | 150 | 120 | 90 | 62 | 66 |
| Total | COD | mg/L | --- | 1000 | 56 | 61 | 42 | 65 | 87 | 110 | 101 | 108 | 73 | 69 | 45 | 50 |
| Total | Conductivity | µS/cm | --- | --- | 1138 | 1195 | 1191 | 1252 | 1508 | 1205 | 1656 | 1755 | 1393 | 1472 | 1087 | 976 |
| Total | Cyanide SAD | mg/L | --- | 1 | 0.00135 | 0.00078 | 0.00128 | 0.00163 | 0.00156 | 0.0016 | 0.00175 | 0.00227 | < 0.0005 | 0.00129 | < 0.0025 | 0.0074 |
| Total | Cyanide WAD | mg/L | --- | 1 | 0.00084 | 0.00082 | < 0.0005 | < 0.0005 | < 0.0005 | < 0.0005 | < 0.0005 | < 0.0005 | 0.00082 | 0.00055 | < 0.0025 | 0.0047 |
| Total | Dissolved Oxygen | mg/L | --- | --- | 6.17 | 3.9 | 4.09 | 4.44 | 8.12 | 3.98 | 3.07 | 5.08 | 49.4 | 2.01 | 29.7 | 2.88 |
| Total | Fecal Coliforms | CFU/100 mL | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | N - NH3 (As N) | mg/L | --- | --- | 41 | 35 | 33 | 43 | 65 | 67 | 63 | 62 | 50 | 47 | 32 | 33 |
| Total | N - NO2 (As N) | mg/L | --- | --- | 0.021 | < 0.02 | < 0.02 | < 0.02 | < 0.02 | < 0.02 | < 0.02 | 0.051 | 0.151 | 0.032 | < 0.02 | 0.025 |
| Total | N - NO3 (As N) | mg/L | --- | --- | 0.0057 | 0.0072 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | 0.0209 | < 0.005 | < 0.005 | < 0.005 |
| 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 | --- | --- | -103.3 | 80.2 | 530 | 59.1 | 20.1 | 57.3 | 76.5 | 69.7 | 58.9 | 110 | 44 | 65.3 |
| Total | pH | pH | 5.5 | 11 | 7.16 | 7.27 | 8.39 | 8.01 | 8.08 | 8.15 | 7.51 | 7.99 | 8.85 | 7.96 | 7.56 | 8.66 |
| Dissolved | Sulphide | mg/L | 1 | --- | | | | | | | 0.024 | --- | --- | | | |
| Total | Sulphide | mg/L | --- | 1 | < 0.0065 | 0.0064 | 0.0092 | 0.006 | 0.012 | 0.015 | 0.009 | 0.062 | 0.0091 | 0.0077 | 0.0086 | 0.0092 |
| Dissolved | Sulphate | mg/L | --- | 1500 | < 1 | 1.6 | < 1 | < 1 | < 1 | < 1 | < 1 | < 1 | 1.5 | < 1 | < 1 | < 1 |
| Total | Temperature | °C | --- | --- | 14.1 | 18.4 | 16.9 | 17.5 | 18.2 | 16.9 | 16.6 | 15.8 | 14.2 | 16.1 | 13.9 | 14.8 |
| Total | TOC | mg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Total Phenols | mg/L | --- | 1 | 0.5 | 0.0033 | 0.0026 | 0.0029 | < 0.5 | 0.0024 | < 0.0015 | < 0.0075 | < 0.5 | < 0.0075 | < 0.0075 | 0.0044 |
| Total | TSS | mg/L | --- | 350 | 16 | 38 | 36 | 43 | 35 | 31 | 48 | 45 | 30 | 58 | 38 | 65 |
| **METALS** | | | | | | | | | | | | | | | | |
| Total | Aluminum | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Antimony | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Arsenic | µg/L | --- | 400 | 3.32 | 3.11 | 2.66 | 6.47 | 7.44 | 7.07 | 5.23 | 5.69 | 4.35 | 3.62 | 5.27 | 4.58 |
| Total | Barium | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Beryllium | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Bismuth | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Boron | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Cadmium | µg/L | --- | 300 | 0.089 | 0.0421 | 0.0163 | 0.111 | 0.055 | < 0.01 | 0.087 | 0.035 | 0.057 | 0.157 | < 0.01 | 0.032 |
| Total | Calcium | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Chromium | µg/L | --- | 4000 | 0.77 | 1.35 | 0.51 | 0.98 | 0.77 | 0.75 | 1.06 | 0.93 | 0.88 | 0.91 | 0.5 | 0.56 |
| Total | Chromium III | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Chromium Vi | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Cobalt | µg/L | --- | 5000 | 1.74 | 1.8 | 1.16 | 1.94 | 2.36 | 2.42 | 2.61 | 2.62 | 2.56 | 2.43 | 1.22 | 1.28 |
| Total | Copper | µg/L | --- | 1000 | 0.77 | 2.65 | 0.3 | 1.6 | 0.68 | 0.23 | 0.8 | 0.45 | 1.63 | 2.35 | 0.39 | 0.47 |
| Total | Hardness (As Caco3) | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Iron | µg/L | --- | 50000 | 11100 | 14900 | 13000 | 15400 | 10400 | 9630 | 8520 | 10900 | 8090 | 11400 | 20700 | 19400 |
| Total | Lead | µg/L | --- | 1000 | 0.799 | 0.764 | 0.647 | 1.12 | 0.667 | 0.628 | 0.538 | 0.488 | 1.16 | 0.63 | 0.826 | 0.89 |
| Total | Lithium | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Magnesium | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Manganese | µg/L | --- | 5000 | 327 | 454 | 400 | 173 | 87.2 | 67.2 | 85.1 | 124 | 247 | 298 | 171 | 239 |
| Total | Mercury | µg/L | --- | 20 | < 0.0019 | < 0.0019 | 0.0019 | < 0.0019 | < 0.019 | < 0.0019 | < 0.0019 | < 0.038 | < 0.0019 | < 0.0019 | < 0.0019 | 0.0196 |
| Total | Molybdenum | µg/L | --- | 5000 | 6.18 | 5.54 | 5.07 | 13.4 | 16.6 | 15.6 | 13.9 | 12.3 | 10.5 | 7.01 | 6.65 | 7.47 |
| Total | Nickel | µg/L | --- | 3000 | 5.08 | 4.7 | 3.67 | 6.43 | 6.09 | 5.5 | 5.77 | 6.27 | 8.45 | 6 | 4.25 | 4.04 |
| Total | Phosphorus | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Potassium | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Selenium | µg/L | --- | 300 | < 0.08 | 0.088 | 0.057 | < 0.08 | 0.35 | < 0.08 | < 0.08 | 0.089 | 0.095 | 0.084 | < 0.08 | < 0.08 |
| Total | Silicon | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Silver | µg/L | --- | 500 | < 0.02 | < 0.01 | < 0.01 | < 0.02 | < 0.02 | < 0.02 | < 0.02 | < 0.02 | < 0.02 | < 0.02 | < 0.02 | < 0.02 |
| Total | Sodium | mg/L | --- | --- | 92.3 | 79.3 | 64.3 | 104 | 140 | 143 | 145 | 161 | 150 | 125 | 65.3 | 70.3 |
| 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 | 11.9 | 13.2 | 8.9 | 16.5 | 3.9 | 2.5 | 5.2 | 12.1 | 27.5 | 99.1 | 12.6 | 9.4 |
| Total | Zirconium | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **VOLATILE ORGANICS** | | | | | | | | | | | | | | | | |
| DISS | Benzene | µg/L | --- | 100 | < 0.4 | < 0.4 | < 0.4 | < 0.4 | 0.43 | 1.1 | < 0.4 | < 0.4 | < 0.4 | < 0.4 | < 0.4 | < 0.4 |
| DISS | 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 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| DISS | Toluene | 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 |
| DISS | Xylenes | 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 |

***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

**Hartland Landfill Groundwater, Surface Water and Leachate Monitoring Program Annual Report (Apr 2023 to Mar 2024)**
**Appendix B-10. Monthly Leachate Quality Data - West Face Drainage**

AECOM

| State | Parameter | Units | Sewer Use Criteria | | West Face Drainage | West Face Drainage | West Face Drainage | West Face Drainage | West Face Drainage | West Face Drainage | West Face Drainage | West Face Drainage | West Face Drainage | West Face Drainage | West Face Drainage | West Face Drainage |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | SS | SS | SS | SS | SS | SS | SS | SS | SS | SS | SS | SS |
| | | | min | max | 13-Apr-2023 | 25-May-2023 | 13-Jun-2023 | 24-Jul-2023 | 24-Aug-2023 | 21-Sep-2023 | 12-Oct-2023 | 9-Nov-2023 | 7-Dec-2023 | 24-Jan-2024 | 24-Feb-2024 | 14-Mar-2024 |
| **CONVENTIONALS** | | | | | | | | | | | | | | | | |
| Total | Alkalinity - Total - Ph 4.5 | mg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | BOD | mg/L | --- | 500 | 12 | Dry | 100 | Dry | Dry | Dry | 12 | 9.3 | 36 | 25 | 12 | 30 |
| Total | CBOD | mg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Dissolved | Chloride | mg/L | --- | 1500 | 1100 | Dry | 1300 | Dry | Dry | Dry | 200 | 120 | 230 | 190 | 350 | 220 |
| Total | COD | mg/L | --- | 1000 | 1750 a | Dry | 2000 a | Dry | Dry | Dry | 344 | 158 | 496 | 363 | 502 | 383 |
| Total | Conductivity | µS/cm | --- | --- | 12628 | Dry | 3371 | Dry | Dry | Dry | 2609 | 1200 | 3348 | 4271 | 12763 | 2632 |
| Total | Cyanide - SAD (total) | mg/L | --- | 1 | 0.051 | Dry | 0.066 | Dry | Dry | Dry | 0.0102 | 0.00683 | 0.0127 | 0.013 | 0.0094 | 0.0157 |
| Total | Cyanide - WAD | mg/L | --- | 1 | 0.027 | Dry | < 0.01 | Dry | < Dry | Dry | 0.0035 | < 0.0005 | 0.0041 | 0.0055 | < 0.0025 | 0.0087 |
| Total | Dissolved Oxygen | mg/L | --- | --- | 2.47 | Dry | 0.5 | Dry | Dry | Dry | 3.45 | 7.67 | 65.4 | 2.7 | 0.79 | 2.15 |
| Total | Fecal Coliforms | CFU/100 mL | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Ammonia | mg/L | --- | --- | 1200 | Dry | 1400 | Dry | Dry | Dry | 170 | 85 | 270 | 220 | 390 | 250 |
| Total | Nitrate | mg/L | --- | --- | < 2 | Dry | 3.01 | Dry | Dry | Dry | 12.5 | 28.2 | 23 | 14 | 18.1 | 17.3 |
| Total | Nitrite | mg/L | --- | --- | < 0.5 | Dry | 0.74 | Dry | Dry | Dry | 2 | 0.604 | 0.97 | 2.28 | 1.57 | 5.85 |
| 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 | Dry | < 2 | < Dry | < Dry | Dry | < 2 | < 2 | < 2 | < 2 | < 2 | < 2 |
| Total | Oil & Grease, Total | mg/L | --- | 100 | 1.3 | Dry | 1.4 | < Dry | < Dry | Dry | 1.6 | < 1 | 1.6 | < 1 | 2.4 | 1.5 |
| Total | ORP | mV | --- | --- | -219 | Dry | 112.6 | Dry | Dry | Dry | 89.1 | 66.9 | 86.3 | 107.1 | 181 | 136.3 |
| Total | pH | pH | 5.5 | 11 | 7.95 | Dry | 7.28 | Dry | Dry | Dry | 8.08 | 8.13 | 8.1 | 7.2 | 8.09 | 8.23 |
| Dissolved | Sulphide | mg/L | 1 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Total Sulphide | mg/L | --- | 1 | < 0.007 | < Dry | 0.18 | < Dry | < Dry | Dry | 0.038 | 0.13 | 0.1 | 0.024 | < 0.036 | 0.014 |
| Dissolved | Sulphate | mg/L | --- | 1500 | 100 | Dry | 78 | < Dry | Dry | Dry | 130 | 240 | 260 | 250 | 260 | 260 |
| Total | Temperature | °C | --- | --- | 24.1 | Dry | 18 | Dry | Dry | Dry | 17.3 | 13.5 | 14.2 | 16.7 | 17.2 | 18.2 |
| Total | TOC | mg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Phenols | mg/L | --- | 1 | 0.5 | Dry | 0.087 | Dry | < Dry | Dry | < 0.5 | < 0.0075 | 0.026 | 0.012 | 0.5 | 0.012 |
| Total | TSS | mg/L | --- | 350 | 21 | Dry | 21 | Dry | Dry | Dry | 36 | 8 | 36 | 17 | 98 | 18 |
| **METALS** | | | | | | | | | | | | | | | | |
| Total | Aluminum | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Antimony | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Arsenic | µg/L | --- | 400 | 38.1 | Dry | 41.4 | Dry | Dry | Dry | 4.83 | 1.6 | 7.9 | 5.5 | 8.09 | 5.48 |
| Total | Barium | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Beryllium | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Bismuth | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Boron | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Cadmium | µg/L | --- | 300 | 0.315 | Dry | 0.333 | Dry | Dry | Dry | 0.0417 | 0.0174 | 0.07 | 0.0524 | 0.088 | 0.046 |
| Total | Calcium | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Chromium | µg/L | --- | 4000 | 191 | Dry | 216 | Dry | Dry | Dry | 35.8 | 10.6 | 64.4 | 31.5 | 56.1 | 37.5 |
| Total | Chromium III | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Chromium Vi | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Cobalt | µg/L | --- | 5000 | 41.2 | Dry | 48.1 | Dry | Dry | Dry | 9.14 | 3.26 | 13.7 | 9.33 | 16.7 | 9.97 |
| Total | Copper | µg/L | --- | 1000 | 45.4 | Dry | 48.4 | Dry | Dry | Dry | 11 | 5.89 | 10.8 | 16.2 | 22 | 11.9 |
| Total | Hardness (As Caco3) | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Iron | µg/L | --- | 50000 | 2900 | Dry | 3650 | Dry | Dry | Dry | 935 | 509 | 1370 | 698 | 1110 | 778 |
| Total | Lead | µg/L | --- | 1000 | 3.92 | Dry | 4.43 | Dry | Dry | Dry | 0.497 | 0.197 | 1.05 | 0.626 | 1.15 | 0.79 |
| Total | Lithium | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Magnesium | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Manganese | µg/L | --- | 5000 | 291 | Dry | 297 | Dry | Dry | Dry | 160 | 112 | 246 | 205 | 316 | 199 |
| Total | Mercury | µg/L | --- | 20 | 0.039 | Dry | < 0.038 | < Dry | < Dry | Dry | < 0.038 | < 0.038 | < 0.038 | < 0.038 | < 0.019 | 0.0326 |
| Total | Molybdenum | µg/L | --- | 5000 | 3.21 | Dry | 2.05 | Dry | Dry | Dry | 3.36 | 3.27 | 4.29 | 2.39 | 2.52 | 2.35 |
| Total | Nickel | µg/L | --- | 3000 | 121 | Dry | 141 | Dry | Dry | Dry | 26.5 | 9.59 | 42.8 | 26.7 | 46.2 | 28.2 |
| Total | Phosphorus | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Potassium | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Selenium | µg/L | --- | 300 | 0.92 | Dry | 1.02 | Dry | Dry | Dry | 0.498 | 1.7 | 2.45 | 0.988 | 0.89 | 0.624 |
| Total | Sodium | mg/L | --- | --- | 874 | Dry | 443 | Dry | Dry | Dry | 171 | 59.6 | 277 | 175 | 280 | 181 |
| Total | Silver | µg/L | --- | 500 | < 0.1 | Dry | < 0.05 | < Dry | < Dry | Dry | < 0.01 | < 0.01 | < 0.02 | < 0.01 | < 0.02 | < 0.02 |
| Total | Sodium | µg/L | --- | --- | 874 | Dry | 443 | Dry | Dry | Dry | 171 | 59.6 | 277 | 175 | 280 | 181 |
| 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 | 85 | Dry | 83.9 | Dry | Dry | Dry | 7 | 4.7 | 21.7 | 11.5 | 17.7 | 18.9 |
| Total | Zirconium | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **VOLATILE ORGANICS** | | | | | | | | | | | | | | | | |
| Total | Benzene | µg/L | --- | 100 | 1.6 | Dry | 0.63 | < Dry | < Dry | Dry | 0.44 | < 0.4 | 0.89 | 0.69 | 0.74 | 0.49 |
| Total | Ethylbenzene | AH µg/L | --- | 200 | 3.5 | Dry | 0.64 | < Dry | < Dry | Dry | < 0.4 | < 0.4 | 1.8 | 1.7 | 1.3 | 0.9 |
| 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 | 2.4 | Dry | 1.2 | Dry | Dry | Dry | 0.69 | 0.65 | 3.8 | 2.6 | 1.2 | 0.86 |
| Total | Xylenes | µg/L | --- | 200 | 13 | Dry | 6.2 | < Dry | < Dry | Dry | < 0.4 | < 0.4 | 3.7 | 3.9 | 3 | 2.5 |

