

**2019 ANNUAL GROUNDWATER MONITORING REPORT
MINDEMOYA WASTE DISPOSAL SITE
MINDEMOYA, ONTARIO**

Submitted to:

The Municipality of Central Manitoulin

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Mindemoya, Ontario

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Submitted by:

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5 December 2019

Wood Project No.: TY1410143



TABLE OF CONTENTS

SECTION	PAGE
1.0 INTRODUCTION.....	1
1.1 Site Location.....	1
1.2 Ownership and Key Personnel.....	1
1.3 Description and Development of the Site.....	2
1.3.1 Site Capacity.....	2
1.4 Monitoring and Reporting Program Objectives and Requirements.....	2
1.5 Assumptions and Limitations.....	3
2.0 PHYSICAL SETTING.....	4
2.1 Geology and Hydrogeology.....	4
3.0 DESCRIPTION OF MONITORING PROGRAM.....	4
3.1 Monitoring Locations.....	4
3.2 Monitoring Frequency.....	5
3.3 Field and Laboratory Parameters and Analysis.....	5
3.4 Monitoring Procedures and Methods.....	6
3.5 Quality Assurance for Sampling and Analysis.....	6
4.0 MONITORING RESULTS.....	7
4.1 Historical Data.....	7
4.2 Data Quality Evaluation.....	7
4.3 Groundwater Flow Monitoring.....	7
4.4 Groundwater Quality Monitoring.....	8
4.4.1 Background Water Quality.....	8
4.4.2 Downgradient Water Quality.....	8
4.4.3 Groundwater Field Parameter Measurements.....	9
5.0 ASSESSMENT, INTERPRETATION AND DISCUSSION.....	9
5.1 Groundwater Chemistry Analysis.....	9
5.2 Guideline B-7.....	10
5.3 Adequacy of the Monitoring Program.....	11
6.0 CONCLUSIONS.....	11
7.0 RECOMMENDATIONS.....	12
8.0 CLOSURE.....	13

TABLES

Table 1: Monitoring Locations On-Site.....	4
Table 2: Groundwater Monitoring Well Construction Details	5
Table 3: Fall 2019 Groundwater Field Parameter Measurements	9

FIGURES

Figure 1	Site Location Map
Figure 2	Site Plan
Figure 3A	Inferred Shallow Groundwater Contours – September 2019
Figure 3B	Inferred Deep Groundwater Contours – September 2019
Figure 4	Groundwater Tri-Linear Piper Plot – September 2019

APPENDICES

Appendix A	Environmental Compliance Approval No. A550701
Appendix B	Groundwater Elevations
Appendix C	2019 Laboratory Analytical Reports
Appendix D	Summary of Groundwater Geochemical Analyses
Appendix E	Photographic Inventory of Groundwater Monitoring Locations
Appendix F	Groundwater Ionic Balance and Piper Plot Data Table
Appendix G	Guideline B-7 Calculations
Appendix H	Monitoring and Screening Checklist

1.0 INTRODUCTION

Wood Environment & Infrastructure (Wood) was retained by The Municipality of Central Manitoulin (the Municipality) to prepare the 2019 annual groundwater monitoring report for the Mindemoya Waste Disposal Site (the Site). The following report provides a detailed evaluation and summary of the 2019 monitoring data and was completed to constitute the 2019 Annual Monitoring Report. This document also includes a review of the available groundwater flow and geochemical data, as well as an evaluation of the groundwater quality with respect to Ministry of the Environment, Conservation and Parks (MECP) Guideline B-7 (Guideline).

1.1 Site Location

The Site is located at 408 Elliot Road, northeast of Mindemoya, Ontario, east of the intersection of Hill Road and Elliot Road, as presented on Figure 1. The legal description of the Site is part Lot 27, Concession 2, Township of Carnarvon, Registered Plan No. 22, District of Manitoulin. The Universal Transverse Mercator (UTM) coordinates of the Site are 411220 Easting and 5067030 Northing, Zone 17, relative to the North American Datum (NAD) 83 (collected via handheld Global Positioning System (GPS), accuracy +/- 5 metres (m)). A Site plan including all monitoring locations, is presented on Figure 2.

1.2 Ownership and Key Personnel

Contact information for the Site contact representative and the Competent Environmental Practitioner (CEP) for groundwater is outlined below.

Site Contact Representative:

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1.3 Description and Development of the Site

The Site was formerly operated under Provisional Certificate of Approval (C of A) No. A550701, issued 18 March 1980, recently replaced on 10 January 2019 with an amended Environmental Compliance Approval (ECA), provided in Appendix A. The Site is reported to have been in use prior to 1980 (Cambium Inc. (Cambium), 2013). Historically, the Site accepted domestic and commercial wastes, however during recent years waste consisted of only domestic waste originating from curbside pickup operations within the Municipality and was not open to the public (Cambium, 2013). The ECA indicates an approved waste disposal area of 0.81 hectares (ha), but it does not specify a total Site area or a maximum approved capacity. The Site stopped accepting waste in June 2016 and has been graded to the final waste contours, although no final cover has been applied. The Municipality made application to the MECP for an ECA amendment with a closure plan in February 2017.

1.3.1 Site Capacity

No topographical survey was undertaken in 2019, as no waste was deposited at the Site since the previous survey, completed 13 October 2017, and there was therefore no change to the volume of existing waste during the current monitoring year. A total volume of existing waste of approximately 37,720 cubic metres (m³) was measured during completion of 2017 survey, including both waste and interim cover material.

Although no maximum allowable capacity is stated in the Site's ECA, a theoretical maximum capacity of 36,050 m³ was previously calculated by Cambium, based on MECP approved design requirements. Based on this theoretical capacity, the Site is marginally over capacity, however if the slopes of the fill area can be graded appropriately (i.e., per MECP landfill standards) during capping, no removal of material is necessary. It is anticipated that the Site will be capped in 2020, pending approval from the MECP.

1.4 Monitoring and Reporting Program Objectives and Requirements

Historical Site investigations completed by others resulted in the instrumentation of the Site with four multi-level well nests, each comprised of a deep and shallow installation. These eight wells comprise the current groundwater monitoring program, which was initiated in 2014. Despite the previous installation of the monitoring well network, an annual sampling program was not historically undertaken at the Site. The locations of the current groundwater monitoring wells are presented on Figure 2.

Four additional well nests (nine wells in total) were installed at the Site during 2019 as part of separate, ongoing study undertaken by Wood on behalf of the Municipality. The program for which the new wells were installed is intended to determine an appropriate contaminant attenuation zone (CAZ) for the Site and is to be completed by 31 March 2020, per a Condition of the amended ECA. Following the completion of this study, the new wells will be incorporated into the annual monitoring program and will be added to the monitoring network beginning in 2020, during the next regularly scheduled monitoring event.

1.5 Assumptions and Limitations

Wood's limitation of liability and scope of work is as follows:

1. The work performed in this report was carried out in accordance with the Terms and Conditions made part of our contract. The conclusions presented herein are based solely upon the scope of services and time and budgetary limitations described in our contract.
2. The report has been prepared in accordance with generally accepted environmental study and/or engineering practices. No other warranties, either expressed or implied, are made as to the professional services provided under the terms of our contract and included in this report.
3. The services performed and outlined in this report were based, in part, upon a previously installed monitoring network, established by others and approved by the applicable regulatory agencies. Our opinion cannot be extended to portions of the Site which were unavailable for direct observations, reasonably beyond the control of Wood.
4. The objective of this report was to assess the water quality conditions at the Site, given the context of our contract, with respect to existing environmental regulations within the applicable jurisdiction.
5. The Site history interpreted herein relies on information supplied by others, such as local, provincial and federal agencies, as well as Site personnel. No attempt has been made to independently verify the accuracy of such information, unless specifically noted in our report.
6. Our interpretations relating to the landfill-derived leachate plume at the Site are described in this report. Where testing was performed, it was executed in accordance with our contract for these services. It should be noted that other compounds or materials not tested for may be present in the Site environment.
7. The conclusions of this report are based, in part, on the information provided by others. The possibility remains that unexpected environmental conditions may be encountered at the Site in locations not specifically investigated. Should such an event occur, Wood must be notified in order that we may determine if modifications to our conclusions are necessary.
8. The utilization of Wood's services during future monitoring at the Site will allow Wood to observe compliance with the conclusions and recommendations contained herein. It will also provide for changes as necessary to suit field conditions as they are encountered.
9. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Wood accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

2.0 PHYSICAL SETTING

2.1 Geology and Hydrogeology

Although borehole logs detailing soil and groundwater conditions for the existing monitoring well network are not available, Cambium reported that the Site is underlain by fractured limestone bedrock, with minimal overburden deposits, which is typical of the area. In addition, water well records for locations within one kilometre of the Site indicate that most wells are installed at depths of between 35 and 45 metres (m) below ground surface, and are installed in limestone bedrock (Cambium, 2013). Well records also indicate that overburden consists of generally between one and six m of clay, loam, fine sand or stoney overburden (Cambium, 2013).

Static water levels were recorded by Wood in each of the wells during the September 2019 groundwater monitoring event. Appendix B presents the groundwater elevations measured during the 2019 groundwater monitoring event. Figures 3A and 3B present the inferred groundwater elevation contours and groundwater flow directions for the shallow and deep aquifers, respectively, for the 2019 monitoring event. In general, the recorded static groundwater levels indicate groundwater flow across the Site towards the northwest. Groundwater flow within the deep aquifer also includes a component of groundwater flow towards the west, as illustrated on Figure 3B.

3.0 DESCRIPTION OF MONITORING PROGRAM

3.1 Monitoring Locations

All groundwater monitoring locations are illustrated on Figure 2. Detailed locations are provided in Table 1. Monitoring well elevations for top of casing are provided in Appendix B.

Table 1: Monitoring Locations On-Site

Monitoring Location	Easting Zone 17 NAD 83	Northing Zone 17 NAD 83	Collection Method	Accuracy	Collection Personnel	Date Collected
Well Nest MW-E	412004	5067059	Handheld GPS	+/- 5 m	Trained Wood field crew	14 October 2014
Well Nest MW-N	411925	5067103				
Well Nest MW-S	411927	5067013				
Well Nest MW-W	411828	5067057				

Table 2 presents a summary of the available installation details and respective on-Site positions of the groundwater monitoring wells. Construction details of the wells are unknown, as borehole logs are not available. According to the groundwater elevation data collected to date, well nest MW-S is situated hydraulically upgradient (i.e., south) of the waste fill area, and is therefore considered unlikely to be impacted by landfill leachate since the groundwater system flows

across the Site to the northwest and west. Based on this conclusion, well nest MW-S is considered to be representative of background water quality conditions, and allows a detailed evaluation of the Site to be undertaken with respect to MECP Guideline B-7. It is noted that the expanded monitoring well network, to be initiated in 2020, will include a new background well nest, situated further upgradient of the waste deposits. Although dependent on the conclusions of the CAZ determination program, it is assumed that the new well nest may be more appropriate for use as a background monitor in the future, should groundwater mounding and subsequent radial groundwater flow occur within the fill area following grading for site closure and application of final cover material.

Well nest MW-E is situated immediately east of the fill area, and is considered a downgradient monitor, despite its position hydraulically upgradient, given its proximity to the waste deposits and the potential for localized radial groundwater flow from the waste towards this monitoring location. Well nests MW-W and MW-N monitor downgradient groundwater conditions at the Site to the west and north of the fill area, respectively, and are used to assess the performance of the natural attenuation process at the Site.

Table 2: Groundwater Monitoring Well Construction Details

Well ID	Condition	Total Depth (mbtop) ¹	On-Site Position
MW-NS	Good	8.11	Downgradient shallow
MW-ND	Good	11.75	Downgradient deep
MW-ES	Good	6.45	Downgradient shallow
MW-ED	Good	10.05	Downgradient deep
MW-SS	Good	7.42	Upgradient shallow
MW-SD	Good	11.75	Upgradient deep
MW-WS	Good	7.54	Downgradient shallow
MW-WD	Good	11.94	Downgradient deep

Notes:

1) mbtop indicates m below top of pipe.

3.2 Monitoring Frequency

Groundwater was sampled by Wood once annually, during the fall. The annual monitoring event occurred on 5 September 2019.

3.3 Field and Laboratory Parameters and Analysis

Geochemical analyses for general chemistry, metals, select volatiles and nitrogen cycle parameters were completed on all samples collected. A detailed list of laboratory parameters is included in Appendix C. Field parameters comprised static water level measurements,

temperature, pH, conductivity and dissolved solids. All field equipment was maintained and calibrated appropriately prior to each use.

3.4 Monitoring Procedures and Methods

Monitoring and sample collection followed typical industry standard practices. Each groundwater monitoring well was purged prior to sampling to ensure the sample was representative of the formation water. Dedicated well instrumentation (Waterra Tube and foot valve system) was used to obtain water samples from the groundwater monitoring wells, and samples were immediately transferred to laboratory-prepared sample vials and bottles. Samples identified for heavy metals analysis were field-filtered using a single use 0.45 µm filter unit, and the remaining samples were preserved following standard laboratory protocols as established in the MECP “*Guidance on Sampling for Use at Contaminated Sites in Ontario*” (revised December 1996) and the above-noted SOP.

Samples were submitted under chain of custody, in a temperature-controlled setting (i.e., in a cooler, on ice) to a Canadian Association for Laboratory Accreditation (CALA) accredited laboratory sub-contractor, AGAT Laboratories (AGAT), in Mississauga for analysis. The analytical results were subsequently forwarded to Wood. Laboratory analytical reports for 2019 are provided in Appendix C. The 2019 groundwater monitoring data were reviewed by comparison to the current MECP Ontario Drinking Water Standards (ODWS).

3.5 Quality Assurance for Sampling and Analysis

Wood uses recognized industry standards, including the Canadian Council of Ministers of the Environment (CCME) *Subsurface Assessment Handbook for Contaminated Sites* and MECP’s manual *Guidance on Sampling and Analytical Methods for Use at Contaminated Sites in Ontario* for conducting environmental assessments. For quality assurance, all work is supervised and internally reviewed by senior staff members.

Field sampling equipment decontamination was completed in accordance with accepted protocols. As a minimum, sampling equipment was washed with detergent solution and rinsed with distilled water between sampling. Decontamination procedures were undertaken to prevent any cross-contamination between monitoring locations and sampling sites. Screening instruments were calibrated prior to each use.

As a minimum, for every ten groundwater samples collected, one field duplicate sample was collected and included in the laboratory submission for analysis. One field duplicate sample was collected during the annual monitoring event. Samples were submitted to a CALA accredited laboratory that is MECP certified for the analysis of drinking water samples. Laboratory blanks and duplicates were used to ensure sample integrity. Relative Percent Differences (RPDs) were calculated and discussed where applicable. Samples were placed in appropriate sample containers provided by the laboratory and preserved (as required based on type of analysis) until delivered (shipped by courier or hand delivered) to the laboratory for analysis. A chain of custody form accompanied samples at all points of handling.

4.0 MONITORING RESULTS

4.1 Historical Data

Historical (i.e., 2014 through 2018) data for groundwater are provided in Appendix D, along with the current data, presented on a well by well basis.

4.2 Data Quality Evaluation

The analytical laboratory employed to perform the laboratory analyses (AGAT) is accredited by the Standards Council of Canada/Canadian Association for Laboratory Accreditation in accordance with ISO/IEC 17025:1999 – “*General Requirements for the Competence of Testing and Calibration Laboratories*” for the tested parameters and has met the standards for proficiency testing developed by the Standards Council of Canada for parameters set out in the Soil, Ground Water and Sediment Standards.

Sample analysis dates provided on the laboratory analytical reports issued by AGAT indicate that all sample analyses were performed within the required sample/extract hold times, as indicated by the dates presented in columns for each sample parameter on the analytical report. The laboratory minimum detection limits were reported to be at or lower than the required MECP reporting detection limits for the parameters analyzed. A comparison of the internal laboratory duplicate samples indicates that all samples and the respective duplicates are within acceptable limits.

As a quality control measure, a groundwater duplicate sample was collected during the annual sampling event. All duplicate data are provided in Appendix C and summarized in Appendix D. The groundwater duplicate sample was collected from MW-SD and identified as DUP 2.

When compared to concentrations reported in the original sample, duplicate water quality data reported that all parameters were within an acceptable range with respect to relative percent difference (i.e., the industry standard of less than 50%), and are therefore interpreted to indicate no sampling or laboratory biases during 2019.

4.3 Groundwater Flow Monitoring

As discussed in Section 2.1, the recorded static groundwater levels indicate groundwater flow across the Site towards the northwest and west. Static groundwater levels are presented in Appendix B; inferred groundwater flow directions for the 2019 groundwater monitoring event are illustrated on Figures 3A and 3B.

In addition to the current groundwater elevation data, previous groundwater elevations were reviewed in order to identify any trends or inconsistencies in the data. Overall, the approximate groundwater elevations reported during 2019 are consistent with those recorded during previous monitoring programs (Appendix B).

4.4 Groundwater Quality Monitoring

Samples were collected from seven of the eight groundwater monitoring wells during the fall 2019 monitoring event. No sample was obtained from MW-NS, as this well was dry at the time of sampling. A partial sample was obtained from MW-WD as a result of a low water table and slow recovery at the time of sampling. A photographic inventory of the monitoring wells in 2019 is provided in Appendix E. The condition of each monitoring well was assessed during the 2019 monitoring event, with no noticeable requirement for maintenance or repair.

4.4.1 Background Water Quality

Water quality in upgradient well nest MW-S was selected to be representative of background, due to the apparent position of the well in the groundwater flow system. Background water quality is characterized by elevated concentrations of alkalinity, dissolved organic carbon (DOC), total dissolved solids (TDS) and manganese, moderate concentrations of chloride, sodium and sulphate, and low concentrations of most metals parameters, when compared to the ODWS. ODWS exceedances comprised alkalinity, DOC, TDS and manganese in both wells, as well as iron in MW-SS, indicated by bold entries in Appendix D. These concentrations are considered to be representative of Site-specific background water quality in the aquifer intersected by the well screen and will be used to evaluate the performance of the Site versus Guideline B-7. A detectable concentration of toluene was quantified in MW-SS and should be confirmed during 2020, as toluene has been non-detect in both background wells since monitoring was initiated in 2014.

