

# **Municipality of Greenstone**

2020 Environmental Quality Monitoring Report Beardmore Landfill Municipality of Greenstone, Ontario

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EXP Services Inc. 1142 Roland Street Thunder Bay, ON, P7B 5M4 Canada T: + 1.807.623.9495 F: + 1.807.623.8070 www.exp.com

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# Legal Notification

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# 1 Introduction and Background

EXP Services Inc. (EXP) was commissioned by the Municipality of Greenstone to prepare the Environmental Quality Monitoring Report (2020) for the Beardmore Landfill site, in accordance with the Ontario Ministry of the Environment, Conservation and Parks (MECP) Amendment to Environmental Compliance Approval (ECA) No. A7249502 - Notice No. 1, issued February 8, 2017. This Notice forms part of the approval issued under Approval No. A7249502, dated July 15, 1979. Copies of the original approval and the amendment notice, as well as other MECP documentation concerning the Beardmore Landfill, are provided in Appendix A. The site is located just north of the community of Beardmore on the west side of Highway 11, approximately 400 m northwest of the Blackwater River, in the Municipality of Greenstone, as shown on Figure 1 in Appendix B.

Details concerning the historical development and operation of the Beardmore Landfill are given in the most recent Design and Operations Plan for the site<sup>1</sup> (awaiting MECP review – submitted August 1, 2019). The currently-approved landfill and attenuation zone areas are as follows:

- Total area of site (including attenuation zone): 22.4 ha (see Figure 2 Appendix B).
- Landfilling area: 4.20 ha.

The approved attenuation zone boundaries for the Beardmore Landfill extend into Crown land. In January 2019, the Municipality of Greenstone submitted an application to the Ministry of Natural Resources and Forestry (MNRF) to purchase these lands, and in July 2019 the lands were surveyed. The Municipality is currently waiting for review comments from the Ministry of Natural Resources and Forestry (MNRF) Office of the Surveyor General to complete the sale.

The MECP most recently inspected the site on June 19, 2017. A copy of the inspection report is given in Appendix A. No action items were identified.

This report represents the fourth monitoring report for the site prepared in compliance with the current ECA. It provides results of the 2020 monitoring program in the context of available historical results (from the 2017, 2018 and 2019 monitoring program<sup>2</sup> and from an initial hydrogeological evaluation<sup>3</sup>) and applicable criteria. Analytical results for groundwater are compared to the MECP's Ontario Drinking Water Standards (ODWS, from *Technical Support Document for Ontario Drinking Water Standards, Objectives and Guidelines,* June 2003), as well as to MECP Guideline B-7 (which incorporates the Reasonable Use concept into MECP groundwater management activities) and the MECP's Aquatic Protection Values (APV's, from

<sup>&</sup>lt;sup>3</sup> Trow Consulting Engineers Ltd. (1991). *Hydrogeological Study for the Beardmore Landfill Site*. Ref. No. F-90211-A/G, March 1991.



<sup>&</sup>lt;sup>1</sup> EXP Services Inc. (2018). Design and Operations Plan, Beardmore Waste Disposal Site, Municipality of Greenstone, Ontario. Project No. THB-00011174-HE, July 23, 2019.

<sup>&</sup>lt;sup>2</sup> EXP Services Inc. (2020). 2019 Environmental Quality Monitoring Report, Beardmore Landfill, Municipality of Greenstone, Ontario. Project No. THB-00011174-HE, April 17, 2020.

Appendix B2 of *Rationale for the Development of Soil and Groundwater Standards for Use at Contaminated Sites in Ontario, April 2011).* 

The MECP issued a memorandum (dated June 26, 2018) regarding their review of the 2017 Environmental Quality Monitoring Report. A copy of the memorandum is included in Appendix A. No MECP memorandum has been received to date regarding their review of the 2018 or 2019 Environmental Quality Monitoring Report. The following recommendations were made by the MECP regarding the 2017 monitoring report, with EXP comments (updated as appropriate) in *italics*:

- During the monitoring of the wells the temperature readings were not taken as specified in ECA. Temperatures must be monitored and recorded in the field in the future. *EXP recorded field temperatures during the 2018, 2019 and 2020 sampling events, and will record field temperatures during each subsequent sampling event.*
- It is recommended to continue the monitoring twice a year for all the wells in accordance with the amended ECA with one cycle of comprehensive parameters specified in schedule 5 of Reg. 232 and one cycle of indicator parameters. *EXP will continue the monitoring program as indicated.*
- BH-A must be checked at each monitoring event and if water is observed it must be measured and sampled. *EXP has and will continue to check well BH-A during each sampling event.*
- The exceedance in BH-G points to the formation of leachate but needs to be confirmed in the next monitoring events. *This issue is discussed in the current report and will continue to be evaluated in future.*
- The analytical results indicate that the maximum concentrations as measured in the trigger well BH-F are below the APV and below the calculated trigger levels for protection of surface water quality. No surface water monitoring is required at this point. *EXP concurred with this assessment. However, in connection with an Environmental Screening currently underway to approve a 60,000 m<sup>3</sup> site expansion, a First Nations group has requested that Blackwater River water quality be monitored, and it is anticipated that such monitoring will commence in 2021.*
- In the future ALL the electronic copies of the report sent to this office must be signed/stamped. *EXP will include signatures on all digital reports going forward.*

This report also contains additional site information required by the ECA.



# 2 Site Setting and Geology

Based on a review of geological mapping, the site generally comprises three landforms. The landform of the main (south) part of the site, which includes the waste footprint, is sand and gravel glaciofluvial outwash plain, with mainly low local relief. The northernmost edge of the site is located in an area that includes two landforms, namely till ground moraine deposits, and bedrock knobs. The topography of both of these landforms is described as undulating to rolling and washed/reworked, again with mainly low local relief. Drainage of all three landforms is described as mixed wet and dry.

Surrounding features are indicated on Figure 2 in Appendix B. The nearest residence is located within the Town of Beardmore, about 700 m southeast of the site; however, a camper and Quonset hut/house are located about 475 m east of the site, which are understood to be occupied occasionally during the year. The nearest potable water well, according to the MECP well records (<u>www.ontario.ca/environment-and-energy/map-well-records</u>) is located at the camper and Quonset hut/house property; however, the online well location information appears to be imprecise and the actual location of the wells has not been confirmed. The next closest potable well is understood to be located at MTO's road maintenance facility about 900 m northeast of the site. A Bell Canada building is located about 350 m east of the site; however, it is understood that there are no water or sanitary systems servicing the building.

The area of the site itself is relatively flat, with a rise in elevation of several meters at the northwest corner. A topographic survey was conducted on October 11, 2011; and was updated on September 30, 2015; June 26, 2017; October 10, 2017; and most recently on September 11, 2020 by Delta Survey Inc. A copy of the updated survey plan is provided on Figure 3 (all elevations geodetic).

Locally, on-site and off-site surface drainage follows the topography in the area, which generally slopes toward the Blackwater River located about 350 m downgradient (southeast) of the site. The elevation of the river was surveyed at two locations (see Figure 2) in fall 2017; the levels are shown in Table 1 (Appendix D).



# 3 Site Hydrogeology

There are six monitoring wells on and in the vicinity of the site (see Figures 2 & 3). Wells BH-G, BH-H and BH-I were installed in May 2017 (in accordance with the ECA), and wells BH-A, BH-C and BH-F were installed during the initial hydrogeological evaluation previously referenced. Borehole logs are found in Appendix C.

Groundwater levels in the wells are summarized in Table 1 (Appendix D).

BH-A, located just inside the access gate, was installed to a depth of 4.35 m (elevation 304.17 m). It was dry during the spring and fall 2020 sampling events (also dry during previous three year's sampling events in 2017, 2018, 2019, and at the time of installation in November 1990). Three additional historical wells (BH-B, BH-D and BH-E [also dry at the time of installation]) were not found in 2011, 2017, 2018, 2019 or 2020 (i.e., they have either been destroyed or buried).

Similar to EXP's 2017, 2018 and 2019 reports, the 2020 data indicates that the groundwater flow direction is generally to the southeast, towards the Blackwater River. It is noted that at BH-H (located south of the waste filling area), groundwater is elevated by nearly 2 m compared to the nearby wells (historical groundwater levels in 2017, 2018 and 2019 also were about 2 m higher).

Two different groundwater gradients are noted on the site (Figure 4). The first groundwater gradient is from the northwest part of the site to the approximate center of the site (BH-I to BH-G) and is about 0.08 m/m. The second gradient is from the approximate center of the site to near the downgradient attenuation zone boundary (BH-G to BH-F), and is smaller, at about 0.003 m/m.

In 2017, grain size analysis, including hydrometer analysis, was conducted on three representative soil samples (one from each new monitoring well [BH-G, BH-H and BH-I]) collected below the apparent groundwater table. Samples of the silt from BH-G – S6 and BH-H – S4 were tested using hydrometer analysis, and one sample of the sand and gravel from BH-I – S4 was tested using sieve analysis; refer to the Grain Size Distribution curves in the EXP MW Installation report in Appendix E. In addition, grain size analysis was conducted on one representative sample below the apparent groundwater table during the 1990 Trow hydrogeological study at BH-C – S8 (sand); refer to Grain Size Distribution Curves in Appendix D. Based on the grain size analysis, the particle size corresponding to the 10% finer than fraction (D<sub>10</sub>) was determined/estimated, for use in the Hazen empirical estimation of hydraulic conductivity (K). While the Hazen method of estimating hydraulic conductivity, where K (cm/s) = [D<sub>10</sub> (mm)]<sup>2</sup>, was originally determined for uniformly graded sands, it can provide a rough, but useful, approximation for most cohesionless (non-plastic) soils. The hydraulic conductivity (K) values for the silt ranged from about 2.0 x 10<sup>-6</sup> to 4.0 x 10<sup>-6</sup> cm/s and for the sand and gravel to sand from about 9.0 x 10<sup>-4</sup> cm/s to 2.5 x 10<sup>-3</sup> cm/s.



Using Darcy's Law, V = K i / n where  $K_{Silt 1} = 2.0 \times 10^{-6}$  cm/s &  $K_{Silt 2} = 4.0 \times 10^{-6}$  cm/s  $K_{S\&G 1} = 9.0 \times 10^{-4}$  cm/s &  $K_{S\&G 2} 2.5 \times 10^{-3}$  cm/s i = 0.08 m/m (calculated hydraulic gradient between BH-I and BH-G) i = 0.003 m/m (calculated hydraulic gradient between BH-G and BH-F) n = 0.3 (assumed porosity)

Based on the above, the flow velocities on site for the silt range between about 0.2 m/yr and 0.3 m/yr where the hydraulic gradient is 0.08 m/m, and between about 0.006 m/yr and 0.013 m/yr where the hydraulic gradient is 0.003 m/m. The flow velocities for the sand and gravel to sand range between about 75 m/yr and 210 m/yr where the hydraulic gradient is 0.08 m/m, and between about 2.8 m/yr and 7.9 m/yr where the hydraulic gradient is 0.003 m/m.

As previously noted, initial groundwater monitoring at the site was conducted in the early 1990's. Historical groundwater monitoring data (presented in the 1991 Trow report) revealed levels of iron and manganese above the PWQOs, but whether this reflected natural conditions or landfill impact is unknown. Regardless, as noted in a previous (2009) MECP review memorandum, the historical water quality data are unlikely to reflect current conditions. However, the limited historical results (available for existing well BH-C only) are presented and discussed along with current data for the historical and new wells in the present report (see Section 7).



## 4 Monitoring and Reporting Requirements

As specified in the amendment to the ECA, dated February 8, 2017 (see Appendix A), an annual report must be prepared and submitted to the MECP by April 30<sup>th</sup>. The report must include the following information:

- a summary of the type and quantity of incoming waste accepted during the reporting period;
- discussion indicating the landfill capacity, current fill volume, volume filled in the last year, and the status of any control measures such as interim, final or progressive cover;
- a summary of the site's operation procedure and compliance as per the Design and Operation Plan;
- a summary of recycling operations;
- an accurately scaled site plan illustrating the location of all buried wastes, the site boundaries, monitoring well locations, the location of the contaminant attenuation zone, and any other significant site features;
- an accurately scaled location map illustrating topography and the site relative to nearby potentially sensitive groundwater/surface water features (i.e., lakes, streams, wells), or any other potentially significant receptors;
- a section describing the field monitoring and sampling program including QA/QC measure and any variance from normal sampling procedures and/or conditions;
- a water table contour map based on current date;
- stratigraphic cross-sections which clearly illustrate the subsurface distribution of geological materials;
- borehole and monitoring well logs for all monitoring wells;
- tables presenting historical water chemistry and water level data, and graphs illustrating quality trends with time for key parameters at all monitoring locations;
- discussion and assessment of groundwater flow direction and velocities, estimates of leachate generation/impacts, effectiveness of mitigation measures, and compliance with the Reasonable Use Policy;
- recommendations as required for future mitigation, monitoring and site characterization activities;
- recommendations for trigger levels as related to contingency plans, considering both the Reasonable Use Policy and Aquatic Protection Values.

Note that other issues regarding site operations are discussed in detail in the updated Design and Operations (D & O) Plan (referenced above). It is understood that any additional operational information required by the ECA and not included in the present report has been or will be provided to the MECP by the Municipality of Greenstone.



# 5 **Operational Information**

## 5.1 Surveyed Landfill Waste Volumes

In 2011, Delta Survey Inc. was commissioned to estimate the volume of waste and cover material deposited at the site since 1990, based on the difference between the 1990 topographical survey and their 2011 survey. This figure was 31,520 m<sup>3</sup>, which represents an average about 1,500 m<sup>3</sup>/year over this 21-year period. As previously stated, the topographical survey was updated in October 2015, and the volume of waste and cover material deposited on site since 2011 was about 5,800 m<sup>3</sup>, which is again about 1,500 m<sup>3</sup>/year. The site was surveyed again on October 10, 2017, and the volume of waste and cover material deposited on site since 2015 was about 2,600 m<sup>3</sup>, which is about 1,300 m<sup>3</sup>/year. The site was most recently surveyed on September 11, 2020, and the volume of waste and cover material deposited in the most recent (draft) Design and Operations (D&O) Plan, assuming average waste deposition rates since the site commenced operations in about 1962 have remained relatively constant (i.e., around 1,500 m<sup>3</sup>/yr., and based on population figures, this is probably a reasonable assumption), the total volume of waste and interim cover material placed on the site, as of September 2020, is estimated to be some 86,675 m<sup>3</sup>.

North and south pits were filled in 2020 and waste placement will proceed in accordance with the most recent D&O Plan, as shown on Figure 5 (Waste Filling Conceptual Site Plan – Year 2027).

Stratigraphic sections (based on Delta Survey plans updated September 2020) are given in Figures 6A and 6B.

## 5.2 Waste Volume Summary for 2020

Based on quantities provided by the Municipality of Greenstone, the weekly/bi-weekly volumes (uncompacted) of waste received/deposited at the Beardmore Landfill in 2020 are summarized in the following table.



Weekly As-Delivered Waste Volumes - 2020					
Week	Volume (m <sup>3</sup> )	Week	Volume (m <sup>3</sup> )	Week	Volume (m <sup>3</sup> )
Jan. 1 – 6	43.5	May 10 - 19	67.5	Sept. 13 - 21	43.0
Jan. 7 – 17	48.0	May 20 - 29	54.0	Sept. 22 – Oct. 2	53.0
Jan. 18 – 25	43.0	May 30 - Jun. 6	65.0	Oct. 3 - 10	56.5
Jan. 26 – Feb. 14	44.0	Jun. 7 - 15	65.0	Oct. 11 - 19	65.5
Feb. 15 - 22	57.5	Jun. 16 - 26	55.5	Oct. 20 - 30	58.0
Feb. 23 – Mar. 2	57.0	Jun. 27 - Jul. 4	59.5	Oct. 31 - Nov. 6	61.0
Mar. 3 - 13	50.5	Jul. 5 - Jul. 11	50.5	Nov. 7 - 14	63.0
Mar. 14 - 20	56.0	Jul. 12 - 20	65.0	Nov. 15 - 23	80.0
Mar. 21 - 28	61.0	Jul. 21 - 31	58.0	Nov. 24 - Dec. 4	57.5
Mar. 29 - Apr. 6	119.5	Aug. 1 - 8	55.0	Dec. 5 - 12	72.0
Apr. 7 - 17	40.0	Aug. 9 - 17	48.5	Dec. 13 - 21	60.0
Apr.18 - 25	68.0	Aug. 18 - 28	45.0	Dec. 22 - 28	18.0
Apr. 26 - May 2	48.0	Aug. 29 - Sept. 4	38.0	TOTAL 2233.5	
May 3 - 9	41.5	Sept. 5 - 12	42.0		

As indicated in the table above, the total estimated waste volume received at the Beardmore Landfill in 2020 was 2,233.5 m<sup>3</sup>. This is an uncompacted volume estimated from load sizes delivered to the landfill site. It is greater than the average annual historical waste volume (compacted, including interim cover) of approximately 1,500 m<sup>3</sup> based on historical survey data. However, based on typical compaction ratios of 3:1 to 4:1, the estimated as-delivered volume appears to be below the historical average. Note that the actual *in situ* quantities (in place and machine compacted, and including daily/interim soil cover), based on the September 2020 survey, indicated an annual increase of about 1,600 m<sup>3</sup>/year.

In 2020, from the above tabulated data, the maximum volume of as-delivered (uncompacted) waste received in a week was 119.5 m<sup>3</sup>, during the period of March 29 to April 6. The maximum daily volume of 75.25 m<sup>3</sup> was received on March 30, 2020 and is attributed to typical



household waste and contaminated soil. The average daily volume in 2020 was about 14.3 m<sup>3</sup> (based on the landfill being open three days per week or 156 days per year).

## 5.3 **Remaining Life Expectancy**

As indicated above, as of September 11, 2020, the waste volume including interim cover on site was estimated to be about 86,675 m<sup>3</sup>. Using the most recent surveyed quantity increase of about 1,600 m<sup>3</sup> per year, or 133 m<sup>3</sup> per month, the estimated volume on site as of December 31, 2020, is about 87,100 m<sup>3</sup>, which represents about 97.5% of the approved capacity of 89,300 m<sup>3</sup>.

Based on an estimated annual waste and cover material volume deposition rate of 1,500 m<sup>3</sup>/yr. going forward, it is estimated that the landfill will reach currently-approved capacity in about 1.5 years (mid-2022).

The Environmental Screening Process to increase the landfill capacity by 60,000 m<sup>3</sup> is approaching completion and should extend the life of the landfill until beyond the middle of the century (subject to confirmation of waste volume estimates).

## 5.4 **Operational Problems and Complaints**

Municipality of Greenstone personnel advised that there were no operational problems or public complaints regarding the Beardmore Landfill in 2020.

## 5.5 Waste Types and Waste Diversion

The landfill only accepts solid non-hazardous municipal waste, including wood, as well as certain recyclable materials (see below).

It was recommended in the Design and Operations Plan (referenced above) that a recycling depot (i.e., for standard recyclables such as glass, plastic, metal containers [steel and aluminum], tetra packs, paper and cardboard) be established at the site. It is understood that no action has yet been taken on this matter. However, the following recyclable materials are accepted at the site: used tires, scrap metal, batteries, electronic waste, fluorescent bulbs, refrigerators/freezers (tagged).

In the D&O Plan, a household hazardous waste (HHW) depot was also recommended. Approval should be obtained from the MECP. It is noted however, that residents of the Beardmore area are currently being directed to use the HHW events at the Geraldton and Longlac Landfills.

Additional details concerning operation of the landfill are provided in the D&O Plan.



# 6 Field Procedures

## 6.1 Monitoring Well Condition

As indicated, EXP was commissioned to conduct two monitoring events (spring and fall) in 2020.

At the time of monitoring, above-ground well components were inspected for condition and compliance with O.Reg. 903. All monitoring wells were in compliance and in generally good condition as of the fall 2020 sampling event; however, the 75 mm diameter plastic ABS pipe (acting as a well protector) at BH-C was broken near ground surface.

## 6.2 **Sampling Protocol**

EXP personnel collected water samples on May 26 and 27, and again on September 22 and 23, 2020. The fieldwork was to include collection of groundwater samples from all six monitoring wells during both sampling events. However, similar to historical conditions, no groundwater samples were obtained from well BH-A because it was dry.

Prior to purging, static water levels were measured in each sampled well using an electronic water level indicator. Between measurements, the stainless-steel probe of the indicator was rinsed with distilled water in order to prevent cross-contamination of the wells. Each well was then purged (minimum 3 well volumes or to dryness) using the dedicated Waterra® sampling equipment and allowed to recover to at least 80% of static level prior to sampling. Upon reaching at least 80% recovery, field measurements of pH, electrical conductivity and temperature were recorded for the groundwater samples. The groundwater samples were collected directly from the sampling equipment into bottles provided precleaned and with appropriate preservatives by the laboratory. Groundwater samples for metals, including mercury, were filtered in the field at the time of sample collection using in-line 0.45-micron filter cartridges.

The samples were placed in an insulated cooler for transport to EXP's offices in Thunder Bay. They were then repackaged in insulated containers and shipped under chain of custody via courier to a Canadian Association for Laboratory Accreditation Inc. (CALA) certified laboratory (Bureau Veritas Laboratories in Mississauga, Ontario) for analysis of the required parameters.



# 7 Results and Discussion

The laboratory reports containing the groundwater analytical results for 2020 are provided in Appendix E. The approved monitoring program consists of twice-annual (spring and fall) sampling of all wells. Samples are to be analyzed for the MECP's Landfill Standards Guideline (Schedule 5 – rev. 2010) "comprehensive" parameter list for one of the two annual events, and for the "indicator" list for the other sampling event, which are to alternate in successive years. In 2020, the spring samples were analyzed for the indicator parameter list, while the fall samples were analyzed for the comprehensive parameter list.

Summary tables of the 2020 results, along with the historical results, are given in Appendix D (Table 2), where they are compared to criteria given in the MECP's *Technical Support Document for Ontario Drinking Water Standards, Objectives and Guidelines* (ODWS, June 2003). The ODWS criteria can be either standards (Maximum Acceptable Concentrations and Interim Maximum Acceptable Concentrations) or objectives (Aesthetic Objectives and Operational Guidelines).

## 7.1 Background Conditions (BH-I)

Monitoring well BH-I (screened from 2.0 to 5.0 m depth in sandy silt to sand and gravel, terminating in possible bedrock) is immediately upgradient of the identified waste footprint. A single exceedance of ODWS criteria was noted in 2020, this being manganese (0.39 mg/L versus 0.05 mg/L ODWS) in fall. Historically, manganese exceeded the ODWS criterion during each comprehensive parameter analysis event (spring 2017, fall 2018 and spring 2019). A historical exceedance for organic nitrogen was also reported (spring 2019). This indicates that groundwater on and in the vicinity of the site can be naturally high in manganese and organic nitrogen. In general, the 2020 results were similar to historical concentrations with the exception of DOC in the spring (historical low and below laboratory detection limits – possibly anomalous).

## 7.2 Source Well Conditions (BH-G)

Monitoring well BH-G (screened from 6.0 to 10.5 m depth, below waste, in silt fill and silt) is located in the southeast (downgradient) part of the identified waste footprint. Similar to 2017, 2018 and 2019, ODWS criteria exceedances were reported for TDS, DOC, organic nitrogen, alkalinity, sulphate and manganese. In addition, iron during both events in 2020 exceeded the criterion. Historically, chloride levels exceeded criteria; however, since fall 2019, levels are below applicable criteria and appear to be decreasing. Overall, parameters at BH-G were notably higher than in any of the other wells, reflecting leachate generation from the waste. The concentrations in 2020 were similar to historical levels with the exception of a historical low for DOC in the spring (below laboratory detection limits – possibly anomalous) and increased iron levels in the spring and fall.

The following table compares source well concentrations with those in the background well:



Parameter (Concentration Units)	Average 2020 Source Well Concentration	Average 2020 Background Well Concentration	Leachate Concentration Factor (LCF)
Conductivity (µS/cm)	3,100	485	6.4
COD (mg/L)	110	10	11.0
TDS (mg/L)	2,315	283	8.2
DOC (mg/L)	14.1	0.95	14.8
Organic Nitrogen (mg/L)	0.759	0.06	12.7
Alkalinity (mg/L)	1,018	255	4.0
Chloride (mg/L)	187.5	<1.0	375
Nitrate (mg/L)	0.355	<0.1	7.1
Sulphate (mg/L)	633	11.4	55.5
Barium (mg/L)	0.046	0.0114	4.0
Boron (mg/L)	0.91	0.021	43.3
Iron (mg/L)	0.45	<0.1	9.0
Manganese (mg/L)	0.565	0.39	1.4

In general, the LCFs were similar to 2020, with the exception of organic nitrogen (which is obtained by the difference between TKN and ammonia-N), chloride, nitrate, sulphate and manganese. The LCF for nitrate, sulphate and manganese is lower in 2020, generally due to reduced concentrations at the source well, while the LCF for organic nitrogen and chloride are higher in 2020 compared to 2019, due mainly to lower concentrations in the background well. Note that an iron LCF was not included historically, as historical iron concentrations at the source well were below laboratory detection limits. Excluding iron, concentrations at the source well in 2020 are generally similar to 2019.

## 7.3 **Proximate Wells (BH-A, BH-C, BH-H)**

Well BH-A (historical well screened from 3.0 to 4.5 m depth in fine sand) is located due east of the waste footprint. This well was dry at the time of installation in 1990, and during the sampling events in 2017, 2018, 2019 and 2020.

Wells BH-H (screened from 1.5 to 6.0 m depth in silt) and BH-C (historical well screened from 5.0 to 6.5 m depth in sandy silt and sand) are situated a short distance southeast of the waste footprint. BH-H is slightly closer to the waste (and to the source well), but the groundwater table at BH-H is at a higher elevation than at the source well (i.e., the groundwater is apparently locally mounded). As a result, BH-H has generally lower levels of potential leachate indicators compared to BH-C, although BH-H is located closer and BH-C is located further away from the waste footprint. In 2020, six exceedances of ODWS criteria were noted for BH-C including: TDS, DOC, organic nitrogen, alkalinity, iron and manganese; all but iron



occurred in the fall event. Similar to historical events, one exceedance was noted at BH-H, this being for organic nitrogen. During the fall sampling event at BH-C historical highs / spikes were reported in the fall 2020 event for conductivity, TDS, DOC, calcium, magnesium, potassium, sodium, alkalinity, chloride, sulphate, boron, and manganese. Historical highs / spikes were also noted for several parameters during the fall sampling event at BH-H, but to a lesser extent, including: calcium, magnesium, potassium, sodium, sulphate and barium. In addition, and similar to BH-I and BH-G, DOC concentrations at BH-C were below laboratory detection limits and represented a historical low.

Well BH-C is the only well for which there are historical laboratory results prior to 2017. As shown on Table 2 (Appendix D), ODWS exceedances for iron and manganese were reported in this well in December 1990.

## 7.4 **Distant Well (BH-F)**

Well BH-F is a historical well located about 200 m from the Blackwater River, and is the furthest well downgradient of the landfill. Construction records for this well are not available, but the current well depth is about 6.4 m below ground surface. One ODWS exceedance was noted in 2020, for organic nitrogen. Results were similar to historical levels.

In general, being the furthest well from the waste footprint, levels of potential leachate indicator parameters are lower than in the other downgradient wells. Due to its location relatively near the downgradient attenuation zone boundary, this well has been selected as a "trigger well", to assess whether contingency measures may need to be implemented to prevent unacceptable off-site impacts (refer to Section 8.1).

## 7.5 **Durov Plots**

Durov plots of the major ion chemistry were prepared and are included in Appendix F. The results continue to indicate that the groundwater on site is generally calcium bicarbonate dominated. The groundwater results at source well BH-G have historically been generally calcium sulphate dominated; however, 2020 results indicate a shift toward calcium bicarbonate dominance.

Calcium bicarbonate dominated groundwater is typical of background (unimpacted) groundwater.

## 7.6 **Time Series Charts**

Time Series graphs depicting concentrations over the monitoring period have been prepared for selected parameters of interest (alkalinity, chloride, DOC, iron, manganese, sulphate and TDS), and are included in Appendix G. Although four years of data may be insufficient for trend analysis, a possible increasing trend is observed for alkalinity at source well, BH-G, while possible decreasing trends are observed for chloride, manganese, sulphate and TDS at BH-G.



In addition, the following spikes were observed in 2020:

- BH-G iron;
- BH-C alkalinity, chloride, DOC, manganese, TDS; and
- BH-H manganese.

### 7.7 **Reasonable Use Assessment**

The MECP's Guideline B-7, which incorporates the Reasonable Use Policy (RUP) into the Ministry's groundwater management activities, allows off-site impacts from waste disposal sites within established guidelines based on ODWS criteria in order to allow for attenuation of impacts while protecting existing and potential downgradient groundwater users. The guideline allows for increases in concentrations up to 25 and 50 percent of the difference between background and ODWS concentrations for health-related and non-health-related parameters, respectively. The guideline applies only to groundwater at or beyond the attenuation zone boundary.

RUP criteria for 2020 were calculated using the arithmetic mean of the most recent three years results for background well BH-I (which is hydraulically upgradient of the waste footprint and has the highest groundwater elevation of any of the wells). The assessment is provided for all wells on Table 2 in Appendix D. The attenuation zone, by definition, is intended to allow for contaminant concentrations to decrease to Guideline B-7 levels as the groundwater migrates toward the attenuation boundary. Exceedances of RUP criteria are normal and not unexpected within an attenuation zone. Although no wells are located at or outside the attenuation zone boundary, BH-F is nearest the downgradient attenuation zone boundary; therefore, Guideline B-7 criteria are considered most applicable to the results for this well. Exceedances of the calculated criteria in 2020 and historically are summarized in the following table.

Parameters Exceeding Guideline B-7 (RUP) Criteria				
Monitoring Woll	Exceedance(s)			
Monitoring weil	2020	Historical		
BH-A	None – dry well	None – dry well		
BH-C	TDS, DOC, organic nitrogen, alkalinity, sulphate, iron and manganese	DOC, organic nitrogen		
BH-F	Organic nitrogen	Organic nitrogen		
BH-G	TDS, DOC, organic nitrogen, sodium, alkalinity, chloride, sulphate, iron, manganese	TDS, DOC, organic nitrogen, sodium, alkalinity, chloride, nitrate, sulphate, boron, manganese		



Parameters Exceeding Guideline B-7 (RUP) Criteria			
Monitoring Moll	Exceedance(s)		
Monitoring wen	2020	Historical	
BH-H	Organic nitrogen	Organic nitrogen	
BH-I	Manganese	Organic nitrogen, Manganese	

Note: **Bold** indicates well nearest attenuation zone boundary (i.e., RUP criteria are potentially applicable).

At well BH-F, only organic nitrogen exceeded the B-7 (RUP) criterion in 2020. A similar exceedance was reported historically. The current and historical exceedances for organic nitrogen in well BH-F are not considered significant, since the well is about 200 m from the attenuation zone boundary (Blackwater River) and there is no Aquatic Protection Value (APV) for organic nitrogen (see Section 8.1.2).

## 7.8 **QA/QC**

## 7.8.1 Cation/Anion Balances

In general, a cation/anion balance difference of up to 10% is considered acceptable. However, since the chemistry of groundwater affected by landfills can be quite complex and may not be balanced by the method indicated, the anion-cation balances of background monitoring wells are considered to be a better indicator of the reliability of results.

For the present results, the ion balance differences (shown on the tables in Appendix D) were all  $\leq$  10%, with the exception of the fall 2020 sample from BH-H, which had an ion balance of plus 34.4%. Based on a review of the analytical results, it appears that the high ion balance was attributable to anomalously high calcium (170 mg/L) and sodium (73 mg/L) levels in this sample.

## 7.8.2 **Duplicates and Blanks**

In 2020, a blind duplicate sample (i.e., a duplicate sample collected in the field and labelled with a different but logical sample number) was submitted to the laboratory for each of the sampling events. The blind duplicate samples were collected from BH-G in the spring and fall events.

The relative percent difference (RPD) between the results for the sample and the field duplicate sample for each analysed parameter (excluding organic nitrogen which is obtained by difference) was calculated as the absolute value of the following:

RPD = <u>(Sample Result – Duplicate Result) x 100</u> (Sample Result + Duplicate Result) / 2



The RPD calculation is not considered valid for parameters reported to be present in very low concentrations (i.e., where the average of the two duplicates is <5 times the laboratory detection limit). For laboratory duplicates, the maximum RPD considered acceptable for most parameters in this study is 20%<sup>4</sup>, with the notable exception of the following:

- Electrical conductivity 10%
- pH 0.3 pH units.