***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.*
** - 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

# Hartland Landfill Groundwater, Surface Water and Leachate Monitoring Program Annual Report (Apr 2023 to Mar 2024)
## Appendix B-11. Monthly Leachate Quality Data - Cell 3 Pipe Outlet

AECOM

| State | Parameter | Units | Sewer Use Criteria | | Cell 3 Pipe Outlet | Cell 3 Pipe Outlet | Cell 3 Pipe Outlet | Cell 3 Pipe Outlet | Cell 3 Pipe Outlet | Cell 3 Pipe Outlet | Cell 3 Pipe Outlet | Cell 3 Pipe Outlet | Cell 3 Pipe Outlet | Cell 3 Pipe Outlet | Cell 3 Pipe Outlet | Cell 3 Pipe Outlet |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | SS | SS | SS | SS | SS | Dry No Sample | Dry No Sample | SS | SS | SS | SS | SS |
| | | | min | max | 13-Apr-2023 | 25-May-2023 | 13-Jun-2023 | 24-Jul-2023 | 24-Aug-2023 | 21-Sep-2023 | 12-Oct-2023 | 9-Nov-2023 | 7-Dec-2023 | 24-Jan-2024 | 24-Feb-2024 | 14-Mar-2024 |
| **CONVENTIONALS** | | | | | | | | | | | | | | | | |
| Total | Alkalinity - Total - Ph 4.5 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | BOD | mg/L | --- | 500 | 12 | < 75 | 70 | Dry | Dry | Dry | Dry | 12 | 130 | 150 | 140 | 12 |
| Total | CBOD | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Dissolved | Chloride | mg/L | --- | 1500 | 780 | 920 | 950 | Dry | Dry | Dry | Dry | 910 | 670 | 810 | 780 | 990 |
| Total | COD | mg/L | --- | 1000 | 1220 a | 1440 a | 1290 a | Dry | Dry | Dry | Dry | 2340 a | 2050 a | 2750 a | 2140 a | 2870 a |
| Total | Conductivity | µS/cm | --- | --- | 6270 | 7945 | 7708 | Dry | Dry | Dry | Dry | 3482 | 8847 | 36712 | 37944 | 12637 |
| Total | Cyanide - SAD (total) | mg/L | --- | 1 | 0.069 | 0.079 | 0.082 | Dry | Dry | Dry | Dry | 0.0441 | 0.0372 | 0.0393 | 0.0358 | 0.0342 |
| Total | Cyanide - WAD | mg/L | --- | 1 | 0.037 | 0.021 | 0.03 | Dry | < Dry | Dry | Dry | 0.0121 | 0.0109 | 0.0111 | 0.0067 | 0.0094 |
| Total | Dissolved Oxygen | mg/L | --- | --- | 3.03 | 1.79 | 2.58 | Dry | Dry | Dry | Dry | 5.45 | 17.7 | 1.34 | 1.88 | 0.69 |
| Total | N - NH3 (As N) | mg/L | --- | --- | 570 | 570 | 580 | Dry | Dry | Dry | Dry | 860 | 780 | 920 | 880 | 1000 |
| Total | N - NO2 (As N) | mg/L | --- | --- | 41.8 | 101 | 101 | Dry | Dry | Dry | Dry | 29.9 | 2.78 | 0.15 | 1.22 | 0.39 |
| Total | N - NO3 (As N) | mg/L | --- | --- | 69.2 | 116 | 101 | Dry | Dry | Dry | Dry | 48.3 | 12.7 | 2.26 | 18.1 | 2.4 |
| Total | N - No3 + No2 (As N) | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | N - Tkn (As N) | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | N - Total (As N) | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Oil & Grease, Mineral | mg/L | --- | 15 | < 2 | < 2 | < 2 | < Dry | < Dry | Dry | Dry | 6 | < 2 | 3.4 | < 2 | < 2 |
| Total | Oil & Grease, Total | mg/L | --- | 100 | 1.4 | 2.9 | < 1 | < Dry | < Dry | Dry | Dry | 69 | 3.5 | 12 | 1.5 | 4.8 |
| Total | ORP | mV | --- | --- | -136.7 | 128.6 | 97.9 | Dry | Dry | Dry | Dry | 75.3 | 116.3 | 118.1 | 65 | 145.2 |
| Total | pH | pH | 5.5 | 11 | 8.82 | 8.4 | 9.7 | Dry | Dry | Dry | Dry | 8.52 | 8.43 | 7.84 | 8.89 | 8.91 |
| Total | Sulphide | --- | --- | 1 | --- | --- | --- | | --- | --- | --- | --- | --- | --- | --- | --- |
| Dissolved | Total Sulphide | mg/L | --- | 1 | < 0.029 | < 0.014 | 0.18 | < Dry | < Dry | Dry | Dry | 0.13 | < 0.0018 | 0.09 | < 0.036 | < 0.09 |
| Total | Sulphate | mg/L | --- | 1500 | 73 | 120 | 110 | < Dry | Dry | Dry | Dry | 300 | 62 | 46 | 28 | 42 |
| Dissolved | Temperature | °C | --- | --- | 14.9 | 20 | 18.5 | Dry | Dry | Dry | Dry | 16.2 | 20 | 18.9 | 17.5 | 22.3 |
| Total | TOC | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Phenols | mg/L | --- | 1 | < 0.5 | 0.03 | 0.0094 | Dry | < Dry | Dry | Dry | 0.5 | 0.094 | 0.11 | 0.081 | 0.5 |
| Total | TSS | mg/L | --- | 350 | 19 | 46 | 44 | Dry | Dry | Dry | Dry | 43 | 57 | 39 | 44 | 64 |
| Total | Fecal Coliforms | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **METALS** | | | | | | | | | | | | | | | | |
| Total | Aluminum | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Antimony | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Arsenic | µg/L | --- | 400 | 37.9 | 53.8 | 42 | Dry | Dry | Dry | Dry | 38.3 | 47.9 | 50.2 | 42.1 | 46.9 |
| Total | Barium | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Beryllium | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Bismuth | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Boron | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Cadmium | µg/L | --- | 300 | 0.267 | 0.373 | 0.316 | Dry | Dry | Dry | Dry | 0.238 | 0.235 | 0.199 | 0.182 | 0.216 |
| Total | Calcium | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Chromium | µg/L | --- | 4000 | 187 | 227 | 171 | Dry | Dry | Dry | Dry | 167 | 264 | 194 | 192 | 250 |
| Total | Chromium III | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Chromium Vi | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Cobalt | µg/L | --- | 5000 | 39.5 | 52.3 | 40.2 | Dry | Dry | Dry | Dry | 42.7 | 45.6 | 35.1 | 36.8 | 37.1 |
| Total | Copper | µg/L | --- | 1000 | 68.6 | 115 | 92.7 | Dry | Dry | Dry | Dry | 90 | 63.4 | 25.8 | 46.6 | 23.5 |
| Total | Hardness (As Caco3) | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Iron | µg/L | --- | 50000 | 2330 | 3620 | 3100 | Dry | Dry | Dry | Dry | 2250 | 3950 | 2880 | 2590 | 3440 |
| Total | Lead | µg/L | --- | 1000 | 2.37 | 3.41 | 2.82 | Dry | Dry | Dry | Dry | 5.6 | 3.93 | 3.63 | 5.95 | 4.37 |
| Total | Lithium | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Magnesium | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Manganese | µg/L | --- | 5000 | 287 | 356 | 285 | Dry | Dry | Dry | Dry | 918 | 752 | 498 | 628 | 461 |
| Total | Mercury | µg/L | --- | 20 | 0.038 | 0.0147 | 0.056 | < Dry | < Dry | Dry | Dry | 0.046 | < 0.038 | < 0.038 | < 0.038 | 0.0547 |
| Total | Molybdenum | µg/L | --- | 5000 | 3.78 | 5.12 | 3.88 | Dry | Dry | Dry | Dry | 3.96 | 4.87 | 1.3 | 1.12 | 2.02 |
| Total | Nickel | µg/L | --- | 3000 | 98.2 | 127 | 104 | Dry | Dry | Dry | Dry | 93.8 | 121 | 94.5 | 101 | 105 |
| Total | Phosphorus | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Potassium | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Selenium | µg/L | --- | 300 | 1.44 | 1.67 | 1.34 | Dry | Dry | Dry | Dry | 1.49 | 1.37 | 0.97 | 1.02 | 0.95 |
| Total | Silicon | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total | Silver | µg/L | --- | 500 | 0.053 | < 0.05 | < 0.05 | < Dry | < Dry | Dry | Dry | 0.07 | 0.071 | < 0.05 | < 0.05 | < 0.1 |
| Total | Sodium | mg/L | --- | --- | 639 | 832 | 676 | Dry | Dry | Dry | Dry | 562 | 756 | 728 | 713 | 806 |
| 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 | 54.6 | 71.7 | 63.8 | Dry | Dry | Dry | Dry | 50.2 | 82.7 | 81 | 82.3 | 94 |
| Total | Zirconium | µg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **VOLATILE ORGANICS** | | | | | | | | | | | | | | | | |
| Dissolved | Benzene | µg/L | --- | 100 | < 0.4 | < 0.4 | < 0.4 | < Dry | < Dry | Dry | Dry | 0.88 | 1.6 | 1.3 | 0.62 | 0.67 |
| Dissolved | Ethylbenzene | µg/L | --- | 200 | < 0.4 | < 0.4 | < 0.4 | < Dry | < Dry | Dry | Dry | 2.7 | 6.3 | 5 | 2.3 | 2.7 |
| 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 | 0.65 | 0.51 | Dry | Dry | Dry | Dry | 5.5 | 16 | 14 | 3.7 | 7.3 |
| Dissolved | Xylenes | µg/L | --- | 200 | < 0.4 | < 0.4 | < 0.4 | < Dry | < Dry | Dry | Dry | 6.4 | 17 | 14 | 6.5 | 9.5 |

