AGENDA
A meeting of the Council of the Corporation
of the Town of Northeastern Manitoulin and the Islands
to be held on Tuesday, August 1, 2023

1. **Call to Order**

2. **Approval of Agenda**

3. **Disclosure of Pecuniary Interest & General Nature Thereof**

4. **Minutes of Previous Meeting**
   i. Confirming By-Law 2023-19

5. **Old Business**
   i. Strategic Planning

6. **New Business**
   i. Request for parking lot closure – Pride Manitoulin
   ii. Sand Tender results

7. **Minutes and Reports**
   i. GM BluePlan – NEMI landfill

8. **Correspondence**
   i. Solicitor General – OPP Detachment Board

9. **In Camera**
   i. **personal matters about an identifiable individual, including municipal or local employees**

10. **Adjournment**

THE CORPORATION OF THE TOWN OF
NORTHEASTERN MANITOULIN AND THE ISLANDS

BY-LAW NO. 2023-19

Being a by-law of the Corporation of the Town of Northeastern Manitoulin and the Islands to adopt the minutes of Council for the term commencing November 15th, 2022 and authorizing the taking of any action authorized therein and thereby.

WHEREAS the Municipal Act, S.O. 2001, c. 25. s. 5 (3) requires a Municipal Council to exercise its powers by by-law, except where otherwise provided;

AND WHEREAS in many cases, action which is taken or authorized to be taken by a Council or a Committee of Council does not lend itself to an individual by-law;

NOW THEREFORE THE COUNCIL OF THE CORPORATION OF THE TOWN OF NORTHEASTERN MANITOULIN AND THE ISLANDS ENACTS AS FOLLOWS:

1. THAT the minutes of the meetings of the Council of the Corporation of the Town of Northeastern Manitoulin and the Islands for the term commencing November 15th, 2022 and held on:

   July 18, 2023

   are hereby adopted.

2. THAT the taking of any action authorized in or by the minutes mentioned in Section 1 hereof and the exercise of any powers by the Council or Committees by the said minutes are hereby ratified, authorized and confirmed.

3. THAT, where no individual by-law has been or is passed with respect to the taking of any action authorized in or by the minutes mentioned in Section 1 hereof or with respect to the exercise of any powers by the Council or Committees in the above-mentioned minutes, then this by-law shall be deemed for all purposes to be the by-law required for approving and authorizing the taking of any action authorized therein or thereby or required for the exercise of any power therein by the Council or Committees.

4. THAT the Mayor and proper Officers of the Corporation of the Town of Northeastern Manitoulin and the Islands are hereby authorized and directed to do all things necessary to give effect to the recommendations, motions, resolutions, reports, action and other decisions of the Council or Committees as evidenced by the above-mentioned minutes in Section 1 and the Mayor and Clerk are hereby authorized and directed to execute all necessary documents in the name of the Corporation of the Town of Northeastern Manitoulin and the Islands and to affix the seal of the Corporation thereto.

READ A FIRST, SECOND AND THIRD TIME AND FINALLY PASSED THIS 1st day of August, 2023.

Al MacNevin Mayor

Pam Myers Clerk

The Corporation of the Town of Northeastern Manitoulin and the Islands
Minutes of a Council meeting held Tuesday, July 18, 2023

PRESENT: Mayor Al MacNevin, Councillors: Patti Aelick, Al Boyd, Laurie Cook, Mike Erskine, George Williamson, Dawn Orr William Koehler and Bruce Wood.

STAFF PRESENT: David Williamson, CAO
Pam Myers, Clerk

Mayor MacNevin called the meeting to order at 7:00 p.m.

Resolution No. 154-07-2023
Moved by: M. Erskine
Seconded by: G. Williamson
RESOLVED THAT the Council of the Corporation of the Town of Northeastern Manitoulin and the Islands approves agenda as amended.

Carried

Resolution No. 155.07-2023
Moved by: W. Koehler
Seconded by: P. Aelick
RESOLVED THAT the Council of the Corporation of the Town of Northeastern Manitoulin and the Islands now reads a first, second and third time and finally passes by-law 2023-18 being a by-law to adopt the minutes of Council for the term commencing November 15th, 2022 and authorizing the taking of any action therein and hereby.

Carried

Resolution No. 156-07-2023
Moved by: L. Cook
Seconded by: M. Erskine
RESOLVED THAT the Council of the Corporation of the Town of Northeastern Manitoulin and the Islands donates $200 to Whitefish River First Nation Pow Wow.

Carried

Ayes: Councillor Aelick, Cook, Erskine, Orr and Williamson
Nays: Mayor MacNevin, Councillors Boyd, Koehler, and Wood

Resolution No. 157-07-2023
Moved by: M. Erskine
Seconded by: A. Boyd
RESOLVED THAT the Council of the Corporation of the Town of Northeastern Manitoulin and the Islands authorizes the closure of Vankoughnet Street from Northern Life Church to west of the Legion on August 5th for the annual soapbox derby from 7am to 12 noon, with the understanding that the Lions Club will notify the home and business owners of this prior to the event and that the street must be cleaned after the event and free of all debris.

Carried

Resolution No. 158-07-2023
Moved by: A. Boyd
Seconded by: M. Erskine
RESOLVED THAT the Council of the Corporation of the Town of Northeastern Manitoulin and the Islands does now adjourn at 7:10 p.m.

Carried

Al MacNevin, Mayor

Pam Myers, Clerk

Town of Northeastern Manitoulin and the Islands
DRAFT 2022-2026 STRATEGIC PLANNING PRIORITIES

BUILDING A HEALTHY AND SUSTAINABLE COMMUNITY	
STRATEGIC GOAL	**TASKS TO ACHIEVE GOAL**
Improve communications with our constituents and partners.	• Place an ad in the newspaper explaining when a building permit is required. • Improve the municipal website, to serve as a main hub for municipal information, and can include links to businesses, events, organizations.
Promote volunteerism in our municipality.	• Promote volunteer involvement within our community and find ways to recognize these valuable contributions. • Promotion of existing volunteer opportunities and their job descriptions, so community members know what is expected of them.
Enhanced safety on our municipal roadways.	• Tackle speeding and high traffic issues on cross streets in town and explore options for implementation of preventative measures (i.e., speed bumps). • Explore increased traffic safety and parking in high-traffic areas (Tim Horton's/Manitoulin Brewing Company. • Greater enforcement required regarding traffic, speeding and

	industrial truck use on our municipal streets. • Explore options to address the traffic back-up during our tourist season.
Explore alternative methods of waste diversion and disposal at our Landfill.	• Explore available options for composting and recycling within our community including public education and awareness, seeking funding to purchase composters, and exploring initiating a composting program at the Landfill. • Creation of a share shed at the Landfill, where good, used items can be dropped off and community members can shop to pick up items.

STRENGTHENING OUR LOCAL ECONOMY	
Business Attraction	• Attract new businesses throughout our municipality. • Work with private sector to lobby for and secure another Grocery Store, a Giant Tiger, or a Dollar Store. • Work towards ensuring all existing stores/businesses are occupied.
Explore opportunities to ensure a Skilled Workforce	• Explore marketing opportunities which will promote recruitment and retention opportunities for a skilled workforce/labor pool. • Complete a Labor Force Analysis.

	• Approach Immigration Canada to see how we can collaborate with them to enhance our workforce.

ENHANCING COMMUNITY INFRASTRUCTURE	
Increase internet accessibility within our community.	• Explore options and availability of fibre for Little Current and broadband to increase rural connectivity and continue to lobby government.
Continue to upgrade critical and necessary municipal buildings, infrastructure, and equipment across our community.	• Explore options and develop a long-term plan for waste treatment. • Continue to commit and maximize funding necessary to upgrade our infrastructure. • Beautification projects within our parks and trails such as elimination of poison ivy and increased signage within our community. • Construction of new Swing Bridge • Development of additional sidewalks throughout town. • Redevelopment of the Sheguiandah Government Dock Park, to accommodate both families who want to enjoy the sport and boaters who utilize the boat ramp, including providing direct access to water for families to utilize. • Installation of additional benches along the Low Island Trail.

	• Continue to upgrade our fire protection vehicles on an ongoing basis, as necessary. • Explore funding opportunities to complete the development of hard-surfaced bicycle trails on the sides of our municipal roadways. • Enhance our indoor facilities, to include the development of a swimming pool and expansion of the NEMI Recreation Center to include other amenities such as an indoor walking/cycling track to encourage year-round participation. • Development of additional hiking trails within our community. • Creation of an off-leash dog park within NEMI.
Affordable Housing	• Explore options to work towards improved and affordable housing projects.
Expand opportunities for community members and visitors to enjoy and connect with nature.	• Expansion of our trails. • Planting additional trees throughout the community. • Provide opportunities for bird watching. • Commitment to dark skies via light pollution shields and community education and awareness.

CREATE AN AGE FRIENDLY COMMUNITY	
Increased access to transportation for seniors, especially accessible transportation.	• Explore options and availability of transportation options for seniors within our community.
Emphasis on ensuring that seniors have access to and can sources services and goods locally.	• Development of a Service Ontario Office within our municipality. • Encourage community members to utilize our website as a hub for municipal information such as events, activities, and programming. • Develop and maintain a list of volunteers that can provide services to seniors and provide this list to community members.

TOURISM PROMOTION & DEVELOPMENT	
Increased availability of EV Charging Stations within our municipality.	• Explore options to work with local businesses to secure additional locations for EV Charging Stations across our municipality.
Ensure that we have a variety of events, activities and programming occurring on a year-round basis.	• Development of a guided, interactive walking tour of the downtown sites, businesses, churches, and arts. • Ensuring we have programming occurring at a variety of times throughout the year. • Creation of a year-round Recreation Guide, that states all of the activities, programs and events that occur within NEMI.

	• Cross promotion of our events and activities with other Island communities and tourism providers. • Development of a tourism rewards system to promote our amenities and attract visitors to our community.

PRIDE MANITOULIN
EST. 2017
INTO THE CURRENT

July 10, 2023

Dear Municipality of Northeastern Manitoulin and the Islands,

NEMI has been a great ally over the years to continually host Pride Manitoulin events during the third weekend in August. Mnaamodzawin Health Services Inc. has taken over Pride Manitoulin from the founder and chair, Sarah Seabrook. We hope to continue this established relationship and are asking for your support again this year from Thursday, August 17th to Sunday, August 20th, 2023.

In addition to the previous requests sent in by Sarah for the parade, flag raising, colour run, and rainbow cross walks, we would like to ask permission for a few more items.

This year, we have planned to expand Pride Manitoulin and add some premiere events.
We ask for your approval to utilize the parking lot of the Little Current Post Office on Friday, August 18th from 5:00PM- 11:30PM to host a concert. This tribute band concert will be alcohol free, open to all ages, and free to attend. In the case of rain or inclement weather, I would like to request the use of the NEMI curling club ice surface as an alternate location.
Lastly, the 5K Colour Run, Walk, Roll has traditionally started at the NEMI Public Library. We would like to continue to use this location as the start/finish line when the race begins on Saturday, August 19th at 9:00 am.

Thank you again for your time and consideration regarding our requests. We look forward to working with NEMI and continue to showcase Manitoulin Island as a progressive, inclusive, safe place where everyone feels welcome regardless of how they identify.