Although there are no set standards for RPDs for field duplicates, which introduce sampling variability, values up to 30% for groundwater (40% for soil) may be considered acceptable.

The maximum RPD in this study was for phosphorus (40%). All other values were <20%. This exercise revealed generally good agreement between the duplicate samples.

### 7.8.3 Hold Times

The samples were received by the laboratory within three days of collection. Based on the analysis dates reported by the laboratory, the MECP's recommended hold times appear to have been generally met.

### 7.8.4 Internal QA/QC

Internal quality control results (for blanks, spiked samples and lab duplicates) reported by the laboratory appear to be acceptable.

<sup>&</sup>lt;sup>4</sup> MECP (2011). Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act, July 1, 2011.



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# 8 Contingency Plan

In accordance with the ECA, a contingency plan and trigger mechanisms relative to groundwater and surface water quality are required for the site.

## 8.1 **Trigger Levels**

Trigger levels for implementation of one or more aspects of a groundwater and surface water contingency plan would consist of predicted or actual exceedances of applicable criteria at or beyond the attenuation zone boundaries. The applicable criteria for groundwater at the north and south attenuation zone boundaries, and the north part of the east attenuation zone boundary, are Reasonable Use Policy (RUP) criteria calculated according to Guideline B-7. The applicable criteria for groundwater at the downgradient (east and southeast) attenuation zone boundary (where discharge is to the Blackwater River) are the Aquatic Protection Values. The applicable criteria for surface water (Blackwater River) are the Provincial Water Quality Objectives. Note, however, that surface water sampling is not a part of the currently mandated monitoring program, although, as previously noted, it has been requested by a First Nations group. It is anticipated that surface water monitoring will commence in 2021.

### 8.1.1 Groundwater Protection

As previously discussed, the groundwater flow pathway to the southeast (i.e., discharging to the river) is considered to be the main route of concern for migration of the contaminant plume from the landfill site. This pathway, and the applicable trigger levels for protection of surface water quality, are discussed in Section 8.1.2 below. With regard to protection of groundwater quality, monitoring well BH-F is the most downgradient well at this site. It is located approximately 230 m from the east attenuation zone boundary that is formed by Highway 11. Although the predominant groundwater flow direction beneath the waste footprint is to the southeast (see Figure 4), the groundwater elevation at well BH-H near the southeast edge of the waste footprint is relatively high, which could tend to skew leachate flow in a more easterly direction toward the highway. Trigger levels at well BH-F are parameter concentrations that are predicted to have the potential to result in exceedances of Reasonable Use Policy (RUP) Guideline B-7 criteria at this boundary location, assuming a linear decrease in concentration with distance from the landfill.

The calculated 2020 trigger levels for protection of groundwater quality are provided in Table 3 in Appendix D.

Based on the available analytical results, similar to 2017, 2018 and 2019, the following parameters have the potential to exceed their B-7 criterion in downgradient groundwater: alkalinity, chloride, DOC, iron, manganese, organic nitrogen, sodium, sulphate and TDS. However, the maximum concentrations measured in the trigger well BH-F were generally below the respective B-7 criteria (except for organic nitrogen), and were, therefore, even further below the calculated trigger levels for protection of groundwater quality (includes



organic nitrogen). There were, therefore, no exceedances of trigger levels for protection of groundwater quality in 2020.

### 8.1.2 Surface Water Protection

In general accordance with the requirements of the ECA, trigger levels for protection of Blackwater River water quality have been developed that are based on predicted exceedances of Aquatic Protection Values (APV's) in groundwater at the downgradient limit of the attenuation zone, adjacent to the river, with reference to concentrations measured in the downgradient well BH-F and in the source well BH-G. We note that the ECA references the GW3 values found in Appendix A3 of the MECP's *Rationale for the Development of Soil and Ground Water Standards for Use at Contaminated Sites in Ontario* (April 2011). The GW3 values (applicable to groundwater within 30 m of surface water) are equal to 10 times the APV's. However, in a memorandum reviewing a report for another waste disposal site, the MECP's Regional Hydrogeologist stated that groundwater quality results for wells located near, and presumably discharging to, surface water need to be compared directly to the APV criteria directly, as found in Appendix B2 of the 2011 rationale document referenced above. This is considered a conservative approach (i.e., assumes no dilution). The trigger levels calculated in this manner are given in Table 4 in Appendix D.

Based on the available analytical results, only chloride has the potential to exceed the APV in downgradient groundwater. However, the maximum concentration measured in the trigger well BH-F is well below the APV criterion and is therefore even further below the calculated trigger levels for protection of surface water quality. There were, therefore, no exceedances of trigger levels for protection of surface water quality in 2020.

### 8.1.3 Landfill Gas

Landfill gas has not been identified as an issue of concern at this site, and no monitoring for downwell methane levels has been conducted. There are no permanent enclosed structures on or in the immediate vicinity of the site that are considered to have the potential to accumulate landfill gases to potentially hazardous levels. Therefore, a contingency plan for landfill gas should not be required at this time.

## 8.2 **Contingency Plan Measures**

As discussed above, no exceedances of MECP Guideline B-7 criteria (excluding organic nitrogen which is typical in northwestern Ontario) or Trigger Levels indicative of potential unacceptable landfill leachate effects at or beyond the established attenuation zone boundary are evident or anticipated, based on available monitoring results.

Should future monitoring results indicate or predict exceedances of applicable criteria indicating possible unacceptable current or future impact beyond the attenuation zone boundary, the data would first be scrutinized to ensure that they are valid and representative of actual conditions. It might be appropriate to require additional monitoring data before any



decisions on remedial actions are made. If it is determined that an unacceptable risk of criteria exceedances downgradient of the landfill (i.e., impact to the Blackwater River) is present, the following measures could be undertaken to reduce leachate volumes and/or strength:

- The groundwater table beneath the waste pile could be lowered through ditching to intercept upgradient surface water and possible shallow groundwater inflow, and/or through other site drainage improvements.
- Landfill waste possibly buried below the groundwater table in some areas could be excavated and deposited above the water table, or alternatively moved to a different approved location.
- The amount and frequency of cover material applications could be increased.
- Lower permeability cover material could be used.
- Volumes of waste deposited in the landfill could be restricted and/or reduced through increased recycling efforts.
- If necessary, active leachate control (e.g., interception via a "French drain" system and redirection or capture for recirculation or treatment) could be implemented.

If the above measures are not successful, as a last recourse, the landfill could require premature capping and closure.

Additional details on contingency measures which would enable the particular nature of the potential impact to be assessed and properly addressed are found in the Design and Operations Plan.



# 9 Summary and Conclusions

The 2020 monitoring results confirm that leachate with concentrations of several potential indicator parameters that exceed ODWS criteria, and that are typically one or two orders of magnitude higher than background, is being generated at the site.

However, leachate-contaminated groundwater appears to be largely confined to the immediate vicinity of the waste footprint. There was a minor exceedance of the B-7 criterion for organic nitrogen in downgradient well BH-F, but this well is about 200 m from the attenuation zone boundary (Blackwater River). There were no exceedances of calculated trigger levels predictive of potential future unacceptable impact to groundwater or surface water. Therefore, there is no requirement to implement contingency plan measures at this time.

As indicated above, as of September 11, 2020, the waste volume including interim cover on site was estimated to be about 86,675 m<sup>3</sup> based on the topographic survey conducted on September 11, 2020. Using the most recent surveyed quantity increase of about 1,600 m<sup>3</sup> per year, or 133 m<sup>3</sup> per month, the estimated volume on site as of December 31, 2020, is about 87,100 m<sup>3</sup>, which represents about 97.5% of the approved capacity of 89,300 m<sup>3</sup>. Based on an estimated annual waste and cover material volume deposition rate of 1,500 m<sup>3</sup>/yr. going forward (typical based on several recent topographic surveys), it is estimated that the landfill will reach the currently-approved capacity in just over one year (mid-2022).

The Environmental Screening Process to increase the landfill capacity by 60,000 m<sup>3</sup> is approaching completion, and should extend the life of the landfill until beyond the middle of the century (subject to confirmation of waste volume estimates).



# 10 **Recommendations**

- In general, the analytical program should be continued in 2021, in accordance with the Amendment to ECA.
- In connection with the Environmental Screening Process currently underway to increase the approved landfill capacity by 60,000 m<sup>3</sup>, sampling and analysis of the Blackwater River, both immediately upstream and downstream of the attenuation zone, should commence in 2021, as requested by a First Nations group.
- The damaged plastic well cover at well BH-C should be replaced during the next sampling event with an above ground metal well protector.
- To minimize leachate production, when areas of the landfill are brought up to final elevation, they should be capped and seeded as soon as possible (refer to the previously referenced D&O Plan).
- The Municipality should increase waste diversion and recycling activities to the extent possible/practical.
- The Municipality should consider seeking MECP approval to operate an annual (summer) HHW depot at the site.
- The approved attenuation zone lands should be obtained from the MNRF and registration on title of the entire site (including the attenuation zone) should be completed as soon as possible. This is currently in progress - in January 2019, the Municipality of Greenstone submitted an application to the Ministry of Natural Resources and Forestry (MNRF) to purchase these lands, and in July 2019 the lands were surveyed. The Municipality is currently waiting for review comments from the Ministry of Natural Resources and Forestry (MNRF) Office of the Surveyor General complete the sale.
- The ECA and MECP Inspection Reports should be carefully reviewed to ensure that all requirements, including record keeping, reporting, staff training, marking limits of fill boundaries, litter fencing, etc. have been complied with.
- The actual annual waste quantities (in place and machine compacted) should be confirmed from the results of the next landfill volume survey to be provided with the annual report for the year 2021.



# 11 Closing Comments

This report has been prepared for and is intended for the use of the client (Municipality of Greenstone) and the MECP to assess compliance. The contents of this report may not be reproduced in whole or in part, or used or relied upon in whole or in part by any other party for any purpose whatsoever without the expressed written consent of EXP. Any use which a third party makes of this report, or any reliance on or decision made based on it, is the sole responsibility of such third party and EXP accepts no responsibility for any damages of any kind or nature whatsoever, suffered by any other third party as a result of decisions made or actions based upon this report. The findings are relevant for the date(s) of the investigation and should not be relied upon to represent conditions of other dates.

This report provides certain information concerning the results of the 2020 groundwater monitoring program at the Beardmore Landfill, as described herein. It is based on an authorized scope of work. Professional judgement was exercised in gathering and interpreting the information obtained and in the formulation of conclusions.

Conclusions regarding site conditions are based on observations of current and historical conditions and the results of limited chemical analyses. The groundwater results are only directly applicable to the actual locations sampled, and conditions could differ in areas not tested. Substances could also exist in forms not indicated by the limited analytical testing conducted. Additionally, the scope of work was based, in part, on rules and regulations that we understand to be current or expected at the time of the work. Changes in regulations, interpretations and/or enforcement policies may occur in the future. Such changes could be reflected in the degree of remediation actually required, if any, at the time of the action.

If additional relevant information becomes available concerning this site, such information should be provided to EXP so that our report may be reviewed and modified as necessary. EXP accepts no responsibility for the consequential effects of this factual report on the real or perceived value of this site, or on the ability to sell, finance or insure the property.

All reports, field data, notes, laboratory test data, calculations, estimates and other documents which are communicated by EXP to the client or third parties, are instruments of service and will be retained by EXP. These records will be stored in our files for a period of 10 years following submission of the final report, during which time they will be made available to the client, at all reasonable times, for review.

EXP has conducted the services reported herein in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practising in the same locality and under similar conditions as this project. No other representation, expressed or implied, is included or intended in this document.



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We trust that this report is satisfactory for your present requirements. Should you have any questions, please contact the undersigned at your convenience.

Yours truly, EXP Services Inc.

Ahileas Mitsopoulos, P.Eng. Project Engineer

Robert J. Rinne, M.Sc., QEP Senior Scientist

Demetri N. Georgiou, MASc., P.Eng. Principal Engineer/Branch Manager



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# **APPENDIX A – MECP Documentation**





Ministry of the Environment and Climate Change Ministère de l'Environnement et de l'Action en matière de changement climatique

#### AMENDMENT TO ENVIRONMENTAL COMPLIANCE APPROVAL

NUMBER A7249502 Notice No. 1 Issue Date: February 8, 2017

The Corporation of the Municipality of Greenstone 1800 Main St Post Office Box, No. 70 Geraldton, Ontario P0T 1M0

### Site Location: Beardmore Waste Disposal Site North of Mining Claim TB 10597, Twp of Summer, Municipality of Greenstone Greenstone Municipality, District of Thunder Bay

You are hereby notified that I have amended Approval No. A7249502 issued on July 15, 1979 for a 4.20 hectare landfill site within a total site area of 22.40 hectares, as follows:

For the purpose of this Environmental Compliance Approval and the terms and conditions specified below, the following definitions apply:

- a) "*Approval*" means this Environmental Compliance Approval including all Notices of Amendment;
- b) "CAZ" means the Contaminant Attenuation Zone, as defined in Section 4 of Regulation 232;
- c) "*Director* " means Director, Section 39, Environmental Protection act, R.S.0. 1990, C.E-19 as amended;
- d) "District Manager" means the District Manager in the Ministry's Thunder Bay District Office
- e) "EPA " means the Environmental Protection Act, R.S.O. 1990, C.E-19 as amended;
- f) "*Ministry*" means the Ontario Ministry of the Environment and Climate Change;
- g) "*Operator* " means the Municipality of Greenstone, its officers, employees, agents or contractors; and

- h) "*Owner*" means any person that is responsible for the establishment or operation of the site being approved by this *Approval*, and includes the Municipality of Greenstone, its successors and assigns;;
- i) "OWRA" mean the Ontario Water Resource Act, R.S.O 1990, Chapter O.40
- "PA" means the Pesticides Act, R.S.O. 1990, c. P-11, as amended from time to time;
- k) "*Reasonable Use Guideline* " means the Ministry Guideline B-7 entitled "Incorporation of the Reasonable Use Concept into MOE Groundwater Management Activities, dated April 1994, as amended
- 1.) "*Regulation 347*" means Regulation 347 R.R.O. 1990;
- m.) "Regulation 232 " means Ontario Regulation 232 R.R.O. 1990;
- n.) "*Site* " means the Beardmore Waste Disposal Site located in the Municipality of Greenstone;
- o.) "*Transfer Station* " means the recycling/public waste drop-off facility as shown in Item (1) of Schedule "A".

You are hereby notified that this approval is issued to you subject to the terms and conditions outlined below:

### GENERAL

### Compliance

- 1. (1) The *Owner* and *Operator* shall ensure compliance with all the conditions of this Approval and shall ensure that any person authorized to carry out work on or operate any aspect of the *Site* is notified of this *Approval* and the conditions herein and shall take all reasonable measures to ensure any such person complies with the same.
  - (2) The *Owner* shall ensure that *MOE* Guideline B-7 Reasonable Use Guideline are applied and met at all points on the property line which are impacted by leachate generated at the *Site*.
- 2. Any person authorized to carry out work on or operate any aspect of the Site shall comply with

the conditions of this Approval.

#### In Accordance

3. Except as otherwise provided for in this *Approval*, the *Site* shall be designed, developed, built, operated and maintained in accordance with the original application for this *Approval*, the condition herein this *Approval* and the supporting documentation listed in Schedule "A".

#### Interpretation

- 4. Where there is a conflict between a provision of any document, including the application, referred to in this *Approval*, and the conditions of this *Approval*, the conditions in this *Approval* shall take precedence.
- 5. Where there is a conflict between the application and a provision in any documents listed in Schedule "A", the application shall take precedence, unless it is clear that the purpose of the document was to amend the application and that the *Ministry* approved the amendment.
- 6. Where there is a conflict between any two documents listed in Schedule "A", other than the application, the document bearing the most recent date shall take precedence.
- 7. The conditions of this *Approval* are severable. If any condition of this *Approval*, or the application of any condition of this *Approval* to any circumstance, is held invalid or unenforceable, the application of such condition to other circumstances and the remainder of this *Approval* shall not be affected thereby.

#### **Other Legal Obligations**

- 8. The issuance of, and compliance with, this *Approval* does not:
  - a. relieve any person of any obligation to comply with any provision of any applicable statute, regulation or other legal requirement; or
  - b. limit in any way the authority of the *Ministry* to require certain steps be taken or to require the *Owner* and *Operator* to furnish any further information related to compliance with this *Approval*;

### **Adverse Effect**

- 9. The *Owner* and *Operator* shall take steps to minimize and ameliorate any adverse effect on the natural environment or impairment of water quality resulting from the *Site*, including such accelerated or additional monitoring as may be necessary to determine the nature and extent of the effect or impairment.
- 10. Despite an Owner, Operator or any other person fulfilling any obligations imposed by this

*Approval* the person remains responsible for any contravention of any other condition of this *Approval* or any applicable statute, regulation, or other legal requirement resulting from any act or omission that caused the adverse effect to the natural environment or impairment of water quality.

### **Change of Owner**

- 11. The *Owner* shall notify the *Director*, in writing, and forward a copy of the notification to the *District Manager*, within 30 days of the occurrence of any changes in the following information:
  - a. the Ownership of the *Site*;
  - b. the Operator of the Site ;
  - c. the address of the *Owner* or *Operator*;
  - d. the partners, where the *Owner* or *Operator* is or at any time becomes a partnership and a copy of the most recent declaration filed under the *Business Names Act*, R. S. O. 1990, c. B.17, shall be included in the notification;
- 12. No portion of this *Site* shall be transferred or encumbered prior to or after closing of the Site unless the *Director* is notified in advance. In the event of any change in *Ownership* of the works, other than change to a successor municipality, the *Owner* shall notify the successor of and provide the successor with a copy of this *Approval*, and the *Owner* shall provide a copy of the notification to the *District Manager* and the *Director*.

### Inspections

- 13. No person shall hinder or obstruct a *Provincial Officer* from carrying out any and all inspections authorized by the *OWRA*, the *EPA*, or the *PA*, of any place to which this *Approval* relates, and without limiting the foregoing:
  - a. to enter upon the premises where the approved works are located, or the location where the records required by the conditions of this *Approval* are kept;
  - b. to have access to, inspect, and copy any records required to be kept by the conditions of this *Approval*;
  - c. to inspect the *Site*, related equipment and appurtenances;
  - d. to inspect the practices, procedures, or operations required by the conditions of this *Approval*; and
  - e. to sample and monitor for the purposes of assessing compliance with the terms and conditions of this *Approval* or the *EPA*, the *OWRA* or the *PA*.

### **Information and Record Retention**

14. a) Any information requested, by the *Ministry*, concerning the *Site* and its operation under this *Approval*, including but not limited to any records required to be kept by this *Approval* shall be provided to the Ministry, upon request, in a timely manner.

- b) Records shall be retained for 5 years except for as otherwise authorized in writing by the *Director*.
- 15. The receipt of any information by the *Ministry* or the failure of the *Ministry* to prosecute any person or to require any person to take any action, under this *Approval* or under any statute, regulation or other legal requirement, in relation to the information, shall not be construed as:
  - a. an approval, waiver, or justification by the *Ministry* of any act or omission of any person that contravenes any term or condition of this *Approval* or any statute, regulation or other legal requirement; or
  - b. acceptance by the *Ministry* of the information's completeness or accuracy.

### **Contaminant Attenuation Zone**

16. By **September 30, 2017**, the Owner shall provide written documentation to the Director that the 18.2 hectare CAZ identified in Item (1) of Schedule "A" has been established in accordance with Section 4 of Regulation 232.

### Site Capacity and Service Area

- 17. The approved capacity for the Site is **89**, **300** cubic meters. The Owner shall construct, operate and manage the Site in accordance with the Design and Operations Plan listed as Item (1) of Schedule "A". The maximum amount of waste, daily cover, intermediate cover and final cover placed shall not exceed the final contours shown in Figure 6 of Item (1).
- 18. Wastes generated only from within the geographic boundaries of the Municipality of Greenstone, the Rocky Bay (Biinjitiwaabik Zaaging Anishinaabek) First Nation, the Lake Nipigon (Animbiigoo Zaagi igan Anishinaabek) First Nation and the Sand Point First Nation (Bingwi Neyaasli Anishinaabek) may be received at this *Site*.
  - 19. Only municipal waste which includes wastes generated by residential, commercial, institutional and industrial sectors, and contaminated fill shall be accepted at the *Site*.
  - 20. Waste may only be disposed of in the approved 4.20 hectare fill area as identified in Item (1) of Schedule "A".

(a) By no later than **August 31, 2017**, the *Owner* shall clearly define the boundaries of the limit of waste by installing permanent markers that can be visible year-round; and

(b) By no later than **June 30** of each year, the Owner shall clearly define the boundaries of the fill area to be used for waste disposal over the following year by installing markers visible to Site operators.

### **Operating Hours, Signage and Site Operations**

- 21. The Owner shall ensure that all Site employees receive initial and ongoing training with respect to the following: the Approval and conditions attached to the Approval, conceptual design and operations; relevant waste management regulations and legislation; environmental concerns related to the waste being handled at the Site; occupational health and safety concerns pertaining to the waste being handled at the Site; fire fighting protocol; and emergency and contingency measures for the preventing of off-site impacts.
- 22. A sign shall be posted in a prominent location at the *Site* entrance clearly stating the following:
  - i. Owner 's name;
  - ii. Operator's name;
  - iii. Approval Number;
  - iv. Applicable Municipal By-Laws;
  - v. The hours of operation; and
  - vi. Municipal government contact telephone number to call with complaints or in the event of an emergency.
- 23. (1) The hours of operation for the *Site* are:
  - i. Monday, Wednesday and Friday between the hours of 1:00 p.m. and 6:00 p.m. and Saturdays from noon to 6:00 pm during the summer; and
  - ii. Monday, Wednesday and Friday between the hours of noon and 5:00 p.m. and Saturdays from 11:00 am to 5:00 pm during the winter;
  - (2) The hours of operation may be changed as necessary with the written concurrence of the *District Manager*.
- 24. No waste shall be received, landfilled or removed from the *Site* unless a site supervisor or attendant is present and supervises the operations during operating hours unless otherwise approved by this *Approval*. The *Site* shall be closed when a site attendant is not present to supervise operations.
- 25. During non-operating hours, the *Owner* shall ensure that the *Site* entrance and exit gates are locked and the *Site* is secured against access by unauthorized persons.
- 26. Burning of clean wood and brush is only permitted during daylight hours under controlled and supervised conditions in a segregated portion of the site. Burning shall not be conducted during periods of elevated forest fire hazards.
- 27. Waste shall be deposited in a manner that minimizes the area of exposed waste at the working face and shall be compacted before cover material is applied.

### Landfill Covers

- 28. On at least a weekly basis, the Owner shall ensure that exposed waste is covered with cover material as specified in Section 28(2) of Regulation 232.
- 29. Intermediate Cover shall be placed in areas where landfilling has been temporarily discontinued for six (6) months or more. A minimum thickness of 300 mm of soil cover or an approved thickness of alternative cover material shall be placed.
- 30. Final cover shall be applied progressively, as each part of the Site reaches final grades. The design of the final cover shall comply with the specifications contained in Section 29 of Regulation 232. Vegetation of completed final cover shall occur within one month of its placement of the final cover, or as soon as weather permits.

### **Transfer Station Operation**

- 31. The Owner may operate a *Transfer Station* for the purposes of diverting waste from final disposal.
- 32. The *Owner* shall ensure that an attendant(s) is/are on duty at all times when the *Transfer Station* is open to ensure proper supervision of all activities.
- 33. All waste types shall be segregated either into bins, or in designated areas defined by barriers. All bins and designated waste storage areas shall be clearly labelled.
- 34. The Owner shall employ a licensed technician to drain refrigerants from appliances. Appliances that have been drained of refrigerants shall be clearly tagged and segregated from those appliances that have not been drained.
- 35. The Owner shall remove all scrap metal and appliances from the Transfer Station at an interval not to exceed six (6) months.
- 36. The Owner shall install and maintain an electric fence around the perimeter of the active disposal area to eliminate access for bears and the *Owner* shall ensure that adequate fire fighting and contingency spill clean up equipment is available and that emergency response personnel are familiar with its use and location.

#### Litter and Vermin

37. The Owner shall take all practical steps to prevent the escape of litter from the Site. Periodic pick-up of litter at the Site and along roads in the vicinity of the Site shall be carried out as required, or every two weeks as a minimum. Property adjacent to the Site shall be inspected weekly and litter shall be collected if necessary, with permission of access from the property owner. Litter fencing shall be erected around the working area of the landfill.

### **Hydrogeological Monitoring**

- 38. The *Owner* shall conduct groundwater monitoring at the *Site* in accordance with the environmental monitoring program outlined in Section 3.12 of Item 1 in Schedule "A" and the following conditions:
  - (a) By June 30, 2017, the Owner shall install 3 new monitoring wells (BH-G, BH-H and BH-I) that are situated in close proximity to the locations indicated on Figure 3 of Item 1 in Schedule "A". The Owner shall submit a report to the District Manager, identifying the specific locations of the new wells and shall indicate casing or groundwater elevations that are surveyed with reference to the same datum as existing wells.
  - (b) Groundwater samples shall be collected at all five monitoring wells (BH-C, BH-F, BH-G, BH-H and BH-I) twice (2) per year in the Spring and Fall. Sample collection shall include measurement of water levels, temperature and conductivity in each well.
  - (c) Collected samples must be submitted to a certified lab for analysis. Each year, the samples from one event are to be analysed for the full list of comprehensive parameters as specified in Schedule 5 of Regulation 232 and the set of samples from the remaining event should be analysed for the indicator parameters as set out in Schedule 5. The spring and fall sampling events should be alternated from year to year as comprehensive or indicator parameters.
    - (d) At each sampling event, monitoring well BH-A should be inspected, and if water is found in the well, the level should be recorded and the water sampled for the full suite of parameters pertaining to that sampling event, assuming adequate water volume is available.
  - (e) For any changes to the monitoring program recommended in the annual report, the Owner shall in a cover letter for the report request the acceptance of the changes by the District Manager. The Owner shall make clear reference to the proposed changes in separate letter that shall accompany the annual report.
  - (f) Within fourteen (14) days of receiving the written correspondence from the District Office confirming that the District Office is in agreement with the proposed changes to the environmental monitoring program identified in Condition 43, the *Owner* shall forward a letter identifying the proposed changes and a copy of the correspondences from the *District Manager* and all other correspondences and responses related to Condition 43, to the *Director* requesting the *Approval* be amended to approve the proposed changes to the environmental monitoring plan.
  - (g) In the event any other changes to the environmental monitoring program are proposed outside of the recommendation of the annual report, the *Owner* shall follow current
ministry procedures for seeking approval for amending the Approval.

39. The *Owner* shall ensure that all groundwater monitoring wells are properly labelled, capped, secure and protected from damage. Any well that is damaged must be re replaced forthwith with a suitable replacement well if damage with written concurrence by the *District Manager* 

### Inspections and Record Keeping

- 40. The *Owner* shall establish and maintain a written record of daily operations at the *Site*. This record must be in a form of a log or a dedicated electronic file and it shall include as a minimum the following information:
  - a) date of record;
  - b) hours of operation;
  - c) an approximation of the type, amount and source of waste received and removed from the site;
  - d) type of the emergency situation and the resulting environmental impact;
  - e) actions taken to address the impact; and
  - f) actions taken to prevent the re-occurrence of a similar emergency situation in the future.
  - g) date and time of any complaints received at the Site and their nature;
  - h) name, address and telephone number of the complainant;
  - i) nature of the complaint;
  - j) date and description of any remedial actions taken to address the received complaints; and
  - k) actions taken to prevent the re-occurrence of a similar incident, in the future.
- 41. The *Owner* shall establish inspections of the Site for every day that the Site is operating and maintain a written record of the Site inspections. This record shall be in the form of a log or a dedicated electronic file and it shall include, as a minimum, the following information:
  - a) date and time of inspection;
  - b) name, title and signature of trained personnel conducting the inspection; and
  - c) a listing of all equipment, fencing, signs, etc. inspected and any deficiencies observed; and
  - d) recommendations for remedial action and the completion date of such action.

### Annual Report

42. By **April 30, 2018** and by every April 30 thereafter, the Owner shall submit, to the *District Manager*, an annual report covering the previous calendar year. The report shall be prepared by a qualified Professional Engineer or Professional Geoscientist in the Province of Ontario. The report shall contain, but is not limited to, the following information:

- a) a summary of type and quantity of incoming waste accepted during the reporting period;
- b) Discussion indicating the landfill capacity, current fill volume, volume filled in the last year, and the status of any control measures such as interim, final or progressive cover
- c) a summary of the site's operation procedure and compliance as per the Design and Operation Plan;
- d) a summary of recycling operations;
- e) An accurately scaled site plan illustrating the location of all buried wastes, the site boundaries, monitoring well locations, the location of the contaminant attenuation zone, and any other significant site features.
- f) An accurately scaled location map illustrating topography and the site relative to nearby potentially sensitive groundwater/surface water features (i.e., lakes, streams, wells), or any other potentially significant receptors.
- g) A section describing the field monitoring and sampling program including QA/QC measures and any variance from normal sampling procedures and/or conditions.
- h) A water table contour map based on current data.
- i) Stratigraphic cross-sections which clearly illustrate the subsurface distribution of geological materials.
- j) Borehole and monitoring well logs for all monitoring wells.
- k) Tables presenting historical water chemistry and water level data, and graphs illustrating quality trends with time for key parameters at all monitoring locations.
- Discussion and assessment of groundwater flow direction and velocities, estimates of leachate generation/impacts, effectiveness of mitigation measures, and compliance with the Reasonable Use Policy;
- m) Recommendations as required for future mitigation, monitoring and site characterization activities.
- 43. The first annual monitoring report, due **April 30, 2018** should include recommendations for trigger levels as related to contingency plans. The trigger levels should be developed in consideration of both the Reasonable Use Policy and the Aquatic Protection Values (GW3 values as described in Appendix A3 of the MOECC's "Rationale for the Development of Ground Water Standards for Use at Contaminated Sites in Ontario" April 15, 2011).

### **Closure Plan**

- 44. By December 31, 2019, the Owner shall submit to the Director, for approval, a Closure Plan for the site which includes, as a minimum, the following:
  - i. Site plan and profiles showing the proposed post-closure topography;
  - ii. Procedures for completion of installing, inspecting and maintaining the final cover and landscaping;
  - iii. Site security (e.g. fencing and access control)
  - iv. Proposal for post closure monitoring
  - v. Identification of structures to be removed from the Site;
  - vi, Identification of post-closure land use;

- vii. Advance public notification of closure and of alternate waste disposal site; and
- viii. Any other improvements or alterations of the Site.

### Schedule "A"

This Schedule "A" forms part of this Approval. If there is a conflict between documents listed in Schedule "A", the document bearing the most recent date shall apply:

- 1. Report entitled "*Design and Operations Plan Beardmore Landfill Site* ", dated February 22, 2016, prepared for the Municipality of Greenstone by exp Services Inc..
- 2. Environmental Compliance Approval Application, dated June 11, 2015 and signed by Brian Aaltonen, Director of Public Services, Municipality of Greenstone requesting approval of and updated Design and Operations Plan for the Beardmore Landfill Site.
- 3. Letter dated September 18, 2015 to Mr. Dale Gable, MOECC from D. Georgiou/A Mitsopoulos, exp Services Inc, providing additional information on the Expansion of the Beardmore Landfill Site.

### The reasons for this amendment to the Approval are as follows:

- 1. The reason for inclusion of the definitions is to define the specific meaning of terms and simplify the wording of conditions in this Approval.
- 2. The reason for Condition 3 is to ensure that the Site is designed, operated, monitored and maintained in accordance with the application and supporting documentation submitted by the Owner, and not in a manner which the Director has not been asked to consider.
- 3. The reason for Conditions 1, 2, 4, 5, 6, 7, 8, 9, 10, 14 and 15 is to clarify the legal rights and responsibilities of the Owner under this Approval.
- 4. The reasons for Condition 12 is to restrict potential transfer or encumbrance of the Site without the approval of the Director and to ensure that any transfer of encumbrance can be made only on the basis that it will not endanger compliance with this ECA of Approval.
- 5. The reasons for Conditions 11 is to ensure that the Site is operated under the corporate name which appears on the application form submitted for this approval and to ensure that the Director is informed of any changes.
- 6. The reason for Condition 13 is to ensure that appropriate Ministry staff have ready access to the Site for inspection of facilities, equipment, practices and operations required by the conditions in this ECA of Approval. These conditions are supplementary to the powers of entry afforded a Provincial Officer pursuant to the EPA and OWRA.
- 7. The reason for Condition 16 is to ensure that there sufficient land available for the attenuation of contaminants and for implementing control measures, if required.
- 8. The reasons for Condition 21 are to ensure that users of the Site are fully aware of important information and restrictions related to Site operations under this ECA of Approval.
- 9. The reasons for Conditions 23 is to specify the normal hours of operation for the landfill Site and a mechanism for amendment of the hours of operation.
- 10. The reasons for Conditions 24 and 25 is to specify site access to/from the Site and to ensure the controlled access and integrity of the Site by preventing unauthorized access when the Site is closed and no site attendant is on duty.
- 11. The reasons for Conditions 27, 31, 33, 34, 35, 36 and 37 are to ensure the site is operated in an manner in which as adverse effect does not occur. This is to ensure the long-term protection of the environment and human health.
- 12. The reason for Conditions 18 and 19 is to specify the approved areas from which waste may be accepted at the Site and the types and amounts of waste that may be accepted for disposal at the

Site, based on the Owner's application and supporting documentation.

