

Bunker's Creek Landfills

2021 Annual Monitoring Program

Submitted to:

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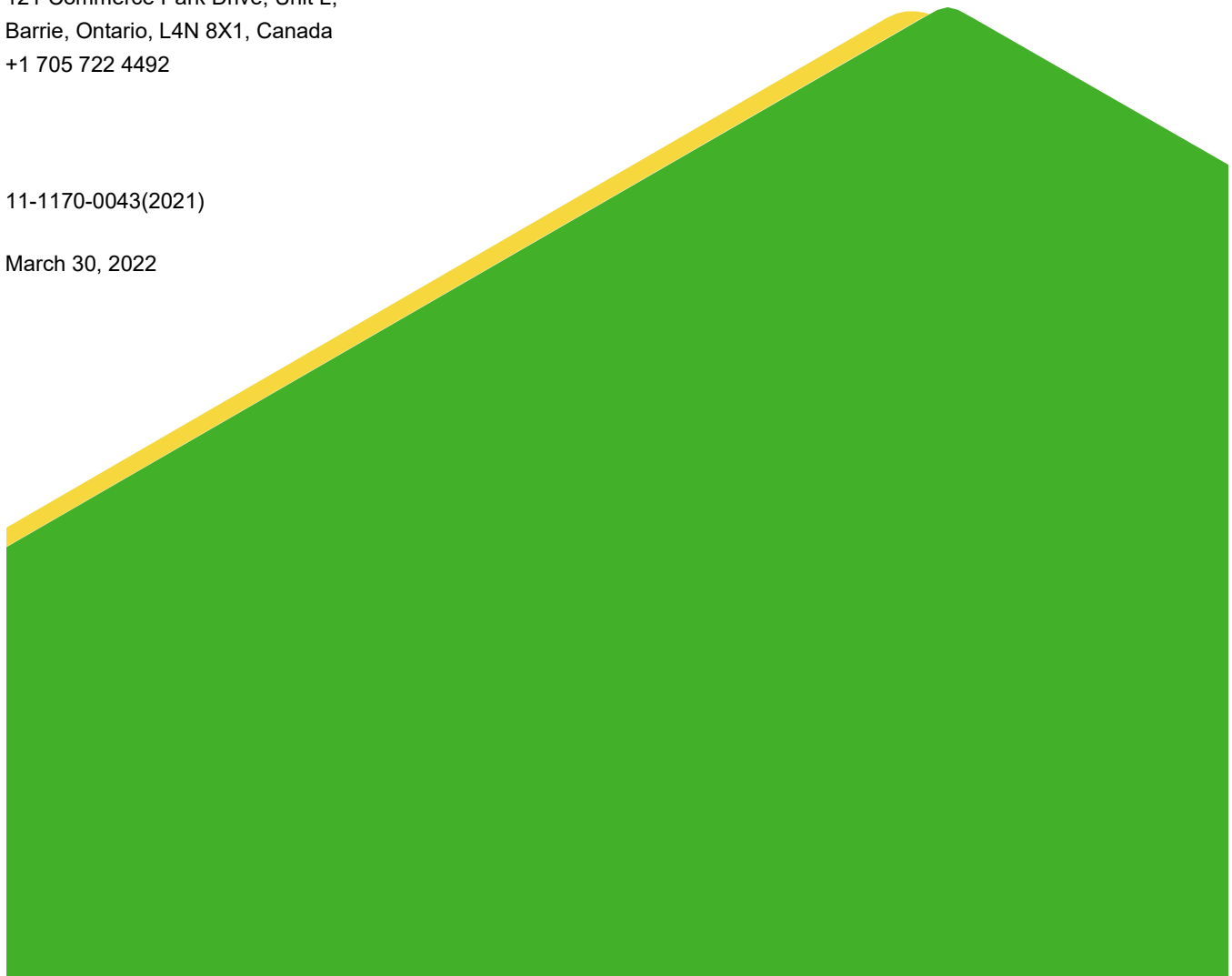
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Executive Summary

Golder Associates Ltd. (Golder) was retained by the City of Barrie (City), to carry out an Annual Monitoring Program at Historical Waste Sites within the City of Barrie located along Bunker's and Dymont's Creeks, generally between Anne Street and Bradford Street approximately 300 to 400 metres west of Kempenfelt Bay. This report describes the results of monitoring conducted between February 3 and September 17, 2021 for the four waste disposal sites referred to as Sites 1, 2, 3 and 7 along Bunker's Creek (see Figures 1 and 2). Sites 4, 5 and 6 are discussed in a separate report. This work program is intended to constitute an assessment relative to the environmental influence of the landfills.

The landfills are located on both sides of Bunker's Creek (herein referred to as the "Bunker's Creek Landfills") and are bounded by Anne Street to the west and Bradford Street to the east, multi-residential and commercial development and Perry Street to the north and Vespra Street (or just beyond its limits) to the south. The available information indicates that the waste extends onto privately owned industrial/commercial properties in the area of Sites 1, 3 and 7 north of Vespra Street, as well as under City owned lands in the area of Milligan's pond and in the northern part of the former Fire Hall property east of Innisfil Street.

Parameters associated with impacts from municipal waste typically include chloride, sodium, metals including iron, manganese and phosphorous, nitrogen compounds including ammonia and low concentrations of chlorinated volatile organic compounds from products co-disposed in the waste. The City implements a monitoring program to monitor the environmental conditions relative to surface water quality in Bunker's Creek and to assess the potential for explosive levels of methane in soil-gas. The Provincial Water Quality Objectives (PWQO) are used to assess surface water compliance. Standards for landfill gas (LFG) are based on the Lower Explosive Limit (LEL) of methane in air (i.e., 5%).

Based on the results of the 2021 Annual Monitoring Program, the following summary and conclusions are provided:

- The sample collected at SWB1 in September 2021 exceeded the PWQO for un-ionized ammonia. The total ammonia concentrations at this location have not substantively changed from previous years; the un-ionized ammonia calculations in 2021 were impacted by the higher than normal stream temperatures present at the time of the sampling. A moderate increase of ammonia at the downstream location presumably attributable to landfill influence.
- Concentrations of iron above the Provincial Water Quality Objectives is typical of surface water quality throughout the City and are not considered to indicate landfill related impacts.
- Low concentrations of several PAH parameters were detected at midstream location SWB3, located at the outlet of Milligan's Pond upstream of SWB2 in 2013 and 2015, including fluoranthene; these parameters have not been detected in analyzed surface water samples collected since that time. Given the detections are only marginally above the RDL, the exceedances are not considered relevant. The presence of detectable concentrations of fluoranthene in the downstream locations requires further assessment in 2022.
- Surface water is the ultimate receptor for potential groundwater impacts from the historical landfills. Based on the surface water results obtained during this investigation during the September 2021 sampling event, it is concluded that the landfills are not adversely effecting surface water quality of Bunker's Creek. Whereas

some exceedances are noted for iron and ammonia (and fluoranthene in 2021), the relative trends are not considered to represent an immediate issue requiring action beyond ongoing sampling and assessment described herein.

- Concentrations of landfill gas in all gas probes located adjacent to waste fill areas were below the 5% LEL of methane in 2021. Elevated methane has not been detected at gas probes in the vicinity of the former Fire Hall.
- Whereas continued monitoring is warranted to ensure conditions do not change, the risk posed to nearby residences from elevated methane in soil gas is not anticipated to increase over time. The waste has been in place for over 50 years and therefore LFG generation is expected to decline slowly. Further monitoring of wells within the waste is not considered necessary as sufficient information on the source area of methane has been collected. Provided that other controlling conditions, for example water table elevation and permeability of the soil cover do not change, methane concentrations are expected to be within the range of recent results. Should future development be considered in the areas where elevated methane is present (i.e., within the waste), additional investigations would be required.

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1.0 INTRODUCTION

Golder Associates Ltd. (Golder) was retained by the City of Barrie (City), to carry out an Annual Monitoring Program at Historical Waste Sites within the City of Barrie located along Bunker's and Dymont's Creeks, generally between Anne Street and Bradford Street approximately 300 to 400 metres west of Kempenfelt Bay. This report describes the results of monitoring conducted between February 3 and September 17, 2021 for the four waste disposal sites referred to as Sites 1, 2, 3 and 7 along Bunker's Creek (see Figures 1 and 2). Sites 4, 5 and 6 are discussed in a separate report. This work program is intended to constitute an assessment relative to the environmental influence of the landfills.

Between 2011 and 2013, Golder conducted an assessment of nine Historical Waste Sites within the City, following the requirements of the Ministry of the Environment, Conservation, and Parks (Ministry, MECP and precursors) D-4 Studies and of the Environmental Site Assessment process. The nine sites were part of an identified list of landfills in Ontario, developed by the Ministry on the basis of information largely collected in a 1979 study (Ministry of the Environment, 1979), supplemented with information available up to 1994 when the Ministry finalized the Waste Inventory. The locations of the landfills were identified based on generalized street descriptions and were reported to be operated from 1956 to 1964, pre-dating the Ministry's Environmental Protection Act (1973). As these waste sites were largely "unorganized" (i.e., none of them were approved under a Ministry process) their exact locations and character were not known.

Following the initial studies, a total of seven landfills were identified, four located along Bunker's Creek and three located along Dymont's Creek. These landfills are located on lands currently developed as parkland, residential, commercial, and industrial land use.

The areas of waste fill have been identified and impact on the environment assessed on the basis of groundwater, surface water and soil gas standards. Whereas the sites contain largely inert fill, waste materials were identified at most of the landfills; key indicators of the impact of the waste fill were identified. Soil gas concentrations exceeding the lower explosive limit (LEL) for methane (5% in air) were not identified in 2021 at any of the sampled locations (i.e., locations adjacent to the waste fill areas). Previous exceedances tended to be located within or immediately adjacent to the waste fill; monitoring of landfill gas in gas probes located within waste ceased in 2019.

Parameters associated with impacts from municipal waste typically include elevated concentrations of chloride, sodium, metals including iron, manganese and phosphorous, nitrogen compounds including ammonia, and low concentrations of volatile organic compounds (VOC) from products co-disposed in the waste. Un-ionized ammonia above the PWQO of 0.02 mg/L represents a potential impact to aquatic organisms.

The City implements a monitoring program to monitor the environmental conditions at the landfills relative to surface water quality in Bunker's Creek and to assess the potential for explosive levels of methane in soil-gas. The Provincial Water Quality Objectives (PWQO) are used to assess surface water compliance. Standards for LFG are based on the Lower Explosive Limit (LEL) of methane in air (i.e., 5%).

2.0 BACKGROUND

Four of the nine Sites identified in the Ministry Waste Disposal Site Inventory within the City of Barrie are included in the Bunker's Creek Landfill area:

- Site 1 – Anne Street North and Vespra Street: Located on the northwest corner of Anne Street North and Vespra Street – closed in 1956 – Ministry Site No. X 4101;
- Site 2 – Vespra Street and Innisfil Street: Located northwest of the intersection of Vespra Street and Innisfil Street – closed in 1959 – Ministry Site No. X 4102;
- Site 3 – Vespra Street and Innisfil Street: Located on the northeast corner of Vespra Street and Innisfil Street – closed in 1960 – Ministry Site No. X 4103; and,
- Site 7 – Vespra Street and Bradford Street: Located northeast of the intersection of Innisfil Street and Vespra Street – closed in 1964 – Ministry Site No. X4107.

The findings of the earlier investigations estimated the approximate areal extent of waste, as illustrated on Figure 2. It is noted that the delineation of waste extent was limited to investigation sites accessible to the City (i.e., City owned lands). Access to Site 2 was further limited due to forest cover and steep slopes in the vicinity of Milligan's Pond.

The landfill sites are more or less continuous on both sides of Bunker's Creek (and herein referred to as the "Bunker's Creek Landfills"), and are bounded by Anne Street to the west, Bradford Street to the east, Perry Street to the north, and Vespra Street to the south. In the area of the former Fire Hall property (southeast of the Vespra and Innisfil Street intersection), the available information, including previous 1996 investigations completed by others (Terraprobe, 1996), indicates that the waste extends to the north of the former building, but not to the south. It was not known whether there was waste under this building. The building was demolished in July 2013 however, we are not aware of any further investigations at the site since its demolition. In other areas, for example, portions of the landfill north of Vespra Street, the extent of waste could not be positively identified, as these parts of the landfills are on private property. Limits of waste fill in these areas are largely based on historical aerial photography and mapping interpretation and have been accepted by the Ministry.

The material within the Bunker's Creek Landfills consists of coarse soil fill overlying thin layers of waste material. The waste materials identified in the boreholes consisted largely of solid materials (e.g., glass, plastic, brick, metal) and did not contain putrescible materials. Waste thickness typically ranges from very thin (0.05 m) at several locations to a maximum thickness of 2.59 m encountered on the south side of Bunker's Creek, east of Milligan's Pond. The maximum depth of waste extended to 7.21 m below ground surface (mbgs) south of Bunker's Creek in the Boys Street easement. Cover material, consisting of topsoil and/or fill, ranged in thickness from 1.27 m to 8.33 m.

The interpreted groundwater flow direction under the landfills is consistently toward Bunker's Creek, and ultimately to the east toward Lake Simcoe. Earlier monitoring results for groundwater at wells MW-B1, MW-B3, MW-B7, located at the northern limits of Sites 1 and 2, and to the east of the north portion of Site 7 indicated the landfills are not impacting these areas. This is consistent with the anticipated limits of the waste fill locations identified in the initial investigations (Golder, 2013). Based on interpreted shallow horizontal groundwater flow, it has been concluded that groundwater outside the limits of waste will not be impacted by the waste. Monitoring of groundwater quality ceased in 2016.

Landfill gas is generated by the decay of organic material typically contained in municipal waste and consists largely of methane and carbon dioxide. Landfill gas (as defined by the presence of elevated methane concentrations) has not migrated significantly beyond the landfill limits and concentrations are generally below a concentration of 5% (i.e., the LEL of methane). Exceptions to this include gas probes located within the waste fill areas in the central and southern portions of these landfills.

3.0 SCOPE AND FIELD INVESTIGATION METHODS

The following scope of work was implemented for the 2021 monitoring program.

- Measurement of water levels and landfill gas monitoring of 12 existing gas probe locations (GP-B1, GP-B3, GP-B7, GP-B8, GP-B14, GP-B17 through GP-B22 and GP-B24 in February 2021/March 2021 (frozen ground));
- Surface water quality samples were collected at the five established surface water monitoring locations on September 17, 2021; and
- Analysis of the surface water samples for major ions and indicators, metals, polycyclic aromatic hydrocarbons (PAH), volatile organic compounds (VOC) and petroleum hydrocarbon fractions F1 to F4 (PHC F1 to F4).

3.1 Landfill Gas Sampling

A portable high-volume pump (10 L/min) was used to purge three times the volume of each gas probe prior to sampling; the wells were outfitted with a valve and cap to prevent atmospheric influence. Readings including the relative concentrations of carbon dioxide (CO₂), methane (CH₄), and oxygen (O₂) were obtained from the gas probes using a calibrated GEM 2000 landfill gas monitor.

Table 6 provides a full list of readings in the gas probes. **Figure 5** provides a summary of methane gas concentrations in plan-view. This figure depicts data collected during the February 2021/March 2021 sampling event (frozen ground conditions).

At some locations, the screened interval above the water table is narrow (greater than 90% saturated), which may result in variation of measured LFG concentrations (i.e., periods with higher water table conditions could reduce the ability of the well to accurately represent landfill gas concentrations).

As landfill gas concentrations within the waste remained relatively consistent between 2013 and 2018, landfill gas monitoring in gas probes located within waste fill was removed from the monitoring program in 2019. This notably includes wells in the vicinity of Innisfil and Vespra Street.

3.2 Gas Probe / Well Decommissioning

The monitoring wells and gas probes located within the waste on City-owned lands, and which are no longer monitored, should be checked annually to ensure they are in good condition (e.g., the surface casing is stable and locked). The City may wish to retain these wells in some areas where sampling may be required for future studies. If these wells are to be abandoned, they should be decommissioned by a licenced water well contractor. There were no wells/probes decommissioned in 2021.

3.3 Surface Water Sampling

Five surface water samples (SWB1 through SWB5) along Bunker's Creek were collected on September 17, 2021 (see Figure 2 for sampling locations). No evidence of leachate seeps, including sheen or discolouration of the water column, were noted during the sampling event.

Samples were collected from downstream (SWB1) to upstream (SWB5) locations to prevent cross-contamination. To prevent spillage of preservatives and to ensure collection of a representative sample, a clean, dry amber glass jar was used to collect each sample from the middle of the water column and was

subsequently poured into laboratory supplied sampling containers. At the time of sampling, the surface water samples were placed in coolers with ice and subsequently submitted to the commercial analytical laboratory under chain-of-custody procedures. Each surface water sample was submitted for laboratory analysis of VOC, metals, PHC, PAH, and major ions and indicators. Table 1 below provides a summary of the measured field parameters for the surface water samples submitted for laboratory analysis.

Table 1: Summary of Analyzed Surface Water Samples – Bunker’s Creek Landfills – Sept. 17, 2021

Sample I.D.	Location Relative to Closed Landfills	Field pH	Field Temp. (°C)	Field Cond. (µS/cm)	DO (mg/L)	ORP (mV)	Flow
SWB1	Downstream	8.87	16.08	1747	10.14	182.6	Low
SWB2	Sites 2, 3 and 7	8.91	16.27	1824	8.50	142.1	Moderate
SWB3	Site 2	9.05	16.98	1844	8.99	146.4	Low
SWB4	Sites 1 and 2	9.12	17.31	2272	8.92	50.3	Low to Moderate
SWB5	Upstream	9.24	17.41	1981	9.15	111.7	Low

Notes:

µS/cm = micro Siemens per centimetre
 DO = Dissolved oxygen
 ORP = Oxidation-reduction potential
 mV = Millivolts

3.4 Analytical Program

Golder retained the services of Bureau Veritas Laboratories of Mississauga, Ontario. Bureau Veritas is accredited by the Standards Council of Canada/Canadian Association of Environmental Analytical Laboratories (“CAEAL”) program.

Analytical methods are reported by the laboratories on the Bureau Veritas Laboratory Certificates of Analysis provided in Appendix C.

3.4.1 Quality Assurance/Quality Control

The standard analytical methods and procedures used, as well as internal laboratory method blanks, duplicates and surrogate recoveries for organic analyses are also provided on the Bureau Veritas Laboratory Certificates of Analysis provided in Appendix C.

The laboratories maintain in-house quality assurance/quality control (“QA/QC”) programs to govern sample analysis. Standard QA/QC protocols include the analysis of method blanks, matrix spikes and 10% replicates for each sample batch. In addition to the quality control employed by the laboratories, the following QA/QC samples were also submitted during the work program:

- One surface water field duplicate sample was submitted for analysis of analyzed parameters during the concurrent work program conducted at Dymen’s Creek, and is reported under separate cover;

- One blind field blank sample was submitted for analysis of all analyzed parameters during the work program (collected during the surface water sampling event); and
- One trip blank sample was submitted for analysis of VOC only (collected during the surface water sampling event).

4.0 GROUNDWATER AND SURFACE WATER RESULTS

4.1 Groundwater Elevations and Flow

The interpreted groundwater flow direction in the area of the landfills is toward Bunker's Creek and ultimately to the east toward Lake Simcoe. Based on interpreted shallow horizontal groundwater flow directions, groundwater outside the limits of waste would not be impacted by the waste materials. As previously recommended by Golder, groundwater quality has not been monitored at the landfills since 2017.

A summary of groundwater elevations obtained from the monitoring wells and gas probes is provided in Table B-1 (Appendix B).

Groundwater elevations during the February 2021 work program ranged from 219.21 metres above sea level (masl) (at GP-B7) to lower than 224.83 masl (at GP-B1).

Figure 3 illustrates the groundwater flow directions based on water levels obtained in February 2021.

Groundwater flow is interpreted to be easterly overall but flows locally to the topographic low formed by Bunker's Creek. At Site 1, shallow groundwater flow is interpreted to be toward Bunker's Creek. Groundwater originating from the waste fill areas flows away from adjacent properties located outside the estimated waste limits and impacts associated with buried waste would not be anticipated outside of the waste fill. At Site 2, shallow groundwater is interpreted to be toward Milligan's Pond or Bunker's Creek in the northern portion of the Site, north of the creek and north-easterly toward Bunker's Creek to the south of the creek. Groundwater originating from within the waste fill areas would not likely impact adjacent properties outside the estimated waste limits as groundwater would flow away from these properties.

At Sites 3 and 7, shallow groundwater flow is interpreted to be largely north toward Bunker's Creek; however, it is expected that a portion of the groundwater flows off-site to the adjacent property to the east, before discharging to Bunker's Creek near monitoring well MW-B7. In 2016, a monitoring well was installed to the east of Site 7, labelled CB16-1¹. Based on the results of the groundwater sample collected at this location, elevated PAH concentrations were noted along with elevated iron, vanadium, sodium and chloride concentrations above the OWDS or MECP Table 2 Standards. The report indicated that impacts identified at this location may be partially influenced by the landfills, but also by surface infiltration, road salting and fill quality in the road allowances. As a result it was recommended that this well not be subsequently sampled.

4.2 Analytical Results

No leachate seeps (i.e., evidently discolored water on the stream banks) were noted during the sampling event. The analytical results for surface water samples were compared to the respective PWQO for surface water and are summarized in Tables 3 through 5 following the text of the report.

¹ Golder, 2017. 2016 Annual Monitoring Report, City of Barrie Bunker's Creek Historical Landfills. Report prepared for the City and dated September 26, 2017.

Surface water sample locations for which the analytical results exceed the various standards used for comparison are provided on Figure 4. Un-ionized ammonia concentrations are shown on Figure 4 for informational purposes, as this parameter represents a potential impact to aquatic organisms. Laboratory Certificates of Analysis for surface water are provided in Appendix C.

4.2.1 VOC, Metals, Major Ions, PHC and PAH

Surface water quality in samples collected from five locations along Bunker's Creek (see Figure 4) met the PWQO for the analyzed parameters, with the following exceptions:

- **Iron at all sampling locations**, ranging in concentration from 0.95 mg/L (SWB5 – the upstream location) to 2.5 mg/L (SWB1 – the downstream location), greater than the PWQO of 0.3 mg/L.
- **Un-ionized ammonia at all sampling locations**, ranging in concentration from 0.055 mg/L (SWB5 – the upstream location) to 0.12 mg/L (SWB1 – the downstream location), greater than the PWQO of 0.02 mg/L.
- **Fluoranthene at SWB1 and SWB2**, the two downstream locations, exhibiting concentrations of 0.011 µg/L and 0.012 µg/L, respectively, greater than the PWQO of 0.0008 µg/L.

It is noted that iron concentrations exceeded the PWQO in Bunker's Creek upstream of the landfill sites. Whereas somewhat higher concentrations of iron are observed at the downstream sampling location SWB1 (2.5 mg/L), the landfills are not appreciably impacting the quality of the creek.

Total ammonia, a common indicator of landfill influence, was present at low concentrations within the stream samples, ranging from 0.13 to 0.53 mg/L in 2021, consistent with previous results. The un-ionized ammonia proportion, calculated based on field pH and temperature, ranged from 0.009 mg/L (SWB5) to 0.025 mg/L (SWB1). The sample collected at SWB1 in September 2021 exceeded the PWQO. The total ammonia concentrations at this location have not substantively changed from previous years. The total ammonia results are consistent with historical trends, which indicate a moderate increase of ammonia at the downstream location presumably attributable to landfill influence. The elevated un-ionized concentrations noted in September 2021 are related to the abnormally high temperatures in the stream (16°C to 17°C in September 2021, whereas they are typically less than 16°C).

In 2021, the reported concentration of fluoranthene (a PAH parameter) was marginally higher compared to historical values at SWB1 (0.012 µg/L), the downstream location and SWB2 (0.011 µg/L), located on the west side of Innisfil Street. This parameter was not detected previously above the laboratory reportable detection limits of 0.05 µg/L (RDL); it is noted that the RDL is orders of magnitude above the PWQO. Low concentrations of several PAH parameters were detected at midstream location SWB3, located at the outlet of Milligan's Pond upstream of SWB2 in 2013 and 2015, including fluoranthene; these parameters have not been detected in analyzed surface water samples collected since that time. Given the detections are only marginally above the RDL, the exceedances are not considered relevant. An additional semi-annual surface water sampling event in 2022 is recommended to gather data which can be used to determine the relevance of this parameter for the purposes of this monitoring program.

Surface water is the ultimate receptor for potential groundwater impacts from the historical landfills. Based on the surface water results obtained during this investigation during the September 2021 sampling event, it is concluded that the landfills are not adversely effecting surface water quality of Bunker's Creek. Whereas some exceedances are noted for iron and ammonia (and fluoranthene in 2021), the relative trends are not considered to represent an immediate issue requiring action beyond ongoing sampling and assessment described herein.

4.2.2 Indicator Parameters

In the absence of a PWQO, relative comparisons can be made regarding general water quality for parameters such as electrical conductivity (1,800 $\mu\text{S}/\text{cm}$ to 2,400 $\mu\text{S}/\text{cm}$) and chloride (410 mg/L to 600 mg/L).

The concentrations of the indicator parameters are similar in all surface water samples. This indicates that the landfills have minimal impact on Bunker's Creek. The sodium and chloride concentrations are expected to include a component of impact from salting of the adjacent municipal roads, specifically at SWB4, located between Anne Street and Milligan's Pond, where electrical conductivity, sodium, and chloride are the highest concentrations reported to date.

4.2.3 Quality Assurance/Quality Control

Based on a comparison between the laboratory and field pH readings, it has been determined that the elevated field pH readings were inaccurate. Whereas the pH meter was calibrated prior to sampling, the meter was not providing accurate results in the field.

Relative Percent Difference (RPD) is calculated where results for both the original and duplicate samples are at concentrations of greater than five times the laboratory RDL. Field duplicate surface water samples with calculated RPD values greater than 50% are considered questionable.

One blind field duplicate surface water sample was collected from SWD2 (Dyment's Creek sampling location conducted concurrently) during the 2021 work program. The results are reported under separate cover.

Concentrations of analyzed parameters in the trip blank and field blank samples were less than their respective laboratory detection limits, except for total aluminum (0.034 mg/L) and chloroform (4.1 $\mu\text{g}/\text{L}$) in the field blank prepared in September 2021. There are no PWQO for these parameters. The presence of chloroform in the field blank was reviewed with Bureau Veritas Laboratories who were unable to identify a potential source of the chloroform in the laboratory. Total aluminum concentrations in the analyzed surface water samples in 2021 remained consistent with previous sampling events while chloroform was not detected. As such, the presence of these parameters in the field blank sample does not significantly alter the findings of this investigation.

Surrogate standard recoveries outside the range, typically, of 50 to 130% are indicative of questionable results for the tested parameters. The reported surrogate recoveries were within the acceptable range, except for D8-Acenaphthylene (6.3%), which is below the acceptable range; however, the lab reported the overall quality control for this analysis meets acceptability criteria and are considered acceptable on this basis.

Matrix spike recoveries outside the typical range for individual parameters are indicative of questionable results for the tested parameters. The reported matrix spike recoveries are within the acceptable range, except for several PAH parameters, including acenaphthene (36%), acenaphthylene (32%), anthracene (43%), benzo(a)pyrene (37%), 2-methylnaphthalene (45%), and perylene (44%) in May 2021. The laboratory reported that although the recoveries for these parameters are outside control limits, the overall quality control for these analyses met acceptability criteria. There were no detectable concentrations of these PAH parameters in the analyzed surface water samples and as such, this does not significantly alter the findings of this investigation. It is noted that fluoranthene (a PAH), was detected in 2021, which requires further assessment. The QA/QC results for fluoranthene are within acceptable ranges and, as such, it appears that the elevated concentration is relevant.

Based on the above, the associated analytical results generally appear to be representative and reproducible.

5.0 LANDFILL GAS RESULTS

Figure 5 provides a plan-view of the highest methane gas concentrations at gas probes located outside of the waste fill area at the Bunker's Creek Landfills measured in February 2021/March 2021 (under frozen ground conditions). In some cases, the gas probe screens were nearly submerged (i.e., at GP-B18, and GP-B19). There were no detections of methane in these wells.

Table 2 provides a summary of 2021 methane gas concentrations. Historical results, up to and including 2021, are provided on **Table 6** following the text of the report. Concentrations of methane gas above the LEL represent a potential safety hazard at adjacent buildings, as the gas within the soil can potentially accumulate within enclosed spaces and result in conditions where open flame or a spark could cause an explosion.

No elevated methane was detected at the sampled gas probes in 2021 indicating that landfill gas has not migrated beyond the landfill limits. It has also not migrated west of Anne Street (west of Site 1), south of Vespra Street (on the west side of Site 1) or south of Victoria Street (south of Site 2). There are no probes north of Sites 3 and 7.

Elevated LFG in the area north of the former Fire Hall was not assessed in 2021, as wells in this area are located in waste and removed from the monitoring program. We understand that the City will assess this issue as part of separate land use studies. No methane was detected at any of the remaining monitoring wells in the vicinity of the former Fire Hall in 2021 (e.g., GP-B17 located south).

Table 2: Summary of 2021 Methane Concentrations – Bunker's Creek Landfills

Location	Screen Interval (mbgs)	Screen Installation Description	Date	Depth to Groundwater (mbgs)	Methane Concentration (% by volume)
Site 1					
GP-B1	1.26 – 2.78	Within the fill overlying waste	3-Feb-21	2.80	CH ₄ = 0.0
GP-B8	0.91 – 3.93	Within the waste fill limits overlying sand	24-Feb-21	3.51	CH ₄ = 0.0
GP-B20	1.52 – 4.57	Sand	3-Mar-21	3.67	CH ₄ = 0.0
GP-B21	1.07 – 4.12	Unknown (daylighted)	3-Feb-21	3.78	CH ₄ = 0.0
GP-B22	0.76 – 3.81	Sand	3-Feb-21	2.00	CH ₄ = 0.0
GP-B24	0.80 – 2.27	Within waste fill area	3-Feb-21	1.58	CH ₄ = 0.0

Location	Screen Interval (mbgs)	Screen Installation Description	Date	Depth to Groundwater (mbgs)	Methane Concentration (% by volume)
Site 2					
GP-B3	0.61 – 2.13	Within the fill overlying waste	3-Feb-21	2.10	CH ₄ = 0.0
Site 3					
GP-B14	0.77 – 3.05	Sand	3-Feb-21	1.86	CH ₄ = 0.0
GP-B17	1.22 – 2.75	Sand	3-Feb-21	2.57	CH ₄ = 0.0
Site 7					
GP-B7	0.77 – 2.29	Sand, some silt and gravel	3-Feb-21	1.12	CH ₄ = 0.0
GP-B18	1.52 – 3.05	Sand	3-Feb-21	1.75	CH ₄ = 0.0
GP-B19	0.77 – 2.29	Unknown (daylighted)	3-Feb-21	0.87	CH ₄ = 0.0
Notes: CH ₄ = methane ** Headspace methane concentration is greater than 5% by volume, the lower explosive limit of methane.					

6.0 SUMMARY AND DISCUSSION

6.1 Surface Water Quality

The un-ionized ammonia proportion, calculated based on field pH and temperature, ranged from 0.009 mg/L (SWB5) to 0.025 mg/L (SWB1). The sample collected at SWB1 in September 2021 exceeded the PWQO for un-ionized ammonia. The total ammonia concentrations at this location have not substantively changed from previous years; the un-ionized ammonia calculations in 2021 were impacted by the higher than normal stream temperatures present at the time of the sampling. The results are consistent with past trends, which indicate a moderate increase of ammonia at the downstream location presumably attributable to landfill influence.

The landfills may contribute total ammonia to the creek; however, based on our review of previous concentrations, the total ammonia concentrations have not changed over time and the elevated un-ionized concentrations are more likely related to the abnormally high temperatures in the stream in September 2021.

Concentrations of iron above the PWQO is typical of surface water quality throughout the City and are not considered to indicate landfill related impacts.

The presence of detectable concentrations of fluoranthene in the downstream locations requires further assessment in 2022.

Surface water is the ultimate receptor for potential groundwater impacts from the historical landfills. Based on the surface water results obtained during this investigation during the September 2021 sampling event, it is concluded that the landfills are not adversely effecting surface water quality of Bunker's Creek. Whereas some exceedances are noted for iron and ammonia (and fluoranthene in 2021), the relative trends are not considered to represent an immediate issue requiring action beyond ongoing sampling and assessment described herein.

6.2 Off-Site Landfill Gas

Concentrations of landfill gas in all gas probes located adjacent to waste fill areas were below the 5% LEL of methane in 2021. Elevated methane has historically been detected at gas probes in the vicinity of the former Fire Hall.

Whereas continued monitoring is warranted to ensure conditions do not change, the risk posed to nearby residences from elevated methane in soil gas is not anticipated to increase over time. The waste has been in place for over 50 years and therefore LFG generation is expected to decline slowly. Further monitoring of wells within the waste is not considered necessary as sufficient information on the source area of methane has been collected. Provided that other controlling conditions, for example water table elevation and permeability of the soil cover do not change, methane concentrations are expected to be within the range of recent results. Should future development be considered in the areas where elevated methane is present (i.e., within the waste), additional investigations would be required.

7.0 LIMITATIONS

This report was prepared for the exclusive use of the City of Barrie and has been prepared as part of environmental due diligence activities and is not intended to be utilized as supporting documentation for a Record of Site Condition under Ontario Regulation 153/04.

Golder's professional services for this assignment addressed only the geo-environmental (chemical and soil gas) aspects of the subsurface conditions at this site. The geotechnical (physical) aspects, including engineering recommendations for the design and construction of building foundations, pavements, underground servicing and the like are outside the terms of reference for this report and have not been investigated or addressed.

This report is based on data and information collected during the subsurface environmental investigations conducted by Golder and is based solely on-site conditions encountered at the time of the field work (i.e., 2020), as described in this report.

In evaluating the site, Golder has relied in good faith on information provided by others and evaluated only conditions at a limited number of test locations. Only limited chemical analyses of soil samples were carried out. It should be noted that the results of an investigation of this nature should, in no way, be construed as a warranty that the Sites are free from any and all contamination from past or current practices.

We accept no responsibility for any deficiency, misstatements or inaccuracies contained in this report as a result of omission, misinterpretations or fraudulent acts of the persons interviewed. Golder accepts no responsibility for any reduction in property value, either real or perceived, as a result of the reporting of factual information herein.

This assessment was carried out using existing historical information as available from various agencies and no assurance is made regarding the accuracy or completeness of this information.

If additional information is obtained during future work at the sites, including excavations, borings, or other studies, and/or if conditions exposed during construction are different from those encountered in this assessment, Golder should be requested to re-evaluate the conclusions presented in this report and provide amendments as required.

Signature Page

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CLG/PJD/lb

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[https://golderassociates.sharepoint.com/sites/140380/project files/6 deliverables/report/2021/bunker's creek/1111700043 rep 2022'03'31 - 2021 annual hws investigation_bunkers creek_final_no recommendations.docx](https://golderassociates.sharepoint.com/sites/140380/project%20files/6%20deliverables/report/2021/bunker's%20creek/1111700043%20rep%202022'03'31%20-%202021%20annual%20hws%20investigation_bunkers%20creek_final_no%20recommendations.docx)

8.0 REFERENCES

The following is a list of references reviewed for the purposes of preparing this report:

- By-Law No. 2009-141. The Corporation of the City of Barrie Comprehensive Zoning By-Law, August 10, 2009. Map last updated January 2011.
- Golder Associates Ltd., 2013. *D-4 Study and Environmental Assessment – Final Report, Bunker’s Creek Landfills, City of Barrie*. Report prepared for the City of Barrie, dated April 2013.
- Golder Associates Ltd., 2014. *Supplemental Environmental Investigations – Final Report, City of Barrie Bunker’s Creek Historical Landfills*. Report prepared for the City of Barrie, dated September 2014.
- Golder Associates Ltd., 2021. *Bunker’s Creek Landfills, City of Barrie, Ontario, 2020 Annual Monitoring Program Report*. Report prepared for the City of Barrie, dated February 17, 2021.
- Ministry of Environment, Conservation and Parks, 2011. *Soil, Groundwater, and Sediment Standards, Part XV.1 Environment Protection Act*, dated April 15, 2011.
- Ministry of Environment and Energy, 1994. *Provincial Water Quality Objectives*, dated July 1994.
- Terraprobe, 1996. Environmental Considerations, Fire Station, 65 Vespra Street, Barrie, Ontario. Letter report addressed to the City of Barrie and dated September 27, 1996.

