Appendix B

Technical Impact Assessment Reports

Appendix B.1

Surface Water Assessment Report

Surface Water Assessment Report (Final)

Emerald Energy from Waste Environmental Screening & ECA Amendment

Emerald Energy From Waste

January 29, 2024

→ The Power of Commitment



Project name		Emerald Energy from Waste Environmental Screening & ECA Amendment					
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Project number		12593193-RPT-3					
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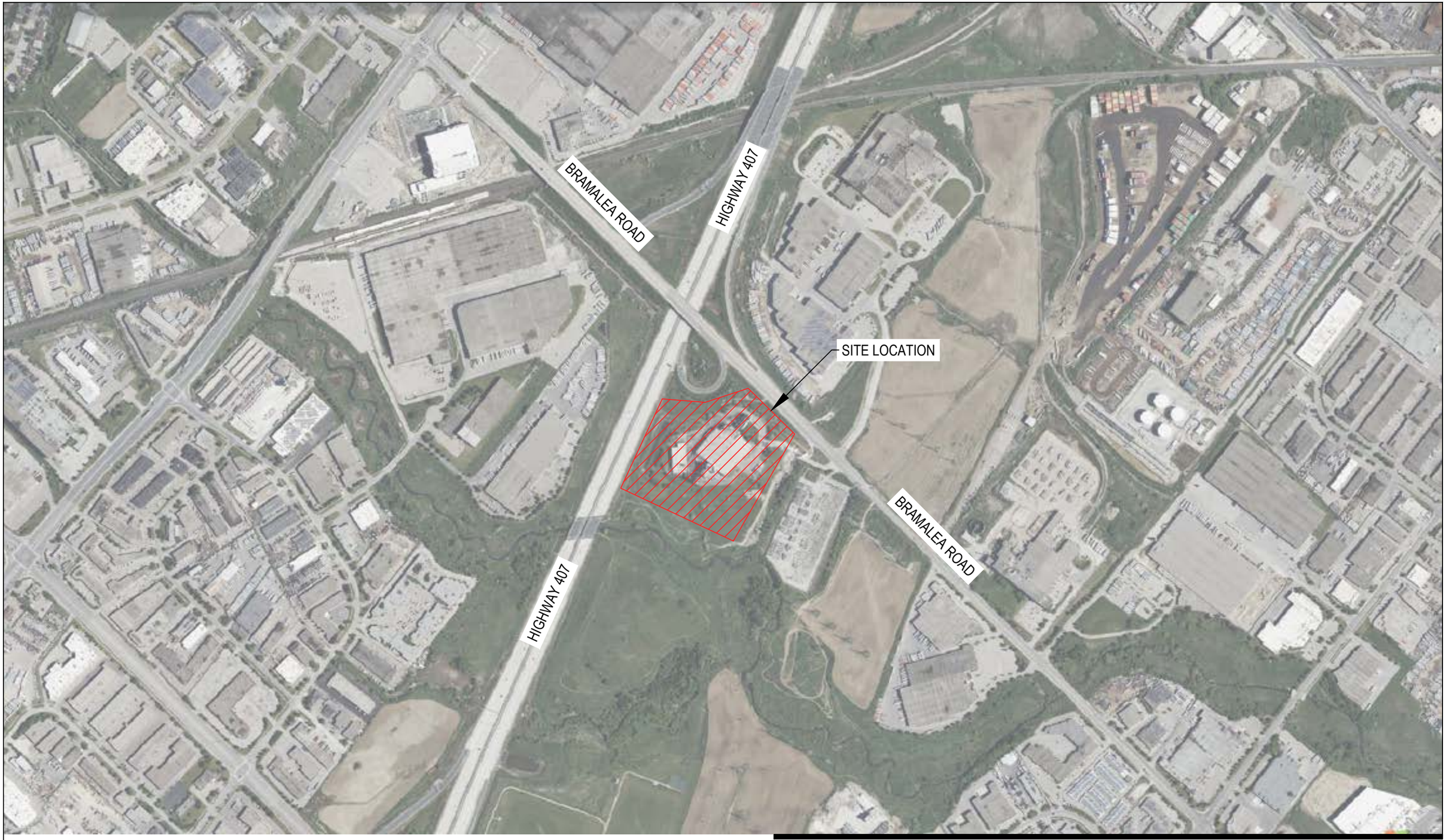
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1. Introduction

This report documents the Surface Water Assessment carried out as part of the Environmental Assessment Screening for the Emerald Energy from Waste Facility.

The Emerald Energy from Waste facility is located at 7656 Bramalea Road, in Brampton, Ontario (Site) and is owned and operated by Emerald Energy from Waste Inc. (also referred to as Emerald EFW, EEFW, Owner and Proponent). The location of the Site is shown on **Figure 1** and the existing Site layout is shown on **Figure 2**.



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EMERALD ENERGY FROM WASTE INC.
EMERALD ENERGY FROM WASTE ENVIRONMENTAL SCREENING & ECA AMENDMENT

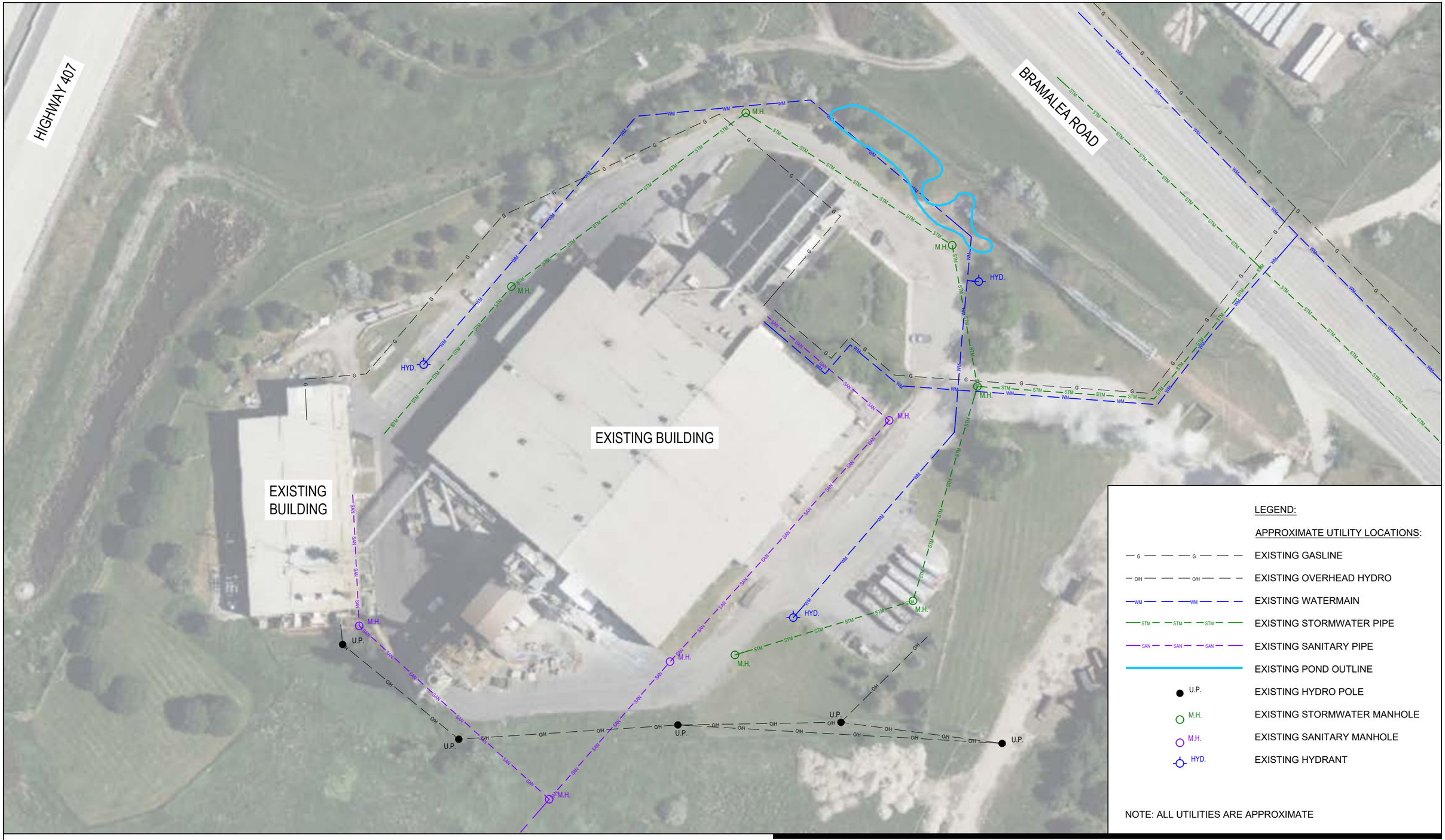
SITE LOCATION

Project No. **12593193**
Date **July 2023**

FIGURE 1

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PROPOSED SITE LAYOUT

Project No. **12593193**
Date **July 2023**

FIGURE 2

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The Site received a Certificate of Approval (CofA, now referred to as an Environmental Compliance Approval [ECA]) (Air) in 1991 and has accepted municipal solid waste since 1992. The Site, which operates under ECA No. 0264-BFGQFY issued March 19, 2021, has approved waste processing rates of 546 tonnes per day and 182,000 tonnes per year. The Site is currently approved for a total of six 2-stage gasification units (five units are currently installed) by Consumat System Inc., each having a nominal design Waste Processing Rate of 91 tonnes per day of municipal solid waste. Under the current ECA, the Site is licensed to receive solid non-hazardous waste from domestic, commercial, industrial and institutional sources and waste designated for thermal treatment by the Canadian Food Inspection Agency and/or Health Canada, from the province of Ontario, as well as solid non-hazardous waste limited to international waste, arriving in the province of Ontario.

Any proposed change to the waste processing limits requires a modification to several conditions of the approved ECA, which specifies the maximum amount of waste to be processed daily and annually as well as the allowable number of equipment units. The proposed Project would amend the approved ECA to allow for up to 900,000 tonnes of non-hazardous residual waste processing capacity annually. It is intended that staged decommissioning of the existing five units would take place as the proposed new units are brought online, such that the annual processing capacity of the entire facility would not exceed 900,000 tonnes per year at any time. Changes to the current approved size and footprint of the Emerald EFW facility will also be required in order to accommodate the proposed new gasification units.

The proposed change to the annual waste processing capacity will allow Emerald EFW to positively respond to reducing reliance on landfill disposal (both Canada and USA) while recovering energy from residual materials and reducing greenhouse-gas emission. This includes diverting a significant amount of Ontario's total residual waste going to landfill (currently 97 percent)[1] while ensuring the longevity of landfill disposal capacity. The proposed facility expansion is expected to have an operating life of at least 20 years. Between 1997 and 2000, Emerald EFW completed an Environmental Assessment (EA) for expansion of the facility by 25 percent. A CofA was issued in 2009. The Site also conducted and Environmental Screening for service area expansion and was approved between 2011-2012. The amendments to the ECA were approved in 2010, 2012, and 2020 by the Ministry of Environment, Conservation and Parks (MOECP).

In order to meet the growing demand from waste generators and customer for a safe and reliable waste management facility for their post diversion solid non-hazardous residential and industrial, commercial & institutional waste, Emerald Energy from Waste Inc. is proposing to redevelop and expand the processing capacity of their existing facility from 500 tonnes/day to up to 2,500 tonnes/day and increase the energy recovery from 10 MW to up to 100 MW. This redevelopment will be implemented in 3 phases.

During Initial Stage (Phase 1), the existing facility will remain operational while the first new processing line is constructed as shown in **Figure 3**. The Ultimate Stage (Phase 2 and 3) will be installed and commissioned in response to market demand. The existing facility would be removed as shown in **Figure 4.**

[1] Solid Waste in Ontario: Landfill Report, Ontario Waste Management Association, January 2021.



Figure 3 Proposed Redevelopment Phase 1



Figure 4 Proposed Redevelopment Phase 2 & 3

This ECA amendment is subject to the Environmental Screening Process in accordance with Section 16 of Ontario Regulation 101/07 – Waste Management Projects Regulation of the Ontario *Environmental Assessment Act*, as follows:

> *A change to a thermal treatment site described in section 11 is defined as a major commercial or business enterprise or activity and is designated as an undertaking to which the Act applies, if the amount of waste that would be subject to thermal treatment at the site on any day after the change would exceed the amount of waste that was authorized under the Environmental Protection Act to be subject to thermal treatment at the site before the change. O. Reg. 101/07, s. 16; O. Reg. 389/22, s. 9.*

Section 16 of Ontario Regulation 101/07 – Waste Management Projects Regulation exempts this Project from Part II of the *EA Act*, subject to fulfilling the Environmental Screening Process. The Screening will be conducted in accordance with the planning and design process outlined in MOECP "*Guide to Environmental Assessment Requirements for Waste Management Projects.*" The Environmental Screening process includes identifying and applying screening criteria to determine and describe potential environmental effects, public/external agency consultation, and the development of measures to mitigate identified environmental effects. The results of the Study will be documented in an Environmental Screening Report (ESR), which will be released for review to Stakeholders including Indigenous communities, the public, and government agencies. Upon completion of the Environmental Screening Process an application will be made to amend the existing ECA No. 0264-BFGQFY.

The Environmental Screening Process is described further in **Section 2** including the application of the Screening Criteria Checklist. The existing surface waters within the study area were confirmed through background research and a site visit and are documented in **Section 3**. In general, the predominant existing Surface Water within the Study Area is Industrial with Spring Creek located to the west, which is anticipated to remain that way for the foreseeable future based on current municipal planning policy.

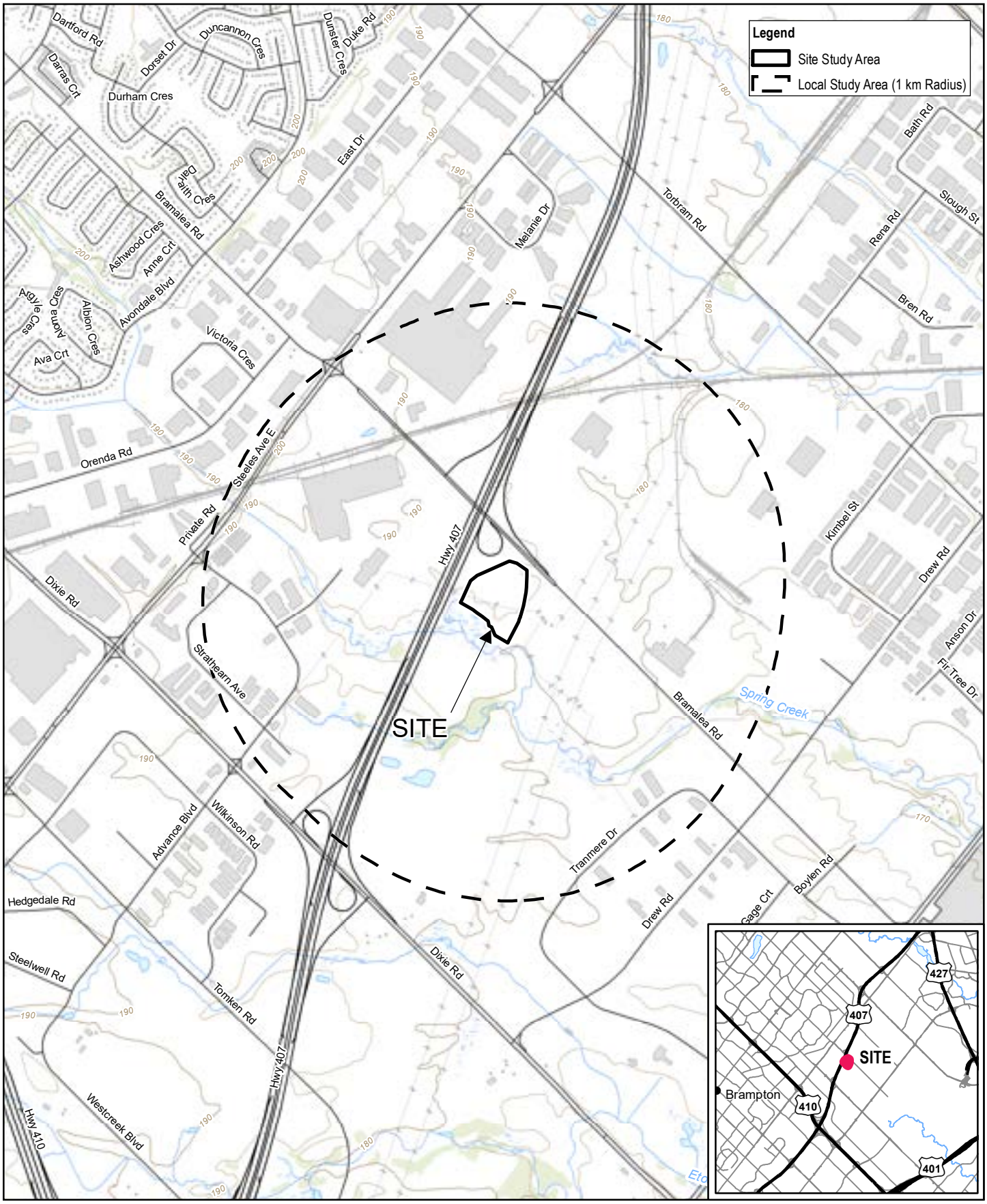
The effects assessment carried out for the Surface Water conditions is documented in **Section 4**. The identification of potential effects of the proposed project, mitigation measures to address the effects and the resultant net effects are described. Lastly the monitoring requirements and additional approvals required are detailed in **Section 5**.

From a Surface Water perspective, the characterization of existing conditions within the following study areas are appropriate to this Environmental Screening:

– **Site Study Area**, including all lands within the existing, approved boundaries of the EEFW, as defined by Environmental Compliance Approval (ECA) No. 4591-56VSTN, as amended; and

– **Local Study Area**, including all lands within a 1 Kilometre (km) radius of the Site Study Area boundaries. An Inventory of sensitive uses within 500 metres (m) of the Site Study Area will also be examined.

Refer to **Figure 5** for details of the above-mentioned study areas.



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Metres

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983
Grid: NAD 1983 UTM Zone 17N

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EMERALD ENERGY FROM WASTE INC.
7656 BRAMALEA ROAD, MISSISSAUGA, ON
SURFACE WATER WORK PLAN

SURFACE WATER STUDY AREAS

Project No. **12593193**
Revision No. **-**
Date **Dec 1, 2023**

FIGURE 5

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2. Screening Criteria Checklist

At the beginning of the Environmental Screening, the Screening Criteria Checklist (provided as Schedule I, pp 67 – 69, to the "Guide to Environmental Assessment Requirements for Waste Management Projects") is to be completed based on the information provided in the Project Description. The Screening Criteria reflect the broad definition of "environment" contained in the *Ontario Environmental Assessment Act*

As noted in the Guide:

*"The Screening Criteria are presented in the form of a checklist with the option of a "Yes" or "No" response. Mitigation measures **are not** to be considered in concluding whether there is "No" potential environmental effect. That is, the proponent is required to answer "Yes" even if the proponent believes that a potential environmental effect could likely be mitigated. The reason for requiring a "Yes" is to ensure that mitigation measures are open to discussion and review. Another reason for this approach is that further discussion and review of a potential effect may reveal that there is no actual effect, in which case no mitigation is required. Where a "Yes" has been identified, the proponent is to provide additional information in the Environmental Screening Report, explaining the potential effect(s), methods to mitigate or address the effect(s), any net effects that are anticipated and if so, their significance. Even where the proponent indicates that no environmental effects are anticipated, it is recommended that additional information is provided in the Environmental Screening Report in order to support the "no effects" conclusion"*.

Each criterion is based on a question which is prefaced with the phrase, "Might the Project…" **Table 1** was completed as the first step of the Environmental Screening Process and is a summary of the criteria for the Surface Water discipline. Further descriptions of the criteria for which a "Yes" response was indicated in the Screening table are discussed in **Section 4.0** of this report.

Table 1 Screening Criteria Checklist

	Criterion	YES	NO	Additional Information
	Might the Project			
Surface Water				
1.1	Cause negative effects on surface water quality, quantities, or flow?	X		The proposed EFW Facility expansion would result in changes to the existing site footprint and on-site operations and may cause potential negative effects on surface water quality, quantities, or flows. The Proponent is considering various Best Management Practices (BMPs) to mitigate such impacts. These may include, among others, the following: Stormwater storage (roofs, surface pond, underground tanks, or oversized pipes). Infiltration trenches or storage. Source control / Low-impact measures such as bioswale/ bioretention, or green roof. Stormwater quality enhancement by oil/ grit separators (or sedimentation ponds) Covering stored material with roof and keeping contaminated runoff separate to be treated in wastewater / sewage treatment plant.

	Criterion	YES	NO	Additional Information
1.3	Cause significant sedimentation or soil erosion or shoreline or riverbank erosion on or off site?	X		Runoff from the expanded EEFW Facility may impact downstream erosion. The following are proposed to be considered: Carrying runoff over paved or grass surface and underground pipe Extended detention/on-site retention/ infiltration of stormwater discharge Oil and grit separators Temporary ESC measures during construction
1.4	Cause negative effects on surface or ground water from accidental spills or releases (e.g., leachate) to the environment?	X		Materials On-Site include fuel, lubricating oils, and other fluids associated with maintaining the equipment. Spill protection measures will be provided on site, e.g., sluice gates in flow control structure. Staff will be routinely trained in spill response and containment techniques, and proper safeguards will be implemented.

3. Existing Conditions

3.1 Study Limits

As described under **Section 1.0**, characterization of the existing conditions within the following study areas was considered appropriate for this Environmental Screening:

– **Site Study Area**, including all lands within the existing, approved boundaries of the EEFW, as defined by Environmental Compliance Approval (ECA) No. 4591-56VSTN, as amended.
– **Local Study Area**, including all lands within a 1 km radius of the Site Study Area boundaries.
– **Regional Study Area** including all lands within a 3 km radius; this only becomes important if external flows are anticipated.

3.2 Information Collection and Review

Available primary and secondary sources of information were collected and reviewed by the Surface Water Study Team to determine the existing surface water conditions within the study area(s).

3.2.1 Primary Source of Information

The following primary sources of information were reviewed:

– Geology and Hydrogeology Assessment Report, Emerald Energy from Waste, Environmental Screening & ECA Amendment, GHD, July 2023.
– Emerald Energy-from-Waste, Project Definition Brief, Ramboll, June 2023.
– Stormwater Drainage and Stormwater Management Design Brief, Emerald Energy from Waste Inc., Proposed Driveway Extension – Ring Road (File No. SPA-2021-0051), Candevcon Limited, May 2022.
– Application for Site Approval, Emerald Energy from Waste Inc. (SPA-2021-0051), City of Brampton, November 2022.
– Grading and Drainage Plan, Driveway Extension – Ring Road (SPA-2021-0051), Candevcon Limited, Jan 2021.
– Proposed Steam Turbine Generator, Emerald Energy from Waste Inc., EXP, Sep 2020.

– Land Exchange Restoration and Enhancement Plan, Emerald Energy from Waste, Palmer Environmental Consulting Group Inc., April 18th, 2019.
– Amended Certificate of Approval, Industrial Sewage Works, Number 5175-83wsb3, Algonquin Power Energy from Waste Generating Station, Brampton City, Regional Municipality of Peel, Ministry of the Environment, May 2010.
– Certificate of Approval, Industrial Sewage Works, Number 7170-7Q3KSC, Algonquin Power Energy from Waste Generating Station, Brampton City, Regional Municipality of Peel, Ministry of the Environment, March 2009.
– Site Plan, Organic Waste Recycling Facility Brampton, Ontario, Peel Bio-Conversion Inc., F. J. Reinders and Associates Canada, Limited, April 1994.

It is to be noted that the following were not available at the time of writing this report:

– Field Observations
– As-builts information
– Existing water quality data and monitoring reports
– Operations and Maintenance Reports

3.2.2 Secondary Source of Information

The following secondary sources of information were reviewed:

– Stormwater Management Criteria, Toronto and Region Conservation Authority (TRCA), August 2012.
– Public Works Stormwater Design Criteria and Procedural Manual, Region of Peel, February 2010.
– Subdivision Design Manual, The Corporation of the City of Brampton, December 2008.
– Stormwater Management Planning and Design Manual, the Ministry of Environment, Conservation and Parks (MECP), March 2003.
– Flood Plain Map Viewer, Toronto and Region Conservation Authority, URL: https://trca.ca/conservation/flood-risk-management/flood-plain-map-viewer/

3.2.3 Process Undertaken

The process undertaken for the Surface Water Assessment of the Site included the following:

– Background Review
– Existing Site Conditions Review
– Proposed Expansion Assessment
– Potential effects, mitigation measures, and net effects analysis

3.3 Description of the Existing Conditions

The following describes the existing land use, topography, and stormwater management system.

The site currently measures approximately 4.98 ha (Candevcon, 2022). The land surface comprises a mix of buildings, paved and grass areas. The site generally slopes from northwest to southeast, with an approximate total drop of 1.0 m (F. J. Reinders & Associates, 1994). The site is topographically high near the middle with drainage flowing east and west from this mid area.

The existing SWM measures within the eastern portion of the Site comprise catchbasins, underground storm pipes, oil and grit separator, and a dry (surge) pond on the east side. The final stormwater outflow is connected to the existing storm sewer concrete pipe of 675 mm located under Bramalea Road. The existing stormwater management system has an Amended Certificate of Approval, Industrial Sewage Works (5175-83wsb3), Ministry of the Environment, May 2010 (currently referred to as Environmental Compliance Approvals [ECA]). The western portion however drains via overland sheet flow to Spring Creek.

There are wetlands located west of the facility within the Spring Creek (a tributary of Etobicoke Creek) floodplain. Development proposed within a portion of the wetland is being offset with a newly created wetland based on an assessment completed by Palmer Environmental and approved by TRCA. Lands are being exchanged to permit development within regulated areas and lands owned by EEFW are being transferred to TRCA.

Water table depth is generally greater than 3 metres below ground surface (mBGS), based on the regional data. Regional groundwater flow is anticipated to be toward the Spring Creek stream valley, based on the topography of the area (GHD, 2023).

4. Description of Project Components and Activities

The following subsections provide a general summary of the proposed undertaking:

Ontario disposes over 97 percent of its residual materials in landfills. The remaining three percent is managed through Energy from Waste (EFW [2]). Of the 97 percent directed to landfill disposal, 70 percent is disposed of within Ontario and 27 percent in Michigan and New York [3]). Based on the current disposal rate of 97 percent, Ontario's landfill capacity is projected to be exhausted in 11 to16 years[4]. To address the compounding issues of growing population and diminishing landfill capacity in southern Ontario, EEFW has identified an opportunity to develop new EFW capacity at their existing facility in Brampton.

The purpose of this Project is to provide additional processing capacity at the EEFW facility in Brampton, Ontario to divert a portion of the non-hazardous residual materials produced by Ontario residents and businesses from landfills, thereby recovering energy for use within the community. The proposed Project would allow for three new gasification units, each capable of processing up to 300,000 tonnes of residual waste per year, for a total processing capacity at the facility of 900,000 tonnes annually. This would increase the permitted annual waste processing amount from 182,000 to 900,000 tonnes. The proposed change in the annual processing capacity requires additional facility infrastructure and a change to the Site footprint.

The project for which the Environmental Screening Process is being undertaken is a proposed redevelopment of the existing site and involves a change to the final site capacity and footprint. A large amount of construction & demolition will be required to implement the proposal. The redevelopment will be implemented in 3 phases. In Phase 1, the existing facility will remain operational while the first new processing line is constructed. Phases 2 and 3 will be installed and commissioned in response to market demand. The existing facility would eventually be removed. Emerald EFW will undergo an ECA amendment for changes to approved processing capacity and other operational activities. From a traffic perspective there will be no changes to existing haul routes or Site entrance. Increasing the annual processing capacity will result in increased truck traffic on the haul route from Highway 407 along Bramalea Road on an annual basis. This is expected to be acceptable relative to local traffic volumes.

A summary of the key elements of the proposed capacity expansion compared to the existing approved Site is provided in **Table 2**.

Table 2 Summary of Proposed EEFW Facility Design vs Existing Facility

Design Component	Existing EfW Facility	Proposed Redevelopment
Waste Processing Capacity (tonnes per annum)	182,000	900,000
Number of Operation Lines	1	3

[2] Solid Waste in Ontario: Landfill Report, Ontario Waste Management Association, January 2021.
[3] Ibid.
[4] Ibid.

5. Potential Effects, Mitigation Measures & Net Effects

This section documents the potential effects on the environment, mitigation measures and net environmental effects for Surface Water resulting from the proposed undertaking.

5.1 Methodology and Investigations

The assessment of effects associated with the proposed undertaking was carried out through a series of steps that is based, in part, on the description of existing conditions, developing a baseline, project description, site plan, development of design and assessment criteria, and assessment of the proposed mitigation measures. The assessment of effects was also undertaken within the context of the previously completed Screening Criteria Checklist, as summarized in **Section 2.0** of this report.

Following the study of the above-mentioned primary and secondary sources of information, (**Section 3.2**), a list of feasible and site-specific Best Management Practices (BMPs) (i.e., mitigation measures) for surface water (i.e., stormwater) management (SWM) were developed, as included on **Figures 6** and **Figure 7** below. Following ongoing stakeholder and client consultations, a final shortlist will be developed which will form the basis of the next stage, i.e., designing, siting, and sizing for each shortlisted BMP.

5.2 Design & Assessment Criteria

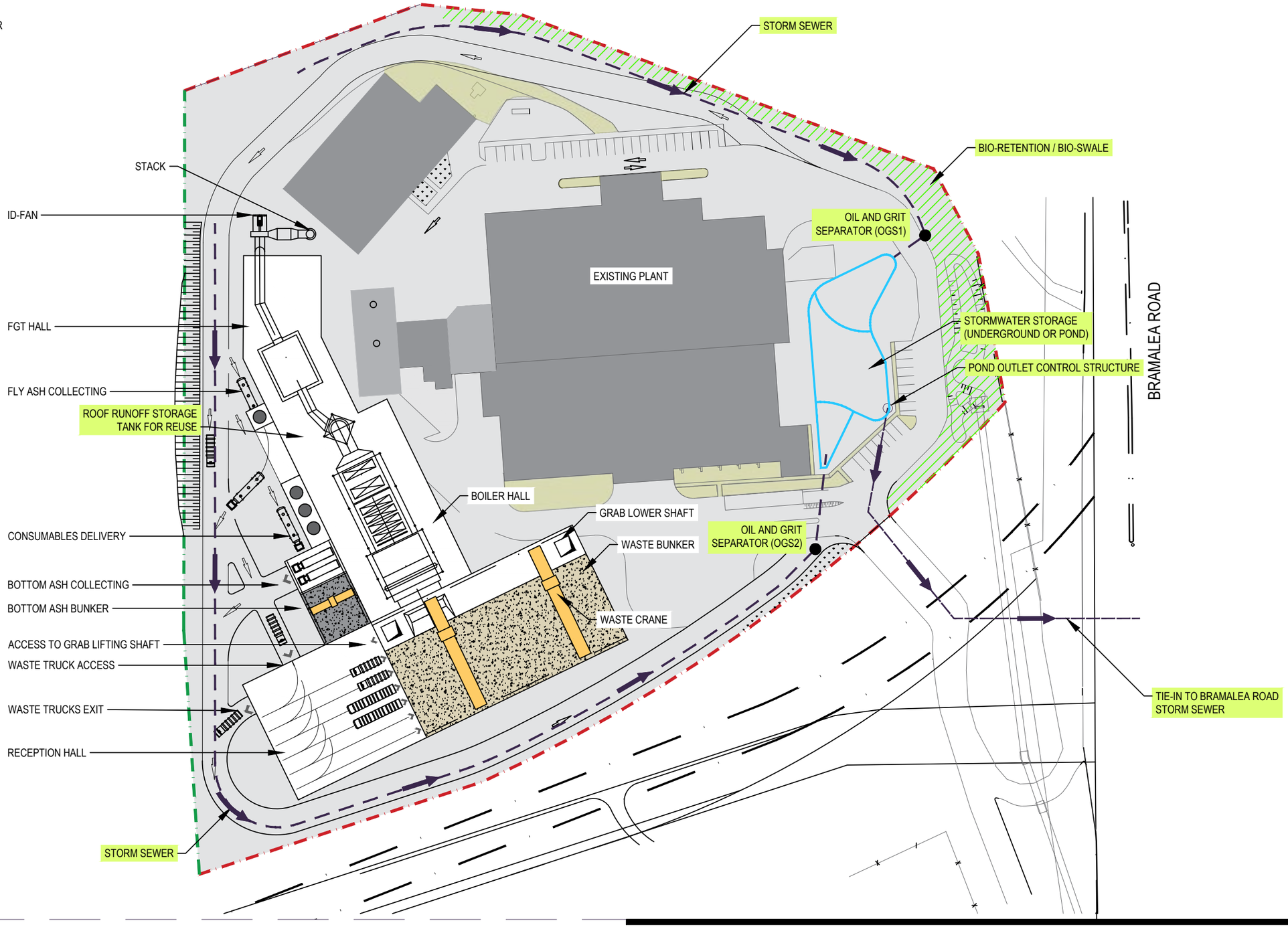
Based upon the background document review (Section 3.2), overall design and assessment criteria for the proposed stormwater BMPs, i.e., mitigation measures have been described below:

– Quantity Control - limit the 10-year return storm flow to 106 Liters/second (L/s) (i.e., 2-year pre-development flow) under the 10-year design storm event based on receiving sewer capacity. Refer to Amended Certificate of Approval, Number 5175-83wsb3, Ministry of the Environment, May 2010. This is to be confirmed based on ongoing consultations.
– Quality Control - enhanced quality control treatment level (minimum 80 % long-term average removal of Total Suspended Solids (TSS))
– Stream Erosion Control – On-site retention of runoff from 5-millimetre (mm) of rainfall (Section 4.2, TRCA, 2019).

It is to be noted that TRCA's water balance control criteria is not applicable as the Site is not located within High Volume, nor Significant Groundwater Recharge Areas and does not impact a sensitive ecological feature. (Appendix C, TRCA, 2019).

Please note that the above-mentioned design and assessment criteria is subject to change based on the ongoing consultation with various stakeholder.

PROPOSED STORMWATER MITIGATION MEASURES



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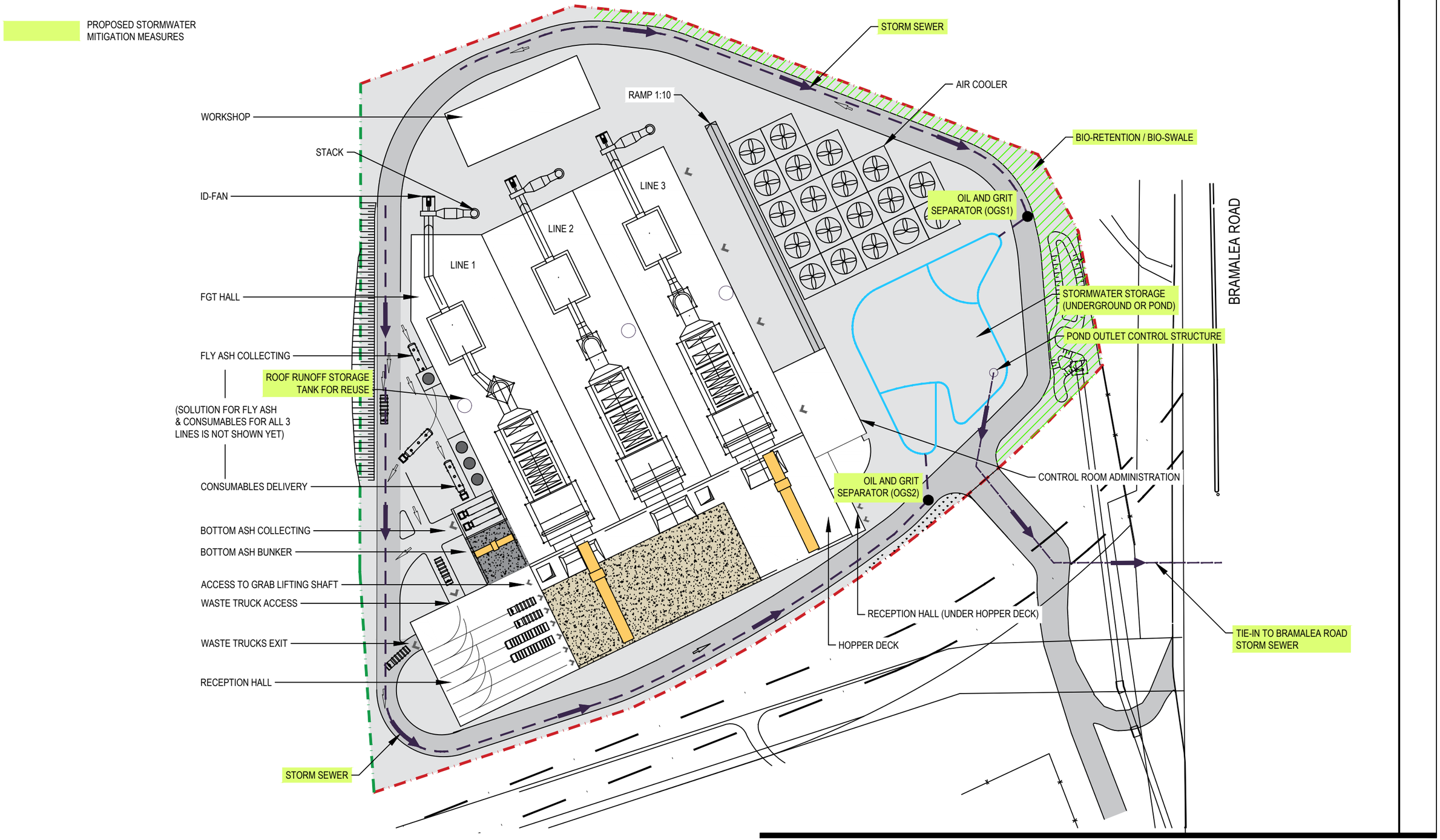
PROPOSED CONDITIONS INITIAL PHASE

Project No. **12593193**
Date **December 2023**

FIGURE 6

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PROPOSED CONDITIONS ULTIMATE PHASE

Project No. **12593193**
Date **December 2023**

FIGURE 7

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5.3 Surface Water Net Effects

This section describes the potential negative environmental effects for those Surface Water criteria that might be affected by the project as identified in **Table 2** of **Section 2.0**. The effects assessment described how the existing environmental conditions in the Study Area(s) would change as a result of the construction and operation of the proposed undertaking.

As described in **Section 2.0**, a “Yes” was applied to the following surface water criteria:

– Cause negative effects on surface water quality, quantities, or flow.
– Cause significant sedimentation or soil erosion or shoreline or riverbank erosion on or off site.
– Cause negative effects on surface or groundwater from accidental spills or releases (e.g., leachate) to the environment.

With respect to the above-mentioned criteria, a description of the potential negative environmental effects, necessary mitigation measures, and the resultant net effects on the environment have been discussed below. In all cases, impact management (mitigation) measures have been identified which, when applied, will eliminate, or reduce to acceptable levels, the potential negative environmental effects.

5.3.1 Potential Effects on Surface Water Environment

As mentioned earlier, the proposed undertaking would result in changes to the existing site footprint and on-site operations, which may cause potential negative effects on surface water quality, quantities, or flows, as described in **Table 2** of **Section 2**. The following describes those effects based on the extent of the study area.

5.3.1.1 Potential Effects within Local Study Area

These include effects from/ onto all lands within a 1 km radius of the Site Study Area boundaries. The Site is generally higher than its surroundings and contains a local drainage divide.

Due to the proposed expansion of the EEFW facility, additional buildings and paved areas are proposed to be developed. Also, the existing stormwater route on the west side is proposed to be modified to convey towards the east side, eventually discharging the entire Site runoff into the existing Bramalea Road storm sewer pipe.

In the absence of any mitigation measures, the above changes can potentially result in the following effects:

– Likely flooding on the Site area and/ or in downstream areas
– An increase in peak flow rate and total volume of runoff
– Deterioration in stormwater quality
– Likely increase in surface erosion on Site area

It is assumed that the Site does not receive any external storm flows from external land areas, nor does it discharge any flows onto the adjacent lands. Under the “Land Exchange Restoration and Enhancement Plan, Emerald Energy from Waste, Palmer Environmental Consulting Group Inc., April 18th, 2019”, the impact on the floodplain has been mitigated and an updated floodplain boundary will be delineated.

5.3.1.2 Potential Effects within Regional Study Area

These include effects from/ onto all lands within a 3 km radius of the Site Study Area boundaries. From a regional perspective, the abovementioned properly managed stormwater will cause little to no environmental impacts at a regional scale, both upstream and downstream.

5.3.2 Mitigation Measures

The following describes the proposed mitigation measures / BMPs for stormwater management (SWM), as shown in **Figures 6** and **7,** for the initial stage (Phase 1) and ultimate stage (Phase 2 and 3) respectively**.**

5.3.2.1 Stormwater Conveyance System

The proposed stormwater management system will collect storm runoff via catchbasins/ inlets and convey it to the east side of the Site, via underground storm pipes. These pipes discharge to east and west oil grit separator (OGS) units, which eventually drains into the proposed stormwater pond. The proposed system will be a 'dual' drainage system to cater to an entire spectrum of large and small storm events. Storm pipes will be designed for frequently occurring smaller (e.g., 1:5-year) storm events and ditches and gutters will be designed for larger, infrequent (e.g., 1:100-year) storm events. Surface ponding will be limited to safe ponding depths under all storm events. The stormwater conveyance system will also help minimize surface erosion by capturing surface flows in storm pipes and preventing concentrate sheet flows.

5.3.2.2 Oil and Grit Separators

Tow OGS units have been proposed to treat stormwater flows from the west and east sides of the Site to help meet the required 'enhanced' level of stormwater quality criteria, i.e., 80% removal of TSS. The OGS units remove surface dust, sand, grit, and floatables such as oil before discharging into the proposed stormwater storage. These also help reduce the costs of pond maintenance as fewer sediments will enter the pond.

5.3.2.3 Stormwater Storage Pond

The proposed stormwater storage pond provides the required stormwater quantity (i.e., runoff peak attenuation) control to prevent likely downstream surface flooding. The stormwater storage pond discharges into the existing storm pipe under Bramalea Road. Subject to ongoing consultations, the proposed pond will likely consist of a combination of the following: surface storage pond, underground storage, oversized storm pipes, and stormwater reuse tanks. The proposed pond consists of two Forebays and a main cell. Forebays remove coarser particles whereas the main cell removes finer particles by extended detention. The pond will be fitted with a flow control structure and an overflow weir or alternative arrangement for emergency flows. The location of the pond is proposed to be east, which is lower in elevation. The final location of the pond is to be finalized based on further consultation and final Site layout plans, to minimize impact on Site operations. The pond is proposed to be lined to prevent any groundwater contamination by infiltration.

To prevent accidental spills or unplanned releases, a sluice gate or control valve will be installed in the flow control structure. This gate can be closed to prevent the entry of contaminated stormwater into the existing storm pipe at the final discharge point. In the meantime, contaminated stormwater can be treated or trucked offsite. Appropriate trained staff and a mitigation plan can be made available to manage such unplanned events.

The facility shall be designed and operated such that the stormwater collected should be free of drippings and wash water and should not come in contact with any process materials.

The proposed pond will be required to expand as EEFW adds more lines. Alternatively, the storage can be built to the final size in Phase 1, which may provide cost savings in the long run.