- 13. The reason for Condition 17 and 20 is to specify restrictions on the extent of landfilling at this Site based on the Owner's application and supporting documentation. These limits define the approved volumetric capacity of the site. Approval to landfill beyond these limits would require an application with supporting documentation submitted to the Director.
- 14. The reason for Condition 28, 29 and 30 is to ensure that landfilling operations are conducted in an environmentally acceptable manner. Daily and intermediate cover is used to control potential nuisance effects, to facilitate vehicle access on the site, and to ensure an acceptable site appearance is maintained. The proper closure of a landfill site requires the application of a final cover which is aesthetically pleasing, controls infiltration, and is suitable for the end use planned for the site.
- 15. The reason for Condition 26 is to ensure the burning of clean wood is conducted in an acceptable manner and best practices.
- 16. The reason for Conditions 40 and 41 to ensure regular inspections of the site are conducted in order to protect the natural environment and that accurate records are maintained to ensure compliance with the conditions in this Approval, the EPA and its regulations. Record keeping is necessary to determine compliance with this ECA of Approval, the EPA and its regulations.
- 17. The reason for Conditions 32 and 34 is to ensure that the Site is supervised and operated by properly trained staff in a manner which does not result in a hazard or nuisance to the natural environment or any person.
- 18. The reason for Condition 38 and 39 is to demonstrate that the landfill site is performing as designed and the impacts on the natural environment are acceptable. Regular monitoring allows for the analysis of trends over time and ensures that there is an early warning of potential problems so that any necessary remedial/contingency action can be taken.
- 19. The reason for Condition 42 and 43 is to ensure that regular review of site development, operations and monitoring data is documented and any possible improvements to site design, operations or monitoring programs are identified. An annual report is an important tool used in reviewing site activities and for determining the effectiveness of site design.
- 20. The reasons for Condition 44 is to ensure that final closure of the Site is completed in an aesthetically pleasing manner and to ensure the long-term protection of the natural environment.

## This Notice shall constitute part of the approval issued under Approval No. A7249502 dated July 15, 1979

In accordance with Section 139 of the Environmental Protection Act, you may by written Notice served upon me and the Environmental Review Tribunal within 15 days after receipt of this Notice, require a hearing by the

Tribunal. Section 142 of the Environmental Protection Act provides that the Notice requiring the hearing shall state:

- 1. The portions of the environmental compliance approval or each term or condition in the environmental compliance approval in respect of which the hearing is required, and;
- 2. The grounds on which you intend to rely at the hearing in relation to each portion appealed.

Pursuant to subsection 139(3) of the Environmental Protection Act, a hearing may not be required with respect to any terms and conditions in this environmental compliance approval, if the terms and conditions are substantially the same as those contained in an approval that is amended or revoked by this environmental compliance approval.

The Notice should also include:

- 3. The name of the appellant;
- 4. The address of the appellant;
- 5. The environmental compliance approval number;
- 6. The date of the environmental compliance approval;
- 7. The name of the Director, and;
- 8. The municipality or municipalities within which the project is to be engaged in.

And the Notice should be signed and dated by the appellant.

This Notice must be served upon:

The Secretary* Environmental Review Tribunal 655 Bay Street, Suite 1500 <u>AND</u> Toronto, Ontario M5G 1E5	The Director appointed for the purposes of Part II.1 of the Environmental Protection Act Ministry of the Environment and Climate Change 135 St. Clair Avenue West, 1st Floor Toronto, Ontario M4V 1P5
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\* Further information on the Environmental Review Tribunal's requirements for an appeal can be obtained directly from the Tribunal at: Tel: (416) 212-6349, Fax: (416) 326-5370 or www.ert.gov.on.ca

The above noted activity is approved under s.20.3 of Part II.1 of the Environmental Protection Act.

DATED AT TORONTO this 8th day of February, 2017

le D. Gelle

Dale Gable, P.Eng. Director appointed for the purposes of Part II.1 of the *Environmental Protection Act* 

IP/

c: District Manager, MOECC Thunder Bay - District Demetri Georgiou, exp Services Inc., The Corporation of the Municipality of Greenstone

RICT OFFICE BOUNDANIES PARTIALLY CUT OUT ( TO NAME TO T PRELIMINARY SURVEY OV . J. H. Auger, DATE OF PRELIMINARY SURVE, NOV. 20, ... 62. NAME OF APPLICANT. Improvement District of ADDRESS BEARDING NE. UNT . Beards re arvants. Lond Use Ferm t for m garbage disposal. District Forester

November 21st, 62.

District Forester, Att. B. Parker: GERAIDTON, Ontario.

MACDIARMID, Ontario.

Mining Claim TB-11545 - Summers Township Our Telephone conversation of Nov. 20th, 1962.

> Please find attached a Freliminary Survey 3-1 of disposal grounds for the Improvement District of Beardmore.

In regards to fire safety stand point, it is suggested that a 20% fire guard be bulldozed fown to mineral soil as outlined on sketch in red.

It is also suggested that 4 pack-cans be filled with water and placed at each corner of the dump; and no burning during high fire hazard and high wind periods.



DETAIL PLAN - Position of shore line taken from most recent information in mlable)





### Department of Energy and Resources Management Waste Management Branch

### APPLICATION FOR A CERTIFICATE OF APPROVAL FOR A WASTE DISPOSAL SITE

TO:	THE DEPARTMENT OF ENERGY AND RESOURCES MANAGEMENT 880 Bay Street, Toronto, Ontario	To be submitted through Regional Waste Management Engineer
(1)	Under the Waste Management Act, 1970 and the regulations, this applica-	
	CORPORATION OF THE IMPROVEMENT	Owner of Facility
	DISTRICT OF BRARDMORE	Owner of Facility
	MOTION OF INALLING	Address
(2)	for the Remewood of a Certificate of Approval for a	Delete item inapplicable
	DUK PLANDE TITEFENGENDENDENVX	Type of Disposal
(3)	located	Full particulars of Location
(4)	A Provisional Certificate of Approval No	Delete item inapplicable
	site was issued19	
(5)	No change in use, operation, or ownership of the site has occurred since the date of the original application.	
	Dated this	
	Improvement District of Bairdmore	
	Soluce (SecTreas.)	
(6)	The following changes in use, operation or ownership (have occurred since the date of the original application) (are proposed)	Delete item inapplicable
		If necessary, provide additional details on separate sheets and attach to application.
	Continued on Attached Sheets	
(7)	The site will be operated in accordance with The Waste Management Act,	
	1970 and the regulations by	Name of Operator
	DISTRICT OF BEARDMORE	
		Address
	The required supporting information to the application is appended hereto.	
(8)	Notice of this application has been published in the	
(9)	A certificate that the site does not contravene any of the by-laws of the municipality is attached.	To be completed if applicant is other than a municipality
		See notes on sections 1 to 9 on back of lest copy (pink) which is to be retained by Applicant.
	Dated this 3rd	
	Improvement Pistrict of Beardmore	
	Signature of Applicant	No Carbon Paper Required

For Head Office Use
2. Origin and Composition of Principal Components of Waste (other than domestic and commercial)
4. Maximum Depth of Excavation Below Surface
6. Operating Equipment
FOR DEPARTMENTAL USE         8. Authorities Consulted:       Health Unit       Objection       No Objection         0.W.R.C.       Objection       No Objection       No Objection         0.W.R.C.       Objection       No Objection       No Objection         A.M.B.       Objection       No Objection       No Objection         A.M.B.       Objection       No Objection       No Objection         Municipality       Objection       No Objection         Conservation       Objection       No Objection         Authority       Objection       No Objection         Other       No Objection       No Objection         Inspection Record Forms Attached       Inspection Record Forms Attached       Inspection         Multiple       Multiple       Multiple       Inspection         DATED       Multiple       Multiple       Multiple         DATED       SIGNEB       Multiple       Multiple

	<b>N</b>	Jepartment of the Enviro Waste Management Br	onment anch	File A -
	онтипе А	PPLICATION FOR A CERTIFICA FOR A WASTE DISPOS	TE OF APPROVAL Al site	
	DTANT NOTE	Waste Man	agement Branch	
IS RC	FORM MUST BE SU DUGH THE OFFICE O REGIONAL WASTE N	BMITTED III Vict F MANAGEMENT ENGINEER THUNDER (SEE SECOND SHEET FOR INSTRUCTIONS FOR	Oria Avenue BAY, "F" ONT. COMPLETING THIS FORM)	A 591501
	Owner (Applicant)	Under the Environmental Protection Act and the Regulations, this application is made by:-	CORPORATION OF (Nam DISTRICT OF B	EAR.D.M.QRE
			(Addre BEARD MORE	ONTARIO
	Type of disposal site	For the Reissue of a Certificate of Approval for a	LAND FILL	S
s.	Site location	Located	NORTH OF MINI TB 10597, TOU SUMMER	NG CLAIM NNSHIP OF
	IF APPLI	ICATION IS FOR REISSUE, COMPLETE	SECTIONS 4 AND 5 (A	OR B)
	Previous Certificate details	Gertificate Provisional Certificate for this site was issued on:	No. 591501 10 August	
	Changes.	(A) The following changes in use, oper- ation or ownership (have occurred since the date of the original appli- cation) OR (are proposed)		
		(B) No change in use, operation or own- ership of the site has occurred since the date of the original application.		
	IF A	PPLICATION IS FOR ISSUE, COMPLET	E SECTIONS 6, 7, 8 AND	D 9
ò.	Operator.	The site will be operated in conformity with the Environmental Protection Act and the regulations by:-	THE MARASE MEN. (Nam OF BEARD MOR	7. DIS. Z.S. (S. T. no) 2. Z
			Addre (Addre ONTARIO	855)
7.	Publication of	Notice of this application has been pub-		
	Notice. Ii	on the following dates STE MANAGEMENT BI RECEIVE	(Name of No D	rwspaper)
		and a copy of the notice is Atlached. 1972		
3.	Municipal Certificate (Non-municipal	A certificate, that the site cost of the site cost of the by-laws of the site cost of the s	ON	pelity)
	applicants only)	signed by is attached.	(Name)	(Position)
).	Additional information	The required supporting information to this application is attached.		
	Da	ted this 7 Latt L day of	age 1 () 19.7	2-

1915 Department of the Environment Waste Management E ch SUPPORTING INFORMATION TO AN APPLICATION FOR APPROVAL OF A LANDFILL DISPOSAL SITE	FOR DEPARTMENTAL USE For Head Office Use File A		
APPLICANT TO COMPLETE ITEMS 1-4 INCLUSIVE			
1.       SITE DETAILS         Applicant /m product men 1 first metodosive         Site Location // and and first metodosive         Total area of Site         Total area of Site         Total area of Site         Total area of Site         Distance to nearest water course         Distance to nearest water course         Distance to nearest potable well water supply         Distance to dwelling         Distance to commenter from working area         Normal surface         Public from original surface to top of fill         Ground conditions encountered measured from original surface         Pine         From       To         From       To         From       To         From       To         Proposed use of land after site fully utilized	FOR REGIONAL USE         Authorities Consulted:         Health Unit       Objection       No Object         O.W.R.C.       Objection       No Object         A.M.B.       Objection       No Object         Municipality       Objection       No Object         Municipality       Objection       No Object         Conservation Authority       Objection       No Object         Other.       No Object       No Object         Inspection Record Forms Attached       Yes       No Object         Number of Forms.       No Object       No Object         Regional Engineer's Report Attached       Ground water monitoring       Yes       No Object         Surface water monitoring       Yes       No Object       No Object         3. Quantities       Total Tons per Day       Interstance       Interstance         Site operated       7       days from       to       Population served         Marks of Municipalities served       Interstance       Interstance       Interstance         Official Plan       Zoning Bylaw       Site land zoned       GREE BECT Zone       Interstance         Official Plan       Zoning Bylaw       Site land zoned       GREE BECT Zone       Interstance		
2. Wastes to be Disposed of Comprise Domestic Commercial Industrial Waste Hauled Liquid Industrial Waste Agricultural Waste Hazardous Waste Hauled Sewage * Other * Describe Origin and Composition of Principal Components of Waste (other than domestic and commercial)	4. The Following Documents are Attached		





Ministry of the Environment

PROVISIONAL CERTIFICATE OF APPROVAL WASTE DISPOSAL SITE

Under The Environmental Protection Act, 1971 and the regulations and subject to the limitations thereof, this Provisional Certificate of Approval is issued to: P.O. Box 293,

Beardmore, Ontario. POT 1G0

for the located

001

Derelict Motor Vehicle Municipal Landfill Site, Beardmore, Township of Summers

subject to the following conditions:

This Provisional Certificate expires on the 15th day of June

Dated this 24th day of October , 19 74

Provisional Certificate No.

DIRECTOR, SECTION 3 (a) T.P.A.

D 7249501



Ministry of the Environment

Provisional Certificate No. 7249502

# PROVISIONAL CERTIFICATE OF APPROVAL WASTE DISPOSAL SITE

Under The Environmental Protection Act, 1971 and the regulations and subject to the limitations thereof, this Provisional Certificate of Approval Improvement District of Beardmore, is issued to:

P. O. Box 239, Beardmore, Ontario.

Landfill for the North of Mining Claim TB 10597, located Township of Summer, District of Thunder Bay.

15th

day of

19 75

subject to the following conditions:

Site

This Provisional Certificate expires on the. Dated this 16th July

day of

July

DIRECTOR, SECT





Provisional Certificate No. A 591550

EXPIRY DAT

THIS IS A TRUE COPY OF ORIGINAL CERTIFICATE MA

Feb. 16/81

DIRECTOR, SECTION

Signed

# PROVISIONAL CERTIFICATE OF APPROVAL WASTE MANAGEMENT SYSTEM

Under The Environmental Protection Act, 1971 and the regulations and subject to the limitations thereof, this Provisional Certificate of Approval Improvement District of Beardonre is issued to:

P.O. Box 239 Beardmore, Ontario POT 1G0

for the Waste Management System serving

Improvement District of Beardwore

1981

in the approved or provisionally approved waste disposal sites and facilities listed below. SITE CERTIFICATE No.

North of Mining Claim TB 10597 Thunder Bay District Township of Summer, and

day of ....

February

A 7249502

subject to the following conditions:

10th

Dated this ....

Ministry of the Environment and Climate Change

435 James Street South Suite 331 Thunder Bay ON P7E 6S7 Tel.: (807) 475-1617 Fax: (807) 475-1754 Ministère de l'Environnement et de l'Action en matière de changement climatique



435, rue James sud Bureau 331 Thunder Bay ON P7E 6S7 Tél. : (807) 475-1617 Téléc.: (807) 475-1754

### June 26, 2018

### MEMORANDUM

- TO: Mike Landers Senior Environmental Officer Thunder Bay District Office
- FROM: Riffat Shamsi Hydrogeologist Northern Region Technical Support
- RE: 2017 Environmental Quality Monitoring Report Beardmore Landfill Municipality of Greenstone, Ontario

As requested, I have reviewed the groundwater related portions of the 2017 Environmental Quality Monitoring Report, Beardmore Landfill, Municipality of Greenstone, ON (the report), dated April 30, 2018 prepared by EXP Services Inc. (the consultants).

This report was prepared by the consultants in accordance with the Ministry of the Environment and Climate Change (MOECC) Amendment to Environmental Compliance Approval (ECA) No. A7249502 - Notice No. 1, issued February 8, 2017. This Notice forms part of the approval issued under Approval No. A7249502 dated July 15, 1979 and represents the initial monitoring carried out for the site prepared in compliance with the current ECA. It provides results of the 2017 monitoring program in the context of available historical results (from an initial hydrogeological evaluation) and applicable criteria. Analytical results for groundwater were compared to the MOECC's Ontario Drinking Water Standards (ODWS, from *Technical Support Document for Ontario Drinking Water Standards, Objectives and Guidelines, June 2003), as* well as to MOECC Guideline B-7 (which incorporates the Reasonable Use Guidelines) RUG and the MOECC's Aquatic Protection Values (APV's, from Appendix B2 of *Rationale for the Development of Soil and Groundwater Standards for Use at Contaminated Sites in Ontario,* April 2011).

### 1. Background (from the report)

The site is located just north of the community of Beardmore on the west side of Highway 11, approximately 400 m northwest of the Blackwater River, in the Municipality of Greenstone. Total area of site (including attenuation zone) is 22.4 ha with a landfilling area of 4.20ha. The site generally comprises three landforms. The landform of the main (south) part of the site, which includes the waste footprint, is sand and gravel glacio-fluvial outwash plain, with mainly low local relief. The northernmost edge of the site is located in an area that includes two landforms, namely till ground moraine deposits, and bedrock knobs. The topography of both of these landforms is described as undulating to rolling and ashed/reworked, again with mainly low local relief. Drainage of all three landforms is described as mixed wet and dry.

### 2. Hydrogeology (from the report)

There are six monitoring wells on and in the vicinity of the site, wells BH-G, BH-H and BH-I were installed in May 2017 in accordance with the ECA and wells BH-A, BH-C and BH-F were installed during the initial hydrogeological evaluation in 1991. Current and historical groundwater levels suggest groundwater flow is generally to the southeast, towards the Blackwater River. Based on the grain size analysis the estimated flow velocity within the silt ranged from about 2.3 x  $10^{-6}$  to  $4.0 \times 10^{-6}$  cm/s (0.8 m/yr to 1.3 m/yr), while the flow velocity within the sand and gravel to sand was much greater, ranging from about 9 x  $10^{-4}$  cm/s to 2.5 x  $10^{-3}$  cm/s (285 m/yr to 790 m/yr).

### 3. Report Review

Two groundwater monitoring/sampling events (May 18, 2017 and September 28, 2017) were completed during the period under review for all the wells.

### 3.1 Groundwater Monitoring

In compliance with MOECC regulations, the groundwater quality findings were referenced to the MOECC's Reasonable Use Guidelines (RUG) criteria defined using the methods outlined in the MOECC Guideline B-7.

The consultant presented the following findings regarding groundwater quality:

- The samples collected from the background groundwater sampling point, BH-I which is up-gradient of the landfill, was in exceedance of ODWS criterion for manganese. Current and historical results at this location are consistent and there are no apparent trends.
- At monitoring well BH-G in the southeast (downgradient) part of the identified waste footprint, ODWS criteria exceedances were reported for TDS, DOC, organic nitrogen, alkalinity, chloride, sulphate and manganese. The levels of all of these parameters, as well as several other parameters, were notably higher than in any of the other wells, reflecting leachate generation from the waste.
- Well BH-A is located due east of the waste footprint. This well was dry at the time of installation in 1990 and was also dry during the 2017 sampling events.
- Wells BH-H and BH-C are screened in sandy silt and sand and are situated a short distance southeast of the waste. BH-H is slightly closer to the waste (and to the source well), but the groundwater table at BH-H is at a higher elevation than at the source well. As a consequence, although BH-C is further away from the waste, it has levels of leachate indicators that are generally higher than at BH-H. In 2017, both wells had ODWS exceedances for organic nitrogen, but the only other ODWS exceedance was for DOC at BH-C (again, with a lower concentration than in the source well). Well BH-C is the only well of these two for which there are historical laboratory results.
- Well BH-F is a historical well located about 200 m from the Blackwater River, and is the furthest well downgradient of the landfill. Construction records for this well are not available. The only ODWS exceedance was for organic nitrogen. In general, levels of potential leachate indicator parameters are lower than in the other downgradient wells. Due to its location relatively near to the downgradient attenuation zone boundary, this well has been selected as a "trigger well", to assess whether contingency measures may need to be implemented to prevent unacceptable off-site impacts.

The water quality data was not collected from 1992 to 2016. Trends cannot be identified based on two years of data (1991 and 2017); however, now that regular water quality sampling is occurring, it will be possible to assess trends in a year or two. The changes in the parameters may be due to seasonal influences and can only be confirmed by additional monitoring.

### **Recommendations**

- 1. During the monitoring of the wells the temperature reading were not taken as specified in ECA. Temperature must be monitored and recorded in the field in the future.
- 2. It is recommended to continue the monitoring twice a year for all the wells in accordance with the amended ECA with one cycle of comprehensive parameters specified in schedule 5 of Reg. 232 and one cycle of indicator parameters.
- 3, BHA must be checked at each monitoring event and if water is observed it must be measured and sampled.
- 3. The exceedance in BH-G points to the formation of leachate but needs to be confirmed in the next monitoring events.
- 4. The analytical results indicate the maximum concentration as measured in the trigger well BH-F are below the APV and also below the calculated trigger levels for protection of the surface water quality. No surface water monitoring is required at this point.
- 5. In future All the electronic copies of the report sent to this office must be signed/stamped.

If you have any questions regarding the above comments and recommendations, please do not hesitate to contact me. The purpose of the preceding review is to provide advice to the Ministry of the Environment and Climate Change regarding matters pertaining to groundwater flow and chemistry, based on the information provided in the above referenced document(s). The conclusions, opinions, and recommendations of the reviewer are based on information provided by others, except where otherwise specifically noted; therefore, the Ministry cannot guarantee that the information is accurate or complete. A lack of specific comment by the reviewer is not to be construed as endorsing the content or views expressed in the material being reviewed.

Riffat Shamsi, P.Geo.

cc:Nelson, Leif Innis Shannon Regional File: GW 01 02 Beardmore Landfill

### **Ahileas Mitsopoulos**

Holenstein, Monika (MOECC) <monika.holenstein@ontario.ca></monika.holenstein@ontario.ca>
Thursday, December 08, 2016 5:43 PM
Ahileas Mitsopoulos
brian.aaltonen@greenstone.ca; Stajkowski, Drew (MOECC)
RE: Nakina Landfill - Initial Hydrogeological Evaluation

Hi Ahileas - you've been very patient! Sorry for the delays - crazy busy!

On the Geraldton site - I did get a verbal ok from our hydrogeologist and we concur the intent is for every 3 year reporting – next one due in 2019. I can give you something more formal on that from the District Manager in the New Year.

I have had a quick look at the Beardmore D and O plan and generally, it looks reasonable. A few specific comments:

- The service area should be specified. I assume the Municipality of Greenstone, but may want to include some additional surrounding townships?
- Should have a section on signage.
- The Plan does not contain too much detail on operating areas just south pit to be filled (estimated by January 2017), then north pit, then site closed.
- The operating plan should note that waste fill boundaries and final contours will be clearly marked and updated on an annual basis as needed.
- Litter Control section should outline what measures to be taken (i.e. snow fencing around working area, regular litter pick up, etc).
- Record Keeping section only requires records of industrial/commercial loads should also have residential loads.
- Should include more detailed information on operator training what will be included in the training (can get this from Longlac/Geraldton C of A's).
- In the burning of waste section operating plan should require an area be established for brush and clean waste only (no painted or treated wood) and signed to ensure only appropriate woodwaste is burned.
- The notes on Figures 7 and 8 (grading and waste placement) should make it into the text of the report in the appropriate sections as they provided detail on how the development/closure will occur.
- The last inspection noted: At the time of inspection, it was suggested to the municipality that this area could be better organized with signs clearly indicating where drained fridges/freezers were to be kept versus those still to be drained. Perhaps the Operating Plan should provide information on how the fridge/freezer area could be set up?

.

The MOECC hydrogeologist had previously commented: *I concur with the consultant's* recommendations regarding the size and location of the CAZ, as well as the recommendations for the monitoring program. The contingency plan provides a reasonable selection of contingency measures, but needs to be more specific on how contingency measures might be triggered. Specifically, a plan which references the monitoring program and applicable assessment criteria to establish trigger criteria for actions should be developed. With respect to the consultant's recommendations regarding cover for the final closure, the prescribed design may be warranted with respect to the current understanding of potential leachate impacts. However, a contingency which provides for a low permeability cap is needed if at closure (or beyond) the leachate concentrations increase to levels that are indicative of off-site impacts. It is recommended that the closure plan will need to be reviewed and details updated closer to the actual closure of the site."

I suggest you proceed with the ESR to increase the capacity. The current Certificate of Approval is clearly not appropriate for the current use at site and must be updated. Once in the ECA amendment process is underway, an updated D and O plan could be submitted and any final comments could be made at that time.

Please note as you proceed with ESR for improved capacity, that recent discussions with BZA (Rocky Bay) and the Department of Indigenous and Northern Affairs indicated that there is some interest in BZA to bring waste from that community to the Beardmore site.

Again, sorry for the delay,

Monika

Monika Holenstein Sr. Environmental Officer Thunder Bay District Ministry of the Environment and Climate Change 435 James St. S., Suite 331 Thunder Bay, Ontario P7E 6S7 (807)475-1699 E-mail: Monika.Holenstein@ontario.ca

From: Ahileas Mitsopoulos [mailto:ahileas.mitsopoulos@exp.com]
Sent: December 08, 2016 11:44 AM
To: Holenstein, Monika (MOECC)
Subject: RE: Nakina Landfill - Initial Hydrogeological Evaluation

Hi Monika,

Just wanted to follow-up again about this, as well as the clarification/issues at the Geraldton LF and Beardmore LF $_{
m s}$ 

As a reminder,

Geraldton LF - ECA indicates report due in March 2017 but we provided a report in March/April 2016 for a three year period (2013, 2014 and 2015). We suspect the ECA intended March 2016. Please confirm that the next monitoring report for the Geraldton LF is due March 2019 (for the years 2016, 2017 and 2018).

Beardmore LF – The Beardmore LF likely reached 90% capacity in mid 2016. As such, a Closure Plan needs to be started but we discussed that **exp** would prepare an Environmental Screening Report to increase the capacity of the landfill to 100,000 m3. To do this we are still waiting for comments on the revised draft D&O Plan which was submitted in February 2016.

Thank you,

### Ahileas Mitsopoulos, P.Eng. | exp

Project Engineer **exp** Services Inc. t: +1.807.623.9495 x223 | m: +1.807.620.6306 | e: <u>Ahileas.Mitsopoulos@exp.com</u> 1142 Roland Street Thunder Bay, ON P7B 5M4 CANADA *exp.com* | *legal disclaimer keep it green, read from the screen* 

From: Ahileas Mitsopoulos
Sent: Monday, November 28, 2016 10:20 AM
To: 'Holenstein, Monika (MOECC)' <<u>Monika.Holenstein@ontario.ca</u>>
Cc: 'Stajkowski, Drew (MOECC)' <<u>Drew.Stajkowski@ontario.ca</u>>; 'Brian Aaltonen' <<u>brian.aaltonen@greenstone.ca</u>>;
Demetri Georgiou <<u>demetri.georgiou@exp.com</u>>; Rob Rinne <<u>Rob.Rinne@exp.com</u>>; 'Katherine Alton'
<<u>katherine.alton@greenstone.ca</u>>
Subject: RE: Nakina Landfill - Initial Hydrogeological Evaluation

Hi Monika,

Just wanted to follow-up on this. Any word?

Thank you,

### Ahileas Mitsopoulos, P.Eng. | exp

Project Engineer **exp** Services Inc. t: +1.807.623.9495 x223 | m: +1.807.620.6306 | e: <u>Ahileas.Mitsopoulos@exp.com</u> 1142 Roland Street Thunder Bay, ON P7B 5M4 CANADA *exp com* | *legal disclaimer keep it green, read from the screen* 

From: Ahileas Mitsopoulos
Sent: Monday, November 14, 2016 11:58 AM
To: 'Holenstein, Monika (MOECC)' <<u>Monika.Holenstein@ontario.ca</u>>
Cc: Stajkowski, Drew (MOECC) <<u>Drew.Stajkowski@ontario.ca</u>>; Brian Aaltonen <<u>brian.aaltonen@greenstone.ca</u>>;
Demetri Georgiou <<u>demetri.georgiou@exp.com</u>>; Rob Rinne <<u>Rob.Rinne@exp.com</u>>; 'Katherine Alton'<<<u>katherine.alton@greenstone.ca</u>>
Subject: RE: Nakina Landfill - Initial Hydrogeological Evaluation
Importance: High

Hi Monika,

Based on the comments below regarding the Initial Hydrogeological Evaluation of the Nakina Landfill, we conducted our first sampling event this fall at the landfill.

In the Initial Hydrogeological Evaluation, we recommended that the monitoring report be submitted after three years of sampling (i.e. six sampling events) with the first sampling event being conducted in the spring of 2015, as such the report would be submitted by April 2018. Since the first round of sampling was conducted in the fall 2016, we request that the first monitoring report be submitted by April 2019. This would allow 2.5 years of sampling (5 sampling events) rather than 1.5 years of sampling (3 sampling events) if the report is due April 2018 (originally proposed date).

Please advise if the first monitoring report submitted by April 2019 is acceptable.

Thank you,

Ahileas Mitsopoulos, P.Eng. | exp

Project Engineer **exp** Services Inc. t: +1.807.623.9495 x223 | m: +1.807.620.6306 | e: <u>Ahileas.Mitsopoulos@exp.com</u> 1142 Roland Street Thunder Bay, ON P7B 5M4 CANADA *exp com* | *legal disclaimer keep it green, read from the screen* 

From: Holenstein, Monika (MOECC) [mailto:Monika.Holenstein@ontario.ca]
Sent: Monday, October 17, 2016 2:12 PM
To: Brian Aaltonen <<u>brian.aaltonen@greenstone.ca</u>>; Ahileas Mitsopoulos <<u>ahileas.mitsopoulos@exp.com</u>>
Cc: Stajkowski, Drew (MOECC) <<u>Drew.Stajkowski@ontario.ca</u>>
Subject: FW: Nakina Landfill - Initial Hydrogeological Evaluation

Brian, Ahileas

Below find the comments from the MOECC Hydrogeologist regarding the Initial Hydrogeological Evaluation – Nakina Landfill. No comments yet from MOECC Approvals Branch on the theoretical capacity work, but hopefully the application to amend ECA can move ahead....

Monika

Monika Holenstein Sr. Environmental Officer Thunder Bay District Ministry of the Environment and Climate Change 435 James St. S., Suite 331 Thunder Bay, Ontario P7E 6S7 (807)475-1699 E-mail: <u>Monika.Holenstein@ontario.ca</u>

From: Haslam, Simon (MOECC)
Sent: September 22, 2016 4:25 PM
To: Holenstein, Monika (MOECC)
Subject: Nakina Landfill - Initial Hydrogeological Evaluation

### Ms. Holenstein,

I have completed a preliminary review of the groundwater-related portions of the report prepared by exp Services Inc., "Municipality of Greenstone – Initial Hydrogeological Evaluation – Nakina Landfill – Nakina, Ontario," dated March 16, 2015. In general the report is reasonable and I am in agreement with the proposed actions moving forward. It is apparent that the site is not currently in compliance with Guideline B-7 ("Incorporation of the Reasonable Use Concept into MOEE Groundwater Management Activities", dated April 1994, as amended). However, the consultant has made recommendations to attempt to bring the site into compliance, which involves expansion of the contaminant attenuation zone (CAZ). Based on the initial evaluation, the consultant has provided the following recommendations.

- 1. Consideration of installation of an additional monitoring well in the future should monitoring results suggest the need.
- 2. Establishment of a surface water sampling location in the unnamed lake within the proposed CAZ.
- 3. Twice annual sampling of 5 monitoring wells and the surface water location with analyses for the Schedule 5 comprehensive list of parameters.
- 4. Submission of a monitoring report to the Ministry of the Environment and Climate Change (MOECC) once every 3 (three) years, with the first report due by April 30, 2018.
- 5. Reassessment of the monitoring program after 3 (three) full years of data have been obtained.
- 6. Future reports should include an assessment of compliance with Guideline B-7.

I concur with all of these recommendations. I note that since there is a surface water receiver within the proposed CAZ, it will be necessary to assess impacts to surface water using appropriate guidelines. Such an assessment, with appropriate guidelines, should be provided in future monitoring reports.

The proposed contingency plan appears reasonable. The consultant notes that the plan will be updated as additional monitoring results are collected and analysed. This method is reasonable and I suggest that a revised contingency plan be provided and assessed in the next monitoring report.

