2023 ANNUAL MONITORING REPORT
WOLF CREEK WASTE DISPOSAL SITE
ENVIRONMENTAL COMPLIANCE APPROVAL
NO. A361102

Prepared for:

The Corporation of the Municipality of Hastings Highlands
P.O. Box 130
33011 Highway No. 62
Maynooth, ON K0L 2S0

Prepared by:

BluMetric Environmental Inc.
4 Cataraqui Street
The Woolen Mill, The Tower
Kingston, ON K7K 1Z7

Project Number: 230225-01
March 25, 2024

2023 ANNUAL MONITORING REPORT
WOLF CREEK WASTE DISPOSAL SITE
ENVIRONMENTAL COMPLIANCE APPROVAL
NO. A361102

Prepared for:

The Corporation of the Municipality of Hastings Highlands
P.O. Box 130
33011 Highway No. 62
Maynooth, ON K0L 2S0

Prepared by:

BluMetric Environmental Inc.
4 Cataraqui Street
The Woolen Mill, The Tower
Kingston, ON K7K 1Z7

Project Number: 230225-01

March 25, 2024

Table of Contents

List of Tables

List of Figures

Site Photographs

Chemistry Trend Graphs

List of Appendices

(Provided On USB Drive for Hard Copy)

1 Introduction

BluMetric Environmental Inc. (BluMetric®) was retained by The Municipality of Hastings Highlands (MHHs or Municipality) to conduct the 2023 environmental monitoring and sampling program and prepare the 2023 Annual Monitoring Report (AMR). This report provides a summary and analysis of environmental monitoring activities at the Wolf Creek Waste Disposal Site (WDS), in Barry's Bay, Ontario. The WDS, as shown in Figure 01 is herein referred to as the "Site".

This report is prepared in accordance with Condition 9 of the Environmental Compliance Approval (ECA) A361102 for the Site, issued December 7, 2017, and most recently amended on October 13, 2023, a copy of which is included in **Appendix A (A1).** The report covers all work and activities carried out for the period from January 1 to December 31, 2023. The report includes both the environmental monitoring and sampling program as well as details relating to site operations, including the Waste Transfer (WT) areas at the Site in 2023.

The MECP Surface Water Review for the 2020 AMR dated January 6, 2022, is also provided in **Appendix A (A2)**. Based on the 2020 AMR, the reviewer indicated that surface water impacts are unlikely. In addition, the review indicates that downgradient wells should be compared to the Provincial Water Quality Objectives (PWQOs) and determine if a surface water monitoring program is required.

The MECP conducted an inspection at the Site on August 31, 2022. The Inspection Report and accompanying summary letter are provided in **Appendix A (A3)**. The MECP identified that outstanding non-compliance items include the lack of the required 30 m buffer area and Contaminated Attenuation Zone (CAZ), and the corresponding approval of the CAZ along with a Closure Plan through an ECA amendment. The MECP noted that at the time of the inspection, the 2021 AMR was awaiting review by the ministry's Technical Support Section.

The intent of this report is to be consistent with the general requirements of the Ontario Ministry of Environment, Conservation and Parks (MECP) document titled; *Monitoring and Reporting for Waste Disposal Sites (WDS), Groundwater and Surface Water: Technical Guidance Document (MOE November 2010)*, referred to as the "WDS Technical Guidance". The Monitoring and Screening Checklist from the WDS Technical Guidance has been completed and is included as **Appendix B** of this report. The screening checklist was completed with the Operational Status set as "open" as the Site operated through 2023.

1.1 Location

The WDS is located east of the intersection of Renfrew County Road 69 (Siberia Road) and River Road in Barry's Bay, Ontario (Figure 01). The civic address is 567 River Road, Barry's Bay, Ontario. The Wolf Creek WDS has a total site area of 0.7 hectares (ha) and is located in a former aggregate pit on Part of Lot 22, Concession 14 of the former townships of Bangor, Wicklow, McClure, now part of the Municipality of Hastings Highlands. The facility layout, current topography (2017), road network, and site features are shown on Figure 02.

1.2 Ownership and Key Personnel

The facility is operated by the MHHs, with the Municipal office located in Maynooth, Ontario. The property is owned by the Crown and administered by the Ministry of Natural Resources and Forestry (MNRF). The MNRF leases the property to MHHs for use as a WDS under a Land Use Permit (LUP). The current Land Use Permit (LUP) for the Site (LUP1634-1004191) dated June 28, 2017, identifies the correct geographic location of the Site and is in effect until May 31, 2026. A copy of the LUP is provided in **Appendix A (A4).**

The facility's operational representative is responsible for all activities on-site. The Site contact is David Stewart and the Competent Environmental Practitioner (CEP) for both groundwater and surface water is S'rana Scholes, P.Eng., of BluMetric. Ms. Scholes is a Professional Engineer as designated by Professional Engineers Ontario (PEO).

Contact information is outlined in Table 1.

Table 1: Contact Information

Role	Name	Address	Phone Number	Email
Site Owner / Contact	CAO, MHHs – David Stewart	P.O. Box 130 33011 Highway No. 62, Maynooth, ON, K0L 2S0	(613) 338-2811 ext. 233	dstewart @hastingshighlands.ca
CEP	Senior Environmental Engineer, BluMetric – S'rana Scholes, P.Eng.	209 Frederick street, Kitchener, ON, N2H 2M7	(877) 487-8436 ext. 218	sscholes @blumetric.ca

1.3 Description and Development of the WDS

The Site has a total area of approximately 0.7 hectares (ha) and is approved for the use and operation of a 0.2 ha waste disposal site with a transfer station within the total site area. In addition to domestic waste, Wolf Creek WDS includes recycling bins for metal, plastic, paper/cardboard products, as well as segregated areas for scrap metal, bulky items, tires, and brush. The Ontario Electronic Stewardship (OES) has approved the Wolf Creek WDS for the collection of Waste Electrical and Electronic Equipment (WEEE) wastes. New regulations came into effect in 2020 with respect to this material, now referred to as Electrical and Electronic Equipment (EEE). The new regulation with respect to EEE falls under the Resource Recovery and Circular Economy Act, 2016, and the regulation was filed on September 21, 2020. The Site is not approved to collect household hazardous waste; however, bins are kept onsite for any inadvertently left HHW.

In accordance with Ontario Regulation (O.Reg.) 347/90, the Site must be located and operated to minimize fire hazards. Due to the location of the Site within a forested area, a minimum 30 m buffer between the waste footprint and the surrounding treeline for a firebreak is required (Forest Fires Prevention Act, R.S.O. 1990, c. F.24). As identified by the MECP in August 2022, the Site does not currently have a sufficient 30 m buffer from

the edge of the active landfilling area, or combustible waste (brush) stored onsite. The 30 m buffer shown on Figure 03 illustrates the maximum extents of the 30 m firebreak based on the final extent of the waste footprint. Several scattered piles of brush were observed across the Site in 2022; these scattered piles should be collected and placed in one permanent brush pile with a 30 m firebreak. The proposed 30 m firebreak surrounding the future combined brush pile is not shown on Figure 03.

In 2022, a Contaminant Attenuation Zone (CAZ) Assessment was carried out for the Site. The MECP issued approval for the CAZ (shown on Figure 03) in the most recently amended ECA A361102 dated October 13, 2023. The 2022 CAZ Assessment is provided in **Appendix G** and is discussed further in Section 5.3.

1.4 Monitoring and Reporting Program and Objectives and Requirements

The objectives of the monitoring and reporting program are to identify and mitigate impacts to the environment caused by the municipal solid WDS and WTS. The monitoring and reporting program has been developed with these objectives in mind. In addition, the monitoring and reporting program are designed to adhere to the MECP's Monitoring and Reporting for Waste Disposal Sites Groundwater and Surface Water-Technical Guidance Document (November 2010) and the ECA for the Site.

2 Physical Setting

2.1 Geology and Hydrogeology

2.1.1 Surficial Geology

The surficial geology of the area is a glaciofluvial plain covered with till veneer. The immediate area of the Site is characterized by generally sandy overburden with a thickness ranging from 5 to 10 metres. Monitoring well logs for the three site monitoring wells drilled in 2003 indicated that the overburden is a sand and gravel unit to depths of over 11 metres below ground surface (mbgs). Monitoring well logs for the five site monitoring wells drilled in July 2019 indicated that the overburden is a sand and

gravel unit to depths of 23.8 mbgs. The 2019 overburden wells along the west property boundary ranged in depth from 12.2 to 13.7 mbgs. A well nest was drilled between the west property boundary and the creek to the west of the property. The well nest consists of three overburden wells to depths of 12.8 mbgs, 18.9 mbgs and 23.4 mbgs. The deepest well was drilled just into granitic bedrock to a depth of 24.4 m. The amount and size of the gravel increases with depth particularly below 15 mbgs.

Well records for four private wells located within 500 m of the Site and along the Madawaska River were obtained from the MECP website. The monitoring well logs and well records are provided in **Appendix C** and indicate the overburden ranges from approximately 18 mbgs to 44 mbgs and are generally sand and gravel with some silt and clay layers.

2.1.2 Overburden Hydrogeology

On October 24, 2019, slug-bail testing was carried out on two of the new monitoring wells (MW6.3-19 and MW6.1-19). The results of the field testing were analyzed using the Hvorlev analyses and indicated the overburden sand and gravel at MW6.1-19 has an estimated hydraulic conductivity of 3.86 to 4.61 x 10^{-4} m/s, while the sand and gravel at MW6.3-19 has an estimated hydraulic conductivity of 1.31 to 7.03 m^{-3} m/s.

2.1.3 Bedrock Geology

The Wolf Creek WDS is located within the Grenville geological province, on Precambrian bedrock. Bedrock is described as Felsic igneous rocks such as tonalite, granodiorite, monzonite, granite, syenite, and derived gneisses (Map 2544, MNDM). The well records mentioned in the Section above, identify the bedrock as granite.

Based on the geology, surface water features, and historic data the shallow aquifer flows in a general west direction toward Wolf Creek, while deep bedrock aquifers have not been measured but may flow southward toward the Madawaska River and/or southeast towards Kamaniskeg Lake.

2.2 Surface Water Features

Based on a review of the topographical maps, combined with a site inspection, it is evident that the surface water drainage at the Site flows into the current waste site, which is a former aggregate pit. The Site topography is shown on Figure 03. The surface water infiltrates into the subsurface and enters into the groundwater system.

In 2017, the MECP confirmed that surface water monitoring is not required unless additional groundwater monitoring demonstrates a potential for leachate impacts to the creek.

3 Description of Monitoring Program

3.1 Site Inspections and Operations Monitoring

Site visits to the Wolf Creek WDS were conducted on May 1, 2023, and October 16, 2023. In general, the Site was in good to excellent condition. The detailed site checklists are provided in **Appendix D (D-1)**. During the spring sampling event, two concerns were noted: both the metals and bulk waste piles were full and overflowing into one another, and the berms dividing the segregated scrap piles need to be better established. During the fall sampling event, the berms dividing the segregated scrap piles need to be better established.

Select photographs taken during the Site visits are provided at the end of the text following the tables and figures.

3.2 Monitoring Locations, Frequency and Monitoring Parameters

3.2.1 Groundwater Monitoring

In accordance with the ECA, semi-annual (spring and fall) groundwater monitoring and sampling is required. There are currently eight groundwater monitoring wells located at the Site. The semi-annual groundwater sampling protocol was identified in the

Development and Operations (D&O) Plan, which was accepted in the December 7, 2017, ECA amendment. The details and descriptions of all existing groundwater monitoring wells are provided in Table 2, while the monitoring well logs are provided in **Appendix C.**

Table 2: Groundwater Monitoring Well Details

Sample Location	Northing[1]	Easting[1]	Screened Interval (mbgs)	Location Description
WC1-03	5032819	285905	4.57 to 7.62	110 m north-northeast of last area of waste
WC2-03	5032777	285842	8.23 to 11.28	100 m northwest of last area of waste deposition
WC3-03	5032701	285860	8.23 to 11.28	30 m west of last area of waste deposition
WC4-19	5032744	285836	9.2 to 12.2	40 m west of last area of waste deposition
WC5-19	5032816	285830	10.8 to 13.8	120 m north-northwest of last area of waste
WC6.1-19	5032773	285818	20.4 to 23.4	90 m northwest of last area of waste deposition
WC6.2-19	5032772	285821	15.9 to 18.9	90 m northwest of last area of waste deposition
WC6.3-19	5032771	285817	9.8 to 12.8	90 m northwest of last area of waste deposition

Note:

[1] UTM Zone 18, NAD 83 as surveyed on December 11, 2019.

Groundwater samples were collected on May 1 and October 16, 2023. The laboratory reports and chain of custody records are included in **Appendix D (D-2)**. Table 3 lists the groundwater quality monitoring parameters.

Table 3: Groundwater Quality Monitoring Parameters

Category	Parameters
Organic Parameters	Dissolved Organic Carbon (DOC)
Inorganic Parameters	Alkalinity, Ammonia, Calcium, Chloride, Magnesium, Nitrate, Potassium, Sodium, Sulphate
Dissolved Metals	Aluminum, Boron, Iron, Lead, Manganese, Strontium, Zinc
Physical/Chemical Parameters	Chemical Oxygen Demand (COD), Conductivity, pH, Total Dissolved Solids (TDS)

Field measurements of groundwater pH, temperature, and conductivity are collected at the time of sampling.

During the fall 2023 monitoring event, the conditions of groundwater monitoring wells were inspected. Any repairs, such as new locks, labels or well caps, were made as necessary. Watertight casings and seals remain in place at all monitors to ensure that surface water or foreign materials cannot enter groundwater monitoring wells. All groundwater monitoring wells are fitted with a vermin proof cap to meet the requirements of O.Reg. 903 and are locked to provide protection against vandalism and are in line with industry best practices.

3.2.1.1 Groundwater Elevation and Flow Monitoring

During each monitoring event, groundwater elevations were collected from all existing monitoring wells. Groundwater level measurements were collected using a Solinst electronic water level meter prior to purging/sampling activity. Groundwater elevation data are presented in Table 4 and are provided on Figure 04 for the spring data and Figure 05 for the fall data.

Table 4: Groundwater Elevation Data

Groundwater Monitor	Elevation	Water Level	Water Level	Groundwater Elevation	Groundwater Elevation
	TPVC	1-May-23	16-Oct-23	1-May-23	16-Oct-23
	(masl)	(mbTPVC)	(mbTPVC)	(masl)	(masl)
WC1-03	289.41	4.40	5.70	285.01	283.71
WC2-03	292.74	8.08	9.14	284.66	283.60
WC3-03	292.93	8.16	9.32	284.77	283.61
WC4-19	292.83	8.19	9.23	284.64	283.60
WC5-19	294.21	9.54	10.52	284.67	283.69
WC6.1-19	293.62	9.05	10.03	284.57	283.59
WC6.2-19	293.55	8.92	9.92	284.63	283.63
WC6.3-19	293.59	9.00	9.975	284.59	283.62

Note: Monitoring well elevations are geodetic based on December 11, 2019, survey.
mbTPVC – metres below top of PVC casing

3.2.1.2 Groundwater Gradients and Flow Direction

Based on the spring (May 1, 2023) water levels, the average horizontal hydraulic gradient was calculated at 0.0030 m/m towards the southwest from north of the WDS footprint, and 0.0022 m/m towards the northwest from the buried waste within the footprint. Based on the spring water levels, groundwater is inferred to flow in a southwesterly direction from WC-1-03 and a northwesterly direction from WC-3-03, both towards WC-6.3-19. The overall groundwater flow direction is inferred to be towards the west for the spring event based on the assumed convergence of the groundwater flow directions, which is consistent with historic results.

The average horizontal hydraulic gradient was calculated to be 0.0013 m/m towards the southwest using the October 16, 2023, groundwater elevation data. Based on the fall data, groundwater is inferred to flow in a southwesterly direction from WC-1-03 and WC-5-19 north of the footprint, towards WC-6.3-19. Based on historic and spring flow directions, groundwater is inferred to flow in a northwesterly direction from WC-3-03 to WC-4-19 towards WC-2-03. However, the fall water levels in recent years (2019 to 2023) have indicated a relatively flat gradient (<0.001 m/m) between the monitoring wells WC-3-03, WC-4-19, and the wells to the west the Site property.

Throughout 2023, a calculated downward vertical gradient of 0.01 m/m from WC6.2-19 to WC6.1-19 was observed based on the spring and fall 2023 data. An upward vertical gradient of 0.007 m/m and 0.003 m/m from WC6.2-19 to WC6.3-19 was also observed based on the spring and fall 2023 data respectively.

3.2.2 Surface Water Monitoring

Surface water monitoring is not required or conducted at the Wolf Creek WDS.

3.2.3 Landfill Gas Monitoring

The primary gas present at landfill sites is methane. Methane cannot cause an explosion unless it accumulates to a concentration above its lower explosive limit (LEL) in an enclosed area. The LEL for methane is 5% in air. O.Reg. 232/98 methane concentration limits are:

- Less than 2.5% methane gas (25,000 ppm, LEL=50%) in the subsurface at the property;
- Less than 1.0% methane gas (10,000 ppm, LEL-20%) in an on-site building, or its foundation; and
- Less than 0.05 % methane gas (500 ppm, LEL=1%) in a building, or its foundation, which is located off-site

Routine landfill gas monitoring within any buildings or structures is required at the Site.

3.3 Monitoring Procedures and Methods

3.3.1 Groundwater Monitoring

Groundwater monitors were purged a minimum of three borehole volumes or until the monitor purged dry. In the case where a monitor was purged dry, samples were collected after sufficient water had returned for sampling purposes. Field temperature, pH, and conductivity measurements were recorded at the time of sampling using a calibrated YSI multi-meter. The instrument was calibrated and/or checked for pH and conductivity. Samples were field filtered for DOC and metals analyses. Samples were collected in laboratory prepared and supplied bottles and submitted to AGAT Laboratories in Ontario for the spring monitoring event and to Bureau Veritas in Ontario for the fall monitoring event for analyses. Laboratory reports and chain of custody forms are compiled in **Appendix D (D-2)**. AGAT and Bureau Veritas are accredited members of the Canadian Association of Laboratory Accreditation (CALA).

3.3.2 Landfill Gas Monitoring

There are no sampling valves, ports, or vapour monitors on-site. Gas monitoring using a calibrated RKI Eagle gas monitor was collected from the on-site Attendant's building and all groundwater monitoring wells during both sampling events in 2023.

Gas monitoring measurements from the building and privy are collected by inserting the intake of the gas monitoring equipment through a small hole or gap within the structures while these structures remain closed. Gas monitoring measurements from the groundwater monitoring wells are collected, prior to collecting groundwater levels or samples, by inserting the intake of the gas monitoring equipment under the cap of the monitoring well prior to removal of the cap and by keeping the best seal possible around the cap and gas equipment intake.

3.3.3 Field QA/QC Program

The Quality Assurance/Quality Control (QA/QC) program for the Site included the collection of field duplicate samples to demonstrate that field sampling techniques utilized by BluMetric personnel are capable of yielding reproducible results. Field duplicates were collected concurrently with the original sample. Field duplicates were collected at a 10% frequency during the sampling program at the WDS.

Precision is a measure of the reproducibility of analytical results and can be expressed quantitatively by the relative percent difference (RPD) between the original sample(s) and their corresponding field blind duplicate sample(s). The RPD is defined by the following equation:

$$RPD = 2 \times \frac{|(S - D)|}{(S + D)} \times 100$$

Where S = concentration in the original sample
D = Concentration in the duplicate

An RPD is calculated where the average of the measured parameter concentrations of the original (S) and duplicate (D) samples are greater than 5X the laboratory readable detection limits (RDL), which represents the RPD qualification criteria. A lower level of precision is expected where the above criteria are not met. A high level of reproducibility with respect to sample results collected at the Site is indicated by an RPD value below 10% for electrical conductivity and 20% for metals and inorganics.

These criteria are used as a general guideline and correspond to those recommended within the O. Reg. 153/04 Analytical Protocol (MOE, 2011) and by the Ontario QA/QC Interpretation Guide – Environmental Services (Maxxam, 2015). An RPD below the recommended criteria is considered acceptable, indicating that the sampling methodology is capable of producing repeatable results.

One blind field duplicate was sampled and submitted for analyses per sampling event. The field duplicate bottles are filled simultaneously to the sample location selected for duplication.
The laboratory prepared bottles (identified and duplicate) for each group of chemical parameters (e.g. metals, nutrients etc.) is first filled for the identified location and then the duplicate for that same group of chemical parameters is immediately filled. This continues until the two sample bottles for each group of parameters are filled.

4 Monitoring Results

4.1 Groundwater Quality

Groundwater quality has been compared to the Ontario Drinking Water Standards and Operational Guidelines (ODWSOG), the calculate Reasonable Use Values (RUVs), and the PWQO.

Ontario Drinking Water Standards and Operational Guidelines (ODWSOG)

Field groundwater measurements in 2023 resulted in pH results from 5.10 to 6.10 in the spring and from 4.76 to 5.85 in the fall, which are generally below the ODWSOG criteria.

The summary of the 2023 groundwater results exceeding the ODWSOG criteria is summarized in Table 5. The full laboratory results are presented in Table 9 at the end of the text.

Table 5: Groundwater Quality Results Exceeding ODWSOG Criteria

Sample Location	Location Description	Parameter Exceeding ODWSOG
WC1-03	Background well - NE of waste footprint	Alkalinity (spring and fall, below criteria)
WC2-03	Downgradient well – NW of waste footprint	None
WC3-03	Leachate well -within waste footprint	Alkalinity (fall, below criteria)
WC4-19	Downgradient well - west boundary of footprint	Manganese (spring and fall)
WC5-19	Upgradient well - North of footprint	None
WC6.1-19	Downgradient well nest- Northwest of the waste footprint	None
WC6.2-19	Downgradient well nest- Northwest of the waste footprint	None
WC6.3-19	Downgradient well nest- Northwest of the waste footprint	None

Reasonable Use Values (RUVs)

The following calculations are based on the median background groundwater (WC1-03) values from the 2006 to 2023 results.

$$Cm = Cb + x(Cr-Cb);$$

Where,

Cm : maximum allowable concentration in groundwater beneath adjacent property (Reasonable Use Values)

Cb : median background concentration before any effects from human activity

Cr : maximum concentration that should be present based on use (ODWSOG)

X : constant that reduces the contamination to a level considered by the MECP to have only a negligible effect on the use of the water (0.25 for a health-related parameter and 0.5 for an aesthetic or physical parameter)

The following Table 6 summarizes the data used to calculate Cm values (RUVs).

Table 6: Reasonable Use Calculations

Parameter	Units	ODWSOG		Historical Median	x	RUV
		Type	Cr	Cb		Cm
Alkalinity as CaCO3 (upper)	mg/L	OG	500	24.5	0.5	262.25
Boron	mg/L	IMAC	5.0	0.014	0.25	1.25
Chloride	mg/L	AO	250	0.65	0.5	125.31
DOC	mg/L	AO	5.0	4.80	0.5	4.90
Iron	mg/L	AO	0.30	0.023	0.5	0.15
Manganese	mg/L	AO	0.05	0.006	0.5	0.03
Nitrate	mg/L	MAC	10	1.02	0.25	3.10
Sodium	mg/L	AO	200	1.96	0.5	100.92
Sulphate	Mg/L		500	7.00	0.5	253.50
TDS	mg/L		500	58.0	0.5	279
Zinc	mg/L	MAC	5.0	0.008	0.50	2.5

Note: The background water quality at WC1-03 and regional groundwater is generally below the lower criterion for alkalinity. Therefore, there is no lower RUV for alkalinity.

Parameters from the 2023 Wolf Creek WDS monitoring program that exceed the RUVs are shown in the following Table 7.

Table 7: Groundwater Quality Results Exceeding RUVs

Groundwater Monitoring Location	Parameter Exceeding RUV (Result)
WC1-03	Nitrate and DOC (spring)
WC2-03	Nitrate (spring)
WC3-03	None
WC4-19	Manganese (spring and fall)
WC5-19	None
WC6.1-19	None
WC6.2-19	None
WC6.3-19	Nitrate (spring and fall), TDS (fall)

PWQO

At the request of the MECP, groundwater results were compared to the PWQO criteria. The only parameters that are tested at the Site and have surface water criteria under the PWQO are alkalinity, pH, aluminum, boron, iron, lead, and zinc.

Parameters from the 2023 Wolf Creek WDS monitoring program that exceed the PWQOs are shown in the following Table 7.

Table 8: Groundwater Quality Results Exceeding PWQOs

Groundwater Monitoring Location	Parameter Exceeding PWQOs (Result)
WC1-03	None
WC2-03	None
WC3-03	None
WC4-19	None
WC5-19	None
WC6.1-19	None
WC6.2-19	None
WC6.3-19	None

Groundwater alkalinity concentrations at the Site are naturally low. The background well mean concentration (2006 to 2023 data) is 24.5 mg/L. PWQO criteria states that alkalinity cannot be decreased by more than 25%. Impacts from the WDS are observed to increase the alkalinity at the Site, therefore the downgradient wells do not exceed the PWQO for this parameter.

Dissolved aluminum groundwater concentrations are naturally high at the Site. The background concentration (2006 to 2023) is 0.073 mg/L. Interim aluminum PWQO criteria states that aluminum should not exceed 0.075 mg/L. A review of the dissolved aluminum groundwater concentrations during the spring and all monitoring events did not reveal any exceedances when compared to the interim PWQO criteria. In order to compare to the interim aluminum PWQO criteria, a clay-free sample is required which is achieved using a 0.2-micron filter. Groundwater samples are field filtered using a 0.45-micron filter; as a result, an accurate comparison between groundwater and the PWQO criteria cannot be made. Consequently, exceedances are not considered to be evidence of potential impacts to surface water.

Field pH readings are considered more indicative of in-situ pH values than laboratory readings. The well nest located closest to the creek had spring field pH readings of 5.80 to 6.10 and fall pH readings of 5.32 to 5.85. Background field pH was 5.10 and 4.76 for the spring and fall, respectively. Low pH values at the well nest are not considered to be attributed to the WDS impacts.

4.2 Landfill Gas Monitoring

Gas readings collected on May 1, 2023, at the existing monitoring wells and the attendant's building ranged from 0 to 10 ppm.

Gas reading collected on October 16, 2023, at the existing monitoring wells and the attendant's building ranged from 0 to 5 ppm.

4.3 QA/QC Results

One groundwater duplicate sample was collected during each sampling event in 2023. The consistency of the results was evaluated based on the relative percentage difference (RPD) of each field duplicate pair. No field duplicate pairs exceeded the recommended percentage difference with the exception of Total Dissolved Solids (TDS) and Dissolved Organic Carbon (DOC) during the spring event. The RPD values for TDS and DOC were 22% and 27% respectively which is above the 20% criteria for a high level of reproducibility. The QA/QC comparison calculations are provided in **Appendix D (D-3).**

5 Assessment, Interpretation, and Discussion

5.1 Groundwater Assessment

The groundwater chemistry results for the eight monitoring wells sampled during the two monitoring events are summarized in Table 10 (at the end of text). Parameters with concentrations that fell outside the RUVs, ODWSOG, and/or PWQO criteria are highlighted.

Groundwater chemistry in 2023 is similar to the historical groundwater quality results from the 2006 to 2023 monitoring events for the historic wells. **Appendix E** presents the historical groundwater quality results from the Wolf Creek WDS. Chemistry trend graphs for select parameters are provided following the tables, figures, and photographs at the end of this report. Graphs demonstrate slight increasing trends of alkalinity and boron at WC2-03 and chloride at WC1-03, WC2-03, WC4-19, WC5-19 and WC6.2-19. All other parameters at all monitoring wells are observed to be generally stable with no evidence of increasing or decreasing trends; however, there is currently insufficient data to assess trends at the monitoring wells installed in 2019 and first sampled in the fall of 2019. It is anticipated that at least five years of semi-annual data will be required prior to analysing trends at these newer wells.

The field pH for all monitoring locations was generally found to be below the ODWSOG limit of 6.5. These results are both typical for the Site and the surrounding region. All laboratory pH results for all wells were within the 6.5 to 8.5 criteria.

Monitoring well WC1-03 is the background well for the Site (hydraulically upgradient from the other historic monitoring well location) and has alkalinity and pH concentrations that typically fall below the lower limit of ODWSOG criteria and RUV limit. On occasion, select metals (iron, manganese, aluminum), TDS, nitrate, and DOC concentrations have exceeded the ODWSOG criteria and/or RUV limit.

Monitoring well WC2-03 is hydraulically downgradient from WC1-03 (background well) and
WC3-03 (leachate well) and the waste disposal footprint area. WC3-03 is adjacent to the last active trench area. Both these wells (WC2-03 and WC3-03) have historically been used to monitor groundwater impacts from the waste disposal activities. Key groundwater leachate indicators for the Site have been identified in the Trigger Mechanisms and Contingency Plan (2017) in **Appendix F** and include alkalinity, nitrate, iron, sulphate, and TDS. These wells are considered impacted by leachate. In the fall of 2021, the leachate well (WC3-03) showed significant increased concentrations of alkalinity, dissolved boron, chloride, DOC, nitrate, sulphate, and TDS. These parameters returned to expected historical values during 2023.

The RUVs apply to groundwater at the property boundary. Downgradient offsite monitoring wells WC2-03, WC4-19, WC6.1-19, WC-6.2-19, and WC-6.3-19 are all north, west, and downgradient of the WDS. Based on historic background data, the DOC RUV exceedances may be due to natural conditions, however the other RUV exceedances at these offsite downgradient monitoring wells are likely due to leachate impacts. These wells are considered out of compliance with respect to Guideline B-7. The 2021 CAZ Assessment was conducted to address non-compliance with Guideline B-7-1 **(Appendix G)** and approved in the most recent ECA. The Site is anticipated to be in compliance with Guideline B-7 based on the CAZ Assessment as discussed in Section 5.3.

5.2 Trigger Mechanisms and Contingency Plan Assessment

A Trigger Mechanisms and Contingency Plan was prepared in December of 2017 and appended to the D & O Plan which was approved by the MECP. A copy is appended to this report as **Appendix F.** The surface water trigger plan is assessed using monitoring well WC2-03. The groundwater trigger plan is assessed using WC2-03 and WC6.3-19. The groundwater chemical results in 2023 did not trigger the Tier 1 Contingency Plan response for surface water and groundwater.

5.3 Contaminant Attenuation Zone (CAZ) Assessment

In 2022, a CAZ Assessment was carried out for the Site. The work was carried using the calculations presented in journal article "*Determination of Groundwater Attenuation Distances for Municipal Landfill Sites in Ontario", E. Zaitsburg, 1995.* Based on the results iron was determined to be the only critical parameter, with a calculated required attenuation distance of 87 m. Based on no future placement of waste at the Site, we would recommend that the Municipality move forward with acquiring a minimum 100 m CAZ/buffer to the West and North of the Site Property Boundary, and a 30 m buffer to the east and south of the property boundary. The initial steps in obtaining the CAZ property, either by ownership or easement, is to initiate discussions with both the MECP and the Ministry of Natural Resources and Forestry (MNRF). Approval with the CAZ distances have been obtained from the MECP, while general agreement to transfer the Crown Land ownership/easement should be obtained from the MNRF. We understand that the process of surrendering the aggregate pit licence to the east must be

completed before any changes to that property can be undertaken. We also understand this was initiated in previous years and is still awaiting processing by the MNRF.

More details on the CAZ assessment, including calculations, are provide in **Appendix G**. The CAZ is shown on Figure 03.

5.4 Additional Assessment Requirements

Surface water sampling was determined not to be required (WESA, 2015) as surface water flows towards the south and then the topography rises again, therefore surface water from the Site remains in the immediate vicinity of the Site and infiltrates into the subsurface. Vertical hydraulic gradients calculated from the fall of 2019 to the fall of 2020 indicate a low potential for impacts to the creek. The 2023 downgradient groundwater data was compared to PWQO criteria to assess potential surface water impacts and to determine if a surface water monitoring program is required. Based on the 2023 results (refer to Section 4.1), no impacts were identified.

5.5 Landfill Gas Assessment

The RKI Eagle gas monitoring results for 2023 (0 to 10 ppm) indicated methane gas concentrations are well below the concentrations of concern, 10,000 ppm for the subsurface, buildings and structures on-site.

6 On-Site Operations

6.1 Site Operations

The Wolf Creek WDS currently collects waste in covered waste bins (8 cubic yard). The waste is periodically picked up and transferred to one of the other WDS operated by the MHHs.

The Site has segregated collection areas for scrap metal, tires, large bulky items (couches and mattresses), electronic waste and a recycling transfer station (8 cubic yard bin) for household blue box recyclable containers (aluminum cans, metal cans, plastic bottles) and fibre (paper and cardboard). Several scattered piles of brush were observed across the Site in 2022; these scattered piles should be collected and placed in one permanent brush pile with a 30 m firebreak. The Municipality implemented a clear bag policy in October 2014 which was updated in May 2018, to facilitate increased waste diversion to extend the operational life of their municipal landfill sites. The clear bag policy applies to both recyclable and household waste, with non-compliant bags to be refused unless residents remove recyclables from the bag.

6.2 Annual Waste Summary

Although access to the Site is controlled via a locked security steel gate, some residents deposit garbage at the disposal site outside of the landfill's normal operating hours. This contribution is collected by site personnel, recorded, and included in the total waste volumes identified for the Site.

The annual recycling (R) and waste (W) tonnages for 2022 and 2023, excluding the segregated materials discussed in Section 6.2.1, are tabulated in Table 9. Tonnages of recycled goods and waste are monitored to ensure that recyclables are not being deposited in the landfill. In 2023, it is estimated that 19.6% of waste, excluding the segregated materials discussed in Section 6.2.1, was diverted from the landfill by recycling.

The 2023 residential / commercial waste calculations are based on bag counts at the waste sites. There were 4743 bags deposited at the Wolf Creek WDS in 2023. An assumed density of 15 kg/bag (MHH's) was used in the tonnage calculations.

Table 9: Annual Recycling and Waste Tonnages

Q1		Q2		Q3		Q4		Year End	
R	**W**	**R**	**W**	**R**	**W**	**R**	**W**	**R**	**W**
2022									
1.9	12.8	2.2	18.5	4.1	32.3	2.9	15.4	11.1	78.9
2023									
2.1	11.1	4.1	17.7	7.6	27.3	3.6	15.1	17.4	71.1

Based on these reported quantities, the mass of recyclables collected in 2023 is 57% more than collected in 2022. The amount of waste received has decreased by 15% since 2022.

6.2.1 Summary of Segregated Materials Removed

Segregated materials are collected at each of the nine WDSs/WTSs in Hastings Highlands. There were 0 tires, 1.27 tonnes of electronics, and 0 tonnes of scrap metal and white goods removed from the Wolf Creek WDS in 2023. No bulky materials were collected at the Wolf Creek WTS.

Household hazardous wastes are not collected at the Wolf Creek WDS. The Municipality however does ensure batteries left at the WDS are disposed of properly. In 2023, 0 tonnes of batteries were collected at the WDS.

6.3 Annual Complaints & Emergency Situations Summary

There were no documented complaints, rejected waste, or emergency situations report at the Wolf Creek WDS in 2023.

6.4 Capacity

The amended ECA for the Site identifies a 0.2 ha footprint with an approved final remaining volume of 2,580 cubic metres (Section 7. (5)). The final volume included waste, daily cover, and intermediate cover, but excluded final cover and the waste historically buried in trenches at the Site (estimated at 1,220 m^3). Currently, the MHHs

has waste placement at the Site on hold pending adjustments to their permitting and closure requirements for the aggregate pit adjacent to the WDS. The Municipality submitted an ECA amendment application for the Closure Plan for the Site, as well as the new WTS D&O Plan and CAZ Assessment which has been approved.

It is our understanding that no waste was placed on-site following the development of the existing D&O Plan (August 2017), therefore as reported in the D&O Plan it is expected that the remaining capacity at the Site is 2,580 m^3, with an estimated life of 15 years based on the five year average annual fill rate of waste alone of 164 m^3/year and an assumed density of 500 kg/m^3; or 13 years when taking interim cover into account. These lifespan calculations are irrelevant unless MHHs choses to resume landfilling activities at the Site. All waste at the Site in 2023 was transferred to another Municipality of Hastings Highlands WDS.

6.5 Cover Materials

No interim or final cover was placed at the Site in 2023.

7 Summary Statements, Conclusions, and Recommendations

The following summary statements, conclusions and recommendations are based on the results of the 2023 monitoring program:

7.1 Site Operations

- There were no records of public concerns/complaints and emergency situations occurrences in 2023 at Wolf Creek. Should they occur in the future, the complaint and the Municipality's response to each is to be documented.
- Site operations, site conditions and the order and the management of debris were observed to be organized.
- It is recommended that periodic inspections be performed and documented by the Municipality to ensure proper burning practices are being followed.

- It is recommended that waste transferred to the Site continues to be accounted for and documented by tracking the number of loads of waste deposited at the Site. Detailed descriptions and quantities of rejected waste should continue to be documented.
- Public Education with respect to waste reduction and recycling should be an on-going effort by the Municipality.

7.2 Groundwater

- Groundwater monitoring should continue on a semi-annual basis for the Wolf Creek WDS (spring and fall) for the same chemical parameters as listed in Table 3, at all existing monitoring wells;
- Due to current or historic exceedances of alkalinity and pH results below the lower limit at the background monitoring well, these parameters are considered naturally occurring.
- Graphs demonstrate slight increasing trends of alkalinity and boron at WC2-03 and chloride at WC1-03, WC2-03, WC4-19, WC5-19 and WC6.2-19. All other parameters at all monitoring wells are observed to be generally stable with no evidence of increasing or decreasing trends; however, there is currently insufficient data to assess trends at the monitoring wells installed in 2019 and first sampled in the fall of 2019. It is anticipated that at least five years of semi-annual data will be required prior to analysing trends at these newer wells.
- The RUVs apply to groundwater at the property boundary. Based on historic background data, the DOC RUV exceedances may be due to natural conditions, however the other RUV exceedances at these offsite downgradient monitoring wells are likely due to leachate impacts. These wells are considered out of compliance with respect to Guideline B-7.
- The groundwater chemical results in 2023 did not trigger the Tier 1 Contingency Plan response for groundwater.
- The CAZ was approved in the most recent ECA therefore, the Site is anticipated to be in compliance with Guideline B-7 once the land is transferred to the Municipality.
- Additional wells are not recommended at this time.

7.3 Surface Water

- The nearest surface water feature is located approximately 180 m west of the Site;
- Surface water sampling was determined not to be required (WESA, 2015) as surface water flows towards the south and then the topography rises again, therefore surface water from the Site remains in the immediate vicinity of the Site and infiltrates into the subsurface.
- Based on the comparison of the 2023 groundwater results to PWQO criteria, surface water monitoring remains unwarranted.
- The groundwater chemical results in 2023 did not trigger the Tier 1 Contingency Plan response for surface water.

7.4 Landfill Gas

- The RKI Eagle gas monitoring results for 2023 (0 to 10 ppm) indicated methane gas concentrations are well below the concentrations of concern as identified above for the subsurface, buildings and structures on-site.
- Landfill gas should continue to be monitored at the on-site structures during the semi-annual monitoring events.

7.5 Landfill Capacity

- The MHHs has waste placement at the Site on hold pending adjustments to their permitting and closure requirements for the aggregate pit adjacent to the WDS. The Municipality submitted an ECA amendment application for the Closure Plan for the Site, as well as the new WTS D&O Plan and CAZ Assessment which has been approved.

8 Limiting Conditions

The conclusions presented in this report represent our professional opinion and are based upon the work described in this report and any limiting conditions in the terms of reference, scope of work, or conditions noted herein.

The findings presented in this report are based on conditions observed at the specified dates and locations, the analysis of samples for the specified parameters, and information obtained for this project. Unless otherwise stated, the findings cannot be extended to previous or future site conditions, locations that were not investigated directly, or types of analysis not performed.

BluMetric Environmental Inc. makes no warranty as to the accuracy or completeness of the information provided by others, or of conclusions and recommendations predicated on the accuracy of that information.

This report has been prepared for The Corporation of the Municipality of Hastings Highlands. Any use a third party makes of this report, any reliance on the report, or decisions based upon the report, are the responsibility of those third parties unless authorization is received from BluMetric Environmental Inc. in writing. BluMetric Environmental Inc. accepts no responsibility for any loss or damages suffered by any unauthorized third party as a result of decisions made or actions taken based on this report.

Respectfully submitted,
BluMetric Environmental Inc.

Jennifer Farrell, B.A.(Hons.)
Environmental Scientist

S'rana Scholes, B.A.Sc., P.Eng.
Senior Environmental Engineer

9 References

BluMetric, 2020. 2019 Annual Monitoring Report Wolf Creek Waste Disposal Site. Submitted to The Corporation of the Municipality of Hastings Highlands, March 2020.

BluMetric, 2021. 2020 Annual Monitoring Report Wolf Creek Waste Disposal Site. Submitted to The Corporation of the Municipality of Hastings Highlands, February 2021.

BluMetric, 2022. 2021 Annual Monitoring Report Wolf Creek Waste Disposal Site. Submitted to The Corporation of the Municipality of Hastings Highlands, February 2022.

BluMetric, 2023. 2022 Annual Monitoring Report Wolf Creek Waste Disposal Site. Submitted to The Corporation of the Municipality of Hastings Highlands, March 2023.

Canadian Water Resources Journal, E. Zaitsburg, Determination of Groundwater Attenuation Distances for Municipal Landfill Sites in Ontario, Vol. 20, No.1, 1995

CCME (Canadian Council of Ministers of the Environment), 2011. Protocols Manual For Water Quality Sampling in Canada (p.12).

CCME (Canadian Council of Ministers of the Environment), 2011. Protocols Manual For Water Quality Sampling in Canada (p.12).

MNDM (Ministry of Energy, Northern Development and Mines), 1991. Map 2544.

Ministry of the Environment (MOE). Procedure B-7-1: Determination of Contaminant Limits and Attenuation Zones. Ministry of Environment, Government of Ontario, 9pp.

Ministry of the Environment (MOE), Monitoring and Reporting for Waste Disposal Sites Groundwater and Surface Water-Technical Guidance Document, November 2010.

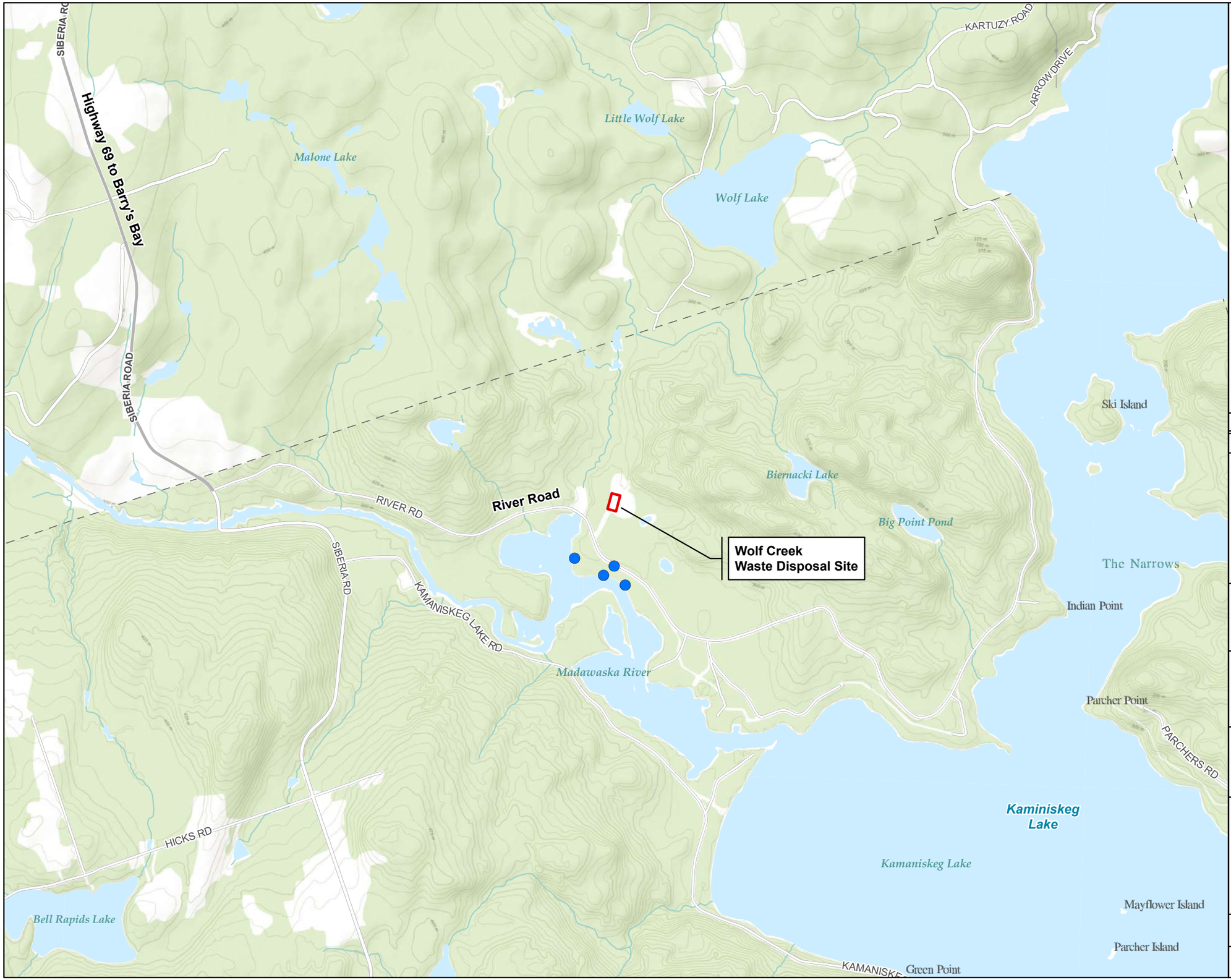
Tables

Table 10: 2023 Groundwater Chemistry Results						Location	WC1-03	WC1-03	WC1-03	WC1-03	WC2-03	WC2-03	WC3-03	WC3-03	WC4-19	WC4-19	WC5-19	WC5-19	WC6.1-19	WC6.1-19	WC6.2-19	WC6.2-19	WC6.3-19	WC6.3-19
Parameter	Units	RUV-WC	ODWQS	PWQO-GENERAL	PWQO-INTERIM	Sample ID	WC1-03	WC-QAQC-GW1	WC1-03	WC-QAQC-GW1	WC2-03	WC2-03	WC3-03	WC3-03	WC4-19	WC4-19	WC5-19	WC5-19	WC6.1-19	WC6.1-19	WC6.2-19	WC6.2-19	WC6.3-19	WC6.3-19
						Sample Date	2023-May-01	2023-May-01	2023-Oct-16	2023-Oct-16	2023-May-01	2023-Oct-16	2023-May-01	2023-Oct-16	2023-May-01	2023-Oct-16	2023-May-01	2023-Oct-16	2023-May-01	2023-Oct-16	2023-May-01	2023-Oct-16	2023-May-01	2023-Oct-16
Anions						Detection Limit																		
Chloride	mg/L	125.31	250	-	-	0.1	0.41	0.47	<1	<1	1.17	<1	2.01	<1	0.9	2.8	0.69	<1	1.41	<1	0.53	<1	1.04	<1
Nitrate as N	mg/L	3.1	10	-	-	0.05	6.42	6.81	0.73	0.75	4.92	2.44	1.56	0.67	2.31	2.09	0.5	3.07	0.06	<0.1	0.07	<0.1	5.32	4
Sulphate	mg/L	253.5	500	-	-	0.1	4.64	4.74	5.2	4.8	26.3	65	5.61	3.2	20.4	31	5.25	14	9.61	7.8	7.21	9	21.9	81
Cations																								
Calcium (diss)	mg/L	-	-	-	-	0.05	12.9	13.9	6.1	6.1	35	48	11	6	37.6	32	7.51	17	20.6	20	18	13	33.1	64
Magnesium (diss)	mg/L	-	-	-	-	0.05	2.33	2.73	1.3	1.4	5.67	7.1	4.56	1.6	5.47	5.3	1.36	3.2	4.29	3.8	3.01	2.7	4.66	11
Potassium (diss)	mg/L	-	-	-	-	0.2	1.29	1.28	1	1.1	8.27	6.4	2.2	1.3	11.3	11	0.8	2.7	2.07	1.8	0.91	1.4	5.53	7.8
Sodium (diss)	mg/L	100.92	200	-	-	0.05	1.821	1.839	1	1.1	5.62	2.9	4.18	1.5	4.51	4	8.23	15	1.6	2	1.53	1.9	6.75	4.7
General Chemistry																								
Alkalinity (as CaCO3)	mg/L	262.25	30 - 500	Factsheet	-	1	20	18	15	15	78	84	46	21	97	78	37	61	63	61	49	42	78	110
Ammonia as N	mg/L	-	-	-	-	0.02	<0.02	<0.02	<0.05	<0.05	<0.02	<0.05	<0.02	<0.05	0.24	0.15	<0.02	<0.05	<0.02	<0.05	<0.02	0.22	<0.02	<0.05
Chemical Oxygen Demand	mg/L	-	-	-	-	4	12	<5	13	14	<5	6.7	<5	7.4	8	10	<5	<4	<5	10	<5	<4	<5	16
Dissolved Organic Carbon	mg/L	4.9	5	-	-	0.4	5	3.8	3.9	3.7	3.2	2.9	1.3	1.3	2.9	3.1	1.7	2.4	1.5	1.6	2.5	2.9	3.4	4.2
Electrical Conductivity	uS/cm	-	-	-	-	1	108	111	53	53	256	330	115	56	262	250	86	180	150	140	112	97	253	430
pH	pH units	-	6.5 - 8.5	6.5 - 8.5	-		6.71	6.75	7.24	6.96	7.04	7.1	7.12	7.08	7.23	7.17	7.15	7.11	7.51	7.45	7.26	6.94	7.37	6.97
Total Dissolved Solids	mg/L	279	500	-	-	10	82	102	<10	45	174	225	72	40	164	160	64	125	100	150	80	90	172	300
Metals																								
Aluminum (diss)	mg/L	-	0.1	-	Calculated	0.004	0.063	0.075	0.07	0.073	0.015	<0.0049	0.037	<0.0049	0.015	<0.0049	0.013	0.0083	0.027	0.022	0.067	0.023	0.011	0.0064
Boron (diss)	mg/L	1.25	5	-	0.2	0.01	0.019	0.018	0.016	<0.01	0.15	0.15	0.019	<0.01	0.092	0.14	0.013	0.14	<0.01	<0.01	<0.01	<0.01	0.166	0.16
Iron (diss)	mg/L	0.15	0.3	0.3	-	0.01	0.021	0.019	<0.1	<0.1	0.029	<0.1	0.022	<0.1	0.029	<0.1	0.01	<0.1	0.036	<0.1	0.014	<0.1	0.025	<0.1
Lead (diss)	mg/L	-	0.01	-	Calculated	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0005	<0.0005	0.0018	<0.0005	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0007	<0.0005	<0.0005	<0.0005
Manganese (diss)	mg/L	0.03	0.05	-	-	0.002	0.006	0.004	<0.002	<0.002	0.003	<0.002	<0.002	<0.002	0.2	0.29	0.002	<0.002	0.002	<0.002	0.007	0.02	<0.002	<0.002
Strontium (diss)	mg/L	-	-	-	-	0.001	0.055	0.056	0.025	0.026	0.23	0.26	0.051	0.04	0.126	0.13	0.043	0.13	0.063	0.057	0.052	0.039	0.367	0.66
Zinc (diss)	mg/L	2.50	5	-	0.02	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005

-LEGEND-

Detection Limit	DL: May vary between sample locations and events
DL exceeds criteria	
Concentration exceeds RUV-WC	Reasonable Use Values Wolf Creek
Concentration exceeds ODWQS	Ontario Drinking Water Quality Standards
Concentration exceeds PWQO-GENERAL	Provincial Water Quality Objectives General
Concentration exceeds PWQO-INTERIM	Provincial Water Quality Objectives Interim

Figures



LEGEND

- Private Wells
- Site Property Boundary (0.7 ha)
- Elevation Contour (5 m)

REV.	DESCRIPTION	YY/MM/DD	BY	CHK
1				

REFERENCES

DO NOT SCALE DRAWING.
THIS DRAWING MAY HAVE BEEN REDUCED. ALL SCALE NOTATIONS INDICATED ARE BASED ON 11"x17" FORMAT DRAWINGS.