5.3.2.4 Bioswale/ Bioretention

A bioswale/ bioretention has been proposed along property boundaries in order to provide conveyance and additional stormwater volume control by onsite retention/ infiltration, subject to future onsite infiltration tests. This sustainable BMP can also provide the benefit of onsite retention to meet stream erosion control targets.

5.3.2.5 Rainwater Re-use

Additionally, runoff from roof areas of the proposed lines is proposed to be collected in surface rainwater tanks. This rainwater, following the required treatment, if any, can be reused in industrial processes, washing, irrigation, or for similar other purposes. This can provide additional runoff quantity control.

5.3.2.6 Erosion and Sediment Control

A temporary erosion and sediment control (ESC) plan is proposed to be developed and implemented during construction. This plan will identify the inspection, monitoring, and maintenance requirements for ensuring that construction period activities do not negatively impact downstream receiving waters. The ESC plan may include mitigation measures such as silt fences, silt socks, catchbasin filters, mud mats, tarps, sediment traps, and erosion control blankets.

5.3.3 Net Effects

As mentioned before, expansion of the Site will increase overall impervious areas on the Site. This will likely result in an increase in stormwater quantity and deterioration in stormwater quality. To mitigate these effects, a set of mitigation measures (stormwater BMPs) have been proposed to be implemented on Site as mentioned under Section 5.3.2. With the application of the proposed mitigation measures, it is envisaged that the net effects of the undertaking will be mitigated or reduced to the required acceptable extent.

– Collection in catchbasins and conveyance in underground storm pipes
– Water quality enhancement by treatment using OGS units.
– Water quantity (peak runoff attenuation) control by storing stormwater in storages, likely to be a combination of surface storage, underground storage, oversized storm pipes and stormwater reuse tanks.
– Water quantity (volume) control by bioswale/ bioretention and rainwater tanks.
– Implementation of temporary erosion and sediment control (ESC) plan during construction

Table 3 Proposed Mitigation Measures

Environmental component	Evaluation criteria	Indicator	Potential effects	Mitigation measures	Net effects
Surface water resources	Surface water quality	Predicted effects on surface water quality on-site and off-site	Potential decrease in the surface water quality	**Oil and Grit Separators** – Stormwater quality enhancement by removing TSS from the runoff	No negative net effects are anticipated.
	Surface water quantity	Change in drainage areas	Potential increase in the surface water quantity	**Stormwater Conveyance System –** On-Site Surface flooding prevention by providing adequate capacity. Surface erosion prevention by eliminating concentrated and/or large sheet flows. **Stormwater Storage (pond, pipe and underground cells, as needed)** Stormwater quantity control to attenuate peak flow discharge rates into the existing storm sewer at Bramalea Road. Surface flooding prevention in downstream areas Emergency spill control by operating valves in the flow control structure **Bioswale/ Bioretention** Stormwater quantity (volume) control to prevent downstream stream erosion. Stormwater quality enhancement by filtering sediments	No negative net effects are anticipated.

Environmental component	Evaluation criteria	Indicator	Potential effects	Mitigation measures	Net effects
				Rainwater Re-use Tanks Stormwater quantity (volume) control to prevent downstream stream erosion. **Erosion and Sediment Control BMPs** Erosion prevention during construction	

6. Monitoring Requirements and Additional Approvals

To ensure that the mitigation measures identified in **Section 4.0** are implemented as envisioned, a strategy and schedule will be developed for monitoring environmental effects. With these mitigation measures and monitoring requirements in mind, commitments have also been proposed to ensure that they are carried out as part of the construction, operation, and maintenance of the proposed undertaking.

6.1 Monitoring Requirements

During long-term operations, a monitoring plan will be prepared to collect and analyze stormwater discharge samples to ensure that the water quality is within acceptable criteria. The frequency and the list of parameters will be selected during the detailed design phase and will be reviewed by regulatory agencies prior to approval and documentation of permits.

6.2 Additional Approvals

Several approvals are required before initiating the construction project as follows:

– Environmental Compliance Approval for Industrial Sewage Works
– Site Plan Approvals
– TRCA Regulation 166/06

7. Conclusions & Recommendations

Emerald Energy from Waste facility (Site), spanning 4.98 ha, located at 7656 Bramalea Road, Brampton, Ontario, has planned to increase its production from 182,000 to 900,000 tonnes per year which requires changes to the current footprint of the Site which may cause potential negative effects on the following: (i) surface water quantity and quality, (ii) sedimentation or soil erosion or shoreline or riverbank erosion on or off site, and (iii) negative effects on surface or groundwater from accidental spills or releases.

The following mitigation measures have been proposed to mitigate or reduce to acceptable level the anticipated net effects due to the proposed undertaking:

The proposed stormwater management system will convey stormwater via underground storm pipes to the proposed oil grit separator (OGS) units which will treat the stormwater meeting the enhanced level of stormwater quality criteria by removal of surface dust, sand, grit, and floatables such as oil.

The proposed stormwater storage provides the required stormwater quantity control, and ultimately discharges into the existing storm pipe under the Bramalea Road mitigating likelihood of downstream surface flooding. Subject to ongoing

consultations, the proposed stormwater storage will likely consist of a combination of surface storage, underground storage cells, oversized storm pipes and/ or stormwater reuse tanks.

A bioswale/ bioretention has also been proposed to provide volume control by onsite retention/ infiltration. Additionally, runoff from roof areas is to be collected in rainwater tanks which can be re-used in industrial processes, washing, irrigation, or similar other purposes. This will provide additional runoff quantity control as well.

To prevent accidental spills or unplanned releases, a sluice gate or control valve will be installed in flow control structure. The facility shall operate such that the stormwater remains free of drippings and washwater and should not come in contact with any process materials.

A temporary erosion and sediment control (ESC) plan will be implemented during construction which will ensure that construction activities do not negatively impact the downstream receiving waters. The ESC plan may comprise silt fence, silt socks, catchbasin filters, mud mats, tarp, sediment traps, and erosion control blankets.

Due to application of the above-mentioned proposed mitigation measures/ BMPs, we envisage that net effects of the undertaking will be mitigated or reduced to the required acceptable extent.

During long term operations, a monitoring plan will be prepared to collect and analyse stormwater discharge samples to ensure that the water quality is withing acceptable criteria. Several approvals are required prior to initiating the construction project such as Environmental Compliance Approval for Industrial Sewage Works, Site Plan Approvals and TRCA Regulation 166/06.

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Appendix B.2

Geology and Hydrogeology Assessment Report

Geology and Hydrogeology Assessment Report

Emerald Energy from Waste Environmental Screening & ECA Amendment

Emerald Energy from Waste Inc.

29 January 2024

→ The Power of Commitment



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1. Introduction

This report documents the Geology and Hydrogeology Assessment carried out as part of the Environmental Assessment Screening for the Emerald Energy from Waste Facility.

The Emerald Energy from Waste facility (Site) is located at 7656 Bramalea Road, in Brampton, Ontario and is owned and operated by Emerald Energy from Waste Inc., herein referred to as Emerald EFW (EEFW, Owner, Proponent). The location of the Site is shown in **Figure 1.1.**



Figure 1.1 Location of the Proposed Undertaking

The Site received a Certificate of Approval (CofA, now referred to as an Environmental Compliance Approval [ECA]) (Air) in 1991 and has accepted municipal solid waste since 1992. The Site, which operates under ECA No. 0264-BFGQFY, has approved waste processing rates of 546 tonnes per day and 182,000 tonnes per year. The Site is currently approved for a total of six 2-stage gasification units (five units are currently installed) by Consumat System Inc., each having a nominal design Waste Processing Rate of 91 tonnes per day of municipal solid waste. Under the current ECA, the Site is licensed to receive solid non-hazardous waste from domestic, commercial, industrial and institutional sources and waste designated for thermal treatment by the Canadian Food Inspection Agency and/or Health Canada, from the province of Ontario, as well as solid non-hazardous waste limited to international waste, arriving in the province of Ontario.

Any proposed change to the waste processing limits requires a modification to several conditions of the approved ECA, which specifies the maximum amount of waste to be processed daily and annually as well as the allowable number of equipment units. The proposed Project would amend the approved ECA to allow for up to 900,000 tonnes

of non-hazardous residual waste processing capacity annually. It is intended that staged decommissioning of the existing five units would take place as the proposed new units are brought online, such that the annual processing capacity of the entire facility would not exceed 900,000 tonnes at any time. Changes to the current approved size and footprint of the EEFW facility will also be required in order to accommodate the proposed new gasification units.

The proposed change to the annual waste processing capacity will allow Emerald EFW to positively respond to reducing Ontario's reliance on landfill disposal (both Canada and USA) while recovering energy from residual materials and reducing greenhouse-gas emission. This includes diverting a significant amount of Ontario's total residual waste going to landfill (currently 97 percent).[1] while ensuring the longevity of landfill disposal capacity. The proposed facility expansion is expected to have an operating life of at least 20 years. Between 1997 and 2000, Emerald EFW completed an Environmental Assessment (EA) for expansion of the facility by 25 percent. A CofA was issued in 2009. The Site also conducted and Environmental Screening for service area expansion and was approved between 2011-2012. The amendments to the ECA were approved in 2010, 2012, and 2020 by the Ministry of Environment, Conservation and Parks.

In order to meet the growing demand from waste generators and customer for a safe and reliable waste management facility for their post diversion solid non-hazardous Residential and Industrial, Commercial & Institutional waste, Emerald Energy from Waste Inc. is proposing to redevelop and expand the processing capacity of their existing facility from 500 tonnes/day to up to 2,500 tonnes/day and increase the energy recovery from 10 MW to up to 100 MW. This redevelopment will be implemented in 3 phases. During Phase 1, the existing facility will remain operational while the first new processing line is constructed **(See Figure 1.2)**. Phase 2 and 3 will installed and commissioned in response to market demand. The existing facility would be removed as shown in **Figure 1.3.**



Figure 1.2 Proposed Redevelopment Phase 1

[1] Solid Waste in Ontario: Landfill Report, Ontario Waste Management Association, January 2021.



Figure 1.3 Proposed Redevelopment Phase 2 & 3

This ECA amendment is subject to the Environmental Screening Process in accordance with Section 16 of Ontario Regulation 101/07 – Waste Management Projects Regulation of the Ontario *Environmental Assessment Act*, as follows:

> *A change to a thermal treatment site described in section 11 is defined as a major commercial or business enterprise or activity and is designated as an undertaking to which the Act applies, if the amount of waste that would be subject to thermal treatment at the site on any day after the change would exceed the amount of waste that was authorized under the Environmental Protection Act to be subject to thermal treatment at the site before the change. O. Reg. 101/07, s. 16; O. Reg. 389/22, s. 9.*

Section 16 of Ontario Regulation 101/07 – Waste Management Projects Regulation exempts this Project from Part II of the *EA Act*, subject to fulfilling the Environmental Screening Process. The Screening will be conducted in accordance with the planning and design process outlined in MECP "*Guide to Environmental Assessment Requirements for Waste Management Projects.*" The Environmental Screening process includes identifying and applying screening criteria to determine and describe potential environmental effects, public/external agency consultation, and the development of measures to mitigate identified environmental effects. The results of the Study will be documented in an Environmental Screening Report (ESR), which will be released for review to Stakeholders including Indigenous communities, the public, and government agencies. Upon completion of the Environmental Screening Process an application will be made to amend the existing ECA No. 0264-BFGQFY.

The Environmental Screening Process is described further in **Section 2** including the application of the Screening Criteria Checklist. The existing, planned and future Geology and Hydrogeology within the study area were confirmed through background research and a site visit are documented in **Section 3**. In general, the predominant existing land use within the Study Area is Industrial, which is anticipated to remain that way for the foreseeable future based on current municipal planning policy.

The effects assessment carried out for the Geology and Hydrogeology conditions is documented in Section 4. The identification potential effects of the proposed project, mitigation measures to address the effects and the resultant net effects are described. Lastly the monitoring requirements and additional approvals required are detailed in **Section 5**.

The Study Areas reviewed for the Geology and Hydrogeology assessment was as follows (see **Figure 1.2**):

From a Geology and Hydrogeology and Economic Environment perspective, the characterization of existing conditions within the following study areas are appropriate to this Environmental Screening:

– **Site Study Area**, including all lands within the existing, approved boundaries of the Emerald EFW, as defined by Environmental Compliance Approval (ECA) No. 4591-56VSTN, as amended; and
– **Local Study Area**, including all lands within a 1 Kilometre (km) radius of the Site Study Area boundaries. An Inventory of sensitive uses within 500 m of the Site Study Area will also be examined.

2. Screening Criteria Checklist

At the beginning of the Environmental Screening, the Screening Criteria Checklist (provided as Schedule I, pp 62 – 64, to the "Guide to Environmental Assessment Requirements for Waste Management Projects") is to be completed based on the information provided in the Project Description. The Screening Criteria reflect the broad definition of "environment" contained in the *Ontario Environmental Assessment Act*

As noted in the Guide:

*"The Screening Criteria are presented in the form of a checklist with the option of a "Yes" or "No" response. Mitigation measures **are not** to be considered in concluding whether there is "No" potential environmental effect. That is, the proponent is required to answer "Yes" even if the proponent believes that a potential environmental effect could likely be mitigated. The reason for requiring a "Yes" is to ensure that mitigation measures are open to discussion and review. Another reason for this approach is that further discussion and review of a potential effect may reveal that there is no actual effect, in which case no mitigation is required. Where a "yes' has been identified, the proponent is to provide additional information in the Environmental Screening Report, explaining the potential effect(s), methods to mitigate or address the effect(s), any net effects that are anticipated and if so, their significance. Even where the proponent indicates that no environmental effects are anticipated, it is recommended that additional information is provided in the Environmental Screening Report in order to support the "no effects" conclusion"*.

Each criterion is based on a question which is prefaced with the phrase, "Might the Project…" Table 2.1 was completed as the first step of the Environmental Screening Process and is a summary of the criteria for the Geology and Hydrogeology discipline. Further descriptions of the criteria for which a "Yes" response was indicated in the Screening table are discussed in **Section 4.0** of this report.

Table 2.1 Screening Criteria Checklist

	Criterion	YES	NO	Additional Information
	Might the project…			
Ground Water				
1.1	Cause negative effects on ground water quality, quantity, or movement?	X		The proposed EFW Facility expansion would result in changes to the existing site footprint and on-site operations and may cause potential negative effects on groundwater quality, quantities, or flows. The Proponent may consider various Best Management Practices (BMPs) to mitigate such impacts. These may include paving of traffic surfaces to limit infiltration through road/access areas, paved-surface cleaning efforts to remove deleterious constituents, direction of poor-quality runoff through water quality improvement systems, direction of clean-runoff to infiltration zones (where suitable conditions permit infiltration).
1.2	Cause negative effects on surface or ground water from accidental spills or releases (e.g., leachate) to the environment?	X		Materials On-Site include fuel, lubricating oils, and other fluids associated with maintaining the equipment. Staff will be routinely trained in spill response and containment techniques, and proper safeguards will be implemented.

3. Existing Conditions

The following subsections describe the existing conditions that are found within the On-Site, Site Vicinity and Regional Study Areas for Geology and Hydrogeology (section 3.1) of the proposed project.

3.1 Methodology

3.1.1 Available Secondary Source Information Collection and Review

Available secondary sources of information were collected and reviewed by the Geology and Hydrogeology Study Team to determine existing geology and hydrogeology conditions within the study area(s). The following sources of secondary information were collected and reviewed:

- Aerial imagery and topographic maps/data
- Ontario GeoHub
- Facility layout, drainage maps, as-builts, and figures
- Site investigations
- Existing stormwater system servicing information, (e.g., layout drawings, plan and profiles, storm drainage area plans, pipe design sheets, models, reports, or masterplans)
- Drawings and design details of the existing stormwater BMPs/SCPs (e.g., ponds, storages, filters, infiltration facilities, bioswales)
- OGS unit information (design sheets and inspection reports)
- Groundwater Monitoring Wells/ Reports
- Quaternary geology from mapping completed by the Ontario Geological Survey
- Applicable guidelines and technical standards produced by MECP, TRCA, City of Brampton, and Region of Peel
- Published water quality and flow information from the MECP, TRCA, and Environment Canada
- Provincial water quality monitoring network (PWQMN)
- Source Water Protection Plan and designated areas
- Provincial water quality objectives (PWQO) and Canadian water quality guidelines (CWQG)
- Existing Design and Operations Report
- Existing Conditions Report
- Existing Operations and Maintenance Report
- Existing Stormwater Management (or Functional Servicing) Report(s)
- Background reports and documentation submitted for previously prepared ECA applications
- Existing ECA’s and CofA’s
- Existing CCTV report(s) and documentation
- Proposed facility conceptual designs

3.1.2 Process Undertaken

GHD reviewed available background information on the facility. Also, GHD completed a Site visit to review existing conditions and confirm Site information compiled from the background review. Available secondary sources of information were collected and reviewed to characterize the geology/ hydrogeology existing conditions within the Site and Local Study area. The following sources of secondary information were collected and review:

- Field Observations
- Review of facility layout, drainage maps, topography, as-builts, and figures
- Review of the current groundwater monitoring system and surface water system for surface water groundwater interactions (drawings, design details/calculations, water quantity controls, water quality controls, etc.)

- Review of existing water quality data and monitoring reports
- Soil, geologic and hydrogeological maps and reports
- Ministry of the Environment, conservation and Parks (MECP) water well records for existing wells, monitoring or observation wells, boreholes, etc.
- Existing Environmental Compliance Approvals and Certificate of Approvals
- Applicable design guidelines and technical standards
- Review of facility documentation including but not limited to Design and Operations Report, Stormwater Management Report, and Operations and Maintenance Report.

The geology/ hydrogeology assessment includes review of the surface water (hydrological/stormwater) modelling to determine any potential interactions between surface water and groundwater on Site. This baseline is used to assess the potential impacts of the proposed plans and to identify potential mitigation measures. The existing environment is characterized based on the geology/ hydrogeologic characteristics of the study area, available geological and hydrogeological data, e.g., and available MECP well records for the Site.

3.1.3 Previous Investigations

Several geotechnical investigations were previously completed on and in the immediate vicinity of the Site, as follows:

- Geotechnical Investigation Proposed Energy from Waste Facility Bramalea Road/Future Hwy.407 Brampton, Ontario (File No. 89357), Terraprobe, January, 1989.
- Supplementary Geotechnical Evaluation Proposed Steam and Power Lines from KMS Peel Facility to Norampac Paper Mill, Bramalea Road Brampton, Ontario. Trow Associates Inc., March 17, 2006.
- Geotechnical Investigation Proposed Steam Turbine Generator Emerald Energy From Waste Inc. 7656 Bramalea Road, Brampton, Ontario (Project Number: BRM- 00607546-A0). Prepared By: EXP, September 29, 2020.

Geotechnical investigation reports in the surrounding area, compiled from the Oak Ridges Moraine Groundwater Monitoring Program, include:

- Geotechnical Investigation Proposed Watermain Replacement, Bramalea Road Mississauga, Ontario. Report for Regional Municipality of Peel (Project No. GEOTETOB08569AA). Coffey Geotechnics, October 30, 2009.
- Foundation Investigation for Proposed Crossing of Tributary of Etobicoke Creek: Diversion and Parking Lot Access Road, Bramalea "GO" Station, District #6, (Toronto). Ministry of Transportation and Communications, Ontario Memorandum. Mr. K.G. Selby, Supervising Foundations Engineer West Building, Downsview. June 13, 1973.

3.2 Description of Existing Conditions

The Site is situated in an Industrial/Commercial and Utility and Transportation area of the City of Brampton, as shown on the aerial photo in **Figure 2.1**. Land uses in the vicinity of the Site include warehouse and commercial enterprises and industrial storage areas, as well as a Hydro corridor, Highway 407 and GO transit railway line.

The Site and surrounding land uses have full municipal services. Potable water at the Site and surrounding area is supplied by the City of Brampton, which obtains water from Lake Ontario.

3.2.1 Regional Setting

The Site is located in the Peel Plain physiographic region (Chapman and Putnam 1984)[2], which is characterized by a relatively level clay and bevelled till plain (**Figure 2.2**). The topography is generally flat to undulating on the till plain at

[2] Chapman, L.J. and Putnam, D.F., 1984. The Physiography of Southern Ontario. Ontario Geological Survey, Special Volume 2.

an elevation of approximately 183 metres above mean sea level (mAMSL), with a gradual slope to the west towards Spring Creek (**Figure 2.3**).

The Site is situated adjacent to Spring Creek, which is a tributary of Etobicoke Creek and is located approximately 130 metres (m) to the west of the current Site activities. The creek is incised into the till plain approximately 3 metres to an elevation of 180 mAMSL. There is a gradual slope from the till plain into the Etobicoke Creek stream valley and floodplain, and drainage is to the west towards the associated wetlands and creek.

The Site is not located within the Oak Ridges Moraine Planning area or any Source Water protection areas related to municipal water supplies, significant groundwater recharge areas or highly vulnerable aquifers (CTC, 2022)[3].

Regional surficial geology mapping of the area indicates that the Site and surrounding lands are underlain by fine textured glaciolacustrine deposits, and fine textured glaciolacustrine or shale derived clay to silt till, referred to as the Halton Till (OGS, 2005)[4] (**Figure 2.4**). Regional mapping also indicates that alluvial deposits (gravel, sand, silt and clay) are present within the Spring Creek stream valley, and that bedrock locally outcrops.

Based on geotechnical boreholes advanced to the north of the Site (OGS Geotechnical Borehole Database, 2012) and bedrock mapping (OGS, 1991)[5], the overburden is generally about 10 m thick and consists of a thin sequence of Pleistocene glacial deposits overlying shale and limestone bedrock of the Upper Ordovician Georgian Bay Formation. The surficial geology and general stratigraphic framework for the Site and surrounding area consists of the following deposits:

Alluvial Deposits – clay, silt, sand, gravel and organic materials

Fine Textured Glaciolacustine Deposits – clay and silt

Halton Till - silt to silty clay till.

Bedrock – shale and limestone.

The location of recorded Ministry of the Environment, Conservation and Parks (MECP) Water Well Information System (WWIS, 2020)[6] records within 500 m of the Site is shown on **Figure 2.5**, and selected water well records are presented in **Appendix B**. Based on review of the well records, the majority of wells reported in the vicinity of the Site consist of old water supply wells completed in the 1950 and 1960s, as well as recent test holes and observation wells completed between about 2006 to present.

Review of the water well record information indicates that the overburden is typically less than about 10 m thick in the area, and that it is primarily comprised of clay till underlain by shale bedrock. Medium sand, and sand and gravel comprised of weathered shale is locally encountered at the overburden bedrock contact, ranging in thickness from approximately 1 to 3 m.

A north-south oriented stratigraphic profile through the Site, based on the Oak Ridges Moraine Groundwater Monitoring Program regional dataset is presented on **Figure 2.6**. Medium to coarse textured deposits encountered within the deep overburden, at the overburden-bedrock contact are considered to be potentially Thorncliffe Formation deposits, an important aquifer based on the regional model.

The hydrostratigraphic framework corresponds to the layered regional stratigraphy, and includes the following aquifer and aquitard units based on the water well record information and regional stratigraphic profile:

Aquitard – fine textured glaciolacustrine deposits (clay, silt)

Aquitard - Halton Till (silty clay till)

Aquifer (Confined) – overburden / bedrock contact, (silty sand, sand, sand and gravel / weathered shale).

Aquitard – shale bedrock.

[3] Credit Valley, Toronto and Region and Central Lake Ontario (CTC) Source Protection Plan (approved on February 23, 2022)
[4] Karrow, P.F. and Easton, J. 2005. Quaternary geology of the Brampton area; Ontario Geological Survey, Map 2223, scale 1:50 000
[5] Bedrock Geology of Ontario, southern sheet: Ontario Geological Survey Map 2544, scale 1:1,000,000. Ontario Geological Survey 1991.
[6] Water Well Information System (WWIS) Ontario Ministry of the Environment and Climate Change (Accessed January 2020).

In general, the fine textured glaciolacustine deposits and till overburden form a thick aquitard that overlies a shale bedrock aquitard. The hydrostratigraphy underlying the Site has potential marginal aquifer conditions within the weathered till, but it is primarily comprised of a thick overburden aquitard and shale bedrock aquitard. Confined aquifer conditions may exist locally at the overburden and weathered shale bedrock contact.

The water table is generally greater than 3 mBGS, based on the regional data. Regional groundwater flow is anticipated to be toward the Spring Creek stream valley, based on the topography of the area.

3.2.2 Site Geology and Hydrogeology

The following sections provide a description of the geology and hydrogeology of the Site, based on the results of previous investigations completed on and in the immediate vicinity of the Site. The investigative borehole and monitoring well locations are shown on **Figure 3.1**, and a compilation of the stratigraphic and instrumentation logs is presented in **Appendix C**. Based on review of the logs, the following surficial materials and geologic deposits underlie the Site:

- ***Surficial Material (0 to 1.5 mBGS)*** – topsoil, pavement structure, concrete, subgrade and fill
- ***Till (1.5 to 6 mBGS)*** – clayey silt till, and sandy silt to silty sand till
- ***Bedrock (greater than 6 mBGS)*** **–**shale

Surficial Material

The surficial material consists of topsoil, pavement structure, concrete with subgrade depending on location on the Site. The surficial materials are underlain by fill and native soils. The fill is anticipated to have variable composition and is described as a dark brown and moist sandy silt fill based on review of borehole log BH1A (Trow, 2006).

Till Deposits

The surficial materials are underlain by a clayey silt to silty sand till. The clayey silt till is described as brown, moist and very stiff to hard. Typically, the clayey silt till is encountered near surface, and changes to a sandy silt to silty sand till with depth. The sandy silt till is brown with oxidation stains in an upper zone, changing to grey at depths below 3 mBGS, and is moist to wet and compact to very dense. The sandy silt till contains interlayers and sand seams based on review of borehole log BH1 (EXP, 2020) and other logs.

A silty sand till was encountered below the sandy silt till (Terraprobe, 1989). The till is similar to the overlying sandy silt till but generally has less than 10 percent clay composition. The till is very dense, and cobbles were frequently encountered in this deposit.

Ground water seepage was encountered in the majority of the geotechnical boreholes at depths between 3 to 6.9 mBGS.

Groundwater levels measured in monitoring well BH1C (Trow, 2006) installed at the overburden bedrock contact indicated groundwater levels at about 180 mAMSL.

Previous grain size analyses are presented in **Table 3.1**. Based on review of the soil descriptions, grain size distribution chart comparisons, and grain size analyses the clayey silt till to silty sand till soils are designated as CL type soils (Inorganic clays, sandy clays, silty clays) under the Unified Soil Classification System. The hydraulic conductivity of the soil is estimated to range from 10^{-6} cm/sec or less based on the CL soil classification (OBC, 1997) [7].

A silty sand till was encountered below the sandy silt till based-on review of the soil descriptions, grain size distribution chart comparisons, sandy silt till is inferred as SM type soils (silty sands, sandy silt mixtures) under the Unified Soil

[7] Supplementary Guideline to the Ontario Building Code, SG-6 Percolation Time and Soil Description (Tables, 1 and 2).

Classification System. The hydraulic conductivity of this soil is estimated to range from 10^{-3} to 10^{-5} cm/sec on the SM soil classification (OBC, 1997).[8]

Bedrock

The till deposit is underlain by shale bedrock at a depth of approximately 6 mBGS (Terraprobe, 1989). The top of the shale was penetrated to a depth of 2.1 m and consisted of grey shale with limestone interbeds. The shale is highly weathered and moist.

Weathered, fragmented and broken shale and limestone was also encountered in the top 1.5 metres of the bedrock. based on review of borehole log BH3 completed as part of the Region of Peel Watermain Replacement along Bramalea Road (Coffey Geotechnics, October 30, 2009). In the absence of in-situ hydraulic conductivity tests, the bulk or secondary hydraulic conductivity of the rock mass was considered to be 10^{-3} cm/sec within the top 1.5 m of the rock formation, and between 10^{-5} and 10^{-6} cm/sec in the deeper zones of the rock.

Based on the available Site information the till and shale bedrock form an aquitard underlying the Site. Locally saturated fill, weathered portions of the till, sand interbeds within the till, overburden bedrock contact and weathered shale bedrock may form local aquifer conditions.

4. Description of Project Components and Activities

A Project Description, which includes a Site Plan, was prepared so that potential environmental effects and mitigation measures could be identified. The following subsections provide a general summary of the proposed undertaking:

Ontario disposes over 97 percent of its residual materials in landfills. The remaining three percent is managed through Energy from Waste (EFW.[9]). Of the 97 percent directed to landfill disposal, 70 percent is disposed of within Ontario and 27 percent in Michigan and New York.[10]. Based on the current disposal rate of 97%, Ontario's landfill capacity is projected to be exhausted in 11 to16 years.[11]. In order to address the compounding issues of growing population and diminishing landfill capacity in southern Ontario, Emerald EFW has identified an opportunity to develop new EFW capacity at their existing facility in Brampton.

The purpose of this Project is to provide additional processing capacity at the Emerald EFW facility in Brampton, Ontario in order to divert a portion of the non-hazardous residual materials produced by Ontario residents and businesses from landfills, thereby recovering energy for use within the community. The proposed Project would allow for three new gasification units, each capable of processing up to 300,000 tonnes of residual waste per year, for a total processing capacity at the facility of 900,000 tonnes annually. This would increase the permitted annual waste processing amount from 182,000 to 900,000 tonnes. The proposed change in the annual processing capacity requires additional facility infrastructure and a change to the Site footprint.

The project for which the Environmental Screening Process is being undertaken is a proposed redevelopment of the existing site and involves a change to the final site capacity and footprint. A high level of construction & demolition will be required to implement the proposal. The redevelopment will be implemented in 3 phases. In phase 1, the existing facility will remain operational while the first new processing line is constructed. Phases 2 and 3 will be installed and commissioned in response to market demand. The existing facility would be removed. Emerald EfW will undergo an ECA amendment for changes to approved processing capacity and other operational activities. From a traffic perspective there will be no changes to existing haul routes or Site entrance. Increasing the annual processing

[8] Supplementary Guideline to the Ontario Building Code, SG-6 Percolation Time and Soil Description (Tables, 1 and 2).
[9] Solid Waste in Ontario: Landfill Report, Ontario Waste Management Association, January 2021.
[10] Ibid.
[11] Ibid.

capacity will result in increased truck traffic on the haul route from Highway 407 along Bramalea Road on an annual basis. This is expected to be acceptable relative to local traffic volumes.

The Redevelopment of the EEFW Facility is presented in two different site plans Line 1 (see **Figure 4.1**) and All Lines (see **Figure 4.2**).

Line 1 would include the addition of a new free-standing building on the southern portion of the property adjacent to the existing facility. The Line 1 site plan consists of a bottom ash bunker 16 m x 18 m, boiler hall with dimensions of 110 m x 35 m, waste bunker with grab lowering shaft 70 m x 40 m and reception hall 45 m x 40 m which will be constructed as large housed structures up to several storeys in height 36 m.

The All Lines design, in addition to the proposed structures of Line 1 would include the redevelopment of the existing plant facilities to include two additional boiler room 110 m x 35 m each, an additional reception hall 45 m x 40 m, control room 15 m x 20 m, access ramp 5 m with a 1:10 Slope, a free standing workshop 20 m x 45 m and air colling array. These additions to the design would replace the existing plant.

The deepest subgrade structure for both Line 1 and All Lines is anticipated to be the Waste Bunker at 15 mBGS, from ground elevation of 183 mAMSL to 168 mAMSL (see **Figures 4.1a,b and 4.2a,b**). All subgrade structures with dimensions are presented on Table 4.1 below:

Table 4.1 Summary of Proposed Emerald EfW Facility Design Buildings Below Grade

Design Components	Lowest Finished Floor Elevation (mBGS)	Lowest Finished Elevation (mAMSL)	Dimensions	
			Length (m)	Width (m)
Line 1				
Waste Bunker	15	168.0	70	30
Bottom Ash Bunker	11.5	171.5	18	16
Boiler Hall	8.5	174.5	60	35
Grab Lifting Shaft	8.5	174.5	70	10
All Lines				
Waste Bunker	15	168.0	70	30
Bottom Ash Bunker	11.5	171.5	18	16
Boiler Hall	8.5	174.5	60	105
Grab Lifting Shaft	8.5	174.5	70	10
Control Room	8.5	175.5	20	15
Exterior Ramp	8.5	174.5	85	5

4.1 Preliminary Construction Groundwater Taking Estimates

The proposed Redevelopment of the EEFW Facility lowest level finished floor elevation (FFE) is at 168.0 mAMSL based on the site profile sketches (**Figures 4.1a,b and 4.2 a,b**). The below ground foundations excavation is anticipated to intersect permeable deposits and weathered shale bedrock at the overburden bedrock contact. Construction dewatering would be needed to lower the groundwater levels below the base of the excavation to provide safe dry working conditions.

Preliminary construction groundwater taking estimates for Line 1 and All Lines is provided below based on secondary source information and soil texture.

4.1.1 Line 1

A summary of the relevant depths and corresponding elevations is provided as follows:

Table 4.2 Summary of Relevant Construction Depths

Excavation	Depth (m)	Elevation (mAMSL)
a) Ground Floor FFE	0.0	183.0
b) Proposed Lowest Structure (FFE)	15.0	168.0
c) Bottom of Dewatering	16.5	166.5
d) Water Table*	1.7	181.3*
e) Bottom (weathered bedrock)	7.5	175.5

Note: *Highest GW level observed in historic logs and is considered to be representative of fluctuation of observed average groundwater level of 3 mBGS.
mBGS - metres below ground surface.
mAMSL - metres above mean sea level

The bottom of the proposed basement is anticipated to be below the overburden bedrock contact. Dewatering is expected to 5.8 m below the water table (181.3 mAMSL – 175.5 mAMSL = 5.8 m). The lower bedrock is expected to be of sufficient competency to be representative of an aquitard.

The soil texture and estimated hydraulic conductivity of the weathered shale bedrock was used to estimate the hydraulic properties (hydraulic conductivity), groundwater taking rates, and area of influence for the structure excavations within the various deposits, as follows:

Table 4.3 Bulk Hydraulic Conductivity – Line 1

Material	Soil	Approximate Elevation Range (mAMSL)	Saturated Thickness (m)	Highest Hydraulic Conductivity (cm/s)
1	Clayey Silt to Sandy Silt Till	181.5 to 179.0	Up to 2.3 m	1.00×10^{-6}
2	Silty Sand Till	179.0 to 177.0	2.0 m	1.00×10^{-3}
3	Weathered Shale Bedrock	177.0 to 175.5	1.5 m	1.00×10^{-3}
4	Shale Bedrock	175.5 to <165.0	>9.0 m	1.00×10^{-5}

The temporary water takings and area of influence during an open cut excavation were determined using the field test results and the analytical solution for groundwater seepage (confined flow) of a shaft (CGS, 2013), as presented below:

EQUATION AND PARAMETERS

1) $$Q = \frac{2\pi KB(H-h_w)}{\ln R_O/r_w}$$

2) $$r_w = \sqrt{\frac{ab}{\pi}}$$

3) $$L = R_O = 3000(\Delta H)\sqrt{K}$$

where:
Q = constant pumping rate (m^3/day)
K = hydraulic conductivity (m/day)
H = height of groundwater pressure (m)
h_w = dewatering height (m)
B = hight of aquifer (m)
R_o = radius of influence (m)

rw = radius of footprint (m)
a = length of excavation (m)
b = width of excavation (m)

The analytical model input parameters are provided on **Table D.1**, and are summarized as follows:

Q = calculated groundwater seepage rate for an excavation with dimensions 105 m x 100 m
K = 0.864 m/day (1.00 x 10^{-3} cm/s)
H = 5.80 m height of water table
h_w = 0.00 m dewatering height
B = 3.5 m aquifer height
R_o = 91.16 m
r_w = 40.88 m
a = 75.0 m
b = 70.0 m

A hydraulic conductivity of 1.00 x10^{-3} cm/s was used to estimate the groundwater seepage. The steady state groundwater takings were estimated to be approximately 125.57 cubic metres per day (m^3/day) (**Table D.1)** or 125,570 L/day, or 87.193 L/min into the excavation. A water taking at this rate was predicted to result in an area of influence of approximately 91 m from the centre of the open cut excavation. A safety factor of 2X is then applied to account for the removal of the initial groundwater storage during the early stages of the water taking. Based on this, the maximum water takings were estimated to be up to 251.14 m^3/day (251,140 L/day).

Registration of construction water takings on the Ministry of the Environment Conservation and Parks (MECP) Environmental Activity and Sector Registry (EASR) is required for construction groundwater takings between 50,000 to 400,000 L/day, and a Permit to Take Water (PTTW) is required for groundwater takings greater than 400,000 L/day.

The preliminary estimated dewatering rate for the proposed Line 1 is 251,140 L/day, which is within the EASR limit between 50,000 to 400,000 L/day. Therefore, a groundwater taking EASR may be required for construction dewatering of the proposed Line 1 below ground excavations. Site specific investigation and assessment are needed to verify the potential construction dewatering rates.

4.1.2 All Lines

A summary of the relevant depths and corresponding elevations for All Lines is provided as follows:

Table 4.4 Summary of Relevant Construction Depths

Excavation	Depth (m)	Elevation (mAMSL)
a) Ground Floor FFE	0.0	183.0
b) Proposed Lowest Structure (FFE)	15	168
c) Bottom of Dewatering	13.0	166.5
d) Water Table*	1.7	181.3*
e) Bottom (weathered bedrock)	7.5	175.5

Note: *Highest GW level observed in historic logs and is considered to be representative of fluctuation of observed average groundwater level of 3 mBGS..
mBGS - metres below ground surface.
mAMSL - metres above mean sea level

Similar to Line 1, the bottom of the proposed basement is anticipated to be below the overburden bedrock contact. Dewatering is expected to 5.8 m below the water table (181.3 mAMSL – 175.5 mAMSL = 5.8 m). The lower bedrock is expected to be of sufficient competency to be representative of an aquitard.

The soil texture and estimated hydraulic conductivity of the weathered shale bedrock was used to estimate the hydraulic properties (hydraulic conductivity), groundwater taking rates, and area of influence for the structure excavations within the various deposits, as follows:

Table 4.5 Bulk Hydraulic Conductivity – All Lines

Material	Soil	Approximate Elevation Range (mAMSL)	Saturated Thickness (m)	Highest Hydraulic Conductivity (cm/s)
1	Clayey Silt to Sandy Silt Till	181.5 to 179.0	Up to 2.3 m	1.00×10^{-6}
2	Silty Sand Till	179.0 to 177.0	2.0 m	1.00×10^{-3}
3	Weathered Shale Bedrock	177.0 to 175.5	1.5 m	1.00×10^{-3}
4	Shale Bedrock	175.5 to <165.0	>9.0 m	1.00×10^{-5}

The temporary water takings and area of influence during an open cut excavation were determined using the field test results and the analytical solution for groundwater seepage (confined flow) of a shaft (CGS, 2013), as presented below:

EQUATION AND PARAMETERS

1) $$Q = \frac{2\pi KB(H-h_w)}{\ln R_O/r_w}$$

2) $$r_w = \sqrt{\frac{ab}{\pi}}$$

3) $$L = R_O = 3000(\Delta H)\sqrt{K}$$

where:
Q = constant pumping rate (m^3/day)
K = hydraulic conductivity (m/day)
H = height of groundwater pressure (m)
h_w = dewatering height (m)
B = hight of aquifer (m)
R_o = radius of influence (m)
rw = radius of footprint (m)
a = length of excavation (m)
b = width of excavation (m)

The analytical model input parameters are provided on **Table D.2**, and are summarized as follows:

Q = calculated groundwater seepage rate for an excavation with dimensions 105 m x 100 m
K = 0.864 m/day (1.00×10^{-3} cm/s)
H = 5.80 m height of water table
h_w = 0.00 m dewatering height
B = 3.5 m aquifer height
R_o = 108.09 m
r_w = 57.81 m
a = 105.0 m
b = 100.0 m

Note: Height measurements are relative to base of the active groundwater flow system.

A hydraulic conductivity of 1.00×10^{-3} cm/s was used to estimate the groundwater seepage. The steady state groundwater takings were estimated to be approximately 160.92 cubic metres per day (m^3/day) (**Table D.2)** or

160,920 L/day, or 111.74 L/min into the excavation. A water taking at this rate was predicted to result in an area of influence of approximately 108 m from the centre of the open cut excavation. A safety factor of 2X is then applied to account for the removal of the initial groundwater storage during the early stages of the water taking. Based on this, the maximum water takings were estimated to be up to 321.84 m^3/day (321,840 L/day).

Registration of construction water takings on the Ontario Environmental Activity and Sector Registry (EASR) is required for construction groundwater takings between 50,000 to 400,000 L/day, and a Permit to Take Water (PTTW) is required for groundwater takings greater than 400,000 L/day.

The preliminary estimated dewatering rate for All Lines is 321,840 L/day, which is within the EASR limit between 50,000 to 400,000 L/day. Therefore, a construction groundwater taking EASR may be required for dewatering of the All Lines below ground excavations. Site specific investigation and assessment are needed to verify the potential construction dewatering rates.

4.2 Long Term Groundwater Management

Due to the groundwater table elevation at the Site and seasonal fluctuations of the groundwater level, hydrostatic pressures on the subfloor and structures are anticipated. There are two alternative methods to manage the hydrostatic pressures:

1. A subfloor and perimeter drainage system (Permanent Drainage System – (PDS)) and a waterproofing membrane compatible with the drainage system installed beneath the slab. The purpose of the subfloor drainage system is primarily to depress the water table thus preventing a build-up of hydrostatic pressure so that the floor slab and foundation walls do not need to be designed to resist hydrostatic load. The drainage system must be designed to collect and dispose of groundwater at a rate sufficient to prevent build-up of hydrostatic pressure. The purpose of the waterproofing membrane is to minimize potential for seepage of groundwater through the slab and walls. Ongoing groundwater collection and discharge to a municipal sewer is required for this option.
2. The below ground structures can also be designed as ‘water tight’. This will eliminate the need to install and maintain subfloor drains, but is otherwise likely to be more costly. The below ground structure slabs will have to be designed to resist hydrostatic and uplift pressures. Groundwater collection is not required for this option.

A water tight (or ‘bathtub’) design is planned for the proposed development, which will minimize or eliminate the potential for any long term groundwater seepage as well as the management of any groundwater. Based on this, an MECP groundwater taking permit to take water (PTTW) would not be required for the long term operation of the facility.

5. Potential Effects, Mitigation Measures & Net Effects

This section documents the potential effects on the environment, mitigation measures and net environmental effects for Geology and Hydrogeology resulting from the proposed undertaking.

5.1 Methodology

The assessment of effects associated with the proposed undertaking was carried out through a series of steps that is based, in part, on the description of existing conditions as well as the Project Description and Site Plan. The assessment of effects was also undertaken within the context of the previously completed Screening Criteria Checklist, as summarized in **Section 2.0** of this report.

The assessment of impacts associated with the Emerald Energy from Waste facility was undertaken based on review of the proposed plans, next the geology and hydrogeology was described based on secondary information sources. With an understanding of the geology and hydrogeology developed, the identified potential effects, recommended mitigation measures, and net effects were reviewed and confirmed to ensure their relevance in relation to the design concept (Sections 5.2.1). Next, the mitigation measures and associated monitoring were prepared, followed by the identification of approvals required for the new design (Section 5.2.2).

The geological and hydrogeological conditions were assessed to determine potential changes to the groundwater quantity or quality as a result of changes to the existing Site footprint and on-site operations which could result in a reduction of groundwater recharge, and increased runoff of potentially poor quality water.