4.4.2 Downgradient Water Quality

Groundwater quality in well nest MW-E, situated immediately east of the fill area, is characterized by slightly higher concentrations of landfill indicator parameters in MW-ED than in MW-ES. Both wells indicate lower concentrations of most analytical parameters than background wells MW-SS and MW-SD, with the exception of toluene, which was quantified at detectable concentrations in both MW-ES and MW-ED, at higher levels than that reported in MW-SS during the 2019 monitoring event.

Groundwater quality in MW-ND, situated downgradient of the Site to the north, reported concentrations of most parameters at levels lower than background, as compared to well nest MW-S. As indicated above, no sample was obtained from the shallow installation at the MW-N nest during 2019 due to a low water table.

Groundwater quality in downgradient well nest MW-W, located to the west of the fill area, is characterized by concentrations of most parameters that are at levels lower than background. Concentrations of indicator parameters are slightly higher in MW-WS, as compared to MW-WD. With the exceptions of iron and manganese, most parameters were quantified at higher levels in the MW-W nest in comparison to MW-ND.

4.4.3 Groundwater Field Parameter Measurements

Field parameters were measured at all monitoring wells at the time of sampling and are presented in Table 3.

Table 3: Fall 2019 Groundwater Field Parameter Measurements

Well ID	Temperature (°C)	pH	Conductivity (mS/cm)	Dissolved Solids (mg/L)
MW-SD	12.5	7.01	1567	784
MW-SS	10.7	6.97	1939	969
MW-ES	13.0	6.66	664	332
MW-ED	13.5	6.99	790	395
MW-NS	Insufficient volume			
MW-ND	11.8	7.15	489	245
MW-WS	11.8	7.05	860	430
MW-WD	Insufficient volume			

5.0 ASSESSMENT, INTERPRETATION AND DISCUSSION

5.1 Groundwater Chemistry Analysis

The groundwater major ion chemistry analyses for the 2019 monitoring event are presented in a Tri-Linear Piper Plot on Figure 4. A table depicting the calculations used to quantify the geochemical data is presented in Appendix F. The Piper diagram plots the major ions as percentages of milli-equivalents (meq) in two base triangles. The total cations and the total anions are set equal to 100% and the data points in the two triangles are projected onto an adjacent grid. It is noted that MW-NS could not be plotted on the Piper diagram, as no sample was obtained at this well during the 2019 monitoring event.

The positions of the seven monitoring wells on the Piper Plot indicate similar water types in wells MW-ND, MW-ES and MW-ED, a marginally different water type in wells MW-WD and MW-WS, and a differing water quality in background monitoring well nest MW-S. This indicates a slight impact at all downgradient locations, marginally greater in MW-ND and well nest MW-E than in well nest MW-W, as displayed by the shift away from the interpreted background water quality on the Piper diagram.

5.2 Guideline B-7

In September 1986, a guideline was introduced by the MECP to assist in the evaluation of groundwater impacts, especially for the case of landfill and/or lagoon operations. The guideline was entitled “The Incorporation of the Reasonable Use Concept into MECP Groundwater

Management Activities” and is referred to now as Guideline B-7. Simply stated, Guideline B-7 sets groundwater contaminant discharge criteria for landfills and/or lagoons that may impair local water quality; the criteria are based on maintaining the protection of groundwater resources on the adjacent lands or properties.

The contaminant discharge criteria, which represent the maximum acceptable levels of contaminants that should not be exceeded, are established using a simple mathematical relationship that incorporates background (existing) water quality and the highest provincial water quality standards for the adjacent land use. Under Guideline B-7, water quality impacts will not be allowed to exceed the maximum calculated discharge criteria at the Site property boundaries.

In order to apply Guideline B-7, the appropriate resource use of the adjacent properties must be selected. For the Mindemoya Waste Disposal Site, the highest end use for groundwater on the adjacent properties is for drinking water purposes, for which the ODWS - Table 1 through Table 4 have been established. The purpose of the ODWS is to protect public health through the provision of safe drinking water. Water intended for human consumption shall not contain unsafe concentrations of toxic chemicals (health related parameters). Health related standards are established for parameters that, when present above a certain concentration, have known or suspected adverse health effects. At the same time, water should also be aesthetically acceptable. Colour, odour and turbidity are parameters that, when controlled, result in water that is clear, colourless and without objectionable or unpleasant taste or odour (non-health related parameters). In addition, operational guidelines have been established for non-health related parameters that need to be controlled to ensure efficient and effective treatment and distribution of the water. As well, Guideline B-7 requires the identification of background water quality conditions in the underlying aquifer.

In order to establish the background geochemical profile (from well nest MW-S), the geometric mean of the valid concentrations of each applicable ODWS parameter is calculated, and the resultant values are applied along with the ODWS, to complete a Guideline B-7 analysis for all of the on-Site groundwater monitoring wells for various landfill indicator parameters. Appendix G presents the Guideline B-7 calculations for the fall 2019 monitoring results that have been developed using all valid background analytical data observed in MW-SS and MW-SD.

It should be noted that these Guideline B-7 values are much lower (i.e., more stringent) than the ODWS, and a well-by-well comparison of the performance of each of the parameters at all of the downgradient groundwater monitoring wells is also presented in Appendix G for the 2019 monitoring events. In the event that the background concentration of a parameter exceeds the ODWS, the background level is considered the maximum allowable concentration not to be exceeded. This is the case for DOC and TDS during the 2019 monitoring event.

Comparing concentrations observed in the groundwater monitoring wells during the 2019 sampling event to the maximum allowable concentration (Appendix G), no parameter exceedances are noted during 2019. Confirmation of these results through additional, regularly scheduled sampling in 2020 is recommended. It is noted that the monitoring network will be expanded to include additional monitoring wells both upgradient and downgradient of the Site during 2020.

5.3 Adequacy of the Monitoring Program

It is Wood's opinion that the current groundwater monitoring program is adequate with respect to the characterization of Site conditions, the evaluation of Site performance and the assessment of Site compliance, particularly given that the Site is now closed. Wood does recommend, however, the expansion of the annual monitoring program in 2020 to include the nine monitoring wells installed during 2019 for the purposes of CAZ determination. These additional wells will be useful to quantify the natural attenuation occurring at the Site. The Monitoring and Screening Checklist is provided in Appendix H.

6.0 CONCLUSIONS

Based on the results of the current (2019) monitoring program, the following conclusions have been made:

1. The Site is no longer receiving waste and is marginally over capacity based on the theoretical capacity calculated previously by Cambium. If the side and top slopes of the fill area can be graded according to MECP landfill standards prior to site closure, removal of material can be avoided.
2. Groundwater movement at the Site was determined by static groundwater level measurements recorded at each of the monitoring wells as being directed towards the northwest in both the shallow and deep aquifers, with flow being more westerly in the deep aquifer.
3. The current monitoring record indicates varying water quality in the upgradient and downgradient portions of the Site.
4. The downgradient monitoring wells indicate a water type that differs from background.
5. No Guideline B-7 exceedances were quantified during the 2019 monitoring year.

7.0 RECOMMENDATIONS

The following recommendations should be considered for inclusion in next year's monitoring program:

1. The Municipality should continue with the current frequency of groundwater monitoring, so that variations for certain parameters could be documented and understood.
2. Groundwater elevations at all existing monitoring wells should continue to be measured during the annual groundwater sampling round to further confirm groundwater flow directions.
3. The Site should be capped, as the addition of low permeability final cover material will significantly reduce infiltration and subsequently reduce leachate generation at the Site. A measureable improvement in groundwater quality in the immediate vicinity of the Site is expected following final capping.

4. Following completion of the CAZ determination program, the nine new monitoring wells installed during 2019 for that study should be incorporated into the annual monitoring network in order to better characterize groundwater quality both upgradient and downgradient of the Site.

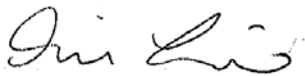
8.0 CLOSURE

This report has been prepared for the exclusive use of the Municipality for specific application to this Site. The annual monitoring report was prepared in accordance with the verbal and written requests from the Municipality and generally accepted assessment practices, restricting the investigations to the assessment of the environmental compliance associated with the Site. No other warranty, expressed or implied is made.

Respectfully Submitted,

Wood Environment & Infrastructure Solutions
A Division of Wood Canada Limited

Prepared by:

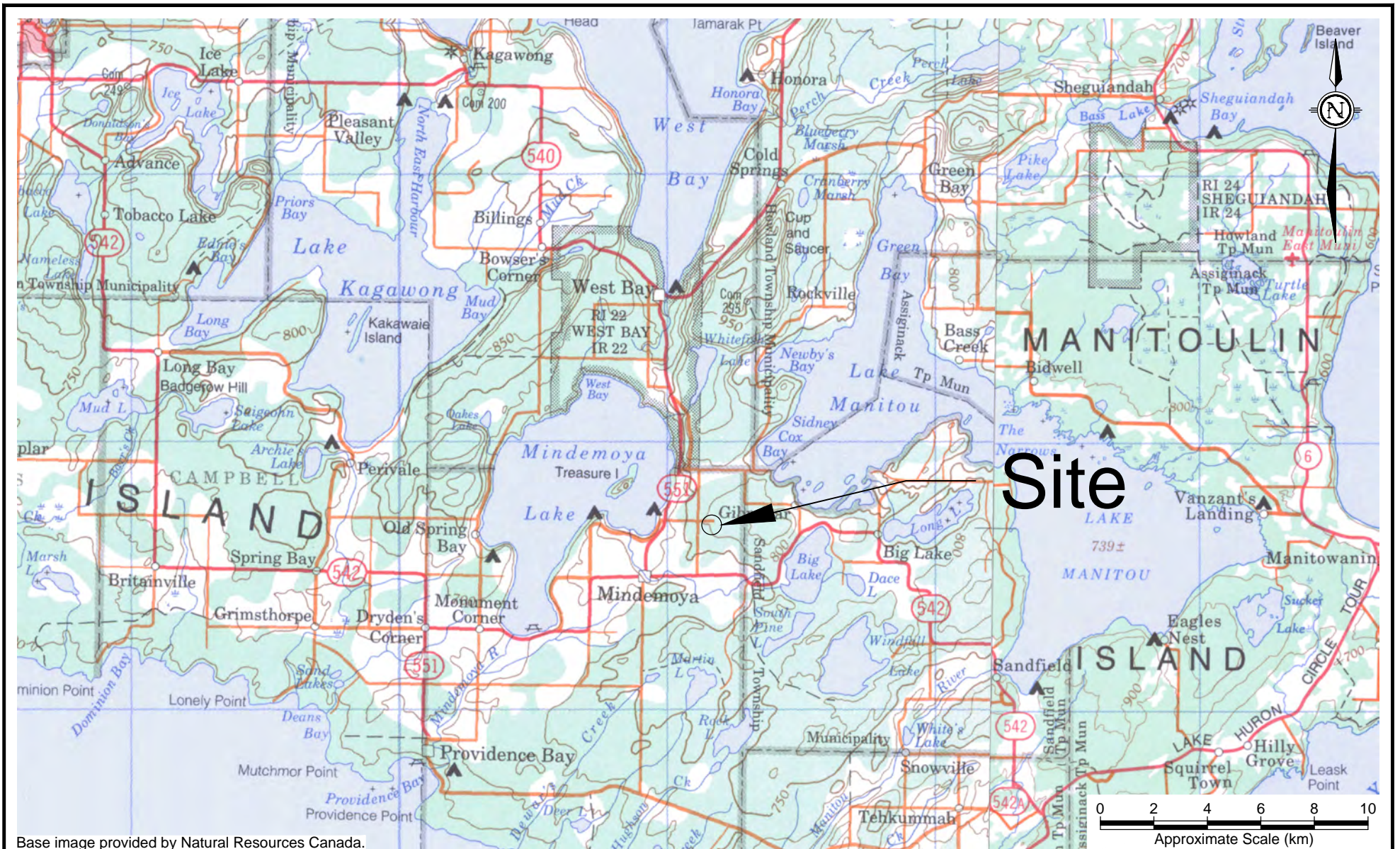


Emily Lemieux, B.Sc.
Environmental Scientist



Reviewed by:



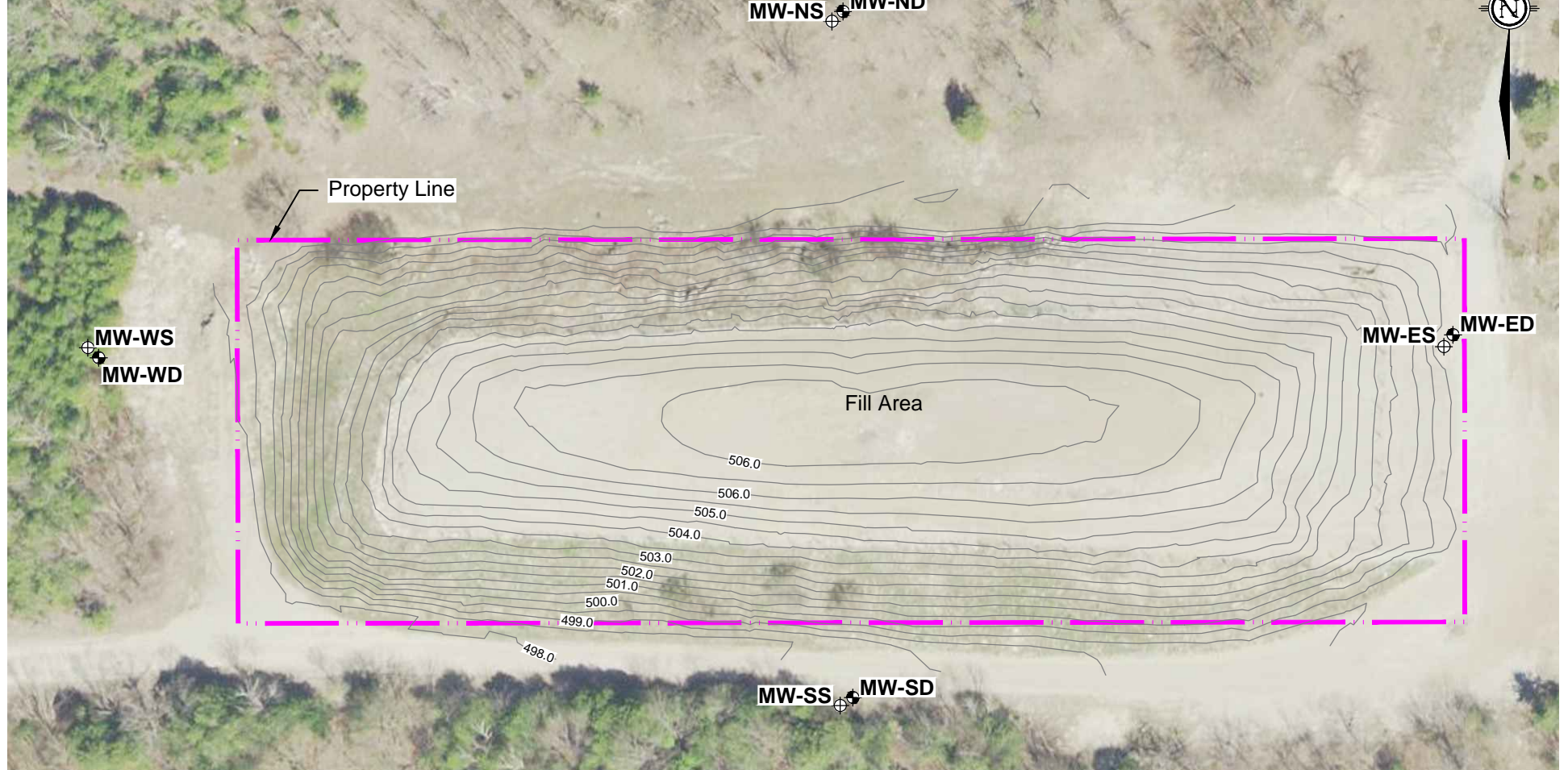
Brian Grant, P.Eng.
Hydrogeologist
Water Resources Engineer



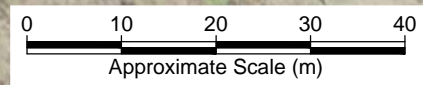
Base image provided by Natural Resources Canada.