N W E S

0 500 1,000 Metres

CLIENT

Municipality of Hastings Highlands

PROJECT

Wolf Creek Waste Disposal Site

TITLE

Site Location Map

BluMetric Environmental

The Tower - The Woolen Mill,
4 Cataraqui St.,
Kingston, Ontario K7K 1Z7
TEL: (613) 531-2725
FAX: (613) 531-1852
Email: info@blumetric.ca
Web: http://www.blumetric.ca

PROJECT #	DATE		
230225-1	February 01, 2024		
DRAWN	CHECKED	FIG NO.	REV
ZS	TH	01	0

LEGEND

- Monitoring Wells
- Site Property Boundary (0.7 ha)
- Approximate Location of Aggregate Pit Boundary

REV.	DESCRIPTION	YY/MM/DD	BY	CHK
1				

REFERENCES

DO NOT SCALE DRAWING.
THIS DRAWING MAY HAVE BEEN REDUCED. ALL SCALE NOTATIONS INDICATED ARE BASED ON 11"x17" FORMAT DRAWINGS.

N W E S

0 20 40 Metres

CLIENT

Municipality of Hastings Highlands

PROJECT

Wolf Creek Waste Disposal Site

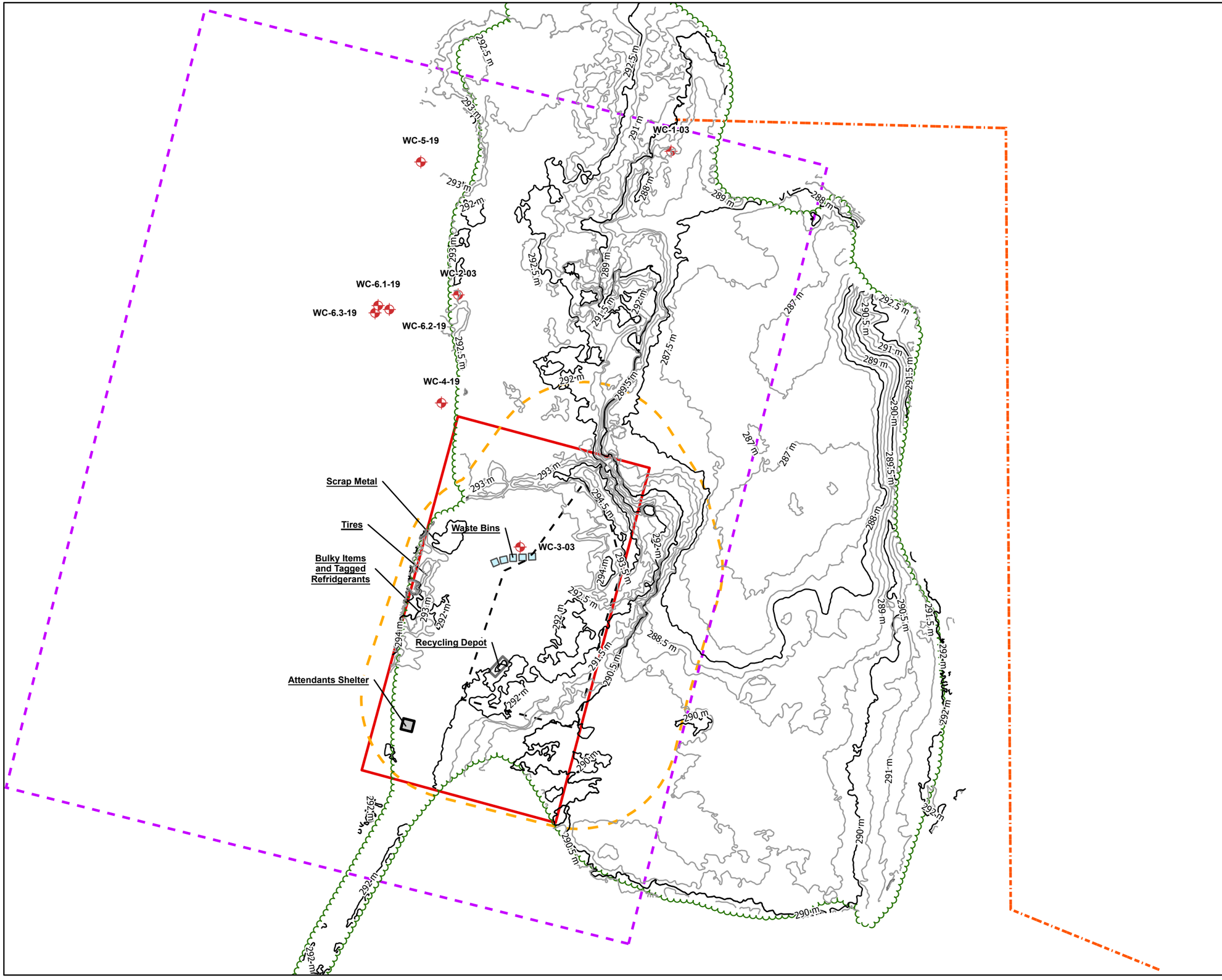
TITLE

Site Plan

BluMetric Environmental
The Tower - The Woolen Mill,
4 Cataraqui St.,
Kingston, Ontario K7K 1Z7
TEL: (613) 531-2725
FAX: (613) 531-1852
Email: info@blumetric.ca
Web: http://www.blumetric.ca

PROJECT #	DATE
230225-1	February 01, 2024

DRAWN	CHECKED	FIG NO.	REV
ZS	TH	02	0



LEGEND

- Monitoring Wells
- Approximate Location of Aggregate Pit Boundary
- Treeline
- Proposed Contaminant Attenuation Zone (4.6 ha)
- Approved Waste Footprint (0.2 ha)
- 30 m Firebreak Buffer
- Site Property Boundary (0.7 ha)
- Elevation Contour (0.5 m)
- Elevation Contour (2.0 m)
- Attendants Shelter
- Recycling Depot
- Waste Bin

REV.	DESCRIPTION	YY/MM/DD	BY	CHK
1				

REFERENCES

CLIENT

Municipality of Hastings Highlands

PROJECT

Wolf Creek Waste Disposal Site

TITLE

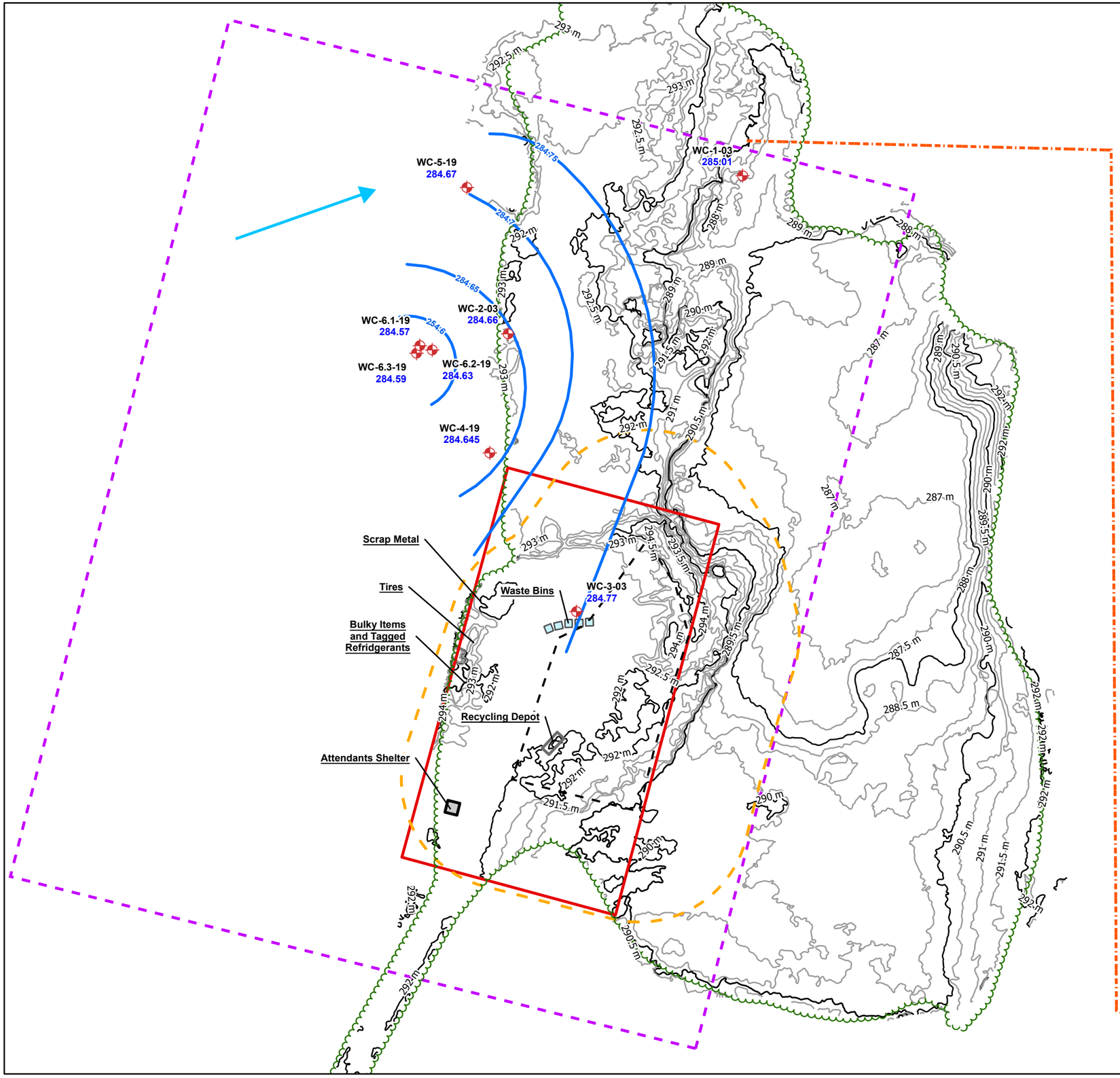
Site Topography and Monitoring Locations

BluMetric Environmental

The Tower - The Woolen Mill,
4 Cataraqui St.,
Kingston, Ontario K7K 1Z7
TEL: (613) 531-2725
FAX: (613) 531-1852
Email: info@blumetric.ca
Web: http://www.blumetric.ca

PROJECT #	DATE
230225-1	February 01, 2024

DRAWN	CHECKED	FIG NO.	REV
ZS	TH	03	0



LEGEND

- Monitoring Wells
- Approximate Location of Aggregate Pit Boundary
- Treeline
- Approved Waste Footprint (0.2 ha)
- 30 m Firebreak Buffer
- Proposed Contaminant Attenuation Zone (4.6 ha)
- Site Property Boundary (0.7 ha)
- Elevation Contour (0.5 m)
- Elevation Contour (2.0 m)
- Groundwater Contour
- Inferred Groundwater Flow Direction
- 284.69 Groundwater Elevation (masl, Spring, 2023)

REV.	DESCRIPTION	YY/MM/DD	BY	CHK
1				

REFERENCES

DO NOT SCALE DRAWING.
THIS DRAWING MAY HAVE BEEN REDUCED. ALL SCALE NOTATIONS INDICATED ARE BASED ON 11"x17" FORMAT DRAWINGS.

N

0 20 40 Metres

CLIENT

Municipality of Hastings Highlands

PROJECT

Wolf Creek Waste Disposal Site

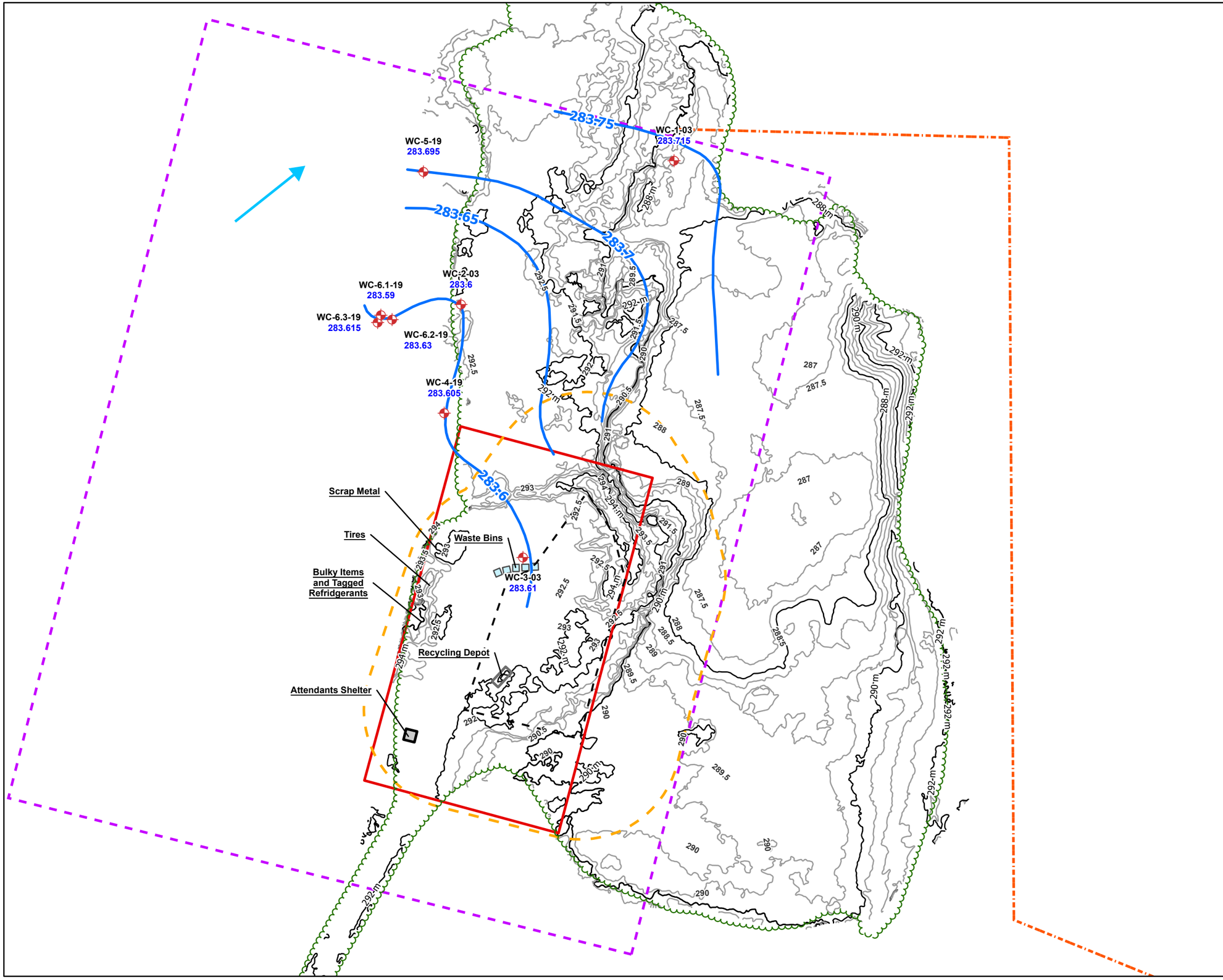
TITLE

Groundwater Flow Direction - Spring 2023

The Tower - The Woolen Mill,
4 Cataraqui St.,
Kingston, Ontario K7K 1Z7
TEL: (613) 531-2725
FAX: (613) 531-1852
Email: info@blumetric.ca
Web: http://www.blumetric.ca

PROJECT #	DATE
230225-1	February 01, 2024

DRAWN	CHECKED	FIG NO.	REV
ZS	JF	04	0



LEGEND

- Monitoring Wells
- Treeline
- Approximate Location of Aggregate Pit Boundary
- Approved Waste Footprint (0.2 ha)
- 30 m Firebreak Buffer
- Proposed Contaminant Attenuation Zone (4.6 ha)
- Site Property Boundary (0.7 ha)
- Elevation Contour (0.5 m)
- Elevation Contour (2.0 m)
- Groundwater Contour
- Inferred Groundwater Flow Direction
- 283.88 Groundwater Elevation (masl) (Fall, 2023)

REV.	DESCRIPTION	YY/MM/DD	BY	CHK
1				

REFERENCES

DO NOT SCALE DRAWING.
THIS DRAWING MAY HAVE BEEN REDUCED. ALL SCALE NOTATIONS INDICATED ARE BASED ON 11"x17" FORMAT DRAWINGS.

N W E S

0 20 40 Metres

CLIENT

Municipality of Hastings Highlands

PROJECT

Wolf Creek Waste Disposal Site

TITLE

Groundwater Flow Direction - Fall 2023

BluMetric Environmental

The Tower - The Woolen Mill,
4 Cataraqui St.,
Kingston, Ontario K7K 1Z7
TEL: (613) 531-2725
FAX: (613) 531-1852
Email: info@blumetric.ca
Web: http://www.blumetric.ca

PROJECT #	DATE
230225-01	February 01, 2024

DRAWN	CHECKED	FIG NO.	REV
ZS	JF	05	0

Site Photographs

Photo 1: Front Signage – May 1, 2023

Photo 2: Front Signage & Secure Gate – May 1, 2023

Photo 3: Waste & Recycling Collection Bins – May 1, 2023

Photo 4: Leaf and Brush Pile East of bins – May 1, 2023

Photo 5: Waste Transfer Area – May 1, 2023

Photo 6: Metal Recyclables – May 1, 2023

Photo 7: Bulk Items – May 1, 2023

Photo 8: Segregated Tires – May 1, 2023

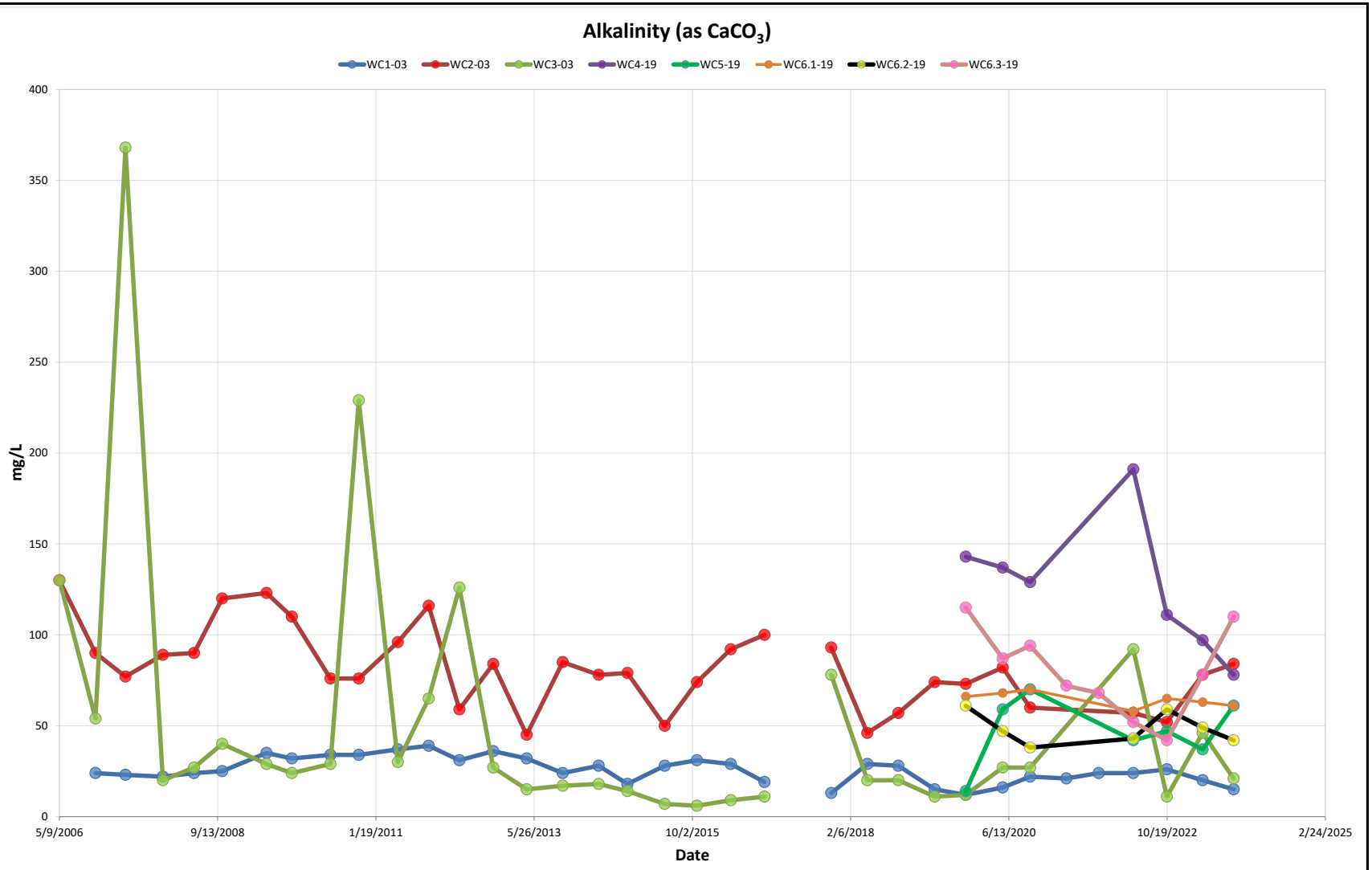
Photo 9: Entrance Signage – October 16, 2023

Photo 10: Segregated Tires – October 16, 2023

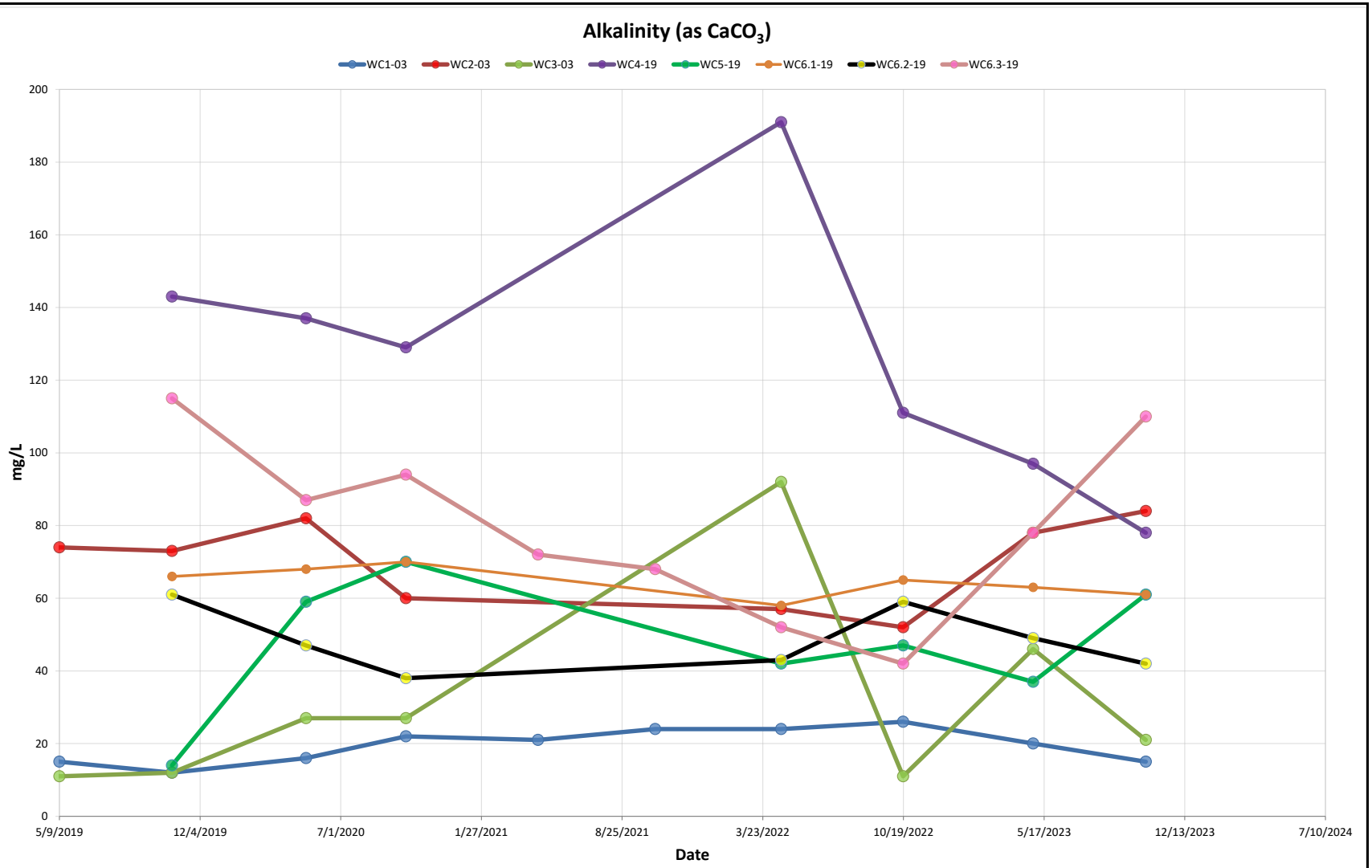
Photo 11: Bulk Items – October 16, 2023

Photo 12: Metal Recyclables – October 16, 2023

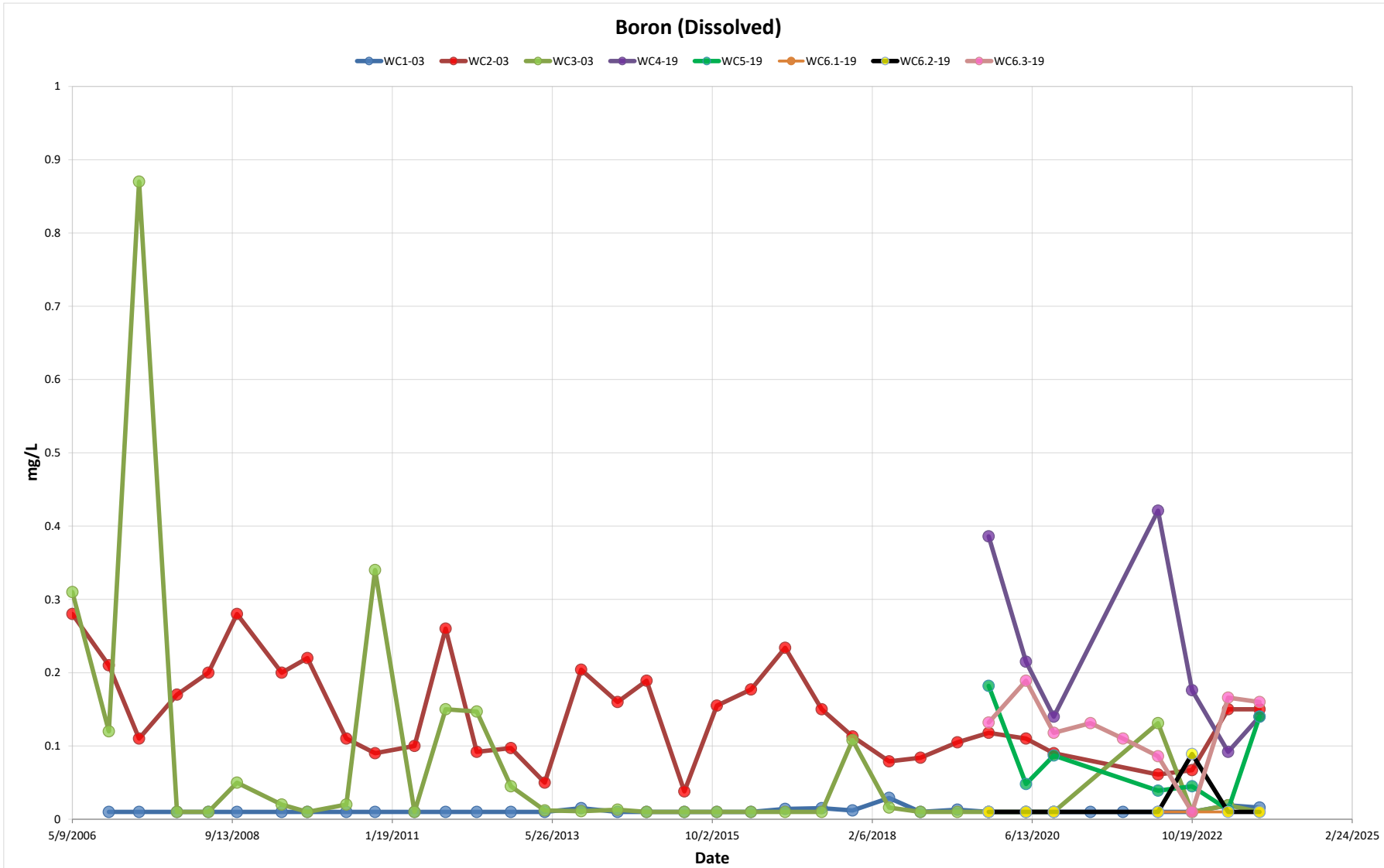
Chemistry Trend Graphs



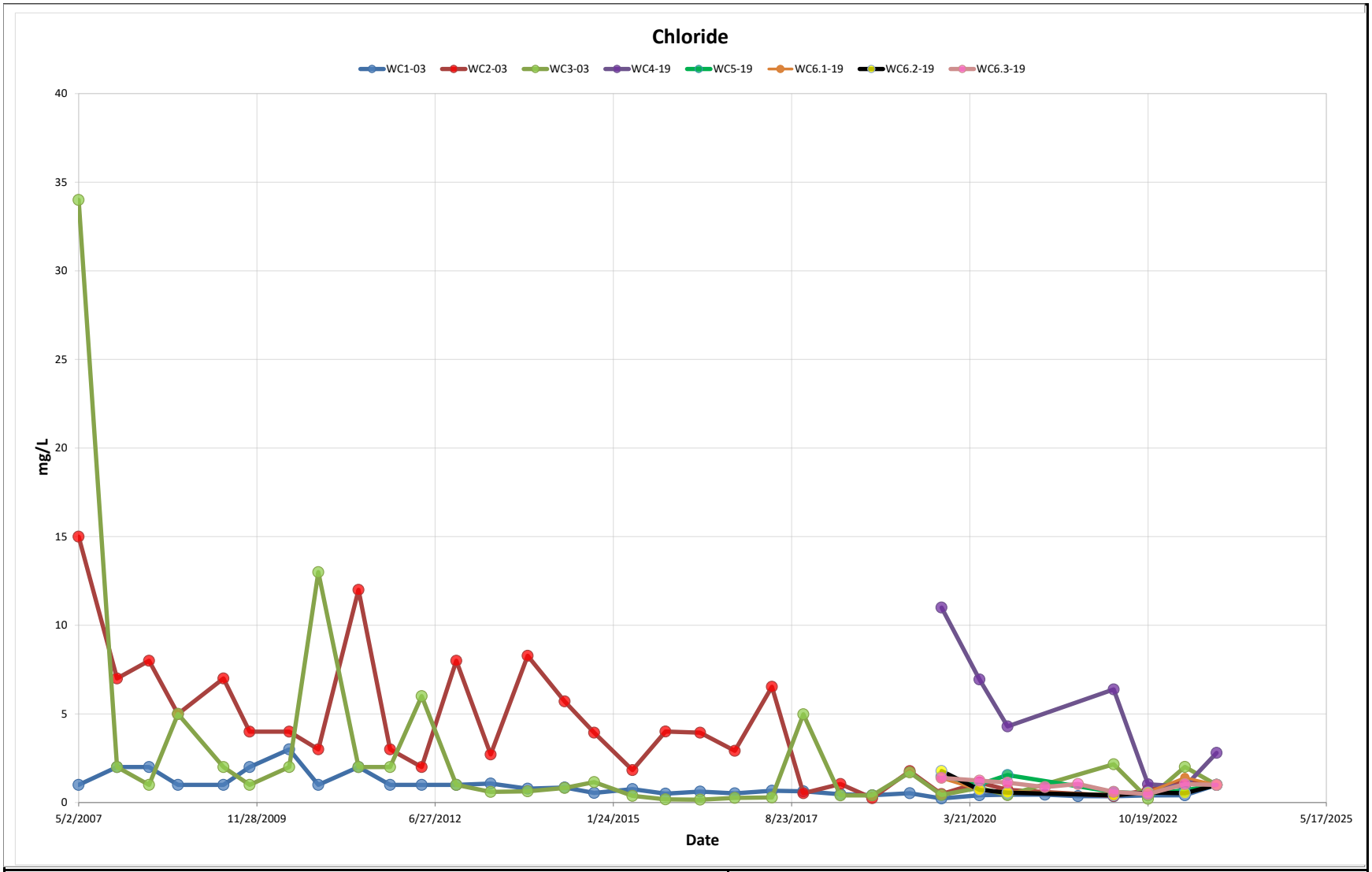
Wolf Creek WDS **Municipality of Hasting's Highlands**	**Graph 1** **Alkalinity in Groundwater 2006-2023**
BluMetric Proj No: 230225-01 **Date: January 25, 2024**	**Created by: Jennifer Farrell** **Checked by: Carolyn Miller**



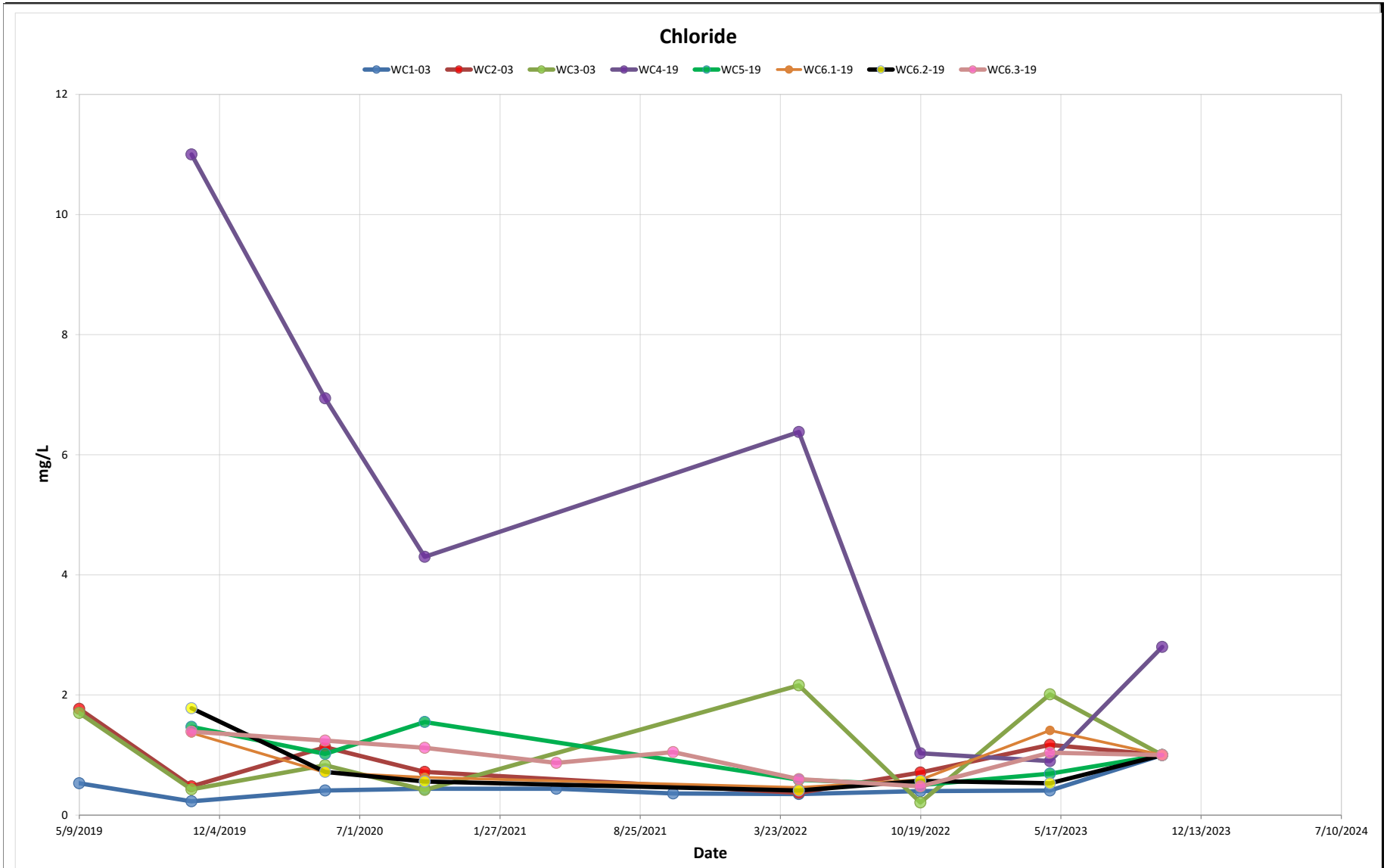
Wolf Creek WDS **Municipality of Hasting's Highlands**	**Graph 2** **Alkalinity in Groundwater 2019-2023**
BluMetric Proj No: 230225-01 **Date: January 25, 2024**	**Created by: Jennifer Farrell** **Checked by: Carolyn Miller**



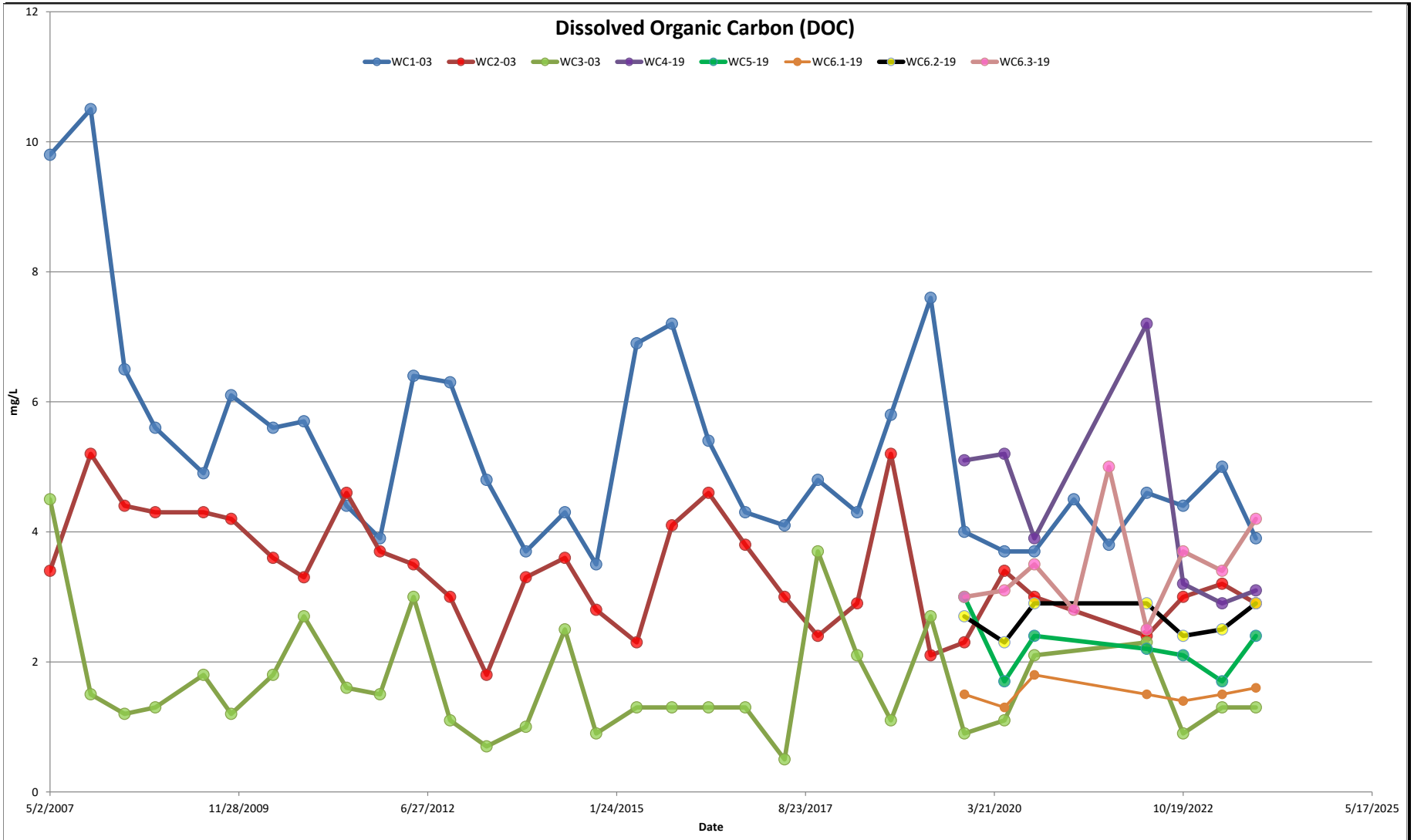
Wolf Creek WDS **Municipality of Hasting's Highlands** **BluMetric Proj No: 230225-01** **Date: January 25, 2024**	**Graph 3** **Dissolved Boron in Groundwater 2006-2023** **Created by: Jennifer Farrell** **Checked by: Carolyn Miller**



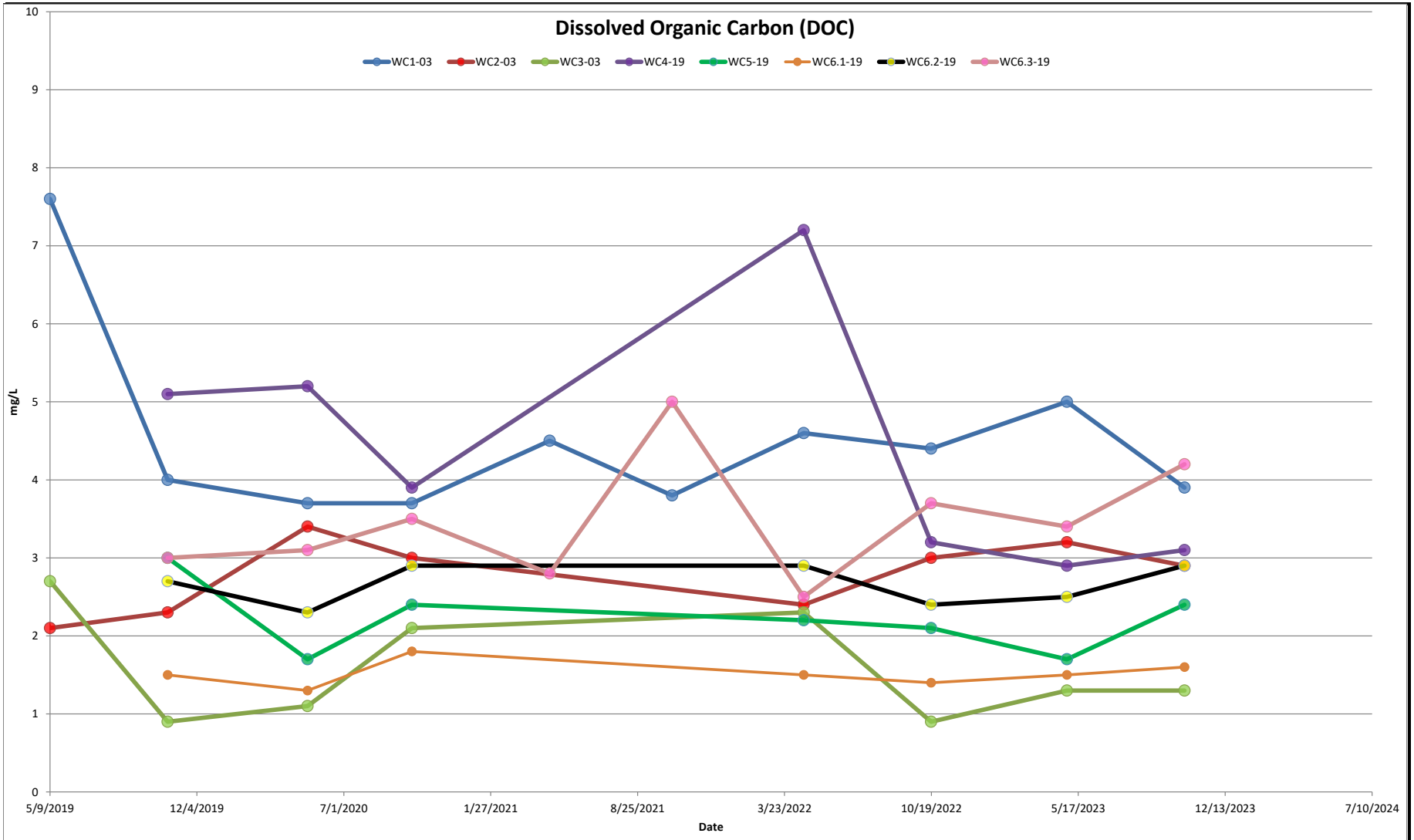
Wolf Creek WDS **Municipality of Hasting's Highlands**	**Graph 4** **Chloride in Groundwater 2007-2023**
BluMetric Proj No: 230225-01 **Date: January 25, 2024**	**Created by: Jennifer Farrell** **Checked by: Carolyn Miller**



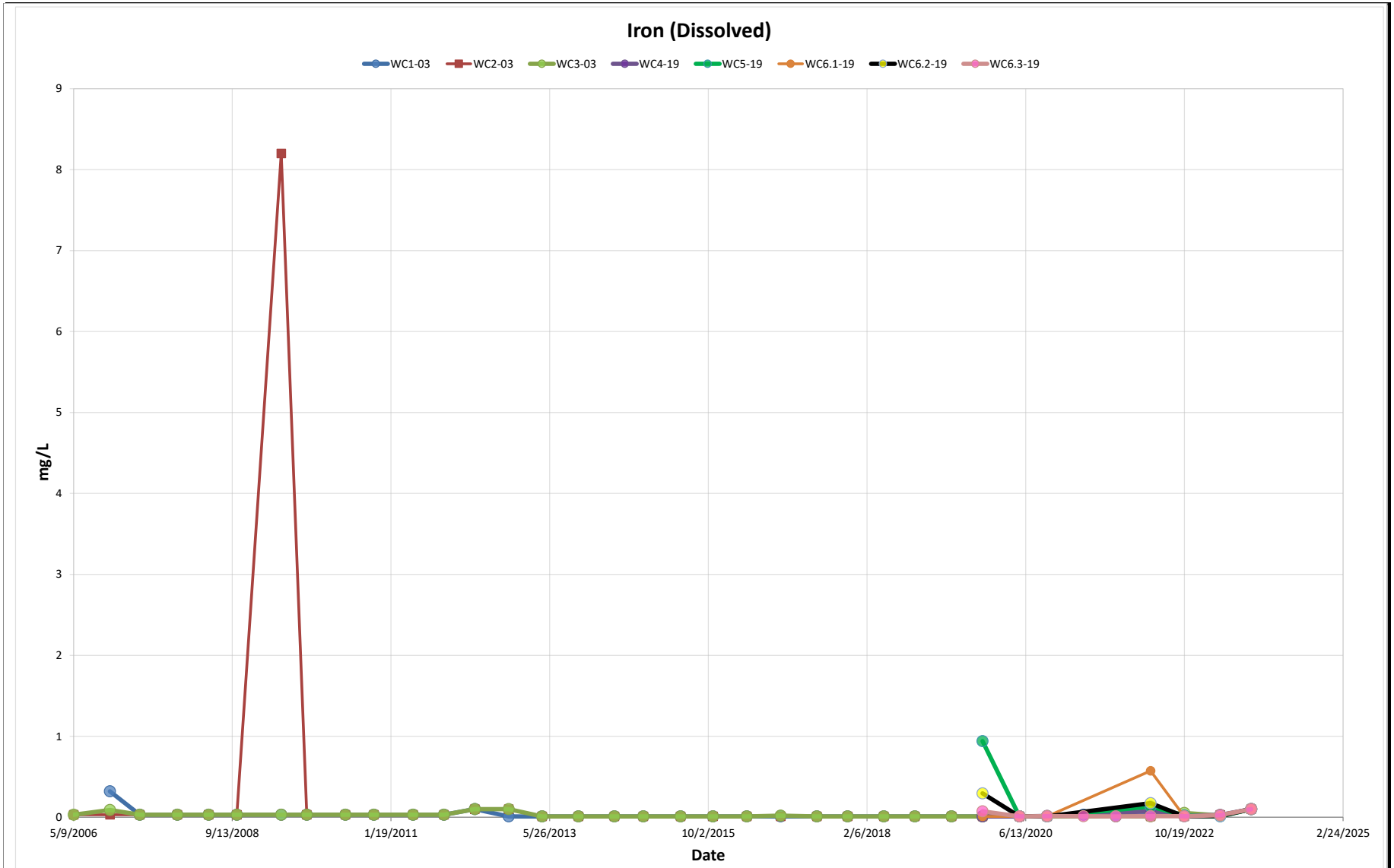
Wolf Creek WDS **Municipality of Hasting's Highlands** **BluMetric Proj No: 230225-01** **Date: January 25, 2024**	**Graph 5** **Chloride in Groundwater 2019-2023** **Created by: Jennifer Farrell** **Checked by: Carolyn Miller**