Miigwech/ Thank you,

Leslie Taylor
2SLGBTQ+ Activities Coordinator, Mnaamodzawin Health Services Inc.
Creating Community and Building Allyship

705-368-2182 x 247
leslie.taylor@mnaamodzawin.com
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48A Hillside Road, Aundeck Omni Kaning First Nation Postal Bag 2003
Little Current, Ontario P0P 1K0

NORTHEASTERN MANITOULIN & THE ISLANDS

Box 608, Little Current, Ontario, P0P 1K0
705-368-3500

Tender Opening

Opened at The Town of Northeastern Manitoulin and the Islands

Opened by Wayne Williamson, Pam Myers _____

_____

Project _____Winter Sand_____

Date _____July 17, 2023_____

Company Name	Bid	HST		Total	Cert chq included
E Corbiere	24.00 m^3	3 12	2712	54 240.-	
Mike Varey	21.33 m^3	2.77	24.10	48 200.-	✓

ANNUAL MONITORING & OPERATIONS REPORT (2022)

NEMI WASTE DISPOSAL SITE
TOWN OF NORTHEASTERN MANITOULIN AND THE ISLANDS

MAY 2023

GMBP FILE: M-1594

1. INTRODUCTION

The NEMI waste disposal site is located at 9571 Highway 6, approximately two kilometres south of the community of Little Current. It is situated on Part of Lots 13 and 14, Concession XI, in the former Township of Howland in the Town of Northeastern Manitoulin and the Islands (NEMI), District of Manitoulin (herein referred to as 'the Town'), as shown in Figure 1. The waste disposal site is owned and operated by the Town. Operations are conducted under the Ministry of the Environment Conservation and Parks (MECP) Provisional Certificate of Approval (C of A) for a Waste Disposal Site No. A612014 issued January 6, 2000 and amended in August 2001, October 2004, September 2006, and October 2007. Copies of the C of A for the site and the amendments are provided in Appendix A.

The MECP has approved a useable area of approximately 6.1 hectares (15 acres) for landfilling within the 54.6 ha (135 acre) waste disposal site. The remaining area is devoted to buffer area, waste receiving, and the stormwater collection and management system. Landfilling at the site was initiated on October 24, 2002. The approved capacity of the site, as described in the Plan of Development and Operations (PDO), is 364,500 m^3 for waste and daily cover material (prior to final cover).

In 2014, the Town obtained the east adjacent property, formerly known as the Mountainside Homes property, which is identified as Parts 1 to 3 on Plan 31R-2185 and Plan 31R-2424. The additional municipally owned lands comprise a total site area of 6.3 hectares (15.47 acres) and represent additional downgradient lands that extend in an easterly direction to the right-of-way for Highway 6. Due to the acquisition of this additional downgradient property, the former Mountainside Homes well, which was previously considered to be in a downgradient offsite location, is no longer a potential receptor. Since there is no longer a downgradient offsite receptor immediately adjacent to the landfill property, it is our understanding that the Town is currently evaluating their on-going operations for the waste disposal site pertaining to the future progression of development. **To further evaluate the progression of development and the attenuation capacity of the Site, it is recommended that the additional downgradient lands (i.e., former Mountainside Homes property) be registered to the landfill property as buffer lands and that the existing Environmental Compliance Approval be amended to recognize the additional landfill buffer lands.**

Condition 47 of the C of A requires that an operations and monitoring report be submitted by June 1st of each year to summarize the previous year's operations, waste quantities, and monitoring results. This report is submitted to meet the annual monitoring and operations reporting requirements specified under Condition 47 of the C of A for the NEMI Waste Disposal Site. Conditions 47 (c) to (g) specify that the annual report should include the following:

(c) a drawing(s) indicating all groundwater, surface water and gas monitoring locations;
(d) tables outlining monitor locations, analytical parameters sampled, and sampling frequency;
(e) an analysis and interpretation of the surface water, groundwater, leachate and gas monitoring data; a review of the adequacy of the monitoring programmes; conclusions of the monitoring data; and recommendations for any changes in monitoring programmes that may be necessary.

In December 2016, a Hydrogeological Assessment was conducted by GM BluePlan Engineering Ltd. (GMBP) in support of a transition of the current waste disposal site to a natural attenuation site. From comments received as part of MECP correspondence dated January 30, 2017, the MECP agreed that the Site conditions are considered suitable for operation as a natural attenuation Site. See correspondence provided in Appendix B. The application for transition to a natural attenuation landfill site has been reviewed and approved by the Ministry with an updated ECA issued for the Site (i.e., ECA A612014, issued March 10, 2022). As such, this report is also being submitted to provide additional details required to facilitate the transition to an approved natural attenuation Site.

Based on the MECP correspondence and hydrogeological review, a primary component of the natural attenuation site will be to establish new background monitoring wells, new compliance wells, and re-calculate the Reasonable Use Criteria (RUC) for the Site based on the updated background conditions. These requirements have been completed and are presented herein. Additionally, an updated Design and Operations Report was prepared and submitted for MECP approval to support the application for an amendment to the existing Environmental Compliance Approval (A612014) for the Site. As previously reported, the updated Hydrogeological Assessment, and new Design and Operations Plan have been reviewed and evaluated by the Approvals Branch and received MECP approval with the new ECA for the Natural Attenuation Site being issued by the MECP on March 10, 2022. A copy of the new ECA is provided in Appendix "A".

2. GENERAL SITE OPERATIONS

Landfilling at the NEMI waste disposal site began in October 2002, subsequent to the closure of the Town's Howland (i.e., Green Bay) and Little Current Waste Disposal Sites. The NEMI landfill and recycling facility services the Town, including the First Nation lands contained within the geographic boundaries of the Town. The waste approved to be received at the site for disposal is restricted to Municipal Waste, which includes solid non-hazardous wastes and dewatered sewage sludge.

The Municipality provides waste collection services to the residents of Ward Two (Little Current) on a weekly basis and bi-weekly curb side blue box pick-up of recyclables. All other residents within the Town are required to drop off their garbage and recyclables at the landfill site.

The operating hours at the site continue to be Tuesday and Saturday from 9am to 3pm. Between the 3rd Sunday in May and the 3rd Sunday in October, the landfill is also open on Sunday from 2 pm to 6 pm. A site attendant is present during operating hours. The current site hours are within the limits outlined under Condition 10 of the C of A.

Activities that currently occur at the NEMI waste disposal site include: waste disposal, collection of recyclable materials and white goods, and stockpiling of scrap metals, tires, brush, and construction materials. The landfill collects waste on-site in the domestic waste reception area (2 bins) and holding area (6 bins). There are 6 additional bins in the recycling reception and holding area. An Existing Features Plan is provided in Figure 2.

3. SITE LIFE EXPECTANCY

Based on a review of municipal information provided by the Town, the following table provides a general summary of the estimated volumes of waste received at the Site on a monthly basis:

Month	Estimated Volume Received (m^3)
January	307*
February	307*
March	307*
April	307*
May	307*
June	307*
July	307*
August	307*
September	307*
October	307*
November	307*
December	307*
Annual Total:	**3,684 m^3**

The above noted monthly averaged estimates provided by the Town are based on the number of loads of waste received at the Site and the permissible volume of each load. The above noted total represents the estimated volume of waste received and does not account for the placement of daily and/or final cover.

According to the PDO for the site, the approved capacity of 364,500 m^3 (prior to final cover) would provide the Town with a 40-year life-span. Based on the current year's capacity determination survey and volumetric calculations prepared by Keatley Surveying Limited (Keatley), conducted on April 11, 2023, the estimated volume of waste and daily cover landfilled since April 11, 2022 was 5,105 m^3, which is consistent with historically measured volumes at the site and is generally consistent with the above noted monthly and annual volume of waste received at the Site when corrected to include the volume of soil and daily cover applied to the waste. A summary of the projected and actual volumes of waste received at the Site since landfilling operations were initiated is provided below:

YEAR	# OF DAYS IN OPERATION	PROJECTED VOLUME (m^3 as per PDO)	ACTUAL VOLUME (m^3)	% OF PROJECTION
2002	68	1,225	1,114	90.9
2003	365	6,677	5,981	89.6
2004	365	6,784	6,408	94.5
2005	365	6,894	5,094	73.9
2006	365	7,007	4,769	68.1
2007	365	7,124	5,240	73.6
2008	365	7,243	4,050	55.9
2009	365	7,362	8,312	112.9
2010	365	7,486	3,764	50.3
2011	365	7,611	5,028	66.1
2012	365	7,739	6,749	87.2
2013	365	7,874	6,083	77.3
2014	365	8,012	5,463	68.2
2015	365	8,153	5,382	66.0
2016	365	8,299	4,260	51.3
2017	365	8,447	4,360	51.6
2018	365	8,599	5,101	59.3
2019	365	8,756	5,652	64.6
2020	365	8,915	6,502	72.9
2021	365	9,079	7,185	79.1
2022	365	9,284	5,105	55.0
TOTAL	--	**158,570**	**111,602**	**70.4**

The above noted totals are based on annual topographic surveys of the active landfilling area and the refuse pile, which are completed by Keatley. It is our understanding that topographic surveys and volumetric determinations have been conducted by Keatley on an annual basis since initiating landfill operations at the Site in 2002. Correspondence provided by Keatley regarding the survey and annual fill rate for the current year is presented for reference in Appendix "B".

The resultant total volume of waste and cover material deposited at the site since the commencement of operations in 2002 equals 111,602 m^3. At the present rate of landfilling, it appears that there is reasonable assurance that the anticipated life span will be met or exceeded since the actual rate of waste disposal has consistently been less than the projected rate of waste disposal that was initially estimated in the PDO.

4. RECYCLING/WASTE REDUCTION

Currently, a recycling depot is maintained at the waste disposal site for the collection of paper, corrugated cardboard, boxboard, glass, metal food and beverage containers, and plastics (HDPE and PET). With the exception of glass, the Town contracts with Municipal Waste and Recycling Consultants (MWRC), located in Blind River, to pick up recyclable materials on a weekly basis. Recyclable goods that are not accepted as part of the blue box program, such as scrap metal, tires, used propane tanks, waste electrical and electronic equipment (WEEE), and vehicle batteries are stockpiled and hauled from the landfill site as required. Clean, dry wood waste is also chipped on an as required basis to further reduce the volume of waste entering the landfill.

Based on the municipal records provided by the Town, the following quantities of recyclables were diverted from the landfill during the current reporting period:

- Onsite Recycling Program (aluminium, metals, plastic) – 46.21 tonnes
- Corrugated Cardboard and Fibre Collection (newsprint) – 119.58 tonnes
- Waste Electrical and Electronic Equipment (WEEE) - 7.932 tonnes
- Tires – 870 units
- Wood Waste Chipped – undetermined
- Glass – none

The above noted totals are generally consistent with previous annual totals. It is important that the Municipality continue to remove stockpiles of recyclable goods on a regular basis to further reduce the volume of waste entering the landfill, to prevent clutter, and to maintain an aesthetically acceptable site.

5. SUMMARY OF GEOLOGIC SETTING

The geologic conditions at the NEMI landfill site have been extensively reviewed as part of previous investigations at the Site and surrounding area. The conditions were presented in the hydrogeologic study for the site prepared by Burnside Environmental (January 1999) as part of the supporting documentation for the EPA Part V application for the landfill. The geologic conditions at the NEMI landfill site were further evaluated using geologic mapping (Chapman and Putnam, 1984) and available borehole logs. Geological properties are summarized in the borehole logs prepared by various other consultants, which are provided within the appendices presented on the enclosed data disc.

In previous correspondence from the MECP (January 2012, Appendix B), some clarification was requested with respect to the borehole logs provided. It is noted that clarification of the borehole logs has been provided in Table 1 of the reports. In order to ensure this Table is available upon review of the borehole logs by the reviewer, this table has been added to the borehole logs provided on the enclosed data link. The monitoring wells at the Site were previously installed by various other consultants, and therefore, the associated borehole logs were also completed by others. As previously noted, although several attempts have been made to obtain a borehole log for well BH5A, a log for this well does not appear to be available at this time. In addition, borehole BH2-05 reportedly represents well BH2 as the original well had been damaged and was replaced by a similar monitoring well in 2005, as noted in Table 1.

Key findings of the geologic setting, as provided in the earlier annual reports prepared by Trow (2006 and 2007) and Terraprobe (2005), are summarized below. A summary of the monitoring well locations and well details is provided in Table 1. Additional investigations with respect to the geology of the area were conducted using information from the Ontario Geological Survey (OGS) Open File Report 6191 – An Updated Guide to the Subsurface Paleozoic Stratigraphy of Southern Ontario.