	<p>The Municipality of Central Manitoulin</p>	DWN BY:	PROJECT	REV. NO.:
		CHK'D BY:	TITLE	DATE:
<p>Wood Environment & Infrastructure Solutions 131 Fielding Road Lively, Ontario P3Y 1L7 705-682-2632</p> 		ESL	2019 Annual Groundwater Monitoring Report Mindemoya Waste Disposal Site	1
		SCALE:	Site Location Map	PROJECT NO: TY1410143
		as shown		FIGURE NO: 1







- Legend:**
- ⊕ Well Location - Deep (D)
 - ⊗ Well Location - Shallow (S)
 - 500- Surface Contours (masl)

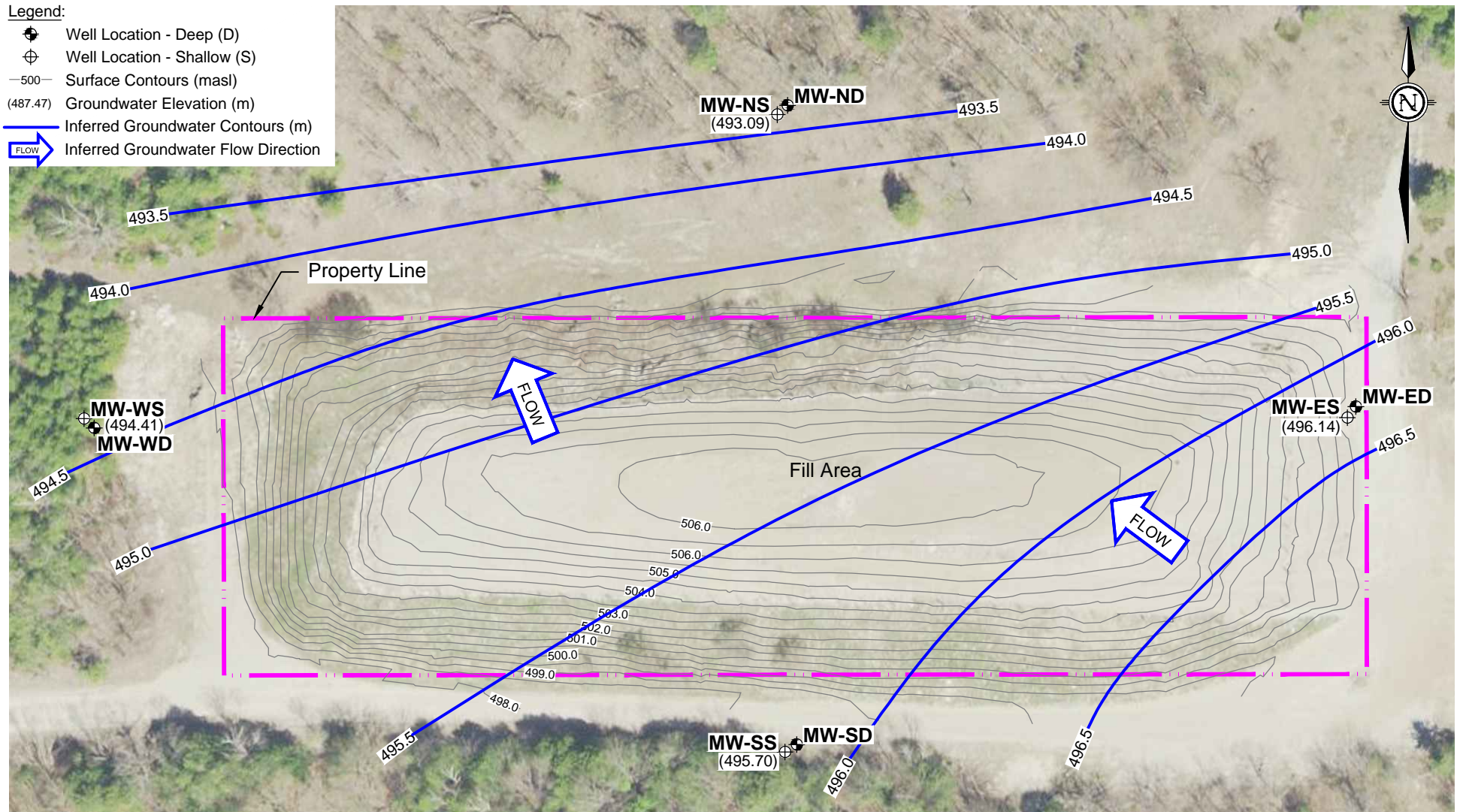


- Notes:**
1. Base image taken from the Ministry of Natural Resources and Forestry.
 2. Survey provided by Keatley Surveying Ltd. dated 16 November 2017.
 3. Well locations based on Cambium Inc. Figure 3 from report dated September 2013.

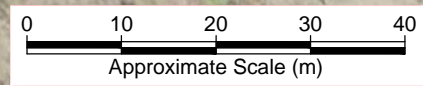




	<p>The Municipality of Central Manitoulin</p>	DWN BY:	<p>PROJECT</p> <p>2019 Annual Groundwater Monitoring Report Mindemoya Waste Disposal Site</p>	REV. NO.:	1
		CHK'D BY:		DATE:	December 2019
<p>Wood Environment & Infrastructure Solutions</p> <p>131 Fielding Road Lively, Ontario P3Y 1L7 705-682-2632</p>		ESL	TITLE	PROJECT NO.:	TY1410143
		SCALE:	Site Plan	FIGURE NO.:	2
		as shown			







- Legend:**
-  Well Location - Deep (D)
 -  Well Location - Shallow (S)
 -  Surface Contours (masl)
 -  Groundwater Elevation (m)
 -  Inferred Groundwater Contours (m)
 -  Inferred Groundwater Flow Direction

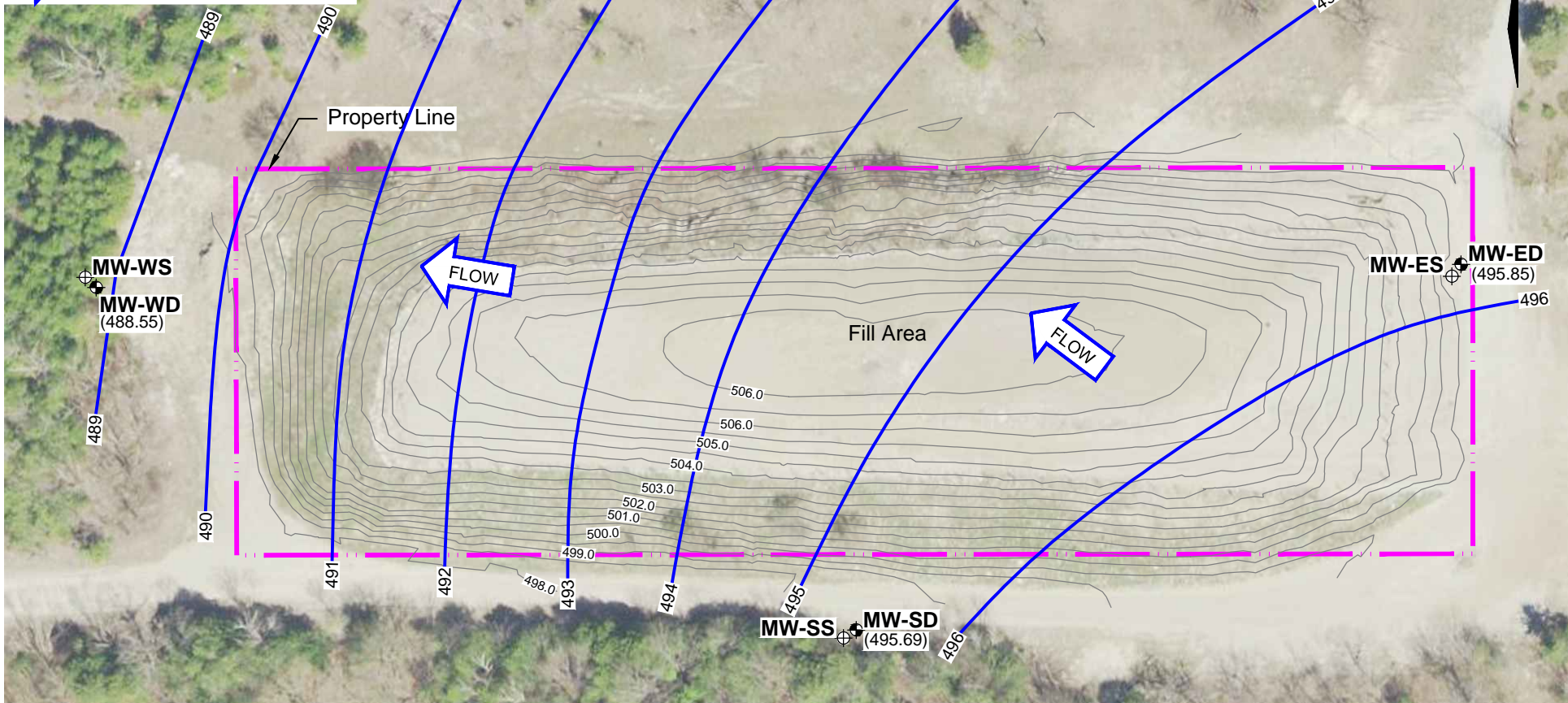


- Notes:**
1. Base image taken from the Ministry of Natural Resources and Forestry.
 2. Survey provided by Keatley Surveying Ltd. dated 16 November 2017.
 3. Well locations based on Cambium Inc. Figure 3 from report dated September 2013.

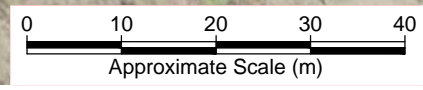




	<p>The Municipality of Central Manitoulin</p>	DWN BY:	PROJECT	REV. NO.:	1
		KKJ	2019 Annual Groundwater Monitoring Report Mindemoya Waste Disposal Site	DATE:	December 2019
<p>Wood Environment & Infrastructure Solutions</p> <p>131 Fielding Road Lively, Ontario P3Y 1L7 705-682-2632</p>		CHK'D BY:	TITLE	PROJECT NO.:	TY1410143
		ESL	Inferred Shallow Groundwater Contours - September 2019	FIGURE NO.:	3A
		SCALE:	as shown		

- Legend:**
-  Well Location - Deep (D)
 -  Well Location - Shallow (S)
 -  Surface Contours (masl)
 -  Groundwater Elevation (m)
 -  Inferred Groundwater Contours (m)
 -  Inferred Groundwater Flow Direction



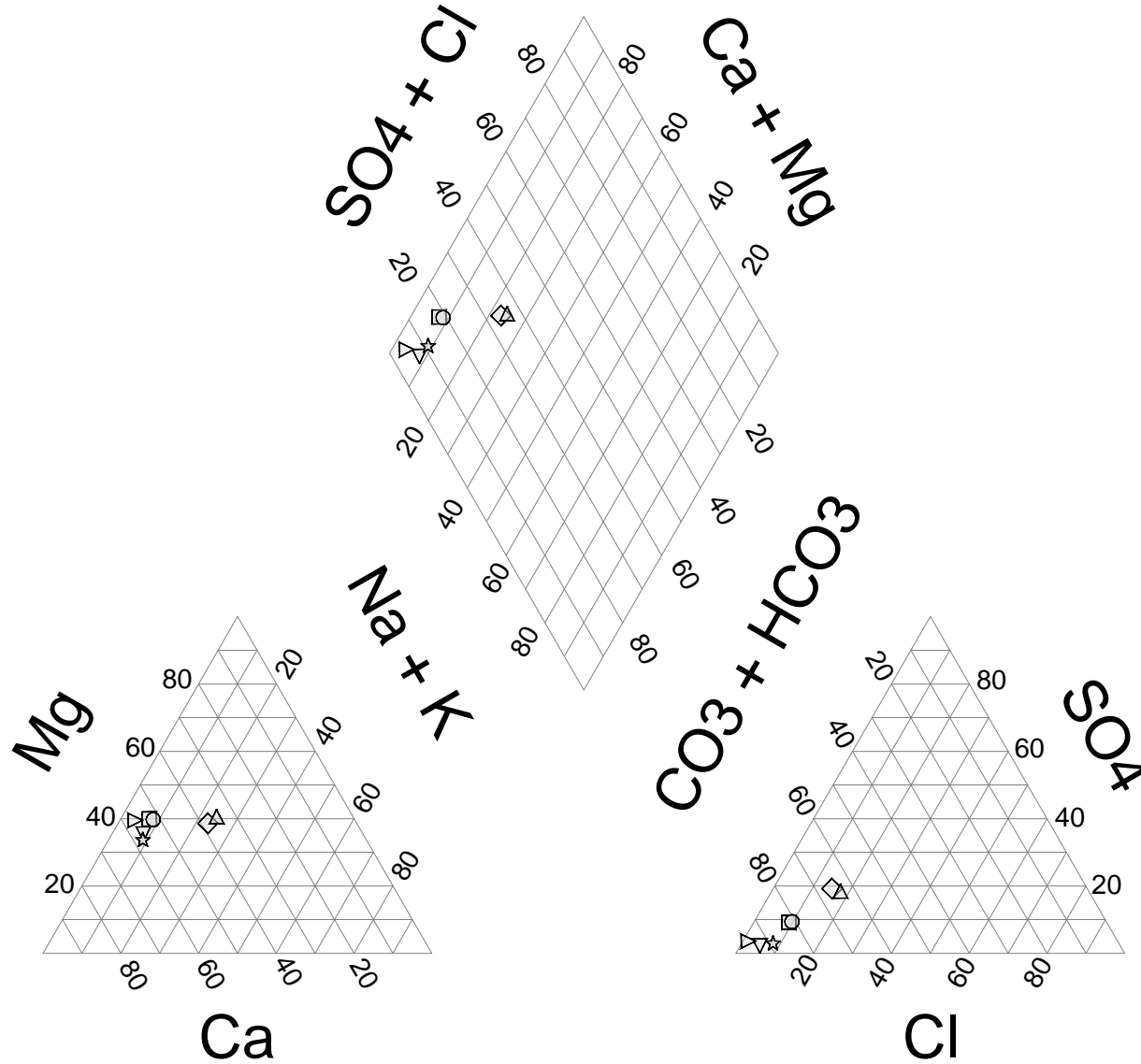
- Notes:**
1. Base image taken from the Ministry of Natural Resources and Forestry.
 2. Survey provided by Keatley Surveying Ltd. dated 16 November 2017.
 3. Well locations based on Cambium Inc. Figure 3 from report dated September 2013.





	<p>The Municipality of Central Manitoulin</p>	DWN BY:	PROJECT	REV. NO.:	1
		KKJ	2019 Annual Groundwater Monitoring Report Mindemoya Waste Disposal Site	DATE:	December 2019
<p>Wood Environment & Infrastructure Solutions 131 Fielding Road Lively, Ontario P3Y 1L7 705-682-2632</p>		CHK'D BY:	TITLE	PROJECT NO.:	TY1410143
		ESL	Inferred Deep Groundwater Contours - September 2019	FIGURE NO.:	3B
		SCALE:	as shown		

Legend:

- MW-WD
- MW-WS
- ◇ MW-SD
- △ MW-SS
- ▽ MW-ES
- ☆ MW-ED
- ▷ MW-ND



	The Municipality of Central Manitoulin	DWN BY:	PROJECT 2019 Annual Groundwater Monitoring Report Mindemoya Waste Disposal Site	REV. NO.:	1
		CHK'D BY:		ESL	DATE:
Wood Environment & Infrastructure Solutions 131 Fielding Road Lively, Ontario P3Y 1L7 705-682-2632		SCALE:	TITLE	PROJECT NO.:	TY1410143
		not applicable	Groundwater Tri-Linear Piper Plot - September 2019	FIGURE NO.:	4

The Municipality of Central Manitoulin
2019 Annual Groundwater Monitoring Report
Mindemoya Waste Disposal Site
Mindemoya, Ontario
December 2019



APPENDIX A
ENVIRONMENTAL COMPLIANCE
APPROVAL
NO. A550701

AMENDMENT TO ENVIRONMENTAL COMPLIANCE APPROVAL

NUMBER A550701

Notice No. 1

Issue Date: January 10, 2019

The Corporation of the Municipality of Central Manitoulin
6020 Highway 542 PO Box 187, Mindemoya
Central Manitoulin, Ontario
P0P 1S0

Site Location: Mindemoya Landfill Site
Lot 27, Concession 2
Municipality of Central Manitoulin, District of Manitoulin

You are hereby notified that I have amended Approval No. A550701 issued on March 18, 1980 for a 0.81 hectare landfilling site , as follows:

I. The following conditions are hereby added:

2. The Site shall cease to receive the waste and be closed in accordance with Item 1-4 of Schedule "A".
3. By March 31, 2020, the Owner shall provide to the Ministry an action plan to acquire the required properties for the Contaminant Attenuation Zone (CAZ) or if necessary to develop an alternative leachate control system.
4. By March 31, 2021, the Owner shall obtain lands necessary to provide a Contaminant Attenuation Zone (CAZ) for the Site and shall register these lands on title.

II. The following items are hereby added to Schedule "A":

1. Application and supporting documentation for a Waste Disposal Site (Landfill) from Municipality of Central Manitoulin, dated February 2, 2017.
2. Report dated January 30, 2017 and revised on November 12, 2018, Closure Plan Mindemoya Waste Disposal Site, prepared for the Corporation of the Municipality of Central Manitoulin.
3. Memorandum dated October 14, 2016, from Luciana Rodrigues, Regional Hydrogeologist, Technical Support, Northern Region, MECP, to Steven Moggy, Senior Environmental Officer, Sudbury District Office, MECP.
4. Memorandum dated October 12, 2018, from Archana Uprety, Hydrogeologist,

Technical Support, Northern Region, MECP, to Steven Moggy, Senior Environmental Officer, Sudbury District Office, MECP.

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

1. The reason of Condition 2 is to approve the closure plan submitted by the proponent.
2. The reasons of Condition 3 and 4 are to ensure the site is in compliance with the Ministry Reasonable Use Concept.

This Notice shall constitute part of the approval issued under Approval No. A550701 dated March 18, 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

AND

The Director appointed for the purposes of Part II.1
of the Environmental Protection Act
Ministry of the Environment, Conservation and

Toronto, Ontario
M5G 1E5

Parks
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 10th day of January,
2019

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

AT/
c: District Manager, MECP Sudbury
David Bucholtz, Cambium Inc.



Ministry
of the
Environment

Provisional Certificate No. A 550701

**PROVISIONAL CERTIFICATE OF APPROVAL
WASTE DISPOSAL SITE**

Under The Environmental Protection Act, 1971 and the regulations and subject to the limitations thereof, this Provisional Certificate of Approval is issued to: ENVIRONMENTAL APPROVALS BRANCH

Township of Carnarvon
Box 119
Mindemoya, Ontario
POP 1S0

RECEIVED

APR 1 1980

MUNICIPAL & PRIVATE
APPROVALS SECTION

for the use and operation of a 0.81 hectare landfilling site

all in accordance with the following plans and specifications:

Located: Lot 27, Concession 2
Township of Carnarvon
District of Manitoulin

which includes the use of the site only for the receiving and disposal of the following categories of waste (NOTE: Use of the site for additional categories of wastes requires a new application and amendments to the Provisional Certificate of Approval) domestic and commercial wastes.

and subject to the following conditions:

1. No operation shall be carried out at the site after sixty days from this condition becoming enforceable unless this Certificate including the reasons for this condition has been registered by the applicant as an instrument in the appropriate Land Registry Office against title to the site and a duplicate registered copy thereof has been returned by the applicant to the Director.

Dated this 18th day of March, 19 80.

Director, Section 39,
The Environmental Protection Act, 1971

The Municipality of Central Manitoulin
2019 Annual Groundwater Monitoring Report
Mindemoya Waste Disposal Site
Mindemoya, Ontario
December 2019



APPENDIX B
GROUNDWATER ELEVATIONS

Summary of Groundwater Elevations

Monitor No.	Measuring Point Elevation (masl) ¹ as of July 2017	Elevation of Water (masl) ¹					
		Oct-14	Sep-15	Sep-16	Oct-17	Sep-18	Sep-19
MW-WS	499.26	495.19	494.48	493.83	495.73	495.36	494.41
MW-WD	499.26	490.37	488.45	488.26	488.63	488.26	488.55
MW-SD	499.85	495.64	495.19	495.22	495.78	495.91	495.69
MW-SS	499.84	495.67	495.29	495.37	495.85	495.96	495.70
MW-ES	501.28	496.44	495.87	495.56	496.37	496.36	496.14
MW-ED	501.28	ND	495.18	494.88	496.04	495.81	495.85
MW-NS	499.93	493.19	493.00	493.11	493.14	493.20	493.09
MW-ND	499.92	493.22	493.05	493.14	493.19	493.20	493.08

Notes:

- (1) masl - metres above sea level.
- (2) ND - no data available.