Tables

Table 3
Surface Water Analytical Results
Metals and Inorganics
City of Barrie Bunker's Creek Historical Waste Sites

Monitoring Well Location				SWB1													
Sampling Date				08-Nov-12	23-Apr-13	23-Aug-13	10-Dec-13	26-Nov-14	24-Sep-15	07-Sep-16	15-Sep-17	15-Sep-17	07-Sep-18	05-Sep-19	05-Sep-19	11-Sep-20	17-Sep-21
Parameter	Units	RDL	PWQO									Field Duplicate of SWB1			Field Duplicate of SWB1		
Dissolved Metals																	
Aluminum-dissolved	mg/L	0.005	0.075	<0.004	0.04	0.04	0.008	0.004	<0.001	0.004	0.002	<0.001	<0.001	<0.005	<0.005	0.006	0.015
Aluminum (total)	mg/L	0.0049	NO	-	-	0.08	-	-	0.034	-	-	-	-	0.024	0.021	0.039	1.2
Antimony	mg/L	0.0005	0.020	<0.003	<0.0005	0.0002	<0.0005	<0.0025	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.00050	<0.00050	<0.0005	<0.00050
Arsenic	mg/L	0.001	0.1	<0.003	<0.001	0.0003	<0.001	<0.005	<0.001	0.002	<0.001	<0.001	<0.001	<0.0010	<0.0010	<0.001	<0.0010
Barium	mg/L	0.002	NO	0.116	0.14	0.163	0.138	0.160	0.166	0.170	0.153	0.159	0.135	0.160	0.160	0.160	0.160
Beryllium	mg/L	0.0004	1.1	<0.001	<0.0005	<0.0001	<0.0005	<0.0025	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.00050	<0.00050	<0.00040	<0.00040
Boron	mg/L	0.01	0.2	0.013	0.01	0.019	0.021	<0.050	0.038	0.024	0.023	0.022	0.015	0.026	0.026	0.020	0.023
Cadmium	mg/L	0.00009	0.0002	<0.0001	<0.0001	0.00013	<0.0001	<0.0005	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.00010	<0.00010	<0.00009	<0.000090
Chromium	mg/L	0.005	NO	0.014	0.003	0.0033	0.008	<0.005	<0.001	0.001	<0.001	<0.001	<0.001	<0.0050	<0.0050	<0.005	<0.0050
Cobalt	mg/L	0.0005	0.0009	<0.0005	0.0004	0.0002	<0.0005	<0.0025	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0050	<0.0050	<0.0005	0.0009
Copper	mg/L	0.0009	0.005	<0.002	0.002	0.0091	0.0048	<0.0025	<0.0005	0.001	<0.0005	<0.0005	0.0009	<0.0010	<0.0010	0.0016	0.0043
Iron	mg/L	0.1	0.3	0.884	1.11	0.675	1.48	1.19	0.448	0.565	0.682	0.692	0.620	0.790	0.800	0.880	2.5
Lead	mg/L	0.0005	0.025	0.001	<0.001	0.00207	0.0017	0.001	<0.0001	<0.0001	0.0002	0.0002	0.0001	<0.00050	<0.00050	<0.00050	0.004
Total Lithium (Li)	mg/L	0.005	NO	-	-	-	-	-	-	-	-	-	-	-	-	<0.005	<0.0050
Manganese	mg/L	0.002	NO	0.073	0.11	0.077	0.10	0.118	0.051	0.038	0.047	0.048	0.046	0.054	0.054	0.062	0.14
Molybdenum	mg/L	0.0005	0.04	<0.002	<0.005	0.0008	<0.0005	<0.0025	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.00050	<0.00050	0.00064	0.00071
Nickel	mg/L	0.001	0.025	<0.003	<0.005	<0.01	0.004	<0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0010	<0.0010	<0.0010	0.0022
Selenium	mg/L	0.002	0.1	<0.004	<0.001	<0.001	<0.001	<0.005	<0.001	0.001	<0.001	<0.001	<0.001	<0.0020	<0.0020	<0.0020	<0.0020
Total Silicon (Si)	mg/L	0.05	NO	-	-	-	-	-	-	-	-	-	-	-	-	4.9	7.2
Silver	mg/L	0.00009	0.0001	<0.0001	<0.0001	0.00002	<0.0001	<0.0005	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.00010	<0.00010	<0.00009	<0.000090
Strontium	mg/L	0.001	NO	0.432	0.607	0.490	0.454	0.611	0.503	0.436	0.482	0.496	0.412	0.46	0.46	0.49	0.62
Total Tellurium (Te)	mg/L	0.001	NO	-	-	-	-	-	-	-	-	-	-	-	-	<0.0010	<0.0010
Thallium	mg/L	0.00005	0.0003	<0.0003	<0.0001	<0.00005	<0.0001	<0.0005	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.000050	<0.000050	<0.00005	<0.000050
Total Tin (Sn)	mg/L	0.001	NO	-	-	-	-	-	<0.005	-	-	-	-	-	-	<0.0010	<0.0010
Titanium	mg/L	0.005	NO	0.002	<0.01	<0.005	<0.005	<0.025	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0050	<0.0050	0.0076	0.057
Tungsten	mg/L	0.001	0.03	<0.010	<0.005	0.02	<0.01	<0.050	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0010	<0.0010	<0.0010	<0.0010
Uranium	mg/L	0.0001	0.005	<0.002	0.001	0.00110	0.0009	0.0013	0.0003	0.0009	0.001	0.001	0.0009	0.00096	0.00095	0.00099	0.0016
Vanadium	mg/L	0.0005	0.006	0.005	0.001	0.0004	0.0027	<0.0025	<0.0005	0.0005	0.0005	0.0005	0.0006	0.00082	0.00083	0.0010	0.0040
Zinc	mg/L	0.005	0.03	0.006	<0.01	0.015	0.015	<0.025	<0.005	0.006	<0.005	<0.005	0.006	<0.0050	<0.0050	0.0055	0.011
Zirconium	mg/L	0.001	0.004	<0.004	<0.002	<0.003	<0.001	<0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0010	<0.0010	<0.0010	<0.0010
Dissolved Mercury	mg/L	0.0001	0.0002	<0.0001	<0.0001	<0.00002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.00010	<0.00010
Inorganics																	
Electrical Conductivity	uS/cm	1.0	NO	1450	2150	1400	2110	3120	1780	1700	1790	1820	1880	1900	1900	2000	1800
pH	pH Units	-	6.5-8.5	8.33	7.96	7.70	7.68	7.52	7.89	7.98	7.58	7.65	7.69	8.14	8.14	8.16	8.23
Total Hardness (as CaCO3)	mg/L	1.0	NO	359	389	340	428	368	387	348	388	389	347	450	460	360	360
Alkalinity (as CaCO3)	mg/L	1.0	NO	263	267	264	279	262	272	258	286	272	255	270	270	270	250
Chloride	mg/L	6.0	NO	343	511	312	467	630	385	413	366	372	375	420	420	430	410
Sulphate	mg/L	1.0	NO	28.8	32	30	30	40	30	34.6	29.7	31.3	30.4	28	28	27	28
Ammonia as N	mg/L	0.050	NO	-	0.72	0.29	0.96	0.85	0.50	0.44	0.47	0.47	0.51	0.52	0.56	0.55	0.53
Unionized Ammonia (calculated)	mg/L	NA	0.02	-	0.005	0.001	<0.001	0.020	0.010	0.018	0.006	0.006	0.007	0.015	0.016	0.023	0.025
Calcium	mg/L	0.2	NO	120	131	123	145	125	129	115	130	130	114	-	-	120	130
Magnesium	mg/L	0.05	NO	14.4	15	14.6	15.8	13.5	16	14.8	15.6	15.6	15.1	-	-	15	17
Sodium	mg/L	0.1	NO	173	288	170	318	414	208	191	210	213	193	-	-	250	260
Potassium	mg/L	0.2	NO	2.96	3	2.6	2.73	3.01	2.83	3.06	2.76	2.80	2.81	-	-	2.7	3.1

- Notes:
- 1. NO = No objective
 - 2. mg/L = Milligrams per Litre
 - 3. RDL = Laboratory Reportable Detection Limit
 - 4. PWQO = Provincial Water Quality Objectives, July, 1994
 - 5. Bold type and shaded indicates an exceedance of the PWQO

Table 3
Surface Water Analytical Results
Metals and Inorganics
City of Barrie Bunker's Creek Historical Waste Sites

Monitoring Well Location				SWB2												
Sampling Date				08-Nov-12	23-Apr-13	23-Aug-13	10-Dec-13	26-Nov-14	24-Sep-15	07-Sep-16		15-Sep-17	07-Sep-18	05-Sep-19	11-Sep-20	17-Sep-21
Parameter	Units	RDL	PWQO								Field Duplicate of SWB2					
Dissolved Metals																
Aluminum-dissolved	mg/L	0.005	0.075	<0.004	0.06	0.04	0.004	0.003	<0.001	<0.001	0.005	0.002	<0.001	<0.005	0.006	0.011
Aluminum (total)	mg/L	0.0049	NO	-	-	0.11	-	-	0.372	-	-	-	-	0.039	0.061	0.75
Antimony	mg/L	0.0005	0.020	<0.003	<0.0005	< 0.0001	<0.0005	<0.0025	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.00050	<0.0005	<0.00050
Arsenic	mg/L	0.001	0.1	0.003	<0.001	0.0003	<0.001	<0.005	<0.001	0.002	0.004	<0.001	<0.001	<0.0010	<0.001	<0.0010
Barium	mg/L	0.002	NO	0.122	0.14	0.173	0.139	0.143	0.174	0.170	0.187	0.161	0.139	0.160	0.160	0.160
Beryllium	mg/L	0.0004	1.1	<0.001	<0.0005	< 0.0001	<0.0005	<0.0025	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.00050	<0.00040	<0.00040
Boron	mg/L	0.01	0.2	0.016	0.01	0.018	0.018	<0.050	0.081	0.037	0.023	0.021	0.013	0.024	0.017	0.022
Cadmium	mg/L	0.00009	0.0002	<0.0001	<0.0001	0.00008	<0.0001	<0.0005	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.00010	<0.00009	<0.000090
Chromium	mg/L	0.005	NO	0.012	0.003	0.0021	0.008	<0.005	<0.001	0.003	0.001	<0.001	<0.001	<0.0050	<0.005	<0.0050
Cobalt	mg/L	0.0005	0.0009	<0.0005	0.0004	< 0.0001	<0.0005	<0.0025	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0050	<0.0005	0.00058
Copper	mg/L	0.0009	0.005	<0.002	0.002	0.0053	0.0028	<0.0025	<0.0005	0.0012	0.0013	<0.0005	0.0031	0.0011	0.0032	0.0031
Iron	mg/L	0.1	0.3	0.831	1.01	0.731	1.03	0.933	0.745	0.553	0.606	0.712	0.613	0.820	0.900	1.9
Lead	mg/L	0.0005	0.025	0.001	<0.001	0.00083	0.0008	0.0007	0.0007	0.0103	<0.0001	0.0003	0.0002	<0.00050	<0.00050	0.0028
Total Lithium (Li)	mg/L	0.005	NO	-	-	-	-	-	-	-	-	-	-	-	<0.005	<0.0050
Manganese	mg/L	0.002	NO	0.07	0.10	0.030	0.080	0.102	0.052	0.034	0.038	0.047	0.045	0.053	0.059	0.13
Molybdenum	mg/L	0.0005	0.04	<0.002	<0.005	0.0007	<0.0005	<0.0025	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.00050	0.00055	0.00064
Nickel	mg/L	0.001	0.025	<0.003	<0.005	< 0.01	0.004	<0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0010	<0.0010	0.0015
Selenium	mg/L	0.002	0.1	<0.004	<0.001	< 0.001	<0.001	<0.005	<0.001	0.002	0.009	<0.001	<0.001	<0.0020	<0.0020	<0.0020
Total Silicon (Si)	mg/L	0.05	NO	-	-	-	-	-	-	-	-	-	-	-	5.0	6.3
Silver	mg/L	0.00009	0.0001	<0.0001	<0.0001	< 0.00002	<0.0001	<0.0005	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.00010	<0.00009	<0.000090
Strontium	mg/L	0.001	NO	0.471	0.615	0.519	0.431	0.545	0.539	0.475	0.533	0.516	0.399	0.480	0.490	0.580
Total Tellurium (Te)	mg/L	0.001	NO	-	-	-	-	-	-	-	-	-	-	-	<0.0010	<0.0010
Thallium	mg/L	0.00005	0.0003	<0.0003	<0.0001	< 0.00005	<0.0001	<0.0005	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.000050	<0.00005	<0.000050
Total Tin (Sn)	mg/L	0.001	NO	-	-	-	-	-	<0.005	-	-	-	-	-	<0.0010	<0.0010
Titanium	mg/L	0.005	NO	0.003	<0.01	< 0.005	<0.005	<0.025	<0.005	<0.005	<0.005	<0.005	<0.005	0.0052	0.0056	0.038
Tungsten	mg/L	0.001	0.03	<0.010	<0.005	0.02	<0.01	<0.050	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0010	<0.0010	<0.0010
Uranium	mg/L	0.0001	0.005	<0.002	0.001	0.00134	0.0009	0.0013	0.0011	0.0010	0.0011	0.0011	0.0008	0.001	0.0011	0.0014
Vanadium	mg/L	0.0005	0.006	0.006	0.002	0.0005	0.0023	<0.0025	0.0008	0.0007	0.0008	0.0007	0.0007	0.00087	0.0011	0.003
Zinc	mg/L	0.005	0.03	0.007	<0.01	0.014	0.011	<0.025	0.008	0.006	0.006	0.008	0.006	0.0059	0.0092	0.008
Zirconium	mg/L	0.001	0.004	<0.004	<0.002	< 0.003	<0.001	<0.005	<0.001	<0.001	0.002	<0.001	<0.001	<0.0010	<0.0010	<0.0010
Dissolved Mercury	mg/L	0.0001	0.0002	<0.0001	<0.0001	< 0.00002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.00010	<0.00010
Inorganics																
Electrical Conductivity	uS/cm	1.0	NO	1430	2180	1380	2130	2980	1790	1780	1790	1790	1860	1900	1900	1900
pH	pH Units	-	6.5-8.5	8.35	7.99	7.72	7.70	7.56	7.99	7.96	8.00	7.66	7.86	8.17	8.18	8.21
Total Hardness (as CaCO3)	mg/L	1.0	NO	348	389	335	384	334	389	383	422	419	352	440	350	360
Alkalinity (as CaCO3)	mg/L	1.0	NO	258	264	269	302	279	273	258	257	274	275	270	270	250
Chloride	mg/L	6.0	NO	340	526	370	478	623	398	401	382	345	370	420	390	440
Sulphate	mg/L	1.0	NO	29.4	32	30	40	40	30	34.3	35.1	31.7	30.6	29	28	27
Ammonia as N	mg/L	0.050	NO	-	0.54	0.11	0.66	0.53	0.34	0.23	0.22	0.29	0.23	0.34	0.29	0.37
Unionized Ammonia (calculated)	mg/L	NA	0.02	-	0.002	<0.001	0.001	0.016	0.013	0.010	0.010	0.004	0.004	0.011	0.012	0.017
Calcium	mg/L	0.2	NO	116	131	132	127	113	128	129	142	141	115	-	120	130
Magnesium	mg/L	0.05	NO	14.2	15	15.7	16.1	12.4	17	14.8	16.5	16.4	15.7	-	15	16
Sodium	mg/L	0.1	NO	166	315	179	301	346	224	203	225	224	187	-	250	250
Potassium	mg/L	0.2	NO	2.97	3	2.7	2.67	2.67	2.97	3.36	3.76	2.80	2.69	-	2.60	2.90

- Notes:
- 1. NO = No objective
 - 2. mg/L = Milligrams per Litre
 - 3. RDL = Laboratory Reportable Detection Limit
 - 4. PWQO = Provincial Water Quality Objectives, July, 1994
 - 5. Bold type and shaded indicates an exceedance of the PWQO

Table 3
Surface Water Analytical Results
Metals and Inorganics
City of Barrie Bunker's Creek Historical Waste Sites

Monitoring Well Location				SWB3													
Sampling Date				08-Nov-12	23-Apr-13	23-Aug-13	10-Dec-13	26-Nov-14	24-Sep-15		07-Sep-16	15-Sep-17	07-Sep-18	05-Sep-19	11-Sep-20	11-Sep-20	17-Sep-21
Parameter	Units	RDL	PWQO							Field Duplicate of SWB3						Field Duplicate of SWB3	
Dissolved Metals																	
Aluminum-dissolved	mg/L	0.005	0.075	<0.004	0.05	0.04	0.004	0.004	<0.001	<0.001	0.003	0.002	<0.001	<0.005	0.006	0.006	0.009
Aluminum (total)	mg/L	0.0049	NO	-	-	0.2	-	-	0.035	0.515	-	-	-	0.021	0.041	0.046	0.33
Antimony	mg/L	0.0005	0.020	<0.003	<0.0005	0.0001	<0.0005	<0.0025	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.00050	<0.0005	<0.0005	<0.00050
Arsenic	mg/L	0.001	0.1	0.003	<0.001	0.0004	<0.001	<0.005	<0.001	<0.001	0.002	<0.001	<0.001	<0.0010	<0.001	<0.001	<0.0010
Barium	mg/L	0.002	NO	0.116	0.15	0.181	0.156	0.158	0.163	0.167	0.199	0.156	0.157	0.140	0.150	0.150	0.150
Beryllium	mg/L	0.0004	1.1	<0.001	<0.0005	<0.0001	<0.0005	<0.0025	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.00050	<0.00040	<0.00040	<0.00040
Boron	mg/L	0.01	0.2	0.017	0.01	0.019	0.018	<0.050	0.032	0.079	0.026	0.020	0.018	0.029	0.016	0.016	0.023
Cadmium	mg/L	0.00009	0.0002	<0.0001	<0.0001	0.00008	<0.0001	<0.0005	<0.0001	0.0001	0.0001	<0.0001	<0.0001	<0.00010	<0.00009	<0.00009	<0.000090
Chromium	mg/L	0.005	NO	0.014	0.003	0.0025	0.009	<0.005	<0.001	0.001	0.001	<0.001	<0.001	<0.0050	<0.005	<0.005	<0.0050
Cobalt	mg/L	0.0005	0.0009	<0.0005	0.0004	0.0001	<0.0005	<0.0025	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0050	<0.0005	<0.0005	<0.00050
Copper	mg/L	0.0009	0.005	0.002	0.002	0.0069	0.0032	<0.0025	<0.0005	<0.0005	0.0022	<0.0005	0.0017	0.0010	0.0014	0.0013	0.0023
Iron	mg/L	0.1	0.3	1.27	1.20	1.20	1.42	1.10	0.391	1.39	1.10	0.742	0.995	1.10	0.800	0.800	1.3
Lead	mg/L	0.0005	0.025	0.001	<0.001	0.00162	0.0013	0.0009	0.0006	0.0041	0.0004	0.0003	0.0009	<0.00050	<0.00050	<0.00050	0.0014
Total Lithium (Li)	mg/L	0.005	NO	-	-	-	-	-	-	-	-	-	-	-	<0.005	<0.005	<0.0050
Manganese	mg/L	0.002	NO	0.095	0.13	0.098	0.106	0.125	0.061	0.075	0.054	0.049	0.063	0.070	0.058	0.059	0.110
Molybdenum	mg/L	0.0005	0.04	<0.002	<0.005	0.0007	<0.0005	<0.0025	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.00050	<0.0005	0.00055	0.00068
Nickel	mg/L	0.001	0.025	<0.003	<0.005	<0.01	0.004	<0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0010	<0.0010	<0.0010	0.0011
Selenium	mg/L	0.002	0.1	<0.004	<0.001	<0.001	<0.001	<0.005	<0.001	<0.001	0.004	<0.001	<0.001	<0.0020	<0.0020	<0.0020	<0.0020
Total Silicon (Si)	mg/L	0.05	NO	-	-	-	-	-	-	-	-	-	-	-	4.8	4.8	5.6
Silver	mg/L	0.00009	0.0001	<0.0001	<0.0001	<0.00002	<0.0001	<0.0005	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.00010	<0.00009	<0.00009	<0.000090
Strontium	mg/L	0.001	NO	0.53	0.715	0.530	0.559	0.653	0.502	0.505	0.584	0.493	0.536	0.580	0.480	0.480	0.570
Total Tellurium (Te)	mg/L	0.001	NO	-	-	-	-	-	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010
Thallium	mg/L	0.00005	0.0003	<0.0003	<0.0001	<0.00005	<0.0001	<0.0005	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.000050	<0.00005	<0.00005	<0.000050
Total Tin (Sn)	mg/L	0.001	NO	-	-	-	-	-	<0.005	<0.005	-	-	-	-	<0.0010	<0.0010	<0.0010
Titanium	mg/L	0.005	NO	0.005	<0.01	0.010	0.006	<0.025	<0.005	0.010	<0.005	<0.005	<0.005	<0.0050	<0.0050	<0.0050	0.019
Tungsten	mg/L	0.001	0.03	<0.010	<0.005	0.01	<0.01	<0.050	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0010	<0.0010	<0.0010	<0.0010
Uranium	mg/L	0.0001	0.005	<0.002	0.001	0.00146	0.0011	0.0013	0.0003	0.0011	0.0011	0.0011	0.0011	0.0012	0.00098	0.00099	0.0015
Vanadium	mg/L	0.0005	0.006	0.007	0.001	0.0008	0.0034	<0.0025	<0.0005	0.0017	0.0010	0.0007	0.0009	0.0009	0.0012	0.0010	0.0020
Zinc	mg/L	0.005	0.03	0.019	<0.01	0.029	0.018	<0.025	0.014	0.030	0.010	<0.005	0.009	<0.0050	0.005	<0.0050	<0.0050
Zirconium	mg/L	0.001	0.004	<0.004	<0.002	<0.003	<0.001	<0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0010	<0.0010	<0.0010	<0.0010
Dissolved Mercury	mg/L	0.0001	0.0002	<0.0001	<0.0001	<0.00002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.00010	<0.00010	<0.00010
Inorganics																	
Electrical Conductivity	uS/cm	1.0	NO	1560	2400	1390	2300	3140	1800	1800	1980	1830	1980	2100	1900	2000	1900
pH	pH Units	-	6.5-8.5	8.32	7.95	7.76	7.66	7.51	7.91	7.95	8.01	7.70	7.56	8.14	8.17	8.22	8.19
Total Hardness (as CaCO3)	mg/L	1.0	NO	374	380	347	461	332	392	400	417	392	388	430	350	350	350
Alkalinity (as CaCO3)	mg/L	1.0	NO	259	264	259	292	279	273	267	269	271	262	260	270	260	240
Chloride	mg/L	6.0	NO	426	589	394	522	788	399	361	466	365	390	480	420	410	440
Sulphate	mg/L	1.0	NO	32.7	35	30	40	40	30	30	36.9	31.4	32.7	30	28	28	28
Ammonia as N	mg/L	0.050	NO	-	0.54	0.11	0.56	0.53	0.27	0.28	0.22	0.26	0.40	0.34	0.31	0.30	0.35
Unionized Ammonia (calculated)	mg/L	NA	0.02	-	0.002	<0.001	0.001	0.011	0.012	0.012	0.011	0.005	0.004	0.011	0.012	0.013	0.016
Calcium	mg/L	0.2	NO	127	129	136	156	113	131	133	141	131	127	-	120	120	120
Magnesium	mg/L	0.05	NO	13.9	14	16.0	17.0	12.2	15.5	16.5	15.6	15.6	17	-	15	15	15
Sodium	mg/L	0.1	NO	227	382	180	414	465	209	208	243	214	232	-	240	240	280
Potassium	mg/L	0.2	NO	3.46	3	2.8	3.04	2.84	2.76	2.78	3.94	2.71	3.27	-	2.50	2.50	2.70

- Notes:
- 1. NO = No objective
 - 2. mg/L = Milligrams per Litre
 - 3. RDL = Laboratory Reportable Detection Limit
 - 4. PWQO = Provincial Water Quality Objectives, July, 1994
 - 5. Bold type and shaded indicates an exceedance of the PWQO

Table 3
Surface Water Analytical Results
Metals and Inorganics
City of Barrie Bunker's Creek Historical Waste Sites

Monitoring Well Location				SWB4											
Sampling Date				08-Nov-12	23-Apr-13	23-Aug-13	10-Dec-13	26-Nov-14	24-Sep-15	07-Sep-16	15-Sep-17	07-Sep-18	05-Sep-19	11-Sep-20	17-Sep-21
Parameter	Units	RDL	PWQO												
Dissolved Metals															
Aluminum-dissolved	mg/L	0.005	0.075	<0.004	0.03	0.04	0.006	0.008	<0.001	<0.001	0.002	<0.001	<0.005	0.006	0.010
Aluminum (total)	mg/L	0.0049	NO	-	-	0.07	-	-	0.347	-	-	-	0.088	0.025	0.82
Antimony	mg/L	0.0005	0.020	<0.003	<0.0005	0.0002	<0.0005	<0.0025	<0.0005	<0.0005	<0.0005	<0.0005	<0.00050	<0.0005	<0.00050
Arsenic	mg/L	0.001	0.1	0.003	<0.001	0.0006	<0.001	<0.005	<0.001	0.002	<0.001	<0.001	<0.0010	<0.001	<0.0010
Barium	mg/L	0.002	NO	0.121	0.14	0.163	0.137	0.161	0.156	0.145	0.147	0.144	0.150	0.130	0.140
Beryllium	mg/L	0.0004	1.1	<0.001	<0.0005	<0.0001	<0.0005	<0.0025	<0.0005	<0.0005	<0.0005	<0.0005	<0.00050	<0.00040	<0.00040
Boron	mg/L	0.01	0.2	0.017	0.01	0.022	0.018	<0.050	0.085	0.039	0.014	0.018	0.029	0.017	0.028
Cadmium	mg/L	0.00009	0.0002	<0.0001	<0.0001	0.00010	<0.0001	<0.0005	<0.0001	<0.0001	<0.0001	<0.0001	<0.00010	<0.00009	<0.000090
Chromium	mg/L	0.005	NO	0.012	0.003	0.0026	0.009	0.005	<0.001	0.001	<0.001	<0.001	<0.0050	<0.005	<0.0050
Cobalt	mg/L	0.0005	0.0009	<0.0005	0.0004	0.0001	<0.0005	<0.0025	<0.0005	<0.0005	<0.0005	<0.0005	<0.0050	<0.0005	0.0006
Copper	mg/L	0.0009	0.005	0.002	0.002	0.0089	0.0018	<0.0025	<0.0005	0.0010	<0.0005	0.0014	0.0023	0.0013	0.0038
Iron	mg/L	0.1	0.3	1.26	1.19	1.01	1.33	1.18	0.927	0.760	<0.100	1.06	1.30	0.960	1.9
Lead	mg/L	0.0005	0.025	<0.001	<0.001	0.00541	0.0003	0.0013	0.0003	<0.0001	<0.0001	0.0002	0.00069	<0.00050	0.0047
Total Lithium (Li)	mg/L	0.005	NO	-	-	-	-	-	-	-	-	-	-	<0.005	<0.0050
Manganese	mg/L	0.002	NO	0.101	0.12	0.079	0.118	0.136	0.064	0.039	0.007	0.068	0.079	0.062	0.12
Molybdenum	mg/L	0.0005	0.04	<0.002	<0.005	0.0008	<0.0005	<0.0025	0.0007	<0.0005	<0.0005	<0.0005	<0.00050	<0.0005	0.0016
Nickel	mg/L	0.001	0.025	<0.003	<0.005	<0.01	0.004	<0.005	<0.001	<0.001	<0.001	<0.001	<0.0010	<0.0010	0.0015
Selenium	mg/L	0.002	0.1	<0.004	<0.001	<0.001	<0.001	<0.005	<0.001	0.003	<0.001	<0.001	<0.0020	<0.0020	<0.0020
Total Silicon (Si)	mg/L	0.05	NO	-	-	-	-	-	-	-	-	-	-	4.3	6.2
Silver	mg/L	0.00009	0.0001	<0.0001	<0.0001	0.00002	<0.0001	<0.0005	<0.0001	<0.0001	<0.0001	<0.0001	<0.00010	<0.00009	<0.000090
Strontium	mg/L	0.001	NO	0.573	0.763	0.690	0.614	0.841	0.695	0.582	0.348	0.562	0.600	0.540	0.560
Total Tellurium (Te)	mg/L	0.001	NO	-	-	-	-	-	-	-	-	-	-	<0.0010	<0.0010
Thallium	mg/L	0.00005	0.0003	<0.0003	<0.0001	<0.00005	<0.0001	<0.0005	<0.0001	<0.0001	<0.0001	<0.0001	<0.000050	<0.00005	<0.000050
Total Tin (Sn)	mg/L	0.001	NO	-	-	-	-	-	<0.005	-	-	-	-	<0.0010	<0.0010
Titanium	mg/L	0.005	NO	0.002	<0.01	<0.005	<0.005	<0.025	<0.005	<0.005	<0.005	<0.005	0.0078	<0.0050	0.043
Tungsten	mg/L	0.001	0.03	<0.010	<0.005	0.02	<0.010	<0.050	<0.010	<0.010	<0.010	<0.010	<0.0010	<0.0010	<0.0010
Uranium	mg/L	0.0001	0.005	<0.002	0.001	0.00144	0.0013	0.0016	0.0014	0.0013	0.0008	0.0011	0.0013	0.0011	0.0042
Vanadium	mg/L	0.0005	0.006	0.007	0.001	0.0006	0.0044	<0.0025	0.0007	0.0006	0.0006	0.0008	0.0012	0.001	0.0035
Zinc	mg/L	0.005	0.03	0.008	0.02	0.013	0.006	<0.025	0.007	<0.005	<0.005	0.014	0.014	<0.0050	0.0098
Zirconium	mg/L	0.001	0.004	<0.004	<0.002	<0.003	<0.001	<0.005	<0.001	<0.001	<0.001	<0.001	<0.0010	<0.0010	<0.0010
Dissolved Mercury	mg/L	0.0001	0.0002	<0.0001	<0.0001	<0.00002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.00010	<0.00010
Inorganics															
Electrical Conductivity	uS/cm	1.0	NO	1600	2580	1450	2310	4410	2010	1870	1590	1960	2100	1900	2400
pH	pH Units	-	6.5-8.5	8.35	7.95	7.72	7.73	7.49	7.81	7.94	7.87	7.60	8.15	8.15	8.20
Total Hardness (as CaCO3)	mg/L	1.0	NO	332	377	335	459	358	374	376	388	388	430	330	350
Alkalinity (as CaCO3)	mg/L	1.0	NO	257	262	268	295	267	278	268	276	249	270	250	240
Chloride	mg/L	6.0	NO	404	649	414	505	1130	442	434	324	365	470	430	600
Sulphate	mg/L	1.0	NO	32.6	37	30	40	40	30	35.7	30.0	34.9	29	28	32
Ammonia as N	mg/L	0.050	NO	-	0.40	0.15	0.51	0.44	0.38	0.24	<0.03	0.34	0.26	0.26	0.30
Unionized Ammonia (calculated)	mg/L	NA	0.02	-	-	0.002	0.001	0.011	0.016	0.009	<0.001	0.004	0.009	0.010	0.015
Calcium	mg/L	0.2	NO	113	128	130	156	123	125	127	129	126	-	110	120
Magnesium	mg/L	0.05	NO	12.2	14	15.1	16.9	12.5	14.7	14.0	15.8	17.5	-	14.0	14.0
Sodium	mg/L	0.1	NO	216	428	221	369	696	258	216	169	239	-	260	370
Potassium	mg/L	0.2	NO	3.11	3	2.8	3.19	3.21	2.99	3.39	2.26	3.26	-	2.60	3.00

- Notes:
- 1. NO = No objective
 - 2. mg/L = Milligrams per Litre
 - 3. RDL = Laboratory Reportable Detection Limit
 - 4. PWQO = Provincial Water Quality Objectives, July, 1994
 - 5. Bold type and shaded indicates an exceedance of the PWQO

Table 3
Surface Water Analytical Results
Metals and Inorganics
City of Barrie Bunker's Creek Historical Waste Sites

Monitoring Well Location				SWB5												Field Blank
Sampling Date				08-Nov-12	23-Apr-13	23-Aug-13	10-Dec-13	26-Nov-14	24-Sep-15	07-Sep-16	15-Sep-17	07-Sep-18	05-Sep-19	11-Sep-20	17-Sep-21	17-Sep-21
Parameter	Units	RDL	PWQO													
Dissolved Metals																
Aluminum-dissolved	mg/L	0.005	0.075	<0.004	0.05	0.04	0.004	0.006	<0.001	<0.001	<0.001	<0.001	<0.005	0.006	0.011	<0.005
Aluminum (total)	mg/L	0.0049	NO	-	-	0.07	-	-	0.348	-	-	-	0.024	0.033	0.29	0.034
Antimony	mg/L	0.0005	0.020	<0.003	<0.0005	< 0.0001	<0.0005	<0.0025	<0.0005	<0.0005	<0.0005	<0.0005	<0.00050	<0.0005	<0.00050	<0.00050
Arsenic	mg/L	0.001	0.1	<0.003	<0.001	0.0004	<0.001	<0.005	<0.001	0.001	<0.001	<0.001	<0.0010	<0.001	<0.0010	<0.0010
Barium	mg/L	0.002	NO	0.102	0.12	0.154	0.127	0.153	0.148	0.140	0.139	0.133	0.140	0.120	0.120	<0.0020
Beryllium	mg/L	0.0004	1.1	<0.001	<0.0005	< 0.0001	<0.0005	<0.0025	<0.0005	<0.0005	<0.0005	<0.0005	<0.00050	<0.00040	<0.00040	<0.00040
Boron	mg/L	0.01	0.2	0.011	<0.01	0.016	0.015	<0.050	0.082	0.030	0.019	0.013	0.024	0.014	0.017	<0.010
Cadmium	mg/L	0.00009	0.0002	<0.0001	<0.0001	0.00012	<0.0001	<0.0005	<0.0001	<0.0001	<0.0001	<0.0001	<0.00010	<0.00009	<0.000090	<0.000090
Chromium	mg/L	0.005	NO	0.012	0.003	0.0049	0.008	<0.005	<0.001	0.001	<0.001	<0.001	<0.0050	<0.005	<0.0050	<0.0050
Cobalt	mg/L	0.0005	0.0009	<0.0005	0.0004	0.0001	<0.0005	<0.0025	<0.0005	<0.0005	<0.0005	<0.0005	<0.0050	<0.0005	<0.00050	<0.00050
Copper	mg/L	0.0009	0.005	<0.002	0.002	0.010	0.0011	<0.0025	<0.0005	0.0008	<0.0005	0.0011	<0.0010	<0.0009	0.0018	<0.00090
Iron	mg/L	0.1	0.3	0.604	0.54	0.605	0.511	1.04	0.586	0.431	0.564	0.521	0.470	0.630	0.950	<0.100
Lead	mg/L	0.0005	0.025	0.001	<0.001	0.00142	0.0001	0.0012	0.0002	<0.0001	<0.0001	0.0001	<0.00050	<0.00050	0.0014	<0.00050
Total Lithium (Li)	mg/L	0.005	NO	-	-	-	-	-	-	-	-	-	-	<0.005	<0.0050	<0.0050
Manganese	mg/L	0.002	NO	0.081	0.10	0.064	0.095	0.168	0.061	0.042	0.058	0.060	0.053	0.058	0.093	<0.0020
Molybdenum	mg/L	0.0005	0.04	<0.002	<0.005	0.0015	<0.0005	<0.0025	<0.0005	<0.0005	<0.0005	<0.0005	<0.00050	<0.0005	0.0014	<0.00050
Nickel	mg/L	0.001	0.025	<0.003	<0.005	< 0.01	0.004	<0.005	<0.001	<0.001	<0.001	0.001	<0.0010	<0.0010	0.001	<0.0010
Selenium	mg/L	0.002	0.1	<0.004	<0.001	< 0.001	<0.001	<0.005	<0.001	0.002	<0.001	<0.001	<0.0020	<0.0020	<0.0020	<0.0020
Total Silicon (Si)	mg/L	0.05	NO	-	-	-	-	-	-	-	-	-	-	4.2	5.1	<0.050
Silver	mg/L	0.00009	0.0001	<0.0001	<0.0001	0.00002	<0.0001	<0.0005	<0.0001	<0.0001	<0.0001	<0.0001	<0.00010	<0.00009	<0.000090	<0.000090
Strontium	mg/L	0.001	NO	0.521	0.684	0.636	0.568	1.01	0.628	0.562	0.600	0.521	0.570	0.500	0.530	<0.0010
Total Tellurium (Te)	mg/L	0.001	NO	-	-	-	-	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010
Thallium	mg/L	0.00005	0.0003	<0.0003	<0.0001	< 0.00005	<0.0001	<0.0005	<0.0001	<0.0001	<0.0001	<0.0001	<0.000050	<0.00005	<0.000050	<0.000050
Total Tin (Sn)	mg/L	0.001	NO	-	-	-	-	-	<0.005	-	-	-	-	<0.0010	<0.0010	<0.0010
Titanium	mg/L	0.005	NO	0.004	<0.01	< 0.005	<0.005	<0.025	<0.005	<0.005	<0.005	<0.005	<0.0050	<0.0050	0.018	<0.0050
Tungsten	mg/L	0.001	0.03	<0.010	<0.005	0.02	<0.010	<0.050	<0.010	<0.010	<0.010	<0.010	<0.0010	<0.0010	<0.0010	<0.0010
Uranium	mg/L	0.0001	0.005	<0.002	0.001	0.00172	0.0014	0.0013	0.0015	0.0014	0.0015	0.0013	0.0013	0.0012	0.0029	<0.00010
Vanadium	mg/L	0.0005	0.006	0.008	0.001	0.0008	0.0042	<0.0025	0.0009	0.0009	0.0009	0.0010	0.0011	0.0011	0.0023	<0.00050
Zinc	mg/L	0.005	0.03	0.016	<0.01	0.013	<0.005	0.034	<0.005	<0.005	<0.005	0.015	<0.0050	<0.0050	<0.0050	<0.0050
Zirconium	mg/L	0.001	0.004	<0.004	<0.002	< 0.003	<0.001	<0.005	<0.001	<0.001	<0.001	<0.001	<0.0010	<0.0010	<0.0010	<0.0010
Dissolved Mercury	mg/L	0.0001	0.0002	<0.0001	<0.0001	< 0.00002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.00010	<0.00010	<0.00010
Inorganics																
Electrical Conductivity	uS/cm	1.0	NO	1520	2560	1410	2260	5360	1910	1800	1900	1890	2000	1900	2100	<1.0
pH	pH Units	-	6.5-8.5	8.38	8	7.80	7.78	7.42	7.91	7.93	7.83	7.80	8.20	8.28	8.37	5.80
Total Hardness (as CaCO3)	mg/L	1.0	NO	327	366	359	449	337	372	386	390	371	430	320	320	<1.0
Alkalinity (as CaCO3)	mg/L	1.0	NO	252	254	259	298	271	268	258	265	245	260	240	220	<1.0
Chloride	mg/L	6.0	NO	389	642	358	469	1260	410	421	417	389	440	430	510	<1.0
Sulphate	mg/L	1.0	NO	33.5	38	40	40	50	30	38.1	35.9	33.6	31	28	30	<1.0
Ammonia as N	mg/L	0.050	NO	-	0.14	<0.03	0.25	0.28	0.12	0.06	0.11	0.080	0.080	0.14	0.13	<0.050
Unionized Ammonia (calculated)	mg/L	NA	0.02	-	0.001	<0.001	0.001	0.006	0.005	0.003	0.002	0.001	0.003	0.007	0.009	na
Calcium	mg/L	0.2	NO	110	125	133	151	116	124	130	131	122	-	110	110	<0.2
Magnesium	mg/L	0.05	NO	12.6	13	15.6	17.2	11.1	14.7	14.7	15.3	15.9	-	13.0	13.0	<0.050
Sodium	mg/L	0.1	NO	192	416	212	355	801	233	215	240	221	-	240	320	<0.1
Potassium	mg/L	0.2	NO	2.69	3	2.7	3.1	3.05	2.73	3.35	2.80	2.86	-	2.40	2.60	<0.2

- Notes:
- 1. NO = No objective
 - 2. mg/L = Milligrams per Litre
 - 3. RDL = Laboratory Reportable Detection Limit
 - 4. PWQO = Provincial Water Quality Objectives, July, 1994
 - 5. Bold type and shaded indicates an exceedance of the PWQO

Table 4
Surface Water Analytical Results
VOC and Petroleum Hydrocarbons
City of Barrie Bunker's Creek Historical Waste Sites