The geological and hydrogeological conditions were assessed to determine potential migration pathways in the unlikely event of an accidental spill or release to the environment. It should be noted that the on Site material would be limited to fuel, lubricating oils, and other fluids associated with maintaining the equipment.

5.2 Geology and Hydrogeology Net Effects

This Section provides an assessment of the potential negative environmental effects (i.e., those for which a "Yes" answer was given in the Screening Criteria Checklist) for those Geology and Hydrogeology criteria which might be affected by the project as identified in **Section 2.0**. The effects assessment describes how existing environmental conditions in the Study Area(s) would change as a result of the construction and operation of the proposed undertaking.

As described in **Section 2.0**, a “Yes” was applied to the following Geology and Hydrogeology criteria:

	Criterion	YES	NO	Additional Information
	Might the project…			
Ground Water				
1.1	Cause negative effects on ground water quality, quantity, or movement?	X		The proposed EFW Facility expansion would result in changes to the existing site footprint and on-site operations and may cause potential negative effects on groundwater quality, quantities, or flows. The Proponent may consider various Best Management Practices (BMPs) to mitigate such impacts. These may include paving of traffic surfaces to limit infiltration through road/access areas, paved-surface cleaning efforts to remove deleterious constituents, direction of poor-quality runoff through water quality improvement systems, direction of clean-runoff to infiltration zones (where suitable conditions permit infiltration).
1.2	Cause negative effects on surface or ground water from accidental spills or releases (e.g., leachate) to the environment?	X		Materials On-Site include fuel, lubricating oils, and other fluids associated with maintaining the equipment. Staff will be routinely trained in spill response and containment techniques, and proper safeguards will be implemented.

With respect to the above criteria/criterion, a description of the potential negative environmental effects, necessary mitigation measures and the resultant net effects on the environment are discussed.

Review of the secondary source information during the screening showed that the anticipated effects will be much less than anticipated based on the low permeability deposits underlying the Site. In all cases, impact management (mitigation) measures have been identified that, when applied, will eliminate the potential environmental effects, or reduce them to acceptable levels.

5.2.1 Potential Effects in Geology and Hydrogeology Environment

Water Balance

The proposed EFW Facility expansion would result in changes to the existing Site footprint and on-site operations and may cause potential negative effects on groundwater quality, quantities, or flows due to an increase in impermeable surface and change in the Site water balance. The increased water surplus/runoff has the potential to decrease groundwater recharge and increase the amount of flow to adjacent surface water features wetlands and creek.

It is anticipated an increase in impermeable surfaces would result in surplus water that would need to be managed by stormwater management and low impact development methods. A given amount of water would need to be infiltrated into the subsurface to maintain the Site water balance, and to reduce potential effects on adjacent surface water features.

A site-specific water balance would be undertaken to determine the amount of water surplus generated for the existing and proposed Site conditions. Water surplus is the total water available in a given month to runoff as surface overland flow and/or infiltrate to the ground and recharge the groundwater table. Under the proposed development scenario, the amount of runoff is anticipated to increase as a result of the increase in impervious area and decrease in pervious area.

The water balance and stormwater management is considered to have a moderate to low potential impact based on the low permeability till and shale bedrock aquitards underlying the Site. The existing recharge on the Site is anticipated to be low, based on the low permeability strata, and thus the increased impermeable surface are not anticipated to have as great an effect on recharge.

Contaminant Sources

Fuel and oils could potentially leak or be released onto the ground such that they infiltrate and impact the groundwater. In the unlikely event of an accidental spill or release to the environment, the materials would need to pass through engineered controls first (i.e. impervious paved surfaces, containment areas). Should the materials pass through the engineered controls, there is the potential to migrate downward into the surficial soils and possibly bedrock. The dense till soils and low permeability shale bedrock beneath the Site are anticipated to prevent the movement of impacted groundwater. Contaminant sources are considered to have a moderate to low potential impact based on the low permeability till and shale bedrock aquitards underlying the Site.

5.2.2 Mitigation Measures

Water Balance

The location, design, and construction of the stormwater management controls would be completed in accordance with, at a minimum, the following guidance documents:

- The Corporation of the City of Brampton Subdivision Design Manual (December 2008)
- Stormwater Management Planning and Design Manual (MECP, 2003)
- Low Impact Development Stormwater Management Planning and Design Guide (CVC & TRCA, 2010)
- Low Impact Development Stormwater Management Guidance Manual – Draft Version (MECP, 2017)
- Toronto and Region Conservation Authority Stormwater Management Criteria (August 2012)

It should be noted that additional construction measures could be required to meet required guidelines. These guidelines include maintaining a minimum of 1.0 m buffer from the seasonally high groundwater table and 4.0 m buffer from building foundations for infiltrative (LID) measures. Additional construction measures that could enhance infiltration and evapotranspiration include:

- Reduction of grading to 0.5 - 1.0% slope in parking lot, landscape areas, and swales to allow for additional evapotranspiration and infiltration.

- Scarification, or tilling of the soil to a depth of approximately 300 mm, would enhance evapotranspiration and infiltration within the landscaped areas to overcome soil compaction that occurs during construction.

Should additional infiltration measures be required to meet infiltration targets, the following stormwater management controls could be further evaluated for feasibility at the Site:

- Underground storage chambers could provide stormwater detention and allow for infiltration into the underlying soils or be directed to the dry detention pond. Surface runoff from the parking lots with appropriate controls and/or roof runoff could be directed to the underground storage chambers. During major storm events, the surface runoff would drain overland towards the dry detention pond and/or existing SWM system.

Contaminant Source

Materials on-Site include fuel, lubricating oils, and other fluids associated with maintaining the equipment. Staff will be routinely trained in spill prevention, response and containment techniques, and proper safeguards will be implemented. Potential fuel handling and storage that may include above or below ground storage tanks would require specific design, protection, inspections, leak detection, monitoring, record keeping, maintenance and other methods to ensure handling and storage of fuel does not impact groundwater.

Accidental spills and releases are difficult events to predict and manage, but having a process designed to minimize and contain releases, a mitigation plan available to address any releases, and staffing resources trained to implement the plan, are all key elements to good stewardship of the environment. Staff will be routinely trained in spill response and containment techniques, and proper safeguards will be implemented. Operations staff would also maintain the following:

- Security
- Site operation and management
- Vehicle management
- Annual maintenance
- Training and record keeping
- Inventory of on-Site fuels, oils, chemicals
- Environmental monitoring

The handling and storage of fuels and oils are determined based on, quantities, storage and handling practices to ensure existing and future handling and storage do not impact the groundwater. Inspections for the handling and storage of fuel, environmental management and prevention plans, and spill emergency and response plans would be implemented to address potential impacts.

Best Management Practices (BMPs) to mitigate potential contaminant source impacts also include paving of traffic surfaces to limit infiltration through road/access areas, paved-surface cleaning efforts to remove deleterious constituents, direction of poor-quality runoff through water quality improvement systems, direction of clean-runoff to infiltration zones (where suitable conditions permit infiltration). Having impervious (paved) surfaces or containment areas where spills are likely to occur will help protect the environment from infiltration of unplanned spills and releases, and having an isolation system in place will help to minimize and contain any releases which make it into the ground/groundwater system.

Should further work be required due to an accident or spill, on Site, the contaminated soil would be excavated and properly disposed off site at a secure facility. The assessment would be based on visual and olfactory examination of the soil. During the excavation work, and depending on the extent of the accidental spill or release, if it was determined that the material entered the subsurface, a shallow monitoring well would be installed downgradient of the spill location. The well would be developed and a groundwater sample collected for appropriate parameters based on the nature of the spill or release.

5.2.3 Net Effects

Water Balance

The reduction of groundwater recharge is anticipated to have a negligible effect on groundwater and nearby surface water features, based on the presence low permeable till deposits and shale bedrock beneath the Site and vicinity. In addition, the implementation of appropriate mitigation measures will mitigate the potential loss of recharge, and increased surface water runoff would be negligible, as the water surplus would be managed through stormwater management and/or low impact development methods.

A potential change in the water balance would have no net effect, based on the Site conditions and mitigation measures.

Contaminant Source

The migration of impacted groundwater would be minimal, based on the presence of thick, fine grained, low permeable overburden and bedrock beneath the Site and vicinity. As such, groundwater within the overburden or bedrock would not be impacted. In addition, the implementation of appropriate mitigation measures will reduce the potential for impact of migrating groundwater affected by an accidental spill or release, as localized cleanup would be conducted in a proper and timely manner prior to any discharge to surface water.

Immediate localized cleanup of any potential spill or release would be conducted and thus impact would not be an issue. It is unlikely that there are any shallow permitted groundwater users downgradient of the Site that utilize groundwater as a source of potable drinking water in this industrial, municipally serviced area.

A potential spill would have no net effect due to the Site conditions and mitigation measures.

6. Monitoring Requirements and Additional Approvals

To ensure that the mitigation measures identified in **Section 5.2.2** are implemented as envisioned, a strategy and schedule will be developed for monitoring environmental effects, if needed. With these mitigation measures and monitoring requirements in mind, commitments will be made as appropriate for ensuring that they are carried out as part of the construction, operation, and maintenance of the proposed undertaking.

6.1 Monitoring Requirements

Stormwater Management

Environmental Compliance Approval (ECA) stormwater management conditions will be reviewed and an appropriate monitoring plan will be prepared, if needed to ensure that the project does not impact groundwater (quantity, quality) or surface water.

Contaminant Sources

It is expected that any surface water or groundwater monitoring requirements would be addressed and included as a condition of an ECA by the MECP issued for the Site. It is envisioned that at most, a couple of shallow overburden wells would be recommended at the downgradient property boundary, if required. However, installation of a monitoring well downgradient of an accidental spill or release, if warranted, would be more appropriate based on the nature of the proposed operations at the facility.

6.2 Additional Approvals

Potentially applicable approvals, permits and regulations related to construction groundwater takings include the following:

Provincial (Ontario)

Ontario Water Resources Act R.S.O. c.0.40, s.34, O. Reg. 387/04 (OWRA)

- Ministry of the Environment, Conservation and Parks – Conditions of Permit to Take Water (PTTW)
- Ministry of the Environment, Conservation and Parks – Conditions of Environmental Activity Sector Registry (EASR)
- Toronto and Region Conservation Authority (TRCA) - O. Reg. 166/06 Regulation of Development, Interference with Wetlands and Alterations to Shorelines and Watercourses. Last update Feb. 8, 2013 TRCA.
- Interim TRCA Technical Guidelines for the Development of Environmental Management Plans for Dewatering, September 2013.
- Conditions of TRCA Voluntary Project Review
- Ontario Ministry of the Environment and Energy, Water Management Policies Guidelines – Provincial Water Quality Objectives (PWQO), 1999
- Applicable Ontario Provincial Standard Specifications, e.g. OPSS 518 Control of Water from Dewatering Operations; OPSS 805 Construction Specification for Temporary Erosion and Sediment Control Measures
- Conditions of Environmental Compliance Approvals (ECA)
- Regulation 903 – Wells, as amended by O.Reg. 389/09, 08 October 2009

Municipal

- City of Brampton– Municipal By-Law 90-75 By-law to control the discharge of sewage into the storm sewer system of the Municipality and to regulate the use of public and private sewers, and the installation and connection of storm sewer connections to the public storm sewer systems and watercourses.
- The Regional Municipality of Peel – By-Law Number 53-2010. By-law to regulate the discharge of matter into the sanitary and storm sewage systems of the Regional Municipality of Peel and making provision for the establishment of sewer rates and charges on persons for such services or activities, pursuant to the Municipal Act, 2001.

7. Conclusion

The Site is primarily underlain by a dense till and shale bedrock, which form an aquitard underlying the Site.

The geological and hydrogeological conditions were assessed to determine potential changes to the groundwater quantity or quality as a result of changes to the existing Site footprint and on-site operations which could result in a reduction of groundwater recharge, and increased runoff of potentially poor quality water. The conditions were also assessed to determine potential migration pathways in the unlikely event of an accidental spill or release to the environment.

Groundwater Takings

The proposed development subsurface excavations for structures that intersect the water table, may require a construction groundwater taking Ministry of the Environment, Conservation and Parks (MECP) Environmental Activity and Sector Registration (EASR), based on the requirements under the Ontario Water Resources Act. An EASR is required for groundwater takings between 50,000 to 400,000 L/day.

Preliminary construction groundwater taking estimates based on secondary source information and soil textures indicates that Line 1 and All Lines would require a construction groundwater taking EASR. Site specific investigation and assessment are needed to verify the potential construction dewatering rates.

A water tight (or 'bathtub') design is planned for the proposed development, which will minimize or eliminate the potential for any long term groundwater seepage as well as the management of any groundwater. Based on this, an MECP groundwater taking permit to take water (PTTW) would not be required for the long term operation of the facility.

Water Balance

An increase in impermeable surfaces would result in surplus water that would need to be managed by stormwater management and low impact development methods. A given amount of water would need to be infiltrated into the subsurface to maintain the Site water balance, and to reduce potential effects on adjacent surface water features.

The reduction of groundwater recharge is anticipated to have a negligible effect on groundwater and nearby surface water features, based on the presence low permeable till deposits and shale bedrock beneath the Site and vicinity. In addition, the implementation of appropriate mitigation measures will mitigate the potential loss of recharge as the water surplus would be managed through stormwater management and/or low impact development methods.

A potential change in the water balance would have no net effect, based on the Site conditions and mitigation measures.

Environmental Compliance Approval (ECA) stormwater management conditions will be reviewed, and an appropriate monitoring plan will be prepared, if needed to ensure that the project does not impact groundwater (quantity, quality) or surface water.

Contaminant Source

Fuel and oils could potentially leak or be released onto the ground such that they infiltrate and impact the groundwater. In the unlikely event of an accidental spill or release to the environment, the materials would need to pass through engineered controls first (i.e. impervious paved surfaces, containment areas). Should the materials pass through the engineered controls, there is the potential to migrate downward into the surficial soils and possibly bedrock.

The migration of impacted groundwater would be minimal, based on the presence of thick, fine grained, low permeable overburden and bedrock beneath the Site and vicinity. As such, groundwater within the overburden or bedrock would not be impacted. In addition, the implementation of appropriate mitigation measures will reduce the potential for impact of migrating groundwater affected by an accidental spill or release, as localized cleanup would be conducted in a proper and timely manner prior to any discharge to surface water.

A potential spill would have no net effect due to the Site conditions and mitigation measures.

It is expected that any surface water or groundwater monitoring requirements would be addressed and included as a condition of an ECA by the MECP issued for the Site.

All of Which is Respectfully Submitted,

GHD



Palmer Willis, B.Sc.





Philip Smart, P. Geo.

Figures



Paper Size ANSI A

0 50 100 150 200

Meters

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983
Grid: NAD 1983 UTM Zone 17N

N

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Emerald Energy from Waste Inc.
EMERALD ENERGY FROM WASTE ENVIRONMENTAL SCREENING & ECA AMENDMENT
GEOLOGY AND HYDROGEOLOGY ASSESSMENT REPORT

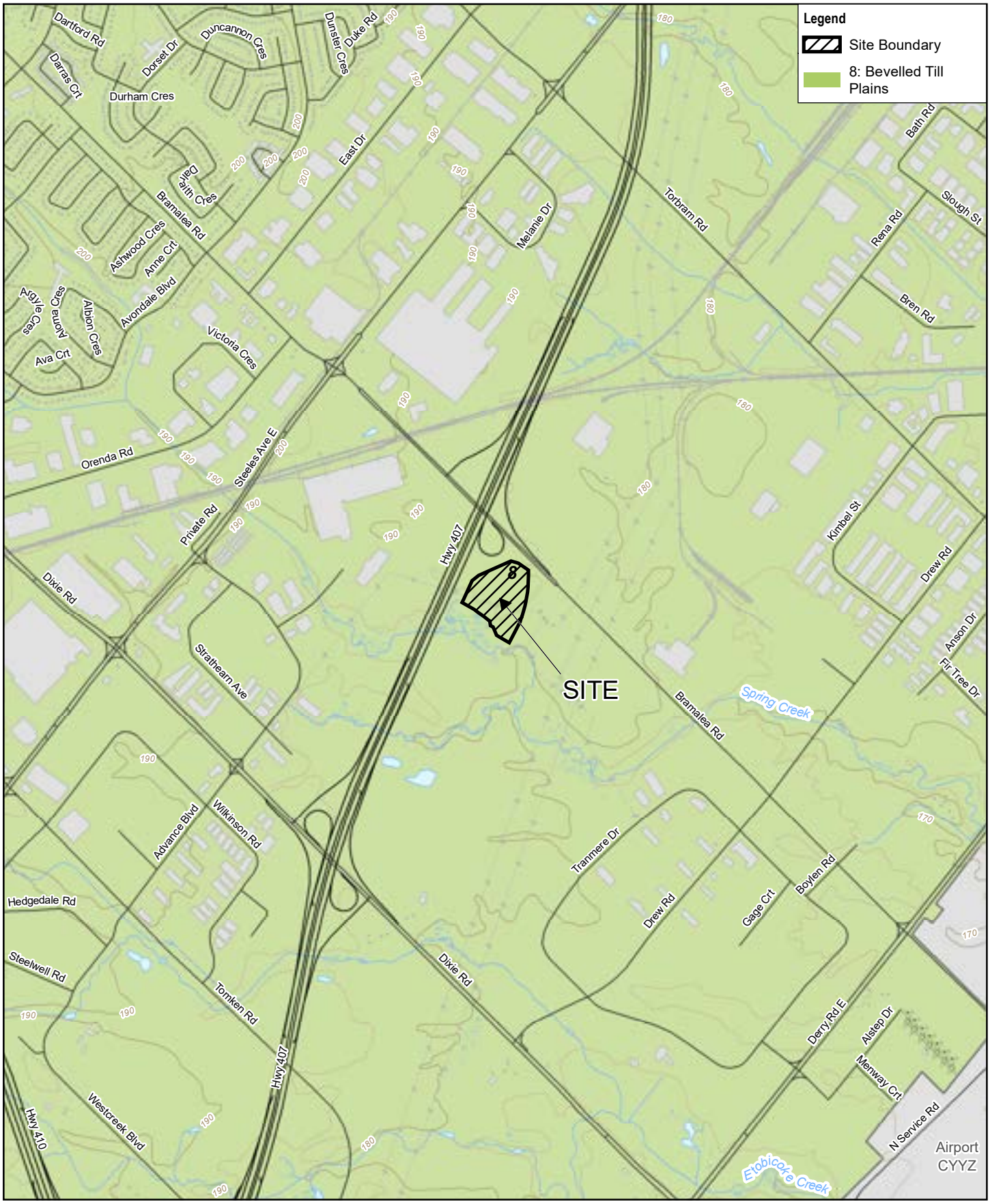
Project No. **12593193**
Revision No. **-**
Date **Jul 11, 2023**

LANDUSE (AERIAL IMAGE)

FIGURE 2.1

Q:\GIS\PROJECTS\12593000s\12593193\Layouts\202307_HydrogeologicalAssessment\12593193_002_RegionalTopographyMap.mxd

Data source: MNDMNRF NRVIS, 2021. Produced by GHD under licence from Ontario Ministry of Natural Resources and Forestry, © King's Printer 2023. Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community



Paper Size ANSI A

0 125 250 375 500

Metres

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983
Grid: NAD 1983 UTM Zone 17N

N

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EMERALD ENERGY FROM WASTE INC.
EMERALD ENERGY FROM WASTE ENVIRONMENTAL SCREENING & ECA AMENDMENT
GEOLOGY AND HYDROGEOLOGY ASSESSMENT REPORT

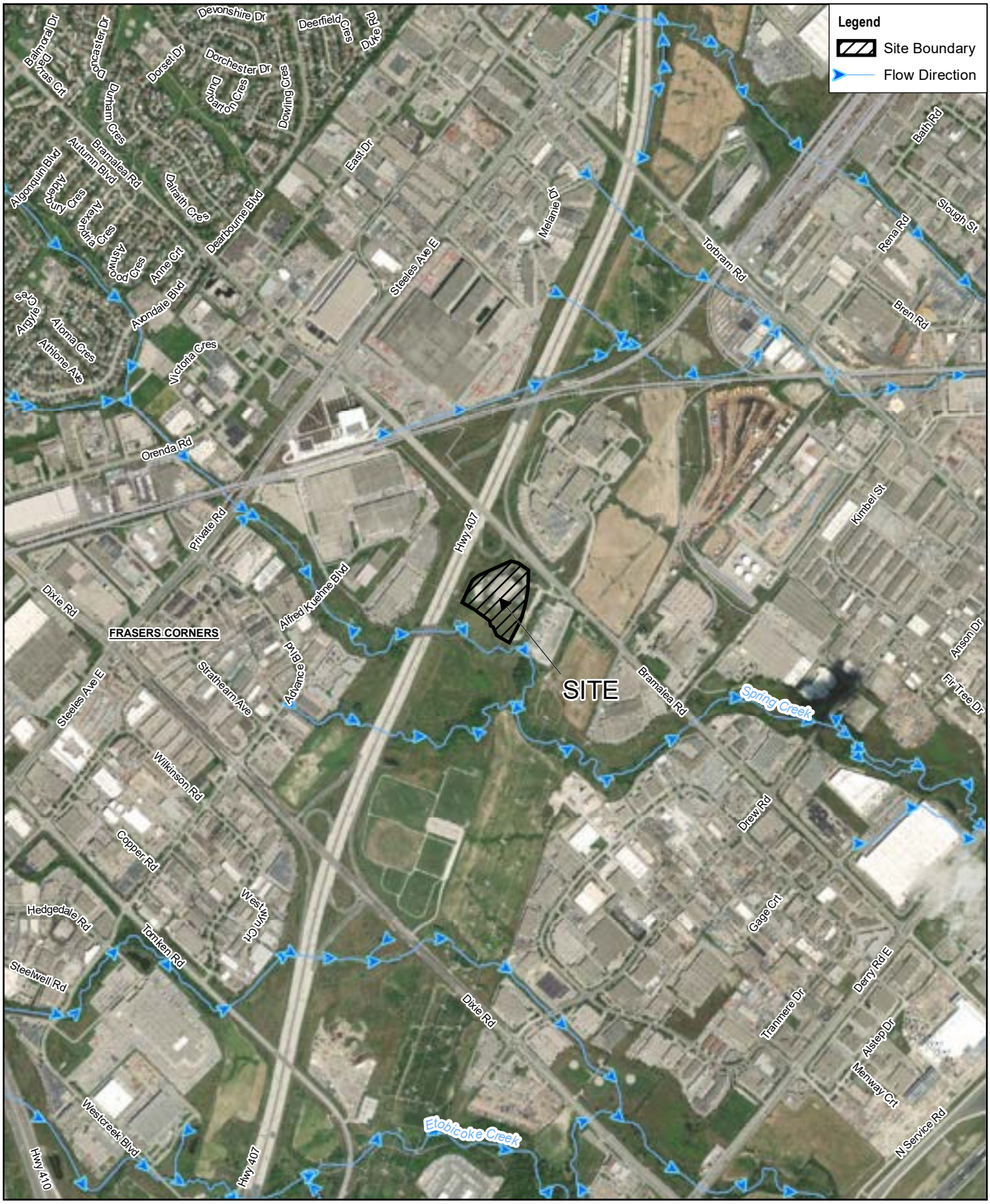
PHYSIOGRAPHY

Project No. **12593193**
Revision No. **-**
Date **Jul 11, 2023**

FIGURE 2.2

O:\GIS\PROJECTS\12593000s\12593193\Layouts\202307_HydrogeologicalAssessment\12593193_004_Physiography.mxd
Print date: 11 Jul 2023 - 07:43

Data source: MNDMNRF NRVIS, 2021. Produced by GHD under licence from Ontario Ministry of Natural Resources and Forestry, © King's Printer 2023. Physiography of Southern Ontario; Ontario Geological Survey, Miscellaneous Release--Data 228 ISBN 978-1-4249-5158-1



Paper Size ANSI A

0 125 250 375 500

Metres

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983
Grid: NAD 1983 UTM Zone 17N

N

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EMERALD ENERGY FROM WASTE INC.
EMERALD ENERGY FROM WASTE ENVIRONMENTAL SCREENING & ECA AMENDMENT
GEOLOGY AND HYDROGEOLOGY ASSESSMENT REPORT

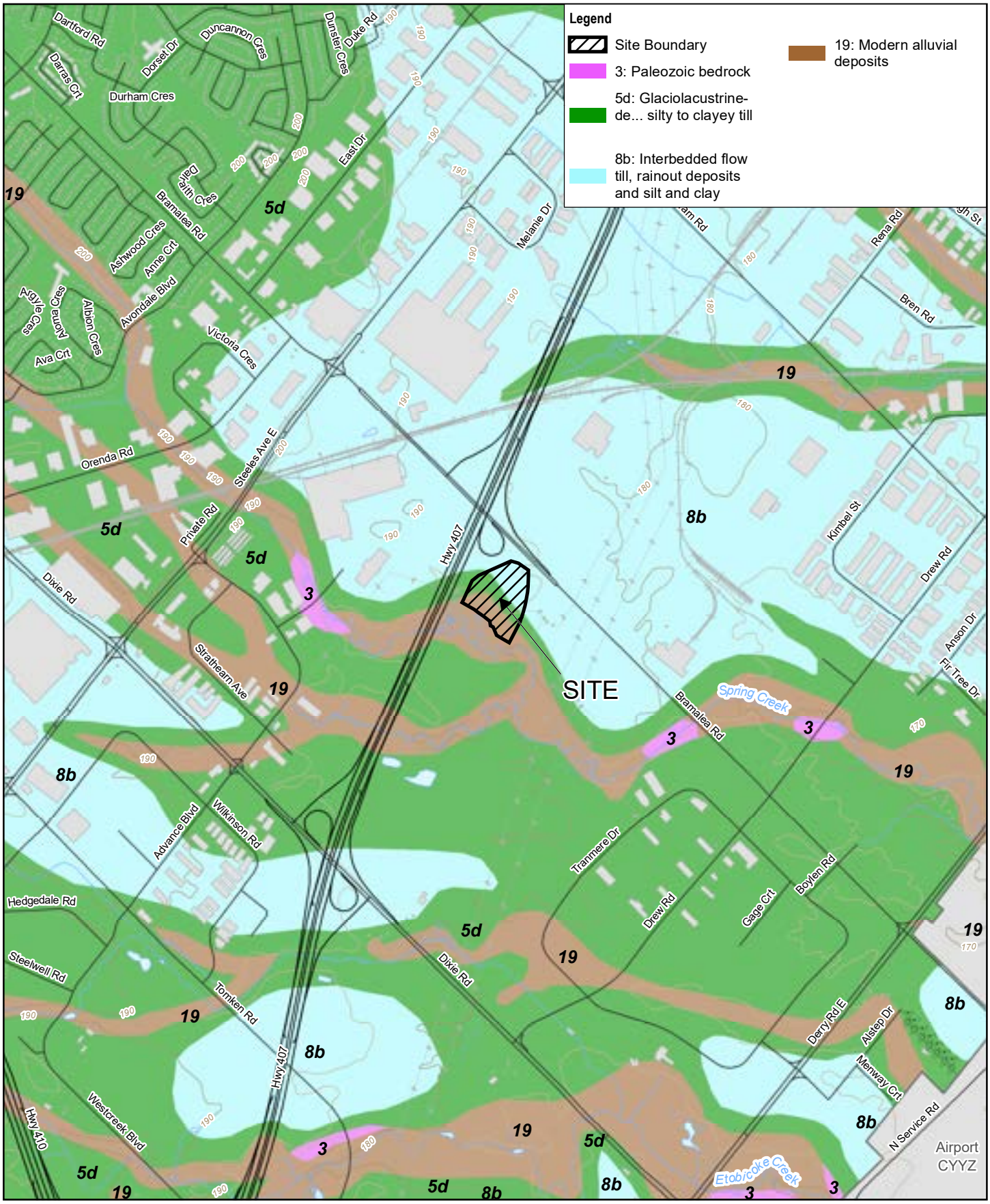
SURFACE WATER FLOW DIRECTION

Project No. **12593193**
Revision No. **-**
Date **Jul 11, 2023**

FIGURE 2.3

O:\GIS\PROJECTS\12593000s\12593193\Layouts\202307_HydrogeologicalAssessment\12593193_005_SurfaceWaterFlowDirection.mxd
Print date: 11 Jul 2023 - 07:46

Data source: MNDMNRF NRVIS, 2021. Produced by GHD under licence from Ontario Ministry of Natural Resources and Forestry, © King's Printer 2023. Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community



Paper Size ANSI A

0 125 250 375 500

Metres

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983
Grid: NAD 1983 UTM Zone 17N

N

GHD

EMERALD ENERGY FROM WASTE INC.
EMERALD ENERGY FROM WASTE ENVIRONMENTAL SCREENING & ECA AMENDMENT
GEOLOGY AND HYDROGEOLOGY ASSESSMENT REPORT

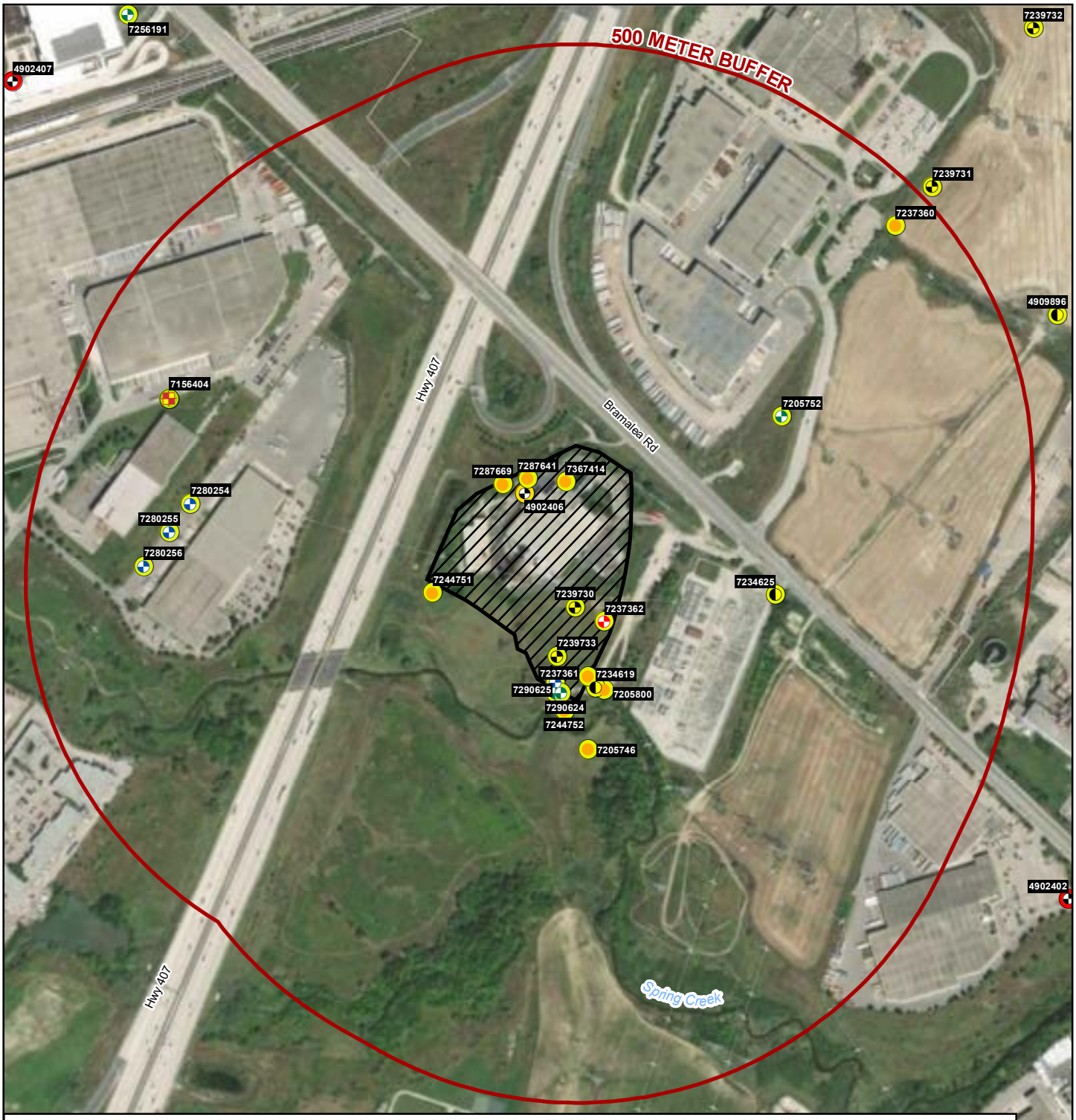
SURFICIAL GEOLOGY

Project No. **12593193**
Revision No. **-**
Date **Jul 11, 2023**

FIGURE 2.4

O:\GIS\PROJECTS\12593000s\12593193\Layouts\202307_HydrogeologicalAssessment\12593193_006_SurficialGeology.mxd
Print date: 11 Jul 2023 - 07:53

Data source: MNDMNRF NRVIS, 2021. Produced by GHD under licence from Ontario Ministry of Natural Resources and Forestry, © King's Printer 2023. Surficial geology of southern Ontario; Ontario Geological Survey, Miscellaneous Release—Data 128 – Revised.



Legend

- Site Boundary
- **WWIS - MECP Well Records**
  - Abandoned Monitoring and Test Hole (4)
  - Abandoned-Other (3)
  - Abandoned-Supply (1)
  - Monitoring and Test Hole (4)
  - Observation Wells (4)
  - Recharge Well (1)
  - Test Hole (1)
  - Water Supply (5)
  - No Data; Not A Well (9)
- **WWIS - UTM Reliability Code**
  - 10 - 30 m (3)
  - 30 - 100 m (26)
  - 100 - 300 m (2)
  - Unknown (2)

Paper Size ANSI A

0 50 100 150 200

Meters

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983
Grid: NAD 1983 UTM Zone 17N

N

GHD

EMERALD ENERGY FROM WASTE INC.
EMERALD ENERGY FROM WASTE ENVIRONMENTAL SCREENING & ECA AMENDMENT
GEOLOGY AND HYDROGEOLOGY ASSESSMENT REPORT

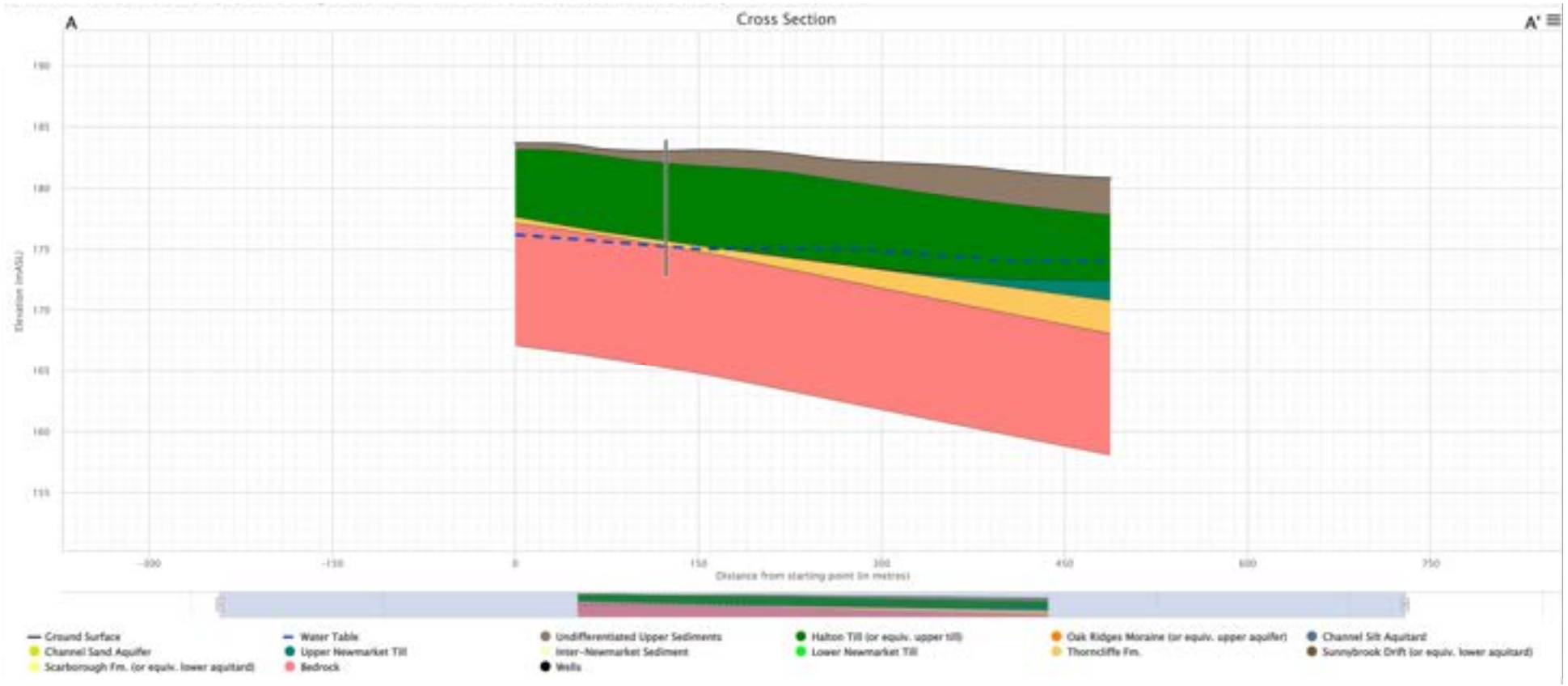
Project No. **12593193**
Revision No. **-**
Date **Jul 11, 2023**

MECP WATER WELL RECORDS

FIGURE 2.5

Q:\GIS\PROJECTS\12593000s\12593193\Layouts\202307_HydrogeologicalAssessment\12593193_007_MECPWaterWellRecords.mxd

Data source: MNDMNRF NRVIS, 2021. Produced by GHD under licence from Ontario Ministry of Natural Resources and Forestry, © King's Printer 2023. WWIS, 2020. Ontario Ministry of the Environment and Climate Change (Accessed January 2020). Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community



HORIZONTAL
1:5000
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0 5 10 15
VERTICAL
1:500

GHD

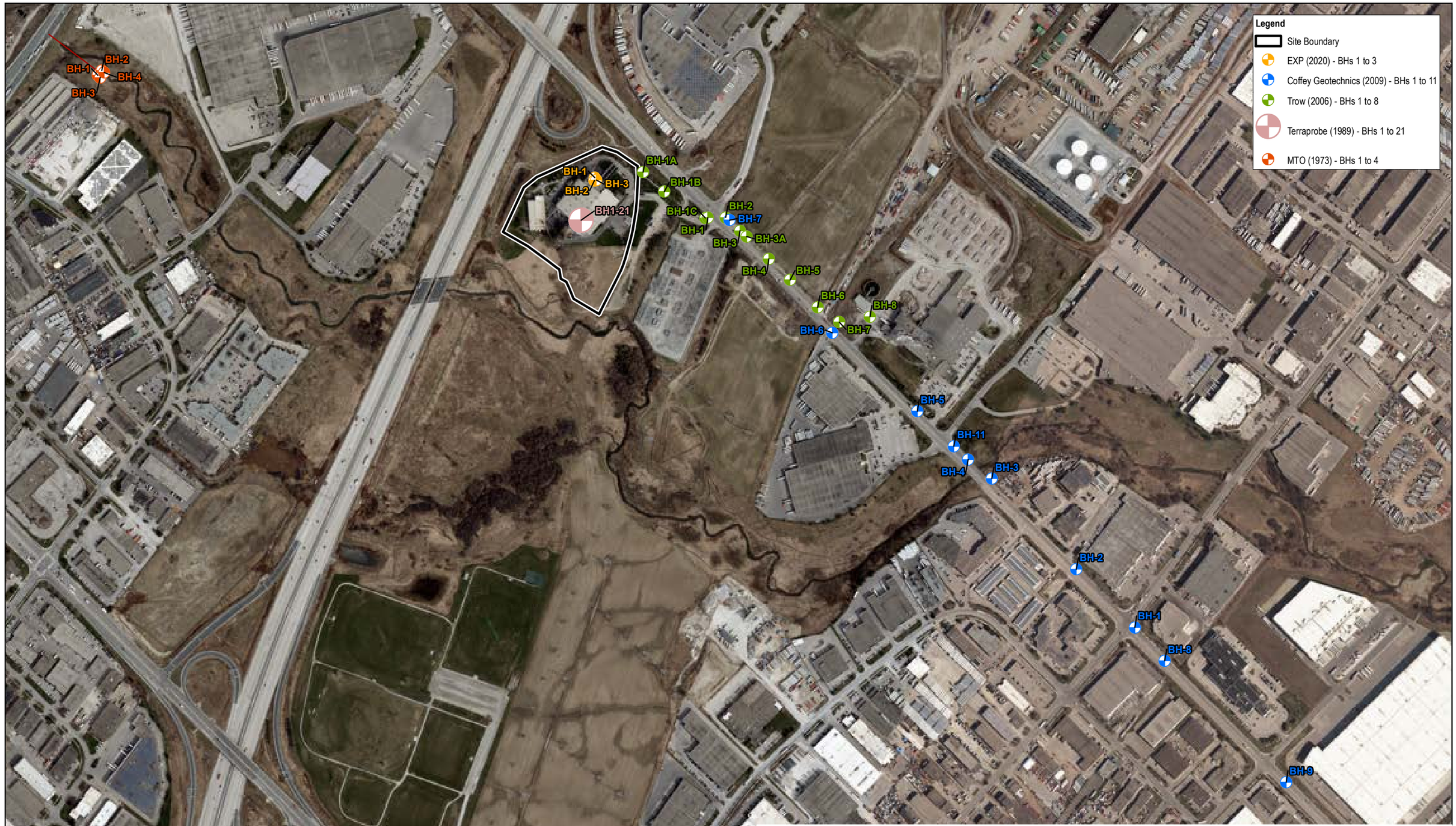
EMERALD ENERGY FROM WASTE INC.
EMERALD ENERGY FROM WASTE ENVIRONMENTAL SCREENING & ECA AMENDMENT
GEOLOGY AND HYDROGEOLOGY ASSESSMENT REPORT

CROSS-SECTION

Project No. **12593193**
Date **July 2023**

FIGURE 2.6

Filename: \\ghdnet\ghd\CA\Toronto\Projects\662\12593193\Digital_Design\ACAD\Figures\RPT-HydroG\12593193-GHD-00-00-RPT-EN-D101_WA-HydroG.dwg
Plot Date: 10 July 2023 3:29 PM



Paper Size ANSI B

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Meters

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983
Grid: NAD 1983 UTM Zone 17N

N

GHD

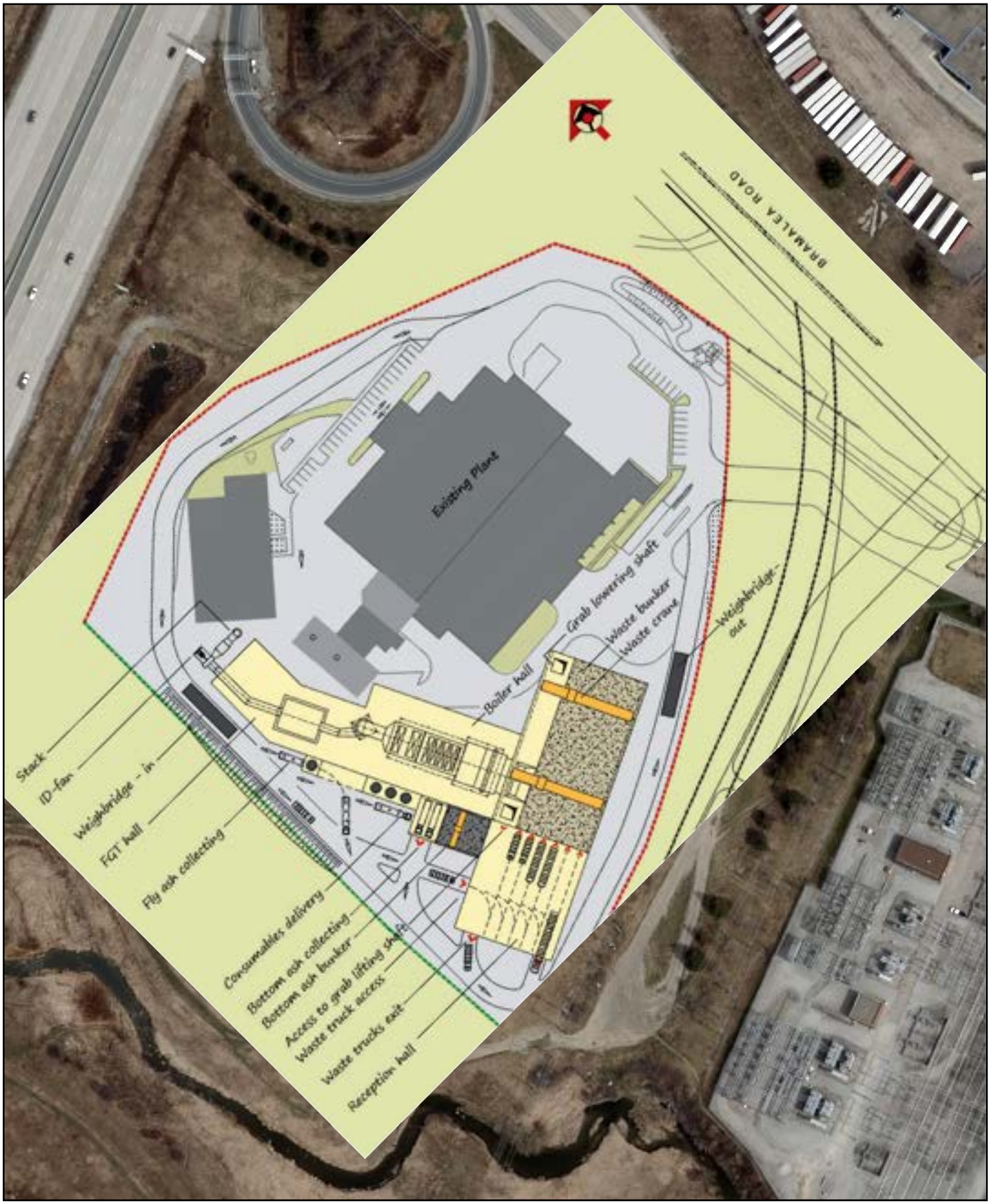
EMERALD ENERGY FROM WASTE INC.
7656 BRAMALEA ROAD, MISSISSAUGA, ON
SCREENING & ECA AMMENDMENT
GEOLOGY AND HYDROGEOLOGY ASSESSMENT REPORT
INVESTIGATIVE LOCATIONS
BOREHOLES/MONITORING WELLS

Project No. **12593193**
Revision No. **-**
Date **Jul 13, 2023**

FIGURE 3.1

Q:\GIS\PROJECTS\12593000s\12593193\Layouts\202307_HydrogeologicalAssessment\12593193_012_ExistingBHLocations.mxd
Print date: 13 Jul 2023 - 15:33

Data source: Peel Region2020; Imagery: Brampton, Spring 2022 and Peel, 2020; Borehole/Monitoring Well locations are digitized from georeferenced plans from EXP (2020), Coffey Geotechnics (2009), Trow (2006), Terraprobe (1989), MTO (1973). As such locations are approximate.