5.1 Topography

Manitoulin Island is part of the Niagara Escarpment and forms a flat tableland area which is primarily characterized by shallow soil cover overlying flat-lying limestone and shale. The southwestern portion of the 54.6 ha waste disposal site is situated on an elevated plateau above the tableland areas of Manitoulin Island. As shown on Figure 2, a steep slope bisects the property from the northwest to southeast corners and slopes downward to the gently sloping tablelands that characterize the northeastern portion of the property.

As previously reported, the Town obtained the former Mountainside Homes property in 2014, which is located in the lower tablelands to the east of the Site. The additional municipally owned lands represent an additional 15.47 acres of downgradient property and additional attenuation capacity.

Landfilling at the site occurs on the elevated plateau. Within the landfill footprint, the area is gently sloping to the east and northeast, as shown on the cross-sections provided in Appendix C (prepared by others). Maximum relief across the property is approximately 40 meters. However, maximum relief across the approved landfill footprint is approximately 1 m. A small creek, which flows in an easterly direction, is located approximately 300 metres to the south of the approved landfill footprint. A deeply incised valley is situated in the northwestern portion of the property.

5.2 Overburden Soils

Based on previous reports, the overburden soils on the elevated plateau and steep slopes generally consist of silty loam. The overburden below the plateau, associated with the tablelands, is reported to consist of lacustrine silty clay to fine sandy silt deposits from glacial Lake Algonquin.

Subsurface investigations on the property encountered glaciolacustrine clayey silt to silty clay deposits with occasional fractures. In general, coarser grained soils were noted on the western portion of the property grading to finer grained soils on the eastern portion of the property within the tablelands. From west to east across the property, soils were observed to grade from sandy silt overlying silt and clay within the elevated plateau to silty clay and clay within the lower tablelands. The overburden on the elevated plateau was observed to have a thickness of approximately 2 m. The overburden thickness associated with the tablelands was slightly greater, typically within the range of 3 to 5 m.

5.3 Bedrock

The overburden at the property is predominantly underlain by bedrock of the Georgian Bay Formation, which is characterized by greenish to bluish grey shale, interbedded with limestone, siltstone and sandstone (OGS Open File Report 6191). The Blue Mountain Formation (previously assigned to the middle and upper members of the Whitby Formation), consisting of blue-grey to grey-brown shales with thin, minor interbeds of limestone and siltstone, is inferred to underlie the overburden on the eastern portion of the property. Both formations consist of shales with variable amounts of limestone, siltstone and sandstone interbeds. The shales are generally non-calcareous, whereas the sandstones and siltstones are commonly calcareous.

Consistent with a review of the geologic mapping, borehole logs from the area indicate that the bedrock on the property is most commonly described as grey shale. The bedrock surface is weathered and fractured. Drilling into the bedrock on the plateau identified that relatively competent bedrock was encountered at depths ranging from 11 to 16 metres below ground surface (bgs).

6. SUMMARY OF HYDROGEOLOGIC SETTING

Based on the findings of the Hydrogeologic Studies conducted by Burnside Environmental (January 1999) and GM BluePlan Engineering Limited (GMBP) (December 2016), there are no major aquifer systems in either the overburden or the bedrock in the vicinity of the site. The characteristic glaciolacustrine clayey silt to silty clay soils on the plateau are of low to moderate conductivity. Consistent with these findings, slug tests conducted by Terraprobe determined that the average hydraulic conductivity in the overburden was 3×10^{-7} m/s [9.4 m/yr]. Within the bedrock, the rate of groundwater flow would be variable, depending on fracture size (i.e., aperture) and density. However, based on the slug test(s), an average hydraulic conductivity of 4×10^{-9} m/s [0.13 m/yr] was determined for the bedrock. In general, the hydraulic conductivity decreases with depth. It should be noted that slug test analysis results were obtained from summaries provided in Annual Reports prepared by others. Slug test analysis results conducted on supplemental monitoring wells MW-15, MW-16S, and MW-16D for the purpose of the 2016 Hydrogeological Study by GMBP are consistent with previously reported hydraulic conductivity values for the intermediate and deep hydrogeological units. Results presented are considered to be consistent with the characteristics of the units described in the borehole logs and publications.

In previous reports, the groundwater flow pattern has been divided into three different systems; shallow, intermediate, and deep. This division was based on an assessment of the borehole depths, screened intervals, soil descriptions, and historical groundwater quality data. A summary of the monitoring well details, including a division of the wells into each separate flow system, is provided in Table 1. An on-going assessment of the flow pattern and groundwater quality will continue in future annual monitoring reports based on their established designations within these units.

Groundwater level measurements are collected bi-annually in conjunction with the established monitoring program. Groundwater flow maps for each differentiated flow system, provided in Figures 3, 4, and 5, were developed using the spring water level measurements. A review of past groundwater contour plans and the fall groundwater elevation data indicates that the flow patterns depicted using the spring data are representative of the typical groundwater flow directions at the site. A summary of the historical groundwater elevation measurements is provided in Appendix D. Characteristics of each unit and the associated groundwater flow patterns are summarized below. In general, the groundwater flow patterns, and vertical and horizontal gradients calculated are consistent with those historically presented.

6.1 Shallow Groundwater Flow System

The shallow groundwater system is monitored from a network of monitoring wells typically screened from 0.7 to 4.3 meters below ground surface (mbgs). The screened interval of these wells is typically situated within the overburden, with some screens extending into the shallow weathered bedrock. Review of historical and background groundwater quality indicates that the water quality in this unit is affected by both precipitation and ambient groundwater flow conditions. Constituent concentrations are typically lowest in these wells.

Consistent with historical results, the groundwater within the shallow unit at the site flows somewhat radially to the north, northeast, and east. The horizontal hydraulic gradients range from 0.001 to 0.016 on the plateau in the area of the approved landfill footprint. Along the steep slopes, hydraulic gradients range approximately 0.01 along the southern property limit and to the north between BH8B and BH10.

The shallow groundwater flow system "pinches out" to the east along the tablelands due to the decreasing thickness of the overburden toward the east (i.e., becomes part of the intermediate system).

6.2 Intermediate Groundwater Flow System

The intermediate groundwater flow system is monitored from a network of wells screened within the weathered shale and/or limestone, with some of the screened intervals extending upward into the overburden or downward into the competent bedrock. The screened intervals range from 3.5 to 10.8 mbgs. The groundwater flow direction is inferred to be generally to the north and northeast. With the exception of the area around BH5, the horizontal gradients range from approximately 0.001 to 0.02 on the plateau to approximately 0.03 across the steeply sloping area to the east of the landfill footprint.

The intermediate groundwater flow system in the eastern tablelands is considered to extend throughout the weathered shale to the interface of competent shale bedrock.

6.3 Deep Groundwater Flow System

The deep groundwater flow system is monitored by a network of 4 monitoring wells screened within the more competent bedrock. The depths of the well screens range from 12.3 to 18.4 mbgs. Groundwater flow appears to be to the east and northeast, with a horizontal gradient of between 0.02 and 0.03 on the elevated plateau and approximately 0.01 across the steeply sloping area.

6.4 Vertical Gradients

Vertical hydraulic gradients between the shallow, intermediate and deep wells were calculated for several locations. A Table summarizing the calculated gradients using the water level measurements from the current monitoring year is provided below.

WELL ID	INTERVAL	SPRING	FALL	DIRECTION OF VERTICAL GRADIENT
MW1-98 (S to I)	SI	NA (S was dry)	NA (S was dry)	NA
MW1-98 (I to D)	ID	NA (D was dry)	0.71	Downward
MW5-98 (S to I)	SI	1.26	NA (S was dry)	Downward
MW5-98 (I to D)	ID	0.06	0.17	Spring Upward / Fall Downward
MW6-98 (S to I)	SI	0.26	0.10	Downward
MW6-98 (I to D)	ID	0.54	0.63	Downward
BH4 (B to A)	SI	0.16	0.22	Upward
BH6 (B to A)	SI	0.44	0.54	Downward
BH8 (B to A)	SI	0.04	0.28	Spring Downward / Fall Upward
BH12 (A to B)	SI	0.01	NA (No WL)	Upward
BH13 (A to B)	ID	0.42	NA (No WL)	Downward
MW-16 (I to D)	ID	0.002	0.023	Downward
MW-19 (S to I)	SI	0.875	NA (S was dry)	Downward
MW-19 (I to D)	ID	0.036	0.11	Downward

In general, the vertical gradients between the overburden (shallow), shallow weathered shale (intermediate), and more competent bedrock (deep) units are best represented by the MW-series, as the screened intervals at these locations have the greatest degree of vertical separation. Historically, the most significant gradients have typically been observed near the steep slope between the elevated plateau and the lower tablelands. Minor and periodic upward gradients have been measured between the shallow and intermediate (SI) units at wells BH-4, BH8, and BH12. These are attributed to the fact that both the shallow and intermediate wells are screened, to some degree, within the weathered shale unit and their location near the base of the slope.

Since the installation of the MW-16 and MW-19 series wells, vertical hydraulic gradients have been measured in these wells. Overall, a relatively high downward hydraulic gradient between the shallow and intermediate units has been observed. However, a minor upward hydraulic gradient (0.02 to 0.05) has been observed between the intermediate and deep bedrock units at each of these locations. Vertical gradients will continue to be monitored in each of the noted wells to verify the recorded gradients and to assess the long-term trends.

6.5 Summary and Implications

A detailed review of the groundwater flow characteristics, including the groundwater flow directions, and the vertical and horizontal hydraulic gradients, was conducted to assess the groundwater flow regime at the site. This information can be used to evaluate the various factors influencing groundwater quality within each hydrostratigraphic unit.

Consistent with the low hydraulic conductivities reported for the overburden and bedrock units, high vertical gradients were noted at the majority of the well nests. The implications of the flow regime at the site are that in the overburden, leachate impacts would likely be limited to the vicinity of the landfill due to the low hydraulic conductivity (K) of the overburden soils and the downward gradients. Potential leachate impacts to groundwater in the intermediate and deep units, typically associated with the weathered and fractured bedrock, would likely have a component of horizontal migration through the fractures and bedding planes. Therefore, key monitoring locations are considered to be those wells situated within the overburden in the vicinity of the landfill and within the intermediate and deep hydrostratigraphic units located further downgradient (i.e., to the north and east) of the landfill.

Based on this assessment, the most critical factors affecting natural groundwater quality in each unit are as follows:

Hydrostratigraphic Unit	Groundwater Quality – Influencing Factors
Shallow	Precipitation, surface water run-off, ambient groundwater quality within overburden clays
Intermediate	Ambient groundwater quality within weathered bedrock and downward migration of groundwater from the shallow unit
Deep	Ambient groundwater quality within competent shale bedrock. Increased residence time within this unit. Downward migration of groundwater from the intermediate unit.

The implications of the flow regime on groundwater quality are considered in more detail in Section 9.0 of this report.

7. MONITORING

7.1 Sampling Requirements

7.1.1 Groundwater

The NEMI Landfill site is monitored by a network of 39 groundwater monitoring wells installed at 23 separate locations throughout the landfill site, as shown on Figure 2. Monitoring wells BH1 through BH10 were installed by Marshall Macklin Monaghan Limited in 1988, monitoring wells/well nests MW1-98 through MW6-98 were installed by Burnside Environmental in 1998, BH2 was re-installed by Terraprobe in 2005, well couplets BH12 and BH13 were installed by Terraprobe in 2006, monitoring wells MW-14, MW-15, MW-16S and MW-16D were installed by London Soil Test Ltd. (LST) in 2016 to support a Hydrogeological Study for the site, and MW-17, MW-18, MW-19S, MW-19I, and MW-19D were installed by LST in 2017 as per requirements outlined in MECP correspondence (January 30, 2017). Monitoring well BH1 was reportedly decommissioned by the Town in 2007.