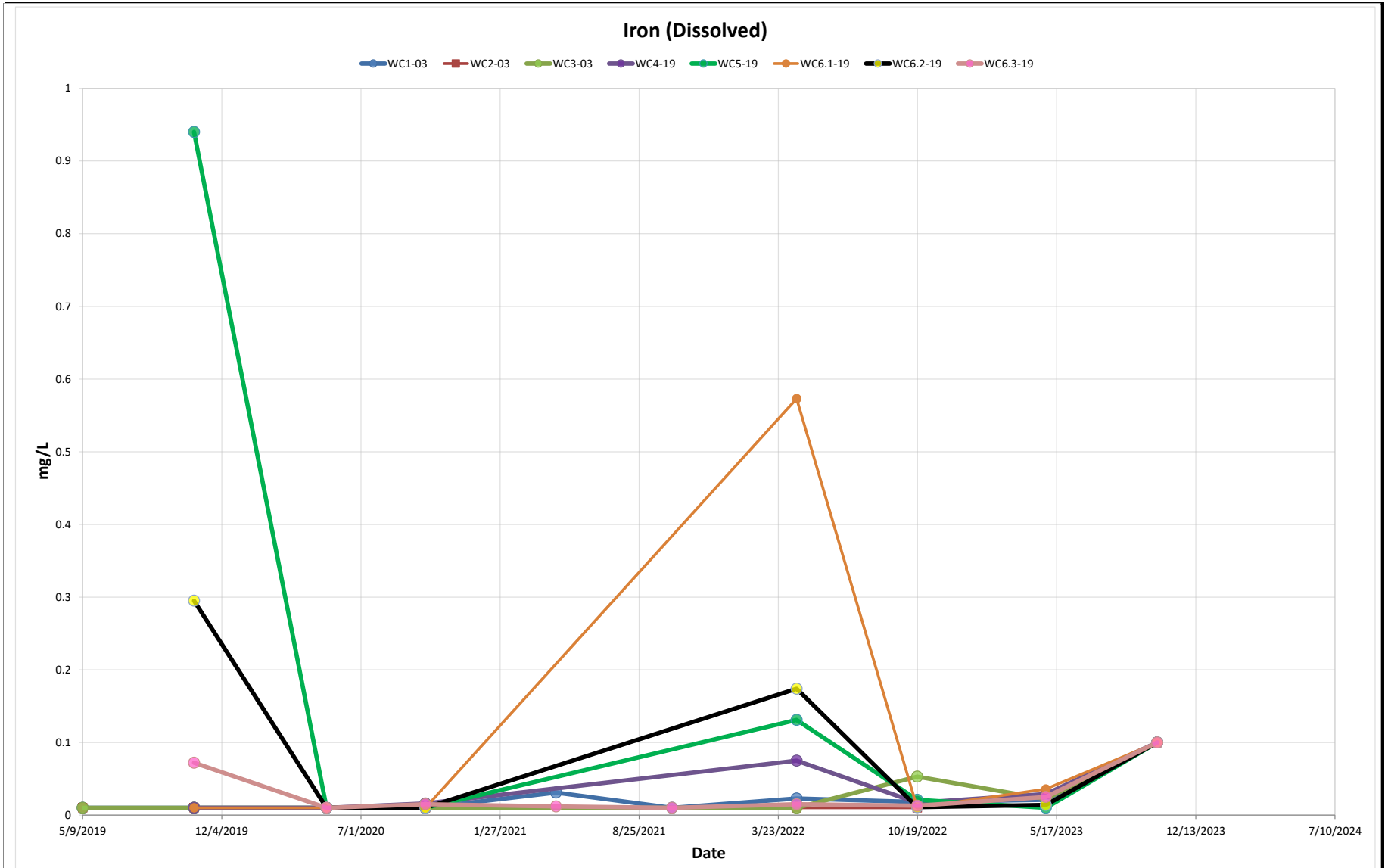
Wolf Creek WDS **Municipality of Hasting's Highlands** **BluMetric Proj No: 230225-01** **Date: January 25, 2024**	**Graph 6** **Dissolved Organic Carbon in Groundwater 2007-2023** **Created by: Jennifer Farrell** **Checked by: Carolyn Miller**



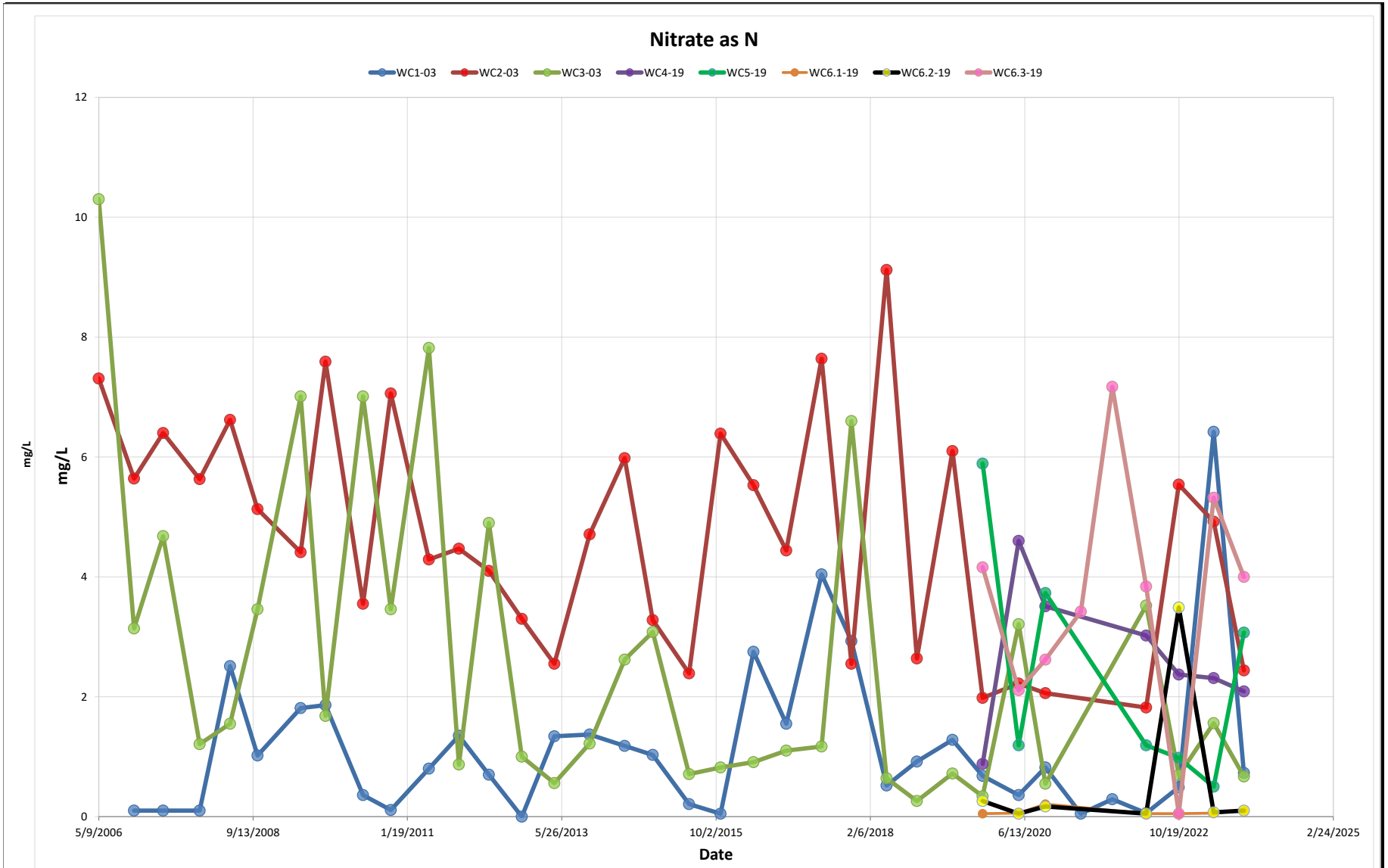
Wolf Creek WDS **Municipality of Hasting's Highlands** **BluMetric Proj No: 230225-01** **Date: January 25, 2024**	**Graph 7** **Dissolved Organic Carbon in Groundwater 2019-2023** **Created by: Jennifer Farrell** **Checked by: Carolyn Miller**



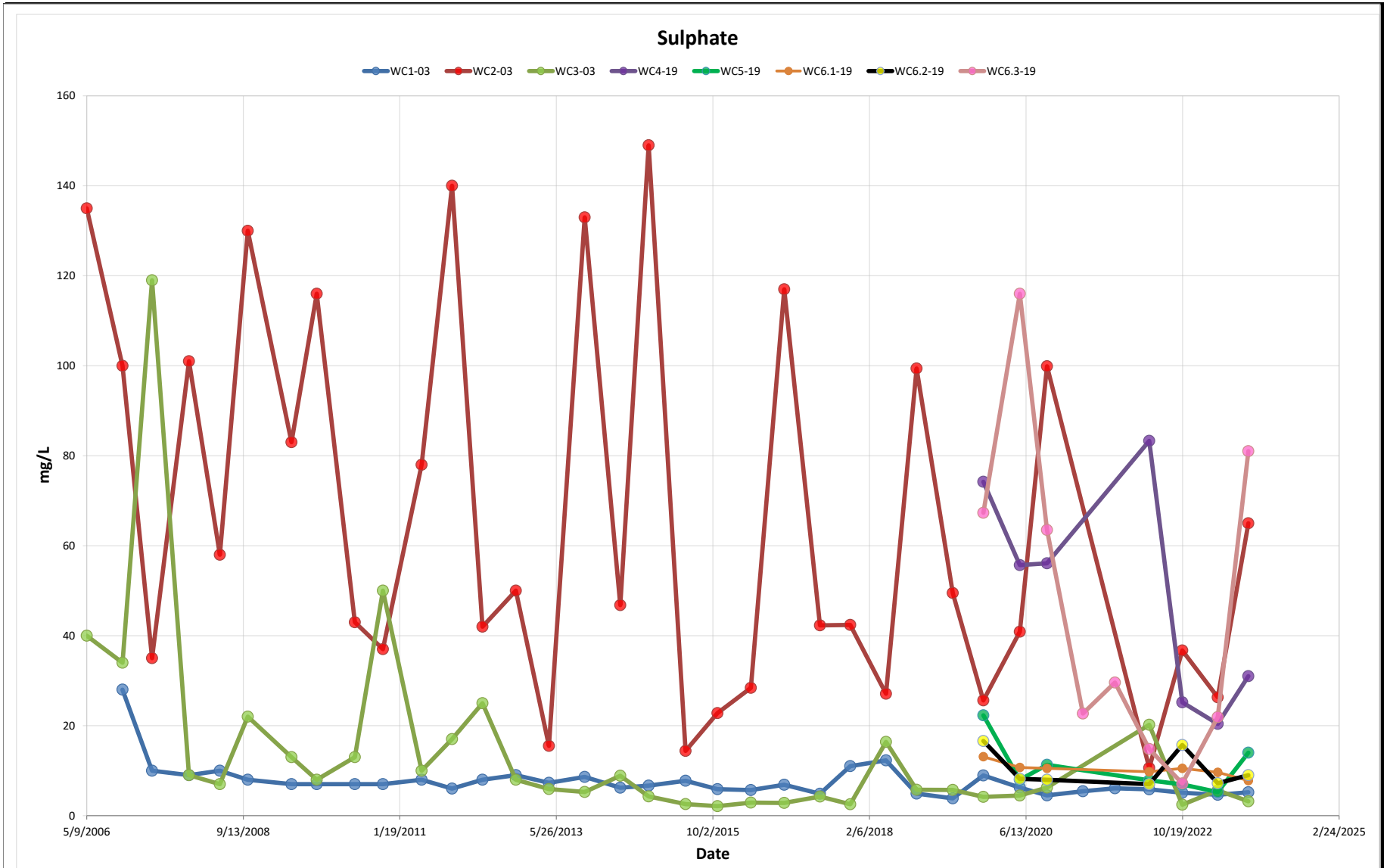
Wolf Creek WDS **Municipality of Hasting's Highlands**	**Graph 8** **Dissolved Iron in Groundwater 2006-2023**
BluMetric Proj No: 230225-01 **Date: January 25, 2024**	**Created by: Jennifer Farrell** **Checked by: Carolyn Miller**



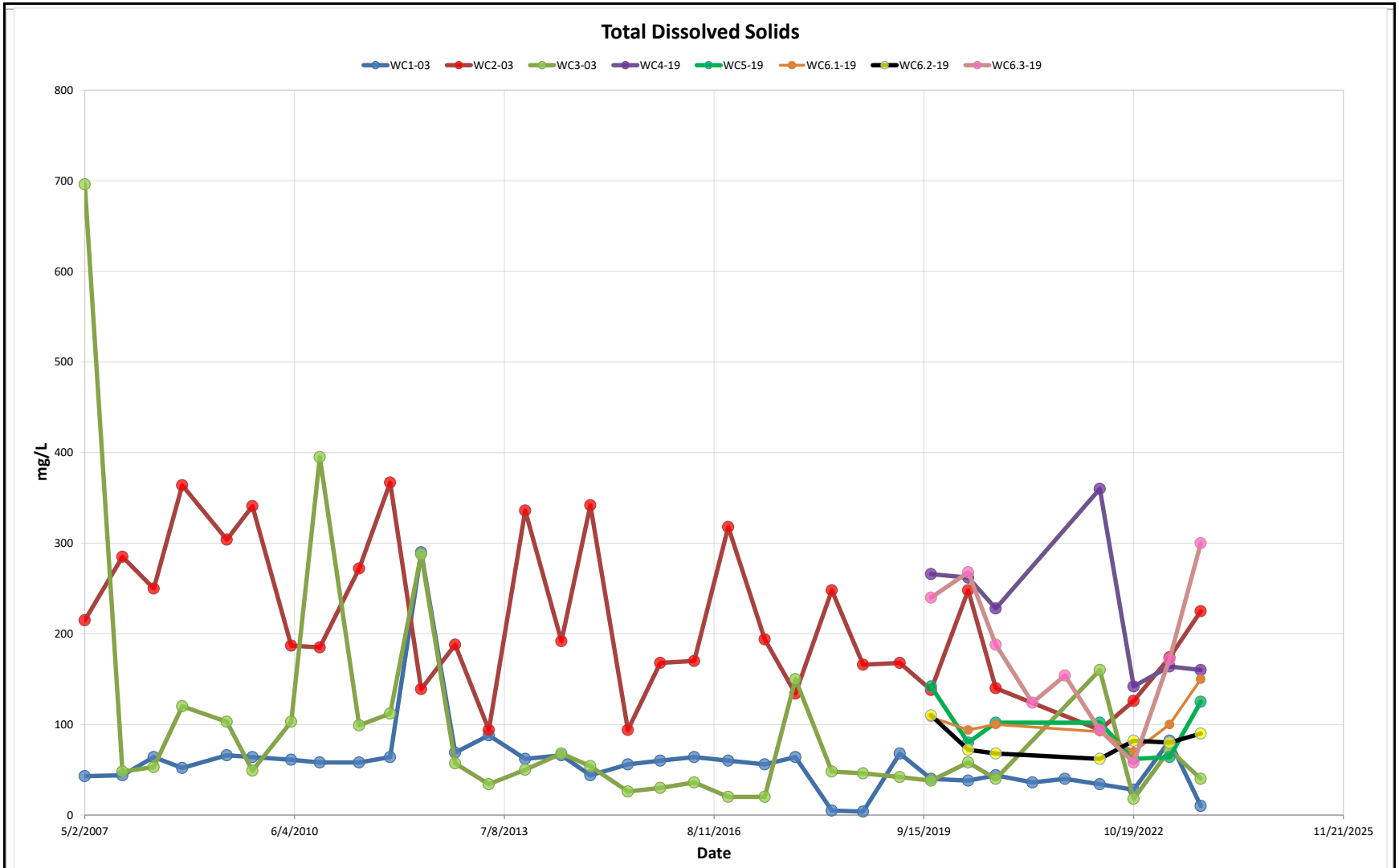
Wolf Creek WDS **Municipality of Hasting's Highlands** **BluMetric Proj No: 230225-01** **Date: January 25, 2024**	**Graph 9** **Dissolved Iron in Groundwater 2019-2023** **Created by: Jennifer Farrell** **Checked by: Carolyn Miller**



Wolf Creek WDS **Municipality of Hasting's Highlands**	**Graph 10** **Nitrate in Groundwater 2006-2023**
BluMetric Proj No: 230225-01 **Date: January 25, 2024**	**Created by: Jennifer Farrell** **Checked by: Carolyn Miller**



Wolf Creek WDS **Municipality of Hasting's Highlands** **BluMetric Proj No: 230225-01** **Date: January 25, 2024**	**Graph 11** **Sulphate in Groundwater 2006-2023** **Created by: Jennifer Farrell** **Checked by: Carolyn Miller**



Wolf Creek WDS
Municipality of Hasting's Highlands

BluMetric Proj No: 230225-01
Date: January 25, 2024

Graph 12
Total Dissolved Solids in Groundwater 2007-2023

Created by: Jennifer Farrell
Checked by: Carolyn Miller

Appendix A

A-1 Environmental Compliance Approval

Ontario

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

AMENDED ENVIRONMENTAL COMPLIANCE APPROVAL
NUMBER A361102
Issue Date: December 7, 2017

The Corporation of the Municipality of Hastings Highlands
33011 Highway 62 N
Post Office Box, No. 130
Maynooth, Ontario
K0L 2S0

Site Location: Wolf Creek WDS
Lot Part of 23, Concession 14
Hastings Highlands Municipality, County of Hastings

You have applied under section 20.2 of Part II.1 of the Environmental Protection Act, R.S.O. 1990, c. E. 19 (Environmental Protection Act) for approval of:

the use and operation of 0.2 hectare waste disposal/transfer site within a total site area of 0.7 hectares.

For the purpose of this environmental compliance approval, the following definitions apply:

- *"Approval"* means this Environmental Compliance Approval and any Schedules to it, including the application and supporting documentation listed in Schedule "A";
- *"Contaminating Life Span"* means contaminating life span as defined in Ontario Regulation 232/98;
- *"Director"* means any *Ministry* employee appointed in writing by the Minister pursuant to section 5 of the EPA as a Director for the purposes of Part II.1 of the *EPA;*
- *"District Manager"* means the District Manager of the local district office of the *Ministry* in which the *Site* is geographically located;
- *"EPA"* means *Environmental Protection Act* , R.S.O. 1990, c. E. 19, as amended;
- *"HHW"* means household hazardous waste;
- *"Ministry"* means the Ontario Ministry of the Environment and Climate Change;

- *"NMA"* means *Nutrient Management Act* , 2002, S.O. 2002, c. 4, as amended;

- *"Ontario Drinking Water Quality Standards"* means Ontario Regulation 169/03 (Ontario Drinking Water Quality Standards) as amended;

- *"Operator"* means any person, other than the *Owner's* employees, authorized by the *Owner* as having the charge, management or control of any aspect of the *Site* and includes its successors or assigns;

- *"Owner"* means any person that is responsible for the establishment or operation of the *Site* being approved by this *Approval,* and includes the Corporation of the Municipality of Hastings Highland and its successors and assigns;

- *"OWRA"* means the *Ontario Water Resources Act* , R.S.O. 1990, c. O.40, as amended;

- *"PA"* means the *Pesticides Act* , R.S.O. 1990, c. P-11, as amended;

- *"Provincial Officer"* means any person designated in writing by the Minister as a provincial officer pursuant to Section 5 of the *OWRA,* Section 5 of the *EPA,* Section 17 of the *PA,* Section 4 of the *NMA,* or Section 8 of the *SDWA;*

- *"Refrigerant Appliances"* means household appliances which use, or may use refrigerants, and which include, but is not restricted to, refrigerators, freezers and air-conditioning systems;

- *"Regional Director"* means the Regional Director of the local Regional Office of the *Ministry* in which the *Site* is located;

- *"Regulation 232"* means Ontario Regulation 232/98 (New Landfill Standards) made under the *EPA,* as amended from time to time;

- *"Regulation 347"* means Regulation 347, R.R.O. 1990, made under the *EPA,* as amended;

- *"Regulation 903"* means Regulation 903, R.R.O. 1990, made under the *OWRA,* as amended;

- *"SDWA"* means *Safe Drinking Water Act,* 2002, S.O. 2002, c. 32, as amended;

- *"Site"* means the entire waste disposal site, including the buffer lands, and contaminant attenuation zone at Wolf Creek Waste Disposal Site, Part of Lot 22, Concession 14, Hastings Highlands Municipality, County of Hastings; and

- *"Trained Personnel"* means personnel knowledgeable in the following through instruction and/or practice:
  - relevant waste management legislation, regulations and guidelines;
  - major environmental concerns pertaining to the waste to be handled;
  - occupational health and safety concerns pertaining to the processes and wastes to be handled;

- management procedures including the use and operation of equipment for the processes and wastes to be handled;
- emergency response procedures;
- specific written procedures for the control of nuisance conditions;
- specific written procedures for refusal of unacceptable waste loads; and
- the requirements of this *Approval.*

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

TERMS AND CONDITIONS

1. GENERAL

Compliance

(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) 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 by this *Approval,* the *Site* shall be designed, developed, built, operated and maintained in accordance with the documentation listed in the attached Schedule "A".

Interpretation

(4) Where there is a conflict between a provision of any document listed in Schedule "A" 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 document 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", 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 Ownership

(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;* and
   (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 and sufficient financial assurance is deposited with the *Ministry* to ensure that these conditions will be carried out.

(13) In the event of any change in ownership of the *Site,* 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.*

Registration on Title Requirement

(14) Prior to dealing with the property in any way, the *Owner* shall provide a copy of this *Approval* and any amendments, to any person who will acquire an interest in the property as a result of the dealing.

(15) (a) Within thirty (30) calendar days from the date of issuance of this *Approval,* the *Owner* shall submit to the *Director* a completed Certificate of Requirement which shall include:

(i) a plan of survey prepared, signed and sealed by an Ontario Land Surveyor, which shows the area of the *Site* where waste has been or is to be deposited at the *Site;*

(ii) proof of ownership of the *Site;*

(iii) a letter signed by a member of the Law Society of Upper Canada or other qualified legal practitioner acceptable to the *Director,* verifying the legal description provided in the Certificate of Requirement;

(iv) the legal abstract of the property; and

(v) any supporting documents including a registerable description of the *Site.*

(b) Within thirty (30) calendar days of receiving a Certificate of Requirement authorized by the *Director,* the *Owner* shall:

(i) register the Certificate of Requirement in the appropriate Land Registry Office on the title to the property; and

(ii) submit to the *Director* and the District Manager, written verification that the Certificate of Requirement has been registered on title.

Inspections by the *Ministry*

(16) No person shall hinder or obstruct a *Provincial Officer* from carrying out any and all inspections authorized by the *OWRA,* the *EPA,* the *PA,* the *SDWA* or the *NMA,* 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,* the *PA,* the *SDWA* or the *NMA.*

Information and Record Retention

(17) (a) Except as authorized in writing by the *Director,* all records required by this *Approval* shall be retained at the *Site* for a minimum of two (2) years from their date of creation.

(b) The *Owner* shall retain all documentation listed in Schedule "A" for as long as this *Approval* is valid.

(c) All monthly summary reports of waste records collected are to be kept at the *Site* until they are included in the Annual Report.

(d) The *Owner* shall retain employee training records as long as the employee is working at the *Site.*

(e) The *Owner* shall make all of the above documents available for inspection upon request of *Ministry* staff.

(18) 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.

(19) The *Owner* shall ensure that a copy of this *Approval,* in its entirety and including all its Notices of Amendment, and documentation listed in Schedule "A", are retained at the *Site* at all times.

(20) Any information related to this *Approval* and contained in *Ministry* files may be made available to the public in accordance with the provisions of the Freedom of Information and Protection of Privacy Act, RSO 1990, CF-31.

2. SITE OPERATION

Operation

(1) The *Site* shall be operated and maintained at all times including management and disposal of all waste, in accordance with the *EPA, Regulation 347,* and the conditions of this *Approval.* At no time shall the discharge of a contaminant that causes or is likely to cause an adverse effect be permitted.

Signs

(2) A sign shall be installed and maintained at the main entrance/exit to the *Site* on which legibly display the following information:

(a) the name of the *Site* and *Owner;*
(b) the number of the *Approval;*
(c) the name of the *Operator;*
(d) the normal hours of operation;
(e) the allowable and prohibited waste types;
(f) the telephone number to which complaints may be directed;
(g) a warning against unauthorized access;
(h) a twenty-four (24) hour emergency telephone number (if different from above); and
(i) a warning against dumping outside the *Site.*

(3) The *Owner* shall install and maintain signs to direct vehicles to working face and recycling areas.

(4) The *Owner* shall provide signs at recycling depot informing users what materials are acceptable and directing users to appropriate storage areas.

Vermin, Vectors, Dust, Litter, Odour, Noise and Traffic

(5) The *Site* shall be operated and maintained such that the vermin, vectors, dust, litter, odour, noise and traffic do not create a nuisance.

Burning Waste Prohibited

(6) (a) Burning of waste at the *Site* is prohibited.

(b) Notwithstanding Condition 2. (6) (a) above, burning of segregated, clean wood and brush at the landfill may be carried out in strict compliance with the Ministry of the Environment Document titled "Guideline C-7, Burning at Landfill Sites" dated April 1994.

Site Access

(7) Waste shall only be accepted during the following time periods:

Winter (Thanksgiving to Victoria Day)
Wednesday and Sunday: 12 p.m.-5 p.m.

Summer (Victoria Day to Thanksgiving)
Wednesday, Sunday and Holiday Mondays: 12 p.m.-5 p.m.

(8) On-site equipment used for site preparation and closing activities may be operated between 7 a.m. and 5 p.m. Monday to Friday.

(9) With the prior written approval from the *District Manager*, the time periods may be extended to accommodate seasonal or unusual quantities of waste.

Site Security

(10) (a) No waste shall be received from the public at the *Site* unless a site Supervisor or an Attendant is present and supervises the operations during operating hours. The *Site* shall be closed to the public when a site Supervisor/Attendant is not present to supervise landfilling operations.

(b) Waste/recyclables relocated on-site or removed from the Site by a registered/licensed waste hauler shall be carried out by trained personnel during the hours of 7 a.m. and 5 p.m. Monday to Friday.

(11) The *Site* shall be operated and maintained in a safe and secure manner. During non-operating hours, the *Site* entrance and exit gates shall be locked and the *Site* shall be secured against access by unauthorized persons.

3. EMPLOYEE TRAINING

(1) A training plan for all employees that operate any aspect of the *Site* shall be developed and implemented by the *Owner* or the *Operator*. Only *Trained Personnel* shall operate any aspect of the *Site* or carry out any activity required under this *Approval* .

4. COMPLAINTS RESPONSE PROCEDURE

(1) If at any time the *Owner* receives complaints regarding the operation of the *Site*, the *Owner* shall respond to these complaints according to the following procedure:

(a) The *Owner* shall record and number each complaint, either electronically or in a log book, and shall include the following information: the nature of the complaint, the name, address and the telephone number of the complainant if the complainant will provide this information and the time and date of the complaint;

(b) The *Owner*, upon notification of the complaint, shall initiate appropriate steps to determine possible causes of the complaint, proceed to take the necessary actions to eliminate the cause of the complaint and forward a formal reply to the complainant; and

(c) The *Owner* shall complete and retain on-site a report written within one (1) week of the complaint date, listing the actions taken to resolve the complaint and any

recommendations for remedial measures, and managerial or operational changes to reasonably avoid the recurrence of similar incidents.

5. EMERGENCY RESPONSE

(1) All Spills as defined in the *EPA* shall be immediately reported to the **Ministry's Spills Action Centre at 1-800-268-6060** and shall be recorded in the log book as to the nature of the emergency situation, and the action taken for clean-up, correction and prevention of future occurrences.

(2) In addition, the *Owner* shall submit, to the *District Manager* a written report within three (3) business days of the emergency situation, outlining the nature of the incident, remedial measures taken, handling of waste generated as a result of the emergency situation and the measures taken to prevent future occurrences at the *Site*.

(3) All wastes resulting from an emergency situation shall be managed and disposed of in accordance with *Reg. 347*.

(4) All equipment and materials required to handle the emergency situations shall be:
- (a) kept on hand at all times that waste landfilling and/or handling is undertaken at the *Site;* and
- (b) adequately maintained and kept in good repair.

(5) The *Owner* shall ensure that the emergency response personnel are familiar with the use of such equipment and its location(s).

6. INSPECTIONS, RECORD KEEPING AND REPORTING

Daily Log Book

(1) A daily log shall be maintained in written or electronic format and shall include the following information:
- (a) the type, date and time of arrival, hauler, and quantity of all waste and cover material received at the *Site;*
- (b) the area of the *Site* in which waste disposal operations are taking place;
- (c) a record of litter collection activities and the application of any dust suppressants;
- (d) a record of the daily inspections; and
- (e) a description of any out-of-service period of any control, treatment, disposal or monitoring facilities, the reasons for the loss of service, and action taken to restore and maintain service.

(2) Any information requested, by the *Director* or a *Provincial Officer,* 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.

Daily Inspections and Log Book

(3) An inspection of the entire *Site* and all equipment on the *Site* shall be conducted each day the *Site* is in operation to ensure that: the *Site* is secure; that the operation of the *Site* is not causing any nuisances; that the operation of the *Site* is not causing any adverse effects on the environment and that the *Site* is being operated in compliance with this *Approval.* Any deficiencies discovered as a result of the inspection shall be remedied immediately, including temporarily ceasing operations at the *Site* if needed.

(4) A record of the inspections shall be kept in a daily log book that includes:
(a) the name and signature of person that conducted the inspection;
(b) the date and time of the inspection;
(c) the list of any deficiencies discovered;
(d) the recommendations for remedial action; and
(e) the date, time and description of actions taken.

(5) A record shall be kept in the daily log book of all refusals of waste shipments, the reason(s) for refusal, and the origin of the waste, if known.

Annual Report

(6) A written report on the development, operation and monitoring of the *Site,* shall be completed annually (the "Annual Report"). The Annual Report shall be submitted to the *District Manager,* by March 31st of the year following the period being reported upon.

(7) The Annual Report shall include but not be limited to the following information:

(a) the results and an interpretive analysis of the results of all leachate, groundwater surface water and landfill gas monitoring, including an assessment of the need to amend the monitoring programs;
(b) an assessment of the operation and performance of all engineered facilities, the need to amend the design or operation of the *Site,* and the adequacy of and need to implement the contingency plans;
(c) site plans showing the existing contours of the *Site;* areas of landfilling operation during the reporting period; areas of intended operation during the next reporting period; areas of excavation during the reporting period; the progress of final cover, vegetative cover, and any intermediate cover application; facilities existing, added or removed during the reporting period; and site preparations and facilities planned for installation during the next reporting period;
(d) calculations of the volume of waste, daily and intermediate cover, and final cover deposited or placed at the *Site* during the reporting period and a calculation of the total volume of *Site* capacity used during the reporting period;
(e) a calculation of the remaining capacity of the *Site* and an estimate of the

remaining *Site* life;

(f) a summary of the weekly, maximum daily and total annual quantity of waste received at the *Site;*

(g) a summary of any complaints received and the responses made;

(h) a discussion of any operational problems encountered at the *Site* and corrective action taken;

(i) any changes to the Design and Operations Report and the Closure Plan that have been approved by the *Director* since the last *Annual Report;*

(j) a report on the status of all monitoring wells and a statement as to compliance with *Ontario Regulation 903;* and

(k) any other information with respect to the *Site* which the *District Manager* may require from time to time.

7. LANDFILL DESIGN AND DEVELOPMENT

Approved Waste Types

(1) Only municipal waste as defined under *Reg.* 347 being solid non-hazardous shall be accepted at the *Site* for landfilling.

(2) The *Owner* shall develop and implement a program to inspect waste to ensure that the waste received at the *Site* is of a type approved for acceptance under this *Approval.*

(3) The *Owner* shall ensure that all loads of waste are properly inspected by *Trained personnel* prior to acceptance at the *Site* and that the waste vehicles are directed to the appropriate areas for disposal or transfer of the waste. The *Owner* shall notify the *District Manager,* in writing, of load rejections at the *Site* within one (1) business day from their occurrence.

Capacity

(4) The calculated theoretical maximum volumetric capacity of the *Site,* consisting of the waste, daily cover and intermediate cover, but excluding the final cover and historical waste is 4000 cubic metres.

(5) This approval is for the design, operation and use of 2580 cubic meters (consisting of waste, daily cover and intermediate cover, but excluding the final cover) of the calculated theoretical maximum volumetric capacity of the *Site* as described in Item 4 of Schedule "A". This volume does not includes the historical waste deposited below ground level.

Service Area

(6) Only waste that is generated within the boundaries of the Municipality of Hastings Highlands may be accepted at the *Site.*

Cover

(7) Alternative materials to soil may be used as weekly and interim cover material, based on an application with supporting information and applicable fee for a trial use or permanent use, submitted by the *Owner* to the *Director*, copied to the *District Manager* and as approved by the *Director* via an amendment to this *Approval*. The alternative material shall be non-hazardous according to *Reg. 347* and will be expected to perform at least as well as soil in relation to the following functions:

(a) Control of blowing litter, odours, dust, landfill gas, gulls, vectors, vermin and fires;

(b) Provision for an aesthetic condition of the landfill during the active life of the *Site;*

(c) Provision for vehicle access to the active tipping face; and

(d) Compatibility with the design of the *Site* for groundwater protection, leachate management and landfill gas management.

(8) Cover material shall be applied as follows:

(a) **Tri-Weekly** Cover - Weather permitting, deposited waste shall be covered every third week in a manner acceptable to the *District Manager* so that no waste is exposed to the atmosphere;

(b) Intermediate Cover - In areas where landfilling has been temporarily discontinued for six (6) months or more, a minimum thickness of 300 millimetre of soil cover or an approved thickness of alternative cover material shall be placed; and

(c) Final Cover - In areas where landfilling has been completed to final contours, a minimum 600 millimetre thick layer of soil of medium permeability and 150 millimetres of top soil (vegetative cover) shall be placed. Fill areas shall be progressively completed and rehabilitated as landfill development reaches final contours.

8. LANDFILL MONITORING

Landfill Gas

(1) The *Owner* shall ensure that any buildings or structures at the *Site* contain adequate ventilation systems to relieve any possible landfill gas accumulation to prevent methane concentration reaching the levels within its explosive range. Routine monitoring for explosive methane gas levels shall be conducted in all buildings or structures at the *Site,* especially enclosed structures which at times are occupied by people.

Compliance

(2) The *Site* shall be operated in such a way as to ensure compliance with the following:

(a) Reasonable Use Guideline B-7 in terms of key leachate indicators for the protection of the groundwater at the *Site;*

(b) Provincial Water Quality Objectives included in the July 1994 publication entitled *Water Management Policies, Guidelines, Provincial Water Quality Objectives,* as amended from time to time or limits set by the *Regional Director,* for the protection of the surface water at and off the *Site;* and

(c) *Ontario Drinking Water Quality Standards* except where background conditions are confirmed to fall above or below the criteria.

Surface Water and Groundwater

(3) The *Owner* shall monitor surface water and ground water in accordance with the monitoring programs outlined in Schedule "B".

(4) A certified Professional Geoscientist or Engineer possessing appropriate hydrogeologic training and experience shall execute or directly supervise the execution of the groundwater monitoring and reporting program.

Groundwater Wells and Monitors

(5) The *Owner* shall ensure that all groundwater monitoring wells which form part of the monitoring program are properly capped, locked and protected from damage.

(6) Where landfilling is to proceed around monitoring wells, suitable extensions shall be added to the wells and the wells shall be properly re-secured.

(7) Any groundwater monitoring well included in the on-going monitoring program that is damaged shall be assessed, repaired, replaced or decommissioned by the *Owner,* as required.

(a) The *Owner* shall repair or replace any monitoring well which is destroyed or in any way made to be inoperable for sampling such that no more than one regular sampling event is missed.

(b) All monitoring wells which are no longer required as part of the groundwater monitoring program, and have been approved by the *Director* for abandonment, shall be decommissioned by the *Owner,* as required, in accordance with *O.Reg. 903,* to prevent contamination through the abandoned well. A report on the decommissioning of the well shall be included in the Annual Report for the period during which the well was decommissioned.

Trigger Mechanisms and Contingency Plans

(8) (a) Trigger mechanisms shall be in accordance with Appendix F of Item 4 in Schedule "A".

(b) Contingency plan in the event of a confirmed exceedance of a site-specific trigger level relating to leachate mounding or groundwater or surface water impacts due to leachate shall be in accordance with Appendix F of Item 4 in Schedule "A".

(9) In the event of a confirmed exceedance of a site-specific trigger level relating to leachate mounding or groundwater or surface water impacts due to leachate, the *Owner* shall immediately notify the *District Manager,* and an investigation into the cause and the need for implementation of remedial or contingency actions shall be carried out by the *Owner* in accordance with the approved trigger mechanisms and associated contingency plans.

(10) If monitoring results, investigative activities and/or trigger mechanisms indicate the need to implement contingency measures, the *Owner* shall ensure that the following steps are taken:

(a) The *Owner* shall notify the *District Manager,* in writing of the need to implement contingency measures, no later than 30 days after confirmation of the exceedances;
(b) Detailed plans, specifications and descriptions for the design, operation and maintenance of the contingency measures shall be prepared and submitted by the *Owner* to the *Director* for approval; and
(c) The contingency measures shall be implemented by the *Owner* upon approval by the *Director* .

(11) The *Owner* shall ensure that any proposed changes to the site-specific trigger levels for leachate impacts to the surface water or groundwater, are approved in advance by the *Director* via an amendment to this *Approval.*

Changes to the Monitoring Plan

(12) The *Owner* may request to make changes to the monitoring program(s) to the *District Manager* in accordance with the recommendations of the annual report. The *Owner* shall make clear reference to the proposed changes in a separate letter that shall accompany the annual report.

(13) Within fourteen (14) days of receiving the written correspondence from the *District Manager* confirming that the *District Manager* is in agreement with the proposed changes to the environmental monitoring program, 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 the changes to the monitoring program, to

the *Director* requesting the *Approval* be amended to approve the proposed changes to the environmental monitoring plan prior to implementation.

(14) 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.*

9. CLOSURE PLAN

(1) At least three (3) years prior to the anticipated date of closure of this *Site,* the *Owner* shall submit to the *Director* for approval, with copies to the *District Manager,* a detailed *Site* closure plan pertaining to the termination of landfilling operations at this *Site,* post-closure inspection, maintenance and monitoring, and end use. The plan shall include but not be limited to the following information:

(a) a plan showing *Site* appearance after closure;

(b) a description of the proposed end use of the *Site;*

(c) a description of the procedures for closure of the *Site,* including:

(i) advance notification of the public of the landfill closure;

(ii) posting of a sign at the *Site* entrance indicating the landfill is closed and identifying any alternative waste disposal arrangements;

(iii) completion, inspection and maintenance of the final cover and landscaping;

(iv) *Site* security;

(v) removal of unnecessary landfill-related structures, buildings and facilities;

(vi) final construction of any control, treatment, disposal and monitoring facilities for leachate, groundwater, surface water and landfill gas; and

(vii) a schedule indicating the time-period for implementing sub-conditions (i) to (vi) above;

(d) descriptions of the procedures for post-closure care of the *Site,* including:

(i) operation, inspection and maintenance of the control, treatment, disposal and monitoring facilities for leachate, groundwater, surface water and landfill gas;

(ii) record keeping and reporting; and

(iii) complaint contact and response procedures;

(e) an assessment of the adequacy of and need to implement the contingency plans for leachate and methane gas; and

(f) an updated estimate of the *contaminating life span* of the *Site,* based on the results of the monitoring programs to date.

(2) The *Site* shall be closed in accordance with the closure plan as approved by the *Director.*

10. WASTE DIVERSION

(1) The *Owner* shall ensure that:
- (a) all bins and waste storage areas are clearly labelled;
- (b) all lids or doors on bins shall be kept closed during non-operating hours and during high wind events; and
- (c) if necessary to prevent litter, waste storage areas shall be covered during high winds events.

(2) The *Owner* shall provide a segregated area for the storage of *Refrigerant Appliances* so that the following are ensured:
- (a) all *Refrigerant Appliances* have been tagged to indicate that the refrigerant has been removed by a licensed technician. The tag number shall be recorded in the log book and shall remain affixed to the appliance until transferred from the *Site;* **or**
- (b) all *Refrigerant Appliances* accepted at the *Site,* which have not been tagged by a licensed technician to verify that the equipment no longer contains refrigerants, are stored segregated, in a clearly marked area, in an upright position and in a manner which allows for the safe handling and transfer from the *Site* for removal of refrigerants as required by O.Reg. 189; and
- (c) all *Refrigerant Appliances* received on-site shall either have the refrigerant removed prior to being transferred from the *Site* or shall be shipped off-site only to facilities where the refrigerants can be removed by a licensed technician in accordance with O.Reg. 189.

(3) The *Owner* shall transfer waste and recyclable materials from the *Site* as follows:
- (a) recyclable materials shall be transferred off-site once their storage bins are full;
- (b) scrap metal shall be transferred off-site at least twice a year;
- (c) tires shall be transferred off-site as soon as a load for the contractor hired by the *Owner* has accumulated or as soon as the accumulated volume exceeds the storage capacity of its bunker; and
- (d) immediately, in the event that waste is creating an odour or vector problem.

(4) The *Owner* shall notify the appropriate contractors that waste and recyclable wastes that are to be transferred off-site are ready for removal. Appropriate notice time, as determined by the contract shall be accommodated in the notification procedure.

HHW and WEEE

(5) Sealable and lockable bins may be used to collect inadvertently left WEEE and HHW.

(6) Storage and transfer of above WEEE shall be in accordance with the guideline titled "Collection Site Organizing & Operating Waste Electrical and Electronic Equipment (WEEE) Guidebook" dated November 2012 as amended prepared by Ontario Electronic Stewardship.

(7) Storage and transfer of above HHW shall be in a way to protect health and safety of the public and the environment.

SCHEDULE "A"

1. Detail site plan "Site No. A361102, Township of Bangor, North End of Kamaniskeg Lake, Lot 23, Conc. 14" dated October 22, 1979.

2. Letter dated August 29, 1974, from J. Tooley to R.M. Sears Clerk-Treasurer.

3. Environmental Compliance Approval Application dated August 21, 2017 and signed by Pat Pilgrim, Chief Administrative Officer, the Corporation of the Municipality of Hastings Highlands, including the attached supporting documentation.

4. Report titled "Development and Operations Plan, Wolf Creek Waste Disposal Site, Environmental Compliance Approval No. A361102" dated August 2017 and prepared by BluMetric Environmental Inc.

Schedule "B"

Wolf Creek Annual Semi-Annual (Spring & Fall) Groundwater Analysis

Location	Parameters
WC1-03 WC2-03 WC3-03	Dissolved Organic Carbon (DOC) Alkalinity Ammonia Calcium Chloride Magnesium Nitrate Potassium Sodium Sulphate Aluminum Boron Iron Lead Manganese Strontium Zinc Chemical Oxygen Demand (COD) Conductivity pH Total Dissolved Solids (TDS)

The reasons for the imposition of these terms and conditions are as follows:

GENERAL

- The reason for Conditions 1(1), (2), (4), (5), (6), (7), (8), (9), (10), (17), (18) and (19) is to clarify the legal rights and responsibilities of the *Owner* and *Operator* under this *Approval.*

- The reasons for Condition 1(3) are 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.

- The reasons for Condition 1(11) are 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.

- The reasons for Condition 1(12) are 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 *Approval* .

- The reason for Condition 1(13) is to ensure that the successor is aware of its legal responsibilities.

- The reasons for Conditions 1(14) and (15) are that the Part II.1 *Director* is an individual with authority pursuant to Section 197 of the Environmental Protection Act to require registration on title and provide any person with an interest in property before dealing with the property in any way to give a copy of the *Approval* to any person who will acquire an interest in the property as a result of the dealing.

- The reason for Condition 1(16) is to ensure that appropriate *Ministry* staff has ready access to the Site for inspection of facilities, equipment, practices and operations required by the conditions in this *Approval* . This Condition is supplementary to the powers of entry afforded a Provincial Officer pursuant to the *Act* , the *OWRA* , the *PA* , the *NMA* and the *SDWA* .

- Condition 1 (20) has been included in order to clarify what information may be subject to the *Freedom of Information Act.*

SITE OPERATION

- The reasons for Conditions 2(1), 2(5) and 6(3) are to ensure that the *Site* is operated, inspected and maintained in an environmentally acceptable manner and does not result in a hazard or nuisance to the natural environment or any person.

- The reason for Conditions 2 (2), 2(3) and 2(4) is to ensure that users of the *Site* are fully aware of

important information and restrictions related to *Site* operations and access under this *Approval.*

- The reasons for Condition 2(6) (a) and (b) are open burning of municipal waste is unacceptable because of concerns with air emissions, smoke and other nuisance effects, and the potential fire hazard and to make sure burning of brush and wood are carried out in accordance with Ministry guidelines.

- The reasons for Condition 2(7), 2(8) and 2(9) are to specify the hours of operation for the landfill site and a mechanism for amendment of the hours of operation, as required.

- The reasons for Condition 2(10) and 2(11) are to ensure that the *Site* is supervised by properly trained staff in a manner which does not result in a hazard or nuisance to the natural environment or any person 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.

EMPLOYEE TRAINING

- The reason for Condition 3(1) 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.

COMPLAINTS RESPONSE PROCEDURE

- The reason for Condition 4(1) is to ensure that any complaints regarding landfill operations at this *Site* are responded to in a timely and efficient manner.

EMERGENCY RESPONSE

- Conditions 5(1) and 5(2) are included to ensure that emergency situations are reported to the Ministry to ensure public health and safety and environmental protection.

- Conditions 5(3), 5(4) and 5(5) are included to ensure that emergency situations are handled in a manner to minimize the likelihood of an adverse effect and to ensure public health and safety and environmental protection.

RECORD KEEPING AND REPORTING

- The reason for Conditions 6(1) and 6(2) is to ensure that accurate waste records are maintained to ensure compliance with the conditions in this *Approval* (such as fill rate, site capacity, record keeping, annual reporting, and financial assurance requirements), the *EPA* and its regulations.

- The reason for Conditions 6(4) and 6(5) is to ensure that detailed records of *Site* inspections are recorded and maintained for inspection and information purposes.

- The reasons for Conditions 6(6) and 6(7) are 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.

LANDFILL DESIGN AND DEVELOPMENT

- The reason for Conditions 7(1) to 7(6) inclusive 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.

- Condition 7(7) is to provide the Owner the process for getting the approval for alternative daily and intermediate cover material.

- The reasons for Condition 7(8) are to ensure that daily/weekly and intermediate cover are 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.*

LANDFILL MONITORING

- Reasons for Condition 8(1) are to ensure that off-site migration of landfill gas is monitored and all buildings at the *Site* are free of any landfill gas accumulation, which due to a methane gas component may be explosive and thus create a danger to any persons at the *Site.*

- Condition 8(2) is included to provide the groundwater and surface water limits to prevent water pollution at the *Site.*

- Conditions 8(3) and 8(4) are included to require the Owner to demonstrate that the *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.

- Conditions 8(5), 8(6) and 8(7) are included to ensure the integrity of the groundwater monitoring network so that accurate monitoring results are achieved and the natural environment is protected.

- Conditions 8(8) to 8(11) inclusive are added to ensure the *Owner* has a plan with an organized set of procedures for identifying and responding to potential issues relating to groundwater and surface water contamination at the *Site's* compliance point.

- Conditions 8(12), 8(13) and 8(14) are included to streamline the approval of the changes to the monitoring plan.

CLOSURE PLAN

- The reasons for Condition 9 are to ensure that final closure of the *Site* is completed in an aesthetically pleasing manner, in accordance with Ministry standards, and to ensure the long-term protection of the health and safety of the public and the environment.

WASTE DIVERSION

- Condition 10 is included to ensure that the recyclable materials are stored in their temporary storage location and transferred off-site in a manner as to minimize a likelihood of an adverse effect or a hazard to the natural environment or any person.