Surface Water Location				SWB1													
Sampling Date				08-Nov-12	23-Apr-13	23-Aug-13	10-Dec-13	26-Nov-14	24-Sep-15	07-Sep-16	15-Sep-17	15-Sep-17	07-Sep-18	05-Sep-19	05-Sep-19	11-Sep-20	17-Sep-21
Parameter	Units	RDL	PWQO									Field Duplicate of SWB1			Field Duplicate of SWB1		
VOC																	
Acetone	µg/L	10	NO	<1.0	<50	< 30	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10	<10	<10	<10
Benzene	µg/L	0.17	100	<0.20	<0.5	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20	<0.20	<0.20	<0.17
Bromodichloromethane	µg/L	0.50	200	<0.20	<0.3	< 2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50	<0.50	<0.50	<0.50
Bromoform	µg/L	1.0	60	<0.10	<0.4	< 5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1.0	<1.0	<1.0	<1.0
Bromomethane	µg/L	0.50	0.9	<0.20	<0.5	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50	<0.50	<0.50	<0.50
Carbon Tetrachloride	µg/L	0.20	NO	<0.20	<0.2	< 0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20	<0.20	<0.20	<0.20
Chlorobenzene	µg/L	0.20	15	<0.10	<0.2	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20	<0.20	<0.20	<0.20
Chloroethane	µg/L	-	NO	<0.20	<0.2	-	<1.0	<1.0	<1.0	<1.0	-	-	-	-	-	-	-
Chloroform	µg/L	0.20	NO	<0.20	<0.5	< 1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20	<0.20	<0.20	<0.20
Chloromethane	µg/L	-	700	<0.40	<0.2	-	<3.0	<3.0	<3.0	<3.0	-	-	-	-	-	-	-
Dibromochloromethane	µg/L	0.50	40	<0.10	<0.3	< 2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50	<0.50	<0.50	<0.50
1,2-Dichlorobenzene	µg/L	0.50	2.5	<0.10	<0.4	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50	<0.50	<0.50	<0.50
1,3-Dichlorobenzene	µg/L	0.50	2.5	<0.10	<0.4	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50	<0.50	<0.50	<0.50
1,4-Dichlorobenzene	µg/L	0.50	4	<0.10	<0.4	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50	<0.50	<0.50	<0.50
Dichlorodifluoromethane	µg/L	1.0	NO	<0.20	<0.5	< 2	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1-Dichloroethane	µg/L	0.20	200	<0.30	<0.4	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20	<0.20	<0.20	<0.20
1,2 - Dichloroethane	µg/L	0.50	100	<0.20	<0.2	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50	<0.50	<0.50	<0.50
1,1 Dichloroethylene	µg/L	0.20	40	<0.30	<0.5	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20	<0.20	<0.20	<0.20
cis- 1,2-Dichloroethylene	µg/L	0.50	200	0.98	<0.4	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50	<0.50	<0.50	<0.50
trans- 1,2-Dichloroethylene	µg/L	0.50	200	<0.20	<0.4	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50	<0.50	<0.50	<0.50
1,2-Dichloropropane	µg/L	0.20	0.7	<0.20	<0.5	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20	<0.20	<0.20	<0.20
1,3-Dichloropropene (Cis + Trans)	µg/L	0.50	NO	<0.30	<0.4	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	<0.50	<0.50
Ethylbenzene	µg/L	0.20	8	<0.10	<0.5	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20	<0.20	<0.20	<0.20
Ethylene Dibromide	µg/L	0.20	5	<0.10	<0.2	< 0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20	<0.20	<0.20	<0.20
n-Hexane	µg/L	1.0	NO	<0.20	<5	< 5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Methylene Chloride	µg/L	2.0	100	<0.30	<4.0	< 5	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<2.0	<2.0	<2.0	<2.0
Methyl Isobutyl Ketone	µg/L	5.0	NO	<1.0	<10	< 20	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Methyl Ethyl Ketone	µg/L	10	400	<1.0	<10	< 20	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10	<10	<10	<10
Methyl tert-butyl ether	µg/L	0.50	200	<0.20	<10	< 2	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<0.50	<0.50	<0.50	<0.50
Styrene	µg/L	0.50	4	<0.10	<0.5	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50	<0.50	<0.50	<0.50
1,1,1,2-Tetrachloroethane	µg/L	0.50	20	<0.10	<0.5	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50	<0.50	<0.50	<0.50
1,1,2,2-Tetrachloroethane	µg/L	0.50	70	<0.10	<0.5	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50	<0.50	<0.50	<0.50
Tetrachloroethylene	µg/L	0.20	50	<0.20	<0.3	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20	<0.20	<0.20	<0.20
Toluene	µg/L	0.20	0.8	<0.20	<0.5	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20	<0.20	<0.20	<0.20
1,1,1-Trichloroethane	µg/L	0.20	10	<0.30	<0.4	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20	<0.20	<0.20	<0.20
1,1,2-Trichloroethane	µg/L	0.50	800	<0.20	<0.4	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50	<0.50	<0.50	<0.50
Trichloroethylene	µg/L	0.20	20	<0.20	<0.3	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20	<0.20	<0.20	<0.20
1,3,5-Trimethylbenzene	µg/L	-	3	-	<0.3	-	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	-	-
Vinyl Chloride	µg/L	0.20	600	<0.17	<0.2	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.28	0.29	<0.20	0.23
m & p-Xylene	µg/L	0.20	32	<0.20	<0.5	< 1.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20	<0.20	<0.20	<0.20
o-Xylene	µg/L	0.20	40	<0.10	<0.5	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20	<0.20	<0.20	<0.20
Xylene Mixture (Total)	µg/L	0.20	NO	<0.20	<1.0	< 1.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20	<0.20	<0.20	<0.20
Trichlorofluoromethane	µg/L	0.50	NO	<0.40	<0.5	< 5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.50	<0.50	<0.50	<0.50
Petroleum Hydrocarbons																	
F1 (C6 to C10) minus BTEX	ug/L	25	NO	-	<100	<50	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
F2 (C10 to C16) minus Naphthalene	ug/L	100	NO	-	<100	<50	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
F3 (C16-C34)	ug/L	200	NO	<200	<400	<100	<100	<100	<100	<100	<100	<100	<100	<200	<200	<200	<200
F4 (C34-C50)	ug/L	200	NO	<200	<400	<100	<100	<100	<100	<100	<100	<100	<100	<200	<200	<200	<200

Table 4
Surface Water Analytical Results
VOC and Petroleum Hydrocarbons
City of Barrie Bunker's Creek Historical Waste Sites

Surface Water Location			SWB2												
Sampling Date			08-Nov-12	23-Apr-13	23-Aug-13	10-Dec-13	26-Nov-14	24-Sep-15	07-Sep-16		15-Sep-17	07-Sep-18	05-Sep-19	11-Sep-20	17-Sep-21
Parameter	Units	RDL								Field Duplicate of SWB2					
VOC															
Acetone	µg/L	10	<1.0	<50	< 30	<5.0	<5.0	<5.0	<5.0	-	<5.0	<5.0	<10	<10	<10
Benzene	µg/L	0.17	<0.20	<0.5	< 0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.20	<0.20	<0.17
Bromodichloromethane	µg/L	0.50	<0.20	<0.3	< 2	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.50	<0.50	<0.50
Bromoform	µg/L	1.0	<0.10	<0.4	< 5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<1.0	<1.0	<1.0
Bromomethane	µg/L	0.50	<0.20	<0.5	< 0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.50	<0.50	<0.50
Carbon Tetrachloride	µg/L	0.20	<0.20	<0.2	< 0.2	<0.2	<0.2	<0.2	<0.2	-	<0.2	<0.2	<0.20	<0.20	<0.20
Chlorobenzene	µg/L	0.20	<0.10	<0.2	< 0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.20	<0.20	<0.20
Chloroethane	µg/L	-	<0.20	<0.2	-	<1.0	<1.0	<1.0	<1.0	-	-	-	-	-	-
Chloroform	µg/L	0.20	<0.20	<0.5	< 1	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.20	<0.20	<0.20
Chloromethane	µg/L	-	<0.40	<0.2	-	<3.0	<3.0	<3.0	<3.0	-	-	-	-	-	-
Dibromochloromethane	µg/L	0.50	<0.10	<0.3	< 2	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.50	<0.50	<0.50
1,2-Dichlorobenzene	µg/L	0.50	<0.10	<0.4	< 0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.50	<0.50	<0.50
1,3-Dichlorobenzene	µg/L	0.50	<0.10	<0.4	< 0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.50	<0.50	<0.50
1,4-Dichlorobenzene	µg/L	0.50	<0.10	<0.4	< 0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.50	<0.50	<0.50
Dichlorodifluoromethane	µg/L	1.0	<0.20	<0.5	< 2	<1.0	<1.0	<1.0	<1.0	-	<1.0	<1.0	<1.0	<1.0	<1.0
1,1-Dichloroethane	µg/L	0.20	<0.30	<0.4	< 0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.20	<0.20	<0.20
1,2 - Dichloroethane	µg/L	0.50	<0.20	<0.2	< 0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.50	<0.50	<0.50
1,1 Dichloroethylene	µg/L	0.20	<0.30	<0.5	< 0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.20	<0.20	<0.20
cis- 1,2-Dichloroethylene	µg/L	0.50	<0.20	<0.4	< 0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.50	<0.50	<0.50
trans- 1,2-Dichloroethylene	µg/L	0.50	<0.20	<0.4	< 0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.50	<0.50	<0.50
1,2-Dichloropropane	µg/L	0.20	<0.20	<0.5	< 0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.20	<0.20	<0.20
1,3-Dichloropropene (Cis + Trans)	µg/L	0.50	<0.30	<0.4	< 0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	-	<0.50	<0.50
Ethylbenzene	µg/L	0.20	<0.10	<0.5	< 0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.20	<0.20	<0.20
Ethylene Dibromide	µg/L	0.20	<0.10	<0.2	< 0.2	<0.2	<0.2	<0.2	<0.2	-	<0.2	<0.2	<0.20	<0.20	<0.20
n-Hexane	µg/L	1.0	<0.20	<5	< 5	<1.0	<1.0	<1.0	<1.0	-	<1.0	<1.0	<1.0	<1.0	<1.0
Methylene Chloride	µg/L	2.0	<0.30	<4.0	< 5	<5.0	<5.0	<5.0	<5.0	-	<5.0	<5.0	<2.0	<2.0	<2.0
Methyl Isobutyl Ketone	µg/L	5.0	<1.0	<10	< 20	<5.0	<5.0	<5.0	<5.0	-	<5.0	<5.0	<5.0	<5.0	<5.0
Methyl Ethyl Ketone	µg/L	10	<1.0	<10	< 20	<5.0	<5.0	<5.0	<5.0	-	<5.0	<5.0	<10	<10	<10
Methyl tert-butyl ether	µg/L	0.50	<0.20	<10	< 2	<2.0	<2.0	<2.0	<2.0	-	<2.0	<2.0	<0.50	<0.50	<0.50
Styrene	µg/L	0.50	<0.10	<0.5	< 0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.50	<0.50	<0.50
1,1,1,2-Tetrachloroethane	µg/L	0.50	<0.10	<0.5	< 0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.50	<0.50	<0.50
1,1,2,2-Tetrachloroethane	µg/L	0.50	<0.10	<0.5	< 0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.50	<0.50	<0.50
Tetrachloroethylene	µg/L	0.20	<0.20	<0.3	< 0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.20	<0.20	<0.20
Toluene	µg/L	0.20	<0.20	<0.5	< 0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.20	<0.20	<0.20
1,1,1-Trichloroethane	µg/L	0.20	<0.30	<0.4	< 0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.20	<0.20	<0.20
1,1,2-Trichloroethane	µg/L	0.50	<0.20	<0.4	< 0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.50	<0.50	<0.50
Trichloroethylene	µg/L	0.20	<0.20	<0.3	< 0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.20	<0.20	<0.20
1,3,5-Trimethylbenzene	µg/L	-	-	<0.3	-	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	-
Vinyl Chloride	µg/L	0.20	<0.17	0.9	< 0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.20	<0.20	<0.20
m & p-Xylene	µg/L	0.20	<0.20	<0.5	< 1.0	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.20	<0.20	<0.20
o-Xylene	µg/L	0.20	<0.10	<0.5	< 0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.20	<0.20	<0.20
Xylene Mixture (Total)	µg/L	0.20	<0.20	<1.0	< 1.1	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.20	<0.20	<0.20
Trichlorofluoromethane	µg/L	0.50	<0.40	<0.5	< 5	<1.0	<1.0	<1.0	<1.0	-	<1.0	<1.0	<0.50	<0.50	<0.50
Petroleum Hydrocarbons															
F1 (C6 to C10) minus BTEX	ug/L	25	-	<100	<50	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
F2 (C10 to C16) minus Naphthalene	ug/L	100	-	<100	<50	<100	<236	<100	<100	<100	<100	<100	<100	<100	<100
F3 (C16-C34)	ug/L	200	<200	<400	<100	<236	<100	<100	<100	<100	<100	<100	<200	<200	<200
F4 (C34-C50)	ug/L	200	<200	<400	<100	<236	<100	<100	<100	<100	<100	<100	<200	<200	<200

Table 4
Surface Water Analytical Results
VOC and Petroleum Hydrocarbons
City of Barrie Bunker's Creek Historical Waste Sites

Surface Water Location			SWB3													
Sampling Date			08-Nov-12	23-Apr-13	23-Aug-13	10-Dec-13	26-Nov-14	24-Sep-15		07-Sep-16	15-Sep-17	07-Sep-18	05-Sep-19	11-Sep-20	11-Sep-20	17-Sep-21
Parameter	Units	RDL							Field Duplicate of SWB3						Field Duplicate of SWB3	
VOC																
Acetone	µg/L	10	<1.0	<50	< 30	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10	<10	<10	<10
Benzene	µg/L	0.17	<0.20	<0.5	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20	<0.20	<0.20	<0.17
Bromodichloromethane	µg/L	0.50	<0.20	<0.3	< 2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50	<0.50	<0.50	<0.50
Bromoform	µg/L	1.0	<0.10	<0.4	< 5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1.0	<1.0	<1.0	<1.0
Bromomethane	µg/L	0.50	<0.20	<0.5	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50	<0.50	<0.50	<0.50
Carbon Tetrachloride	µg/L	0.20	<0.20	<0.2	< 0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20	<0.20	<0.20	<0.20
Chlorobenzene	µg/L	0.20	<0.10	<0.2	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20	<0.20	<0.20	<0.20
Chloroethane	µg/L	-	<0.20	<0.2	-	<1.0	<1.0	<1.0	<1.0	<1.0	-	-	-	-	-	-
Chloroform	µg/L	0.20	<0.20	<0.5	< 1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20	<0.20	<0.20	<0.20
Chloromethane	µg/L	-	<0.40	<0.2	-	<3.0	<3.0	<3.0	<3.0	<3.0	-	-	-	-	-	-
Dibromochloromethane	µg/L	0.50	<0.10	<0.3	< 2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50	<0.50	<0.50	<0.50
1,2-Dichlorobenzene	µg/L	0.50	<0.10	<0.4	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50	<0.50	<0.50	<0.50
1,3-Dichlorobenzene	µg/L	0.50	<0.10	<0.4	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50	<0.50	<0.50	<0.50
1,4-Dichlorobenzene	µg/L	0.50	<0.10	<0.4	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50	<0.50	<0.50	<0.50
Dichlorodifluoromethane	µg/L	1.0	<0.20	<0.5	< 2	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1-Dichloroethane	µg/L	0.20	<0.30	<0.4	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20	<0.20	<0.20	<0.20
1,2 - Dichloroethane	µg/L	0.50	<0.20	<0.2	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50	<0.50	<0.50	<0.50
1,1 Dichloroethylene	µg/L	0.20	<0.30	<0.5	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20	<0.20	<0.20	<0.20
cis- 1,2-Dichloroethylene	µg/L	0.50	<0.20	<0.4	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50	<0.50	<0.50	<0.50
trans- 1,2-Dichloroethylene	µg/L	0.50	<0.20	<0.4	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50	<0.50	<0.50	<0.50
1,2-Dichloropropane	µg/L	0.20	<0.20	<0.5	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20	<0.20	<0.20	<0.20
1,3-Dichloropropene (Cis + Trans)	µg/L	0.50	<0.30	<0.4	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.50	<0.50	<0.50
Ethylbenzene	µg/L	0.20	<0.10	<0.5	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20	<0.20	<0.20	<0.20
Ethylene Dibromide	µg/L	0.20	<0.10	<0.2	< 0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20	<0.20	<0.20	<0.20
n-Hexane	µg/L	1.0	<0.20	<5	< 5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Methylene Chloride	µg/L	2.0	<0.30	<4.0	< 5	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<2.0	<2.0	<2.0	<2.0
Methyl Isobutyl Ketone	µg/L	5.0	<1.0	<10	< 20	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Methyl Ethyl Ketone	µg/L	10	<1.0	<10	< 20	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10	<10	<10	<10
Methyl tert-butyl ether	µg/L	0.50	<0.20	<10	< 2	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<0.50	<0.50	<0.50	<0.50
Styrene	µg/L	0.50	<0.10	<0.5	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50	<0.50	<0.50	<0.50
1,1,1,2-Tetrachloroethane	µg/L	0.50	<0.10	<0.5	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50	<0.50	<0.50	<0.50
1,1,2,2-Tetrachloroethane	µg/L	0.50	<0.10	<0.5	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50	<0.50	<0.50	<0.50
Tetrachloroethylene	µg/L	0.20	<0.20	0.5	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20	<0.20	<0.20	<0.20
Toluene	µg/L	0.20	<0.20	<0.5	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20	<0.20	<0.20	<0.20
1,1,1-Trichloroethane	µg/L	0.20	<0.30	<0.4	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20	<0.20	<0.20	<0.20
1,1,2-Trichloroethane	µg/L	0.50	<0.20	<0.4	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50	<0.50	<0.50	<0.50
Trichloroethylene	µg/L	0.20	<0.20	<0.3	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20	<0.20	<0.20	<0.20
1,3,5-Trimethylbenzene	µg/L	-	-	<0.3	-	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	-
Vinyl Chloride	µg/L	0.20	<0.17	<0.2	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20	<0.20	<0.20	<0.20
m & p-Xylene	µg/L	0.20	<0.20	<0.5	< 1.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20	<0.20	<0.20	<0.20
o-Xylene	µg/L	0.20	<0.10	<0.5	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20	<0.20	<0.20	<0.20
Xylene Mixture (Total)	µg/L	0.20	<0.20	<1.0	< 1.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20	<0.20	<0.20	<0.20
Trichlorofluoromethane	µg/L	0.50	<0.40	<0.5	< 5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.50	<0.50	<0.50	<0.50
Petroleum Hydrocarbons																
F1 (C6 to C10) minus BTEX	ug/L	25	-	<100	<50	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
F2 (C10 to C16) minus Naphthalene	ug/L	100	-	<100	<50	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
F3 (C16-C34)	ug/L	200	<200	<400	<100	<100	<100	<100	<100	<100	<100	<100	<200	<200	<200	<200
F4 (C34-C50)	ug/L	200	<200	<400	<100	<100	<100	<100	<100	<100	<100	<100	<200	<200	<200	<200

Table 4
Surface Water Analytical Results
VOC and Petroleum Hydrocarbons
City of Barrie Bunker's Creek Historical Waste Sites

Surface Water Location			SWB4											
Sampling Date			08-Nov-12	23-Apr-13	23-Aug-13	10-Dec-13	26-Nov-14	24-Sep-15	07-Sep-16	15-Sep-17	07-Sep-18	05-Sep-19	11-Sep-20	17-Sep-21
Parameter	Units	RDL												
VOC														
Acetone	µg/L	10	<1.0	<50	< 30	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10	<10	<10
Benzene	µg/L	0.17	<0.20	<0.5	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20	<0.20	<0.17
Bromodichloromethane	µg/L	0.50	<0.20	<0.3	< 2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50	<0.50	<0.50
Bromoform	µg/L	1.0	<0.10	<0.4	< 5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1.0	<1.0	<1.0
Bromomethane	µg/L	0.50	<0.20	<0.5	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50	<0.50	<0.50
Carbon Tetrachloride	µg/L	0.20	<0.20	<0.2	< 0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20	<0.20	<0.20
Chlorobenzene	µg/L	0.20	<0.10	<0.2	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20	<0.20	<0.20
Chloroethane	µg/L	-	<0.20	<0.2	-	<1.0	<1.0	<1.0	<1.0	-	-	-	-	-
Chloroform	µg/L	0.20	<0.20	<0.5	< 1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20	<0.20	<0.20
Chloromethane	µg/L	-	<0.40	<0.2	-	<3.0	<3.0	<3.0	<3.0	-	-	-	-	-
Dibromochloromethane	µg/L	0.50	<0.10	<0.3	< 2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50	<0.50	<0.50
1,2-Dichlorobenzene	µg/L	0.50	<0.10	<0.4	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50	<0.50	<0.50
1,3-Dichlorobenzene	µg/L	0.50	<0.10	<0.4	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50	<0.50	<0.50
1,4-Dichlorobenzene	µg/L	0.50	<0.10	<0.4	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50	<0.50	<0.50
Dichlorodifluoromethane	µg/L	1.0	<0.20	<0.5	< 2	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1-Dichloroethane	µg/L	0.20	<0.30	<0.4	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20	<0.20	<0.20
1,2 - Dichloroethane	µg/L	0.50	<0.20	<0.2	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50	<0.50	<0.50
1,1 Dichloroethylene	µg/L	0.20	<0.30	<0.5	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20	<0.20	<0.20
cis- 1,2-Dichloroethylene	µg/L	0.50	<0.20	<0.4	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50	<0.50	<0.50
trans- 1,2-Dichloroethylene	µg/L	0.50	<0.20	<0.4	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50	<0.50	<0.50
1,2-Dichloropropane	µg/L	0.20	<0.20	<0.5	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20	<0.20	<0.20
1,3-Dichloropropene (Cis + Trans)	µg/L	0.50	<0.30	<0.4	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.50	<0.50
Ethylbenzene	µg/L	0.20	<0.10	<0.5	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20	<0.20	<0.20
Ethylene Dibromide	µg/L	0.20	<0.10	<0.2	< 0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20	<0.20	<0.20
n-Hexane	µg/L	1.0	<0.20	<5	< 5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Methylene Chloride	µg/L	2.0	<0.30	<4.0	< 5	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<2.0	<2.0	<2.0
Methyl Isobutyl Ketone	µg/L	5.0	<1.0	<10	< 20	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Methyl Ethyl Ketone	µg/L	10	<1.0	<10	< 20	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10	<10	<10
Methyl tert-butyl ether	µg/L	0.50	<0.20	<10	< 2	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<0.50	<0.50	<0.50
Styrene	µg/L	0.50	<0.10	<0.5	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50	<0.50	<0.50
1,1,1,2-Tetrachloroethane	µg/L	0.50	<0.10	<0.5	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50	<0.50	<0.50
1,1,2,2-Tetrachloroethane	µg/L	0.50	<0.10	<0.5	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50	<0.50	<0.50
Tetrachloroethylene	µg/L	0.20	<0.20	<0.3	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20	<0.20	<0.20
Toluene	µg/L	0.20	<0.20	<0.5	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20	<0.20	<0.20
1,1,1-Trichloroethane	µg/L	0.20	<0.30	<0.4	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20	<0.20	<0.20
1,1,2-Trichloroethane	µg/L	0.50	<0.20	<0.4	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50	<0.50	<0.50
Trichloroethylene	µg/L	0.20	<0.20	<0.3	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20	<0.20	<0.20
1,3,5-Trimethylbenzene	µg/L	-	-	<0.3	-	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-
Vinyl Chloride	µg/L	0.20	<0.17	<0.2	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20	<0.20	<0.20
m & p-Xylene	µg/L	0.20	<0.20	<0.5	< 1.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20	<0.20	<0.20
o-Xylene	µg/L	0.20	<0.10	<0.5	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20	<0.20	<0.20
Xylene Mixture (Total)	µg/L	0.20	<0.20	<1.0	< 1.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20	<0.20	<0.20
Trichlorofluoromethane	µg/L	0.50	<0.40	<0.5	< 5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.50	<0.50	<0.50
Petroleum Hydrocarbons														
F1 (C6 to C10) minus BTEX	ug/L	25	-	<100	<50	<25	<25	<25	<25	<25	<25	<25	<25	<25
F2 (C10 to C16) minus Naphthalene	ug/L	100	-	<100	<50	<100	<100	<100	<100	<100	<100	<100	<100	<100
F3 (C16-C34)	ug/L	200	-	<200	<400	<100	<100	<100	<100	<100	<100	<200	<200	<200
F4 (C34-C50)	ug/L	200	-	<200	<400	<100	<100	<100	<100	<100	<100	<200	<200	<200

Table 4
Surface Water Analytical Results
VOC and Petroleum Hydrocarbons
City of Barrie Bunker's Creek Historical Waste Sites

Surface Water Location			SWB5												Field Blank	Trip Blank
Sampling Date			08-Nov-12	23-Apr-13	23-Aug-13	10-Dec-13	26-Nov-14	24-Sep-15	07-Sep-16	15-Sep-17	07-Sep-18	05-Sep-19	11-Sep-20	17-Sep-21	17-Sep-21	17-Sep-21
Parameter	Units	RDL														
VOC																
Acetone	µg/L	10	<1.0	<50	< 30	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10	<10	<10	<10	<10
Benzene	µg/L	0.17	<0.20	<0.5	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20	<0.20	<0.17	<0.17	<0.17
Bromodichloromethane	µg/L	0.50	<0.20	<0.3	< 2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50	<0.50	<0.50	<0.50	<0.50
Bromoform	µg/L	1.0	<0.10	<0.4	< 5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0
Bromomethane	µg/L	0.50	<0.20	<0.5	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50	<0.50	<0.50	<0.50	<0.50
Carbon Tetrachloride	µg/L	0.20	<0.20	<0.2	< 0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20	<0.20	<0.20	<0.20	<0.20
Chlorobenzene	µg/L	0.20	<0.10	<0.2	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20	<0.20	<0.20	<0.20	<0.20
Chloroethane	µg/L	-	<0.20	<0.2	-	<1.0	<1.0	<1.0	<1.0	-	-	-	-	-	-	-
Chloroform	µg/L	0.20	<0.20	<0.5	< 1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20	<0.20	<0.20	4.1	<0.20
Chloromethane	µg/L	-	<0.40	<0.2	-	<3.0	<3.0	<3.0	<3.0	-	-	-	-	-	-	-
Dibromochloromethane	µg/L	0.50	<0.10	<0.3	< 2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50	<0.50	<0.50	<0.50	<0.50
1,2-Dichlorobenzene	µg/L	0.50	<0.10	<0.4	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50	<0.50	<0.50	<0.50	<0.50
1,3-Dichlorobenzene	µg/L	0.50	<0.10	<0.4	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50	<0.50	<0.50	<0.50	<0.50
1,4-Dichlorobenzene	µg/L	0.50	<0.10	<0.4	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50	<0.50	<0.50	<0.50	<0.50
Dichlorodifluoromethane	µg/L	1.0	<0.20	<0.5	< 2	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1-Dichloroethane	µg/L	0.20	<0.30	<0.4	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20	<0.20	<0.20	<0.20	<0.20
1,2 - Dichloroethane	µg/L	0.50	<0.20	<0.2	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50	<0.50	<0.50	<0.50	<0.50
1,1 Dichloroethylene	µg/L	0.20	<0.30	<0.5	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20	<0.20	<0.20	<0.20	<0.20
cis- 1,2-Dichloroethylene	µg/L	0.50	<0.20	<0.4	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50	<0.50	<0.50	<0.50	<0.50
trans- 1,2-Dichloroethylene	µg/L	0.50	<0.20	<0.4	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50	<0.50	<0.50	<0.50	<0.50
1,2-Dichloropropane	µg/L	0.20	<0.20	<0.5	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20	<0.20	<0.20	<0.20	<0.20
1,3-Dichloropropene (Cis + Trans)	µg/L	0.50	<0.30	<0.4	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.50	<0.50	<0.50	<0.50
Ethylbenzene	µg/L	0.20	<0.10	<0.5	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20	<0.20	<0.20	<0.20	<0.20
Ethylene Dibromide	µg/L	0.20	<0.10	<0.2	< 0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20	<0.20	<0.20	<0.20	<0.20
n-Hexane	µg/L	1.0	<0.20	<5	< 5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Methylene Chloride	µg/L	2.0	<0.30	<4.0	< 5	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<2.0	<2.0	<2.0	<2.0	<2.0
Methyl Isobutyl Ketone	µg/L	5.0	<1.0	<10	< 20	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Methyl Ethyl Ketone	µg/L	10	<1.0	<10	< 20	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10	<10	<10	<10	<10
Methyl tert-butyl ether	µg/L	0.50	<0.20	<10	< 2	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<0.50	<0.50	<0.50	<0.50	<0.50
Styrene	µg/L	0.50	<0.10	<0.5	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50	<0.50	<0.50	<0.50	<0.50
1,1,1,2-Tetrachloroethane	µg/L	0.50	<0.10	<0.5	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50	<0.50	<0.50	<0.50	<0.50
1,1,2,2-Tetrachloroethane	µg/L	0.50	<0.10	<0.5	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50	<0.50	<0.50	<0.50	<0.50
Tetrachloroethylene	µg/L	0.20	<0.20	<0.3	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20	<0.20	<0.20	<0.20	<0.20
Toluene	µg/L	0.20	<0.20	<0.5	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20	<0.20	<0.20	<0.20	<0.20
1,1,1-Trichloroethane	µg/L	0.20	<0.30	<0.4	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20	<0.20	<0.20	<0.20	<0.20
1,1,2-Trichloroethane	µg/L	0.50	<0.20	<0.4	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50	<0.50	<0.50	<0.50	<0.50
Trichloroethylene	µg/L	0.20	<0.20	<0.3	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20	<0.20	<0.20	<0.20	<0.20
1,3,5-Trimethylbenzene	µg/L	-	-	<0.3	-	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	-	-
Vinyl Chloride	µg/L	0.20	<0.17	<0.2	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20	<0.20	<0.20	<0.20	<0.20
m & p-Xylene	µg/L	0.20	<0.20	<0.5	< 1.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20	<0.20	<0.20	<0.20	<0.20
o-Xylene	µg/L	0.20	<0.10	<0.5	< 0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20	<0.20	<0.20	<0.20	<0.20
Xylene Mixture (Total)	µg/L	0.20	<0.20	<1.0	< 1.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20	<0.20	<0.20	<0.20	<0.20
Trichlorofluoromethane	µg/L	0.50	<0.40	<0.5	< 5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.50	<0.50	<0.50	<0.50	<0.50
Petroleum Hydrocarbons																
F1 (C6 to C10) minus BTEX	ug/L	25	-	<100	<50	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
F2 (C10 to C16) minus Naphthalene	ug/L	100	-	<100	<50	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	-
F3 (C16-C34)	ug/L	200	-	<200	<400	<100	<100	<100	<100	<100	<100	<200	<200	<200	<200	-
F4 (C34-C50)	ug/L	200	-	<200	<400	<100	<100	<100	<100	<100	<100	<200	<200	<200	<200	-

Table 5
Surface Water Analytical Results
Polycyclic Aromatic Hydrocarbons
City of Barrie Bunker's Creek Historical Waste Sites

Surface Water Location				SWB1												
Sampling Date				23-Apr-13	23-Aug-13	10-Dec-13	26-Nov-14	24-Sep-15	07-Sep-16	15-Sep-17	15-Sep-17	07-Sep-18	05-Sep-19	05-Sep-19	11-Sep-20	17-Sep-21
Parameter	Units	RDL	PWQO								Field Duplicate of SWB1			Field Duplicate of SWB1		
PAH																
Naphthalene	ug/L	0.010	7	<0.1	< 0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050	0.050	<0.050	0.013
Acenaphthylene	ug/L	0.010	NO	<0.1	< 0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050	<0.050	<0.050	<0.010
Acenaphthene	ug/L	0.010	NO	<0.1	< 0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050	<0.050	<0.050	0.015
Fluorene	ug/L	0.010	0.2	<0.1	< 0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050	<0.050	<0.050	0.011
Phenanthrene	ug/L	0.010	0.03	<0.1	< 0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.030	<0.030	<0.030	0.016
Anthracene	ug/L	0.010	0.0008	<0.1	< 0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.050	<0.050	<0.050	<0.010
Fluoranthene	ug/L	0.010	0.0008	<0.1	< 0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.050	<0.050	<0.050	0.012
Pyrene	ug/L	0.010	NO	<0.1	< 0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.050	<0.050	<0.050	0.011
Benz(a)anthracene	ug/L	0.010	0.0004	<0.1	< 0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.050	<0.050	<0.050	<0.010
Chrysene	ug/L	0.010	0.0001	<0.05	< 0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050	<0.050	<0.050	<0.010
Benzo(b)fluoranthene	ug/L	0.010	NO	<0.05	< 0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050	<0.050	<0.050	<0.010
Benzo(k)fluoranthene	ug/L	0.010	0.0002	<0.05	< 0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050	<0.050	<0.050	<0.010
Benzo(a)pyrene	ug/L	0.0090	NO	<0.01	< 0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.010	<0.010	<0.0090	<0.0090
Indeno(1,2,3-cd)pyrene	ug/L	0.010	NO	<0.1	< 0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050	<0.050	<0.050	<0.010
Dibenz(a,h)anthracene	ug/L	0.010	0.002	<0.1	< 0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050	<0.050	<0.050	<0.010
Benzo(g,h,i)perylene	ug/L	0.010	0.00002	<0.1	< 0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050	<0.050	<0.050	<0.010
Biphenyl	ug/L	0.05	0.2	-	-	<0.05	<0.05	<0.05	<0.05	-	-	-	-	-	-	-
1-methylnaphthalene	ug/L	0.010	2	<0.1	< 0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050	<0.050	<0.050	0.017
2-methylnaphthalene	ug/L	0.010	2	<0.1	< 0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050	<0.050	<0.050	<0.010

- Notes:
- 1. NO = No objective
 - 2. µg/L = Microgram per Litre
 - 4. RDL = Laboratory Reportable Detection Limit
 - 5. PWQO = Provincial Water Quality Objectives, July, 1994
 - 6. Bold type and shaded indicates an exceedance of the PWQO
 - 7. Italicized indicates the RDL is above the PWQO

Table 5
Surface Water Analytical Results
Polycyclic Aromatic Hydrocarbons
City of Barrie Bunker's Creek Historical Waste Sites

Surface Water Location				SWB2											
Sampling Date				23-Apr-13	23-Aug-13	10-Dec-13	26-Nov-14	24-Sep-15	07-Sep-16		15-Sep-17	07-Sep-18	05-Sep-19	11-Sep-20	17-Sep-21
Parameter	Units	RDL	PWQO							Field Duplicate of SWB2					
PAH															
Naphthalene	ug/L	0.010	7	<0.1	< 0.05	<0.05	<0.05	0.64	<0.05	<0.05	<0.05	<0.05	<0.050	<0.050	<0.010
Acenaphthylene	ug/L	0.010	NO	<0.1	< 0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050	<0.050	<0.010
Acenaphthene	ug/L	0.010	NO	<0.1	< 0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050	<0.050	<0.010
Fluorene	ug/L	0.010	0.2	<0.1	< 0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050	<0.050	<0.010
Phenanthrene	ug/L	0.010	0.03	<0.1	< 0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.030	<0.030	0.010
Anthracene	ug/L	0.010	0.0008	<0.1	< 0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.050	<0.050	<0.010
Fluoranthene	ug/L	0.010	0.0008	<0.1	< 0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.050	<0.050	0.011
Pyrene	ug/L	0.010	NO	<0.1	< 0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.050	<0.050	0.010
Benz(a)anthracene	ug/L	0.010	0.0004	<0.1	< 0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.050	<0.050	<0.010
Chrysene	ug/L	0.010	0.0001	<0.05	< 0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050	<0.050	<0.010
Benzo(b)fluoranthene	ug/L	0.010	NO	<0.05	< 0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050	<0.050	<0.010
Benzo(k)fluoranthene	ug/L	0.010	0.0002	<0.05	< 0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050	<0.050	<0.010
Benzo(a)pyrene	ug/L	0.0090	NO	<0.01	< 0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.010	<0.0090	<0.0090
Indeno(1,2,3-cd)pyrene	ug/L	0.010	NO	<0.1	< 0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050	<0.050	<0.010
Dibenz(a,h)anthracene	ug/L	0.010	0.002	<0.1	< 0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050	<0.050	<0.010
Benzo(g,h,i)perylene	ug/L	0.010	0.00002	<0.1	< 0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050	<0.050	<0.010
Biphenyl	ug/L	0.05	0.2	-	-	<0.05	<0.05	0.08	<0.05	<0.05	-	-	-	-	-
1-methylnaphthalene	ug/L	0.010	2	<0.1	< 0.05	<0.05	<0.05	0.66	<0.05	<0.05	<0.05	<0.05	<0.050	<0.050	<0.010
2-methylnaphthalene	ug/L	0.010	2	<0.1	< 0.05	<0.05	<0.05	0.96	<0.05	<0.05	<0.05	<0.05	<0.050	<0.050	<0.010

- Notes:
- 1. NO = No objective
 - 2. µg/L = Microgram per Litre
 - 4. RDL = Laboratory Reportable Detection Limit
 - 5. PWQO = Provincial Water Quality Objectives, July, 1994
 - 6. Bold type and shaded indicates an exceedance of the PWQO
 - 7. Italicized indicates the RDL is above the PWQO

Table 5
Surface Water Analytical Results
Polycyclic Aromatic Hydrocarbons
City of Barrie Bunker's Creek Historical Waste Sites

Surface Water Location				SWB3											
Sampling Date				23-Apr-13	23-Aug-13	10-Dec-13	26-Nov-14	24-Sep-15		07-Sep-16	15-Sep-17	07-Sep-18	05-Sep-19	11-Sep-20	17-Sep-21
Parameter	Units	RDL	PWQO						Field Duplicate of SWB3						
PAH															
Naphthalene	ug/L	0.010	7	0.1	< 0.05	<0.05	<0.05	0.64	0.59	<0.05	<0.05	<0.05	<0.050	<0.050	<0.010
Acenaphthylene	ug/L	0.010	NO	<0.1	< 0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050	<0.050	<0.010
Acenaphthene	ug/L	0.010	NO	<0.1	< 0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050	<0.050	<0.010
Fluorene	ug/L	0.010	0.2	<0.1	< 0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050	<0.050	<0.010
Phenanthrene	ug/L	0.010	0.03	<0.1	< 0.05	<0.05	<0.05	0.16	0.13	<0.05	<0.05	<0.05	<0.030	<0.030	0.011
Anthracene	ug/L	0.010	0.0008	<0.1	< 0.05	<0.01	<0.01	0.02	0.02	<0.01	<0.01	<0.01	<0.050	<0.050	<0.010
Fluoranthene	ug/L	0.010	0.0008	<0.1	0.09	<0.01	<0.01	0.33	0.33	<0.01	<0.01	<0.01	<0.050	<0.050	<0.010
Pyrene	ug/L	0.010	NO	<0.1	< 0.05	<0.01	<0.01	0.27	0.28	<0.01	<0.01	<0.01	<0.050	<0.050	<0.010
Benz(a)anthracene	ug/L	0.010	0.0004	<0.1	< 0.05	<0.01	<0.01	0.10	0.09	<0.01	<0.01	<0.01	<0.050	<0.050	<0.010
Chrysene	ug/L	0.010	0.0001	<0.05	< 0.05	<0.05	<0.05	0.19	0.16	<0.05	<0.05	<0.05	<0.050	<0.050	<0.010
Benzo(b)fluoranthene	ug/L	0.010	NO	<0.05	< 0.05	<0.05	<0.05	0.24	0.25	<0.05	<0.05	<0.05	<0.050	<0.050	<0.010
Benzo(k)fluoranthene	ug/L	0.010	0.0002	<0.05	< 0.05	<0.05	<0.05	0.13	0.13	<0.05	<0.05	<0.05	<0.050	<0.050	<0.010
Benzo(a)pyrene	ug/L	0.0090	NO	<0.01	< 0.01	<0.01	<0.01	0.14	0.13	<0.01	<0.01	<0.01	<0.010	<0.0090	<0.0090
Indeno(1,2,3-cd)pyrene	ug/L	0.010	NO	<0.1	< 0.05	<0.05	<0.05	0.12	0.12	<0.05	<0.05	<0.05	<0.050	<0.050	<0.010
Dibenz(a,h)anthracene	ug/L	0.010	0.002	<0.1	< 0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050	<0.050	<0.010
Benzo(g,h,i)perylene	ug/L	0.010	0.00002	<0.1	< 0.05	<0.05	<0.05	0.14	0.14	<0.05	<0.05	<0.05	<0.050	<0.050	<0.010
Biphenyl	ug/L	0.05	0.2	-	-	<0.05	<0.05	0.09	0.09	<0.05	-	-	-	-	-
1-methylnaphthalene	ug/L	0.010	2	<0.1	< 0.05	<0.05	<0.05	0.72	0.74	<0.05	<0.05	<0.05	<0.050	<0.050	<0.010
2-methylnaphthalene	ug/L	0.010	2	<0.1	< 0.05	<0.05	<0.05	0.97	0.95	<0.05	<0.05	<0.05	<0.050	<0.050	<0.010