In summary:

- The site is not currently in compliance with Guideline B-7.
- The consultant has recommended actions to bring the site into compliance, including a proposed CAZ expansion.
- I provide the following recommendations related to groundwater:
  - The proposed CAZ expansion should be pursued and finalized as soon as is reasonable to attempt to bring the site into compliance with Guideline B-7.
  - The recommendations proposed by the consultant shall be implemented as soon as is reasonable, including twice annual monitoring and reporting once every 3 (three) years, with the first report due to the MOECC by April 30, 2018.
  - Appropriate guidelines shall be included in all future monitoring reports to assess potential impacts to the surface water receiver within the proposed CAZ expansion.
  - A revised contingency plan shall be provided and assessed in the next monitoring report.

If you have any questions regarding the above comments and recommendations, do not hesitate to contact the undersigned. The purpose of the preceding review is to provide advice to the MOECC regarding groundwater conditions based on the information provided in the above referenced documents. The conclusions, opinions and recommendations of the reviewer are based on the information provided by others, except where otherwise specifically noted. The MOECC cannot guarantee that the information that has been provided by others is accurate or complete. A lack of specific comment by the reviewer is not to be construed as endorsing the content or views expressed in the reviewed material.

Sincerely, Simon **Simon R. Haslam, MASc, P.Eng.** | Regional Hydrogeologist | 807.475.1428 | Ontario Ministry of the Environment and Climate Change | Northern Region Technical Support



Ministry of the Environment and Climate Change Ministère de l'Environnement et de l'Action en matière de changement climatique

### Solid Non-Hazardous Waste Disposal Site Inspection Report

Client:	The Corporation of the Municipality of Greenstone Mailing Address: 1800 Main St, Post Office Box, 70, Geraldton, Ontario, Canada, POT 1M0 Physical Address: 1800 Main St Geraldton, Greenstone, Municipality, District of Thunder Bay, Ontario, Canada, POT 1M0 Telephone: (807)854-1100, Extension: 2060, FAX: (807)854-1150, email: brian.aaltonen@greenstone.ca Client #: 0380-4TKQAV, Client Type: Municipal Government, NAICS: 913910 Additional Address Info: Geraldton Beardmore Waste Disposal Site Address: North of Mining Claim TB 10597 Twp of Summer Municipality of Greenstone, Greenstone, Municipality, District of Thunder Bay District Office: Thunder Bay - District Site #: 8237-6YSLW2			
Inspection Site Address:				
Contact Name:	John Fendley	Title:	Operations Foreman	
Contact Telephone:	(807)854-8637 ext	Contact Fax:		
Last Inspection Date:	2011/05/16			
Inspection Start Date:	2017/06/19	Inspection Finish Date:	2017/07/06	
Region:	Northern			

### 1.0 INTRODUCTION

The community of Beardmore is located on Highway 11 on the eastern edge of the Municipality of Greenstone, approximately 150 km north east of Thunder Bay. Beardmore became part of the Municipality of Greenstone in 2001 through an amalgamation, which joined the communities of Geraldton, Longlac, Nakina, and Beardmore. Beardmore has a population of approximately 250 people. The waste disposal site appears to have been established in the 1960's, with the last Certificate of Approval for the site issued in 1975. The waste disposal site is located just north of the community on the west side of Highway 11, approximately 500 metres north of the Blackwater River.

The 2011 inspection of the Beardmore site required a number of actions to bring the site into full compliance. Progress was documented and the site has made improvements to the operation of the site and in June, 2015, an application to amend the Certificate of Approval, to reflect the current operation and expand the site capacity, was submitted to the Ministry of Environment and Climate Change (MOECC). The Site received the Notice 1 to the Environmental Compliance Approval #A7249502 on February 8, 2017.

The purpose of this inspection was to assess compliance with Ministry of Environment legislation,

specifically the Environmental Compliance Approval, Regulation 347 and the waste management provisions of the Environmental Protection Act. The inspection consisted of a review of files and reports, as well as a site visit on June 19, 2017, accompanied by John Findley and Kim Brunet of the Municipality of Greenstone.

### 2.0 INSPECTION OBSERVATIONS

### **Certificate of Approval Number(s):**

Environmental Compliance Approval (ECA) # A7249502 issued July 15, 1979 and the Environmental Compliance Approval Amendment Notice 1 issued on February 8, 2017 for a landfill located at: North of Mining ClaimTB10597, Township of Summer, District of Thunder Bay. The Amendment Notice 1 allowed for an expansion of the fill area from 2 ha to 4.2 ha (with a corresponding volume increase of 40,000 m3 to a total of 89,300 m3), this resolved the fill beyond approved boundaries issue, and brought the site into compliance by ensuring that all historic and future waste placement is within the approved boundaries. In addition, the amendment designated a 18.2 ha contaminant attenuation zone located downgradient of the fill area which needs to be completed by September 30 2017 as in accordance of Section 4 of Regulation 232.

### 2.1 FINANCIAL ASSURANCE:

### Specifics:

The MOECC does not require Financial Assurance for waste disposal sites owned and operated by Municipal governments.

### 2.2 APPROVED AREA OF THE SITE:

### **Specifics:**

The newly approved ECA has an operating 4.20 Ha landfill site within a total site area of 22.40 Ha

### 2.3 APPROVED CAPACITY:

### Specifics:

During the 2011 investigation, the estimated total volume of waste and interim cover material placed on the site was 76,000 m3. This exceeds the theoretical approved capacity of 49,300 m3. Therefore the Municipality applied to increase the approved landfill volume which would allow the operation to continue. The approval now states the site capacity is approved for 89,300 m3. **ACCESS CONTROL**:

### 2.4 ACCESS CO

### Specifics:

Access to the site is controlled by a locked gate which is only opened when an attendant is on duty. Since the last inspection, Beardmore Public Works staff have implemented a policy that keys will not be provided to any contractors using the site. Instead, municipal staff will meet contractors at the site to open the gate.

The attendant is also required to maintain a log book to record the types and quantities of wastes delivered to the site and to make note of any unusual occurrences at the site.



### 2.5 COVER MATERIAL:

### Specifics:

The newly adopted practice for the site is to cover the waste at the end of the day for each day the site is open (Monday, Wednesday, Friday and Saturday).

### 2.6 WASTE BURNING:

### Specifics:

There was no evidence of burning wood waste at the time of inspection. Noted was a small pile of brush being segregated to burn in the fall. There is also another location where "other wood- not clean wood" gets deposited as waste. This waste does not get covered as frequently as there are minimal chance of vermin and wind throw.



### 2.7 GROUNDWATER/SURFACEWATER IMPACT:

### **Specifics:**

As part of the approval that amended the current ECA, the contamination attenuation zone (CAZ) is to be established, as per section 4 of regulation 232, which will extend down gradient to the Blackwater River, with an area of 18.2 hectares. This CAZ has been estimated based on the loading and attenuation estimates from the 1991 hydrogeological study. It is understood that the lands for the CAZ will need to be obtained from the MNRF.

In addition to the CAZ, a groundwater monitoring program has been established. The monitoring program includes existing wells BH-C and BH-F; and the three new wells (source, background, and down gradient) which were installed May are included in the program. Sampling twice each year (spring and fall) with samples analysed for the comprehensive parameter list from Schedule 5 of the MOECC''s Landfill Standards for one sampling event each year, and for the indicator list the other sampling event.

The Design and Operations Plan also includes a contingency plan. The plan states that if "adverse levels of leachate impact" are confirmed, then actions will be taken. A list of potential contingency measures that would be considered is presented, including moving waste, lowering the water table, improved cover, improved drainage, expansion of the CAZ, restriction on waste volumes, leachate control system, or closure

The MOECC has reviewed the relevant groundwater sections provided in the Application to Amend the Certificate of Approval and has provided the following comments: "I concur with the consultant's recommendations regarding the size and location of the CAZ, as well as the recommendations for the monitoring program. The contingency plan provides a reasonable selection of contingency measures, but needs to be more specific on how contingency measures might be triggered. Specifically, a plan which references the monitoring program and applicable assessment criteria to establish trigger criteria for actions should be developed. With respect to the consultant's recommendations regarding cover for the final closure, the prescribed design may be warranted with respect to the current understanding of potential leachate impacts. However, a contingency which provides for a low permeability cap is needed if at closure (or beyond) the leachate concentrations increase to levels that are indicative of off-site impacts. It is recommended that the closure plan will need to be reviewed and details updated closer to the actual closure of the site."



Newly constructed well 2.8 LEACHATE CONTROL SYSTEM:

### Specifics:

There is no Leachate Control System required at this site. The site is considered to be naturally attenuating, and a large attenuation zone has been proposed as part of the amendments to the Certificate of Approval currently before the MOECC. The Design and operation Plan for the site

does speak of Leachate control if adverse affects are noted in the sampling program.

#### 2.9 METHANE GAS CONTROL SYSTEM:

### **Specifics:**

There is no requirement for a Methane Gas Control System at this site due to its small size. The production of significant amounts of Methane Gas is not anticipated.

#### OTHER WASTES: 2.10

### Specifics:

The site is organized with a number of areas for specific waste types:

- 1. The brush waste area which only accepts "clean wood";
- 2. The wood waste area accepts both treated and contaminated wood waste;
- 3. There is an area for fridges/freezers. The municipality periodically hires a licensed technician to come to the site and drain the refrigerants. The fridges and freezers get drained a few days in advance of the metal recycling company (Dutchak) arriving to the site.
- 4. There is a shipping container to collect electronic wastes. (Pack Pro)
- 5. The municipality periodically holds household hazardous waste days to allow area residents to dispose of household hazardous wastes.
- 6. There is a general scrap metal area. Scrap metal is removed by Duchak Recycling at a minimum, within the entire Municipality, every 6 months. At the time of inspection there were no refrigerants noted in the general scrap metal pile.
- 7. Tire storage location. Recycling company from Thunder Bay picks up within the entire Municipality yearly.



E waste

used tires

Refridgerants

#### **REVIEW OF PREVIOUS NON-COMPLIANCE ISSUES** 3.0

The previous non-compliance issue identified in the 2015 inspection was related to amending the ECA. This has been completed and the ECA was issued February 8, 2017.

#### SUMMARY OF INSPECTION FINDINGS (HEALTH/ENVIRONMENTAL IMPACT) 4.0

Was there any indication of a known or anticipated human health impact during the inspection and/or review

of relevant material, related to this Ministry's mandate? No

### **Specifics:**

Was there any indication of a known or anticipated environmental impact during the inspection and/or review of relevant material ?

### Specifics:

Was there any indication of a known or suspected violation of a legal requirement during the inspection and/or review of relevant material which could cause a human health impact or environmental impairment ? No

### **Specifics:**

Was there any indication of a potential for environmental impairment during the inspection and/or the review of relevant material ? No

### **Specifics:**

Was there any indication of minor administrative non-compliance?

### **Specifics:**

Staff are trained on the administrative and working operations of the waste disposal site.

### 5.0 ACTION(S) REQUIRED

There were no required actions identified at the time of inspection

### 6.0 OTHER INSPECTION FINDINGS

The New ECA has a few administrative components.

- One is to have documentation/recording system in place on site for complaints. The current practice is to forward complaints to the Greenstone main office in Geraldton. Bob Gendreau Manager of Public Works will forward documentation to the Beardmore WDS for future use. This will satisfy condition 40 in the ECA.
- Hours of operation have changed at the location to maintain consistency between winter and summer hours. The ECA allows for this administrative change with a letter to the District Manager advising of the change. A letter will be sent shortly to identify the change of summer hours to 1200 Noon - 5:00 PM (Monday, Wednesday, Fridays) and 11 AM - 500 PM on Saturdays. This relates to one hour earlier then previously approved. This will satisfy condition 23 of the ECA.

### 7.0 INCIDENT REPORT

Not Applicable

### 8.0 ATTACHMENTS

PREPARED BY: Environmental Officer: Name: District Office: Date: Signature

.....

Mike Landers IEB Thunder Bay District 2017/07/06

REVIEWED BY: District Supervisor: Name: District Office: Date:

Drew Stajkowski Thunder Bay District Office 2017/07/17

Signature:

File Storage Number:

**TB BE SU 610** 

Note:

"This inspection report does not in any way suggest that there is or has been compliance with applicable legislation and regulations as they may apply to this facility. It is, and remains, the responsibility of the owner and/or the operating authority to ensure compliance with all applicable legislative and regulatory requirements"

Ministry of the Environment 435 James Street South Suite 331 Thunder Bay, ON P7E 657 ilstère de l'Environnement sois rue James aud Bureau 331 Thunder Bay, ON P7E 6S7



Fax: (807) 475-1754 Direct Line: (807) 475-1218

August 4, 2009

### MEMORANDUM:

- TO: Monika Holenstein Senior Environmental Officer Thunder Bay District Office
- FROM: Alisdair Brown Regional Hydrogeologist Technical Support Section, Northern Region
- RE: GROUNDWATER MONITORING MUNICIPAL WASTE DISPOSAL SITE BEARDMORE, ONTARIO

As requested, I have reviewed the hydrogeological study prepared by Trow Consulting Engineers Ltd. entitled "Hydrogeological Study for the Beardmore Landfill" dated March, 1991. In support of this review, I accompanied you on a site visit on July 29, 2009.

The hydrogeological study was prepared in 1991, and the water quality data provided is unlikely to reflect current conditions. In 1991, Trow installed five monitoring wells at the site. However, based on our site visit, it would appear that at least two of those wells have since been lost to the filling operations at the site. The three wells understood to remain are BH-A, BH-D, and BH-C, which are all located on the down gradient side of the waste disposal site, along the anticipated migration pathway from the waste disposal site to the Blackwater River. Based on current information, the Blackwater River is the most likely sensitive down gradient receptor.

In the 1991 hydrogeological study, using hypothetical dilution rates, Trow calculated the required down gradient attenuation zone for the site based on the concentration of key contaminants. Based on these calculations, Trow recommended an attenuation zone extending from the WDS all the way to the bank of the River.

It is my understanding that groundwater monitoring has not been undertaken at the site for several years, nor has the attenuation zone recommended by Trow been put in place.

Based on the currently available data, I recommend that the municipality needs to resume a groundwater monitoring program at this site. It is recommended that the three existing wells should be sampled twice this year – once this summer and again in the fall. Sampling should be done in accordance with the sampling protocols described in the Ministry of Environment's publication "Guidance on Sampling and Analytical Methods for Use at Contaminated Sites in Ontario", December 1996. Samples should be submitted for analysis to a certified environmental analytical laboratory for the parameters specified in Column 2 of Schedule 5 in the Ministry of Environment's "Landfill Standards: A Guideline on the Regulatory and Approval Regulrements for New or Expanding Landfilling Sites" May 1998. Upon completion of both rounds of sampling, the analytical results should be submitted to the MOE's Thunder Bay District Office.

In addition to the sampling program, it is recommended that the Municipality should establish an attenuation zone as recommended by Trow, extending to the bank of the Blackwater River. The purpose of the Blackwater River would be to limit the development of groundwater resources between the waste disposal site and the river. This generally can be done through either the municipality's ownership of these lands, or through restrictions on title to these lands. With If you have any questions regarding the above comments and recommendations, do not hesitate to contact me. The purpose of the preceding review is to provide advice to the Ministry of the Environment regarding groundwater conditions based on the information provided in the above referenced documents. The conclusions, opinions and recommendations of the reviewer are based on information provided by others, except where otherwise specifically noted. The Ministry cannot guarantee that the information that has been provided by others is accurate or complete. A lack of specific comment by the reviewer is not to be construed as endorsing the content or views expressed in the reviewed material.

Alisdair Brown, P.Eng. Regional Hydrogeologist

c.c. Regional File: TB BE SU 410

U:lgw reviews/municipal landfills/beardmore wds jul 30 09.doc

Municipality of Greenstone 2020 Environmental Quality Monitoring Report Beardmore Landfill, Municipality of Greenstone, ON EXP Project Number: THB-00011174-IE April 22, 2021

**APPENDIX B – Figures** 



Municipality of Greenstone 2020 Environmental Quality Monitoring Report Beardmore Landfill, Municipality of Greenstone, ON EXP Project Number: THB-00011174-IE April 22, 2021

### **LIST OF FIGURES**

- Figure 1: Site Location Plan
- Figure 2: Monitoring Well Location Plan and Attenuation Zone
- Figure 3: Monitoring Well Location Plan
- Figure 4: Groundwater Contour Plan
- Figure 5: Waste Filling Conceptual Site Plan Year 2027
- Figure 6A: Stratigraphic Section A-A
- Figure 6B: Stratigraphic Section B-B














- 1) AFTER BACKFILLING THE EXISTING SOUTH PIT AND NORTH PIT IS COMPLETE (FILLED IN 2020), A WASTE FILL PILE IS TO BE USED FOR THE WASTE STORAGE. THE BASE DIMENSIONS OF THE WASTE FILL PILE ARE 10 m x 40 m x 2 m IN HEIGHT. BERMS ARE TO BE MADE ON ALL FOUR SIDES OF THE WASTE FILL PILE. THE BERMS ARE TO BE SLOPED AT ABOUT 1H:1V (1 HORIZONTAL TO 1 VERTICAL) AND BE ABOUT 2 m HIGH. THE DIMENSIONS OF THE WASTE FILL PILE WITH THE BERMS IS 14 m x 44 m, AND THE TOTAL VOLUME OF THE WASTE FILL PILE IS ABOUT 1,230 m<sup>3</sup>.
- 2) A TOTAL OF TWELVE (12) WASTE FILL PILES ARE Í INCLUDED IN THIS STÀGÉ, WHICH WILL REPRESENT A TOTAL VOLUME OF 14,800 m<sup>3</sup>. AT A RATE OF 1,500 m<sup>3</sup>/yr, THE TWELVE (12) WASTE FILL PILES SHOULD BE FILLED N 2027.
- 3) THE WASTE FILL PILES SHOULD BE CONSTRUCTED ONE AT A TIME, AND THE BERMS OF THE THE NEXT PILE SHOULD BE CONSTRUCTED WHEN THE CURRENT PILE IS ABOUT 80% FULL.
- 4) THE EXISTING FILL PILE LOCATED AT THE NORTHWEST PART OF THE SITE SHOULD BE REMOVED/RELOCATED PRIOR TO CONSTRUCTING THE WASTE FILL PILES AT THAT LOCATION.
- 5) TARGET MARKERS INDICATING LOCATION AND ELEVATION SHOULD BE INSTALLED IN THE FIELD ALONG THE INDICATED CONTOUR LINES.



LEGEND: 	GROUND ELEVATION CONTOUR (SEPTEMBER 2020) IN METRES	<u>NO</u>	TES:	*exp.
	PIT BOUNDARY	1.	REFERENCE: BASE PLAN (2020 TOPOGRAPHY SURVEY) PROVIDED	
$\boxtimes$	WASTE FILL PILE FILLED AT THE END OF DEC. 2020	2.	ELEVATION CONTOURS ARE IN METRES.	WASTE FILLI
$\times \times \times$	WASTE FILL PILE TO BE FILLED BY YEAR 2030			2020
	BASE OF WASTE FILL PILE			1UM



#### NOTES:

1) REFERENCE: BASE PLAN PROVIDED BY DELTA SURVEY INC, DATED SEPTEMBER 11, 2020. 2011 AND 2015 GROUND SURFACE ELEVATIONS ARE BASED ON DELTA SURVEY'S 2011 AND 2015 SURVEY PLAN. 2) MONITORING WELLS BH-A, BH-C, BH-F WERE INSTALLED IN 1990 AND 1991, AND MONITORING WELLS BH-G, BH-H AND BH-I WERE INSTALLED IN MAY 2017.

3) TEST PITS TP1 TO TP22 WERE ADVANCED IN OCTOBER 2011.

- 4) GROUNDWATER LEVELS OBTAINED ON SEPTEMBER 22, 2020.
- 5) SEE FIGURE 3 FOR SECTION LOCATION.
- 6) BOREHOLES / MONITORING WELLS AND TEST PITS NOT DIRECTLY ON THE SECTION LINE ARE
- PROJECTED PERPENDICULAR TO THE SECTION LINE.

LEGEND:

- BH-C 306.48 MONITORING WELL LOCATION
  - GROUND SURFACE ELEVATION IN METRES
- TP4 306.63 HISTORICAL TEST PIT LOCATION (2011) GROUND SURFACE ELEVATION IN METRES
- $\overline{\Delta}$ **GROUNDWATER ELEVATION - SEPTEMBER 22, 2020**

*eyn				FIGURE
	Th	under Bay	, Ontario	6A
		PROJECT NO .:	THB-0001	1174-IE
STRATIGRAPHIC SECTION A-A		SCALE:	1:1000H /	1:100V
2020 GROUNDWATER MONITORING		DRAWN BY:	MS	
BEARDMORE LANDFILL		CHECKED BY:	AM	
MUNICIPALITY OF GREENSTONE		DATE:	April 13, 2	021



# **APPENDIX C – Borehole Logs and Grain Size Curves**



# SYMBOLS AND TERMS USED ON THE BOREHOLE AND TEST PIT RECORDS

# SOIL DESCRIPTION

Behavioural properties (i.e. plasticity, permeability) take precedence over particle gradation in describing soils.

Terminology describing soil structure:

Desiccated	-	having visible signs of weathering by oxidization of clay minerals, shrinkage cracks, etc.
Fissured	-	having cracks, and hence a blocky structure
Varved	-	composed of regular alternating layers of silt and clay
Stratified	-	composed of alternating layers of different soil types, e.g. silt and sand or slit and clay
Well Graded	-	having wide range in grain sizes and substantial amounts of all intermediate particle sizes.
Uniformly Graded	-	predominantly of one grain size.

Terminology used for describing soil strata based upon the proportion of individual particle sizes present:

less than 10%
10-20%
20-35%
35-50%

The standard terminology to describe cohesionless soils includes the relative density, as determined by laboratory test or by the Standard Penetration Test 'N' – value: the number of blows of 140 pound (64kg) hammer falling 30 inches (760mm), required to drive a 2 inch (50.8mm) O.D. split spoon sample one foot (305mm) into the soil.

Relative Density	'N' Value	Relative Density %
Very Loose	<4	<15
Loose	4-10	15-35
Compact	10-30	35-65
Dense	30-50	65-85
Very Dense	>50	>85

The standard terminology to describe cohesive soils includes the consistency, which is based on undrained shear strength as measured by insitu vane tests, penetrometer tests, unconfined compression tests, or occasionally by standard penetration tests.

Consistency	Undrained SI	'N' Value	
	kips/sq.ft.	kPa	
Very Soft	<0.25	<12.5	<2
Soft	0.25-0.5	12.5-25	2-4
Firm	0.5-1.0	25-50	4-8
Stiff	1.0-2.0	50-100	8-15
Very Stiff	2.0-4.0	100-200	15-30
Hard	>4.0	>200	>30

\*ехр.

# SYMBOLS AND TERMS CONTINUED

# STRATA PLOT



Boulders

**SAMPLES** 

SS...

ST...

PS...



Sand



Silt

Clay





Bedrock



Sedimentary

Bedrock

Metamorphic Bedrock

WATER LEVEL MEASUREMENT

Split spoon sample

penetration test)

Piston sample

(obtained by performing the standard

Shelby tube or thin wall tube



Standpipe



# BS... Bulk sample WS... Wash sample RC... Rock core AXT, BXL. etc... Rock core samples obtained with the use of standard diamond drilling bits.

# **OTHER TESTS**

- G... Specific gravity
- H... Hydrometer analysis
- S... Sieve analysis
- γ Unit weight
- C.... Consolidation
- CD... Consolidated drained triaxial

# **ROCK DESCRIPTION**

CU	Consolidated undrained triaxial with pore pressure measurements
UU	Unconsolidated undrained triaxial
DS	Direct shear
P	Field permeability

The description of bedrock is based on the rock quality designation (RQD). The classification is based on a modified core recovery percentage in which all pieces of sound core over 100mm long are counted as recovery. The smaller pieces are considered to be due to close shearing, jointing, faulting, or weathering in the rock mass and are not counted. In most cases RQD is run on NXL core; however, it can be used on different core sizes if the bulk of the fractures caused by drilling stresses are easily distinguishable from normal insitu fractures.

RQD	ROCK QUALITY
90-100	Excellent, intact, very sound
75-90	Good, massive, moderately jointed or sound
50-75	Fair, blocky and seamy, fractured
25-50	Poor, shattered and very seamy or blocky, severely fractured
0-25	Very poor, crushed, very severely fractured



Beardmore Landfill Site Boreho				ced No	vember 7,	BOREHOLE No. 90211-A				
Towns	hip of Be	ardmore	Water level mea	sured	November	Project No: F-90211-A/G				
CME-	45 Drill U	nit			1.222			ELEVATION 308	3.23 (m)	
SAMP	LE TYPE	SHELBY TUBE GRAB	AUGER	-	SF	T SAMPLE	Line A		CORE RE	COVERY
DEPTH (m)	USC	SOIL DESCRIPTIO	N	SAMPLE TYPE SAMPLE NO	0.6 20 PLASTIC	40 50 40 50 M.C.	2.4 80 LIQUID	Сомі	MENTS	DEPTH (ft)
0.0		SAND - brown, fine to medium or rootlets, very loose.	grain, some	1			Co	ncrete	1	0.0
-1.0		– some pebbles. –moist.		2			<b>Be</b> l	tonite		-2.0
-		— brown to grey, trace of silt to compact.	, loose	3						-4.0 - -6.0
-2.0		— fine to large grain, silty, gr few small pebbles, compact.	ey, a	4						-
-		- fine, grey, compact, some	silt.	5				514 		-8.0
-3.0		—fine to medium grain, a few pebbles, compact.	rocks and	6			Ottav	va Sand		-10.0 - -12.0
-4.0	14 14 14 14 14 14 14 14 14 14 14 14 14 1	— gravelly, grey, fine to mediu	ım qrain,	7						 14.0
-5.0	0	moist, dense.		8						-16.0
-6.0	0. e. 0	BEDROCK— shale, trace to some brown, wet, dense to very den END OF BOREHOLE — 6.0 m (19.	sand, se/	9			88/9.			-20.0
7.0		NOTES: 1) Well installed to 4.35 m (14.3 2) Top of well at elevation 309.88 3) 1.5 m of screen installed.	ft.). 3 m.							-22.0
1.0 [		Trow Ontario Itd			COMPLETIO	N DEPTH 6	0 m	COMPLE	TF	_
		Thunder Ray Onter	io	H	DGGED RY	' RM	 Tr	WG NO 1	Page	of 1
		munuel Day, Untar	10		LUGGLU BI	DIAI		TIO NU.1	Fode	ULL

Towards of Reardman       Boreface Advanced November 8, 1990.       Project Nor-PointA/G         CME-AS Drill Unit       CRAWLE TIPE       SHLEP TUBE       COMMENTS       COMMENTS         E       USC       SOIL       Sole for the sole of the sole	Beardmore Landfill Site Water Level Mearsure					November	- 26, 1990.		BOREHOLE No. 90211-C		
LELARIA TURE         COMPLET TYPE         SHELPY TURE         COMPLET TYPE         SHELPY TURE         COMPLET TYPE         SHELPY TURE         COMPLET TYPE         COMPLET TO N	Towns	hip of Be	eardmore	Borehole Advan	ced No	vember 8,	1990.		Project No: F-90211-A/G		
SMAPLE TYPE       SHELPT THE       GRAG       GARGE       GRAGE       COMMENTS         E       USC       SOIL       SOIL       Compare total total       Compare total total       Compare total total         C0       DESCRIPTION       SS       Pactice       Account of the send       Compare total total       Comments	CME-	45 Drill L	Init		_				ELEVATION 306.6	52 (m)	
SOIL       SOIL       Soil       Soil       Soil       Soil       COMMENTS         Correction       DESCRIPTION       Correction       Correction       Comment       Comment <td< td=""><td>SAMP</td><td>LE TYPE</td><td>SHELBY TUBE GRAB</td><td>AUGER</td><td></td><td>SF</td><td>T SAMPLE</td><td></td><td></td><td>CORE RECOV</td><td>VERY</td></td<>	SAMP	LE TYPE	SHELBY TUBE GRAB	AUGER		SF	T SAMPLE			CORE RECOV	VERY
CO         IOPSOIL - 3 In, brown, notlet, leaves.         20         40         60         60         0.0           SAND - grey to brown, fine to medium grain, errors, loss, brown, famp, stiff, trace of sill, brown, damp, stiff, trace of sill, frown.         1         - </td <td>DEPTH (m)</td> <td>USC</td> <td>SOIL DESCRIPTIO</td> <td>N</td> <td>SAMPLE TYPE SAMPLE NO</td> <td>20 PLASTIC</td> <td>ear Strengtn – 0.8 1.2 ■ N Value ■ 40 60 M.C.</td> <td>kst A 1.6 80 Liquid</td> <td>Соммі</td> <td>INTS</td> <td>DEPTH (ft)</td>	DEPTH (m)	USC	SOIL DESCRIPTIO	N	SAMPLE TYPE SAMPLE NO	20 PLASTIC	ear Strengtn – 0.8 1.2 ■ N Value ■ 40 60 M.C.	kst A 1.6 80 Liquid	Соммі	INTS	DEPTH (ft)
Control       Contro       Control       Control	00	1.24	TOPSOIL - 3 in brown rootlat	laguas		20	40 60	80	1 ISAN	VA/	0.0
Trow Ontario Ltd. COMPLETION DEPTH 6.7 m COMPLETE			<ul> <li>IOPSOIL - 3 in., brown, rootlet, SAND - grey to brown, fine to m grain, very loose. - trace of silt, brown.</li> <li>SILT - some clay, brown, damp, trace of fine sand, rootlets.</li> <li>- moist to wet.</li> <li>- grey, saturated, loose to co - saturated, trace of fine sar</li> <li>- sandier.</li> <li>SAND - some silt, trace of pebb fine to medium grained, trace gravel, saturated.</li> <li>- trace of silt.</li> <li>END OF BOREHOLE - 6.7 m (22 NOTES:</li> <li>1) Well installed to 6.7 m (22 ft.</li> <li>2) 1.5 m of screen installed.</li> <li>3) Top of well elevation at 307.3</li> </ul>	leaves. redium stiff, pmpact. nd. hd. les, of ft.) ). m.	1 2 3 4 5 6 7 7 8						0.0 -2.0 -4.0 - -6.0 - -10.0 - -10.0 - -12.0 - -14.0 - -14.0 - - -16.0 - - -18.0 - - -22.0 - - -22.0 - - -22.0 - - -22.0 - - - - - - - - - - - - -
Trow Ontario Ltd. COMPLETION DEPTH 6.7 m COMPLETE	-										-28.0
			Trow Ontario Ltd.			COMPLETIC	ON DEPTH 6	i.7 m	COMPLETE		
Inunder Bay, Uniario Luger By BM DWG NO. Page 1 of 1			Thunder Bav. Ontar	rio	Ī	LOGGED B	Y BM		DWG NO.	Page 1 o	F1

DJEC	T Monitoring Well Installation, Beardmore Municipality of Greenstone	Landfil	l, On	tario				_ PI	ROJECT NO. <u>THB-00011174-BE</u> ATUM
LL TY	PE/METHOD		DAT	ES: B	oring	Au	g. 9, 199	91	Water Level Oct. 2011
ELE		STR	w		SAM	PLES		OT H	SHEAR STRENGTH S Field Vane Test (#=Sensitivity) A Penatrometer Torvane
VAT ION (m)	STRATA DESCRIPTION	AT A PLOT	LL LOG	T Y P E	NUTR	ЦСО≻ШК≻ (П ог (%)	N VALUE (blows) or RQD (%)	ER TESTS	40 80 kPa Atterberg Limits and Moisture Wp W WL • SPT N Value × Dynamic Cone 20, 40, 60, 80,
	SILTY SAND - loose, light brown, damp, some organics, fine to medium grained			SS SS	S1 S2		6 6		
1.22	SILT AND SAND - compact to dense, grey, damp, fine grained			SS	<b>S</b> 3		30		
	- becoming wet at about 2.4 m depth			SS	S4 S5		37 30		
			¥	SS	S6		20		
				ss	S7		37		
				ss	S8		19		
				SS	S9		22		
9.76				ss	S10		26		
	End of Borenole	-1	-		SAN	APLE		nle	
ES or defir orehole format monite	nition of symbols & terms used on logs, see sheet e log generated using field borehole log from Aug ion was available on the field log. pring well was installed at the borehole location; h	ts prior t ust 9, 19 owever, visit, th	o logs 991. I well e dep	s. _imited		AS AU Rock IER T Specifi lydror Sieve / Jnit W	iger Sam Core (eg ESTS ic Gravity neter Analysis eight ermeabil	BQ,	C Consolidation CD Consolidated Drained Triaxial CU Consolidated Undrained Triaxial UU Unconsolidated Undrained Triaxial UC Unconfined Compression