Upon issuance of the environmental compliance approval, I hereby revoke Approval No(s). A361102 issued on March 27, 1980

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:

a. 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;
b. 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:

1. The name of the appellant;
2. The address of the appellant;
3. The environmental compliance approval number;
4. The date of the environmental compliance approval;
5. The name of the Director, and;
6. 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
Toronto, Ontario
M5G 1E5

AND

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

*** 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 7th day of December, 2017

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

RM/
c: Area Manager, MOECC Belleville
c: District Manager, MOECC Kingston - District
Iris O'Connor, BluMetric Environmental Inc.

Ontario

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 A361102
Notice No. 1
Issue Date: March 21, 2018

The Corporation of the Municipality of Hastings Highlands
33011 Highway 62 N
Post Office Box, No. 130
Maynooth, Ontario
K0L 2S0

Site Location: Wolf Creek WDS
Lot Part of 22, Concession 14
Hastings Highlands Municipality, County of Hastings

You are hereby notified that I have amended Approval No. A361102 issued on December 7, 2017 for a waste disposal site (transfer) , as follows:

The site location is hereby amended and replaced by the following:

Wolf Creek WDS
Lot Part of 22, Concession 14
Hastings Highlands Municipality, County of Hastings

The reason for this amendment to the Approval is as follows:

Receipt of the ECA amendment application dated August 17, 2017, which confirms the site location at the above address.

This Notice shall constitute part of the approval issued under Approval No. A361102 dated December 7, 2017

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:

a. 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;
b. 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:

1. The name of the appellant;
2. The address of the appellant;
3. The environmental compliance approval number;
4. The date of the environmental compliance approval;
5. The name of the Director, and;
6. 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
Toronto, Ontario
M5G 1E5

AND

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

*** 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 21st day of March, 2018

THIS APPROVAL WAS MAILED
ON APR 0 6 2018
MP
(Signed)

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

ND/
c: Area Manager, MOECC Belleville
c: District Manager, MOECC Kingston - District
Iris O'Connor, BluMetric Environmental Inc.

AMENDED ENVIRONMENTAL COMPLIANCE APPROVAL
NUMBER A361102
Issue Date: October 13, 2023

The Corporation of the Municipality of Hastings Highlands
33011 Highway 62
Post Office Box, No. 130
Maynooth, Ontario
K0L 2S0

Site Location: Wolf Creek WDS
Lot Part of 22, Concession 14
Hastings Highlands Municipality, County of Hastings

You have applied under section 20.2 of Part II.1 of the Environmental Protection Act, R.S.O. 1990, c. E. 19 (Environmental Protection Act) for approval of:

the use and operation of 0.2 hectare waste disposal/transfer site within a total site area of 0.7 hectares.

For the purpose of this environmental compliance approval, the following definitions apply:

- "Approval" means this Environmental Compliance Approval and any Schedules to it, including the application and supporting documentation listed in Schedule "A";
- "Contaminating Life Span" means contaminating life span as defined in Ontario Regulation 232/98;
- "Director" means any Ministry employee appointed in writing by the Minister pursuant to section 5 of the EPA as a Director for the purposes of Part II.1 of the EPA;
- "District Manager" means the District Manager of the local district office of the Ministry in which the Site is geographically located;
- "EPA" means *Environmental Protection Act* , R.S.O. 1990, c. E. 19, as amended;
- "HHW" means household hazardous waste;
- "Ministry" means the Ontario Ministry of the Environment, Conservation and Parks;

- "NMA" means *Nutrient Management Act* , 2002, S.O. 2002, c. 4, as amended;

- "Ontario Drinking Water Quality Standards" means Ontario Regulation 169/03 (Ontario Drinking Water Quality Standards) as amended;

- "Operator" means any person, other than the Owner's employees, authorized by the Owner as having the charge, management or control of any aspect of the Site and includes its successors or assigns;

- "Owner" means any person that is responsible for the establishment or operation of the Site being approved by this Approval, and includes the Corporation of the Municipality of Hastings Highland and its successors and assigns;

- "OWRA" means the *Ontario Water Resources Act* , R.S.O. 1990, c. O.40, as amended;

- "PA" means the *Pesticides Act* , R.S.O. 1990, c. P-11, as amended;

- "Provincial Officer" means any person designated in writing by the Minister as a provincial officer pursuant to Section 5 of the OWRA, Section 5 of the EPA, Section 17 of the PA, Section 4 of the NMA, or Section 8 of the SDWA;

- "Refrigerant Appliances" means household appliances which use, or may use refrigerants, and which include, but is not restricted to, refrigerators, freezers and air-conditioning systems;

- "Regional Director" means the Regional Director of the local Regional Office of the Ministry in which the Site is located;

- "Regulation 232" means Ontario Regulation 232/98 (New Landfill Standards) made under the EPA, as amended from time to time;

- "Regulation 347" means Regulation 347, R.R.O. 1990, made under the EPA, as amended;

- "Regulation 903" means Regulation 903, R.R.O. 1990, made under the OWRA, as amended;

- "SDWA" means Safe Drinking Water Act, 2002, S.O. 2002, c. 32, as amended;

- "Site" means the entire waste disposal site, including the buffer lands, and contaminant attenuation zone at Wolf Creek Waste Disposal Site, Part of Lot 22, Concession 14, Hastings Highlands Municipality, County of Hastings; and

- "Trained Personnel" means personnel knowledgeable in the following through instruction and/or practice:
  - relevant waste management legislation, regulations and guidelines;
  - major environmental concerns pertaining to the waste to be handled;
  - occupational health and safety concerns pertaining to the processes and wastes to be handled;

- management procedures including the use and operation of equipment for the processes and wastes to be handled;
- emergency response procedures;
- specific written procedures for the control of nuisance conditions;
- specific written procedures for refusal of unacceptable waste loads; and
- the requirements of this Approval.

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

TERMS AND CONDITIONS

1. GENERAL

Compliance

(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) 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 by this Approval, the Site shall be designed, developed, built, operated and maintained in accordance with the documentation listed in the attached Schedule “A”.

Interpretation

(4) Where there is a conflict between a provision of any document listed in Schedule "A" 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 document 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", 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 Ownership

(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; and
   (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 and sufficient financial assurance is deposited with the Ministry to ensure that these conditions will be carried out.

(13) In the event of any change in ownership of the Site, 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.

Registration on Title Requirement

(14) Prior to dealing with the property in any way, the Owner shall provide a copy of this Approval and any amendments, to any person who will acquire an interest in the property as a result of the dealing.

(15) (a) Within thirty (30) calendar days from the date of issuance of this Approval, the Owner shall submit to the Director a completed Certificate of Requirement which shall include:
- (i) a plan of survey prepared, signed and sealed by an Ontario Land Surveyor, which shows the area of the Site where waste has been or is to be deposited at the Site;
- (ii) proof of ownership of the Site;
- (iii) a letter signed by a member of the Law Society of Upper Canada or other qualified legal practitioner acceptable to the Director, verifying the legal description provided in the Certificate of Requirement;
- (iv) the legal abstract of the property; and
- (v) any supporting documents including a registerable description of the Site.

(b) Within thirty (30) calendar days of receiving a Certificate of Requirement authorized by the Director, the Owner shall:
- (i) register the Certificate of Requirement in the appropriate Land Registry Office on the title to the property; and
- (ii) submit to the Director and the District Manager, written verification that the Certificate of Requirement has been registered on title.

Inspections by the Ministry

(16) No person shall hinder or obstruct a Provincial Officer from carrying out any and all inspections authorized by the OWRA, the EPA, the PA, the SDWA or the NMA, 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, the PA, the SDWA or the NMA.

Information and Record Retention

(17) (a) Except as authorized in writing by the Director, all records required by this Approval shall be retained at the Site for a minimum of two (2) years from their date of creation.

(b) The Owner shall retain all documentation listed in Schedule "A" for as long as this Approval is valid.

(c) All monthly summary reports of waste records collected are to be kept at the Site until they are included in the Annual Report.

(d) The Owner shall retain employee training records as long as the employee is working at the Site.

(e) The Owner shall make all of the above documents available for inspection upon request of Ministry staff.

(18) 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.

(19) The Owner shall ensure that a copy of this Approval, in its entirety and including all its Notices of Amendment, and documentation listed in Schedule "A", are retained at the Site at all times.

(20) Any information related to this Approval and contained in Ministry files may be made available to the public in accordance with the provisions of the Freedom of Information and Protection of Privacy Act, RSO 1990, CF-31.

2. SITE OPERATION

Operation

(1) The Site shall be operated and maintained at all times including management and disposal of all waste, in accordance with the EPA, Regulation 347, and the conditions of this Approval. At no time shall the discharge of a contaminant that causes or is likely to cause an adverse effect be permitted.

Signs

(2) A sign shall be installed and maintained at the main entrance/exit to the Site on which legibly display the following information:
- (a) the name of the Site and Owner;
- (b) the number of the Approval;
- (c) the name of the Operator;
- (d) the normal hours of operation;
- (e) the allowable and prohibited waste types;
- (f) the telephone number to which complaints may be directed;
- (g) a warning against unauthorized access;
- (h) a twenty-four (24) hour emergency telephone number (if different from above);
- (i) a warning against dumping outside the Site;
- (j) display of "No smoking and no open fire"; and
- (k) indicates that the landfill is closed and the nearest location for disposal of unacceptable wastes; and

(3) The Owner shall install and maintain signs to direct vehicles to working face and recycling areas.

(4) The Owner shall provide signs at recycling depot informing users what materials are acceptable and directing users to appropriate storage areas.

Vermin, Vectors, Dust, Litter, Odour, Noise and Traffic

(5) The Site shall be operated and maintained such that the vermin, vectors, dust, litter, odour, noise and traffic do not create a nuisance.

Burning Waste Prohibited

(6) (a) Burning of waste at the Site is prohibited.

(b) Notwithstanding Condition 2. (6) (a) above, burning of segregated, clean wood and brush at the landfill may be carried out in strict compliance with the Ministry of the Environment Document titled "Guideline C-7, Burning at Landfill Sites" dated April 1994.

Site Access

(7) Waste shall only be accepted during the following time periods:

Winter (Thanksgiving to Victoria Day)
Wednesday and Sunday: 12 p.m.-5 p.m.

Summer (Victoria Day to Thanksgiving)
Wednesday, Sunday and Holiday Mondays: 12 p.m.-5 p.m.

(8) On-site equipment used for site preparation and closing activities may be operated between 7 a.m. and 5 p.m. Monday to Friday.

(9) With the prior written approval from the District Manager, the time periods may be extended to accommodate seasonal or unusual quantities of waste.

Site Security

(10) (a) No waste shall be received from the public at the Site unless a site Supervisor or an Attendant is present and supervises the operations during operating hours. The Site shall be closed to the public when a site Supervisor/Attendant is not present to supervise landfilling operations.

(b) Waste/recyclables relocated on-site or removed from the Site by a registered/licensed waste hauler shall be carried out by trained personnel during the hours of 7 a.m. and 5 p.m. Monday to Friday.

(11) The Site shall be operated and maintained in a safe and secure manner. During non-operating hours, the Site entrance and exit gates shall be locked and the Site shall be secured against access by unauthorized persons.

3. EMPLOYEE TRAINING

(1) A training plan for all employees that operate any aspect of the Site shall be developed and implemented by the Owner or the Operator. Only Trained Personnel shall operate any aspect of the Site or carry out any activity required under this Approval.

4. COMPLAINTS RESPONSE PROCEDURE

(1) If at any time the Owner receives complaints regarding the operation of the Site, the Owner shall respond to these complaints according to the following procedure:

(a) The Owner shall record and number each complaint, either electronically or in a log book, and shall include the following information: the nature of the complaint, the name, address and the telephone number of the complainant if the complainant will provide this information and the time and date of the complaint;

(b) The Owner, upon notification of the complaint, shall initiate appropriate steps to determine possible causes of the complaint, proceed to take the necessary actions to eliminate the cause of the complaint and forward a formal reply to the complainant; and

(c) The Owner shall complete and retain on-site a report written within one (1) week of the complaint date, listing the actions taken to resolve the complaint and any recommendations for remedial measures, and managerial or operational changes to reasonably avoid the recurrence of similar incidents.

5. EMERGENCY RESPONSE

(1) All Spills as defined in the EPA shall be immediately reported to the **Ministry's Spills Action Centre at 1-800-268-6060** and shall be recorded in the log book as to the nature of the emergency situation, and the action taken for clean-up, correction and prevention of future occurrences.

(2) In addition, the Owner shall submit, to the District Manager a written report within three (3) business days of the emergency situation, outlining the nature of the incident, remedial measures taken, handling of waste generated as a result of the emergency situation and the measures taken to prevent future occurrences at the Site.

(3) All wastes resulting from an emergency situation shall be managed and disposed of in accordance with Reg. 347.

(4) All equipment and materials required to handle the emergency situations shall be:
(a) kept on hand at all times that waste landfilling and/or handling is undertaken at the Site; and
(b) adequately maintained and kept in good repair.

(5) The Owner shall ensure that the emergency response personnel are familiar with the use of such equipment and its location(s).

6. INSPECTIONS, RECORD KEEPING

Daily Inspections and Log Book

(1) An inspection of the Site shall be conducted each day the Site is in operation to ensure that: the Site is secure; that the operation of the Site is not causing any nuisances; that the operation of the Site is not causing any adverse effects on the environment and that the Site is being operated in compliance with this Approval. Any deficiencies discovered as a result of the inspection shall be remedied immediately, including temporarily ceasing operations at the Site if needed.

(2) A record of the inspections shall be kept in a daily log book that includes:
(a) the name and signature of person that conducted the inspection;
(b) the date and time of the inspection;
(c) the list of any deficiencies discovered;

(d) the recommendations for remedial action; and
(e) the date, time and description of actions taken.

(3) Any information requested, by the Director or a Provincial Officer, 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.

7. LANDFILL CLOSURE

(1) The landfill shall be closed in accordance with the closure plan included in Item 5 of Schedule A. No additional waste shall be disposed of at the landfill.

Final Cover

(2) The landfill top surface shall be graded to have a slope of no less than 20(H):1(V) and no more than 4(H):1(V).

(3) The final cover shall consists of a minimum 600 millimetre thick layer of soil of medium permeability and 150 millimetres of top soil, and shall be properly seeded immediately following the topsoil placement for the establishment of vegetative cover.

(4) Within ten (10) days of the completion of the landfill closure, the Owner shall notify the District Manager in writing, that the landfill has been closed in accordance with the approved closure plan.

(5) By December 31, 2025, the Owner shall complete acquisition or obtaining the property right of the proposed contaminate attenuation zone as detailed in Attachment 4 of Item 5 in Schedule A.

8. LANDFILL MONITORING

Landfill Gas

(1) The Owner shall ensure that any buildings or structures at the Site contain adequate ventilation systems to relieve any possible landfill gas accumulation to prevent methane concentration reaching the levels within its explosive range. Routine monitoring for explosive methane gas levels shall be conducted in all buildings or structures at the Site, especially enclosed structures which at times are occupied by people.

Compliance

(2) The Site shall be maintained in such a way as to ensure compliance with the following:

(a) Reasonable Use Guideline B-7 in terms of key leachate indicators for the protection of the groundwater at the Site;

(b) Provincial Water Quality Objectives included in the July 1994 publication entitled Water Management Policies, Guidelines, Provincial Water Quality Objectives, as amended from time to time or limits set by the Regional Director, for the protection of the surface water at and off the Site; and

(c) Ontario Drinking Water Quality Standards except where background conditions are confirmed to fall above or below the criteria.

Surface Water and Groundwater

(3) The Owner shall monitor surface water and ground water in accordance with the monitoring programs outlined in Schedule "B".

(4) A certified Professional Geoscientist or Engineer possessing appropriate hydrogeologic training and experience shall execute or directly supervise the execution of the groundwater monitoring and reporting program.

Groundwater Wells and Monitors

(5) The Owner shall ensure that all groundwater monitoring wells which form part of the monitoring program are properly capped, locked and protected from damage.

(6) Where landfilling is to proceed around monitoring wells, suitable extensions shall be added to the wells and the wells shall be properly re-secured.

(7) Any groundwater monitoring well included in the on-going monitoring program that is damaged shall be assessed, repaired, replaced or decommissioned by the Owner, as required.

(a) The Owner shall repair or replace any monitoring well which is destroyed or in any way made to be inoperable for sampling such that no more than one regular sampling event is missed.

(b) All monitoring wells which are no longer required as part of the groundwater monitoring program, and have been approved by the Director for abandonment, shall be decommissioned by the Owner, as required, in accordance with O.Reg. 903, to prevent contamination through the abandoned well. A report on the decommissioning of the well shall be included in the Annual Report for the period during which the well was decommissioned.

Trigger Mechanisms and Contingency Plans

(8) (a) Trigger mechanisms shall be in accordance with Section 6 of the Closure Plan included in Item 5 of Schedule "A".

(b) Contingency plan in the event of a confirmed exceedance of a site-specific trigger level relating to leachate mounding or groundwater or surface water impacts due to leachate shall be in accordance with Section 6 of the Closure Plan included in Item 5 of Schedule "A".

(9) In the event of a confirmed exceedance of a site-specific trigger level relating to leachate mounding or groundwater or surface water impacts due to leachate, the Owner shall immediately notify the District Manager, and an investigation into the cause and the need for implementation of remedial or contingency actions shall be carried out by the Owner in accordance with the approved trigger mechanisms and associated contingency plans.

(10) If monitoring results, investigative activities and/or trigger mechanisms indicate the need to implement contingency measures, the Owner shall ensure that the following steps are taken:

(a) The Owner shall notify the District Manager, in writing of the need to implement contingency measures, no later than 30 days after confirmation of the exceedances;
(b) Detailed plans, specifications and descriptions for the design, operation and maintenance of the contingency measures shall be prepared and submitted by the Owner to the Director for approval; and
(c) The contingency measures shall be implemented by the Owner upon approval by the Director.

(11) The Owner shall ensure that any proposed changes to the site-specific trigger levels for leachate impacts to the surface water or groundwater, are approved in advance by the Director via an amendment to this Approval.

Changes to the Monitoring Plan

(12) The Owner may request to make changes to the monitoring program(s) to the District Manager in accordance with the recommendations of the annual report. The Owner shall make clear reference to the proposed changes in a separate letter that shall accompany the annual report.

(13) Within fourteen (14) days of receiving the written correspondence from the District Manager confirming that the District Manager is in agreement with the proposed changes to the environmental monitoring program, 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 the changes to the monitoring program, to

the Director requesting the Approval be amended to approve the proposed changes to the environmental monitoring plan prior to implementation.

(14) 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.

9. ANNUAL REPORT

(1) A written report on the operation and monitoring of the Site, shall be completed annually (the "Annual Report"). The Annual Report shall be submitted to the District Manager, by March 31st of the year following the period being reported upon.

(2) The Annual Report shall include but not be limited to the following information:

(a) the results and an interpretive analysis of the results of all leachate, groundwater surface water and landfill gas monitoring, including an assessment of the need to amend the monitoring programs;
(b) an assessment of the operation and performance of all engineered facilities, the need to amend the design or operation of the Site, and the adequacy of and need to implement the contingency plans;
(c) site plans showing the existing contours of the Site; the progress of final cover, vegetative cover; facilities existing, added or removed during the reporting period; and site preparations and facilities planned for installation during the next reporting period;
(d) quantities of waste and recyclables received during the reporting period;
(e) a summary of the weekly, maximum daily and total annual quantity of waste received at the Site;
(f) a summary of any complaints received and the responses made;
(g) a discussion of any operational problems encountered at the Site and corrective action taken;
(h) any changes to the Design and Operations Report and the Closure Plan that have been approved by the Director since the last Annual Report;
(i) a report on the status of all monitoring wells and a statement as to compliance with Ontario Regulation 903; and
(j) any other information with respect to the Site which the District Manager may require from time to time.

10. WASTE TRANSFER STATION

(1) The Waste Transfer Station shall be operated in accordance with the Wolf Creek Waste Transfer Station Design and Operations Plan included in Item 5 of the Schedule A.

(2) Only waste that is generated within the boundaries of the Municipality of Hastings Highlands may be accepted at the Waste Transfer Station.

(3) Only the following types of waste shall be accepted at the Waste Transfer Station:

i. solid non-hazardous household waste;
ii. blue box recyclables including glass, cardboard, paper, plastic, metals;
iii. scrap metals;
iv. household appliances;
v. household batteries;
vi. tires;
vii. styrofoam;
viii. clean wood and brush;
ix. bulky items; and
x. Waste Electrical and Electronic Equipment

(4) Total amount of waste and recyclables accepted at the Waste Transfer Station shall not exceed 2 metric tonnes per week and 107 metric tonnes per year.

(5) The Owner shall ensure that:
(a) all bins and waste storage areas are clearly labelled;
(b) all lids or doors on bins shall be kept closed during non-operating hours and during high wind events; and
(c) if necessary to prevent litter, waste storage areas shall be covered during high winds events.

(6) The Owner shall provide a segregated area for the storage of Refrigerant Appliances so that the following are ensured:
(a) all Refrigerant Appliances have been tagged to indicate that the refrigerant has been removed by a licensed technician. The tag number shall be recorded in the log book and shall remain affixed to the appliance until transferred from the Site; **or**
(b) all Refrigerant Appliances accepted at the Site, which have not been tagged by a licensed technician to verify that the equipment no longer contains refrigerants, are stored segregated, in a clearly marked area, in an upright position and in a manner which allows for the safe handling and transfer from the Site for removal of refrigerants as required by O.Reg. 189; and
(c) all Refrigerant Appliances received on-site shall either have the refrigerant removed prior to being transferred from the Site or shall be shipped off-site only to facilities where the refrigerants can be removed by a licensed technician in accordance with O.Reg. 189.
(d) a segregated area is not required if Refrigerant Appliances are not accepted at the waste transfer station

(7) The Owner shall transfer waste and recyclable materials from the Site as follows:

(a) recyclable materials shall be transferred off-site once their storage bins are full;
(b) scrap metal shall be transferred off-site at least twice a year;
(c) tires shall be transferred off-site as soon as a load for the contractor hired by the Owner has accumulated or as soon as the accumulated volume exceeds the storage capacity of its bunker; and
(d) immediately, in the event that waste is creating an odour or vector problem.

(8) The Owner shall notify the appropriate contractors that waste and recyclable wastes that are to be transferred off-site are ready for removal. Appropriate notice time, as determined by the contract shall be accommodated in the notification procedure.

HHW and WEEE

(9) Sealable and lockable bins may be used to collect inadvertently left WEEE and HHW.

(10) Storage and transfer of above WEEE shall be in accordance with the guideline titled "Collection Site Organizing & Operating Waste Electrical and Electronic Equipment (WEEE) Guidebook" dated November 2012 as amended prepared by Ontario Electronic Stewardship.

(11) Storage and transfer of above HHW shall be in a way to protect health and safety of the public and the environment.

SCHEDULE "A"

1. Detail site plan "Site No. A361102, Township of Bangor, North End of Kamaniskeg Lake, Lot 23, Conc. 14" dated October 22, 1979.

2. Letter dated August 29, 1974, from J. Tooley to R.M. Sears Clerk-Treasurer.

3. Environmental Compliance Approval Application dated August 21, 2017 and signed by Pat Pilgrim, Chief Administrative Officer, the Corporation of the Municipality of Hastings Highlands, including the attached supporting documentation.

4. Report titled "Development and Operations Plan, Wolf Creek Waste Disposal Site, Environmental Compliance Approval No. A361102" dated August 2017 and prepared by BluMetric Environmental Inc.

5. Amendment Application, Environmental Compliance Approval No. A361102 Wolf Creek Waste Disposal Site dated February 27, 2023 prepared by Blue Metric Environmental, that includes the following documents:
   i. Environmental Compliance Approval Application signed by David Steward dated February 24, 2023;
   ii. Wolf Creek Waste Disposal Site Closure Plan dated February 27, 2023 prepared by Blue Metric Environmental;
   iii. Wolf Creek Waste Transfer Station Design and Operations Plan dated February 27, 2023 prepared by Blue Metric Environmental.

Schedule "B"

Wolf Creek Annual Semi-Annual (Spring & Fall) Groundwater Analysis

Location	Parameters
WC1-03 WC2-03 WC3-03 WC4-19 WC5-19 WC6.1-19 WC6.2-19 WC6.3-19	Dissolved Organic Carbon (DOC) Alkalinity Ammonia Calcium Chloride Magnesium Nitrate Potassium Sodium Sulphate Aluminum Boron Iron Lead Manganese Strontium Zinc Chemical Oxygen Demand (COD) Conductivity pH Total Dissolved Solids (TDS)

The reasons for the imposition of these terms and conditions are as follows:

GENERAL

- The reason for Conditions 1(1), (2), (4), (5), (6), (7), (8), (9), (10), (17), (18) and (19) is to clarify the legal rights and responsibilities of the *Owner* and *Operator* under this *Approval.*

- The reasons for Condition 1(3) are 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.

- The reasons for Condition 1(11) are 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.

- The reasons for Condition 1(12) are 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 *Approval* .

- The reason for Condition 1(13) is to ensure that the successor is aware of its legal responsibilities.

- The reasons for Conditions 1(14) and (15) are that the Part II.1 *Director* is an individual with authority pursuant to Section 197 of the Environmental Protection Act to require registration on title and provide any person with an interest in property before dealing with the property in any way to give a copy of the *Approval* to any person who will acquire an interest in the property as a result of the dealing.

- The reason for Condition 1(16) is to ensure that appropriate *Ministry* staff has ready access to the Site for inspection of facilities, equipment, practices and operations required by the conditions in this *Approval* . This Condition is supplementary to the powers of entry afforded a Provincial Officer pursuant to the *Act* , the *OWRA* , the *PA* , the *NMA* and the *SDWA* .

- Condition 1 (20) has been included in order to clarify what information may be subject to the *Freedom of Information Act.*

SITE OPERATION

- The reasons for Conditions 2(1), 2(5) and 6(3) are to ensure that the *Site* is operated, inspected and maintained in an environmentally acceptable manner and does not result in a hazard or nuisance to the natural environment or any person.

- The reason for Conditions 2 (2), 2(3) and 2(4) is to ensure that users of the *Site* are fully aware of important information and restrictions related to *Site* operations and access under this *Approval.*

- The reasons for Condition 2(6) (a) and (b) are open burning of municipal waste is unacceptable because of concerns with air emissions, smoke and other nuisance effects, and the potential fire hazard and to make sure burning of brush and wood are carried out in accordance with Ministry guidelines.

- The reasons for Condition 2(7), 2(8) and 2(9) are to specify the hours of operation for the landfill site and a mechanism for amendment of the hours of operation, as required.

- The reasons for Condition 2(10) and 2(11) are to ensure that the *Site* is supervised by properly trained staff in a manner which does not result in a hazard or nuisance to the natural environment or any person 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.

EMPLOYEE TRAINING

- The reason for Condition 3(1) 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.

COMPLAINTS RESPONSE PROCEDURE

- The reason for Condition 4(1) is to ensure that any complaints regarding landfill operations at this *Site* are responded to in a timely and efficient manner.

EMERGENCY RESPONSE

- Conditions 5(1) and 5(2) are included to ensure that emergency situations are reported to the Ministry to ensure public health and safety and environmental protection.

- Conditions 5(3), 5(4) and 5(5) are included to ensure that emergency situations are handled in a manner to minimize the likelihood of an adverse effect and to ensure public health and safety and environmental protection.

RECORD KEEPING

- The reason for Conditions 6(1) and 6(2) is to ensure that accurate waste records are maintained to ensure compliance with the conditions in this *Approval* , the *EPA* and its regulations.

- The reason for Condition 6(3) is to ensure that detailed records of *Site* inspections are recorded and maintained for inspection and information purposes.

LANDFILL CLOSURE

- The reason for Conditions 7(1) 7(2) 7(3) and 7(4) is to approve the landfill closure plan, and to ensure the landfill is closed in accordance with the Ministry landfill standards. 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.*

- Condition 7(5) is to ensure adequate contaminant attenuation zone is established for the site to comply with the ministry's Reasonable Use Guideline.

LANDFILL MONITORING

- Reasons for Condition 8(1) are to ensure that off-site migration of landfill gas is monitored and all buildings at the *Site* are free of any landfill gas accumulation, which due to a methane gas component may be explosive and thus create a danger to any persons at the *Site.*

- Condition 8(2) is included to provide the groundwater and surface water limits to prevent water pollution at the *Site.*

- Conditions 8(3) and 8(4) are included to require the Owner to demonstrate that the *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.

- Conditions 8(5), 8(6) and 8(7) are included to ensure the integrity of the groundwater monitoring network so that accurate monitoring results are achieved and the natural environment is protected.

- Conditions 8(8) to 8(11) inclusive are added to ensure the *Owner* has a plan with an organized set of procedures for identifying and responding to potential issues relating to groundwater and surface water contamination at the *Site's* compliance point.

- Conditions 8(12), 8(13) and 8(14) are included to streamline the approval of the changes to the monitoring plan.

REPORTING

- The reasons for Conditions 9(1) and 9(2) are 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.

WASTE DIVERSION

- Condition 10(1) is to approve the Waste Transfer Station Design and Operations Plan.

- Conditions 10 (2), 10(3), and 10(4) is to specify the service area of the waste transfer station and the waste types and quantities that can be received.

- Conditions 10 (5) to 10(11) are included to ensure that the Waste Transfer Station is operated ina a manner that does not cause adverse effect to the environment, and to ensure recyclable materials are stored in their temporary storage location and transferred off-site in a manner as to minimize a likelihood of an adverse effect or a hazard to the natural environment or any person.

Upon issuance of the environmental compliance approval, I hereby revoke Approval No(s). A361102 issued on December 7, 2017

In accordance with Section 139 of the *Environmental Protection Act,* you may by written notice served upon me and the Ontario Land 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 ("the Notice") shall state:

a. 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;

b. 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:

1. The name of the appellant;
2. The address of the appellant;
3. The environmental compliance approval number;
4. The date of the environmental compliance approval;
5. The name of the Director, and;
6. 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:

Registrar*
Ontario Land Tribunal
655 Bay Street, Suite 1500
Toronto, Ontario
M5G 1E5
OLT.Registrar@ontario.ca

and

The Director appointed for the purposes of Part II.1 of the *Environmental Protection Act*
Ministry of the Environment, Conservation and Parks
135 St. Clair Avenue West, 1st Floor
Toronto, Ontario
M4V 1P5

*** Further information on the Ontario Land Tribunal's requirements for an appeal can be obtained directly from the Tribunal at: Tel: (416) 212-6349 or 1 (866) 448-2248, or www.oltt.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 13th day of October, 2023

Mohsen Keyvani, P.Eng.
Director
appointed for the purposes of Part II.1 of the
Environmental Protection Act

RL/
c: Area Manager, MECP Belleville
c: District Manager, MECP Kingston - District
Carolyn Miller B.A.Sc., P.Eng., BluMetric Environmental Inc.

Appendix A

A-2 Surface Water Comments on the 2020 Annual Monitoring Report

Ministry of the Environment, Conservation and Parks
Eastern Region
1259 Gardiners Road, Unit 3
Kingston ON K7P 3J6
Phone: 613.549.4000
or 1.800.267.0974

Ministère de l'Environnement, de la Protection de la nature et des Parcs
Région de l'Est
1259, rue Gardiners, unité 3
Kingston (Ontario) K7P 3J6
Tél: 613 549-4000
ou 1 800 267-0974

Ontario

M E M O R A N D U M

January 6, 2022

TO: Jon Morrish
Senior Environmental Officer
Belleville Area Office
Eastern Region

FROM: Sarah Baxter
Surface Water Specialist
Technical Support Section
Eastern Region

RE: Wolf Creek Waste Disposal Site
2020 Annual Monitoring Report
Township Hastings Highlands; County of Hastings
Environmental Compliance Approval #A361102
ECHO #1-25671878

I have reviewed the "2020 Annual Monitoring Report, Wolf Creek Waste Disposal Site, Environmental Compliance Approval No. A361102" dated March 2021 and prepared by BluMetric Environmental Inc. The following comments, relative to surface water impact concerns, are provided for your consideration.

Background

The Wolf Creek Waste Disposal Site (WDS) is an active natural attenuation landfill and recycling transfer station. The site is operated by the Township of Hastings Highlands and has been operating since at least 1980. The WDS is situated on Crown Land leased from the Ministry of Northern Development, Mines, Natural Resources, and Forestry (MNDMNRF).

The WDS is regulated by Environmental Compliance Approval (ECA) #A361102 and has an approved footprint of 0.2 hectares on a 0.7 hectare site. The landfill is approved to receive solid non-hazardous waste, blue box recyclables, scrap metal, tires, brush, waste electrical and electronic equipment (WEEE), bulky items, and white goods.

The annual report indicates that the site has approximately 27 years of site life remaining. However, BluMetric suggests that no waste has been landfilled at the site since 2017; the waste has been collected in bins and transferred to other WDSs within the township. BluMetric also indicates that the township anticipates closing the site and that a closure plan has been developed.

Site Description

The Wolf Creek WDS is located on Lot 22, Concession 14, Geographic Township of Bangor, in the Township of Hastings Highlands. The site is approximately 10 kilometers southwest of the village of Barry's Bay and is accessed via River Road (civic address 567).

The landfill is located in a heavily forested portion of the Upper Madawaska tertiary watershed and is situated within a former aggregate pit. The site is bound by River Road to the south, Wolf Creek to the west, and forest to the north and east.

Wolf Creek flows southward approximately 200 meters west of the site. Soon after passing the site, flows join Mud Bay of the Madawaska River which flows eastward to the south basin of Kaminiskeg Lake. Kaminiskeg Lake is managed as a naturally-reproducing Lake Trout Lake and according to the County of Renfrew Official Plan, the lake is designated as being "at capacity".

According to the annual report, the overburden is composed of sand and gravel up to 23.8 meters in depth. The bedrock is Precambrian granite. Interpreted groundwater flow is typically towards the west or northwest, towards Wolf Creek.

BluMetric characterizes the landfill leachate as having elevated alkalinity, iron, nitrate, sulphate and total dissolved solids (TDS). As inferred from groundwater monitoring wells WC1-03 (background), WC2-03 (downgradient) and WC4-19 (downgradient), the leachate may also be characterized as having elevated boron, chloride, conductivity, magnesium, sodium, and strontium.

Surface Water Monitoring Program

There is currently no surface water monitoring program at the site, as the nearest surface water feature (i.e. Wolf Creek) is nearly 200 meters downgradient of the WDS. In addition, all surface water runoff that comes onsite quickly infiltrates into the sandy overburden.

Instead, potential impacts to Wolf Creek can be assessed by examining water quality in the most westerly, downgradient groundwater monitoring wells. Newly installed wells WC4-19 and WC6-19 appear to be impacted by landfill leachate. At one or more of these wells, the chronic Canadian Water Quality Guideline (CWQG) for nitrate was exceeded. Concentrations of most landfill indicator parameters are elevated above background levels, however the elevations are relatively minor in nature and concentrations of most parameters are still within the ranges characteristic of natural surface waters. In addition, Wolf Creek is a significant distance downgradient of these wells, so impacts to the creek are unlikely at this time.

Conclusions and Recommendations

1. The Wolf Creek WDS is an active natural attenuation landfill site that is operated by the Township of Hastings Highlands. The site is situated on leased Crown Land.

2. The report indicates that waste has not been deposited at the site since 2017 and that the Township is preparing to close the site. BluMetric estimates that there is approximately 27 years of site life remaining, so it is unclear as to why the Township would close the site with so much capacity available.

3. Surface water monitoring is not conducted at the Wolf Creek WDS as the nearest receiver (i.e. Wolf Creek) is approximately 200 meters downgradient of the landfill.

4. The most westward and downgradient groundwater monitoring wells appear to be impacted by landfill leachate, but to a relatively minor degree. Considering the limited leachate impacts in these wells, and the wells' significant distance from Wolf Creek, surface water impacts are unlikely at this time.

5. Water quality in the most downgradient groundwater monitoring wells should be compared to surface water criteria to infer impacts to Wolf Creek and determine the need for the establishment of a surface water monitoring program.

If you have any questions regarding the above comments, I would be pleased to discuss them with you.

SB/sb

ec: Victor Castro
Obai Mohammad

c: File SW HA HH 03 06 (Wolf Creek WDS)

Appendix A

A-3 MECP Letter and 2022 Inspection Report

Ministry of the Environment, Conservation and Parks
Eastern Region
Belleville Area Office
345 College Street East
Belleville ON K8N 5S7
Tel: (613) 848-0853
or 1.800.860.2763

Ministère de l'Environnement, de la Protection de la nature et des Parcs
Région de l'Est
Bureau du secteur de Belleville
345, rue College Est
Belleville (Ontario) K8N 5S7
Tél: (613) 848-0853
ou 1 800 860 2763

Ontario

August 31, 2022

Adrian Tomasini
Operations Manager
The Corporation of the Municipality of Hastings Highlands
33011 Highway 62 N
Maynooth, ON K0L 2S0

Dear Mr. Tomasini:

RE: Solid Non-Hazardous Waste Disposal Site Compliance Inspection, Wolf Creek Landfill, 567 River Road (former Bangor Township)
Municipality of Hastings Highlands, County of Hastings

Thank you for your time and cooperation in relation to the above-referenced inspection, which I conducted on and about June 30, 2022. A copy of the associated inspection report is attached.

As outlined in the report, the outstanding non-compliance items associated with the site are the lack of required buffer area and Contaminant Attenuation Zone (CAZ; needed to satisfy the ministry's Guideline B-7), and corresponding approval of them (through an ECA amendment), along with a Closure Plan for the landfilling area.

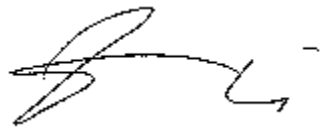
Comments from the ministry's Technical Support Section, on review of the 2021 Annual Monitoring Report (and proposed buffer and CAZ areas), are anticipated shortly and will be forwarded upon their availability.

It is understood that the Municipality will be continuing discussions with NDMNRF, with a view to transfer of the relevant lands, and that an application to amend the ECA will then be submitted (to incorporate the buffer and CAZ lands, and Closure Plan).

Accordingly, a response to this inspection and letter is not requested at this time. However, the Municipality is respectfully reminded that the site remains in non-compliance / non-conformance until the above-noted actions are achieved.

Thanks again, and please don't hesitate to contact me (at 613-848-0853 or jon.morrish@ontario.ca) if you have any questions or concerns.

Sincerely,



Jon Morrish
Senior Environmental Officer
Belleville Area Office

Ontario

Wolf Creek Waste Disposal Site
567 RIVER RD, HASTINGS HIGHLANDS, ON,

Inspection Report

Entity:	CORPORATION OF THE MUNICIPALITY OF HASTINGS HIGHLANDS
Inspection Start Date:	08/31/2022
Inspection End Date:	08/31/2022
Inspected By:	Jon Morrish
Badge #:	847

(signature)

NON-COMPLIANCE/NON-CONFORMANCE ITEMS

The following item(s) have been identified as non-compliance/non-conformance, based on a "No" response captured for a legislative or best management practice (BMP) question (s), respectively.

Question Group: Operations

Question ID	NOL 12	**Question Type**	Legislative
Question: Does the landfill have a large enough Buffer Area as specified in the ECA or Regulation 232/98?			
Legislative Requirement	EPA | 27 | (1);		
Observation/Corrective Action(s)			
No See comments above.			

Question ID	NOL 33	**Question Type**	Legislative
Question: Is the water quality being monitored/sampled for surface water features on-site and for any off-site surface water features that receive run-off from the site?			
Legislative Requirement	EPA | 27 | (1); EPA | O. Reg. 232/98 | 24;		
Observation/Corrective Action(s)			
No There is currently no surface water monitoring program at the site, as the nearest surface water feature (i.e. Wolf Creek) is approximately 200 m downgradient of the site. In addition, all surface water runoff at the site quickly infiltrates into the sandy overburden. In review of the 2020 AMR, the ministry's surface water reviewer (Baxter) noted that: "potential impacts to Wolf Creek can be assessed by examining water quality in the most westerly, downgradient groundwater monitoring wells. Newly installed wells WC4-19 and WC6-19 appear to be impacted by landfill leachate. At one or more of these wells, the chronic Canadian Water Quality Guideline (CWQG) for nitrate was exceeded. Concentrations of most landfill indicator parameters are elevated above background levels, however the elevations are relatively minor in nature and concentrations of most parameters are still within the ranges characteristic of natural surface waters. In addition, Wolf Creek is a significant distance downgradient of these wells, so impacts to the creek are unlikely at this time."			

The same review recommended that "Water quality in the most downgradient groundwater monitoring wells should be compared to surface water criteria to infer impacts to Wolf Creek and determine the need for the establishment of a surface water monitoring program."

INSPECTION DETAILS

This section includes all questions that were assessed during the inspection.

Ministry Program: WASTE | **Regulated Activity:** Landfills

Question ID	NOL 1	**Question Type**	Legislative
Question: Does the Open landfill site have an Environmental Compliance Approval (ECA)?			
Legislative Requirement	EPA | 27 | (1);		
Observation			
Yes This inspection of the Wolf Creek Waste Disposal Site (at 567 River Road, Hastings Highlands)included a site visit on June 30, 2022, attended by Adrian Tomasini, Operations Manager for the Municipality of Hastings Highlands, and Jon Morrish, MECP. The site was closed to the public at the time. No waste has been landfilled at the site since 2017; the site currently operates as a waste transfer site (waste is collected in bins and transferred to another landfill within the municipality). The current version of the (amended) ECA Number A361102, for the Wolf Creek WDS, was issued on December 7, 2017. The ECA was first issued on March 27, 1980. The ECA approves the use and operation of a 0.2 ha waste disposal/transfer site within a total site area of 0.7 ha. Notice No. 1 under the current ECA was issued on March 21, 2018, in order to correct the site location - as Part of Lot 22 (instead of Part of Lot 23)… at Concession 14 in the former Bangor Township.			

Question ID	NOL 2	**Question Type**	Information
Question: Is this landfill on Crown land?			
Legislative Requirement	Not Applicable		
Observation			

Yes This site is located on Crown Land, under the authorization of Land Use Permit LUP1634-1004191. The LUP recognizes an area of 0.7 ha. It was issued on June 1, 2016 and expires on May 31, 2026.

Question ID	NOL 4	Question Type	Information

Question:

Does the landfill have a Contaminant Attenuation Zone (CAZ)?

Legislative Requirement	Not Applicable

Observation

No The site does not currently have a buffer zone or Contaminant Attenuation Zone (CAZ).

The 2021 Annual Monitoring Report (AMR) for the site (by BluMetric) notes that in 2021, a CAZ assessment was carried out for the site. The AMR noted that iron was determined to be the only critical parameter, with a calculated required attenuation distance of 87 m. It stated that "Based on no future placement of waste at the site, we would recommend that the municipality move with acquiring a minimum 100 m CAZ/buffer to the west and north of the site property boundary, and a 30 m buffer to the east and south of the property boundary. The initial steps in obtaining the CAZ property, either by ownership or easement, is to initiate discussions with both the MECP...and NDMNRF. General agreement with the CAZ distances should be obtained from the MECP, while general agreement to transfer the Crown Land ownership/easement should be obtained from the NDMNRF. We understand that the process of surrendering the aggregate pit licence to the east must be completed before any changes to the property can be undertaken. We also understand that this was initiated in previous years and is still awaiting processing by the NDMNRF."

Further details of the CAZ assessment are included in Appendix G of the AMR - which was carried out as part of 'Phase 3' work to address the MECP's concerns regarding non-compliance with Guideline B-7. A summary of that phased work (taken from the 2021 annual report) is as follows:

"Phase 1 (2019 and 2020):
- Five new monitoring wells, including one well nest were installed in 2019...
Phase 2 (summer 2021):
- Sampling events...
Phase 3 (Winter - Summer of 2022):
- The horizontal extent of impact has not yet been determined. Based on 2019, 2020 and 2021 data, and the CAZ assessment (2022) the current impacts may extend 87 m to the north and west of the footprint, or approximately 50 m from the property boundary.
- Based on the 2022 CAZ assessment we recommend that the 30 m buffer to the east and south, and the 100 m CAZ to the west, and the 100 m CAZ/buffer to the north is adequate to prevent RUV exceedances, or surface water impacts to the west.

- Initiate discussion with the MECP regarding general approval of the proposed size for the CAZ/buffer areas.
- Discuss easement rights or the intent to purchase the required CAZ/buffer lands from NDMNRF.
- Once the proposed CAZ/buffer areas are put into place, the site is anticipated to be in compliance with Guideline B-7. Additional wells are not recommended at this time.

Once the request is made to NDMNRF it is expected that they will carry out their Environmental Assessment (EA) process which is required for them to grant easement rights. Once this process is complete, the Municipality should submit an ECA amendment to include CAZ lands to the site. However, should the Municipality submit a Closure Plan ECA amendment application prior to this CAZ work then they should consider submitting the application to accept both the Closure Plan and the CAZ lands at the same time."

The 2021 AMR was still awaiting review by the ministry's Technical Support Section, at the time of this report preparation.

Question ID	NOL 12	**Question Type**	Legislative
Question: Does the landfill have a large enough Buffer Area as specified in the ECA or Regulation 232/98?			
Legislative Requirement	EPA | 27 | (1);		
Observation			
No See comments above.			

Question ID	NOL 13	**Question Type**	Information
Question: Are access roads and on-site roads provided so that vehicles hauling waste to and on the site may travel readily on any day under all normal weather conditions?			
Legislative Requirement	EPA | 27 | (1);		
Observation			
Yes			

Question ID	NOL 14	Question Type	Legislative
Question: Is site access limited to times when an attendant is on duty?			
Legislative Requirement	EPA | 27 | (1);		
Observation			
Yes			

Question ID	NOL 15	Question Type	Legislative
Question: Does the site only receive waste from within its approved service area?			
Legislative Requirement	EPA | 27 | (1);		
Observation			
Yes			

Question ID	NOL 16	Question Type	Information
Question: Is the site required to have a ground water monitoring program by the ECA?			
Legislative Requirement	Not Applicable		
Observation			
Yes			

Question ID	NOL 17	Question Type	Legislative
Question: Is the site implementing the groundwater monitoring program as required by the ECA?			
Legislative Requirement	EPA | 27 | (1);		
Observation			
Yes Groundwater monitoring is being done as per the requirements of the ECA. Currently, eight (8) monitoring wells are in place at the site; five of them were installed in 2019.			

Question ID	NOL 18	**Question Type**	Legislative
Question: Are monitoring well samples taken and tested to determine the quality of the ground water?			
Legislative Requirement	EPA | 27 | (1); EPA | O. Reg. 232/98 | 25;		
Observation			
Yes Dissolved Organic Carbon (DOC) results exceeded the Ontario Drinking Water Standards and Operational Guidelines criteria at seven of the eight monitoring wells. However, the Municipality's consultant provided an explanation in relation to a laboratory process 'upset'. The site is out of compliance with the Guideline B-7 'Reasonable Use Values', along the northwest property boundary. A Trigger Mechanism and Contingency Plan (prepared in August 2017 and included in the Design Operations Plan - which was approved through the 2017 ECA amendment) is in place. No triggers of 'Tier 1' of the Contingency Plan were reached in 2021.			

Question ID	NOL 19	**Question Type**	Information
Question: Is the ministry concerned with the results of the samples that have been tested?			
Legislative Requirement	Not Applicable		
Observation			
No			

Question ID	NOL 21	**Question Type**	Information
Question: Is the site required to manage leachate by the ECA?			
Legislative Requirement	Not Applicable		
Observation			
No			

Question ID	NOL 23	Question Type	Legislative
Question: Are samples taken to monitor leachate quality?			
Legislative Requirement	EPA | 27 | (1); EPA | O. Reg. 232/98 | 26;		
Observation			
Yes			

Question ID	NOL 24	Question Type	Information
Question: Is the ministry concerned with the leachate quality?			
Legislative Requirement	Not Applicable		
Observation			
Yes			

Question ID	NOL 25	Question Type	Information
Question: Is there ongoing abatement to address any concerns the ministry has with the leachate monitoring?			
Legislative Requirement	Not Applicable		
Observation			
Yes			

Question ID	NOL 26	Question Type	Information
Question: Is the site required to manage landfill gas by the ECA?			
Legislative Requirement	Not Applicable		
Observation			
No Condition 8 of the ECA requires that adequate ventilation of methane be provided at any buildings, and that routine monitoring be conducted. The 2021 Annual Monitoring			

Report indicated that methane was monitored at the site during the semi-annual monitoring events.

Question ID	NOL 28	**Question Type**	Legislative
Question: Is landfill gas managed and monitored at this site?			
Legislative Requirement	EPA | 27 | (1);		
Observation			
Yes As indicated in the 2021 Annual Monitoring Report (BluMetric), methane gas monitoring results revealed concentrations (0 to 35 ppm) well below the concentration of concern (10,000 ppm).			

Question ID	NOL 29	**Question Type**	Information
Question: Is the ministry concerned with landfill gas at this site?			
Legislative Requirement	Not Applicable		
Observation			
No			

Question ID	NOL 30	**Question Type**	Information
Question: Is there ongoing abatement to address any concerns the ministry has with landfill gas at this site?			
Legislative Requirement	Not Applicable		
Observation			
No			

Question ID	NOL 31	**Question Type**	Information
Question: Is the site required to have a surface water monitoring program by the ECA?			
Legislative Requirement	Not Applicable		

Observation
No The site does not currently have a surface water monitoring program. In review of the 2020 AMR for the site (by BluMetric), the ministry's reviewer noted that surface water impacts are unlikely, and that downgradient wells should be compared to the Provincial Water Quality Objectives (PWQOs)…and that surface water monitoring is not required unless additional groundwater monitoring demonstrates a potential for leachate impacts to the creek. The AMR noted that comparison to the PWQOs was done (for those parameters that have PWQOs - alkalinity, aluminum, boron, iron, lead, pH and zinc), and none were found to exceed their respective criteria at the downgradient wells. Surface water drainage at the site flows into the waste site (i.e. stays on the site), which is a former aggregate pit (and very sandy).