The Municipality of Central Manitoulin
2019 Annual Groundwater Monitoring Report
Mindemoya Waste Disposal Site
Mindemoya, Ontario
December 2019



APPENDIX C
2019 LABORATORY ANALYTICAL
REPORTS

**CLIENT NAME: WOOD CANADA LTD.
131 FIELDING ROAD
LIVELY, ON P3Y1L7
(705) 682-2632**

ATTENTION TO: Emily Lemieux

PROJECT: Mindemoya GW

AGAT WORK ORDER: 19T515028

TRACE ORGANICS REVIEWED BY: Pinkal Patel, Report Reviewer

WATER ANALYSIS REVIEWED BY: Nivine Basily, Inorganics Report Writer

DATE REPORTED: Nov 18, 2019

PAGES (INCLUDING COVER): 18

VERSION*: 1

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

*NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

Certificate of Analysis

AGAT WORK ORDER: 19T515028

PROJECT: Mindemoya GW

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

CLIENT NAME: WOOD CANADA LTD.

ATTENTION TO: Emily Lemieux

SAMPLING SITE:

SAMPLED BY:

Volatile Organic Compounds in Water

DATE RECEIVED: 2019-09-07

DATE REPORTED: 2019-11-18

SAMPLE DESCRIPTION:		MW-WS	MW-SS	MW-SD	MW-ES	MW-ED	MW-ND	MW19-01S	MW19-01D		
SAMPLE TYPE:		Water	Water	Water	Water	Water	Water	Water	Water		
DATE SAMPLED:		2019-09-05	2019-09-05	2019-09-05	2019-09-06	2019-09-05	2019-09-06	2019-09-05	2019-09-05		
Parameter	Unit	G / S	RDL	507052	507070	507071	507072	507073	507074	507075	507076
Vinyl Chloride	µg/L	1	0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17
Methylene Chloride	µg/L		0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Benzene	µg/L	1	0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Toluene	µg/L	60	0.20	<0.20	0.33	<0.20	0.64	0.38	<0.20	<0.20	0.40
1,4-Dichlorobenzene	µg/L	5	0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Surrogate	Unit	Acceptable Limits									
Toluene-d8	% Recovery	50-140	115	111	100	113	104	116	115	115	115
4-Bromofluorobenzene	% Recovery	50-140	96	96	94	94	97	94	94	94	94

SAMPLE DESCRIPTION:		MW19-02S	MW19-03B	MW19-03D	MW19-04S	MIND-DUP	DUP 2		
SAMPLE TYPE:		Water	Water	Water	Water	Water	Water		
DATE SAMPLED:		2019-09-05	2019-09-06	2019-09-06	2019-09-05	2019-09-06	2019-09-06		
Parameter	Unit	G / S	RDL	507077	507107	507109	507112	507114	507115
Vinyl Chloride	µg/L	1	0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17
Methylene Chloride	µg/L		0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Benzene	µg/L	1	0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Toluene	µg/L	60	0.20	<0.20	0.29	0.31	<0.20	<0.20	<0.20
1,4-Dichlorobenzene	µg/L	5	0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Surrogate	Unit	Acceptable Limits							
Toluene-d8	% Recovery	50-140	105	115	107	105	114	102	
4-Bromofluorobenzene	% Recovery	50-140	92	94	96	93	90	98	

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Ontario Drinking Water Quality Standards. Na value is derived from O. Reg. 248
 Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

507070-507115 Xylenes total is a calculated parameter. The calculated value is the sum of m&p-Xylene + o-Xylene.
 1,3-Dichloropropene total is a calculated parameter. The calculated value is the sum of Cis-1,3-Dichloropropene and Trans-1,3-Dichloropropene.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By:



Certificate of Analysis

AGAT WORK ORDER: 19T515028

PROJECT: Mindemoya GW

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

CLIENT NAME: WOOD CANADA LTD.

ATTENTION TO: Emily Lemieux

SAMPLING SITE:

SAMPLED BY:

Comprehensive List for GW Parameters - Column 1

DATE RECEIVED: 2019-09-07

DATE REPORTED: 2019-11-18

Parameter	Unit	SAMPLE DESCRIPTION:		MW-WS		MW-SS		MW-SD		MW-ES	
		SAMPLE TYPE:		Water		Water		Water		Water	
		DATE SAMPLED:		2019-09-05		2019-09-05		2019-09-05		2019-09-06	
		G / S	RDL	507052	RDL	507070	RDL	507071	RDL	507072	
pH	pH Units		NA	7.57	NA	7.69	NA	7.64	NA	7.48	
Alkalinity (as CaCO3)	mg/L		5	518	5	902	5	767	5	428	
Electrical Conductivity	uS/cm		2	1120	2	2390	2	2010	2	847	
Total Dissolved Solids	mg/L		20	584	20	1330	20	1170	20	426	
Chloride	mg/L		0.50	44.2	2.0	179	1.0	125	0.50	15.3	
Nitrate as N	mg/L	10.0	0.25	0.35	1.0	<1.0	0.5	<0.5	0.25	<0.25	
Nitrite as N	mg/L	1.0	0.25	<0.25	1.0	<1.0	0.5	<0.5	0.25	<0.25	
Sulphate	mg/L		0.50	57.8	2.0	241	1.0	215	0.50	13.0	
Ammonia as N	mg/L		0.02	0.14	0.04	4.72	0.04	13.1	0.02	0.42	
Total Kjeldahl Nitrogen	mg/L		0.10	1.08	1.0	24.9	0.10	13.9	0.10	1.08	
Total Phosphorus	mg/L		0.02	1.11	0.02	1.00	0.02	0.04	0.02	0.69	
Chemical Oxygen Demand	mg/L		5	24	5	66	5	29	5	10	
Dissolved Organic Carbon	mg/L		0.5	3.4	0.5	15.0	0.5	10.0	0.5	3.5	
Phenols	mg/L		0.001	<0.001	0.001	0.001	0.001	0.002	0.001	<0.001	
Calcium	mg/L		0.10	130	0.25	186	0.25	167	0.05	102	
Magnesium	mg/L		0.10	60.3	0.25	127	0.25	102	0.05	39.7	
Sodium	mg/L	20	0.10	20.4	0.25	115	0.25	85.7	0.05	14.0	
Potassium	mg/L		0.10	6.94	0.25	57.1	0.25	51.0	0.05	3.66	
Arsenic	mg/L	0.01	0.003	<0.003	0.003	<0.003	0.003	<0.003	0.003	<0.003	
Barium	mg/L	1	0.002	0.072	0.002	0.125	0.002	0.157	0.002	0.036	
Boron	mg/L	5	0.010	0.126	0.010	0.694	0.010	0.606	0.010	0.068	
Cadmium	mg/L	0.005	0.002	<0.002	0.002	<0.002	0.002	<0.002	0.002	<0.002	
Chromium	mg/L	0.05	0.003	<0.003	0.003	0.004	0.003	<0.003	0.003	<0.003	
Copper	mg/L		0.003	0.003	0.003	0.004	0.003	0.005	0.003	<0.003	
Iron	mg/L		0.010	<0.010	0.010	1.45	0.010	<0.010	0.010	<0.010	
Lead	mg/L	0.01	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	
Manganese	mg/L		0.002	0.266	0.002	1.56	0.002	1.13	0.002	0.439	
Mercury	mg/L	0.001	0.0001	<0.0001	0.0001	<0.0001	0.0001	<0.0001	0.0001	<0.0001	
Zinc	mg/L		0.005	0.014	0.005	<0.005	0.005	<0.005	0.005	0.006	

Certified By:

Divine Basily

Certificate of Analysis

AGAT WORK ORDER: 19T515028

PROJECT: Mindemoya GW

CLIENT NAME: WOOD CANADA LTD.

ATTENTION TO: Emily Lemieux

SAMPLING SITE:

SAMPLED BY:

Comprehensive List for GW Parameters - Column 1

DATE RECEIVED: 2019-09-07

DATE REPORTED: 2019-11-18

Parameter	Unit	SAMPLE DESCRIPTION:		MW-ED	MW-ND	MW19-01S	MW19-01D	MW19-02S			
		SAMPLE TYPE:		Water	Water	Water	Water	Water			
		DATE SAMPLED:		2019-09-05	2019-09-06	2019-09-05	2019-09-05	2019-09-05			
		G / S	RDL	507073	RDL	507074	507075	RDL	507076	RDL	507077
pH	pH Units		NA	7.56	NA	7.64	7.74	NA	7.74	NA	7.90
Alkalinity (as CaCO3)	mg/L		5	484	5	357	287	5	221	5	555
Electrical Conductivity	uS/cm		2	986	2	674	611	2	1420	2	1200
Total Dissolved Solids	mg/L		20	514	20	318	296	20	710	20	620
Chloride	mg/L		0.50	31.2	0.20	2.06	12.6	0.50	288	0.50	53.3
Nitrate as N	mg/L	10.0	0.25	<0.25	0.10	<0.10	<0.10	0.25	<0.25	0.25	1.15
Nitrite as N	mg/L	1.0	0.25	<0.25	0.10	<0.10	<0.10	0.25	<0.25	0.25	<0.25
Sulphate	mg/L		0.50	15.0	0.20	12.9	20.3	0.50	97.4	0.50	31.8
Ammonia as N	mg/L		0.02	0.41	0.02	0.32	0.21	0.02	0.13	0.04	7.22
Total Kjeldahl Nitrogen	mg/L		0.10	1.45	0.10	0.82	0.56	0.10	0.50	0.10	7.87
Total Phosphorus	mg/L		0.02	0.77	0.02	0.29	0.57	0.02	0.38	0.02	0.57
Chemical Oxygen Demand	mg/L		5	24	5	6	10	5	7	5	16
Dissolved Organic Carbon	mg/L		0.5	4.5	0.5	3.0	2.0	0.5	2.6	0.5	5.5
Phenols	mg/L		0.001	<0.001	0.001	<0.001	<0.001	0.001	<0.001	0.001	<0.001
Calcium	mg/L		0.10	125	0.05	84.3	57.9	0.25	125	0.10	119
Magnesium	mg/L		0.10	44.3	0.05	35.4	29.7	0.25	63.8	0.10	61.2
Sodium	mg/L	20	0.10	20.3	0.05	4.99	27.2	0.25	47.2	0.10	33.3
Potassium	mg/L		0.10	3.33	0.05	1.16	0.60	0.25	10.9	0.10	12.6
Arsenic	mg/L	0.01	0.003	0.006	0.003	<0.003	<0.003	0.003	0.006	0.003	<0.003
Barium	mg/L	1	0.002	0.120	0.002	0.030	0.031	0.002	0.096	0.002	0.066
Boron	mg/L	5	0.010	0.032	0.010	0.015	0.026	0.010	0.181	0.010	0.228
Cadmium	mg/L	0.005	0.002	<0.002	0.002	<0.002	<0.002	0.002	<0.002	0.002	<0.002
Chromium	mg/L	0.05	0.003	<0.003	0.003	<0.003	<0.003	0.003	<0.003	0.003	<0.003
Copper	mg/L		0.003	<0.003	0.003	<0.003	<0.003	0.003	0.004	0.003	0.008
Iron	mg/L		0.010	5.17	0.010	0.350	0.074	0.010	<0.010	0.010	<0.010
Lead	mg/L	0.01	0.001	<0.001	0.001	<0.001	<0.001	0.001	<0.001	0.001	<0.001
Manganese	mg/L		0.002	1.80	0.002	0.358	0.156	0.002	0.133	0.002	0.088
Mercury	mg/L	0.001	0.0001	<0.0001	0.0001	<0.0001	<0.0001	0.0001	<0.0001	0.0001	<0.0001
Zinc	mg/L		0.005	<0.005	0.005	<0.005	0.006	0.005	0.008	0.005	<0.005

Certified By:

divine Basily

Certificate of Analysis

AGAT WORK ORDER: 19T515028

PROJECT: Mindemoya GW

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

CLIENT NAME: WOOD CANADA LTD.

ATTENTION TO: Emily Lemieux

SAMPLING SITE:

SAMPLED BY:

Comprehensive List for GW Parameters - Column 1

DATE RECEIVED: 2019-09-07

DATE REPORTED: 2019-11-18

Parameter	Unit	SAMPLE DESCRIPTION:		MW19-03B		MW19-03D		MW19-04S		MIND-DUP
		SAMPLE TYPE:		Water		Water		Water		Water
		DATE SAMPLED:		2019-09-06		2019-09-06		2019-09-05		2019-09-06
		G / S	RDL	507107	RDL	507109	RDL	507112	RDL	507114
pH	pH Units		NA	7.72	NA	7.76	NA	7.72	NA	7.86
Alkalinity (as CaCO3)	mg/L		5	341	5	245	5	285	5	285
Electrical Conductivity	µS/cm		2	1780	2	1230	2	2290	2	610
Total Dissolved Solids	mg/L		20	860	20	966	20	1260	20	344
Chloride	mg/L		1.0	494	0.50	241	1.0	699	0.20	13.0
Nitrate as N	mg/L	10.0	0.5	<0.5	0.25	<0.25	0.5	<0.5	0.10	<0.10
Nitrite as N	mg/L	1.0	0.5	<0.5	0.25	<0.25	0.5	<0.5	0.10	<0.10
Sulphate	mg/L		1.0	104	0.50	41.4	1.0	116	0.20	20.3
Ammonia as N	mg/L		0.02	0.04	0.02	0.11	0.02	0.15	0.02	0.21
Total Kjeldahl Nitrogen	mg/L		0.10	0.55	0.10	0.80	0.10	0.56	0.10	0.59
Total Phosphorus	mg/L		0.02	1.11	0.02	0.14	0.02	0.04	0.02	0.60
Chemical Oxygen Demand	mg/L		5	18	5	15	5	7	5	13
Dissolved Organic Carbon	mg/L		0.5	2.5	0.5	3.0	0.5	2.9	0.5	2.1
Phenols	mg/L		0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001
Calcium	mg/L		0.25	170	0.10	101	0.25	215	0.05	58.6
Magnesium	mg/L		0.25	90.2	0.10	51.8	0.25	114	0.05	30.1
Sodium	mg/L	20	0.25	35.2	0.10	29.8	0.25	40.2	0.05	27.2
Potassium	mg/L		0.25	10.7	0.10	7.07	0.25	16.5	0.05	0.54
Arsenic	mg/L	0.01	0.003	0.006	0.003	0.004	0.003	0.010	0.003	<0.003
Barium	mg/L	1	0.002	0.123	0.002	0.101	0.002	0.164	0.002	0.032
Boron	mg/L	5	0.010	0.203	0.010	0.146	0.010	0.274	0.010	0.034
Cadmium	mg/L	0.005	0.002	<0.002	0.002	<0.002	0.002	<0.002	0.002	<0.002
Chromium	mg/L	0.05	0.003	<0.003	0.003	<0.003	0.003	<0.003	0.003	<0.003
Copper	mg/L		0.003	0.005	0.003	0.004	0.003	<0.003	0.003	<0.003
Iron	mg/L		0.010	<0.010	0.010	<0.010	0.010	<0.010	0.010	0.037
Lead	mg/L	0.01	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001
Manganese	mg/L		0.002	0.352	0.002	0.273	0.002	0.599	0.002	0.151
Mercury	mg/L	0.001	0.0001	<0.0001	0.0001	<0.0001	0.0001	<0.0001	0.0001	<0.0001
Zinc	mg/L		0.005	0.008	0.005	0.012	0.005	0.007	0.005	<0.005

Certified By:

Divine Basily

Certificate of Analysis

AGAT WORK ORDER: 19T515028

PROJECT: Mindemoya GW

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
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<http://www.agatlabs.com>

CLIENT NAME: WOOD CANADA LTD.

ATTENTION TO: Emily Lemieux

SAMPLING SITE:

SAMPLED BY:

Comprehensive List for GW Parameters - Column 1

DATE RECEIVED: 2019-09-07

DATE REPORTED: 2019-11-18

Parameter	Unit	SAMPLE DESCRIPTION: DUP 2		
		G / S	RDL	507115
pH	pH Units		NA	7.79
Alkalinity (as CaCO ₃)	mg/L		5	773
Electrical Conductivity	uS/cm		2	2020
Total Dissolved Solids	mg/L		20	1160
Chloride	mg/L		1.0	143
Nitrate as N	mg/L	10.0	0.5	<0.5
Nitrite as N	mg/L	1.0	0.5	<0.5
Sulphate	mg/L		1.0	247
Ammonia as N	mg/L		0.04	13.8
Total Kjeldahl Nitrogen	mg/L		0.10	14.2
Total Phosphorus	mg/L		0.02	0.04
Chemical Oxygen Demand	mg/L		5	28
Dissolved Organic Carbon	mg/L		0.5	9.8
Phenols	mg/L		0.001	0.002
Calcium	mg/L		0.25	168
Magnesium	mg/L		0.25	103
Sodium	mg/L	20	0.25	85.3
Potassium	mg/L		0.25	50.9
Arsenic	mg/L	0.01	0.003	<0.003
Barium	mg/L	1	0.002	0.160
Boron	mg/L	5	0.010	0.690
Cadmium	mg/L	0.005	0.002	<0.002
Chromium	mg/L	0.05	0.003	<0.003
Copper	mg/L		0.003	0.005
Iron	mg/L		0.010	<0.010
Lead	mg/L	0.01	0.001	<0.001
Manganese	mg/L		0.002	1.13
Mercury	mg/L	0.001	0.0001	<0.0001
Zinc	mg/L		0.005	<0.005

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AGAT WORK ORDER: 19T515028

PROJECT: Mindemoya GW

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ATTENTION TO: Emily Lemieux

SAMPLING SITE:

SAMPLED BY:

Comprehensive List for GW Parameters - Column 1

DATE RECEIVED: 2019-09-07

DATE REPORTED: 2019-11-18

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Ontario Drinking Water Quality Standards. Na value is derived from O. Reg. 248
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.
507052-507115 Elevated RDLs indicate the degree of sample dilutions prior to the analysis to keep analytes within the calibration range, reduce matrix interference and/or to avoid contaminating the instrument.