4	<sup>*</sup> ехр. вокеноце LOG вн-G										
PR	Thunder Bay Branch Sheet 1 of 1 PROJECT Monitoring Well Installations Beardmore Waste Disposal Site Beardmore ON PROJECT NO THB-00011174-FF										
CL	CLIENT Municipality of Greenstone Depresentation of Client Content of Content of Client Content of Cli										
DR	ILL TYP	E/METHOD CME 850 Track Mount / HSA		DA	TES	6: B	oring	Ma	iy 9, 201	17	Water Level May 18/17
DEPTH		STRATA DESCRIPTION	STRATA PLO	WELL LOG		TYPE	SAM NUMBER	PLES RECOVERY	N VALUE (blows) or RQD	OF HUR TUST	SHEAR STRENGTH ♣ S Field Vane Test (#=Sensitivity) ▲ Penetrometer ■ Torvane 40 80 kPa Atterberg Limits and Moisture W <sub>P</sub> W W <sub>L</sub>
(m)	(m) 311.88		Ť					(mm) or (%)	(%)	Š	● SPT N Value × Dynamic Cone 20 40 60 80
-0 - 		WASTE AND SAND (FILL) - some gravel, some silt at about 1.5 m depth				SS	S1	150	16		
- - - - - 4 -	307 30					SS	S2	250	11		
- 5	001.00	SILT (FILL) - dense, grey, moist, trace to some sand				SS	S3	310	34		
- - - - - 7 - -	204.25	- becoming compact, dark brown, moist to wet, trace to some peat, trace waste at about 6.1 m depth				SS	S4	230	20		
	304.23	SILT - compact, brown, wet, trace sand, trace to some clay				ss	S5	360	13		
  10						ss	S6	360	16	Н	
- 11 	300.59	End of Borehole				SS	S7	310	14		
- - - 12											
1) F 2) 5 5 3) T 4) G	<ul> <li><i>I</i>OTES</li> <li>) For definition of symbols &amp; terms used on logs, see sheets prior to logs.</li> <li>1) 50 mm PVC monitoring well installed upon completion, screened from about 5.9 m to 10.5 m below ground surface.</li> <li>3) Top of pipe elevation is 312.65 m.</li> <li>4) GPS coordinates in UTM NAD83 16 U 430293E 5495765N.</li> </ul>							SAMPLE LEGEND         ☑ AS Auger Sample       ☑ SS Split Spoon         ☑ Rock Core (eg. BQ, NQ, etc.)       ☑ VN Vane Sample         OTHER TESTS       G Specific Gravity         C Consolidation       C Consolidated Drained Triaxial         S Sieve Analysis       CU Consolidated Undrained Triaxial         Y Unit Weight       UU Unconsolidated Undrained Triaxial         P Field Permeability       DS Direct Shear         WATER LEVELS       ✓ Autorian (See Matching)			

1	exp	D. BO	RE	HC	DLI	ΞL	00	6		BH-H
PR	OJECT	Monitoring Well Installations, Beardmore	Waste	e Disp	osal	Site,	Bearc	lmore,	<u>on</u> pf	ROJECT NO. <u>THB-00011174-FE</u>
CL		Iunicipality of Greenstone							DA	ATUM <u>Geodetic</u>
	LL TYF	PE/METHOD <u>CME 850 Track Mount / HSA</u>		DAT	ES: I	Boring	g <u>Ma</u>	iy 10, 2	017	Water Level May 18/17
	ELEVAT-ON	STRATA DESCRIPTION	STRATA PLO	WELL LOG	ТҮРЕ		R E C O V E R Y	N VALUE (blows) or RQD	OT HUR TUST	SHEAR STRENGTH     S Field Vane Test (#=Sensitivity)     Penetrometer ■ Torvane     40 80 kPa     Atterberg Limits and Moisture     W <sub>P</sub> W W <sub>L</sub>
(m)	(m) 308.27		Ť				(mm) or (%)	(%)	Ś	● SPT N Value × Dynamic Cone 20 40 60 80
-0 - - - - -	308.19	<b>ROOTMAT</b> - brown, frozen // SILT AND SAND - loose, brown, wet, trace gravel, some roots and rootlets, some oxidation				S1 S2				
2	307.03	<b>SILT</b> - loose, light brown, moist, some sand to sandy, trace clay			ss	S3	360	8		
- - -3 -		- becoming compact, wet at about 2.8 m depth			ss	S4	410	12	Н	• 0
- -4 					ss	S5	410	17		
	301.86				ss	S6	430	17		
		End of Borehole								-
-										
- - 8										-
-										-
- 9 -										-
- - 10										
										-
- - - 12						CAN				
NOT	TES						AS Aug Rock C	ger Sam	ple 🖾 BQ. N	SS Split Spoon ST Shelby Tube Q, etc.)
1) F 2) 5 1 3) T 4) G	or definiti 0 mm PV .5 m to 6 op of pipe PS coord	on ot symbols & terms used on logs, see sheets p C monitoring well installed upon completion, scre 1 m below ground surface. e elevation is 308.88 m. linates in UTM NAD83 16 U 430364E 5495734N.	orior to	o logs. From al	oout	OTH GS HH SS YU PF KL	ER TE pecific ydrom ieve A nit We eld Pe ab Per	STS Gravity eter nalysis ight meability	C Cl Cl Ul ty Ul y D:	Consolidation D Consolidated Drained Triaxial U Consolidated Undrained Triaxial U Unconsolidated Undrained Triaxial C Unconfined Compression S Direct Shear
						Į vvA Į Į Į	Appare	ent	¥ M	easured <b>Ā</b> Artesian (see Notes)

1	BOREHOLE LOG BH-I Thunder Bay Branch Sheet 1 of 1 COLECT. Monitoring Well Installations. Beardmore Waste Disposal Site Beardmore ON PROJECT NO. THB-00011174-FE										
PF	ROJECT	Monitoring Well Installations, Beardmore	Waste	e Disp	osa	Site,	Bearc	lmore,	<u>on</u> pf	ROJECT NO. <b>THB-00011174-FE</b>	
	RILL TYF	Nunicipality of Greenstone PE/METHOD <u>CME 850 Track Mount / HSA</u>		DAT	ES:	Borin	g <u>M</u> a	ay 9, 20 <sup>°</sup>	D# 17	ATOM <u>Geodetic</u> Water Level <u>May 18/17</u>	
<b>D</b> ШР Н (m)	E LE VA T O N (m) 316.80	STRATA DESCRIPTION	STRATA PLOT	WELL LOG	TYPE	SAM N U B E R	IPLES RECOVERY (mm) or (%)	N VALUE (blows) or RQD (%)		SHEAR STRENGTH         ◆ S Field Vane Test (#=Sensitivity)         ▲ Penetrometer       ■ Torvane         40       80 kPa         Atterberg Limits and Moisture         WP W WL         ●         SPT N Value       X Dynamic Cone         20       40       60       80	
- - - - - - - - -	<del>-316.65</del> -	SAND AND GRAVEL - very loose, brown, moist, some silt, some roots and rootlets SANDY SILT - loose to compact, grey to brown, moist to wet, some cobbles and boulders, trace gravel, trace clay	0.00			S S1 S S2	010	45			
-2 2 	313.75	SAND AND GRAVEL - very dense, grey to	0.000		s	S S3	460	85	S		
- 4 - - -	<u>312.22</u> 311.77	POSSIBLE BEDROCK - shale, grey			zz S:	6 S5	80	100			
		End of Borehole - refusal to auger				SAN	1PI F 1	EGEND			
<u>NO</u> 1) F 2) <u></u> 2 3) T 4) G	TES for definiti 50 mm P\ 0 m to 5 fop of pipe 6PS coord	on of symbols & terms used on logs, see sheets p /C monitoring well installed upon completion, scre 0 m below ground surface. e elevation is 317.47 m. linates in UTM NAD83 16 U 430223E 5495869N.	prior to	) logs. from a	bout	OTH GSHH SS γΩ WA Z	AS Auc Rock C IER TE pecific lydrom ieve A nit We ield Pe ab Per FER LE Appare	core (eg. STS Gravity eter nalysis ight ermeability EVELS ent	ple ⊠ BQ, N C C C U U U U U V V V	SS Split Spoon Q, etc.) ST Shelby Tube VN Vane Sample Consolidation D Consolidated Drained Triaxial U Consolidated Undrained Triaxial U Unconsolidated Undrained Triaxial C Unconfined Compression S Direct Shear easured Artesian (see Notes)	



# **APPENDIX D – Summary Tables**



# LIST OF TABLES

- Table 1: Summary of Groundwater and Surface Water Levels and Elevations
- Table 2: Groundwater Data
- Table 3: Calculation of Alert Criteria Groundwater Impact
- Table 4: Calculation of Alert Criteria Surface Water Impact



# **General Notes for Tables**

- 1. Concentrations are mg/L (ppm), unless indicated otherwise.
- 2. ODWS: MECP Ontario Drinking Water Standards, from *Technical Support Document for Ontario Drinking Water Standards, Objectives and Guidelines, June 2003.* Exceedances are indicated in **bold** type face.
- Background = arithmetic mean of the results for the most recent three years from background well BH-I. Non-detect (<) values are assumed equal to one-half of the detection limit.
- MECP Guideline B-7, Incorporation of the Reasonable Use Concept into MOE Ground Water Management Activities (1994). <u>Underlining</u> indicates exceedance (current reporting period results only). Asterisk (\*) indicates that background exceeds ODWS; therefore, B-7 criterion = background.

All tables are to be read in conjunction with the accompanying report.



Table 1: Summary of Groundwater Levels and Elevations (m)												
THB-00011174	I-IE											
Monitorir	ng Well No.	BH-A	вн-с	BH-F	BH-G	ВН-Н	BH-I	S1⁴	S2 <sup>4</sup>			
Well Com	pletion Date	Nov. 7, 1990	Nov. 8, 1990	Aug. 9, 1991	May 9, 2017	10-May-17	May 9, 2017					
Ground Sur	face Elevation <sup>1</sup>	308.52	306.48	305.30	311.88	308.27	316.78					
Top of Pip	ce Elevation <sup>1</sup>	309.84	307.18	306.22	312.65	308.88	317.47					
Ground Sur	face Elevation <sup>5</sup>	308.45	306.48	305.30	311.91	308.16	316.85					
Top of Pip	ce Elevation⁵	309.89	307.22	306.24	312.67	308.85	317.49					
May 18, 2017	GW Depth <sup>2</sup>	Dry <sup>3</sup>	3.95	3.35	9.29	3.55	4.51					
Way 10, ∠017	GW Elevation		303.23	302.87	303.36	305.33	312.96					
0 09 0017	GW Depth <sup>2</sup>	Dry <sup>3</sup>	4.89	4.09	10.24	4.72	4.57					
Sep. 28, 2017	GW Elevation		302.29	302.13	302.41	304.16	312.90					
Oct. 19, 2017	Water Elevation							301.21	301.17			
Mar: 46, 2019	GW Depth <sup>2</sup>	Dry <sup>3</sup>	4.32	3.43	9.59	4.03	4.51					
May 10, 2010	GW Elevation		302.86	302.79	303.06	304.85	312.96					
0.4.45.0040	GW Depth <sup>2</sup>	Dry <sup>3</sup>	5.41	4.67	10.38	4.59	4.57					
Oct. 15, 2018	GW Elevation		301.77	301.55	302.27	304.29	312.90					
11	GW Depth <sup>2</sup>	Dry <sup>3</sup>	4.51	4.84	9.79	4.00	4.54					
May 5, 2019	GW Elevation		302.67	301.38	302.86	304.88	312.93					
22 0-1 10	GW Depth <sup>2</sup>	Dry <sup>3</sup>	5.06	4.10	9.77	3.93	4.53					
22-Uci- 19	GW Elevation		302.12	302.12	302.88	304.95	312.94					
07 May 00	GW Depth <sup>2</sup>	Dry <sup>3</sup>	4.64	3.89	9.49	4.04	4.51					
27-May-20	GW Elevation		302.58	302.35	303.18	304.81	312.98					
00.0	GW Depth <sup>2</sup>	Dry <sup>3</sup>	4.72	4.14	9.58	4.14	4.61					
22-Sep-20	GW Elevation		302.50	302.10	303.09	304.71	312.88					

Notes:

1. Ground surface and top of pipe elevations were surveyed by Delta Survey Inc. on October 10, 2017.

Depths are relative to top of riser pipe.
 Monitoring well BH-A extends to about 4.35 m below ground surface or to elevation 304.17 m.
 Spot surface water location at Blackwater River; refer to Figure 2 for locations. Top of water at location surveyed by

Delta Survey Inc. on October 19, 2017.

5. Ground surface and top of pipe elevations were surveyed by Delta Survey Inc. on September 11, 2020.



THB-00011174-IE				Table	2: Gro	undwate	er Data <sup>1</sup>				
		0000	0000 D 7				BH	I-A			
Parameter	ODWS <sup>2</sup>	2020 Background <sup>3</sup>	2020 B-7 Criteria⁴	18 May 2017	28 Sept. 2017	16-May 2018	15 Oct. 2018	5 May 2019	22 Oct. 2019	27 May 2020	23 Sept. 2020
General											
pН	6.5 to 8.5	7.92		Well	Well	Well	Well	Well	Well	Well	Well
Field pH				Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
Water Temperature (°C)											
Conductivity (uS/cm)											
Field Conductivity (uS/cm)											
Total Dissolved Solids	500	269	385								
Total Suspended Solids											
Organics											
Dissolved Organic Carbon	5	1.9	3.5								
Total Chemical Oxygen Demand											
Phenols											
Total Kjeldahl Nitrogen											
Ammonia-N											
Organic Nitrogen	0.15	0.124	0.137								
Cations											
Calcium											
Magnesium											
Potassium											
Sodium	200	9.52	105								
Anions											
Alkalinity as CaCO <sub>3</sub>	30-500	252	376								
Chloride	250	1.05	126								
Nitrate	10	0.05	2.54								
Nitrite	1	0.005	0.25								
Total Phosphorus											
Sulphate	500	10.0	255								
Ion Balance											
Metals - Dissolved											
Arsenic	0.025	0.0047	0.0098								
Barium	1	0.011	0.26								
Boron	5	0.023	1.27								
Cadmium	0.005	0.00003	0.0013								
Chromium	0.05	0.0025	0.014								
Copper	1	0.0003	0.50	-							
Iron	0.3	0.05	0.180								
Lead	0.01	0.00025	0.0027	-							
Manganese	0.05	0.25	0.25*								
Mercury	0.001	0.00005	0.003								
Zinc	5	0.0025	2.50								
VOCs											
Benzene	0.005	0.00005	0.0013								
1,4-Dichlorobenzene	0.005	0.00010	0.0013								
Dichloromethane	0.05	0.00025	0.013								
Toluene	0.024	0.00010	0.012								
Vinyl Chloride	0.002	0.00010	0.00058								



THB-00011174-IE				Table	e 2 (cont	'd): Gro	oundwat	er Data <sup>1</sup>	l			
		2020	0000 D 7					BH-C				
Parameter	ODWS <sup>2</sup>	Background <sup>3</sup>	2020 B-7 Criteria⁴	06 Dec. 1990	18 May 2017	28 Sept. 2017	16 May 2018	15 Oct. 2018	5 May 2019	22 Oct. 2019	27 May 2020	22 Sept. 2020
General												
pН	6.5 to 8.5	7.92		7.6	8.04	7.93	8	7.89	8.04	7.97	7.91	7.77
Field pH					7.86	7.55	7.15	8.02	7.76	7.34	7.32	6.98
Water Temperature (°C)						-	6.4	3.2	6.5	7.2	7.7	11.9
Conductivity (uS/cm)				440	270	610	170	700	600	620	630	2,200
Field Conductivity (uS/cm)					315	600	115	675	566	520	522	731
Total Dissolved Solids	500	269	385	172	168	330	140	345	340	360	455	1,620
Total Suspended Solids						-						
Organics												
Dissolved Organic Carbon	5	1.9	3.5		4.5	14	5.9	1.4	1.3	2.4	<0.40	<u>18</u>
Total Chemical Oxygen Demand					18	67	15	5.9	<4.0	20	16	55
Phenols				<0.5	<0.0010			<0.0010	<0.0010			0.0021
Total Kjeldahl Nitrogen					1.1			0.48	0.11			1.1
Ammonia-N					0.12	7.1	0.11	0.25	0.14	0.066	<0.050	0.17
Organic Nitrogen	0.15	0.124	0.137		0.98	-		0.23	~0			<u>0.93</u>
Cations												
Calcium	-			72.9	40	77	25	110	97	100	110	290
Magnesium	-			22.1	5.1	18	2.8	27	22	18	25	100
Potassium	-			1.3	0.87	-		1.3	1.3			3.7
Sodium	200	9.52	105	5	1.8	3.9	1.3	4.3	4	3.4	3.9	96
Anions												
Alkalinity as CaCO <sub>3</sub>	30-500	252	376	263	130	300	92	350	300	300	310	<u>680</u>
Chloride	250	1.05	126	7	2.3	7.2	2.5	5.8	3.3	4.8	3.8	120
Nitrate	10	0.05	2.54	0.09	0.42	<0.10	0.14	1	0.65	0.75	0.72	0.36
Nitrite	1	0.005	0.25	0.01	<0.010	-		<0.010	<0.010			<0.010
Total Phosphorus	-			<0.5	8.7	-		5.9	0.8			0.69
Sulphate	500	10.0	255	6	5.2	27	1.1	33	14	30	28	<u>470</u>
Ion Balance					5.02		NC	1.11	3.17	0.94	4.81	0.88
Metals - Dissolved												
Arsenic	0.025	0.0047	0.0098	0.005	0.0013			<0.001	<0.001			0.0013
Barium	1	0.011	0.26	0.014	0.0057	0.037	0.0064	0.025	0.018	0.025	0.024	0.046
Boron	5	0.023	1.27	0.01	0.015	0.014	0.012	0.025	0.016	0.017	0.016	0.66
Cadmium	0.005	0.00003	0.0013	<0.005	<0.0001			< 0.0001	<0.0001			0.00023
Chromium	0.05	0.0025	0.014	<0.01	<0.005			<0.005	<0.005			<0.005
Copper	1	0.0003	0.50	<0.01	0.0018			0.0082	0.0088			0.009
Iron	0.3	0.05	0.180	0.490	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<u>0.32</u>	<0.1
Lead	0.01	0.00025	0.0027	<0.05	<0.0005			<0.0005	<0.0005			<0.0005
Manganese	0.05	0.25	0.25*	0.11	<0.002			<0.002	<0.002			<u>0.42</u>
Mercury	0.001	0.00005	0.003	0.00009	<0.0001			<0.0001	<0.0001			<0.0001
Zinc	5	0.0025	2.50	0.12	<0.005			0.01	0.011			0.018
VOCs							1	1			1	
Benzene	0.005	0.00005	0.0013		<0.0001			<0.00010	<0.0001			<0.00025
1,4-Dichlorobenzene	0.005	0.00010	0.0013		< 0.0002			<0.00020	<0.0002			<0.0005
Dichloromethane	0.05	0.00025	0.013		<0.0005			<0.00050	<0.0005			<0.0013
Toluene	0.024	0.00010	0.012		0.00025			<0.00020	<0.0002			<0.0005
Vinyl Chloride	0.002	0.00010	0.00058		<0.0002			<0.00020	<0.0002			<0.0005

THB-00011174-IE			Ta	able 2 (c	ont'd): (	Ground	water Da	ata <sup>1</sup>			
		0000	0000 B 7				BH	I-F			
Parameter	ODWS <sup>2</sup>	2020 Background <sup>3</sup>	2020 B-7 Criteria⁴	18 May 2017	28 Sept. 2017	16 May 2018	15 Oct. 2018	5 May 2019	22 Oct. 2019	27 May 2020	23 Sept. 2020
General											
pН	6.5 to 8.5	7.92		8.08	8.01	7.88	8.01	8.05	8.05	7.98	8.07
Field pH				7.53	7.82	7.45	8.6	8.27	7.52	8.52	7.63
Water Temperature (°C)						6.8	3.7	6.4	6.1	13.6	12.9
Conductivity (uS/cm)				420	440	470	470	450	420	420	410
Field Conductivity (uS/cm)				412	449	406	586	509	359	420	245
Total Dissolved Solids	500	269	385	246	275	190	230	265	220	210	255
Total Suspended Solids											
Organics											
Dissolved Organic Carbon	5	1.9	3.5	0.6	0.96	0.62	0.52	0.98	0.54	<0.40	0.69
Total Chemical Oxygen Demand				<4.0	6.5	<4.0	<4.0	<4.0	<4.0	12	<4.0
Phenols				<0.0010			<0.0010	<0.0010			0.0014
Total Kjeldahl Nitrogen				0.64			0.13	<0.10			0.25
Ammonia-N				< 0.050	<0.050	<0.050	0.06	0.073	0.19	<0.050	< 0.050
Organic Nitrogen	0.15	0.124	0.137	0.64			0.07	~0			0.225
Cations											
Calcium				68	64	73	79	78	67	67	74
Magnesium				13	13	14	15	14	12	13	13
Potassium				0.26			0.33	5			0.38
Sodium	200	9.52	105	1.6	1.4	1.6	2	1.8	1.5	2.1	1.80
Anions											
Alkalinity as CaCO <sub>3</sub>	30-500	252	376	230	240	250	240	230	220	230	220
Chloride	250	1.05	126	2.5	3.5	5.8	8	7.5	3.5	2.4	2.2
Nitrate	10	0.05	2.54	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Nitrite	1	0.005	0.25	<0.010			<0.010	<0.010			<0.010
Total Phosphorus				9			0.12	0.81			0.76
Sulphate	500	10.0	255	1.1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Ion Balance				5.47		3.36	1.37	4.33	1.48	0.82	2.89
Metals - Dissolved											
Arsenic	0.025	0.0047	0.0098	< 0.001			< 0.001	<0.001			<0.001
Barium	1	0.011	0.26	0.0041	0.0044	0.0048	0.0041	0.0087	0.0045	0.0045	0.0054
Boron	5	0.023	1.27	0.016	<0.01	<0.01	0.016	<0.01	<0.01	<0.01	<0.01
Cadmium	0.005	0.00003	0.0013	<0.0001			<0.0001	<0.0001			< 0.00009
Chromium	0.05	0.0025	0.014	<0.005			<0.005	<0.005			<0.005
Copper	1	0.0003	0.50	0.001			0.016	0.0036			0.0012
Iron	0.3	0.05	0.180	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.10
Lead	0.01	0.00025	0.0027	<0.0005			0.00069	<0.0005			<0.0005
Manganese	0.05	0.25	0.25*	<0.002			<0.002	<0.002			<0.002
Mercury	0.001	0.00005	0.003	<0.0001			<0.0001	<0.0001			<0.0001
Zinc	5	0.0025	2.50	<0.005			0.017	<0.005			<0.005
VOCs											
Benzene	0.005	0.00005	0.0013	<0.0001			<0.00010	< 0.00010			<0.0001
1,4-Dichlorobenzene	0.005	0.00010	0.0013	< 0.0002			<0.00020	< 0.00020			<0.0002
Dichloromethane	0.05	0.00025	0.013	<0.0005			<0.00050	< 0.00050			<0.0005
Toluene	0.024	0.00010	0.012	<0.0002			0.0002	<0.00020			<0.0002
Vinyl Chloride	0.002	0.00010	0.00058	<0.0002			<0.00020	<0.00020			<0.0002

THB-00011174-IE							Tab	ole 2 (cc	ont'd): G	iroundwa	ater Dat	a <sup>1</sup>							
		2020	2020 P 7								B	H-G							
Parameter	ODWS <sup>2</sup>	Background <sup>3</sup>	2020 B-7 Criteria⁴	18 May 2017	18 May 2017	28 Sept. 2017	28 Sept. 2017	16 May 2018	16 May 2018	15 Oct. 2018	15 Oct. 2018	5 May 2019	5 May 2019	Oct 22 2019	Oct 22 2019	27 May 2020	27 May 2020	22 Sept. 2020	22 Sept. 2020
General					Blind Dup.		Blind Dup.		Blind Dup.		Blind Dup.		Blind Dup.		Blind Dup.		Blind Dup.		Blind Dup.
рН	6.5 to 8.5	7.92		7.35	7.38	7.52	7.4	7.16	7.14	7.42	7.42	7.5	7.31	7.14	7.1	7.2	7.22	7.46	7.44
Field pH				6.87		7.12		6.7		7.2		7.28		6.56		7.86		6.79	
Water Temperature (°C)								7.9		4		6.3		7.1		7.9		9.1	
Conductivity (uS/cm)				4,000	4,000	3,800	3,800	3,600	3,600	4,000	4,100	3,800	3,800	3,400	3,400	3,200	3,200	3,000	3,000
Field Conductivity (uS/cm)				3,181		2,834		3,047		2,995		2,138		1,951		1,122		940	
Total Dissolved Solids	500	269	385	3,310	3,290	3,010	3,140	2,810	2,830	3,160	3,180	2,990	2,970	2,610	2,570	<u>2,300</u>	<u>2,390</u>	<u>2,210</u>	<u>2,360</u>
Total Suspended Solids								-	-	-	-								
Organics				L			1								1				
Dissolved Organic Carbon	5	1.9	3.5	25	25	29	29	26	26	27	27	30	30	35	35	< 0.40	< 0.40	<u>28</u>	<u>28</u>
Total Chemical Oxygen Demand				80	79	88	89	86	83	77	75	75	76	96	96	140	140	81	80
				0.007	0.0059			-	-	0.001	<0.001	0.001	< 0.001					<0.001	<0.001
I otal Kjeldahl Nitrogen				2.2	1.7			-	-	0.97	1.1	1.1	1.2					0.9	0.88
Ammonia-N				< 0.050	<0.050	0.075	0.079	0.13	0.093	0.27	0.29	0.13	0.081	0.14	<0.050	0.079	0.053	0.19	0.073
	0.15	0.124	0.137	2.2	1.7			-	-	0.7	0.81	0.97	1.12					<u>0.71</u>	<u>0.807</u>
	1			400	480	460	460	460	470	450	450	400	400	410	410	310	300	380	400
Magnosium				490	200	400	400	400	470	430	430	490	490 200	410	410	210	210	140	400
Potossium				200	200	100	100	100	100	170	170	200	200	170	170	210	210	2.8	2.0
Sodium	200	9.52	105	170	170	170	170	- 160	- 160	4.2	170	180	100	160	160	160	160	130	130
Anions	200	0.02	100	170	170	170	170	100	100	170	170	100	100	100	100	100	100	100	100
Alkalinity as CaCO <sub>3</sub>	30-500	252	376	670	670	740	740	790	790	700	680	780	780	920	920	1.100	1.100	930	940
Chloride	250	1.05	126	290	300	280	280	260	260	360	360	290	280	220	220	210	210	170	160
Nitrate	10	0.05	2.54	6.31	6.43	6.81	6.8	4.57	4.41	8.13	8.71	5.07	5	1.49	1.69	0.56	0.59	0.13	0.14
Nitrite	1	0.005	0.25	0.15	0.15			-	-	0.198	0.19	0.11	0.108					0.032	0.032
Total Phosphorus				25	25			-	-	7	8.1	0.3	0.29					0.39	0.26
Sulphate	500	10.0	255	1,300	1,300	1,100	1,200	1,100	1,100	1,200	1,300	1,100	1,100	800	820	<u>510</u>	<u>510</u>	<u>760</u>	<u>750</u>
Ion Balance				1.98	1.72			1.60	0.940	6.2	7.56	3.41	2.71	1.01	0.28	1.14	0.87	3.46	2.15
Metals - Dissolved																			
Arsenic	0.025	0.0047	0.0098	<0.001	<0.001			-	-	<0.001	<0.001	0.001	0.0011					0.002	0.0019
Barium	1	0.011	0.26	0.066	0.065	0.075	0.073	0.056	0.058	0.07	0.068	0.051	0.054	0.046	0.042	0.046	0.045	0.045	0.047
Boron	5	0.023	1.27	2.5	2.5	1.1	1.1	1.4	1.4	1.3	1.2	1.1	1.1	1	1	0.9	0.91	0.90	0.93
Cadmium	0.005	0.00003	0.0013	<0.0001	<0.0001			-	-	<0.0001	<0.0001	<0.0001	<0.0001					<0.00009	<0.00009
Chromium	0.05	0.0025	0.014	<0.005	<0.005			-	-	<0.005	<0.005	<0.005	<0.005					<0.005	<0.005
Copper	1	0.0003	0.50	0.0072	0.0071			-	-	0.0055	0.0049	0.007	0.0066					0.003	0.004
Iron	0.3	0.05	0.180	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	< 0.1	<0.1	<0.1	< 0.1	<0.1	<0.1	<u>0.35</u>	<u>0.35</u>	<u>0.51</u>	<u>0.58</u>
Lead	0.01	0.00025	0.0027	<0.0005	<0.0005			-	-	<0.0005	<0.0005	< 0.0005	<0.0005					<0.0005	<0.0005
Manganese	0.05	0.25	0.25*	1.3	1.3			-	-	0.66	0.66	0.92	0.92					<u>0.56</u>	<u>0.57</u>
	0.001	0.00005	0.003	<0.0001	<0.0001			-	-	<0.0001	<0.0001	<0.0001	<0.0001					<0.0001	<0.0001
	5	0.0025	2.50	<0.005	<0.005			-	-	<0.005	<0.005	<0.005	<0.005					<0.005	<0.005
Renzene	0.005	0.00005	0.0013	0.00015	0.00016					0.00019	0.00017	<0.001	<0.001					<0.00025	<0.00025
1 1-Dichlorobenzene	0.005	0.00005	0.0013					-	-										
	0.005	0.00010	0.0013					-	-			<0.002							<0.0005
Toluene	0.00	0.00020	0.012	0.00033	0.00036				-	0.00023	0.00000	<0.000	<0.000						<0.0013
Vinvl Chloride	0.002	0.00010	0.00058	<0.0002	<0.0002			-	-	<0.00020	<0.00021	<0.002	<0.002					<0.0005	<0.0005
	0.002	0.00010	0.00000	-0.0002	-0.0002			_	-	-0.0002	-0.0002	-0.002	-0.002					-0.0000	-0.0000

\*exp.