Question ID	NOL 33	Question Type	Legislative
Question: Is the water quality being monitored/sampled for surface water features on-site and for any off-site surface water features that receive run-off from the site?			
Legislative Requirement	EPA | 27 | (1); EPA | O. Reg. 232/98 | 24;		
Observation			
No There is currently no surface water monitoring program at the site, as the nearest surface water feature (i.e. Wolf Creek) is approximately 200 m downgradient of the site. In addition, all surface water runoff at the site quickly infiltrates into the sandy overburden. In review of the 2020 AMR, the ministry's surface water reviewer (Baxter) noted that: "potential impacts to Wolf Creek can be assessed by examining water quality in the most westerly, downgradient groundwater monitoring wells. Newly installed wells WC4-19 and WC6-19 appear to be impacted by landfill leachate. At one or more of these wells, the chronic Canadian Water Quality Guideline (CWQG) for nitrate was exceeded. Concentrations of most landfill indicator parameters are elevated above background levels, however the elevations are relatively minor in nature and concentrations of most parameters are still within the ranges characteristic of natural surface waters. In addition, Wolf Creek is a significant distance downgradient of these wells, so impacts to the creek are unlikely at this time." The same review recommended that "Water quality in the most downgradient groundwater monitoring wells should be compared to surface water criteria to infer impacts to Wolf Creek and determine the need for the establishment of a surface water monitoring program."			

Question ID	NOL 35	**Question Type**	Information
Question: Is there ongoing abatement to address any concerns the ministry has with the surface water monitoring?			
Legislative Requirement	Not Applicable		
Observation			
No			

Question ID	NOL 36	**Question Type**	Legislative
Question: Is proper equipment available for the compaction of waste and applying cover material?			
Legislative Requirement	EPA | 27 | (1);		
Observation			
Yes			

Question ID	NOL 37	**Question Type**	Legislative
Question: Is the landfill able to accurately determine the amount of waste received?			
Legislative Requirement	EPA | 27 | (1);		
Observation			
Yes			

Question ID	NOL 38	**Question Type**	Legislative
Question: Are all disposal operations at the site adequately and continually supervised?			
Legislative Requirement	EPA | 27 | (1);		
Observation			
Yes			

Question ID	NOL 39	Question Type	Information
Question: Does the landfill operator have a site inspection program as required by the ECA?			
Legislative Requirement	Not Applicable		
Observation			
Yes			

Question ID	NOL 44	Question Type	Legislative
Question: Is site access restricted by use of a gate, fence, or physical barrier when the site is not operating?			
Legislative Requirement	EPA | 27 | (1);		
Observation			
Yes			

Question ID	NOL 45	Question Type	Legislative
Question: Is the waste disposal area adequately screened from public view?			
Legislative Requirement	EPA | 27 | (1);		
Observation			
Yes			

Question ID	NOL 46	Question Type	Legislative
Question: Are daily records of site operations available at the site for at least the past 2 years or as otherwise required by the ECA?			
Legislative Requirement	EPA | 27 | (1); EPA | O. Reg. 232/98 | 21;		
Observation			
Yes			

Question ID	NOL 47	Question Type	Legislative
Question: Has the annual operations report been submitted to MECP or available on site as required by the ECA?			
Legislative Requirement	EPA | 27 | (1);		
Observation			
Yes			

Question ID	NOL 48	Question Type	Legislative
Question: Is scavenging being prevented?			
Legislative Requirement	EPA | 27 | (1); EPA | O. Reg. 232/98 | 23;		
Observation			
Yes			

Question ID	NOL 49	Question Type	Information
Question: Has a closure plan been submitted to the MECP?			
Legislative Requirement	Not Applicable		
Observation			
No As indicated in the 2020 AMR, the Municipality is planning to formally close the site, and a closure plan has been developed.			

Question ID	NOL 51	Question Type	Legislative
Question: Is the landfill only accepting the types of waste that they are approved to receive?			
Legislative Requirement	EPA | 27 | (1);		
Observation			
Yes			

Question ID	NOL 52	Question Type	Information
Question: Does the landfill have a waste refusal procedure in place to manage waste that arrives at the site that the site is not approved the accept?			
Legislative Requirement	Not Applicable		
Observation			
Yes			

Question ID	NOL 53	Question Type	Legislative
Question: is the waste refusal procedure being followed?			
Legislative Requirement	EPA | 27 | (1);		
Observation			
Yes			

Question ID	NOL 54	Question Type	Legislative
Question: Does the landfill have a procedure in place to address and document spills and fires?			
Legislative Requirement	EPA | 27 | (1);		
Observation			
Yes			

Question ID	NOL 55	Question Type	Legislative
Question: Does the landfill have emergency contingency plan as required by the ECA?			
Legislative Requirement	EPA | 27 | (1);		
Observation			
Yes			

Question ID	NOL 56	Question Type	Information

Question: Is there an ECA condition requiring financial assurance?	
Legislative Requirement	Not Applicable
Observation	
No	

Question ID	NOL 59	**Question Type**	Legislative
Question: Does the landfill have a procedure in place to address complaints?			
Legislative Requirement	EPA | 27 | (1);		
Observation			
Yes			

Question ID	NOL 61	**Question Type**	Information
Question: Has the landfill operator developed a Design and Operations Manual?			
Legislative Requirement	EPA | 27 | (1);		
Observation			
Yes The 'Development and Operations Plan', dated August 2017, was prepared by BluMetric Environmental.			

Question ID	NOL 62	**Question Type**	Information
Question: Is the Design and Operations Manual up to date?			
Legislative Requirement	Not Applicable		
Observation			
Yes			

Question ID	NOL 63	**Question Type**	Legislative
Question:			

Does the landfill operator have training procedures for site personnel?	
Legislative Requirement	EPA | 27 | (1);
Observation	
Yes	

Question ID	NOL 64	**Question Type**	Legislative
Question: Is the landfill operator following the established training procedures?			
Legislative Requirement	EPA | 27 | (1);		
Observation			
Yes			

Question ID	949100	**Question Type**	Legislative
Question: Were the inspection questions sufficient to address other identified non-compliance items?			
Legislative Requirement	Not Applicable		
Observation			

Appendix A

A-4 Land Use Permit

Ontario

Land Use Permit

Public Lands Act

File: (MAY)

RECEIVED
JUL 7 - 2017

Permit No.
LUP1634-1004191

Use shaded areas for corrections.

Name of Applicant/Permittee (insert Corporate Name if Applicant is "Limited" or "Incorporated")	Area Code	Telephone No.
Municipality of Hastings Highlands	613	338-2811

As Trustee for

Postal Address of Applicant/Permittee
33011 Hwy. 62 P.O. Box 130

City, Town or Village	Prov./State	Country	Postal Code
Maynooth	ON	Canada	K0L 2S0

Location of Land

Lot	Concession/Block No.	Geographic Township	Municipality
Pt. 22	14	BANGOR	HASTINGS HIGHLANDS M

U.T.M. Grid	Geographic Location	Area in ha.
Zone 18 E. 285870 N. 5032695	Kamaniskeg Lake, Wolf Creek Waste Disposal Site.	0.70

As per sketch and description which is attached to the original permit for this site and forms part of this permit. A copy of this sketch and description is on file at the District Office and available for inspection by the applicant at any time during normal business hours.

Improvement Type	Sales Tax I.D. Number
WASTE DISPOSAL, GARBAGE	R124668666

Fee(s) and Period of Land Use

Amount Due	Annual Fee (subject to adjustment)	Permit Effective Date	Permit Termination Date
$937.90	$680.00 + $88.40 (HST)	Jun 1, 2016	May 31, 2026

Note: Terms and Conditions applicable to all Land Use Permits are on the reverse side of this form.

Terms and Conditions applicable to this permit

MINISTRY OF NATURAL RESOURCES
RECEIVED
JUN 26 2017
BANCROFT, ONTARIO

Purpose

Waste Disposal Site

Sub-Purpose

Dump

Applicant's certification

I certify that the information given herein is true and complete, and that I have read, fully understand, and agree to comply with all of the terms and conditions set out in this permit and that I am of the age of majority. I agree that this is the complete agreement between the parties hereto.

Signature of Applicant (Incl. Corporation Official) | Date Signed: May 30/17

Corporation Use Only

I have authority to bind the herein-named Corporation

Initials and Surname of Corporation Official (Please Print): P PILGRIM | Signature of Corporation Official | Position: CAO / Clerk

Ministry Approval

Under authority of the Regulations under the Public Lands Act, this Land Use Permit is hereby issued to the above applicant, subject to all terms and conditions contained herein and no other, and these shall be the exclusive terms and conditions applicable to the use of this land.

Signature of MNRF Official	Date Signed	Cash Register Validation or Receipt No.	Amount Paid
	06/28/2017	13770	$937.90

Personal information on this form is collected under authority of the Public Lands Act and will be used for the administration of that Act. Questions about this information should be directed to the local MNRF Office, whose address and telephone number appear in the Ontario Government Telephone Directory.

1620(95-03)

Return all parts of this form to the District/Area Office for authorization.

Terms and Conditions

It is agreed by the parties hereto that:

1. This Land Use Permit gives the permittee only the right to use the described site for the purpose specified in this permit and does not convey any right, title or interest in the land or in any trees standing, growing or being on the permit area, or in any minerals, sand, gravel or similar materials, in, on, or under the land. Use of any such materials, unless authorized herein, must have separate written approval from the MNRF Official. Without limiting the generality of the foregoing, this agreement is a Land Use Permit and is not a Grant, Licence of Occupation, or Lease of Land.

2. (i) A permittee is an occupier under the Trespass to Property Act and the Occupier's Liability Act and shall take such care as in all circumstances of the case is reasonable to see that persons entering on the premises, and the property brought on the premises by these persons, are reasonably safe while on the premises;
   (ii) Any posting of signs or notices pursuant to the Trespass to Property Act and the Occupier's Liability Act, on the land use permit area, shall be subject to prior approval of the issuing officer;
   (iii) The permittee agrees to remove all signs or notices on termination of the permit, or at the direction of the issuing officer.

3. Any building, structure, or works, erected or to be erected on the site, or any alteration, renovation, enlargement or reconstruction of improvements, including any land improvements or alterations whatsoever, must be approved by a MNRF official and any other applicable agencies or authorities. The application to the MNRF Official for approval must contain a written description of the work and the permittee's evaluation of the cost of work.

4. The permittee will maintain the site in a clean, sanitary and fire-safe condition in accordance with any applicable Acts or municipal by-laws, and dispose of all garbage in an approved waste disposal site.

5. Access to the site, and quality of that access, is strictly the responsibility of the permittee. A work permit must be obtained from the MNRF Official prior to the construction of any road or other access facilities. The Crown reserves the right to enter and inspect the site and the right of access for Crown purposes.

6. If the term of this Land Use Permit is longer than one year, the permittee will pay the prescribed annual fee, which is subject to change, at the beginning of each year of the term. The MNRF Official may terminate this permit if the fee is not paid by the due date.

7. The permittee will pay any municipal or other taxes that may be levied against the property, in the manner prescribed by the taxing authority.

8. The permittee covenants to indemnify and forever save and keep harmless the Crown, its officer, servants and agents from and against any and all claims, demands, suits, actions, damages, loss, cost or expenses arising out of any injury to persons including death, or loss or damage to property of others which may be or be alleged to be caused by or suffered as a result of or in any manner associated with the exercise of any right or privilege granted to the permittee by this Land Use permit.

9. This Land Use Permit shall not be assigned or transferred, mortgaged or pledged.

10. This permit will automatically terminate, and all rights of the permittee will expire, on the stated termination date, or on the death or bankruptcy of the permittee, or on the winding up or dissolution of the permittee's affairs. This condition cannot be waived by the Crown and, if further use of the land is desired, an application for a new Land Use Permit must be submitted.

11. The MNRF Official may refuse to issue a new permit, or may, upon sixty (60) days written notice or such further period of time as the MNRF Official prescribes, revoke or cancels an existing permit when:
   (i) the permittee has violated any condition or provision of this permit;
   (ii) the hereby authorized land use comes into conflict with a new or revised land zoning plan; or
   (iii) it is, in the opinion of the MNRF Official or the Crown, considered to be in the public interest so to do.
   It is, hereby agreed that any decision, made by the MNRF Official or the Crown pursuant to this condition, is final.

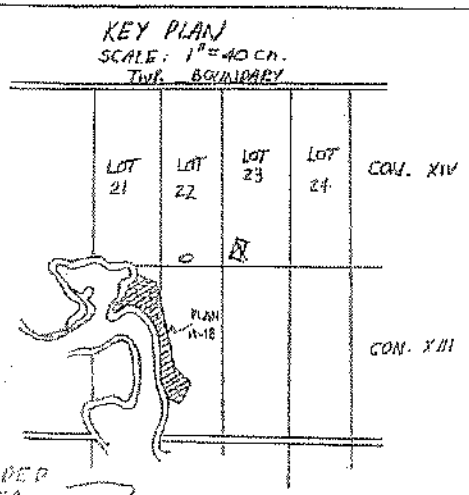
12. Upon expiry, cancellation, revocation or other termination of this Land Use Permit:
   (i) Unless an MNRF Official orders otherwise, all improvements, property or other assets remaining on the site automatically become the property of the Crown and the Crown has no obligation whatsoever to pay compensation therefor;
   (ii) The permittee will at the MNRF Official's request, remove the improvements, property or other assets from the site, and leave the site in a clean and safe condition, restored as much as possible to it's original state except where the requirement to restore has been waived in writing by the MNRF Official;
   (iii) Where the permittee fails to remove the improvements, property or other assets from the site and/or fails to restore the site to a clean and safe condition, within a reasonable time, the permittee will pay to the Ministry any costs incurred by the Ministry in, disposing of or destroying the said improvements, property or other assets pursuant to subject 24(5) of the Public Lands Act, and/or restoring the site to a clean and safe condition.

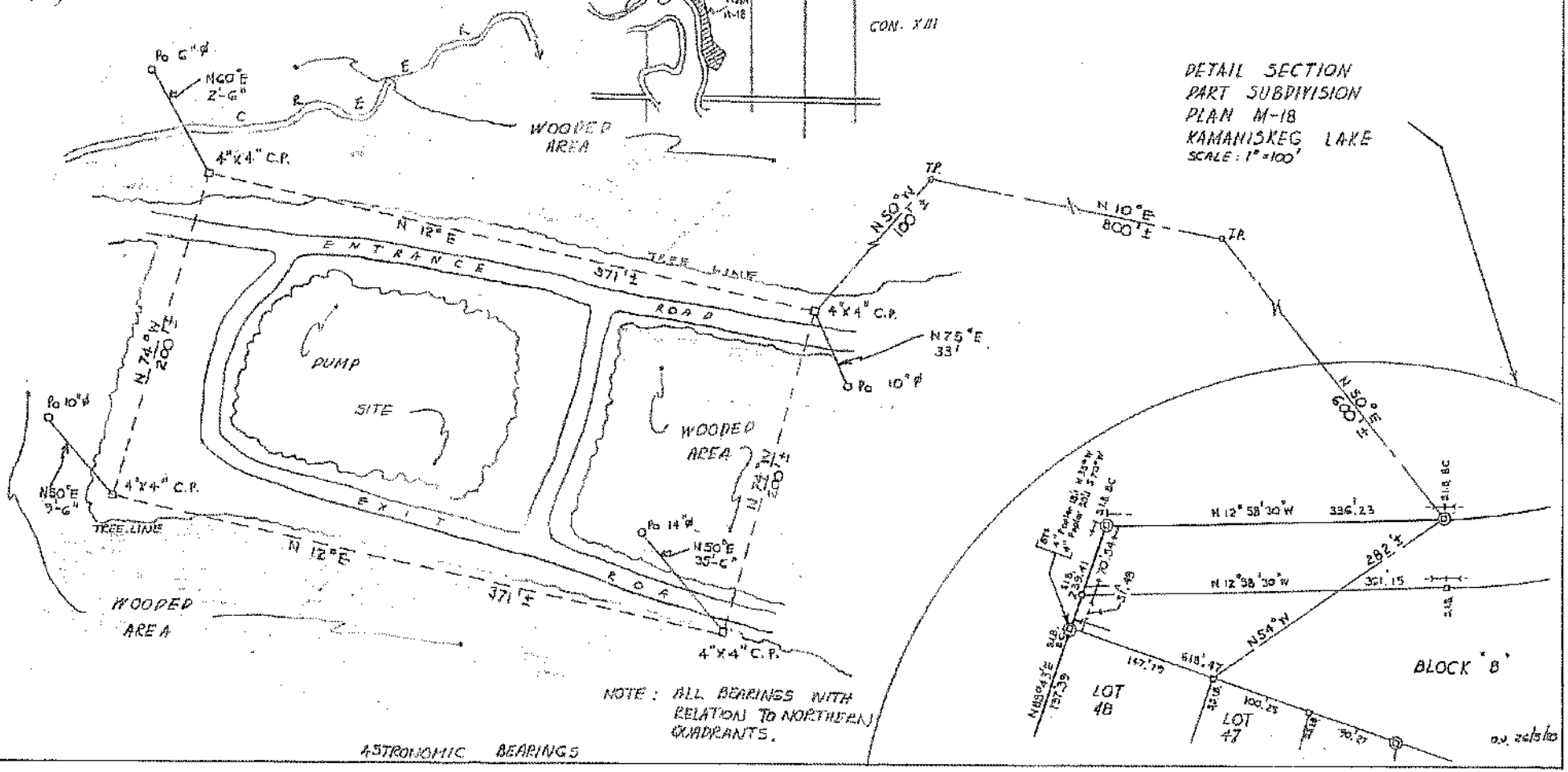
13. The permittee acknowledges and confirms that:
   (i) upon termination of this permit, the decision to issue a new permit is at the sole discretion of the MNRF Official, and the permittee has no right to, nor reasonable expectation for, the issuance of a new permit based on prior use of the land;
   (ii) the successive issuance of any permit or permits for the use of the land described herein will not create any future rights or interests whatsoever in the land;
   (iii) should any improvements whatsoever be made to or on the land, this will not confer upon the permittee any right to use the land other than within the terms of this permit, nor will it give the permittee any right to an expectation of future permits;
   (iv) no additional terms and conditions to this permit, if inserted on the face hereof, shall alter, vary, qualify, or diminish the terms and conditions set out on this page;
   (v) there are no other representations, warranties or conditions between the Crown and the permittee, for the use of this land.

LAND USE PERMIT
COVERING WASTE DISPOSAL SITE

SITUATE ON PART OF
LOT 23 ~~22~~ CONCESSION XIV
BANGOR TWP., HASTINGS CO.
SCALE: 1"=60'

Sept 1/70





DETAIL SECTION
PART SUBDIVISION
PLAN M-18
KAMANISKEG LAKE
SCALE: 1"=100'

Appendix B

Monitoring and Screening Checklist (MECP/MOE)

Appendix D-Monitoring and Screening Checklist
General Information and Instructions

General Information: The checklist is to be completed, and submitted with the Monitoring Report.
Instructions: A complete checklist consists of:
(a) a completed and signed checklist, including any additional pages of information which can be attached as needed to provide further details where indicated.
(b) completed contact information for the Competent Environmental Practitioner (CEP)
(c) self-declaration that CEP(s) meet(s) the qualifications as set out below and in Section 1.2 of the Technical Guidance Document.

Definition of Groundwater CEP:
For groundwater, the CEP must have expertise in hydrogeology and meet one of the following:
(a) the person holds a licence, limited licence or temporary licence under the *Professional Engineers Act*; or
(b) the person holds a certificate of registration under the *Professional Geoscientists Act, 2000* and is a practicing member, temporary, member or limited member of the Association of Professional Geoscientists of Ontario. O. Reg. 66/08, s. 2..
Definition of Surface water CEP:
A CEP for surface water assessments is a scientist, professional engineer or professional geoscientist as described in (a) and (b) above with demonstrated experience and post-secondary education, either a diploma or degree, in hydrology, aquatic ecology, limnology, aquatic biology, physical geography with specialization in surface water, and/or water resource management.

The type of scientific work that a CEP performs must be consistent with that person's education and experience. If an individual has appropriate training and credentials in both groundwater and surface water and is responsible for both areas of expertise, the CEP may then complete and validate both sections of the checklist.

Monitoring Report and Site Information	
Waste Disposal Site Name	Wolf Creek
Location (e.g. street address, lot, concession)	567 River Road, Part of Lot 22, Concession 14
GPS Location (taken within the property boundary at front gate/ front entry)	
Municipality	Municipality of Hastings Highlands
Client and/or Site Owner	Municipality of Hastings Highlands
Monitoring Period (Year)	2023
This Monitoring Report is being submitted under the following:	
Environmental Compliance Approval Number:	A361102
Director's Order No.:	
Provincial Officer's Order No.:	
Other:	

Report Submission Frequency	◉ **Annual** ○ **Other**		
The site is: **(Operation Status)**	◉ **Open** ○ **Inactive** ○ **Closed**		
Does your Site have a Total Approved Capacity?	◉ **Yes** ○ **No**		
If yes, please specify Total Approved Capacity	2580	*Units*	
Does your Site have a Maximum Approved Fill Rate?	○ **Yes** ◉ **No**		
If yes, please specify Maximum Approved Fill Rate	0	*Units*	
Total Waste Received within Monitoring Period (Year)		*Units*	Tonnes
Total Waste Received within Monitoring Period (Year) *Methodology*	Estimation		
Estimated Remaining Capacity	2,580	*Units*	Cubic Metres
Estimated Remaining Capacity *Methodology*	Estimation		
Estimated Remaining Capacity *Date Last Determined*	31/12/2035		
Non-Hazardous Approved Waste Types	☒ Domestic ☐ Industrial, Commercial & Institutional (IC&I) ☐ Source Separated Organics (Green Bin) ☒ Tires	☒ Contaminated Soil ☒ Wood Waste ☒ Blue Box Material ☐ Processed Organics ☒ Leaf and Yard Waste	☐ Food Processing/Preparation Operations Waste ☐ Hauled Sewage Other:
Subject Waste Approved Waste Classes: Hazardous & Liquid Industrial *(separate waste classes by comma)*			
Year Site Opened *(enter the Calendar Year only)*		**Current ECA Issue Date**	3/21/2018
Is your Site required to submit Financial Assurance?		○ **Yes** ◉ **No**	
Describe how your Landfill is designed.		◉ Natural Attenuation only ○ Fully engineered Facility ○ Partially engineered Facility	
Does your Site have an approved Contaminant Attenuation Zone?		◉ **Yes** ○ **No**	

If closed, specify C of A, control or authorizing document closure date:	Select Date

Has the nature of the operations at the site changed during this monitoring period?	○ **Yes** ◉ **No**
If yes, provide details:	
Have any measurements been taken since the last reporting period that indicate landfill gas volumes have exceeded the MOE limits for subsurface or adjacent buildings? (i.e. exceeded the LEL for methane)	○ Yes ◉ No

Groundwater WDS Verification:

Based on all available information about the site and site knowledge, it is my opinion that:

Sampling and Monitoring Program Status:

1) The monitoring program continues to effectively characterize site conditions and any groundwater discharges from the site. All monitoring wells are confirmed to be in good condition and are secure:	◉ **Yes** ○ **No**	
2) All groundwater, leachate and WDS gas sampling and monitoring for the monitoring period being reported on was successfully completed as required by Certificate(s) of Approval or other relevant authorizing/control document (s):	◉ **Yes** ○ **No** ○ **Not Applicable**	If no, list exceptions below or attach information.

Groundwater Sampling Location	**Description/Explanation for change (change in name or location, additions, deletions)**	**Date**

3) a) Is landfill gas being monitored or controlled at the site?	◉ **Yes** ○ **No**	
If yes to 3(a), please answer the next two questions below.		
b) Have any measurements been taken since the last reporting period that indicate landfill gas is present in the subsurface at levels exceeding criteria established for the site?	○ **Yes** ◉ **No**	
c) Has the sampling and monitoring identified under 3(a) for the monitoring period being reported on was successfully completed in accordance with established protocols, frequencies, locations, and parameters developed as per the Technical Guidance Document:	◉ **Yes** ○ **No** ○ **Not Applicable**	If no, list exceptions below or attach additional information.

Groundwater Sampling Location	**Description/Explanation for change (change in name or location, additions, deletions)**	**Date**

4) All field work for groundwater investigations was done in accordance with standard operating procedures as established/outlined per the Technical Guidance Document (including internal/external QA/QC requirements) (Note: A SOP can be from a published source, developed internally by the site owner's consultant, or adopted by the consultant from another organization):	◉ **Yes** ○ **No**	

Sampling and Monitoring Program Results/WDS Conditions and Assessment:

5) The site has an adequate buffer, Contaminant Attenuation Zone (CAZ) and/or contingency plan in place. Design and operational measures, including the size and configuration of any CAZ, are adequate to prevent potential human health impacts and impairment of the environment.	(●) **Yes** ( ) **No**	The CAZ is adequate for current site conditions.	
6) The site meets compliance and assessment criteria.	( ) **Yes** (●) **No**	There are RUV exceedances west of the current property boundary.	
7) The site continues to perform as anticipated. There have been no unusual trends/ changes in measured leachate and groundwater levels or concentrations.	(●) **Yes** ( ) **No**		
1) Is one or more of the following risk reduction practices in place at the site: ***(a)*** **There is minimal reliance on natural attenuation of leachate due to the presence of an effective waste liner and active leachate collection/ treatment; or** ***(b)*** **There is a predictive monitoring program in-place (modeled indicator concentrations projected over time for key locations); or** ***(c)*** **The site meets the following two conditions (typically achieved after 15 years or longer of site operation):** ***i.*** **The site has developed stable leachate mound(s) and stable leachate plume geometry/concentrations; and** ***ii.*** **Seasonal and annual water levels and water quality fluctuations are well understood.**	(●) **Yes** ( ) **No**	**Note which practice(s):**	☐ **(a)** ☐ **(b)** ☒ **(c)**
9) Have trigger values for contingency plans or site remedial actions been exceeded (where they exist):	( ) **Yes** (●) **No** ( ) **Not Applicable**		

Groundwater CEP Declaration:

I am a licensed professional Engineer or a registered professional geoscientist in Ontario with expertise in hydrogeology, as defined in Appendix D under Instructions. Where additional expertise was needed to evaluate the site monitoring data, I have relied on individuals who I believe to be experts in the relevant discipline, who have co-signed the compliance monitoring report or monitoring program status report, and who have provided evidence to me of their credentials.

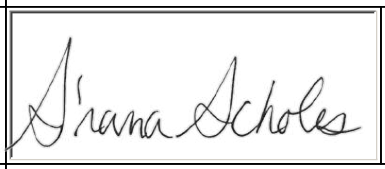
I have examined the applicable Certificate of Approval and any other environmental authorizing or control documents that apply to the site. I have read and followed the Monitoring and Reporting for Waste Disposal Sites Groundwater and Surface Water Technical Guidance Document (MOE, 2010, or as amended), and associated monitoring and sampling guidance documents, as amended from time to time. I have reviewed all of the data collected for the above-referenced site for the monitoring period(s) identified in this checklist. Except as otherwise agreed with the ministry for certain parameters, all of the analytical work has been undertaken by a laboratory which is accredited for the parameters analysed to *ISO/IEC 17025:2005 (E)- General requirements for the competence of testing and calibration laboratories,* or as amended from time to time by the ministry.

If any exceptions or potential concerns have been noted in the questions in the checklist attached to this declaration, it is my opinion that these exceptions and concerns are minor in nature and will be rectified for the next monitoring/reporting period. Where this is not the case, the circumstances concerning the exception or potential concern and my client's proposed action have been documented in writing to the Ministry of the Environment District Manager in a letter from me dated:

Recommendations:

Based on my technical review of the monitoring results for the waste disposal site:

◉ **No changes to the monitoring program are recommended** ○ **The following change(s) to the monitoring program is/are recommended:**	
○ **No Changes to site design and operation are recommended** ◉ **The following change(s) to the site design and operation is/ are recommended:**	Based on no future placement of waste at the Site, we would recommend that the Municipality move forward with acquiring a CAZ. The initial steps in obtaining the CAZ property, either by ownership or easement, is to initiate discussions with both the MECP and the Ministry of Natural Resources and Forestry (MNRF). General agreement with the CAZ distances should be obtained from the MECP, while general agreement to transfer the Crown Land ownership/easement should be obtained from the MNRF. We understand that the process of surrendering the aggregate pit licence to the east must be completed before any changes to that property can be undertaken. We also understand this was initiated in previous years and is still awaiting processing by the MNRF. The Municipality is also considering closure of the WDS.

Name:	S'rana Scholes, P.Eng.		
Seal:			
Signature:		**Date:**	25-Mar-2024
CEP Contact Information:			
Company:	BluMetric Environmental Inc.		
Address:	209 Frederick street, Kitchener, ON, N2H 2M7		
Telephone No.:	(877) 487-8436 ext. 218	Fax No. :	
E-mail Address:	sscholes@blumetric.ca		
Co-signers for additional expertise provided:			
Signature:		**Date:**	Select Date
Signature:		**Date:**	Select Date

Surface Water WDS Verification:

Provide the name of surface water body/bodies potentially receiving the WDS effluent and the approximate distance to the waterbody (including the nearest surface water body/bodies to the site):

Name (s)	Un-named Marsh and Creek
Distance(s)	100 m east, 180 m west, but are at higher elevations than base of the WDS.

Based on all available information and site knowledge, it is my opinion that:

Sampling and Monitoring Program Status:

1) The current surface water monitoring program continues to effectively characterize the surface water conditions, and includes data that relates upstream/background and downstream receiving water conditions:	(●) Yes ( ) No	Surface water sampling is not required.
2) All surface water sampling for the monitoring period being reported was successfully completed in accordance with the Certificate(s) of Approval or relevant authorizing/control document(s) (if applicable):	( ) Yes ( ) No (●) **Not applicable (No C of A, authorizing / control document applies)**	If no, specify below or provide details in an attachment.

Surface Water Sampling Location	Description/Explanation for change (change in name or location, additions, deletions)	Date

3) a) Some or all surface water sampling and monitoring program requirements for the monitoring period have been established outside of a ministry C of A or authorizing/control document.	○ **Yes** ○ **No** ◉ **Not Applicable**	
b) If yes, all surface water sampling and monitoring identified under 3 (a) was successfully completed in accordance with the established program from the site, including sampling protocols, frequencies, locations and parameters) as developed per the Technical Guidance Document:	○ **Yes** ○ **No** ◉ **Not Applicable**	If no, specify below or provide details in an attachment.

Surface Water Sampling Location	**Description/Explanation for change (change in name or location, additions, deletions)**	**Date**

4) All field work for surface water investigations was done in accordance with standard operating procedures, including internal/external QA/QC requirements, as established/outlined as per the Technical Guidance Document, MOE 2010, or as amended. (Note: A SOP can be from a published source, developed internally by the site owner's consultant, or adopted by the consultant from another organization):	◉ **Yes** ○ **No**	Not applicable

Sampling and Monitoring Program Results/WDS Conditions and Assessment:

5) The receiving water body meets surface water-related compliance criteria and assessment criteria: i.e., there are no exceedances of criteria, based on MOE legislation, regulations, Water Management Policies, Guidelines and Provincial Water Quality Objectives and other assessment criteria (e.g., CWQGs, APVs), as noted in Table A or Table B in the Technical Guidance Document (Section 4.6):	◉ **Yes** ○ **No**

If no, list parameters that exceed criteria outlined above and the amount/percentage of the exceedance as per the table below or provide details in an attachment:

Parameter	Compliance or Assessment Criteria or Background	Amount by which Compliance or Assessment Criteria or Background Exceeded
e.g. Nickel	e.g. C of A limit, PWQO, background	e.g. X% above PWQO
Not applicable		.
6) In my opinion, any exceedances listed in Question 5 are the result of non-WDS related influences (such as background, road salting, sampling site conditions)?	○ **Yes** ◉ **No**	

7) All monitoring program surface water parameter concentrations fall within a stable or decreasing trend. The site is not characterized by historical ranges of concentrations above assessment and compliance criteria.	(●) **Yes** ( ) **No**	
8) For the monitoring program parameters, does the water quality in the groundwater zones adjacent to surface water receivers exceed assessment or compliance criteria (e.g. , PWQOs, CWQGs, or toxicity values for aquatic biota (APVs)):	( ) Yes ( ) No ( ) Not Known (●) Not Applicable	
9) Have trigger values for contingency plans or site remedial actions been exceeded (where they exist):	( ) **Yes** (●) **No** ( ) **Not Applicable**	

Surface Water CEP Declaration:

I, the undersigned hereby declare that I am a Competent Environmental Practitioner as defined in Appendix D under Instructions, holding the necessary level of experience and education to design surface water monitoring and sampling programs, conduct appropriate surface water investigations and interpret the related data as it pertains to the site for this monitoring period.

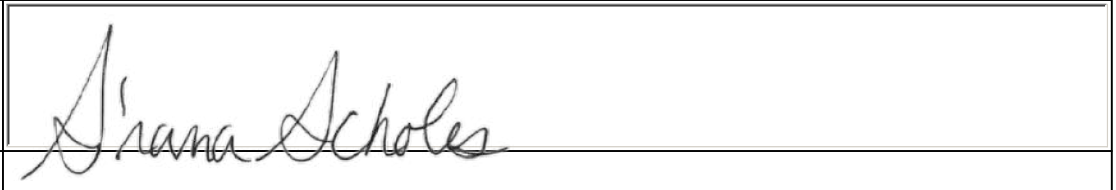
I have examined the applicable Certificate of Approval and any other environmental authorizing or control documents that apply to the site. I have read and followed the Monitoring and Reporting for Waste Disposal Sites Groundwater and Surface Water Technical Guidance Document (MOE, 2010, or as amended) and associated monitoring and sampling guidance documents, as amended from time to time. I have reviewed all of the data collected for the above-referenced site for the monitoring period(s) identified in this checklist. Except as otherwise agreed with the ministry for certain parameters, all of the analytical work has been undertaken by a laboratory which is accredited for the parameters analysed to *ISO/IEC 17025:2005 (E)- General requirements for the competence of testing and calibration laboratories,* or as amended from time to time by the ministry.

If any exceptions or potential concerns have been noted in the questions in the checklist attached to this declaration, it is my opinion that these exceptions and concerns are minor in nature or will be rectified for future monitoring events. Where this is not the case, the circumstances concerning the exception or potential concern and my client's proposed action have been documented in writing to the Ministry of the Environment District Manager in a letter from me dated:

Recommendations:

Based on my technical review of the monitoring results for the waste disposal site:

◉ **No Changes to the monitoring program are recommended**	
○ **The following change(s) to the monitoring program is/are recommended:**	
○ **No changes to the site design and operation are recommended**	
◉ **The following change(s) to the site design and operation is/are recommended:**	Waste is currently not being placed at the Site.

CEP Signature	
Relevant Discipline	Senior Environmental P.Eng. with 19 years experience assessing landfill SW at landfills. Hydrology a
Date:	25-Mar-2024
CEP Contact Information:	
Company:	BluMetric Environmental Inc.
Address:	Unit 3B, 209 Frederick Street, Kitchener, ON, N2H 2M7
Telephone No.:	877-487-8436 x218
Fax No. :	
E-mail Address:	sscholes@blumetric.ca

Save As **Print Form**

Appendix C

C-1 Monitoring Well Logs

Project No: KB1946-1

Project: Wolf Creek WDS

Client: Municipality of Hastings Highlands

Site Coordinates: Zone 18 T North 5032818, East 285898

Log of Borehole: WC1-03

Field Personnel: B. M.

SUBSURFACE PROFILE				SAMPLE				WELL INSTALLATION	
Depth (ft / m)	Elevation	Symbol	Description	Number	Type	SPT N-Value	Recovery	Well Construction	Comments
0	97.31		Ground Surface						Steel locking protective cover and casing Stick-up: 0.885m
0 – 1			SAND and COBBLES, trace Garbage (plastic).						
1	95.78								51mm (2") I.D. Sch. 40 PVC pipe
1 – 2			Brown SAND, dry.	SS1	SS	8	15"		Native backfill
2 – 3				SS2	SS	13	16"		
3 – 4									3/8" Bentonite holeplug
4	92.73								#3 Silica sand pack
4 – 5			Brown SAND, saturated.	SS3	SS	11	16"		
5 – 6	91.21								
6			Brown Sand, saturated.	SS4	SS	2			10' Slot 10 PVC screen (2")
6 – 7	89.69								
7			End of Borehole						

Drill Method: 8" Hollow Stem Auger

Hole Size: 8" (205mm)

Drill Date: July 22/03

Datum: Top of PVC Elevation - 98.192 m

Checked by:

Sheet: 1 of 1

Project No: KB1946-1

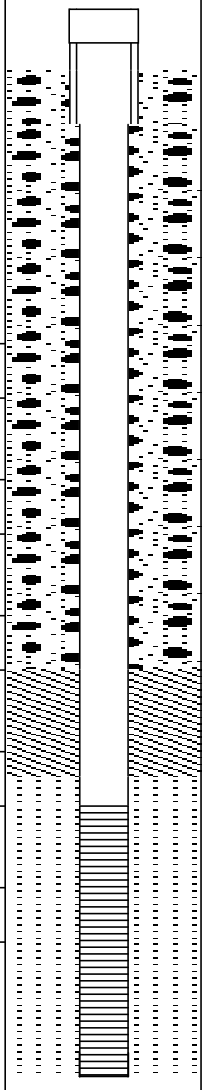
Project: Wolf Creek WDS

Client: Municipality of Hastings Highlands

Site Coordinates: Zone 18 T North 5032777, East 285840

Log of Borehole: WC2-03

Field Personnel: B. M.

SUBSURFACE PROFILE				SAMPLE				WELL INSTALLATION	
Depth (ft / m)	Elevation	Symbol	Description	Number	Type	SPT N-Value	Recovery	Well Construction	Comments
0 / 0	100.98		Ground Surface						Steel locking protective cover and casing Stick-up: 0.59m
0 – 6 / 0 – 2	99.00		Brown SAND, GRAVEL, and COBBLE, dry.						51mm (2") I.D. Sch. 40 PVC pipe
6 – 9 / 2 – 3	97.93		Brown SAND, dry.						Native backfill
9 – 14 / 3 – 4	96.41		Brown SAND, trace small gravel, dry.	SS1	SS	15	15"		
14 – 19 / 4 – 6	94.88		Brown SAND, dry.	SS2	SS	15	16"		
19 – 24 / 6 – 7	93.36		Brown SAND, moist.	SS3	SS	15	18"		3/8" Bentonite holeplug
24 – 29 / 7 – 9	91.83		Brown, SAND and GRAVEL, moist to wet.	SS4	SS	18	12"		#3 Silica sand pack
29 – 36 / 9 – 11	89.70		Brown SAND and GRAVEL, saturated.	SS5	SS	8	10"		10' Slot 10 PVC screen (2")
36 / 11			End of Borehole						

Drill Method: 8" Hollow Stem Auger

Hole Size: 8" (205mm)

Drill Date: July 23/03

Datum: Elevation TPVC - 101.569 m

Checked by:

Project No: KB1946-1

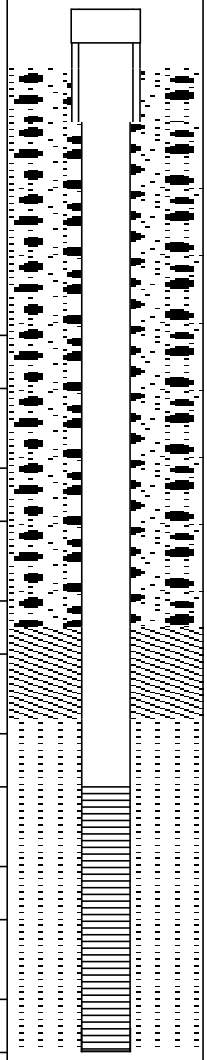
Project: Wolf Creek WDS

Client: Municipality of Hastings Highlands

Site Coordinates: Zone 18 T North 5032703, East 285859

Log of Borehole: WC3-03

Field Personnel: B. M.

SUBSURFACE PROFILE				SAMPLE				WELL INSTALLATION	
Depth (ft / m)	Elevation	Symbol	Description	Number	Type	SPT N-Value	Recovery	Well Construction	Comments
0 / 0	101.00		Ground Surface						Steel locking protective cover and casing Stick-up: 0.78m 51mm (2") I.D. Sch. 40 PVC pipe Native backfill 3/8" Bentonite holeplug #3 Silica sand pack 10' Slot 10 PVC screen (2")
			SAND, GRAVEL, and COBBLE, dry.						
3 / 1	99.01		Brown SAND, dry.						
6 / 2	97.95		Brown SAND, dry.	SS1	SS	6	15"		
9 / 3	96.42		Brown SAND, trace small gravel, dry.	SS2	SS	13	12"		
12 / 4	94.90		Brown SAND, dry.	SS3	SS	17	16"		
15 / 5	93.38		Brown SAND, wet.	SS4	SS	20	14"		
18 / 6	91.85		Brown SAND, trace small gravel, saturated.	SS5	SS	3	9"		
21 / 7	90.33		Brown SAND, trace small gravel, saturated.	SS6	SS	7			
24 / 8	89.72		End of Borehole						
27 / 9									
30 / 10									
33 / 11									
36 / 12									

Drill Method: 8" Hollow Stem Auger

Hole Size: 8" (205mm)

Drill Date: July 23/03

Datum: Elevation TPVC - 101.775 m

Checked by:

Sheet: 1 of 1

Appendix C

C-2 Private Well Records

Well ID: WC4-19

Project No.: 190495-00
Client: Municipality of Hastings Highlands
Report: 2019 Monitoring Well Installations
Site Address: Wolfe Creek W.D.S.
567 River Road, Maynooth, Ontario

Elevation Ground: *292.08 m*
TOP: *292.83 m*

UTM NAD83 (Zone 18T): 5032744 N
285836 E

Depth (m)	Description	Depth (m) / Elev. (m.a.s.l.)	Notes
	Ground Surface	0.00 / 292.08	4 in. sq. steel monument with lock PVC Stickup = 0.75m
0–1	**Sand and Gravel** Light brown, dry, trace cobbles.	1.52 / 290.56	backfilled with drill cuttings
2–12	**Sand** Light brown, dry, medium to coarse grained. - trace gravel. - moist to wet. - (8.53m) wet	12.25 / 279.83	bentonite gravel seal 3.05m x 50mm slot 10 PVC screen within No. 2 silica sand pack
13–14	End of well at 12.25 m Well Completion Details: Screened interval from 9.20 m to 12.25 m below surface Elevation at top of pipe (TOP) = 292.83 m		

Headspace Vapour Level (ppm): 10 100 1000 10000

Drill Date: 2019 July 17
Drilled By: Canadian Environmental Drilling
Drilling Method: Hollow Stem Auger
Hole Diameter: 0.2 m (OD)
Logged By: B.M.
Checked By: I.O'C.

Notes: AUGER SAMPLE

Sheet 1 of 1

BH MW OB LOGV1.0 190495-00 WOLFE CREEK.GPJ WESA TEMPLATE V1.2.GDT 20-3-5

Well ID: WC5-19

Project No.: 190495-00
Client: Municipality of Hastings Highlands
Report: 2019 Monitoring Well Installations
Site Address: Wolfe Creek W.D.S.
567 River Road, Maynooth, Ontario

Elevation Ground: *293.36 m*
TOP: *294.21 m*

UTM NAD83 (Zone 18T): 5032816 N
285830 E

SUBSURFACE PROFILE				SAMPLE						WELL COMPLETION	
Depth (m)	Symbol	Description	Depth (m) / Elev. (m.a.s.l.)	Sample ID	Type	Blow Counts	Recovery (%)	Lab Analysis	Headspace Vapour Level (ppm) 10 100 1000 10000	Construction	Notes
		Ground Surface	0.00								4 in. sq. steel monument with lock PVC Stickup = 0.85m
0		**Sand and Gravel** Brown, dry, trace cobbles.	293.36								
1			1.52								
		Sand Brown, dry, trace gravel.	291.84								
2											
3											
4											
		- light brown,									bentonite gravel seal
5											
6											
7											
		- light brown, moist to wet.									
8											
9											
		- wet to saturated.									
10											
		- saturated.									
11											
12											3.05m x 50mm slot 10 PVC screen within No. 2 silica sand pack
13			13.75								
14		End of well at 13.75 m	279.61								
		Well Completion Details: Screened interval from 10.70 m to 13.75 m below surface Elevation at top of pipe (TOP) = 294.21 m									
15											

Drill Date: 2019 July 17
Drilled By: Canadian Environmental Drilling
Drilling Method: Hollow Stem Auger
Logged By: B.M.
Hole Diameter: 0.2 m (OD)
Checked By: I.O'C.

Notes: AUGER SAMPLE

Sheet 1 of 1

BH MW OB LOGV1.0 190495-00 WOLFE CREEK.GPJ WESA TEMPLATE V1.2.GDT 20-3-5

Well ID: WC6.1-19

Project No.: 190495-00
Client: Municipality of Hastings Highlands
Report: 2019 Monitoring Well Installations
Site Address: Wolfe Creek W.D.S.
567 River Road, Maynooth, Ontario

Elevation Ground: *292.80 m*
TOP: *293.62 m*
MOECC Well Tag: A236144
UTM NAD83 (Zone 18T): 5032773 N
285817 E

Depth (m)	Description	Depth (m) / Elev. (m.a.s.l.)	Sample ID	Type	Blow Counts	Recovery (%)	Lab Analysis	Headspace Vapour Level (ppm)	Construction	Notes
	Ground Surface	0.00								4 in. sq. steel monument with lock PVC Stickup = 0.79m
0	**Sand and Gravel** Brown, dry, trace cobbles.	292.80								
3		3.05								
3	**Sand** Brown, dry, trace gravel.	289.75								
6										bentonite gravel seal
9	- wet, medium grained, trace gravel. - brownish grey, wet.									
12	- saturated, trace gravel.									native soil collaspe
15		15.24								
15	**Sand** Sand, some gravel.	277.56								
17										bentonite gravel seal
22	- cobbles.									
23		23.77								3.05m x 50mm slot 10 PVC screen within No. 2 silica sand pack
24	**Granite**	269.03								
		24.38								
	End of well at 24.38 m	268.42								
25	Well Completion Details: Screened interval from 22.77 m to 24.29 m below surface Elevation at top of pipe (TOP) = 293.62 m									

Drill Date: 2019 July 18
Drilled By: Canadian Environmental Drilling
Drilling Method: Mud Rotary
Logged By: B.M.
Hole Diameter: 0.2 m (OD)
Checked By: I.O'C.

Notes: AUGER SAMPLE GRAB SAMPLE

Sheet 1 of 1

BH MW OB LOGV1.0 190495-00 WOLFE CREEK.GPJ WESA TEMPLATE V1.2.GDT 20-3-5

Well ID: WC6.2-19

Project No.: 190495-00
Client: Municipality of Hastings Highlands
Report: 2019 Monitoring Well Installations
Site Address: Wolfe Creek W.D.S.
567 River Road, Maynooth, Ontario

Elevation Ground: *292.76 m*
TOP: *293.55 m*

UTM NAD83 (Zone 18T): 5032772 N
285821 E

Depth (m)	Description	Depth (m) / Elev. (m.a.s.l.)
	Ground Surface	0.00 / 292.76
0–3	**Sand and Gravel** Brown, dry, trace cobbles.	3.05 / 289.71
3–15	**Sand** Brown, dry, trace gravel. - wet, medium grained, trace gravel. - brownish grey, wet. - saturated, trace gravel.	15.24 / 277.52
15–19	**Sand and Gravel** Sand and Gravel	18.90 / 273.86
19	End of well at 18.95 m	

Well Completion Details:
Screened interval from 15.90 m to 18.95 m below surface
Elevation at top of pipe (TOP) = 293.55 m

SAMPLE: Sample ID, Type, Blow Counts, Recovery (%), Lab Analysis, Headspace Vapour Level (ppm) 10 100 1000 10000

WELL COMPLETION: Construction

Notes:
- 4 in. sq. steel monument with lock
- PVC Stickup = 0.79m
- bentonite gravel seal
- backfill with drill cuttings
- bentonite gravel seal
- 3.05m x 50mm slot 10 PVC screen within No. 2 silica sand pack

Drill Date: 2019 July 19
Drilled By: Canadian Environmental Drilling
Drilling Method: Mud Rotary
Hole Diameter: 0.2 m (OD)
Logged By: B.M.
Checked By: I.O'C.

Notes: AUGER SAMPLE GRAB SAMPLE

Well ID: WC6.3-19

Project No.: 190495-00
Client: Municipality of Hastings Highlands
Report: 2019 Monitoring Well Installations
Site Address: Wolfe Creek W.D.S.
567 River Road, Maynooth, Ontario

Elevation Ground: *292.78 m*
TOP: *293.59 m*

UTM NAD83 (Zone 18T): 5032771 N
285817 E

Depth (m)	Description	Depth (m) / Elev. (m.a.s.l.)	Sample ID	Type	Blow Counts	Recovery (%)	Lab Analysis	Headspace Vapour Level (ppm)	Construction	Notes
	Ground Surface	0.00 / 292.78								4 in. sq. steel monument with lock PVC Stickup = 0.81m
0–3	**Sand and Gravel** Brown, dry, trace cobbles.	3.05 / 289.73								backfill with drill cuttings
3–15	**Sand** Brown, dry, trace gravel.									bentonite gravel seal
9	- wet, medium grained, trace gravel.									
9	- brownish grey, wet.									
										3.05m x 50mm slot 10 PVC screen within No. 2 silica sand pack
12	- saturated, trace gravel.									
										native soil collaspe
15	End of well at 15.24 m	15.24 / 277.54								
	Well Completion Details: Screened interval from 9.81 m to 12.86 m below surface Elevation at top of pipe (TOP) = 293.59 m									

Drill Date: 2019 July 17
Drilled By: Canadian Environmental Drilling
Drilling Method: Hollow Stem Auger
Hole Diameter: 0.2 m (OD)
Logged By: B.M.
Checked By: I.O'C.