Currently, groundwater samples are collected from all 39 monitoring wells located on the landfill property. As per Schedule B of the C of A, the monitoring network was sampled three times per year between 2003 and 2007 and bi-annual sampling commenced in 2008 and was to continue until 2012. Starting in 2013, Schedule B of the C of A indicates that groundwater sampling can be reduced to once every two years, odd-numbered years only, for the comprehensive list of parameters. **Although this reduced groundwater sampling frequency is outlined in the C of A, the MECP has recommended that sampling be conducted at a minimum of twice annually in the spring and fall.** A list of the parameters sampled during each sampling event is provided in Table 2. Historical summaries of the groundwater monitoring results and trend graphs are provided in Appendix E.

7.1.2 Surface Water

Schedule B of the C of A states that surface water monitoring at the site is to consist of monitoring from a network of five locations (SW-1 through SW-5) twice annually, in the spring and the fall, and during two storm events. The surface water sampling locations, as shown on Figure 2, are as follows:

SW-1: Beaver Pond – upstream of landfill
SW-2: Creek adjacent to landfill – flowing east
SW-3: Stream east of the site beneath bridge on Highway 6 – flowing east
SW-4: Extended detention wet pond
SW-5: Pond at main entrance to landfill

Required surface water sampling parameters, as per Schedule E of the C of A, are summarized in Table 2. A summary of the historical surface water sampling results are provided in Appendix F.

Since frequent and/or quick access to the site by a qualified consultant is difficult for many reasons, sampling during storm events is not considered practical. **Based on the limitations imposed by the location of the site, it is recommended that the surface water sampling program be revised from twice annually and during storm events to three times annually in the spring, summer and fall. It is also proposed that the list of parameters be revised to better correlate with those required for groundwater and leachate monitoring. This would include the removal of phenols from the indicator list and barium, cadmium, copper, lead, mercury, zinc and phenol from the comprehensive list (i.e., for SW-4).** Based on MECP correspondence dated January 6, 2012, it is our understanding that this recommendation has been forwarded to the Surface Water Technical Support Section and is awaiting further review and approval.

7.1.3 Leachate Management

Based on a review of the Plan of Development and Operations completed by R.J. Burnside & Associates Limited (Burnside), and the *As Constructed* drawings provided for Cell 1 of the landfill, the Cell was designed by Burnside and constructed in consultation with the MECP. The Cell reportedly consists of a compacted clay base that was designed to provide a sufficient separation distance between the bottom of the cell and the shallow groundwater table.

The floor of Cell 1 was reportedly compacted, inspected, and tested throughout the construction period. Additionally, the sidewalls of the Cell were reportedly constructed with a bentofix and clay liner. Based on this design and construction of the Cell, which was inspected and approved at the time of the initial site development, there is considered to be limited hydraulic connectivity between the leachate within Cell 1 and the shallow groundwater flow system. This appears to be further supported by the leachate levels measured at the manhole prior to and after recirculation operations where the leachate level is drawn down during recirculation operations but recovers to a consistent level once pumping has ceased.

Based on information provided by the Town, leachate re-circulation efforts were initiated in April and were completed periodically on an as-required basis until mid-November. The procedure for re-circulation of the leachate was to pump the leachate from the manhole onto the top of the active waste area and permit it to evaporate or infiltrate into the cell. Leachate flows were calculated by documenting the pump times and measuring the flow rate, which was determined to be at approximately 40 gallons per minute. The monthly leachate flow volumes measured by Town staff during the current reporting year indicate that the volume being pumped and recirculated is generally consistent with recent years. Quarterly measured leachate levels in the manhole were not available for review at the time of the issue of the report. The measured totals provided by the Town are summarized in the following Table:

LEACHATE FLOW MEASUREMENTS

Month Measured	Recirculated Leachate Flow Volumes (Cubic Metres)	Leachate Level (Metres Below Top of Manhole Lid)
January	0	-
February	0	-
March	0	-
April	0	-
May	21.8	-
June	18.2	-
July	21.8	-
August	29.1	-
September	21.8	-
October	36.4	-
November	7.3	-
December	0	-
Annual Total:	**156.4**	**Average level: N/A**

Based on the reported historical leachate level measurements that have been collected at the leachate collection manhole to date, the average measurement of the leachate within Cell 1 appears to be about 0.99 metres (39") below the top of the manhole. The elevation of the top of the manhole is 228.75, which equates to an approximate leachate elevation of 227.76 within the landfill footprint at the general location of the manhole. Since the measured depth to the leachate within the manhole is commonly much greater, this elevation is considered to represent an estimate of the average seasonal high leachate elevation within the Cell. Based on the measured groundwater elevations in the adjacent shallow monitoring wells (MW6-98S, BH-3, and BH-5A), the elevation of the leachate surface in the refuse pile is approximately 0.75 to 2.2 metres lower hydraulically than the groundwater elevations in the monitoring wells located to the south and west of the refuse pile (i.e., hydraulically upgradient monitoring locations).

Therefore, should any leakage, or a component of minor radial flow occur out of the clay and bentofix lined cell, the flow of leachate would be consistent with the direction of the measured groundwater flow (i.e., north and east) and would be measured within the existing network of monitoring wells. Quarterly leachate level measurements will continue to be collected for future monitoring programs to confirm the leachate elevation in the cell.

In addition to the designed clay and bentofix cell floor and walls, a perimeter leachate collection system was constructed in 2002 as part of the landfill design. The system consists of sloped and graded contours that direct leachate within the cell toward granular side slopes, filter fabric, and a leachate collection manhole. At this time, leachate is periodically circulated between the manhole (MH) and the top of the refuse pile. According to the C of A, any monitoring wells situated within the waste filled area are also to be considered as leachate monitors. Currently, there are no monitoring wells installed in the waste filled area. Therefore, leachate sampling is only conducted from the Manhole (designated MH). However, monitoring wells BH-4A/4B and BH-2 are situated immediately adjacent to, and downgradient of, the current landfilled area and directly downgradient of the perimeter leachate collection system. Therefore, should there be any radial flow from the constructed Cell, a review of analytical results from these downgradient monitoring locations would provide additional leachate characterization data.

The C of A requires that:

- Leachate samples are to be collected annually from monitors within the waste filled areas and from the collection manhole. These samples should be analyzed for the Comprehensive List of leachate parameters, as outlined in Table 2;
- Leachate samples be collected monthly from the manhole and analyzed for the Indicator List of leachate parameters (Table 2);
- Leachate levels be monitored on a quarterly basis;
- The leachate flow volume be measured during re-circulation between the manhole and the collection pond; and
- The perimeter of the waste area along the side slopes be inspected on a monthly basis after waste fill occurs above ground level.

Based on concurrence from the MECP regarding recommendations made in previous Annual Reports (January 6, 2012 correspondence enclosed in Appendix B), monthly monitoring from the manhole is conducted by trained Township staff unless it can be conducted by a qualified consultant in conjunction with the groundwater and surface water monitoring programs for the site. Therefore, during the current monitoring year, leachate samples were collected by GMBP personnel in May, July, and October. Additionally, the comprehensive sampling event was completed by GMBP staff as per comments provided by the MECP. Historical summaries of the leachate quality sampling results are provided in Appendix G.

As per previous MECP correspondence (i.e., dated January 30, 2017), it was noted that the leachate sampling schedule from the manhole can be decreased from monthly to quarterly according to the recommendations made in previous annual monitoring reports. **In order to maximize the sampling conducted by a qualified consultant, it is recommended that three of the quarterly samples be collected by a qualified consultant in conjunction with the groundwater and surface water monitoring programs, and one sample be collected in January by trained Township staff.** This results in the following leachate sampling/monitoring schedule:

Monitoring Description	Sampling Frequency	Personnel
Leachate Levels	Quarterly: January, April, July, and October	Township Staff
Flow Volumes	Monthly	Township Staff
Leachate Seep Inspections	Monthly	Township Staff
Quarterly Leachate Sampling	January – Indicator List	Township Staff
	Spring – Comprehensive List	GMBP
	Summer and Fall – Indicator List	GMBP

Inspections for leachate seeps were reportedly completed monthly by Town staff as required by the Certificate of Approval. The Town reports that there continues to be no evidence of leachate seepage identified during any of the monthly inspections. In the short-term, the Town plans to continue the re-circulation procedures from the manhole back to the active working face of the landfill on an as-needed basis. Leachate holding tanks were previously installed at the Site in 2008 by JI Enterprise. The approved holding tanks would be used to store leachate for trucking to an approved treatment facility if a time comes when re-circulation is no longer effective at controlling leachate accumulations.

7.2 Sampling Procedures

For the groundwater sampling, the static groundwater level and well depth are measured in each monitoring well. Each monitoring well is then purged of three casing volumes of stagnant water or until dry, whichever is first. After purging, monitoring wells are allowed to recharge with fresh groundwater before sampling occurs. Groundwater purging and sampling is conducted using dedicated Waterra™ tubing and inertial-type pumps. As per the C of A, the pH and conductivity is measured in the field at each sample location.

Surface water samples are collected by submerging the appropriate sample container into the water body and removing the container when a sufficient volume of sample has been collected. During collection, contact with the bottom of the well is avoided to prevent stirring-up sediment. When collecting surface water samples, direct dipping of the sample bottle is completed unless the bottle contains preservative. For those samples requiring preservative, a clean unpreserved bottle is used to obtain the sample at each location, and then it is transferred into the appropriate preserved bottle. Field parameter measurements, such as the temperature, pH, conductivity, dissolved oxygen, and flow are measured and recorded at the time of sampling.

Leachate samples are collected from the manhole using a dedicated bailer. The bailer is lowered into the manhole and the sample is transferred directly into the laboratory provided containers. Samples collected by the Town for analysis of the selected metals are placed in unpreserved laboratory supplied containers. Filtering and the addition of the lab-preservative occur prior to analysis.

Samples are kept chilled following completion of the sampling program and sent within 24 hours of the sampling event to Bureau Veritas Laboratories Inc. (BV Labs) of Mississauga for analysis. The laboratory Certificates of Analysis are included on the appended link.

7.3 QA/QC

The Relative Percent Difference (RPD) was calculated to determine the variance between the actual sample and the replicate sample using the following equation:

$$RPD = \frac{(\text{sample result} - \text{duplicate result}) \times 100}{(\text{sample result} + \text{duplicate result}) \div 2}$$

Values which exceed a RPD of 20% are considered 'unacceptable'. During the current monitoring period, all analytes compared were considered to be within the 'acceptable' range. Since the samples are replicates (i.e., collected in succession), an element of natural variability will exist, and the variability observed may be attributable to this sampling methodology as opposed to laboratory controls. Consequently, it is recommended that true duplicate samples be collected to further evaluate the laboratory analysis. A summary table showing the monitoring results for these samples and the associated RPD values is provided as Table 3.

7.4 Determination of Action Levels

MECP Guideline B-7 establishes the basis for determining what constitutes the reasonable use of groundwater on properties adjacent to landfill sites. By applying the Reasonable Use Concept (RUC), the potential use of groundwater for domestic consumption will usually provide the lowest allowable concentration limits. MECP Procedure B-7-1 provides technical details for the application of the reasonable use approach. A change in quality of groundwater on an adjacent property, where the reasonable use is determined to be for drinking water, will be acceptable only where:

i) Quality is not degraded by more than 50% of the difference between background concentrations and the Ontario Drinking Water Standards for non-health related parameters; and,

ii) Quality is not degraded by more than 25% of the difference between background concentrations and the Ontario Drinking Water Standards for health related parameters.

Background concentrations are considered to be the quality of the groundwater prior to contamination from landfill activities.

7.4.1 Background Water Quality

The groundwater quality within each of the three hydrostratigraphic units varies significantly due to the flow regime at the site and the different geochemical characteristics associated with the silt/clay overburden and shale/limestone bedrock. As a result, background groundwater quality within each unit has been evaluated separately. Available historical data, collected from wells MW6-98S, MW6-98I and MW6-98D between 2003 and the spring of 2008, were used to calculate the average groundwater concentrations for leachate indicator parameters. More recent data collected from these monitoring locations is generally consistent with historical data. Background concentrations within each unit are presented in Table 4.