THB-00011174-IE			Ta	ible 2 (c	ont'd): (	Groundv	water Da	ata <sup>1</sup>			
		2020	2020 D 7				Bl	1-H			
Parameter	ODWS <sup>2</sup>	2020 Background <sup>3</sup>	2020 B-7 Criteria⁴	18 May 2017	28 Sept. 2017	16 May 2018	15 Oct. 2018	5 May 2019	22 Oct. 2019	27 May 2020	22 Sept. 2020
General											
рН	6.5 to 8.5	7.92		8.07	8.13	8.01	7.93	8.01	7.84	7.93	8.19
Field pH				8.09	7.95	7.29	8.66	7.87	7.46	7.53	6.79
Water Temperature (°C)						6.3	3.5	4.7	8	7.6	10.6
Conductivity (uS/cm)				240	500	360	500	350	560	430	570
Field Conductivity (uS/cm)				223	480	312	491	324	442	367	485
Total Dissolved Solids	500	269	385	142	275	155	160	225	300	230	325
Total Suspended Solids											
Organics		•									
Dissolved Organic Carbon	5	1.9	3.5	1.6	1.5	1	1.4	1.1	1.2	1.5	1.7
Total Chemical Oxygen Demand				4.1	9.7	<4.0	39	<4.0	<4.0	12	6.4
Phenols				<0.0010			<0.0010	<0.0010			<0.0010
Total Kjeldahl Nitrogen				0.79			0.19	0.18			0.33
Ammonia-N				<0.050	<0.050	0.068	0.22	<0.050	<0.050	<0.050	0.15
Organic Nitrogen	0.15	0.124	0.137	0.79		-	~0	0.155	-		<u>0.18</u>
Cations											
Calcium	-			32	75	57	86	65	92	73	170
Magnesium				4.6	9.5	5.8	8.9	5.1	9	6	17
Potassium				0.97			1.8	1.3			3.1
Sodium	200	9.52	105	8.9	7.2	6.1	8	4.6	6.5	6.2	73
Anions											
Alkalinity as CaCO <sub>3</sub>	30-500	252	376	120	250	180	240	170	290	210	300
Chloride	250	1.05	126	2.5	8.9	5.8	12	8.1	4.7	10	3.3
Nitrate	10	0.05	2.54	0.14	<0.10	0.18	<0.10	<0.10	<0.10	<0.10	0.37
Nitrite	1	0.005	0.25	<0.010			<0.010	<0.010			<0.010
Total Phosphorus				16			5.6	0.39			0.80
Sulphate	500	10.0	255	<1.0	4.1	3.5	8.7	3.6	5.6	5.3	22
Ion Balance				5.28		4.44	1.25	3.12	2.73	1.44	34.40
Metals - Dissolved											
Arsenic	0.025	0.0047	0.0098	<0.001			<0.001	<0.001			<0.001
Barium	1	0.011	0.26	0.0096	0.037	0.021	0.038	0.023	0.031	0.022	0.078
Boron	5	0.023	1.27	0.022	0.041	0.016	0.038	0.022	0.027	0.013	0.047
Cadmium	0.005	0.00003	0.0013	< 0.0001			<0.0001	<0.0001			<0.00009
Chromium	0.05	0.0025	0.014	<0.005			<0.005	<0.005			<0.005
Copper	1	0.0003	0.50	<0.001			<0.001	0.011			0.0033
Iron	0.3	0.05	0.180	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.10
Lead	0.01	0.00025	0.0027	<0.0005			<0.0005	0.0005			<0.0005
Manganese	0.05	0.25	0.25*	0.028			0.0038	<0.002			0.0026
Mercury	0.001	0.00005	0.003	<0.0001			<0.0001	<0.0001			<0.0001
Zinc	5	0.0025	2.50	<0.005			<0.005	0.011			<0.005
VOCs											
Benzene	0.005	0.00005	0.0013	<0.0001			<0.0001	<0.0001			<0.0001
1,4-Dichlorobenzene	0.005	0.00010	0.0013	<0.0002			<0.0002	<0.0002			<0.0002
Dichloromethane	0.05	0.00025	0.013	<0.0005			<0.0005	<0.0005			<0.0005
Toluene	0.024	0.00010	0.012	0.00021			<0.0002	<0.0002			<0.0002
Vinyl Chloride	0.002	0.00010	0.00058	<0.0002			<0.0002	<0.0002			<0.0002

THB-00011174-IE			Tab	le 2 (cor	ıt'd): Gr	oundwa	ater Data	a <sup>1</sup>			
							BH	1-1			
Parameter	ODWS <sup>2</sup>	2020	2020 B-7	18 May	28 Sent	16 May	15 Oct	5 May	22 Oct	26 May	22 Sent
	-	Background	Criteria*	2017	2017	2018	2018	2019	2019	2020	2020
General				1		1	1			1	
pН	6.5 to 8.5	7.92		7.97	8.17	7.95	7.98	7.86	8	7.79	7.92
Field pH				7.67	8.22	7.32	8.22	7.71	7.43	7.53	7.08
Water Temperature (°C)						6.9	6.6	6.5	10.3	9.1	9.4
Conductivity (uS/cm)				440	500	470	500	480	470	460	510
Field Conductivity (uS/cm)				427	496	413	459	475	196	210	214
Total Dissolved Solids	500	269	385	256	290	200	315	270	265	255	310
Total Suspended Solids											
Organics			-								
Dissolved Organic Carbon	5	1.9	3.5	2.5	1.8	2.5	1.8	2.8	2.4	<0.4	1.7
Total Chemical Oxygen Demand				5.5	9	5.9	5.9	<4.0	7.4	18	<4.0
Phenols				<0.0010	-		<0.0010	<0.0010			<0.0010
Total Kjeldahl Nitrogen				0.14	-		0.16	0.38			0.18
Ammonia-N				<0.050	<0.050	0.055	0.13	0.097	0.1	<0.050	0.12
Organic Nitrogen	0.15	0.124	0.137	0.14			0.03	0.283			0.06
Cations											
Calcium				58	54	68	64	72	65	66	70
Magnesium				16	18	15	20	17	16	16	19
Potassium				2.1			1.7	1.5			1.70
Sodium	200	9.52	105	10	16	4.9	16	8.4	7.4	7.4	13
Anions						r	<b>1</b>	1		1	
Alkalinity as CaCO <sub>3</sub>	30-500	252	376	230	260	250	260	250	240	240	270
Chloride	250	1.05	126	1.7	<1.0	1	1.2	1.3	1.8	<1.0	<1.0
Nitrate	10	0.05	2.54	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Nitrite	1	0.005	0.25	<0.010			<0.010	<0.010			<0.010
Total Phosphorus				2.1			0.75	1.3			0.067
Sulphate	500	10.0	255	7.1	14	6.3	13	8.4	9.3	6.7	16
Ion Balance				5.63		2.99	0.3	2.18	1.96	0.19	0.19
Metals - Dissolved	1	1		1		n	T.	1		1	T
Arsenic	0.025	0.0047	0.0098	0.003			0.0031	0.0047			0.0063
Barium	1	0.011	0.26	0.017	0.018	0.01	0.012	0.012	0.012	0.0098	0.013
Boron	5	0.023	1.27	0.024	0.041	0.012	0.04	0.021	0.025	0.015	0.027
Cadmium	0.005	0.00003	0.0013	<0.0001			<0.0001	<0.0001			<0.00009
Chromium	0.05	0.0025	0.014	<0.005			<0.005	<0.005			<0.005
Copper	1	0.0003	0.50	0.0014			<0.001	<0.001			<0.0009
Iron	0.3	0.05	0.180	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.10
Lead	0.01	0.00025	0.0027	<0.0005			<0.0005	<0.0005			< 0.0005
Manganese	0.05	0.25	0.25*	0.2			0.29	0.071			<u>0.39</u>
Mercury	0.001	0.00005	0.003	< 0.0001			< 0.0001	< 0.0001			< 0.0001
	5	0.0025	2.50	<0.005			<0.005	<0.005			<0.005
	0.005	0.00005	0.0010	0.00040			10.00040	10.00010			-0.0001
Benzene	0.005	0.00005	0.0013	0.00013			<0.00010	<0.00010			<0.0001
	0.005	0.00010	0.0013	<0.0002			<0.00020	<0.00020			<0.0002
	0.05	0.00025	0.013	<0.0005			<0.00050	<0.00050			<0.0005
	0.024	0.00010	0.012	0.0011			<0.00020	<0.00020			<0.0002
vinyi Chioride	0.002	0.00010	0.00058	< 0.0002			<0.00020	< 0.00020			<0.0002

Table 3: Calculation of Alert Criteria													
	Groundwater Impact												
Parameter	Source Concentration (BH-G)	Background Concentration (BH-I)	B-7 Criteria	BH-F Tigger Levels	BH-F Maximum 2020 Concentration								
Alkalinity	1,018	255	376	610	230								
Arsenic	0.00195	0.0063	0.0098	n/a	<0.001								
Barium	0.046	0.0114	0.26	n/a	0.0054								
Benzene	<0.00025	<0.0001	0.0013	n/a	<0.0001								
Boron	0.910	0.021	1.27	n/a	<0.01								
Cadmium	<0.00009	<0.00009	0.0013	n/a	< 0.00009								
Chloride	187.5	<1.0	126	148	2.4								
Chromium	<0.005	<0.005	0.014	n/a	< 0.005								
Copper	0.0035	<0.0009	0.50	n/a	0.0012								
1,4-Dichlorobenzene	<0.0005	<0.0002	0.0013	n/a	<0.0002								
Dichloromethane	<0.0013	<0.0005	0.013	n/a	<0.0005								
DOC	14.1	0.95	3.5	7.37	0.69								
Iron	0.448	<0.10	0.180	0.28	<0.10								
Lead	<0.0005	<0.0005	0.0027	n/a	<0.0005								
Manganese	0.565	0.39	0.25	0.37	< 0.002								
Mercury	<0.0001	<0.0001	0.003	n/a	<0.0001								
Nitrate	0.355	<0.10	2.54	n/a	<0.10								
Nitrite	0.032	<0.010	0.25	n/a	<0.010								
Organic Nitrogen	0.759	0.06	0.137	0.36	0.225								
Sodium	145	10.2	105	120	2.1								
Sulphate	633	11.4	255	393	<1.0								
Toluene	<0.005	<0.0002	0.012	n/a	<0.0002								
TDS	2,315	283	385	1090	255								
Vinyl Chloride	<0.005	<0.0002	0.00058	n/a	<0.0002								
Zinc	<0.005	<0.005	2.50	n/a	<0.005								
Distance from source well BH-G to trigger well BH-F (m) 365.00													
Distance from source we	ell BH-G to east atten	uation zone boundary	/ (m)	575	5.00								
Notes:	<ol> <li>Source and background</li> <li>Non-detectable backgro</li> <li>Where background exc of groundwater quality is a</li> <li>Where the source conc</li> <li>All concentrations expri</li> </ol>	d concentrations are the ar bund concentrations have l eeds the ODWS, the B-7 c acceptable). entration is lower than or e essed in milligrams per litre	ithmetic means of 2020 r been assumed to be one- riterion defaults to backg equal to the B-7 criterion, a a (mg/L).	esults for the respective w half of the detection limit. round (i.e., no further dete a trigger level is not applic	ells. rioration able (n/a).								



	Tab	le 4: Calculation	of Alert Criteria	a							
		Surface Wate	r Impact								
Parameter	Source Concentration (BH-G)	Background Concentration (BH-I)	APV <sup>3</sup>	BH-F Tigger Levels	BH-F Maximum 2020 Concentration						
Arsenic	0.00195	0.0063	0.15	n/a	<0.001						
Barium	0.046	0.0114	2.30	n/a	0.0054						
Benzene	<0.0025	<0.0001	0.46	n/a	<0.0001						
Boron	0.91	0.021	3.55	n/a	<0.01						
Cadmium	< 0.00009	<0.00009	0.00021	n/a	<0.00009						
Chloride	187.5	<1.0	180	183	2.4						
Chromium <0.005 <0.005 0.064 n/a <0.005											
Copper	0.0035	<0.0009	0.0069	n/a	0.0012						
1,4-Dichlorobenzene	nzene <0.0005 <0.0002 0.76 n/a <0.0002										
Dichloromethane	<0.0013	<0.0005	1.30	n/a	<0.0005						
Lead	< 0.0005	<0.0005	0.0020	n/a	<0.0005						
Mercury	<0.0001	<0.0001	0.00077	n/a	< 0.0001						
Phenols	<0.001	<0.001	0.961	n/a	0.0014						
Sodium	145	10.2	180	n/a	2.1						
Toluene	< 0.005	<0.0002	1.40	n/a	<0.0002						
Vinyl Chloride	< 0.005	<0.0002	36.0	n/a	< 0.0002						
Zinc	<0.005	<0.005	0.089	n/a	< 0.005						
Distance from source w	ell BH-G to trigger we	ll BH-F (m)		36	5.00						
Distance from source w	ell BH-G to east atten	uation zone boundary	′ (m)	575	5.00						
Notes: 1. Source and background concentrations are the arithmetic means of 2020 results for the respective wells.											
	2. Non-detectable backgro	ound concentrations have b	been assumed to be one	-half of the detection limit.							
	3. APV (Aquatic Protection	n Values) as found in Appe	endix B2 of the MECP's	Rationale for the Developr	nent of Soil						
	and Ground Water Standa	ards for Use at Contaminat	ed Sites in Ontario (Apr	il 2011).							
	4. Where the source conc	entration is lower than or e	qual to the APV criterion	, a trigger level is not appl	icable (n/a).						
5. All concentrations expressed in milligrams per litre (mg/L).											



# **APPENDIX E – Laboratory Reports of Analysis**





Your Project #: THB-00011174-IE Site#: Beardmore Landfill Your C.O.C. #: 770956-01-01

#### **Attention: Ahileas Mitsopoulos**

exp Services Inc Thunder Bay Branch 1142 Roland St Thunder Bay, ON CANADA P7B 5M4

> Report Date: 2020/06/03 Report #: R6196925 Version: 1 - Final

## **CERTIFICATE OF ANALYSIS**

#### BV LABS JOB #: COD2282

Received: 2020/05/29, 14:30

Sample Matrix: Water # Samples Received: 6

		Date	Date		
Analyses	Quantity	Extracted	Analyzed	Laboratory Method	Analytical Method
Alkalinity	6	N/A	2020/06/02	CAM SOP-00448	SM 23 2320 B m
Chloride by Automated Colourimetry	6	N/A	2020/06/02	CAM SOP-00463	SM 23 4500-Cl E m
Chemical Oxygen Demand	6	N/A	2020/06/03	CAM SOP-00416	SM 23 5220 D m
Conductivity	6	N/A	2020/06/02	CAM SOP-00414	SM 23 2510 m
Dissolved Organic Carbon (DOC) (1)	6	N/A	2020/06/02	CAM SOP-00446	SM 23 5310 B m
Dissolved Metals by ICPMS	6	N/A	2020/06/01	CAM SOP-00447	EPA 6020B m
Ion Balance (% Difference)	6	N/A	2020/06/03		
Total Ammonia-N	6	N/A	2020/06/03	CAM SOP-00441	USGS I-2522-90 m
Nitrate (NO3) and Nitrite (NO2) in Water (2)	6	N/A	2020/06/01	CAM SOP-00440	SM 23 4500-NO3I/NO2B
рН	6	2020/06/01	2020/06/02	CAM SOP-00413	SM 4500H+ B m
Sulphate by Automated Colourimetry	6	N/A	2020/06/02	CAM SOP-00464	EPA 375.4 m
Total Dissolved Solids	6	2020/06/02	2020/06/03	CAM SOP-00428	SM 23 2540C m

#### Remarks:

Bureau Veritas Laboratories are accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by BV Labs 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 BV Labs profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and BV Labs 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.

BV Labs liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. BV Labs 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 BV Labs, unless otherwise agreed in writing. BV Labs 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 BV Labs, results relate to the supplied samples tested. This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

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Your Project #: THB-00011174-IE Site#: Beardmore Landfill Your C.O.C. #: 770956-01-01

#### **Attention: Ahileas Mitsopoulos**

exp Services Inc Thunder Bay Branch 1142 Roland St Thunder Bay, ON CANADA P7B 5M4

> Report Date: 2020/06/03 Report #: R6196925 Version: 1 - Final

# **CERTIFICATE OF ANALYSIS**

#### BV LABS JOB #: COD2282

Received: 2020/05/29, 14:30

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance. (1) Dissolved Organic Carbon (DOC) present in the sample should be considered as non-purgeable DOC. (2) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.

**Encryption Key** 

Please direct all questions regarding this Certificate of Analysis to your Project Manager. Julie Clement, Technical Account Manager Email: Julie.CLEMENT@bvlabs.com Phone# (613)868-6079

This report has been generated and distributed using a secure automated process.

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.



## LANDFILL STANDARDS SCH 5 - GW IND. LIST (WATER)

BV Labs ID		MTE120			MTE120			MTE121		
Sampling Date		2020/05/27			2020/05/27			2020/05/27		
		11:45			11:45			15:45		
COC Number		770956-01-01			770956-01-01			770956-01-01		
	UNITS	BH-C	RDL	QC Batch	BH-C Lab-Dup	RDL	QC Batch	BH-F	RDL	QC Batch
Inorganics										
Total Ammonia-N	mg/L	<0.050	0.050	6766094				<0.050	0.050	6766094
Total Chemical Oxygen Demand (COD)	mg/L	16	4.0	6765606				12	4.0	6765606
Conductivity	umho/cm	630	1.0	6762560				420	1.0	6762560
Total Dissolved Solids	mg/L	455	10	6766673	400	10	6766673	210	10	6766673
Dissolved Organic Carbon	mg/L	<0.40	0.40	6762367				<0.40	0.40	6762367
рН	рН	7.91		6762561				7.98		6762561
Dissolved Sulphate (SO4)	mg/L	28	1.0	6763700				<1.0	1.0	6763700
Alkalinity (Total as CaCO3)	mg/L	310	1.0	6763754				230	1.0	6763754
Dissolved Chloride (Cl-)	mg/L	3.8	1.0	6763691				2.4	1.0	6763691
Nitrate (N)	mg/L	0.72	0.10	6764152				<0.10	0.10	6764152
Metals						-				
Dissolved Barium (Ba)	ug/L	24	2.0	6763789				4.5	2.0	6763789
Dissolved Boron (B)	ug/L	16	10	6763789				<10	10	6763789
Dissolved Calcium (Ca)	ug/L	110000	200	6763789				67000	200	6763789
Dissolved Iron (Fe)	ug/L	320	100	6763789				<100	100	6763789
Dissolved Magnesium (Mg)	ug/L	25000	50	6763789				13000	50	6763789
Dissolved Sodium (Na)	ug/L	3900	100	6763789				2100	100	6763789
RDL = Reportable Detection Limit								-		
QC Batch = Quality Control Batch										
Lab-Dup = Laboratory Initiated Duplicate	e									



## LANDFILL STANDARDS SCH 5 - GW IND. LIST (WATER)

BV Labs ID		MTE122		MTE123	MTE124					
Sampling Date		2020/05/27		2020/05/27	2020/05/27					
		12:45		13:45	12:05					
COC Number		770956-01-01		770956-01-01	770956-01-01					
	UNITS	BH-G	RDL	BH-I	BH-H	RDL	QC Batch			
norganics										
Total Ammonia-N	mg/L	0.079	0.050	<0.050	<0.050	0.050	6766094			
Total Chemical Oxygen Demand (COD)	mg/L	140	4.0	18	12	4.0	6765606			
Conductivity	umho/cm	3200	1.0	460	430	1.0	6762560			
Total Dissolved Solids	mg/L	2300	10	255	230	10	6765323			
Dissolved Organic Carbon	mg/L	<0.40	0.40	<0.40	1.5	0.40	6762367			
рН	рН	7.20		7.79	7.93		6762561			
Dissolved Sulphate (SO4)	mg/L	510	5.0	6.7	5.3	1.0	6763700			
Alkalinity (Total as CaCO3)	mg/L	1100	1.0	240	210	1.0	6763754			
Dissolved Chloride (Cl-)	mg/L	210	2.0	<1.0	10	1.0	6763691			
Nitrate (N)	mg/L	0.56	0.10	<0.10	<0.10	0.10	6764152			
Metals										
Dissolved Barium (Ba)	ug/L	46	2.0	9.8	22	2.0	6763789			
Dissolved Boron (B)	ug/L	900	10	15	13	10	6763789			
Dissolved Calcium (Ca)	ug/L	310000	200	66000	73000	200	6763789			
Dissolved Iron (Fe)	ug/L	350	100	<100	<100	100	6763789			
Dissolved Magnesium (Mg)	ug/L	210000	50	16000	6000	50	6763789			
Dissolved Sodium (Na)	ug/L	160000	100	7400	6200	100	6763789			
RDL = Reportable Detection Limit										
QC Batch = Quality Control Batch										



BV Labs ID		MTE125		
Sampling Data		2020/05/27		
		10:41		
COC Number		770956-01-01		
	UNITS	BH-J	RDL	QC Batch
Inorganics				
Total Ammonia-N	mg/L	0.053	0.050	6766094
Total Chemical Oxygen Demand (COD)	mg/L	140	4.0	6765606
Conductivity	umho/cm	3200	1.0	6762560
Total Dissolved Solids	mg/L	2390	10	6766673
Dissolved Organic Carbon	mg/L	<0.40	0.40	6762367
рН	рН	7.22		6762561
Dissolved Sulphate (SO4)	mg/L	510	5.0	6763700
Alkalinity (Total as CaCO3)	mg/L	1100	1.0	6763754
Dissolved Chloride (Cl-)	mg/L	210	2.0	6763691
Nitrate (N)	mg/L	0.59	0.10	6764152
Metals				
Dissolved Barium (Ba)	ug/L	45	2.0	6763789
Dissolved Boron (B)	ug/L	910	10	6763789
Dissolved Calcium (Ca)	ug/L	300000	200	6763789
Dissolved Iron (Fe)	ug/L	350	100	6763789
Dissolved Magnesium (Mg)	ug/L	210000	50	6763789
Dissolved Sodium (Na)	ug/L	160000	100	6763789
RDL = Reportable Detection Limit QC Batch = Quality Control Batch				

## LANDFILL STANDARDS SCH 5 - GW IND. LIST (WATER)



## **RESULTS OF ANALYSES OF WATER**

BV Labs ID		MTE120	MTE121	MTE122	MTE123	MTE124	MTE125	
Sampling Data		2020/05/27	2020/05/27	2020/05/27	2020/05/27	2020/05/27	2020/05/27	
		11:45	15:45	12:45	13:45	12:05	10:41	
COC Number		770956-01-01	770956-01-01	770956-01-01	770956-01-01	770956-01-01	770956-01-01	
	UNITS	BH-C	BH-F	BH-G	BH-I	BH-H	BH-J	QC Batch
Calculated Parameters								
Ion Balance (% Difference)	%	4.81	0.820	1.14	0.190	1.44	0.870	6762321
QC Batch = Quality Control B	atch		· · · · · · · · · · · · · · · · · · ·	·	·	· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·	

Page 6 of 13 Bureau Veritas Laboratories 6740 Campobello Road, Mississauga, Ontario, LSN 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvlabs.com


# **TEST SUMMARY**

Sample ID: Matrix:	Water			Snipped: Received:	2020/05/29
BV Labs ID:	MTE120			Collected:	2020/05/27

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	6763754	N/A	2020/06/02	Surinder Rai
Chloride by Automated Colourimetry	KONE	6763691	N/A	2020/06/02	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	6765606	N/A	2020/06/03	Viorica Rotaru
Conductivity	AT	6762560	N/A	2020/06/02	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	6762367	N/A	2020/06/02	Nimarta Singh
Dissolved Metals by ICPMS	ICP/MS	6763789	N/A	2020/06/01	Daniel Teclu
Ion Balance (% Difference)	CALC	6762321	N/A	2020/06/03	Automated Statchk
Total Ammonia-N	LACH/NH4	6766094	N/A	2020/06/03	Amanpreet Sappal
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	6764152	N/A	2020/06/01	Chandra Nandlal
рН	AT	6762561	2020/06/01	2020/06/02	Surinder Rai
Sulphate by Automated Colourimetry	KONE	6763700	N/A	2020/06/02	Deonarine Ramnarine
Total Dissolved Solids	BAL	6766673	2020/06/02	2020/06/03	Jingwei (Alvin) Shi
-					

BV Labs ID:	MTE120 Dup
Sample ID:	BH-C
Matrix:	Water

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Dissolved Solids	BAL	6766673	2020/06/02	2020/06/03	Jingwei (Alvin) Shi

BV Labs ID:	MTE121
Sample ID:	BH-F
Matrix:	Water

Collected:	2020/05/27
Shipped: Received:	2020/05/29

Collected: 2020/05/27

Received: 2020/05/29

Shipped:

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	6763754	N/A	2020/06/02	Surinder Rai
Chloride by Automated Colourimetry	KONE	6763691	N/A	2020/06/02	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	6765606	N/A	2020/06/03	Viorica Rotaru
Conductivity	AT	6762560	N/A	2020/06/02	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	6762367	N/A	2020/06/02	Nimarta Singh
Dissolved Metals by ICPMS	ICP/MS	6763789	N/A	2020/06/01	Daniel Teclu
Ion Balance (% Difference)	CALC	6762321	N/A	2020/06/03	Automated Statchk
Total Ammonia-N	LACH/NH4	6766094	N/A	2020/06/03	Amanpreet Sappal
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	6764152	N/A	2020/06/01	Chandra Nandlal
рН	AT	6762561	2020/06/01	2020/06/02	Surinder Rai
Sulphate by Automated Colourimetry	KONE	6763700	N/A	2020/06/02	Deonarine Ramnarine
Total Dissolved Solids	BAL	6766673	2020/06/02	2020/06/03	Jingwei (Alvin) Shi

BV Labs ID: Sample ID: Matrix:	MTE122 BH-G Water					Collected: Shipped: Received:	2020/05/27 2020/05/29
Test Description		Instrumentation	Batch	Extracted	Date Analyzed	Analyst	
Alkalinity		AT	6763754	N/A	2020/06/02	Surinder Ra	i
Chloride by Automated Co	olourimetry	KONE	6763691	N/A	2020/06/02	Deonarine I	Ramnarine

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# **TEST SUMMARY**

		 Batal	E transfer d	A I	
Matrix:	Water			Received:	2020/05/29
BV Labs ID: Sample ID:	MTE122 BH-G			Collected: Shipped:	2020/05/27

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chemical Oxygen Demand	SPEC	6765606	N/A	2020/06/03	Viorica Rotaru
Conductivity	AT	6762560	N/A	2020/06/02	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	6762367	N/A	2020/06/02	Nimarta Singh
Dissolved Metals by ICPMS	ICP/MS	6763789	N/A	2020/06/01	Daniel Teclu
Ion Balance (% Difference)	CALC	6762321	N/A	2020/06/03	Automated Statchk
Total Ammonia-N	LACH/NH4	6766094	N/A	2020/06/03	Amanpreet Sappal
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	6764152	N/A	2020/06/01	Chandra Nandlal
рН	AT	6762561	2020/06/01	2020/06/02	Surinder Rai
Sulphate by Automated Colourimetry	KONE	6763700	N/A	2020/06/02	Deonarine Ramnarine
Total Dissolved Solids	BAL	6765323	2020/06/02	2020/06/03	Massarat Jan

BV Labs ID:	MTE123
Sample ID:	BH-I
Matrix:	Water

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	6763754	N/A	2020/06/02	Surinder Rai
Chloride by Automated Colourimetry	KONE	6763691	N/A	2020/06/02	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	6765606	N/A	2020/06/03	Viorica Rotaru
Conductivity	AT	6762560	N/A	2020/06/02	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	6762367	N/A	2020/06/02	Nimarta Singh
Dissolved Metals by ICPMS	ICP/MS	6763789	N/A	2020/06/01	Daniel Teclu
Ion Balance (% Difference)	CALC	6762321	N/A	2020/06/03	Automated Statchk
Total Ammonia-N	LACH/NH4	6766094	N/A	2020/06/03	Amanpreet Sappal
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	6764152	N/A	2020/06/01	Chandra Nandlal
рН	AT	6762561	2020/06/01	2020/06/02	Surinder Rai
Sulphate by Automated Colourimetry	KONE	6763700	N/A	2020/06/02	Deonarine Ramnarine
Total Dissolved Solids	BAL	6765323	2020/06/02	2020/06/03	Massarat Jan

BV Labs ID:	MTE124
Sample ID:	BH-H
Matrix:	Water

Instrumentation	Batch	Extracted	Date Analyzed	Analyst
AT	6763754	N/A	2020/06/02	Surinder Rai
KONE	6763691	N/A	2020/06/02	Deonarine Ramnarine
SPEC	6765606	N/A	2020/06/03	Viorica Rotaru
AT	6762560	N/A	2020/06/02	Surinder Rai
TOCV/NDIR	6762367	N/A	2020/06/02	Nimarta Singh
ICP/MS	6763789	N/A	2020/06/01	Daniel Teclu
CALC	6762321	N/A	2020/06/03	Automated Statchk
LACH/NH4	6766094	N/A	2020/06/03	Amanpreet Sappal
LACH	6764152	N/A	2020/06/01	Chandra Nandlal
AT	6762561	2020/06/01	2020/06/02	Surinder Rai
KONE	6763700	N/A	2020/06/02	Deonarine Ramnarine
	Instrumentation AT KONE SPEC AT TOCV/NDIR ICP/MS CALC LACH/NH4 LACH AT KONE	Instrumentation         Batch           AT         6763754           KONE         6763691           SPEC         6765606           AT         6762560           TOCV/NDIR         6762367           ICP/MS         6763789           CALC         6762321           LACH/NH4         6766094           LACH         6762561           KONE         6763700	Instrumentation         Batch         Extracted           AT         6763754         N/A           KONE         6763691         N/A           SPEC         6765606         N/A           AT         6762560         N/A           TOCV/NDIR         6762367         N/A           ICP/MS         6763789         N/A           CALC         6762321         N/A           LACH/NH4         6766094         N/A           LACH         6762561         2020/06/01           KONE         6763700         N/A	Instrumentation         Batch         Extracted         Date Analyzed           AT         6763754         N/A         2020/06/02           KONE         6763691         N/A         2020/06/02           SPEC         6765606         N/A         2020/06/03           AT         6762560         N/A         2020/06/02           TOCV/NDIR         6762367         N/A         2020/06/02           ICP/MS         6763789         N/A         2020/06/01           CALC         6762321         N/A         2020/06/03           LACH/NH4         6766094         N/A         2020/06/03           LACH         6762561         2020/06/01         2020/06/03           KONE         6763700         N/A         2020/06/02

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Bureau Veritas Laboratories 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvlabs.com

Collected: 2020/05/27 Shipped: Received: 2020/05/29

Collected: 2020/05/27 Shipped:

Received: 2020/05/29



#### **TEST SUMMARY**

BV Labs ID: Sample ID: Matrix:	MTE124 BH-H Water					Collected: Shipped: Received:	2020/05/27 2020/05/29
Test Description		Instrumentation	Batch	Extracted	Date Analyzed	Analyst	
Total Dissolved Solids		BAL	6765323	2020/06/02	2020/06/03	Massarat J	lan
BV Labs ID: Sample ID: Matrix:	MTE125 BH-J Water					Collected: Shipped: Received:	2020/05/27 2020/05/29
Test Description		Instrumentation	Batch	Extracted	Date Analyzed	Analyst	
Alkalinity		AT	6763754	N/A	2020/06/02	Surinder R	ai
Chloride by Automated C	Colourimetry	KONE	6763691	N/A	2020/06/02	Deonarine	Ramnarine
Chemical Oxygen Deman	d	SPEC	6765606	N/A	2020/06/03	Viorica Ro	taru
Conductivity		AT	6762560	N/A	2020/06/02	Surinder R	ai
Dissolved Organic Carbor	n (DOC)	TOCV/NDIR	6762367	N/A	2020/06/02	Nimarta Si	ngh
Dissolved Metals by ICPN	٨S	ICP/MS	6763789	N/A	2020/06/01	Daniel Tec	lu
Ion Balance (% Difference	e)	CALC	6762321	N/A	2020/06/03	Automate	d Statchk
Total Ammonia-N		LACH/NH4	6766094	N/A	2020/06/03	Amanpree	t Sappal
Nitrate (NO3) and Nitrite	(NO2) in Water	LACH	6764152	N/A	2020/06/01	Chandra N	landlal
рН		AT	6762561	2020/06/01	2020/06/02	Surinder R	ai
Sulphate by Automated 0	Colourimetry	KONE	6763700	N/A	2020/06/02	Deonarine	Ramnarine
Total Dissolved Solids		BAL	6766673	2020/06/02	2020/06/03	Jingwei (A	lvin) Shi



# **GENERAL COMMENTS**

Package 1	4.3°C	
	-	_
Results relate only to the i	tems tested.	



#### QUALITY ASSURANCE REPORT

exp Services Inc Client Project #: THB-00011174-IE Sampler Initials: EF

			Matrix Spike		SPIKED	SPIKED BLANK		Blank	RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
6762367	Dissolved Organic Carbon	2020/06/02	95	80 - 120	98	80 - 120	<0.40	mg/L	1.0	20		
6762560	Conductivity	2020/06/02			102	85 - 115	<1.0	umho/c m	7.1	25		
6762561	рН	2020/06/02			101	98 - 103			1.7	N/A		
6763691	Dissolved Chloride (Cl-)	2020/06/02	111	80 - 120	103	80 - 120	<1.0	mg/L	2.8	20		
6763700	Dissolved Sulphate (SO4)	2020/06/02	NC	75 - 125	104	80 - 120	<1.0	mg/L	0.64	20		
6763754	Alkalinity (Total as CaCO3)	2020/06/02			96	85 - 115	<1.0	mg/L	7.8	20		
6763789	Dissolved Barium (Ba)	2020/06/01	106	80 - 120	98	80 - 120	<2.0	ug/L	0.47	20		
6763789	Dissolved Boron (B)	2020/06/01	92	80 - 120	84	80 - 120	<10	ug/L	7.3	20		
6763789	Dissolved Calcium (Ca)	2020/06/01	NC	80 - 120	97	80 - 120	<200	ug/L				
6763789	Dissolved Iron (Fe)	2020/06/01	106	80 - 120	96	80 - 120	<100	ug/L				
6763789	Dissolved Magnesium (Mg)	2020/06/01	NC	80 - 120	97	80 - 120	<50	ug/L				
6763789	Dissolved Sodium (Na)	2020/06/01	NC	80 - 120	96	80 - 120	<100	ug/L	1.6	20		
6764152	Nitrate (N)	2020/06/02	NC	80 - 120	102	80 - 120	<0.10	mg/L	0.81	20		
6765323	Total Dissolved Solids	2020/06/03					<10	mg/L	1.9	25	102	90 - 110
6765606	Total Chemical Oxygen Demand (COD)	2020/06/03	99	80 - 120	99	80 - 120	<4.0	mg/L	9.6	20		
6766094	Total Ammonia-N	2020/06/03	97	75 - 125	99	80 - 120	<0.050	mg/L	NC	20		
6766673	Total Dissolved Solids	2020/06/03					<10	mg/L	13	25	103	90 - 110

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.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

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

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

NC (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 <= 2x RDL).



#### VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Brad Newman, 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.

		Bureau Veritas Laboratorie 6740 Campobello Road, M	is Ississauga, Ontario Ca	anada L5N 21	8 Tel (905) 817-57	700 Toll-free 80	0-563-6266 Fax( *	905) 817-57	77 www	bylabs con	1			•			Juli	29-M ie Clem	ay-20 14:30 ent	Paga	at
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any Name	#17501 exp Serv	ices Inc		Company	Name			1.			Quotation	#:	B9056	60						Bottle Order	er #:
ion	accounts payable			Attention	Ahileas	Mitsopoulos	, Milce	Soran	aki		P.O.#.				_		_L_	EN	V-1364		010
\$5	1142 Roland St			Address			-				Project:		THB-	00011174-	IE		5			770956	
	Thunder Bay ON F	P7B 5M4		_				-		-	Project Na	me	_		-				COC #:	Project Mana	iger:
	(807) 623-9495	Fax: (80)	7) 623-8070	Tel			Fax				Site #		Beard	imore Land	dfill			DUN		Julie Cleme	ent
	thunderbay@exp.c	com; Karen Burke@e	exp_com;AP@ex	Email	ahileas	.mitsopoulos	@exp.com, c	connor po	rter@	exp:coni	Sampled B	By	E	EF.	_		-		C#770956-01-01	40.000	20
IOE REG	ULATED DRINKING SUBMITTED OI	WATER OR WATER	INTENDED FOR NKING WATER CI	HUMAN C HAIN OF C	ONSUMPTION	MUST BE	(e);	10		- AN	IALYSIS REI	QUESTED	(PLEASE E	BE SPECIFIC				Regular (S	Turnaround Time ( Please provide advance r tandard) TAT:	TAT) Required: notice for rush projects	1. 1. 1
Regulati	ion 153 (2011) Res/Park Medium/I Ind/Comm Coarse Agri/Other For RSC	Fine CCME CCME CCME CCME CCME CCME CCME CCM	her Regulations Sanitary Sewer Bylaw Storm Sewer Bylaw Inicipality		Special In	structions	Filtered (please circ	itenderds Sch 5 - GW Be					÷					(will be applied Standard TAT Please note S days - contact Job Specific Date Required	d if Rush TAT is not specified): = 5-7 Working days for most te- standard TAT for certain tests si your Project Manager for detail: = Rush TAT (if applies to enti-	sts ich as BOD and Dioxins/Furana s re submission) Time Required	1 are > 5
	Include Criteria	on Certificate of Analy	sis (Y/N)?	-			A lield	S I I							-			Rush Confirm	ation Number;	(call lab for #)	
Sample	e Barcode (Jabel	Sample (Location) Iden	tification Date	e Sampled	Time Sampled	Matrix		Lan		1	-		1					# of Botties		Comments	
		BH-C	Mary	27/20	11:45:0	GW	4	×										11			
		BH-F	Na	27/20	3:45 pm	GW	Y-	x										11			
		BH-G	Nes	y 27/20	12:45 pr	GW	Y	x										11			
		BH-I	Ma	y ZA/20	145pm	GW	4	×										11			
		1314-14	Na	3 23/20	12:05 pm	GW	Y	x	_			-	_	2				1			
		BH-J	Me	1 27/20	10.41mg	GW	Y	x										11			
_						GW		x													
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																			RE	CEIVED	1-
																			u.uc	they b	
1	RELINQUISHED BY: (Sig	nature/Print)	Date: (YY/MM/DD	Tir	ne	RECEIVED	BY: (Signature/F	Print)		Date: (YY/	MM/DD)	Tir	me	# jars use not subm	d and			Laborate	ory Use Only		
Dh	T Marin	(	20/05/29	/ 3	or a	ALC AN	Tarnes Kla	Presici	1 1	2020/0	5/29	14:	30	-		Time Sen	sitive	Temperatur	a ("G) on Recei _ Cust	ody Seal Yes esent	NO
ESS OTHER	WISE AGREED TO IN WRI	TING, WORK SUBMITTED C	IN THIS CHAIN OF CUS	STODY IS SUR	BJECT TO BV LABS	STANDARD TE	RMS AND CONDI	TIONS. SIG	NING OF	THIS CHAI	N OF CUSTO	BY DOCUM	MENT.IS		E.	$= p_{i_T}$	and a	VALSE	W	hite: BV Labs/ Yello	w Clien



Your Project #: THB-00011174-IE Site Location: BEARDMORE LANDFILL Your C.O.C. #: 791123-01-01

#### **Attention: Ahileas Mitsopoulos**

exp Services Inc Thunder Bay Branch 1142 Roland St Thunder Bay, ON CANADA P7B 5M4

> Report Date: 2020/10/05 Report #: R6358911 Version: 1 - Final

# **CERTIFICATE OF ANALYSIS**

#### BV LABS JOB #: COP0645

#### Received: 2020/09/24, 11:31

Sample Matrix: Water # Samples Received: 6

		Date	Date		
Analyses	Quantity	Extracted	Analyzed	Laboratory Method	Analytical Method
Alkalinity	2	N/A	2020/10/01	CAM SOP-00448	SM 23 2320 B m
Alkalinity	4	N/A	2020/09/30	CAM SOP-00448	SM 23 2320 B m
Chloride by Automated Colourimetry	6	N/A	2020/10/02	CAM SOP-00463	SM 23 4500-Cl E m
Chemical Oxygen Demand	6	N/A	2020/10/01	CAM SOP-00416	SM 23 5220 D m
Conductivity	2	N/A	2020/10/01	CAM SOP-00414	SM 23 2510 m
Conductivity	4	N/A	2020/09/30	CAM SOP-00414	SM 23 2510 m
Dissolved Organic Carbon (DOC) (1)	6	N/A	2020/10/01	CAM SOP-00446	SM 23 5310 B m
Mercury in Water by CVAA	6	2020/10/01	2020/10/01	CAM SOP-00453	EPA 7470A m
Dissolved Metals by ICPMS	1	N/A	2020/10/05	CAM SOP-00447	EPA 6020B m
Dissolved Metals by ICPMS	5	N/A	2020/09/30	CAM SOP-00447	EPA 6020B m
Ion Balance (% Difference)	6	N/A	2020/10/03		
Total Ammonia-N	6	N/A	2020/10/01	CAM SOP-00441	USGS I-2522-90 m
Nitrate (NO3) and Nitrite (NO2) in Water (2)	2	N/A	2020/10/01	CAM SOP-00440	SM 23 4500-NO3I/NO2B
Nitrate (NO3) and Nitrite (NO2) in Water (2)	4	N/A	2020/09/30	CAM SOP-00440	SM 23 4500-NO3I/NO2B
рН	2	2020/09/29	2020/10/01	CAM SOP-00413	SM 4500H+ B m
рН	4	2020/09/29	2020/09/30	CAM SOP-00413	SM 4500H+ B m
Phenols (4AAP)	6	N/A	2020/09/30	CAM SOP-00444	OMOE E3179 m
Sulphate by Automated Colourimetry	6	N/A	2020/10/03	CAM SOP-00464	EPA 375.4 m
Total Dissolved Solids	6	2020/09/29	2020/09/30	CAM SOP-00428	SM 23 2540C m
Total Kjeldahl Nitrogen in Water	6	2020/09/30	2020/09/30	CAM SOP-00938	OMOE E3516 m
Total Phosphorus (Colourimetric)	6	2020/09/30	2020/09/30	CAM SOP-00407	SM 23 4500 P B H m
Volatile Organic Compounds in Water	1	N/A	2020/10/01	CAM SOP-00226	EPA 8260C m
Volatile Organic Compounds in Water	5	N/A	2020/09/30	CAM SOP-00226	EPA 8260C m

#### Remarks:

Bureau Veritas Laboratories are accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by BV Labs 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 BV Labs profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and BV Labs 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

Page 1 of 21



Your Project #: THB-00011174-IE Site Location: BEARDMORE LANDFILL Your C.O.C. #: 791123-01-01

#### **Attention: Ahileas Mitsopoulos**

exp Services Inc Thunder Bay Branch 1142 Roland St Thunder Bay, ON CANADA P7B 5M4

> Report Date: 2020/10/05 Report #: R6358911 Version: 1 - Final

# **CERTIFICATE OF ANALYSIS**

#### BV LABS JOB #: C0P0645

#### Received: 2020/09/24, 11:31

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.

BV Labs liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. BV Labs 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 BV Labs, unless otherwise agreed in writing. BV Labs 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 BV Labs, 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.

(1) Dissolved Organic Carbon (DOC) present in the sample should be considered as non-purgeable DOC.

(2) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.

**Encryption Key** 

Please direct all questions regarding this Certificate of Analysis to your Project Manager. Julie Clement, Technical Account Manager Email: Julie.CLEMENT@bvlabs.com Phone# (613)868-6079

This report has been generated and distributed using a secure automated process.

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.

Total Cover Pages : 2 Page 2 of 21



# LANDFILL STANDARDS SCH 5 - GW COMP. LIST (WATER)

BV Labs ID		NSP252			NSP252	1	
Sampling Data		2020/09/23			2020/09/23		
		08:45			08:45		
COC Number		791123-01-01			791123-01-01		
	UNITS	BH-I	RDL	QC Batch	BH-I Lab-Dup	RDL	QC Batch
Inorganics							
Total Ammonia-N	mg/L	0.12	0.050	6974196			
Total Chemical Oxygen Demand (COD)	mg/L	<4.0	4.0	6972446			
Conductivity	umho/cm	510	1.0	6971455			
Total Dissolved Solids	mg/L	310	10	6972296	300	10	6972296
Total Kjeldahl Nitrogen (TKN)	mg/L	0.18	0.10	6973439			
Dissolved Organic Carbon	mg/L	1.7	0.40	6972374			
рН	рН	7.92		6971461			
Phenols-4AAP	mg/L	<0.0010	0.0010	6973179			
Total Phosphorus	mg/L	0.067	0.020	6973533			
Dissolved Sulphate (SO4)	mg/L	16	1.0	6971962			
Alkalinity (Total as CaCO3)	mg/L	270	1.0	6971414			
Dissolved Chloride (Cl-)	mg/L	<1.0	1.0	6971945			
Nitrite (N)	mg/L	<0.010	0.010	6971886	<0.010	0.010	6971886
Nitrate (N)	mg/L	<0.10	0.10	6971886	<0.10	0.10	6971886
Metals							
Mercury (Hg)	mg/L	<0.00010	0.00010	6976512			
Dissolved Arsenic (As)	ug/L	6.3	1.0	6972154			
Dissolved Barium (Ba)	ug/L	13	2.0	6972154			
Dissolved Boron (B)	ug/L	27	10	6972154			
Dissolved Cadmium (Cd)	ug/L	<0.090	0.090	6972154			
Dissolved Calcium (Ca)	ug/L	70000	200	6972154			
Dissolved Chromium (Cr)	ug/L	<5.0	5.0	6972154			
Dissolved Copper (Cu)	ug/L	<0.90	0.90	6972154			
Dissolved Iron (Fe)	ug/L	<100	100	6972154			
Dissolved Lead (Pb)	ug/L	<0.50	0.50	6972154			
Dissolved Magnesium (Mg)	ug/L	19000	50	6972154			
Dissolved Manganese (Mn)	ug/L	390	2.0	6972154			
Dissolved Potassium (K)	ug/L	1700	200	6972154			
Dissolved Sodium (Na)	ug/L	13000	100	6972154			
Dissolved Zinc (Zn)	ug/L	<5.0	5.0	6972154			
Volatile Organics							
Benzene	ug/L	<0.10	0.10	6967743			
1,4-Dichlorobenzene	ug/L	<0.20	0.20	6967743			
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Lab-Dup = Laboratory Initiated Duplicate							



# LANDFILL STANDARDS SCH 5 - GW COMP. LIST (WATER)

BV Labs ID		NSP252			NSP252		
Sampling Date		2020/09/23 08:45			2020/09/23 08:45		
COC Number		791123-01-01			791123-01-01		
	UNITS	BH-I	RDL	QC Batch	BH-I Lab-Dup	RDL	QC Batch
Methylene Chloride(Dichloromethane)	ug/L	<0.50	0.50	6967743			
Toluene	ug/L	<0.20	0.20	6967743			
Vinyl Chloride	ug/L	<0.20	0.20	6967743			
Surrogate Recovery (%)							
4-Bromofluorobenzene	%	96		6967743			
D4-1,2-Dichloroethane	%	103		6967743			
D8-Toluene	%	99		6967743			
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Lab-Dup = Laboratory Initiated Duplicate							



# LANDFILL STANDARDS SCH 5 - GW COMP. LIST (WATER)

BV Labs ID		NSP253			NSP254		
Sampling Date		2020/09/23			2020/09/23		
		09:10			10:15		
COC Number		791123-01-01			791123-01-01		
	UNITS	BH-G	RDL	QC Batch	BH-H	RDL	QC Batch
Inorganics							
Total Ammonia-N	mg/L	0.19	0.050	6974196	0.15	0.050	6974196
Total Chemical Oxygen Demand (COD)	mg/L	81	4.0	6972446	6.4	4.0	6972446
Conductivity	umho/cm	3000	1.0	6971455	570	1.0	6971409
Total Dissolved Solids	mg/L	2210	10	6972296	325	10	6972296
Total Kjeldahl Nitrogen (TKN)	mg/L	0.90	0.10	6973439	0.33	0.10	6973439
Dissolved Organic Carbon	mg/L	28	0.40	6972374	1.7	0.40	6972374
рН	рН	7.46		6971461	8.19		6971410
Phenols-4AAP	mg/L	<0.0010	0.0010	6973179	<0.0010	0.0010	6973179
Total Phosphorus	mg/L	0.39	0.020	6973533	0.80	0.10	6973533
Dissolved Sulphate (SO4)	mg/L	760	5.0	6971962	22	1.0	6971962
Alkalinity (Total as CaCO3)	mg/L	930	1.0	6971414	300	1.0	6971408
Dissolved Chloride (Cl-)	mg/L	170	2.0	6971945	3.3	1.0	6971945
Nitrite (N)	mg/L	0.032	0.010	6971839	<0.010	0.010	6971839
Nitrate (N)	mg/L	0.13	0.10	6971839	0.37	0.10	6971839
Metals							
Mercury (Hg)	mg/L	<0.00010	0.00010	6976512	<0.00010	0.00010	6976512
Dissolved Arsenic (As)	ug/L	2.0	1.0	6972154	<1.0	1.0	6982697
Dissolved Barium (Ba)	ug/L	45	2.0	6972154	78	2.0	6982697
Dissolved Boron (B)	ug/L	900	10	6972154	47	10	6982697
Dissolved Cadmium (Cd)	ug/L	<0.090	0.090	6972154	<0.090	0.090	6982697
Dissolved Calcium (Ca)	ug/L	380000	200	6972154	170000	200	6982697
Dissolved Chromium (Cr)	ug/L	<5.0	5.0	6972154	<5.0	5.0	6982697
Dissolved Copper (Cu)	ug/L	3.0	0.90	6972154	3.3	0.90	6982697
Dissolved Iron (Fe)	ug/L	510	100	6972154	<100	100	6982697
Dissolved Lead (Pb)	ug/L	<0.50	0.50	6972154	<0.50	0.50	6982697
Dissolved Magnesium (Mg)	ug/L	140000	50	6972154	17000	50	6982697
Dissolved Manganese (Mn)	ug/L	560	2.0	6972154	2.6	2.0	6982697
Dissolved Potassium (K)	ug/L	2800	200	6972154	3100	200	6982697
Dissolved Sodium (Na)	ug/L	130000	100	6972154	73000	100	6982697
Dissolved Zinc (Zn)	ug/L	<5.0	5.0	6972154	<5.0	5.0	6982697
Volatile Organics							
Benzene	ug/L	<0.25	0.25	6967743	<0.10	0.10	6967743
1,4-Dichlorobenzene	ug/L	<0.50	0.50	6967743	<0.20	0.20	6967743
RDL = Reportable Detection Limit							
QC Batch = Quality Control Batch							



# LANDFILL STANDARDS SCH 5 - GW COMP. LIST (WATER)

BV Labs ID		NSP253			NSP254		
Sampling Date		2020/09/23			2020/09/23		
		09:10			10:15		
COC Number		791123-01-01			791123-01-01		
	UNITS	BH-G	RDL	QC Batch	BH-H	RDL	QC Batch
Methylene Chloride(Dichloromethane)	ug/L	<1.3	1.3	6967743	<0.50	0.50	6967743
Toluene	ug/L	<0.50	0.50	6967743	<0.20	0.20	6967743
Vinyl Chloride	ug/L	<0.50	0.50	6967743	<0.20	0.20	6967743
Surrogate Recovery (%)							
4-Bromofluorobenzene	%	96		6967743	95		6967743
D4-1,2-Dichloroethane	%	104		6967743	104		6967743
D8-Toluene	%	97		6967743	99		6967743
RDL = Reportable Detection Limit		·					
QC Batch = Quality Control Batch							



# LANDFILL STANDARDS SCH 5 - GW COMP. LIST (WATER)

BV Labs ID		NSP255			NSP255		
Sampling Date		2020/09/23			2020/09/23		
		09:45			09:45		
COC Number		791123-01-01			791123-01-01		
	UNITS	BH-C	RDL	QC Batch	BH-C Lab-Dup	RDL	QC Batch
Inorganics							
Total Ammonia-N	mg/L	0.17	0.050	6974196			
Total Chemical Oxygen Demand (COD)	mg/L	55	4.0	6972446			
Conductivity	umho/cm	2200	1.0	6971455			
Total Dissolved Solids	mg/L	1620	10	6972296			
Total Kjeldahl Nitrogen (TKN)	mg/L	1.1	0.10	6973439			
Dissolved Organic Carbon	mg/L	18	0.40	6972374			
рН	рН	7.77		6971461			
Phenols-4AAP	mg/L	0.0021	0.0010	6973177			
Total Phosphorus	mg/L	0.69	0.10	6973533			
Dissolved Sulphate (SO4)	mg/L	470	2.0	6971962			
Alkalinity (Total as CaCO3)	mg/L	680	1.0	6971414			
Dissolved Chloride (Cl-)	mg/L	120	1.0	6971945			
Nitrite (N)	mg/L	<0.010	0.010	6971839			
Nitrate (N)	mg/L	0.36	0.10	6971839			
Metals		-			-		
Mercury (Hg)	mg/L	<0.00010	0.00010	6976512			
Dissolved Arsenic (As)	ug/L	1.3	1.0	6972154	1.4	1.0	6972154
Dissolved Barium (Ba)	ug/L	46	2.0	6972154	45	2.0	6972154
Dissolved Boron (B)	ug/L	660	10	6972154	640	10	6972154
Dissolved Cadmium (Cd)	ug/L	0.23	0.090	6972154	0.24	0.090	6972154
Dissolved Calcium (Ca)	ug/L	290000	200	6972154	300000	200	6972154
Dissolved Chromium (Cr)	ug/L	<5.0	5.0	6972154	<5.0	5.0	6972154
Dissolved Copper (Cu)	ug/L	9.0	0.90	6972154	9.7	0.90	6972154
Dissolved Iron (Fe)	ug/L	<100	100	6972154	<100	100	6972154
Dissolved Lead (Pb)	ug/L	<0.50	0.50	6972154	<0.50	0.50	6972154
Dissolved Magnesium (Mg)	ug/L	100000	50	6972154	100000	50	6972154
Dissolved Manganese (Mn)	ug/L	420	2.0	6972154	420	2.0	6972154
Dissolved Potassium (K)	ug/L	3700	200	6972154	3700	200	6972154
Dissolved Sodium (Na)	ug/L	96000	100	6972154	97000	100	6972154
Dissolved Zinc (Zn)	ug/L	18	5.0	6972154	20	5.0	6972154
Volatile Organics							
Benzene	ug/L	<0.25	0.25	6967743			
1,4-Dichlorobenzene	ug/L	<0.50	0.50	6967743			
RDL = Reportable Detection Limit							
QC Batch = Quality Control Batch							
l ab-Dup = Laboratory Initiated Duplicate	2						



# LANDFILL STANDARDS SCH 5 - GW COMP. LIST (WATER)

BV Labs ID		NSP255			NSP255		
Sampling Date		2020/09/23 09:45			2020/09/23 09:45		
COC Number		791123-01-01			791123-01-01		
	UNITS	BH-C	RDL	QC Batch	BH-C Lab-Dup	RDL	QC Batch
Methylene Chloride(Dichloromethane)	ug/L	<1.3	1.3	6967743			
Toluene	ug/L	<0.50	0.50	6967743			
Vinyl Chloride	ug/L	<0.50	0.50	6967743			
Surrogate Recovery (%)							
4-Bromofluorobenzene	%	96		6967743			
D4-1,2-Dichloroethane	%	105		6967743			
D8-Toluene	%	98		6967743			
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Lab-Dup = Laboratory Initiated Duplicate							



# LANDFILL STANDARDS SCH 5 - GW COMP. LIST (WATER)

BV Labs ID		NSP256			NSP257			
Sampling Data		2020/09/23			2020/09/23			
		09:35			11:35			
COC Number		791123-01-01			791123-01-01			
	UNITS	BH-J	RDL	QC Batch	BH-F	RDL	QC Batch	
Inorganics								
Total Ammonia-N	mg/L	0.073	0.050	6974196	<0.050	0.050	6974196	
Total Chemical Oxygen Demand (COD)	mg/L	80	4.0	6972446	<4.0	4.0	6972446	
Conductivity	umho/cm	3000	1.0	6971455	410	1.0	6971409	
Total Dissolved Solids	mg/L	2360	10	6972296	255	10	6972296	
Total Kjeldahl Nitrogen (TKN)	mg/L	0.88	0.10	6973439	0.25	0.10	6973439	
Dissolved Organic Carbon	mg/L	28	0.40	6972374	0.69	0.40	6972514	
рН	рН	7.44		6971461	8.07		6971410	
Phenols-4AAP	mg/L	<0.0010	0.0010	6973179	0.0014	0.0010	6973179	
Total Phosphorus	mg/L	0.26	0.020	6973533	0.76	0.10	6973533	
Dissolved Sulphate (SO4)	mg/L	750	5.0	6971962	<1.0	1.0	6971962	
Alkalinity (Total as CaCO3)	mg/L	940	1.0	6971414	220	1.0	6971408	
Dissolved Chloride (Cl-)	mg/L	160	2.0	6971945	2.2	1.0	6971945	
Nitrite (N)	mg/L	0.032	0.010	6971839	<0.010	0.010	6971886	
Nitrate (N)	mg/L	0.14	0.10	6971839	<0.10	0.10	6971886	
Metals								
Mercury (Hg)	mg/L	<0.00010	0.00010	6976512	<0.00010	0.00010	6976512	
Dissolved Arsenic (As)	ug/L	1.9	1.0	6972154	<1.0	1.0	6972154	
Dissolved Barium (Ba)	ug/L	47	2.0	6972154	5.4	2.0	6972154	
Dissolved Boron (B)	ug/L	930	10	6972154	<10	10	6972154	
Dissolved Cadmium (Cd)	ug/L	<0.090	0.090	6972154	<0.090	0.090	6972154	
Dissolved Calcium (Ca)	ug/L	400000	200	6972154	74000	200	6972154	
Dissolved Chromium (Cr)	ug/L	<5.0	5.0	6972154	<5.0	5.0	6972154	
Dissolved Copper (Cu)	ug/L	4.0	0.90	6972154	1.2	0.90	6972154	
Dissolved Iron (Fe)	ug/L	580	100	6972154	<100	100	6972154	
Dissolved Lead (Pb)	ug/L	<0.50	0.50	6972154	<0.50	0.50	6972154	
Dissolved Magnesium (Mg)	ug/L	140000	50	6972154	13000	50	6972154	
Dissolved Manganese (Mn)	ug/L	570	2.0	6972154	<2.0	2.0	6972154	
Dissolved Potassium (K)	ug/L	2900	200	6972154	380	200	6972154	
Dissolved Sodium (Na)	ug/L	130000	100	6972154	1800	100	6972154	
Dissolved Zinc (Zn)	ug/L	<5.0	5.0	6972154	<5.0	5.0	6972154	
Volatile Organics	1		T	1	1		-	
Benzene	ug/L	<0.25	0.25	6967743	<0.10	0.10	6967743	
1,4-Dichlorobenzene	ug/L	<0.50	0.50	6967743	<0.20	0.20	6967743	
RDL = Reportable Detection Limit								
QC Batch = Quality Control Batch								



# LANDFILL STANDARDS SCH 5 - GW COMP. LIST (WATER)

BV Labs ID		NSP256			NSP257		
Sampling Date		2020/09/23 09:35			2020/09/23 11:35		
COC Number		791123-01-01			791123-01-01		
	UNITS	BH-J	RDL	QC Batch	BH-F	RDL	QC Batch
Methylene Chloride(Dichloromethane)	ug/L	<1.3	1.3	6967743	<0.50	0.50	6967743
Toluene	ug/L	<0.50	0.50	6967743	<0.20	0.20	6967743
Vinyl Chloride	ug/L	<0.50	0.50	6967743	<0.20	0.20	6967743
Surrogate Recovery (%)		·					
4-Bromofluorobenzene	%	96		6967743	95		6967743
D4-1,2-Dichloroethane	%	106		6967743	105		6967743
D8-Toluene	%	97		6967743	97		6967743
RDL = Reportable Detection Limit							
QC Batch = Quality Control Batch							



#### **RESULTS OF ANALYSES OF WATER**

BV Labs ID		NSP252	NSP253	NSP254	NSP255	NSP256	NSP257	
Sampling Data		2020/09/23	2020/09/23	2020/09/23	2020/09/23	2020/09/23	2020/09/23	
Sampling Date		08:45	09:10	10:15	09:45	09:35	11:35	
COC Number		791123-01-01	791123-01-01	791123-01-01	791123-01-01	791123-01-01	791123-01-01	
	UNITS	BH-I	BH-G	BH-H	BH-C	BH-J	BH-F	QC Batch
Calculated Parameters								
Ion Balance (% Difference)	%	0.190	3.46	34.4	0.880	2.15	2.89	6967207
QC Batch = Quality Control Batch								



Collected: 2020/09/23

Shipped:

#### **TEST SUMMARY**

BV Labs ID:	NSP252
Sample ID:	BH-I
Matrix:	Water

Matrix: Water					Received: 2020/09/24
Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	6971414	N/A	2020/09/30	Surinder Rai
Chloride by Automated Colourimetry	KONE	6971945	N/A	2020/10/02	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	6972446	N/A	2020/10/01	Nimarta Singh
Conductivity	AT	6971455	N/A	2020/09/30	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	6972374	N/A	2020/10/01	Nimarta Singh
Mercury in Water by CVAA	CV/AA	6976512	2020/10/01	2020/10/01	Meghaben Patel
Dissolved Metals by ICPMS	ICP/MS	6972154	N/A	2020/09/30	Arefa Dabhad
Ion Balance (% Difference)	CALC	6967207	N/A	2020/10/03	Automated Statchk
Total Ammonia-N	LACH/NH4	6974196	N/A	2020/10/01	Alina Dobreanu
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	6971886	N/A	2020/10/01	Amanpreet Sappal
рН	AT	6971461	2020/09/29	2020/09/30	Surinder Rai
Phenols (4AAP)	TECH/PHEN	6973179	N/A	2020/09/30	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	6971962	N/A	2020/10/03	Deonarine Ramnarine
Total Dissolved Solids	BAL	6972296	2020/09/29	2020/09/30	Shivani Desai
Total Kjeldahl Nitrogen in Water	SKAL	6973439	2020/09/30	2020/09/30	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	6973533	2020/09/30	2020/09/30	Shivani Shivani
Volatile Organic Compounds in Water	P&T/MS	6967743	N/A	2020/09/30	Dina Wang

BV Labs ID:	NSP252 Dup
Sample ID:	BH-I
Matrix:	Water

Collected: Shipped:	2020/09/23
Received:	2020/09/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	6971886	N/A	2020/10/01	Amanpreet Sappal
Total Dissolved Solids	BAL	6972296	2020/09/29	2020/09/30	Shivani Desai

BV Labs ID:	NSP253
Sample ID:	BH-G
Matrix:	Water

Collected:	2020/09/23
Shipped:	
Received:	2020/09/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	6971414	N/A	2020/09/30	Surinder Rai
Chloride by Automated Colourimetry	KONE	6971945	N/A	2020/10/02	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	6972446	N/A	2020/10/01	Nimarta Singh
Conductivity	AT	6971455	N/A	2020/09/30	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	6972374	N/A	2020/10/01	Nimarta Singh
Mercury in Water by CVAA	CV/AA	6976512	2020/10/01	2020/10/01	Meghaben Patel
Dissolved Metals by ICPMS	ICP/MS	6972154	N/A	2020/09/30	Arefa Dabhad
Ion Balance (% Difference)	CALC	6967207	N/A	2020/10/03	Automated Statchk
Total Ammonia-N	LACH/NH4	6974196	N/A	2020/10/01	Alina Dobreanu
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	6971839	N/A	2020/09/30	Amanpreet Sappal
рН	AT	6971461	2020/09/29	2020/09/30	Surinder Rai
Phenols (4AAP)	TECH/PHEN	6973179	N/A	2020/09/30	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	6971962	N/A	2020/10/03	Deonarine Ramnarine

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**Test Description** 

exp Services Inc Client Project #: THB-00011174-IE Site Location: BEARDMORE LANDFILL Sampler Initials: EF

Collected:

Shipped: Received: 2020/09/23

2020/09/24

#### **TEST SUMMARY**

BV Labs ID:	NSP253
Sample ID:	BH-G
Matrix:	Water

				Collected: Shipped:	2020/09/23	
				Received:	2020/09/24	
Instrumentation	Batch	Extracted	Date Analyzed	Analyst		
BAL	6972296	2020/09/29	2020/09/30	Shivani De	sai	

Total Dissolved Solids	BAL	6972296	2020/09/29	2020/09/30	Shivani Desai
Total Kjeldahl Nitrogen in Water	SKAL	6973439	2020/09/30	2020/09/30	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	6973533	2020/09/30	2020/09/30	Shivani Shivani
Volatile Organic Compounds in Water	P&T/MS	6967743	N/A	2020/09/30	Dina Wang

BV Labs ID:	NSP254
Sample ID:	BH-H
Matrix:	Water

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	6971408	N/A	2020/10/01	Surinder Rai
Chloride by Automated Colourimetry	KONE	6971945	N/A	2020/10/02	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	6972446	N/A	2020/10/01	Nimarta Singh
Conductivity	AT	6971409	N/A	2020/10/01	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	6972374	N/A	2020/10/01	Nimarta Singh
Mercury in Water by CVAA	CV/AA	6976512	2020/10/01	2020/10/01	Meghaben Patel
Dissolved Metals by ICPMS	ICP/MS	6982697	N/A	2020/10/05	Azita Fazaeli
Ion Balance (% Difference)	CALC	6967207	N/A	2020/10/03	Automated Statchk
Total Ammonia-N	LACH/NH4	6974196	N/A	2020/10/01	Alina Dobreanu
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	6971839	N/A	2020/09/30	Amanpreet Sappal
рН	AT	6971410	2020/09/29	2020/10/01	Surinder Rai
Phenols (4AAP)	TECH/PHEN	6973179	N/A	2020/09/30	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	6971962	N/A	2020/10/03	Deonarine Ramnarine
Total Dissolved Solids	BAL	6972296	2020/09/29	2020/09/30	Shivani Desai
Total Kjeldahl Nitrogen in Water	SKAL	6973439	2020/09/30	2020/09/30	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	6973533	2020/09/30	2020/09/30	Shivani Shivani
Volatile Organic Compounds in Water	P&T/MS	6967743	N/A	2020/10/01	Dina Wang

BV Labs ID:	NSP255
Sample ID:	BH-C
Matrix:	Water

Collected:	2020/09/23
Shipped:	
Received:	2020/09/24

**Test Description** Instrumentation Batch Extracted **Date Analyzed** Analyst Alkalinity AT 6971414 N/A 2020/09/30 Surinder Rai Chloride by Automated Colourimetry KONE 6971945 N/A 2020/10/02 Deonarine Ramnarine SPEC Chemical Oxygen Demand 6972446 N/A 2020/10/01 Nimarta Singh Conductivity AT 6971455 N/A 2020/09/30 Surinder Rai TOCV/NDIR Dissolved Organic Carbon (DOC) 6972374 N/A 2020/10/01 Nimarta Singh 2020/10/01 Mercury in Water by CVAA CV/AA 6976512 2020/10/01 Meghaben Patel **Dissolved Metals by ICPMS** ICP/MS 6972154 N/A 2020/09/30 Arefa Dabhad Ion Balance (% Difference) CALC 6967207 N/A 2020/10/03 Automated Statchk Total Ammonia-N LACH/NH4 6974196 N/A 2020/10/01 Alina Dobreanu Nitrate (NO3) and Nitrite (NO2) in Water LACH 6971839 N/A 2020/09/30 Amanpreet Sappal рΗ AT 6971461 2020/09/29 2020/09/30 Surinder Rai