Paper Size ANSI A

0 10 20 30 40

Metres

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983
Grid: NAD 1983 UTM Zone 17N

N

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EMERALD ENERGY FROM WASTE INC.
EMERALD ENERGY FROM WASTE ENVIRONMENTAL SCREENING & ECA AMENDMENT
GEOLOGY AND HYDROGEOLOGY ASSESSMENT REPORT

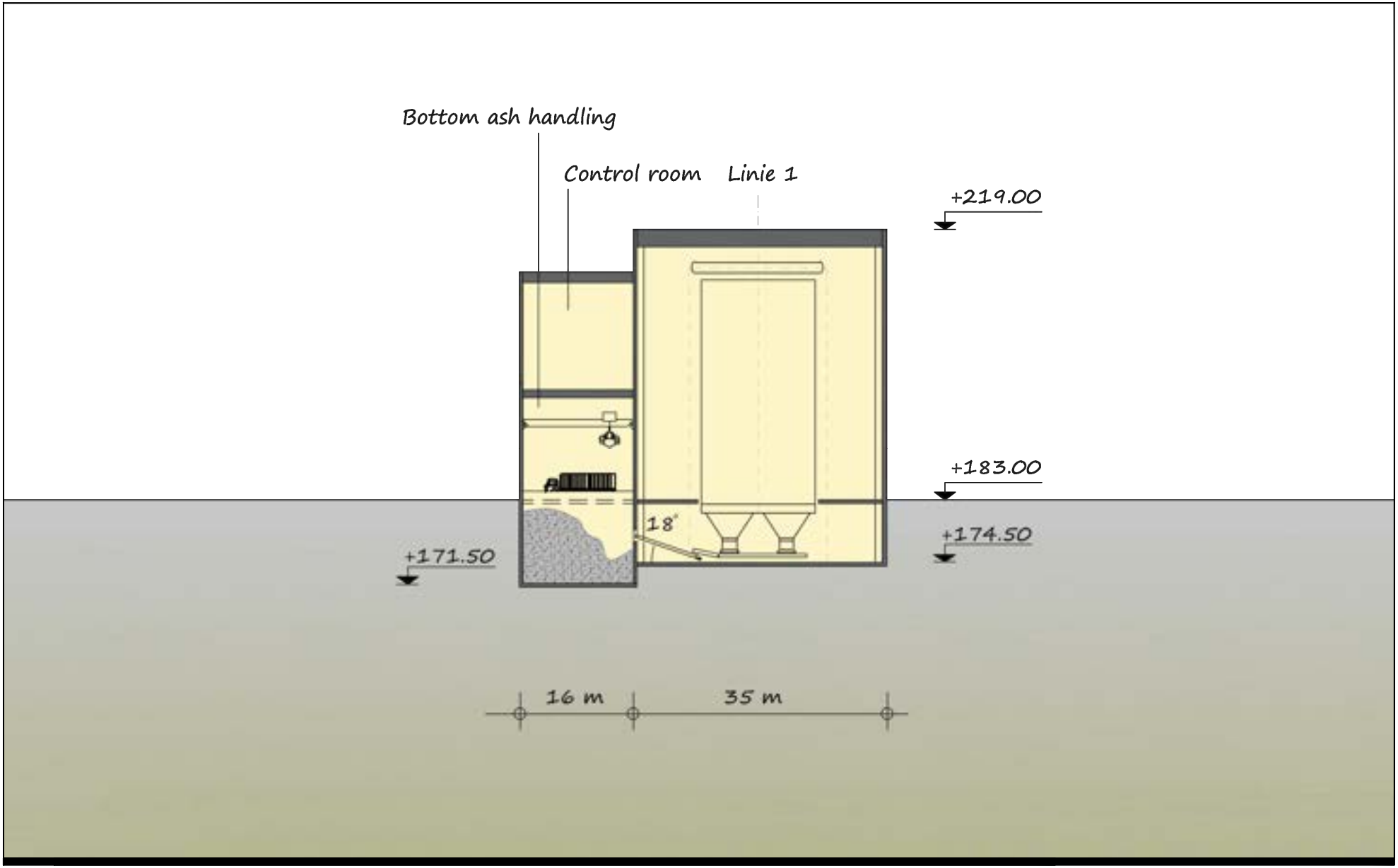
SITE PLAN LINE 1

Project No. **12593193**
Revision No. **-**
Date **Nov 23, 2023**

FIGURE 4.1

C:\Users\jdiotte\AppData\Local\Temp\arc4445\12593193_013_SitePlanLine1.mxd
Print date: 23 Nov 2023 - 14:07

Data source: Imagery: City of Brampton, 2022 (Spring); Site Plan Line 1: Project Definition Brief, titled: "Emerald Energy-From-Waste, Project Definition Brief" by Ramboll, dated: June 30, 2023. Georeferenced by GHD. As such, location on the figure is approximate.



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GHD

EMERALD ENERGY FROM WASTE INC.
EMERALD ENERGY FROM WASTE ENVIRONMENTAL SCREENING & ECA AMENDMENT
GEOLOGY AND HYDROGEOLOGY ASSESSMENT REPORT

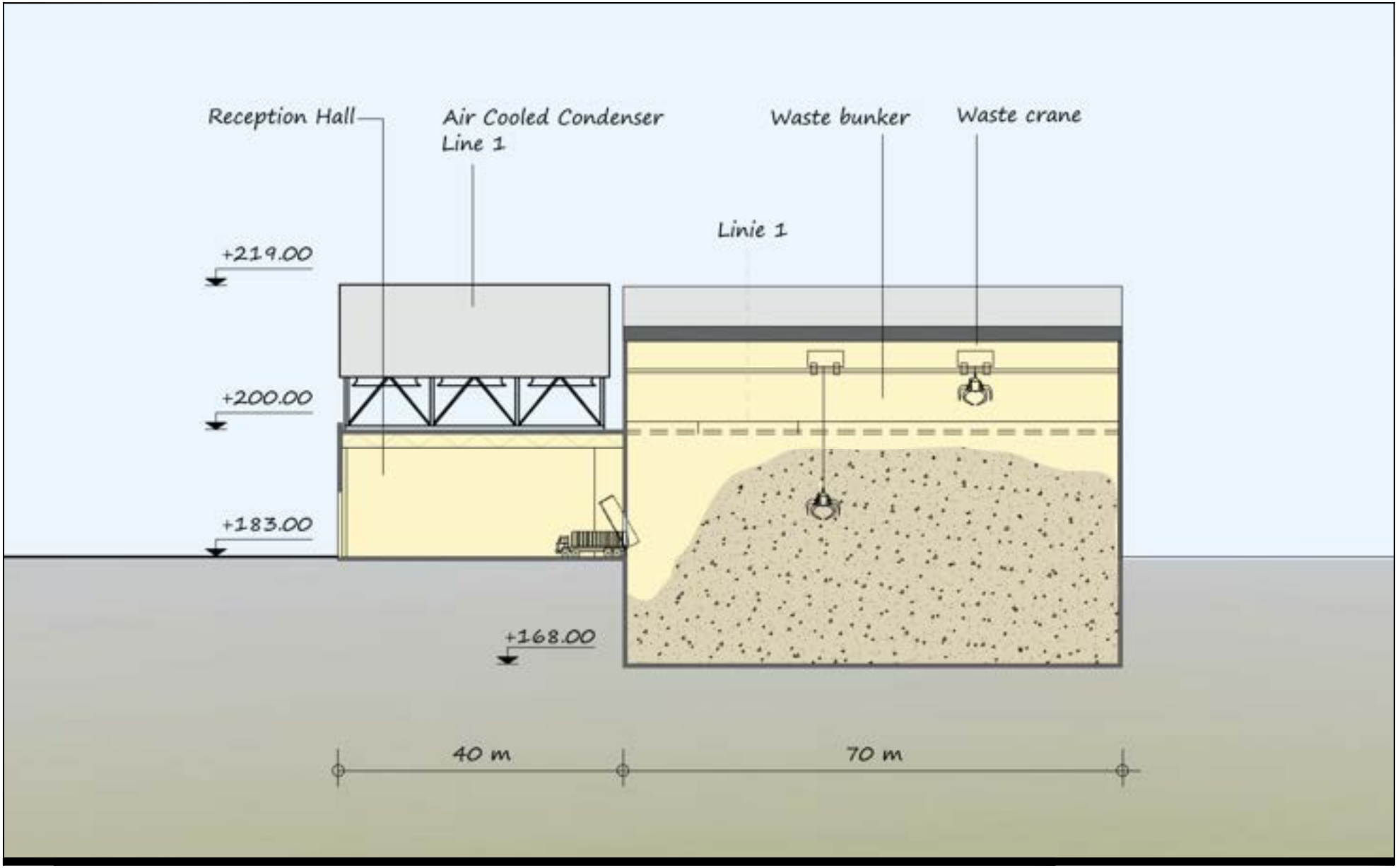
LINE 1 - SECTION A

Project No. **12593193**
Date **November 2023**

FIG RE .1

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Plot Date: 23 November 2023 3:14 PM

Data Source: Section Detail provided by Client



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EMERALD ENERGY FROM WASTE INC.
EMERALD ENERGY FROM WASTE ENVIRONMENTAL SCREENING & ECA AMENDMENT
GEOLOGY AND HYDROGEOLOGY ASSESSMENT REPORT

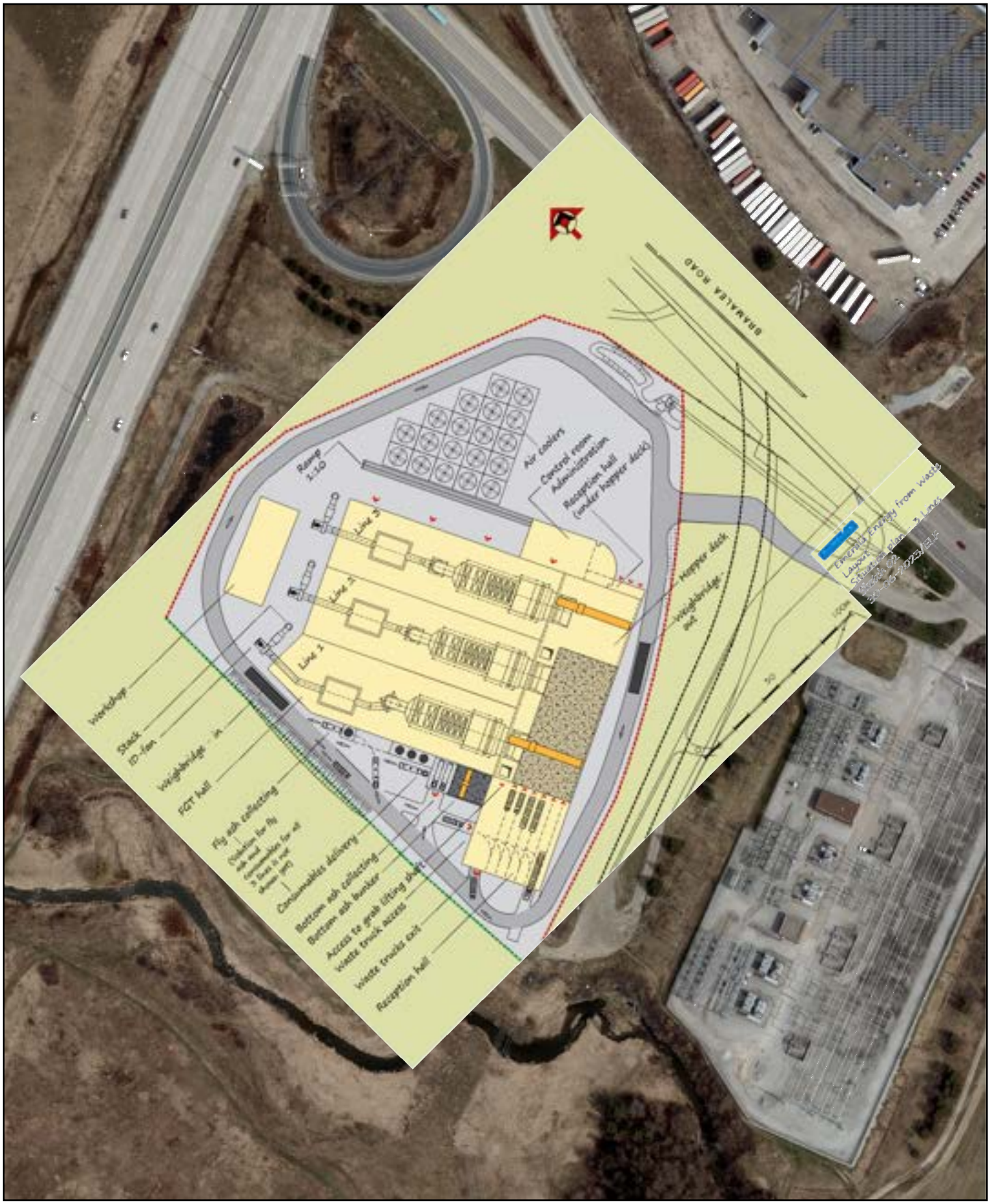
LINE 1 - SECTION B

Project No. **12593193**
Date **November 2023**

FIGURE 4.1b

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Plot Date: 23 November 2023 3:14 PM

Data Source: Section Detail provided by Client



Paper Size ANSI A

0 10 20 30 40

Metres

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983
Grid: NAD 1983 UTM Zone 17N

N

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EMERALD ENERGY FROM WASTE INC.
EMERALD ENERGY FROM WASTE ENVIRONMENTAL SCREENING & ECA AMENDMENT
GEOLOGY AND HYDROGEOLOGY ASSESSMENT REPORT

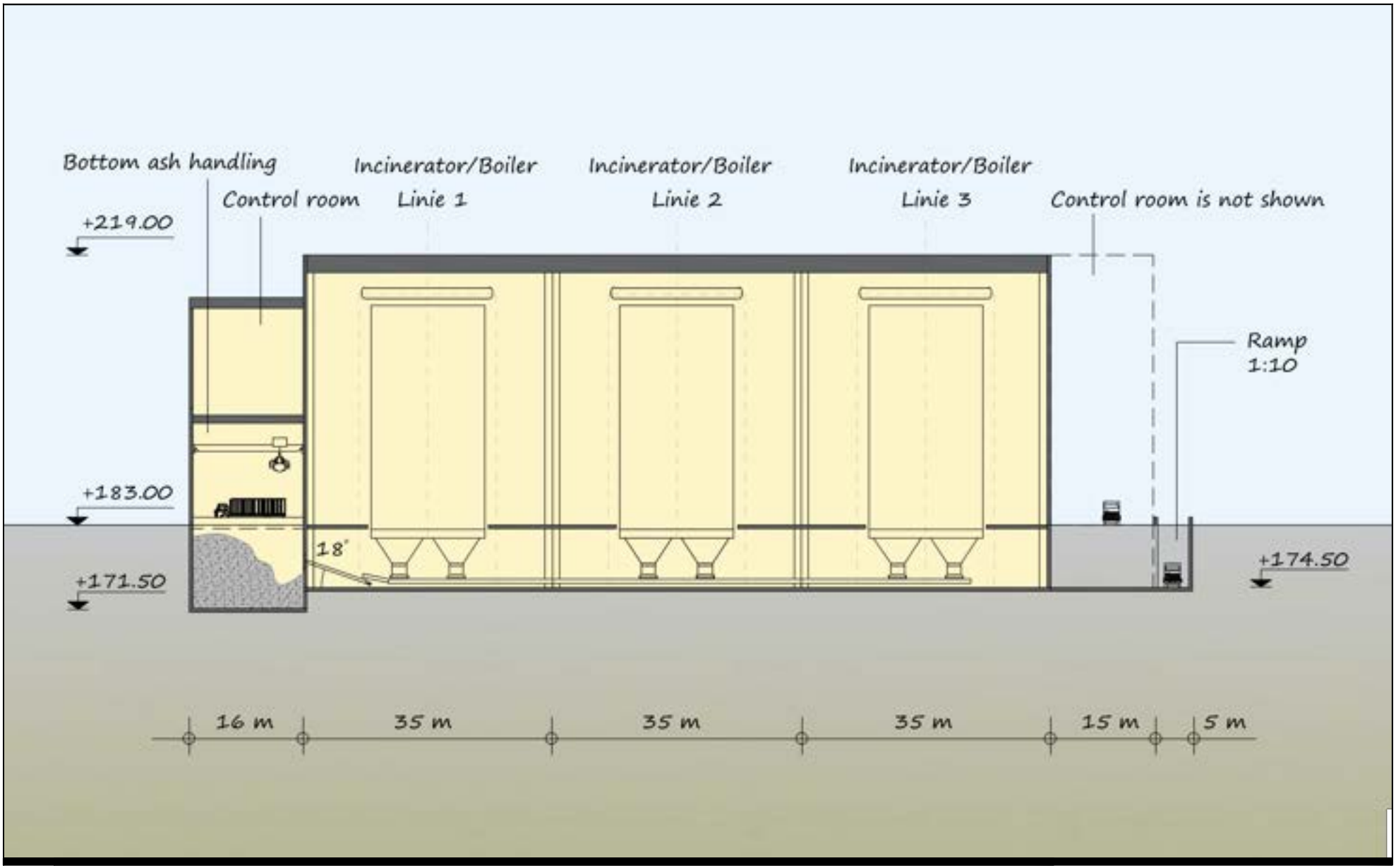
Project No. **12593193**
Revision No. **-**
Date **Nov 23, 2023**

SITE PLAN ALL LINES

FIGURE 4.2

C:\Users\jdiotte\AppData\Local\Temp\arc4138\12593193_014_SitePlanAllLines.mxd
Print date: 23 Nov 2023 - 14:53

Data source: Imagery: City of Brampton, 2022 (Spring); Site Plan Line 1: Project Definition Brief, titled: "Emerald Energy-From-Waste, Project Definition Brief" by Ramboll, dated: June 30, 2023. Georeferenced by GHD. As such, location on the figure is approximate.



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EMERALD ENERGY FROM WASTE INC.
EMERALD ENERGY FROM WASTE ENVIRONMENTAL SCREENING & ECA AMENDMENT
GEOLOGY AND HYDROGEOLOGY ASSESSMENT REPORT

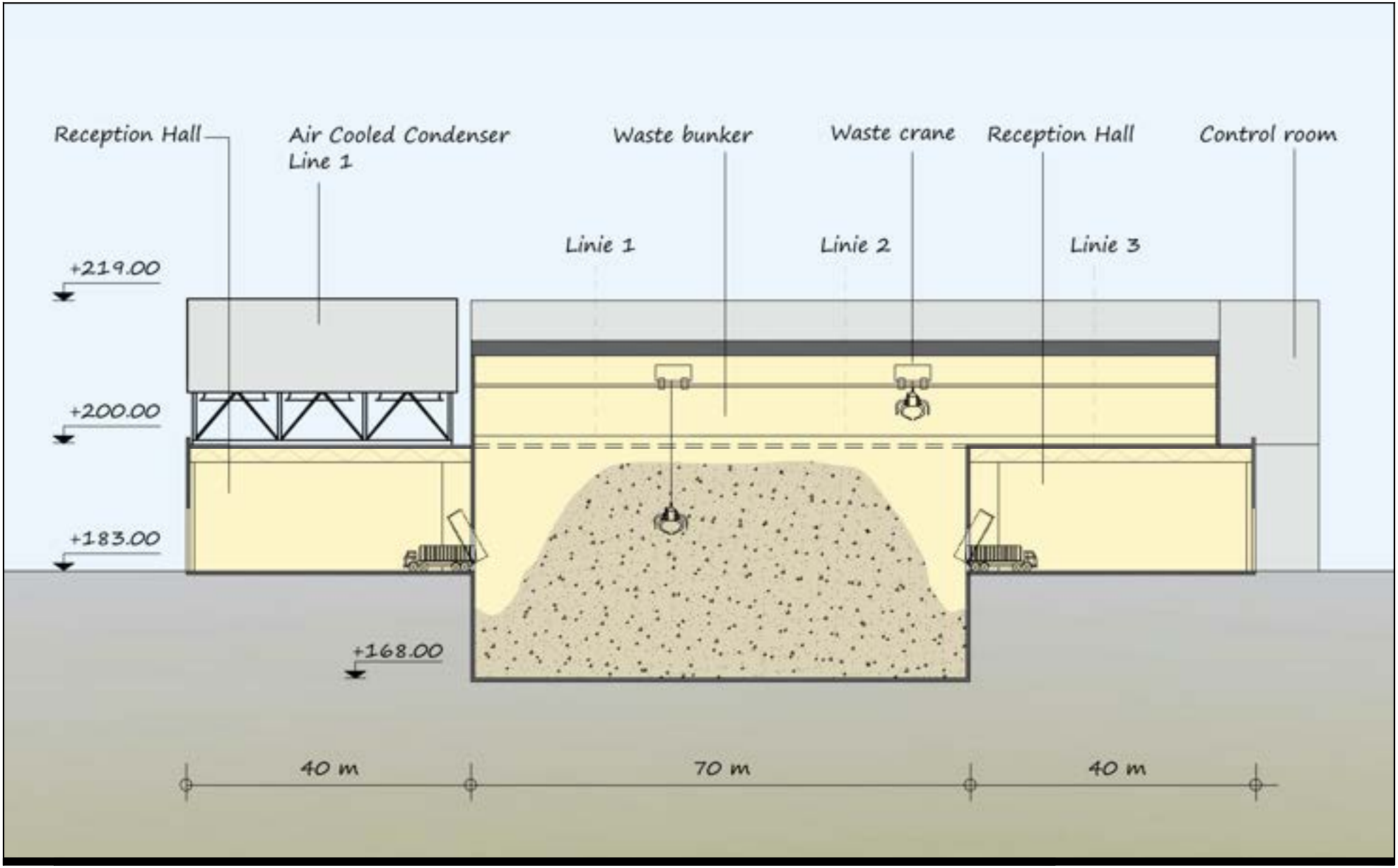
ALL LINES - SECTION A

Project No. **12593193**
Date **November 2023**

FIGURE 4.2a

Filename: \\ghdnet\ghd\CA\Toronto\Projects\662\12593193\Digital_Design\ACAD\Figures\RPT-HydroG\12593193-GHD-00-00-RPT-EN-D101_WA-HydroG.dwg
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Data Source: Section Detail provided by Client



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EMERALD ENERGY FROM WASTE INC.
EMERALD ENERGY FROM WASTE ENVIRONMENTAL SCREENING & ECA AMENDMENT
GEOLOGY AND HYDROGEOLOGY ASSESSMENT REPORT

ALL LINES - SECTION B

Project No. **12593193**
Date **November 2023**

FIGURE 4.2b

Filename: \\ghdnet\ghd\CA\Toronto\Projects\662\12593193\Digital_Design\ACAD\Figures\RPT-HydroG\12593193-GHD-00-00-RPT-EN-D101_WA-HydroG.dwg
Plot Date: 23 November 2023 3:14 PM

Data Source: Section Detail provided by Client

Tables

Table 3.1

Summary of Grain Size Analysis
Geology and Hydrogeological Assessment
7656 Bramalea, Brampton, Ontario
Emerald Energy from Waste Inc.

Bore Hole No.		Depth (m)	Grain Size Distribution (%)				Description	Soil Classification	Moisture Content (%)	Grain Size Distribution Chart Hydraulic Conductivity Range (cm/s)
			Gravel	Sand	Silt	Clay				
BH14	Terraprobe	1.0	8	8	43	41	Clayey Silt; trace Sand and Gravel	CL	16	10^{-6} and Less
BH19	Terraprobe	1.0	5	23	46	26	Clayey Silt; some Sand and Gravel	CL	16	10^{-6} and Less
BH4	MTO	1.0	0	12	64	24	Clayey Silt; some Sand	CL	23	10^{-6} and Less
BH2	Exp	1.5 - 2.1	3	28	47	22	Clayey, Sandy Silt; trace Gravel	CL	11	10^{-6} and Less
BH3	Terraprobe	1.8	4	23	41	32	Sandy Silt; some Gravel and Clay	CL	16	10^{-6} and Less
BH7	Terraprobe	1.8	6	29	43	22	Sandy Silt; some Gravel and Clay	CL	12	10^{-6} and Less
BH12	Terraprobe	1.8	5	28	39	28	Sandy Silt; some Gravel and Clay	CL	17	10^{-6} and Less
BH12	Terraprobe	3.2	12	32	40	16	Sandy Silt; some Gravel and Clay	SM	9	10^{-3} to 10^{-6}
BH1	MTO	3.2	16	16	52	16	Clayey Silt; some Sand and Gravel	SM	16	10^{-3} to 10^{-6}
BH3	MTO	3.2	26	24	38	12	Clayey Silt; with Sand and Gravel	SM	12	10^{-3} to 10^{-6}

Notes:

Percolation Time and Soil Descriptions. Supplementary Guidelines to the Ontario Building Code 1997, Article 8.2.1.2.

Appendices

Appendix A

Ontario Geological Survey (OGS) Geotechnical Boreholes

Geotechnical Borehole Logs

Borehole ID 642416

Completion Year : 1969
Elevation (DEM) : 178.5 m
Total Depth : 5.7 m
Static Water Level : 0.6 m

Borehole Log (metres)
0 ~ 2.3 m silt, clay, sand, gravel, brown, stiff
2.3 ~ 3.5 m gravel, sand, silt, grey, compact
3.5 ~ 4.9 m till, silt, sand, clay, grey, dense
4.9 ~ 5.7 m bedrock, shale, grey

Borehole ID 642458

Completion Year : 1969
Elevation (DEM) : 178 m
Total Depth : 3.7 m
Static Water Level : m

Borehole Log (metres)
0 ~ 0.2 m soil, silt, brown
0.2 ~ 0.9 m silt, sand, clay, brown, loose
0.9 ~ 1.1 m silt, clay, organic, grey, soft
1.1 ~ 1.5 m gravel, boulders, sand, silt, loose
1.5 ~ 3.7 m sand, silt, clay, gravel, brown, dense

Borehole ID 638839

Completion Year : 1969
Elevation (DEM) : 189.9 m
Total Depth : 6.2 m
Static Water Level : 0.1 m

Borehole Log (metres)
0 ~ 0.3 m soil, organic material
0.3 ~ 1.4 m till, silt, sand, clay, brown, compact
1.4 ~ 3.4 m till, silt, sand, clay, brown, dense
3.4 ~ 5 m till, silt, sand, clay, grey, dense
5 ~ 6.2 m bedrock, shale, red
6.2 ~ 6.2 m bedrock, shale
Directions: To here - From here

Borehole ID 841391

Completion Year : 1980
Elevation (DEM) : 185.1 m
Total Depth : 10.8 m
Static Water Level : 5.8 m

Borehole Log (metres)
0 ~ 2.1 m clay, silt, hard
2.1 ~ 4.6 m silt, sand, very dense
4.6 ~ 10.8 m till, clay, silt, sand, hard

Borehole ID 638841

Completion Year : 1969
Elevation (DEM) : 186.5 m
Total Depth : 6.1 m
Static Water Level : 0.1 m

Borehole Log (metres)
0 ~ 0.3 m soil, organic material
0.3 ~ 1.2 m till, silt, sand, clay, brown, compact
1.2 ~ 1.8 m till, silt, sand, clay, brown, dense
1.8 ~ 3.5 m till, sand, silt, clay, brown, dense
3.5 ~ 5.1 m till, silt, sand, clay, grey, dense
5.1 ~ 6.1 m bedrock, shale, soft

Borehole ID 638842

Completion Year : 1969
Elevation (DEM) : 189.4 m
Total Depth : 7.7 m
Static Water Level : 0.4 m

Borehole Log (metres)
0 ~ 0.3 m soil, organic material
0.3 ~ 0.9 m till, silt, sand, clay, brown, compact
0.9 ~ 2.3 m till, silt, sand, clay, brown, dense
2.3 ~ 3.7 m sand, silt, brown, dense
3.7 ~ 4.9 m till, silt, sand, clay, grey, dense
4.9 ~ 6.2 m till, silt, sand, clay, grey, dense
6.2 ~ 7.7 m bedrock, shale, soft

Appendix B

MECP Selected Water Well Records

17 Z 6 0 6 7 7 4 E
9 R 4 8 3 8 3 7 0 N
Tract [redacted] 10 5 8 3 4 0
Basin 24

ONTARIO

RECEIVED
OCT - 2 1953
GEOLOGICAL BRANCH
DEPARTMENT OF MINES

49 No 2402

The Well Drillers Act

Department of Mines, Province of Ontario

Water Well Record

MISSISSAUGA

[redacted] Village, ~~(Town) or City~~ (Streetsville)

wn or City)

Owner

Date Completed 1 (day) Oct (month) 53 (year) Cost of Well (excluding pump)

Pipe and Casing Record

Casing diameter(s) 4"

Length(s) of casing(s) 28'

Type of screen

Length of screen

Distance from top of screen to ground level

Is well a gravel-wall type?

Pumping Test

Date

Static level 10'

Pumping level could not lower

Pumping rate supply one gal. per minute

Duration of test at that level

Distance from cylinder or bowls to ground level

Water Record

Kind (fresh or mineral) fresh

Quality (hard, soft, contains iron, sulphur, etc.) hard

Appearance (clear, cloudy, coloured) clear

For what purpose(s) is the water to be used? domestic

How far is well from possible source of contamination? none

What is the source of contamination?

Enclose a copy of any mineral analysis that has been made of water

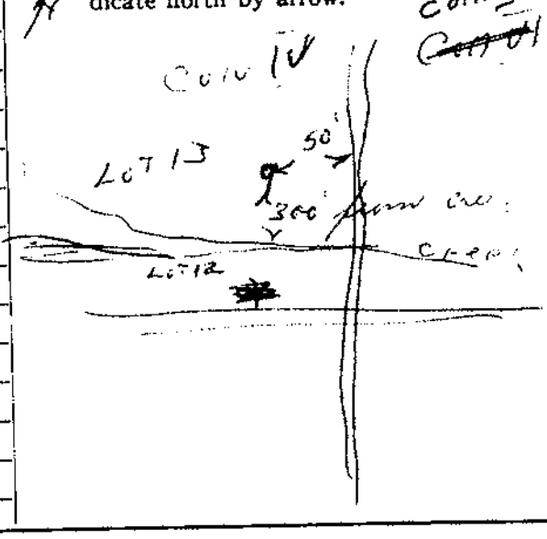
Depth(s) to Water Horizon(s)	Kind of Water	No. of Feet Water Rises
38	fresh	28

Well Log

Overburden and Bedrock Record	From	To
top soil	0 ft.	1 ft.
clay, gravel	1	26
blue shale	26	40

Location of Well

In diagram below show distances of well from road and lot line. Indicate north by arrow.



Situation: Is well on upland, in valley, or on hillside?

Drilling Firm

Address

Name of Driller Address

Date Oct. 1/53 Licence Number 296

Signature of Licensee

FORM 5

C55.56

GROUND WATER BRANCH
49 No. 2406
RESOURCES
MISSISSAUGA

UTM 17 6 0 6 1 0 9 E
Hwy Ontario St East
Co. 5 4 8 3 8 9 1 N
Elev: 4 0 6 0 5

The Ontario Water Resources Commission Act

WATER WELL RECORD

Basin 24 Peel
County or District ..... Township, Village, Town or City Toronto Twp
Con. 11 E Lot 14 east half Date completed 22 (day) June (month) 1961 (year)
Owner [redacted] (print in block letters) Address .....

Casing and Screen Record

Inside diameter of casing 30 inches
Total length of casing 37 feet
Type of screen .....
Length of screen .....
Depth to top of screen .....
Diameter of finished hole 30 inches

Pumping Test

Static level Ground to water 26 feet
Test-pumping rate 2 gallons per min G.P.M.
Pumping level .....
Duration of test pumping .....
Water clear or cloudy at end of test Clear
Recommended pumping rate ..... G.P.M.
with pump setting of ..... feet below ground surface

Well Log

Overburden and Bedrock Record	From ft.	To ft.	Water Record: Depth(s) at which water(s) found	Water Record: Kind of water (fresh, salty, sulphur)
Top brown soil	0	10		
Grey clay with pebbly	10	26		
Sand & gravel & water	26	36	26 feet	fresh
Grey shale on the bottom				

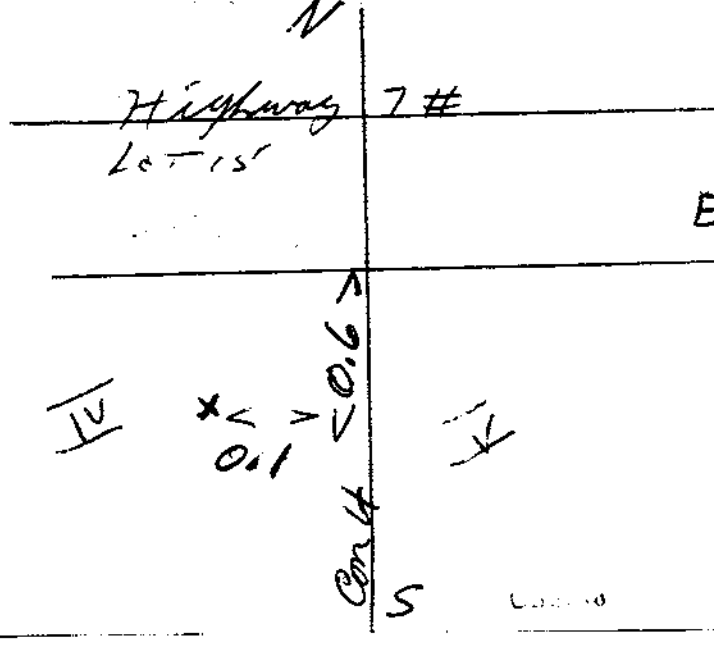
For what purpose(s) is the water to be used? house
Is well on upland, in valley, or on hillside? upland
Drilling or Boring Firm .....
Address .....
Licence Number 7
Name of Driller or Borer Maurice Babink
Address 590 Burnhamthorpe Rd Toronto Ont.
Date June 22/61
Maurice Babink
(Signature of Licensed Drilling or Boring Contractor)

Form 7 15M Sets 60-5930

OWRC COPY

Location of Well

In diagram below show distances of well from road and lot line. Indicate north by arrow.



UTM | 17 | 607159 E
| 9 | 4838077 N
Elev. 1580

Basin 24

ONTARIO

The Water-well Drillers Act, 1954
Department of Mines

49 No 2412

RECEIVED
AUG 1 1956
GEOLOGICAL BRANCH
DEPARTMENT of MINES

Water-Well Record

MISSISSAUGA (TORONTO FWY)

County or Territorial District PEEL Township, Village, Town or City

[redacted] Village, Town or City) MALTON

ddress 94 CRAWFORD ST TORONTO

(day) 6 (month) (year)

Pipe and Casing Record

Casing diameter(s) 36 inches
Length(s) 30 inches
Type of screen —
Length of screen —

Pumping Test

Static level Ground to water 9 feet
Pumping rate Two gallons per minute
Pumping level —
Duration of test —

Well Log

Overburden and Bedrock Record	From ft.	To ft.	Depth(s) at which water(s) found	No. of feet water rises	Kind of water (fresh, salty, or sulphur)
Brown Top soil	0	10			
blue clay	10	27	27 feet	19 feet	fresh
mixed gravel & sand	27	28			
blue shale on the bottom					

Water Record

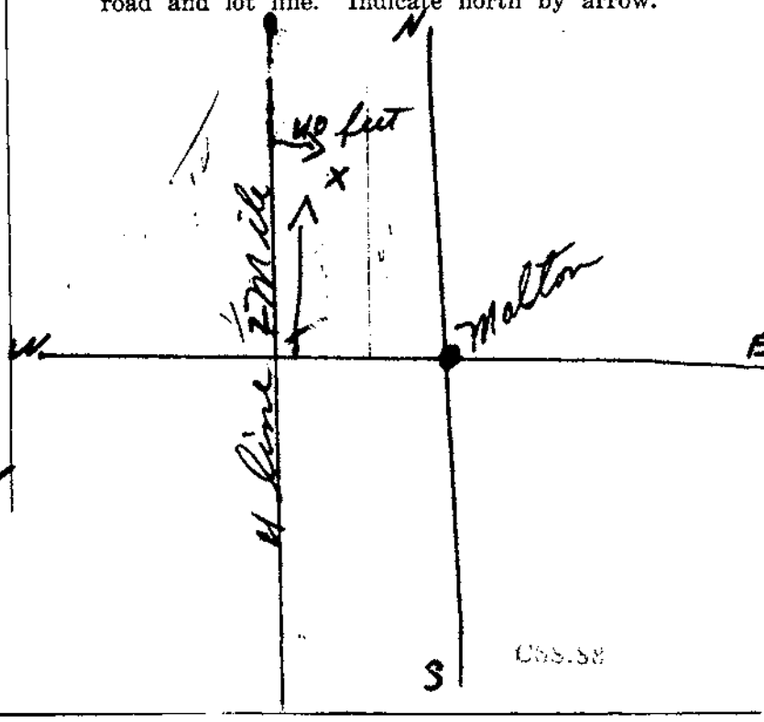
For what purpose(s) is the water to be used?
House
Is water clear or cloudy? clear
Is well on upland, in valley, or on hillside?
up land
Drilling firm
Address
Name of Driller Maurice Babich
Address 590 Burnhamthorpe
Licence Number 634

I certify that the foregoing statements of fact are true.

Date July 16/56 Maurice Babich
Signature of Licensee

Location of Well

In diagram below show distances of well from road and lot line. Indicate north by arrow.



Form 5

CSS.58

UTM 17 6069955 E
9 R 4838269 N
Elev [redacted] 0680
Basin 24

ONTARIO

The Water-well Drillers Act, 1954
Department of Mines

49 No 2413

RECEIVED
AUG 1 1956
GEOLOGICAL BRANCH
DEPARTMENT of MINES

Water-Well Record

County or Territorial District PEEL Township, Village, Town or City (formerly Toronto Township) MISSISSAUGA

[redacted] Village, Town or City)

[redacted] ddress R.R. 2 Malton

Date completed [redacted] (day) (month) (year)

Pipe and Casing Record

Casing diameter(s) 26"
Length(s) 20"
Type of screen —
Length of screen —

Pumping Test

Static level Ground to water 12 feet
Pumping rate Two gallons per min
Pumping level —
Duration of test —

Well Log

Overburden and Bedrock Record	From ft.	To ft.
Brown Top soil	0	12
blue clay	12	25
Mixed gravel & sand	25	26
blue shale on		
The bottom		

Water Record

Depth(s) at which water(s) found	No. of feet water rises	Kind of water (fresh, salty, or sulphur)
25 feet	14 feet	fresh

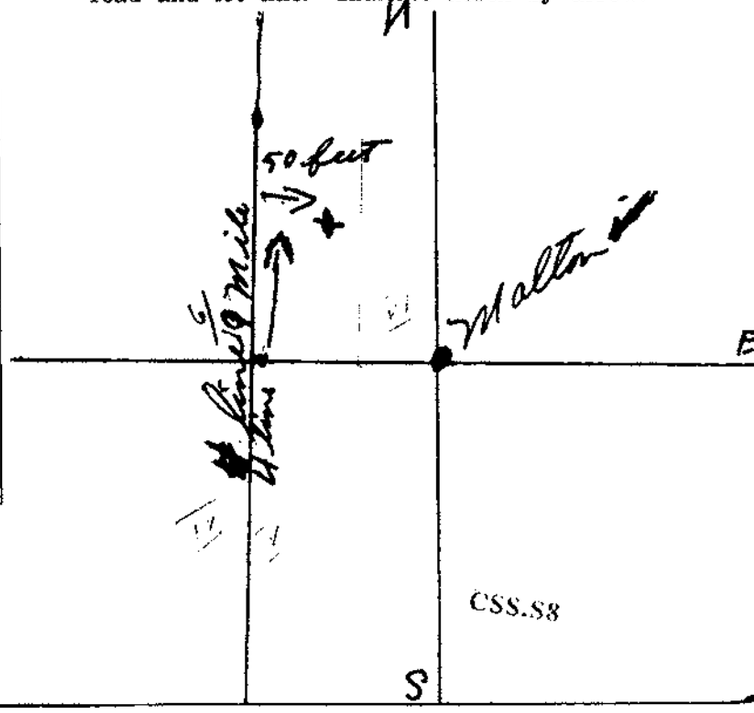
For what purpose(s) is the water to be used? house
Is water clear or cloudy? clear
Is well on upland, in valley, or on hillside? hill side
Drilling firm [redacted]
Address [redacted] Burnhamthorpe st
Name of Driller Maurice Babin
Address [redacted] Malton
Licence Number 634

I certify that the foregoing statements of fact are true.