Previously, according to the MECP correspondence (dated January 22, 2008); the nested monitoring wells at MW6-98 were established as the background well for the site at a January 11, 2008 site meeting with MECP personnel. However, as was indicated in the correspondence, if monitoring from these wells indicates that groundwater is flowing towards this well location from the landfill footprint, a new suitable background well will need to be established. Water level measurements continue to indicate that the MW6-98 well nest is situated hydraulically upgradient of the landfill footprint and is representative of background conditions.

As per the MECP correspondence dated January 30, 2017, a new set of background monitoring wells were recommended in the areas of BH-8A/B, BH-9, and BH-10 in order to replace the MW6-98 series wells that have historically been used as background groundwater monitoring wells. This is noted to be due to the proximity of MW6-98 to the proposed landfill footprint. In response to the MECP recommendations, in September 2017, three new background monitoring wells were installed in the overburden, weathered bedrock, and competent bedrock (MW-19S, MW-19I, MW-19D, respectively) near the foot of the slope of the landfill west-northwest of the proposed landfill footprint to be used as the new background groundwater monitoring wells. The locations of the new background wells are presented in Figure 2.

In general, groundwater at the site is very highly mineralized with the concentrations of conductivity, TDS, COD, hardness, chloride, sodium and iron generally increasing with depth. Slight increases with depth in the concentrations of ammonia and TKN were also noted (i.e. from an average of approximately 1 mg/L in the shallow unit to approximately 40 mg/L in the deep unit). Alkalinity concentrations, which were highest in the shallow unit, do not exceed 450 mg/L in the background wells. In general, concentrations of BOD, DOC, and total phosphorus were consistently low in all the background wells.

Background groundwater quality within the deep unit is notably poor. The relatively high sodium, chloride, ammonia, and TDS concentrations are likely caused by natural salt brines associated with the carboniferous-shale bedrock.

The MW6-98 series of monitoring wells were previously used as the background monitoring locations for use in calculating the Reasonable Use Criteria due to the availability of monitoring data from all three units identified. As discussed, moving forward, the newly installed background monitoring wells (MW-19S, MW-19I, and MW-19D) will be used to characterize the background groundwater quality in each of the hydrogeological units and to re-calculate the RUC for the Site. It should be noted that, at this time, there are several other monitoring locations situated upgradient from the active fill area. These wells include BH3, BH5A, BH5B, BH6A, BH6B, and BH7. Due to the variability of the data, these wells are also used as a reference for background groundwater quality in addition to the comparison to the RUC.

Based on a review of the analytical findings available since the late 1990's (and pre-dating the operation of the landfill), it should be noted that a typical leachate plume has lower concentrations of characteristic indicator parameters than seen in each of the geologic units. Given that the purpose of the Reasonable Use Guidelines is to not permit further degradation of the groundwater on adjacent properties, a leachate plume with significant indicator concentrations would be required to further degrade the groundwater quality at the site.

7.4.2 Calculation of Objective Levels

Table 4 identifies the concentrations of groundwater quality indicator parameters used for evaluating the acceptable level of contaminant concentrations at the site boundary. Background concentrations (Cb) are the site-specific values (discussed in the previous section). The Provincial maximum allowable concentrations (Cr) are identified in the Ontario Drinking Water Standards (ODWS). Acceptable concentrations at the site boundary (Cm) are calculated from MECP Procedure B-7-1 using the following formula.

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

Where:

Cm = Maximum concentration acceptable in groundwater beneath an adjacent property.
Cb = Background concentration.
Cr = Maximum concentration that should be present in groundwater for domestic consumption according to the Ontario Drinking Water Standards (ODWS).
x = 0.5 for non-health related parameters (AO and OG) and 0.25 for health related parameters (MAC and IMAC).

AO = Aesthetic Objective
OG = Operational Guideline
MAC = Maximum Acceptable Concentration, Parameters Related to Health
IMAC = Interim Maximum Acceptable Concentration, Parameters Related to Health

To determine if leachate is impacting groundwater, individual indicator parameters were evaluated in conjunction with other indicator parameters and concentration trends. Wells with elevated and stable concentrations of the identified naturally elevated constituents, that show no increases in other leachate indicator parameters, are deemed unimpacted by landfill leachate. Additionally, known leachate impacted groundwater is compared to the groundwater chemistry at locations with naturally elevated concentrations to determine if leachate is contributing to the elevated concentrations that have been measured.

8. LEACHATE CHARACTERIZATION

Leachate is produced when surface water percolates down through refuse resulting in impacted water that has the potential to migrate along the surface or in the ground. Landfill derived leachate that enters into the surface water and/or groundwater is often attenuated by natural mechanisms along the water migration pathway. The attenuation of leachate can occur by dilution, biologic activity, and geochemical mechanisms.

8.1 Leachate Quality Data

Currently, leachate monitoring is conducted at the manhole (MH). Monthly leachate monitoring is typically conducted by Township staff, however for comparative purposes, sampling is conducted by GMBP personnel three times annually in conjunction with the groundwater and surface water sampling programs. In addition to the monthly leachate sampling, the annual comprehensive leachate sampling event is also conducted by GMBP personnel at the time of the annual sampling programs. As discussed, as per the January 30, 2017 MECP correspondence, the monthly leachate sampling schedule has been reduced to a quarterly sampling schedule. Historical summaries of the leachate quality sampling results are provided in Appendix G.

As noted in previous MECP correspondence, there is a considerable degree of data variability associated with the sample results from the manhole. A discussion regarding the amount of data variability associated with the manhole data was provided in follow-up correspondence (dated April 6, 2010) from GMBP (formerly G&M) to the Town. A summary of the correspondence is provided below.

The manhole provides catchment for (i) leachate generated within the used portion of Cell 1; (ii) stormwater that falls in the unused portion of the active cell; and (iii) stormwater that falls onto waste that has been covered and capped with clayey soils. In the event of significant precipitation, including a thaw/snowmelt event or a storm event, the introduction of non-contact run-off into the system would take place. Should sampling at the manhole be conducted shortly after such an event, the analytical results would logically represent a more dilute form of landfill leachate.

Based on discussion with Town staff and receipt of operational updates regarding the progression of waste placement, it is our understanding that waste placement in Cell 1 is no longer occurring. As a result of the progression of landfill operations to above-grade waste placement operations within the Cell 2, the active area and adjacent refuse pile will be sloped and graded to promote runoff of precipitation and reduce the volume of non-contact surface water that was previously entering the waste Cell.

It is our understanding that the adjacent Cell 2 development and construction has been completed as per the approved Cell 2 design specifications due to the progression of waste placement and the remaining airspace capacity. It is noted that the leachate monitoring program specified in Table C.1 of Schedule "C" of the Certificate of Approval specifies that additional leachate monitors are required to be installed between Cells 1 and 2 as landfilling progresses. To address this requirement, two additional leachate monitoring wells (MW-17 and MW-18) were installed between Cell 1 and Cell 2 in September 2017. The locations of the new leachate monitoring wells are presented in Figure 2.

8.2 Leachate Indicator Parameters

As part of the ongoing data review, an analysis of the leachate quality and comparison to the background groundwater quality at the site was conducted. Based on our assessment and in consideration of the MECP correspondence dated January 22, 2008 (Comment 6 and 7) and April 6, 2010 (Comment 2), the list of leachate indicator parameters includes the following:

- Alkalinity, ammonia, total phosphorus, iron, chromium, TKN, BOD, COD, and DOC

8.3 Leachate Containment

As previously reported, several provisions with respect to the design, development and operations at the NEMI landfill site have been made to prevent and/or limit leachate migration from the approved 6.1 ha landfill area. Measures that have been taken to limit leachate migration from the landfill area include the following:

- The landfill base and sidewalls are lined with an engineered liner constructed to meet the required base hydraulic conductivity of 1×10^{-7} m/s to 5×10^{-8} m/s for the design of the site. This was completed to prevent leachate migration into the underlying bedrock unit;
- Leachate is further controlled by a designed leachate collection system that directs leachate to a manhole where leachate is recirculated by pumping from the manhole onto Cell 1 to encourage evaporation. In 2008, leachate holding tanks were installed to provide leachate collection and subsequent off-site disposal, so as to prevent leachate from infiltrating into the bedrock unit; and
- Additional operational measures have been taken to minimize leachate production within the active Cell. These include proper sloping, improved daily covering provisions, progressive closure of landfilled areas, and minimization of the size of the active working area. No further waste placement is occurring in Cell 1 and landfill operations have progressed to above-grade landfilling of Cell 2, Phase 1.

As discussed, from comments received as part of MECP correspondence dated January 30, 2017 in response to the December 2016 Hydrogeological Assessment was conducted by GM BluePlan Engineering Ltd. (GMBP) in support of a transition of the current waste disposal site into a natural attenuation site, **the MECP has agreed that the Site conditions are considered suitable for operation as a natural attenuation Site.**

Therefore, this report is also being submitted to provide additional details required to facilitate the transition to an approved natural attenuation Site for future phases of landfill development. Additionally, the application for transition to the natural attenuation site has been accepted and approved along with the supporting documents prepared by GMBP. The new ECA was issued by the MECP in March of 2022.

8.4 Short-Term Use of Infiltration Trenches

According to the Operations and Design report for the landfill, leachate collection and handling/treatment was not expected to be needed until landfilling progressed above grade (which was estimated to be 5 to 10 years after landfilling began) or if recirculation efforts became excessive (i.e. the pumping of leachate from the manhole back into Cell 1). However, based on a review of the 2003 Annual Report, it was indicated that the volume of water in Cell 1 was greater than anticipated.

As a result, temporary infiltration trenches were excavated in the upgradient portion of the site and leachate was circulated from the manhole and Cell 1 into the upgradient infiltration trenches. Reportedly, this practice occurred between the summer of 2003 and early 2005, with no pumping or circulation operations completed during the winter periods. Based on the information available, the historical infiltration trenches that operated for a limited period of time would likely have provided the main source of leachate migration into the subsurface.

9. WATER QUALITY RESULTS

To determine the presence or potential impacts from leachate, several indicator parameters are monitored, and a trend analysis is conducted to determine changes in water quality over time. The following sections discuss the potential impacts to groundwater both on-site and leaving the property boundaries and discuss compliance with the Reasonable Use Criteria. To evaluate potential impacts, several different points of reference were used for comparison including:

1. May 1998 – analytical data prior to initiating landfill operations (as available);
2. Comparison to RUC values;
3. Comparison to groundwater quality in all background monitoring wells;
4. Evaluation of long-term analytical trends at each monitoring location; and
5. Comparison of the suite of elevated parameters to the leachate indicator parameters, as established in Section 8.2 of this report.

The following sections discuss potential impacts to groundwater downgradient of the active landfill area, the potential impacts to groundwater leaving the property boundaries, and compliance with the Reasonable Use Criteria. The analysis for the presence/absence of leachate-derived impacts to groundwater includes an evaluation considering only the general water chemistry, which includes the metals, natural organic, and inorganic analytes, and a separate evaluation regarding the current and historical VOC and petroleum hydrocarbon results. The groundwater quality results (General Water Chemistry only), including a comparison to the RUC, are summarized in Tables 5A, 5B, and 5C for the shallow, intermediate, and deep units, respectively. Historical groundwater sampling results and graphical trends of indicator parameters are included in Appendix E. A summary of the VOC detections and concentrations in groundwater is provided in Table 6.

9.1 Water Quality – General Water Chemistry

9.1.1 Leachate Impact Assessment - Downgradient Monitoring Wells

Several RUC exceedances were noted in the downgradient groundwater wells that are monitored. However, as previously established by several consultants and acknowledged by the MECP, many of the analytes monitored occur naturally and concentrations of the inorganics and metals have been highly variable in both the upgradient and downgradient monitoring locations.