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exp Services Inc Client Project #: THB-00011174-IE Site Location: BEARDMORE LANDFILL Sampler Initials: EF

Collected:

Shipped:

Received:

2020/09/23

2020/09/24

#### **TEST SUMMARY**

BV Labs ID:	NSP255
Sample ID:	BH-C
Matrix:	Water

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Phenols (4AAP)	TECH/PHEN	6973177	N/A	2020/09/30	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	6971962	N/A	2020/10/03	Deonarine Ramnarine
Total Dissolved Solids	BAL	6972296	2020/09/29	2020/09/30	Shivani Desai
Total Kjeldahl Nitrogen in Water	SKAL	6973439	2020/09/30	2020/09/30	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	6973533	2020/09/30	2020/09/30	Shivani Shivani
Volatile Organic Compounds in Water	P&T/MS	6967743	N/A	2020/09/30	Dina Wang
BV Labs ID: NSP255 Dup Sample ID: BH-C Matrix: Water					Collected: 2020/09/23 Shipped: Received: 2020/09/24
Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Dissolved Metals by ICPMS	ICP/MS	6972154	N/A	2020/09/30	Arefa Dabhad
BV Labs ID: NSP256 Sample ID: BH-J Matrix: Water				(	Collected: 2020/09/23 Shipped: Received: 2020/09/24
Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Test Description Alkalinity	Instrumentation AT	Batch 6971414	Extracted	Date Analyzed 2020/09/30	<b>Analyst</b> Surinder Rai
Test Description Alkalinity Chloride by Automated Colourimetry	Instrumentation AT KONE	Batch 6971414 6971945	Extracted N/A N/A	Date Analyzed           2020/09/30           2020/10/02	Analyst Surinder Rai Deonarine Ramnarine
Test Description Alkalinity Chloride by Automated Colourimetry Chemical Oxygen Demand	Instrumentation AT KONE SPEC	Batch           6971414           6971945           6972446	Extracted N/A N/A N/A	Date Analyzed           2020/09/30           2020/10/02           2020/10/01	Analyst Surinder Rai Deonarine Ramnarine Nimarta Singh
Test Description Alkalinity Chloride by Automated Colourimetry Chemical Oxygen Demand Conductivity	Instrumentation AT KONE SPEC AT	Batch           6971414           6971945           6972446           6971455	Extracted N/A N/A N/A N/A	Date Analyzed           2020/09/30           2020/10/02           2020/10/01           2020/09/30	Analyst Surinder Rai Deonarine Ramnarine Nimarta Singh Surinder Rai
Test Description Alkalinity Chloride by Automated Colourimetry Chemical Oxygen Demand Conductivity Dissolved Organic Carbon (DOC)	Instrumentation AT KONE SPEC AT TOCV/NDIR	Batch           6971414           6971945           6972446           6971455           6972374	Extracted N/A N/A N/A N/A N/A	Date Analyzed           2020/09/30           2020/10/02           2020/10/01           2020/09/30           2020/10/01	AnalystSurinder RaiDeonarine RamnarineNimarta SinghSurinder RaiNimarta Singh
Test Description Alkalinity Chloride by Automated Colourimetry Chemical Oxygen Demand Conductivity Dissolved Organic Carbon (DOC) Mercury in Water by CVAA	Instrumentation AT KONE SPEC AT TOCV/NDIR CV/AA	Batch           6971414           6971945           6972446           6971455           6972374           6976512	Extracted N/A N/A N/A N/A N/A 2020/10/01	Date Analyzed           2020/09/30           2020/10/02           2020/10/01           2020/09/30           2020/10/01           2020/10/01	AnalystSurinder RaiDeonarine RamnarineNimarta SinghSurinder RaiNimarta SinghMeghaben Patel
Test Description Alkalinity Chloride by Automated Colourimetry Chemical Oxygen Demand Conductivity Dissolved Organic Carbon (DOC) Mercury in Water by CVAA Dissolved Metals by ICPMS	Instrumentation AT KONE SPEC AT TOCV/NDIR CV/AA ICP/MS	Batch           6971414           6971945           6972446           6971455           6972374           6976512           6972154	Extracted N/A N/A N/A N/A N/A 2020/10/01 N/A	Date Analyzed           2020/09/30           2020/10/02           2020/10/01           2020/09/30           2020/10/01           2020/10/01           2020/10/01           2020/10/03	AnalystSurinder RaiDeonarine RamnarineNimarta SinghSurinder RaiNimarta SinghMeghaben PatelArefa Dabhad
Test Description Alkalinity Chloride by Automated Colourimetry Chemical Oxygen Demand Conductivity Dissolved Organic Carbon (DOC) Mercury in Water by CVAA Dissolved Metals by ICPMS Ion Balance (% Difference)	Instrumentation AT KONE SPEC AT TOCV/NDIR CV/AA ICP/MS CALC	Batch           6971414           6971945           6972446           6971455           6972374           6976512           6972154           6967207	Extracted N/A N/A N/A N/A N/A 2020/10/01 N/A N/A	Date Analyzed           2020/09/30           2020/10/02           2020/10/01           2020/09/30           2020/10/01           2020/10/01           2020/10/03	AnalystSurinder RaiDeonarine RamnarineNimarta SinghSurinder RaiNimarta SinghMeghaben PatelArefa DabhadAutomated Statchk
Test DescriptionAlkalinityChloride by Automated ColourimetryChemical Oxygen DemandConductivityDissolved Organic Carbon (DOC)Mercury in Water by CVAADissolved Metals by ICPMSIon Balance (% Difference)Total Ammonia-N	Instrumentation AT KONE SPEC AT TOCV/NDIR CV/AA ICP/MS CALC LACH/NH4	Batch           6971414           6971945           6972446           6972374           6976512           6972154           6967207           6974196	Extracted N/A N/A N/A N/A 2020/10/01 N/A N/A N/A	Date Analyzed           2020/09/30           2020/10/02           2020/10/01           2020/09/30           2020/10/01           2020/10/01           2020/09/30           2020/10/03           2020/10/01	AnalystSurinder RaiDeonarine RamnarineNimarta SinghSurinder RaiNimarta SinghMeghaben PatelArefa DabhadAutomated StatchkAlina Dobreanu
Test Description Alkalinity Chloride by Automated Colourimetry Chemical Oxygen Demand Conductivity Dissolved Organic Carbon (DOC) Mercury in Water by CVAA Dissolved Metals by ICPMS Ion Balance (% Difference) Total Ammonia-N Nitrate (NO3) and Nitrite (NO2) in Water	Instrumentation AT KONE SPEC AT TOCV/NDIR CV/AA ICP/MS CALC LACH/NH4 LACH	Batch           6971414           6971945           6972446           6971455           6972374           6976512           6972154           6967207           6974196           6971839	Extracted N/A N/A N/A N/A 2020/10/01 N/A N/A N/A N/A N/A	Date Analyzed           2020/09/30           2020/10/02           2020/10/01           2020/10/01           2020/10/01           2020/10/01           2020/10/01           2020/10/01           2020/10/01           2020/10/03           2020/10/03           2020/10/03           2020/10/03           2020/10/03           2020/10/03	AnalystSurinder RaiDeonarine RamnarineNimarta SinghSurinder RaiNimarta SinghMeghaben PatelArefa DabhadAutomated StatchkAlina DobreanuAmanpreet Sappal
Test DescriptionAlkalinityChloride by Automated ColourimetryChemical Oxygen DemandConductivityDissolved Organic Carbon (DOC)Mercury in Water by CVAADissolved Metals by ICPMSIon Balance (% Difference)Total Ammonia-NNitrate (NO3) and Nitrite (NO2) in WaterpH	Instrumentation AT KONE SPEC AT TOCV/NDIR CV/AA ICP/MS CALC LACH/NH4 LACH AT	Batch           6971414           6971945           6972446           6971455           6972474           6971455           6972374           6976512           6972154           6967207           6974196           6971839           6971461	Extracted N/A N/A N/A N/A N/A 2020/10/01 N/A N/A N/A N/A N/A 2020/09/29	Date Analyzed           2020/09/30           2020/10/02           2020/10/01           2020/10/01           2020/10/01           2020/10/01           2020/10/03           2020/10/03           2020/10/03           2020/10/03           2020/10/03           2020/10/03           2020/10/03           2020/10/03           2020/10/03           2020/09/30           2020/09/30	AnalystSurinder RaiDeonarine RamnarineNimarta SinghSurinder RaiNimarta SinghMeghaben PatelArefa DabhadAutomated StatchkAlina DobreanuAmanpreet SappalSurinder Rai
Test DescriptionAlkalinityChloride by Automated ColourimetryChemical Oxygen DemandConductivityDissolved Organic Carbon (DOC)Mercury in Water by CVAADissolved Metals by ICPMSIon Balance (% Difference)Total Ammonia-NNitrate (NO3) and Nitrite (NO2) in WaterpHPhenols (4AAP)	Instrumentation AT KONE SPEC AT TOCV/NDIR CV/AA ICP/MS CALC LACH/NH4 LACH AT TECH/PHEN	Batch           6971414           6971945           6972446           6971455           6972374           6976512           6972154           6967207           6974196           6971839           6971461           6973179	Extracted N/A N/A N/A N/A 2020/10/01 N/A N/A N/A N/A 2020/09/29 N/A	Date Analyzed           2020/09/30           2020/10/02           2020/10/01           2020/10/01           2020/10/01           2020/10/01           2020/10/03           2020/10/03           2020/10/03           2020/10/03           2020/10/03           2020/10/03           2020/09/30           2020/09/30           2020/09/30           2020/09/30	AnalystSurinder RaiDeonarine RamnarineNimarta SinghSurinder RaiNimarta SinghMeghaben PatelArefa DabhadAutomated StatchkAlina DobreanuAmanpreet SappalSurinder RaiBramdeo Motiram
Test DescriptionAlkalinityChloride by Automated ColourimetryChemical Oxygen DemandConductivityDissolved Organic Carbon (DOC)Mercury in Water by CVAADissolved Metals by ICPMSIon Balance (% Difference)Total Ammonia-NNitrate (NO3) and Nitrite (NO2) in WaterpHPhenols (4AAP)Sulphate by Automated Colourimetry	Instrumentation AT KONE SPEC AT TOCV/NDIR CV/AA ICP/MS CALC LACH/NH4 LACH AT TECH/PHEN KONE	Batch           6971414           6971945           6972446           6971455           6972374           6976512           6972154           6967207           6971439           6971439           6971839           6971461           6973179           6971962	Extracted N/A N/A N/A N/A 2020/10/01 N/A N/A N/A N/A 2020/09/29 N/A N/A N/A	Date Analyzed           2020/09/30           2020/10/02           2020/10/01           2020/10/01           2020/10/01           2020/10/01           2020/10/03           2020/10/03           2020/10/03           2020/10/03           2020/09/30           2020/09/30           2020/09/30           2020/09/30           2020/09/30           2020/09/30           2020/09/30           2020/09/30           2020/10/03	AnalystSurinder RaiDeonarine RamnarineNimarta SinghSurinder RaiNimarta SinghMeghaben PatelArefa DabhadAutomated StatchkAlina DobreanuAmanpreet SappalSurinder RaiBramdeo MotiramDeonarine Ramnarine
Test DescriptionAlkalinityChloride by Automated ColourimetryChemical Oxygen DemandConductivityDissolved Organic Carbon (DOC)Mercury in Water by CVAADissolved Metals by ICPMSIon Balance (% Difference)Total Ammonia-NNitrate (NO3) and Nitrite (NO2) in WaterpHPhenols (4AAP)Sulphate by Automated ColourimetryTotal Dissolved Solids	Instrumentation AT KONE SPEC AT TOCV/NDIR CV/AA ICP/MS CALC LACH/NH4 LACH AT TECH/PHEN KONE BAL	Batch           6971414           6971945           6972446           6972374           6976512           6972154           6967207           6971456           6971457           6972154           6967207           6971459           6971459           6971450           6971451           6971461           6971962           6972296	Extracted N/A N/A N/A N/A 2020/10/01 N/A N/A N/A N/A 2020/09/29 N/A N/A 2020/09/29	Date Analyzed           2020/09/30           2020/10/02           2020/10/01           2020/10/01           2020/10/01           2020/10/01           2020/10/03           2020/10/03           2020/10/03           2020/09/30           2020/09/30           2020/09/30           2020/09/30           2020/09/30           2020/09/30           2020/09/30           2020/09/30           2020/10/03           2020/10/03	AnalystSurinder RaiDeonarine RamnarineNimarta SinghSurinder RaiNimarta SinghMeghaben PatelArefa DabhadAutomated StatchkAlina DobreanuAmanpreet SappalSurinder RaiBramdeo MotiramDeonarine RamnarineShivani Desai
Test DescriptionAlkalinityChloride by Automated ColourimetryChemical Oxygen DemandConductivityDissolved Organic Carbon (DOC)Mercury in Water by CVAADissolved Metals by ICPMSIon Balance (% Difference)Total Ammonia-NNitrate (NO3) and Nitrite (NO2) in WaterPHPhenols (4AAP)Sulphate by Automated ColourimetryTotal Dissolved SolidsTotal Kjeldahl Nitrogen in Water	Instrumentation AT KONE SPEC AT TOCV/NDIR CV/AA ICP/MS CALC LACH/NH4 LACH LACH AT TECH/PHEN KONE BAL SKAL	Batch           6971414           6971945           6972446           6972474           6972474           6972474           6972154           6972154           6967207           6974196           6971451           6971452           6971453           6971461           6973179           6971962           6972296           6973439	Extracted N/A N/A N/A N/A 2020/10/01 N/A N/A N/A N/A 2020/09/29 N/A N/A 2020/09/29 2020/09/30	Date Analyzed           2020/09/30           2020/10/02           2020/10/01           2020/10/01           2020/10/01           2020/10/01           2020/10/01           2020/10/01           2020/10/03           2020/10/03           2020/10/03           2020/10/03           2020/10/03           2020/10/03           2020/09/30           2020/09/30           2020/09/30           2020/10/03           2020/09/30           2020/09/30           2020/09/30	AnalystSurinder RaiDeonarine RamnarineNimarta SinghSurinder RaiNimarta SinghMeghaben PatelArefa DabhadAutomated StatchkAlina DobreanuAmanpreet SappalSurinder RaiBramdeo MotiramDeonarine RamnarineShivani DesaiRajni Tyagi
Test Description         Alkalinity         Chloride by Automated Colourimetry         Chemical Oxygen Demand         Conductivity         Dissolved Organic Carbon (DOC)         Mercury in Water by CVAA         Dissolved Metals by ICPMS         Ion Balance (% Difference)         Total Ammonia-N         Nitrate (NO3) and Nitrite (NO2) in Water         PH         Phenols (4AAP)         Sulphate by Automated Colourimetry         Total Dissolved Solids         Total Kjeldahl Nitrogen in Water         Total Phosphorus (Colourimetric)	Instrumentation AT KONE SPEC AT TOCV/NDIR CV/AA ICP/MS CALC LACH/NH4 LACH AT TECH/PHEN KONE BAL SKAL LACH/P	Batch           6971414           6971945           6972446           6971455           697247           6972374           6976512           6972154           6972154           6972154           6974196           6974196           6971839           6971461           6973179           6972296           6972393           6973439	Extracted N/A N/A N/A N/A 2020/10/01 N/A 2020/09/01 N/A N/A 2020/09/29 N/A N/A 2020/09/29 2020/09/29 2020/09/30	Date Analyzed           2020/09/30           2020/10/02           2020/10/01           2020/10/01           2020/10/01           2020/10/01           2020/10/01           2020/10/03           2020/10/03           2020/10/03           2020/10/03           2020/09/30           2020/09/30           2020/09/30           2020/09/30           2020/09/30           2020/09/30           2020/09/30           2020/09/30           2020/09/30	AnalystSurinder RaiDeonarine RamnarineNimarta SinghSurinder RaiNimarta SinghMeghaben PatelArefa DabhadAutomated StatchkAlina DobreanuAmanpreet SappalSurinder RaiBramdeo MotiramDeonarine RamnarineShivani DesaiRajni TyagiShivani Shivani

BV Labs ID: Sample ID: Matrix:	NSP257 BH-F Water					Collected: 2020/09/23 Shipped: Received: 2020/09/24	
Test Description		Instrumentation	Batch	Extracted	Date Analyzed	Analyst	
Alkalinity		AT	6971408	N/A	2020/10/01	Surinder Rai	
Chloride by Automated Co	olourimetry	KONE	6971945	N/A	2020/10/02	Deonarine Ramnarine	

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#### **TEST SUMMARY**

BV Labs ID: NSP257 Sample ID: BH-F					Collected: 2020/09/23 Shipped:
Matrix: Water					Received: 2020/09/24
Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chemical Oxygen Demand	SPEC	6972446	N/A	2020/10/01	Nimarta Singh
Conductivity	AT	6971409	N/A	2020/10/01	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	6972514	N/A	2020/10/01	Nimarta Singh
Mercury in Water by CVAA	CV/AA	6976512	2020/10/01	2020/10/01	Meghaben Patel
Dissolved Metals by ICPMS	ICP/MS	6972154	N/A	2020/09/30	Arefa Dabhad
Ion Balance (% Difference)	CALC	6967207	N/A	2020/10/03	Automated Statchk
Total Ammonia-N	LACH/NH4	6974196	N/A	2020/10/01	Alina Dobreanu
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	6971886	N/A	2020/10/01	Amanpreet Sappal
рН	AT	6971410	2020/09/29	2020/10/01	Surinder Rai
Phenols (4AAP)	TECH/PHEN	6973179	N/A	2020/09/30	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	6971962	N/A	2020/10/03	Deonarine Ramnarine
Total Dissolved Solids	BAL	6972296	2020/09/29	2020/09/30	Shivani Desai
Total Kjeldahl Nitrogen in Water	SKAL	6973439	2020/09/30	2020/09/30	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	6973533	2020/09/30	2020/09/30	Shivani Shivani
Volatile Organic Compounds in Water	P&T/MS	6967743	N/A	2020/09/30	Dina Wang



# **GENERAL COMMENTS**

Each temperature is the average of up to three cooler temperatures taken at receipt							
	Package 1	12.3°C					
VOC Wate	VOC Water Analysis: Due to foaming, some of the samples required dilution. The detection limits were adjusted accordingly.						
Sample NSP254 [BH-H] : Elevated ion balance confirmed by re-analysis. Cations suspected to be biased high.							
Results re	elate only to the ite	ms tested.					



# QUALITY ASSURANCE REPORT

exp Services Inc Client Project #: THB-00011174-IE Site Location: BEARDMORE LANDFILL Sampler Initials: EF

			Matrix	Spike	SPIKED	BLANK	Method I	Blank	RP	D	QC Sta	indard
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
6967743	4-Bromofluorobenzene	2020/09/30	100	70 - 130	99	70 - 130	94	%				
6967743	D4-1,2-Dichloroethane	2020/09/30	101	70 - 130	100	70 - 130	102	%				
6967743	D8-Toluene	2020/09/30	100	70 - 130	100	70 - 130	99	%				
6967743	1,4-Dichlorobenzene	2020/09/30	100	70 - 130	100	70 - 130	<0.20	ug/L	NC	30		
6967743	Benzene	2020/09/30	98	70 - 130	99	70 - 130	<0.10	ug/L	NC	30		
6967743	Methylene Chloride(Dichloromethane)	2020/09/30	89	70 - 130	89	70 - 130	<0.50	ug/L	NC	30		
6967743	Toluene	2020/09/30	96	70 - 130	97	70 - 130	<0.20	ug/L	NC	30		
6967743	Vinyl Chloride	2020/09/30	95	70 - 130	96	70 - 130	<0.20	ug/L	NC	30		
6971408	Alkalinity (Total as CaCO3)	2020/10/01			96	85 - 115	<1.0	mg/L	0.70	20		
6971409	Conductivity	2020/10/01			100	85 - 115	<1.0	umho/c m	0	25		
6971410	рН	2020/10/01			102	98 - 103			0.21	N/A		
6971414	Alkalinity (Total as CaCO3)	2020/09/30			95	85 - 115	<1.0	mg/L	0.39	20		
6971455	Conductivity	2020/09/30			100	85 - 115	<1.0	umho/c m	3.1	25		
6971461	рН	2020/09/30			102	98 - 103			0.50	N/A		
6971839	Nitrate (N)	2020/09/30	105	80 - 120	104	80 - 120	<0.10	mg/L	0.49	20		
6971839	Nitrite (N)	2020/09/30	104	80 - 120	101	80 - 120	<0.010	mg/L	0.11	20		
6971886	Nitrate (N)	2020/10/01	111	80 - 120	104	80 - 120	<0.10	mg/L	NC	20		
6971886	Nitrite (N)	2020/10/01	103	80 - 120	96	80 - 120	<0.010	mg/L	NC	20		
6971945	Dissolved Chloride (Cl-)	2020/10/02	104	80 - 120	106	80 - 120	<1.0	mg/L	NC	20		
6971962	Dissolved Sulphate (SO4)	2020/10/03	NC	75 - 125	102	80 - 120	<1.0	mg/L	2.3	20		
6972154	Dissolved Arsenic (As)	2020/09/30	100	80 - 120	98	80 - 120	<1.0	ug/L	9.5	20		
6972154	Dissolved Barium (Ba)	2020/09/30	99	80 - 120	99	80 - 120	<2.0	ug/L	1.5	20		
6972154	Dissolved Boron (B)	2020/09/30	NC	80 - 120	96	80 - 120	<10	ug/L	2.9	20		
6972154	Dissolved Cadmium (Cd)	2020/09/30	101	80 - 120	100	80 - 120	<0.090	ug/L	3.8	20		
6972154	Dissolved Calcium (Ca)	2020/09/30	NC	80 - 120	103	80 - 120	<200	ug/L	2.4	20		
6972154	Dissolved Chromium (Cr)	2020/09/30	96	80 - 120	94	80 - 120	<5.0	ug/L	NC	20		
6972154	Dissolved Copper (Cu)	2020/09/30	102	80 - 120	102	80 - 120	<0.90	ug/L	8.0	20		
6972154	Dissolved Iron (Fe)	2020/09/30	100	80 - 120	98	80 - 120	<100	ug/L	NC	20		
6972154	Dissolved Lead (Pb)	2020/09/30	96	80 - 120	98	80 - 120	<0.50	ug/L	NC	20		

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# QUALITY ASSURANCE REPORT(CONT'D)

exp Services Inc Client Project #: THB-00011174-IE Site Location: BEARDMORE LANDFILL Sampler Initials: EF

			Matrix	Spike	SPIKED	BLANK	Method E	Blank	RP	D	QC Sta	ndard
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
6972154	Dissolved Magnesium (Mg)	2020/09/30	NC	80 - 120	100	80 - 120	<50	ug/L	0.65	20		
6972154	Dissolved Manganese (Mn)	2020/09/30	98	80 - 120	98	80 - 120	<2.0	ug/L	0.31	20		
6972154	Dissolved Potassium (K)	2020/09/30	99	80 - 120	100	80 - 120	<200	ug/L	0.046	20		
6972154	Dissolved Sodium (Na)	2020/09/30	NC	80 - 120	97	80 - 120	<100	ug/L	0.78	20		
6972154	Dissolved Zinc (Zn)	2020/09/30	97	80 - 120	99	80 - 120	<5.0	ug/L	6.3	20		
6972296	Total Dissolved Solids	2020/09/30					<10	mg/L	3.3	25	102	90 - 110
6972374	Dissolved Organic Carbon	2020/10/01	91	80 - 120	97	80 - 120	<0.40	mg/L	4.0	20		
6972446	Total Chemical Oxygen Demand (COD)	2020/10/01	95	80 - 120	98	80 - 120	<4.0	mg/L	NC	20		
6972514	Dissolved Organic Carbon	2020/10/01	97	80 - 120	102	80 - 120	<0.40	mg/L	1.6	20		
6973177	Phenols-4AAP	2020/09/30	96	80 - 120	97	80 - 120	<0.0010	mg/L	0	20		
6973179	Phenols-4AAP	2020/09/30	97	80 - 120	97	80 - 120	<0.0010	mg/L	9.5	20		
6973439	Total Kjeldahl Nitrogen (TKN)	2020/09/30	104	80 - 120	102	80 - 120	<0.10	mg/L	NC	20	104	80 - 120
6973533	Total Phosphorus	2020/09/30	97	80 - 120	97	80 - 120	<0.020	mg/L	2.2	20	95	80 - 120
6974196	Total Ammonia-N	2020/10/01	96	75 - 125	97	80 - 120	<0.050	mg/L	0.93	20		
6976512	Mercury (Hg)	2020/10/01	94	75 - 125	93	80 - 120	<0.00010	mg/L	NC	20		
6982697	Dissolved Arsenic (As)	2020/10/05	97	80 - 120	98	80 - 120	<1.0	ug/L	NC	20		
6982697	Dissolved Barium (Ba)	2020/10/05	96	80 - 120	98	80 - 120	<2.0	ug/L	0.15	20		
6982697	Dissolved Boron (B)	2020/10/05	93	80 - 120	99	80 - 120	<10	ug/L	6.2	20		
6982697	Dissolved Cadmium (Cd)	2020/10/05	97	80 - 120	99	80 - 120	<0.090	ug/L	NC	20		
6982697	Dissolved Calcium (Ca)	2020/10/05	NC	80 - 120	102	80 - 120	<200	ug/L	3.3	20		
6982697	Dissolved Chromium (Cr)	2020/10/05	96	80 - 120	99	80 - 120	<5.0	ug/L	NC	20		
6982697	Dissolved Copper (Cu)	2020/10/05	99	80 - 120	101	80 - 120	<0.90	ug/L	0.16	20		
6982697	Dissolved Iron (Fe)	2020/10/05	96	80 - 120	98	80 - 120	<100	ug/L	NC	20		
6982697	Dissolved Lead (Pb)	2020/10/05	92	80 - 120	95	80 - 120	<0.50	ug/L	NC	20		
6982697	Dissolved Magnesium (Mg)	2020/10/05	94	80 - 120	98	80 - 120	<50	ug/L	0.48	20		
6982697	Dissolved Manganese (Mn)	2020/10/05	94	80 - 120	96	80 - 120	<2.0	ug/L	1.9	20		
6982697	Dissolved Potassium (K)	2020/10/05	98	80 - 120	99	80 - 120	<200	ug/L	0.56	20		
6982697	Dissolved Sodium (Na)	2020/10/05	NC	80 - 120	100	80 - 120	<100	ug/L	0.74	20		



# QUALITY ASSURANCE REPORT(CONT'D)

exp Services Inc Client Project #: THB-00011174-IE Site Location: BEARDMORE LANDFILL Sampler Initials: EF

			r		1						1	
			Matrix	Spike	SPIKED	BLANK	Method	Blank	RP	D	QC Sta	indard
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
6982697	Dissolved Zinc (Zn)	2020/10/05	95	80 - 120	95	80 - 120	<5.0	ug/L	NC	20		
N/A = Not A	pplicable											
Duplicate: P	Paired analysis of a separate portion of the same	sample. Used to	evaluate the	variance in	the measurem	ient.						
Matrix Spike	e: A sample to which a known amount of the ana	lyte of interest	has been adde	ed. Used to e	evaluate samp	le matrix inte	rference.					
QC Standard	I: A sample of known concentration prepared by	an external age	ncy under stri	ngent condi	tions. Used as	an independ	ent check of	method ac	curacy.			
Spiked Blank	k: A blank matrix sample to which a known amou	nt of the analyt	e, usually from	n a second s	ource, has bee	en added. Use	d to evaluat	e method a	ccuracy.			
Method Blar	nk: A blank matrix containing all reagents used ir	the analytical p	procedure. Us	ed to identif	y laboratory c	ontamination						
Surrogate: A	A pure or isotopically labeled compound whose b	ehavior mirrors	the analytes of	of interest. l	Jsed to evalua	te extraction	efficiency.					
NC (Matrix S	pike): The recovery in the matrix spike was not ca	alculated. The r	elative differe	nce betwee	n the concenti	ration in the p	arent sample	e and the s	pike amount v	vas too smal	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 <= 2x RDL).



#### VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Anastassia Hamanov, Scientific Specialist

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.

	INVO	ICE TO:		REPORT TO:						PR	OJECT INFORMA	TION:	1	Laboratory Use (	Only:	
pany Name: #17501 exp Services Inc			Con	Company Name:						В	390560		1	Bottle Order	#:	
ntion:	s Accounts Payable 1142 Roland St Thunder Bay ON P7B 5M4			Attention: Ahileas Mitsopoulos, Kalk, PitKanish					P.O. #	P.O.#						
0\$5									Project: THB-00011174-IE					791123	an.	
(807) 623-9495			8070			-			Project Name	Project Name:				COC #:	Project Manag	jer:
thunderbay@exp.com; Karen.Burke@exp.com;AP@ex		m;AP@ex Ema	ahilea	s.mitsopoulo	s@exp.com	KALL JULT	anza E 130.0	Site #:	1	Seardmore	Landfill			Julie Clemer	nt	
MOER	EGULATED DRINKING V	VATER OR WATER INTEN	DED FOR HUMA	N CONSUMPTION	MUST BE		1	A	VALYSIS REQUE	STED (PLE	ASE BE SPECIFIC	5)	-	C#791123-01-01 Turnaround Time (TAT) R	equired:	
	SUBMITTED ON	THE BV LABS DRINKING	WATER CHAIN (	OF CUSTODY		-	101						10	Please provide advance notice fo	r rush projects	-
Regulation 153 (2011)         Other Regulations           Table 1         Res/Park         Medium/Fine         CCME         Sanitary Sower Bylaw           Table 2         Ind/Comm         Coarse         Reg 558.         Storm Sewer Bylaw           Table 3         Agri/Other         For RSC         MIISA         Municipatity		lations	Special Instructions			C C C						Regular (Stan	idard) TAT: Rush TAT is not specified:		X	
		Sewer Bylaw				ase Cr-V						Standard TAT = 5	-7 Working days for most lests			
		and by du		Sch 5						Please note: Stan days - contact you	dard TAT for certain tests such as B ir Project Manager for details.	DD and Dioxins/Furans (	are > 5			
Table PW00 Reg 406 Table X Other OD1A1 S			6 Table	_		Is	ards						Job Specific Ru	sh TAT (if applies to entire subm	ission)	-
				-		Meta	Stand						Date Required:	Tim	e Required:	-
Sar	nciude Criteria or	Certificate of Analysis (Y/N	<u>)?</u>		1	Field	Ilitor						Rush Confirmatio	n Number:(c	all lab for #)	
		Q11-1	Date Sampl	ed Time Sampled	Matrix	-	Lis	-					# of Bottles	Comm	ints	
		DHI	202050 2	3 8:45A	GW		×						12			
		BH-G	2010/20 2	3 9:10A	GW	V	×						12			
		BH-H	2020540 7	3 10:15A	H GW	V	×		3				12			-
		BH-C	200000 7	39.454	GW	1.1	v			-			12			
-		011 1		o se tom	7		^	_		_			12			
-		BH-J	2020sep 2	3 9:35AM	GW	V	X				_		12			
-		BH-F	2020Sepi	311:35	GW	1	X						12			
			4		GW								1	Rec'd In Thu	ider Bay	
								-	- ·	24	-Sep-20 I	1:51	-			_
									1111		ement					
										COP	0645					_
									KV	G	ENV-137	78				1
	RELINQUISHED BY: (Signati	re/Print) Date:	(YY/MM/DD)	Time	RECEIVED	BY: (Signature/P	rint)	Date: (YY)	MM/DD)	Time	# jars us	ed and	Laboratory	Use Only Toplum	and in Ocel	t
UN	Jorno Elu	in Farkah		6	2 Jan	nes Klappe	erich	2020/0	9/24	1:31	not sub	mitted Time Sensiti	ve Temperature	"C) on Recei Custody Se	al Yos	No
Kola	- FITKANKIN / KAR	Mer		m		ang 14	1C	- Cagis	940	09127			14/11/	12 Present		NI

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# **APPENDIX F – Durov Plots**













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**APPENDIX G – Time Series Graphs** 