- Notes:
- 1. NO = No objective
 - 2. µg/L = Microgram per Litre
 - 4. RDL = Laboratory Reportable Detection Limit
 - 5. PWQO = Provincial Water Quality Objectives, July, 1994
 - 6. Bold type and shaded indicates an exceedance of the PWQO
 - 7. Italicized indicates the RDL is above the PWQO

Table 5
Surface Water Analytical Results
Polycyclic Aromatic Hydrocarbons
City of Barrie Bunker's Creek Historical Waste Sites

Surface Water Location				SWB4											
Sampling Date				23-Apr-13	23-Aug-13	10-Dec-13	26-Nov-14	24-Sep-15	07-Sep-16	15-Sep-17	07-Sep-18	05-Sep-19	11-Sep-20	11-Sep-20	17-Sep-21
Parameter	Units	RDL	PWQO											Field Duplicate of SWB3	
PAH															
Naphthalene	ug/L	0.010	7	<0.1	< 0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050	<0.050	<0.050	<0.010
Acenaphthylene	ug/L	0.010	NO	<0.1	< 0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050	<0.050	<0.050	<0.010
Acenaphthene	ug/L	0.010	NO	<0.1	< 0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050	<0.050	<0.050	<0.010
Fluorene	ug/L	0.010	0.2	<0.1	< 0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050	<0.050	<0.050	<0.010
Phenanthrene	ug/L	0.010	0.03	<0.1	< 0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.030	<0.030	<0.030	0.011
Anthracene	ug/L	0.010	0.0008	<0.1	< 0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.050	<0.050	<0.050	<0.010
Fluoranthene	ug/L	0.010	0.0008	<0.1	< 0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.050	<0.050	<0.050	<0.010
Pyrene	ug/L	0.010	NO	<0.1	< 0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.050	<0.050	<0.050	<0.010
Benz(a)anthracene	ug/L	0.010	0.0004	<0.1	< 0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.050	<0.050	<0.050	<0.010
Chrysene	ug/L	0.010	0.0001	<0.05	< 0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050	<0.050	<0.050	<0.010
Benzo(b)fluoranthene	ug/L	0.010	NO	<0.05	< 0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050	<0.050	<0.050	<0.010
Benzo(k)fluoranthene	ug/L	0.010	0.0002	<0.05	< 0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050	<0.050	<0.050	<0.010
Benzo(a)pyrene	ug/L	0.0090	NO	<0.01	< 0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.010	<0.0090	<0.0090	<0.0090
Indeno(1,2,3-cd)pyrene	ug/L	0.010	NO	<0.1	< 0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050	<0.050	<0.050	<0.010
Dibenz(a,h)anthracene	ug/L	0.010	0.002	<0.1	< 0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050	<0.050	<0.050	<0.010
Benzo(g,h,i)perylene	ug/L	0.010	0.00002	<0.1	< 0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050	<0.050	<0.050	<0.010
Biphenyl	ug/L	0.05	0.2	-	-	<0.05	<0.05	<0.05	<0.05	-	-	-	-	-	-
1-methylnaphthalene	ug/L	0.010	2	<0.1	< 0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050	<0.050	<0.050	<0.010
2-methylnaphthalene	ug/L	0.010	2	<0.1	< 0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050	<0.050	<0.050	<0.010

- Notes:
- 1. NO = No objective
 - 2. µg/L = Microgram per Litre
 - 4. RDL = Laboratory Reportable Detection Limit
 - 5. PWQO = Provincial Water Quality Objectives, July, 1994
 - 6. Bold type and shaded indicates an exceedance of the PWQO
 - 7. Italicized indicates the RDL is above the PWQO

Table 5
Surface Water Analytical Results
Polycyclic Aromatic Hydrocarbons
City of Barrie Bunker's Creek Historical Waste Sites

Surface Water Location				SWB5										Field Blank	
Sampling Date				23-Apr-13	23-Aug-13	10-Dec-13	26-Nov-14	24-Sep-15	07-Sep-16	15-Sep-17	07-Sep-18	05-Sep-19	11-Sep-20	17-Sep-21	17-Sep-21
Parameter	Units	RDL	PWQO												
PAH															
Naphthalene	ug/L	0.010	7	<0.1	< 0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050	<0.050	<0.010	<0.010
Acenaphthylene	ug/L	0.010	NO	<0.1	< 0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050	<0.050	<0.010	<0.010
Acenaphthene	ug/L	0.010	NO	<0.1	< 0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050	<0.050	<0.010	<0.010
Fluorene	ug/L	0.010	0.2	<0.1	< 0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050	<0.050	<0.010	<0.010
Phenanthrene	ug/L	0.010	0.03	<0.1	< 0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.030	<0.030	<0.010	<0.010
Anthracene	ug/L	0.010	0.0008	<0.1	< 0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.050	<0.050	<0.010	<0.010
Fluoranthene	ug/L	0.010	0.0008	<0.1	< 0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.050	<0.050	<0.010	<0.010
Pyrene	ug/L	0.010	NO	<0.1	< 0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.050	<0.050	<0.010	<0.010
Benz(a)anthracene	ug/L	0.010	0.0004	<0.1	< 0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.050	<0.050	<0.010	<0.010
Chrysene	ug/L	0.010	0.0001	<0.05	< 0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050	<0.050	<0.010	<0.010
Benzo(b)fluoranthene	ug/L	0.010	NO	<0.05	< 0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050	<0.050	<0.010	<0.010
Benzo(k)fluoranthene	ug/L	0.010	0.0002	<0.05	< 0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050	<0.050	<0.010	<0.010
Benzo(a)pyrene	ug/L	0.0090	NO	<0.01	< 0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.010	<0.0090	<0.0090	<0.0090
Indeno(1,2,3-cd)pyrene	ug/L	0.010	NO	<0.1	< 0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050	<0.050	<0.010	<0.010
Dibenz(a,h)anthracene	ug/L	0.010	0.002	<0.1	< 0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050	<0.050	<0.010	<0.010
Benzo(g,h,i)perylene	ug/L	0.010	0.00002	<0.1	< 0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050	<0.050	<0.010	<0.010
Biphenyl	ug/L	0.05	0.2	-	-	<0.05	<0.05	<0.05	<0.05	-	-	-	-	-	-
1-methylnaphthalene	ug/L	0.010	2	<0.1	< 0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050	<0.050	<0.010	<0.010
2-methylnaphthalene	ug/L	0.010	2	<0.1	< 0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050	<0.050	<0.010	<0.010

- Notes:
- 1. NO = No objective
 - 2. µg/L = Microgram per Litre
 - 4. RDL = Laboratory Reportable Detection Limit
 - 5. PWQO = Provincial Water Quality Objectives, July, 1994
 - 6. Bold type and shaded indicates an exceedance of the PWQO
 - 7. Italicized indicates the RDL is above the PWQO

Table 6
Landfill Gas Concentrations (% methane by volume)
Bunker's Creek Landfills

				Landfill Gas Readings - GEM 2000			
Well ID	Water (mbgs)	Site	Sample Date	CH4 (%)	CO2 (%)	O2 (%)	Bal. (%)
GP-B1	2.80	Site 1	28-Jun-12	0.0	5.6	13.7	80.4
GP-B1		Site 1	18-Oct-12	0.0	6.6	13.7	79.7
GP-B1	2.80	Site 1	03-Dec-12	0.0	7.8	11.9	80.3
GP-B1	2.80	Site 1	18-Dec-12	0.0	6.0	13.8	80.2
GP-B1	2.80	Site 1	04-Apr-13	0.0	5.3	13.1	81.6
GP-B1	2.80	Site 1	20-Jun-13	0.0	5.7	13.5	80.8
GP-B1	2.80	Site 1	22-Aug-13	0.0	6.0	15.4	78.6
GP-B1	2.80	Site 1	10-Oct-13	0.1	6.6	14.9	78.4
GP-B1	2.80	Site 1	12-Dec-13	0.0	3.3	20.5	76.0
GP-B1	2.80	Site 1	12-Feb-14	0.0	8.0	15.9	76.1
GP-B1	2.80	Site 1	27-Nov-14	0.0	8.0	15.9	76.1
GP-B2	2.80	Site 1	11-Mar-15	0.0	2.6	20.4	77.0
GP-B1	2.80	Site 1	18-Sep-15	0.0	8.1	14.6	77.3
GP-B1	2.70	Site 1	14-Mar-16	0.0	3.2	18.1	78.7
GP-B1	2.78	Site 1	28-Feb-17	0.0	4.2	16.2	79.6
GP-B1	2.80	Site 1	23-Feb-18	0.1	1.3	20.3	78.3
GP-B1	2.80	Site 1	01-Apr-19	0.0	0.7	19.7	79.6
GP-B1	2.80	Site 1	20-Aug-19	0.1	6.1	14.5	79.3
GP-B1	2.72	Site 1	13-Feb-20	0.0	0.0	20.6	79.4
GP-B1	2.80	Site 1	03-Feb-21	0.0	6.8	14.7	78.6
GP-B2		Site 1	18-Oct-12	12.6	3.7	9.0	74.7
GP-B2		Site 1	24-Oct-12	15.4	4.0	6.7	74.0
GP-B2	1.77	Site 1	03-Dec-12	19.9	3.9	3.7	72.5
GP-B2	2.90	Site 1	18-Dec-12	21.5	4.2	1.6	72.6
GP-B2	2.90	Site 1	23-Apr-13	15.3	2.9	6.6	75.4
GP-B2		Site 1	20-Jun-13	Well Damaged- No Reading Taken			
GP-B2	2.90	Site 1	22-Aug-13	15.3	4.1	7.4	73.4
GP-B2	2.90	Site 1	10-Oct-13	21.4	5.4	3.0	70.1
GP-B2	2.90	Site 1	12-Dec-13	4.5	1.0	18.8	75.8
GP-B2		Site 1	12-Feb-14	Well Buried- No Reading Taken			
GP-B2		Site 1	25-Nov-14	Well Damaged- No Reading Taken			
GP-B2		Site 1	11-Mar-15	Well Damaged- No Reading Taken			
GP-B2		Site 1	18-Sep-15	Could not locate			
GP-B2		Site 1	14-Mar-16	Could not locate			
GP-B2		Site 1	06-Jul-16	Gas Probe Decommissioned			

Table 6
Landfill Gas Concentrations (% methane by volume)
Bunker's Creek Landfills

				Landfill Gas Readings - GEM 2000			
Well ID	Water (mbgs)	Site	Sample Date	CH4 (%)	CO2 (%)	O2 (%)	Bal. (%)
GP-B3	2.10	Site 2	28-Jun-12	0.0	1.3	18.1	80.1
GP-B3		Site 2	18-Oct-12	0.0	1.7	18.7	79.6
GP-B3	2.10	Site 2	03-Dec-12	0.0	2.1	19.2	78.7
GP-B3	2.10	Site 2	18-Dec-12	0.0	2.2	19.0	78.8
GP-B3	2.10	Site 2	04-Apr-13	0.0	2.5	17.1	80.2
GP-B3	2.10	Site 2	20-Jun-13	0.0	2.8	18.2	79.0
GP-B3	2.10	Site 2	22-Aug-13	0.0	3.6	18.3	78.1
GP-B3	2.10	Site 2	10-Oct-13	0.0	0.5	21.4	78.1
GP-B3	2.10	Site 2	12-Dec-13	0.0	3.0	20.5	76.5
GP-B3	2.10	Site 2	12-Feb-14	0.0	3.0	20.2	76.8
GP-B3	2.10	Site 2	27-Nov-14	0.0	2.2	20.4	77.4
GP-B3	2.10	Site 2	12-Mar-15	0.0	0.9	22.1	77.0
GP-B3	2.10	Site 2	18-Sep-15	0.0	2.5	19.9	77.6
GP-B3	2.10	Site 2	14-Mar-16	0.0	2.0	19.5	78.5
GP-B3	2.10	Site 2	28-Feb-17	0.0	1.7	19.2	79.1
GP-B3	1.78	Site 2	28-Feb-18	0.1	0.4	19.2	80.3
GP-B3	2.03	Site 2	01-Apr-19	0.0	0.4	20.1	79.5
GP-B3	2.10	Site 2	20-Aug-19	0.1	4.1	16.1	79.7
GP-B3	1.99	Site 2	13-Feb-20	0.0	0.1	20.8	79.1
GP-B3	2.10	Site 2	03-Feb-21	0.0	1.5	20.5	78.0
GP-B7		Site 7	28-Jun-12	0.0	0.9	18.2	80.9
GP-B7		Site 7	18-Oct-12	0.0	1.9	19.2	78.9
GP-B7	1.10	Site 7	03-Dec-12	0.0	1.8	19.8	78.4
GP-B7	1.12	Site 7	18-Dec-12	0.0	1.2	20.1	78.7
GP-B7	1.11	Site 7	04-Apr-13	0.0	0.4	20.4	79.2
GP-B7	1.07	Site 7	20-Jun-13	0.0	2.3	17.9	79.8
GP-B7	0.85	Site 7	22-Aug-13	0.0	1.9	19.5	78.6
GP-B7	0.83	Site 7	10-Oct-13	0.0	0.2	21.7	78.1
GP-B7	1.01	Site 7	12-Dec-13	0.0	0.7	20.9	78.4
GP-B7	1.02	Site 7	12-Feb-14	0.0	0.7	20.7	78.6
GP-B7	1.09	Site 7	27-Nov-14	0.0	1.1	21.2	77.7
GP-B7	1.15	Site 7	11-Mar-15	0.0	0.6	21.7	77.7
GP-B7	1.19	Site 7	18-Sep-15	0.0	2.1	19.6	78.3
GP-B7	1.14	Site 7	28-Feb-17	0.0	0.6	20.7	78.7
GP-B7	0.97	Site 7	23-Feb-18	0.0	0.0	21.8	78.2
GP-B7	1.09	Site 7	01-Apr-19	0.1	0.2	20.7	79.0
GP-B7	1.15	Site 7	20-Aug-19	0.1	1.2	17.9	80.8
GP-B7	1.13	Site 7	13-Feb-20	0.0	0.0	19.7	80.3
GP-B7	1.12	Site 7	03-Feb-21	0.0	0.6	20.4	79.0

Table 6
Landfill Gas Concentrations (% methane by volume)
Bunker's Creek Landfills

				Landfill Gas Readings - GEM 2000			
Well ID	Water (mbgs)	Site	Sample Date	CH4 (%)	CO2 (%)	O2 (%)	Bal. (%)
GP-B8	3.43	Site 1	03-Dec-12	0.0	12.6	0.5	86.9
GP-B8	3.40	Site 1	18-Dec-12	0.0	2.0	18.0	80.0
GP-B8	3.34	Site 1	04-Apr-13	0.0	10.2	1.2	88.6
GP-B8	3.34	Site 1	20-Jun-13	0.0	2.6	16.8	80.5
GP-B8		Site 1	22-Aug-13	Not Accessible- No Reading Taken			
GP-B8	3.45	Site 1	10-Oct-13	0.1	3.4	17.2	79.3
GP-B8	3.42	Site 1	12-Dec-13	0.1	11.8	8.2	80.0
GP-B8	3.53	Site 1	13-Feb-14	0.0	8.6	9.5	81.9
GP-B8		Site 1	25-Nov-14	Well Damaged- No Reading Taken			
GP-B8	3.65	Site 1	27-Nov-14	0.0	0.1	21.8	78.1
GP-B8	3.59	Site 1	12-Mar-15	0.0	0.1	21.1	78.8
GP-B8	3.53	Site 1	18-Sep-15	0.0	0.7	20.4	78.8
GP-B8		Site 1	14-Mar-16	0.0	2.5	18.8	78.7
GP-B8		Site 1	28-Feb-17	Frozen - No Reading Taken			
GP-B8	0.32	Site 1	20-Mar-17	0.0	0.1	21.3	78.6
GP-B8	3.44	Site 1	28-Feb-18	0.0	0.0	22.5	77.5
GP-B8	1.96	Site 1	01-Apr-19	0.0	0.0	20.9	79.1
GP-B8	3.56	Site 1	20-Aug-19	0.1	0.3	18.6	81.0
GP-B8	1.94	Site 1	13-Feb-20	0.0	0.0	20.7	79.3
GP-B8	3.51	Site 1	24-Feb-21	0.0	0.1	21.0	78.9
GP-B14	1.57	Site 3	03-Dec-12	0.0	0.4	20.5	79.1
GP-B14	1.56	Site 3	18-Dec-12	0.0	0.4	20.5	79.1
GP-B14	1.42	Site 3	04-Apr-13	0.0	0.5	20.3	79.2
GP-B14	1.54	Site 3	20-Jun-13	0.0	1.1	19.3	79.6
GP-B14	1.70	Site 3	22-Aug-13	0.0	0.7	20.5	78.8
GP-B14	1.59	Site 3	10-Oct-13	0.0	0.7	20.7	78.6
GP-B14	1.57	Site 3	12-Dec-13	0.0	0.5	20.9	78.6
GP-B14	1.72	Site 3	12-Feb-14	0.0	0.6	21.0	78.4
GP-B14	1.47	Site 3	27-Nov-14	0.0	0.6	21.7	77.7
GP-B14	1.89	Site 3	11-Mar-15	0.0	0.5	21.9	77.6
GP-B14	1.89	Site 3	18-Sep-15	0.0	1.0	20.2	78.8
GP-B14	1.49	Site 3	28-Feb-17	0.0	0.4	21.2	78.4
GP-B14	1.76	Site 3	28-Feb-18	0.1	0.4	19.2	80.3
GP-B14	1.72	Site 3	01-Apr-19	0.0	0.0	20.4	79.6
GP-B14	1.99	Site 3	20-Aug-19	0.0	0.4	18.9	80.7
GP-B14	1.69	Site 3	13-Feb-20	0.0	0.0	20.4	79.6
GP-B14	1.86	Site 3	03-Feb-21	0.0	0.2	21.8	78.0

Table 6
Landfill Gas Concentrations (% methane by volume)
Bunker's Creek Landfills

				Landfill Gas Readings - GEM 2000			
Well ID	Water (mbgs)	Site	Sample Date	CH4 (%)	CO2 (%)	O2 (%)	Bal. (%)
GP-B17	2.59	Site 3	03-Dec-12	0.0	1.0	20.5	78.5
GP-B17	2.57	Site 3	18-Dec-12	0.0	0.9	20.8	78.3
GP-B17	2.39	Site 3	04-Apr-13	0.0	1.0	18.1	80.9
GP-B17	2.48	Site 3	20-Jun-13	0.0	1.5	19.1	79.4
GP-B17	2.70	Site 3	22-Aug-13	0.0	1.1	20.3	78.6
GP-B17	2.61	Site 3	10-Oct-13	0.0	1.4	20.5	78.1
GP-B17	2.53	Site 3	12-Dec-13	0.0	0.9	20.8	78.3
GP-B17	2.74	Site 3	12-Feb-14	0.0	1.1	22.8	76.1
GP-B17	2.51	Site 3	27-Nov-14	0.0	1.1	21.4	77.5
GP-B17	2.63	Site 3	11-Mar-15	0.0	1.0	21.8	77.2
GP-B17	2.68	Site 3	18-Sep-15	0.0	1.5	20.0	78.5
GP-B17	2.22	Site 3	28-Feb-17	0.0	0.5	21.1	78.4
GP-B17	2.50	Site 3	28-Feb-18	0.1	0.8	18.3	80.8
GP-B17	2.43	Site 3	01-Apr-19	0.0	0.2	20.6	79.2
GP-B17	2.75	Site 3	20-Aug-19	0.1	0.8	18.8	80.3
GP-B17	2.40	Site 3	13-Feb-20	0.0	0.0	20.6	79.4
GP-B17	2.57	Site 3	03-Feb-21	0.0	0.5	21.9	77.6
GP-B18		Site 7	28-Jun-12	0.0	0.2	19.0	80.8
GP-B18		Site 7	18-Oct-12	0.0	1.3	18.9	79.8
GP-B18	1.69	Site 7	03-Dec-12	0.1	0.8	20.2	78.9
GP-B18	1.69	Site 7	18-Dec-12	0.1	0.8	20.0	79.1
GP-B18	1.54	Site 7	04-Apr-13	0.0	0.9	20.0	79.1
GP-B18	1.64	Site 7	20-Jun-13	0.0	2.1	17.5	80.4
GP-B18		Site 7	22-Aug-13	0.0	1.5	19.8	78.7
GP-B18	1.76	Site 7	10-Oct-13	0.0	1.7	20.0	78.3
GP-B18	1.69	Site 7	12-Dec-13	0.0	0.7	20.8	78.5
GP-B18	1.86	Site 7	12-Feb-14	0.0	0.9	22.7	76.4
GP-B18	1.63	Site 7	27-Nov-14	0.0	0.7	21.5	77.8
GP-B18	1.87	Site 7	11-Mar-15	0.1	0.7	22.1	77.1
GP-B18	1.89	Site 7	18-Sep-15	0.0	1.7	19.3	79.0
GP-B18	1.39	Site 7	28-Feb-17	0.0	0.1	21.5	78.4
GP-B18	1.53	Site 7	28-Feb-18	0.1	0.1	20.6	79.2
GP-B18	1.66	Site 7	01-Apr-19	0.0	0.1	20.7	79.2
GP-B18	1.92	Site 7	20-Aug-19	0.1	0.6	18.6	80.8
GP-B18	1.66	Site 7	13-Feb-20	0.0	0.3	19.5	80.2
GP-B18	1.75	Site 7	03-Feb-21	0.0	0.4	21.9	77.7

Table 6
Landfill Gas Concentrations (% methane by volume)
Bunker's Creek Landfills

				Landfill Gas Readings - GEM 2000			
Well ID	Water (mbgs)	Site	Sample Date	CH4 (%)	CO2 (%)	O2 (%)	Bal. (%)
GP-B19		Site 7	28-Jun-12	0.0	0.1	18.9	81.0
GP-B19		Site 7	18-Oct-12	0.0	0.0	20.5	79.5
GP-B19	0.51	Site 7	03-Dec-12	0.0	0.0	21.2	78.8
GP-B19	0.55	Site 7	18-Dec-12	0.0	0.1	21.5	78.4
GP-B19	0.59	Site 7	04-Apr-13	0.0	0.0	20.8	79.2
GP-B19	0.67	Site 7	20-Jun-13	0.0	0.0	19.7	80.3
GP-B19	0.98	Site 7	22-Aug-13	0.0	0.9	19.2	79.9
GP-B19	0.82	Site 7	10-Oct-13	0.0	0.1	21.5	78.4
GP-B19	0.80	Site 7	12-Dec-13	0.0	0.1	21.2	78.7
GP-B19	0.85	Site 7	12-Feb-14	0.0	0.2	21.1	78.7
GP-B19	0.76	Site 7	27-Nov-14	0.0	0.2	22.0	77.8
GP-B19	0.75	Site 7	11-Mar-15	0.0	0.1	22.8	77.1
GP-B19	0.97	Site 7	18-Sep-15	0.0	0.1	21.2	78.7
GP-B19	0.68	Site 7	28-Feb-17	0.0	0.1	21.5	78.4
GP-B19	0.70	Site 7	28-Feb-18	0.1	0.0	21.0	78.9
GP-B19	0.59	Site 7	01-Apr-19	0.1	0.1	20.4	79.4
GP-B19	1.00	Site 7	20-Aug-19	0.1	1.6	17.2	81.1
GP-B19	1.08	Site 7	29-Aug-19	0.0	2.0	17.3	80.7
GP-B19	0.80	Site 7	13-Feb-20	0.0	0.0	20.1	79.9
GP-B19	0.87	Site 7	03-Feb-21	0.0	0.0	21.4	78.6
GP-B20	3.66	Site 1	22-Aug-13	0.0	1.1	19.1	79.8
GP-B20	3.67	Site 1	10-Oct-13	0.0	0.8	20.4	78.9
GP-B20	3.66	Site 1	12-Dec-13	0.0	0.3	22.8	77.2
GP-B20	3.80	Site 1	25-Feb-14	0.0	0.6	21.6	77.8
GP-B20	3.68	Site 1	25-Nov-14	0.0	0.5	20.4	79.1
GP-B20	3.59	Site 1	27-Nov-14	0.0	0.5	21.2	78.3
GP-B20		Site 1	11-Mar-15	Well Buried- No Reading Taken			
GP-B20	3.75	Site 1	18-Sep-15	0.0	1.1	20.2	78.7
GP-B20	3.47	Site 1	28-Feb-17	0.0	0.5	20.6	78.9
GP-B20	3.30	Site 1	23-Feb-18	0.0	0.0	22.6	77.4
GP-B20	3.62	Site 1	01-Apr-19	0.0	0.0	20.6	79.4
GP-B20	3.65	Site 1	20-Aug-19	0.1	0.9	18.4	80.6
GP-B20	3.70	Site 1	29-Aug-19	0.0	1.1	18.2	80.7
GP-B20	3.62	Site 1	13-Feb-20	0.0	0.1	19.8	80.1
GP-B20	3.67	Site 1	03-Mar-21	0.0	0.3	21.3	78.4

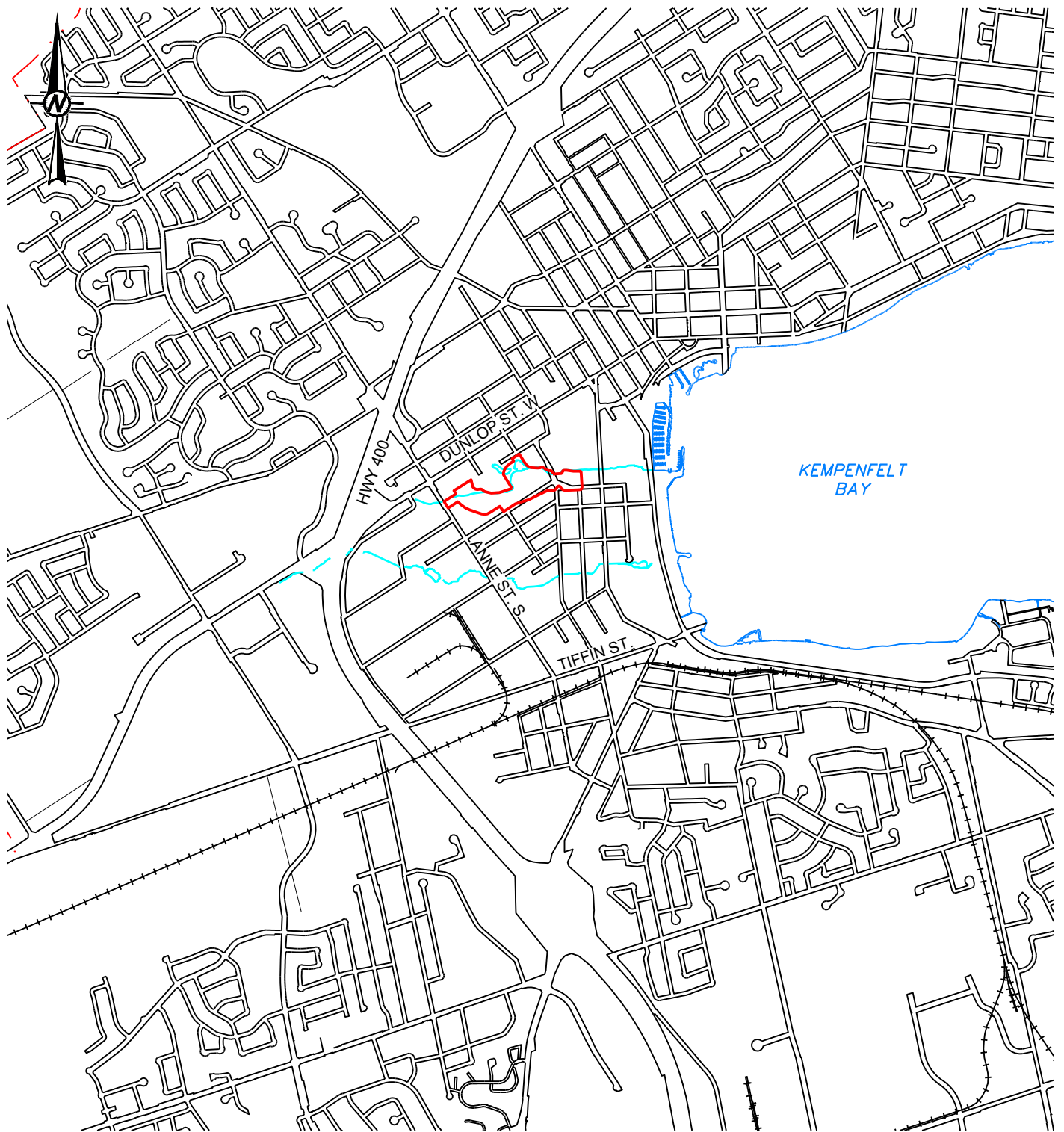
Table 6
Landfill Gas Concentrations (% methane by volume)
Bunker's Creek Landfills

Well ID	Water (mbgs)	Site	Sample Date	Landfill Gas Readings - GEM 2000			
				CH4 (%)	CO2 (%)	O2 (%)	Bal. (%)
GP-B21	3.83	Site 1	22-Aug-13	0.0	1.0	19.9	79.1
GP-B21	3.80	Site 1	10-Oct-13	0.0	0.7	20.8	78.5
GP-B21	3.39	Site 1	12-Dec-13	0.0	0.5	22.7	76.8
GP-B21	3.89	Site 1	12-Feb-14	0.0	0.6	22.6	76.8
GP-B21	3.80	Site 1	27-Nov-14	0.0	0.7	21.5	77.8
GP-B21	3.94	Site 1	12-Mar-15	0.0	0.5	22.2	77.3
GP-B21	3.89	Site 1	18-Sep-15	0.0	0.8	20.2	79.0
GP-B21	3.64	Site 1	28-Feb-17	0.0	0.5	20.5	79.0
GP-B21	3.77	Site 1	23-Feb-18	0.2	0.1	21.4	78.3
GP-B21	3.81	Site 1	01-Apr-19	0.0	0.7	19.1	80.2
GP-B21	4.12	Site 1	20-Aug-19	0.1	0.8	18.7	80.4
GP-B21	3.76	Site 1	13-Feb-20	0.0	0.0	20.6	79.4
GP-B21	3.78	Site 1	03-Feb-21	0.0	0.5	21.3	78.2
GP-B22	2.09	Site 1	22-Aug-13	0.0	1.1	19.7	79.2
GP-B22	2.03	Site 1	10-Oct-13	0.1	0.2	21.6	78.1
GP-B22	1.96	Site 1	12-Dec-13	0.0	0.2	20.9	78.9
GP-B22	2.12	Site 1	25-Feb-14	0.0	0.5	22.0	77.5
GP-B22	1.98	Site 1	25-Nov-14	0.0	0.6	21.0	78.4
GP-B22	2.16	Site 1	12-Mar-15	0.0	0.1	21.3	78.6
GP-B22	2.11	Site 1	18-Sep-15	0.0	0.1	20.0	79.9
GP-B22	1.71	Site 1	28-Feb-17	0.0	0.4	21.1	78.5
GP-B22	1.92	Site 1	23-Feb-18	0.0	0.0	21.4	78.6
GP-B22	1.89	Site 1	01-Apr-19	0.0	0.0	20.8	79.2
GP-B22	2.15	Site 1	20-Aug-19	0.0	1.8	17.5	80.7
GP-B22	1.89	Site 1	13-Feb-20	0.0	0.2	19.7	80.1
GP-B22	2.00	Site 1	03-Feb-21	0.0	0.5	20.0	79.5
GP-B24	1.61	Site 1	20-Dec-17	0.0	0.5	20.4	79.1
GP-B24	1.52	Site 1	27-Mar-18	0.0	0.7	19.0	80.3
GP-B24	1.41	Site 1	01-Apr-19	0.0	0.2	20.1	79.7
GP-B24	1.63	Site 1	20-Aug-19	0.1	1.0	17.3	81.6
GP-B24	1.72	Site 1	29-Aug-19	0.0	1.4	18.4	80.2
GP-B24	1.42	Site 1	13-Feb-20	0.0	0.0	20.4	79.6
GP-B24	1.58	Site 1	03-Feb-21	0.0	0.5	21.0	78.5

Notes:

bold and shaded indicates a methane concentration above 5%, the lower explosive limit of methane

Figures



APPROXIMATE LANDFILL LIMIT

NOTES:

1. Datum is NAD UTM 83 Zone 17
2. Mapping Based on County of Simcoe Municipal Base
3. 500 m Offset D4 Assessment as per City of Barrie 2009 Official Plan



CLIENT
CITY OF BARRIE

PROJECT
BUNKER'S CREEK HISTORICAL LANDFILLS
2021 ANNUAL MONITORING REPORT

CONSULTANT

YYYY-MM-DD 2021-12-02

DESIGNED

PREPARED

REVIEWED

APPROVED

STB

CLG

TITLE

REGIONAL LOCATION MAP

PROJECT NO.
1111700043

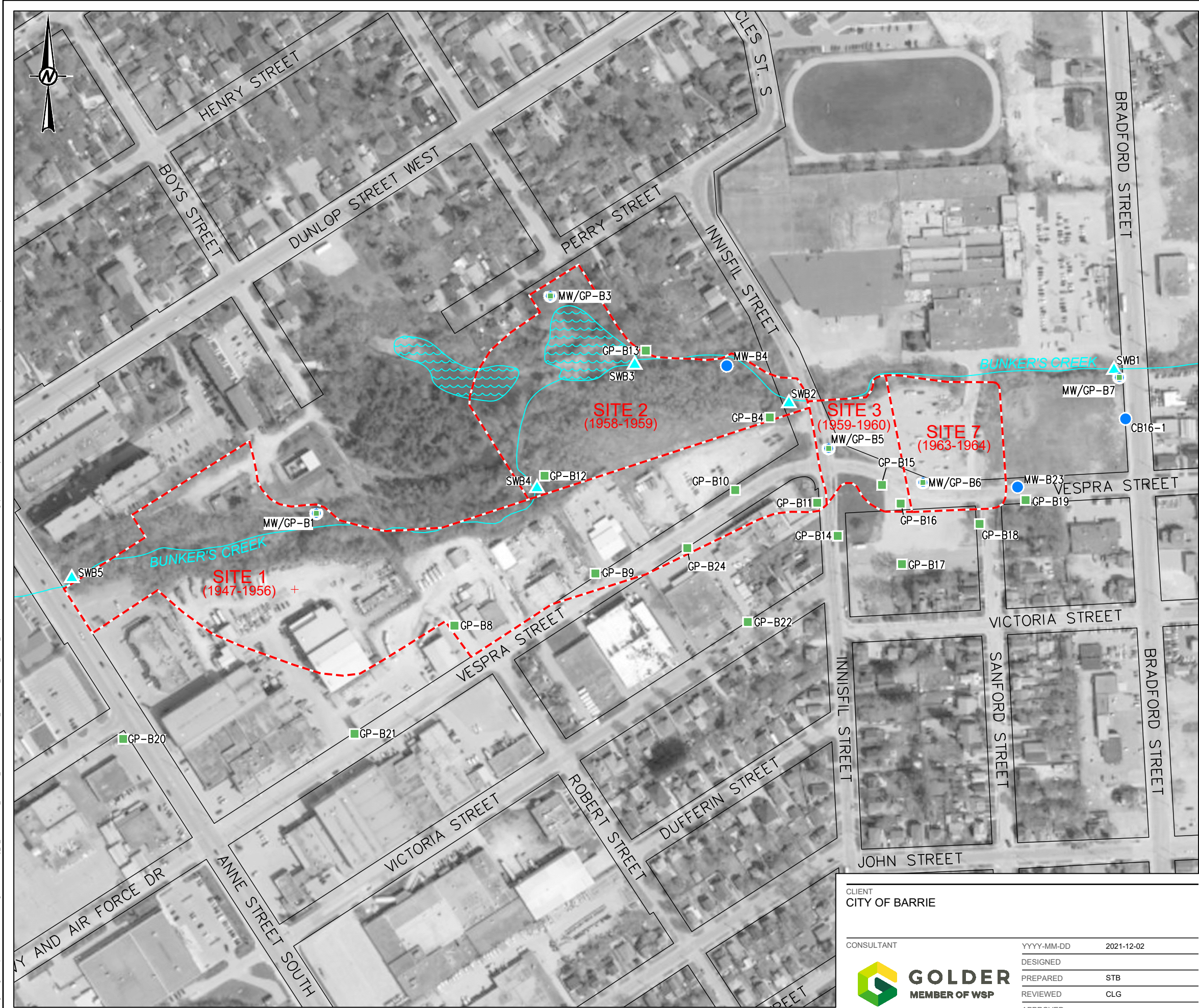
CONTROL
0003

REV.
A

FIGURE
1



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LEGEND:

- Estimated Waste Limit
- Gas Probe
- Monitoring Well
- Monitoring Well / Gas Probe
- Surface Water Sampling Location

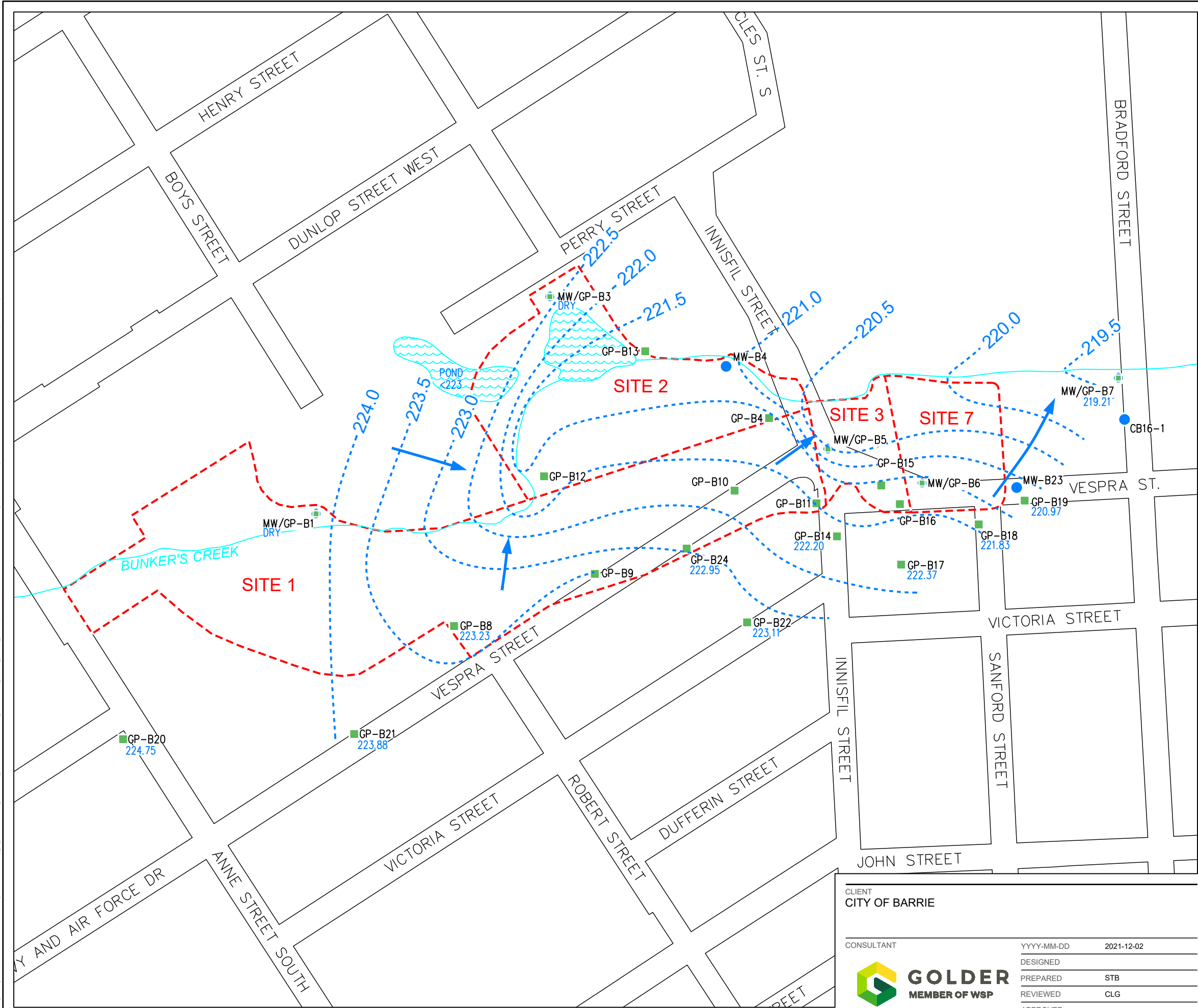
NOTES:

- Datum is NAD83 Zone 17
- All Mapped Boundaries, Limits, and Interpolated Features are Approximate
- CAD Base Digital 1:2000 Municipal Mapping Courtesy City of Barrie
- Image County of Simcoe 2018, Site Features are Approximate

CLIENT CITY OF BARRIE		PROJECT BUNKER'S CREEK HISTORICAL LANDFILLS 2021 ANNUAL MONITORING REPORT	
CONSULTANT	YYYY-MM-DD 2021-12-02	TITLE	SAMPLING LOCATION MAP
 GOLDER MEMBER OF WSP	DESIGNED	STB	PROJECT NO. 1111700043
	PREPARED	CLG	CONTROL 0003
	REVIEWED		REV. A
	APPROVED		FIGURE 2

25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B

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LEGEND:

- Estimated Waste Limit
- Interpolated Equipotential Line
- Interpolated Groundwater Flow Direction
- 221.61 Shallow Static Water Elevation (masl)
- Gas Probe
- Monitoring Well
- Monitoring Well / Gas Probe

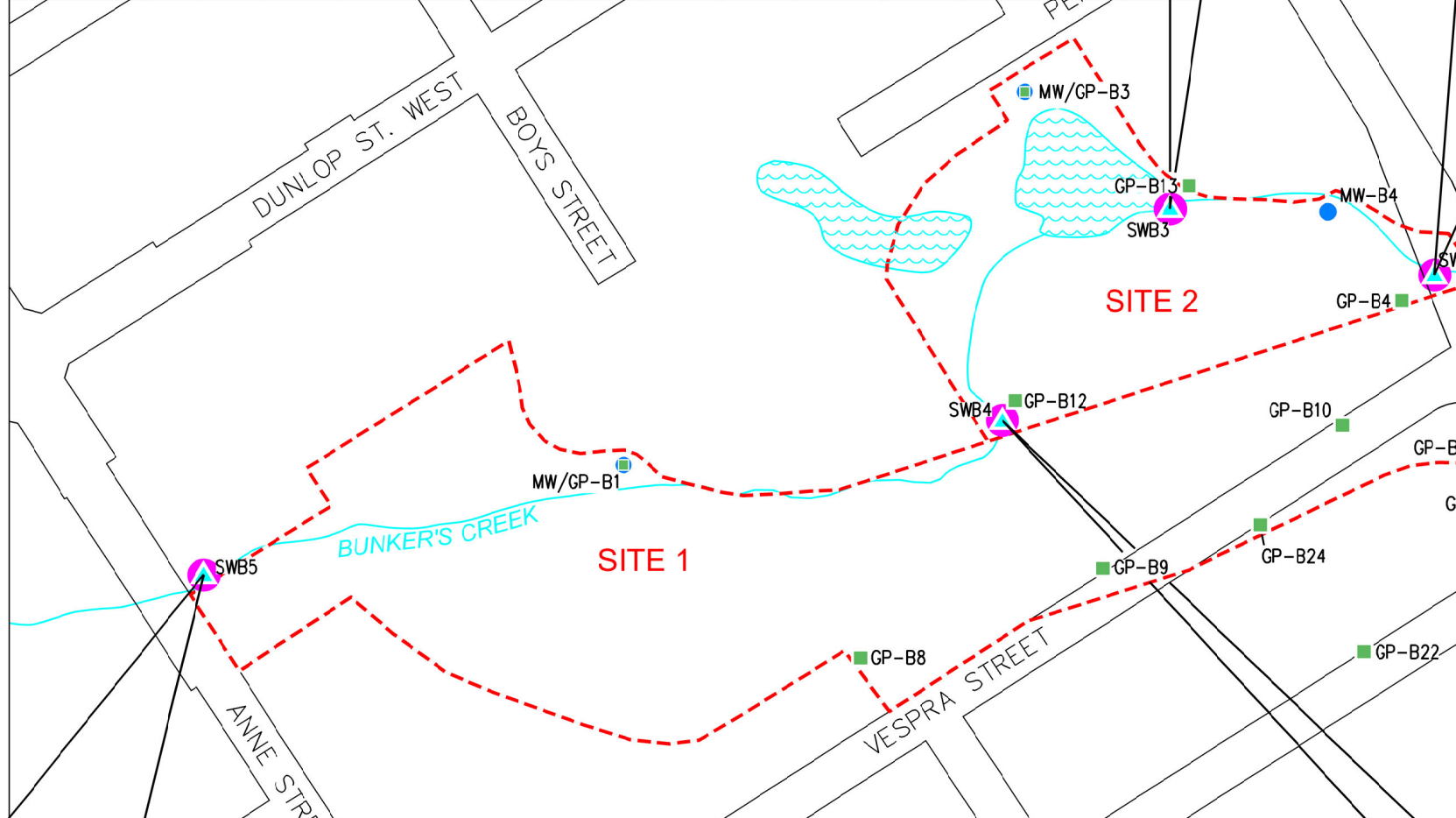


- NOTES:**
1. Datum is NAD83 Zone 17
 2. All Mapped Boundaries, Limits, and Interpolated Features are Approximate
 3. CAD Base Digital 1:2000 Municipal Mapping Courtesy City of Barrie
 4. Shallow Static Water Elevations Taken February 3, 2021

CLIENT CITY OF BARRIE		PROJECT BUNKER'S CREEK HISTORICAL LANDFILLS 2021 ANNUAL MONITORING REPORT	
CONSULTANT  GOLDER MEMBER OF WSP		TITLE GROUNDWATER ELEVATIONS FEBRUARY 2021	
YYYY-MM-DD	2021-12-02	PROJECT NO.	1111700043
DESIGNED		CONTROL	0003
PREPARED	STB	REV.	A
REVIEWED	CLG	FIGURE	3
APPROVED			

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B 25 mm

SWB3														
Parameter	Units	PWQO	Results											
			Nov-12	Apr-13	Aug-13	Dec-13	Nov-14	Sep-15	Sep-16	Sep-17	Sep-18	Sep-19	Sep-20	Sep-21
Metals														
Copper	µg/L	5	2	2	6.9	3.2	<2.5	<0.5/<0.5	2.2	<0.5	1.7	1.0	1.4/1.3	2.3
Vanadium	µg/L	6	7	1	0.8	3.4	<2.5	<0.5/1.7	1.0	0.7	0.9	0.9	1.2/1.0	2.0
Polynuclear Aromatic Hydrocarbons														
Phenanthrene	µg/L	0.03	-	<0.1	< 0.05	<0.05	<0.05	0.16/0.13	<0.05	<0.05	<0.05	<0.05	<0.03/<0.03	0.011
Anthracene	µg/L	0.0008	-	<0.1	< 0.05	<0.01	<0.01	0.02/0.02	<0.01	<0.01	<0.01	<0.01	<0.05/<0.05	<0.010
Fluoranthene	µg/L	0.0008	-	<0.1	0.09	<0.01	<0.01	0.33/0.33	<0.01	<0.01	<0.01	<0.01	<0.05/<0.05	<0.010
Benzo(a)anthracene	µg/L	0.0004	-	<0.1	< 0.05	<0.01	<0.01	0.10/0.09	<0.01	<0.01	<0.01	<0.01	<0.05/<0.05	<0.010
Chrysene	µg/L	0.0001	-	<0.05	< 0.05	<0.05	<0.05	0.19/0.16	<0.05	<0.05	<0.05	<0.05	<0.05/<0.05	<0.010
Benzo(k)fluoranthene	µg/L	0.0002	-	<0.05	< 0.05	<0.05	<0.05	0.13/0.13	<0.05	<0.05	<0.05	<0.05	<0.05/<0.05	<0.010
Benzo(g,h,i)perylene	µg/L	0.00002	-	<0.1	< 0.05	<0.05	<0.05	0.14/0.14	<0.05	<0.05	<0.05	<0.05	<0.05/<0.05	<0.010
Landfill Tracer Parameters														
Iron	µg/L	300	1270	1200	1200	1420	1100	391/1390	1100	742	995	1100	800/800	1300
Unionized Ammonia	mg/L	0.02	-	0.002	<0.001	0.001	0.011	0.012/0.012	0.011	0.005	0.004	0.011	0.012/0.013	0.016



SWB5														
Parameter	Units	PWQC	Results											
			Nov-12	Apr-13	Aug-13	Dec-13	Nov-14	Sep-15	Sep-16	Sep-17	Sep-18	Sep-19	Sep-20	Sep-21
Metals														
Copper	µg/L	5	<2	2	10	1	<2.5	<0.5	0.8	<0.5	1.1	<1.0	<0.9	1.8
Vanadium	µg/L	6	8	1	0.8	4.2	<2.5	0.9	0.9	0.9	1.0	1.1	1.1	2.3
Polynuclear Aromatic Hydrocarbons														
Fluoranthene	µg/L	0.0008	-	<0.1	<0.05	<0.01	<0.01	<0.01	<0.01	<0.01/<0.01	<0.01	<0.050/<0.050	<0.050	<0.010
Landfill Tracer Parameters														
Iron	µg/L	300	604	540	605	5110	1040	586	431	564	521	470	630	950
Unizened Ammonia	mg/L	0.02	-	0.001	<0.001	0.001	0.006	0.005	0.003	0.002	0.001	0.003	0.007	0.009

LEGEND:

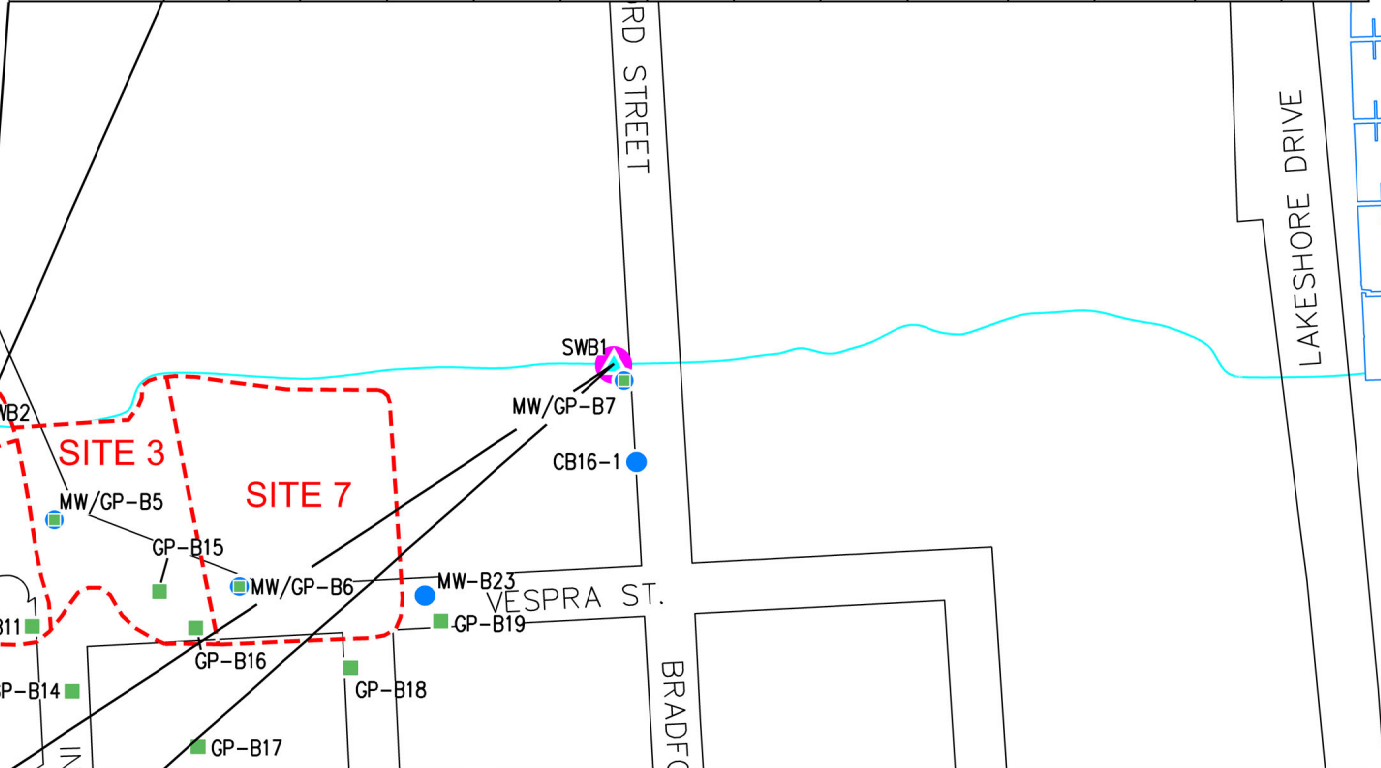
-
- Estimated Waste Limit
- Gas Probe
- Monitoring Well
- Monitoring Well / Gas Probe
- Surface Water Sampling Location
- < PWQO
- >PWQO
- Exceedance of PWQO

NOTES:

1. Datum is NAD83 Zone 17
2. All Mapped Boundaries, Limits, and Interpolated Features are Approximate
3. CAD Base Digital 1:2000 Municipal Mapping Courtesy City of Barrie
4. PWQO = Provincial Water Quality Objectives, July 1994



SWB2														
Parameter	Units	PWQO	Results											
			Nov-12	Apr-13	Aug-13	Dec-13	Nov-14	Sep-15	Sep-16	Sep-17	Sep-18	Sep-19	Sep-20	Sep-21
Metals														
Copper	µg/L	5	<2	2	5.3	2.8	<2.5	<0.5	1.2/1.3	<0.5	3.1	1.1	3.2	3.1
Lead	µg/L	5	1	<1	0.83	0.8	0.7	0.7	10.3/<0.1	0.3	0.2	<0.5	<0.5	2.8
Vanadium	µg/L	6	5	2	0.5	2.3	<2.5	0.8	0.7/0.8	0.7	0.7	0.87	1.1	3.0
Polynuclear Aromatic Hydrocarbons														
Fluoranthene	µg/L	0.0008	-	<0.1	<0.05	<0.01	<0.01	<0.01	<0.01	<0.01/<0.01	<0.01	<0.050/<0.050	<0.050	0.011
Landfill Tracer Parameters														
Iron	µg/L	300	831	1010	731	1030	933	745	553/606	712	613	820	900	1900
Unionized Ammonia	mg/L	0.02	-	0.002	<0.001	0.001	0.016	0.013	0.010/0.010	0.004	0.004	0.011	0.012	0.017



SWB1														
Parameter	Units	PWQO	Results											
			Nov-12	Apr-13	Aug-13	Dec-13	Nov-14	Sep-15	Sep-16	Sep-17	Sep-18	Sep-19	Sep-20	Sep-21
Metals														
Copper	µg/L	5	<2	2	9.1	4.8	<2.5	<0.5	1.0	<0.5/<0.5	0.9	<1/<1	1.6	4.3
Vanadium	µg/L	6	5	1	0.4	2.7	<2.5	<0.5	0.5	0.5/0.5	0.6	0.82/0.83	1.0	4.0
Polynuclear Aromatic Hydrocarbons														
Fluoranthene	µg/L	0.0008	-	<0.1	<0.05	<0.01	<0.01	<0.01	<0.01	<0.01/<0.01	<0.01	<0.050/<0.050	<0.050	0.012
Landfill Tracer Parameters														
Iron	µg/L	300	894	1110	675	1480	1190	448	565	682/692	620	790/800	880	2500
Unionized Ammonia	mg/L	0.02	-	0.005	0.001	<0.001	0.020	0.010	0.018	0.006/0.006	0.007	0.015/0.016	0.023	0.025

SWB4														
Parameter	Units	PWQO	Results											
			Nov-12	Apr-13	Aug-13	Dec-13	Nov-14	Sep-15	Sep-16	Sep-17	Sep-18	Sep-19	Sep-20	Sep-21
Metals														
Copper	µg/L	5	2	2	8.9	1.8	<2.5	<0.5	1.0	<0.5	1.4	2.3	1.3	3.8
Vanadium	µg/L	6	7	1	0.6	4.4	<2.5	0.7	0.6	0.6	0.8	1.2	1	3.5
Polynuclear Aromatic Hydrocarbons														
Fluoranthene	µg/L	0.0008	-	<0.1	<0.05	<0.01	<0.01	<0.01	<0.01	<0.01/<0.01	<0.01	<0.050/<0.050	<0.050	<0.010
Landfill Tracer Parameters														
Iron	µg/L	300	1260	1190	1010	1330	1180	927	760	<100	1060	1300	960	1900
Unionized Ammonia	mg/L	0.02	-	-	0.002	0.001	0.011	0.016	0.009	<0.001	0.004	0.009	0.010	0.015

CLIENT
CITY OF BARRIE

CONSULTANT



YYYY-MM-DD 2021-12-02

DESIGNED

PREPARED STB

REVIEWED CLG

PROJECT
BUNKER'S CREEK HISTORICAL LANDFILLS
2021 ANNUAL MONITORING REPORT

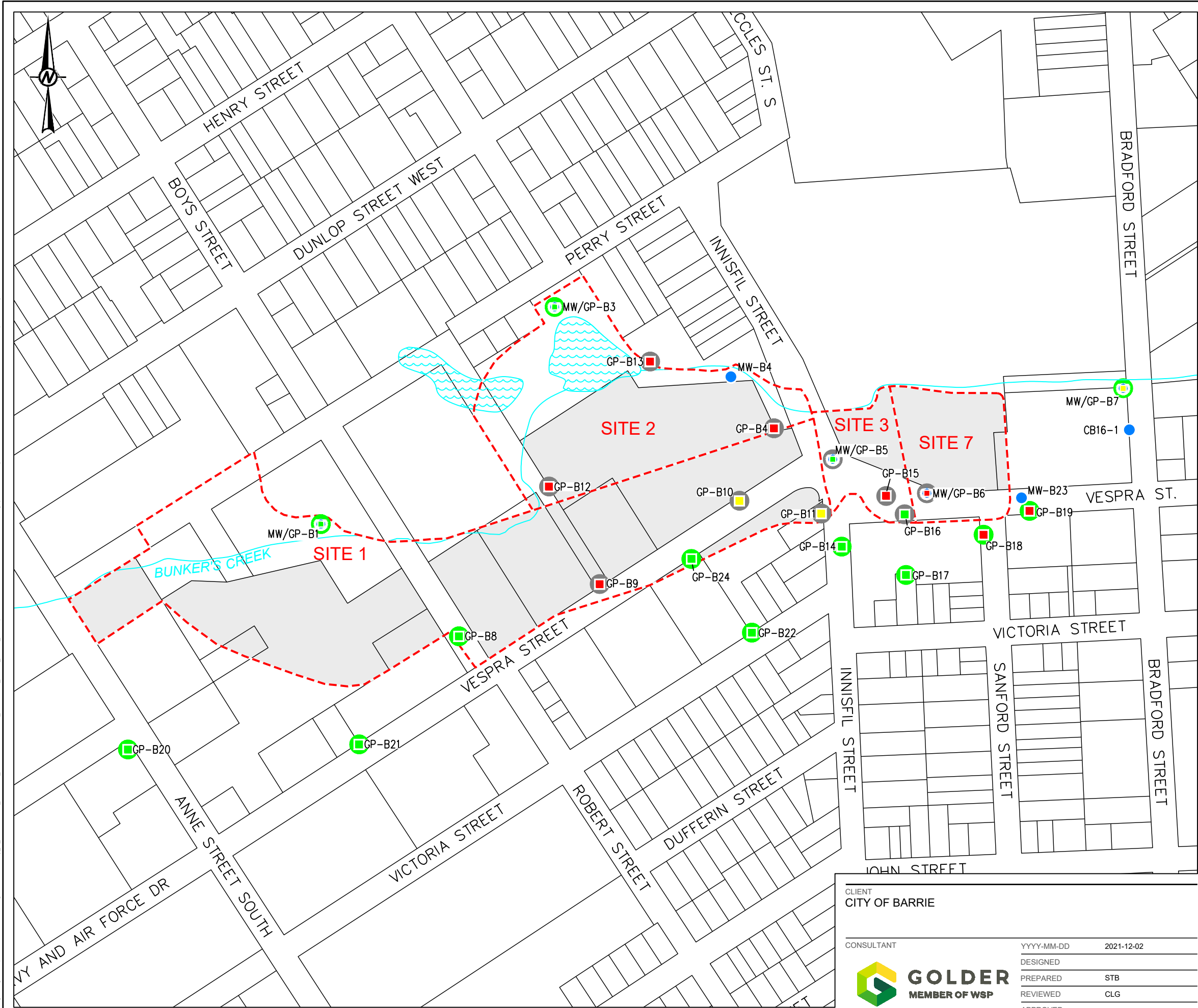
TITLE
**SURFACE WATER RESULTS
SEPTEMBER 2021**

PROJECT NO.
1111700043

CONTROL
0003REV.
A

FIGURE 4

Path: \\golder-gsk-compl\data\offices\barrie\GIS\MapClients\City_of_Barrie\Historic_Landfills\99_PROJ\111700043\2021-12-02_Time 10:45:40 AM | File Name: 111700043_2021-12-02_Time 10:45:40 AM | Printed By: sbowman Date: 2021-12-02 Time: 10:45:40 AM



LEGEND:

- Estimated Waste Limit
- Gas Probe (Typical Screen Saturation <50%)
- Gas Probe (Typical Screen Saturation 50% - 90%)
- Gas Probe (Typical Screen Saturation >90%)
- Monitoring Well
- Monitoring Well / Gas Probe (Typical Screen Saturation <50%)
- Monitoring Well / Gas Probe (Typical Screen Saturation 50% - 90%)
- Monitoring Well / Gas Probe (Typical Screen Saturation >90%)
- <0.2% Methane Gas Concentration
- 0.2% - 4.9% Methane Gas Concentration
- >5.0% Methane Gas Concentration
- Methane Gas Concentration Not Monitored
- Privately Owned Property

- NOTES:**
- Datum is NAD83 Zone 17
 - All Mapped Boundaries, Limits, and Interpolated Features are Approximate
 - CAD Base Digital 1:2000 Municipal Mapping Courtesy City of Barrie

CLIENT CITY OF BARRIE		PROJECT BUNKER'S CREEK HISTORICAL LANDFILLS 2021 ANNUAL MONITORING REPORT	
CONSULTANT  GOLDER MEMBER OF WSP		TITLE METHANE GAS CONCENTRATIONS FEBRUARY 2021	
YYYY-MM-DD DESIGNED PREPARED REVIEWED APPROVED	2021-12-02 STB CLG	PROJECT NO. 1111700043	CONTROL 0003
		REV. A	FIGURE 5

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B 25 mm

APPENDIX A

**Table A-1 - 2021 Sampling
Locations and Elevations**

Table A-1
City of Barrie Bunker's Creek Landfills
2021 Sampling Locations and Elevations

11-1170-0043(2021)

Well	Monitoring Pipe Elevations (masl)	Ground Surface Elevations (masl)	Well Screen Elevations (masl)	
			Top of Screen (masl)	Bottom of Screen (masl)
Site 1				
GP-B1	228.52	227.60	226.41	224.89
GP-B8	226.65	226.75	225.83	222.79
GP-B20	228.29	228.43	226.90	223.85
GP-B21	228.71	227.66	226.59	223.54
GP-B24	225.39	224.54	223.79	222.27
Site 2				
GP-B3	226.07	225.07	224.46	222.94
GP-B22	225.01	225.11	224.35	221.30
Site 3				
GP-B14	224.81	224.06	223.30	221.77
GP-B17	225.85	224.94	223.87	222.35
Site 7				
GP-B7	221.43	220.34	219.57	218.05
GP-B18	224.53	223.58	222.05	220.53
GP-B19	222.62	221.84	221.08	219.56

APPENDIX B

Table B-1 - Groundwater Elevations

Table B-1
Groundwater Elevations
Bunker's Creek Historic Landfill Sites

Well ID	Monitoring Pipe Elevation (masl)	Ground Elevation (masl)	Depth to Bottom of Well (mbmp)	Depth to Bottom of Well (mbgs)	Screen Length (m)	Top of Screen Elevation (masl)	Base of Well Elevation (masl)	Date	Depth to Groundwater (mbmp)	Depth to Groundwater (mbgs)	Groundwater Elevation (masl)
GP-B1	228.52	227.60	3.69	2.78	1.52	226.35	224.83	2012-09-17	dry	dry	NA
								2012-12-03	dry	dry	NA
								2012-12-18	dry	dry	NA
								2013-04-04	dry	dry	NA
								2013-06-20	dry	dry	NA
								2013-08-22	dry	dry	NA
								2013-10-10	dry	dry	NA
								2013-12-12	dry	dry	NA
								2014-02-12	dry	dry	NA
								2014-11-27	dry	dry	NA
								2015-03-11	dry	dry	NA
								2015-09-18	dry	dry	NA
								2016-03-14	3.58	2.70	224.83
								2017-02-28	3.66	2.78	224.75
								2018-02-23	dry	dry	NA
								2018-02-23	dry	dry	NA
								2019-04-01	dry	dry	NA
								2019-08-20	dry	dry	NA
								2020-02-13	3.60	2.72	224.82
								2021-02-03	dry	dry	NA
GP-B3	226.03	225.07	3.09	2.13	1.52	224.46	222.94	2012-09-17	dry	dry	NA
								2012-12-03	dry	dry	NA
								2012-12-18	dry	dry	NA
								2013-04-04	dry	dry	NA
								2013-06-20	dry	dry	NA
								2013-08-22	dry	dry	NA
								2013-10-10	dry	dry	NA
								2013-12-12	dry	dry	NA
								2014-02-12	dry	dry	NA
								2014-11-27	dry	dry	NA
								2015-03-12	dry	dry	NA
								2015-09-18	dry	dry	NA
								2016-03-14	dry	dry	NA
								2017-02-28	dry	dry	NA
								2018-02-28	2.73	1.78	223.30
								2019-04-01	2.99	2.03	223.05
								2019-08-20	dry	dry	NA
								2020-02-13	2.95	1.99	223.08
								2021-02-03	dry	dry	NA

Table B-1
Groundwater Elevations
Bunker's Creek Historic Landfill Sites

Well ID	Monitoring Pipe Elevation (masl)	Ground Elevation (masl)	Depth to Bottom of Well (mbmp)	Depth to Bottom of Well (mbgs)	Screen Length (m)	Top of Screen Elevation (masl)	Base of Well Elevation (masl)	Date	Depth to Groundwater (mbmp)	Depth to Groundwater (mbgs)	Groundwater Elevation (masl)
GP-B7	221.43	220.34	3.38	2.29	1.52	219.57	218.05	2012-09-17	2.20	1.11	219.23
								2012-12-03	2.19	1.10	219.23
								2012-12-18	2.21	1.12	219.21
								2013-04-04	2.19	1.11	219.23
								2013-06-20	2.16	1.07	219.26
								2013-08-22	1.94	0.85	219.49
								2013-10-10	1.92	0.83	219.51
								2013-12-12	2.10	1.01	219.32
								2014-02-12	2.11	1.02	219.32
								2014-11-27	2.18	1.09	219.25
								2015-03-11	2.24	1.15	219.19
								2015-09-18	2.28	1.19	219.15
								2017-02-28	2.23	1.14	219.20
								2018-02-23	2.06	0.97	219.36
								2019-04-01	2.18	1.09	219.25
								2019-08-20	2.24	1.15	219.18
								2020-02-13	2.22	1.13	219.21
								2021-02-03	2.21	1.12	219.21
GP-B8	226.65	226.75	3.86	3.96	3.05	225.83	222.79	2012-12-03	3.33	3.43	223.32
								2012-12-18	3.30	3.40	223.35
								2013-04-04	3.24	3.34	223.41
								2013-06-20	3.24	3.34	223.41
								2013-08-22	Not Accessible	NA	NA
								2013-10-10	3.35	3.45	223.30
								2013-12-12	3.32	3.42	223.33
								2014-02-13	3.43	3.53	223.22
								2014-11-25	Damaged	NA	NA
								2014-11-27	3.55	3.65	223.10
								2015-03-12	3.49	3.59	223.16
								2015-09-18	3.43	3.53	223.22
								2016-03-14	Frozen @ 0.26	NA	NA
								2017-02-28	Frozen @ TOP	NA	NA
								2017-03-20	0.22	0.32	226.43
								2018-02-23	3.34	3.44	223.31
								2019-04-01	1.85	1.96	224.79
								2019-08-20	3.46	3.56	223.19
								2020-02-13	1.84	1.94	224.81
								2021-02-24	3.41	3.51	223.23

Table B-1
Groundwater Elevations
Bunker's Creek Historic Landfill Sites

Well ID	Monitoring Pipe Elevation (masl)	Ground Elevation (masl)	Depth to Bottom of Well (mbmp)	Depth to Bottom of Well (mbgs)	Screen Length (m)	Top of Screen Elevation (masl)	Base of Well Elevation (masl)	Date	Depth to Groundwater (mbmp)	Depth to Groundwater (mbgs)	Groundwater Elevation (masl)
GP-B14	224.81	224.06	3.03	2.29	1.52	223.30	221.77	2012-12-03	2.32	1.57	222.49
								2012-12-18	2.30	1.56	222.50
								2013-04-04	2.17	1.42	222.64
								2013-06-20	2.29	1.54	222.52
								2013-08-22	2.45	1.70	222.36
								2013-10-10	2.33	1.59	222.48
								2013-12-12	2.31	1.57	222.50
								2014-02-12	2.46	1.72	222.34
								2014-11-27	2.22	1.47	222.59
								2015-03-11	2.63	1.89	222.18
								2015-09-18	2.64	1.89	222.17
								2017-02-28	2.23	1.49	222.58
								2018-02-28	2.51	1.76	222.30
								2019-04-01	2.47	1.72	222.34
								2019-08-20	2.74	1.99	222.07
								2020-02-13	2.43	1.69	222.38
								2021-02-03	2.60	1.86	222.20
GP-B17	225.85	224.94	3.65	2.75	1.52	223.72	222.20	2012-12-03	3.50	2.59	222.35
								2012-12-18	3.48	2.57	222.37
								2013-04-04	3.29	2.39	222.56
								2013-06-20	3.38	2.48	222.46
								2013-08-22	3.61	2.70	222.24
								2013-10-10	3.52	2.61	222.33
								2013-12-12	3.43	2.53	222.42
								2014-02-12	3.65	2.74	222.20
								2014-11-27	3.42	2.51	222.43
								2015-03-11	3.53	2.63	222.32
								2015-09-18	3.58	2.68	222.26
								2017-02-28	3.13	2.22	222.72
								2018-02-28	3.40	2.50	222.44
								2019-04-01	3.34	2.43	222.51
								2019-08-20	3.65	2.75	222.20
								2020-02-13	3.31	2.40	222.54
								2021-02-03	3.47	2.57	222.37

Table B-1
Groundwater Elevations
Bunker's Creek Historic Landfill Sites

Well ID	Monitoring Pipe Elevation (masl)	Ground Elevation (masl)	Depth to Bottom of Well (mbmp)	Depth to Bottom of Well (mbgs)	Screen Length (m)	Top of Screen Elevation (masl)	Base of Well Elevation (masl)	Date	Depth to Groundwater (mbmp)	Depth to Groundwater (mbgs)	Groundwater Elevation (masl)
GP-B18	224.53	223.58	4.00	3.05	1.52	222.05	220.53	2012-09-17	2.92	1.97	221.61
								2012-12-03	2.64	1.69	221.89
								2012-12-18	2.64	1.69	221.89
								2013-04-04	2.50	1.54	222.04
								2013-06-20	2.59	1.64	221.94
								2013-08-22	dry	dry	NA
								2013-10-10	2.72	1.76	221.82
								2013-12-12	2.65	1.69	221.89
								2014-02-12	2.81	1.86	221.72
								2014-11-27	2.59	1.63	221.95
								2015-03-11	2.82	1.87	221.71
								2015-09-18	2.84	1.89	221.69
								2017-02-28	2.34	1.39	222.19
								2018-02-28	2.48	1.53	222.05
								2019-04-01	2.61	1.66	221.92
								2019-08-20	2.87	1.92	221.66
								2020-02-13	2.61	1.66	221.92
								2021-02-03	2.70	1.75	221.83
GP-B19	222.62	221.84	3.07	2.29	1.52	221.08	219.56	2012-09-17	1.62	0.84	221.00
								2012-12-03	1.29	0.51	221.34
								2012-12-18	1.34	0.55	221.29
								2013-04-04	1.37	0.59	221.26
								2013-06-20	1.45	0.67	221.17
								2013-08-22	1.76	0.98	220.86
								2013-10-10	1.60	0.82	221.02
								2013-12-12	1.58	0.80	221.04
								2014-02-12	1.63	0.85	220.99
								2014-11-27	1.54	0.76	221.08
								2015-03-11	1.53	0.75	221.09
								2015-09-18	1.75	0.97	220.87
								2017-02-28	1.46	0.68	221.16
								2018-02-28	1.48	0.70	221.14
								2019-04-01	1.37	0.59	221.25
								2019-08-20	1.78	1.00	220.84
								2019-08-29	1.86	1.08	220.76
								2020-02-13	1.58	0.80	221.04
								2021-02-03	1.65	0.87	220.97

Table B-1
Groundwater Elevations
Bunker's Creek Historic Landfill Sites

Well ID	Monitoring Pipe Elevation (masl)	Ground Elevation (masl)	Depth to Bottom of Well (mbmp)	Depth to Bottom of Well (mbgs)	Screen Length (m)	Top of Screen Elevation (masl)	Base of Well Elevation (masl)	Date	Depth to Groundwater (mbmp)	Depth to Groundwater (mbgs)	Groundwater Elevation (masl)
GP-B20	228.29	228.43	4.43	4.57	3.05	226.90	223.85	2013-08-22	3.52	3.66	224.77
								2013-10-10	3.53	3.67	224.76
								2013-12-12	3.52	3.66	224.77
								2014-02-25	3.66	3.80	224.63
								2014-11-25	3.54	3.68	224.75
								2014-11-27	3.45	3.59	224.84
								2015-03-11	Buried	NA	NA
								2015-09-18	3.61	3.75	224.68
								2017-02-28	3.33	3.47	224.95
								2018-02-23	3.16	3.30	225.13
								2019-04-01	3.48	3.62	224.80
								2019-08-20	3.51	3.65	224.78
								2019-08-29	3.56	3.70	224.72
								2020-02-13	3.48	3.62	224.80
								2021-03-03	3.53	3.67	224.75
GP-B21	228.71	227.66	5.17	4.12	3.05	226.59	223.54	2013-08-22	4.88	3.83	223.83
								2013-10-10	4.86	3.80	223.85
								2013-12-12	4.44	3.39	224.27
								2014-02-12	4.95	3.89	223.76
								2014-11-27	4.85	3.80	223.86
								2015-03-12	4.99	3.94	223.72
								2015-09-18	4.94	3.89	223.77
								2017-02-28	4.69	3.64	224.02
								2018-02-23	4.82	3.77	223.89
								2019-04-01	4.86	3.81	223.85
								2019-08-20	dry	dry	NA
								2020-02-13	4.82	3.76	223.90
								2021-02-03	4.83	3.78	223.88

Table B-1
Groundwater Elevations
Bunker's Creek Historic Landfill Sites

Well ID	Monitoring Pipe Elevation (masl)	Ground Elevation (masl)	Depth to Bottom of Well (mbmp)	Depth to Bottom of Well (mbgs)	Screen Length (m)	Top of Screen Elevation (masl)	Base of Well Elevation (masl)	Date	Depth to Groundwater (mbmp)	Depth to Groundwater (mbgs)	Groundwater Elevation (masl)
GP-B22	225.01	225.11	3.71	3.81	3.05	224.35	221.30	2013-08-22	2.00	2.09	223.02
								2013-10-10	1.93	2.03	223.08
								2013-12-12	1.86	1.96	223.15
								2014-02-25	2.02	2.12	222.99
								2014-11-25	1.88	1.98	223.13
								2015-03-12	2.06	2.16	222.95
								2015-09-18	2.01	2.11	223.00
								2017-02-28	1.61	1.71	223.40
								2018-02-23	1.82	1.92	223.19
								2019-04-01	1.79	1.89	223.23
								2019-08-20	2.05	2.15	222.96
								2020-02-13	1.80	1.89	223.22
								2021-02-03	1.90	2.00	223.11
GP-B24	225.39	224.54	3.12	2.27	1.52	223.79	222.27	2017-12-20	2.47	1.61	222.93
								2018-03-27	2.38	1.52	223.02
								2019-04-01	2.27	1.41	223.13
								2019-08-20	2.49	1.63	222.90
								2019-08-29	2.58	1.72	222.81
								2020-02-13	2.28	1.42	223.11
								2021-02-03	2.44	1.58	222.95

Notes:
masl = metres above sea level
mbmp = metres below monitoring pipe
mbgs = metres below ground surface

APPENDIX C

Analytical Results – Surface Water



Your Project #: 11-1170-0043
 Site Location: HWS BARRIE
 Your C.O.C. #: 830380-11-01

Attention: Dawn Hoyle

Golder Associates Ltd
 121 Commerce Park Drive
 Unit L
 Barrie, ON
 CANADA L4N 8X1

Report Date: 2021/09/27
 Report #: R6829749
 Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C1R1206

Received: 2021/09/20, 15:52

Sample Matrix: Water
 # Samples Received: 5

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Methylnaphthalene Sum	5	N/A	2021/09/24	CAM SOP-00301	EPA 8270D m
Dissolved Aluminum (0.2 u, clay free)	5	N/A	2021/09/23	CAM SOP-00447	EPA 6020B m
Alkalinity	5	N/A	2021/09/23	CAM SOP-00448	SM 23 2320 B m
1,3-Dichloropropene Sum	5	N/A	2021/09/27		EPA 8260C m
Chloride by Automated Colourimetry	5	N/A	2021/09/23	CAM SOP-00463	SM 23 4500-Cl E m
Conductivity	5	N/A	2021/09/23	CAM SOP-00414	SM 23 2510 m
Petroleum Hydrocarbons F2-F4 in Water (1)	5	2021/09/24	2021/09/24	CAM SOP-00316	CCME PHC-CWS m
Hardness (calculated as CaCO3)	5	N/A	2021/09/23	CAM SOP 00102/00408/00447	SM 2340 B
Dissolved Mercury in Water by CVAA	5	2021/09/23	2021/09/23	CAM SOP-00453	EPA 7470A m
Total Metals Analysis by ICPMS	5	N/A	2021/09/24	CAM SOP-00447	EPA 6020B m
Total Ammonia-N	3	N/A	2021/09/23	CAM SOP-00441	USGS I-2522-90 m
Total Ammonia-N	2	N/A	2021/09/24	CAM SOP-00441	USGS I-2522-90 m
PAH Compounds in Water by GC/MS (SIM)	5	2021/09/23	2021/09/24	CAM SOP-00318	EPA 8270 m
pH	5	2021/09/22	2021/09/23	CAM SOP-00413	SM 4500H+ B m
Field Measured pH (2)	5	N/A	2021/09/20		Field pH Meter
Sulphate by Automated Colourimetry	5	N/A	2021/09/23	CAM SOP-00464	EPA 375.4 m
Field Temperature (2)	5	N/A	2021/09/20		Field Thermometer
Un-ionized Ammonia	3	2021/09/21	2021/09/23	Auto Calc.	PWQO
Un-ionized Ammonia	2	2021/09/21	2021/09/24	Auto Calc.	PWQO
Volatile Organic Compounds and F1 PHCs	5	N/A	2021/09/25	CAM SOP-00230	EPA 8260C 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, MELCC, EPA, APHA.