Based on the groundwater flow direction and the relative location of the landfill area to the wells monitored, it is anticipated that any leachate that was to leak through the landfill liner, or leachate associated with the short-term implementation of the infiltration trenches, would be first observed at monitoring wells MW1-98S, MW1-98I, MW1-98D, BH-4A, BH-4B, and BH2. An evaluation of the groundwater quality at these locations is provided below.

Shallow Monitoring Wells

Monitoring wells BH2 and BH-4B are located approximately 1 metre downgradient of the limit of the landfilled area. Therefore, the analytical findings for these wells are expected to provide additional leachate characterization data.

Analytical data from recent reporting periods for BH-2 indicate elevated concentrations of nitrate that are not consistent with historical values and the long-term trend. The source of these elevated parameters is currently unknown. However, ongoing monitoring of this well will determine whether these values are anomalous or part of a more long-term trend. The long-term elevated parameters measured in BH-2 suggest that leachate migration in this direction is possible.

Relative to other monitoring locations, the analytical findings at BH-2 indicate elevated concentrations of conductivity, chloride, TDS, COD, ammonia, boron, manganese and TKN. These results are indicative of potential minor leachate impacts. However, it is noted that the concentrations are generally decreasing or remaining stable relative to the historical groundwater quality at this location and in the recent monitoring periods, significant decreases were noted for conductivity, chloride, and sodium. An evaluation of the ongoing trends at this location will continue to be monitored.

Analytical data from recent reporting periods for BH-4B indicate elevated concentrations of BOD that are inconsistent with historical values. Anomalous elevated concentrations of chloride and conductivity were reported during the fall monitoring period. The source of these elevated parameters is currently unknown. However, ongoing monitoring of this well will determine whether these values are anomalous or part of a more long-term trend. The other analytical results at BH-4B indicate that the general water chemistry was consistent with historical trends at this location. Based on the recent and historical monitoring data, the concentrations of alkalinity, TDS, BOD, COD, and DOC appear to fluctuate somewhat at this location. However, a review of the historical results for this well (Appendix E) indicates that the concentrations for these parameters have become somewhat more consistent in recent monitoring years, as summarized in Table 5A. The long-term trends for indicator parameters including chloride, conductivity, hardness, and alkalinity remain stable to decreasing at BH-4B, with very stable trends and relatively low reported concentrations since about 2014.

A review of the analytical trend graphs for these monitoring locations indicates that the short-term infiltration trenches that operated in the years 2003 and 2004 may have resulted in some increased leachate migration into the shallow groundwater system. This is indicated by the continued decreasing trend in leachate parameter concentrations at well BH-2 and the spike in leachate parameter concentrations noted in 2003/2004 at well BH-4B, followed by a decreasing and subsequent generally stable trend since that time. Continued monitoring will be completed to evaluate the ongoing trends at these near-source monitoring locations.

Intermediate Monitoring Wells

Monitoring wells BH4A and MW1-98I monitor groundwater quality in the intermediate unit downgradient of the approved footprint of Cell 1. Several RUC exceedances were noted, however, similar exceedances were also measured at some of the upgradient monitoring locations (Table 5B). Comparison of groundwater quality in these wells to the upgradient groundwater quality, as measured in wells BH5B, BH6A, and MW6-98I, indicates that there has been some seasonal fluctuation in reported concentrations, with anomalous one-time increases in certain parameters that are not repeated in the subsequent data. Generally, the long-term trends indicate stable to decreasing concentrations and the analytical findings further indicate that concentrations remain within natural background values and that leachate impacts to these downgradient monitoring locations screened within the intermediate unit are not apparent.

Deep Monitoring Wells

Monitoring well MW1-98D monitors groundwater quality in the deep unit directly downgradient of the landfill area. Samples are only obtained from this well periodically due to insufficient groundwater recharge into the well during the sampling periods. A sample could not be collected from MW1-98D during the current reporting year due to dry conditions. The limited data available for this monitoring location indicates that the groundwater chemistry is consistent with upgradient monitoring wells that are screened in the deep unit. Based on the data available, leachate impacts into the competent bedrock unit do not appear to be occurring at this location.

9.1.2 RUC Compliance at Property Boundaries

NORTH BOUNDARY CONDITION

The north property boundary is located approximately 300 m downgradient from the landfill footprint, as shown on Figure 2. Monitoring wells BH-8A, BH-8B, BH-9, and BH-10 monitor groundwater flowing to the north and northwest from the landfill area, within the shallow and intermediate units. These wells are currently considered to be situated crossgradient to the active landfill area (Cell 2). RUC exceedances for alkalinity have consistently been reported in monitoring wells BH-8A and BH-8B. In addition, sulphate and TDS concentrations in well BH-8A, chloride, TDS, DOC, and manganese concentrations in BH-8B, TDS concentrations in BH-9, and manganese concentrations in BH-10 exceeded the RUC.

However, concentrations are within the historical ranges reported for these monitoring wells and within the range of concentrations noted in the upgradient wells screened within the intermediate unit. All other parameters at these four monitoring locations met the RUC criteria.

An assessment of the trend graphs indicates relatively stable trends for monitoring wells BH9 and BH10, and to a lesser degree wells BH8A and BH8B. However, it is noted that groundwater quality in monitoring wells BH8A and BH8B has become much less variable since 2008. It is noted that an increasing trend in alkalinity concentrations was previously being observed in BH8B between 2011 and 2015 but has remained stable to slightly decreasing since that time. Additionally, slight increases in the concentrations of chloride and conductivity were observed during the same general period (i.e., 2011 to 2015) but have also stabilized since that time. This well will continue to be monitored to determine long-term trends. Based on a comparison of the groundwater quality to the north with the upgradient monitoring wells and the historical groundwater quality trends at these locations, only minor potential influence related to landfill leachate is apparent to the north and northwest of the fill area. Monitoring well BH10 is located furthest downgradient. In general, the groundwater quality at BH-10 is similar to the background groundwater quality at the Site and continues to have very stable long-term analytical trends.

WEST BOUNDARY CONDITION

The west property boundary is considered to be upgradient from the approved fill area along the southern portion of the property and crossgradient to the landfill along the northern portion of the property. It is located approximately 350 meters from the current fill area at its closest point. Based on the established groundwater flow direction, the western property boundary is considered low risk for leachate impact.

Directly west of the fill area, the groundwater quality is monitored at wells BH-5A, BH-5B, BH-6A, BH-6B and BH-7. These wells are considered to be located upgradient of the fill area. Due to the variable nature of groundwater quality at the site, these monitoring wells have been used in conjunction with former background wells MW6-98S, MW6-98I, and MW6-98D, and the MW-19 series of monitoring wells to help assess the range of concentrations that occur naturally in groundwater at the site. As previously reported, the MW-19 well nest is considered to represent background groundwater conditions, which is discussed in more detail in Section 7.4.1. Several exceedances of the RUC were noted at these upgradient locations. Based on the location of these wells relative to the existing fill area, these exceedances are not considered to be attributable to landfill leachate.

Elevated concentrations of alkalinity, DOC (BH-7 only), TDS, boron, sulphate, sodium, manganese, and chloride were reported in BH-5A, BH-6B and BH-7 during the spring and fall analytical data from the current monitoring year. However, the concentrations are generally consistent with historical data. The long-term trend at BH-5A and BH-5B is variable and displays a reduction in indicator parameters since the temporary increase that was previously measured. Minor leachate influence may be present within the groundwater at this location which is to be expected as the waste placement continues westerly toward BH-5A, BH-5B, BH-6A and BH-6B. The long-term trend graphs for BH-6A/B continue to be very flat and indicate stable trends over time. Additionally, the trends at BH-7 display some slight fluctuation and variability but have consistently indicated a stable to downward trend since about 2006.

As discussed within section 7.4.1 and as noted above, more representative background water quality wells were installed at MW-19. MW-19S was found to have insufficient water for sampling during the fall sampling event. The spring water quality at MW-19S within the shallow overburden aquifer was consistent with historical data in the current reporting period. Both MW-19I and the deeper interval, MW-19D had reported elevated concentrations of TDS, chloride, sodium, sulphate, boron and manganese.

Monitoring wells BH8A, BH8B, BH9 and BH10 are considered to be crossgradient of the landfill footprint to the west. These wells monitor groundwater flowing towards the northern property boundary, however, can also be used to determine compliance along the western property boundary within the northern portion of the site. The groundwater quality observed at these locations has been discussed in more detail in the North Boundary Condition portion of this report, and are generally comparable to the background water quality.

SOUTH BOUNDARY CONDITION

The south limit of the active landfill area is located approximately 100 m from the southern property boundary at its closest point. In this area of the site, groundwater flow is generally to the northeast. Within the west portion of the site, in the vicinity of the active area, water quality is monitored at monitoring wells MW6-98S, MW6-98I, MW6-98D and BH3. These wells are considered to be upgradient monitoring locations.

To the east of the active area of the site, groundwater quality is monitored along the southern property boundary at monitoring well MW4-98 and to a lesser degree monitoring wells MW5-98S, MW5-98I, MW5-98D and MW3-98, which monitor groundwater flowing to the east and are located within approximately 100 meters of the southern property boundary.

RUC exceedances for TDS, sulphate, alkalinity, boron, DOC, chloride, sodium, and manganese were noted in well MW3-98S. At the location of MW5-98D, RUC exceedances for TDS, chloride, sodium, boron and manganese were reported. Review of the historical monitoring results for these locations indicates that the reported concentrations are within the typical historical ranges and display stable concentration trends for the majority of the indicator parameters. In addition, these RUC exceedances are generally consistent with the range of concentrations observed in the upgradient monitoring wells and may therefore be related to natural background conditions. It is also noted that the majority of the above referenced parameters for which RUC exceedances are noted are not considered to represent leachate indicator parameters.

At monitoring well MW4-98, slightly elevated concentrations of TDS, sulphate, and manganese continue to be measured. The groundwater quality parameters meet the RUC for all parameters analysed and groundwater quality trends have remained stable since the inception of groundwater monitoring at the site. Results from these cross-gradient southern boundary wells do not indicate the presence of leachate-derived impacts in this direction.

EAST BOUNDARY CONDITION

As previously discussed, the Town acquired the former Mountainside Homes property in 2014. Therefore, the municipally owned lands to the east (downgradient) of the landfill extend an additional distance of approximately 250 metres up to the right-of-way for Highway 6, which is located greater than 500 metres east of the landfill limit at its closest point. The former Mountainside Homes (MSH) facility is located directly east of the property boundary, with the MSH well located approximately 400 meters from the active area of the landfill. The former MSH well was decommissioned in 2016 and is discussed in Section 9.3 of this report.

In August 2006, two monitoring well couplets, BH12A/B and BH13A/B were installed along the eastern property boundary upgradient from Mountainside Homes. These locations monitor groundwater quality in the shallow, intermediate, and deep units. Consistent with the background monitoring locations, groundwater quality results at these locations indicated that the groundwater becomes increasingly mineralized with depth, with a significant degree of variability.

Due to the addition of the new eastern boundary monitoring wells (MW-14, MW-15, MW-16S, and MW-16D) and the removal of the former MSH well, which was formerly considered to be a potential downgradient receptor, the wells that were formerly used as eastern boundary condition wells (i.e., MW-12A, MW-12B, MW-13A, and MW-13B) are now considered to be redundant, and are recommended to be used for water level measurements but removed from the monitoring program. Therefore, these wells were measured only during the spring sampling event during the current monitoring period.

The following RUC exceedances were noted at each sampling location:

BH12A: TDS, chloride, sodium, sulphate, boron, and manganese
BH12B: DOC and chloride
BH13B: DOC and sulphate

Overall, the long-term trend in each of these wells is generally stable with the exception of highly variable conductivity values in BH-12A and BH-12B.