Notes: AUGER SAMPLE

Sheet 1 of 1

BH MW OB LOGV1.0 190495-00 WOLFE CREEK.GPJ WESA TEMPLATE V1.2.GDT 20-3-5

Appendix D

Inspection Forms and Laboratory & Chain of Custody Reports

Appendix D

D-1 Operation and Inspection Forms

SMALL LANDFILL
OPERATION AND INSPECTION FORM

Site Name: Wolf Creek WDS, MHHs	Date: May 1, 2023	Weather: Overcast, Rain, 3°c
Project #: 230225-01	BluMetric Staff:	

Photographs of each item below should be collected during site visits.

OVERALL INSPECTION AND OPERATION REVIEW

❑ Signage in good condition	Yes ✓	No _	
❑ ECA and emergency numbers on signage	Yes ✓	No _	
❑ Hour of operation observed	Yes ✓	No _	
❑ Site open under normal operating hours	Yes _	No ✓	Site closed during inspection
❑ Perimeter fencing and gate in good condition	Yes ✓	No _	
❑ Gate locked if closed	Yes ✓	No _	

DESIGNATED WASTE AREA

❑ Working active/trench area (moderate size, daily cover, compacted)	Yes _	No _	NA Transfer Station
❑ Designated waste areas are properly signed and easily accessed by public	Yes _	No _	

RECYCLING OPERATION (if applicable)

❑ Proper signage and bins present	Yes ✓	No _
❑ Clearly signed	Yes ✓	No _
❑ Overall neat in appearance	Yes ✓	No _

SEGREGATED SCRAP PILES (metal, tires, brush, etc.)

❑ Metals neat and appropriate size	Yes _	No ✓	Metals + Bulk both full and overflowing into each other
❑ Tires neat and appropriate size	Yes ✓	No _	
❑ Bulky Items neat and appropriate size	Yes _	No ✓	
❑ Brush pile neat and appropriate size	Yes ✓	No _	Berms require attention
❑ Construction debris neat and appropriate size	Yes _	No _	NA - No construction debris

MONITORING WELL CONDITION

❑ Casing conditions (frost heave, lock, cap)	Yes ✓	No _
❑ Monitor condition (capped, vented)	Yes ✓	No _
❑ Wells clearly labeled (re-label as required)	Yes ✓	No _
❑ Well clearly visible (clear brush if necessary)	Yes ✓	No _

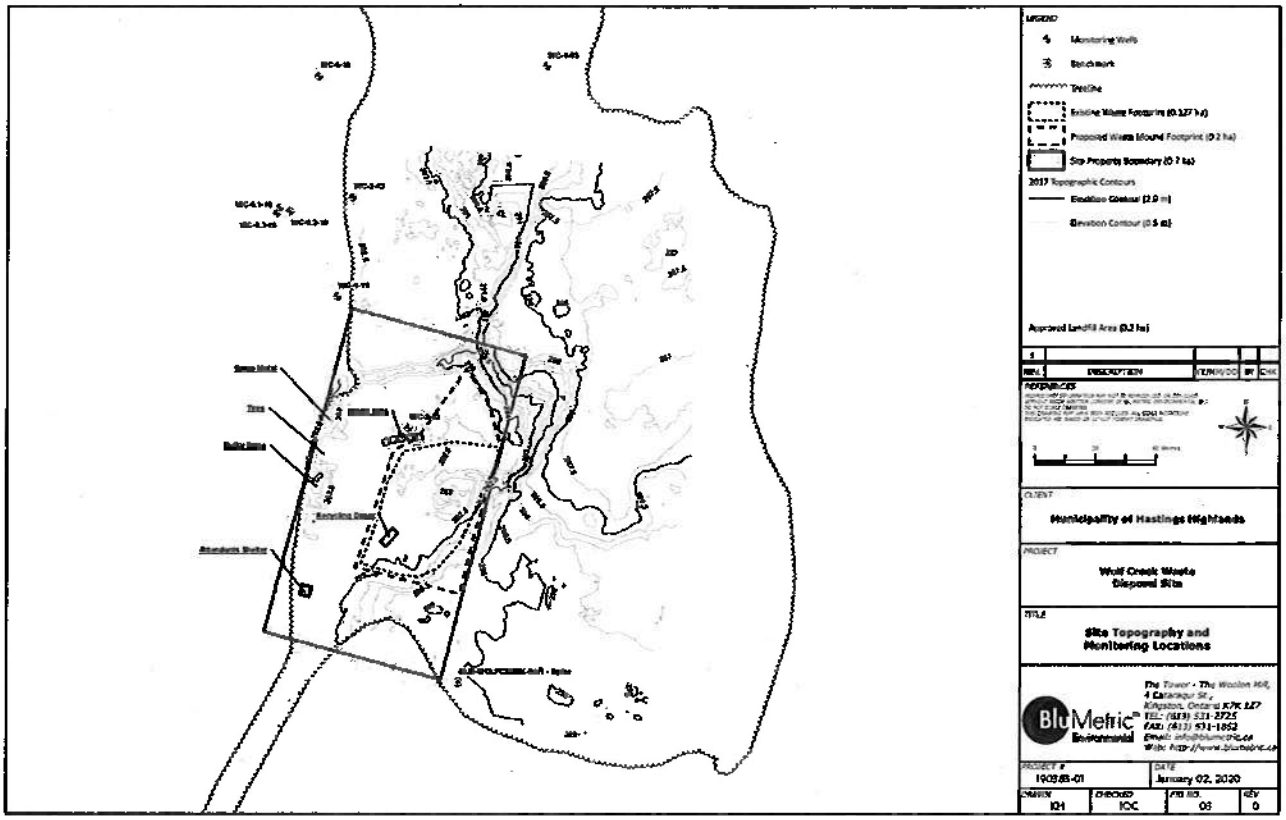
LANDFILL GAS MONITORING

❑ Conducted at structures	Yes ✓	No _
❑ Conducted at monitoring wells	Yes ✓	No _

REPAIRS: Provide details of repairs made or materials required for repairs upon next site visit:

OBSERVATIONS OF PHYSICAL ENVIRONMENT: Please comment on any changes to the local environment (e.g. settling or slumping of waste/cover, new or altered drainage, presence of seeps, changes in vegetation cover, etc.)

This form is intended as a general reminder of information that should recorded during monitoring activities. The above information is a minimum guide. Any information deemed important should be recorded in the field notes for each site.



Identify any changes to site layout on drawing and/or comment:

This form is intended as a general reminder of information that should recorded during monitoring activities. The above information is a minimum guide. Any information deemed important should be recorded in the field notes for each site.

SMALL LANDFILL
OPERATION AND INSPECTION FORM

Site Name: Wolf Creek WDS, MHHs	Date: Oct 16/23	Weather: Cloudy 8°C
Project #: 230225-01	BluMetric Staff: BM/MD	

Photographs of each item below should be collected during site visits.

OVERALL INSPECTION AND OPERATION REVIEW

❑	Signage in good condition	Yes ✓	No _
❑	ECA and emergency numbers on signage	Yes ✓	No _
❑	Hour of operation observed	Yes ✓	No _
❑	Site open under normal operating hours	Yes ✓	No _
❑	Perimeter fencing and gate in good condition	Yes ✓	No _
❑	Gate locked if closed	Yes _	No ✓ - locked but not secured

DESIGNATED WASTE AREA

❑	Working active/trench area (moderate size, daily cover, compacted)	Yes _	No _ NA
❑	Designated waste areas are properly signed and easily accessed by public	Yes ✓	No _

RECYCLING OPERATION (if applicable)

❑	Proper signage and bins present	Yes ✓	No _
❑	Clearly signed	Yes ✓	No _
❑	Overall neat in appearance	Yes ✓	No _

SEGREGATED SCRAP PILES (metal, tires, brush, etc.)

❑	Metals neat and appropriate size	Yes ✓	No _
❑	Tires neat and appropriate size	Yes ✓	No _
❑	Bulky Items neat and appropriate size	Yes _	No ✓ - awaiting removal - dividing burns need to be more substantial
❑	Brush pile neat and appropriate size	Yes ✓	No _
❑	Construction debris neat and appropriate size	Yes _	No _ NA

MONITORING WELL CONDITION

❑	Casing conditions (frost heave, lock, cap)	Yes ✓	No _
❑	Monitor condition (capped, vented)	Yes ✓	No _
❑	Wells clearly labeled (re-label as required)	Yes ✓	No _
❑	Well clearly visible (clear brush if necessary)	Yes ✓	No _

LANDFILL GAS MONITORING

❑	Conducted at structures	Yes ✓	No _ 0 PPM
❑	Conducted at monitoring wells	Yes ✓	No _ [redacted]

REPAIRS: Provide details of repairs made or materials required for repairs upon next site visit:

OBSERVATIONS OF PHYSICAL ENVIRONMENT: Please comment on any changes to the local environment (e.g. settling or slumping of waste/cover, new or altered drainage, presence of seeps, changes in vegetation cover, etc.)

This form is intended as a general reminder of information that should recorded during monitoring activities. The above information is a minimum guide. Any information deemed important should be recorded in the field notes for each site.

Appendix D

D-2 Groundwater Laboratory & Chain of Custody Reports

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: BLUMETRIC ENVIRONMENTAL INC.
4 Cataraqui Street
Kingston, ON K7K1Z7
(613) 531-2725
ATTENTION TO: Carolyn Miller
PROJECT: 230225-01
AGAT WORK ORDER: 23T020443
WATER ANALYSIS REVIEWED BY: Chuandi Zhang, Lab Team Lead
DATE REPORTED: May 17, 2023
PAGES (INCLUDING COVER): 6
VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

*Notes

Disclaimer:

- *All work conducted herein has been done using accepted standard protocols, and generally accepted practices and methods. AGAT test methods may incorporate modifications from the specified reference methods to improve performance.*
- *All samples will be disposed of within 30 days after receipt unless a Long Term Storage Agreement is signed and returned. Some specialty analysis may be exempt, please contact your Client Project Manager for details.*
- *AGAT's liability in connection with any delay, performance or non-performance of these services is only to the Client and does not extend to any other third party. Unless expressly agreed otherwise in writing, AGAT's liability is limited to the actual cost of the specific analysis or analyses included in the services.*
- *This Certificate shall not be reproduced except in full, without the written approval of the laboratory.*
- *The test results reported herewith relate only to the samples as received by the laboratory.*
- *Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to, warranties of merchantability, fitness for a particular purpose, or non-infringement. AGAT assumes no responsibility for any errors or omissions in the guidelines contained in this document.*
- *All reportable information as specified by ISO/IEC 17025:2017 is available from AGAT Laboratories upon request.*
- *For environmental samples in the Province of Quebec: The analysis is performed on and results apply to samples as received. A temperature above 6°C upon receipt, as indicated in the Sample Reception Notification (SRN), could indicate the integrity of the samples has been compromised if the delay between sampling and submission to the laboratory could not be minimized.*

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 23T020443

PROJECT: 230225-01

CLIENT NAME: BLUMETRIC ENVIRONMENTAL INC.

ATTENTION TO: Carolyn Miller

SAMPLING SITE:Wolf Creek

SAMPLED BY:

Groundwater Parameters

DATE RECEIVED: 2023-05-03

DATE REPORTED: 2023-05-17

		SAMPLE DESCRIPTION:		WC1-03	WC2-03	WC3-03	WC4-19	WC5-19	WC6.1-19	WC6.2-19	WC6.3-19
		SAMPLE TYPE:		Water	Water	Water	Water	Water	Water	Water	Water
		DATE SAMPLED:		2023-05-01 11:05	2023-05-01 11:21	2023-05-01 10:55	2023-05-01 10:57	2023-05-01 11:17	2023-05-01 11:30	2023-05-01 11:38	2023-05-01 11:43
Parameter	**Unit**	**G / S**	**RDL**	**4957938**	**4957942**	**4957943**	**4957944**	**4957945**	**4957946**	**4957947**	**4957948**
Electrical Conductivity	µS/cm		2	108	256	115	262	86	150	112	253
pH	pH Units		NA	6.71	7.04	7.12	7.23	7.15	7.51	7.26	7.37
Total Dissolved Solids	mg/L		10	82	174	72	164	64	100	80	172
Alkalinity (as CaCO3)	mg/L		5	20	78	46	97	37	63	49	78
Chloride	mg/L		0.10	0.41	1.17	2.01	0.90	0.69	1.41	0.53	1.04
Nitrate as N	mg/L		0.05	6.42	4.92	1.56	2.31	0.50	0.06	0.07	5.32
Sulphate	mg/L		0.10	4.64	26.3	5.61	20.4	5.25	9.61	7.21	21.9
Ammonia as N	mg/L		0.02	<0.02	<0.02	<0.02	0.24	<0.02	<0.02	<0.02	<0.02
Chemical Oxygen Demand	mg/L		5	12	<5	<5	8	<5	<5	<5	<5
Dissolved Organic Carbon	mg/L		0.5	5.0	3.2	1.3	2.9	1.7	1.5	2.5	3.4
Dissolved Calcium	mg/L		0.05	12.9	35.0	11.0	37.6	7.51	20.6	18.0	33.1
Dissolved Magnesium	mg/L		0.05	2.33	5.67	4.56	5.47	1.36	4.29	3.01	4.66
Dissolved Potassium	mg/L		0.50	1.29	8.27	2.20	11.3	0.80	2.07	0.91	5.53
Dissolved Sodium	mg/L		0.05	1.821	5.62	4.18	4.51	8.23	1.60	1.53	6.75
Dissolved Aluminum	mg/L		0.004	0.063	0.015	0.037	0.015	0.013	0.027	0.067	0.011
Dissolved Boron	mg/L		0.010	0.019	0.150	0.019	0.092	0.013	<0.010	<0.010	0.166
Dissolved Iron	mg/L		0.010	0.021	0.029	0.022	0.029	0.010	0.036	0.014	0.025
Dissolved Lead	mg/L		0.0005	<0.0005	0.0005	0.0018	0.0005	<0.0005	<0.0005	0.0007	<0.0005
Dissolved Manganese	mg/L		0.002	0.006	0.003	<0.002	0.200	0.002	0.002	0.007	<0.002
Dissolved Strontium	mg/L		0.005	0.055	0.230	0.051	0.126	0.043	0.063	0.052	0.367
Dissolved Zinc	mg/L		0.005	<0.005	<0.005	<0.005	<0.005	0.005	<0.005	<0.005	<0.005

Certified By:

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 23T020443

PROJECT: 230225-01

CLIENT NAME: BLUMETRIC ENVIRONMENTAL INC.

ATTENTION TO: Carolyn Miller

SAMPLING SITE:Wolf Creek

SAMPLED BY:

Groundwater Parameters

DATE RECEIVED: 2023-05-03

DATE REPORTED: 2023-05-17

			SAMPLE DESCRIPTION:	WC-QAQC-GW1
			SAMPLE TYPE:	Water
			DATE SAMPLED:	2023-05-01 11:05
Parameter	**Unit**	**G / S**	**RDL**	**4957949**
Electrical Conductivity	µS/cm		2	111
pH	pH Units		NA	6.75
Total Dissolved Solids	mg/L		10	102
Alkalinity (as CaCO3)	mg/L		5	18
Chloride	mg/L		0.10	0.47
Nitrate as N	mg/L		0.05	6.81
Sulphate	mg/L		0.10	4.74
Ammonia as N	mg/L		0.02	<0.02
Chemical Oxygen Demand	mg/L		5	<5
Dissolved Organic Carbon	mg/L		0.5	3.8
Dissolved Calcium	mg/L		0.05	13.9
Dissolved Magnesium	mg/L		0.05	2.73
Dissolved Potassium	mg/L		0.50	1.28
Dissolved Sodium	mg/L		0.05	1.839
Dissolved Aluminum	mg/L		0.004	0.075
Dissolved Boron	mg/L		0.010	0.018
Dissolved Iron	mg/L		0.010	0.019
Dissolved Lead	mg/L		0.0005	<0.0005
Dissolved Manganese	mg/L		0.002	0.004
Dissolved Strontium	mg/L		0.005	0.056
Dissolved Zinc	mg/L		0.005	<0.005

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Analysis performed at AGAT Toronto (unless marked by *)

Certified By:

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: BLUMETRIC ENVIRONMENTAL INC.

AGAT WORK ORDER: 23T020443

PROJECT: 230225-01

ATTENTION TO: Carolyn Miller

SAMPLING SITE:Wolf Creek

SAMPLED BY:

Water Analysis

RPT Date: May 17, 2023			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Groundwater Parameters															
Electrical Conductivity	4958096		447	449	0.4%	< 2	106%	90%	110%						
pH	4958096		6.82	6.74	1.2%		101%	90%	110%						
Total Dissolved Solids	4957938		82	90	9.3%	< 10	104%	80%	120%						
Alkalinity (as CaCO3)	4958096		132	128	3.0%	< 5	97%	80%	120%						
Chloride	4958100		91.4	91.1	0.3%	< 0.10	94%	70%	130%	98%	80%	120%	102%	70%	130%
Nitrate as N	4958100		<0.05	<0.05	NA	< 0.05	95%	70%	130%	97%	80%	120%	99%	70%	130%
Sulphate	4958100		31.4	31.2	0.6%	< 0.10	97%	70%	130%	95%	80%	120%	101%	70%	130%
Ammonia as N	4968612		<0.02	<0.02	NA	< 0.02	97%	70%	130%	102%	80%	120%	96%	70%	130%
Chemical Oxygen Demand	4957938	4957938	12	14	NA	< 5	111%	80%	120%	109%	90%	110%	108%	70%	130%
Dissolved Organic Carbon	4957938	4957938	5.0	5.2	4.1%	< 0.5	105%	90%	110%	100%	90%	110%	91%	80%	120%
Dissolved Calcium	4957890		44.7	42.0	6.1%	< 0.05	109%	70%	130%	97%	80%	120%	88%	70%	130%
Dissolved Magnesium	4957890		11.0	11.3	2.9%	< 0.05	91%	70%	130%	105%	80%	120%	120%	70%	130%
Dissolved Potassium	4957890		1.80	1.71	NA	< 0.50	106%	70%	130%	109%	80%	120%	104%	70%	130%
Dissolved Sodium	4957890		12.2	13.5	10.1%	< 0.05	93%	70%	130%	100%	80%	120%	116%	70%	130%
Dissolved Aluminum	4957890		0.008	0.009	NA	< 0.004	88%	70%	130%	93%	80%	120%	101%	70%	130%
Dissolved Boron	4957890		<0.010	<0.010	NA	< 0.010	96%	70%	130%	100%	80%	120%	100%	70%	130%
Dissolved Iron	4957890		0.017	<0.010	NA	< 0.010	96%	70%	130%	110%	80%	120%	95%	70%	130%
Dissolved Lead	4957890		<0.0005	<0.0005	NA	< 0.0005	94%	70%	130%	96%	80%	120%	100%	70%	130%
Dissolved Manganese	4957890		0.005	0.004	NA	< 0.002	98%	70%	130%	99%	80%	120%	102%	70%	130%
Dissolved Strontium	4957890		0.425	0.412	3.0%	< 0.005	91%	70%	130%	107%	80%	120%	106%	70%	130%
Dissolved Zinc	4957890		<0.005	<0.005	NA	< 0.005	101%	70%	130%	98%	80%	120%	97%	70%	130%

Comments: If the RPD value is NA, the results of the duplicates are under 5X the RDL and will not be calculated.

Groundwater Parameters															
Electrical Conductivity	4957942	4957942	256	254	0.8%	< 2	99%	90%	110%						
pH	4957942	4957942	7.04	7.02	0.3%		102%	90%	110%						
Alkalinity (as CaCO3)	4957942	4957942	78	75	4.4%	< 5	100%	80%	120%						
Ammonia as N	4957947	4957947	<0.02	<0.02	NA	< 0.02	99%	70%	130%	103%	80%	120%	94%	70%	130%

Comments: If the RPD value is NA, the results of the duplicates are under 5X the RDL and will not be calculated.

Certified By:

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Method Summary

CLIENT NAME: BLUMETRIC ENVIRONMENTAL INC.

AGAT WORK ORDER: 23T020443

PROJECT: 230225-01

ATTENTION TO: Carolyn Miller

SAMPLING SITE:Wolf Creek

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Water Analysis			
Electrical Conductivity	INOR-93-6000	modified from SM 2510 B	PC TITRATE
pH	INOR-93-6000	modified from SM 4500-H+ B	PC TITRATE
Total Dissolved Solids	INOR-93-6028	modified from EPA 1684,ON MOECC E3139,SM 2540C,D	BALANCE
Alkalinity (as CaCO3)	INOR-93-6000	Modified from SM 2320 B	PC TITRATE
Chloride	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
Nitrate as N	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
Sulphate	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
Ammonia as N	INOR-93-6059	modified from SM 4500-NH3 H	LACHAT FIA
Chemical Oxygen Demand	INOR-93-6042	modified from SM 5220 A and SM 5220 D	SPECTROPHOTOMETER
Dissolved Organic Carbon	INOR-93-6049	modified from SM 5310 B	SHIMADZU CARBON ANALYZER
Dissolved Calcium	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP/MS
Dissolved Magnesium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP/MS
Dissolved Potassium	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP/MS
Dissolved Sodium	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP/MS
Dissolved Aluminum	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Boron	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Iron	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Lead	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Manganese	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Strontium	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Zinc	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS

AGAT Laboratories
5835 Coopers Avenue
Mississauga, Ontario L4Z 1Y2
Ph: 905.712.5100 Fax: 905.712.5122
webearth.agatlabs.com

Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water consumed by humans)

Laboratory Use Only
Work Order #: 23T020443
Cooler Quantity: 1 large
Arrival Temperatures: 7.2 | 6.8 | 6.2
Custody Seal Intact: ☐ Yes ☐ No ☒ N/A
Notes: logged in

Report Information:
Company: BluMetric
Contact: Carolyn Miller
Address: 4 Cataraqui St
Kingston, ON, K7K 1Z7
Phone: 613-328-0243 Fax:
Reports to be sent to:
1. Email: cmiller@blumetric.ca
2. Email: cbandler@blumetric.ca

Regulatory Requirements:
(Please check all applicable boxes)

☐ Regulation 153/04
Table (Indicate One) ☐ Ind/Com ☐ Res/Park ☐ Agriculture
Soil Texture (Check One) ☐ Coarse ☐ Fine

☐ Excess Soils R406
Table (Indicate One)
☐ Regulation 558
☐ CCME

☐ Sewer Use ☐ Sanitary ☐ Storm
(Region)
☐ Prov. Water Quality Objectives (PWQO)
☐ Other
(Indicate One)

Is this submission for a **Record of Site Condition?** ☐ Yes ☒ No

Report Guideline on *Certificate of Analysis* ☐ Yes ☒ No

Turnaround Time (TAT) Required:
Regular TAT ☒ 5 to 7 Business Days
Rush TAT (Rush Surcharges Apply)
☐ 3 Business Days ☐ 2 Business Days ☐ Next Business Day
OR Date Required (Rush Surcharges May Apply):
Please provide prior notification for rush TAT
*TAT is exclusive of weekends and statutory holidays
For 'Same Day' analysis, please contact your AGAT CPM

Project Information:
Project: 230225-01
Site Location: Wolf Creek
Sampled By:
AGAT Quote #: 740808 PO: 230225-01
Please note: If quotation number is not provided, client will be billed full price for analysis.

Invoice Information:
Bill To Same: Yes ☒ No ☐
Company:
Contact:
Address:
Email: ap@blumetric.ca

Sample Matrix Legend
B Biota
GW Ground Water
O Oil
P Paint
S Soil
SD Sediment
SW Surface Water

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Field Filtered (Metals, Hg, CrVI, DOC) Y/N	O. Reg 153: Metals & Inorganics	O. Reg 153: Metals - ☐ CrVI, ☐ Hg, ☐ HWSB	O. Reg 153: BTEX, F1-F4 PHCs	O. Reg 153: Analyze F4G if required ☐ Yes ☐ No	O. Reg 153: PAHs	O. Reg 153: PCBs	O. Reg 153: VOC	O. Reg 558: Landfill Disposal Characterization TCLP: ☐ M&I ☐ VOCs ☐ ABNs ☐ B(a)P ☐ PCBs	O. Reg 406: Excess Soils SPLP Rainwater Leach SPLP: ☐ Metals ☐ VOCs ☐ SVOCs	O. Reg 406: Excess Soils Characterization Package pH, ICPMS Metals, BTEX, F1-F4	Salt - EC/SAR	93-262 Groundwater	Potentially Hazardous or High Concentration (Y/N)
WC1-03	May 1, 2023	11:05 AM/PM	5	GW		Y												☑	
WC2-03	May 1, 2023	11:21 AM/PM	5	GW	Field filter: DOC, Metals	Y												☑	
WC3-03	May 1, 2023	10:55 AM/PM	5	GW		Y												☑	
WC4-19	May 1, 2023	11:58 AM/PM	5	GW		Y												☑	
WC5-19	May 1, 2023	11:17 AM/PM	5	GW		Y												☑	
WC6.1-19	May 1, 2023	11:30 AM/PM	5	GW		Y												☑	
WC6.2-19	May 1, 2023	11:38 AM/PM	5	GW		Y												☑	
WC6.3-19	May 1, 2023	11:43 AM/PM	5	GW		Y												☑	
WC-QAQC-GW1	May 1, 2023	11:05 AM/PM	5	GW		Y												☑	
				AM/PM															
				AM/PM															

Samples Relinquished By (Print Name and Sign)	Date	Time	Samples Received By (Print Name and Sign)	Date	Time
Brad M'Callum / Brad M'Callum	May 2, 2023	8:00 AM	T. Pearson	May 3	8:45 AM

Page 1 of 1

Your P.O. #: 230225-01
Your Project #: 230225-01
Site#: 200
Site Location: Wolf Creek
Your C.O.C. #: 784735

Attention: Cecilia Bandler

BluMetric Environmental Inc
The Tower - The Woolen Mill
4 Cataraqui St
Kingston, ON
CANADA K7K 1Z7

Report Date: 2023/10/25
Report #: R7878881
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C3W4760
Received: 2023/10/18, 09:57

Sample Matrix: Water
Samples Received: 9

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity	1	N/A	2023/10/21	CAM SOP-00448	SM 23 2320 B m
Alkalinity	3	N/A	2023/10/23	CAM SOP-00448	SM 23 2320 B m
Alkalinity	5	N/A	2023/10/24	CAM SOP-00448	SM 23 2320 B m
Chloride by Automated Colourimetry	8	N/A	2023/10/21	CAM SOP-00463	SM 23 4500-Cl E m
Chloride by Automated Colourimetry	1	N/A	2023/10/23	CAM SOP-00463	SM 23 4500-Cl E m
Chemical Oxygen Demand	3	N/A	2023/10/21	CAM SOP-00416	SM 23 5220 D m
Chemical Oxygen Demand	1	N/A	2023/10/23	CAM SOP-00416	SM 23 5220 D m
Chemical Oxygen Demand	5	N/A	2023/10/25	CAM SOP-00416	SM 23 5220 D m
Conductivity	1	N/A	2023/10/21	CAM SOP-00414	SM 23 2510 m
Conductivity	3	N/A	2023/10/23	CAM SOP-00414	SM 23 2510 m
Conductivity	5	N/A	2023/10/24	CAM SOP-00414	SM 23 2510 m
Dissolved Organic Carbon (DOC) (1)	9	N/A	2023/10/25	CAM SOP-00446	SM 23 5310 B m
Dissolved Metals by ICPMS	5	N/A	2023/10/20	CAM SOP-00447	EPA 6020B m
Dissolved Metals by ICPMS	4	N/A	2023/10/21	CAM SOP-00447	EPA 6020B m
Total Ammonia-N	9	N/A	2023/10/23	CAM SOP-00441	USGS I-2522-90 m
Nitrate & Nitrite as Nitrogen in Water (2)	9	N/A	2023/10/22	CAM SOP-00440	SM 23 4500-NO3I/NO2B
pH	3	2023/10/19	2023/10/23	CAM SOP-00413	SM 4500H+ B m
pH	5	2023/10/19	2023/10/24	CAM SOP-00413	SM 4500H+ B m
pH	1	2023/10/20	2023/10/21	CAM SOP-00413	SM 4500H+ B m
Sulphate by Automated Turbidimetry	8	N/A	2023/10/21	CAM SOP-00464	SM 23 4500-SO42- E m
Sulphate by Automated Turbidimetry	1	N/A	2023/10/23	CAM SOP-00464	SM 23 4500-SO42- E m
Total Dissolved Solids	1	2023/10/21	2023/10/23	CAM SOP-00428	SM 23 2540C m
Total Dissolved Solids	8	2023/10/24	2023/10/25	CAM SOP-00428	SM 23 2540C m

Remarks:

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

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are

Your P.O. #: 230225-01
Your Project #: 230225-01
Site#: 200
Site Location: Wolf Creek
Your C.O.C. #: 784735

Attention: Cecilia Bandler

BluMetric Environmental Inc
The Tower - The Woolen Mill
4 Cataraqui St
Kingston, ON
CANADA K7K 1Z7

Report Date: 2023/10/25
Report #: R7878881
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C3W4760
Received: 2023/10/18, 09:57

reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

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

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

Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) Dissolved 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:
Christine Gripton, Senior Project Manager
Email: Christine.Gripton@bureauveritas.com
Phone# (519)652-9444

==========

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

Bureau Veritas Job #: C3W4760
Report Date: 2023/10/25

BluMetric Environmental Inc
Client Project #: 230225-01
Site Location: Wolf Creek
Your P.O. #: 230225-01
Sampler Initials: BM

RESULTS OF ANALYSES OF WATER

Bureau Veritas ID		XIG976			XIG976			XIG977		
Sampling Date		2023/10/16 12:20			2023/10/16 12:20			2023/10/16 12:45		
COC Number		784735			784735			784735		
	UNITS	WC1-03	RDL	QC Batch	WC1-03 Lab-Dup	RDL	QC Batch	WC2-03	RDL	QC Batch
Inorganics										
Total Ammonia-N	mg/L	ND	0.050	8997085	ND	0.050	8997085	ND	0.050	8997085
Total Chemical Oxygen Demand (COD)	mg/L	13	4.0	8996976				6.7	4.0	8996976
Conductivity	umho/cm	53	1.0	8993823				330	1.0	8993823
Total Dissolved Solids	mg/L	ND	10	8996238	10	10	8996238	225	10	8998965
Dissolved Organic Carbon	mg/L	3.9	0.4	8999401				2.9	0.4	8999401
pH	pH	7.24		8993824				7.10		8993824
Dissolved Sulphate (SO4)	mg/L	5.2	1.0	8993915				65	1.0	8993915
Alkalinity (Total as CaCO3)	mg/L	15	1.0	8993818				84	1.0	8993818
Dissolved Chloride (Cl-)	mg/L	ND	1.0	8993910				ND	1.0	8993910
Nitrate (N)	mg/L	0.73	0.10	8993884				2.44	0.10	8993886

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
ND = Not Detected at a concentration equal or greater than the indicated Detection Limit.

Bureau Veritas ID		XIG978		XIG979		XIG980		
Sampling Date		2023/10/16 12:00		2023/10/16 12:35		2023/10/16 13:30		
COC Number		784735		784735		784735		
	UNITS	WC3-03	QC Batch	WC4-19	QC Batch	WC5-19	RDL	QC Batch
Inorganics								
Total Ammonia-N	mg/L	ND	8997085	0.15	8997085	ND	0.050	8997085
Total Chemical Oxygen Demand (COD)	mg/L	7.4	8996976	10	8996976	ND	4.0	8995728
Conductivity	umho/cm	56	8993823	250	8993823	180	1.0	8993823
Total Dissolved Solids	mg/L	40	8998965	160	8998965	125	10	8998994
Dissolved Organic Carbon	mg/L	1.3	8999401	3.1	8999401	2.4	0.4	8999401
pH	pH	7.08	8993824	7.17	8993824	7.11		8993824
Dissolved Sulphate (SO4)	mg/L	3.2	8993915	31	8993915	14	1.0	8993915
Alkalinity (Total as CaCO3)	mg/L	21	8993818	78	8993818	61	1.0	8993818
Dissolved Chloride (Cl-)	mg/L	ND	8993910	2.8	8993910	ND	1.0	8993910
Nitrate (N)	mg/L	0.67	8993886	2.09	8993884	3.07	0.10	8993884

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
ND = Not Detected at a concentration equal or greater than the indicated Detection Limit.

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

Bureau Veritas Job #: C3W4760
Report Date: 2023/10/25

BluMetric Environmental Inc
Client Project #: 230225-01
Site Location: Wolf Creek
Your P.O. #: 230225-01
Sampler Initials: BM

RESULTS OF ANALYSES OF WATER

Bureau Veritas ID		XIG981		XIG982		XIG983		
Sampling Date		2023/10/16 13:07		2023/10/16 13:00		2023/10/16 13:17		
COC Number		784735		784735		784735		
	UNITS	WC6.1-19	QC Batch	WC6.2-19	QC Batch	WC6.3-19	RDL	QC Batch
Inorganics								
Total Ammonia-N	mg/L	ND	8997085	0.22	8997085	ND	0.050	8997085
Total Chemical Oxygen Demand (COD)	mg/L	10	8996976	ND	8995728	16	4.0	8995728
Conductivity	umho/cm	140	8993823	97	8994485	430	1.0	8993823
Total Dissolved Solids	mg/L	150	8998965	90	8998994	300	10	8998965
Dissolved Organic Carbon	mg/L	1.6	8999401	2.9	8999401	4.2	0.4	8999401
pH	pH	7.45	8993824	6.94	8994484	6.97		8993824
Dissolved Sulphate (SO4)	mg/L	7.8	8993915	9.0	8994524	81	1.0	8993915
Alkalinity (Total as CaCO3)	mg/L	61	8993818	42	8994482	110	1.0	8993818
Dissolved Chloride (Cl-)	mg/L	ND	8993910	ND	8994520	ND	1.0	8993910
Nitrate (N)	mg/L	ND	8993886	ND	8994459	4.00	0.10	8993886

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
ND = Not Detected at a concentration equal or greater than the indicated Detection Limit.

Bureau Veritas ID		XIG983			XIG984		
Sampling Date		2023/10/16 13:17			2023/10/16 12:20		
COC Number		784735			784735		
	UNITS	WC6.3-19 Lab-Dup	RDL	QC Batch	WC-QAQC-GW1	RDL	QC Batch
Inorganics							
Total Ammonia-N	mg/L				ND	0.050	8997085
Total Chemical Oxygen Demand (COD)	mg/L				14	4.0	8995728
Conductivity	umho/cm				53	1.0	8993823
Total Dissolved Solids	mg/L				45	10	8998965
Dissolved Organic Carbon	mg/L	4.2	0.4	8999401	3.7	0.4	8999401
pH	pH				6.96		8993824
Dissolved Sulphate (SO4)	mg/L				4.8	1.0	8993915
Alkalinity (Total as CaCO3)	mg/L				15	1.0	8993818
Dissolved Chloride (Cl-)	mg/L				ND	1.0	8993910
Nitrate (N)	mg/L				0.75	0.10	8993886

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
ND = Not Detected at a concentration equal or greater than the indicated Detection Limit.

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

Bureau Veritas Job #: C3W4760
Report Date: 2023/10/25

BluMetric Environmental Inc
Client Project #: 230225-01
Site Location: Wolf Creek
Your P.O. #: 230225-01
Sampler Initials: BM

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Bureau Veritas ID		XIG976	XIG977		XIG978		XIG979		XIG980		
Sampling Date		2023/10/16 12:20	2023/10/16 12:45		2023/10/16 12:00		2023/10/16 12:35		2023/10/16 13:30		
COC Number		784735	784735		784735		784735		784735		
	UNITS	WC1-03	WC2-03	QC Batch	WC3-03	QC Batch	WC4-19	QC Batch	WC5-19	RDL	QC Batch
Metals											
Dissolved Aluminum (Al)	ug/L	70	ND	8995103	ND	8994737	ND	8995103	8.3	4.9	8994737
Dissolved Boron (B)	ug/L	16	150	8995103	ND	8994737	140	8995103	140	10	8994737
Dissolved Calcium (Ca)	ug/L	6100	48000	8995103	6000	8994737	32000	8995103	17000	200	8994737
Dissolved Iron (Fe)	ug/L	ND	ND	8995103	ND	8994737	ND	8995103	ND	100	8994737
Dissolved Lead (Pb)	ug/L	ND	ND	8995103	ND	8994737	ND	8995103	ND	0.50	8994737
Dissolved Magnesium (Mg)	ug/L	1300	7100	8995103	1600	8994737	5300	8995103	3200	50	8994737
Dissolved Manganese (Mn)	ug/L	ND	ND	8995103	ND	8994737	290	8995103	ND	2.0	8994737
Dissolved Potassium (K)	ug/L	1000	6400	8995103	1300	8994737	11000	8995103	2700	200	8994737
Dissolved Sodium (Na)	ug/L	1000	2900	8995103	1500	8994737	4000	8995103	15000	100	8994737
Dissolved Strontium (Sr)	ug/L	25	260	8995103	40	8994737	130	8995103	130	1.0	8994737
Dissolved Zinc (Zn)	ug/L	ND	ND	8995103	ND	8994737	ND	8995103	ND	5.0	8994737

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
ND = Not Detected at a concentration equal or greater than the indicated Detection Limit.

Bureau Veritas ID		XIG981	XIG982		XIG983		XIG984		
Sampling Date		2023/10/16 13:07	2023/10/16 13:00		2023/10/16 13:17		2023/10/16 12:20		
COC Number		784735	784735		784735		784735		
	UNITS	WC6.1-19	WC6.2-19	QC Batch	WC6.3-19	QC Batch	WC-QAQC-GW1	RDL	QC Batch
Metals									
Dissolved Aluminum (Al)	ug/L	22	23	8994737	6.4	8995103	73	4.9	8994737
Dissolved Boron (B)	ug/L	ND	ND	8994737	160	8995103	ND	10	8994737
Dissolved Calcium (Ca)	ug/L	20000	13000	8994737	64000	8995103	6100	200	8994737
Dissolved Iron (Fe)	ug/L	ND	ND	8994737	ND	8995103	ND	100	8994737
Dissolved Lead (Pb)	ug/L	ND	ND	8994737	ND	8995103	ND	0.50	8994737
Dissolved Magnesium (Mg)	ug/L	3800	2700	8994737	11000	8995103	1400	50	8994737
Dissolved Manganese (Mn)	ug/L	ND	20	8994737	ND	8995103	ND	2.0	8994737
Dissolved Potassium (K)	ug/L	1800	1400	8994737	7800	8995103	1100	200	8994737
Dissolved Sodium (Na)	ug/L	2000	1900	8994737	4700	8995103	1100	100	8994737
Dissolved Strontium (Sr)	ug/L	57	39	8994737	660	8995103	26	1.0	8994737
Dissolved Zinc (Zn)	ug/L	ND	ND	8994737	ND	8995103	ND	5.0	8994737

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
ND = Not Detected at a concentration equal or greater than the indicated Detection Limit.

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

Bureau Veritas Job #: C3W4760
Report Date: 2023/10/25

BluMetric Environmental Inc
Client Project #: 230225-01
Site Location: Wolf Creek
Your P.O. #: 230225-01
Sampler Initials: BM

TEST SUMMARY

Bureau Veritas ID: XIG976
Sample ID: WC1-03
Matrix: Water

Collected: 2023/10/16
Shipped:
Received: 2023/10/18

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	8993818	N/A	2023/10/23	Surinder Rai
Chloride by Automated Colourimetry	KONE	8993910	N/A	2023/10/21	Massarat Jan
Chemical Oxygen Demand	SPEC	8996976	N/A	2023/10/25	Nimarta Singh
Conductivity	AT	8993823	N/A	2023/10/23	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	8999401	N/A	2023/10/25	Gyulshen Idriz
Dissolved Metals by ICPMS	ICP/MS	8995103	N/A	2023/10/21	Azita Fazaeli
Total Ammonia-N	LACH/NH4	8997085	N/A	2023/10/23	Prabhjot Kaur
Nitrate & Nitrite as Nitrogen in Water	LACH	8993884	N/A	2023/10/22	Chandra Nandlal
pH	AT	8993824	2023/10/19	2023/10/23	Surinder Rai
Sulphate by Automated Turbidimetry	KONE	8993915	N/A	2023/10/21	Yogesh Patel
Total Dissolved Solids	BAL	8996238	2023/10/21	2023/10/23	Shaneil Hall

Bureau Veritas ID: XIG976 Dup
Sample ID: WC1-03
Matrix: Water

Collected: 2023/10/16
Shipped:
Received: 2023/10/18

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Ammonia-N	LACH/NH4	8997085	N/A	2023/10/23	Prabhjot Kaur
Total Dissolved Solids	BAL	8996238	2023/10/21	2023/10/23	Shaneil Hall

Bureau Veritas ID: XIG977
Sample ID: WC2-03
Matrix: Water

Collected: 2023/10/16
Shipped:
Received: 2023/10/18

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	8993818	N/A	2023/10/24	Surinder Rai
Chloride by Automated Colourimetry	KONE	8993910	N/A	2023/10/21	Massarat Jan
Chemical Oxygen Demand	SPEC	8996976	N/A	2023/10/25	Nimarta Singh
Conductivity	AT	8993823	N/A	2023/10/24	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	8999401	N/A	2023/10/25	Gyulshen Idriz
Dissolved Metals by ICPMS	ICP/MS	8995103	N/A	2023/10/21	Azita Fazaeli
Total Ammonia-N	LACH/NH4	8997085	N/A	2023/10/23	Prabhjot Kaur
Nitrate & Nitrite as Nitrogen in Water	LACH	8993886	N/A	2023/10/22	Chandra Nandlal
pH	AT	8993824	2023/10/19	2023/10/24	Surinder Rai
Sulphate by Automated Turbidimetry	KONE	8993915	N/A	2023/10/21	Yogesh Patel
Total Dissolved Solids	BAL	8998965	2023/10/24	2023/10/25	Shaneil Hall

Bureau Veritas ID: XIG978
Sample ID: WC3-03
Matrix: Water

Collected: 2023/10/16
Shipped:
Received: 2023/10/18

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	8993818	N/A	2023/10/24	Surinder Rai

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

Bureau Veritas Job #: C3W4760
Report Date: 2023/10/25

BluMetric Environmental Inc
Client Project #: 230225-01
Site Location: Wolf Creek
Your P.O. #: 230225-01
Sampler Initials: BM

TEST SUMMARY

Bureau Veritas ID: XIG978
Sample ID: WC3-03
Matrix: Water

Collected: 2023/10/16
Shipped:
Received: 2023/10/18

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride by Automated Colourimetry	KONE	8993910	N/A	2023/10/21	Massarat Jan
Chemical Oxygen Demand	SPEC	8996976	N/A	2023/10/25	Nimarta Singh
Conductivity	AT	8993823	N/A	2023/10/24	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	8999401	N/A	2023/10/25	Gyulshen Idriz
Dissolved Metals by ICPMS	ICP/MS	8994737	N/A	2023/10/20	Arefa Dabhad
Total Ammonia-N	LACH/NH4	8997085	N/A	2023/10/23	Prabhjot Kaur
Nitrate & Nitrite as Nitrogen in Water	LACH	8993886	N/A	2023/10/22	Chandra Nandlal
pH	AT	8993824	2023/10/19	2023/10/24	Surinder Rai
Sulphate by Automated Turbidimetry	KONE	8993915	N/A	2023/10/21	Yogesh Patel
Total Dissolved Solids	BAL	8998965	2023/10/24	2023/10/25	Shaneil Hall

Bureau Veritas ID: XIG979
Sample ID: WC4-19
Matrix: Water

Collected: 2023/10/16
Shipped:
Received: 2023/10/18

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	8993818	N/A	2023/10/24	Surinder Rai
Chloride by Automated Colourimetry	KONE	8993910	N/A	2023/10/21	Massarat Jan
Chemical Oxygen Demand	SPEC	8996976	N/A	2023/10/25	Nimarta Singh
Conductivity	AT	8993823	N/A	2023/10/24	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	8999401	N/A	2023/10/25	Gyulshen Idriz
Dissolved Metals by ICPMS	ICP/MS	8995103	N/A	2023/10/21	Azita Fazaeli
Total Ammonia-N	LACH/NH4	8997085	N/A	2023/10/23	Prabhjot Kaur
Nitrate & Nitrite as Nitrogen in Water	LACH	8993884	N/A	2023/10/22	Chandra Nandlal
pH	AT	8993824	2023/10/19	2023/10/24	Surinder Rai
Sulphate by Automated Turbidimetry	KONE	8993915	N/A	2023/10/21	Yogesh Patel
Total Dissolved Solids	BAL	8998965	2023/10/24	2023/10/25	Shaneil Hall

Bureau Veritas ID: XIG980
Sample ID: WC5-19
Matrix: Water

Collected: 2023/10/16
Shipped:
Received: 2023/10/18

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	8993818	N/A	2023/10/23	Surinder Rai
Chloride by Automated Colourimetry	KONE	8993910	N/A	2023/10/21	Massarat Jan
Chemical Oxygen Demand	SPEC	8995728	N/A	2023/10/21	Nimarta Singh
Conductivity	AT	8993823	N/A	2023/10/23	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	8999401	N/A	2023/10/25	Gyulshen Idriz
Dissolved Metals by ICPMS	ICP/MS	8994737	N/A	2023/10/20	Arefa Dabhad
Total Ammonia-N	LACH/NH4	8997085	N/A	2023/10/23	Prabhjot Kaur
Nitrate & Nitrite as Nitrogen in Water	LACH	8993884	N/A	2023/10/22	Chandra Nandlal
pH	AT	8993824	2023/10/19	2023/10/23	Surinder Rai
Sulphate by Automated Turbidimetry	KONE	8993915	N/A	2023/10/21	Yogesh Patel

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

TEST SUMMARY

Bureau Veritas ID: XIG980
Sample ID: WC5-19
Matrix: Water

Collected: 2023/10/16
Shipped:
Received: 2023/10/18

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Dissolved Solids	BAL	8998994	2023/10/24	2023/10/25	Razieh Tabesh

Bureau Veritas ID: XIG981
Sample ID: WC6.1-19
Matrix: Water

Collected: 2023/10/16
Shipped:
Received: 2023/10/18

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	8993818	N/A	2023/10/24	Surinder Rai
Chloride by Automated Colourimetry	KONE	8993910	N/A	2023/10/21	Massarat Jan
Chemical Oxygen Demand	SPEC	8996976	N/A	2023/10/25	Nimarta Singh
Conductivity	AT	8993823	N/A	2023/10/24	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	8999401	N/A	2023/10/25	Gyulshen Idriz
Dissolved Metals by ICPMS	ICP/MS	8994737	N/A	2023/10/20	Arefa Dabhad
Total Ammonia-N	LACH/NH4	8997085	N/A	2023/10/23	Prabhjot Kaur
Nitrate & Nitrite as Nitrogen in Water	LACH	8993886	N/A	2023/10/22	Chandra Nandlal
pH	AT	8993824	2023/10/19	2023/10/24	Surinder Rai
Sulphate by Automated Turbidimetry	KONE	8993915	N/A	2023/10/21	Yogesh Patel
Total Dissolved Solids	BAL	8998965	2023/10/24	2023/10/25	Shaneil Hall

Bureau Veritas ID: XIG982
Sample ID: WC6.2-19
Matrix: Water

Collected: 2023/10/16
Shipped:
Received: 2023/10/18

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	8994482	N/A	2023/10/21	Nachiketa Gohil
Chloride by Automated Colourimetry	KONE	8994520	N/A	2023/10/23	Massarat Jan
Chemical Oxygen Demand	SPEC	8995728	N/A	2023/10/21	Nimarta Singh
Conductivity	AT	8994485	N/A	2023/10/21	Nachiketa Gohil
Dissolved Organic Carbon (DOC)	TOCV/NDIR	8999401	N/A	2023/10/25	Gyulshen Idriz
Dissolved Metals by ICPMS	ICP/MS	8994737	N/A	2023/10/20	Arefa Dabhad
Total Ammonia-N	LACH/NH4	8997085	N/A	2023/10/23	Prabhjot Kaur
Nitrate & Nitrite as Nitrogen in Water	LACH	8994459	N/A	2023/10/22	Chandra Nandlal
pH	AT	8994484	2023/10/20	2023/10/21	Nachiketa Gohil
Sulphate by Automated Turbidimetry	KONE	8994524	N/A	2023/10/23	Alina Dobreanu
Total Dissolved Solids	BAL	8998994	2023/10/24	2023/10/25	Razieh Tabesh

Bureau Veritas ID: XIG983
Sample ID: WC6.3-19
Matrix: Water

Collected: 2023/10/16
Shipped:
Received: 2023/10/18

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	8993818	N/A	2023/10/23	Surinder Rai
Chloride by Automated Colourimetry	KONE	8993910	N/A	2023/10/21	Massarat Jan

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

Bureau Veritas Job #: C3W4760
Report Date: 2023/10/25

BluMetric Environmental Inc
Client Project #: 230225-01
Site Location: Wolf Creek
Your P.O. #: 230225-01
Sampler Initials: BM

TEST SUMMARY

Bureau Veritas ID: XIG983
Sample ID: WC6.3-19
Matrix: Water

Collected: 2023/10/16
Shipped:
Received: 2023/10/18

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chemical Oxygen Demand	SPEC	8995728	N/A	2023/10/23	Nimarta Singh
Conductivity	AT	8993823	N/A	2023/10/23	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	8999401	N/A	2023/10/25	Gyulshen Idriz
Dissolved Metals by ICPMS	ICP/MS	8995103	N/A	2023/10/21	Azita Fazaeli
Total Ammonia-N	LACH/NH4	8997085	N/A	2023/10/23	Prabhjot Kaur
Nitrate & Nitrite as Nitrogen in Water	LACH	8993886	N/A	2023/10/22	Chandra Nandlal
pH	AT	8993824	2023/10/19	2023/10/23	Surinder Rai
Sulphate by Automated Turbidimetry	KONE	8993915	N/A	2023/10/21	Yogesh Patel
Total Dissolved Solids	BAL	8998965	2023/10/24	2023/10/25	Shaneil Hall

Bureau Veritas ID: XIG983 Dup
Sample ID: WC6.3-19
Matrix: Water

Collected: 2023/10/16
Shipped:
Received: 2023/10/18

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Dissolved Organic Carbon (DOC)	TOCV/NDIR	8999401	N/A	2023/10/25	Gyulshen Idriz

Bureau Veritas ID: XIG984
Sample ID: WC-QAQC-GW1
Matrix: Water

Collected: 2023/10/16
Shipped:
Received: 2023/10/18

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	8993818	N/A	2023/10/24	Surinder Rai
Chloride by Automated Colourimetry	KONE	8993910	N/A	2023/10/21	Massarat Jan
Chemical Oxygen Demand	SPEC	8995728	N/A	2023/10/21	Nimarta Singh
Conductivity	AT	8993823	N/A	2023/10/24	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	8999401	N/A	2023/10/25	Gyulshen Idriz
Dissolved Metals by ICPMS	ICP/MS	8994737	N/A	2023/10/20	Arefa Dabhad
Total Ammonia-N	LACH/NH4	8997085	N/A	2023/10/23	Prabhjot Kaur
Nitrate & Nitrite as Nitrogen in Water	LACH	8993886	N/A	2023/10/22	Chandra Nandlal
pH	AT	8993824	2023/10/19	2023/10/24	Surinder Rai
Sulphate by Automated Turbidimetry	KONE	8993915	N/A	2023/10/21	Yogesh Patel
Total Dissolved Solids	BAL	8998965	2023/10/24	2023/10/25	Shaneil Hall

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

GENERAL COMMENTS

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

Package 1	3.3°C

TDS Analysis was performed past sample holding time. This may increase the variability associated with these results.