Date July 29/56 Maurice Babin
Signature of Licensee

Location of Well

In diagram below show distances of well from road and lot line. Indicate north by arrow.



Form 5

E

Ministry of the Environment
Ontario

The Ontario Water Resources Act

WATER WELL RECORD

1. PRINT ONLY IN SPACES PROVIDED
2. CHECK ☒ CORRECT BOX WHERE APPLICABLE

11 — 4906753 — MUNICIP — CON.

COUNTY OR DISTRICT: PEEL
TOWNSHIP, BOROUGH, CITY, TOWN, VILLAGE: TORONTO (BRAMPTON)
CON: EHS 5
BLOCK, TRACT, SURVEY, ETC:
LOT: ?
[redacted] 47 BRAMALEA RD.
DATE COMPLETED: DAY 11 MO 5 YR 87
RC: ELEVATION: RC: BASIN CODE:

LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

GENERAL COLOUR	MOST COMMON MATERIAL	OTHER MATERIALS	GENERAL DESCRIPTION	DEPTH - FEET FROM	DEPTH - FEET TO
Brown	gravel		fill	0	7
Blue	clay	stones		7	18
11	gravel			18	37
Green	clay			37	42
Gray	sand		coarse	42	54
11	gravel			54	68
11	sand		coarse	68	69
11	gravel			69	72

31
32 WELL ID

41 WATER RECORD

WATER FOUND AT - FEET	KIND OF WATER
42	1 ☒ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERAL
	1 ☐ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERAL
	1 ☐ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERAL
	1 ☐ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERAL
	1 ☐ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERAL

51 CASING & OPEN HOLE RECORD

INSIDE DIAM INCHES	MATERIAL	WALL THICKNESS INCHES	DEPTH - FEET FROM	DEPTH - FEET TO
6 1/4	1 ☒ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE	1.88	0	52
	1 ☐ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE			
	1 ☐ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE			

SCREEN

SIZE(S) OF OPENING (SLOT NO.): DIAMETER: 6 INCHES — LENGTH: 20 FEET
MATERIAL AND TYPE: SS
DEPTH TO TOP OF SCREEN: 52 FEET

61 PLUGGING & SEALING RECORD

DEPTH SET AT - FEET FROM	TO	MATERIAL AND TYPE (CEMENT GROUT LEAD PACKER, ETC.)

71 PUMPING TEST

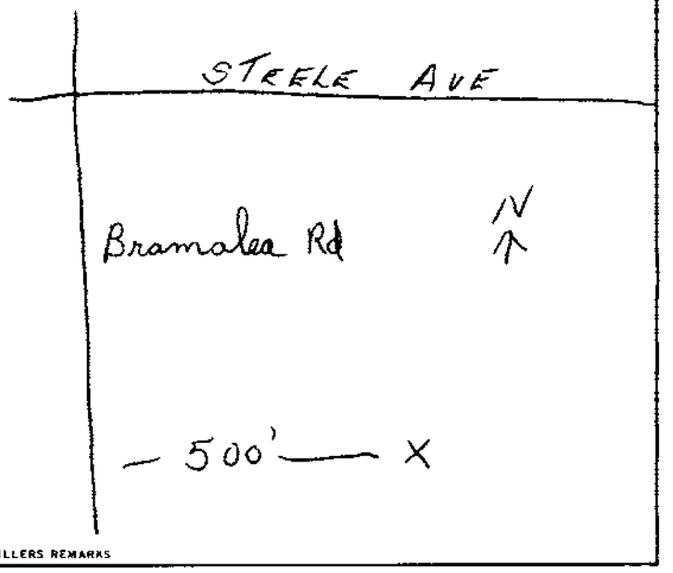
PUMPING TEST METHOD: 1 ☐ PUMP 2 ☒ BAILER
PUMPING RATE: 20 GPM
DURATION OF PUMPING: 5 HOURS 30 MINS
WATER LEVELS DURING: 1 ☒ PUMPING 2 ☐ RECOVERY

STATIC LEVEL	WATER LEVEL END OF PUMPING	15 MINUTES	30 MINUTES	45 MINUTES	60 MINUTES
6 FEET	8 FEET	6 FEET	7 FEET	7 FEET	8 FEET

IF FLOWING, GIVE RATE: GPM
PUMP INTAKE SET AT: 45 FEET
WATER AT END OF TEST: 1 ☐ CLEAR 2 ☐ CLOUDY
RECOMMENDED PUMP TYPE: ☐ SHALLOW ☒ DEEP
RECOMMENDED PUMP SETTING: 45 FEET
RECOMMENDED PUMPING RATE: GPM

LOCATION OF WELL

IN DIAGRAM BELOW SHOW DISTANCES OF WELL FROM ROAD AND LOT LINE. INDICATE NORTH BY ARROW.



DRILLERS REMARKS

FINAL STATUS OF WELL
1 ☒ WATER SUPPLY 2 ☐ OBSERVATION WELL 3 ☐ TEST HOLE 4 ☐ RECHARGE WELL 5 ☐ ABANDONED, INSUFFICIENT SUPPLY 6 ☐ ABANDONED, POOR QUALITY 7 ☐ UNFINISHED

WATER USE
1 ☐ DOMESTIC 2 ☐ STOCK 3 ☐ IRRIGATION 4 ☒ INDUSTRIAL 5 ☐ COMMERCIAL 6 ☐ MUNICIPAL 7 ☐ PUBLIC SUPPLY 8 ☐ COOLING OR AIR CONDITIONING ☐ OTHER 9 ☐ NOT USED

METHOD OF DRILLING
1 ☒ CABLE TOOL 2 ☐ ROTARY (CONVENTIONAL) 3 ☐ ROTARY (REVERSE) 4 ☐ ROTARY (AIR) 5 ☐ AIR PERCUSSION 6 ☐ BORING 7 ☐ DIAMOND 8 ☐ JETTING 9 ☐ DRIVING

CONTRACTOR

NAME OF WELL CONTRACTOR: Wilson water Wells — LICENCE NUMBER: 5459
ADDRESS: RR#4 Stouffville
NAME OF DRILLER OR BORER: Norm Rennie — LICENCE NUMBER: T-0339
SIGNATURE OF CONTRACTOR: William Wilson — SUBMISSION DATE: DAY ____ MO. ____ YR. ____

OFFICE USE ONLY

DATA SOURCE — CONTRACTOR — DATE RECEIVED: DEC 23 1987
DATE OF INSPECTION — INSPECTOR
REMARKS

MINISTRY OF THE ENVIRONMENT COPY

FORM NO. 0506—4—77 FORM 7

Ministry of the Environment
Ontario

The Ontario Water Resources Act

WATER WELL RECORD

1. PRINT ONLY IN SPACES PROVIDED
2. CHECK ☒ CORRECT BOX WHERE APPLICABLE

11 4906754

COUNTY OR DISTRICT	TOWNSHIP, BOROUGH, CITY, TOWN, VILLAGE	CON	BLOCK, TRACT, SURVEY, ETC	LOT
PEEL	TORONTO (Brampton)	EHS	5	

[redacted] 17 BRAMALEA RD.

DATE COMPLETED: DAY 12 MO 5 YR 87

ELEVATION | BASIN CODE

LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

GENERAL COLOUR	MOST COMMON MATERIAL	OTHER MATERIALS	GENERAL DESCRIPTION	DEPTH - FEET FROM	DEPTH - FEET TO
Brown	fill		clay	0	8
"	clay	stones		8	19
"	"	gravel		19	21
Gray	"		hard	21	36
"	shale			36	60

31
32 WELL #3

41 WATER RECORD

WATER FOUND AT - FEET	KIND OF WATER
10-13	1 ☐ FRESH 3 ☐ SULPHUR 14 / 2 ☐ SALTY 4 ☐ MINERAL
15-18	1 ☐ FRESH 3 ☐ SULPHUR 19 / 2 ☐ SALTY 4 ☐ MINERAL
20-23	1 ☐ FRESH 3 ☐ SULPHUR 24 / 2 ☐ SALTY 4 ☐ MINERAL
25-28	1 ☐ FRESH 3 ☐ SULPHUR 29 / 2 ☐ SALTY 4 ☐ MINERAL
30-33	1 ☐ FRESH 3 ☐ SULPHUR 34 / 2 ☐ SALTY 4 ☐ MINERAL 35

51 CASING & OPEN HOLE RECORD

INSIDE DIAM INCHES	MATERIAL	WALL THICKNESS INCHES	DEPTH - FEET FROM	DEPTH - FEET TO
10-11 6 1/4	1 ☒ STEEL 12 / 2 ☐ GALVANIZED / 3 ☐ CONCRETE / 4 ☐ OPEN HOLE	1.088	0	13-16 37
17-18	1 ☐ STEEL 19 / 2 ☐ GALVANIZED / 3 ☐ CONCRETE / 4 ☐ OPEN HOLE			20-23
24-25	1 ☐ STEEL 26 / 2 ☐ GALVANIZED / 3 ☐ CONCRETE / 4 ☐ OPEN HOLE			27-30

SCREEN

SIZE(S) OF OPENING (SLOT NO.) 31-33	DIAMETER 34-38 INCHES	LENGTH 39-40 FEET
MATERIAL AND TYPE	DEPTH TO TOP OF SCREEN 41-44 FEET	45

61 PLUGGING & SEALING RECORD

DEPTH SET AT - FEET FROM	TO	MATERIAL AND TYPE (CEMENT GROUT, LEAD PACKER, ETC.)
10-13	14-17	
18-21	22-25	
26-29	30-33	50

71 PUMPING TEST

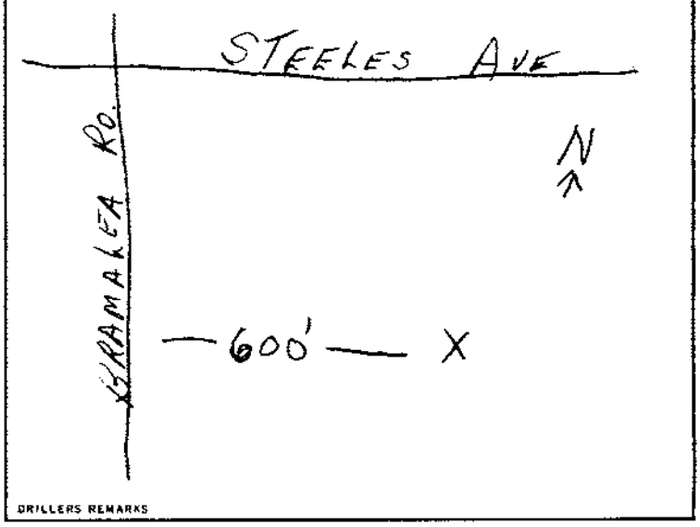
PUMPING TEST METHOD 10: 1 ☐ PUMP 2 ☒ BAILER
PUMPING RATE 11-14: 1/2 GPM
DURATION OF PUMPING: 1 HOURS 00 MINS (15-16, 17-18)

STATIC LEVEL	WATER LEVEL END OF PUMPING	WATER LEVELS DURING (25: 1 ☐ PUMPING 2 ☐ RECOVERY) 15 MINUTES	30 MINUTES	45 MINUTES	60 MINUTES
6 (19-21) FEET	55 (22-24) FEET	55 (26-28) FEET	55 (29-31) FEET	55 (32-34) FEET	55 (35-37) FEET

IF FLOWING, GIVE RATE 38-41 GPM
PUMP INTAKE SET AT FEET
WATER AT END OF TEST 42: 1 ☒ CLEAR 2 ☐ CLOUDY
RECOMMENDED PUMP TYPE: ☐ SHALLOW ☐ DEEP
RECOMMENDED PUMP SETTING 43-45 FEET
RECOMMENDED PUMPING RATE 46-49 GPM
50-53

LOCATION OF WELL

IN DIAGRAM BELOW SHOW DISTANCES OF WELL FROM ROAD AND LOT LINE. INDICATE NORTH BY ARROW.



DRILLERS REMARKS

FINAL STATUS OF WELL 54

1 ☒ WATER SUPPLY 2 ☐ OBSERVATION WELL 3 ☐ TEST HOLE 4 ☐ RECHARGE WELL 5 ☐ ABANDONED, INSUFFICIENT SUPPLY 6 ☐ ABANDONED, POOR QUALITY 7 ☐ UNFINISHED

WATER USE 55-56

1 ☐ DOMESTIC 2 ☐ STOCK 3 ☐ IRRIGATION 4 ☒ INDUSTRIAL ☐ OTHER 5 ☐ COMMERCIAL 6 ☐ MUNICIPAL 7 ☐ PUBLIC SUPPLY 8 ☐ COOLING OR AIR CONDITIONING 9 ☐ NOT USED

METHOD OF DRILLING 57

1 ☒ CABLE TOOL 2 ☐ ROTARY (CONVENTIONAL) 3 ☐ ROTARY (REVERSE) 4 ☐ ROTARY (AIR) 5 ☐ AIR PERCUSSION 6 ☐ BORING 7 ☐ DIAMOND 8 ☐ JETTING 9 ☐ DRIVING

5459

CONTRACTOR

NAME OF WELL CONTRACTOR: Wilson water Wells — LICENCE NUMBER: 5459
ADDRESS: RR# 4 Stouffville
NAME OF DRILLER OR BORER: Norm Renfrew — LICENCE NUMBER: 1-0339
SIGNATURE OF CONTRACTOR: William Wilson — SUBMISSION DATE: DAY ____ NO. ____ YR. ____

OFFICE USE ONLY

DATA SOURCE 58 | CONTRACTOR 59-62 | DATE RECEIVED 63-68: DEC 23 1987 | 69
DATE OF INSPECTION | INSPECTOR
REMARKS

MINISTRY OF THE ENVIRONMENT COPY

FORM NO. 0506—4—77 FORM 7

Ontario Ministry of the Environment

Well Tag Number (Place sticker and print number below): A028068

Well Record

Regulation 903 Ontario Water Resources Act

page ___ of ___

Instructions for Completing Form

- For use in the **Province of Ontario** only. This document is a permanent **legal** document. Please retain for future reference.
- All Sections **must** be completed in full to avoid delays in processing. Further instructions and explanations are available on the back of this form.
- Questions regarding completing this application can be directed to the Water Well Management Coordinator at 416-235-6203.
- **All metre measurements shall be reported to 1/10th of a metre.**
- Please print clearly in blue or black ink only.

Ministry Use Only

MUN | CON | LOT

Well Owner's Information and Location of Well Information

[redacted]

RR#/Street Number/Name: 2111 Steeles Ave E.

City/Town/Village: Brampton

Site/Compartment/Block/Tract etc.

GPS Reading: NAD 8.3 | Zone 17 | Easting 605821 | Northing 4839743

Unit Make/Model

Mode of Operation: ☐ Undifferentiated ☐ Averaged ☐ Differentiated, specify

Log of Overburden and Bedrock Materials (see instructions)

General Colour	Most common material	Other Materials	General Description	Depth From	Depth To
Brown	Fill	Gravel		0	1.5
Brown	Clay Till		Dense	1.5	5
Grey	Shale		Soft Layered	5	7.5

Hole Diameter

Depth From	Depth To	Diameter Centimetres
0	7.5	12

Water Record

Water found at ___ Metres	Kind of Water
6.5 m	☒ Fresh ☐ Salty ☐ Sulphur ☐ Minerals ☐ Gas ☐ Other:
___ m	☐ Fresh ☐ Salty ☐ Sulphur ☐ Minerals ☐ Gas ☐ Other:
___ m	☐ Fresh ☐ Salty ☐ Sulphur ☐ Minerals ☐ Gas ☐ Other:

After test of well yield, water was ☐ Clear and sediment free ☐ Other, specify

Chlorinated ☐ Yes ☐ No

Construction Record

Inside diam centimetres	Material	Wall thickness centimetres	Depth From	Depth To
Casing				
4	☐ Steel ☐ Fibreglass ☒ Plastic ☐ Concrete ☐ Galvanized		0	2.6
	☐ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized			
	☒ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized			
Screen				
Outside diam 4	☐ Steel ☐ Fibreglass ☒ Plastic ☐ Concrete ☐ Galvanized	Slot No.	2.6	7.5
No Casing or Screen				
	☐ Open hole			

Test of Well Yield

Pumping test method	Draw Down Time min	Draw Down Water Level Metres	Recovery Time min	Recovery Water Level Metres
Pump intake set at - (metres)	Static Level			
Pumping rate - (litres/min)	1		1	
Duration of pumping ___hrs +___ min	2		2	
Final water level end of pumping ___metres	3		3	
Recommended pump type. ☐ Shallow ☐ Deep	4		4	
Recommended pump depth. ___metres	5		5	
Recommended pump rate. (litres/min)	10		10	
	15		15	
If flowing give rate - (litres/min)	20		20	
	25		25	
If pumping discontinued, give reason.	30		30	
	40		40	
	50		50	
	60		60	

Plugging and Sealing Record

☒ Annular space ☐ Abandonment

Depth set at - From	Metres To	Material and type (bentonite slurry, neat cement slurry) etc.	Volume Placed (cubic metres)
0	2.6	Bentonite Pellets	200 lbs
2.6	7.5	#3 Well Sand	200 lbs

Method of Construction

☐ Cable Tool ☐ Rotary (air) ☐ Diamond ☐ Digging
☒ Rotary (conventional) ☐ Air percussion ☐ Jetting ☐ Other
☐ Rotary (reverse) ☐ Boring ☐ Driving

Water Use

☐ Domestic ☐ Industrial ☐ Public Supply ☐ Other
☐ Stock ☐ Commercial ☐ Not used
☐ Irrigation ☐ Municipal ☐ Cooling & air conditioning

Final Status of Well

☐ Water Supply ☐ Recharge well ☐ Unfinished ☐ Abandoned, (Other)
☒ Observation well ☐ Abandoned, insufficient supply ☐ Dewatering
☒ Test Hole ☐ Abandoned, poor quality ☐ Replacement well

Well Contractor/Technician Information

Name of Well Contractor: Aardvark Drilling Inc — Well Contractor's Licence No.: 7238

Business Address (street name, number, city etc.): C-25 Lewis Rd, Guelph, Ont.

Name of Well Technician (last name, first name): Henry, Nathan — Well Technician's Licence No.: 04-1196

Signature of Technician/Contractor: X [signature] — Date Submitted YYYY MM DD: 2004 10 26

Location of Well

In diagram below show distances of well from road, lot line, and building. Indicate north by arrow.

See plan

Audit No. Z 30091 — Date Well Completed YYYY MM DD: 2005 07 26

Was the well owner's information package delivered? ☐ Yes ☐ No — Date Delivered YYYY MM DD: 2005 11 26

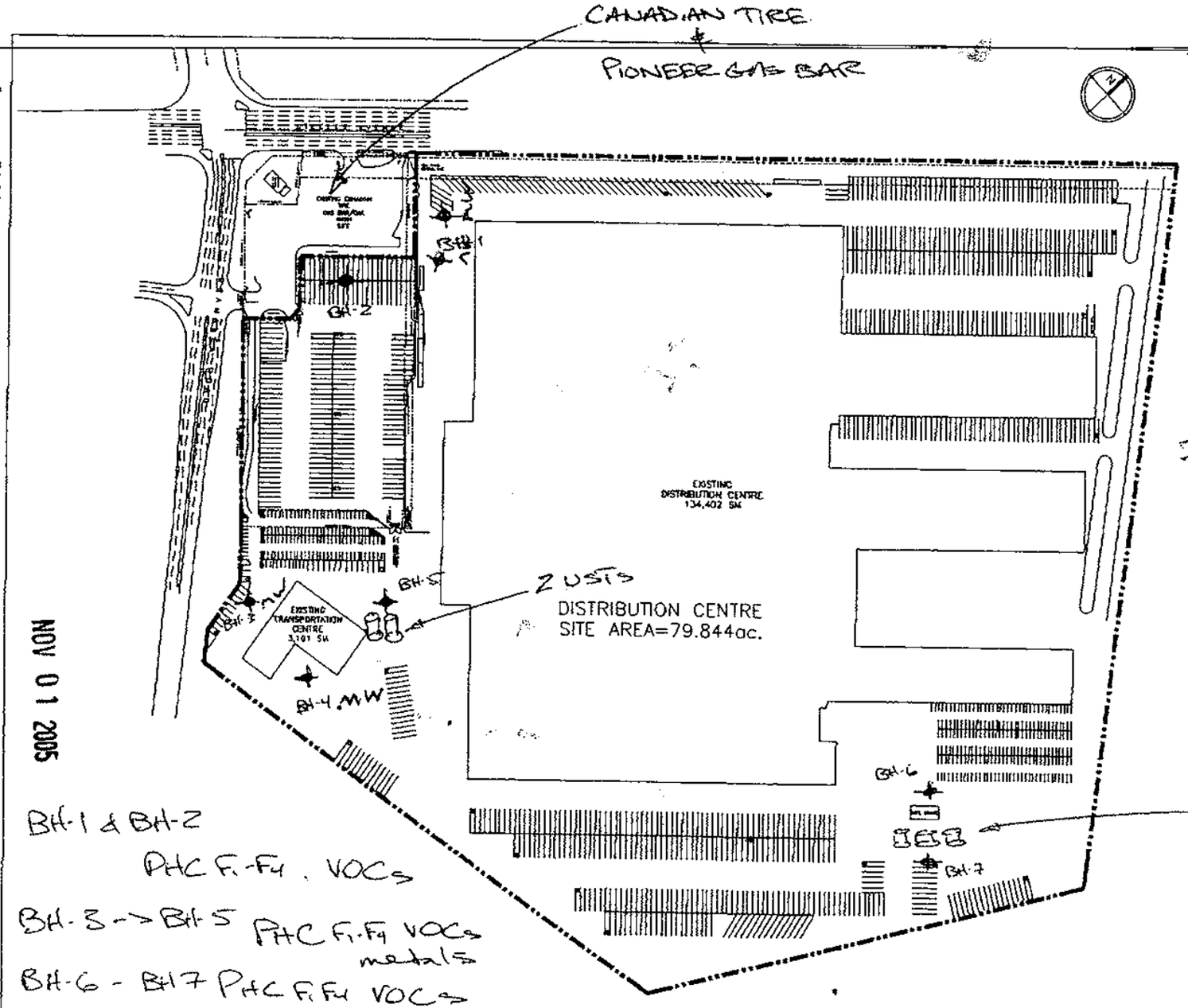
Ministry Use Only

Data Source — Contractor: 7238

Date Received YYYY MM DD: NOV 01 2005 — Date of Inspection YYYY MM DD

Remarks — Well Record Number

0506E (09/03) Contractor's Copy ☐ Ministry's Copy ☐ Well Owner's Copy ☐ *Cette formule est disponible en français*



No. 6842 P. 3
Jul. 15. 2005 3:32PM
NOV 01 2005

Ontario Ministry of the Environment

Well Tag No. *(Place Sticker and/or Print Below)* A 063685 A063685

Well Record

Regulation 903 Ontario Water Resources Act

Page 1 of 3

[redacted]

Address of Well Location (Street Number/Name, RR)	Township	Lot	Concession
2021 Steeles Ave. E			
County/District/Municipality	**City/Town/Village**	**Province**	**Postal Code**
Peel county	Brampton	Ontario	L6T4L5

UTM Coordinates NAD 83 Zone 17 Easting 605569 Northing 4839912 GPS Unit Make Garmin Model Etrex Mode of Operation: ☐ Differentiated, specify ☐ Undifferentiated ☑ Averaged

General Colour	Most Common Material	Other Materials	General Description	Depth (Metres) From	To
brown	gravel	sand	soft	0	2.13
brown	clay	shale	hard	2.13	3.66
grey	shale		hard	3.66	3.35

Depth Set at (Metres) From	To	Type of Sealant Used (Material and Type)	Volume Placed (Cubic Metres)
0	.31	Concrete	.0021
.31	1.65	Bentonite	.0137
1.65	3.50	Silica Sand	.0105

☐ Cable Tool ☐ Rotary (Conventional) ☐ Rotary (Reverse) ☐ Rotary (Air) ☐ Air percussion ☐ Other, specify

☐ Diamond ☐ Jetting ☑ Driving ☐ Digging ☐ Boring

☐ Public ☐ Domestic ☐ Livestock ☐ Irrigation ☐ Industrial ☐ Other, specify

☐ Commercial ☐ Municipal ☐ Test Hole ☐ Cooling & Air Conditioning

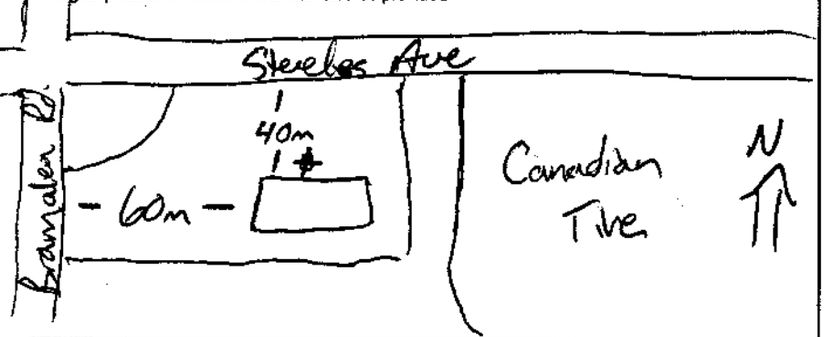
☐ Not used ☐ Dewatering ☑ Monitoring

☐ Water Supply ☐ Replacement Well ☑ Test Hole ☐ Recharge Well

☐ Dewatering Well ☐ Abandoned, Insufficient Supply ☐ Abandoned, Poor Water Quality ☐ Abandoned, other, specify

☑ Observation and/or Monitoring Hole ☐ Alteration (Construction) ☐ Other, specify

Please provide a map below showing:
- all property boundaries, and measurements sufficient to locate the well in relation to fixed points,
- an arrow indicating the North direction
- detailed drawings can be provided as attachments no larger than legal size (8.5" by 14")
- v digital pictures of inside of well can also be provided



Check box if after last of well yield, water was:
☐ Clear and sand free
☐ Cannot develop to sand-free state

If pumping discontinued, give reason:

Pumping test method

Pump intake set at (Metres)

Pumping rate (Litres/min)

Duration of pumping hrs + min

Final water level end of pumping (Metres)

Recommended pump type ☐ Shallow ☐ Deep

Recommended pump depth Metres

Recommended pump rate (Litres/min)

If flowing give rate (Litres/min)

	Draw Down		Recovery	
	Time (Min)	Water Level (Metres)	Time (Min)	Water Level (Metres)
Static Level			Static Level	
1			1	
2			2	
3			3	
4			4	
5			5	
10			10	
15			15	
20			20	
25			25	
30			30	
40			40	
50			50	
60			60	

Water found at Depth	Kind of Water
Metres ☐ Gas	☐ Fresh ☐ Salty ☐ Sulphur ☐ Minerals
Metres ☐ Gas	☐ Fresh ☐ Salty ☐ Sulphur ☐ Minerals
Metres ☐ Gas	☐ Fresh ☐ Salty ☐ Sulphur ☐ Minerals

☐ Galvanized ☐ Steel ☐ Fibreglass ☑ Plastic ☐ Concrete	☐ Galvanized ☐ Steel ☐ Fibreglass ☑ Plastic ☐ Concrete

☐ Open Hole

Disinfected? ☐ Yes ☐ No

Diameter of the Hole (Centimetres) 10.92

Depth of the Hole (Metres) 3.50

Well Thickness (Metres) .0039

Inside Diameter of the Casing (Metres) .052

Depth of the Casing (Metres) 2.00

Date Well Completed (yyyy/mm/dd)	Was the well owner's information package delivered?	Date the Well Record and Package Delivered to Well Owner (yyyy/mm/dd)
2008/01/29	☐ Yes ☑ No	

Business Name of Well Contractor	Well Contractor's Licence No.
Strata soil Sampling Inc	7241

Business Address (Street No./Name, number RR)	Municipality
2-147 West Beaver Creek Unit 2	Richmond Hill

Province	Postal Code	Business E-mail Address
Ont	L4B1C6	info@stratasoil.com

Bus. Telephone No. (inc. area code)	Name of Well Technician (Last Name, First Name)
9057649304	Mike Brown

Well Technician's Licence No.	Signature of Technician	Date Submitted (yyyy/mm/dd)
T-2977	[signature]	2008/01/31

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7205746

Ontario — Ministry of the Environment

Measurements recorded in: ☐ Metric ☐ Imperial

Well Tag No. *(Place Sticker and/or Print Below)*
Tag#: A146782

Stellar – Water Well ID
FB 17

Well Record

Regulation 903 Ontario Water Resources Act

June 3/13 Page 1 of 1

ENBRIDGE GAS

Address of Well Location (Street Number/Name) | Township | Lot | Concession
5 of 407 between Dixie & Bramalea rd

County/District/Municipality | City/Town/Village | Province | Postal Code
Brampton | Ontario

UTM Coordinates: Zone | Easting | Northing | Municipal Plan and Sublot Number | Other
NAD 8 3 17 606195 4838793

Overburden and Bedrock Materials/Abandonment Sealing Record *(see instructions on the back of this form)*

General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft) From	Depth (m/ft) To
S3C11-1					
Brown	Silty clay till			0	2.1
Grey	Silty clay till			2.1	3.6
Grey	Fine Sand			3.6	4.5
Grey	Coarse Sand			4.5	9.7

Annular Space

Depth Set at (m/ft) From	To	Type of Sealant Used (Material and Type)	Volume Placed (m³/ft³)
0	.3	concrete	
.3	1.8	Bentonite chips	
1.8	7.5	Bentonite grout	
7.5	7.8	Bentonite chips	

Method of Construction

☐ Cable Tool ☐ Diamond
☐ Rotary (Conventional) ☐ Jetting
☐ Rotary (Reverse) ☐ Driving
☑ Boring ☐ Digging
☐ Air percussion
☐ Other, *specify*

Well Use

☐ Public ☐ Commercial ☐ Not used
☐ Domestic ☐ Municipal ☐ Dewatering
☐ Livestock ☑ Test Hole ☐ Monitoring
☐ Irrigation ☐ Cooling & Air Conditioning
☐ Industrial
☐ Other, *specify*

Construction Record - Casing

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft) From	Depth (m/ft) To
5.1	Plastic	.105	+.9	8.1

Construction Record - Screen

Inside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft) From	Depth (m/ft) To
6.4	Plastic	010	8.1	9.7

Status of Well

☐ Water Supply
☐ Replacement Well
☑ Test Hole
☐ Recharge Well
☐ Dewatering Well
☐ Observation and/or Monitoring Hole
☐ Alteration (Construction)
☐ Abandoned, Insufficient Supply
☐ Abandoned, Poor Water Quality
☐ Abandoned, other, *specify*
☐ Other, *specify*

Water Details

Water found at Depth: 3.6 (m/ft) | Kind of Water: ☐ Fresh ☐ Untested ☐ Gas ☐ Other, *specify*
Water found at Depth: (m/ft) | Kind of Water: ☐ Fresh ☐ Untested ☐ Gas ☐ Other, *specify*
Water found at Depth: (m/ft) | Kind of Water: ☐ Fresh ☐ Untested ☐ Gas ☐ Other, *specify*

Hole Diameter

Depth (m/ft) From	To	Diameter (cm/in)
0	9.7	21cm

Results of Well Yield Testing

After test of well yield, water was:
☐ Clear and sand free
☐ Other, *specify*

If pumping discontinued, give reason:

Pump intake set at (m/ft)

Pumping rate (l/min / GPM)

Duration of pumping: hrs + min

Final water level end of pumping (m/ft)

If flowing give rate (l/min / GPM)

Recommended pump depth (m/ft)

Recommended pump rate (l/min / GPM)

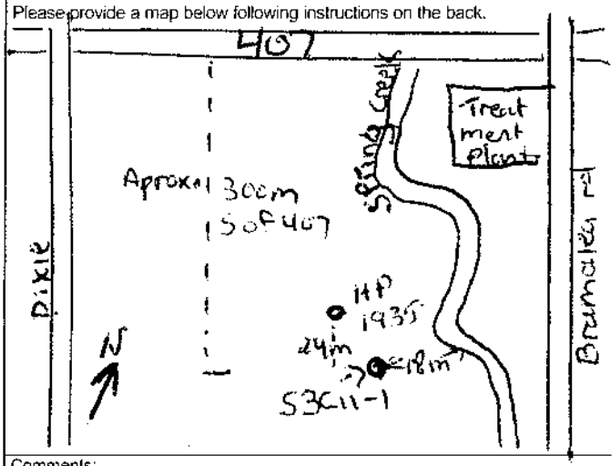
Well production (l/min / GPM)

Disinfected? ☐ Yes ☐ No

	Draw Down Time (min)	Draw Down Water Level (m/ft)	Recovery Time (min)	Recovery Water Level (m/ft)
Static Level				
1			1	
2			2	
3			3	
4			4	
5			5	
10			10	
15			15	
20			20	
25			25	
30			30	
40			40	
50			50	
60			60	

Map of Well Location

Please provide a map below following instructions on the back.



Comments:

Well Contractor and Well Technician Information

Business Name of Well Contractor: Geo Environmental | Well Contractor's Licence No.: 6607
Business Address (Street Number/Name): 1 Rumwood Crt | Municipality: Markham
Province: Ont | Postal Code: L3R 0A1 | Business E-mail Address:
Bus. Telephone No. (inc. area code): 905 475 3578 | Name of Well Technician (Last Name, First Name): Paquette Jeff
Well Technician's Licence No.: 2386 | Signature of Technician and/or Contractor: Paquette | Date Submitted: 20130603

Well owner's information package delivered: ☐ Yes ☐ No
Date Package Delivered:
Date Work Completed: 20130603

Ministry Use Only
Audit No.: Z 169904
JUL 31 2013

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Ontario Ministry of the Environment

Measurements recorded in: ☐ Metric ☐ Imperial

Well Tag No. *(Place Sticker and/or Print Below)*

Tag#: A146780

Well Record

Regulation 903 Ontario Water Resources Act

Page 1 of 1

[redacted]

Address of Well Location (Street Number/Name): 7659 Bramalea rd

Township: —

Lot: —

Concession: —

County/District/Municipality: —

City/Town/Village: Brampton

Province: Ontario

Postal Code: —

UTM Coordinates: Zone 17 | Easting 606446 | Northing 4839202 (NAD 83)

Municipal Plan and Sublot Number: —

Other: —

Overburden and Bedrock Materials/Abandonment Sealing Record *(see instructions on the back of this form)*

General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft) From	Depth (m/ft) To
S3C12-2					
Brown	Clay silt till			0	4.5
Brown	Sandy silt till			4.5	7.5
Grey	Silt till			7.5	15.1
Grey	Weathered shale			15.1	16.6

Annular Space

Depth Set at (m/ft) From	To	Type of Sealant Used (Material and Type)	Volume Placed (m³/ft³)
0	.3	concrete	
.3	1.8	Bentonite chips	
1.8	13.8	Bentonite grout	
13.8	14.8	Bentonite chips	

Method of Construction

☐ Cable Tool ☐ Diamond
☐ Rotary (Conventional) ☐ Jetting
☐ Rotary (Reverse) ☐ Driving
☑ Boring ☐ Digging
☐ Air percussion
☐ Other, *specify*

Well Use

☐ Public ☐ Commercial ☐ Not used
☐ Domestic ☐ Municipal ☐ Dewatering
☐ Livestock ☑ Test Hole ☐ Monitoring
☐ Irrigation ☐ Cooling & Air Conditioning
☐ Industrial
☐ Other, *specify*

Construction Record - Casing

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft) From	Depth (m/ft) To
5.1	Plastic	.64	[redacted]	[redacted]
			1.9	15.1

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft) From	Depth (m/ft) To
6.5	Plastic	.010	15.1	16.6

Status of Well

☐ Water Supply
☐ Replacement Well
☐ Test Hole
☐ Recharge Well
☐ Dewatering Well
☑ Observation and/or Monitoring Hole
☐ Alteration (Construction)
☐ Abandoned, Insufficient Supply
☐ Abandoned, Poor Water Quality
☐ Abandoned, other, *specify*
☐ Other, *specify*

Water Details

Water found at Depth (m/ft)	Kind of Water	
7.0	☐ Fresh ☐ Untested ☐ Gas ☐ Other, *specify*	
	☐ Fresh ☐ Untested ☐ Gas ☐ Other, *specify*	
	☐ Fresh ☐ Untested ☐ Gas ☐ Other, *specify*	

Hole Diameter

Depth (m/ft) From	Depth (m/ft) To	Diameter (cm/in)
0	16.6	21cm

Well Contractor and Well Technician Information

Business Name of Well Contractor: Geo Environmental

Well Contractor's Licence No.: 6607

Business Address (Street Number/Name): 1 Wanless Crt

Municipality: Nobleton

Province: Ont

Postal Code: L7B 0H1

Business E-mail Address: —

Bus. Telephone No. *(inc. area code)*: 905 7763586

Name of Well Technician (Last Name, First Name): RAQUETTE JEFF

Well Technician's Licence No.: 2386

Signature of Technician and/or Contractor: Raquette

Date Submitted: 20130522

Results of Well Yield Testing

After test of well yield, water was:
☐ Clear and sand free
☐ Other, *specify*

If pumping discontinued, give reason:

Pump intake set at (m/ft)

Pumping rate (l/min / GPM)

Duration of pumping: hrs + min

Final water level end of pumping (m/ft)

If flowing give rate (l/min / GPM)

Recommended pump depth (m/ft)

Recommended pump rate (l/min / GPM)

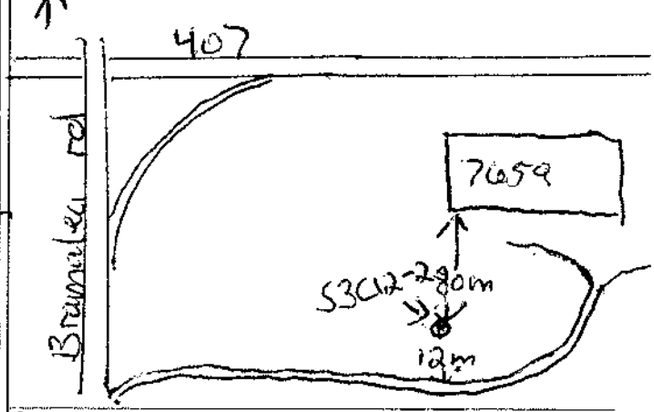
Well production (l/min / GPM)

Disinfected? Yes No

	Draw Down Time (min)	Draw Down Water Level (m/ft)	Recovery Time (min)	Recovery Water Level (m/ft)
Static Level				
1			1	
2			2	
3			3	
4			4	
5			5	
10			10	
15			15	
20			20	
25			25	
30			30	
40			40	
50			50	
60			60	

Map of Well Location

Please provide a map below following instructions on the back.



Comments:

Well owner's information package delivered: Yes / No

Date Package Delivered: —

Date Work Completed: 20130522

Ministry Use Only

Audit No. Z 169898

JUL 31 2013

Ontario — Ministry of the Environment

Well Tag No. (Place Sticker and/or Print Below): A143107

Well Record

Regulation 903 Ontario Water Resources Act

Page ____ of ____

Measurements recorded in: ☐ Metric ☐ Imperial

Well Owner's Information

First Name	Last Name / Organization	E-mail Address	☐ Well Constructed by Well Owner
	Stantec		

Mailing Address (Street Number/Name)	Municipality	Province	Postal Code	Telephone No. (inc. area code)

Well Location

Address of Well Location (Street Number/Name)	Township	Lot	Concession
Goreway @ CN Rail			

County/District/Municipality	City/Town/Village	Province	Postal Code
	Brampton	Ontario	L6T0B1

UTM Coordinates	Zone	Easting	Northing	Municipal Plan and Sublot Number	Other
NAD 83	17	606217	4838867		

Overburden and Bedrock Materials/Abandonment Sealing Record *(see instructions on the back of this form)*

General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft) From	Depth (m/ft) To
Brown	Top soil	Clay	soft	0'	5'
Brown	Clay	silt	dense	5'	12'
Brown	Sand	gravel	loose	12'	18.5'

Annular Space

Depth Set at (m/ft) From	To	Type of Sealant Used (Material and Type)	Volume Placed (m³/ft³)
0'	11.5'	Bentonite.	

Method of Construction

☐ Cable Tool ☐ Diamond ☐ Rotary (Conventional) ☐ Jetting ☐ Rotary (Reverse) ☐ Driving ☐ Boring ☐ Digging ☐ Air percussion ☐ Other, specify

Well Use

☐ Public ☐ Commercial ☐ Not used ☐ Domestic ☐ Municipal ☐ Dewatering ☐ Livestock ☐ Test Hole ☑ Monitoring ☐ Irrigation ☐ Cooling & Air Conditioning ☐ Industrial ☐ Other, specify

Construction Record - Casing

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft) From	Depth (m/ft) To
2"	Plastic		0'	13.5'

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft) From	Depth (m/ft) To
2"	Plastic	10	13.5'	18.5'

Status of Well

☐ Water Supply ☐ Replacement Well ☐ Test Hole ☐ Recharge Well ☐ Dewatering Well ☐ Observation and/or Monitoring Hole ☐ Alteration (Construction) ☐ Abandoned, Insufficient Supply ☐ Abandoned, Poor Water Quality ☐ Abandoned, other, specify ☐ Other, specify

Results of Well Yield Testing

After test of well yield, water was: ☐ Clear and sand free ☐ Other, specify

If pumping discontinued, give reason:

Pump intake set at (m/ft)

Pumping rate (l/min / GPM)

Duration of pumping ____ hrs + ____ min

Final water level end of pumping (m/ft)

If flowing give rate (l/min / GPM)

Recommended pump depth (m/ft)

Recommended pump rate (l/min / GPM)

Well production (l/min / GPM)

Disinfected? ☐ Yes ☐ No

	Draw Down Time (min)	Draw Down Water Level (m/ft)	Recovery Time (min)	Recovery Water Level (m/ft)
Static Level				
1			1	
2			2	
3			3	
4			4	
5			5	
10			10	
15			15	
20			20	
25			25	
30			30	
40			40	
50			50	
60			60	

Water Details

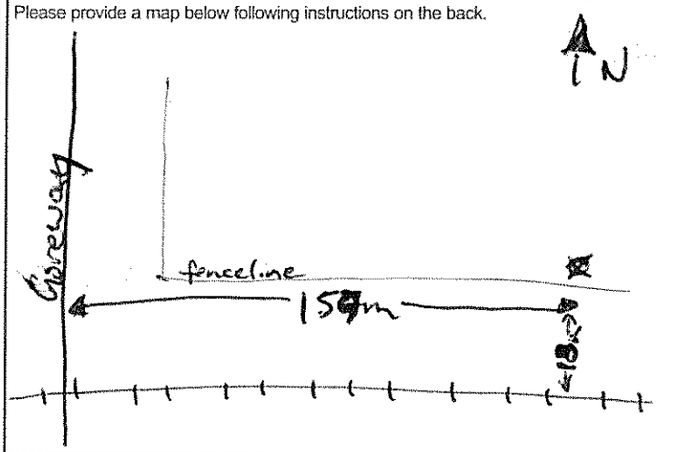
Water found at Depth (m/ft)	Kind of Water	
	☐ Gas	☐ Fresh ☐ Untested ☐ Other, specify
	☐ Gas	☐ Fresh ☐ Untested ☐ Other, specify
	☐ Gas	☐ Fresh ☐ Untested ☐ Other, specify

Hole Diameter

Depth (m/ft) From	To	Diameter (cm/in)
0'	18.5'	8.25"

Map of Well Location

Please provide a map below following instructions on the back.