***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.*

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

*SS - Single sample*

*NS - Not sampled*

# 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

# Hartland Landfill Groundwater, Surface Water and Leachate Monitoring Program Annual Report (Apr 2023 to Mar 2024)

## 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 | 2023 | 2024 |
| 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 | 0 | 0 |
| 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 | 0 | 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 | 0.75 | 0.75 |
| 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 | 0 | 0 |
| 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 | 0.25 | 0.25 |
| 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 | 0.5 | 0.5 |
| 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 | 0 | 0 |
| 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 | 0 | 0 |
| 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 | 0 | 0 |
| 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 | 0 | 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 | 1.5 | 1.5 |
| 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 | 17 | 17 |
| 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 | 3.25 | 3.25 |
| 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 | 0 | 0 |
| 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 | 5.5 | 5.5 |
| 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 | 0 | 0 |
| 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 | 2.25 | 2.25 |
| 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 | 1.5 | 1.5 |
| 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 | 0 | 0 |
| 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 | 0 | 0 |
| 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 | 2.25 | 2.25 |
| 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 | 0.25 | 0.25 |
| 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 | 2 | 2 |
| 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 | 2 | 2 |
| 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 | 0.25 | 0.25 |
| 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 | 1.5 | 1.5 |
| 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 | 0.5 | 0.5 |
| 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 | 0 | 0 |
| 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 | 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 | 0 | 0 |
| 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 | 4 | 4 |
| ***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*** | ***160.75*** | ***114.5*** | ***26*** | ***153.5*** | ***158.75*** | ***166.5*** | ***194.5*** | ***149.5*** | ***45.25*** | ***45.25*** |
| ***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*** | ***17*** | ***17*** |

**Hartland Landfill Groundwater, Surface Water and Leachate Monitoring Program Annual Report**
**(Apr 2023 to Mar 2024)**
**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 | 2023 | 2024 |
| 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 | 1.5 | 1.5 |
| 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 | 0 | 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 | 4.25 | 4.25 |
| 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 | 2.5 | 2.5 |
| 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 | 2 | 2 |
| 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 | 11.5 | 11.5 |
| 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 | 27.25 | 27.25 |
| 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 | 0.5 | 0.5 |
| 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 | 5.75 | 5.75 |
| 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 | 1.25 | 1.25 |
| 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 | 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 | 2 | 2 |
| 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 | 8 | 8 |
| 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 | 0 | 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 | 0 | 0 |
| 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 | 2.25 | 2.25 |
| 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 | 1.75 | 1.75 |
| 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 | 0.5 | 0.5 |
| 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 | 0 | 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 | 1.25 | 1.25 |
| 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 | 2.25 | 2.25 |
| 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 | 0 | 0 |
| 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 | 0 | 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 | 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 | 0 | 0 |
| 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 | 9 | 9 |
| 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 | 1 | 1 |
| 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 | 14.5 | 14.5 |
| 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 | | | | 3.25 | | | | 1 | | | | |
| ***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*** | ***172.8*** | ***50.0*** | ***70.0*** | ***39.3*** | ***129.0*** | ***104.8*** | ***56.0*** | ***99.0*** | ***99.0*** |
| ***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*** | ***14.75*** | ***20.75*** | ***11.25*** | ***24.25*** | ***22*** | ***31.75*** | ***27.25*** | ***27.25*** |

# Hartland Landfill Groundwater, Surface Water and Leachate Monitoring Program Annual Report
# (Apr 2023 to Mar 2024)
## 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 | 2023 | 2024 |
| 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 | 0.25 | 0.25 |
| 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 | 10 | 10 |
| 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 | 3.5 | 3.5 |
| 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 | 3.5 | 3.5 |
| 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 | 0.25 | 0.25 |
| 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 | 0.25 | 0.25 |
| 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 | 0 | 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 | 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 | 0 | 0 |
| 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 | 1.25 | 1.25 |
| 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 | 0.75 | 0.75 |
| 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 | 15.25 | 15.25 |
| 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 | 3.25 | 3.25 |
| 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 | 0.5 | 0.5 |
| 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 | 0 | 0 |
| 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 | 0 | 0 |
| 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 | 0 | 0 |
| 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 | 0 | 0 |
| 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 | 0 | 0 |
| 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 | 4.75 | 4.75 |
| 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 | 0.25 | 0.25 |
| 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 | 0 | 0 |
| 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 | 0.5 | 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 | 19.5 | 19.5 |
| 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 | 1.5 | 1.5 |
| 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 | 0.5 | 0.5 |
| 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 | 0 | 0 |
| 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 | 0 | 0 |
| 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 | 0 | 0 |
| 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 | 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 | 4.25 | 4.25 |
| ***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*** | ***70*** | ***70*** |
| ***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*** | ***19.5*** | ***19.5*** |

**Hartland Landfill Groundwater, Surface Water and Leachate Monitoring Program Annual Report**
**(Apr 2023 to Mar 2024)**
**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 | 2023 | 2024 |
| 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 | 0.25 | 4.25 | |
| 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 | 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 | 18.3 | 4.8 | |
| 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 | 30.00 | 10.00 | |
| 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 | 18.8 | 1 | 0 | 0 | 3 | 3 | |
| 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 | 0.00 | 0.25 | |
| 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 | 0.00 | 1.00 | |
| 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 | 11.8 | 11.5 | 0 | 5 | 2 | 1 | |
| 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 | 2 | 2 | |
| 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 | 26 | 5 | |
| 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 | 0.5 | 0.0 | |
| 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 | 2.50 | 5.00 | |
| 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 | 0.50 | 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 | 0.00 | 1.00 | |
| 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 | 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 | 0.00 | 0.50 | |
| 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 | 12.3 | 0 | 0 | 0 | 0 | 2 | |
| 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 | 0.5 | 11.25 | 0 | 0 | 1 | 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 | 1 | 3 | |
| 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 | 1.75 | 3.25 | |
| 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 | 1.3 | 7.3 | |
| 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 | 1.5 | 3.25 | 17 | 0 | 3 | 1 | |
| 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 | 0 | 6 | |
| 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 | 3 | 2 | |
| 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 | 4 | 1 | |
| 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 | 1.00 | 0.00 | |
| 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 | 6 | 2 | |
| 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 | 0.00 | 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 | 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 | 0.3 | 0 | 0 | 0 | 12 | 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*** | ***14*** | ***90.75*** | ***108*** | ***54.25*** | ***32.75*** | ***37.25*** | ***118*** | ***64.25*** | |
| ***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*** | ***11.50*** | ***4.75*** | ***20.50*** | ***24.50*** | ***11.50*** | ***16.75*** | ***12.75*** | ***30*** | ***10*** | |

## 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 | 2023 | 2024 |
| 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 | 0 | 0 | |
| 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 | 1.5 | 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 | 0.25 | 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 | 1 | 0 | |
| 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 | 9.25 | 0.25 | |
| 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 | 0 | 12.75 | |
| 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 | 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 | 1.25 | 0 | |
| 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 | 0.25 | 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 | 0 | 0 | |
| 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 | 0 | 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 | 3 | 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 | 0 | 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 | 2.5 | 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 | 14.25 | 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 | 1 | 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 | 0 | 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 | 5 | 0 | |
| 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 | 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 | 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 | 0 | 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 | 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 | 0 | 2.25 | |
| 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 | 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 | 0.5 | 0 | |
| 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 | 6.25 | 0 | |
| 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 | 3.5 | 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 | 0.5 | 0 | |
| 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 | 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 | 0.25 | 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 | 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*** | ***50.25*** | ***15.25*** | |
| ***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*** | ***14.25*** | ***12.75*** | |

## 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 | 2023 | 2024 |
| 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 | 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 | 0 | 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 | 4.5 | 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 | 6 | 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 | 0.25 | 0 | |
| 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 | 0 | 0 | |
| 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 | 0.25 | 0 | |
| 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 | 0 | 0 | |
| 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 | 24.75 | 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 | 0.25 | 5.5 | |
| 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 | 0 | 22 | |
| 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 | 1 | 0 | |
| 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 | 0.25 | 0 | |
| 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 | 0 | 0 | |
| 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 | 0.5 | 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 | 7.25 | 0 | |
| 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 | 0.25 | 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 | 1.25 | 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 | 0 | 0.5 | |
| 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 | 0 | 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 | 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 | 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 | 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 | 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 | 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 | 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 | 0 | 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 | 0 | 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 | 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 | 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*** | ***46.5*** | ***28*** | |
| ***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*** | ***24.75*** | ***22*** | |

# Hartland Landfill Groundwater, Surface Water and Leachate Monitoring Program Annual Report
# (Apr 2023 to Mar 2024)
## 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 | 2023 | 2024 |
| 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 | 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 | 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 | 16.5 | 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 | 1.75 | 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 | 0.25 | 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 | 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 | 2.25 | 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 | 0 | 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 | 0 | 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 | 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 | 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 | 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 | 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 | 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 | 0.25 | 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 | 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 | 0.25 | 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 | 0.25 | 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 | 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 | 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 | 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 | 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 | 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 | 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 | 0 | 13.25 | |
| 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 | 0 | 0.25 | |
| 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 | 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 | 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 | 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 | 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 | 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*** | ***21.5*** | ***13.5*** | |
| ***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*** | ***16.5*** | ***13.25*** | |

# Hartland Landfill Groundwater, Surface Water and Leachate Monitoring Program Annual Report (Apr 2023 to Mar 2024)

## 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 | 2023 | 2024 |
| 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 | 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 | 0 | 0 | |
| August | 3 | 0 | 0 | 0.2 | 0 | 13.6 | 0 | 0 | 0.4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2.75 | 0 | 0 | 0 | 0 | 0 | 1.25 | 0 | 0 | 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 | 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 | 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 | 0 | 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 | 0.31 | 0.00 | |
| 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 | 1.19 | 0.00 | |
| 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 | 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 | 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 | 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 | 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 | 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 | 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 | 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 | 0 | 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 | 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 | 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 | 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 | 0 | 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 | 0 | 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 | 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 | 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 | 0 | 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 | 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 | 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 | 0.44 | 0.00 | |
| 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 | 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 | 0 | 2.5 | |
| 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 | 0 | 2.5 | |
| 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 | 0 | 1.25 | |
| ***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*** | ***1.94*** | ***6.25*** | |
| ***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*** | ***1.19*** | ***2.50*** | |

## 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 | 2023 | 2024 |
| 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 | 0 | 2 | |
| 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 | 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 | 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 | 1 | 4.25 | |
| 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 | 0 | 0 | |
| 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 | 0 | 0 | |
| 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 | 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 | 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 | 0 | 0 | |
| 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 | 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 | 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 | 0 | 0 | |
| 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 | 0 | 0 | |
| 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 | 0 | 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 | 0 | 0 | |
| 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 | 0 | 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 | 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 | 0 | 0 | |
| 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 | 0 | 0 | |
| 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 | 0 | 0.5 | |
| 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 | 0 | 1 | |
| 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 | 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 | 0 | 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 | 0 | 1.25 | |
| 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 | 0 | 2.25 | |
| 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 | 0 | 1.25 | |
| 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 | 0 | 1.5 | |
| 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 | 0.25 | 3 | |
| 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 | 0 | 1.25 | |
| 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 | 0 | 0 | |
| ***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*** | ***1.25*** | ***18.25*** | |
| ***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*** | ***1*** | ***4.25*** | |