Phenols were sub-sampled from the non-preservative bottles.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By:

Divine Basily

Certificate of Analysis

AGAT WORK ORDER: 19T515028

PROJECT: Mindemoya GW

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CLIENT NAME: WOOD CANADA LTD.

ATTENTION TO: Emily Lemieux

SAMPLING SITE:

SAMPLED BY:

Comprehensive List for GW Parameters - Column 1 (Excl. DOC)

DATE RECEIVED: 2019-09-07

DATE REPORTED: 2019-11-18

Parameter	Unit	SAMPLE DESCRIPTION: MW19-02D		
		G / S	RDL	507080
pH	pH Units		NA	7.61
Alkalinity (as CaCO ₃)	mg/L		5	212
Electrical Conductivity	µS/cm		2	1460
Total Dissolved Solids	mg/L		20	1080
Chloride	mg/L		0.50	320
Nitrate as N	mg/L	10.0	0.25	0.60
Nitrite as N	mg/L	1.0	0.25	<0.25
Sulphate	mg/L		0.50	79.9
Ammonia as N	mg/L		0.02	0.12
Total Kjeldahl Nitrogen	mg/L		0.10	2.18
Total Phosphorus	mg/L		0.02	2.37
Chemical Oxygen Demand	mg/L		5	28
Phenols	mg/L		0.001	<0.001
Calcium	mg/L		0.10	109
Magnesium	mg/L		0.10	57.1
Sodium	mg/L	20	0.10	69.5
Potassium	mg/L		0.10	10.3
Arsenic	mg/L	0.01	0.003	0.006
Barium	mg/L	1	0.002	0.070
Boron	mg/L	5	0.010	0.195
Cadmium	mg/L	0.005	0.002	<0.002
Chromium	mg/L	0.05	0.003	<0.003
Copper	mg/L		0.003	0.017
Iron	mg/L		0.010	<0.010
Lead	mg/L	0.01	0.001	<0.001
Manganese	mg/L		0.002	0.109
Mercury	mg/L	0.001	0.0001	<0.0001
Zinc	mg/L		0.005	0.010

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Certificate of Analysis

AGAT WORK ORDER: 19T515028

PROJECT: Mindemoya GW

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ATTENTION TO: Emily Lemieux

SAMPLING SITE:

SAMPLED BY:

Comprehensive List for GW Parameters - Column 1 (Excl. DOC)

DATE RECEIVED: 2019-09-07

DATE REPORTED: 2019-11-18

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Ontario Drinking Water Quality Standards. Na value is derived from O. Reg. 248
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

507080 Elevated RDLs indicate the degree of sample dilutions prior to the analysis to keep analytes within the calibration range, reduce matrix interference and/or to avoid contaminating the instrument.
Analysis performed at AGAT Toronto (unless marked by *)

Certified By:

Divine Basily

Certificate of Analysis

AGAT WORK ORDER: 19T515028

PROJECT: Mindemoya GW

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CLIENT NAME: WOOD CANADA LTD.

ATTENTION TO: Emily Lemieux

SAMPLING SITE:

SAMPLED BY:

Comprehensive List for GW Parameters - Column 1 (Excl. Nutrients)

DATE RECEIVED: 2019-09-07

DATE REPORTED: 2019-11-18

SAMPLE DESCRIPTION: MW19-03A

SAMPLE TYPE: Water

DATE SAMPLED: 2019-09-06

Parameter	Unit	G / S	RDL	507106
pH	pH Units		NA	7.82
Alkalinity (as CaCO ₃)	mg/L		5	362
Electrical Conductivity	µS/cm		2	1540
Total Dissolved Solids	mg/L		20	1080
Chloride	mg/L		0.50	272
Nitrate as N	mg/L	10.0	0.25	<0.25
Nitrite as N	mg/L	1.0	0.25	<0.25
Sulphate	mg/L		0.50	78.5
Phenols	mg/L		0.001	<0.001
Calcium	mg/L		0.10	147
Magnesium	mg/L		0.10	75.5
Sodium	mg/L	20	0.10	21.2
Potassium	mg/L		0.10	8.48
Arsenic	mg/L	0.01	0.003	0.007
Barium	mg/L	1	0.002	0.110
Boron	mg/L	5	0.010	0.208
Cadmium	mg/L	0.005	0.002	<0.002
Chromium	mg/L	0.05	0.003	<0.003
Copper	mg/L		0.003	0.003
Iron	mg/L		0.010	<0.010
Lead	mg/L	0.01	0.001	<0.001
Manganese	mg/L		0.002	0.354
Mercury	mg/L	0.001	0.0001	<0.0001
Zinc	mg/L		0.005	0.014

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Ontario Drinking Water Quality Standards. Na value is derived from O. Reg. 248
 Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.
507106 Elevated RDLs indicate the degree of sample dilutions prior to the analysis to keep analytes within the calibration range, reduce matrix interference and/or to avoid contaminating the instrument.
 Analysis performed at AGAT Toronto (unless marked by *)

Certified By:



Certificate of Analysis

AGAT WORK ORDER: 19T515028

PROJECT: Mindemoya GW

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CLIENT NAME: WOOD CANADA LTD.

ATTENTION TO: Emily Lemieux

SAMPLING SITE:

SAMPLED BY:

Comprehensive List for GW Parameters - Column 1 (Excl. TDS, Inorganics, Nutrients & Hg)

DATE RECEIVED: 2019-09-07

DATE REPORTED: 2019-11-18

		SAMPLE DESCRIPTION: MW19-04D			
		SAMPLE TYPE: Water			
		DATE SAMPLED: 2019-09-06			
Parameter	Unit	G / S	RDL	507113	
Arsenic	mg/L	0.01	0.003	0.006	
Barium	mg/L	1	0.002	0.075	
Boron	mg/L	5	0.010	0.181	
Cadmium	mg/L	0.005	0.002	<0.002	
Chromium	mg/L	0.05	0.003	<0.003	
Copper	mg/L		0.003	0.005	
Iron	mg/L		0.010	<0.010	
Lead	mg/L	0.01	0.001	<0.001	
Manganese	mg/L		0.002	0.134	
Zinc	mg/L		0.005	0.006	

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Ontario Drinking Water Quality Standards. Na value is derived from O. Reg. 248
 Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By:



Certificate of Analysis

AGAT WORK ORDER: 19T515028

PROJECT: Mindemoya GW

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CLIENT NAME: WOOD CANADA LTD.

ATTENTION TO: Emily Lemieux

SAMPLING SITE:

SAMPLED BY:

Comprehensive List for GW Parameters - Column 1 (excl. Nutrients)

DATE RECEIVED: 2019-09-07

DATE REPORTED: 2019-11-18

Parameter	Unit	SAMPLE DESCRIPTION:		MW-WD
		G / S	RDL	507069
pH	pH Units		NA	7.66
Alkalinity (as CaCO ₃)	mg/L		5	456
Electrical Conductivity	uS/cm		2	1000
Total Dissolved Solids	mg/L		20	528
Chloride	mg/L		0.50	35.2
Nitrate as N	mg/L	10.0	0.25	0.90
Nitrite as N	mg/L	1.0	0.25	<0.25
Sulphate	mg/L		0.50	49.4
Phenols	mg/L		0.001	<0.001
Calcium	mg/L		0.10	116
Magnesium	mg/L		0.10	53.2
Sodium	mg/L	20	0.10	15.4
Potassium	mg/L		0.10	5.67
Arsenic	mg/L	0.01	0.003	<0.003
Barium	mg/L	1	0.002	0.086
Boron	mg/L	5	0.010	0.085
Cadmium	mg/L	0.005	0.002	<0.002
Chromium	mg/L	0.05	0.003	<0.003
Copper	mg/L		0.003	0.012
Iron	mg/L		0.010	<0.010
Lead	mg/L	0.01	0.001	<0.001
Manganese	mg/L		0.002	0.003
Mercury	mg/L	0.001	0.0001	<0.0001
Zinc	mg/L		0.005	0.019

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Ontario Drinking Water Quality Standards. Na value is derived from O. Reg. 248
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

507069 Elevated RDLs indicate the degree of sample dilutions prior to the analysis to keep analytes within the calibration range, reduce matrix interference and/or to avoid contaminating the instrument.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By:

Divine Basily



Guideline Violation

AGAT WORK ORDER: 19T515028

PROJECT: Mindemoya GW

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CLIENT NAME: WOOD CANADA LTD.

ATTENTION TO: Emily Lemieux

SAMPLEID	SAMPLE TITLE	GUIDELINE	ANALYSIS PACKAGE	PARAMETER	UNIT	GUIDEVALUE	RESULT
507052	MW-WS	O.Reg.169/03(mg/L)	Comprehensive List for GW Parameters - Column 1	Sodium	mg/L	20	20.4
507070	MW-SS	O.Reg.169/03(mg/L)	Comprehensive List for GW Parameters - Column 1	Sodium	mg/L	20	115
507071	MW-SD	O.Reg.169/03(mg/L)	Comprehensive List for GW Parameters - Column 1	Sodium	mg/L	20	85.7
507073	MW-ED	O.Reg.169/03(mg/L)	Comprehensive List for GW Parameters - Column 1	Sodium	mg/L	20	20.3
507075	MW19-01S	O.Reg.169/03(mg/L)	Comprehensive List for GW Parameters - Column 1	Sodium	mg/L	20	27.2
507076	MW19-01D	O.Reg.169/03(mg/L)	Comprehensive List for GW Parameters - Column 1	Sodium	mg/L	20	47.2
507077	MW19-02S	O.Reg.169/03(mg/L)	Comprehensive List for GW Parameters - Column 1	Sodium	mg/L	20	33.3
507080	MW19-02D	O.Reg.169/03(mg/L)	Comprehensive List for GW Parameters - Column 1 (Excl. DOC)	Sodium	mg/L	20	69.5
507106	MW19-03A	O.Reg.169/03(mg/L)	Comprehensive List for GW Parameters - Column 1 (Excl. Nutrients)	Sodium	mg/L	20	21.2
507107	MW19-03B	O.Reg.169/03(mg/L)	Comprehensive List for GW Parameters - Column 1	Sodium	mg/L	20	35.2
507109	MW19-03D	O.Reg.169/03(mg/L)	Comprehensive List for GW Parameters - Column 1	Sodium	mg/L	20	29.8
507112	MW19-04S	O.Reg.169/03(mg/L)	Comprehensive List for GW Parameters - Column 1	Sodium	mg/L	20	40.2
507114	MIND-DUP	O.Reg.169/03(mg/L)	Comprehensive List for GW Parameters - Column 1	Sodium	mg/L	20	27.2
507115	DUP 2	O.Reg.169/03(mg/L)	Comprehensive List for GW Parameters - Column 1	Sodium	mg/L	20	85.3

Quality Assurance

CLIENT NAME: WOOD CANADA LTD.
 PROJECT: Mindemoya GW
 SAMPLING SITE:

AGAT WORK ORDER: 19T515028
 ATTENTION TO: Emily Lemieux
 SAMPLED BY:

Trace Organics Analysis


RPT Date: Nov 18, 2019			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	

Volatile Organic Compounds in Water

Vinyl Chloride	507104	< 0.17	< 0.17	NA	< 0.17	103%	50%	140%	82%	50%	140%	85%	50%	140%
Methylene Chloride	507104	< 0.30	< 0.30	NA	< 0.30	90%	50%	140%	103%	60%	130%	83%	50%	140%
Benzene	507104	< 0.20	< 0.20	NA	< 0.20	99%	50%	140%	79%	60%	130%	89%	50%	140%
Toluene	507104	< 0.20	< 0.20	NA	< 0.20	110%	50%	140%	114%	60%	130%	95%	50%	140%
1,4-Dichlorobenzene	507104	< 0.10	< 0.10	NA	< 0.10	98%	50%	140%	102%	60%	130%	95%	50%	140%

Comments: When the average of the sample and duplicate results is less than 5x the RDL, the Relative Percent Difference (RPD) will be indicated as Not Applicable (NA).

Certified By: _____



Quality Assurance

CLIENT NAME: WOOD CANADA LTD.
PROJECT: Mindemoya GW
SAMPLING SITE:

AGAT WORK ORDER: 19T515028
ATTENTION TO: Emily Lemieux
SAMPLED BY:

Water Analysis															
RPT Date: Nov 18, 2019			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

Comprehensive List for GW Parameters - Column 1

pH	507104		7.90	7.80	1.3%	NA	100%	90%	110%						
Alkalinity (as CaCO3)	507104		253	253	0.0%	< 5	98%	80%	120%						
Electrical Conductivity	507104		655	655	0.0%	< 2	101%	80%	120%						
Total Dissolved Solids	506947		22	24	NA	< 20	98%	80%	120%						
Chloride	507071	507071	125	125	0.0%	< 0.10	98%	90%	110%	109%	90%	110%	109%	85%	115%
Nitrate as N	507071	507071	<0.5	<0.5	NA	< 0.05	95%	90%	110%	106%	90%	110%	107%	85%	115%
Nitrite as N	507071	507071	<0.5	<0.5	NA	< 0.05	NA	90%	110%	103%	90%	110%	111%	85%	115%
Sulphate	507071	507071	215	217	0.9%	< 0.10	100%	90%	110%	106%	90%	110%	106%	85%	115%
Ammonia as N	507100		0.30	0.30	0.0%	< 0.02	97%	90%	110%	105%	90%	110%	86%	70%	130%
Total Kjeldahl Nitrogen	507052	507052	1.08	1.09	0.9%	< 0.10	102%	80%	120%	96%	80%	120%	96%	70%	130%
Total Phosphorus	507096		0.06	0.05	NA	< 0.02	103%	80%	120%	102%	90%	110%	106%	70%	130%
Chemical Oxygen Demand	506861		<5	<5	NA	< 5	103%	90%	110%	102%	90%	110%	95%	70%	130%
Dissolved Organic Carbon	506739		0.83	0.85	NA	< 0.5	97%	90%	110%	92%	90%	110%	99%	80%	120%
Phenols	722637		<0.001	<0.001	NA	< 0.001	100%	90%	110%	103%	90%	110%	104%	80%	120%
Calcium	507075	507075	57.9	58.5	1.0%	< 0.05	100%	90%	110%	101%	90%	110%	97%	70%	130%
Magnesium	507075	507075	29.7	29.9	0.7%	< 0.05	97%	90%	110%	98%	90%	110%	94%	70%	130%
Sodium	507075	507075	27.2	27.5	1.1%	< 0.05	99%	90%	110%	99%	90%	110%	93%	70%	130%
Potassium	507075	507075	0.60	0.65	8.0%	< 0.05	98%	90%	110%	98%	90%	110%	95%	70%	130%
Arsenic	507052	507052	<0.003	<0.003	NA	< 0.003	104%	90%	110%	102%	90%	110%	108%	70%	130%
Barium	507052	507052	0.072	0.073	1.4%	< 0.002	95%	90%	110%	95%	90%	110%	100%	70%	130%
Boron	507052	507052	0.126	0.125	0.8%	< 0.010	105%	90%	110%	100%	90%	110%	102%	70%	130%
Cadmium	507052	507052	<0.002	<0.002	NA	< 0.002	99%	90%	110%	101%	90%	110%	121%	70%	130%
Chromium	507052	507052	<0.003	<0.003	NA	< 0.003	98%	90%	110%	97%	90%	110%	96%	70%	130%
Copper	507052	507052	0.003	0.003	NA	< 0.003	100%	90%	110%	101%	90%	110%	91%	70%	130%
Iron	507052	507052	<0.010	<0.010	NA	< 0.010	101%	90%	110%	97%	90%	110%	90%	70%	130%
Lead	507052	507052	<0.001	<0.001	NA	< 0.001	96%	90%	110%	95%	90%	110%	99%	70%	130%
Manganese	507052	507052	0.266	0.264	0.8%	< 0.002	99%	90%	110%	100%	90%	110%	98%	70%	130%
Mercury	507052	507052	<0.0001	<0.0001	NA	< 0.0001	101%	90%	110%	100%	80%	120%	101%	80%	120%
Zinc	507052	507052	0.014	0.011	NA	< 0.005	102%	90%	110%	103%	90%	110%	100%	70%	130%

Comments: NA signifies Not Applicable.

Duplicate Qualifier: As the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Certified By: _____

Divine Basily

Method Summary

CLIENT NAME: WOOD CANADA LTD.