Comments: N. of fence line.

Well Contractor and Well Technician Information

Business Name of Well Contractor	Well Contractor's Licence No.
Terex Drilling Solutions	7501

Business Address (Street Number/Name)	Municipality
2382 Stauffville Rd	Gormley

Province	Postal Code	Business E-mail Address
Ont	L0H1G0	terexdrillingsolutions@gmail.com

Bus. Telephone No. (inc. area code)	Name of Well Technician (Last Name, First Name)
4167503636	Mirowski, Dustin

Well Technician's Licence No.	Signature of Technician and/or Contractor	Date Submitted
3680		

Well owner's information package delivered	Date Package Delivered	Date Work Completed
☐ Yes ☐ No		2013/06/18

Ministry Use Only

Audit No. Z172711

Received AUG 02 2013

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Ministry's Copy

Ontario — Ministry of the Environment and Climate Change

Measurements recorded in: ☐ Metric ☒ Imperial

Well Tag No. *(Place Sticker and/or Print Below)* A176719

5-16752

Well Record

Regulation 903 Ontario Water Resources Act

Page ____ of ____

Well Owner's Information

First Name	Last Name / Organization	E-mail Address	☐ Well Constructed by Well Owner
	Enbridge		

Mailing Address (Street Number/Name)	Municipality	Province	Postal Code	Telephone No. *(inc. area code)*
2225 Sheppard Ave. E., 17th Floor	North York	ON	M2J 5C2	

Well Location

Address of Well Location (Street Number/Name)	Township	Lot	Concession
Bramalea Rd			

County/District/Municipality	City/Town/Village	Province	Postal Code
	Brampton	Ontario	

UTM Coordinates	Zone	Easting	Northing	Municipal Plan and Sublot Number	Other
NAD 8 3	17	606183	4838971		WKQ-007766 A0 - A0

Overburden and Bedrock Materials/Abandonment Sealing Record *(see instructions on the back of this form)*

General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft) From	Depth (m/ft) To
			Well Decommission		

Annular Space

Depth Set at (m/ft) From	To	Type of Sealant Used (Material and Type)	Volume Placed (m³/ft³)
0	20'	Grout	

Method of Construction

☐ Cable Tool ☐ Diamond
☐ Rotary (Conventional) ☐ Jetting
☐ Rotary (Reverse) ☐ Driving
☐ Boring ☐ Digging
☐ Air percussion
☒ Other, *specify* Direct Push

Well Use

☐ Public ☐ Commercial ☐ Not used
☐ Domestic ☐ Municipal ☐ Dewatering
☐ Livestock ☐ Test Hole ☒ Monitoring
☐ Irrigation ☐ Cooling & Air Conditioning
☐ Industrial
☐ Other, *specify*

Construction Record - Casing

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft) From	Depth (m/ft) To
1"	PVC	0.125"	0	10'

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No	Depth (m/ft) From	Depth (m/ft) To
1.25"	PVC	10	10'	20'

Status of Well

☐ Water Supply
☐ Replacement Well
☒ Test Hole
☐ Recharge Well
☐ Dewatering Well
☒ Observation and/or Monitoring Hole
☐ Alteration (Construction)
☐ Abandoned, Insufficient Supply
☐ Abandoned, Poor Water Quality
☒ Abandoned, other, *specify* not needed
☐ Other, *specify*

Water Details

Water found at Depth (m/ft)	Kind of Water: Fresh	Untested	Gas	Other, *specify*

Hole Diameter

Depth (m/ft) From	Depth (m/ft) To	Diameter (cm/in)
0	20'	1"

Results of Well Yield Testing

After test of well yield, water was:
☐ Clear and sand free
☐ Other, *specify*

If pumping discontinued, give reason:

Pump intake set at (m/ft)

Pumping rate (l/min / GPM)

Duration of pumping hrs + min

Final water level end of pumping (m/ft)

If flowing give rate (l/min / GPM)

Recommended pump depth (m/ft)

Recommended pump rate (l/min / GPM)

Well production (l/min / GPM)

Disinfected? ☐ Yes ☐ No

	Draw Down Time (min)	Draw Down Water Level (m/ft)	Recovery Time (min)	Recovery Water Level (m/ft)
Static Level				
1			1	
2			2	
3			3	
4			4	
5			5	
10			10	
15			15	
20			20	
25			25	
30			30	
40			40	
50			50	
60			60	

Map of Well Location

Please provide a map below following instructions on the back.

See Map
S3-F6 BH2a

Comments: General contractor:
Dillon Consulting Limited

Well Contractor and Well Technician Information

Business Name of Well Contractor	Well Contractor's Licence No.
Strata Soil Sampling Inc.	7241

Business Address (Street Number/Name)	Municipality
165 Shields Court	Markham

Province	Postal Code	Business E-mail Address
Ontario	L3R 8V2	wrecords@stratasoil.com

Bus. Telephone No. *(inc. area code)*	Name of Well Technician (Last Name, First Name)
905-764-9304	Walker, Jonathan

Well Technician's Licence No.	Signature of Technician and/or Contractor	Date Submitted
5833		2015 04 02

Well owner's information package delivered: ☐ Yes ☒ No

Date Package Delivered:

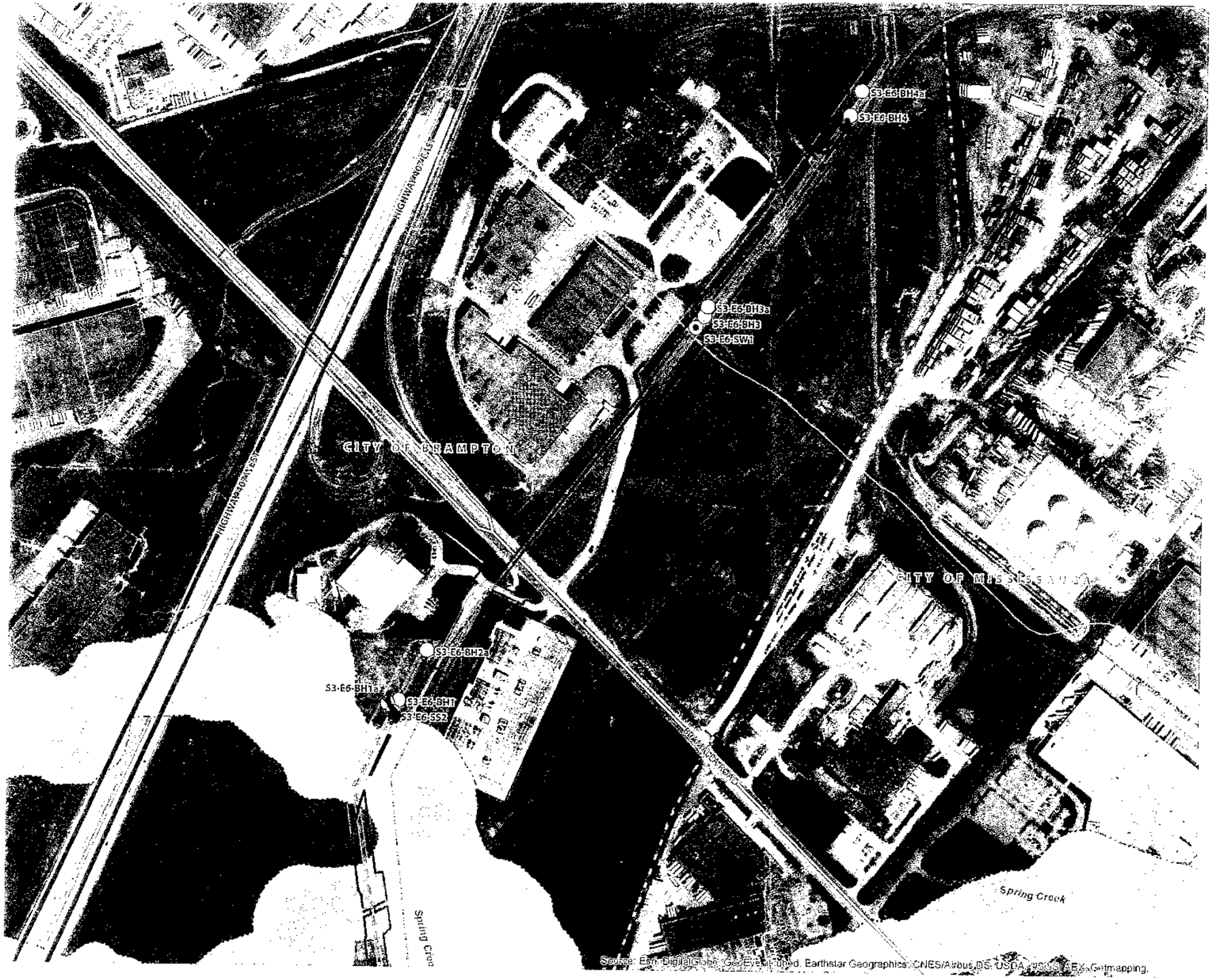
Date Work Completed: 2015 03 18

Ministry Use Only

Audit No: Z 207704

APR 10 2015

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GTA PROJECT

ENBRIDGE GAS DISTRIBUTION GTA PROJECT

S3-E6
PINS 140280007, 140280145, 140280342
BRAMPTON, ONTARIO

PROPOSED PRE-CONSTRUCTION SAMPLING LOCATIONS
FIGURE 9

- Proposed Primary Borehole
- Proposed Secondary Borehole
- Proposed Shallow Soil Sampling
- Proposed Surface Water Sampling
- HDD Bore Pit
- Site
- Property Limits
- Existing Underground Pipeline
- Temporary Working Area
- Water Body
- Conservation Authority Regulated Area
- Municipality

Remove Park flags

Parkway

1:5,000
0 50 100 200 m

MAP DRAWING INFORMATION:
DATA PROVIDED BY MNR

MAP CREATED BY: SW
MAP CHECKED BY: JH
MAP PROJECTION: NAD 1983 UTM Zone 17N

DILLON CONSULTING

PROJECT: 14-0281
STATUS: DRAFT
DATE: 10 Feb 2015

14-0281
Feb 22

Ontario — Ministry of the Environment and Climate Change

Measurements recorded in: ☐ Metric ☒ Imperial

Well Tag No. *(Place Sticker and/or Print Below)* A174798

5-16752

Well Record

Regulation 903 Ontario Water Resources Act

Page ___ of ___

Well Owner's Information

First Name | Last Name / Organization: Enbridge | E-mail Address | ☐ Well Constructed by Well Owner

Mailing Address (Street Number/Name): 2225 Sheppard Ave. E., 17th Floor | Municipality: North York | Province: ON | Postal Code: M2J 5C2 | Telephone No. *(inc. area code)*

Well Location

Address of Well Location (Street Number/Name): Bramalea Rd | Township | Lot | Concession

County/District/Municipality | City/Town/Village: Brampton | Province: Ontario | Postal Code

UTM Coordinates: Zone | Easting | Northing | Municipal Plan and Sublot Number | Other: WKQ-007766 A0-A0

NAD 8 3 1 7 | 606159 | 4839910

Overburden and Bedrock Materials/Abandonment Sealing Record *(see instructions on the back of this form)*

General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft) From	Depth (m/ft) To

well Decommission

Annular Space

Depth Set at (m/ft) From	To	Type of Sealant Used (Material and Type)	Volume Placed (m³/ft³)
0	10'	Grout	

Method of Construction

☐ Cable Tool ☐ Diamond
☐ Rotary (Conventional) ☐ Jetting
☐ Rotary (Reverse) ☐ Driving
☐ Boring ☐ Digging
☐ Air percussion
☒ Other, specify: Direct Push

Well Use

☐ Public ☐ Commercial ☐ Not used
☐ Domestic ☐ Municipal ☐ Dewatering
☐ Livestock ☒ Test Hole ☒ Monitoring
☐ Irrigation ☐ Cooling & Air Conditioning
☐ Industrial
☐ Other, specify

Construction Record - Casing

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft) From	Depth (m/ft) To
1"	PVC	0.125"	0	5'

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft) From	Depth (m/ft) To
1.25"	PVC	10	5'	10'

Status of Well

☐ Water Supply
☐ Replacement Well
☒ Test Hole
☐ Recharge Well
☐ Dewatering Well
☒ Observation and/or Monitoring Hole
☐ Alteration (Construction)
☐ Abandoned, Insufficient Supply
☐ Abandoned, Poor Water Quality
☑ Abandoned, other, specify: not needed
☐ Other, specify

Water Details

Water found at Depth (m/ft) | Kind of Water: Fresh / Untested / Gas / Other, specify
Water found at Depth (m/ft) | Kind of Water: Fresh / Untested / Gas / Other, specify
Water found at Depth (m/ft) | Kind of Water: Fresh / Untested / Gas / Other, specify

Hole Diameter

Depth (m/ft) From	To	Diameter (cm/in)
0	10'	1"

Well Contractor and Well Technician Information

Business Name of Well Contractor: Strata Soil Sampling Inc. | Well Contractor's Licence No.: 7241

Business Address (Street Number/Name): 165 Shields Court | Municipality: Markham

Province: Ontario | Postal Code: L3R 8V2 | Business E-mail Address: wrecords@stratasoil.com

Bus. Telephone No. *(inc. area code)*: 905-764-9304 | Name of Well Technician (Last Name, First Name): Walker, Jonathan

Well Technician's Licence No.: 3833 | Signature of Technician and/or Contractor | Date Submitted: 20150402

Results of Well Yield Testing

After test of well yield, water was: ☐ Clear and sand free ☐ Other, specify

If pumping discontinued, give reason:

Pump intake set at (m/ft)

Pumping rate (l/min / GPM)

Duration of pumping: hrs + min

Final water level end of pumping (m/ft)

If flowing give rate (l/min / GPM)

Recommended pump depth (m/ft)

Recommended pump rate (l/min / GPM)

Well production (l/min / GPM)

Disinfected? Yes / No

	Draw Down Time (min)	Draw Down Water Level (m/ft)	Recovery Time (min)	Recovery Water Level (m/ft)
Static Level				
1			1	
2			2	
3			3	
4			4	
5			5	
10			10	
15			15	
20			20	
25			25	
30			30	
40			40	
50			50	
60			60	

Map of Well Location

Please provide a map below following instructions on the back.

See Map

53-E6-BH1a

Comments: ~~General contractor:~~ Dillon Consulting Limited

Well owner's information package delivered: Yes ☒ / No

Date Package Delivered

Date Work Completed: 20150315

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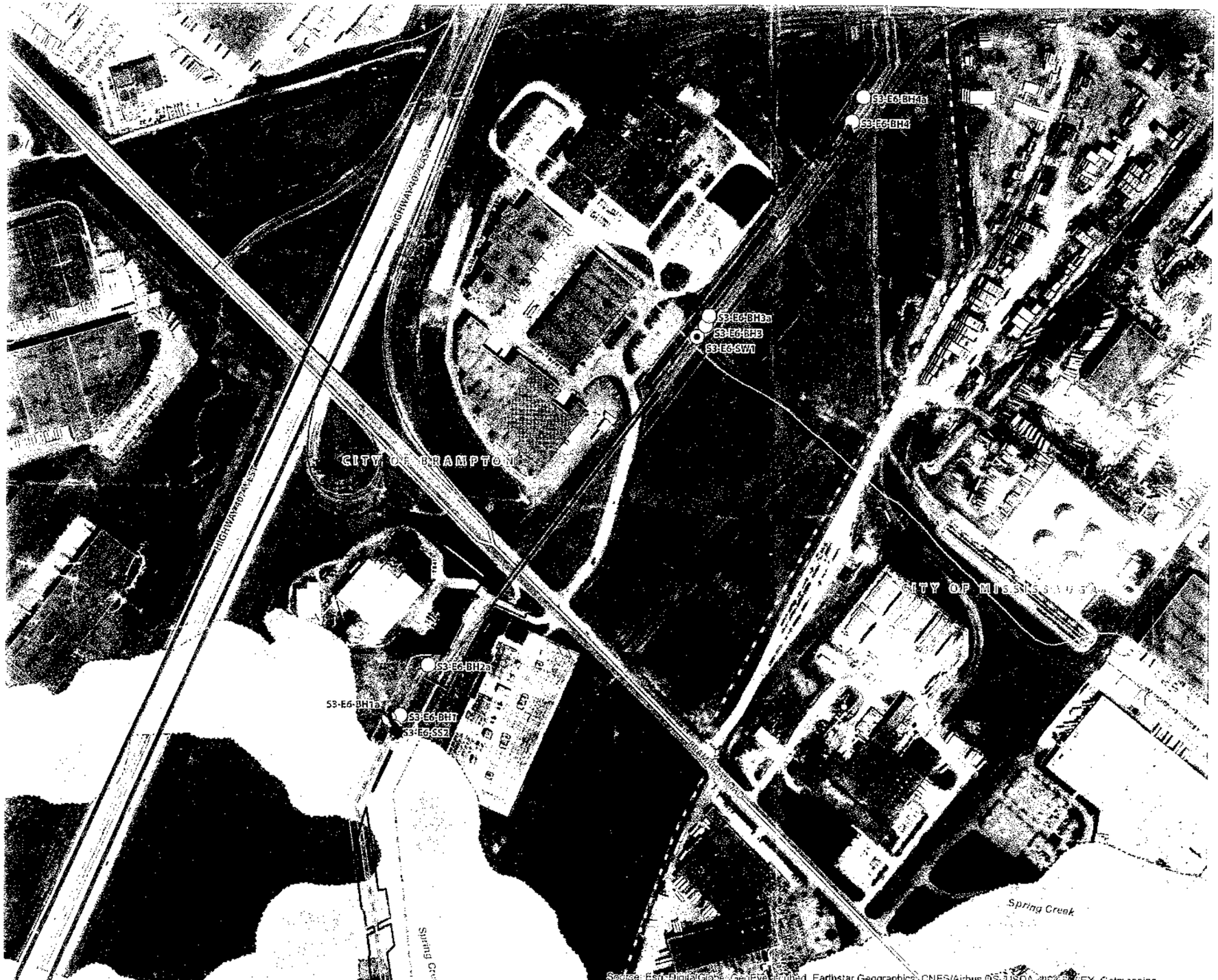
Audit No: Z 207705

APR 09 2015

0506E (2014/11)

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GTA PROJECT

ENBRIDGE GAS DISTRIBUTION GTA PROJECT

S3-E6
PINS 1-40280007, 1-40280145, 1-40280[illegible]
BRAMPTON, ONTARIO

PROPOSED PRE-CONSTRUCTION SAMPLING LOCATIONS
FIGURE 9

- Proposed Primary Borehole
- Proposed Secondary Borehole
- Proposed Shallow Soil Sampling
- Proposed Surface Water Sampling
- HDD Exit Pit
- Site
- Preferred Route
- Enbridge Property Boundary
- Temporary Working Space
- Watercourse
- Conservation Authority Regulated Area
- Study Area

Remove Park flags

Parkway

C-7241
20285

1:5,000

MAP DRAWING AND PRINTING DONE PROPERLY BY DILLON

MAP CREATED BY: GM
MAP CHECKED BY: KT
MAP PRINTED ON: [illegible]

DILLON

PROJECT NUMBER
[illegible]
STATUS: DRAFT

7256191

Ontario — Ministry of the Environment

Measurements recorded in: ☐ Metric ☒ Imperial

Well Tag No. (Place Sticker and/or Print Below): A194381 Tag#: A194381

Well Record

Regulation 903 Ontario Water Resources Act

Page 1 of 1

METROLINX

Address of Well Location (Street Number/Name): 1713 Steeles Ave E.
Township: Bramalea.
Lot:
Concession:
County/District/Municipality: Peel
City/Town/Village: Brampton
Province: Ontario
Postal Code: L6T4K3
UTM Coordinates Zone: NAD 83 17
Easting: 605644
Northing: 4839721
Municipal Plan and Sublot Number:
Other:

Overburden and Bedrock Materials/Abandonment Sealing Record *(see instructions on the back of this form)*

General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft) From	Depth (m/ft) To
Black	Asphalt	gravel	hard	0.	.6
Brown	Silt	Clay	hard	.6	14
Grey	Shale.	Clay	hard.	14	24

② 605553 4839661
③ 605591 4839785.

Annular Space

Depth Set at (m/ft) From	To	Type of Sealant Used (Material and Type)	Volume Placed (m³/ft³)
15	2.0	Bentonite Chips	
2.0	1.0	Sand	
1.0	0	Cement.	

Method of Construction

☐ Cable Tool ☒ Diamond
☐ Rotary (Conventional) ☐ Jetting
☐ Rotary (Reverse) ☐ Driving
☒ Boring ☐ Digging
☐ Air percussion
☐ Other, specify

Well Use

☐ Public ☐ Commercial ☐ Not used
☐ Domestic ☐ Municipal ☐ Dewatering
☐ Livestock ☐ Test Hole ☒ Monitoring
☐ Irrigation ☐ Cooling & Air Conditioning
☐ Industrial
☐ Other, specify

Construction Record - Casing

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft) From	Depth (m/ft) To
2	PVC	SCH40	17	0

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft) From	Depth (m/ft) To
2	PVC	10	24	17.

Status of Well

☐ Water Supply
☐ Replacement Well
☐ Test Hole
☐ Recharge Well
☐ Dewatering Well
☒ Observation and/or Monitoring Hole
☐ Alteration (Construction)
☐ Abandoned, Insufficient Supply
☐ Abandoned, Poor Water Quality
☐ Abandoned, other, specify
☐ Other, specify

Water Details

Water found at Depth (m/ft)	Kind of Water: Fresh	Untested	Gas	Other, specify

Hole Diameter

Depth (m/ft) From	To	Diameter (cm/in)
0	14	8
14	24	4

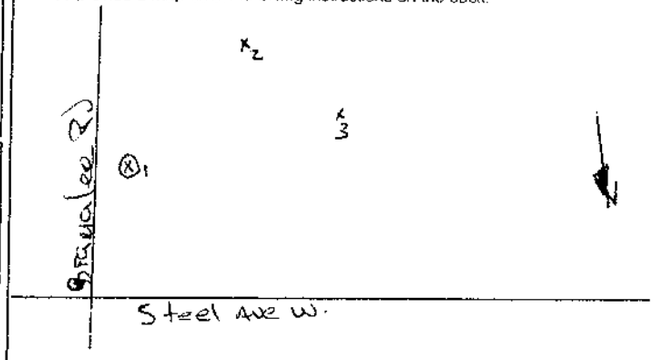
Results of Well Yield Testing

After test of well yield, water was: ☐ Clear and sand free ☐ Other, specify
If pumping discontinued, give reason:
Pump intake set at (m/ft)
Pumping rate (l/min / GPM)
Duration of pumping: hrs + min
Final water level end of pumping (m/ft)
If flowing give rate (l/min / GPM)
Recommended pump depth (m/ft)
Recommended pump rate (l/min / GPM)
Well production (l/min / GPM)
Disinfected? ☐ Yes ☐ No

	Draw Down Time (min)	Draw Down Water Level (m/ft)	Recovery Time (min)	Recovery Water Level (m/ft)
Static Level				
1			1	
2			2	
3			3	
4			4	
5			5	
10			10	
15			15	
20			20	
25			25	
30			30	
40			40	
50			50	
60			60	

Map of Well Location

Please provide a map below following instructions on the back.



Well Contractor and Well Technician Information

Business Name of Well Contractor: Atcost Drilling
Well Contractor's Licence No.: 6032
Business Address (Street Number/Name): 186 Crumley Industrial Ave
Municipality: York.
Province: ONT
Postal Code: L0H1G0
Business E-mail Address: atcostdrilling.com
Bus. Telephone No. (inc. area code): 9058889999
Name of Well Technician (Last Name, First Name): Monette, Chris
Well Technician's Licence No.: T685
Signature of Technician and/or Contractor:
Date Submitted: 2015 1030

Comments: CH2M 15A 191.

Well owner's information package delivered: ☐ Yes ☒ No
Date Package Delivered:
Date Work Completed: 2015 1030

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Audit No: Z 194361
JAN 19 2016

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Ontario — Ministry of the Environment, Conservation and Parks

Measurements recorded in: ☐ Metric ☑ Imperial

Well Tag No. (Place Sticker and/or Print Below): Tag#:A304811

20-431

Well Record

Regulation 903 Ontario Water Resources Act

Page 1 of 1

Well Owner's Information

First Name	Last Name/Organization	E-mail Address	☐ Well Constructed by Well Owner
	EXP		

Mailing Address (Street Number/Name)	Municipality	Province	Postal Code	Telephone No. (inc. area code)
1595 Clark Blvd.	Brampton	ON	L6T4V1	9057939800

Well Location

Address of Well Location (Street Number/Name)	Township	Lot	Concession
7656 Bramalea Rd	Brampton		

County/District/Municipality	City/Town/Village	Province	Postal Code
		Ontario	L6T5M5

UTM Coordinates	Zone	Easting	Northing	Municipal Plan and Sublot Number	Other
NAD 83	17	601175	4839127		

Overburden and Bedrock Materials/Abandonment Sealing Record (see instructions on the back of this form)

General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft) From	Depth (m/ft) To
Brown	Fill	Sand	loose, dry	0	5
Yellow	Sand		loose, dry	5	10
Grey	gravel	Sand	loose, dry	10	20
~~Other~~					

Annular Space

Depth Set at (m/ft) From	Depth Set at (m/ft) To	Type of Sealant Used (Material and Type)	Volume Placed (m^3/ft^3)
0	9	Bentonite	1.62
9	20	Sand	1.98

Method of Construction

☐ Cable Tool ☐ Diamond
☐ Rotary (Conventional) ☐ Jetting
☐ Rotary (Reverse) ☐ Driving
☐ Boring ☐ Digging
☐ Air percussion
☑ Other, specify Auger

Well Use

☐ Public ☐ Commercial ☐ Not used
☐ Domestic ☐ Municipal ☐ Dewatering
☐ Livestock ☐ Test Hole ☑ Monitoring
☐ Irrigation ☐ Cooling & Air Conditioning
☐ Industrial
☐ Other, specify

Construction Record - Casing

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft) From	Depth (m/ft) To
2	PVC	0.188	0	10

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft) From	Depth (m/ft) To
2.375	PVC	10	10	20

Status of Well

☐ Water Supply
☐ Replacement Well
☐ Test Hole
☐ Recharge Well
☐ Dewatering Well
☑ Observation and/or Monitoring Hole
☐ Alteration (Construction)
☐ Abandoned, Insufficient Supply
☐ Abandoned, Poor Water Quality
☐ Abandoned, other, specify
☐ Other, specify

Water Details

Water found at Depth (m/ft)	Kind of Water	Water found at Depth (m/ft)	Kind of Water
☐ Gas	☐ Fresh ☐ Untested ☐ Other, specify	☐ Gas	☐ Fresh ☐ Untested ☐ Other, specify
Water found at Depth (m/ft) ☐ Gas	Kind of Water: ☐ Fresh ☐ Untested ☐ Other, specify		

Hole Diameter

Depth (m/ft) From	Depth (m/ft) To	Diameter (cm/in)
0	20	6

Results of Well Yield Testing

After test of well yield, water was:
☐ Clear and sand free
☐ Other, specify

If pumping discontinued, give reason:

Pump intake set at (m/ft)

Pumping rate (l/min / GPM) /

Duration of pumping ____ hrs + ____ min

Final water level end of pumping (m/ft)

If flowing give rate (l/min/GPM)

Recommended pump depth (m/ft)

Recommended pump rate (l/min/GPM)

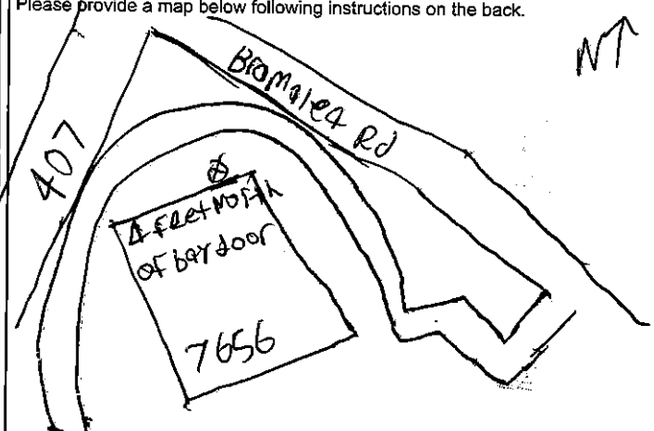
Well production (l/min/GPM)

Disinfected? ☐ Yes ☐ No

	Draw Down Time (min)	Draw Down Water Level (m/ft)	Recovery Time (min)	Recovery Water Level (m/ft)
Static Level				
1			1	
2			2	
3			3	
4			4	
5			5	
10			10	
15			15	
20			20	
25			25	
30			30	
40			40	
50			50	
60			60	

Map of Well Location

Please provide a map below following instructions on the back.



Comments:

Well Contractor and Well Technician Information

Business Name of Well Contractor: **Terra Firma Environmental Services Ltd.**
Well Contractor Licence #: 6946
84 Martin Ross Ave. Toronto, ON M3J 2L4
Bus #: 416.450.6244, E: info@terrafirmaservices.com
Well Tech & Licence #: Welch, David, #: 4129

Well Contractor's Licence No.

Well Technician's Licence No.

Signature of Technician and/or Contractor

Date Submitted: 2020/09/08

Well owner's information package delivered: ☐ Yes ☐ No

Date Package Delivered: Y Y Y Y M M D D

Date Work Completed: 2020/09/08

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Audit No. Z346312

Received SEP 16 2020

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Appendix C

Selected Borehole Logs

Terraprobe

LOG OF BOREHOLE 1

PROJECT: Energy From Waste Facility
LOCATION: Bramalea Rd., Brampton
CLIENT: SNC Services Limited

DATE: December 20, 1989
EQUIPMENT: CME 55
ELEVATION DATUM:
FILE: 89357

ELEV. DEPTH m.	DESCRIPTION	NUMBER	TYPE	'N' VALUES
183.7	Ground Surface			
	TOPSOIL			
0.2	Brown Stiff to very Stiff Moist **CLAYEY SILT**, some sand and gravel. (TILL)	1	SS	9
		2	SS	24
182.2				
1.5	Brown Dense to very Dense Moist **SANDY SILT**, some gravel and clay, frequent oxidized horizontal planes (TILL)	3	SS	47
		4	SS	57
180.3		5	SS	50/6"
3.4	Grey Very Dense Moist to Wet **SILTY SAND**, some gravel, trace clay, occasional cobbles. (TILL) grinding at 3.4m depth on cobble or boulder.	6	SS	50/6"
		7	SS	63
176.1		8	SS	70/0
7.6	End of Borehole			

ELEVATION SCALE m.: 183, 182, 181, 180, 179, 178, 177, 176

PENETRATION RESISTANCE BLOWS/0.3 m — 10 20 30 40
SHEAR STRENGTH, kPa

WATER CONTENT PERCENT
Wp Wl
10 20 30

NOTES:
1) Borehole encountered refusal at 3.4m depth; hole deepened, 1.5M E.
2) Borehole open and water level measured at 7.0m upon completion; Samples 6 & 7

Terraprobe

LOG OF BOREHOLE 2

PROJECT: Energy From Waste Facility
LOCATION: Bramalea Rd., Brampton
CLIENT: SNC Services Limited

DATE: December 20, 1989
EQUIPMENT: CME 55
ELEVATION DATUM:
FILE: 89357

STRATIGRAPHY				SAMPLES			m.	PENETRATION RESISTANCE	WATER CONTENT
ELEV. DEPTH m.	DESCRIPTION	STRAT. PLOT	GROUND WATER	NUMBER	TYPE	'N' VALUES	ELEVATION SCALE	BLOWS/0.3 m x; 10 20 30 40; SHEAR STRENGTH, kPa	PERCENT ○; Wp WI; 10 20 30
182.8	Ground Surface								
	TOPSOIL								
0.25	Brown Stiff to very Stiff Moist CLAYEY SILT, some sand, trace gravel. (TILL)			1	SS	10	182		
181.3				2	SS	22			
1.5	Brown Dense to very Dense Moist SANDY SILT, some gravel and clay, oxidized planes (TILL)			3	SS	41	181		
178.5				4	SS	60	180		
				5	SS	66			
4.3	Grey Very Dense Moist SILTY SAND, some gravel trace clay. (TILL)			6	SS	80	179		
176.7				7	SS	75/4"	178		
6.1	Grey Highly Weathered Dry SHALE, limestone interbeds		▽				177		
175.2				8	SS	60/102"	176		
7.6	End of Borehole						175		

NOTES: 1) Borehole open and water level at 6.4m depth upon completion.

Terraprobe

LOG OF BOREHOLE 3

PROJECT: Energy From Waste Facility
LOCATION: Bramalea Rd., Brampton
CLIENT: SNC Services Limited

DATE: December 15, 1989
EQUIPMENT: CME 55
ELEVATION DATUM:
FILE: 89357

ELEV. DEPTH m.	DESCRIPTION	STRAT. PLOT	GROUND WATER	SAMPLES NUMBER	TYPE	'N' VALUES
183.1	Ground Surface					
	TOPSOIL					
0.20 / 182.1	Brown Stiff Moist CLAYEY SILT, some sand			1	SS	14
1.0	Brown Compact to Moist very Dense SANDY SILT, some gravel and clay, slightly mottled grey, oxidized horizontal planes. (TILL)			2	SS	18
				3	SS	43
				4	SS	48
179.1				5	SS	72
4.0	Brown Very Dense Wet SILTY SAND, some gravel trace clay (TILL)			6	SS	75/6"
177.6						
5.5	Grey Highly Weathered Moist SHALE, limestone interbeds			7	SS	80/6"
175.5				8	SS	70/3"
7.6	End of Borehole					

m. ELEVATION SCALE: 183, 182, 181, 180, 179, 178, 177, 176, 175

PENETRATION RESISTANCE BLOWS/0.3m x — 10 20 30 40 — SHEAR STRENGTH, kPa

WATER CONTENT PERCENT ○ — Wp — Wl — 10 20 30

NOTES:
1) Borehole open and water level at 6.7m upon completion.
2) Water level measured January 2, 1990 at 4.0m (elev. 179.1m)

Terraprobe

LOG OF BOREHOLE 4

PROJECT: Energy From Waste Facility
LOCATION: Bramalea Rd., Brampton
CLIENT: SNC Services Limited

DATE: December 18, 1989
EQUIPMENT: CME 55
ELEVATION DATUM:
FILE: 89357

ELEV. DEPTH m.	DESCRIPTION	NUMBER	TYPE	'N' VALUES
184.8	Ground Surface			
	TOPSOIL			
0.20	Brown Stiff Moist **CLAYEY SILT**, some sand, gravel	1	SS	9
183.6	(TILL)	2	SS	30
1.2	Brown Dense Moist **SANDY SILT**, some gravel and clay, slightly oxidized planes. (TILL)	3	SS	48
		4	SS	53
		5	SS	47
180.5				
4.3	Brown Very Dense Moist to Wet **SILTY SAND**, some gravel trace clay, cobbles. (TILL)	6	SS	63/5"
		7	SS	55/5"
178.4				
6.4	Grey cobbles/boulders			
177.2	Shale fragments	8	SS	60/2"
7.6	End of Borehole			

ELEVATION SCALE m.: 184, 183, 182, 181, 180, 179, 178, 177

PENETRATION RESISTANCE BLOWS/0.3 m (x) 10 20 30 40
SHEAR STRENGTH, kPa

WATER CONTENT PERCENT (O) Wp Wl 10 20 30

NOTES: 1) Borehole open to 6.3m depth and water level at 5.8m upon completion.
2) Water level measured January 2, 1990 at 4.5m depth(Elev. 180.3m)

Terraprobe

LOG OF BOREHOLE 5

PROJECT: Energy From Waste Facility
LOCATION: Bramalea Rd., Brampton
CLIENT: SNC Services Limited

DATE: December 19, 1989
EQUIPMENT: CME 55
ELEVATION DATUM:
FILE: 89357

ELEV. DEPTH m.	DESCRIPTION	NUMBER	TYPE	'N' VALUES	ELEVATION SCALE m.
183.0	Ground Surface				
	TOPSOIL				
0.25	Brown very Stiff Moist CLAYEY SILT, some sand, trace gravel. (TILL)	1	SS	11	
		2	SS	20	182
181.5					
1.5	Brown Dense to very Dense Moist SANDY SILT, some gravel and clay, oxidized planes. (TILL)	3	SS	38	
		4	SS	54	181
		5	SS	55	
179.0					180
4.0	Brown Very Dense Moist to Wet SILTY SAND, some gravel trace clay.	6	SS	65/6"	
					179
177.5					
5.5	Grey (TILL)				178
		7	SS	75	177
					176
175.4		8	SS	52/6"	
7.6	End of Borehole				175

PENETRATION RESISTANCE BLOWS/0.3 m (x) — 10 20 30 40
SHEAR STRENGTH, kPa

WATER CONTENT PERCENT (O)
Wp — Wl
10 20 30

NOTES: 1) Borehole open to 6.1m and water level at 5.6m upon completion.
2) Water level measured January 2, 1990 at 4.4m depth (Elev. 178.6m)

Terraprobe

LOG OF BOREHOLE 6

PROJECT: Energy From Waste Facility
LOCATION: Bramalea Rd., Brampton
CLIENT: SNC Services Limited

DATE: December 18, 1989
EQUIPMENT: CME 55
ELEVATION DATUM:
FILE: 89357

ELEV. DEPTH m.	DESCRIPTION	NUMBER	TYPE	'N' VALUES
183.4	Ground Surface			
	TOPSOIL			
0.20	Brown Stiff Moist	1	SS	9
182.4	CLAYEY SILT, some sand (TILL)			
1.0	Brown Dense to Brown very Dense	2	SS	28
	SANDY SILT, some gravel and clay.	3	SS	49
	(TILL)	4	SS	47
		5	SS	50/6"
179.4				
4.0	Grey			
		6	SS	89
177.6				
5.8	Grey Highly Weathered Dry	7	SS	65/6"
	SHALE, limestone interbeds			
175.8		8	SS	90/5"
7.6	End of Borehole			

ELEVATION SCALE m.: 183, 182, 181, 180, 179, 178, 177, 176

PENETRATION RESISTANCE BLOWS/0.3 m (x): 10, 20, 30, 40
SHEAR STRENGTH, kPa

WATER CONTENT PERCENT (○): Wp, Wl; 10, 20, 30

NOTES:
1) Borehole open to 6.7m depth and dry upon completion.
2) Water level measured January 2, 1990 at 3.1m depth (Elev. 180.3m)

Terraprobe

LOG OF BOREHOLE 7

PROJECT: Energy From Waste Facility
LOCATION: Bramalea Rd., Brampton
CLIENT: SNC Services Limited

DATE: December 15, 1989
EQUIPMENT: CME 55
ELEVATION DATUM:
FILE: 89357

ELEV. DEPTH m.	DESCRIPTION	NUMBER	TYPE	'N' VALUES
183.3	Ground Surface			
	TOPSOIL			
0.20	Brown Stiff Moist CLAYEY SILT, some sand and gravel.	1	SS	9
182.1	(TILL)	2	SS	25
1.2	Brown Dense to Moist very Dense SANDY SILT, some gravel and clay, slightly oxidized. (TILL)	3	SS	31
		4	SS	43
		5	SS	67
179.3				
4.0	Grey	6	SS	70/6"
177.8				
5.5	Grey Highly Weathered Moist SHALE, limestone interbeds.	7	SS	70/6"
		8	SS	80/3"
175.7				
7.6	End of Borehole			

ELEVATION SCALE m.: 183, 182, 181, 180, 179, 178, 177, 176, 175

PENETRATION RESISTANCE BLOWS/0.3 m x — 10 20 30 40 — SHEAR STRENGTH, kPa

WATER CONTENT PERCENT O — Wp — Wl — 10 20 30

NOTES:
1) Borehole open and water level at 7.3m depth upon completion.

Terraprobe

LOG OF BOREHOLE 8

PROJECT: Energy From Waste Facility
LOCATION: Bramalea Rd., Brampton
CLIENT: SNC Services Limited

DATE: December 18, 1989
EQUIPMENT: CME 55
ELEVATION DATUM:
FILE: 89357

ELEV. DEPTH m.	DESCRIPTION	STRAT. PLOT	GROUND WATER	NUMBER	TYPE	'N' VALUES	ELEVATION m.
183.4	Ground Surface						
	TOPSOIL						
0.25	Brown Stiff Moist **CLAYEY SILT**, some sand and gravel.			1	SS	8	183
182.2	(TILL)			2	SS	20	
1.2	Brown Dense to very Dense Moist **SANDY SILT**, some gravel and clay. (TILL)			3	SS	46	182
				4	SS	54	181
				5	SS	58	
179.4							180
4.0	Brown Very Dense Moist to Wet **SILTY SAND**, some gravel, trace clay			6	SS	55/4"	179
							178
177.6			▽	7	SS	90/6"	
5.8	Grey (TILL) cobbles at 4.4m						177
175.8				8	SS	50/5"	176
7.6	End of Borehole						175

PENETRATION RESISTANCE
BLOWS/0.3 m x
10 20 30 40
SHEAR STRENGTH, kPa

WATER CONTENT
PERCENT ○
Wp Wl
10 20 30

NOTES: 1) Borehole open and water level at 6.1m depth upon completion.

Terraprobe

LOG OF BOREHOLE 9

PROJECT: Energy From Waste Facility
LOCATION: Bramalea Rd., Brampton
CLIENT: SNC Services Limited

DATE: December 19, 1989
EQUIPMENT: CME 55
ELEVATION DATUM:
FILE: 89357

ELEV. DEPTH m.	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES
183.2	Ground Surface				
	TOPSOIL				
0.20	Brown Very Stiff Moist **CLAYEY SILT**, some sand and gravel. **(TILL)**		1	SS	9
			2	SS	24
			3	SS	28
181.1					
2.1	Brown Dense Moist **SANDY SILT**, some gravel and clay, slightly oxidized **(TILL)**		4	SS	48
			5	SS	53
179.2					
4.0	Brown very Dense Moist **SILTY SAND**, some gravel, trace clay.		6	SS	55/6"
177.7					
5.5	Grey **(TILL)**		7	SS	55/6"
175.6			8	SS	60/6"
7.6	End of Borehole				

ELEVATION SCALE m.: 183, 182, 181, 180, 179, 178, 177, 176, 175

PENETRATION RESISTANCE
BLOWS/0.3 m x
10 20 30 40
SHEAR STRENGTH, kPa

WATER CONTENT
PERCENT O
Wp Wl
10 20 30

NOTES:
1) Borehole became wet below 5.5m depth.