**Hartland Landfill Groundwater, Surface Water and Leachate Monitoring Program Annual Report**
**(Apr 2023 to Mar 2024)**
**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 | 2023 | 2024 |
| 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 | 0 | 0 | |
| 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 | 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 | 0 | 17.75 | |
| 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 | 0 | 0.25 | |
| 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 | 0 | 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 | 0 | 0 | |
| 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 | 0 | 0 | |
| 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 | 0 | 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 | 0 | 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 | 0 | 3 | |
| 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 | 0 | 2.75 | |
| 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 | 5 | 2.25 | |
| 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 | 0 | 0.25 | |
| 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 | 19.75 | 1 | |
| 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 | 0 | 1 | |
| 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 | 0 | 4 | |
| 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 | 0 | 4.5 | |
| 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 | 0 | 16.5 | |
| 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 | 0 | 11.5 | |
| 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 | 0 | 0.25 | |
| 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 | 3.5 | 0 | |
| 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 | 0 | 0 | |
| 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 | 2.75 | 0 | |
| 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 | 7.75 | 0 | |
| 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 | 5.5 | 56 | |
| 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 | 0.75 | 16 | |
| 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 | 21.75 | 0 | |
| 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 | 4.25 | 0 | |
| 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 | 0.25 | 0 | |
| 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 | 37 | 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 | 3.75 | 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*** | ***112*** | ***137*** | |
| ***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*** | ***21.75*** | ***56*** | |

## 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 | 2023 | 2024 |
| 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 | 0.25 | 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 | 13.5 | 12.75 | |
| 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 | 22.75 | 32.75 | |
| 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 | 8 | 7.75 | |
| 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 | 0 | 20 | |
| 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 | 7.75 | 1.25 | |
| 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 | 4.25 | 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 | 3.25 | 0 | |
| 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 | 0 | 0.5 | |
| 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 | 0 | 3 | |
| 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 | 0.25 | 9.75 | |
| 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 | 0 | 20.75 | |
| 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 | 0 | 6.75 | |
| 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 | 0 | 0.75 | |
| 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 | 0.25 | 0.25 | |
| 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 | 0.5 | 1 | |
| 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 | 0 | 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 | 0 | 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 | 0 | 4.5 | |
| 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 | 0.75 | 1 | |
| 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 | 0 | 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 | 17.75 | 8.5 | |
| 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 | 0 | 0.5 | |
| 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 | 0 | 0 | |
| 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 | 5.75 | 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 | 10 | 0 | |
| 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 | 0 | 0.5 | |
| 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 | 0 | 0 | |
| 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 | 15.25 | 0 | |
| 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 | 6.5 | 0 | |
| ***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*** | ***116.75*** | ***135.5*** | |
| ***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*** | ***22.75*** | ***32.75*** | |

## 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 | 2023 | 2024 |
| 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 | 0 | 1.25 | |
| 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 | 3.5 | 8.25 | |
| 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 | 10 | 13.75 | |
| 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 | 0 | 9 | |
| 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 | 0.25 | 47.25 | |
| 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 | 5.25 | 6.75 | |
| 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 | 0.25 | 0.25 | |
| 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 | 7.75 | 4.75 | |
| 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 | 2 | 0 | |
| 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 | 3 | 33.75 | |
| 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 | 0 | 8 | |
| 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 | 0 | 0.5 | |
| 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 | 0 | 0 | |
| 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 | 0 | 0 | |
| 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 | 0 | 2.75 | |
| 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 | 0 | 3.75 | |
| 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 | 1.75 | 0.25 | |
| 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 | 0 | 0.25 | |
| 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 | 0 | 3.5 | |
| 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 | 0.25 | 3.75 | |
| 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 | 0 | 0.25 | |
| 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 | 0 | 1 | |
| 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 | 8.25 | 1.25 | |
| 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 | 44.75 | 0 | |
| 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 | 9.25 | 0 | |
| 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 | 26.75 | 3.75 | |
| 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 | 10.5 | 0.5 | |
| 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 | 0.75 | 0.25 | |
| 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 | 5 | 1.25 | |
| 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 | 13 | 0.25 | |
| 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 | 2.75 | 0.5 | |
| ***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*** | ***155*** | ***156.75*** | |
| ***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*** | ***44.75*** | ***47.25*** | |

# C2. Monthly Rainfall Data – Hartland Landfill Weather Station

**Hartland Landfill Groundwater, Surface Water and Leachate Monitoring Program Annual Report**
**(Apr 2023 to Mar 2024)**
**Appendix C-2. Monthly Rainfall Data: Hartland Landfill Weather Station**

AECOM

| Month | Monthly Rainfall (mm) | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | Avg |
| January | 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 | 45.3 | 206.0 | 152.3 |
| February | 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 | 99.0 | 117.3 | 87.8 |
| March | 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 | 70.0 | 64.0 | 93.6 |
| April | 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 | 118.0 | 64.3 | 43.5 | 54.8 |
| May | 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 | 50.3 | 15.3 | | 35.4 |
| June | 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 | 46.5 | 28.0 | | 25.4 |
| July | 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 | 21.5 | 13.5 | | 14.2 |
| August | 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 | 1.9 | 6.3 | | 16.8 |
| September | 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 | 1.3 | 18.3 | | 45.4 |
| October | 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 | 112.0 | 137.0 | | 108.3 |
| November | 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 | 116.8 | 135.5 | | 172.7 |
| December | 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 | 155.0 | 156.8 | | 151.7 |
| ***Total Yearly Rainfall*** | ***1211*** | ***919*** | ***703*** | ***1278*** | ***1238*** | ***807*** | ***1100*** | ***887*** | ***941*** | ***1052*** | ***589*** | ***929*** | ***1127*** | ***858*** | ***709*** | ***1031*** | ***552*** | ***1128*** | ***1298*** | ***946*** | ***789*** | ***431*** | ***958*** |

***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

| 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 |

AECOM

| 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 |

| 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 |

| 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 |

| 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 |

| 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 |

| 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 |

| 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 |

| 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** | 4 | 3539 | 0 | 1880.00 | 56406 |
| **May-2022** | 10 | 6914 | 0 | 1538.00 | 47688 |
| **Jun-2022** | 20 | 5661 | 0 | 854.00 | 25631 |
| **Jul-2022** | 14 | 5058 | 0 | 1293.00 | 41368 |
| **Aug-2022** | 8 | 4974 | 0 | 716.00 | 22212 |
| **Sep-2022** | 0 | 6619 | 3 | 1266.00 | 38006 |
| **Oct-2022** | 1 | 2454 | 0 | 578.00 | 17933 |
| **Nov-2022** | 5 | 4306 | 0 | 1052.00 | 31578 |
| **Dec-2022** | 2 | 6489 | 0 | 1588.00 | 49249 |
| **TOTAL** | 69 | 6914 | 0 | 1461 | 535375 |

| 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-2023** | 0 | 7783 | 538 | 2912.00 | 90297 |
| **Feb-2023** | 0 | 4881 | 503 | 1762.00 | 49340 |
| **Mar-2023** | 5 | 5463 | 0 | 1701.00 | 51032 |
| **Apr-2023** | 4 | 3388 | 0 | 1198.77 | 35963 |
| **May-2023** | 11 | 2487 | 0 | 751.71 | 23303 |
| **Jun-2023** | 15 | 6015 | 0 | 507.07 | 15212 |
| **Jul-2023** | 20 | 5557 | 0 | 783.29 | 24282 |
| **Aug-2023** | 18 | 4496 | 0 | 658.74 | 20421 |
| **Sep-2023** | 8 | 5228 | 0 | 817.60 | 24528 |
| **Oct-2023** | 10 | 3905 | 0 | 915.26 | 28373 |
| **Nov-2023** | 0 | 3951 | 0 | 1606.43 | 48193 |
| **Dec-2023** | 0 | 907 | 4531 | 2563.74 | 79476 |
| **TOTAL** | 91 | 7783 | 0 | 1348 | 490420 |

| 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-2024** | 0 | 388 | 4225 | 2705.10 | 83858 |
| **Feb-2024** | 0 | 1254 | 5096 | 2763.76 | 80149 |
| **Mar-2024** | 0 | 958 | 3240 | 2160.55 | 66977 |
| **Apr-2024** | | | | | |
| **May-2024** | | | | | |
| **Jun-2024** | | | | | |
| **Jul-2024** | | | | | |
| **Aug-2024** | | | | | |
| **Sep-2024** | | | | | |
| **Oct-2024** | | | | | |
| **Nov-2024** | | | | | |
| **Dec-2024** | | | | | |
| **TOTAL** | 0 | 1254 | 3240 | 2543 | 230984 |

# 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

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- 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

GW-55-1-1
GW-41-1-1
GW-56-1-1
GW-57-1-1
GW-42-1-1
GW-43-1-1
GW-44-1-1
GW-62-1-1
GW-62-2-1
GW 91-1-1
GW 93-1-1
GW 92-1-1
GW 94-1-1
GW-77-1-1
GW-77-2-1
GW-78-1-1
GW-78-2-1
GW-88-1-1
GW-88-2-1
GW-87-1-1
GW-87-2-1
GW-104-1-1
GW-99-1-1
GW-100-1-1
GW-101-1-1
GW-105-1-1
GW-106-1-1
GW-103-1-1
LW22-01
GW-109-1-1
GW-110-1-1
GW-27-1-1
GW-27-1-2
GW-25-1-1
GW-25-1-2
GW-98-1-1
GW-96-1-1
GW-95-1-1
GW-97-1-1
GW-53-1-1
GW-28-1-0
GW-29-1-1
GW-29-1-2
GW-30-1-1
GW-30-1-2
GW-31-1-1
GW-31-1-2
GW-20-1-1
GW-20-1-2
GW-21-1-1
GW-21-1-2
GW-21-2-1
GW-50-1-1
GW-38-1-1
GW-39-1-1
GW-39-2-1
GW-51-1-1
GW-51-2-1
GW-51-3-1
GW-40-1-1
P11
P12
GW-108-1-1
GW-37-1-1
GW-37-2-1
GW-37-3-1
GW-107-1-1
GW-107-1-2
GW-81-1-0-P9
GW-52-1-1
GW-52-2-0
GW-36-1-1
GW-36-2-1
GW-36-3-1
GW-52-3-0-P52
GW-52-4-0-P7
GW-80-1-0-P8
GW-83-1-1
GW-58-1-0
GW-16-1-1
GW-16-1-2
GW-16-2-1
GW-16-2-2
GW-90-1-1
GW-90-2-1
GW-82-1-1
GW-17-1-1
GW-17-1-2
GW-17-1-3
GW-75-1-1
GW-54-1-1
GW-54-2-1
GW-54-3-1
VLGW-26-D
VLGW-21-D
VLGW-20-D
VLGW-08-D
GW-46-3-1
GW-46-4-1
GW-46-2-1
VLGW-19-D
GW-89-1-1
GW-89-2-1
GW-74-2-1
VLGW-18-D
GW-18-1-1
GW-18-1-2
GW-18-2-1
GW-18-2-2
VLGW-11-S
GW-61-1-1
VLGW-17-D
GW-76-1-1
GW-76-2-1
GW-76-3-1
VLGW-16-D
GW-47-2-1
VLGW-04-D
VLGW-15-D
GW-48-1-1
GW-48-2-1
VLGW-01-D
GW-63-1-1
GW-63-2-1
VLGW-03-D
VLGW-02-D
P4
P2
P10
P1
P3
GW-09-1-0
GW-85-1-1
GW-72-1-1
GW-72-2-1
GW-72-3-1
GW-71-1-1
GW-71-2-1
GW-71-3-1
GW-60-1-1
GW-60-2-1
GW-60-3-1
GW-07-1-0
GW-19-1-1
GW-19-1-2
GW-19-2-1
GW-19-2-2
GW-73-1-1
GW-73-2-1
GW-73-3-1
GW-04-2-1
GW-04-3-1
GW-04-4-1

Willis Point Entrance Road
Old Compost Road
Willis Point Rd
Tuttle Valley Road
Tuttle Slope Rd
160 Bench Road
170 Bench Road
140 Bench Road
150 Bench Road
East Perimeter Road
Northwest Slope Road
High Level Road
North Main Haul Road
South Diversion Road
Main Access Road
Recycle & Public Road
East Hydro Road
Berm Road
Hartland Ave

N
W
E
S

CRD
Making a difference...together

Metres
0 25 50 100 150

Projection: UTM ZONE 10N NAD 83

**Groundwater Level Monitoring Locations**
Monitoring Frequency (# times per year)
- 4
- Continuous
- Variable - Focused Investigation

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.