Sample XIG980 [WC5-19] : TDS Analysis: Analysis was performed past sample holding time. This may increase the variability associated with these results.

Sample XIG982 [WC6.2-19] : TDS Analysis: Analysis was performed past sample holding time. This may increase the variability associated with these results.

Results relate only to the items tested.

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

Bureau Veritas Job #: C3W4760
Report Date: 2023/10/25

QUALITY ASSURANCE REPORT

BluMetric Environmental Inc
Client Project #: 230225-01
Site Location: Wolf Creek
Your P.O. #: 230225-01
Sampler Initials: BM

			Matrix Spike		SPIKED BLANK		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
8993818	Alkalinity (Total as CaCO3)	2023/10/23			97	85 - 115	ND, RDL=1.0	mg/L	2.0	20
8993823	Conductivity	2023/10/23			101	85 - 115	ND, RDL=1.0	umho/cm	0.31	10
8993824	pH	2023/10/23			102	98 - 103			0.93	N/A
8993884	Nitrate (N)	2023/10/22	106	80 - 120	101	80 - 120	ND, RDL=0.10	mg/L	1.1	20
8993886	Nitrate (N)	2023/10/22	104	80 - 120	102	80 - 120	ND, RDL=0.10	mg/L	NC	20
8993910	Dissolved Chloride (Cl-)	2023/10/21	NC	80 - 120	94	80 - 120	ND, RDL=1.0	mg/L	2.8	20
8993915	Dissolved Sulphate (SO4)	2023/10/21	98	75 - 125	104	80 - 120	ND, RDL=1.0	mg/L	NC	20
8994459	Nitrate (N)	2023/10/22	105	80 - 120	107	80 - 120	ND, RDL=0.10	mg/L	3.5	20
8994482	Alkalinity (Total as CaCO3)	2023/10/21			96	85 - 115	ND, RDL=1.0	mg/L	0.43	20
8994484	pH	2023/10/21			102	98 - 103			1.4	N/A
8994485	Conductivity	2023/10/21			100	85 - 115	ND, RDL=1.0	umho/cm	0.18	10
8994520	Dissolved Chloride (Cl-)	2023/10/23	NC	80 - 120	98	80 - 120	ND, RDL=1.0	mg/L	1.3	20
8994524	Dissolved Sulphate (SO4)	2023/10/23	90	75 - 125	93	80 - 120	ND, RDL=1.0	mg/L	0.64	20
8994737	Dissolved Aluminum (Al)	2023/10/20	105	80 - 120	107	80 - 120	ND, RDL=4.9	ug/L		
8994737	Dissolved Boron (B)	2023/10/20	105	80 - 120	101	80 - 120	ND, RDL=10	ug/L		
8994737	Dissolved Calcium (Ca)	2023/10/20	NC	80 - 120	106	80 - 120	ND, RDL=200	ug/L	3.6	20
8994737	Dissolved Iron (Fe)	2023/10/20	102	80 - 120	103	80 - 120	ND, RDL=100	ug/L		
8994737	Dissolved Lead (Pb)	2023/10/20	93	80 - 120	94	80 - 120	ND, RDL=0.50	ug/L		
8994737	Dissolved Magnesium (Mg)	2023/10/20	NC	80 - 120	105	80 - 120	ND, RDL=50	ug/L	0.91	20
8994737	Dissolved Manganese (Mn)	2023/10/20	101	80 - 120	100	80 - 120	ND, RDL=2.0	ug/L		
8994737	Dissolved Potassium (K)	2023/10/20	112	80 - 120	108	80 - 120	ND, RDL=200	ug/L	0.55	20
8994737	Dissolved Sodium (Na)	2023/10/20	NC	80 - 120	104	80 - 120	ND, RDL=100	ug/L	0.17	20
8994737	Dissolved Strontium (Sr)	2023/10/20	NC	80 - 120	98	80 - 120	ND, RDL=1.0	ug/L		
8994737	Dissolved Zinc (Zn)	2023/10/20	97	80 - 120	98	80 - 120	ND, RDL=5.0	ug/L		
8995103	Dissolved Aluminum (Al)	2023/10/21	100	80 - 120	99	80 - 120	ND, RDL=4.9	ug/L	4.8	20
8995103	Dissolved Boron (B)	2023/10/21	NC	80 - 120	100	80 - 120	ND, RDL=10	ug/L		
8995103	Dissolved Calcium (Ca)	2023/10/21	NC	80 - 120	104	80 - 120	ND, RDL=200	ug/L	0.36	20
8995103	Dissolved Iron (Fe)	2023/10/21	97	80 - 120	99	80 - 120	ND, RDL=100	ug/L	NC	20
8995103	Dissolved Lead (Pb)	2023/10/21	94	80 - 120	95	80 - 120	ND, RDL=0.50	ug/L	NC	20
8995103	Dissolved Magnesium (Mg)	2023/10/21	NC	80 - 120	98	80 - 120	ND, RDL=50	ug/L	0.17	20

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

QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
8995103	Dissolved Manganese (Mn)	2023/10/21	96	80 - 120	98	80 - 120	ND, RDL=2.0	ug/L	0.0089	20
8995103	Dissolved Potassium (K)	2023/10/21	99	80 - 120	101	80 - 120	ND, RDL=200	ug/L	0.57	20
8995103	Dissolved Sodium (Na)	2023/10/21	NC	80 - 120	100	80 - 120	ND, RDL=100	ug/L	0.12	20
8995103	Dissolved Strontium (Sr)	2023/10/21	NC	80 - 120	98	80 - 120	ND, RDL=1.0	ug/L	0.17	20
8995103	Dissolved Zinc (Zn)	2023/10/21	96	80 - 120	98	80 - 120	ND, RDL=5.0	ug/L	NC	20
8995728	Total Chemical Oxygen Demand (COD)	2023/10/20	87	80 - 120	97	80 - 120	ND, RDL=4.0	mg/L	13	20
8996238	Total Dissolved Solids	2023/10/23			98	90 - 110	ND, RDL=10	mg/L	0	20
8996976	Total Chemical Oxygen Demand (COD)	2023/10/25	99	80 - 120	97	80 - 120	ND, RDL=4.0	mg/L	0	20
8997085	Total Ammonia-N	2023/10/23	101	75 - 125	100	80 - 120	ND, RDL=0.050	mg/L	NC	20
8998965	Total Dissolved Solids	2023/10/25			102	90 - 110	ND, RDL=10	mg/L	2.8	20
8998994	Total Dissolved Solids	2023/10/25			98	90 - 110	ND, RDL=10	mg/L	1.1	20
8999401	Dissolved Organic Carbon	2023/10/25	95	80 - 120	99	80 - 120	ND, RDL=0.4	mg/L	0.41	20

N/A = Not Applicable

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

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

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

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

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).

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

Bureau Veritas Job #: C3W4760
Report Date: 2023/10/25

BluMetric Environmental Inc
Client Project #: 230225-01
Site Location: Wolf Creek
Your P.O. #: 230225-01
Sampler Initials: BM

VALIDATION SIGNATURE PAGE

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

Cristina Carriere

Cristina Carriere, Senior Scientific Specialist

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

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

Custody Tracking Form

1784735

2023/10/18 ASR

1781219

2023/10/18 ASL

Please use this form for custody tracking when submitting the work instructions via eCOC (electronic Chain of Custody). Please ensure your form has a barcode or a Bureau Veritas eCOC confirmation number in the top right hand side. This number links your electronic submission to your samples. This form should be placed in the cooler with your samples.

First Sample: WC1-03
Last Sample: WC-QAQC-GW1
Sample Count: 9

Relinquished By				Received By			
Brad McCallum	Brad McCa	Date	2023/10/17	Ashitha Sukumaran	ASHITHA Sukumaran	Date	2023/10/18
		Time (24 HR)	08:00			Time (24 HR)	09:57
Print	Sign	Date	YYYY/MM/DD	Print	Sign	Date	YYYY/MM/DD
		Time (24 HR)	HH:MM			Time (24 HR)	HH:MM
Print	Sign	Date	YYYY/MM/DD	Print	Sign	Date	YYYY/MM/DD
		Time (24 HR)	HH:MM			Time (24 HR)	HH:MM

Unless otherwise agreed to, submissions and use of services are governed by Bureau Veritas' standard terms and conditions which can be found at www.bvna.com.

Triage Information

Sampled By (Print): Brad McCallum / Matt DeGeer

# of Coolers/Pkgs: 1

Rush ☐ Immediate Test ☐ Food Residue ☐

Micro ☐ Food Chemistry ☐

*** LABORATORY USE ONLY ***

Received At

Labeled By

Verified By

Lab Comments:

18-Oct-23 09:57
Christine Gripton
C3W4760
SWP env-1305

Custody Seal		Cooling Media	Temperature °C		
Present (Y/N)	Intact (Y/N)	Present (Y/N)	1	2	3
Y	Y	Y	3	4	3

Drinking Water Metals Preservation Check Done (Circle) **YES** **NO**

COR FCD-00383/4

Page 1 of 1

Appendix D

D-3 QA/QC Comparison Calculations

2023 Groundwater Sampling Quality Assurance and Quality Control
(Spring)

Sample Description		RDL	WC1-03	WC-QAQC GW1 (WC1-03)	Relative Percent Difference
Date Sampled			1-May-23	1-May-23	
Parameter	Unit				
pH	pH Units	0.01	6.71	6.75	1%
Alkalinity (as CaCO3)	mg/L	5	20	18	NA
Electrical Conductivity	uS/cm	2	108	111	3%
Total Dissolved Solids	mg/L	10	82	102	22%
Chloride	mg/L	0.10	0.41	0.47	NA
Nitrate as N	mg/L	0.05	6.42	6.81	6%
Sulphate	mg/L	0.10	4.64	4.74	2%
Ammonia as N	mg/L	0.02	<0.02	<0.02	NA
Chemical Oxygen Demand	mg/L	5	12	5	NA
Dissolved Organic Carbon	mg/L	0.5	5	3.8	27%
Dissolved Calcium	mg/L	0.05	12.9	13.9	7%
Dissolved Magnesium	mg/L	0.05	2.33	2.73	16%
Dissolved Potassium	mg/L	0.50	1.29	1.28	NA
Dissolved Sodium	mg/L	0.05	1.821	1.839	1%
Dissolved Aluminum	mg/L	0.004	0.063	0.075	17%
Dissolved Boron	mg/L	0.010	0.019	0.018	NA
Dissolved Lead	mg/L	0.001	<0.0005	<0.0005	NA
Dissolved Iron	mg/L	0.010	0.021	0.019	NA
Dissolved Manganese	mg/L	0.002	0.006	0.004	NA
Dissolved Strontium	mg/L	0.005	0.055	0.056	2%
Dissolved Zinc	mg/L	0.005	<0.005	<0.005	NA

Grey shading indicates the maximum RPD calculated when no value exceeds high level of reproducibility.

Yellow shading indicates RPD value is above the percentage for a high level of reproducibility:

NA - RPD not applicable when average result is <5x RDL

10% for electrical conductivity

20% for metals and inorganics

30% for BTEX and PHC.

2023 Groundwater Sampling Quality Assurance and Quality Control
(Fall)

Sample Description		RDL	WC2-03	WC-QAQC GW1 (WC1-03)	Relative Percent Difference
Date Sampled			16-Oct-23	16-Oct-23	
Parameter	Unit				
pH	pH Units	0.01	7.24	6.96	4%
Alkalinity (as CaCO3)	mg/L	5	15.00	15.00	NA
Electrical Conductivity	uS/cm	2	53	53	0%
Total Dissolved Solids	mg/L	10	<10	45	NA
Chloride	mg/L	0.10	<1	<1	NA
Nitrate as N	mg/L	0.05	0.73	0.75	3%
Sulphate	mg/L	0.10	5.2	4.8	8%
Ammonia as N	mg/L	0.02	<0.05	<0.05	NA
Chemical Oxygen Demand	mg/L	5	13	14	NA
Dissolved Organic Carbon	mg/L	0.5	3.9	3.7	5%
Dissolved Calcium	mg/L	0.05	6.1	6.1	0%
Dissolved Magnesium	mg/L	0.05	1.30	1.40	7%
Dissolved Potassium	mg/L	0.50	1.00	1.10	NA
Dissolved Sodium	mg/L	0.05	1.000	1.100	10%
Dissolved Aluminum	mg/L	0.004	0.070	0.073	4%
Dissolved Boron	mg/L	0.010	0.016	<0.01	NA
Dissolved Lead	mg/L	0.001	<0.0005	<0.0005	NA
Dissolved Iron	mg/L	0.010	<0.1	<0.1	NA
Dissolved Manganese	mg/L	0.002	<0.002	<0.002	NA
Dissolved Strontium	mg/L	0.005	0.025	0.026	4%
Dissolved Zinc	mg/L	0.005	<0.005	<0.005	NA

Grey shading indicates the maximum RPD calculated when no value exceeds high level of reproducibility.

Yellow shading indicates RPD value is above the percentage for a high level of reproducibility:

NA - RPD not applicable when average result is <5x RDL

10% for electrical conductivity

20% for metals and inorganics

30% for BTEX and PHC.

Appendix E

Historical Groundwater Chemistry (2006 to 2023)

Appendix E: Historical Groundwater Chemistry						Location	WC1-03	WC1-03	WC1-03	WC1-03	WC1-03	WC1-03	WC1-03	WC1-03	WC1-03	WC1-03	WC1-03	WC1-03	WC1-03	WC1-03	WC1-03	WC1-03
Parameter	Units	RUV-WC	ODWQS	PWQO-GENERAL	PWQO-INTERIM	Sample ID	WC1-03	WC1-03	WC1-03	WC1-03	WC1-03	WC1-03	WC1-03	WC1-03	WC1-03	WC1-03	WC1-03	WC1-03	WC1-03	WC1-03	WC1-03	WC1-03
						Sample Date	2006-Nov-21	2007-May-02	2007-Nov-21	2008-May-08	2008-Oct-08	2009-Jun-05	2009-Oct-21	2010-May-18	2010-Oct-19	2011-May-19	2011-Nov-02	2012-Apr-17	2012-Oct-17	2013-Apr-16	2013-Oct-29	2014-May-12	2014-Oct-15
Anions						Detection Limit																	
Chloride	mg/L	125.31	250	-	-	0.1	-	<1	2	2	1	1	2	3	1	2	1	1	1	1.07	0.78	0.85	0.54
Nitrate as N	mg/L	3.1	10	-	-	0.05	<0.1	<0.1	<0.1	2.51	1.02	1.81	1.86	0.36	0.11	0.8	1.35	0.7	<0.0001	1.34	1.37	1.18	1.03
Sulphate	mg/L	253.5	500	-	-	0.1	28	10	9	10	8	7	7	7	7	8	6	8	9	7.3	8.61	6.22	6.66
Cations																							
Calcium (diss)	mg/L	-	-	-	-	0.05	6	7	7	10	8	11	10	11	10	10	11	13.2	7.35	14	9.98	9.95	8.67
Magnesium (diss)	mg/L	-	-	-	-	0.05	1	2	1	2	2	3	2	2	2	2	2	2.26	2.58	3.02	2.16	2.09	1.8
Potassium (diss)	mg/L	-	-	-	-	0.05	1	1	1	2	1	2	2	2	1	1	2	1.51	1.78	2.01	1.69	1.53	1.46
Sodium (diss)	mg/L	100.92	200	-	-	0.05	5	2	<2	3	<2	3	2	<2	<2	<2	<2	1.96	2.01	2.25	2.01	2.38	2.08
General Chemistry																							
Alkalinity (as CaCO3)	mg/L	262.25	30 - 500	Factsheet	-	1	24	23	22	24	25	35	32	34	34	37	39	31	36	32	24	28	18
Ammonia as N	mg/L	-	-	-	-	0.02	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.02	0.03	0.04	0.02	0.15	<0.02	0.03	0.14
Chemical Oxygen Demand	mg/L	-	-	-	-	4	-	14	13	14	10	13	15	18	13	10	8	18	18	12	11	<5	9
Dissolved Organic Carbon	mg/L	4.9	5	-	-	0.4	-	9.8	10.5	6.5	5.6	4.9	6.1	5.6	5.7	4.4	3.9	6.4	6.3	4.8	3.7	4.3	3.5
Electrical Conductivity	uS/cm	-	-	-	-	1	72	66	67	98	80	101	98	94	89	90	98	102	118	102	81	87	82
pH	pH units	-	6.5 - 8.5	6.5 - 8.5	-		6.53	**6.38**	6.59	6.68	6.99	**6.42**	**6.33**	6.79	6.53	6.83	**6.2**	**6.2**	**6.3**	**5.53**	**5.85**	6.71	6.65
Total Dissolved Solids	mg/L	279	500	-	-	10	-	43	44	64	52	66	64	61	58	58	64	290	69	88	62	66	44
Unionized Ammonia (Calc)	mg/L	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Metals																							
Aluminum (diss)	mg/L	-	0.1	-	Calculated	0.004	0.14	0.1	0.09	0.06	0.07	0.06	0.07	0.07	0.08	0.07	0.07	0.07	0.107	0.108	0.08	0.071	0.07
Barium (diss)	mg/L	-	1	-	-	0.001	0.02	0.02	0.02	0.03	0.02	0.03	0.03	0.02	0.02	0.03	0.03	0.023	0.029	0.026	0.022	0.025	0.025
Beryllium (diss)	mg/L	-	-	Calculated	-	0.0005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.001	<0.001	<0.001	<0.001
Boron (diss)	mg/L	1.25	5	-	0.2	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.015	<0.01	<0.01
Cadmium (diss)	mg/L	-	0.005	-	Calculated	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.002	<0.002	<0.002	<0.002
Chromium (diss)	mg/L	-	0.05	-	-	0.001	0.001	0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.003	<0.003	<0.003	<0.003	<0.003
Cobalt (diss)	mg/L	-	-	-	0.0009	0.0005	0.0016	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.001	<0.001	<0.001	<0.001
Copper (diss)	mg/L	-	1	-	Calculated	0.0005	0.002	0.004	0.003	0.003	0.001	0.001	0.002	0.002	0.002	0.001	0.001	0.0014	0.0017	<0.003	<0.003	<0.003	<0.003
Iron (diss)	mg/L	0.15	0.3	0.3	-	0.01	**0.32**	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.1	<0.01	<0.01	<0.01	<0.01	<0.01
Lead (diss)	mg/L	-	0.01	-	Calculated	0.0005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0001	<0.0001	<0.002	<0.002	<0.002	<0.002
Manganese (diss)	mg/L	0.03	0.05	-	-	0.002	0.11	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.007	<0.005	0.014	0.008	0.004	0.003
Molybdenum (diss)	mg/L	-	-	-	0.04	0.0005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0005	<0.0005	<0.002	<0.002	<0.002	<0.002
Nickel (diss)	mg/L	-	-	0.025	-	0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.001	<0.003	<0.003	<0.003	<0.003
Silicon (diss)	mg/L	-	-	-	-	0.01	6.5	5.9	5.2	5.4	6.1	6.1	6.6	5.4	5.9	5.9	6	4.8	6.99	5.87	5.51	6.1	5.84
Silver (diss)	mg/L	-	-	0.0001	-	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.002	<0.002	<0.002	<0.002
Strontium (diss)	mg/L	-	-	-	-	0.001	0.032	0.03	0.03	0.04	0.048	0.058	0.051	0.046	0.046	0.043	0.052	0.044	0.049	0.05	0.041	0.046	0.045
Thallium (diss)	mg/L	-	-	-	0.0003	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.006	<0.006	<0.006	<0.006
Titanium (diss)	mg/L	-	-	-	-	0.005	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002
Vanadium (diss)	mg/L	-	-	-	0.006	0.0005	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	0.001	0.0008	0.0012	<0.002	<0.002	<0.002	<0.002
Zinc (diss)	mg/L	2.50	5	-	0.02	0.005	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.005	<0.005	<0.005	0.094	<0.005	<0.005

-LEGEND-

Detection Limit	DL: May vary between sample locations and events
DL exceeds criteria	
Concentration exceeds RUV-WC	Reasonable Use Values Wolf Creek
Concentration exceeds ODWQS	Ontario Drinking Water Quality Standards
Concentration exceeds PWQO-GENERAL	Provincial Water Quality Objectives General
Concentration exceeds PWQO-INTERIM	Provincial Water Quality Objectives Interim

Appendix E: Historical Groundwater Chemistry						Location	WC1-03	WC1-03	WC1-03	WC1-03	WC1-03	WC1-03	WC1-03	WC1-03	WC1-03	WC1-03	WC1-03	WC1-03	WC1-03	WC1-03	WC1-03	WC1-03
Parameter	Units	RUV-WC	ODWQS	PWQO-GENERAL	PWQO-INTERIM	Sample ID	WC1-03	WC1-03	WC1-03	WC1-03	WC1-03	WC1-03	WC1-03	WC1-03	WC1-03	WC1-03	WC1-03	WC1-03	WC1-03	WC1-03	WC1-03	WC1-03
						Sample Date	2015-May-05	2015-Oct-27	2016-Apr-27	2016-Oct-27	2017-May-11	2017-Oct-24	2018-May-08	2018-Oct-23	2019-May-09	2019-Oct-24	2020-May-11	2020-Oct-07	2021-Apr-22	2021-Oct-14	2022-Apr-20	2022-Oct-19	2023-May-01
Anions						Detection Limit																	
Chloride	mg/L	125.31	250	-	-	0.1	0.76	0.5	0.62	0.52	0.67	0.63	0.47	0.41	0.53	0.23	0.41	0.44	0.44	0.36	0.35	0.4	0.41
Nitrate as N	mg/L	3.1	10	-	-	0.05	0.21	<0.05	2.75	1.55	4.04	2.93	0.52	0.92	1.28	0.68	0.36	0.82	<0.05	0.29	0.06	0.49	6.42
Sulphate	mg/L	253.5	500	-	-	0.1	7.74	5.88	5.7	6.88	11	12.3	4.9	3.84	8.94	6.23	4.5	4.88	5.42	6.08	5.85	5.11	4.64
Cations																							
Calcium (diss)	mg/L	-	-	-	-	0.05	9.7	9.09	9.58	7.08	8.96	9.35	7.19	7.96	6.22	5.17	5.63	7.17	6.31	6.78	7.26	7.85	12.9
Magnesium (diss)	mg/L	-	-	-	-	0.05	1.93	1.88	2.03	1.52	2.16	2.08	1.69	1.65	1.5	1.15	1.25	1.48	1.38	1.42	1.52	1.6	2.33
Potassium (diss)	mg/L	-	-	-	-	0.05	1.54	1.55	1.52	1.37	1.32	1.52	1.23	1.41	1.15	1.05	0.98	1.25	1.16	1.19	1.19	1.34	1.29
Sodium (diss)	mg/L	100.92	200	-	-	0.05	1.96	2.04	2.08	2	2.01	1.84	1.6	1.83	1.36	1.12	1.17	1.37	1.28	1.16	1.2	1.15	1.821
General Chemistry																							
Alkalinity (as CaCO3)	mg/L	262.25	30 - 500	Factsheet	-	1	28	31	29	19	-	13	29	28	15	12	16	22	21	24	24	26	20
Ammonia as N	mg/L	-	-	-	-	0.02	<0.02	<0.02	0.03	0.21	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.02	<0.02
Chemical Oxygen Demand	mg/L	-	-	-	-	4	5	15	6	6	10	5	6	<5	8	<5	6	12	<5	<5	30	15	12
Dissolved Organic Carbon	mg/L	4.9	5	-	-	0.4	6.9	7.2	5.4	4.3	4.1	4.8	4.3	5.8	7.6	4	3.7	3.7	4.5	3.8	4.6	4.4	5
Electrical Conductivity	uS/cm	-	-	-	-	1	79	77	88	69	100	82	65	76	62	74	67	57	55	58	64	68	108
pH	pH units	-	6.5 - 8.5	6.5 - 8.5	-		6.72	6.96	7.04	7.1	7.22	6.8	6.64	**6.48**	**6.28**	6.88	**6.41**	6.53	**6.47**	6.74	6.53	6.97	6.71
Total Dissolved Solids	mg/L	279	500	-	-	10	56	60	64	60	56	64	4.9	3.84	68	40	38	44	36	40	34	28	82
Unionized Ammonia (Calc)	mg/L	-	-	-	-		-	-	-	-	-	-	-	-	0.0000028	0.0000028	-	-	-	-	-	-	-
Metals																							
Aluminum (diss)	mg/L	-	0.1	-	Calculated	0.004	0.103	0.114	0.088	0.064	0.039	0.065	0.073	0.076	0.055	0.081	0.078	0.085	0.117	0.076	0.081	0.07	0.063
Barium (diss)	mg/L	-	1	-	-	0.001	0.022	0.021	0.024	0.018	-	-	-	-	-	-	-	-	-	-	-	-	-
Beryllium (diss)	mg/L	-	-	Calculated	-	0.0005	<0.001	<0.001	<0.001	<0.001	-	-	-	-	-	-	-	-	-	-	-	-	-
Boron (diss)	mg/L	1.25	5	-	0.2	0.01	<0.01	<0.01	<0.01	0.014	0.015	0.012	0.029	<0.01	0.013	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.019
Cadmium (diss)	mg/L	-	0.005	-	Calculated	0.0001	<0.002	<0.002	<0.002	<0.001	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium (diss)	mg/L	-	0.05	-	-	0.001	<0.003	<0.003	<0.003	<0.003	-	-	-	-	-	-	-	-	-	-	-	-	-
Cobalt (diss)	mg/L	-	-	-	0.0009	0.0005	<0.001	<0.001	<0.001	<0.001	-	-	-	-	-	-	-	-	-	-	-	-	-
Copper (diss)	mg/L	-	1	-	Calculated	0.0005	<0.003	<0.003	<0.003	<0.003	-	-	-	-	-	-	-	-	-	-	-	-	-
Iron (diss)	mg/L	0.15	0.3	0.3	-	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.031	<0.01	0.023	0.018	0.021
Lead (diss)	mg/L	-	0.01	-	Calculated	0.0005	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0005	<0.0005
Manganese (diss)	mg/L	0.03	0.05	-	-	0.002	0.005	0.009	0.006	0.003	<0.002	0.002	<0.002	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.002	<0.002	0.006
Molybdenum (diss)	mg/L	-	-	-	0.04	0.0005	<0.002	<0.002	<0.002	<0.002	-	-	-	-	-	-	-	-	-	-	-	-	-
Nickel (diss)	mg/L	-	-	0.025	-	0.001	<0.003	<0.003	<0.003	<0.003	-	-	-	-	-	-	-	-	-	-	-	-	-
Silicon (diss)	mg/L	-	-	-	-	0.01	5.48	5.14	5.22	4.85	-	-	-	-	-	-	-	-	-	-	-	-	-
Silver (diss)	mg/L	-	-	0.0001	-	0.0001	<0.002	<0.002	<0.002	<0.002	-	-	-	-	-	-	-	-	-	-	-	-	-
Strontium (diss)	mg/L	-	-	-	-	0.001	0.038	0.034	0.041	0.032	0.047	0.049	0.034	0.038	0.037	0.032	0.03	0.032	0.03	0.027	0.031	0.032	0.055
Thallium (diss)	mg/L	-	-	-	0.0003	0.0001	<0.006	<0.006	<0.006	<0.006	-	-	-	-	-	-	-	-	-	-	-	-	-
Titanium (diss)	mg/L	-	-	-	-	0.005	<0.002	<0.002	<0.002	<0.002	-	-	-	-	-	-	-	-	-	-	-	-	-
Vanadium (diss)	mg/L	-	-	-	0.006	0.0005	<0.002	<0.002	<0.002	<0.002	-	-	-	-	-	-	-	-	-	-	-	-	-
Zinc (diss)	mg/L	2.50	5	-	0.02	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.006	<0.005	<0.005	<0.005	0.005	<0.005	<0.005	<0.005	<0.005	0.014	<0.005	<0.005

-LEGEND-

Detection Limit	DL: May vary between sample locations and events
DL exceeds criteria	
Concentration exceeds RUV-WC	Reasonable Use Values Wolf Creek
Concentration exceeds ODWQS	Ontario Drinking Water Quality Standards
Concentration exceeds PWQO-GENERAL	Provincial Water Quality Objectives General
Concentration exceeds PWQO-INTERIM	Provincial Water Quality Objectives Interim

Appendix E: Historical Groundwater Chemistry						Location	WC1-03	WC1-03	WC1-03	WC2-03	WC2-03	WC2-03	WC2-03	WC2-03	WC2-03	WC2-03	WC2-03	WC2-03	WC2-03	WC2-03	WC2-03	WC2-03
Parameter	Units	RUV-WC	ODWQS	PWQO-GENERAL	PWQO-INTERIM	Sample ID	AQC-GW1 (WC	WC1-03	AQC-GW1 (WC	WC2-03	WC2-03	WC2-03	WC2-03	WC2-03	WC2-03	WC2-03	WC2-03	WC2-03	WC2-03	WC2-03	WC2-03	WC2-03
						Sample Date	2023-May-01	2023-Oct-16	2023-Oct-16	2006-May-09	2006-Nov-21	2007-May-02	2007-Nov-21	2008-May-08	2008-Oct-08	2009-Jun-05	2009-Oct-21	2010-May-18	2010-Oct-19	2011-May-19	2011-Nov-02	2012-Apr-17	2012-Oct-17
Anions						Detection Limit																
Chloride	mg/L	125.31	250	-	-	0.1	0.47	<1	<1	-	-	15	7	8	5	7	4	4	3	12	3	2	8
Nitrate as N	mg/L	3.1	10	-	-	0.05	6.81	0.73	0.75	7.31	5.64	6.4	5.63	6.62	5.13	4.41	7.59	3.55	7.06	4.29	4.47	4.1	3.3
Sulphate	mg/L	253.5	500	-	-	0.1	4.74	5.2	4.8	135	100	35	101	58	130	83	116	43	37	78	140	42	50
Cations																							
Calcium (diss)	mg/L	-	-	-	-	0.05	13.9	6.1	6.1	81	62	41	54	47	61	59	67	33	38	46	72	24.7	35
Magnesium (diss)	mg/L	-	-	-	-	0.05	2.73	1.3	1.4	19	13	8	12	10	15	12	15	7	6	9	16	5.6	9.17
Potassium (diss)	mg/L	-	-	-	-	0.05	1.28	1	1.1	12	8	4	9	12	12	13	12	9	6	8	9	4.98	5.76
Sodium (diss)	mg/L	100.92	200	-	-	0.05	1.839	1	1.1	9	8	5	6	6	7	7	7	4	4	5	7	4.3	5.49
General Chemistry																							
Alkalinity (as CaCO3)	mg/L	262.25	30 - 500	Factsheet	-	1	18	15	15	130	90	77	89	90	120	123	110	76	76	96	116	59	84
Ammonia as N	mg/L	-	-	-	-	0.02	<0.02	<0.05	<0.05	-	-	0.06	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.04	0.01	0.02
Chemical Oxygen Demand	mg/L	-	-	-	-	4	<5	13	14	-	-	<5	<5	5	10	13	13	8	<5	15	10	21	15
Dissolved Organic Carbon	mg/L	4.9	5	-	-	0.4	3.8	3.9	3.7	-	-	3.4	5.2	4.4	4.3	4.3	4.2	3.6	3.3	4.6	3.7	3.5	3
Electrical Conductivity	uS/cm	-	-	-	-	1	111	53	53	626	457	330	438	384	560	467	524	287	285	418	565	271	342
pH	pH units	-	6.5 - 8.5	6.5 - 8.5	-		6.75	7.24	6.96	6.93	6.81	6.79	6.71	7.05	7.48	6.8	6.78	7.1	6.77	7.21	6.59	7.1	6.7
Total Dissolved Solids	mg/L	279	500	-	-	10	102	<10	45	-	-	215	285	250	364	304	341	187	185	272	367	139	188
Unionized Ammonia (Calc)	mg/L	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Metals																							
Aluminum (diss)	mg/L	-	0.1	-	Calculated	0.004	0.075	0.07	0.073	0.02	0.01	0.02	<0.01	<0.01	<0.01	2.4	<0.01	<0.01	<0.01	<0.01	<0.01	0.003	0.004
Barium (diss)	mg/L	-	1	-	-	0.001	-	-	-	0.06	0.03	0.02	0.04	0.05	0.07	<0.1	0.05	0.03	0.02	0.05	0.05	0.019	0.026
Beryllium (diss)	mg/L	-	-	Calculated	-	0.0005	-	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.001	<0.001	<0.001	<0.0005	<0.0005	<0.0005	<0.0005
Boron (diss)	mg/L	1.25	5	-	0.2	0.01	0.018	0.016	<0.01	0.28	0.21	0.11	0.17	0.2	0.28	0.2	0.22	0.11	0.09	0.1	0.26	0.092	0.097
Cadmium (diss)	mg/L	-	0.005	-	Calculated	0.0001	-	-	-	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium (diss)	mg/L	-	0.05	-	-	0.001	-	-	-	0.001	0.001	0.002	<0.001	<0.001	<0.001	<0.01	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002
Cobalt (diss)	mg/L	-	-	-	0.0009	0.0005	-	-	-	0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.004	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005
Copper (diss)	mg/L	-	1	-	Calculated	0.0005	-	-	-	0.005	0.002	0.004	0.003	0.003	0.003	0.02	0.002	0.002	0.002	0.002	0.002	0.001	0.0013
Iron (diss)	mg/L	0.15	0.3	0.3	-	0.01	0.019	<0.1	<0.1	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	8.2	<0.03	<0.03	<0.03	<0.03	<0.03	<0.1	<0.1
Lead (diss)	mg/L	-	0.01	-	Calculated	0.0005	<0.0005	<0.0005	<0.0005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0001	<0.0001
Manganese (diss)	mg/L	0.03	0.05	-	-	0.002	0.004	<0.002	<0.002	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.1	<0.01	<0.01	<0.01	<0.01	<0.01	<0.005	<0.005
Molybdenum (diss)	mg/L	-	-	-	0.04	0.0005	-	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0005	<0.0005
Nickel (diss)	mg/L	-	-	0.025	-	0.001	-	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	0.001
Silicon (diss)	mg/L	-	-	-	-	0.01	-	-	-	4.9	6.4	6.3	5.5	5.8	4.9	8	5.2	4.5	5.2	5.8	5	4.14	6.03
Silver (diss)	mg/L	-	-	0.0001	-	0.0001	-	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Strontium (diss)	mg/L	-	-	-	-	0.001	0.056	0.025	0.026	0.874	0.557	0.242	0.549	0.427	0.149	0.46	0.536	0.25	0.269	0.369	0.538	0.142	0.221
Thallium (diss)	mg/L	-	-	-	0.0003	0.0001	-	-	-	<0.0001	<0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium (diss)	mg/L	-	-	-	-	0.005	-	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.2	<0.01	<0.01	<0.01	<0.01	<0.01	<0.005	<0.005
Vanadium (diss)	mg/L	-	-	-	0.006	0.0005	-	-	-	0.002	<0.001	<0.001	0.003	0.002	<0.001	0.02	0.002	<0.001	<0.001	<0.001	0.002	0.0009	0.0009
Zinc (diss)	mg/L	2.50	5	-	0.02	0.005	<0.005	<0.005	<0.005	<0.01	<0.01	0.02	0.01	<0.01	<0.01	<0.1	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.005

-LEGEND-

Detection Limit	DL: May vary between sample locations and events
DL exceeds criteria	
Concentration exceeds RUV-WC	Reasonable Use Values Wolf Creek
Concentration exceeds ODWQS	Ontario Drinking Water Quality Standards
Concentration exceeds PWQO-GENERAL	Provincial Water Quality Objectives General
Concentration exceeds PWQO-INTERIM	Provincial Water Quality Objectives Interim

Appendix E: Historical Groundwater Chemistry						Location	WC2-03	WC2-03	WC2-03	WC2-03	WC2-03	WC2-03	WC2-03	WC2-03	WC2-03	WC2-03	WC2-03	WC2-03	WC2-03	WC2-03	WC2-03	WC2-03
Parameter	Units	RUV-WC	ODWQS	PWQO-GENERAL	PWQO-INTERIM	Sample ID	WC2-03	WC2-03	WC2-03	WC2-03	WC2-03	WC2-03	WC2-03	WC2-03	WC2-03	WC2-03	WC2-03	WC2-03	-03 QAQC (WC	WC2-03	WC2-03	WC2-03
						Sample Date	2013-Apr-16	2013-Oct-29	2014-May-12	2014-Oct-15	2015-May-05	2015-Oct-27	2016-Apr-27	2016-Oct-27	2017-May-11	2017-Oct-24	2018-May-08	2018-Oct-23	2019-May-09	2019-May-09	2019-Oct-24	2020-May-11	2020-Oct-07
Anions						Detection Limit																	
Chloride	mg/L	125.31	250	-	-	0.1	2.71	8.28	5.71	3.94	1.83	4.01	3.94	2.92	6.53	0.53	1.05	0.25	1.77	1.75	0.48	1.13	0.72
Nitrate as N	mg/L	3.1	10	-	-	0.05	2.55	4.71	5.98	3.28	2.39	6.39	5.53	4.44	7.64	2.55	9.12	2.64	6.1	6.15	1.98	2.22	2.06
Sulphate	mg/L	253.5	500	-	-	0.1	15.5	133	46.8	149	14.4	22.8	28.4	117	42.4	27.1	99.4	49.5	25.6	25.8	40.9	99.9	42.3
Cations																							
Calcium (diss)	mg/L	-	-	-	-	0.05	20.1	69.9	38	73.5	20.6	31.5	35.3	65.1	40.2	32.8	44.9	30.3	28	27.8	32.8	55.7	29.9
Magnesium (diss)	mg/L	-	-	-	-	0.05	4.13	14.2	7.56	14	3.98	6.19	7.06	12.2	7.9	5.42	8.71	5.25	4.69	4.63	5.22	8.71	4.77
Potassium (diss)	mg/L	-	-	-	-	0.05	4.21	9.06	7.91	9.24	4.35	6.17	5.2	7.61	7.73	8.67	4.85	5.36	6.86	6.8	5.73	8.25	4.9
Sodium (diss)	mg/L	100.92	200	-	-	0.05	4.29	5.63	6.54	6.5	3.63	4.99	4.54	5.7	4.87	3.94	4.55	3.59	3.98	3.93	2.87	3.62	2.74
General Chemistry																							
Alkalinity (as CaCO3)	mg/L	262.25	30 - 500	Factsheet	-	1	45	85	78	79	50	74	92	100	-	93	46	57	74	73	73	82	60
Ammonia as N	mg/L	-	-	-	-	0.02	0.33	<0.02	0.03	0.13	<0.02	<0.02	0.03	0.17	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Chemical Oxygen Demand	mg/L	-	-	-	-	4	<5	11	<5	8	<5	12	<5	<5	<5	<5	<5	<5	<5	<5	<5	7	<5
Dissolved Organic Carbon	mg/L	4.9	5	-	-	0.4	1.8	3.3	3.6	2.8	2.3	4.1	4.6	3.8	3	2.4	2.9	5.2	2.1	2.4	2.3	3.4	3
Electrical Conductivity	uS/cm	-	-	-	-	1	154	496	325	558	171	261	270	486	371	233	348	256	235	237	252	496	205
pH	pH units	-	6.5 - 8.5	6.5 - 8.5	-		5.7	6.05	7.29	7.64	7.07	7.35	7.39	8	7.88	7.86	6.84	6.83	6.7	6.72	7.48	6.59	6.73
Total Dissolved Solids	mg/L	279	500	-	-	10	94	336	192	342	94	168	170	318	194	134	248	166	168	170	138	248	140
Unionized Ammonia (Calc)	mg/L	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	0.0000044	0.0000044	0.0000046	-	-
Metals																							
Aluminum (diss)	mg/L	-	0.1	-	Calculated	0.004	0.007	0.01	0.004	0.005	0.004	0.004	0.007	<0.004	0.005	0.004	0.008	0.007	0.005	0.004	0.064	0.01	0.008
Barium (diss)	mg/L	-	1	-	-	0.001	0.01	0.045	0.032	0.049	0.012	0.024	0.022	0.042	-	-	-	-	-	-	-	-	-
Beryllium (diss)	mg/L	-	-	Calculated	-	0.0005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-	-	-	-	-	-	-	-	-
Boron (diss)	mg/L	1.25	5	-	0.2	0.01	0.05	0.204	0.16	0.189	0.038	0.155	0.177	0.234	0.15	0.113	0.079	0.084	0.105	0.11	0.118	0.11	0.09
Cadmium (diss)	mg/L	-	0.005	-	Calculated	0.0001	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.001	-	-	-	-	-	-	-	-	-
Chromium (diss)	mg/L	-	0.05	-	-	0.001	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	-	-	-	-	-	-	-	-	-
Cobalt (diss)	mg/L	-	-	-	0.0009	0.0005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-	-	-	-	-	-	-	-	-
Copper (diss)	mg/L	-	1	-	Calculated	0.0005	<0.003	0.006	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	-	-	-	-	-	-	-	-	-
Iron (diss)	mg/L	0.15	0.3	0.3	-	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Lead (diss)	mg/L	-	0.01	-	Calculated	0.0005	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Manganese (diss)	mg/L	0.03	0.05	-	-	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.006	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Molybdenum (diss)	mg/L	-	-	-	0.04	0.0005	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	-	-	-	-	-	-	-	-	-
Nickel (diss)	mg/L	-	-	0.025	-	0.001	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	-	-	-	-	-	-	-	-	-
Silicon (diss)	mg/L	-	-	-	-	0.01	6.23	5.46	6.41	5.72	6.81	5.49	5.37	5.68	-	-	-	-	-	-	-	-	-
Silver (diss)	mg/L	-	-	0.0001	-	0.0001	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	-	-	-	-	-	-	-	-	-
Strontium (diss)	mg/L	-	-	-	-	0.001	0.11	0.421	0.242	0.451	0.119	0.176	0.225	0.468	0.275	0.209	0.284	0.18	0.156	0.159	0.196	0.402	0.217
Thallium (diss)	mg/L	-	-	-	0.0003	0.0001	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	-	-	-	-	-	-	-	-	-
Titanium (diss)	mg/L	-	-	-	-	0.005	<0.002	<0.002	<0.002	0.003	<0.002	<0.002	<0.002	0.002	-	-	-	-	-	-	-	-	-
Vanadium (diss)	mg/L	-	-	-	0.006	0.0005	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	-	-	-	-	-	-	-	-	-
Zinc (diss)	mg/L	2.50	5	-	0.02	0.005	<0.005	0.113	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005

-LEGEND-

Detection Limit	DL: May vary between sample locations and events
DL exceeds criteria	
Concentration exceeds RUV-WC	Reasonable Use Values Wolf Creek
Concentration exceeds ODWQS	Ontario Drinking Water Quality Standards
Concentration exceeds PWQO-GENERAL	Provincial Water Quality Objectives General
Concentration exceeds PWQO-INTERIM	Provincial Water Quality Objectives Interim

Appendix E: Historical Groundwater Chemistry						Location	WC2-03	WC2-03	WC2-03	WC2-03	WC2-03	WC2-03	WC2-03	WC2-03	WC3-03	WC3-03	WC3-03	WC3-03	WC3-03	WC3-03	WC3-03	WC3-03	WC3-03
Parameter	Units	RUV-WC	ODWQS	PWQO-GENERAL	PWQO-INTERIM	Sample ID	WC2-03	WC2-03	AQCGW-F21 (W	WC2-03	WC2-03	AQC GW-F22 (W	WC2-03	WC2-03	WC3-03	WC3-03	WC3-03	WC3-03	WC3-03	WC3-03	WC3-03	WC3-03	WC3-03
						Sample Date	2021-Apr-22	2021-Oct-14	2021-Oct-14	2022-Apr-20	2022-Oct-19	2022-Oct-19	2023-May-01	2023-Oct-16	2006-May-09	2006-Nov-21	2007-May-02	2007-Nov-21	2008-May-08	2008-Oct-08	2009-Jun-05	2009-Oct-21	2010-May-18
Anions						Detection Limit																	
Chloride	mg/L	125.31	250	-	-	0.1	0.75	0.46	0.57	0.34	0.71	0.78	1.17	<1	-	-	34	2	<1	5	2	1	2
Nitrate as N	mg/L	3.1	10	-	-	0.05	2.05	2.63	2.69	1.82	5.54	5.37	4.92	2.44	10.3	3.14	4.68	1.21	1.55	3.46	7.01	1.68	7.01
Sulphate	mg/L	253.5	500	-	-	0.1	13.4	14	14.3	10.6	36.7	36.4	26.3	65	40	34	119	9	7	22	13	8	13
Cations																							
Calcium (diss)	mg/L	-	-	-	-	0.05	15.3	16.1	16.1	18	29.9	31.9	35	48	31	14	107	5	6	16	13	5	13
Magnesium (diss)	mg/L	-	-	-	-	0.05	2.77	2.83	2.8	2.93	4.79	4.6	5.67	7.1	13	5	33	2	2	5	4	2	4
Potassium (diss)	mg/L	-	-	-	-	0.05	3.22	3.84	3.81	4.32	5.11	5.18	8.27	6.4	51	17	66	5	7	6	8	3	8
Sodium (diss)	mg/L	100.92	200	-	-	0.05	2.85	2.06	2.04	2.44	2.51	2.79	5.62	2.9	25	7	31	<2	<2	4	4	2	4
General Chemistry																							
Alkalinity (as CaCO3)	mg/L	262.25	30 - 500	Factsheet	-	1	40	42	51	55	52	52	78	84	130	54	368	20	27	40	29	24	29
Ammonia as N	mg/L	-	-	-	-	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.05	-	-	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Chemical Oxygen Demand	mg/L	-	-	-	-	4	<5	<5	<5	<5	11	<5	<5	6.7	-	-	<5	<5	<5	8	5	<5	5
Dissolved Organic Carbon	mg/L	4.9	5	-	-	0.4	2.3	8.2	16	2.5	3	3.3	3.2	2.9	-	-	4.5	1.5	1.2	1.3	1.8	1.2	1.8
Electrical Conductivity	uS/cm	-	-	-	-	1	132	136	136	154	232	233	256	330	542	187	1070	74	82	184	159	76	159
pH	pH units	-	6.5 - 8.5	6.5 - 8.5	-		6.69	6.96	7.06	6.93	7.12	7.25	7.04	7.1	7.45	7.01	7.77	6.95	7.12	7.35	6.63	6.76	6.63
Total Dissolved Solids	mg/L	279	500	-	-	10	84	82	76	84	126	124	174	225	-	-	696	48	53	120	103	49	103
Unionized Ammonia (Calc)	mg/L	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Metals																							
Aluminum (diss)	mg/L	-	0.1	-	Calculated	0.004	0.004	0.008	0.018	0.008	0.023	0.01	0.015	<0.0049	0.02	0.06	0.02	0.01	0.01	<0.01	<0.01	<0.01	<0.01
Barium (diss)	mg/L	-	1	-	-	0.001	-	-	-	-	-	-	-	-	0.05	<0.01	0.08	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Beryllium (diss)	mg/L	-	-	Calculated	-	0.0005	-	-	-	-	-	-	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Boron (diss)	mg/L	1.25	5	-	0.2	0.01	0.058	0.047	0.044	0.062	0.067	0.069	0.15	0.15	0.31	0.12	0.87	<0.01	0.01	0.05	0.02	0.01	0.02
Cadmium (diss)	mg/L	-	0.005	-	Calculated	0.0001	-	-	-	-	-	-	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium (diss)	mg/L	-	0.05	-	-	0.001	-	-	-	-	-	-	-	-	0.002	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cobalt (diss)	mg/L	-	-	-	0.0009	0.0005	-	-	-	-	-	-	-	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Copper (diss)	mg/L	-	1	-	Calculated	0.0005	-	-	-	-	-	-	-	-	0.003	0.001	0.007	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Iron (diss)	mg/L	0.15	0.3	0.3	-	0.01	<0.01	<0.01	<0.01	0.017	<0.01	<0.01	0.029	<0.1	<0.03	0.09	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Lead (diss)	mg/L	-	0.01	-	Calculated	0.0005	<0.001	<0.001	<0.001	<0.001	<0.0005	<0.0005	0.0005	<0.0005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Manganese (diss)	mg/L	0.03	0.05	-	-	0.002	<0.002	<0.002	0.003	<0.002	<0.002	<0.002	0.003	<0.002	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Molybdenum (diss)	mg/L	-	-	-	0.04	0.0005	-	-	-	-	-	-	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Nickel (diss)	mg/L	-	-	0.025	-	0.001	-	-	-	-	-	-	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Silicon (diss)	mg/L	-	-	-	-	0.01	-	-	-	-	-	-	-	-	5.5	7.6	4.1	6	7.4	7.8	6.6	7	6.6
Silver (diss)	mg/L	-	-	0.0001	-	0.0001	-	-	-	-	-	-	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Strontium (diss)	mg/L	-	-	-	-	0.001	0.091	0.106	0.104	0.114	0.187	0.178	0.23	0.26	0.131	0.057	0.251	0.016	0.025	0.069	0.043	0.033	0.043
Thallium (diss)	mg/L	-	-	-	0.0003	0.0001	-	-	-	-	-	-	-	-	<0.0001	<0.0001	0.0003	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium (diss)	mg/L	-	-	-	-	0.005	-	-	-	-	-	-	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Vanadium (diss)	mg/L	-	-	-	0.006	0.0005	-	-	-	-	-	-	-	-	0.002	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Zinc (diss)	mg/L	2.50	5	-	0.02	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