As discussed in June 2016, as part of a supplemental investigation for the Hydrogeological Study supporting the NEMI Landfill site titled *"Hydrogeological Study – Northeastern Manitoulin and the Islands (NEMI) – 9571 Highway 6, Little Current, ON"* and dated December 2016, four additional monitoring wells (MW-14, MW-15, MW-16S, and MW-16D) were installed along the new eastern downgradient boundary adjacent to Highway 6. The groundwater quality at these wells was reported to be consistent with the groundwater quality observed at the background monitoring locations.

The following RUC exceedances were noted at the four new east boundary wells:

MW-14: alkalinity, sodium, boron, and manganese
MW-15: TDS, chloride, sodium, boron, and manganese
MW-16S: TDS, DOC, and chloride
MW-16D: alkalinity, boron, manganese, chloride (fall only), and sodium (fall only)

Anomalous elevated concentrations of chloride and sodium were reported during the fall sampling event. The source of these elevated parameters is currently unknown. However, ongoing monitoring of this well will determine whether these values are anomalous or part of a more long-term trend.

Although exceedances were noted at all locations, parameter concentrations generally remain stable and within the range of those historically noted at these monitoring locations (except MW-16D) and are consistent with, or below, the background concentrations observed at the monitoring wells located upgradient of the landfill. In addition, the majority of the above referenced parameters for which RUC exceedances are noted are not considered to represent a suite of leachate indicator parameters. Therefore, based on the general water chemistry, leachate-derived impacts are not evident at these downgradient property boundary monitoring locations.

9.2 Water Quality - Volatile Organic Compounds (VOCs)

9.2.1 VOC Leachate Indicator Parameters – Leachate Historical Results

Toluene was previously selected by the MECP as the primary VOC indicator of leachate and is included on the list of leachate indicator parameters provided by the MECP. Leachate characterization samples have been collected from the leachate collection system "manhole" (i.e., 'MH' sample) on a quarterly basis. A Table summarizing the historical VOC results for the leachate samples is provided in Appendix G.

The long-term trend graph indicates that toluene concentrations have decreased significantly since the inception of leachate monitoring in 2005. Toluene was frequently detected in the manhole samples collected between April 2005 and June 2007 at concentrations exceeding the ODWS. Initial concentrations generally ranged between 100 ug/L and 350 ug/L with the peak concentration of 1,300 ug/L measured in April of 2005. However, toluene concentrations have been consistently decreasing, and since July 2007 has typically been less than 15 ug/L.

In the current reporting period, the toluene concentrations did not exceed 1 ug/L in any of the monitoring wells with the exception of MW-19D (15 µg/L fall).

Overall, the recent leachate quality results indicate that toluene concentrations have decreased dramatically and have stabilized at low concentrations in recent monitoring years. A similar trend of decreasing concentrations has been noted for several VOCs that were historically detected in the leachate. Concentrations of ethylbenzene have also reduced significantly and continue to display a relatively consistent and stable concentration trend through time.

A review of the historical VOC results from the manhole indicates that benzene, ethylbenzene, and xylene concentrations were typically much lower than the toluene concentrations. However, since July 2009, ethylbenzene concentrations have typically been higher than toluene when measured above the laboratory detection limits. The highest reported concentrations of these compounds in the manhole samples collected to date are as follows:

- Benzene – 7.7 ug/L (August 2014);
- Ethylbenzene – 32 ug/L (August 2014 & May 2016); and
- Total Xylenes – 224 ug/L (July 2006).

The combination and relative concentrations of these compounds, with toluene historically being the most prevalent, suggests a potential source of solvents or petroleum distillates in the historical data.

9.2.2 Detection of VOCs in Groundwater

In order to facilitate the review of VOCs in groundwater at the site, a summary list of analytes detected at the site since the implementation of the groundwater sampling program was completed and is provided as Table 6. The analytes that have been measured at concentrations above the laboratory detection limits (i.e., measurable through laboratory analyses) include the following:

> Chloromethane, vinyl chloride, bromomethane, acetone, methyl ethyl ketone (MEK), chloroform, benzene, trichloroethylene, bromochloro-methane, toluene, 2-Hexanone, ethylbenzene, m&p-xylene, o-xylene, and naphthalene.

These VOC compounds are not considered to occur naturally in groundwater at the site. Consequently, RUC values were calculated assuming VOCs were not present in groundwater prior to the initiation of landfilling at the site. Compounds historically detected at concentrations greater than the RUC include benzene, toluene, and ethylbenzene, as well as one minor exceedance for vinyl chloride in 2003, which has not been re-measured since that time. Monitoring locations where ODWS exceedances have been noted within the current monitoring period include MW1-98I, BH12B, MW-15, MW-16D, MW-19I, and MW-19D.

9.2.3 VOC Distribution and Concentration Trends in Groundwater

The use of the general water chemistry at the site for leachate indicators is useful, however is relatively complex considering the naturally highly mineralized background groundwater quality. Based on our assessment of the inorganic analytes and metals, leachate migration, particularly to the property boundaries, is not evident.

Figure 6 presents the current and historical distribution of BTEX compounds in groundwater. Analytical results at several upgradient monitoring locations indicate that VOCs have consistently been detected below 5 ug/L, including at the upgradient MW6-series of wells, at the MW-19 well nest (i.e., background wells), and at BH3, BH7, BH5A, BH6A and BH6B. Additionally, more significant concentrations of benzene have periodically been detected in upgradient monitoring well BH5B. Benzene concentrations as high as 20.7 ug/L, which exceeds the ODWS of 5 ug/L, have been noted at this upgradient location.

BTEX compounds have consistently been detected in the intermediate and deep units directly downgradient of the landfill at wells MW1-98I and MW1-98D and periodically in wells MW5-98I and MW5-98D. Historical results indicate that VOC concentrations generally increase with depth, and that VOC concentrations continue to display a decreasing concentration trend with time.

Downgradient monitoring well couplets BH-12 and BH-13 formerly monitored groundwater quality along the eastern property boundary. However, since the Town obtained the former MSH property extending the east property boundary to the right of way for the Highway, these monitoring locations now represent central onsite wells rather than east boundary locations. BH-12 and BH-13 (A & B) were first sampled in September 2006. VOCs, including BTEX, have been detected at monitoring locations BH-12A, BH-12B, and BH-13B. At monitoring well BH-12B, located centrally onsite to the east of the landfill footprint, and BH-13B, located in the southeast portion of the property, benzene concentrations typically exceed the RUC and ODWS.

It is noted that the monitoring wells installed along the eastern property boundary in 2016 (MW-14, MW-15, MW-16S, and MW-16D) have had reported concentrations of benzene, toluene, and/or ethylbenzene above the ODWS since monitoring began in July 2016. Each of these monitoring wells is installed at a lower elevation than the rest of the wells on Site within the shale of the Blue Mountain formation. Additionally, in the fall of 2017 analytical results from the new background groundwater monitoring wells that were installed in September 2017 (MW-19I, and MW-19D) indicate benzene, toluene, and/or ethylbenzene concentrations that exceed the ODWS. MW-19I and MW-19D are also screened within the weathered and consolidated shale of the Blue Mountain formation, respectively.

Similar to the upgradient wells, VOC concentrations generally increase with depth, which is especially apparent in wells installed in the lower tablelands portion of the property associated with the Blue Mountain formation. Based on the most recent results, BTEX concentrations at these monitoring locations appear to be decreasing and becoming more stable with time, which suggests that their initial measurement in the groundwater may have been influenced by the disturbance of the soils/shale bedrock through the initial drilling process and have reduced since. In shallow monitoring well BH-12A, benzene and ethylbenzene concentrations have never exceeded 10 ug/L and 4 ug/L, respectively. In well BH-12B, screened in the intermediate unit, benzene concentrations have consistently exceeded the RUC and ODWS of 1.25 ug/L and 5 ug/L, respectively, with concentrations of benzene ranging between 21 ug/L and 100 ug/L. However, a decreasing trend has been observed since peak concentrations were measured in 2009/10.

9.2.4 Potential Source of VOCs along the Eastern Property Boundary

Based on a review of: (i) the distribution and nature of the identified compounds; (ii) the relative concentrations; (iii) the hydrogeology of the site; and (iv) the historical property uses, there are several factors that suggest the BTEX compounds detected to the east of the landfill operations (i.e., at BH-12, BH-13, BH-14, BH-15, BH-16S, BH-16D), may not be solely related to impacts from landfill leachate. These factors, discussed in detail in previous Annual Reports, are summarized as follows:

- The specific compounds and their relative concentrations reported in these wells are different than those observed in the leachate characterization samples (i.e., "manhole"). When high concentrations of toluene were being detected in the leachate, the corresponding ratio of toluene to benzene (toluene:benzene) was in the range 100:1, more typically associated with solvents or petroleum distillates. In contrast, at the eastern boundary wells, the predominant BTEX compound is benzene which occurs at a toluene:benzene ratio of approximately 1:3 to 1:6, which is more typically associated with petroleum hydrocarbons.

- Based on the initiation of landfilling at the Site in October 2002, the immediate detection of BTEX compounds at that time in monitoring wells BH12 and BH13 (i.e., September 2006) and the hydrogeological properties associated with the Site (i.e., the bedrock properties and the groundwater flow velocities), the 'immediate' or 'early' occurrence of landfill derived BTEX compounds at the eastern property boundary is inconsistent with the hydrogeological conditions at the site.

- The historical property use(s) reportedly included the operation of a wrecking yard by the previous property owners. Based on discussions with the Municipality, the land situated directly upgradient of BH-12 and BH-13 was the area where derelict vehicles were historically stockpiled and stored. In addition, the other properties situated adjacent to the landfill site were also reportedly used historically as vehicle wrecking yards and as an automobile servicing garage.

- The recently installed new background groundwater monitoring wells MW-19I and MW-19D indicate BTEX concentrations and ratios that are similar to the concentrations reported at the eastern property boundary, which suggests that the BTEX concentrations are associated with naturally derived BTEX compounds from the Blue Mountain formation, which is known to be locally bituminous in the region.

Consequently, in order to further assess historical property uses and to determine with more certainty the potential contribution of petroleum products (i.e., gasoline, diesel, and/or fuel oil) to the concentrations of BTEX reported at BH-12 and BH-13, additional investigative groundwater sampling was conducted. In 2009 and May 2010, a variety of petroleum hydrocarbons (F1 to F4 fractions) analyses were completed on select groundwater samples which were collected in conjunction with the groundwater sampling requirements. An assessment of the potential petroleum impacts to groundwater was provided in the 2009 and 2010 Annual Monitoring Reports. A general summary of the results and conclusions of this additional sampling is provided below.

Consistent with BTEX detections, elevated F1 concentrations, typically indicative of gasoline impacts, were detected at BH12A (100 ug/L), BH12B (230 ug/L in May 2009 and 150 ug/L in May 2010), and at MW6-98D (110 ug/L). No F1 petroleum hydrocarbons were identified at any other monitoring locations, including the former MSH well.

- In October 2009, F2 to F4 petroleum hydrocarbons were not detected in any of the onsite wells. However, petroleum hydrocarbons in the F2 and F3 fractions, chemically consistent with diesel and/or fuel oil, were identified in the former MSH well at concentrations of 120 ug/L and 170 ug/L, respectively. Additional sampling conducted in May 2010 resulted in the detection of F3 petroleum hydrocarbons at MW1-98I at a concentration of 420 ug/L.

Therefore, although groundwater quality in monitoring well BH-13B, located approximately 100 metres upgradient of the former MSH well, displays exceedances of some VOC compounds, no detections of F1 to F4 petroleum hydrocarbons were noted during the sampling conducted in 2009/2010 at BH13A/B. In contrast, VOC and petroleum hydrocarbon sampling conducted to date indicates the presence of F2 and F3 petroleum hydrocarbons in groundwater collected from the former downgradient MSH well. However, VOCs and F1 petroleum hydrocarbons have not been detected at this location.

Based on a comparison of the analytical data from the manhole to the monitoring wells immediately downgradient of the landfill footprint (i.e., BH-2, BH-4A, and BH-4B), the petroleum impacts identified by the eastern property boundary do not appear to be consistent with leachate quality.