AGAT WORK ORDER: 19T515028

PROJECT: Mindemoya GW

ATTENTION TO: Emily Lemieux

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Trace Organics Analysis			
Vinyl Chloride	VOL-91-5001	EPA SW-846 5030C & 8260D	(P&T)GC/MS
Methylene Chloride	VOL-91-5001	EPA SW-846 5030C & 8260D	(P&T)GC/MS
Benzene	VOL-91-5001	EPA SW-846 5030C & 8260D	(P&T)GC/MS
Toluene	VOL-91-5001	EPA SW-846 5030C & 8260D	(P&T)GC/MS
1,4-Dichlorobenzene	VOL-91-5001	EPA SW-846 5030C & 8260D	(P&T)GC/MS
Toluene-d8	VOL-91-5001	EPA SW-846 5030C & 8260D	(P&T)GC/MS
4-Bromofluorobenzene	VOL-91-5001	EPA SW-846 5030C & 8260D	(P&T)GC/MS
Water Analysis			
pH	INOR-93-6000	SM 4500-H+ B	PC TITRATE
Alkalinity (as CaCO ₃)	INOR-93-6000	SM 2320 B	PC TITRATE
Electrical Conductivity	INOR-93-6000	SM 2510 B	PC TITRATE
Total Dissolved Solids	INOR-93-6028	SM 2540 C	BALANCE
Chloride	INOR-93-6004	SM 4110 B	ION CHROMATOGRAPH
Nitrate as N	INOR-93-6004	SM 4110 B	ION CHROMATOGRAPH
Nitrite as N	INOR-93-6004	SM 4110 B	ION CHROMATOGRAPH
Sulphate	INOR-93-6004	SM 4110 B	ION CHROMATOGRAPH
Ammonia as N	INOR-93-6059	SM 4500-NH ₃ H	LACHAT FIA
Total Kjeldahl Nitrogen	INOR-93-6048	QuikChem 10-107-06-2-I & SM 4500-Norg D	LACHAT FIA
Total Phosphorus	INOR-93-6057	QuikChem 10-115-01-3-A & SM 4500-P I	LACHAT FIA
Chemical Oxygen Demand	INOR-93-6042	SM 5220 D	SPECTROPHOTOMETER
Dissolved Organic Carbon	INOR-93-6049	EPA 415.1 & SM 5310 B	SHIMADZU CARBON ANALYZER
Phenols	INOR-93-6050	MOE ROPHEN-E 3179 & SM 5530 D	TECHNICON AUTO ANALYZER
Calcium	MET-93-6105	EPA SW-846 6010C & 200.7	ICP/OES
Magnesium	MET-93-6105	EPA SW-846 6010C & 200.7	ICP/OES
Sodium	MET-93-6105	EPA SW-846 6010C & 200.7	ICP/OES
Potassium	MET-93-6105	EPA SW-846 6010C & 200.7	ICP/OES
Arsenic	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Barium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Boron	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Cadmium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Chromium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Copper	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Iron	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Lead	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Manganese	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Mercury	MET-93-6100	EPA SW 846 7470 & 245.1	CVAAS
Zinc	MET-93-6103	EPA SW-846 6020A & 200.8	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)

Report Information:

Company: Wood
Contact: Emily Lemieux
Address: 131 Fielding Road
Lively, ON P3Y 1L7
Phone: 705-682-2632 Fax: 705-682-2260
Reports to be sent to:
1. Email: emily.lemieux@woodplc.com
2. Email:

Project Information:

Project: Mindemoya GW
Site Location:
Sampled By:
AGAT Quote #: 42882 PO:
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:

Regulatory Requirements: No Regulatory Requirement

(Please check all applicable boxes)

Regulation 153/04 Sewer Use Regulation 558
 Table Indicate One
 Ind/Com Sanitary CCME
 Res/Park Storm Prov. Water Quality Objectives (PWQO)
 Agriculture Other
 Soil Texture (Check One) Region Indicate One
 Coarse MISA
 Fine

Is this submission for a Record of Site Condition?

Yes No

Report Guideline on Certificate of Analysis

Yes No

Sample Matrix Legend

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

Field Filtered - Metals, Hg, CVI

O. Reg 153

Metals and Inorganics
 All Metals 153 Metals (excl. Hydroides)
 Hydride Metals 153 Metals (Incl. Hydroides)
 ORPs: B-HWS Cl CN
 Cr⁶⁺ EC FOC Hg
 pH SAR
 Full Metals Scan
 Regulatory/Custom Metals
 Nutrients: TP NH₃ TKN
 NO₃ NO₂ NO₃+NO₂
 Volatiles: VOC BTEX THM
 PHCs F1 - F4
 ABNs
 PAHs
 PCBs: Total Aroclors
 Organochlorine Pesticides
 TCLP: M&I VOCs ABNs Btap PCBs
 Sewer Use

Groundwater Column

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Y / N	Metals and Inorganics	O. Reg 153	Field Filtered - Metals, Hg, CVI	Nutrients	Volatiles	PHCs F1 - F4	ABNs	PAHs	PCBs	Organochlorine Pesticides	TCLP	Sewer Use	Groundwater Column
MW-WS	09/05/19		9	Water		Y													<input checked="" type="checkbox"/>
MW-WD	09/06/19		4	Water	Partial Sample / Subsample	Y													<input checked="" type="checkbox"/>
MW-SS	09/05/19		9	Water		Y													<input checked="" type="checkbox"/>
MW-SD	09/05/19		9	Water		Y													<input checked="" type="checkbox"/>
MW-ES	09/06/19		9	Water		Y													<input checked="" type="checkbox"/>
MW-ED	09/05/19		9	Water		Y													<input checked="" type="checkbox"/>
MW-NS	09/06/19			Water	NO SAMPLE.														<input checked="" type="checkbox"/>
MW-ND	09/06/19		9	Water		Y													<input checked="" type="checkbox"/>
MW19-01S	09/05/19		9	Water		Y													<input checked="" type="checkbox"/>
MW19-01D	09/05/19		9	Water		Y													<input checked="" type="checkbox"/>
MW19-02S	09/05/19		9	Water		Y													<input checked="" type="checkbox"/>

Samples Relinquished By (Print Name and Sign) <i>Dominique Courcenoche</i>	Date 09/06/19	Time 18:30	Samples Received By (Print Name and Sign) <i>Chagan Ahsanad</i>	Date Sept 7/19	Time 11:30 AM
Samples Relinquished By (Print Name and Sign) <i>D Courcenoche</i>	Date	Time	Samples Received By (Print Name and Sign)	Date	Time
Samples Relinquished By (Print Name and Sign)	Date	Time	Samples Received By (Print Name and Sign)	Date	Time

Page 1 of 2

Laboratory Use Only

Work Order #: 19TS15028
 Cooler Quantity: 3 Cargos
 Arrival Temperatures: 2.6 | 5.6 | 4.3
 2.4 | 3.9 | 3.4
 5.1 | 4.6 | 6.7
 Custody Seal Intact: Yes No N/A
 Notes: on ice

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

Chain of Custody Record

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

Report Information:

Company: Wood
Contact: Emily Lemieux
Address: 131 Fielding Road
Lively, ON P3Y 1L7
Phone: 705-682-2632 Fax: 705-682-2260
Reports to be sent to:
1. Email: emily.lemieux@woodplc.com
2. Email:

Project Information:

Project: Mindemoya GW
Site Location:
Sampled By:
AGAT Quote #: 42882 PO:
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:

Regulatory Requirements: No Regulatory Requirement

(Please check all applicable boxes)

Regulation 153/04
Table Indicate One
 Ind/Com
 Res/Park
 Agriculture
Soil Texture (Check One)
 Coarse
 Fine
 Sewer Use
 Sanitary
 Storm
Region Indicate One
 MISA
 Regulation 558
 CCME
 Prov. Water Quality Objectives (PWQO)
 Other
ODWS
Indicate One

Is this submission for a Record of Site Condition?

Yes No

Report Guideline on Certificate of Analysis

Yes No

Sample Matrix Legend

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

Laboratory Use Only

Work Order #: _____
Cooler Quantity: 3 larger
Arrival Temperatures: 2.6 5.6 4.3
2.4 3.9 3.4
5.1 4.4 6.7
Custody Seal Intact: Yes No N/A
Notes:

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

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Y/N	Field Filtered - Metals, Hg, CWI	Metals and Inorganics	0. Reg 153	Full Metals Scan	Regulatory/Custom Metals	Nutrients: <input type="checkbox"/> TP <input type="checkbox"/> NH ₄ <input type="checkbox"/> TKN <input type="checkbox"/> NO ₃ <input type="checkbox"/> NO ₂ <input type="checkbox"/> NO ₃ +NO ₂	Volatiles: <input type="checkbox"/> VOC <input type="checkbox"/> BTEX <input type="checkbox"/> THM	PHCs F1 - F4	ABNs	PAHs	PCBs: <input type="checkbox"/> Total <input type="checkbox"/> Aroclors	Organochlorine Pesticides	TCLP: <input type="checkbox"/> M&I <input type="checkbox"/> VOCs <input type="checkbox"/> ABNs <input type="checkbox"/> Biop <input type="checkbox"/> PCBs	Sewer Use	Groundwater Column		
MW19-02D	09/06/19	11 AM	4	Water	partial sample - please sub-sample if possible (prioritize TDS from only water sample on only 2/3)	Y															<input checked="" type="checkbox"/>		
MW19-03A			3	Water	Partial sample	Y																<input checked="" type="checkbox"/>	
MW19-03B			9	Water		Y																<input checked="" type="checkbox"/>	
MW19-03D			6	Water	partial sample - please sub-sample if possible (prioritize TDS from only 1/2)	Y																<input checked="" type="checkbox"/>	
MW19-04S	09/05/19		9	Water		Y																<input checked="" type="checkbox"/>	
MW19-04D	09/06/19		1	Water		Y																<input checked="" type="checkbox"/>	
MIND-DUP			9	Water		Y																<input checked="" type="checkbox"/>	
DUP 2			9	Water		Y																<input checked="" type="checkbox"/>	

Samples Relinquished By (Print Name and Sign): Dominique Courchesne	Date: 09/06/19	Time: 18:30	Samples Received By (Print Name and Sign):	Date:	Time:
Samples Relinquished By (Print Name and Sign): D Courchesne	Date:	Time:	Samples Received By (Print Name and Sign):	Date:	Time:
Samples Relinquished By (Print Name and Sign):	Date:	Time:	Samples Received By (Print Name and Sign):	Date:	Time:

The Municipality of Central Manitoulin
2019 Annual Groundwater Monitoring Report
Mindemoya Waste Disposal Site
Mindemoya, Ontario
December 2019



APPENDIX D

**SUMMARY OF GROUNDWATER
GEOCHEMICAL ANALYSES**

Groundwater Geochemical Results MW-ED

Parameters	Units	ODWS ⁽¹⁾	Oct-14	Sep-15	Sep-16	Oct-17	Sep-18	Sep-19
General Chemistry								
Alkalinity (Total as CaCO ₃)	mg/L	30-500 OG ⁽²⁾	No sample obtained	517	706	496	521	484
Ammonia	mg/L			5.6	6.74	1.68	0.73	0.41
Chloride	mg/L	250 AO ⁽³⁾		59.6	141	13.4	27.8	31.2
COD	mg/L			52	51	47	29	24
Conductivity	umho/cm			1240	1630	873	1040	986
Dissolved Organic Carbon (DOC)	mg/L	5 AO		6.9	9.6	19.2	4.1	4.5
Nitrate (N)	mg/L	10 MAC ⁽⁴⁾		<0.05	<0.25	<0.25	<0.25	<0.25
Nitrite (N)	mg/L	1 MAC		<0.05	<0.25	<0.25	<0.25	<0.25
pH	pH	6.5-8.5		7.59	7.84	8.13	7.32	7.56
Phenols	mg/L			0.009	<0.001	<0.001	0.001	<0.001
Total Phosphorus	mg/L			0.78	<0.05	2.31	1.21	0.77
Sulphate	mg/L	500 AO		29.0	25.1	23.7	25.7	15.0
Total Dissolved Solids (TDS)	mg/L	500 AO		662	884	500	540	514
TKN	mg/L			8.6	9.38	4.7	1.82	1.45
Metals								
Arsenic	mg/L	0.025 IMAC ⁽⁵⁾		0.018	0.024	0.009	0.011	0.006
Barium	mg/L	1 MAC		0.256	0.212	0.118	0.152	0.12
Boron	mg/L	5 IMAC		<0.010	0.011	<0.010	0.025	0.032
Cadmium	mg/L	0.005 MAC		<0.002	<0.002	<0.002	<0.002	<0.002
Calcium	mg/L			134	166	114	121	125
Chromium	mg/L	0.05 MAC		<0.003	<0.003	<0.003	<0.003	<0.003
Copper	mg/L	1 AO		<0.003	<0.003	<0.003	<0.003	<0.003
Iron	mg/L	0.3 AO		2.29	22.2	10.0	11.6	5.2
Lead	mg/L	0.01 MAC		<0.002	<0.002	<0.002	<0.001	<0.001
Magnesium	mg/L			46.2	53	36	41.9	44.3
Manganese	mg/L	0.05 AO		1.31	2.21	1.64	1.71	1.8
Mercury	mg/L	0.001 MAC		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Potassium	mg/L			8.71	6.79	3.68	4.88	3.33
Sodium	mg/L	200 AO		34.3	101	34.9	32.2	20.3
Zinc	mg/L	5 AO		0.005	0.013	0.007	<0.005	<0.005
Volatile Organic Compounds								
1,4-Dichlorobenzene	mg/L	0.005 MAC		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Benzene	mg/L	0.001 MAC		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Methylene Chloride(Dichloromethane)	mg/L	0.05 MAC		<0.0003	<0.0003	<0.0003	<0.0003	<0.0003
Toluene	mg/L	0.024 AO		0.310	0.290	0.031	0.00050	0.00038
Vinyl Chloride	mg/L	0.001 MAC		<0.00017	<0.00017	<0.00017	<0.00017	<0.00017

Notes:

- (1) MECP Ontario Drinking Water Standards.
- (2) Operational Guideline (OG) within ODWS.
- (3) Aesthetic Objective (AO) within ODWS.
- (4) Maximum Acceptable Concentration (MAC) within ODWS.
- (5) Interim Maximum Acceptable Concentration (IMAC) within ODWS.
- (6) ODWS exceedances indicated by **bold** entries.

Groundwater Geochemical Results MW-ES

Parameters	Units	ODWS ⁽¹⁾	Oct-14	Sep-15	Sep-16	Oct-17	Sep-18	Sep-19
General Chemistry								
Alkalinity (Total as CaCO ₃)	mg/L	30-500 OG ⁽²⁾	294	450	638	384	399	428
Ammonia	mg/L		0.52	1.15	3.08	0.37	0.24	0.42
Chloride	mg/L	250 AO ⁽³⁾	6.81	69.8	119	7.85	4.88	15.3
COD	mg/L		16	59	60	25	18	10
Conductivity	umho/cm		567	1160	1500	694	727	847
Dissolved Organic Carbon (DOC)	mg/L	5 AO	8.5	4.5	9.1	10.3	4.1	3.5
Nitrate (N)	mg/L	10 MAC ⁽⁴⁾	<0.10	<0.05	<0.25	<0.10	<0.05	<0.25
Nitrite (N)	mg/L	1 MAC	<0.10	<0.05	<0.25	<0.10	<0.05	<0.25
pH	pH	6.5-8.5	6.98	7.56	7.78	7.90	7.08	7.48
Phenols	mg/L		<0.001	0.005	0.039	0.002	0.002	<0.001
Total Phosphorus	mg/L		0.70	2.71	2.4	1.44	1.36	0.69
Sulphate	mg/L	500 AO	9.14	46.1	22.2	25.2	10.3	13.0
Total Dissolved Solids (TDS)	mg/L	500 AO	298	634	800	382	396	426
TKN	mg/L		1.09	5.65	5.05	1.14	1.66	1.08
Metals								
Arsenic	mg/L	0.025 IMAC ⁽⁵⁾	0.006	0.008	0.005	0.003	0.004	<0.003
Barium	mg/L	1 MAC	0.024	0.061	0.071	0.031	0.045	0.036
Boron	mg/L	5 IMAC	0.016	0.032	0.045	0.026	0.035	0.068
Cadmium	mg/L	0.005 MAC	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Calcium	mg/L		69.7	116	143	88.4	88.7	102
Chromium	mg/L	0.05 MAC	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Copper	mg/L	1 AO	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Iron	mg/L	0.3 AO	11.3	8.73	14.7	4.74	3.58	<0.010
Lead	mg/L	0.01 MAC	<0.002	<0.002	<0.002	<0.002	<0.001	<0.001
Magnesium	mg/L		31.6	46.9	52.0	37.7	39.2	39.7
Manganese	mg/L	0.05 AO	1.65	2.13	2.05	0.887	1.17	0.439
Mercury	mg/L	0.001 MAC	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Potassium	mg/L		2.17	4.77	8.96	2.29	2.83	3.66
Sodium	mg/L	200 AO	4.24	31.5	89.0	11.9	6.74	14.0
Zinc	mg/L	5 AO	<0.005	<0.005	0.008	<0.005	<0.005	0.006
Volatile Organic Compounds								
1,4-Dichlorobenzene	mg/L	0.005 MAC	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Benzene	mg/L	0.001 MAC	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Methylene Chloride(Dichloromethane)	mg/L	0.05 MAC	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003
Toluene	mg/L	0.024 AO	0.00097	0.0058	0.0150	0.00024	0.00056	0.00064
Vinyl Chloride	mg/L	0.001 MAC	<0.00017	<0.00018	<0.00017	<0.00017	<0.00017	<0.00017

Notes:

- (1) MECP Ontario Drinking Water Standards.
- (2) Operational Guideline (OG) within ODWS.
- (3) Aesthetic Objective (AO) within ODWS.
- (4) Maximum Acceptable Concentration (MAC) within ODWS.
- (5) Interim Maximum Acceptable Concentration (IMAC) within ODWS.
- (6) ODWS exceedances indicated by **bold** entries.