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.



Your Project #: 11-1170-0043
Site Location: HWS BARRIE
Your C.O.C. #: 830380-11-01

Attention: Dawn Hoyle

Golder Associates Ltd
121 Commerce Park Drive
Unit L
Barrie, ON
CANADA L4N 8X1

Report Date: 2021/09/27
Report #: R6829749
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C1R1206

Received: 2021/09/20, 15:52

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.

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) All CCME PHC results met required criteria unless otherwise stated in the report. The CWS PHC methods employed by Bureau Veritas Laboratories conform to all prescribed elements of the reference method and performance based elements have been validated. All modifications have been validated and proven equivalent following "Alberta Environment's Interpretation of the Reference Method for the Canada-Wide Standard for Petroleum Hydrocarbons in Soil Validation of Performance-Based Alternative Methods September 2003". Documentation is available upon request. Modifications from Reference Method for the Canada-wide Standard for Petroleum Hydrocarbons in Soil-Tier 1 Method: F2/F3/F4 data reported using validated cold solvent extraction instead of Soxhlet extraction.

(2) This is a field test, therefore, the results relate to items that were not analysed at Bureau Veritas Laboratories.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Ema Gitej, Senior Project Manager

Email: emese.gitej@bureauveritas.com

Phone# (905)817-5829

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BV Labs 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 Signature Page.



BUREAU
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BV Labs Job #: C1R1206
Report Date: 2021/09/27

Golder Associates Ltd
Client Project #: 11-1170-0043
Site Location: HWS BARRIE
Sampler Initials: DP

RESULTS OF ANALYSES OF WATER

BV Labs ID		QRX474		QRX475		QRX476			QRX477		
Sampling Date		2021/09/17 12:00		2021/09/17 12:15		2021/09/17 12:45			2021/09/17 01:30		
COC Number		830380-11-01		830380-11-01		830380-11-01			830380-11-01		
	UNITS	SWB1	RDL	SWB2	RDL	SWB3	RDL	QC Batch	SWB4	RDL	QC Batch
Calculated Parameters											
Hardness (CaCO ₃)	mg/L	360	1.0	360	1.0	350	1.0	7591480	350	1.0	7591480
Total Un-ionized Ammonia	mg/L	0.12	0.011	0.088	0.012	0.11	0.016	7590133	0.11	0.018	7590133
Field Measurements											
Field Temperature	Celsius	16.08	N/A	16.27	N/A	16.98	N/A	ONSITE	17.31	N/A	ONSITE
Field Measured pH	pH	8.87		8.91		9.05		ONSITE	9.12		ONSITE
Inorganics											
Total Ammonia-N	mg/L	0.53	0.050	0.37	0.050	0.35	0.050	7595509	0.30	0.050	7595499
Conductivity	umho/cm	1800	1.0	1900	1.0	1900	1.0	7593137	2400	1.0	7593137
pH	pH	8.23		8.21		8.19		7593133	8.20		7593133
Dissolved Sulphate (SO ₄)	mg/L	28	1.0	27	1.0	28	1.0	7593056	32	1.0	7593056
Alkalinity (Total as CaCO ₃)	mg/L	250	1.0	250	1.0	240	1.0	7593115	240	1.0	7593115
Dissolved Chloride (Cl ⁻)	mg/L	410	5.0	440	5.0	440	5.0	7593075	600	7.0	7593075
RDL = Reportable Detection Limit QC Batch = Quality Control Batch N/A = Not Applicable											



BUREAU
VERITAS

BV Labs Job #: C1R1206
Report Date: 2021/09/27

Golder Associates Ltd
Client Project #: 11-1170-0043
Site Location: HWS BARRIE
Sampler Initials: DP

RESULTS OF ANALYSES OF WATER

BV Labs ID		QRX477			QRX478		
Sampling Date		2021/09/17 01:30			2021/09/17 02:30		
COC Number		830380-11-01			830380-11-01		
	UNITS	SWB4 Lab-Dup	RDL	QC Batch	SWB5	RDL	QC Batch
Calculated Parameters							
Hardness (CaCO ₃)	mg/L				320	1.0	7591480
Total Un-ionized Ammonia	mg/L				0.055	0.022	7590133
Field Measurements							
Field Temperature	Celsius				17.41	N/A	ONSITE
Field Measured pH	pH				9.24		ONSITE
Inorganics							
Total Ammonia-N	mg/L	0.27	0.050	7595499	0.13	0.050	7595499
Conductivity	umho/cm				2100	1.0	7593137
pH	pH				8.37		7593133
Dissolved Sulphate (SO ₄)	mg/L				30	1.0	7593056
Alkalinity (Total as CaCO ₃)	mg/L				220	1.0	7593115
Dissolved Chloride (Cl ⁻)	mg/L				510	6.0	7593075
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Lab-Dup = Laboratory Initiated Duplicate N/A = Not Applicable							



BUREAU
VERITAS

BV Labs Job #: C1R1206
Report Date: 2021/09/27

Golder Associates Ltd
Client Project #: 11-1170-0043
Site Location: HWS BARRIE
Sampler Initials: DP

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

BV Labs ID		QRX474	QRX475			QRX475			QRX476		
Sampling Date		2021/09/17 12:00	2021/09/17 12:15			2021/09/17 12:15			2021/09/17 12:45		
COC Number		830380-11-01	830380-11-01			830380-11-01			830380-11-01		
	UNITS	SWB1	SWB2	RDL	QC Batch	SWB2 Lab-Dup	RDL	QC Batch	SWB3	RDL	QC Batch

Metals

Dissolved (0.2u) Aluminum (Al)	ug/L	15	11	5	7593803				9	5	7593803
Dissolved Mercury (Hg)	ug/L	<0.10	<0.10	0.10	7595605	<0.10	0.10	7595605	<0.10	0.10	7595605
Total Aluminum (Al)	ug/L	1200	750	4.9	7596258				330	4.9	7596258
Total Antimony (Sb)	ug/L	<0.50	<0.50	0.50	7596258				<0.50	0.50	7596258
Total Arsenic (As)	ug/L	<1.0	<1.0	1.0	7596258				<1.0	1.0	7596258
Total Barium (Ba)	ug/L	160	160	2.0	7596258				150	2.0	7596258
Total Beryllium (Be)	ug/L	<0.40	<0.40	0.40	7596258				<0.40	0.40	7596258
Total Bismuth (Bi)	ug/L	<1.0	<1.0	1.0	7596258				<1.0	1.0	7596258
Total Boron (B)	ug/L	23	22	10	7596258				23	10	7596258
Total Cadmium (Cd)	ug/L	<0.090	<0.090	0.090	7596258				<0.090	0.090	7596258
Total Calcium (Ca)	ug/L	130000	130000	200	7596258				120000	200	7596258
Total Chromium (Cr)	ug/L	<5.0	<5.0	5.0	7596258				<5.0	5.0	7596258
Total Cobalt (Co)	ug/L	0.90	0.58	0.50	7596258				<0.50	0.50	7596258
Total Copper (Cu)	ug/L	4.3	3.1	0.90	7596258				2.3	0.90	7596258
Total Iron (Fe)	ug/L	2500	1900	100	7596258				1300	100	7596258
Total Lead (Pb)	ug/L	4.0	2.8	0.50	7596258				1.4	0.50	7596258
Total Lithium (Li)	ug/L	<5.0	<5.0	5.0	7596258				<5.0	5.0	7596258
Total Magnesium (Mg)	ug/L	17000	16000	50	7596258				15000	50	7596258
Total Manganese (Mn)	ug/L	140	130	2.0	7596258				110	2.0	7596258
Total Molybdenum (Mo)	ug/L	0.71	0.64	0.50	7596258				0.68	0.50	7596258
Total Nickel (Ni)	ug/L	2.2	1.5	1.0	7596258				1.1	1.0	7596258
Total Potassium (K)	ug/L	3100	2900	200	7596258				2700	200	7596258
Total Selenium (Se)	ug/L	<2.0	<2.0	2.0	7596258				<2.0	2.0	7596258
Total Silicon (Si)	ug/L	7200	6300	50	7596258				5600	50	7596258
Total Silver (Ag)	ug/L	<0.090	<0.090	0.090	7596258				<0.090	0.090	7596258
Total Sodium (Na)	ug/L	260000	250000	100	7596258				280000	100	7596258
Total Strontium (Sr)	ug/L	620	580	1.0	7596258				570	1.0	7596258
Total Tellurium (Te)	ug/L	<1.0	<1.0	1.0	7596258				<1.0	1.0	7596258
Total Thallium (Tl)	ug/L	<0.050	<0.050	0.050	7596258				<0.050	0.050	7596258
Total Tin (Sn)	ug/L	<1.0	<1.0	1.0	7596258				<1.0	1.0	7596258

RDL = Reportable Detection Limit

QC Batch = Quality Control Batch

Lab-Dup = Laboratory Initiated Duplicate



BUREAU
VERITAS

BV Labs Job #: C1R1206
Report Date: 2021/09/27

Golder Associates Ltd
Client Project #: 11-1170-0043
Site Location: HWS BARRIE
Sampler Initials: DP

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

BV Labs ID		QRX474	QRX475			QRX475			QRX476		
Sampling Date		2021/09/17 12:00	2021/09/17 12:15			2021/09/17 12:15			2021/09/17 12:45		
COC Number		830380-11-01	830380-11-01			830380-11-01			830380-11-01		
	UNITS	SWB1	SWB2	RDL	QC Batch	SWB2 Lab-Dup	RDL	QC Batch	SWB3	RDL	QC Batch
Total Titanium (Ti)	ug/L	57	38	5.0	7596258				19	5.0	7596258
Total Tungsten (W)	ug/L	<1.0	<1.0	1.0	7596258				<1.0	1.0	7596258
Total Uranium (U)	ug/L	1.6	1.4	0.10	7596258				1.5	0.10	7596258
Total Vanadium (V)	ug/L	4.0	3.0	0.50	7596258				2.0	0.50	7596258
Total Zinc (Zn)	ug/L	11	8.0	5.0	7596258				<5.0	5.0	7596258
Total Zirconium (Zr)	ug/L	<1.0	<1.0	1.0	7596258				<1.0	1.0	7596258
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Lab-Dup = Laboratory Initiated Duplicate											

BUREAU
VERITASBV Labs Job #: C1R1206
Report Date: 2021/09/27Golder Associates Ltd
Client Project #: 11-1170-0043
Site Location: HWS BARRIE
Sampler Initials: DP**ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)**

BV Labs ID		QRX477	QRX478		
Sampling Date		2021/09/17 01:30	2021/09/17 02:30		
COC Number		830380-11-01	830380-11-01		
	UNITS	SWB4	SWB5	RDL	QC Batch
Metals					
Dissolved (0.2u) Aluminum (Al)	ug/L	10	11	5	7593803
Dissolved Mercury (Hg)	ug/L	<0.10	<0.10	0.10	7595605
Total Aluminum (Al)	ug/L	820	290	4.9	7596258
Total Antimony (Sb)	ug/L	<0.50	<0.50	0.50	7596258
Total Arsenic (As)	ug/L	<1.0	<1.0	1.0	7596258
Total Barium (Ba)	ug/L	140	120	2.0	7596258
Total Beryllium (Be)	ug/L	<0.40	<0.40	0.40	7596258
Total Bismuth (Bi)	ug/L	<1.0	<1.0	1.0	7596258
Total Boron (B)	ug/L	28	17	10	7596258
Total Cadmium (Cd)	ug/L	<0.090	<0.090	0.090	7596258
Total Calcium (Ca)	ug/L	120000	110000	200	7596258
Total Chromium (Cr)	ug/L	<5.0	<5.0	5.0	7596258
Total Cobalt (Co)	ug/L	0.60	<0.50	0.50	7596258
Total Copper (Cu)	ug/L	3.8	1.8	0.90	7596258
Total Iron (Fe)	ug/L	1900	950	100	7596258
Total Lead (Pb)	ug/L	4.7	1.4	0.50	7596258
Total Lithium (Li)	ug/L	<5.0	<5.0	5.0	7596258
Total Magnesium (Mg)	ug/L	14000	13000	50	7596258
Total Manganese (Mn)	ug/L	120	93	2.0	7596258
Total Molybdenum (Mo)	ug/L	1.6	1.4	0.50	7596258
Total Nickel (Ni)	ug/L	1.5	1.0	1.0	7596258
Total Potassium (K)	ug/L	3000	2600	200	7596258
Total Selenium (Se)	ug/L	<2.0	<2.0	2.0	7596258
Total Silicon (Si)	ug/L	6200	5100	50	7596258
Total Silver (Ag)	ug/L	<0.090	<0.090	0.090	7596258
Total Sodium (Na)	ug/L	370000	320000	100	7596258
Total Strontium (Sr)	ug/L	560	530	1.0	7596258
Total Tellurium (Te)	ug/L	<1.0	<1.0	1.0	7596258
Total Thallium (Tl)	ug/L	<0.050	<0.050	0.050	7596258
Total Tin (Sn)	ug/L	<1.0	<1.0	1.0	7596258
Total Titanium (Ti)	ug/L	43	18	5.0	7596258
RDL = Reportable Detection Limit					
QC Batch = Quality Control Batch					



BUREAU
VERITAS

BV Labs Job #: C1R1206
Report Date: 2021/09/27

Golder Associates Ltd
Client Project #: 11-1170-0043
Site Location: HWS BARRIE
Sampler Initials: DP

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

BV Labs ID		QRX477	QRX478		
Sampling Date		2021/09/17 01:30	2021/09/17 02:30		
COC Number		830380-11-01	830380-11-01		
	UNITS	SWB4	SWB5	RDL	QC Batch
Total Tungsten (W)	ug/L	<1.0	<1.0	1.0	7596258
Total Uranium (U)	ug/L	4.2	2.9	0.10	7596258
Total Vanadium (V)	ug/L	3.5	2.3	0.50	7596258
Total Zinc (Zn)	ug/L	9.8	<5.0	5.0	7596258
Total Zirconium (Zr)	ug/L	<1.0	<1.0	1.0	7596258
RDL = Reportable Detection Limit					
QC Batch = Quality Control Batch					



BUREAU
VERITAS

BV Labs Job #: C1R1206
Report Date: 2021/09/27

Golder Associates Ltd
Client Project #: 11-1170-0043
Site Location: HWS BARRIE
Sampler Initials: DP

SEMI-VOLATILE ORGANICS BY GC-MS (WATER)

BV Labs ID		QRX474	QRX475	QRX476	QRX477	QRX478		
Sampling Date		2021/09/17 12:00	2021/09/17 12:15	2021/09/17 12:45	2021/09/17 01:30	2021/09/17 02:30		
COC Number		830380-11-01	830380-11-01	830380-11-01	830380-11-01	830380-11-01		
	UNITS	SWB1	SWB2	SWB3	SWB4	SWB5	RDL	QC Batch
Calculated Parameters								
Methylnaphthalene, 2-(1-)	ug/L	0.017	<0.014	<0.014	<0.014	<0.014	0.014	7591192
Polyaromatic Hydrocarbons								
Acenaphthene	ug/L	0.015	<0.010	<0.010	<0.010	<0.010	0.010	7596771
Acenaphthylene	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	7596771
Anthracene	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	7596771
Benzo(a)anthracene	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	7596771
Benzo(a)pyrene	ug/L	<0.0090	<0.0090	<0.0090	<0.0090	<0.0090	0.0090	7596771
Benzo(b,j)fluoranthene	ug/L	<0.010	<0.010	<0.010	0.010	<0.010	0.010	7596771
Benzo(g,h,i)perylene	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	7596771
Benzo(k)fluoranthene	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	7596771
Chrysene	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	7596771
Dibenzo(a,h)anthracene	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	7596771
Fluoranthene	ug/L	0.012	0.011	<0.010	0.019	<0.010	0.010	7596771
Fluorene	ug/L	0.011	<0.010	<0.010	<0.010	<0.010	0.010	7596771
Indeno(1,2,3-cd)pyrene	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	7596771
1-Methylnaphthalene	ug/L	0.017	<0.010	<0.010	<0.010	<0.010	0.010	7596771
2-Methylnaphthalene	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	7596771
Naphthalene	ug/L	0.013	<0.010	<0.010	<0.010	<0.010	0.010	7596771
Phenanthrene	ug/L	0.016	0.010	0.011	0.016	<0.010	0.010	7596771
Pyrene	ug/L	0.011	0.010	<0.010	0.017	<0.010	0.010	7596771
Surrogate Recovery (%)								
D10-Anthracene	%	87	88	91	82	94		7596771
D14-Terphenyl (FS)	%	92	91	94	84	93		7596771
D8-Acenaphthylene	%	73	76	80	69	80		7596771
RDL = Reportable Detection Limit								
QC Batch = Quality Control Batch								



BV Labs Job #: C1R1206
Report Date: 2021/09/27

Golder Associates Ltd
Client Project #: 11-1170-0043
Site Location: HWS BARRIE
Sampler Initials: DP

O.REG 153 VOCs BY HS & F1-F4 (WATER)

BV Labs ID		QRX474	QRX475	QRX476	QRX477		
Sampling Date		2021/09/17 12:00	2021/09/17 12:15	2021/09/17 12:45	2021/09/17 01:30		
COC Number		830380-11-01	830380-11-01	830380-11-01	830380-11-01		
	UNITS	SWB1	SWB2	SWB3	SWB4	RDL	QC Batch
Calculated Parameters							
1,3-Dichloropropene (cis+trans)	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	7591996
Volatile Organics							
Acetone (2-Propanone)	ug/L	<10	<10	<10	<10	10	7585928
Benzene	ug/L	<0.17	<0.17	<0.17	<0.17	0.17	7585928
Bromodichloromethane	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	7585928
Bromoform	ug/L	<1.0	<1.0	<1.0	<1.0	1.0	7585928
Bromomethane	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	7585928
Carbon Tetrachloride	ug/L	<0.20	<0.20	<0.20	<0.20	0.20	7585928
Chlorobenzene	ug/L	<0.20	<0.20	<0.20	<0.20	0.20	7585928
Chloroform	ug/L	<0.20	<0.20	<0.20	<0.20	0.20	7585928
Dibromochloromethane	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	7585928
1,2-Dichlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	7585928
1,3-Dichlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	7585928
1,4-Dichlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	7585928
Dichlorodifluoromethane (FREON 12)	ug/L	<1.0	<1.0	<1.0	<1.0	1.0	7585928
1,1-Dichloroethane	ug/L	<0.20	<0.20	<0.20	<0.20	0.20	7585928
1,2-Dichloroethane	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	7585928
1,1-Dichloroethylene	ug/L	<0.20	<0.20	<0.20	<0.20	0.20	7585928
cis-1,2-Dichloroethylene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	7585928
trans-1,2-Dichloroethylene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	7585928
1,2-Dichloropropane	ug/L	<0.20	<0.20	<0.20	<0.20	0.20	7585928
cis-1,3-Dichloropropene	ug/L	<0.30	<0.30	<0.30	<0.30	0.30	7585928
trans-1,3-Dichloropropene	ug/L	<0.40	<0.40	<0.40	<0.40	0.40	7585928
Ethylbenzene	ug/L	<0.20	<0.20	<0.20	<0.20	0.20	7585928
Ethylene Dibromide	ug/L	<0.20	<0.20	<0.20	<0.20	0.20	7585928
Hexane	ug/L	<1.0	<1.0	<1.0	<1.0	1.0	7585928
Methylene Chloride(Dichloromethane)	ug/L	<2.0	<2.0	<2.0	<2.0	2.0	7585928
Methyl Ethyl Ketone (2-Butanone)	ug/L	<10	<10	<10	<10	10	7585928
Methyl Isobutyl Ketone	ug/L	<5.0	<5.0	<5.0	<5.0	5.0	7585928
Methyl t-butyl ether (MTBE)	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	7585928
Styrene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	7585928
RDL = Reportable Detection Limit							
QC Batch = Quality Control Batch							

BUREAU
VERITASBV Labs Job #: C1R1206
Report Date: 2021/09/27Golder Associates Ltd
Client Project #: 11-1170-0043
Site Location: HWS BARRIE
Sampler Initials: DP**O.REG 153 VOCs BY HS & F1-F4 (WATER)**

BV Labs ID		QRX474	QRX475	QRX476	QRX477		
Sampling Date		2021/09/17 12:00	2021/09/17 12:15	2021/09/17 12:45	2021/09/17 01:30		
COC Number		830380-11-01	830380-11-01	830380-11-01	830380-11-01		
	UNITS	SWB1	SWB2	SWB3	SWB4	RDL	QC Batch
1,1,1,2-Tetrachloroethane	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	7585928
1,1,2,2-Tetrachloroethane	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	7585928
Tetrachloroethylene	ug/L	<0.20	<0.20	<0.20	<0.20	0.20	7585928
Toluene	ug/L	<0.20	<0.20	<0.20	<0.20	0.20	7585928
1,1,1-Trichloroethane	ug/L	<0.20	<0.20	<0.20	<0.20	0.20	7585928
1,1,2-Trichloroethane	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	7585928
Trichloroethylene	ug/L	<0.20	<0.20	<0.20	<0.20	0.20	7585928
Trichlorofluoromethane (FREON 11)	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	7585928
Vinyl Chloride	ug/L	0.23	<0.20	<0.20	<0.20	0.20	7585928
p+m-Xylene	ug/L	<0.20	<0.20	<0.20	<0.20	0.20	7585928
o-Xylene	ug/L	<0.20	<0.20	<0.20	<0.20	0.20	7585928
Total Xylenes	ug/L	<0.20	<0.20	<0.20	<0.20	0.20	7585928
F1 (C6-C10)	ug/L	<25	<25	<25	<25	25	7585928
F1 (C6-C10) - BTEX	ug/L	<25	<25	<25	<25	25	7585928
F2-F4 Hydrocarbons							
F2 (C10-C16 Hydrocarbons)	ug/L	<100	<100	<100	<100	100	7597851
F3 (C16-C34 Hydrocarbons)	ug/L	<200	<200	<200	<200	200	7597851
F4 (C34-C50 Hydrocarbons)	ug/L	<200	<200	<200	<200	200	7597851
Reached Baseline at C50	ug/L	Yes	Yes	Yes	Yes		7597851
Surrogate Recovery (%)							
o-Terphenyl	%	92	95	96	98		7597851
4-Bromofluorobenzene	%	81	80	81	84		7585928
D4-1,2-Dichloroethane	%	97	101	100	120		7585928
D8-Toluene	%	105	103	103	97		7585928
RDL = Reportable Detection Limit							
QC Batch = Quality Control Batch							

BUREAU
VERITASBV Labs Job #: C1R1206
Report Date: 2021/09/27Golder Associates Ltd
Client Project #: 11-1170-0043
Site Location: HWS BARRIE
Sampler Initials: DP**O.REG 153 VOCs BY HS & F1-F4 (WATER)**

BV Labs ID		QRX477			QRX478		
Sampling Date		2021/09/17 01:30			2021/09/17 02:30		
COC Number		830380-11-01			830380-11-01		
	UNITS	SWB4 Lab-Dup	RDL	QC Batch	SWB5	RDL	QC Batch
Calculated Parameters							
1,3-Dichloropropene (cis+trans)	ug/L				<0.50	0.50	7591996
Volatile Organics							
Acetone (2-Propanone)	ug/L				<10	10	7585928
Benzene	ug/L				<0.17	0.17	7585928
Bromodichloromethane	ug/L				<0.50	0.50	7585928
Bromoform	ug/L				<1.0	1.0	7585928
Bromomethane	ug/L				<0.50	0.50	7585928
Carbon Tetrachloride	ug/L				<0.20	0.20	7585928
Chlorobenzene	ug/L				<0.20	0.20	7585928
Chloroform	ug/L				<0.20	0.20	7585928
Dibromochloromethane	ug/L				<0.50	0.50	7585928
1,2-Dichlorobenzene	ug/L				<0.50	0.50	7585928
1,3-Dichlorobenzene	ug/L				<0.50	0.50	7585928
1,4-Dichlorobenzene	ug/L				<0.50	0.50	7585928
Dichlorodifluoromethane (FREON 12)	ug/L				<1.0	1.0	7585928
1,1-Dichloroethane	ug/L				<0.20	0.20	7585928
1,2-Dichloroethane	ug/L				<0.50	0.50	7585928
1,1-Dichloroethylene	ug/L				<0.20	0.20	7585928
cis-1,2-Dichloroethylene	ug/L				<0.50	0.50	7585928
trans-1,2-Dichloroethylene	ug/L				<0.50	0.50	7585928
1,2-Dichloropropane	ug/L				<0.20	0.20	7585928
cis-1,3-Dichloropropene	ug/L				<0.30	0.30	7585928
trans-1,3-Dichloropropene	ug/L				<0.40	0.40	7585928
Ethylbenzene	ug/L				<0.20	0.20	7585928
Ethylene Dibromide	ug/L				<0.20	0.20	7585928
Hexane	ug/L				<1.0	1.0	7585928
Methylene Chloride(Dichloromethane)	ug/L				<2.0	2.0	7585928
Methyl Ethyl Ketone (2-Butanone)	ug/L				<10	10	7585928
Methyl Isobutyl Ketone	ug/L				<5.0	5.0	7585928
Methyl t-butyl ether (MTBE)	ug/L				<0.50	0.50	7585928
RDL = Reportable Detection Limit							
QC Batch = Quality Control Batch							
Lab-Dup = Laboratory Initiated Duplicate							

BUREAU
VERITASBV Labs Job #: C1R1206
Report Date: 2021/09/27Golder Associates Ltd
Client Project #: 11-1170-0043
Site Location: HWS BARRIE
Sampler Initials: DP**O.REG 153 VOCs BY HS & F1-F4 (WATER)**

BV Labs ID		QRX477			QRX478		
Sampling Date		2021/09/17 01:30			2021/09/17 02:30		
COC Number		830380-11-01			830380-11-01		
	UNITS	SWB4 Lab-Dup	RDL	QC Batch	SWB5	RDL	QC Batch
Styrene	ug/L				<0.50	0.50	7585928
1,1,1,2-Tetrachloroethane	ug/L				<0.50	0.50	7585928
1,1,2,2-Tetrachloroethane	ug/L				<0.50	0.50	7585928
Tetrachloroethylene	ug/L				<0.20	0.20	7585928
Toluene	ug/L				<0.20	0.20	7585928
1,1,1-Trichloroethane	ug/L				<0.20	0.20	7585928
1,1,2-Trichloroethane	ug/L				<0.50	0.50	7585928
Trichloroethylene	ug/L				<0.20	0.20	7585928
Trichlorofluoromethane (FREON 11)	ug/L				<0.50	0.50	7585928
Vinyl Chloride	ug/L				<0.20	0.20	7585928
p+m-Xylene	ug/L				<0.20	0.20	7585928
o-Xylene	ug/L				<0.20	0.20	7585928
Total Xylenes	ug/L				<0.20	0.20	7585928
F1 (C6-C10)	ug/L				<25	25	7585928
F1 (C6-C10) - BTEX	ug/L				<25	25	7585928
F2-F4 Hydrocarbons							
F2 (C10-C16 Hydrocarbons)	ug/L	<100	100	7597851	<100	100	7597851
F3 (C16-C34 Hydrocarbons)	ug/L	<200	200	7597851	<200	200	7597851
F4 (C34-C50 Hydrocarbons)	ug/L	<200	200	7597851	<200	200	7597851
Reached Baseline at C50	ug/L	Yes		7597851	Yes		7597851
Surrogate Recovery (%)							
o-Terphenyl	%	97		7597851	88		7597851
4-Bromofluorobenzene	%				83		7585928
D4-1,2-Dichloroethane	%				118		7585928
D8-Toluene	%				97		7585928
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Lab-Dup = Laboratory Initiated Duplicate							



BUREAU
VERITAS

BV Labs Job #: C1R1206
Report Date: 2021/09/27

Golder Associates Ltd
Client Project #: 11-1170-0043
Site Location: HWS BARRIE
Sampler Initials: DP

TEST SUMMARY

BV Labs ID: QRX474
Sample ID: SWB1
Matrix: Water

Collected: 2021/09/17
Shipped:
Received: 2021/09/20

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Methylnaphthalene Sum	CALC	7591192	N/A	2021/09/24	Automated Statchk
Dissolved Aluminum (0.2 u, clay free)	ICP/MS	7593803	N/A	2021/09/23	Arefa Dabhad
Alkalinity	AT	7593115	N/A	2021/09/23	Surinder Rai
1,3-Dichloropropene Sum	CALC	7591996	N/A	2021/09/27	Automated Statchk
Chloride by Automated Colourimetry	KONE	7593075	N/A	2021/09/23	Alina Dobreanu
Conductivity	AT	7593137	N/A	2021/09/23	Surinder Rai
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	7597851	2021/09/24	2021/09/24	Ksenia Trofimova
Hardness (calculated as CaCO3)		7591480	N/A	2021/09/23	Automated Statchk
Dissolved Mercury in Water by CVAA	CV/AA	7595605	2021/09/23	2021/09/23	Medhat Nasr
Total Metals Analysis by ICPMS	ICP/MS	7596258	N/A	2021/09/24	Arefa Dabhad
Total Ammonia-N	LACH/NH4	7595509	N/A	2021/09/23	Viorica Rotaru
PAH Compounds in Water by GC/MS (SIM)	GC/MS	7596771	2021/09/23	2021/09/24	Mitesh Raj
pH	AT	7593133	2021/09/22	2021/09/23	Surinder Rai
Field Measured pH	PH	ONSITE	N/A	2021/09/20	Ankita Bhalla
Sulphate by Automated Colourimetry	KONE	7593056	N/A	2021/09/23	Alina Dobreanu
Field Measured pH	PH	ONSITE	N/A	2021/09/20	Ankita Bhalla
Un-ionized Ammonia	CALC/NH3	7590133	2021/09/23	2021/09/23	Automated Statchk
Volatile Organic Compounds and F1 PHCs	GC/MSFD	7585928	N/A	2021/09/25	Blair Gannon

BV Labs ID: QRX475
Sample ID: SWB2
Matrix: Water

Collected: 2021/09/17
Shipped:
Received: 2021/09/20

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Methylnaphthalene Sum	CALC	7591192	N/A	2021/09/24	Automated Statchk
Dissolved Aluminum (0.2 u, clay free)	ICP/MS	7593803	N/A	2021/09/23	Arefa Dabhad
Alkalinity	AT	7593115	N/A	2021/09/23	Surinder Rai
1,3-Dichloropropene Sum	CALC	7591996	N/A	2021/09/27	Automated Statchk
Chloride by Automated Colourimetry	KONE	7593075	N/A	2021/09/23	Alina Dobreanu
Conductivity	AT	7593137	N/A	2021/09/23	Surinder Rai
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	7597851	2021/09/24	2021/09/24	Ksenia Trofimova
Hardness (calculated as CaCO3)		7591480	N/A	2021/09/23	Automated Statchk
Dissolved Mercury in Water by CVAA	CV/AA	7595605	2021/09/23	2021/09/23	Medhat Nasr
Total Metals Analysis by ICPMS	ICP/MS	7596258	N/A	2021/09/24	Arefa Dabhad
Total Ammonia-N	LACH/NH4	7595509	N/A	2021/09/23	Viorica Rotaru
PAH Compounds in Water by GC/MS (SIM)	GC/MS	7596771	2021/09/23	2021/09/24	Mitesh Raj
pH	AT	7593133	2021/09/22	2021/09/23	Surinder Rai
Field Measured pH	PH	ONSITE	N/A	2021/09/20	Ankita Bhalla
Sulphate by Automated Colourimetry	KONE	7593056	N/A	2021/09/23	Alina Dobreanu
Field Measured pH	PH	ONSITE	N/A	2021/09/20	Ankita Bhalla
Un-ionized Ammonia	CALC/NH3	7590133	2021/09/23	2021/09/23	Automated Statchk
Volatile Organic Compounds and F1 PHCs	GC/MSFD	7585928	N/A	2021/09/25	Blair Gannon



BUREAU
VERITAS

BV Labs Job #: C1R1206
Report Date: 2021/09/27

Golder Associates Ltd
Client Project #: 11-1170-0043
Site Location: HWS BARRIE
Sampler Initials: DP

TEST SUMMARY

BV Labs ID: QRX475 Dup
Sample ID: SWB2
Matrix: Water

Collected: 2021/09/17
Shipped:
Received: 2021/09/20

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Dissolved Mercury in Water by CVAA	CV/AA	7595605	2021/09/23	2021/09/23	Medhat Nasr

BV Labs ID: QRX476
Sample ID: SWB3
Matrix: Water

Collected: 2021/09/17
Shipped:
Received: 2021/09/20

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Methylnaphthalene Sum	CALC	7591192	N/A	2021/09/24	Automated Statchk
Dissolved Aluminum (0.2 u, clay free)	ICP/MS	7593803	N/A	2021/09/23	Arefa Dabhad
Alkalinity	AT	7593115	N/A	2021/09/23	Surinder Rai
1,3-Dichloropropene Sum	CALC	7591996	N/A	2021/09/27	Automated Statchk
Chloride by Automated Colourimetry	KONE	7593075	N/A	2021/09/23	Alina Dobreanu
Conductivity	AT	7593137	N/A	2021/09/23	Surinder Rai
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	7597851	2021/09/24	2021/09/24	Ksenia Trofimova
Hardness (calculated as CaCO3)		7591480	N/A	2021/09/23	Automated Statchk
Dissolved Mercury in Water by CVAA	CV/AA	7595605	2021/09/23	2021/09/23	Medhat Nasr
Total Metals Analysis by ICPMS	ICP/MS	7596258	N/A	2021/09/24	Arefa Dabhad
Total Ammonia-N	LACH/NH4	7595509	N/A	2021/09/23	Viorica Rotaru
PAH Compounds in Water by GC/MS (SIM)	GC/MS	7596771	2021/09/23	2021/09/24	Mitesh Raj
pH	AT	7593133	2021/09/22	2021/09/23	Surinder Rai
Field Measured pH	PH	ONSITE	N/A	2021/09/20	Ankita Bhalla
Sulphate by Automated Colourimetry	KONE	7593056	N/A	2021/09/23	Alina Dobreanu
Field Measured pH	PH	ONSITE	N/A	2021/09/20	Ankita Bhalla
Un-ionized Ammonia	CALC/NH3	7590133	2021/09/23	2021/09/23	Automated Statchk
Volatile Organic Compounds and F1 PHCs	GC/MSFD	7585928	N/A	2021/09/25	Blair Gannon

BV Labs ID: QRX477
Sample ID: SWB4
Matrix: Water

Collected: 2021/09/17
Shipped:
Received: 2021/09/20

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Methylnaphthalene Sum	CALC	7591192	N/A	2021/09/24	Automated Statchk
Dissolved Aluminum (0.2 u, clay free)	ICP/MS	7593803	N/A	2021/09/23	Arefa Dabhad
Alkalinity	AT	7593115	N/A	2021/09/23	Surinder Rai
1,3-Dichloropropene Sum	CALC	7591996	N/A	2021/09/27	Automated Statchk
Chloride by Automated Colourimetry	KONE	7593075	N/A	2021/09/23	Alina Dobreanu
Conductivity	AT	7593137	N/A	2021/09/23	Surinder Rai
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	7597851	2021/09/24	2021/09/24	Ksenia Trofimova
Hardness (calculated as CaCO3)		7591480	N/A	2021/09/23	Automated Statchk
Dissolved Mercury in Water by CVAA	CV/AA	7595605	2021/09/23	2021/09/23	Medhat Nasr
Total Metals Analysis by ICPMS	ICP/MS	7596258	N/A	2021/09/24	Arefa Dabhad
Total Ammonia-N	LACH/NH4	7595499	N/A	2021/09/24	Chandra Nandlal
PAH Compounds in Water by GC/MS (SIM)	GC/MS	7596771	2021/09/23	2021/09/24	Mitesh Raj
pH	AT	7593133	2021/09/22	2021/09/23	Surinder Rai

BUREAU
VERITASBV Labs Job #: C1R1206
Report Date: 2021/09/27Golder Associates Ltd
Client Project #: 11-1170-0043
Site Location: HWS BARRIE
Sampler Initials: DP

TEST SUMMARY

BV Labs ID: QRX477
Sample ID: SWB4
Matrix: WaterCollected: 2021/09/17
Shipped:
Received: 2021/09/20

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Field Measured pH	PH	ONSITE	N/A	2021/09/20	Ankita Bhalla
Sulphate by Automated Colourimetry	KONE	7593056	N/A	2021/09/23	Alina Dobreanu
Field Measured pH	PH	ONSITE	N/A	2021/09/20	Ankita Bhalla
Un-ionized Ammonia	CALC/NH3	7590133	2021/09/24	2021/09/24	Automated Statchk
Volatile Organic Compounds and F1 PHCs	GC/MSFD	7585928	N/A	2021/09/25	Blair Gannon

BV Labs ID: QRX477 Dup
Sample ID: SWB4
Matrix: WaterCollected: 2021/09/17
Shipped:
Received: 2021/09/20

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	7597851	2021/09/24	2021/09/24	Ksenia Trofimova
Total Ammonia-N	LACH/NH4	7595499	N/A	2021/09/24	Chandra Nandlal

BV Labs ID: QRX478
Sample ID: SWB5
Matrix: WaterCollected: 2021/09/17
Shipped:
Received: 2021/09/20

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Methylnaphthalene Sum	CALC	7591192	N/A	2021/09/24	Automated Statchk
Dissolved Aluminum (0.2 u, clay free)	ICP/MS	7593803	N/A	2021/09/23	Arefa Dabhad
Alkalinity	AT	7593115	N/A	2021/09/23	Surinder Rai
1,3-Dichloropropene Sum	CALC	7591996	N/A	2021/09/27	Automated Statchk
Chloride by Automated Colourimetry	KONE	7593075	N/A	2021/09/23	Alina Dobreanu
Conductivity	AT	7593137	N/A	2021/09/23	Surinder Rai
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	7597851	2021/09/24	2021/09/24	Ksenia Trofimova
Hardness (calculated as CaCO3)		7591480	N/A	2021/09/23	Automated Statchk
Dissolved Mercury in Water by CVAA	CV/AA	7595605	2021/09/23	2021/09/23	Medhat Nasr
Total Metals Analysis by ICPMS	ICP/MS	7596258	N/A	2021/09/24	Arefa Dabhad
Total Ammonia-N	LACH/NH4	7595499	N/A	2021/09/24	Chandra Nandlal
PAH Compounds in Water by GC/MS (SIM)	GC/MS	7596771	2021/09/23	2021/09/24	Mitesh Raj
pH	AT	7593133	2021/09/22	2021/09/23	Surinder Rai
Field Measured pH	PH	ONSITE	N/A	2021/09/20	Ankita Bhalla
Sulphate by Automated Colourimetry	KONE	7593056	N/A	2021/09/23	Alina Dobreanu
Field Measured pH	PH	ONSITE	N/A	2021/09/20	Ankita Bhalla
Un-ionized Ammonia	CALC/NH3	7590133	2021/09/24	2021/09/24	Automated Statchk
Volatile Organic Compounds and F1 PHCs	GC/MSFD	7585928	N/A	2021/09/25	Blair Gannon



GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	5.0°C
Package 2	8.0°C
Package 3	8.0°C

Results relate only to the items tested.