-LEGEND-

Detection Limit	DL: May vary between sample locations and events
DL exceeds criteria	
Concentration exceeds RUV-WC	Reasonable Use Values Wolf Creek
Concentration exceeds ODWQS	Ontario Drinking Water Quality Standards
Concentration exceeds PWQO-GENERAL	Provincial Water Quality Objectives General
Concentration exceeds PWQO-INTERIM	Provincial Water Quality Objectives Interim

Appendix E: Historical Groundwater Chemistry						Location	WC3-03	WC3-03	WC3-03	WC3-03	WC3-03	WC3-03	WC3-03	WC3-03	WC3-03	WC3-03	WC3-03	WC3-03	WC3-03	WC3-03	WC3-03	WC3-03	WC3-03
Parameter	Units	RUV-WC	ODWQS	PWQO-GENERAL	PWQO-INTERIM	Sample ID	WC3-03	WC3-03	WC3-03	WC3-03	WC3-03	WC3-03	WC3-03	WC3-03	WC3-03	WC3-03	WC3-03	WC3-03	WC3-03	WC3-03	WC3-03	WC3-03	WC3-03
						Sample Date	2010-Oct-19	2011-May-19	2011-Nov-02	2012-Apr-17	2012-Oct-17	2013-Apr-16	2013-Oct-29	2014-May-12	2014-Oct-15	2015-May-05	2015-Oct-27	2016-Apr-27	2016-Oct-27	2017-May-11	2017-Oct-24	2018-May-08	2018-Oct-23
Anions						Detection Limit																	
Chloride	mg/L	125.31	250	-	-	0.1	13	2	2	6	1	0.6	0.63	0.82	1.15	0.38	0.18	0.16	0.26	0.29	4.98	0.4	0.4
Nitrate as N	mg/L	3.1	10	-	-	0.05	3.46	7.82	0.87	4.9	1	0.56	1.22	2.62	3.08	0.71	0.82	0.91	1.1	1.17	6.6	0.64	0.26
Sulphate	mg/L	253.5	500	-	-	0.1	50	10	17	25	8	5.91	5.26	8.86	4.29	2.58	2.11	2.89	2.82	2.53	16.4	5.75	5.72
Cations																							
Calcium (diss)	mg/L	-	-	-	-	0.05	62	10	20	24.3	6.56	6.27	5.88	7.56	6.85	2.75	2.28	2.65	3.14	2.51	27.5	5.6	5.54
Magnesium (diss)	mg/L	-	-	-	-	0.05	14	3	7	7.6	3.93	1.63	2.09	2.86	2.35	0.71	0.69	0.83	1.13	0.62	8.28	1.39	1.78
Potassium (diss)	mg/L	-	-	-	-	0.05	29	5	4	16.1	2.08	1.29	2	1.6	1.77	0.8	0.7	1.15	2.2	1.77	1.9	0.87	1.1
Sodium (diss)	mg/L	100.92	200	-	-	0.05	15	2	6	8.74	3.03	1.95	1.55	2.44	1.75	0.9	0.97	1.17	1.05	0.99	0.01	1.27	1.26
General Chemistry																							
Alkalinity (as CaCO3)	mg/L	262.25	30 - 500	Factsheet	-	1	229	30	65	126	27	15	17	18	14	7	6	9	11	-	78	20	20
Ammonia as N	mg/L	-	-	-	-	0.02	<0.02	<0.02	0.06	0.02	0.02	0.15	<0.02	0.03	0.13	<0.02	<0.02	0.02	0.19	<0.02	0.06	<0.02	<0.02
Chemical Oxygen Demand	mg/L	-	-	-	-	4	<5	13	5	38	23	<5	5	<5	<5	<5	7	<5	<5	<5	<5	<5	<5
Dissolved Organic Carbon	mg/L	4.9	5	-	-	0.4	2.7	1.6	1.5	3	1.1	0.7	1	2.5	0.9	1.3	1.3	1.3	1.3	0.5	3.7	2.1	1.1
Electrical Conductivity	uS/cm	-	-	-	-	1	607	152	172	385	86	52	59	88	83	29	27	32	41	36	229	53	60
pH	pH units	-	6.5 - 8.5	6.5 - 8.5	-		7.75	6.95	6.44	7.4	6.4	5.88	6.74	6.89	6.78	6.84	6.63	6.86	7	6.97	7.71	6.6	6.72
Total Dissolved Solids	mg/L	279	500	-	-	10	395	99	112	288	57	34	50	68	54	26	30	36	20	20	150	48	46
Unionized Ammonia (Calc)	mg/L	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Metals																							
Aluminum (diss)	mg/L	-	0.1	-	Calculated	0.004	<0.01	<0.01	<0.01	0.002	0.005	0.008	0.016	<0.004	0.007	0.007	0.004	0.01	0.035	<0.004	0.007	0.005	0.006
Barium (diss)	mg/L	-	1	-	-	0.001	0.04	<0.01	<0.01	0.021	0.003	<0.002	<0.002	0.003	<0.002	<0.002	<0.002	<0.002	0.003	-	-	-	-
Beryllium (diss)	mg/L	-	-	Calculated	-	0.0005	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-	-	-	-
Boron (diss)	mg/L	1.25	5	-	0.2	0.01	0.34	<0.01	0.15	0.147	0.045	0.012	0.011	0.013	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.108	0.016	<0.01
Cadmium (diss)	mg/L	-	0.005	-	Calculated	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.001	-	-	-	-
Chromium (diss)	mg/L	-	0.05	-	-	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	-	-	-	-
Cobalt (diss)	mg/L	-	-	-	0.0009	0.0005	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-	-	-	-
Copper (diss)	mg/L	-	1	-	Calculated	0.0005	0.002	<0.001	0.001	0.0007	<0.0005	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	-	-	-	-
Iron (diss)	mg/L	0.15	0.3	0.3	-	0.01	<0.03	<0.03	<0.03	<0.1	<0.1	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.019	<0.01	<0.01	<0.01	<0.01
Lead (diss)	mg/L	-	0.01	-	Calculated	0.0005	<0.001	<0.001	<0.001	<0.0001	<0.0001	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.001	<0.001
Manganese (diss)	mg/L	0.03	0.05	-	-	0.002	<0.01	<0.01	<0.01	<0.005	<0.005	<0.002	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Molybdenum (diss)	mg/L	-	-	-	0.04	0.0005	<0.005	<0.005	<0.005	<0.0005	<0.0005	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	-	-	-	-
Nickel (diss)	mg/L	-	-	0.025	-	0.001	<0.005	<0.005	<0.005	<0.001	<0.001	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	-	-	-	-
Silicon (diss)	mg/L	-	-	-	-	0.01	5.1	6.9	4.7	5.95	7.14	6.15	5.9	7.61	6.72	5.58	5.24	5.77	5.44	-	-	-	-
Silver (diss)	mg/L	-	-	0.0001	-	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	-	-	-	-
Strontium (diss)	mg/L	-	-	-	-	0.001	0.173	0.053	0.115	0.083	0.035	0.009	0.02	0.03	0.031	0.006	0.007	0.012	0.02	0.007	0.175	0.023	0.041
Thallium (diss)	mg/L	-	-	-	0.0003	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	-	-	-	-
Titanium (diss)	mg/L	-	-	-	-	0.005	<0.01	<0.01	<0.01	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	-	-	-	-
Vanadium (diss)	mg/L	-	-	-	0.006	0.0005	0.001	<0.001	<0.001	0.0009	0.0005	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	-	-	-	-
Zinc (diss)	mg/L	2.50	5	-	0.02	0.005	<0.01	<0.01	<0.01	<0.005	<0.005	<0.005	0.168	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005

-LEGEND-

Detection Limit	DL: May vary between sample locations and events
DL exceeds criteria	
Concentration exceeds RUV-WC	Reasonable Use Values Wolf Creek
Concentration exceeds ODWQS	Ontario Drinking Water Quality Standards
Concentration exceeds PWQO-GENERAL	Provincial Water Quality Objectives General
Concentration exceeds PWQO-INTERIM	Provincial Water Quality Objectives Interim

Appendix E: Historical Groundwater Chemistry						Location	WC3-03	WC3-03	WC3-03	WC3-03	WC3-03	WC3-03	WC3-03	WC3-03	WC3-03	WC3-03	WC4-19	WC4-19	WC4-19	WC4-19	WC4-19	WC4-19	WC4-19
Parameter	Units	RUV-WC	ODWQS	PWQO-GENERAL	PWQO-INTERIM	Sample ID	WC3-03	WC3-03	WC3-03	WC3-03	WC3-03	WC3-03	WC3-03	WC3-03	WC3-03	WC3-03	WC4-19	WC4-19	QAQC GW-S20	WC4-19	WC4-19	WC4-19	WC4-19
						Sample Date	2019-May-09	2019-Oct-24	2020-May-11	2020-Oct-07	2021-Apr-22	2021-Oct-14	2022-Apr-20	2022-Oct-19	2023-May-01	2023-Oct-16	2019-Oct-24	2020-May-11	2020-May-11	2020-Oct-07	2021-Apr-22	2021-Oct-14	2022-Apr-20
Anions						Detection Limit																	
Chloride	mg/L	125.31	250	-	-	0.1	1.7	0.43	0.83	0.42	7.88	11.2	2.16	0.21	2.01	<1	11	6.94	6.95	4.3	0.7	2.07	6.38
Nitrate as N	mg/L	3.1	10	-	-	0.05	0.72	0.34	3.21	0.55	5.4	11	3.52	0.69	1.56	0.67	0.88	4.6	4.61	3.51	2.02	3.1	3.02
Sulphate	mg/L	253.5	500	-	-	0.1	4.16	4.46	6.25	4.25	36.5	68.2	20.2	2.44	5.61	3.2	74.2	55.7	56.4	56.1	10.6	47.1	83.3
Cations																							
Calcium (diss)	mg/L	-	-	-	-	0.05	3.8	3.62	8.06	7.2	61.1	130	30.5	3.58	11	6	59.3	57.3	57.3	50	20.9	43.8	71.1
Magnesium (diss)	mg/L	-	-	-	-	0.05	1.09	1.55	3.44	2.71	12.9	23.2	5.45	0.91	4.56	1.6	9.32	9.15	9.27	8.04	3.53	7.38	12.3
Potassium (diss)	mg/L	-	-	-	-	0.05	1.1	0.82	1.43	1.46	16	30.6	9.97	2.4	2.2	1.3	10.5	6.76	6.81	6.37	4.78	6.73	11.5
Sodium (diss)	mg/L	100.92	200	-	-	0.05	1.45	1.21	2.41	1.56	13	20.6	5.7	1.02	4.18	1.5	13.5	11.8	11.7	9.33	7.2	12.4	17.6
General Chemistry																							
Alkalinity (as CaCO3)	mg/L	262.25	30 - 500	Factsheet	-	1	11	12	27	27	178	380	92	11	46	21	143	137	142	129	72	120	191
Ammonia as N	mg/L	-	-	-	-	0.02	<0.02	0.04	0.05	<0.02	<0.02	<0.02	<0.02	0.02	<0.02	<0.05	0.14	<0.02	0.04	0.03	0.03	0.11	0.19
Chemical Oxygen Demand	mg/L	-	-	-	-	4	<5	<5	<5	7	<5	<5	<5	6	<5	7.4	<5	11	13	15	<5	<5	15
Dissolved Organic Carbon	mg/L	4.9	5	-	-	0.4	2.7	0.9	1.1	2.1	3.1	52.5	2.3	0.9	1.3	1.3	5.1	5.2	5.3	3.9	3.1	14.6	7.2
Electrical Conductivity	uS/cm	-	-	-	-	1	42	44	116	58	493	928	259	40	115	56	479	552	557	356	186	343	558
pH	pH units	-	6.5 - 8.5	6.5 - 8.5	-		**6.24**	7.01	**6.17**	6.71	7	7.49	7	6.84	7.12	7.08	7.62	6.68	6.84	6.96	7.13	7.36	7.1
Total Dissolved Solids	mg/L	279	500	-	-	10	42	38	58	40	272	532	160	18	72	40	266	262	260	228	84	198	360
Unionized Ammonia (Calc)	mg/L	-	-	-	-		0.000003	0.0000153	-	-	-	-	-	-	-	-	0.0000395	-	-	-	-	-	-
Metals																							
Aluminum (diss)	mg/L	-	0.1	-	Calculated	0.004	0.008	0.011	0.009	0.016	0.004	0.007	0.02	0.059	0.037	<0.0049	0.021	0.014	0.013	0.006	0.017	0.005	0.059
Barium (diss)	mg/L	-	1	-	-	0.001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Beryllium (diss)	mg/L	-	-	Calculated	-	0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boron (diss)	mg/L	1.25	5	-	0.2	0.01	<0.01	<0.01	<0.01	<0.01	0.315	0.59	0.131	<0.01	0.019	<0.01	0.386	0.215	0.224	0.14	0.116	0.177	0.421
Cadmium (diss)	mg/L	-	0.005	-	Calculated	0.0001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium (diss)	mg/L	-	0.05	-	-	0.001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cobalt (diss)	mg/L	-	-	-	0.0009	0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Copper (diss)	mg/L	-	1	-	Calculated	0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Iron (diss)	mg/L	0.15	0.3	0.3	-	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.053	0.022	<0.1	<0.01	<0.01	<0.01	0.016	<0.01	<0.01	0.075
Lead (diss)	mg/L	-	0.01	-	Calculated	0.0005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0005	0.0018	<0.0005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Manganese (diss)	mg/L	0.03	0.05	-	-	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.953	0.092	0.093	0.038	0.043	0.082	0.628
Molybdenum (diss)	mg/L	-	-	-	0.04	0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nickel (diss)	mg/L	-	-	0.025	-	0.001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Silicon (diss)	mg/L	-	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Silver (diss)	mg/L	-	-	0.0001	-	0.0001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Strontium (diss)	mg/L	-	-	-	-	0.001	0.017	0.027	0.065	0.052	0.255	0.455	0.071	0.021	0.051	0.04	0.235	0.189	0.19	0.161	0.068	0.124	0.257
Thallium (diss)	mg/L	-	-	-	0.0003	0.0001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Titanium (diss)	mg/L	-	-	-	-	0.005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vanadium (diss)	mg/L	-	-	-	0.006	0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zinc (diss)	mg/L	2.50	5	-	0.02	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005

-LEGEND-

Detection Limit	DL: May vary between sample locations and events
DL exceeds criteria	
Concentration exceeds RUV-WC	Reasonable Use Values Wolf Creek
Concentration exceeds ODWQS	Ontario Drinking Water Quality Standards
Concentration exceeds PWQO-GENERAL	Provincial Water Quality Objectives General
Concentration exceeds PWQO-INTERIM	Provincial Water Quality Objectives Interim

Appendix E: Historical Groundwater Chemistry						Location	WC4-19	WC4-19	WC4-19	WC5-19	WC5-19	WC5-19	QC GW-F20 (W	WC5-19	WC5-19	WC5-19	WC5-19	WC5-19	WC5-19	WC6.1-19	WC6.1-19	WC6.1-19	WC6.1-19
Parameter	Units	RUV-WC	ODWQS	PWQO-GENERAL	PWQO-INTERIM	Sample ID	WC4-19	WC4-19	WC4-19	WC5-19	WC5-19	WC5-19	QC GW-F20 (W	WC5-19	WC5-19	WC5-19	WC5-19	WC5-19	WC5-19	WC6.1-19	WC6.1-19	WC6.1-19	WC6.1-19
						Sample Date	2022-Oct-19	2023-May-01	2023-Oct-16	2019-Oct-24	2020-May-11	2020-Oct-07	2020-Oct-07	2021-Apr-22	2021-Oct-14	2022-Apr-20	2022-Oct-19	2023-May-01	2023-Oct-16	2019-Oct-24	2020-May-11	2020-Oct-07	2021-Apr-22
Anions						Detection Limit																	
Chloride	mg/L	125.31	250	-	-	0.1	1.03	0.9	2.8	1.47	1.02	1.55	1.37	0.6	0.53	0.59	0.5	0.69	<1	1.37	0.71	0.63	0.66
Nitrate as N	mg/L	3.1	10	-	-	0.05	2.37	2.31	2.09	5.89	1.19	3.73	3.76	1.28	2.5	1.19	0.98	0.5	3.07	0.05	0.06	0.21	<0.05
Sulphate	mg/L	253.5	500	-	-	0.1	25.2	20.4	31	22.3	7.94	11.3	14.8	6.22	7.59	7.84	6.94	5.25	14	13.1	10.7	10.5	8.87
Cations																							
Calcium (diss)	mg/L	-	-	-	-	0.05	38.2	37.6	32	24.2	10.3	18.7	18.3	8.98	13.3	11.2	12	7.51	17	18.2	19.4	19.3	18.6
Magnesium (diss)	mg/L	-	-	-	-	0.05	6.24	5.47	5.3	4.71	2.29	3.56	3.47	2	2.92	2.25	2.28	1.36	3.2	3.51	4.11	3.72	3.96
Potassium (diss)	mg/L	-	-	-	-	0.05	9.72	11.3	11	3.63	1.79	3.12	3.1	1.44	1.9	1.98	2.39	0.8	2.7	2.33	1.97	1.92	1.9
Sodium (diss)	mg/L	100.92	200	-	-	0.05	8.28	4.51	4	14.8	9.31	10.5	10.6	8.59	6.72	5.38	7.28	8.23	15	7.18	1.87	2.25	1.98
General Chemistry																							
Alkalinity (as CaCO3)	mg/L	262.25	30 - 500	Factsheet	-	1	111	97	78	14	59	70	70	42	51	42	47	37	61	66	68	70	62
Ammonia as N	mg/L	-	-	-	-	0.02	0.37	0.24	0.15	0.07	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.13	<0.02	<0.05	0.05	<0.02	<0.02	<0.02
Chemical Oxygen Demand	mg/L	-	-	-	-	4	13	8	10	<5	8	17	12	<5	<5	<5	11	<5	<4	<5	<5	5	<5
Dissolved Organic Carbon	mg/L	4.9	5	-	-	0.4	3.2	2.9	3.1	3	1.7	2.4	2.5	2	11.9	2.2	2.1	1.7	2.4	1.5	1.3	1.8	1.5
Electrical Conductivity	uS/cm	-	-	-	-	1	299	262	250	44	164	175	176	107	133	111	117	86	180	186	190	141	144
pH	pH units	-	6.5 - 8.5	6.5 - 8.5	-		7.47	7.23	7.17	6.88	6.69	6.76	6.85	6.82	7.01	6.78	7.11	7.15	7.11	7.75	6.96	6.89	7.17
Total Dissolved Solids	mg/L	279	500	-	-	10	142	164	160	142	80	102	116	70	72	102	62	64	125	108	94	100	28
Unionized Ammonia (Calc)	mg/L	-	-	-	-		-	-	-	0.0000161	-	-	-	-	-	-	-	-	-	0.0000252	-	-	-
Metals																							
Aluminum (diss)	mg/L	-	0.1	-	Calculated	0.004	0.024	0.015	<0.0049	0.463	0.024	0.014	0.018	0.016	0.092	0.077	0.032	0.013	0.0083	0.036	0.021	0.01	0.011
Barium (diss)	mg/L	-	1	-	-	0.001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Beryllium (diss)	mg/L	-	-	Calculated	-	0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boron (diss)	mg/L	1.25	5	-	0.2	0.01	0.176	0.092	0.14	0.182	0.048	0.087	0.088	0.037	0.042	0.039	0.045	0.013	0.14	<0.01	<0.01	<0.01	<0.01
Cadmium (diss)	mg/L	-	0.005	-	Calculated	0.0001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium (diss)	mg/L	-	0.05	-	-	0.001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cobalt (diss)	mg/L	-	-	-	0.0009	0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Copper (diss)	mg/L	-	1	-	Calculated	0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Iron (diss)	mg/L	0.15	0.3	0.3	-	0.01	0.017	0.029	<0.1	**0.94**	<0.01	<0.01	<0.01	0.05	0.053	0.131	0.021	0.01	<0.1	<0.01	<0.01	<0.01	<0.01
Lead (diss)	mg/L	-	0.01	-	Calculated	0.0005	<0.0005	0.0005	<0.0005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0005	<0.0005	<0.0005	<0.001	<0.001	<0.001	<0.001
Manganese (diss)	mg/L	0.03	0.05	-	-	0.002	0.201	0.2	0.29	0.062	0.002	<0.002	<0.002	0.003	0.002	0.002	<0.002	0.002	<0.002	0.042	0.014	<0.002	0.002
Molybdenum (diss)	mg/L	-	-	-	0.04	0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nickel (diss)	mg/L	-	-	0.025	-	0.001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Silicon (diss)	mg/L	-	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Silver (diss)	mg/L	-	-	0.0001	-	0.0001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Strontium (diss)	mg/L	-	-	-	-	0.001	0.127	0.126	0.13	0.236	0.079	0.133	0.127	0.051	0.078	0.065	0.073	0.043	0.13	0.075	0.069	0.062	0.06
Thallium (diss)	mg/L	-	-	-	0.0003	0.0001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Titanium (diss)	mg/L	-	-	-	-	0.005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vanadium (diss)	mg/L	-	-	-	0.006	0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zinc (diss)	mg/L	2.50	5	-	0.02	0.005	<0.005	<0.005	<0.005	0.006	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.005	<0.005	<0.005	<0.005	<0.005	<0.005

-LEGEND-

Detection Limit	DL: May vary between sample locations and events
DL exceeds criteria	
Concentration exceeds RUV-WC	Reasonable Use Values Wolf Creek
Concentration exceeds ODWQS	Ontario Drinking Water Quality Standards
Concentration exceeds PWQO-GENERAL	Provincial Water Quality Objectives General
Concentration exceeds PWQO-INTERIM	Provincial Water Quality Objectives Interim

Appendix E: Historical Groundwater Chemistry						Location	WC6.1-19	WC6.1-19	WC6.1-19	WC6.1-19	WC6.1-19	WC6.2-19	WC6.2-19	WC6.2-19	WC6.2-19	WC6.2-19	WC6.2-19	WC6.2-19	WC6.2-19	WC6.2-19	WC6.2-19	WC6.2-19	WC6.3-19
Parameter	Units	RUV-WC	ODWQS	PWQO-GENERAL	PWQO-INTERIM	Sample ID	WC6.1-19	WC6.1-19	WC6.1-19	WC6.1-19	WC6.1-19	WC6.2-19	-19-QAQC (WC	WC6.2-19	WC6.2-19	WC6.2-19	QC GW-S21 (W	WC6.2-19	WC6.2-19	WC6.2-19	WC6.2-19	WC6.2-19	WC6.3-19
						Sample Date	2021-Oct-14	2022-Apr-20	2022-Oct-19	2023-May-01	2023-Oct-16	2019-Oct-24	2019-Oct-24	2020-May-11	2020-Oct-07	2021-Apr-22	2021-Apr-22	2021-Oct-14	2022-Apr-20	2022-Oct-19	2023-May-01	2023-Oct-16	2019-Oct-24
Anions						Detection Limit																	
Chloride	mg/L	125.31	250	-	-	0.1	0.54	0.46	0.59	1.41	<1	1.78	1.93	0.72	0.56	0.56	0.69	0.53	0.41	0.57	0.53	<1	1.39
Nitrate as N	mg/L	3.1	10	-	-	0.05	<0.05	<0.05	<0.05	0.06	<0.1	0.26	0.28	<0.05	0.17	<0.05	0.08	<0.05	<0.05	3.49	0.07	<0.1	4.16
Sulphate	mg/L	253.5	500	-	-	0.1	9.5	9.75	10.5	9.61	7.8	16.6	17.4	8.18	7.97	7.38	7.36	7.83	6.99	15.7	7.21	9	67.3
Cations																							
Calcium (diss)	mg/L	-	-	-	-	0.05	17.7	19	21.8	20.6	20	11.5	11	12.6	10.8	12.9	12.9	11.8	12.7	23.3	18	13	50.4
Magnesium (diss)	mg/L	-	-	-	-	0.05	3.65	3.88	4.03	4.29	3.8	2.1	1.99	2.72	2.22	2.86	2.9	2.69	2.76	4.2	3.01	2.7	9.76
Potassium (diss)	mg/L	-	-	-	-	0.05	1.69	1.86	2.07	2.07	1.8	1.33	1.24	1.39	1.55	1.33	1.36	1.36	1.33	3.67	0.91	1.4	7.67
Sodium (diss)	mg/L	100.92	200	-	-	0.05	1.82	1.9	2.04	1.6	2	17.4	18.5	1.74	2.13	1.88	1.89	1.75	1.79	3.07	1.53	1.9	5.25
General Chemistry																							
Alkalinity (as CaCO3)	mg/L	262.25	30 - 500	Factsheet	-	1	58	58	65	63	61	61	60	47	38	44	44	44	43	59	49	42	115
Ammonia as N	mg/L	-	-	-	-	0.02	<0.02	<0.02	0.04	<0.02	<0.05	0.08	0.04	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.02	<0.02	0.22	0.07
Chemical Oxygen Demand	mg/L	-	-	-	-	4	<5	<5	7	<5	10	<5	<5	<5	9	<5	<5	<5	<5	<5	<5	<4	12
Dissolved Organic Carbon	mg/L	4.9	5	-	-	0.4	14	1.5	1.4	1.5	1.6	2.7	2.3	2.3	2.9	2.9	2.6	15.2	2.9	2.4	2.5	2.9	3
Electrical Conductivity	uS/cm	-	-	-	-	1	135	142	152	150	140	191	192	131	87	104	104	100	104	182	112	97	400
pH	pH units	-	6.5 - 8.5	6.5 - 8.5	-		7.36	7.12	7.46	7.51	7.45	7.47	7.37	6.85	6.67	6.83	6.82	6.9	6.92	7.3	7.26	6.94	7.39
Total Dissolved Solids	mg/L	279	500	-	-	10	76	92	70	100	150	110	116	72	68	66	62	60	62	82	80	90	240
Unionized Ammonia (Calc)	mg/L	-	-	-	-		-	-	-	-	-	0.0000297	0.0000149	-	-	-	-	-	-	-	-	-	0.0000117
Metals																							
Aluminum (diss)	mg/L	-	0.1	-	Calculated	0.004	0.02	0.354	0.038	0.027	0.022	0.251	0.266	0.015	0.01	0.009	<0.004	0.032	0.141	0.014	0.067	0.023	0.069
Barium (diss)	mg/L	-	1	-	-	0.001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Beryllium (diss)	mg/L	-	-	Calculated	-	0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boron (diss)	mg/L	1.25	5	-	0.2	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.089	<0.01	<0.01	0.132
Cadmium (diss)	mg/L	-	0.005	-	Calculated	0.0001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium (diss)	mg/L	-	0.05	-	-	0.001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cobalt (diss)	mg/L	-	-	-	0.0009	0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Copper (diss)	mg/L	-	1	-	Calculated	0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Iron (diss)	mg/L	0.15	0.3	0.3	-	0.01	<0.01	**0.573**	<0.01	0.036	<0.1	0.295	**0.415**	<0.01	<0.01	<0.01	0.026	<0.01	0.174	0.011	0.014	<0.1	0.072
Lead (diss)	mg/L	-	0.01	-	Calculated	0.0005	<0.001	<0.001	<0.0005	<0.0005	<0.0005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0005	0.0007	<0.0005	<0.001
Manganese (diss)	mg/L	0.03	0.05	-	-	0.002	<0.002	0.009	<0.002	0.002	<0.002	0.094	0.084	0.074	0.083	0.03	0.029	0.037	0.03	<0.002	0.007	0.02	0.006
Molybdenum (diss)	mg/L	-	-	-	0.04	0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nickel (diss)	mg/L	-	-	0.025	-	0.001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Silicon (diss)	mg/L	-	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Silver (diss)	mg/L	-	-	0.0001	-	0.0001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Strontium (diss)	mg/L	-	-	-	-	0.001	0.052	0.062	0.057	0.063	0.057	0.086	0.084	0.057	0.047	0.058	0.043	0.04	0.042	0.214	0.052	0.039	0.575
Thallium (diss)	mg/L	-	-	-	0.0003	0.0001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Titanium (diss)	mg/L	-	-	-	-	0.005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vanadium (diss)	mg/L	-	-	-	0.006	0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zinc (diss)	mg/L	2.50	5	-	0.02	0.005	<0.005	0.007	<0.005	<0.005	<0.005	0.005	0.014	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005

-LEGEND-

Detection Limit	DL: May vary between sample locations and events
DL exceeds criteria	
Concentration exceeds RUV-WC	Reasonable Use Values Wolf Creek
Concentration exceeds ODWQS	Ontario Drinking Water Quality Standards
Concentration exceeds PWQO-GENERAL	Provincial Water Quality Objectives General
Concentration exceeds PWQO-INTERIM	Provincial Water Quality Objectives Interim

Appendix E: Historical Groundwater Chemistry						Location	WC6.3-19	WC6.3-19	WC6.3-19	WC6.3-19	WC6.3-19	WC6.3-19	WC6.3-19	WC6.3-19
Parameter	Units	RUV-WC	ODWQS	PWQO-GENERAL	PWQO-INTERIM	Sample ID	WC6.3-19	WC6.3-19	WC6.3-19	WC6.3-19	WC6.3-19	WC6.3-19	WC6.3-19	WC6.3-19
						Sample Date	2020-May-11	2020-Oct-07	2021-Apr-22	2021-Oct-14	2022-Apr-20	2022-Oct-19	2023-May-01	2023-Oct-16
Anions						Detection Limit								
Chloride	mg/L	125.31	250	-	-	0.1	1.24	1.12	0.87	1.05	0.6	0.48	1.04	<1
Nitrate as N	mg/L	3.1	10	-	-	0.05	2.11	2.62	3.42	7.17	3.84	<0.05	5.32	4
Sulphate	mg/L	253.5	500	-	-	0.1	116	63.5	22.7	29.6	14.8	7.16	21.9	81
Cations														
Calcium (diss)	mg/L	-	-	-	-	0.05	54.6	42.5	28.6	31.4	20.1	13	33.1	64
Magnesium (diss)	mg/L	-	-	-	-	0.05	11	8.03	5.72	6.33	3.98	2.74	4.66	11
Potassium (diss)	mg/L	-	-	-	-	0.05	5.19	5.02	3.07	3.96	2.99	1.55	5.53	7.8
Sodium (diss)	mg/L	100.92	200	-	-	0.05	4.72	3.89	4	3.68	3.34	1.96	6.75	4.7
General Chemistry														
Alkalinity (as CaCO3)	mg/L	262.25	30 - 500	Factsheet	-	1	87	94	72	68	52	42	78	110
Ammonia as N	mg/L	-	-	-	-	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.1	<0.02	<0.05
Chemical Oxygen Demand	mg/L	-	-	-	-	4	9	17	<5	<5	8	<5	<5	16
Dissolved Organic Carbon	mg/L	4.9	5	-	-	0.4	3.1	3.5	2.8	27.6	2.5	3.7	3.4	4.2
Electrical Conductivity	uS/cm	-	-	-	-	1	526	305	225	250	171	101	253	430
pH	pH units	-	6.5 - 8.5	6.5 - 8.5	-		6.61	6.96	6.83	7.1	6.91	7.2	7.37	6.97
Total Dissolved Solids	mg/L	279	500	-	-	10	268	188	124	154	94	58	172	300
Unionized Ammonia (Calc)	mg/L	-	-	-	-		-	-	-	-	-	-	-	-
Metals														
Aluminum (diss)	mg/L	-	0.1	-	Calculated	0.004	0.015	0.011	0.009	0.016	0.022	0.03	0.011	0.0064
Barium (diss)	mg/L	-	1	-	-	0.001	-	-	-	-	-	-	-	-
Beryllium (diss)	mg/L	-	-	Calculated	-	0.0005	-	-	-	-	-	-	-	-
Boron (diss)	mg/L	1.25	5	-	0.2	0.01	0.189	0.118	0.131	0.11	0.086	<0.01	0.166	0.16
Cadmium (diss)	mg/L	-	0.005	-	Calculated	0.0001	-	-	-	-	-	-	-	-
Chromium (diss)	mg/L	-	0.05	-	-	0.001	-	-	-	-	-	-	-	-
Cobalt (diss)	mg/L	-	-	-	0.0009	0.0005	-	-	-	-	-	-	-	-
Copper (diss)	mg/L	-	1	-	Calculated	0.0005	-	-	-	-	-	-	-	-
Iron (diss)	mg/L	0.15	0.3	0.3	-	0.01	<0.01	0.015	0.012	<0.01	0.015	0.013	0.025	<0.1
Lead (diss)	mg/L	-	0.01	-	Calculated	0.0005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0005	<0.0005	<0.0005
Manganese (diss)	mg/L	0.03	0.05	-	-	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.04	<0.002	<0.002
Molybdenum (diss)	mg/L	-	-	-	0.04	0.0005	-	-	-	-	-	-	-	-
Nickel (diss)	mg/L	-	-	0.025	-	0.001	-	-	-	-	-	-	-	-
Silicon (diss)	mg/L	-	-	-	-	0.01	-	-	-	-	-	-	-	-
Silver (diss)	mg/L	-	-	0.0001	-	0.0001	-	-	-	-	-	-	-	-
Strontium (diss)	mg/L	-	-	-	-	0.001	0.688	0.452	0.283	0.362	0.227	0.046	0.367	0.66
Thallium (diss)	mg/L	-	-	-	0.0003	0.0001	-	-	-	-	-	-	-	-
Titanium (diss)	mg/L	-	-	-	-	0.005	-	-	-	-	-	-	-	-
Vanadium (diss)	mg/L	-	-	-	0.006	0.0005	-	-	-	-	-	-	-	-
Zinc (diss)	mg/L	2.50	5	-	0.02	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005

-LEGEND-

Detection Limit	DL: May vary between sample locations and events
DL exceeds criteria	
Concentration exceeds RUV-WC	Reasonable Use Values Wolf Creek
Concentration exceeds ODWQS	Ontario Drinking Water Quality Standards
Concentration exceeds PWQO-GENERAL	Provincial Water Quality Objectives General
Concentration exceeds PWQO-INTERIM	Provincial Water Quality Objectives Interim

Appendix F

Trigger Mechanisms and Contingency Plan

WOLF CREEK WASTE DISPOSAL SITE
TRIGGER MECHANISMS
SURFACE WATER AND GROUNDWATER
Accepted December 7, 2017

OBJECTIVE AND BACKGROUND

The objective of the trigger mechanisms and contingency plan for the Wolf Creek Waste Disposal Site (WDS) is to identify the offsite migration of leachate impacted groundwater, and ensure timely action to prevent and mitigate any adverse impacts to the environment.

OBJECTIVE 1: SURFACE WATER IMPACTS

To identify migration of leachate impacted groundwater discharging to adjacent surface water bodies and to identify impacts to surface water bodies and ensure timely action to prevent and mitigate any adverse impacts to the environment.

West Property Boundary-Surface Water

Assessment Points- WC2-03
Trigger Mechanisms-Alkalinity, Nitrate, Sulphate, TDS, Iron and Un-ionized Ammonia
Frequency-Sampling twice per year (Spring and Fall)
Contingency Plan is activated if:

- Three or more of the following chemical parameters; Alkalinity, Nitrite. Sulphate, TDS exceeds the 75th percentile of the historical data for three of the chemical parameters; or
- Iron or un-ionized ammonia exceeds the Provincial Water Quality Objectives (PWQO). for either of the assessment points.

The 75th percentile for the sampling locations and chemical parameters based on the sampling results from May 2006 to May 2017 are provided in the following tables:

Table 1: WC2-03 Trigger Values for Select Parameters

Parameter	75th Percentile Concentration mg/L	PWQO mg/L
WC2-03		
Alkalinity	99	
Nitrate	6.4	
Sulphate	117	
TDS	318	
Iron		0.3
Unionized Ammonia		0.02

OBJECTIVE 2: GROUNDWATER IMPACTS

To identify migration of leachate impacted groundwater and ensure timely action to prevent and mitigate any adverse impacts to the environment.

<u>West Property Boundary-Groundwater</u>
Assessment Point- WC2-03 and future western boundary well(s)
Trigger Mechanisms- Alkalinity, Iron, Nitrate, Sulphate, TDS
Frequency-Sampling twice per year (Spring and Fall)
Contingency Plan is activated if the following occurs: —

- Three or more of the RUVs are exceeded

Table 2: Trigger Values for Select Parameters

Parameter	RUV mg/L
Alkalinity	265
Iron	0.3
Nitrate	3.4
Sulphate	254
TDS	318

WOLF CREEK WASTE DISPOSAL SITE
CONTINGENCY PLAN FOR SURFACE AND GROUNDWATER

Tier 1: If the triggers are exceeded, a repeat sampling will be conducted within one (1) month to confirm or refute the result.

Tier 2: If the exceedance is confirmed through Tier 1 then the following will be carried out:

- Additional sampling will be conducted at an increased monitoring frequency to twice monthly, for four months (if exceedances continue). Revert back to semi-annual sampling if there are two consecutive sampling results that do not show exceedances;
- For surface water, if the exceedance is confirmed through four months of Tier 1 additional sampling then a Toxicity test (Single Concentration – Acute Lethality) sample will be collected to determine the impacts to surface water. If the toxicity test passes then no additional mitigation measures will be required. If toxicity tests fail then proceed to Tier 3.
- For groundwater, if the exceedance is confirmed through four months of Tier 1 additional sampling then proceed to Tier 3.

Tier 3: If the increased sampling indicates a continuing issue resulting in impacts or potential significant impacts to the environment, then mitigation/remediation measures will be implemented to prevent further impact. These measures would be aimed at intercepting or diverting the impacted surface water and/or groundwater before it reaches a receptor. The specifics of the plan will be dependent on the nature of the impact.

Appendix G

2021 Contaminant Attenuation Zone (CAZ) Assessment

08-February 2022
Project Number: 210217-01

Adrian Tomasini, Operations Manager, Municipality of Hastings Highland
P.O. Box 130
Maynooth, ON K0L 2S0

RE: 2021 - 2022 Contaminant Attenuation Zone Assessment – Wolf Creek WDS

BluMetric Environmental Inc. (BluMetric™), was retained by the Corporation of the Municipality of Hastings Highlands (MHHs or Municipality) to conduct the CAZ Assessment work in 2021. This Assessment is being reported on as "Appendix G" of the 2021 Annual Monitoring Report (AMR) for the Site, and therefore the Site information (e.g. location, description, figures etc.) are not repeated within this letter report. The geology and hydrogeology for the Site is describe in Section 2 of the AMR, the groundwater elevations and flow direction are described in Section 3 of the AMR.

This report provides a summary of the Contaminant Attenuation Zone (CAZ) Assessment that was carried out on the Site's historic water quality data (2007 to 2021) and the Assessment was completed early in 2022 and therefore includes both the spring and fall results for 2021. This work was carried out as part of the Phase 3 work to address Ministry of Environment, Conservation and Parks (MECP) concerns regarding non-compliance with Guideline B-7.

In 2003 there were three monitoring wells installed at the Site and in 2019 five more wells were installed as identified in the following Table. A description of how each well location relates to the CAZ Assessment work is provided in Table A. These monitoring well locations are shown on Figures 02 to 03 in the AMR, while spring and fall groundwater elevations and flow directions are provided on Figures 04 and 05, respectively.

Table A: Monitoring Well Locations and Relationship to CAZ Assessment

Well Identification	Relationship to CAZ Assessment
WC1-03	Upgradient from waste footprint, used as background well. Historic data from 2007 to 2021 used to determine Mean Background values for the Assessment.
WC2-03	Downgradient well from waste footprint, historically having the highest concentrations of leachate indicators. Historic data for this well used to determine the geometric mean of leachate concentration for Assessment.
WC3-03	Leachate well in north portion of waste footprint, historically having lower concentrations of leachate indicators than WC2-03. Historic data for this well used to determine the geometric mean of leachate concentration for Assessment.
WC4-19	Downgradient well, not used in the assessment.
WC5-19	Upgradient well from waste footprint, not used in Assessment.
WC6.1-19 (well nest, deepest)	Downgradient well, not used in the assessment.
WC6.2-19 (well nest, mid-level)	Downgradient well, not used in the assessment.
WC6.3-19 (well nest, shallowest)	Downgradient well, exhibiting the highest elevated concentrations of leachate indicator parameters of the three in the well nest and directly downgradient of WC2-03. Data from 2019 to 2021 used as the downgradient concentration of water quality impacted by the WDS.

CAZ Assessment

Mean and geometric mean concentrations for the background and leachate wells, respectively, are based on 16 years of data (2007 to 2021), while the geometric mean concentration of the downgradient well is based on three years of data (five datasets). The 2019 data for downgradient well WC6.3-19 only includes fall data as the well was installed until after the spring 2019 sampling event. There was a significant increase is some leachate indicator parameters in the fall of 2021. These increases appear to be an anomaly.

Attenuation distances were calculated based on the methods presented by Zaltsburg (1995) and the following:

- The geometric mean chemical parameter concentrations from 2007 to 2021 at the leachate indicator well. Data from downgradient well WC2-03 and the leachate monitoring WC3-03 were used as it historically had the highest concentrations of leachate parameter concentrations.
- The RUG criteria was revised to include all 2021 water quality data for the Site; and
- The 2019 to 2021 downgradient impacted well geometric mean chemical parameter concentrations (WC6.3-19).

Based on historic data and BluMetric's experience at other sites, the RUG criteria for on-site alkalinity, aluminum, boron, chloride, DOC, iron, nitrate, manganese, sodium, sulphate, and TDS were calculated. Manganese was not carried through in CAZ calculations as upgradient and downgradient concentrations were both lower than the leachate concentration for this parameter. Table B below provides a summary of the results obtained from the CAZ calculations.

The only parameter identified as a Critical Parameter was iron. Meaning, the concentration of this parameters at the leachate indicator well is more than one times greater than the concentration of the RUG criteria. No other “Critical Parameters” were identified. The attenuation distance was then calculated for this parameter.

Table B: Calculation for Attenuation Distance

Parameter	Leachate Well Conc. Geometric Mean (mg/L)	Downgradient Well Conc. Geometric Mean (mg/L)	Conc. Ratio	2007 to 2021 RUV Conc. (mg/L)	Specific Attenuation As	Required Attenuation Distance from footprint
Iron	0.241	0.020	12.06	0.17	0.0101	87.08

Note: Conc. - denotes Concentration

Currently there is no CAZ at the Site. There is no 30 m buffer between the waste footprint and the Site property boundary to the east, and the buffer to the north and west is less than 30 m. Considering the overburden at the Site has a high permeability, and the elevated concentrations observed in water quality off-site, we would recommend that the following CAZ areas (ownership or easements) be obtained for the Site:

- 30 m buffer ownership/easement to the east and south of the existing Site Property Boundary (inferred area of upgradient groundwater), and
- 100 m CAZ ownership/easement to the north and west of the existing Site Property Boundary.

Calculations indicate an 87 m CAZ distance is required from the footprint, or approximately 50 m is required to the west of the property boundary for iron attenuation; however, we recommend the 100 m distance to the north and west to include the existing background wells. The CAZ area to the north will primarily provide access for sampling and maintaining the existing background well WC1-03 and cross-gradient well WC5-19. The CAZ area to the west will serve as the primary downgradient attenuation zone. The proposed CAZ area has been illustrated on Figure 03 Site Topography and Monitoring Locations, included as part of the 2021 AMR.

Additional monitoring wells are not recommended at this time. Future monitoring will confirm if elevated concentrations in the fall of 2021 are an anomaly, or if the downward trends which have been observed in recent years is changing.

Site Property Information

The MHHs does not own the 0.7 ha WDS property, it is situated on Crown land. The MHHs is granted use of the property under a Land Use Permit (LUP). The Ministry of Northern Development, Mines, and Natural Resources (NDMNRF) currently administers Crown land use. All land surrounding the Site is Crown land. The MHHs is in the process of surrendering the Aggregate Permit License for the property immediately to the east of the Site. This land transaction will need to be completed prior to new land transactions being initiated. We understand that documentation has been provided to NDMNRF and it is awaiting processing.

Once the MECP generally reviews and confirms their general agreement with this CAZ Assessment, and the process of the Aggregate Permit License is completed, discussions should begin with NDMNRF regarding purchasing or obtaining an easement of the CAZ/buffer areas.

Additional Actions

The Municipality may be required to submit additional land ownership information or easement information to the MECP. The extent of this information will depend on what type agreement is reached with NDMNRF for the Site and CAZ/buffer areas.

Summary Statement

The conclusions presented in this report represent our professional opinion and are based upon the work described in this report and any limiting conditions in the terms of reference, scope of work, or conditions noted herein.

The findings presented in this report are based on conditions observed at the specified dates and locations, the analysis of samples for the specified analyses, and information obtained for this project. Unless otherwise stated, the findings cannot be extended to previous or future site conditions, locations that were not investigated directly, or types of analysis not performed.

BluMetric Environmental Inc. makes no warranty as to the accuracy or completeness of the information provided by others, or of conclusions and recommendations predicated on the accuracy of that information. This report has been prepared for The Corporation of the Municipality of Hastings Highlands.

Any use a third party makes of this report, any reliance on the report, or decisions based upon the report, are the responsibility of those third parties unless authorization is received from BluMetric Environmental Inc. in writing. BluMetric Environmental Inc. accepts no responsibility for any loss or damages suffered by any unauthorized third party as a result of decisions made or actions taken based on this report.

Please feel free to call or e-mail the undersigned if you have any questions.

Respectfully submitted,
BluMetric Environmental Inc.

Iris O'Connor, P.Eng.
Project Engineer/Senior Environmental Engineer
ioconnor@blumetric.ca
Office: 613-531-2725 ext. 245
Cell: 613-328-0243

Carolyn Miller, B.A.Sc., EIT.
Engineering Intern
cmiller@blumetric.ca
Cell: 613-898-7360

References

BluMetric, 2021. Wolf Creek WDS 2020 Annual Report. Submitted to The Corporation of the Municipality of Hastings Highlands, March 2020.

Ministry of the Environment (MOE). Procedure B-7-1: Determination of Contaminant Limits and Attenuation Zones. Ministry of Environment, Government of Ontario. 9pp.

E. Zaltsburg, 1995. Determination of Groundwater Attenuation Distances for Municipal Landfill Sites in Ontario, Canadian Water Resources Journal, Vol. 20, No.1, 1995.

BluMetric Environmental Inc.

1682 Woodward Drive
Ottawa, Ontario
Canada K2C 3R8
Tel: 877.487.8436
Fax: 877.487.8436
Ottawa@blumetric.ca

4 Cataraqui Street
The Tower, The Woolen Mill
Kingston, Ontario
Canada K7K 1Z7
Tel: 877.487.8436
Kingston@blumetric.ca

3B - 209 Frederick Street
Kitchener, Ontario
Canada N2H 2M7
Tel: 877.487.8436
Kitchener@blumetric.ca

825 Milner Avenue
Toronto, Ontario
Canada M1B 3C3
Tel: 877.487.8436
Toronto@blumetric.ca

6-410 Falconbridge Road
Sudbury, Ontario Canada
P3A 4S4
Tel: 877.487.8436
Sudbury@blumetric.ca

260-15 Taschereau Street
Gatineau, Quebec
Canada J8Y 2V6
Tel: 877.487.8436
Gatineau@blumetric.ca

200-1500 Du College Street
Saint-Laurent, Quebec
Canada H4L 5G6
Tel: 877.487.8436
Montreal@blumetric.ca

4916 – 49th Street
Yellowknife, NT
Canada X1A 1P3
Tel: 877.487.8436
Yellowknife@blumetric.ca

Whitehorse, Yukon
Canada Y1A 2J8
Tel: 877.487.8436
Whitehorse@blumetric.ca

www.blumetric.ca