# 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)

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# E4. Surface Water Quality Monitoring Locations

CRD - Parks & Environmental Services - Facilities Management & Engineering Services - May 30, 2023 - Technologist: jpbezeau - Map Document: HartlandSurfaceWaterQuality2023Seasonal.mxd

# HARTLAND LANDFILL
# SURFACE WATER QUALITY MONITORING LOCATIONS

N
W
E
S

SW-N-65
SW-N-63
SW-N-64
SW-N-41-S-4
SW-N-41s3
SW-N-15
SW-N-CSs2
SW-N-41s1
SW-N-14
SW-N-42s1
SW-N-45
SW-N-17
SW-N-05
SW-N-16
SW-N-61
SW-N-60
SW-N-53
SW-N-59
SW-N-18
SW-N-57
SW-N-58
SW-N-54
SW-N-19
SW-N-62
SW-S-52
SW-S-12
SW-S-03
SW-S-20
SW-S-27
SW-S-24
SW-S-21
SW-S-04

Capital Regional District

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
Contours (10m 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.

# 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

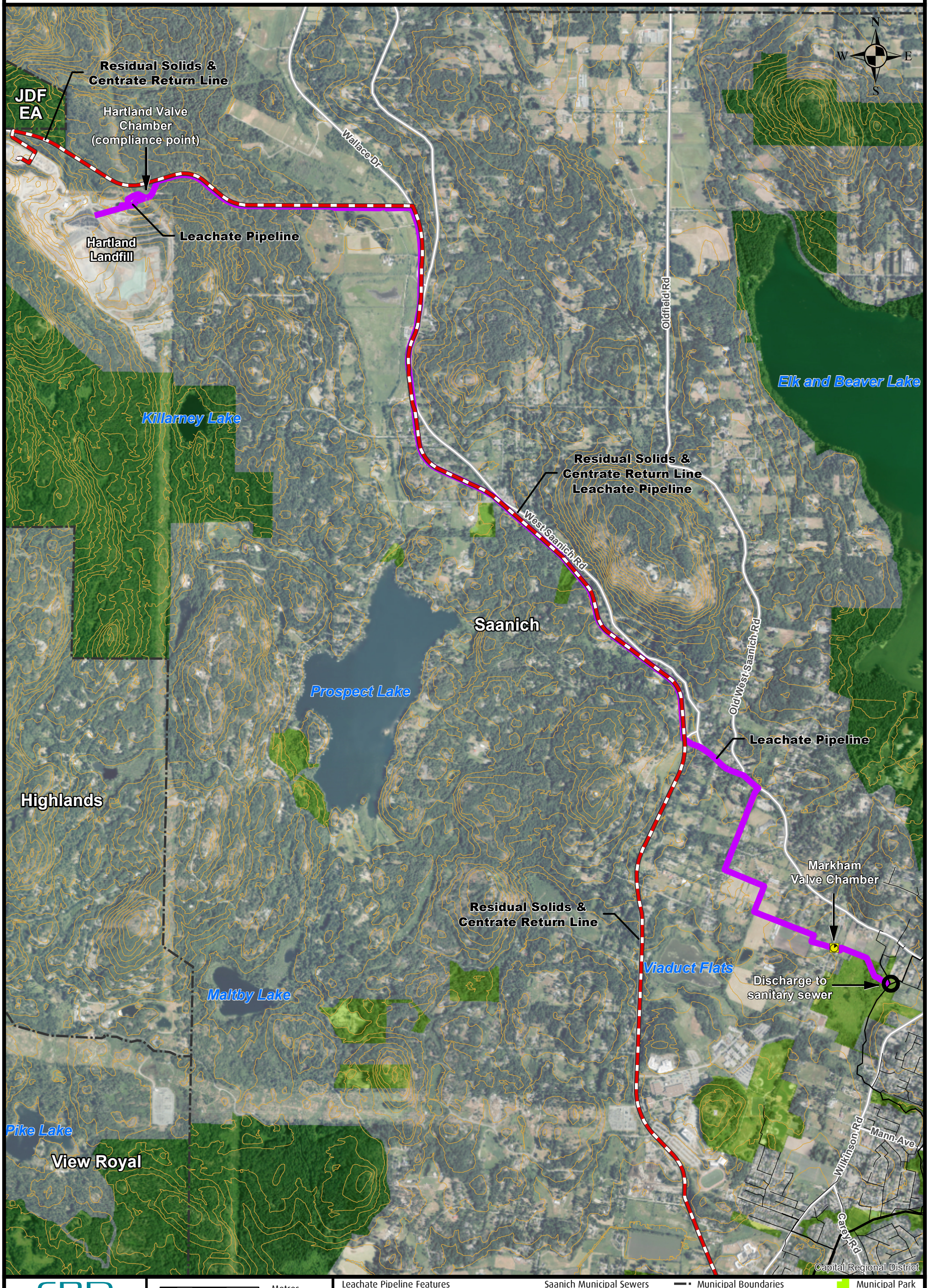
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# Appendix F

## 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

AECOM

# Appendix G

## Results of Statistical Analysis

- G1. Groundwater
- G2. Surface Water
- G3. Leachate

# G1. Groundwater

# Hartland Landfill Groundwater, Surface Water and Leachate Monitoring Program Annual Report (Apr 2023 to Mar 2024)
# Appendix G-1. Results of Statistical Analysis - Groundwater

AECOM

| 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 | 2019-2024 | N | N | NA | NA | Y | N | Y | N | N | Y |
| Gw-04-4-1 | 2019-2024 | N | N | NA | NA | N | N | N | N | Y | N |
| Gw-17-1-1 | 2019-2023 | Y | N | NA | NA | N | N | N | N | N | N |
| Gw-17-1-2 | 2019-2023 | N | N | N | N | N | Y | N | N | N | N |
| Gw-17-1-3 | 2019-2023 | N | N | NA | NA | N | N | N | N | N | N |
| Gw-18-1-1 | 2019-2024 | Y | N | N | N | N | Y | Y | N | NA | NA |
| Gw-18-2-1 | 2019-2024 | N | N | N | N | Y | N | N | N | N | N |
| Gw-18-2-2 | 2019-2024 | N | N | NA | NA | N | N | N | N | N | N |
| Gw-20-1-1 | 2019-2024 | N | N | N | N | N | Y | N | N | NA | NA |
| Gw-20-1-2 | 2019-2024 | N | N | N | Y | N | Y | N | N | NA | NA |
| Gw-21-1-1 | 2019-2024 | Y | N | N | N | N | N | N | N | NA | NA |
| Gw-21-1-2 | 2019-2024 | N | N | N | N | N | N | Y | N | NA | NA |
| Gw-21-2-1 | 2019-2024 | N | N | N | Y | N | N | Y | N | N | N |
| Gw-28-1-0 | 2019-2024 | Y | N | NA | NA | N | N | N | N | Y | N |
| Gw-29-1-1 | 2019-2024 | Y | N | N | N | N | N | N | N | N | N |
| Gw-29-1-2 | 2019-2024 | Y | N | NA | NA | Y | N | N | N | N | N |
| Gw-30-1-1 | 2019-2024 | Y | N | N | Y | N | Y | Y | N | N | N |
| Gw-30-1-2 | 2019-2024 | N | N | N | N | N | N | N | N | N | N |
| Gw-31-1-1 | 2019-2024 | Y | N | N | N | N | N | N | N | Y | N |
| Gw-31-1-2 | 2019-2024 | N | N | N | N | N | N | N | N | N | N |
| Gw-41-1-1 | 2019-2024 | N | N | N | N | Y | N | N | Y | Y | N |
| Gw-42-1-1 | 2019-2024 | Y | N | N | N | Y | N | N | N | NA | NA |
| Gw-53-1-1 | 2019-2024 | Y | N | N | N | N | N | Y | N | NA | NA |
| Gw-55-1-1 | 2019-2023 | N | N | N | N | N | N | N | Y | N | N |
| Gw-56-1-1 | 2019-2024 | N | N | N | N | N | N | N | Y | NA | NA |
| Gw-57-1-1 | 2019-2023 | N | N | N | N | N | N | N | N | NA | NA |
| Gw-71-1-1 | 2019-2024 | Y | N | N | N | N | N | Y | N | NA | NA |
| Gw-71-2-1 | 2019-2024 | Y | N | N | N | N | Y | Y | N | NA | NA |
| Gw-71-3-1 | 2019-2024 | Y | N | NA | NA | N | N | Y | N | Y | N |
| Gw-72-1-1 | 2019-2024 | N | N | N | N | N | Y | N | N | NA | NA |
| Gw-72-3-1 | 2019-2024 | N | N | N | N | N | Y | N | N | NA | NA |
| Gw-73-1-1 | 2019-2024 | N | N | NA | NA | N | N | Y | N | Y | N |
| Gw-73-2-1 | 2019-2024 | N | N | N | N | N | N | N | N | Y | N |
| Gw-73-3-1 | 2019-2024 | Y | N | N | N | N | N | Y | 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*

# Hartland Landfill Groundwater, Surface Water and Leachate Monitoring Program Annual Report (Apr 2023 to Mar 2024)
# Appendix G-1. Results of Statistical Analysis - Groundwater

AECOM

| 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 |
| **Additional Monitoring Wells** | | | | | | | | | | | |
| Gw-16-1-1 | 2019-2023 | Y | N | N | N | N | N | N | N | N | N |
| Gw-16-1-2 | 2019-2023 | N | N | N | N | Y | N | N | N | Y | N |
| Gw-16-2-1 | 2019-2023 | N | N | N | N | Y | N | N | N | N | N |
| Gw-16-2-2 | 2019-2023 | Y | N | NA | NA | Y | N | N | N | N | N |
| Gw-19-1-1 | 2019-2024 | N | N | Y | N | N | N | N | N | NA | NA |
| Gw-19-1-2 | 2019-2024 | N | N | N | N | N | N | N | Y | NA | NA |
| Gw-19-2-1 | 2019-2024 | N | N | N | N | N | N | N | N | NA | NA |
| Gw-19-2-2 | 2019-2024 | N | N | N | N | N | N | N | N | NA | NA |
| Gw-25-1-1 | 2019-2024 | Y | N | N | N | N | N | N | N | N | N |
| Gw-25-1-2 | 2019-2024 | Y | N | N | Y | N | N | N | N | Y | N |
| Gw-27-1-1 | 2019-2023 | Y | N | N | N | N | N | Y | N | NA | NA |
| Gw-27-1-2 | 2019-2021 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Gw-36-2-1 | - | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Gw-36-3-1 | 2019-2024 | N | N | N | N | N | N | N | N | N | Y |
| Gw-37-2-1 | - | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Gw-37-3-1 | 2019-2024 | Y | N | N | N | Y | N | N | N | N | N |
| Gw-38-1-1 | 2019-2024 | Y | N | N | N | Y | N | N | N | N | N |
| Gw-39-1-1 | 2019-2024 | Y | N | N | N | N | N | Y | N | Y | N |
| Gw-39-2-1 | 2019-2024 | Y | N | NA | NA | N | N | Y | N | Y | N |
| Gw-40-1-1 | 2019-2024 | N | N | N | N | N | N | N | N | N | N |
| Gw-43-1-1 | 2019-2024 | N | N | N | N | N | N | N | N | N | N |
| Gw-44-1-1 | 2019-2024 | N | N | NA | NA | N | N | N | N | N | N |
| Gw-51-1-1 | 2019-2024 | N | N | NA | NA | N | N | N | N | N | N |
| Gw-51-2-1 | 2019-2023 | N | N | NA | NA | N | N | N | N | N | N |
| Gw-51-3-1 | 2019-2023 | N | N | NA | NA | N | N | N | N | N | N |
| Gw-52-1-1 | 2019-2024 | N | N | N | N | N | Y | NA | NA | NA | NA |
| Gw-52-4-0(P7) | 2019-2024 | N | N | N | N | N | N | N | N | N | Y |
| Gw-58-1-0 | 2019-2024 | Y | N | N | N | N | N | Y | N | Y | N |
| Gw-60-1-1 | 2019-2024 | Y | N | N | N | Y | N | N | Y | NA | NA |
| Gw-60-2-1 | 2019-2024 | N | N | NA | NA | N | N | N | N | N | Y |
| Gw-60-3-1 | 2019-2024 | Y | N | N | N | N | N | N | N | N | N |
| Gw-62-1-1 | 2019-2023 | N | Y | NA | NA | N | Y | N | N | Y | N |
| Gw-62-2-1 | 2021-2023 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Gw-63-1-1 | 2019-2023 | N | N | NA | NA | N | Y | N | N | NA | NA |
| Gw-63-2-1 | 2019-2023 | N | N | N | N | N | Y | N | N | NA | NA |
| Gw-77-1-1 | 2019-2023 | N | N | N | N | N | N | N | N | NA | NA |
| Gw-77-2-1 | 2019-2023 | Y | N | NA | NA | N | N | Y | N | N | N |
| Gw-78-1-1 | 2019-2023 | N | N | NA | NA | N | N | N | N | N | N |
| Gw-78-2-1 | 2019-2023 | N | N | NA | NA | N | Y | N | N | N | N |
| Gw-85-1-1 | 2019-2024 | N | N | N | Y | N | N | N | N | N | N |
| Gw-87-1-1 | 2019-2023 | N | N | N | N | N | N | N | N | N | N |
| Gw-87-2-1 | 2019-2022 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Gw-88-1-1 | 2019-2023 | Y | N | NA | NA | N | Y | Y | N | Y | N |
| Gw-88-2-1 | 2019-2023 | N | N | NA | NA | N | Y | N | N | N | N |
| Gw-91-1-1 | 2020-2024 | Y | N | N | N | N | N | Y | N | N | Y |
| Gw-92-1-1 | 2020-2023 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Gw-93-1-1 | 2020-2020 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Gw-94-1-1 | 2020-2023 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Gw-95-1-1 | 2022-2024 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Gw-96-1-1 | 2022-2024 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Gw-97-1-1 | 2022-2024 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Gw-98-1-1 | 2022-2024 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Gw-100-1-1 | 2022-2023 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Gw-103-1-1 | 2022-2024 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Gw-104-1-1 | 2022-2024 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Gw-105-1-1 | 2022-2023 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Gw-106-1-1 | 2022-2024 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Gw-107-1-1 | 2022-2023 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Gw-108-1-1 | 2022-2024 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Gw-109-1-1 | 2022-2024 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Gw-110-1-1 | 2022 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Gw-P1 | 2019-2024 | N | N | N | N | N | N | N | N | NA | NA |
| Gw-P2 | 2019-2024 | N | N | N | Y | N | N | NA | NA | N | N |
| Gw-P3 | 2019-2024 | N | N | N | Y | N | Y | N | N | N | N |
| Gw-P4 | 2019-2024 | N | N | N | Y | N | Y | NA | NA | N | N |
| Gw-80-1-0(P8) | 2019-2024 | Y | N | Y | N | Y | N | N | Y | N | Y |
| Gw-81-1-0(P9) | 2019-2024 | N | Y | N | N | N | Y | N | Y | N | N |
| Gw-P10 | 2019-2024 | N | N | N | N | N | N | N | N | N | N |
| Gw-P11 | 2022-2023 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Gw-P12 | 2023-2024 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |

***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

| 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 Surface Water Quality Location** | | | | | | | | | | | |
| SW-S-04 | 2019-2024 | N | N | N | N | N | N | N | N | Y | N |
| SW-N-05 | 2019-2024 | Y | N | N | N | Y | N | N | N | Y | N |
| SW-N-16 | 2019-2024 | N | N | N | Y | N | N | N | N | Y | N |
| SW-N-41s1 | 2019-2024 | N | N | N | N | N | N | N | Y | N | N |
| SW-N-42s1 | 2019-2024 | N | N | N | N | Y | N | N | N | N | N |
| **Routine Surface Water Quality Location** | | | | | | | | | | | |
| SW-S-03 | 2019-2024 | N | N | N | N | N | N | N | N | N | N |
| SW-N-CS2 | 2020-2024 | N | N | N | N | N | N | N | N | N | N |
| SW-S-12 | 2019-2024 | N | N | N | N | N | N | N | Y | N | N |
| SW-N-14 | 2019-2024 | N | N | NA | NA | N | N | N | N | N | N |
| SW-N-15 | 2023-2024 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| SW-N-17 | 2019-2024 | N | N | N | N | Y | N | N | N | N | N |
| SW-N-18 | 2019-2023 | N | N | N | N | N | N | N | N | N | N |
| SW-N-19 | 2019-2024 | N | N | N | N | N | N | N | Y | N | N |
| SW-S-20 | 2020-2023 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| SW-S-21 | 2020-2024 | N | N | N | N | N | N | N | N | N | N |
| SW-S-24 | 2019-2024 | N | N | N | N | N | N | N | N | N | N |
| SW-S-27 | 2020-2024 | N | N | N | N | N | N | N | N | N | N |
| SW-S-52 | 2019-2023 | N | N | N | N | N | N | N | N | N | N |
| SW-N-41s3 | 2019-2024 | N | N | N | N | N | N | N | N | N | N |
| SW-N-41s4 | 2023-2024 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| SW-N-45 | 2019-2024 | N | N | N | N | Y | N | N | N | N | N |
| SW-N-50 | 2019-2021 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| SW-N-51 | 2020 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| SW-N-53 | 2020-2023 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| SW-N-54 | 2019-2024 | N | N | N | N | Y | N | N | N | Y | N |
| SW-N-58 | 2023 (dry) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| SW-N-59 | 2023 (dry) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| SW-N-60 | 2023 (dry) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| SW-N-61 | 2023 (dry) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| SW-N-62 | 2023 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| SW-N-63 | 2023-2024 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| SW-N-64 | 2023-2024 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| SW-N-65 | 2023-2024 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |

***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

**Hartland Landfill Groundwater, Surface Water and Leachate Monitoring Program Annual Report (Apr 2023 to Mar 2024)**
**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 | 2019-2024 | N | N | N | Y | N | Y | N | N | N | N |

***Notes:***

*Green highlights indicate decreasing trends*

*Red highlights indicate increasing trends*

AECOM

# Appendix H

## Aggregate SFE Results

## Appendix H1. Aggregate Shake Flask Testing Results

| Sample ID | Units | Referenced Guidelines | | WR22-01 (Old) | WR22-02 (Fresh) | WR23-01 | WR23-02 | WR23-03 | Averages | Medians |
|---|---|---|---|---|---|---|---|---|---|---|
| Depth (m BGS) | | | | Surface | Surface | Surface | Surface | Surface | | |
| Sampling Location | | BCWQG[a] | | Northwest Stockpile | Northwest Stockpile | Toutle Valley | Northeast. Stockpile | Northeast. Stockpile | | |
| Lithology Description | | | | Diorite Gneiss | Diorite Gneiss | Meta. Mafic Rock | Meta. Mafic Rock | Meta. Mafic Rock | | |
| Acid Generating Status | | | | - | - | non-PAG | non-PAG | non-PAG | | |
| Age | | Short-Term Acute | Long-Term Chronic | Approx. 1 year | <1 week | <1 week | <2 days | <2 days | | |
| **Inorganics** | | | | | | | | | | |
| Hardness (as CaCO3) | mg/L | --- | --- | 24.1 | 27.7 | 21.5 | 33.2 | 24.6 | 26.2 | 24.6 |
| pH (Lab) | --- | 6.5-9 | 6.5-9 | 7.95 | 8.46 | **9.05** | **9.19** | 8.99 | 8.73 | 8.99 |
| Electrical Conductivity (Lab) | µS/cm | --- | --- | 67.0 | 74.0 | 49.0 | 56.0 | 84.0 | 66.0 | 67.0 |
| Total Alkalinity | mg CaCO3/L | --- | --- | 16.0 | 16.0 | 21.0 | 16.0 | 18.0 | 17.4 | 16.0 |
| Bicarbonate | mg/L | --- | --- | 20.0 | 19.0 | 26.0 | 19.0 | 22.0 | 21.2 | 20.0 |
| Carbonate | mg/L | --- | --- | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 |
| Hydroxide | mg/L | --- | --- | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 |
| Sulfate (SO4) | mg/L | 128 - 429[c] | 128 - 429[c] | 9.20 | 8.10 | 1.70 | 9.80 | 5.50 | 6.86 | 8.10 |
| Ammonia (NH3) | mg/L as N | 0.75 - 5.74[c] | 0.135 - 1.770[c] | 0.061 | 0.104 | 0.166 | 0.768 | 0.167 | 0.25 | 0.17 |
| Nitrite (NO2) | mg/L as N | 0.06 - 0.6[f] | 0.02 - 0.2[f] | <0.05 | <0.05 | 0.007 | 0.07 | 0.023 | 0.05 | 0.05 |
| Nitrate (NO3) | mg/L as N | 32.8 | 3.0 | <0.20 | 2.40 | 0.25 | 2.52 | 0.44 | 1.71 | 2.40 |
| Total Nitrogen (NH3+NO2+NO3 as N) | mg/L as N | --- | --- | 0.31 | 2.55 | 0.42 | 3.36 | 0.63 | 1.46 | 0.63 |
| Fluoride (F) | mg/L | 0.4 - 1.876[d] | --- | 0.07 | 0.04 | <0.01 | <0.01 | 0.02 | 0.04 | 0.04 |
| Chloride (Cl) | mg/L | 600 | 150 | <0.5 | <0.5 | <0.5 | 0.8 | <0.5 | <0.5 | <0.5 |
| **Dissolved Metals** | | | | | | | | | | |
| Aluminum (Al) | mg/L | --- | --- | 0.278 | 0.281 | 0.238 | 0.187 | 0.155 | 0.23 | 0.24 |
| Antimony (Sb) | mg/L | --- | --- | 0.000088 | 0.000040 | 0.000077 | 0.000146 | 0.000098 | 0.00009 | 0.00009 |
| Arsenic (As) | mg/L | --- | --- | 0.000257 | 0.000105 | 0.000132 | 0.000088 | 0.000358 | 0.00019 | 0.00013 |
| Barium (Ba) | mg/L | --- | --- | 0.00262 | 0.00074 | 0.000546 | 0.00121 | 0.000612 | 0.00115 | 0.00074 |
| Beryllium (Be) | mg/L | --- | --- | <0.000010 | <0.000010 | <0.000010 | <0.000010 | <0.000010 | <0.000010 | <0.000010 |
| Bismuth (Bi) | mg/L | --- | --- | <0.0000050 | <0.0000050 | <0.0000050 | <0.0000050 | <0.0000050 | <0.0000050 | <0.0000050 |
| Boron (B) | mg/L | --- | --- | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 |
| Cadmium (Cd) | mg/L | 0.000038 - 0.0028[d] | 0.000018 - 0.0028[d] | 0.0000078 | <0.0000050 | <0.0000050 | <0.0000050 | <0.0000050 | 0.00001 | 0.00001 |
| Cesium (Cs) | mg/L | --- | --- | <0.00005 | <0.00005 | 0.000127 | 0.000311 | 0.000153 | 0.00005 | 0.00005 |
| Calcium (Ca) | mg/L | --- | --- | 8.660 | 8.450 | 6.280 | 10.800 | 6.910 | 8.22 | 8.45 |
| Chromium (Cr) | mg/L | --- | --- | 0.00027 | 0.00010 | <0.0001 | <0.0001 | 0.00012 | 0.00014 | 0.00010 |
| Cobalt (Co) | mg/L | --- | --- | 0.0001780 | 0.0000688 | 0.0000351 | 0.0000179 | 0.000103 | 0.00008 | 0.00007 |
| Copper (Cu) | mg/L | Variable[g] | Variable[g] | **0.002260** | 0.000051 | 0.000242 | 0.000099 | 0.000135 | 0.00056 | 0.00014 |
| Iron (Fe) | mg/L | 0.35 | --- | 0.175 | 0.031 | 0.0619 | 0.0218 | 0.0884 | 0.07570 | 0.06190 |
| Lead (Pb) | mg/L | --- | --- | 0.000215 | 0.000006 | 0.0000264 | 0.0000109 | 0.0000365 | 0.00006 | 0.00003 |
| Lanthanum (La) | mg/L | --- | --- | <0.000050 | <0.000050 | <0.000050 | <0.000050 | <0.000050 | <0.000050 | <0.000050 |
| Lithium (Li) | mg/L | --- | --- | <0.00050 | <0.00050 | <0.00050 | <0.00050 | <0.00050 | <0.00050 | <0.00050 |
| Magnesium (Mg) | mg/L | --- | --- | 0.591 | 1.610 | 1.410 | 1.530 | 1.780 | 1.38 | 1.53 |
| Manganese (Mn) | mg/L | --- | --- | 0.0044 | 0.0014 | 0.00121 | 0.000931 | 0.00161 | 0.00190 | 0.00140 |
| Mercury (Hg) | mg/L | --- | --- | <0.000050 | <0.000050 | <0.000050 | <0.000050 | <0.000050 | <0.000050 | <0.000050 |
| Molybdenum (Mo) | mg/L | --- | --- | 0.000476 | 0.001150 | 0.001 | 0.000395 | 0.00324 | 0.00125 | 0.00100 |
| Nickel (Ni) | mg/L | --- | --- | 0.000433 | 0.000149 | 0.00008 | 0.000067 | 0.000199 | 0.00019 | 0.00015 |
| Phosphorus (P) | mg/L | --- | --- | 0.0147 | 0.0056 | 0.0163 | 0.0116 | 0.0073 | 0.01 | 0.01 |
| Potassium (K) | mg/L | --- | --- | 0.41 | 0.29 | 0.134 | 0.204 | 0.272 | 0.26 | 0.27 |
| Rubidium (Rb) | mg/L | --- | --- | 0.00033 | 0.00088 | 0.00135 | 0.00199 | 0.00304 | 0.00152 | 0.00135 |
| Selenium (Se) | mg/L | --- | --- | 0.000243 | 0.000297 | 0.000071 | 0.000137 | 0.00009 | 0.00017 | 0.00014 |
| Silicon (Si) | mg/L | --- | --- | 1.28 | 1.53 | 1.54 | 1.48 | 1.99 | 1.56 | 1.53 |
| Silver (Ag) | mg/L | --- | --- | 0.0000109 | <0.0000050 | <0.0000050 | <0.0000050 | <0.0000050 | <0.0000050 | <0.0000050 |
| Sodium (Na) | mg/L | --- | --- | 0.661 | 0.961 | 0.379 | 0.755 | 0.42 | 0.64 | 0.66 |
| Strontium (Sr) | mg/L | --- | --- | 0.01920 | 0.02320 | 0.0283 | 0.0368 | 0.0203 | 0.03 | 0.02 |
| Sulphur (S) | mg/L | --- | --- | <10 | <10 | <10 | <10 | <10 | <10 | <10 |
| Thallium (Tl) | mg/L | --- | --- | <0.0000020 | 0.0000033 | 0.0000041 | 0.0000052 | 0.0000032 | 0.0000040 | 0.0000037 |
| Thorium (Th) | mg/L | --- | --- | 0.000010 | 0.000007 | <0.000050 | <0.000050 | <0.000050 | 0.00001 | 0.00001 |
| Tellurium (Te) | mg/L | --- | --- | <0.000020 | <0.000020 | <0.000020 | <0.000020 | <0.000020 | <0.000020 | <0.000020 |
| Tin (Sn) | mg/L | --- | --- | <0.00020 | <0.00020 | <0.00020 | <0.00020 | <0.00020 | <0.00020 | <0.00020 |
| Titanium (Ti) | mg/L | --- | --- | 0.00746 | 0.00161 | 0.00161 | 0.00064 | 0.00314 | 0.00289 | 0.00161 |
| Uranium (U) | mg/L | --- | --- | 0.000019 | 0.000022 | 0.0000034 | 0.0000022 | 0.0000025 | 0.00001 | 0.00000 |
| Vanadium (V) | mg/L | --- | --- | 0.00297 | 0.00330 | 0.0403 | 0.0044 | 0.0113 | 0.01245 | 0.00440 |
| Tungsten (W) | mg/L | --- | --- | 0.000036 | 0.000044 | 0.000152 | 0.000035 | 0.000024 | 0.00006 | 0.00004 |
| Zinc (Zn) | mg/L | Variable[e] | Variable[e] | <0.0001 | <0.0001 | 0.0005 | 0.00013 | 0.00033 | 0.00010 | 0.00010 |
| Zirconium (Zr) | mg/L | --- | --- | <0.00010 | <0.00010 | <0.00010 | <0.00010 | <0.00010 | <0.00010 | <0.00010 |