Terraprobe

LOG OF BOREHOLE 10

PROJECT: Energy From Waste Facility
LOCATION: Bramalea Rd., Brampton
CLIENT: SNC Services Limited

DATE: December 20, 1989
EQUIPMENT: CME 55
ELEVATION DATUM:
FILE: 89357

ELEV. DEPTH m.	DESCRIPTION	NUMBER	TYPE	'N' VALUES
182.8	Ground Surface			
	TOPSOIL			
0.2	Brown Hard Moist CLAYEY SILT, some sand, occasional gravel. (TILL)	1	SS	10
		2	SS	40
		3	SS	56
180.7				
2.1	Brown very Moist Dense SANDY SILT, some gravel and clay (TILL)	4	SS	52
		5	SS	52/6"
179.1				
3.7	Brown very Wet Dense SILTY SAND, some gravel, trace clay. (TILL)	6	SS	82/6"
177.6				
5.2	Brown very Moist Dense SANDY SILT, some gravel, trace clay.	7	SS	63
176.4				
6.4	Grey (TILL)			
175.2		8	SS	60/6"
7.6	End of Borehole			

ELEVATION SCALE m.: 182, 181, 180, 179, 178, 177, 176, 175, 174

PENETRATION RESISTANCE
BLOWS/0.3 m x
10 20 30 40
SHEAR STRENGTH, kPa

WATER CONTENT
PERCENT O
Wp Wl
10 20 30

NOTES: 1) Borehole open and water level at 6.1m upon completion.

Terraprobe

LOG OF BOREHOLE 11

PROJECT: Energy From Waste Facility
LOCATION: Bramalea Rd., Brampton
CLIENT: SNC Services Limited

DATE: December 18, 1989
EQUIPMENT: CME 55
ELEVATION DATUM:
FILE: 89357

STRATIGRAPHY				SAMPLES			m.	PENETRATION RESISTANCE BLOWS/0.3 m x	WATER CONTENT PERCENT ○
ELEV. DEPTH m.	DESCRIPTION	STRAT. PLOT	GROUND WATER	NUMBER	TYPE	'N' VALUES	ELEVATION SCALE	10 20 30 40 SHEAR STRENGTH, kPa	Wp Wl 10 20 30
183.1	Ground Surface						183		
	TOPSOIL								
0.20	Brown very Stiff Moist			1	SS	12			
182.1	CLAYEY SILT, some sand, trace gravel.								
1.0	Brown Dense to very Dense Moist			2	SS	30	182		
	SANDY SILT, some gravel and clay, slightly oxidized.			3	SS	37			
	(TILL)			4	SS	55	181		
				5	SS	60			
179.1							180		
4.0	Grey								
				6	SS	50/5"	179		
177.0							178		
6.1	Grey Highly Weathered Moist			7	SS	65/5"	177		
	SHALE - limestone interbeds								
175.5				8	SS	80/4"	176		
7.6	End of Borehole						175		

NOTES: 1) Borehole open and water level at 6.9m upon completion. Borehole became wet at approimately Elev. 178.0 drilling.

Terraprobe

LOG OF BOREHOLE 12

PROJECT: Energy From Waste Facility
LOCATION: Bramalea Rd., Brampton
CLIENT: SNC Services Limited

DATE: December 15, 1989
EQUIPMENT: CME 55
ELEVATION DATUM:
FILE: 89357

ELEV. DEPTH m.	DESCRIPTION	NUMBER	TYPE	'N' VALUES
183.5	Ground Surface			
	Brown very Stiff Moist **CLAYEY SILT**, some sand, occasional gravel **(TILL)**	1	SS	10
		2	SS	30
182.0				
1.5	Brown very Dense Moist to Wet **SANDY SILT**, some clay and gravel. **(TILL)**	3	SS	32
		4	SS	60
		5	SS	50/3"
179.5				
4.0	Grey cobbles at 3.0m.	6	SS	77
		7	SS	89
175.4		8	SS	41
8.1	End of Borehole			

STRATIGRAPHY | SAMPLES | m. | PENETRATION RESISTANCE BLOWS/0.3 m x | WATER CONTENT PERCENT O

STRAT. PLOT | GROUND WATER | ELEVATION SCALE | SHEAR STRENGTH, kPa | Wp Wl

ELEVATION SCALE: 183, 182, 181, 180, 179, 178, 177, 176, 175

PENETRATION RESISTANCE: 10 20 30 40

WATER CONTENT: 10 20 30

NOTES:
1) Borehole remained open and water level at 4.0m upon completion.
2) Water level measured at 3.5m depth(Elev. 180.0) on January 2, 1990.

Terraprobe

LOG OF BOREHOLE 13

PROJECT: Energy From Waste Facility
LOCATION: Bramalea Rd., Brampton
CLIENT: SNC Services Limited

DATE: December 15, 1989
EQUIPMENT: CME-55
ELEVATION DATUM:
FILE: 89357

ELEV. DEPTH m.	DESCRIPTION	STRAT. PLOT	GROUND WATER	NUMBER	TYPE	'N' VALUES	ELEVATION m.
183.2	Ground Surface						
	TOPSOIL						
0.20	Brown Stiff Moist **CLAYEY SILT**, some sand and gravel. (TILL)			1	SS	76/8"	183
182.0				2	SS	18	182
1.2	Brown Dense to very Dense Moist **SANDY SILT**, some gravel and clay, slightly oxidized planes. (TILL)			3	SS	40	
				4	SS	50/6"	181
			▽	5	SS	89	180
							179
				6	SS	90/5"	
178.0							
5.2	Grey						178
176.8				7	SS	70/6"	177
6.4	Grey very Dense Moist **SILTY SAND**, some gravel, trace clay. (TILL)						176
175.4				8	SS	80/6"	
7.8	End of Borehole						175

PENETRATION RESISTANCE
BLOWS/0.3 m x
10 20 30 40
SHEAR STRENGTH, kPa

WATER CONTENT
PERCENT ○
Wp Wl
10 20 30

NOTES: 1) Borehole open and water level at 3.4m upon completion.

Terraprobe

LOG OF BOREHOLE 14

PROJECT: Energy From Waste Facility
LOCATION: Bramalea Rd., Brampton
CLIENT: SNC Services Limited

DATE: December 14, 1989
EQUIPMENT: CME 55
ELEVATION DATUM:
FILE: 89357

ELEV. DEPTH m.	DESCRIPTION	NUMBER	TYPE	'N' VALUES
182.5	Ground Surface			
	TOPSOIL			
0.25	Brown Stiff Moist CLAYEY SILT, some sand and gravel.	1	SS	5
181.3	(TILL)	2	SS	23
1.2	Brown Dense to very Dense Moist SANDY SILT, some gravel and clay (TILL)	3	SS	42
179.8		4	SS	72
2.7	Brown very Dense Moist SILTY SAND,	5	SS	53/6"
178.8				
3.7	Grey some gravel, trace clay, frequent cobbles. (TILL)	6	SS	56/6"
175.5		7	SS	66/6"
7.0	Grey very Dense Moist SANDY SILT, some gravel and clay. (TILL)	8	SS	71/6"
173.2		9	SS	83/6"
9.3	End of Borehole			

STRATIGRAPHY | SAMPLES | m. ELEVATION SCALE (182, 181, 180, 179, 178, 177, 176, 175, 174, 173) | PENETRATION RESISTANCE BLOWS/0.3 m x (10 20 30 40) SHEAR STRENGTH, kPa | WATER CONTENT PERCENT O (Wp, Wl) (10 20 30)

NOTES: 1) Borehole caved below 4.6m; water level at 4.3m upon completion.
2) Water level measured on January 2, 1990 at 2.4m (Elev. 180.1m)

Terraprobe

LOG OF BOREHOLE 15

PROJECT: Energy From Waste Facility
LOCATION: Bramalea Rd., Brampton
CLIENT: SNC Services Limited

DATE: December 19, 1989
EQUIPMENT: CME 55
ELEVATION DATUM:
FILE: 89357

ELEV. DEPTH m.	DESCRIPTION	NUMBER	TYPE	'N' VALUES
183.2	Ground Surface			
	Brown Stiff to very Stiff Moist **CLAYEY SILT**, some sand and gravel.	1	SS	8
182.0	(TILL)	2	SS	29
1.2	Brown Dense to very Dense Moist **SANDY SILT**, some gravel and clay, slightly oxidized. **(TILL)**	3	SS	35
		4	SS	55/6"
		5	SS	50/6"
		6	SS	55/6"
177.7		7	SS	47
5.5	Grey			
175.4		8	SS	65/6"
7.8	End of Borehole			

STRATIGRAPHY | SAMPLES | m. | PENETRATION RESISTANCE BLOWS/0.3 m x | WATER CONTENT PERCENT O

STRAT. PLOT | GROUND WATER | ELEVATION SCALE | SHEAR STRENGTH, kPa | Wp Wl

NOTES:
1) Borehole open and water level at 4.6m depth upon completion.
2) Water level measured January 2, 1990 at 1.9m (Elev. 181.3m)

Terraprobe

LOG OF BOREHOLE 16

PROJECT: Energy From Waste Facility
LOCATION: Bramalea Rd., Brampton
CLIENT: SNC Services Limited

DATE: December 20, 1989
EQUIPMENT: CME 55
ELEVATION DATUM:
FILE: 89357

STRATIGRAPHY				SAMPLES			m.	PENETRATION RESISTANCE BLOWS/0.3 m (10 20 30 40) SHEAR STRENGTH, kPa	WATER CONTENT PERCENT Wp WI (10 20 30)
ELEV. DEPTH m.	DESCRIPTION	STRAT. PLOT	GROUND WATER	NUMBER	TYPE	'N' VALUES	ELEVATION SCALE		
182.7	Ground Surface								
	TOPSOIL								
0.20	Brown Very stiff Moist CLAYEY SILT, some sand and gravel. (TILL)			1	SS	10	182		
181.2				2	SS	33			
1.5	Brown very Dense Moist SANDY SILT, some gravel and clay. (TILL)			3	SS	48	181		
179.6				4	SS	87			
3.1	Brown very Dense Moist SILTY SAND, some gravel, trace clay. (TILL)		▽	5	SS	53/6"	180		
177.2				6	SS	50/6"	179		
5.5	Grey very Dense Moist SANDY SILT, some gravel and clay. (TILL)			7	SS	42	178		
174.9				8	SS	50/6"	177		
7.8	End of Borehole						176		
							175		
							174		

NOTES:
1) Borehole open and water level at 3.7m upon completion of drilling.

Terraprobe

LOG OF BOREHOLE 17

PROJECT: Energy From Waste Facility
LOCATION: Bramalea Rd., Brampton
CLIENT: SNC Services Limited

DATE: December 20, 1989
EQUIPMENT: CME 55
ELEVATION DATUM:
FILE: 89357

STRATIGRAPHY				SAMPLES			m.	PENETRATION RESISTANCE BLOWS/0.3 m x 10 20 30 40 SHEAR STRENGTH, kPa	WATER CONTENT PERCENT O Wp Wl 10 20 30
ELEV. DEPTH m.	DESCRIPTION	STRAT. PLOT	GROUND WATER	NUMBER	TYPE	'N' VALUES	ELEVATION SCALE		
181.9	Ground Surface								
	GRANULAR BASE 150mm			1	SS	81/6"			
	TOPSOIL - 200mm Brown Hard Moist								
	CLAYEY SILT, some sand and gravel			2	SS	34	181	X	
180.2	(TILL)			3	SS	50/6"			
1.7	End of Borehole						180		

NOTES: 1) Borehole open and dry upon completion of drilling.

Terraprobe

LOG OF BOREHOLE 18

PROJECT: Energy From Waste Facility
LOCATION: Bramalea Rd., Brampton
CLIENT: SNC Services Limited

DATE: December 20, 1989
EQUIPMENT: CME 55
ELEVATION DATUM:
FILE: 89357

STRATIGRAPHY				SAMPLES			m.	PENETRATION RESISTANCE BLOWS/0.3 m x 10 20 30 40 SHEAR STRENGTH, kPa	WATER CONTENT PERCENT O Wp Wl 10 20 30
ELEV. DEPTH m.	DESCRIPTION	STRAT. PLOT	GROUND WATER	NUMBER	TYPE	'N' VALUES	ELEVATION SCALE		
181.9	Ground Surface								
	TOPSOIL ~ 200mm								
	Brown very Stiff Moist			1	SS	12			
	CLAYEY SILT, some sand and gravel.			2	SS	19	181		
	(TILL)								
179.9				3	SS	36	180		
2.0	End of Borehole								
							179		

NOTES:
1) Borehole open and dry upon completion of drilling.

Terraprobe

LOG OF BOREHOLE 19

PROJECT: Energy From Waste Facility
LOCATION: Bramalea Rd., Brampton
CLIENT: SNC Services Limited

DATE: December 20, 1989
EQUIPMENT: CME 55
ELEVATION DATUM:
FILE: 89357

STRATIGRAPHY				SAMPLES			m.	PENETRATION RESISTANCE BLOWS/0.3 m x	WATER CONTENT PERCENT O
ELEV. DEPTH m.	DESCRIPTION	STRAT. PLOT	GROUND WATER	NUMBER	TYPE	'N' VALUES	ELEVATION SCALE	10 20 30 40 SHEAR STRENGTH, kPa	Wp WI 10 20 30
181.4	Ground Surface								
180.9	GRAVELLY FILL			1	SS	58	181		
0.5	Brown Hard Moist CLAYEY SILT, some sand and gravel. (TILL)			2	SS	25	180		
179.4				3	SS	49			
2.0	End of Borehole						179		

NOTES: 1) Borehole open and dry upon completion.

Terraprobe

LOG OF BOREHOLE 20

PROJECT: Energy From Waste Facility
LOCATION: Bramalea Rd., Brampton
CLIENT: SNC Services Limited

DATE: December 19, 1989
EQUIPMENT: CME 55
ELEVATION DATUM:
FILE: 89357

ELEV. DEPTH m.	DESCRIPTION	NUMBER	TYPE	'N' VALUES
182.8	Ground Surface			
	GRANULAR - 100mm			
	Brown Compact Moist to very Dense	1	SS	50/4"
	SANDY SILT, some gravel and trace clay.	2	SS	24
	(TILL)	3	SS	38
		4	SS	80
		5	SS	68
179.1 3.7	Grey			
177.8		6	Ss	60/6"
5.0	End of Borehole			

STRATIGRAPHY | SAMPLES | ELEVATION SCALE m. | PENETRATION RESISTANCE BLOWS/0.3 m (10 20 30 40) SHEAR STRENGTH, kPa | WATER CONTENT PERCENT (Wp Wl) (10 20 30)

182 181 180 179 178

NOTES: 1) Borehole open and water at 5.0m upon completion.
2) Water level measured January 2, 1990 at 1.9m depth (Elev. 180.9m)

Terraprobe

LOG OF BOREHOLE 21

PROJECT: Energy From Waste Facility
LOCATION: Bramalea Rd., Brampton
CLIENT: SNC Services Limited

DATE: December 19, 1989
EQUIPMENT: CME 55
ELEVATION DATUM:
FILE: 89357

ELEV. DEPTH m.	DESCRIPTION	STRAT. PLOT	GROUND WATER	SAMPLES NUMBER	TYPE	'N' VALUES	ELEVATION SCALE m.
182.1	Ground Surface						182
	TOPSOIL						
0.20	Brown Stiff Moist			1	SS	9	
	CLAYEY SILT, some sand and gravel.						
180.9	(TILL)			2	SS	22	181
1.2	Brown very Moist Dense			3	SS	41	
	SANDY SILT, some gravel, trace clay.						180
				4	SS	100	
	(TILL)			5	SS	65/6"	179
178.1	_ _ _ _ _						
4.0	Grey						178
177.1				6	SS	100/6"	
5.0	End of Borehole						177

PENETRATION RESISTANCE
BLOWS/0.3 m
10 20 30 40
SHEAR STRENGTH, kPa

WATER CONTENT
PERCENT
Wp Wl
10 20 30

NOTES:
1) Borehole open and water level at 4.9m depth upon completion.
2) Water level measured January 2, 1990 at 1.5m depth(Elev. 180.6m)

Log of Borehole 1A

Project No. brge0065870d

Project: Geotechnical Investigation - Steam and Power Lines

Location: From KMS Peel Facility to Norampac Paper Mill, Brampton, Ontario

Drawing No. 3

Sheet No. 1 of 1

Date Drilled: February 23, 2006

Drill Type: Solid Stem Augers

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH
		182.06		0
		~100 mm TOPSOIL over	~182.0	
		FILL - sandy silt, topsoil inclusions, dark brown, moist.	~181.5	1
		CLAYEY SILT TILL- trace to some sand and gravel, trace rootlets, brown with grey mottling, moist, very stiff to hard.	~180.1	2
		SANDY SILT TILL- cobble and gravel sizes, brown, moist, very dense.		3
		SO4=80.3 ppm, Cl=12.2 ppm, pH=9.2 - becoming grey	~177.3	4
				5
				6
				7
				8
				9
				10
		- isolated thin, moist sand seams.	~171.4	11
				12
				13
		- some highly weathered, grey shale platelets.	~168.3	14
		END OF BOREHOLE	~168.2	15
				16
				17
				18
				19
				20

N Value: 20 40 60 80 — Shear Strength kPa: 100 200

Combustible Vapour Reading (ppm): 25 50 75

Natural Moisture Content % Atterberg Limits (% Dry Weight): 10 20 30

Natural Unit Weight kN/m³
22.0
22.8
23.7
22.9
22.2
22.0
20.5

Notes:
1. Borehole advanced by continuous flight augers using conventional soil sampling equipment, owned and operated by a specialist contractor.
2. Borehole backfilled on completion.
3. This drawing forms part of subject report, project number as referenced, and must only be read in conjunction with that report.
4. Interpretation assistance by Trow is required before use by others.

Time	Water Level (m)	Depth to Cave (m)
On completion	moist	12.7

Trow Associates Inc.
Brampton, Ontario

LAGMSLIF 65870DBOREHOLELOGS.GPJ NEW.GDT 06/03/22

Log of Borehole 1B

Project No. brge0065870d

Drawing No. 4

Project: Geotechnical Investigation - Steam and Power Lines

Sheet No. 1 of 1

Location: From KMS Peel Facility to Norampac Paper Mill, Brampton, Ontario

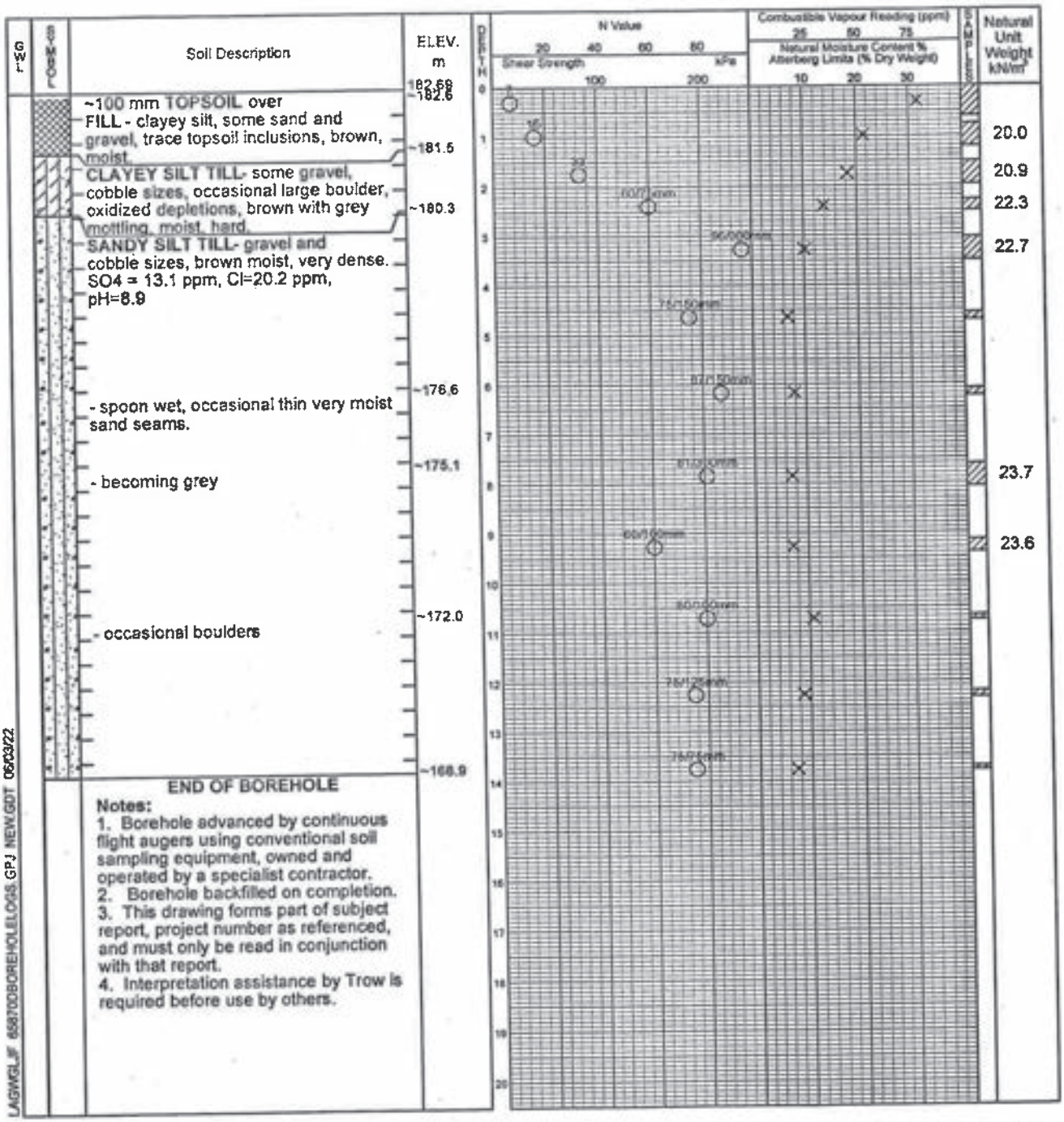
Date Drilled: February 23, 2006

Drill Type: Solid Stem Augers

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer



Notes:
1. Borehole advanced by continuous flight augers using conventional soil sampling equipment, owned and operated by a specialist contractor.
2. Borehole backfilled on completion.
3. This drawing forms part of subject report, project number as referenced, and must only be read in conjunction with that report.
4. Interpretation assistance by Trow is required before use by others.

Time	Water Level (m)	Depth to Cave (m)
On completion	4.49	7.9

Trow Associates Inc.
Brampton, Ontario

LAGWGLIF 6587OOBOREHOLELOGS.GPJ NEW.GDT 06/03/22

Log of Borehole 1C

Project No. brge0065870d

Drawing No. 5

Project: Geotechnical Investigation - Steam and Power Lines

Sheet No. 1 of 1

Location: From KMS Peel Facility to Norampac Paper Mill, Brampton, Ontario

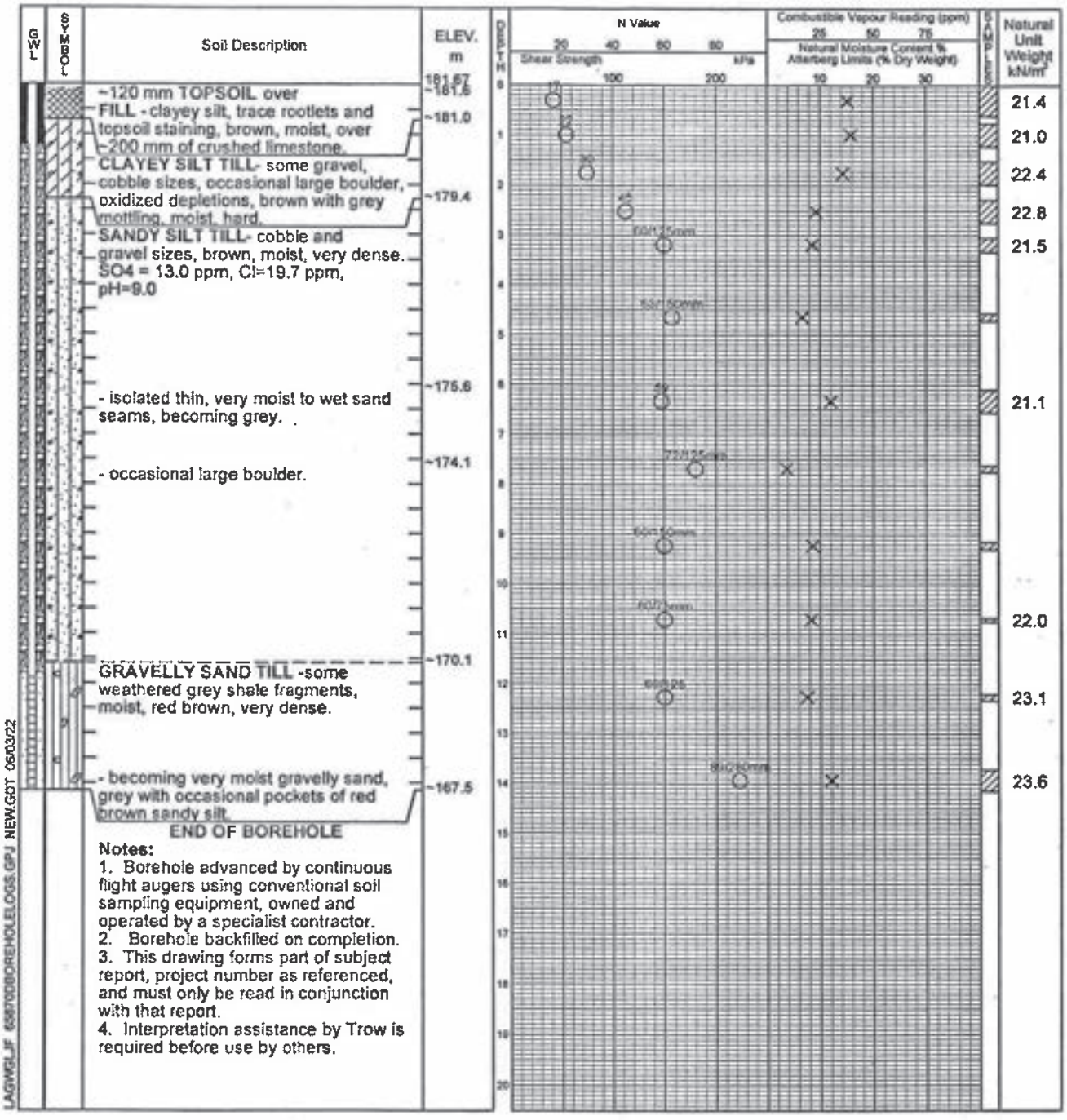
Date Drilled: February 24, 2006

Drill Type: Solid Stem Augers

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer



Notes:

1. Borehole advanced by continuous flight augers using conventional soil sampling equipment, owned and operated by a specialist contractor.
2. Borehole backfilled on completion.
3. This drawing forms part of subject report, project number as referenced, and must only be read in conjunction with that report.
4. Interpretation assistance by Trow is required before use by others.

LAG\WGL.IF 6587000\BOREHOLELOGS.GPJ NEW.GDT 06/03/22

Trow Associates Inc.
Brampton, Ontario

Time	Water Level (m)	Depth to Cave (m)
On completion	8.23	8.8
After 1 Day	10.67	-
After 2 Days	9.86	-
After 4 Days	8.60	-
After 7 Days	5.95	-

Log of Borehole 2

Project No. brge0065870d

Project: Geotechnical Investigation - Steam and Power Lines

Location: From KMS Peel Facility to Norampac Paper Mill, Brampton, Ontario

Drawing No. 6

Sheet No. 1 of 1

Date Drilled: May 21, 2003

Drill Type: Solid Stem Augers

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH m	N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLE	Natural Unit Weight kN/m³
			181.34					
		~ 180 mm TOPSOIL over FILL: - sand and gravel, dark brown, moist	~181.2	0				19.9
		FILL - clayey silt, trace gravel, some organic stains, dark brown, moist	~180.2	1				20.8
		SANDY SILT TO SILTY SAND- trace gravel, trace to some clay, oxidized fissures in upper layers, brown, moist, dense to very dense	~179.2	2				19.2
		- becoming grey at ~4 m depth		3				22.1
				4				23.2
				5				22.5
				6				24.1
		END OF BOREHOLE	~174.8	7				
				8				
				9				
				10				
				11				
				12				
				13				
				14				
				15				
				16				
				17				
				18				
				19				
				20				

Notes:
1. Borehole advanced by continuous flight augers using conventional soil sampling equipment, owned and operated by a specialist contractor.
2. Borehole backfilled on completion.
3. This drawing forms part of subject report, project number as referenced, and must only be read in conjunction with that report.
4. Interpretation assistance by Trow is required before use by others.

Time	Water Level (m)	Depth to Cave (m)
On completion	3.5	5.5

Trow Associates Inc.
Brampton, Ontario

LAGWOLJF 6587008OREHOLELOGS.GPJ NEW.GDT 06/03/20

Log of Borehole 3

Project No. brge0065870d

Drawing No. 7

Project: Geotechnical Investigation - Steam and Power Lines

Sheet No. 1 of 1

Location: From KMS Peel Facility to Norampac Paper Mill, Brampton, Ontario

Date Drilled: May 20, 2003

Drill Type: Solid Stem Augers

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

GWL	SOIL SYMBOL	Soil Description	ELEV. m	DEPTH	N Value (20 40 60 80) / Shear Strength kPa (100 200)	Combustible Vapour Reading (ppm) (25 50 75) / Natural Moisture Content % Atterberg Limits (% Dry Weight) (10 20 30)	SAMPLES	Natural Unit Weight kN/m³
		TOPSOIL - rootlets, dark brown, moist	181.17	0				20.1
		FILL - clayey silt, topsoil inclusions, trace gravel, brown, very moist	~180.3	1				19.0
		CLAYEY SILT TILL - some gravel, trace sand, oxidized fissures, brown to grey, moist, very stiff	~179.7 ~179.0	2				21.4 22.6
		SANDY SILT - trace gravel, trace to some clay, oxidized fissures, brown, moist, dense - grinding from 3.7 to 4.3 m depth.	~177.2	3 4				22.8
		CLAYEY SILT TILL - trace gravel, grey, moist, very stiff	~175.7	5				22.1
		SANDY SILT TO SILTY SAND - some gravel, grey, wet, dense	~174.6	6				23.3
		END OF BOREHOLE		7 8 9 10 11 12 13 14 15 16 17 18 19 20				

Notes:
1. Borehole advanced by continuous flight augers using conventional soil sampling equipment, owned and operated by a specialist contractor.
2. Standpipe piezometer installed and borehole backfilled as shown on completion.
3. This drawing forms part of subject report, project number as referenced, and must only be read in conjunction with that report.
4. Interpretation assistance by Trow is required before use by others.

LAGWGLIF 6587/0BOREHOLELOGS.GPJ NEW.GDT 06/03/20

Time	Water Level (m)	Depth to Cave (m)
On completion	5.5	6.0
After 1 Day	1.7	-
After 3 Days	1.7	-
After 9 Days	1.5	-

Trow Associates Inc.
Brampton, Ontario

Log of Borehole 3A

Project No. brge0065870d
Drawing No. 8
Project: Geotechnical Investigation - Steam and Power Lines
Sheet No. 1 of 1
Location: From KMS Peel Facility to Norampac Paper Mill, Brampton, Ontario

Date Drilled: February 24, 2006
Drill Type: Solid Stem Augers
Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test
Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH	Natural Unit Weight kN/m³
		~300 mm TOPSOIL over	181.05	0	
		CLAYEY SILT TILL- trace to some sand and gravel, trace rootlets, oxidized depletions, brown with grey mottling, moist, very stiff to hard.	~180.8		23.4
				1	18.7
			~178.8	2	20.8
		SANDY SILT TILL- gravel and cobble sizes, occasional large boulder and thin sand seams, brown, moist, very dense.			21.1
		SO4 = 13.5 ppm, Cl=13.3 ppm, pH=9.0		3	22.7
				4	
				5	22.7
			~175.6		
		SAND - medium to coarse, some gravel, grey, wet, very dense.	~174.7	6	22.2
		SANDY SILT TILL- gravel sizes, occasional thin sand seams, grey, moist, very dense.		7	
				8	
				9	
				10	
				11	22.4
			~169.5		
		SILTY SAND AND GRAVEL TILL - reddish brown, moist to very moist.		12	23.0
				13	
		highly weathered shale fragments.		14	22.3
			~166.9		
		END OF BOREHOLE		15	
				16	
				17	
				18	
				19	
				20	

N Value: 20 40 60 80
Shear Strength kPa: 100 200
Combustible Vapour Reading (ppm): 25 50 75
Natural Moisture Content % - Atterberg Limits (% Dry Weight): 10 20 30

Notes:
1. Borehole advanced by continuous flight augers using conventional soil sampling equipment, owned and operated by a specialist contractor.
2. Borehole backfilled on completion.
3. This drawing forms part of subject report, project number as referenced, and must only be read in conjunction with that report.
4. Interpretation assistance by Trow is required before use by others.

Time	Water Level (m)	Depth to Cave (m)
On completion	6.31	6.6
After 1 Day	11.43	-
After 2 Days	10.83	-
After 4 Days	9.41	
After 7 Days	6.70	-

Trow Associates Inc.
Brampton, Ontario

LAGWGLJF 65870DBOREHOLELOGS.GPJ NEW.GDT 06/03/22

Log of Borehole 4

Project No. brge0065870d
Drawing No. 9
Project: Geotechnical Investigation - Steam and Power Lines
Sheet No. 1 of 1
Location: From KMS Peel Facility to Norampac Paper Mill, Brampton, Ontario

Date Drilled: May 21, 2003
Drill Type: Solid Stem Augers
Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test
Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH m	N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	KMS Formation	Natural Unit Weight kN/m³
		~230 mm TOPSOIL over FILL - sandy silt, rootlets, some gravel, dark brown, moist	180.98 ~180.7	0				19.3
		CLAYEY SILT TILL - some gravel, trace sand, oxidized fissures, brown, moist, very stiff to hard	~179.9	1				19.5
				2				21.8
				3				22.9
		- becoming grey at ~4 m depth		4				23.2
		SANDY SILT TO SILTY SAND- trace gravel, trace to some clay, grey, moist to wet, dense to very dense	~177.0	5				22.8
				6				22.6
		END OF BOREHOLE	~174.4	7				
				8				
				9				
				10				
				11				
				12				
				13				
				14				
				15				
				16				
				17				
				18				
				19				
				20				

Notes:
1. Borehole advanced by continuous flight augers using conventional soil sampling equipment, owned and operated by a specialist contractor.
2. Borehole backfilled on completion.
3. This drawing forms part of subject report, project number as referenced, and must only be read in conjunction with that report.
4. Interpretation assistance by Trow is required before use by others.

LAGWGLIF 6587005CREHOLELOGS.GPJ NEW.GDT 06/03/20

Time	Water Level (m)	Depth to Cave (m)
On completion	5.6	6.0

Trow Associates Inc.
Brampton, Ontario

Log of Borehole 5

Project No. brge0065870d
Drawing No. 10
Project: Geotechnical Investigation - Steam and Power Lines
Sheet No. 1 of 1
Location: From KMS Peel Facility to Norampac Paper Mill, Brampton, Ontario

Date Drilled: May 21, 2003
Drill Type: Solid Stem Augers
Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH	N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Weight kN/m³
		~200 mm TOPSOIL over FILL - sandy to clayey silt, some gravel, some topsoil inclusions, brown, moist	181.19 ~181.0 ~180.3	0				20.0
		CLAYEY SILT TILL - some gravel, occasional sand seams, oxidized fissures, brown, moist, very stiff to hard		1				20.4
				2				21.8
		- spoon wet, becoming grey at ~4 m depth		3				21.9
				4				22.9
		SANDY SILT TO SILTY SAND- trace gravel, trace to some clay, grey, moist to wet, compact to dense	~175.7	5				22.9
		END OF BOREHOLE	~174.6	6				22.8
				7				
				8				
				9				
				10				
				11				
				12				
				13				
				14				
				15				
				16				
				17				
				18				
				19				
				20				

Notes:
1. Borehole advanced by continuous flight augers using conventional soil sampling equipment, owned and operated by a specialist contractor.
2. Borehole backfilled on completion.
3. This drawing forms part of subject report, project number as referenced, and must only be read in conjunction with that report.
4. Interpretation assistance by Trow is required before use by others.

LAGWGLIF 65870BOREHOLELOGS.GPJ NEW.GDT 05/03/20

Time	Water Level (m)	Depth to Cave (m)
On completion	4.0	5.6

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Brampton, Ontario

Log of Borehole 6

Project No. brge0065870d

Drawing No. 11

Project: Geotechnical Investigation - Steam and Power Lines

Sheet No. 1 of 1

Location: From KMS Peel Facility to Norampac Paper Mill, Brampton, Ontario

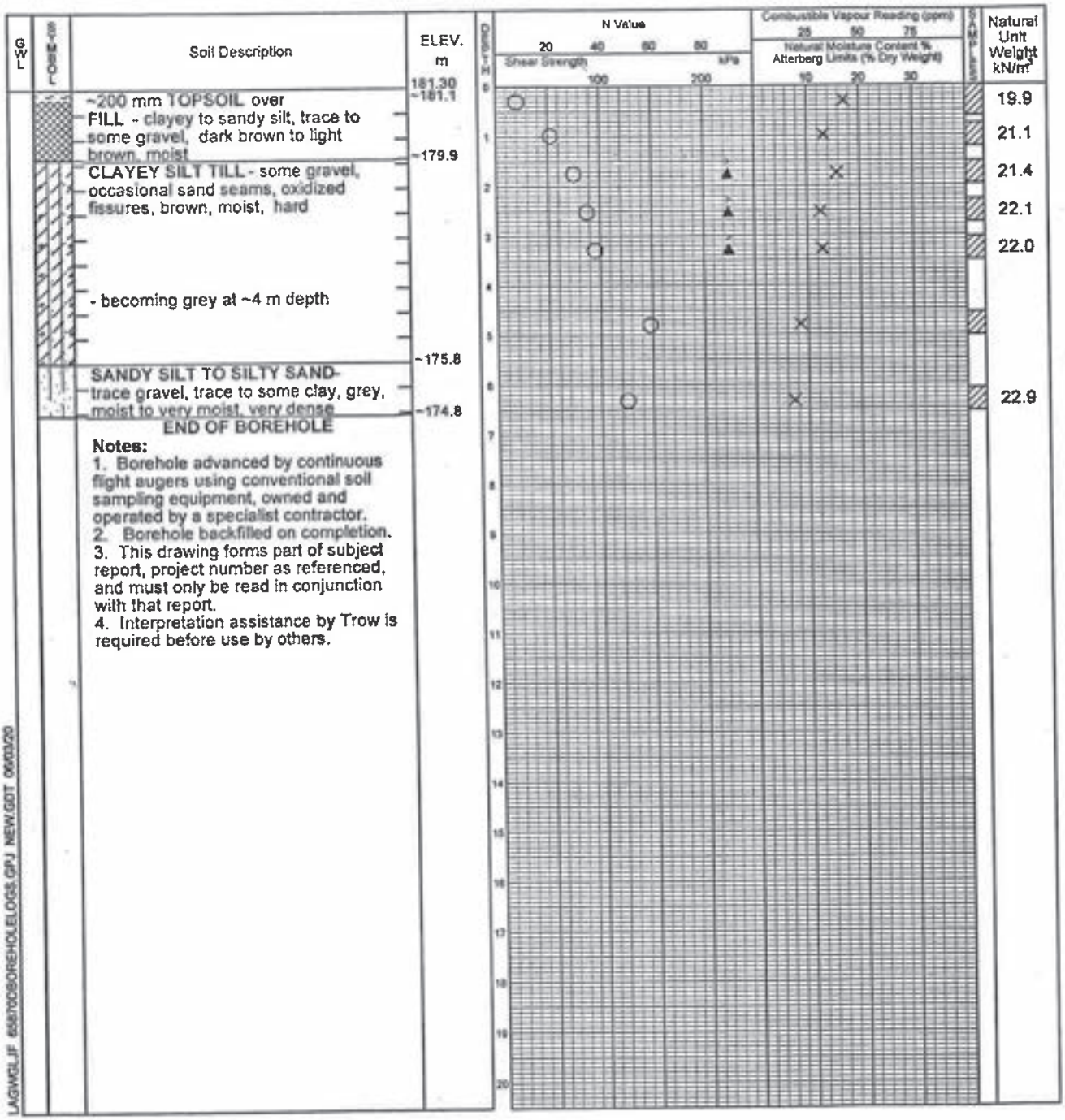
Date Drilled: May 21, 2003

Drill Type: Solid Stem Augers

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer



Notes:

1. Borehole advanced by continuous flight augers using conventional soil sampling equipment, owned and operated by a specialist contractor.
2. Borehole backfilled on completion.
3. This drawing forms part of subject report, project number as referenced, and must only be read in conjunction with that report.
4. Interpretation assistance by Trow is required before use by others.

Time	Water Level (m)	Depth to Cave (m)
On completion	6.0	6.0

Trow Associates Inc.
Brampton, Ontario

Log of Borehole 7

Project No. brge0065870d
Drawing No. 12
Project: Geotechnical Investigation - Steam and Power Lines
Sheet No. 1 of 1
Location: From KMS Peel Facility to Norampac Paper Mill, Brampton, Ontario

Date Drilled: May 23, 2003
Drill Type: Solid Stem Augers
Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test
Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH
		~80 mm TOPSOIL over	180.63	0
		FILL - sand and gravel, grey, moist	~180.5	
		CLAYEY SILT TILL - some gravel, occasional sand seams, oxidized fissures, brown, moist, very stiff to hard	~180.4	1
		- hard grinding	~176.6	4
		SANDY SILT TO SILTY SAND - trace gravel, trace to some clay, grey, moist to wet, very dense		5
		END OF BOREHOLE	~174.1	7

N Value: 20 40 60 80
Shear Strength: 100 200 kPa
Combustible Vapour Reading (ppm): 25 50 75
Natural Moisture Content % Atterberg Limits (% Dry Weight): 10 20 30

Natural Unit Weight kN/m³
20.1
20.6
21.5
22.0
22.3
23.8
21.5

Notes:
1. Borehole advanced by continuous flight augers using conventional soil sampling equipment, owned and operated by a specialist contractor.
2. Borehole backfilled on completion.
3. This drawing forms part of subject report, project number as referenced, and must only be read in conjunction with that report.
4. Interpretation assistance by Trow is required before use by others.

LAGWGLJF 65870DBOREHOLELOGS.GPJ NEW.GDT 06/03/20

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Brampton, Ontario

Time	Water Level (m)	Depth to Cave (m)
On completion	4.4	5.3

Log of Borehole 8

Project No. brge0065870d
Drawing No. 13
Project: Geotechnical Investigation - Steam and Power Lines
Sheet No. 1 of 1
Location: From KMS Peel Facility to Norampac Paper Mill, Brampton, Ontario

Date Drilled: May 20, 2003
Drill Type: Solid Stem Augers
Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH m	Natural Unit Weight kN/m³
		~100 mm TOPSOIL over	179.48	0	
		FILL - sand and gravel in upper level followed by clayey silt, trace gravel, brown, moist	~178.7	1	21.5
		CLAYEY SILT TILL - some gravel, trace sand, rootlets and oxidized fissures in upper level, brown, moist, very stiff to hard	~176.9	2	22.2
		- becoming grey at ~2.6 m depth	~176.5	3	22.3
		SANDY SILT TO SILTY SAND- trace gravel, trace to some clay, becoming more sand with depth, grey, moist to wet, compact to very dense		4	
				5	21.8
				6	22.8
		END OF BOREHOLE	~172.9	7	
				8	
				9	
				10	
				11	
				12	
				13	
				14	
				15	
				16	
				17	
				18	
				19	
				20	

N Value: 20 40 60 80
Shear Strength: 100 200 kPa
Combustible Vapour Reading (ppm): 25 50 75
Natural Moisture Content % Atterberg Limits (% Dry Weight): 10 20 30

Notes:
1. Borehole advanced by continuous flight augers using conventional soil sampling equipment, owned and operated by a specialist contractor.
2. Standpipe piezometer installed and borehole backfilled as shown on completion.
3. This drawing forms part of subject report, project number as referenced, and must only be read in conjunction with that report.
4. Interpretation assistance by Trow is required before use by others.