Based on the most recent field work and observation of wide-spread occurrences of BTEX and PHC parameters, the occurrence of these compounds is considered to be naturally occurring. It is shown that the elevated concentrations of BTEX predominantly occur in either the deepest wells on the plateau of the site or in the wells that are situated at a lower elevation and in the eastern tablelands of the property. From an analysis of well logs, the wells in the eastern and lower portion of the property are screened in the Blue Mountain formation whereas the wells in the western plateau that show lower concentrations of BTEX are screened in the Georgian Bay formation.

As a reference, a monitoring well (MW-1) that was installed at the nearby closed Little Current landfill site within the Blue Mountain formation was shown to produce oil and gas. The bedrock geology in the oil producing well at the former Little Current landfill and in the wells installed in the eastern tablelands of the NEMI landfill site was found to be the same. In both cases, the monitoring wells were drilled into what appears to be the lower portion of the Blue Mountain formation. From an analysis of historical oil and gas producing well records, and MW1 at the former Little Current landfill site, there are indications that the shale of the Blue Mountain formation is petroliferous and hosts petroleum hydrocarbons in the form of oil and natural gas in various areas on Manitoulin Island.

Although the closest oil and gas producing wells are located approximately 10 kilometres southwest and south of the landfill, the intersection of oil and gas in a monitoring well at the former Little Current landfill (i.e., approximately 4.0 km from the site) confirms the presence of petroliferous shale in this geologic unit.

Further evaluation and/or delineation of the potential petroleum hydrocarbon impacts and the potential source(s) of the impacts would require further investigation and additional sampling. However, further petroleum hydrocarbon sampling is not considered necessary at this time as the additional petroleum hydrocarbon sampling conducted to date and a brief review of the historical property uses suggest that the identified impacts along the eastern property boundary are not related to landfill leachate.

9.3 Downgradient Bedrock Well – Former Mountainside Homes Property

The MSH Well was reportedly installed in 1970 and was decommissioned in 2016 by a licenced well driller as per the requirements of Ontario Regulation 903. This well was formerly located approximately 400 metres downgradient and to the east-southeast of the landfilled area within the additional lands owned by the Town. The well was reportedly screened from 6.7 to 23.4 m (22 ft. to 77 ft.) and reportedly intersected the "*black slate*" (inferred to be black shale) unit. The MSH well, previously referred to as the Smith well (designated SM), was first sampled in 1998 prior to the commencement of landfilling operations and was subsequently added to the annual sampling program in 2005.

In the February 2005 correspondence from the MECP, the Ministry reported that the well did not comply with the requirements of the regulations and the MECP identified several O.Reg. 903 deficiencies associated with the well.

The MSH well was reportedly never used as a potable water supply. Based on the Town's acquisition of the Mountainside Homes property, and since the well does not represent a potential offsite water supply, the MSH well was discontinued from the sampling program in 2015 and was subsequently decommissioned in 2016.

9.4 Surface Water Quality

Surface water monitoring at the site consists of monitoring from a network of five locations (SW1 through SW5) in the spring, summer and fall, when sufficient water is available. The surface water sampling locations are presented on Figure 2. A summary of the surface water sampling results is provided in Table 7. Summaries of the historical surface water sampling results and trend graphs are provided in Appendix F.

Surface water sampling locations SW1 through SW3 monitor groundwater quality in a small watercourse located approximately 300 metres to the south of the site. Surface water flows from the Beaver Pond, at SW1, to the east towards Highway 6. Monitoring locations SW2 and SW3 monitor surface water quality downgradient of the landfill (SW2) and at the downstream side of the concrete box culvert where the stream crosses Highway 6 (SW3). This stream is considered to be intermittent, with generally low flows and is interpreted to get its base flow from groundwater discharge, with some surface water drainage contributions, mainly during storm events.

Surface water quality within this intermittent stream has generally been consistent, with some seasonal variability. Infrequent elevated concentrations of chloride and/or sulphate are noted at SW2 and SW3. Additionally, the conductivity generally increases as the surface water flows to the east. Surface water quality at SW3 is more variable relative to the upgradient sampling locations. Since this sampling location is situated adjacent to and immediately downgradient of Highway 6, the variability is potentially associated with surface water run-off from the provincial highway. Historically, phosphorus and iron exceedances of the PWQO are commonly noted at SW-1, SW-2, and SW-3. In the current reporting period, exceedances of the PWQO for phosphorous and iron were identified and are consistent with previous monitoring years and with historical trends at these locations. These exceedances and the variability in concentrations noted are not considered to be related to landfill leachate and appear to be naturally derived.

Surface water sampling location SW4, collected from the extended detention pond, and surface water sampling location SW5, located in the northeast corner of the site near the entrance, collect surface water run-off from the site. These surface water locations are also considered to be intermittent, with generally low water conditions during dry seasons. Relative to the water quality in the intermittent stream, surface water quality at these sampling locations is more highly mineralized, generally showing a higher conductivity and concentrations of chloride and sulphate. Based on the absence of high concentrations of other leachate indicator parameters, surface water quality in the detention pond and the pond at the main entrance to the landfill do not appear to be influenced by landfill leachate.

In summary, although some PWQO exceedances are noted for phosphorous and iron, these appear to be naturally derived. Therefore, impacts from landfill activities to the surface water quality are not apparent.

10. SUMMARY AND CONCLUSIONS

Due to the documented direction of groundwater flow from the south-southwest to the north-northeast and considering the distance from the active landfill area to the west and south property boundaries, leachate impacts at these property boundaries are not anticipated.

The ongoing use of the general water chemistry at the site as leachate indicator parameters is useful. However, the groundwater chemistry and impact characterization are relatively complex considering the highly mineralized background groundwater quality. Based on a detailed review and assessment of the upgradient groundwater quality, a comparison of groundwater quality to leachate quality, as well as on a review of correspondence from the MECP, the list of leachate indicator parameters includes the following:

- Alkalinity, ammonia, total phosphorus, iron, chromium, TKN, BOD, COD, and DOC

Based on our assessment of the inorganic analytes, natural organics, and metals, potential leachate migration to the north and east was identified. However, leachate migration and groundwater quality degradation related to these analytes was not evident at the downgradient property boundaries to the north and east.

VOC compounds have been detected at several upgradient and downgradient monitoring locations, including the background monitoring wells (MW-19D), well couplet BH-12 and the newly installed eastern boundary wells MW-14, MW-15, and MW-16D, which monitor groundwater quality in proximity to the eastern property boundary. The concentrations of benzene and to a lesser extent, ethylbenzene compounds exceeded the applicable RUC at some of these boundary wells. However, based on the occurrence, relative concentrations as compared to the leachate quality, nature of the identified compounds, as well as the site hydrogeology, the BTEX compounds detected do not appear to be related to landfill-derived leachate and are expected to be naturally derived.

PWQO exceedances of total phosphorous and iron were noted in the intermittent stream and the onsite detention ponds designed to collect surface water run-off from the site. These occurrences are considered to be naturally derived. Therefore, impacts from landfill activities to the surface water quality are not apparent.

11. RECOMMENDATIONS

1. To further evaluate the progression of development and the attenuation capacity of the Site, it is recommended that the additional downgradient property be registered as landfill buffer lands and that the existing Environmental Compliance Approval be amended accordingly to recognize the new buffer lands.

2. It is recommended that the surface water sampling program be revised from twice annually and during storm events to three times annually in the spring, summer and fall to coincide with the groundwater monitoring program. Sampling during storm events by a qualified consultant is limited by the location of the site. It is also proposed that the list of parameters be revised to better correlate with those required for groundwater and leachate monitoring parameters. This would include the removal of phenols from the indicator list and barium, cadmium, copper, lead, mercury, zinc and phenols from the comprehensive list (i.e. for SW-4). Based on MECP correspondence dated January 6, 2012, it is our understanding that this recommendation has been forwarded to the Surface Water Technical Support Section for their review but has not formally been reviewed and accepted to date.

3. As per comments enclosed in the MECP correspondence dated January 30, 2017, it is recommended that the leachate sampling schedule from the manhole continue to be completed on a quarterly basis rather than the previous monthly sampling frequency. In order to maximize sampling conducted by a qualified consultant, it is recommended that three of the four samples be collected by a qualified consultant in conjunction with the groundwater and surface water monitoring programs, and one sample be collected in January by trained Township staff. This would result in the following leachate sampling/monitoring schedule:

Monitoring Description	Sampling Frequency	Personnel
Leachate Levels	Quarterly: January, April, July, and October	Township Staff
Flow Volumes	Monthly	Township Staff
Leachate Seep Inspections	Monthly	Township Staff
Quarterly Leachate Sampling	January – Indicator List	Township Staff
	May – Comprehensive List	GMBP
	July/August and October – Indicator List	GMBP

4. Due to the addition of the new eastern boundary monitoring wells (MW-14, MW-15, MW-16S, and MW-16D) and the removal of the former MSH well, which was formerly considered to be a potential downgradient receptor, the wells that were formerly used as eastern boundary condition wells (i.e., MW-12A, MW-12B, MW-13A, and MW-13B) are now considered to be redundant as they are located 200 and 300 metres from the established downgradient boundary and do not provide additional info pertaining to the site's compliance with the RUC. Therefore, it is recommended that MW-12A, MW-12B, MW-13A, and MW-13B continue to be used for water level measurements but be removed from the monitoring program.

5. Based on the issuance of the new Environmental Compliance Approval (March 10, 2022), future operations, monitoring, and reporting are to be conducted as per the new ECA and supporting documents (i.e., the updated Design and Operations Report by GMBP).

All of which is respectfully submitted,

GM BLUEPLAN ENGINEERING LIMITED

Per:

K.M. Charpontier, C.E.T.

Per:

A.W. Bringleson B.E.S., C.E.T.

Per:

M.D. Nelson, P.Eng., P.Geo

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July 19, 2023

Greetings,

Thank you for submitting your proposal for the Ontario Provincial Police (OPP) detachment board framework. Your patience has been greatly appreciated while all proposals went through a thorough review process.

At this time, I am pleased to confirm that the Manitoulin OPP detachment board proposal has been approved by the Solicitor General to the next step in finalizing the board compositions, which is posting the composition on the Ontario Regulatory Registry (ORR). The ministry is currently working on drafting the regulation, which is expected to be available on the Ontario Regulatory Registry (ORR) for public comment in the summer or fall. Posting of the regulation is one of the last steps before the regulation can be finalized in advance of bringing the *Community Safety and Policing Act, 2019* (CSPA) into force in early 2024.

The following board composition(s) have been approved for posting.

Board	Communities Serviced	Council Seats	Community Representative Seat(s)	Provincial Appointment Seat(s)	Total Seat(s)
1	Assiginack Township, Billings Township, Burpee and Mills Township, Municipality of Central Manitoulin, Cockburn Island Township, Municipality of	6	2	2	10

	Gordon/Barrie Island, Town of Gore Bay, Town of Northeastern Manitoulin and The Islands, Tehkummah Township				
2	Township of Baldwin, Town of Espanola, Township of Narin and Hyman, Township of Spanish Rivers	4	2	2	8

On behalf of the Ministry of the Solicitor General, I would like to express my appreciation to all the communities involved in the proposal development process. I acknowledge and value the significant efforts undertaken to create a proposal for a detachment board that addresses the unique needs of each community that receives OPP policing services in your detachment. As the proposal lead, I kindly request that you disseminate this correspondence to all communities serviced by the proposed detachment board.

The ministry is planning to share more guidance as soon as possible on next steps, with the understanding that municipalities and First Nations require time to plan for the implementation of OPP detachment boards before the CSPA comes into force.

If you have any questions or concerns in the meantime, please contact Devendra Sukhdeo, Senior Policy Advisor, Public Safety and Policing Policy Unit (PSPPU), Strategic Policy Division, at Devendra.Sukhdeo@ontario.ca.

Sincerely,

Sarah Caldwell
Assistant Deputy Minister, Strategic Policy Division
Ministry of the Solicitor General