**NOTES**

[a] *Approved BC Water Quality Guidelines for Freshwater Aquatic Life - Long-Term Chronic and Short-Term Acute Solute Concentrations*

[b] *Guideline/standard varies with hardness*

[c] *Guideline/standard varies with pH and temperature. pH and Temperature at receiving water is assumed to be 7.5 and 10° C, respectively.*

[d] *Guideline/standard varies with hardness*

[e] *Guideline/standard varies with hardness, DOC, and pH; DOC of 4.5 mg/L was applied for calculation, derived from the average DOC concentrations measured in surface water during the 2020-2021 monitoring period*

[f] *Applicable guideline varies with chloride. Background chloride concentration of 20 mg/L is applied for criteria calculation*

[g] *Dissolved copper guidelines determined using BLM*

**Exceeds BCWQG AW 30-Day Average**

**Exceeds BCWQG AW MAC**

# Appendix I

## Dust Suppressant Testing Results

Your Project #: HARTLAND GROUND WATER QUALITY
Your C.O.C. #: 08539314

**Attention: Geo Lab Data**

CAPITAL REGIONAL DISTRICT
CRD-VIC 625 FISGARD
PO Box 1000
625 Fisgard Street
VICTORIA, BC
Canada V8W 2S6

**Report Date: 2024/07/12**
Report #: R3526794
Version: 1 - Final

# CERTIFICATE OF ANALYSIS

**BUREAU VERITAS JOB #: C450249**
**Received: 2024/07/05, 08:48**

Sample Matrix: Water
# Samples Received: 1

| Analyses | Quantity | Date Extracted | Date Analyzed | Laboratory Method | Analytical Method |
|---|---|---|---|---|---|
| Alkalinity @25C (pp, total), CO3,HCO3,OH | 1 | N/A | 2024/07/11 | BBY6SOP-00026 | SM 24 2320 B m |
| Chloride/Sulphate by Auto Colourimetry | 1 | N/A | 2024/07/11 | BBY6SOP-00011 / BBY6SOP-00017 | SM24-4500-Cl/SO4-E m |
| Conductivity @25C | 1 | N/A | 2024/07/11 | BBY6SOP-00026 | SM 24 2510 B m |
| Hardness (calculated as CaCO3) | 1 | N/A | 2024/07/10 | BBY WI-00033 | Auto Calc |
| Na, K, Ca, Mg, S by CRC ICPMS (diss.) | 1 | N/A | 2024/07/10 | BBY WI-00033 | Auto Calc |
| Elements by ICPMS Low Level (dissolved) (1) | 1 | N/A | 2024/07/09 | BBY7SOP-00002 | EPA 6020b R2 m |
| Ammonia-N (Total) | 1 | N/A | 2024/07/10 | AB SOP-00007 | SM 24 4500 NH3 A G m |
| Nitrate + Nitrite (N) | 1 | N/A | 2024/07/06 | BBY6SOP-00010 | SM 24 4500-NO3- H m |
| Nitrite (N) Regular Level Water | 1 | N/A | 2024/07/06 | BBY6SOP-00010 | SM 24 4500-NO2- m |
| Nitrogen - Nitrate (as N) | 1 | N/A | 2024/07/06 | BBY WI-00033 | Auto Calc |
| pH @25°C (2) | 1 | N/A | 2024/07/11 | BBY6SOP-00026 | SM 24 4500-H+ B m |

**Remarks:**

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, EPA, APHA or the Quebec Ministry of Environment.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.



Bureau Veritas Burnaby: 4606 Canada Way V5G 1K5 Telephone(604) 734-7276 Fax(604) 731-2386

Your Project #: HARTLAND GROUND WATER QUALITY
Your C.O.C. #: 08539314

**Attention: Geo Lab Data**

CAPITAL REGIONAL DISTRICT
CRD-VIC 625 FISGARD
PO Box 1000
625 Fisgard Street
VICTORIA, BC
Canada V8W 2S6

**Report Date: 2024/07/12**
Report #: R3526794
Version: 1 - Final

# CERTIFICATE OF ANALYSIS

**BUREAU VERITAS JOB #: C450249**
**Received: 2024/07/05, 08:48**

This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) Dissolved > Total Imbalance: When applicable, Dissolved and Total results were reviewed and data quality meets acceptable levels unless otherwise noted.

(2) The CCME method requires pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the CCME holding time. Bureau Veritas endeavours to analyze samples as soon as possible after receipt.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to:
Debbie Nordbruget, Key Account Specialist
Email: Debra.NORDBRUGET@bureauveritas.com
Phone# (250)385-6112

==========

This report has been generated and distributed using a secure automated process.
Bureau Veritas has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation, please refer to the Validation Signatures page if included, otherwise available by request. For Department specific Analyst/Supervisor validation names, please refer to the Test Summary section if included, otherwise available by request. This report is authorized by Raphael Kwan, Senior Manager, BC and Yukon Regions responsible for British Columbia Environmental laboratory operations.

## RESULTS OF CHEMICAL ANALYSES OF WATER

| Bureau Veritas ID | | CQQ442 | | |
|---|---|---|---|---|
| Sampling Date | | 2024/07/04 14:50 | | |
| COC Number | | 08539314 | | |
| | **UNITS** | **2024-0038698** | **RDL** | **QC Batch** |
| **ANIONS** | | | | |
| Nitrite (N) | mg/L | <0.050 (1) | 0.050 | B429086 |
| **Calculated Parameters** | | | | |
| Dissolved Hardness (CaCO3) | mg/L | 11.0 | 0.50 | B428387 |
| Nitrate (N) | mg/L | <0.20 | 0.20 | B427826 |
| **Misc. Inorganics** | | | | |
| Conductivity | uS/cm | 520 | 2.0 | B434568 |
| pH | pH | 5.37 | N/A | B434565 |
| **Anions** | | | | |
| Alkalinity (PP as CaCO3) | mg/L | <1.0 | 1.0 | B434533 |
| Alkalinity (Total as CaCO3) | mg/L | 40 | 1.0 | B434533 |
| Bicarbonate (HCO3) | mg/L | 48 | 1.0 | B434533 |
| Carbonate (CO3) | mg/L | <1.0 | 1.0 | B434533 |
| Hydroxide (OH) | mg/L | <1.0 | 1.0 | B434533 |
| Chloride (Cl) | mg/L | <10 (1) | 10 | B434602 |
| Sulphate (SO4) | mg/L | <100 (1) | 100 | B434602 |
| **Nutrients** | | | | |
| Total Ammonia (N) | mg/L | 51 | 0.75 | B433338 |
| Nitrate plus Nitrite (N) | mg/L | <0.20 (1) | 0.20 | B429084 |

RDL = Reportable Detection Limit
N/A = Not Applicable
(1) Detection limits raised due to matrix interference.



Bureau Veritas Burnaby: 4606 Canada Way V5G 1K5 Telephone(604) 734-7276 Fax(604) 731-2386

## ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

| Bureau Veritas ID | | CQQ442 | | |
|---|---|---|---|---|
| Sampling Date | | 2024/07/04 14:50 | | |
| COC Number | | 08539314 | | |
| | UNITS | 2024-0038698 | RDL | QC Batch |
| **Dissolved Metals by ICPMS** | | | | |
| Dissolved Aluminum (Al) | ug/L | 43.6 | 0.50 | B430636 |
| Dissolved Antimony (Sb) | ug/L | 0.080 | 0.020 | B430636 |
| Dissolved Arsenic (As) | ug/L | 1.14 | 0.020 | B430636 |
| Dissolved Barium (Ba) | ug/L | 18.0 | 0.020 | B430636 |
| Dissolved Beryllium (Be) | ug/L | 0.012 | 0.010 | B430636 |
| Dissolved Bismuth (Bi) | ug/L | <0.0050 | 0.0050 | B430636 |
| Dissolved Boron (B) | ug/L | 17 | 10 | B430636 |
| Dissolved Cadmium (Cd) | ug/L | 0.0391 | 0.0050 | B430636 |
| Dissolved Chromium (Cr) | ug/L | 2.37 | 0.10 | B430636 |
| Dissolved Cobalt (Co) | ug/L | 0.115 | 0.0050 | B430636 |
| Dissolved Copper (Cu) | ug/L | 1.66 | 0.050 | B430636 |
| Dissolved Iron (Fe) | ug/L | 1750 | 1.0 | B430636 |
| Dissolved Lead (Pb) | ug/L | 0.172 | 0.0050 | B430636 |
| Dissolved Lithium (Li) | ug/L | <0.50 | 0.50 | B430636 |
| Dissolved Manganese (Mn) | ug/L | 159 | 0.050 | B430636 |
| Dissolved Molybdenum (Mo) | ug/L | 0.219 | 0.050 | B430636 |
| Dissolved Nickel (Ni) | ug/L | 2.04 | 0.020 | B430636 |
| Dissolved Phosphorus (P) | ug/L | 231 | 2.0 | B430636 |
| Dissolved Selenium (Se) | ug/L | 0.096 | 0.040 | B430636 |
| Dissolved Silicon (Si) | ug/L | 161 | 50 | B430636 |
| Dissolved Silver (Ag) | ug/L | <0.0050 | 0.0050 | B430636 |
| Dissolved Strontium (Sr) | ug/L | 19.4 | 0.050 | B430636 |
| Dissolved Thallium (Tl) | ug/L | <0.0020 | 0.0020 | B430636 |
| Dissolved Tin (Sn) | ug/L | <0.20 | 0.20 | B430636 |
| Dissolved Titanium (Ti) | ug/L | <0.50 | 0.50 | B430636 |
| Dissolved Uranium (U) | ug/L | 0.0029 | 0.0020 | B430636 |
| Dissolved Vanadium (V) | ug/L | <0.20 | 0.20 | B430636 |
| Dissolved Zinc (Zn) | ug/L | 7.17 | 0.10 | B430636 |
| Dissolved Zirconium (Zr) | ug/L | <0.10 | 0.10 | B430636 |
| Dissolved Calcium (Ca) | mg/L | 1.85 | 0.050 | B428117 |
| Dissolved Magnesium (Mg) | mg/L | 1.55 | 0.050 | B428117 |
| Dissolved Potassium (K) | mg/L | 3.33 | 0.050 | B428117 |
| Dissolved Sodium (Na) | mg/L | 13.9 | 0.050 | B428117 |
| RDL = Reportable Detection Limit | | | | |