Groundwater Geochemical Results MW-ND

Parameters	Units	ODWS ⁽¹⁾	Oct-14	Sep-15	Sep-16	Oct-17	Sep-18	Sep-19
General Chemistry								
Alkalinity (Total as CaCO ₃)	mg/L	30-500 OG ⁽²⁾	480	275	312	376	402	357
Ammonia	mg/L		38.6	1.5	0.85	0.4	0.28	0.32
Chloride	mg/L	250 AO ⁽³⁾	6.74	2.43	3.25	0.92	1.67	2.06
COD	mg/L		482	30	37	18	19	6
Conductivity	umho/cm		1030	588	699	622	733	674
Dissolved Organic Carbon (DOC)	mg/L	5 AO	40.1	3.0	2.9	9.6	3.1	3.0
Nitrate (N)	mg/L	10 MAC ⁽⁴⁾	<0.25	0.23	0.9	<0.10	<0.25	<0.10
Nitrite (N)	mg/L	1 MAC	<0.25	<0.05	0.10	<0.10	<0.25	<0.10
pH	pH	6.5-8.5	7.36	7.63	7.97	8.20	7.71	7.64
Phenols	mg/L		0.364	<0.001	<0.001	<0.001	<0.001	<0.001
Total Phosphorus	mg/L		5.83	0.96	2.34	0.8	2.58	0.29
Sulphate	mg/L	500 AO	3.16	14.8	8.05	11.3	14.3	12.9
Total Dissolved Solids (TDS)	mg/L	500 AO	430	344	380	326	402	318
TKN	mg/L		38.6	8.54	2.2	0.86	1.01	0.82
Metals								
Arsenic	mg/L	0.025 IMAC ⁽⁵⁾	<0.003	0.006	<0.003	<0.003	<0.003	<0.003
Barium	mg/L	1 MAC	0.035	0.024	0.028	0.030	0.034	0.030
Boron	mg/L	5 IMAC	<0.010	<0.010	<0.010	<0.010	<0.010	0.015
Cadmium	mg/L	0.005 MAC	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Calcium	mg/L		77.6	70.9	72.5	83.9	92.7	84.3
Chromium	mg/L	0.05 MAC	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Copper	mg/L	1 AO	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Iron	mg/L	0.3 AO	1.13	4.79	1.66	0.941	1.14	0.35
Lead	mg/L	0.01 MAC	<0.002	<0.002	<0.002	<0.002	<0.001	<0.001
Magnesium	mg/L		36.0	29.7	30.1	37.4	42.5	35.4
Manganese	mg/L	0.05 AO	0.269	0.622	0.678	0.263	0.19	0.358
Mercury	mg/L	0.001 MAC	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Potassium	mg/L		11.1	1.47	1.27	1.2	1.27	1.16
Sodium	mg/L	200 AO	6.58	4.06	5.15	4.99	3.91	4.99
Zinc	mg/L	5 AO	<0.005	<0.005	0.014	<0.005	<0.005	<0.005
Volatile Organic Compounds								
1,4-Dichlorobenzene	mg/L	0.005 MAC	<0.0001	<0.0001	<0.0001	<0.0001		<0.0001
Benzene	mg/L	0.001 MAC	<0.0002	<0.0002	<0.0002	<0.0002		<0.0002
Methylene Chloride(Dichloromethane)	mg/L	0.05 MAC	<0.0003	<0.0003	<0.0003	<0.0003		<0.0003
Toluene	mg/L	0.024 AO	0.0052	0.00084	0.00068	<0.0002		<0.0002
Vinyl Chloride	mg/L	0.001 MAC	<0.00017	<0.00018	<0.00017	<0.00017		<0.00017

Notes:

- (1) MECP Ontario Drinking Water Standards.
- (2) Operational Guideline (OG) within ODWS.
- (3) Aesthetic Objective (AO) within ODWS.
- (4) Maximum Acceptable Concentration (MAC) within ODWS.
- (5) Interim Maximum Acceptable Concentration (IMAC) within ODWS.
- (6) ODWS exceedances indicated by **bold** entries.

Groundwater Geochemical Results MW-NS

Parameters	Units	ODWS ⁽¹⁾	Oct-14	Sep-15	Sep-16	Oct-17	Sep-18	Sep-19
General Chemistry								
Alkalinity (Total as CaCO ₃)	mg/L	30-500 OG ⁽²⁾	397	549	431	375		No sample obtained
Ammonia	mg/L		0.11	0.05	0.06	0.02		
Chloride	mg/L	250 AO ⁽³⁾	2.18	2.68	2.01	1.0		
COD	mg/L		20	32	13	35		
Conductivity	umho/cm		722	1080	780	625		
Dissolved Organic Carbon (DOC)	mg/L	5 AO	13.4	3.3	3.1	12.5		
Nitrate (N)	mg/L	10 MAC ⁽⁴⁾	<0.10	<0.05	0.44	0.20		
Nitrite (N)	mg/L	1 MAC	<0.10	<0.05	0.08	<0.10		
pH	pH	6.5-8.5	7.62	7.57	8.04	8.08		
Phenols	mg/L		<0.001	<0.001	<0.001	<0.001		
Total Phosphorus	mg/L		1.59	1.84	<0.05	1.85		
Sulphate	mg/L	500 AO	11.5	12.3	15.2	12.9		
Total Dissolved Solids (TDS)	mg/L	500 AO	418	538		342		
TKN	mg/L		1.2	4.09	0.33	0.69		
Metals								
Arsenic	mg/L	0.025 IMAC ⁽⁵⁾	<0.003	<0.003	<0.003	<0.003	<0.003	
Barium	mg/L	1 MAC	0.04	0.048	0.041	0.028	0.037	
Boron	mg/L	5 IMAC	<0.010	0.011	<0.010	<0.010	0.013	
Cadmium	mg/L	0.005 MAC	<0.002	<0.002	<0.002	<0.002	<0.002	
Calcium	mg/L		93.7	131	102	87.2		
Chromium	mg/L	0.05 MAC	<0.003	<0.003	<0.003	<0.003	<0.003	
Copper	mg/L	1 AO	<0.003	<0.003	<0.003	<0.003	<0.003	
Iron	mg/L	0.3 AO	1.23	0.561	0.241	0.048	<0.010	
Lead	mg/L	0.01 MAC	<0.002	<0.002	<0.002	<0.002	<0.001	
Magnesium	mg/L		43.3	57.1	45.3	38.1		
Manganese	mg/L	0.05 AO	0.155	0.452	0.140	0.072	0.022	
Mercury	mg/L	0.001 MAC	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
Potassium	mg/L		0.96	0.99	1.12	0.64		
Sodium	mg/L	200 AO	1.96	1.49	3.35	1.48		
Zinc	mg/L	5 AO	<0.005	<0.005	0.010	0.005	<0.005	
Volatile Organic Compounds								
1,4-Dichlorobenzene	mg/L	0.005 MAC	<0.0001	<0.0001	<0.0001	<0.0001		
Benzene	mg/L	0.001 MAC	<0.0002	<0.0002	<0.0002	<0.0002		
Methylene Chloride(Dichloromethane)	mg/L	0.05 MAC	<0.0003	<0.0003	<0.0003	<0.0003		
Toluene	mg/L	0.024 AO	0.00048	0.0003	<0.0002	<0.0002		
Vinyl Chloride	mg/L	0.001 MAC	<0.00017	<0.00018	<0.00017	<0.00017		

Notes:

- (1) MECP Ontario Drinking Water Standards.
- (2) Operational Guideline (OG) within ODWS.
- (3) Aesthetic Objective (AO) within ODWS.
- (4) Maximum Acceptable Concentration (MAC) within ODWS.
- (5) Interim Maximum Acceptable Concentration (IMAC) within ODWS.
- (6) ODWS exceedances indicated by **bold** entries.

Groundwater Geochemical Results MW-SD

Parameters	Units	ODWS ⁽¹⁾	Oct-14	Sep-15	Sep-16	Oct-17	Sep-18	Sep-19
General Chemistry								
Alkalinity (Total as CaCO ₃)	mg/L	30-500 OG ⁽²⁾	539	543	522	729	850	767
Ammonia	mg/L		0.03	0.10	0.55	<0.02	13.1	13.1
Chloride	mg/L	250 AO ⁽³⁾	117	133	178	140	106	125
COD	mg/L		7	15	16	45	27	29
Conductivity	umho/cm		1530	1840	1990	1870	2070	2010
Dissolved Organic Carbon (DOC)	mg/L	5 AO	4.9	6.2	5.8	13.4	12.2	10.0
Nitrate (N)	mg/L	10 MAC ⁽⁴⁾	<0.25	<0.25	<0.5	<0.5	<0.25	<0.5
Nitrite (N)	mg/L	1 MAC	<0.25	<0.25	<0.5	<0.5	<0.25	<0.5
pH	pH	6.5-8.5	7.58	7.68	7.98	8.15	7.47	7.64
Phenols	mg/L		<0.001	<0.001	<0.001	<0.001	0.001	0.002
Total Phosphorus	mg/L		0.07	0.15	0.09	0.12	0.04	0.04
Sulphate	mg/L	500 AO	199	249	357	266	223	215
Total Dissolved Solids (TDS)	mg/L	500 AO	1000	1110	1180	1210	1200	1170
TKN	mg/L		0.35	0.78	0.97	6.06	15.7	13.9
Metals								
Arsenic	mg/L	0.025 IMAC ⁽⁵⁾	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Barium	mg/L	1 MAC	0.071	0.090	0.100	0.143	0.145	0.157
Boron	mg/L	5 IMAC	0.115	0.182	0.203	0.546	0.526	0.606
Cadmium	mg/L	0.005 MAC	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Calcium	mg/L		168	168	188	178	176	167
Chromium	mg/L	0.05 MAC	<0.003	0.003	<0.003	<0.003	0.004	<0.003
Copper	mg/L	1 AO	<0.003	0.004	0.004	0.012	0.007	0.005
Iron	mg/L	0.3 AO	0.188	<0.010	0.103	<0.010	<0.010	<0.010
Lead	mg/L	0.01 MAC	<0.002	<0.002	<0.002	<0.002	<0.001	<0.001
Magnesium	mg/L		78.6	84.4	100	107	108	102
Manganese	mg/L	0.05 AO	1.19	1.0	1.1	1.3	1.2	1.1
Mercury	mg/L	0.001 MAC	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Potassium	mg/L		14.1	21.4	27.1	52.2	54.7	51
Sodium	mg/L	200 AO	46.3	80.2	103	99.3	87.1	85.7
Zinc	mg/L	5 AO	0.01	0.006	0.006	<0.005	<0.005	<0.005
Volatile Organic Compounds								
1,4-Dichlorobenzene	mg/L	0.005 MAC	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Benzene	mg/L	0.001 MAC	<0.0002	<0.0002	<0.0002	<0.0002	0.00041	<0.0002
Methylene Chloride(Dichloromethane)	mg/L	0.05 MAC	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003
Toluene	mg/L	0.024 AO	<0.0002	0.0003	<0.0002	<0.0002	<0.0002	<0.0002
Vinyl Chloride	mg/L	0.001 MAC	<0.00017	<0.00017	<0.00017	<0.00017	<0.00017	<0.00017

Notes:

- (1) MECP Ontario Drinking Water Standards.
- (2) Operational Guideline (OG) within ODWS.
- (3) Aesthetic Objective (AO) within ODWS.
- (4) Maximum Acceptable Concentration (MAC) within ODWS.
- (5) Interim Maximum Acceptable Concentration (IMAC) within ODWS.
- (6) ODWS exceedances indicated by **bold** entries.

Groundwater Geochemical Results MW-SS

Parameters	Units	ODWS ⁽¹⁾	Oct-14	Sep-15	Sep-16	Oct-17	Sep-18	Sep-19
General Chemistry								
Alkalinity (Total as CaCO ₃)	mg/L	30-500 OG ⁽²⁾	519	505	463	870	920	902
Ammonia	mg/L		0.06	1.26	1.02	16.8	17.0	4.72
Chloride	mg/L	250 AO ⁽³⁾	158	109	110	181	131	179
COD	mg/L		21	23	30	60	42	66
Conductivity	umho/cm		1720	1640	1520	2240	2290	2390
Dissolved Organic Carbon (DOC)	mg/L	5 AO	12.2	5.7	4.5	17.5	16.4	15.0
Nitrate (N)	mg/L	10 MAC ⁽⁴⁾	<0.25	0.56	0.63	<0.5	<0.5	<1.0
Nitrite (N)	mg/L	1 MAC	<0.25	<0.25	<0.25	<0.5	<0.5	<1.0
pH	pH	6.5-8.5	7.21	7.73	7.89	8.19	7.40	7.69
Phenols	mg/L		<0.001	<0.001	0.001	<0.001	0.001	0.001
Total Phosphorus	mg/L		0.86	0.79	0.83	0.94	0.84	1.0
Sulphate	mg/L	500 AO	246	206	232	326	296	241
Total Dissolved Solids (TDS)	mg/L	500 AO	1190	898	934	1440	1420	1330
TKN	mg/L		0.63	3.58	2.96	18.3	22.5	24.9
Metals								
Arsenic	mg/L	0.025 IMAC ⁽⁵⁾	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Barium	mg/L	1 MAC	0.077	0.095	0.093	0.136	0.105	0.125
Boron	mg/L	5 IMAC	0.134	0.165	0.181	0.683	0.631	0.694
Cadmium	mg/L	0.005 MAC	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Calcium	mg/L		167	149	149	194	194	186
Chromium	mg/L	0.05 MAC	<0.003	<0.003	<0.003	<0.003	0.004	0.004
Copper	mg/L	1 AO	0.004	<0.003	0.003	0.010	<0.003	0.004
Iron	mg/L	0.3 AO	0.023	<0.010	0.059	0.042	4.13	1.45
Lead	mg/L	0.01 MAC	<0.002	<0.002	<0.002	<0.002	<0.001	<0.001
Magnesium	mg/L		83.2	78.3	78.9	130	132	127
Manganese	mg/L	0.05 AO	0.769	1.24	1.05	1.41	1.63	1.56
Mercury	mg/L	0.001 MAC	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Potassium	mg/L		17.0	22.3	21.0	63.4	59.5	57.1
Sodium	mg/L	200 AO	69.3	56.2	53.2	118	98.8	115
Zinc	mg/L	5 AO	<0.005	0.007	0.006	<0.005	0.007	<0.005
Volatile Organic Compounds								
1,4-Dichlorobenzene	mg/L	0.005 MAC	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Benzene	mg/L	0.001 MAC	<0.0002	<0.0002	<0.0002	0.00029	0.00036	<0.0002
Methylene Chloride(Dichloromethane)	mg/L	0.05 MAC	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003
Toluene	mg/L	0.024 AO	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.00033
Vinyl Chloride	mg/L	0.001 MAC	<0.00017	<0.00017	<0.00017	<0.00017	<0.00017	<0.00017

Notes:

- (1) MECP Ontario Drinking Water Standards.
- (2) Operational Guideline (OG) within ODWS.
- (3) Aesthetic Objective (AO) within ODWS.
- (4) Maximum Acceptable Concentration (MAC) within ODWS.
- (5) Interim Maximum Acceptable Concentration (IMAC) within ODWS.
- (6) ODWS exceedances indicated by **bold** entries.

Groundwater Geochemical Results MW-WD

Parameters	Units	ODWS ⁽¹⁾	Oct-14	Sep-15	Sep-16	Oct-17	Sep-18	Sep-19
General Chemistry								
Alkalinity (Total as CaCO ₃)	mg/L	30-500 OG ⁽²⁾	467	448		514		456
Ammonia	mg/L		<0.02	1.32	0.07	<0.02		
Chloride	mg/L	250 AO ⁽³⁾	18.7	36.3		25.5		35.2
COD	mg/L		18	64	24	19		
Conductivity	umho/cm		914	1050		943		1000
Dissolved Organic Carbon (DOC)	mg/L	5 AO	14.4	6.5	4.7	6.8		
Nitrate (N)	mg/L	10 MAC ⁽⁴⁾	<0.25	0.29		0.5		0.9
Nitrite (N)	mg/L	1 MAC	<0.25	<0.25		<0.25		<0.25
pH	pH	6.5-8.5	7.50	7.72		8.19		7.66
Phenols	mg/L		<0.001	0.031		<0.001		<0.001
Total Phosphorus	mg/L		1.1	1.39	<0.05	0.34		
Sulphate	mg/L	500 AO	25.5	36.8		39.5		49.4
Total Dissolved Solids (TDS)	mg/L	500 AO	528	518		554		528
TKN	mg/L		0.47	5.5	1.37	0.3		
Metals								
Arsenic	mg/L	0.025 IMAC ⁽⁵⁾	<0.003	0.003	<0.003	<0.003	<0.003	<0.003
Barium	mg/L	1 MAC	0.074	0.068	0.075	0.083	0.077	0.086
Boron	mg/L	5 IMAC	0.052	0.054	0.041	0.084	0.064	0.085
Cadmium	mg/L	0.005 MAC	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Calcium	mg/L		113	110		119		116
Chromium	mg/L	0.05 MAC	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Copper	mg/L	1 AO	<0.003	<0.003	<0.003	0.006	0.012	0.012
Iron	mg/L	0.3 AO	<0.010	0.252	<0.010	<0.010	<0.010	<0.010
Lead	mg/L	0.01 MAC	<0.002	<0.002	<0.002	<0.002	0.002	<0.001
Magnesium	mg/L		53.8	50.7		57.1		53.2
Manganese	mg/L	0.05 AO	<0.002	0.314	0.005	0.003	0.004	0.003
Mercury	mg/L	0.001 MAC	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Potassium	mg/L		4.75	4.77		5.74		5.67
Sodium	mg/L	200 AO	9.93	13.8		15.6		15.4
Zinc	mg/L	5 AO	<0.005	<0.005	0.013	0.006	0.027	0.019
Volatile Organic Compounds								
1,4-Dichlorobenzene	mg/L	0.005 MAC	<0.0001	<0.0001	<0.0001	<0.0001		
Benzene	mg/L	0.001 MAC	<0.0002	<0.0002	<0.0002	<0.0002		
Methylene Chloride(Dichloromethane)	mg/L	0.05 MAC	<0.0003	<0.0003	<0.0003	<0.0003		
Toluene	mg/L	0.024 AO	<0.0002	0.0079	<0.0002	<0.0002		
Vinyl Chloride	mg/L	0.001 MAC	<0.00017	<0.00018	<0.00017	<0.00017		

Notes:

- (1) MECP Ontario Drinking Water Standards.
- (2) Operational Guideline (OG) within ODWS.
- (3) Aesthetic Objective (AO) within ODWS.
- (4) Maximum Acceptable Concentration (MAC) within ODWS.
- (5) Interim Maximum Acceptable Concentration (IMAC) within ODWS.
- (6) ODWS exceedances indicated by **bold** entries.