BUREAU
VERITAS

BV Labs Job #: C1R1206
Report Date: 2021/09/27

Golder Associates Ltd
Client Project #: 11-1170-0043
Site Location: HWS BARRIE
Sampler Initials: DP

QUALITY ASSURANCE REPORT

QA/QC	Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
7585928	BG1	Matrix Spike		4-Bromofluorobenzene	2021/09/25		96	%	70 - 130
				D4-1,2-Dichloroethane	2021/09/25		100	%	70 - 130
				D8-Toluene	2021/09/25		106	%	70 - 130
				Acetone (2-Propanone)	2021/09/25		90	%	60 - 140
				Benzene	2021/09/25		88	%	70 - 130
				Bromodichloromethane	2021/09/25		99	%	70 - 130
				Bromoform	2021/09/25		91	%	70 - 130
				Bromomethane	2021/09/25		96	%	60 - 140
				Carbon Tetrachloride	2021/09/25		104	%	70 - 130
				Chlorobenzene	2021/09/25		97	%	70 - 130
				Chloroform	2021/09/25		98	%	70 - 130
				Dibromochloromethane	2021/09/25		95	%	70 - 130
				1,2-Dichlorobenzene	2021/09/25		96	%	70 - 130
				1,3-Dichlorobenzene	2021/09/25		105	%	70 - 130
				1,4-Dichlorobenzene	2021/09/25		97	%	70 - 130
				Dichlorodifluoromethane (FREON 12)	2021/09/25		134	%	60 - 140
				1,1-Dichloroethane	2021/09/25		95	%	70 - 130
				1,2-Dichloroethane	2021/09/25		93	%	70 - 130
				1,1-Dichloroethylene	2021/09/25		102	%	70 - 130
				cis-1,2-Dichloroethylene	2021/09/25		93	%	70 - 130
				trans-1,2-Dichloroethylene	2021/09/25		94	%	70 - 130
				1,2-Dichloropropane	2021/09/25		95	%	70 - 130
				cis-1,3-Dichloropropene	2021/09/25		84	%	70 - 130
				trans-1,3-Dichloropropene	2021/09/25		95	%	70 - 130
				Ethylbenzene	2021/09/25		92	%	70 - 130
				Ethylene Dibromide	2021/09/25		89	%	70 - 130
				Hexane	2021/09/25		108	%	70 - 130
				Methylene Chloride(Dichloromethane)	2021/09/25		97	%	70 - 130
				Methyl Ethyl Ketone (2-Butanone)	2021/09/25		90	%	60 - 140
				Methyl Isobutyl Ketone	2021/09/25		61 (1)	%	70 - 130
				Methyl t-butyl ether (MTBE)	2021/09/25		82	%	70 - 130
				Styrene	2021/09/25		77	%	70 - 130
				1,1,1,2-Tetrachloroethane	2021/09/25		99	%	70 - 130
				1,1,2,2-Tetrachloroethane	2021/09/25		91	%	70 - 130
				Tetrachloroethylene	2021/09/25		98	%	70 - 130
				Toluene	2021/09/25		98	%	70 - 130
				1,1,1-Trichloroethane	2021/09/25		104	%	70 - 130
				1,1,2-Trichloroethane	2021/09/25		106	%	70 - 130
				Trichloroethylene	2021/09/25		102	%	70 - 130
				Trichlorofluoromethane (FREON 11)	2021/09/25		105	%	70 - 130
				Vinyl Chloride	2021/09/25		120	%	70 - 130
				p+m-Xylene	2021/09/25		92	%	70 - 130
				o-Xylene	2021/09/25		88	%	70 - 130
				F1 (C6-C10)	2021/09/25		105	%	60 - 140
7585928	BG1	Spiked Blank		4-Bromofluorobenzene	2021/09/24		102	%	70 - 130
				D4-1,2-Dichloroethane	2021/09/24		114	%	70 - 130
				D8-Toluene	2021/09/24		104	%	70 - 130
				Acetone (2-Propanone)	2021/09/24		107	%	60 - 140
				Benzene	2021/09/24		93	%	70 - 130
				Bromodichloromethane	2021/09/24		110	%	70 - 130
				Bromoform	2021/09/24		104	%	70 - 130

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QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Bromomethane	2021/09/24		99	%	60 - 140
			Carbon Tetrachloride	2021/09/24		100	%	70 - 130
			Chlorobenzene	2021/09/24		99	%	70 - 130
			Chloroform	2021/09/24		104	%	70 - 130
			Dibromochloromethane	2021/09/24		103	%	70 - 130
			1,2-Dichlorobenzene	2021/09/24		97	%	70 - 130
			1,3-Dichlorobenzene	2021/09/24		100	%	70 - 130
			1,4-Dichlorobenzene	2021/09/24		98	%	70 - 130
			Dichlorodifluoromethane (FREON 12)	2021/09/24		123	%	60 - 140
			1,1-Dichloroethane	2021/09/24		99	%	70 - 130
			1,2-Dichloroethane	2021/09/24		107	%	70 - 130
			1,1-Dichloroethylene	2021/09/24		100	%	70 - 130
			cis-1,2-Dichloroethylene	2021/09/24		100	%	70 - 130
			trans-1,2-Dichloroethylene	2021/09/24		98	%	70 - 130
			1,2-Dichloropropane	2021/09/24		105	%	70 - 130
			cis-1,3-Dichloropropene	2021/09/24		93	%	70 - 130
			trans-1,3-Dichloropropene	2021/09/24		105	%	70 - 130
			Ethylbenzene	2021/09/24		90	%	70 - 130
			Ethylene Dibromide	2021/09/24		103	%	70 - 130
			Hexane	2021/09/24		103	%	70 - 130
			Methylene Chloride(Dichloromethane)	2021/09/24		106	%	70 - 130
			Methyl Ethyl Ketone (2-Butanone)	2021/09/24		118	%	60 - 140
			Methyl Isobutyl Ketone	2021/09/24		91	%	70 - 130
			Methyl t-butyl ether (MTBE)	2021/09/24		96	%	70 - 130
			Styrene	2021/09/24		85	%	70 - 130
			1,1,1,2-Tetrachloroethane	2021/09/24		103	%	70 - 130
			1,1,2,2-Tetrachloroethane	2021/09/24		108	%	70 - 130
			Tetrachloroethylene	2021/09/24		91	%	70 - 130
			Toluene	2021/09/24		99	%	70 - 130
			1,1,1-Trichloroethane	2021/09/24		102	%	70 - 130
			1,1,2-Trichloroethane	2021/09/24		117	%	70 - 130
			Trichloroethylene	2021/09/24		103	%	70 - 130
			Trichlorofluoromethane (FREON 11)	2021/09/24		100	%	70 - 130
			Vinyl Chloride	2021/09/24		118	%	70 - 130
			p+m-Xylene	2021/09/24		91	%	70 - 130
			o-Xylene	2021/09/24		89	%	70 - 130
			F1 (C6-C10)	2021/09/24		94	%	60 - 140
7585928	BG1	Method Blank	4-Bromofluorobenzene	2021/09/24		85	%	70 - 130
			D4-1,2-Dichloroethane	2021/09/24		103	%	70 - 130
			D8-Toluene	2021/09/24		103	%	70 - 130
			Acetone (2-Propanone)	2021/09/24	<10		ug/L	
			Benzene	2021/09/24	<0.17		ug/L	
			Bromodichloromethane	2021/09/24	<0.50		ug/L	
			Bromoform	2021/09/24	<1.0		ug/L	
			Bromomethane	2021/09/24	<0.50		ug/L	
			Carbon Tetrachloride	2021/09/24	<0.20		ug/L	
			Chlorobenzene	2021/09/24	<0.20		ug/L	
			Chloroform	2021/09/24	<0.20		ug/L	
			Dibromochloromethane	2021/09/24	<0.50		ug/L	
			1,2-Dichlorobenzene	2021/09/24	<0.50		ug/L	
			1,3-Dichlorobenzene	2021/09/24	<0.50		ug/L	



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7585928	BG1	RPD	1,4-Dichlorobenzene	2021/09/24	<0.50		ug/L	
			Dichlorodifluoromethane (FREON 12)	2021/09/24	<1.0		ug/L	
			1,1-Dichloroethane	2021/09/24	<0.20		ug/L	
			1,2-Dichloroethane	2021/09/24	<0.50		ug/L	
			1,1-Dichloroethylene	2021/09/24	<0.20		ug/L	
			cis-1,2-Dichloroethylene	2021/09/24	<0.50		ug/L	
			trans-1,2-Dichloroethylene	2021/09/24	<0.50		ug/L	
			1,2-Dichloropropane	2021/09/24	<0.20		ug/L	
			cis-1,3-Dichloropropene	2021/09/24	<0.30		ug/L	
			trans-1,3-Dichloropropene	2021/09/24	<0.40		ug/L	
			Ethylbenzene	2021/09/24	<0.20		ug/L	
			Ethylene Dibromide	2021/09/24	<0.20		ug/L	
			Hexane	2021/09/24	<1.0		ug/L	
			Methylene Chloride(Dichloromethane)	2021/09/24	<2.0		ug/L	
			Methyl Ethyl Ketone (2-Butanone)	2021/09/24	<10		ug/L	
			Methyl Isobutyl Ketone	2021/09/24	<5.0		ug/L	
			Methyl t-butyl ether (MTBE)	2021/09/24	<0.50		ug/L	
			Styrene	2021/09/24	<0.50		ug/L	
			1,1,1,2-Tetrachloroethane	2021/09/24	<0.50		ug/L	
			1,1,2,2-Tetrachloroethane	2021/09/24	<0.50		ug/L	
			Tetrachloroethylene	2021/09/24	<0.20		ug/L	
			Toluene	2021/09/24	<0.20		ug/L	
			1,1,1-Trichloroethane	2021/09/24	<0.20		ug/L	
			1,1,2-Trichloroethane	2021/09/24	<0.50		ug/L	
			Trichloroethylene	2021/09/24	<0.20		ug/L	
			Trichlorofluoromethane (FREON 11)	2021/09/24	<0.50		ug/L	
			Vinyl Chloride	2021/09/24	<0.20		ug/L	
			p+m-Xylene	2021/09/24	<0.20		ug/L	
			o-Xylene	2021/09/24	<0.20		ug/L	
			Total Xylenes	2021/09/24	<0.20		ug/L	
			F1 (C6-C10)	2021/09/24	<25		ug/L	
			F1 (C6-C10) - BTEX	2021/09/24	<25		ug/L	
			Acetone (2-Propanone)	2021/09/25	NC		%	30
			Benzene	2021/09/25	NC		%	30
			Bromodichloromethane	2021/09/25	NC		%	30
			Bromoform	2021/09/25	NC		%	30
			Bromomethane	2021/09/25	NC		%	30
			Carbon Tetrachloride	2021/09/25	NC		%	30
			Chlorobenzene	2021/09/25	NC		%	30
			Chloroform	2021/09/25	NC		%	30
			Dibromochloromethane	2021/09/25	NC		%	30
			1,2-Dichlorobenzene	2021/09/25	NC		%	30
			1,3-Dichlorobenzene	2021/09/25	NC		%	30
			1,4-Dichlorobenzene	2021/09/25	NC		%	30
			Dichlorodifluoromethane (FREON 12)	2021/09/25	NC		%	30
			1,1-Dichloroethane	2021/09/25	NC		%	30
			1,2-Dichloroethane	2021/09/25	NC		%	30
			1,1-Dichloroethylene	2021/09/25	NC		%	30
			cis-1,2-Dichloroethylene	2021/09/25	NC		%	30
			trans-1,2-Dichloroethylene	2021/09/25	NC		%	30
			1,2-Dichloropropane	2021/09/25	NC		%	30

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			cis-1,3-Dichloropropene	2021/09/25	NC		%	30
			trans-1,3-Dichloropropene	2021/09/25	NC		%	30
			Ethylbenzene	2021/09/25	NC		%	30
			Ethylene Dibromide	2021/09/25	NC		%	30
			Hexane	2021/09/25	NC		%	30
			Methylene Chloride(Dichloromethane)	2021/09/25	NC		%	30
			Methyl Ethyl Ketone (2-Butanone)	2021/09/25	NC		%	30
			Methyl Isobutyl Ketone	2021/09/25	NC		%	30
			Methyl t-butyl ether (MTBE)	2021/09/25	NC		%	30
			Styrene	2021/09/25	NC		%	30
			1,1,1,2-Tetrachloroethane	2021/09/25	NC		%	30
			1,1,2,2-Tetrachloroethane	2021/09/25	NC		%	30
			Tetrachloroethylene	2021/09/25	NC		%	30
			Toluene	2021/09/25	NC		%	30
			1,1,1-Trichloroethane	2021/09/25	NC		%	30
			1,1,2-Trichloroethane	2021/09/25	NC		%	30
			Trichloroethylene	2021/09/25	NC		%	30
			Trichlorofluoromethane (FREON 11)	2021/09/25	NC		%	30
			Vinyl Chloride	2021/09/25	NC		%	30
			p+m-Xylene	2021/09/25	NC		%	30
			o-Xylene	2021/09/25	NC		%	30
			Total Xylenes	2021/09/25	NC		%	30
			F1 (C6-C10)	2021/09/25	NC		%	30
			F1 (C6-C10) - BTEX	2021/09/25	NC		%	30
7593056	ADB	Matrix Spike	Dissolved Sulphate (SO4)	2021/09/23		NC	%	75 - 125
7593056	ADB	Spiked Blank	Dissolved Sulphate (SO4)	2021/09/23		103	%	80 - 120
7593056	ADB	Method Blank	Dissolved Sulphate (SO4)	2021/09/23	<1.0		mg/L	
7593056	ADB	RPD	Dissolved Sulphate (SO4)	2021/09/23	1.5		%	20
7593075	ADB	Matrix Spike	Dissolved Chloride (Cl-)	2021/09/23		NC	%	80 - 120
7593075	ADB	Spiked Blank	Dissolved Chloride (Cl-)	2021/09/23		106	%	80 - 120
7593075	ADB	Method Blank	Dissolved Chloride (Cl-)	2021/09/23	<1.0		mg/L	
7593075	ADB	RPD	Dissolved Chloride (Cl-)	2021/09/23	1.6		%	20
7593115	SAU	Spiked Blank	Alkalinity (Total as CaCO3)	2021/09/23		96	%	85 - 115
7593115	SAU	Method Blank	Alkalinity (Total as CaCO3)	2021/09/23	<1.0		mg/L	
7593115	SAU	RPD	Alkalinity (Total as CaCO3)	2021/09/23	0.84		%	20
7593133	SAU	Spiked Blank	pH	2021/09/23		102	%	98 - 103
7593133	SAU	RPD	pH	2021/09/23	2.4		%	N/A
7593137	SAU	Spiked Blank	Conductivity	2021/09/23		99	%	85 - 115
7593137	SAU	Method Blank	Conductivity	2021/09/23	<1.0		umho/cm	
7593137	SAU	RPD	Conductivity	2021/09/23	0.36		%	25
7593803	ADA	Matrix Spike	Dissolved (0.2u) Aluminum (Al)	2021/09/23		105	%	80 - 120
7593803	ADA	Spiked Blank	Dissolved (0.2u) Aluminum (Al)	2021/09/23		105	%	80 - 120
7593803	ADA	Method Blank	Dissolved (0.2u) Aluminum (Al)	2021/09/23	<5		ug/L	
7593803	ADA	RPD	Dissolved (0.2u) Aluminum (Al)	2021/09/23	0.58		%	20
7595499	C_N	Matrix Spike [QRX477-07]	Total Ammonia-N	2021/09/24		100	%	75 - 125
7595499	C_N	Spiked Blank	Total Ammonia-N	2021/09/24		104	%	80 - 120
7595499	C_N	Method Blank	Total Ammonia-N	2021/09/24	<0.050		mg/L	
7595499	C_N	RPD [QRX477-07]	Total Ammonia-N	2021/09/24	10		%	20
7595509	VRO	Matrix Spike	Total Ammonia-N	2021/09/23		99	%	75 - 125
7595509	VRO	Spiked Blank	Total Ammonia-N	2021/09/23		102	%	80 - 120
7595509	VRO	Method Blank	Total Ammonia-N	2021/09/23	<0.050		mg/L	



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7595509	VRO	RPD	Total Ammonia-N	2021/09/23	5.0		%	20
7595605	MEN	Matrix Spike [QRX475-03]	Dissolved Mercury (Hg)	2021/09/23		94	%	75 - 125
7595605	MEN	Spiked Blank	Dissolved Mercury (Hg)	2021/09/23		96	%	80 - 120
7595605	MEN	Method Blank	Dissolved Mercury (Hg)	2021/09/23	<0.10		ug/L	
7595605	MEN	RPD [QRX475-03]	Dissolved Mercury (Hg)	2021/09/23	NC		%	20
7596258	ADA	Matrix Spike	Total Aluminum (Al)	2021/09/24		108	%	80 - 120
			Total Antimony (Sb)	2021/09/24		110	%	80 - 120
			Total Arsenic (As)	2021/09/24		104	%	80 - 120
			Total Barium (Ba)	2021/09/24		107	%	80 - 120
			Total Beryllium (Be)	2021/09/24		108	%	80 - 120
			Total Bismuth (Bi)	2021/09/24		101	%	80 - 120
			Total Boron (B)	2021/09/24		98	%	80 - 120
			Total Cadmium (Cd)	2021/09/24		105	%	80 - 120
			Total Calcium (Ca)	2021/09/24		NC	%	80 - 120
			Total Chromium (Cr)	2021/09/24		99	%	80 - 120
			Total Cobalt (Co)	2021/09/24		100	%	80 - 120
			Total Copper (Cu)	2021/09/24		104	%	80 - 120
			Total Iron (Fe)	2021/09/24		101	%	80 - 120
			Total Lead (Pb)	2021/09/24		100	%	80 - 120
			Total Lithium (Li)	2021/09/24		111	%	80 - 120
			Total Magnesium (Mg)	2021/09/24		102	%	80 - 120
			Total Manganese (Mn)	2021/09/24		100	%	80 - 120
			Total Molybdenum (Mo)	2021/09/24		105	%	80 - 120
			Total Nickel (Ni)	2021/09/24		100	%	80 - 120
			Total Potassium (K)	2021/09/24		105	%	80 - 120
			Total Selenium (Se)	2021/09/24		109	%	80 - 120
			Total Silicon (Si)	2021/09/24		106	%	80 - 120
			Total Silver (Ag)	2021/09/24		99	%	80 - 120
			Total Sodium (Na)	2021/09/24		104	%	80 - 120
			Total Strontium (Sr)	2021/09/24		98	%	80 - 120
			Total Tellurium (Te)	2021/09/24		102	%	80 - 120
			Total Thallium (Tl)	2021/09/24		106	%	80 - 120
			Total Tin (Sn)	2021/09/24		106	%	80 - 120
			Total Titanium (Ti)	2021/09/24		104	%	80 - 120
			Total Tungsten (W)	2021/09/24		110	%	80 - 120
			Total Uranium (U)	2021/09/24		104	%	80 - 120
			Total Vanadium (V)	2021/09/24		99	%	80 - 120
			Total Zinc (Zn)	2021/09/24		101	%	80 - 120
			Total Zirconium (Zr)	2021/09/24		109	%	80 - 120
7596258	ADA	Spiked Blank	Total Aluminum (Al)	2021/09/24		104	%	80 - 120
			Total Antimony (Sb)	2021/09/24		106	%	80 - 120
			Total Arsenic (As)	2021/09/24		103	%	80 - 120
			Total Barium (Ba)	2021/09/24		104	%	80 - 120
			Total Beryllium (Be)	2021/09/24		103	%	80 - 120
			Total Bismuth (Bi)	2021/09/24		99	%	80 - 120
			Total Boron (B)	2021/09/24		96	%	80 - 120
			Total Cadmium (Cd)	2021/09/24		102	%	80 - 120
			Total Calcium (Ca)	2021/09/24		104	%	80 - 120
			Total Chromium (Cr)	2021/09/24		98	%	80 - 120
			Total Cobalt (Co)	2021/09/24		103	%	80 - 120
			Total Copper (Cu)	2021/09/24		102	%	80 - 120



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7596258	ADA	Method Blank	Total Iron (Fe)	2021/09/24		104	%	80 - 120
			Total Lead (Pb)	2021/09/24		103	%	80 - 120
			Total Lithium (Li)	2021/09/24		108	%	80 - 120
			Total Magnesium (Mg)	2021/09/24		107	%	80 - 120
			Total Manganese (Mn)	2021/09/24		101	%	80 - 120
			Total Molybdenum (Mo)	2021/09/24		102	%	80 - 120
			Total Nickel (Ni)	2021/09/24		100	%	80 - 120
			Total Potassium (K)	2021/09/24		104	%	80 - 120
			Total Selenium (Se)	2021/09/24		104	%	80 - 120
			Total Silicon (Si)	2021/09/24		101	%	80 - 120
			Total Silver (Ag)	2021/09/24		95	%	80 - 120
			Total Sodium (Na)	2021/09/24		105	%	80 - 120
			Total Strontium (Sr)	2021/09/24		99	%	80 - 120
			Total Tellurium (Te)	2021/09/24		100	%	80 - 120
			Total Thallium (Tl)	2021/09/24		104	%	80 - 120
			Total Tin (Sn)	2021/09/24		104	%	80 - 120
			Total Titanium (Ti)	2021/09/24		101	%	80 - 120
			Total Tungsten (W)	2021/09/24		101	%	80 - 120
			Total Uranium (U)	2021/09/24		104	%	80 - 120
			Total Vanadium (V)	2021/09/24		98	%	80 - 120
			Total Zinc (Zn)	2021/09/24		103	%	80 - 120
			Total Zirconium (Zr)	2021/09/24		106	%	80 - 120
			Total Aluminum (Al)	2021/09/24	<4.9		ug/L	
			Total Antimony (Sb)	2021/09/24	<0.50		ug/L	
			Total Arsenic (As)	2021/09/24	<1.0		ug/L	
			Total Barium (Ba)	2021/09/24	<2.0		ug/L	
			Total Beryllium (Be)	2021/09/24	<0.40		ug/L	
			Total Bismuth (Bi)	2021/09/24	<1.0		ug/L	
			Total Boron (B)	2021/09/24	<10		ug/L	
			Total Cadmium (Cd)	2021/09/24	<0.090		ug/L	
			Total Calcium (Ca)	2021/09/24	280, RDL=200		ug/L	
			Total Chromium (Cr)	2021/09/24	<5.0		ug/L	
			Total Cobalt (Co)	2021/09/24	<0.50		ug/L	
			Total Copper (Cu)	2021/09/24	<0.90		ug/L	
			Total Iron (Fe)	2021/09/24	<100		ug/L	
			Total Lead (Pb)	2021/09/24	<0.50		ug/L	
			Total Lithium (Li)	2021/09/24	<5.0		ug/L	
			Total Magnesium (Mg)	2021/09/24	<50		ug/L	
			Total Manganese (Mn)	2021/09/24	<2.0		ug/L	
			Total Molybdenum (Mo)	2021/09/24	<0.50		ug/L	
			Total Nickel (Ni)	2021/09/24	<1.0		ug/L	
			Total Potassium (K)	2021/09/24	<200		ug/L	
			Total Selenium (Se)	2021/09/24	<2.0		ug/L	
			Total Silicon (Si)	2021/09/24	<50		ug/L	
			Total Silver (Ag)	2021/09/24	<0.090		ug/L	
			Total Sodium (Na)	2021/09/24	<100		ug/L	
			Total Strontium (Sr)	2021/09/24	<1.0		ug/L	
			Total Tellurium (Te)	2021/09/24	<1.0		ug/L	
			Total Thallium (Tl)	2021/09/24	<0.050		ug/L	
			Total Tin (Sn)	2021/09/24	<1.0		ug/L	



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Golder Associates Ltd
Client Project #: 11-1170-0043
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Sampler Initials: DP

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
7596258	ADA	RPD	Total Titanium (Ti)	2021/09/24	<5.0		ug/L	
			Total Tungsten (W)	2021/09/24	<1.0		ug/L	
			Total Uranium (U)	2021/09/24	<0.10		ug/L	
			Total Vanadium (V)	2021/09/24	<0.50		ug/L	
			Total Zinc (Zn)	2021/09/24	<5.0		ug/L	
			Total Zirconium (Zr)	2021/09/24	<1.0		ug/L	
			Total Aluminum (Al)	2021/09/24	3.3		%	20
			Total Arsenic (As)	2021/09/24	1.4		%	20
			Total Boron (B)	2021/09/24	1.6		%	20
			Total Chromium (Cr)	2021/09/24	NC		%	20
			Total Cobalt (Co)	2021/09/24	NC		%	20
			Total Copper (Cu)	2021/09/24	1.8		%	20
			Total Lead (Pb)	2021/09/24	3.7		%	20
			Total Nickel (Ni)	2021/09/24	NC		%	20
			Total Uranium (U)	2021/09/24	0.42		%	20
			Total Vanadium (V)	2021/09/24	11		%	20
			Total Zinc (Zn)	2021/09/24	NC		%	20
7596771	RAJ	Matrix Spike	D10-Anthracene	2021/09/24		84	%	50 - 130
			D14-Terphenyl (FS)	2021/09/24		92	%	50 - 130
			D8-Acenaphthylene	2021/09/24		72	%	50 - 130
			Acenaphthene	2021/09/24		71	%	50 - 130
			Acenaphthylene	2021/09/24		68	%	50 - 130
			Anthracene	2021/09/24		77	%	50 - 130
			Benzo(a)anthracene	2021/09/24		86	%	50 - 130
			Benzo(a)pyrene	2021/09/24		71	%	50 - 130
			Benzo(b/j)fluoranthene	2021/09/24		82	%	50 - 130
			Benzo(g,h,i)perylene	2021/09/24		61	%	50 - 130
			Benzo(k)fluoranthene	2021/09/24		83	%	50 - 130
			Chrysene	2021/09/24		87	%	50 - 130
			Dibenzo(a,h)anthracene	2021/09/24		59	%	50 - 130
			Fluoranthene	2021/09/24		92	%	50 - 130
			Fluorene	2021/09/24		74	%	50 - 130
			Indeno(1,2,3-cd)pyrene	2021/09/24		66	%	50 - 130
			1-Methylnaphthalene	2021/09/24		70	%	50 - 130
			2-Methylnaphthalene	2021/09/24		66	%	50 - 130
			Naphthalene	2021/09/24		63	%	50 - 130
			Phenanthrene	2021/09/24		82	%	50 - 130
			Pyrene	2021/09/24		90	%	50 - 130
			D10-Anthracene	2021/09/24		101	%	50 - 130
			D14-Terphenyl (FS)	2021/09/24		105	%	50 - 130
			D8-Acenaphthylene	2021/09/24		98	%	50 - 130
7596771	RAJ	Spiked Blank	Acenaphthene	2021/09/24		91	%	50 - 130
			Acenaphthylene	2021/09/24		89	%	50 - 130
			Anthracene	2021/09/24		92	%	50 - 130
			Benzo(a)anthracene	2021/09/24		106	%	50 - 130
			Benzo(a)pyrene	2021/09/24		91	%	50 - 130
			Benzo(b/j)fluoranthene	2021/09/24		99	%	50 - 130
			Benzo(g,h,i)perylene	2021/09/24		87	%	50 - 130
			Benzo(k)fluoranthene	2021/09/24		110	%	50 - 130
			Chrysene	2021/09/24		105	%	50 - 130
			Dibenzo(a,h)anthracene	2021/09/24		70	%	50 - 130



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BV Labs Job #: C1R1206
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Golder Associates Ltd
Client Project #: 11-1170-0043
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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
7596771	RAJ	RPD	Fluoranthene	2021/09/24		103	%	50 - 130
			Fluorene	2021/09/24		94	%	50 - 130
			Indeno(1,2,3-cd)pyrene	2021/09/24		95	%	50 - 130
			1-Methylnaphthalene	2021/09/24		90	%	50 - 130
			2-Methylnaphthalene	2021/09/24		86	%	50 - 130
			Naphthalene	2021/09/24		82	%	50 - 130
			Phenanthrene	2021/09/24		98	%	50 - 130
			Pyrene	2021/09/24		102	%	50 - 130
			Acenaphthene	2021/09/24	1.4		%	30
			Acenaphthylene	2021/09/24	1.6		%	30
			Anthracene	2021/09/24	2.0		%	30
			Benzo(a)anthracene	2021/09/24	1.6		%	30
			Benzo(a)pyrene	2021/09/24	1.6		%	30
			Benzo(b/j)fluoranthene	2021/09/24	0.93		%	30
			Benzo(g,h,i)perylene	2021/09/24	3.6		%	30
			Benzo(k)fluoranthene	2021/09/24	1.8		%	30
			Chrysene	2021/09/24	0.11		%	30
			Dibenzo(a,h)anthracene	2021/09/24	7.5		%	30
			Fluoranthene	2021/09/24	6.7		%	30
			Fluorene	2021/09/24	1.8		%	30
			Indeno(1,2,3-cd)pyrene	2021/09/24	3.7		%	30
			1-Methylnaphthalene	2021/09/24	0.14		%	30
			2-Methylnaphthalene	2021/09/24	0.89		%	30
			Naphthalene	2021/09/24	1.3		%	30
			Phenanthrene	2021/09/24	1.6		%	30
			Pyrene	2021/09/24	5.8		%	30
7596771	RAJ	Method Blank	D10-Anthracene	2021/09/24		103	%	50 - 130
			D14-Terphenyl (F5)	2021/09/24		111	%	50 - 130
			D8-Acenaphthylene	2021/09/24		94	%	50 - 130
			Acenaphthene	2021/09/24	<0.010		ug/L	
			Acenaphthylene	2021/09/24	<0.010		ug/L	
			Anthracene	2021/09/24	<0.010		ug/L	
			Benzo(a)anthracene	2021/09/24	<0.010		ug/L	
			Benzo(a)pyrene	2021/09/24	<0.0090		ug/L	
			Benzo(b/j)fluoranthene	2021/09/24	<0.010		ug/L	
			Benzo(g,h,i)perylene	2021/09/24	<0.010		ug/L	
			Benzo(k)fluoranthene	2021/09/24	<0.010		ug/L	
			Chrysene	2021/09/24	<0.010		ug/L	
			Dibenzo(a,h)anthracene	2021/09/24	<0.010		ug/L	
			Fluoranthene	2021/09/24	<0.010		ug/L	
			Fluorene	2021/09/24	<0.010		ug/L	
			Indeno(1,2,3-cd)pyrene	2021/09/24	<0.010		ug/L	
			1-Methylnaphthalene	2021/09/24	<0.010		ug/L	
			2-Methylnaphthalene	2021/09/24	<0.010		ug/L	
			Naphthalene	2021/09/24	<0.010		ug/L	
			Phenanthrene	2021/09/24	<0.010		ug/L	
			Pyrene	2021/09/24	<0.010		ug/L	
7597851	KTR	Matrix Spike [QRX474-05]	o-Terphenyl	2021/09/24		96	%	60 - 130
			F2 (C10-C16 Hydrocarbons)	2021/09/24		98	%	60 - 130
			F3 (C16-C34 Hydrocarbons)	2021/09/24		94	%	60 - 130
			F4 (C34-C50 Hydrocarbons)	2021/09/24		95	%	60 - 130



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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
7597851	KTR	Spiked Blank	o-Terphenyl	2021/09/24		97	%	60 - 130
			F2 (C10-C16 Hydrocarbons)	2021/09/24		97	%	60 - 130
			F3 (C16-C34 Hydrocarbons)	2021/09/24		96	%	60 - 130
			F4 (C34-C50 Hydrocarbons)	2021/09/24		95	%	60 - 130
7597851	KTR	Method Blank	o-Terphenyl	2021/09/24		97	%	60 - 130
			F2 (C10-C16 Hydrocarbons)	2021/09/24	<100		ug/L	
			F3 (C16-C34 Hydrocarbons)	2021/09/24	<200		ug/L	
			F4 (C34-C50 Hydrocarbons)	2021/09/24	<200		ug/L	
7597851	KTR	RPD [QRX477-05]	F2 (C10-C16 Hydrocarbons)	2021/09/24	NC		%	30
			F3 (C16-C34 Hydrocarbons)	2021/09/24	NC		%	30
			F4 (C34-C50 Hydrocarbons)	2021/09/24	NC		%	30

N/A = Not Applicable

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.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

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 $\leq 2 \times$ RDL).

(1) The recovery was below the lower control limit. This may represent a low bias in some results for this specific analyte.



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VALIDATION SIGNATURE PAGE

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

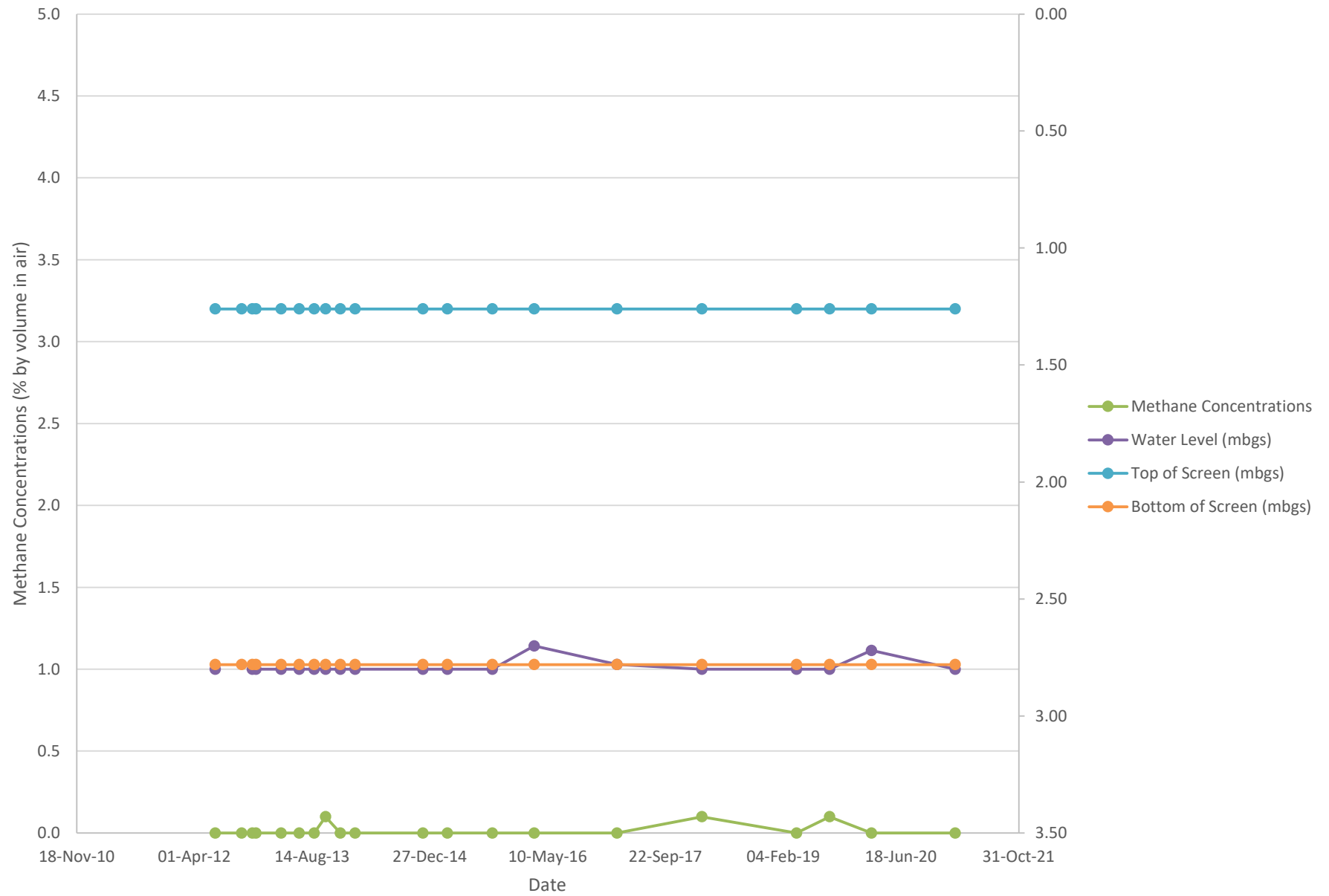
Brad Newman, B.Sc., C.Chem., Scientific Service Specialist

BV Labs 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 Signature Page.