Bureau Veritas Burnaby: 4606 Canada Way V5G 1K5 Telephone(604) 734-7276 Fax(604) 731-2386

## ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

| **Bureau Veritas ID** | | CQQ442 | | |
|---|---|---|---|---|
| **Sampling Date** | | 2024/07/04 14:50 | | |
| **COC Number** | | 08539314 | | |
| | **UNITS** | **2024-0038698** | **RDL** | **QC Batch** |
| Dissolved Sulphur (S) | mg/L | 83.7 | 3.0 | B428117 |
| RDL = Reportable Detection Limit | | | | |



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## GENERAL COMMENTS

**Results relate only to the items tested.**



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# QUALITY ASSURANCE REPORT



| | | | Matrix Spike | | Spiked Blank | | Method Blank | | RPD | |
|---|---|---|---|---|---|---|---|---|---|---|
| QC Batch | Parameter | Date | % Recovery | QC Limits | % Recovery | QC Limits | Value | UNITS | Value (%) | QC Limits |
| B429084 | Nitrate plus Nitrite (N) | 2024/07/06 | 120 | 80 - 120 | 109 | 80 - 120 | <0.020 | mg/L | 1.7 | 25 |
| B429086 | Nitrite (N) | 2024/07/06 | 113 | 80 - 120 | 107 | 80 - 120 | <0.0050 | mg/L | NC | 20 |
| B430636 | Dissolved Aluminum (Al) | 2024/07/10 | 101 | 80 - 120 | 99 | 80 - 120 | <0.50 | ug/L | 5.0 | 20 |
| B430636 | Dissolved Antimony (Sb) | 2024/07/10 | 100 | 80 - 120 | 99 | 80 - 120 | <0.020 | ug/L | NC | 20 |
| B430636 | Dissolved Arsenic (As) | 2024/07/10 | 102 | 80 - 120 | 100 | 80 - 120 | <0.020 | ug/L | NC | 20 |
| B430636 | Dissolved Barium (Ba) | 2024/07/10 | 101 | 80 - 120 | 97 | 80 - 120 | <0.020 | ug/L | NC | 20 |
| B430636 | Dissolved Beryllium (Be) | 2024/07/10 | 98 | 80 - 120 | 95 | 80 - 120 | <0.010 | ug/L | NC | 20 |
| B430636 | Dissolved Bismuth (Bi) | 2024/07/10 | 104 | 80 - 120 | 102 | 80 - 120 | <0.0050 | ug/L | NC | 20 |
| B430636 | Dissolved Boron (B) | 2024/07/10 | 105 | 80 - 120 | 96 | 80 - 120 | <10 | ug/L | NC | 20 |
| B430636 | Dissolved Cadmium (Cd) | 2024/07/10 | 101 | 80 - 120 | 97 | 80 - 120 | <0.0050 | ug/L | NC | 20 |
| B430636 | Dissolved Chromium (Cr) | 2024/07/10 | 102 | 80 - 120 | 99 | 80 - 120 | <0.10 | ug/L | NC | 20 |
| B430636 | Dissolved Cobalt (Co) | 2024/07/10 | 96 | 80 - 120 | 94 | 80 - 120 | <0.0050 | ug/L | NC | 20 |
| B430636 | Dissolved Copper (Cu) | 2024/07/10 | 99 | 80 - 120 | 97 | 80 - 120 | <0.050 | ug/L | NC | 20 |
| B430636 | Dissolved Iron (Fe) | 2024/07/10 | 102 | 80 - 120 | 100 | 80 - 120 | <1.0 | ug/L | 0.52 | 20 |
| B430636 | Dissolved Lead (Pb) | 2024/07/10 | 101 | 80 - 120 | 100 | 80 - 120 | <0.0050 | ug/L | 12 | 20 |
| B430636 | Dissolved Lithium (Li) | 2024/07/10 | 99 | 80 - 120 | 97 | 80 - 120 | <0.50 | ug/L | NC | 20 |
| B430636 | Dissolved Manganese (Mn) | 2024/07/10 | 101 | 80 - 120 | 99 | 80 - 120 | <0.050 | ug/L | NC | 20 |
| B430636 | Dissolved Molybdenum (Mo) | 2024/07/10 | 103 | 80 - 120 | 102 | 80 - 120 | <0.050 | ug/L | NC | 20 |
| B430636 | Dissolved Nickel (Ni) | 2024/07/10 | 100 | 80 - 120 | 98 | 80 - 120 | <0.020 | ug/L | NC | 20 |
| B430636 | Dissolved Phosphorus (P) | 2024/07/10 | 104 | 80 - 120 | 100 | 80 - 120 | <2.0 | ug/L | NC | 20 |
| B430636 | Dissolved Selenium (Se) | 2024/07/10 | 100 | 80 - 120 | 96 | 80 - 120 | <0.040 | ug/L | NC | 20 |
| B430636 | Dissolved Silicon (Si) | 2024/07/10 | 103 | 80 - 120 | 104 | 80 - 120 | <50 | ug/L | NC | 20 |
| B430636 | Dissolved Silver (Ag) | 2024/07/10 | 100 | 80 - 120 | 98 | 80 - 120 | <0.0050 | ug/L | NC | 20 |
| B430636 | Dissolved Strontium (Sr) | 2024/07/10 | 100 | 80 - 120 | 98 | 80 - 120 | <0.050 | ug/L | NC | 20 |
| B430636 | Dissolved Thallium (Tl) | 2024/07/10 | 103 | 80 - 120 | 101 | 80 - 120 | <0.0020 | ug/L | NC | 20 |
| B430636 | Dissolved Tin (Sn) | 2024/07/10 | 102 | 80 - 120 | 100 | 80 - 120 | <0.20 | ug/L | NC | 20 |
| B430636 | Dissolved Titanium (Ti) | 2024/07/10 | 102 | 80 - 120 | 99 | 80 - 120 | <0.50 | ug/L | NC | 20 |
| B430636 | Dissolved Uranium (U) | 2024/07/10 | 104 | 80 - 120 | 104 | 80 - 120 | <0.0020 | ug/L | NC | 20 |
| B430636 | Dissolved Vanadium (V) | 2024/07/10 | 101 | 80 - 120 | 98 | 80 - 120 | <0.20 | ug/L | NC | 20 |
| B430636 | Dissolved Zinc (Zn) | 2024/07/10 | 101 | 80 - 120 | 99 | 80 - 120 | <0.10 | ug/L | NC | 20 |
| B430636 | Dissolved Zirconium (Zr) | 2024/07/10 | 101 | 80 - 120 | 98 | 80 - 120 | <0.10 | ug/L | NC | 20 |
| B433338 | Total Ammonia (N) | 2024/07/10 | 91 | 80 - 120 | 98 | 80 - 120 | <0.015 | mg/L | NC | 20 |
| B434533 | Alkalinity (PP as CaCO3) | 2024/07/11 | | | | | <1.0 | mg/L | NC | 20 |



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## QUALITY ASSURANCE REPORT(CONT'D)



| | | | Matrix Spike | | Spiked Blank | | Method Blank | | RPD | |
|---|---|---|---|---|---|---|---|---|---|---|
| QC Batch | Parameter | Date | % Recovery | QC Limits | % Recovery | QC Limits | Value | UNITS | Value (%) | QC Limits |
| B434533 | Alkalinity (Total as CaCO3) | 2024/07/11 | | | 101 | 80 - 120 | <1.0 | mg/L | 1.1 | 20 |
| B434533 | Bicarbonate (HCO3) | 2024/07/11 | | | | | <1.0 | mg/L | 1.1 | 20 |
| B434533 | Carbonate (CO3) | 2024/07/11 | | | | | <1.0 | mg/L | NC | 20 |
| B434533 | Hydroxide (OH) | 2024/07/11 | | | | | <1.0 | mg/L | NC | 20 |
| B434565 | pH | 2024/07/11 | | | 100 | 97 - 103 | | | | |
| B434568 | Conductivity | 2024/07/11 | | | 103 | 90 - 110 | <2.0 | uS/cm | | |
| B434602 | Chloride (Cl) | 2024/07/11 | 99 | 80 - 120 | 97 | 80 - 120 | <1.0 | mg/L | | |
| B434602 | Sulphate (SO4) | 2024/07/11 | 87 | 80 - 120 | 98 | 80 - 120 | <1.0 | mg/L | NC | 20 |

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

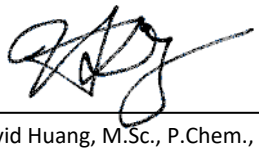
NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).



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## VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:



David Huang, M.Sc., P.Chem., QP, Scientific Services Manager

Bureau Veritas has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation, please refer to the Validation Signatures page if included, otherwise available by request. For Department specific Analyst/Supervisor validation names, please refer to the Test Summary section if included, otherwise available by request. This report is authorized by Raphael Kwan, Senior Manager, BC and Yukon Regions responsible for British Columbia Environmental laboratory operations.



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**BUREAU VERITAS**
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Burnaby, B.C. V5G 1K5

Central: 250-385-6112
Desk: 604-639-8425
Mobile: 250-661-3420

08539314



| | |
|---|---|
| **COMPANY NAME:** | CAPITAL REGIONAL DISTRICT (CRD) |
| **COMPANY ADDRESS:** | HARTLAND LANDFILL<br>280 WILLIS POINT ROAD<br>VICTORIA, B.C.<br>V9E 1K1 |
| **SAMPLER NAME:** | Shelley Donovan |
| **PH. #:** | 250-360-347 |
| **CELL #:** | 250-4808711 |
| **EMAIL** | geolabdata@crd.bc.ca |
| **CLIENT PROJECT ID: (#)** | HARTLAND GROUND WATER QUALITY |
| **PROJECT MANAGER:** | DEBBIE NORDBRUGET |

ANALYSIS REQUESTED

| | CRD ID | Sample Type | PSC LAB # (Lab Use Only) | MATRIX: Ground Water | MATRIX: Surface Water | MATRIX: Soil | MATRIX: Other | SAMPLING: DATE (DD-MMM-YYYY) | SAMPLING: TIME | CRD Groundwater Package Routine |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2024-0038698 | SS | | X | | | | 4-Jul-2024 | 14:50 | X |
| 2 | | | | | | | | | | |
| 3 | | | | | | | | | | |
| 4 | | | | | | | | | | |
| 5 | | | | | | | | | | |
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| 8 | | | | | | | | | | |
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| 10 | | | | | | | | | | |
| 11 | | | | | | | | | | |
| 12 | | | | | | | | | | |

MVAN-2024-07-255

**TAT (Turnaround Time)**
< 5 DAY TAT ONLY WITH PRIOR APPROVAL

Regular TAT

OTHER (SPECIFY)

**IOL SITE LOCATION:**

**PSC SAP#:**

**IOL CONTACT:**

**SPECIAL INSTRUCTIONS:**
Invoice to: geolabinvoices@crd.bc.ca

☐ CCME ☐ CSR
☐ ALBERTA TIER ☐ OTHER

| | | | |
|---|---|---|---|
| **RELINQUISHED BY SAMPLER:** | Shelley Donovan | **DATE:** 4-Jul-2024 | **TIME:** Shipped 15:30 |
| **RELINQUISHED BY:** | | **DATE:** | **TIME:** |
| **RELINQUISHED BY:** | | **DATE** | **TIME:** |

**LAB USE ONLY**

| Sample Arrival Temp °C | DUE DATE | LOG IN CHECK |
|---|---|---|
| 11/11/11 | | |

**RECEIVED BY:**

**RECEIVED BY:**

**RECEIVED BY LABORATORY:** N Ocampo Zamora 2024/07/05

NO Seal / ICE Pack frozen. 08:48

aecom.com