Groundwater Geochemical Results MW-WS

Parameters	Units	ODWS ⁽¹⁾	Oct-14	Sep-15	Sep-16	Oct-17	Sep-18	Sep-19
General Chemistry								
Alkalinity (Total as CaCO ₃)	mg/L	30-500 OG ⁽²⁾	353	494	512	510	539	518
Ammonia	mg/L		0.03	2.37	0.12	0.11	<0.02	0.14
Chloride	mg/L	250 AO ⁽³⁾	10.3	46.0	39.0	24.2	33.8	44.2
COD	mg/L		33	51	18	19	18	24
Conductivity	umho/cm		689	1150	1080	938	1050	1120
Dissolved Organic Carbon (DOC)	mg/L	5 AO	14.4	10.7	3.5	7.2	4.2	3.4
Nitrate (N)	mg/L	10 MAC ⁽⁴⁾	0.49	0.26	0.45	0.8	1.21	0.35
Nitrite (N)	mg/L	1 MAC	<0.10	<0.25	<0.25	<0.25	<0.25	<0.25
pH	pH	6.5-8.5	7.36	7.74	8.03	8.27	7.41	7.57
Phenols	mg/L		<0.001	0.015	<0.001	<0.001	<0.001	<0.001
Total Phosphorus	mg/L		1.98	2.1	0.79	0.48	1.34	1.11
Sulphate	mg/L	500 AO	16.0	31.7	43.8	36.8	46.3	57.8
Total Dissolved Solids (TDS)	mg/L	500 AO	398	616	598	526	632	584
TKN	mg/L		0.79	14.5	0.74	0.41	0.76	1.08
Metals								
Arsenic	mg/L	0.025 IMAC ⁽⁵⁾	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Barium	mg/L	1 MAC	0.051	0.083	0.064	0.073	0.065	0.072
Boron	mg/L	5 IMAC	0.047	0.093	0.071	0.106	0.095	0.126
Cadmium	mg/L	0.005 MAC	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Calcium	mg/L		88.4	123	127	119	131	130
Chromium	mg/L	0.05 MAC	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Copper	mg/L	1 AO	<0.003	<0.003	<0.003	<0.003	<0.003	0.003
Iron	mg/L	0.3 AO	0.19	0.535	0.099	0.127	<0.010	<0.010
Lead	mg/L	0.01 MAC	<0.002	<0.002	<0.002	<0.002	<0.001	<0.001
Magnesium	mg/L		41.9	53.8	59.8	56.5	61.9	60.3
Manganese	mg/L	0.05 AO	0.050	0.441	0.086	0.163	0.021	0.266
Mercury	mg/L	0.001 MAC	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Potassium	mg/L		3.58	8.56	6.89	7.02	7.82	6.94
Sodium	mg/L	200 AO	5.43	18.9	18.5	15.6	19.5	20.4
Zinc	mg/L	5 AO	<0.005	0.007	0.012	<0.005	<0.005	0.014
Volatile Organic Compounds								
1,4-Dichlorobenzene	mg/L	0.005 MAC	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Benzene	mg/L	0.001 MAC	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Methylene Chloride(Dichloromethane)	mg/L	0.05 MAC	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003
Toluene	mg/L	0.024 AO	<0.0002	0.0180	<0.0002	<0.0002	0.00059	<0.0002
Vinyl Chloride	mg/L	0.001 MAC	<0.00017	<0.00018	<0.00017	<0.00017	<0.00017	<0.00017

Notes:

- (1) MECP Ontario Drinking Water Standards.
- (2) Operational Guideline (OG) within ODWS.
- (3) Aesthetic Objective (AO) within ODWS.
- (4) Maximum Acceptable Concentration (MAC) within ODWS.
- (5) Interim Maximum Acceptable Concentration (IMAC) within ODWS.
- (6) ODWS exceedances indicated by **bold** entries.

2019 Groundwater Duplicate Data

Parameters	Units	Sep-19		
		MW-SD	DUP 2	Relative Percent Difference (%)
General Chemistry				
Alkalinity (Total as CaCO ₃)	mg/L	767	773	(0.779)
Ammonia	mg/L	13.1	13.8	(5.204)
Chloride	mg/L	125	143	(13.433)
COD	mg/L	29	28	3.509
Conductivity	umho/cm	2010	2020	(0.496)
Dissolved Organic Carbon (DOC)	mg/L	10.0	9.8	2.020
Nitrate (N)	mg/L	<0.5	<0.5	NC
Nitrite (N)	mg/L	<0.5	<0.5	NC
pH	pH	7.64	7.79	(1.944)
Phenols	mg/L	0.002	0.002	0.000
Total Phosphorus	mg/L	0.04	0.04	0.000
Sulphate	mg/L	215	247	(13.853)
Total Dissolved Solids (TDS)	mg/L	1170	1160	0.858
TKN	mg/L	13.9	14.2	(2.135)
Metals				
Arsenic	mg/L	<0.003	<0.003	NC
Barium	mg/L	0.157	0.160	(1.893)
Boron	mg/L	0.606	0.690	(12.963)
Cadmium	mg/L	<0.002	<0.002	NC
Calcium	mg/L	167	168	(0.597)
Chromium	mg/L	<0.003	<0.003	NC
Copper	mg/L	0.005	0.005	0.000
Iron	mg/L	<0.010	<0.010	NC
Lead	mg/L	<0.001	<0.001	NC
Magnesium	mg/L	102	103	(0.976)
Manganese	mg/L	1.13	1.13	0.000
Mercury	mg/L	<0.0001	<0.0001	NC
Potassium	mg/L	51.0	50.9	0.196
Sodium	mg/L	85.7	85.3	0.468
Zinc	mg/L	<0.005	<0.005	NC
Volatile Organic Compounds				
1,4-Dichlorobenzene	mg/L	<0.0001	<0.0001	NC
Benzene	mg/L	<0.0002	<0.0002	NC
Methylene Chloride(Dichloromethane)	mg/L	<0.0003	<0.0003	NC
Toluene	mg/L	<0.0002	<0.0002	NC
Vinyl Chloride	mg/L	<0.00017	<0.00017	NC

Notes:

(1) NC - not calculable as one or both concentrations are below the laboratory method detection limit.

The Municipality of Central Manitoulin
2019 Annual Groundwater Monitoring Report
Mindemoya Waste Disposal Site
Mindemoya, Ontario
December 2019



APPENDIX E

**PHOTOGRAPHIC INVENTORY OF
GROUNDWATER MONITORING
LOCATIONS**



**MW-E
Well Nest
2019**



**MW-E
Well Nest
2019**



**MW-S
Well Nest
2019**



**MW-S
Well Nest
2019**



MW-W
Well Nest
2019



MW-W
Well Nest
2019



MW-N
Well Nest
2019



MW-N
Well Nest
2019

APPENDIX F

**GROUNDWATER IONIC BALANCE AND
PIPER PLOT DATA TABLE**

Groundwater Ionic Balance and Piper Plot Data - September 2019

Raw Data (mg/L)	MW-WD	MW-WS	MW-SD	MW-SS	MW-ES	MW-ED	MW-ND
Ca	116	130	167	186	102	125	84.3
Mg	53.2	60.3	102	127	39.7	44.3	35.4
Na	15.4	20.4	85.7	115	14.0	20.3	4.99
K	5.67	6.94	51.0	57.1	3.66	3.33	1.16
Cl	35.2	44.2	125	179	15.3	31.2	2.06
SO4	49.4	57.8	215	241	13.0	15.0	12.9
ALK	456	518	767	902	428	484	357
pH	7.66	7.57	7.64	7.69	7.48	7.56	7.64
Ion Balance Data and Piper Plot (%)							
Cations:	10.98	12.51	21.76	26.20	9.06	10.85	7.37
Anions:	11.13	12.80	23.33	28.09	9.25	10.86	7.46
CBE (%):	-0.69	-1.13	-3.48	-3.49	-1.07	-0.06	-0.63
Mg:	39.9	39.7	38.6	39.9	36.1	33.6	39.5
Ca:	52.7	51.8	38.3	35.4	56.2	57.5	57.1
Na+K:	7.4	8.5	23.1	24.7	7.8	8.9	3.3
Cl:	8.9	9.7	15.1	18.0	4.7	8.1	0.8
SO4:	9.2	9.4	19.2	17.9	2.9	2.9	3.6
HCO3+CO3:	81.8	80.9	65.7	64.2	92.4	89.0	95.6

The Municipality of Central Manitoulin
2019 Annual Groundwater Monitoring Report
Mindemoya Waste Disposal Site
Mindemoya, Ontario
December 2019



APPENDIX G
GUIDELINE B-7 CALCULATIONS

**Guideline B-7
 September 2019 Monitoring Event**

Guideline B-7								
Parameter	ODWS ⁽³⁾ C_r (mg/L)	Background Concentration C_b ⁽¹⁾ (mg/L)	Maximum Concentration C_m=C_b+x(C_r-C_b) (mg/L)	MW-ES (mg/L)	MW-ED (mg/L)	MW-ND (mg/L)	MW-WS (mg/L)	MW-WD (mg/L)
Health Related				x=0.25 ⁽²⁾				
Arsenic	0.025	0.0015	0.007	<0.003	0.006	<0.003	<0.003	<0.003
Barium	1	0.108	0.331	0.036	0.120	0.030	0.072	0.086
Boron	5	0.313	1.48	0.068	0.032	0.015	0.126	0.085
Cadmium	0.005	0.0010	0.0020	<0.002	<0.002	<0.002	<0.002	<0.002
Chromium	0.05	0.0020	0.014	<0.003	<0.003	<0.003	<0.003	<0.003
Lead	0.01	0.0008	0.003	<0.001	<0.001	<0.001	<0.001	<0.001
Nitrate-N	10	0.243	2.68	<0.25	<0.25	<0.10	0.35	
Nitrite-N	1	0.187	0.39	<0.25	<0.25	<0.10	<0.25	
Non-Health Related				x=0.50 ⁽²⁾				
Chloride	250	136.4	193	15.3	31.2	2.06	44.2	
Copper	1	0.0039	0.50	<0.003	<0.003	<0.003	0.003	0.012
DOC	5	9.24	9.24 ⁽⁴⁾	3.5	4.5	3.0	3.4	
pH	6.5-8.5	7.71	6.5-8.5	7.48	7.56	7.64	7.57	
Sodium	200	80.9	140	14.0	20.3	4.99	20.4	
Sulphate	500	250.7	375	13.0	15.0	12.9	57.8	
TDS	500	1162	1162 ⁽⁴⁾	426	514	318	584	
Toluene	0.024	0.0001	0.0121	0.0006	0.0004		<0.0002	
Zinc	5	0.0041	2.50	0.006	<0.005	<0.005	0.014	0.019

Notes:

- (1) Average of valid sampling rounds at MW-SS and MW-SD.
- (2) Defined according to Guideline B-7 (MECP, 1994).
- (3) ODWS - Ontario Drinking Water Standards (MECP, 2001).
- (4) Background exceeds the ODWS, therefore the maximum concentration has been set at background.

The Municipality of Central Manitoulin
2019 Annual Groundwater Monitoring Report
Mindemoya Waste Disposal Site
Mindemoya, Ontario
December 2019



APPENDIX H

**MONITORING AND SCREENING
CHECKLIST**

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	Mindemoya Waste Disposal Site
Location (e.g. street address, lot, concession)	408 Elliot Road, Lot 27, Concession 2, Township of Canarvon, Registered Plan No. 22, District of Manitoulin
GPS Location (taken within the property boundary at front gate/ front entry)	411220 Easting and 5067030 Northing, Zone 17
Municipality	Central Manitoulin
Client and/or Site Owner	The Municipality of Central Manitoulin
Monitoring Period (Year)	2019
This Monitoring Report is being submitted under the following:	
Certificate of Approval No.:	A550701
Director's Order No.:	
Provincial Officer's Order No.:	
Other:	

Report Submission Frequency	<input checked="" type="radio"/> Annual <input type="radio"/> Other	Specify (Type Here):
The site is:	<input type="radio"/> Active <input type="radio"/> Inactive <input checked="" type="radio"/> Closed	
If closed, specify C of A, control or authorizing document closure date:		
Has the nature of the operations at the site changed during this monitoring period?	<input type="radio"/> Yes <input checked="" type="radio"/> 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)	<input type="radio"/> Yes <input checked="" type="radio"/> 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:

<p>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:</p>	<p><input checked="" type="radio"/> Yes <input type="radio"/> No</p>	<p>If no, list exceptions (Type Here):</p>
<p>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):</p>	<p><input type="radio"/> Yes <input checked="" type="radio"/> No <input type="radio"/> Not Applicable</p>	<p>If no, list exceptions below or attach information.</p>

Groundwater Sampling Location	Description/Explanation for change (change in name or location, additions, deletions)	Date
MW-NS	Well dry - no sample obtained.	5-Sep-2019
Type Here	Type Here	Select Date
Type Here	Type Here	Select Date
Type Here	Type Here	Select Date

3) a) Some or all groundwater, leachate and WDS gas sampling and monitoring requirements have been established or defined outside of a ministry C of A, authorizing, or control document.	<input type="radio"/> Yes <input checked="" type="radio"/> No <input type="radio"/> Not Applicable	
b) If yes, 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:	<input type="radio"/> Yes <input type="radio"/> No <input checked="" type="radio"/> 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
Type Here	Type Here	Select Date
Type Here	Type Here	Select Date
Type Here	Type Here	Select Date
Type Here	Type Here	Select 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):	<input checked="" type="radio"/> Yes <input type="radio"/> No	If no, specify (Type Here):

Sampling and Monitoring Program Results/WDS Conditions and Assessment:

<p>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.</p>	<p><input checked="" type="radio"/> Yes <input type="radio"/> No</p>	<p>Unknown at this time. CAZ determination program ongoing - to be completed by 31 March 2020.</p>	
<p>6) The site meets compliance and assessment criteria.</p>	<p><input checked="" type="radio"/> Yes <input type="radio"/> No</p>		
<p>7) The site continues to perform as anticipated. There have been no unusual trends/ changes in measured leachate and groundwater levels or concentrations.</p>	<p><input checked="" type="radio"/> Yes <input type="radio"/> No</p>		
<p>1) Is one or more of the following risk reduction practices in place at the site:</p> <p>(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</p> <p>(b) There is a predictive monitoring program in-place (modeled indicator concentrations projected over time for key locations); or</p> <p>(c) The site meets the following two conditions (typically achieved after 15 years or longer of site operation):</p> <p><i>i.</i> The site has developed stable leachate mound(s) and stable leachate plume geometry/concentrations; and</p> <p><i>ii.</i> Seasonal and annual water levels and water quality fluctuations are well understood.</p>	<p><input checked="" type="radio"/> Yes <input type="radio"/> No</p>	<p>Note which practice(s):</p>	<p><input type="checkbox"/> (a) <input type="checkbox"/> (b) <input checked="" type="checkbox"/> (c)</p>
<p>9) Have trigger values for contingency plans or site remedial actions been exceeded (where they exist):</p>	<p><input type="radio"/> Yes <input type="radio"/> No <input checked="" type="radio"/> Not Applicable</p>	<p>If yes, list value(s) that are/have been exceeded and follow-up action taken (Type Here):</p>	

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

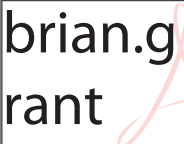

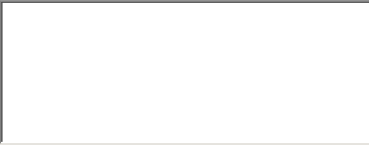
The following change(s) to the monitoring program is/are recommended:

It is recommended that the nine wells installed during 2019 as part of the ongoing CAZ determination program be incorporated into the annual monitoring network during 2020.

No Changes to site design and operation are recommended

The following change(s) to the site design and operation is/are recommended:

The Site should be capped, as the addition of low permeability final cover material will significantly reduce infiltration and subsequently reduce leachate generation at the Site. A measureable improvement in groundwater quality in the immediate vicinity of the Site is expected following final capping.

Name:	Brian Grant		
Seal:	Add Image		
Signature:	 Digitally signed by brian.grant Date: 2019.11.29 12:41:21 -05'00'	Date:	29-Nov-2019
CEP Contact Information:	Brian Grant, P.Eng.		
Company:	Wood Environment & Infrastructure Solutions		
Address:	131 Fielding Road, Lively, Ontario, P3Y 1L7		
Telephone No.:	705-682-2632 x 235	Fax No. :	705-682-2260
E-mail Address:	brian.grant@woodplc.com		
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)	NONE
Distance(s)	N/A

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:	<input checked="" type="radio"/> Yes <input type="radio"/> No	No surface water monitoring program 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):	<input type="radio"/> Yes <input type="radio"/> No <input checked="" type="radio"/> 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
Type Here	Type Here	Select Date
Type Here	Type Here	Select Date
Type Here	Type Here	Select Date
Type Here	Type Here	Select Date

<p>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.</p>	<p><input type="radio"/> Yes</p> <p><input type="radio"/> No</p> <p><input checked="" type="radio"/> Not Applicable</p>	
<p>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:</p>	<p><input type="radio"/> Yes</p> <p><input type="radio"/> No</p> <p><input checked="" type="radio"/> Not Applicable</p>	<p>If no, specify below or provide details in an attachment.</p>
<p>Surface Water Sampling Location</p>	<p>Description/Explanation for change (change in name or location, additions, deletions)</p>	<p>Date</p>
<p>Type Here</p>	<p>Type Here</p>	<p>Select Date</p>
<p>Type Here</p>	<p>Type Here</p>	<p>Select Date</p>
<p>Type Here</p>	<p>Type Here</p>	<p>Select Date</p>
<p>Type Here</p>	<p>Type Here</p>	<p>Select Date</p>
<p>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):</p>	<p><input checked="" type="radio"/> Yes</p> <p><input type="radio"/> No</p>	<p>No surface water monitoring program required.</p>

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
Type Here	Type Here	Type Here
Type Here	Type Here	Type Here

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

If yes, specify (Type Here)

<p>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.</p>	<p><input checked="" type="radio"/> Yes</p> <p><input type="radio"/> No</p>	<p>N/A</p>
<p>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)):</p>	<p><input type="radio"/> Yes</p> <p><input type="radio"/> No</p> <p><input type="radio"/> Not Known</p> <p><input checked="" type="radio"/> Not Applicable</p>	<p>If yes, provide details and whether remedial measures are necessary (Type Here)</p>
<p>9) Have trigger values for contingency plans or site remedial actions been exceeded (where they exist):</p>	<p><input type="radio"/> Yes</p> <p><input type="radio"/> No</p> <p><input checked="" type="radio"/> Not Applicable</p>	<p>If yes, list value(s) that are/have been exceeded and follow-up action taken (Type Here)</p>

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:

<p><input checked="" type="radio"/> No Changes to the monitoring program are recommended</p> <p><input type="radio"/> The following change(s) to the monitoring program is/are recommended:</p>	<p>Type Here</p>
<p><input checked="" type="radio"/> No changes to the site design and operation are recommended</p> <p><input type="radio"/> The following change(s) to the site design and operation is/are recommended:</p>	<p>Type Here</p>

CEP Signature	brian.grant Digitally signed by brian.grant Date: 2019.11.29 12:42:07 -05'00'	
Relevant Discipline	Hydrogeologist	
Date:	29-Nov-2019	
CEP Contact Information:	Brian Grant	
Company:	Wood Environment & Infrastructure Solutions	
Address:	131 Fielding Road, Lively, Ontario, P3Y 1L7	
Telephone No.:	705-682-2632 x 235	
Fax No. :	705-682-2260	
E-mail Address:	brian.grant@woodplc.com	
Save As		Print Form