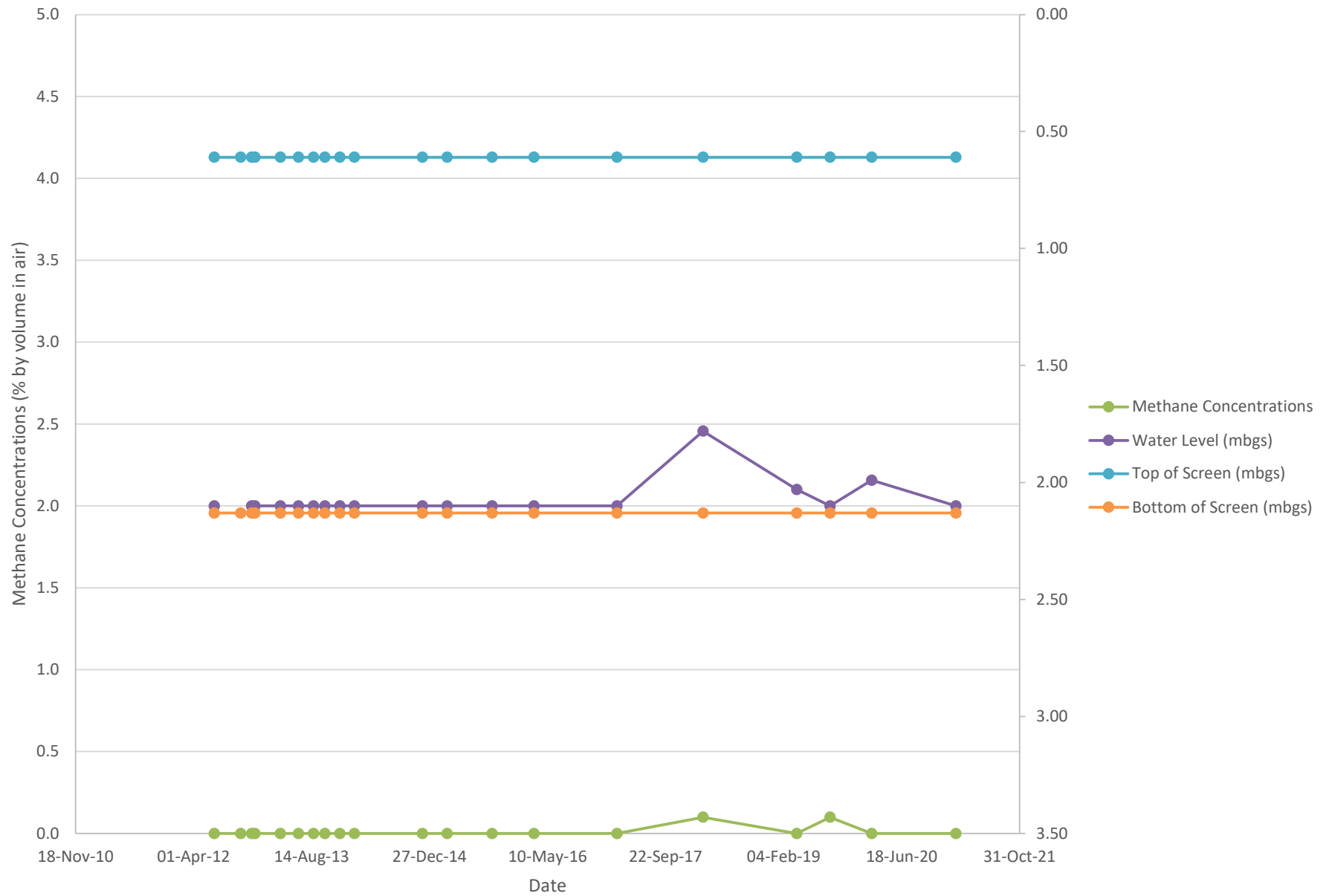
APPENDIX D

Landfill Gas Charts

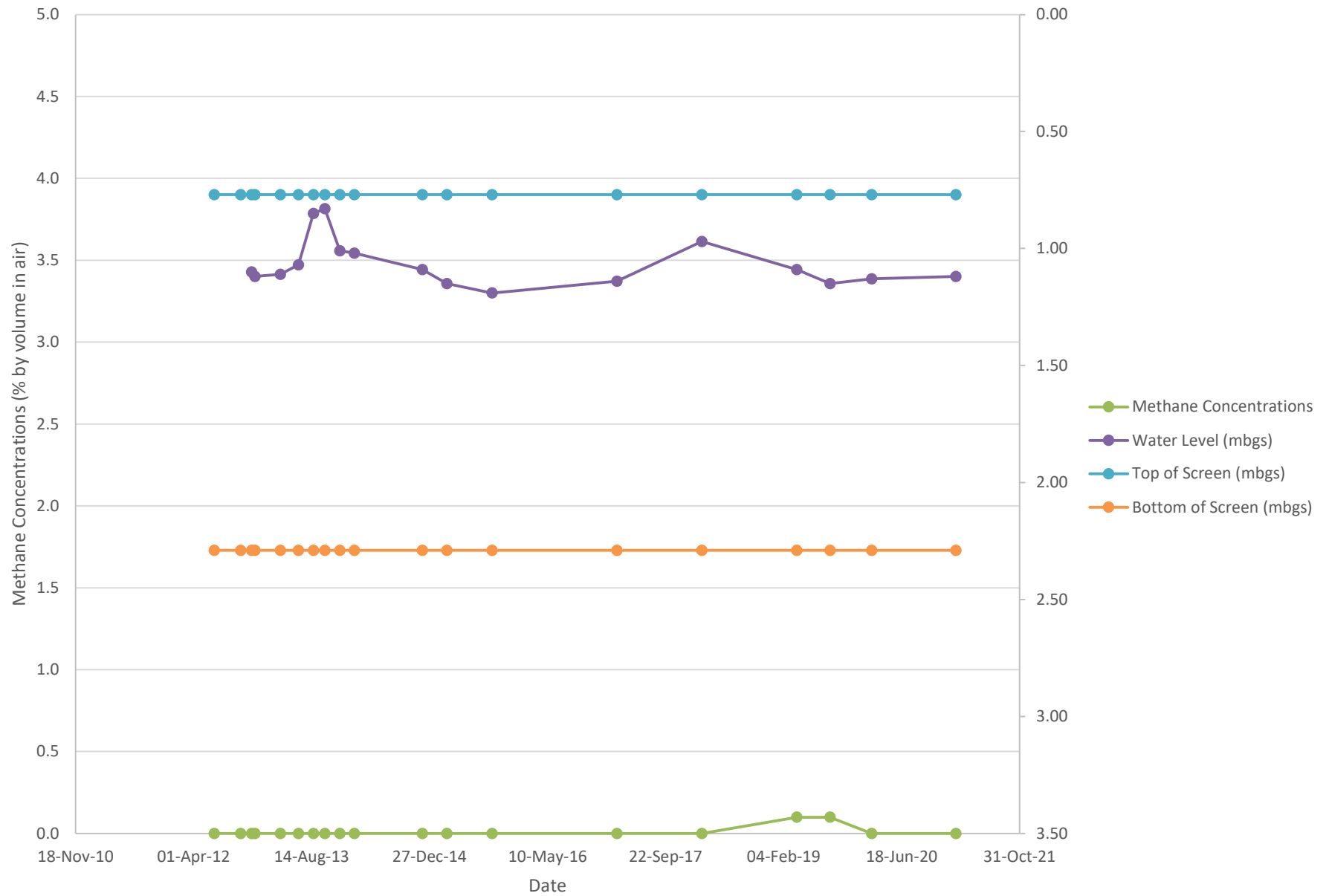
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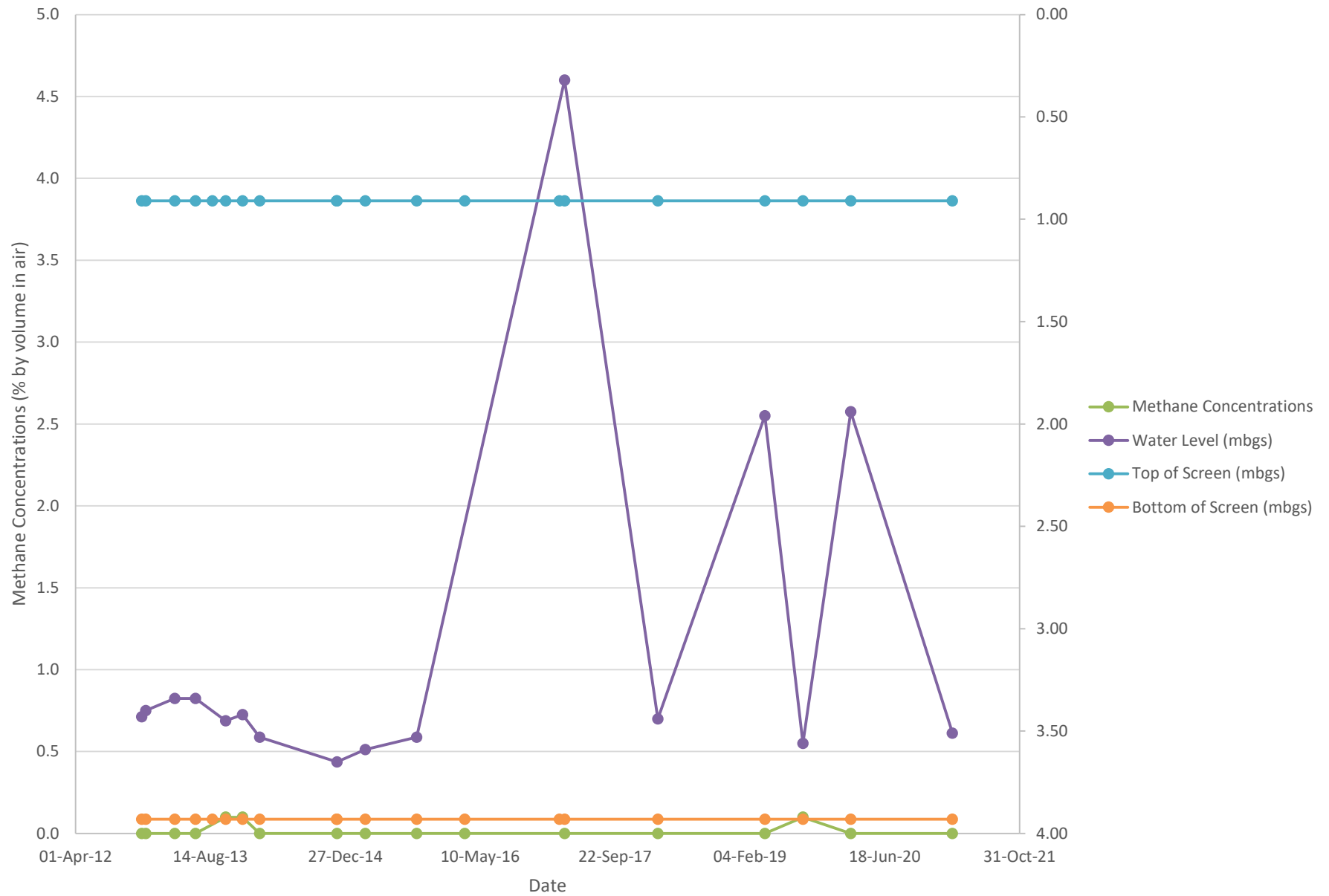
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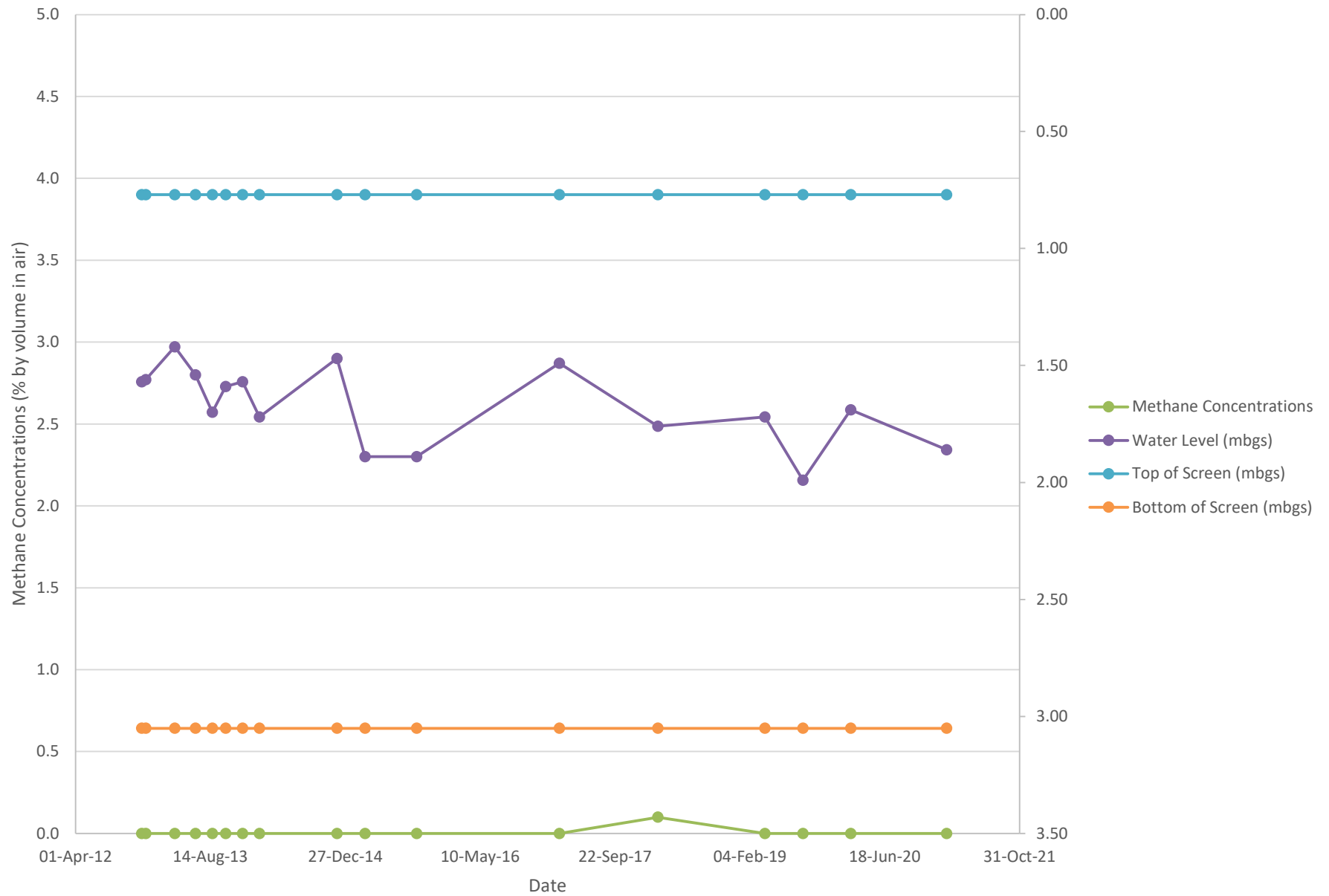
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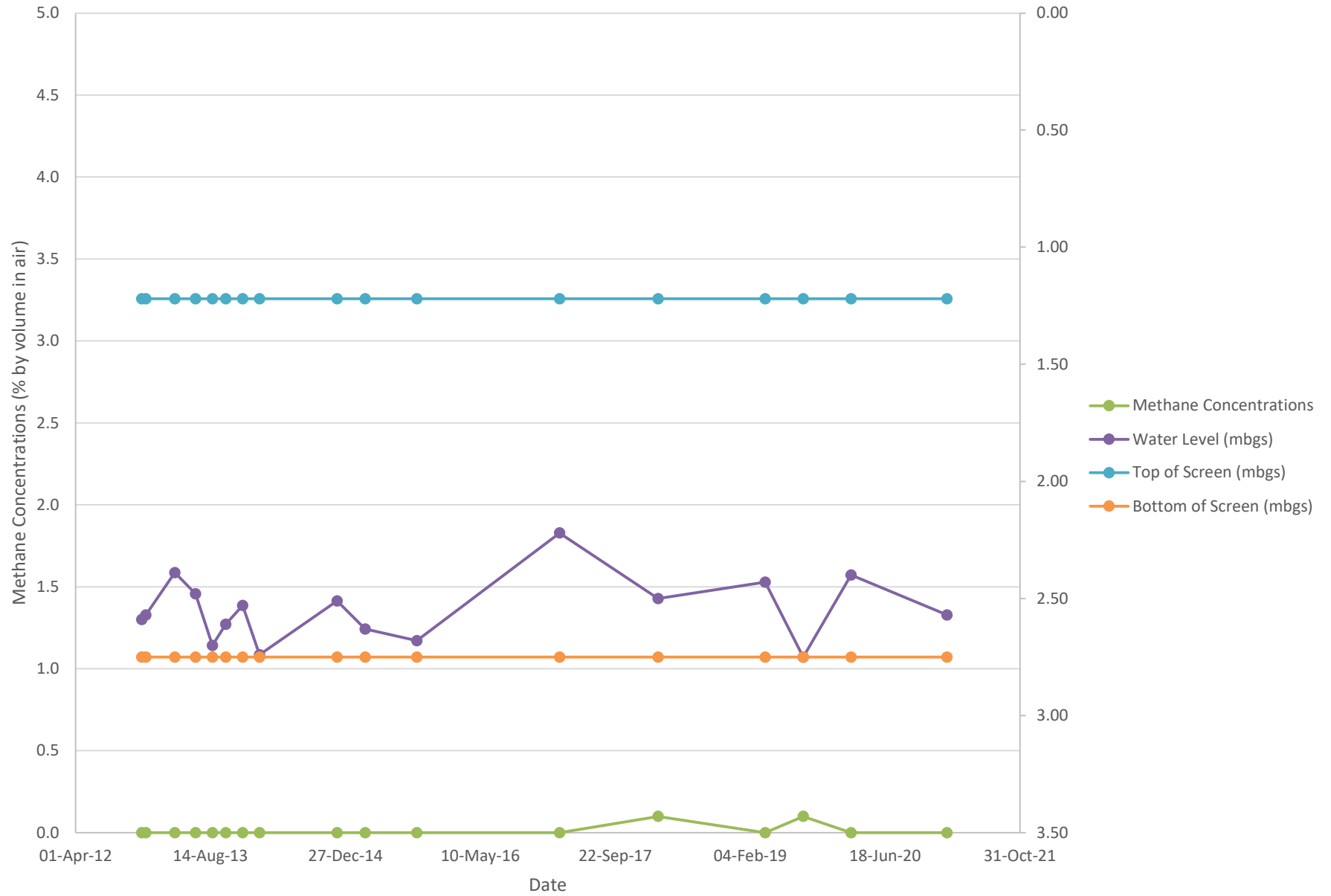
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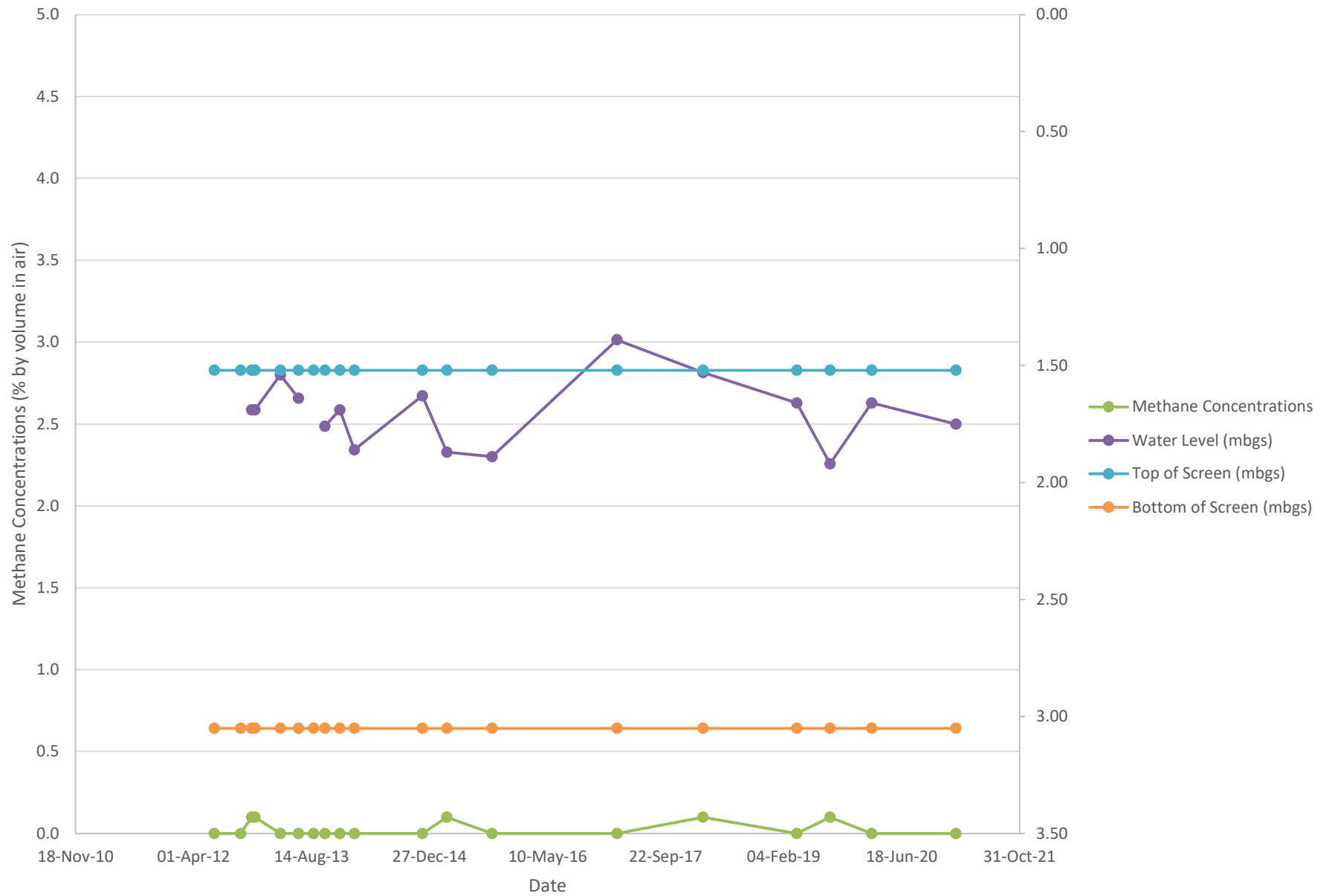
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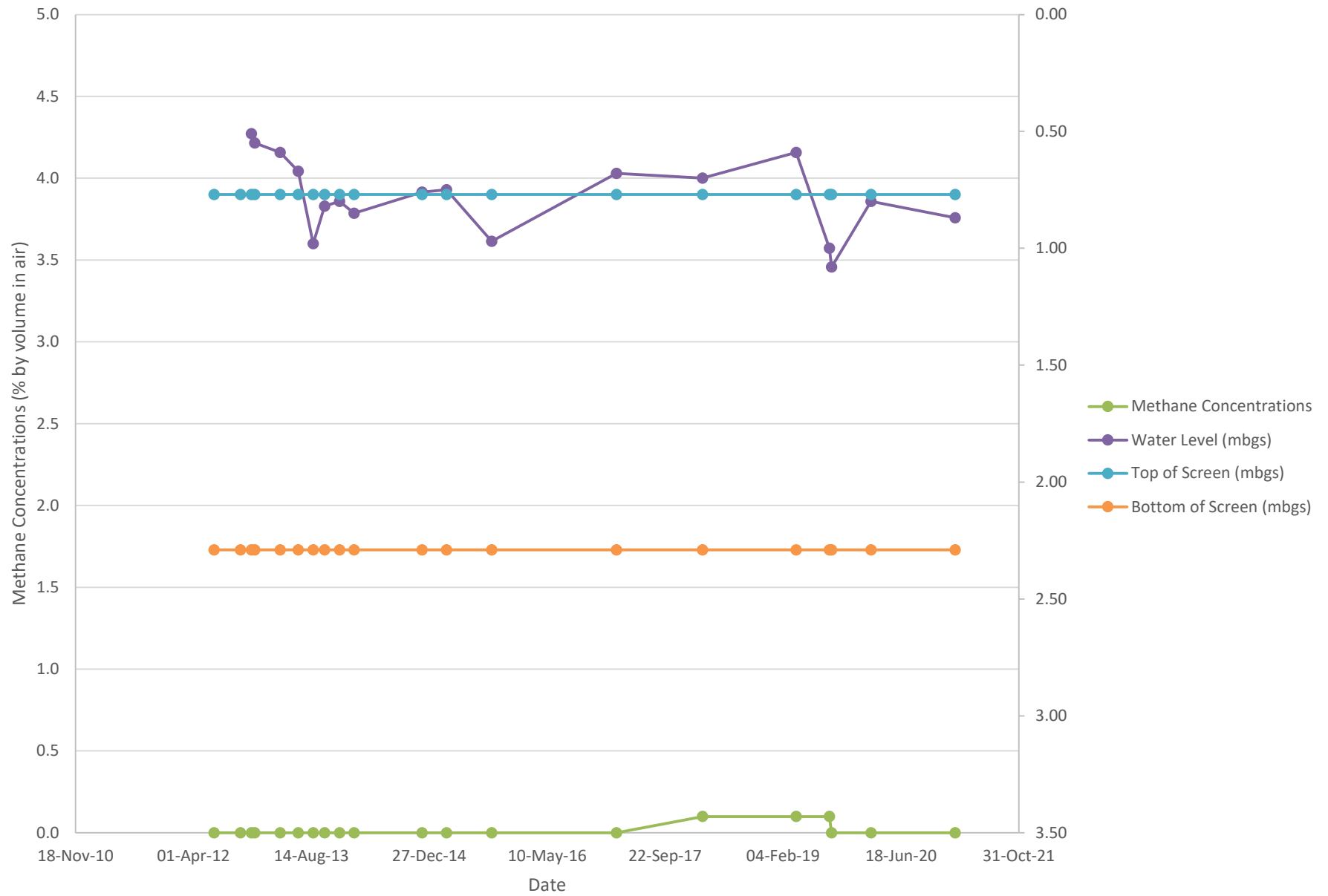
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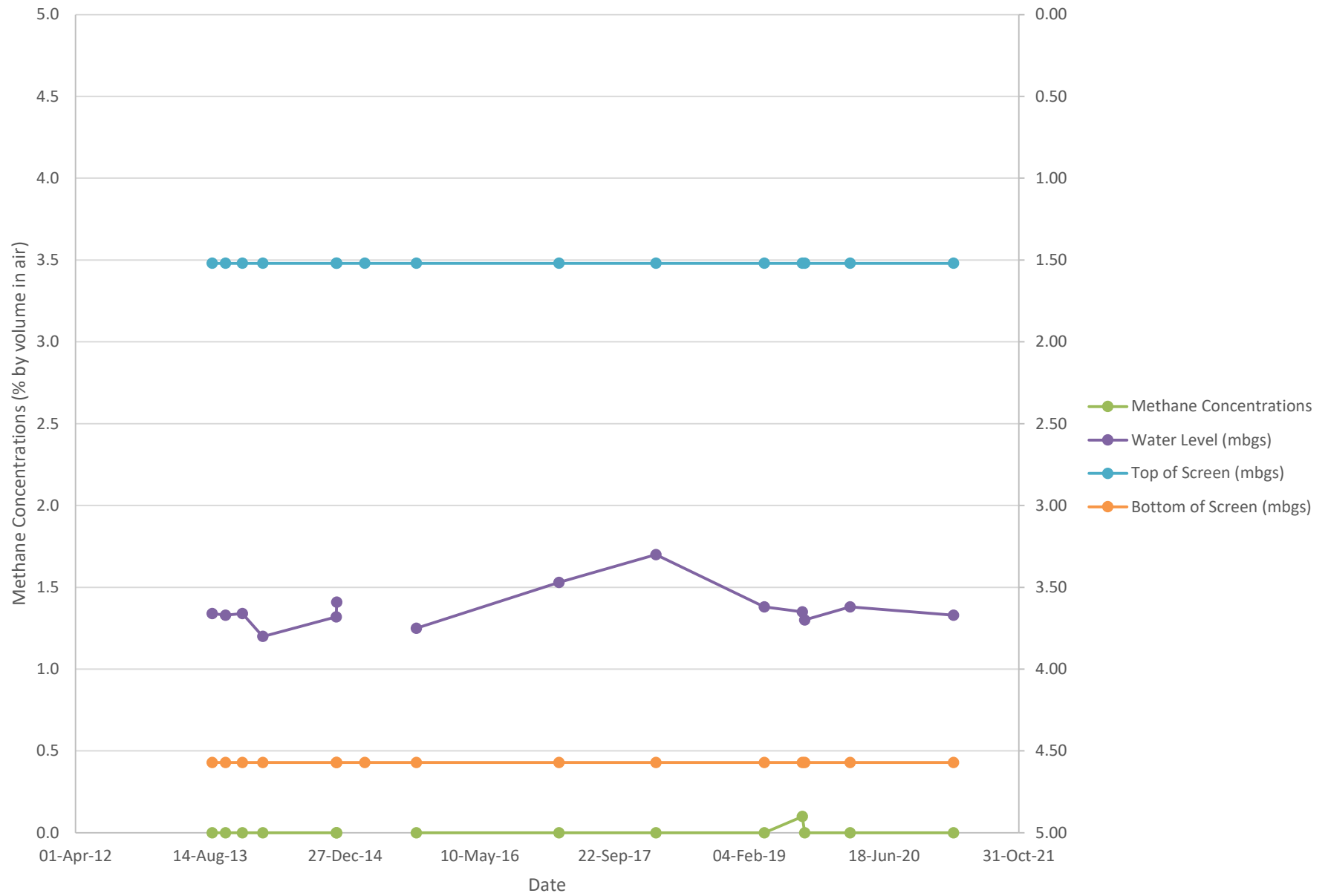
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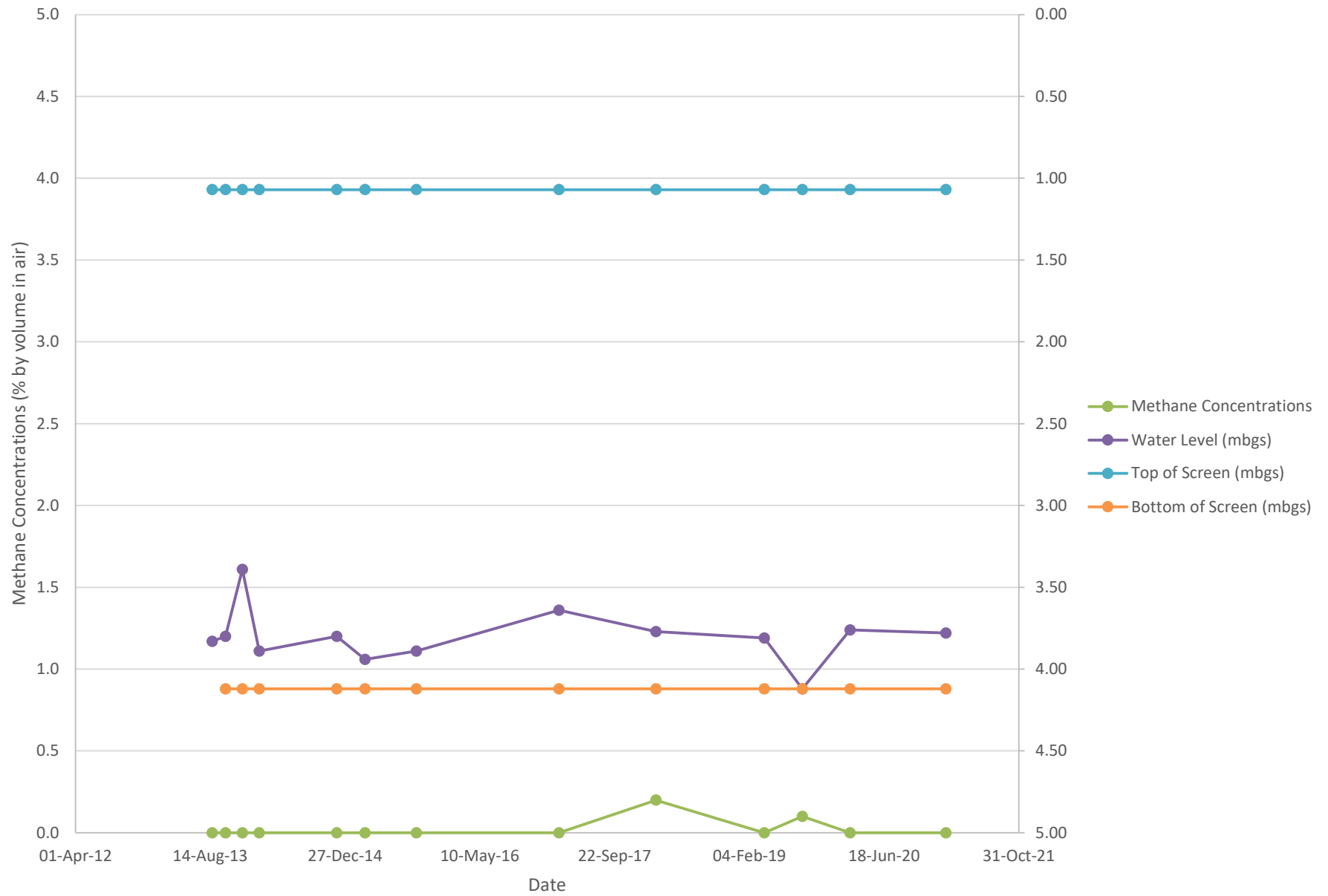
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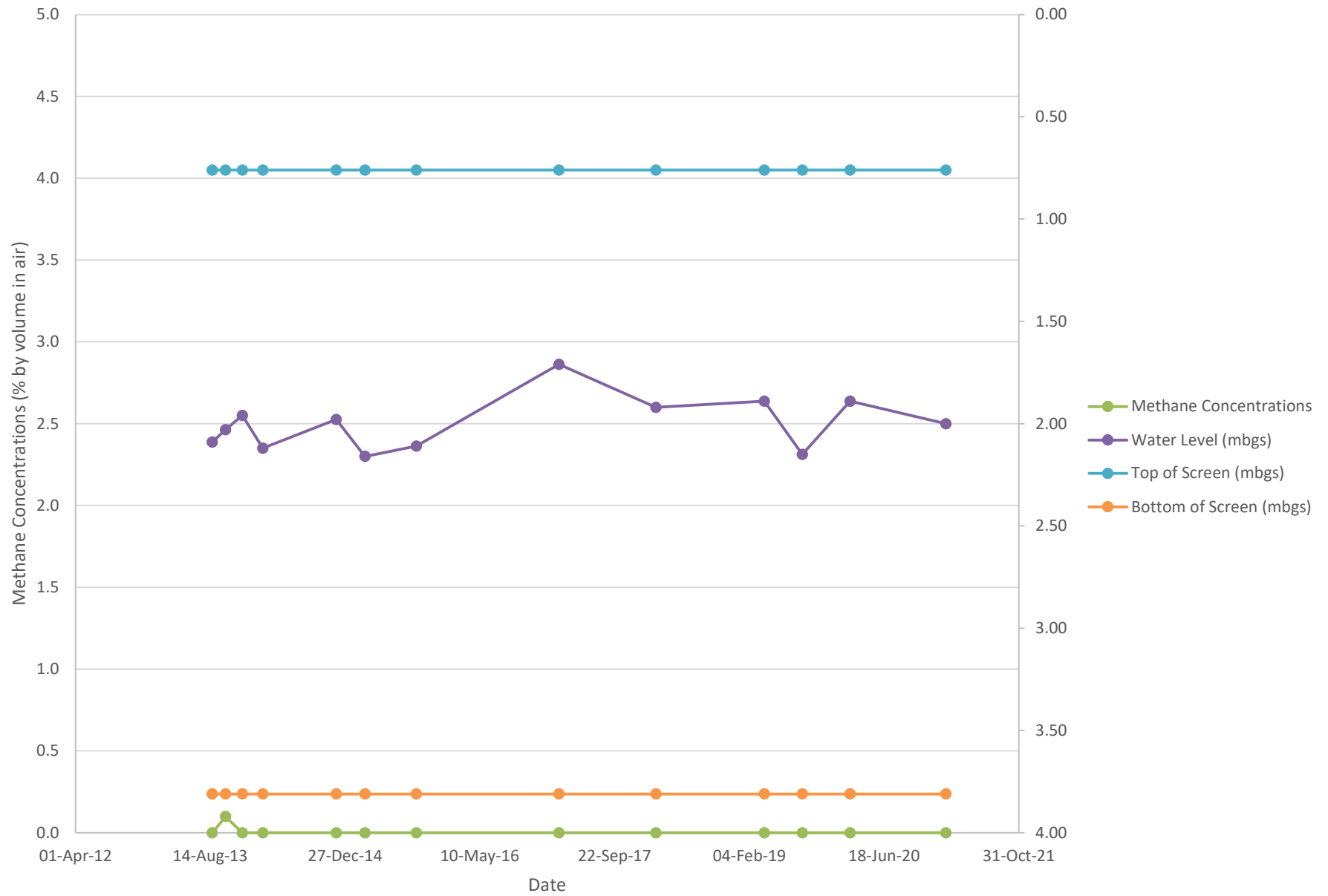
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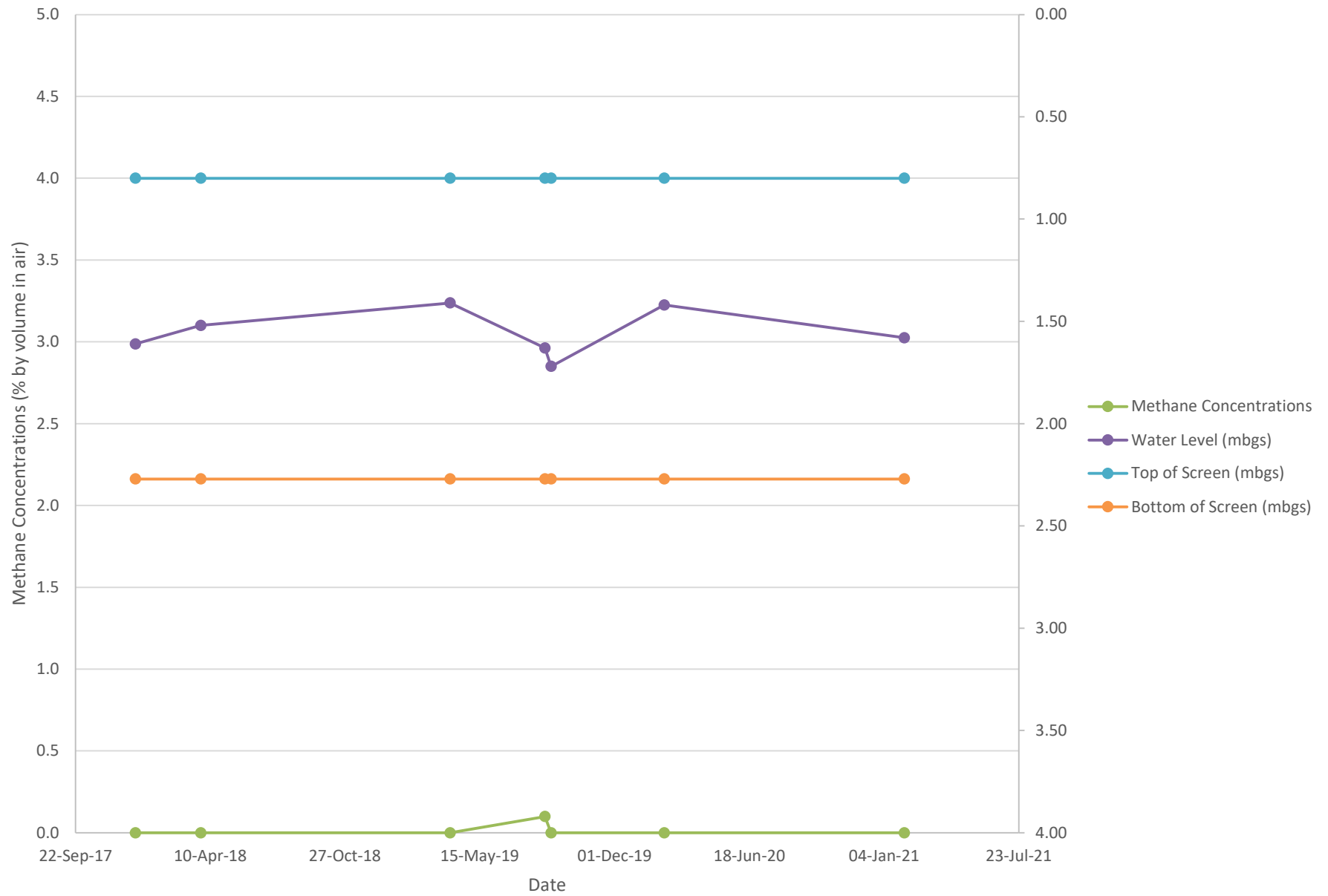
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GP-B22



GP-B24





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