LAGWGLIF 6587OOBOREHOLELOGS.GPJ NEW.GDT 06/03/20

Time	Water Level (m)	Depth to Cave (m)
On completion	5.8	6.0
After 1 Day	2.8	-
After 3 Days	2.8	-
After 9 Days	2.6	-

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Brampton, Ontario

Log of Borehole 1

Project No. BRM00607546-A0 Drawing No. 2

Project: Geotechnical Investigation - Proposed Steam Turbine Unit Sheet No. 1 of 1

Location: 7656 Bramalea Road, Brampton, Ontario

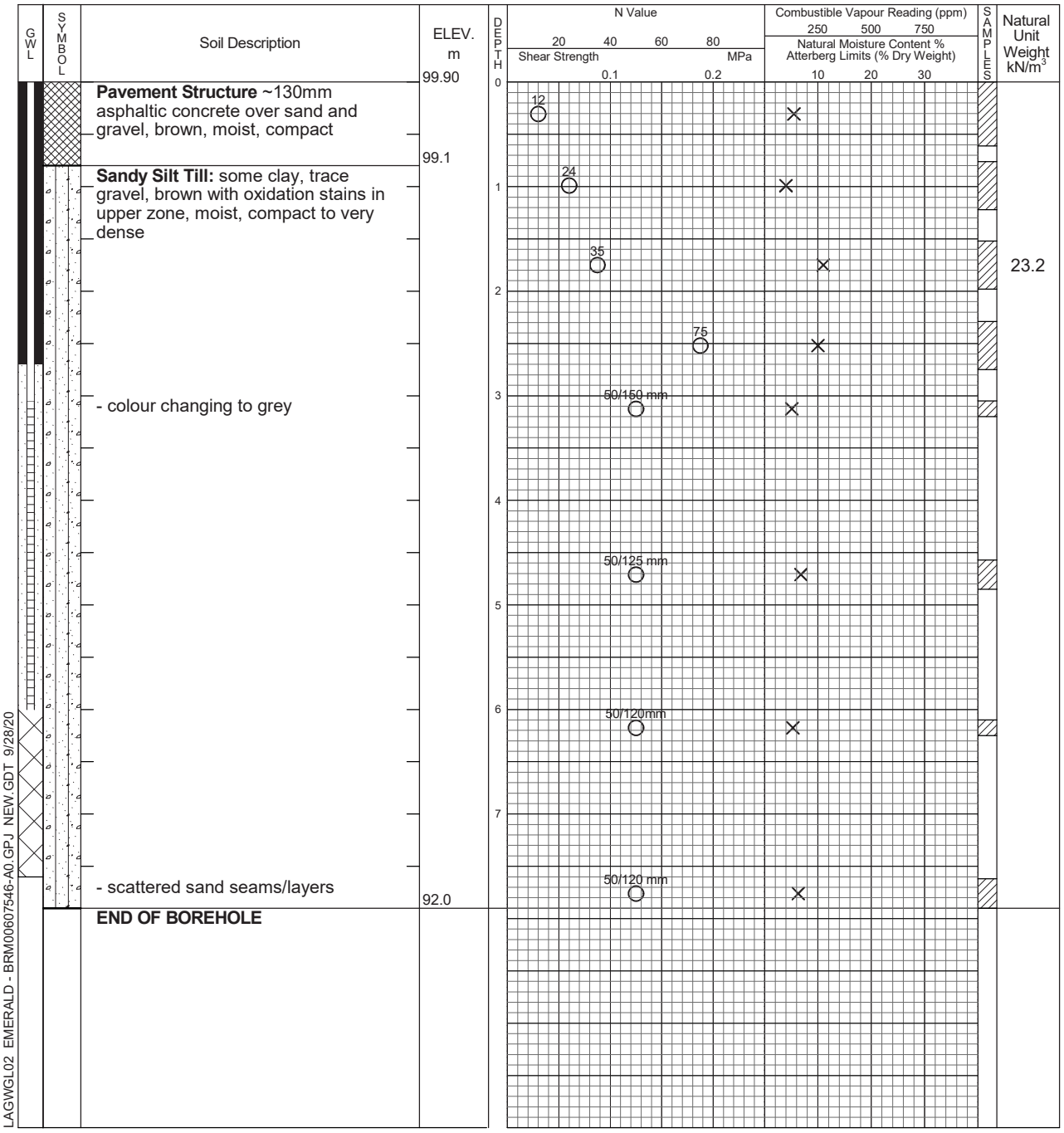
Date Drilled: September 8, 2020

Drill Type: CME- Truck Mount

Datum: Top of Floor Elev. 100.0 m (assumed)

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test S

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer



LAGWGL02 EMERALD - BRM00607546-A0.GPJ NEW.GDT 9/28/20

Time	Water Level (m)	Depth to Cave (m)
On Completion	Dry	
September 9, 2020	Dry	
September 15, 2020	2.2	

Log of Borehole 2

Project No. BRM00607546-A0 | Drawing No. 3

Project: Geotechnical Investigation - Proposed Steam Turbine Unit | Sheet No. 1 of 1

Location: 7656 Bramalea Road, Brampton, Ontario

Date Drilled: September 8, 2020

Drill Type: RAM-Sounder

Datum: Top of Floor Elev. 100.0 m (assumed)

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

Soil Description	ELEV. m	Depth (m)
Concrete Floor Slab ~210mm concrete over sand and gravel changing to sandy silt, brown, moist	100.00	0
	~98.6	1
Sandy Silt Till: some clay, trace gravel, brown, moist, dense to very dense		2
	~96.9	3
END OF BOREHOLE		

SPT (N Value): 17, 6, 36, 73, 88/ 230 mm

Shear Strength (kPa): 20 40 60 80 | 100 200

Combustible Vapour Reading (ppm): 25 50 75

Natural Moisture Content % / Atterberg Limits (% Dry Weight): 10 20 30

Natural Unit Weight kN/m³: 23.0, 23.6

Date	Water Level (m)	Hole Open to (m)
On Completion	Dry	

EXPLOGBRAMPTON EMERALD - BRM00607546-A0.GPJ NEW.GDT 9/29/20

Log of Borehole 3

Project No. BRM00607546-A0 Drawing No. 4

Project: Geotechnical Investigation - Proposed Steam Turbine Unit Sheet No. 1 of 1

Location: 7656 Bramalea Road, Brampton, Ontario

Date Drilled: September 9, 2020

Drill Type: RAM-Sounder

Datum: Top of Floor Elev. 100.0 m (assumed)

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test S

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH	N Value 20 40 60 80 / Shear Strength 0.1 0.2 MPa	Combustible Vapour Reading (ppm) 250 500 750 / Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30	SAMPLES	Natural Unit Weight kN/m³
		Concrete Foundation ~1600mm thick reinforced concrete footing	100.00	0				
			98.4	1				
		Sandy Silt Till: some sand, trace gravel, brown, moist, dense to very dense		2	41			22.8
			97.3		85/140mm			
		END OF BOREHOLE						

LAGWGL02 EMERALD - BRM00607546-A0.GPJ NEW.GDT 9/28/20

Time	Water Level (m)	Depth to Cave (m)
On Completion	Dry	

Log of Borehole BH1

Project No. GEOTETOB08569 (Ref. SP8569)

Drawing No. 2

Project: Region of Peel - Watermain Replacement

Sheet No. 1 of 1

Location: Bramalea Road from Derry Road to Hydro Easement, Mississauga, Ontario

Date Drilled: July 20, 2009

Drill Type: Solid Stem Auger

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test
Sensitivity
Piezometric Water Level

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

Soil Description	ELEV. m	Natural Unit Weight kN/m³
ASPHALT: 230 mm	176.90	
GRANULAR BASE: 450 mm (Crushed limestone)	176.70	
CLAYEY SILT TILL: trace gravel, greyish brown, moist, very stiff	176.20	
hard below 2.3 m		21.2
brownish grey below 3.1 m	173.40	
END OF BOREHOLE Notes: 1) Gas not detected		

N Value: 20 40 60 80
Shear Strength: 0.1 0.2 MPa
Combustible Vapour Reading (ppm): 250 500 750
Natural Moisture Content % Atterberg Limits (% Dry Weight): 10 20 30

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SPECIALISTS MANAGING THE EARTH

Time	Water Level (m)	Depth to Cave (m)
At Completion	dry	open

Borehole BH1

Log of Borehole BH2

Project No. GEOTETOB08569 (Ref. SP8569) Drawing No. 3

Project: Region of Peel - Watermain Replacement Sheet No. 1 of 1

Location: Bramalea Road from Derry Road to Hydro Easement, Mississauga, Ontario

Date Drilled: July 20, 2009

Drill Type: Solid Stem Auger

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test
Sensitivity 5
Piezometric Water Level

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH m	N Value / Shear Strength (20 40 60 80, 0.1 0.2 MPa)	Combustible Vapour Reading (ppm) 250 500 750 / Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30	SCALE	Natural Unit Weight kN/m³
		ASPHALT: 175 mm	177.10	0				
		GRANULAR BASE: 600 mm (Sand & Gravel)	176.90					
		FILL: sand, trace to some gravel, brown, very moist to wet, compact	176.30	1				
		FILL: clayey silt mixed with organics, dark grey, moist, compact	176.00					
		CLAYEY SILT TILL: trace gravel, greyish brown, moist, very stiff	175.60	2				
		hard below 2.3 m			>220			
				3	>220			
		END OF BOREHOLE	173.60					

Notes:
1) Gas not detected

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SPECIALISTS MANAGING THE EARTH

Time	Water Level (m)	Depth to Cave (m)
At Completion	dry	open

Borehole BH2

Log of Borehole BH3

Project No. GEOTETOB08569 (Ref. SP8569) Drawing No. 4

Project: Region of Peel - Watermain Replacement Sheet No. 1 of 1

Location: Bramalea Road from Derry Road to Hydro Easement, Mississauga, Ontario

Date Drilled: July 21, 2009

Drill Type: Solid Stem Auger

Datum: Geodetic

Auger Sample ⊠
SPT (N) Value ○ ⊠
Dynamic Cone Test ——
Shelby Tube ■
Field Vane Test ✤
Sensitivity S
Piezometric Water Level ⧗

Combustible Vapour Reading □
Natural Moisture ×
Plastic and Liquid Limit ⊢—○
Undrained Triaxial at % Strain at Failure ⊕
Penetrometer ▲

Soil Description	ELEV. m	DEPTH m	N Value / Shear Strength kPa / MPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Weight kN/m³
	175.20	0	20 40 60 80; 0.1 0.2 MPa	250 500 750; 10 20 30		
ASPHALT: 125 mm	175.08					
GRANULAR BASE: 450 mm (Sand & Gravel)	174.60					
FILL: clayey silt, trace organics & gravel, grey, moist, compact	174.10	1				
CLAYEY SILT TILL: trace gravel, brown, moist, very stiff to hard some sand below 1.5 m		2				22.5
	172.90					
SANDY SILT TILL: trace clay & gravel, brown, moist, very dense	172.40					
	172.10	3				
SANDY SILT TO SILTY FINE SAND: brown, wet, very dense		4				
grey below 4.6 m	170.30					
SHALE: weathered, grey	169.90	5				
fragmented zone upto 6.1 m, shale interbedded with thin layers of limestone (hard layer 40%)	169.10			TCR=60%, SCR=0, RQD=0		RUN1
broken zone upto 6.6 m, shale interbedded with thin layers of limestone (hard layer 10%)	168.60	6		TCR=90%, SCR=28%, RQD=0		RUN2
frequent limestone layer (40%) & maximum thickness of 150 mm, F.I. = 2		7		TCR=100%, SCR=78%, RQD=74%		RUN3
	167.20	8				
occasional limestone layer (10%) & maximum thickness of 50 mm, F.I. = 2				TCR=100%, SCR=91%, RQD=90%		RUN4
	165.90	9				
END OF BOREHOLE Notes: 1) Gas not detected						

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SPECIALISTS MANAGING THE EARTH

Time	Water Level (m)	Depth to Cave (m)
At Completion	3.1	-
September 3, 2009	2.8	Piezo.

Log of Borehole BH4

Project No. GEOTETOB08569 (Ref. SP8569)

Drawing No. 5

Project: Region of Peel - Watermain Replacement

Sheet No. 1 of 1

Location: Bramalea Road from Derry Road to Hydro Easement, Mississauga, Ontario

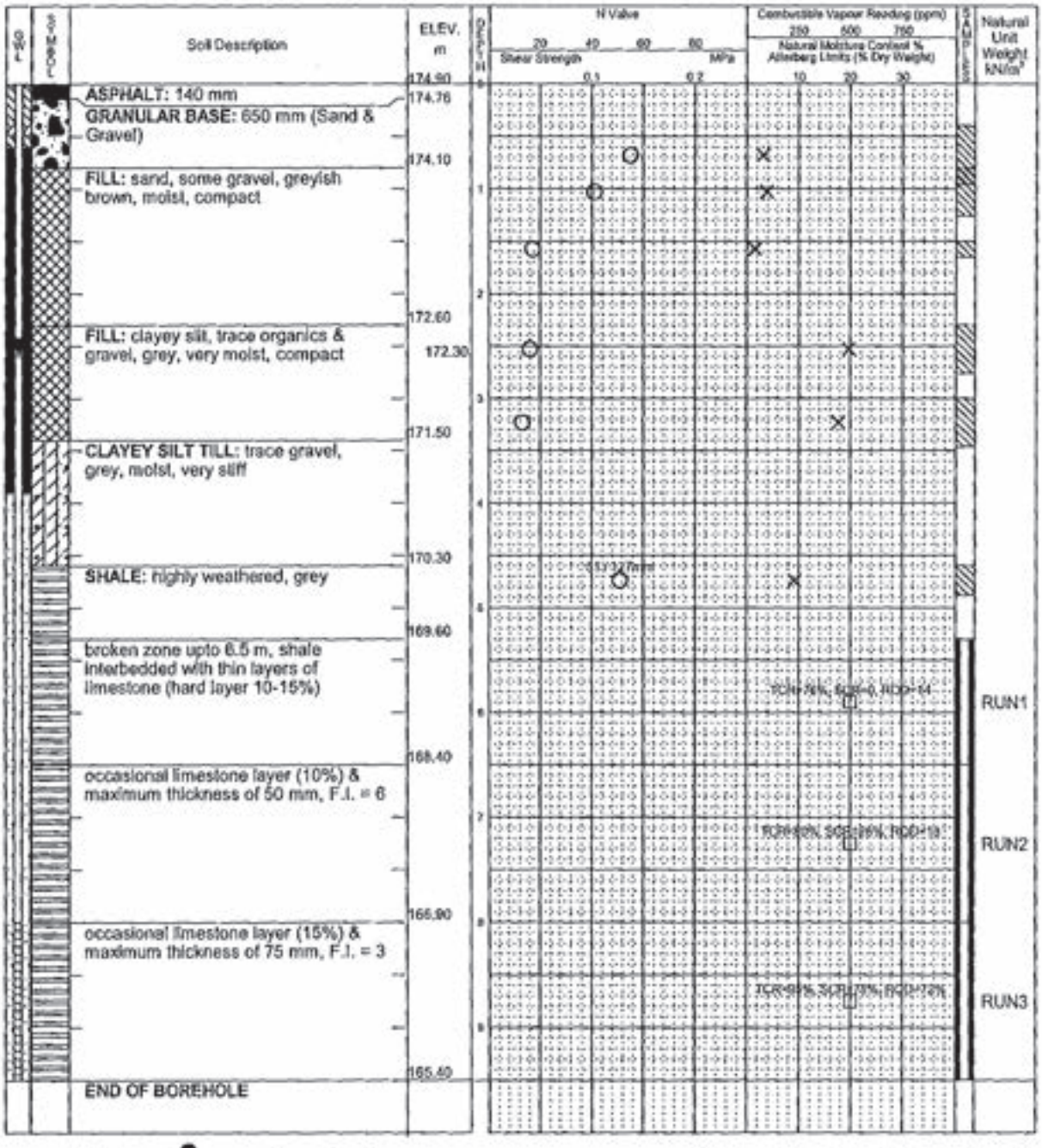
Date Drilled: July 22, 2009

Drill Type: Solid Stem Auger

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test
Sensitivity
Piezometric Water Level

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer



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SPECIALISTS MANAGING THE EARTH

Time	Water Level (m)	Depth to Cave (m)
At Completion	4.4	-
September 3, 2009	2.6	Piezo.

Log of Borehole BH5

Project No. GEOTETOB08569 (Ref. SP8569)

Drawing No. 6

Project: Region of Peel - Watermain Replacement

Sheet No. 1 of 1

Location: Bramalea Road from Derry Road to Hydro Easement, Mississauga, Ontario

Date Drilled: July22, 2009

Drill Type: Solid Stem Auger

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test
Sensitivity
Piezometric Water Level

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

Soil Description	ELEV. m	Depth (m)	N Value / Shear Strength (MPa)	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	Natural Unit Weight kN/m³
	177.80	0	20 40 60 80 / 0.1 0.2	200 400 600 / 10 20 30	
ASPHALT: 110 mm	177.69				
GRANULAR BASE: 300 mm (Sand & Gravel)	177.40				
CLAYEY SILT TILL: trace to some sand, trace gravel, brown, moist, hard		1			22.9
		2			22.3
	174.70	3			
SANDY SILT TILL: trace gravel, grey, moist, very dense	174.30				
END OF BOREHOLE					

coffey geotechnics
SPECIALISTS MANAGING THE EARTH

Time	Water Level (m)	Depth to Cave (m)
At Completion	dry	open

Borehole BH5

Log of Borehole BH6

Project No. GEOTETOB08569 (Ref. SP8569)

Drawing No. 7

Project: Region of Peel - Watermain Replacement

Sheet No. 1 of 1

Location: Bramalea Road from Derry Road to Hydro Easement, Mississauga, Ontario

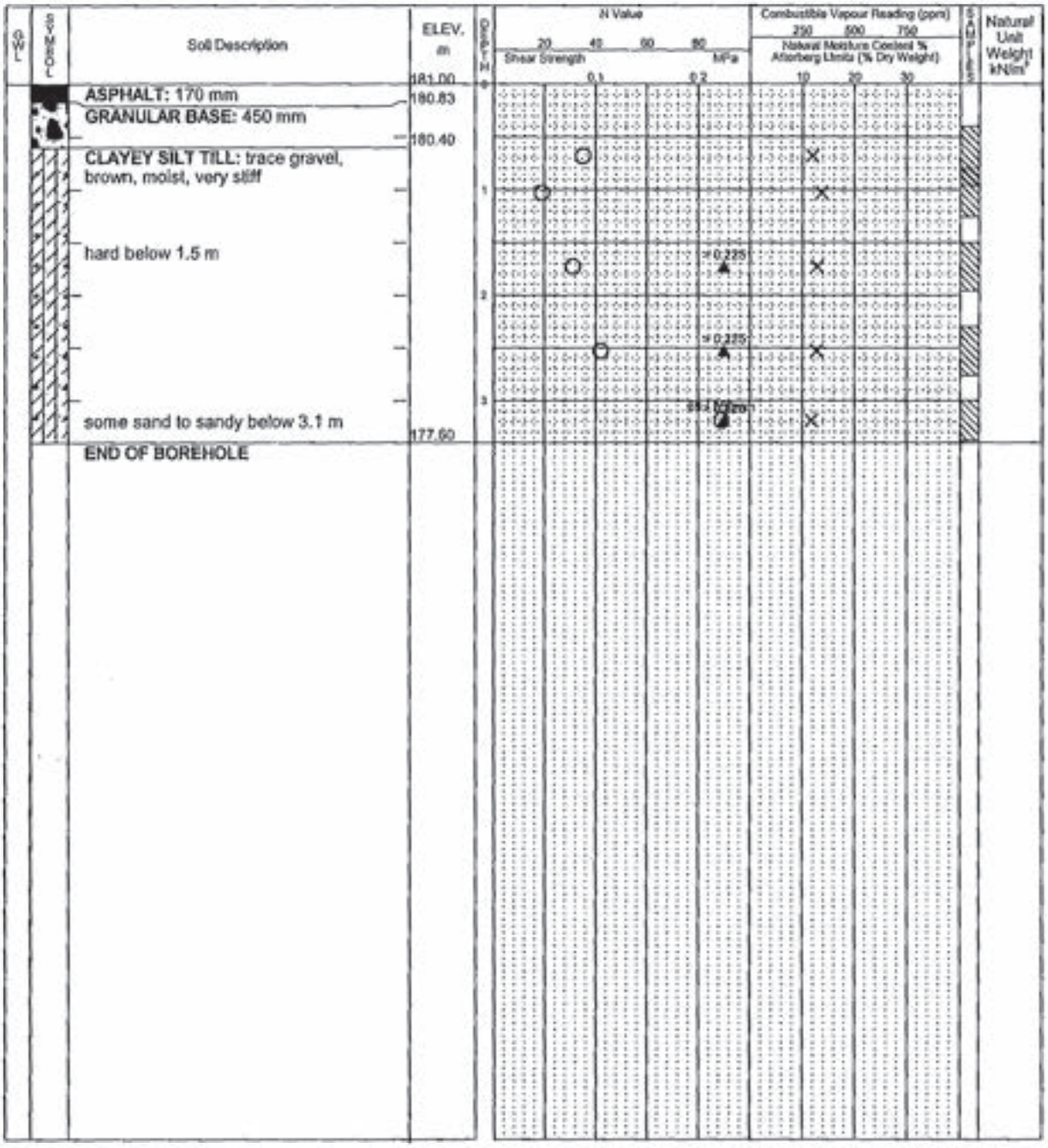
Date Drilled: July 22, 2009

Drill Type: Solid Stem Auger

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test
Sensitivity
Piezometric Water Level

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer



coffey geotechnics
SPECIALISTS MANAGING THE EARTH

Time	Water Level (m)	Depth to Cave (m)
At Completion	dry	open

Borehole BH6

Log of Borehole BH7

Project No. GEOTETOB08569 (Ref. SP8569)

Drawing No. 8

Project: Region of Peel - Watermain Replacement

Sheet No. 1 of 1

Location: Bramalea Road from Derry Road to Hydro Easement, Mississauga, Ontario

Date Drilled: July 22, 2009

Drill Type: Solid Stem Auger

Datum: Geodetic

Auger Sample ⊠
SPT (N) Value ○ ⊠
Dynamic Cone Test ——
Shelby Tube ■
Field Vane Test ✦
Sensitivity S
Piezometric Water Level ▼

Combustible Vapour Reading □
Natural Moisture ×
Plastic and Liquid Limit ⊢—○
Undrained Triaxial at % Strain at Failure ⊕
Penetrometer ▲

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH	N Value 20 40 60 80 / Shear Strength 0.1 0.2 MPa	Combustible Vapour Reading (ppm) 250 500 750 / Natural Moisture Content % / Atterberg Limits (% Dry Weight) 10 20 30	SAMPLES	Natural Unit Weight kN/m³
			181.30	0				
		ASPHALT: 200 mm	181.10					
		GRANULAR BASE: 450 mm (Crushed limestone & sand)	180.50					
		100 mm **SAND & GRAVEL** over **FILL:** silty clay, trace topsoil & rootlets, greyish brown, moist, compact	180.20	1				
		CLAYEY SILT TILL: trace gravel, brown, moist, very stiff some sand, hard below 1.5 m		2	▲ 0.225 ▲ 0.225			
				3	▲ 0.225			
			177.80					
		END OF BOREHOLE						

coffey geotechnics
SPECIALISTS MANAGING THE EARTH

Time	Water Level (m)	Depth to Cave (m)
At Completion	dry	open

Borehole BH7

Log of Borehole BH8

Project No. GEOTETOB08569 (Ref. SP8569)

Drawing No. 9

Project: Region of Peel - Watermain Replacement

Sheet No. 1 of 1

Location: Bramalea Road from Derry Road to Hydro Easement, Mississauga, Ontario

Date Drilled: October 17, 2009

Drill Type: Solid Stem Auger

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test
Sensitivity
Piezometric Water Level

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

Soil Description	ELEV. m	DEPTH	N Value 20 40 60 80 / Shear Strength 0.1 0.2 MPa	Combustible Vapour Reading (ppm) 250 500 750 / Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30	Natural Unit Weight kN/m³
ASPHALT: 200 mm	177.40	0			
GRANULAR BASE: 350 mm	177.20				
FILL: clayey silt, trace organics upto 0.8 m, brownish grey, moist, compact	176.85	1			
CLAYEY SILT TILL: trace gravel, greyish brown, moist, hard	175.90	2			21.5
grey below 3.1 m		3			22.0
END OF BOREHOLE	173.10	4			

coffey geotechnics
SPECIALISTS MANAGING THE EARTH

Time	Water Level (m)	Depth to Cave (m)
At Completion	dry	open

Borehole BH8

Log of Borehole BH9

Project No. GEOTETOB08569 (Ref. SP8569)

Drawing No. 10

Project: Region of Peel - Watermain Replacement

Sheet No. 1 of 1

Location: Bramalea Road from Derry Road to Hydro Easement, Mississauga, Ontario

Date Drilled: October 17, 2009

Drill Type: Solid Stem Auger

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test
Sensitivity
Piezometric Water Level

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

Soil Description	ELEV. m	DEPTH m
	176.00	0
ASPHALT: 180 mm	175.82	
GRANULAR BASE: 350 mm	175.47	
FILL: clayey silt, trace gravel, greyish brown, moist, compact	175.20	
CLAYEY SILT TILL: trace gravel, brown, moist, hard		1
		2
grey, very stiff below 3.1 m		3
	171.70	4
END OF BOREHOLE		

N Value: 20, 40, 60, 80
Shear Strength: 0.1, 0.2 MPa
Combustible Vapour Reading (ppm): 250, 500, 750
Natural Moisture Content % Atterberg Limits (% Dry Weight): 10, 20, 30
Natural Unit Weight kN/m³

coffey geotechnics
SPECIALISTS MANAGING THE EARTH

Time	Water Level (m)	Depth to Cave (m)
At Completion	dry	open

Borehole BH9

Log of Borehole BH10

Project No. GEOTETOB08569 (Ref. SP8569)

Drawing No. 11

Project: Region of Peel - Watermain Replacement

Sheet No. 1 of 1

Location: Bramalea Road from Derry Road to Hydro Easement, Mississauga, Ontario

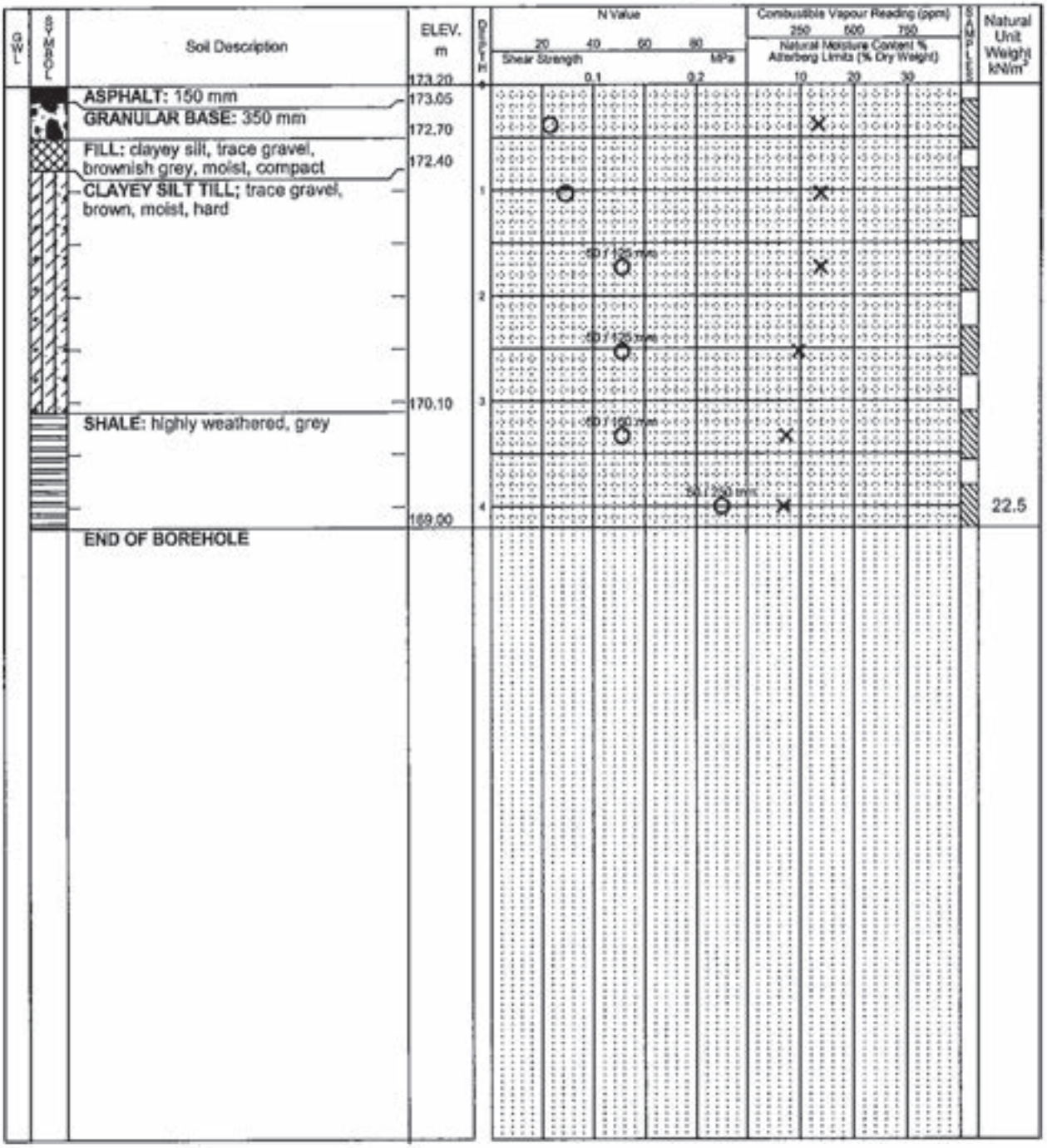
Date Drilled: October 17, 2009

Drill Type: Solid Stem Auger

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test
Sensitivity
Piezometric Water Level

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer



coffey geotechnics
SPECIALISTS MANAGING THE EARTH

Time	Water Level (m)	Depth to Cave (m)
At Completion	dry	open

Log of Borehole BH11

Project No. GEOTETOB08569 (Ref. SP8569) Drawing No. 12

Project: Region of Peel - Watermain Replacement Sheet No. 1 of 1

Location: Bramalea Road from Derry Road to Hydro Easement, Mississauga, Ontario

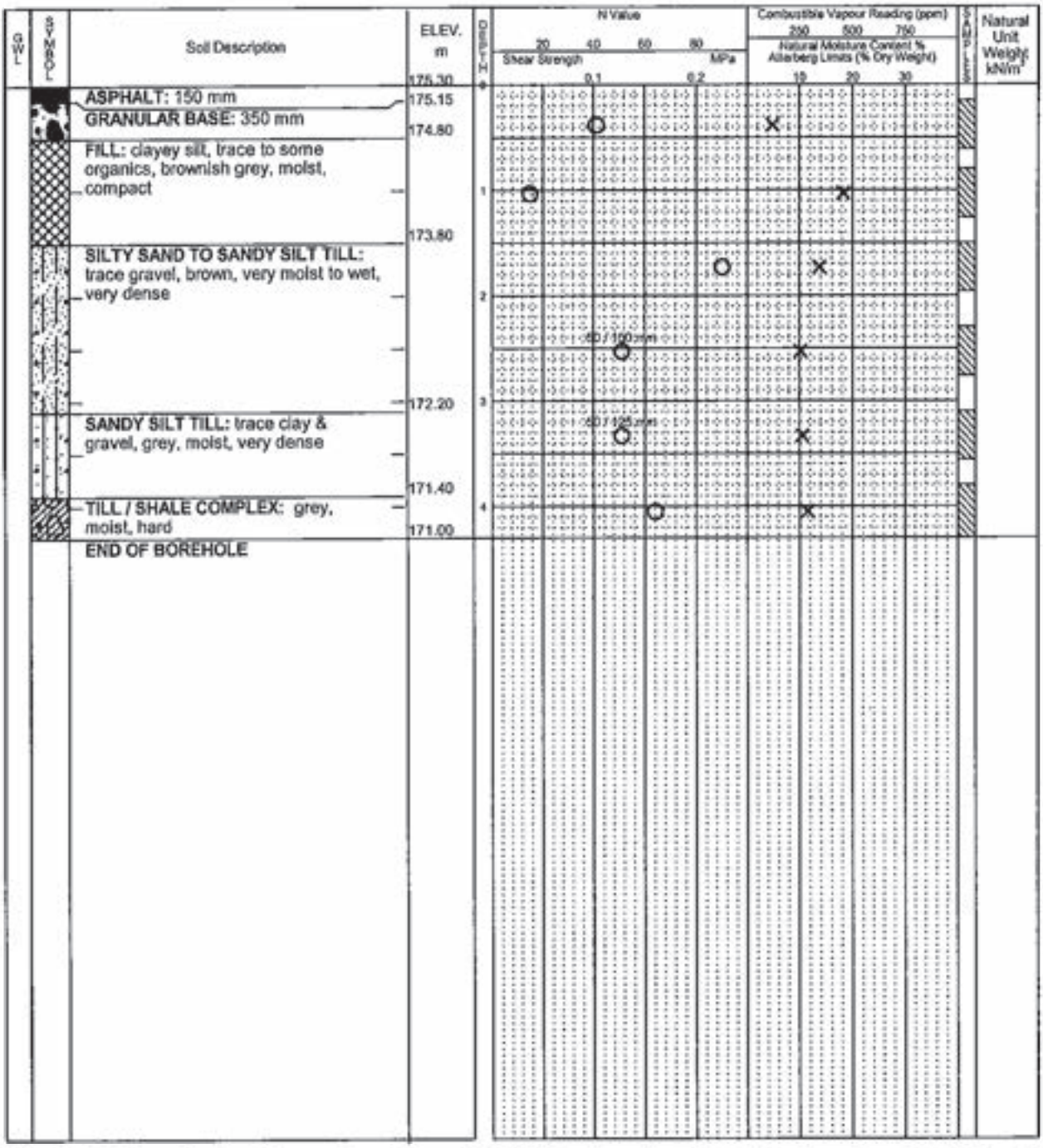
Date Drilled: October 17, 2009

Drill Type: Solid Stem Auger

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test
Sensitivity
Piezometric Water Level

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer



coffey geotechnics
SPECIALISTS MANAGING THE EARTH

Time	Water Level (m)	Depth to Cave (m)
At Completion	dry	open

Borehole BH11

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS - ONTARIO

DESIGN SERVICES BRANCH — FOUNDATIONS OFFICE

RECORD OF BOREHOLE No 1

JOB 73-11041 — LOCATION Sta. 4 + 10 15' Rt. Trav. 'B' — ORIGINATED BY PK

W.P. 133-71-05 — BORING DATE June 11, 1973 — COMPILED BY

DATUM Geodetic — BOREHOLE TYPE Auger & Dcnn Test — CHECKED BY

SOIL PROFILE			SAMPLES				DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 25 50 75 100 125	LIQUID LIMIT w_L / PLASTIC LIMIT w_P / WATER CONTENT w	BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	BLOWS/FOOT	ELEV SCALE	SHEAR STRENGTH PSF ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE	WATER CONTENT % 10 20 30	γ PCF	GR SA SI CL
610.1	Ground Level									
0.0	Clayey silt, some sand and gravel.		1	SS	9	610				
603.3	Stiff		2	SS	15					16 16 52 16
6.8	Bedrock, slightly weathered calcareous shale interbedded with sound shaley dolomite		3	SS	100/9"					
596.1			4	RC 100%	86%	600				
14.0	End of Borehole									

20
15 ◇ 5 % STRAIN AT FAILURE
10

OFFICE REPORTING SOIL EXPLORATION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS - ONTARIO

DESIGN SERVICES BRANCH — FOUNDATIONS OFFICE

RECORD OF BOREHOLE Nº 2

JOB 73-1100 | LOCATION Sta. 4 + 10 15' Lt. Trav. 'B' | ORIGINATED BY JK
WP 131-71-05 | BORING DATE June 12, 1973 | COMPILED BY JK
DATUM Geodetic | BOREHOLE TYPE Auger & Cone Test | CHECKED BY

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/FOOT	ELEV SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 25 50 75 100 125; SHEAR STRENGTH P.S.F. ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE	LIQUID LIMIT w_L, PLASTIC LIMIT w_P, WATER CONTENT w; WATER CONTENT % 10 20 30	BULK DENSITY γ P.C.F.	REMARKS GR SA SI CL
609.2	Ground Level									
0.0	Clayey silt, some sand		1	SS						
603.2	Firm to Very Stiff		2	SS	14					
6.0	Bedrock, slightly weathered calcareous shale interbedded with sound shaley dolomite		4	RC NQ	75%	600				
595.7										
13.5	End of Borehole									

20
15 ◇ 5 % STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS - ONTARIO

DESIGN SERVICES BRANCH — FOUNDATIONS OFFICE

RECORD OF BOREHOLE Nº 3

JOB 73-11041 — LOCATION Sta. L + 50 15' Rt. Trav. 'B' — ORIGINATED BY PK

WP 131-71-05 — BORING DATE June 11, 1973 — COMPILED BY PK

DATUM Geodetic — BOREHOLE TYPE Auger & Cone Test — CHECKED BY [illegible]

SOIL PROFILE			SAMPLES				DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 25 50 75 100 125	LIQUID LIMIT w_L — PLASTIC LIMIT w_p — WATER CONTENT w		BULK DENSITY	REMARKS
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE	SHEAR STRENGTH P.S.F. ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE	w_p	w	w_L	WATER CONTENT % 10 20 30	γ P.C.F.	GR SA SI CL
609.7	Ground Level												
0.0	Clayey silt with sand and gravel.		1	SS	9						○		
			2	SS	36						○		26 24 38 12
602.9	Stiff to Very Stiff		3	SS	100/6"								
6.8	Bedrock, slightly weathered calcareous shale interbedded with sound shaley dolomite		4	RC NX	81%	600							
596.9													
13.5	End of Borehole												

20
15 ◇ S % STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS–ONTARIO

DESIGN SERVICES BRANCH — FOUNDATIONS OFFICE

RECORD OF BOREHOLE No 4

JOB 73-1101 — LOCATION Sta. 4 + 50 15' Lt. Trav. 'B' — ORIGINATED BY FK

W.P. 131-71-05 — BORING DATE June 12, 1973 — COMPILED BY FK

DATUM Geodetic — BOREHOLE TYPE Auger & Cone Test — CHECKED BY

SOIL PROFILE ELEV/DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	BLOWS/FOOT	ELEV SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 25 50 75 100 125 — SHEAR STRENGTH P.S.F. ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE	LIQUID LIMIT w_L — PLASTIC LIMIT w_P — WATER CONTENT w — WATER CONTENT % 10 20 30	BULK DENSITY γ P C F	REMARKS GR SA SI CL
609.1	Ground Level									
0.0	Clayey silt, some sand.		1	SS	5			P		0 12 44 2
			2	SS	10			○		
603.1	Firm to Stiff									
6.0	Bedrock, slightly weathered clacareous shale interbedded with sound shaley dolomite		3	SS	100/5"					
						600				
595.6			4	RC NX	62%					
13.5	End of Borehole									

20
15 ◇ S % STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

Appendix D

Preliminary Dewatering Estimates

TABLE D.1

LINE ONE - TOTAL EXCAVATON
ESTIMATED WATER TAKINGS AND AREA OF INFLUENCE (STEADY STATE)
SCREENING AND ECA AMENDMENT
GEOLOGY AND HYDROGEOLOGICAL ASSESSMENT REPORT
EMERALD ENERGY FROM WASTE INC.

Flow to a Shaft in an *Confined Aquifer*

Information

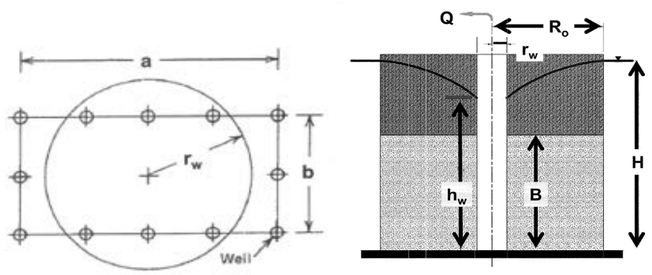
Steady State flow to a shaft within a confined aquifer.
Use this equation when a/b < 1.5.
Equation 2.0

$$Q = \frac{2\pi KB(H - h_w)}{\ln R_0 / r_w}$$

Equation 2.1

$$r_w = \sqrt{\frac{ab}{\pi}}$$

Ro is deterined by the Siechardt Equation: Ro = 3000(H-hw)K^0.5 when K is in m/s



Input Parameters

Shaft or Trench Eq'n Check: **1.071428571** This number **must be less than 1.5**; if not, then use a Trench equation.

K=	**1.00E-03**	cm/s	Input Hydraulic Conductivity in cm/s
=>	0.864	m/day	Hydraulic Conductivity converted to m/day
H=	**5.3**	m	Input height of groundwater pressure
h_w=	**0**	m	Input dewatering height
B=	**3.5**	m	Input height of aquifer
a=	**75**	m	Input length of excavation
b=	**70**	m	Input width of excavation
rw=	**40.88**	m	Input/calculate radius of shaft
π=	3.141592654		Pi

Note: Height measurements are relative to base of active groundwater

Calculating Ro using: $R_o = 1.5(Tt/S)^{0.5}$

T=	3.024	m²/day	Input transmissivity in m²/day
t=	30	days	Input pumping duration in days
S=	0.3		Input storage coefficient
Ro=	26.08	m	Radius of Influence

Alternative equation by Bear (Bear, J., 1979. **Hydraulics of Groundwater**, McGraw-Hill, New York, 569p) $R_o = 1.5(Tt/S)^{0.5}$ where **T** is transmissivity in **m²/day**, **t** is pumping duration in **days.** **R_o** will be in **metres.**

*Note: The above Ro is not the Ro used to calculate Q below.

Input additional K values (optional)

K=	**1.00E-03**	**cm/s**	**K=**	**0.864**	**m/day**
K2=	1.00E-06	cm/s	K2=	0.000864	m/day
K3=	1.00E-05	cm/s	K3=	0.00864	m/day
K4=	1.00E-04	cm/s	K4=	0.0864	m/day
K5=	1.00E-03	cm/s	K5=	0.864	m/day
K6=	1.00E-02	cm/s	K6=	8.64	m/day
K7=	1.00E-01	cm/s	K7=	86.4	m/day
K8=	1.00E+00	cm/s	K8=	864	m/day
K9=	1.00E+01	cm/s	K9=	8640	m/day
K10=	1.00E+02	cm/s	K10=	86400	m/day

Calculated Flow Rate using Equation 2.0 and 2.1

Results for Ro (radius of influence)			Flow Results in m³/day			Flow Results in L/min			Flow Results in gal/min		
Ro=	**91.16**	**m**	**Q=**	**125.566**	**m³/day**	**Q=**	**87.193**	**L/min**	**Q=**	**19.1797**	**gal/min**
Ro2=	42.47	m	Q2=	2.639	m³/day	Q2=	1.833	L/min	Q2=	0.4031	gal/min
Ro3=	45.91	m	Q3=	8.681	m³/day	Q3=	6.028	L/min	Q3=	1.3260	gal/min
Ro4=	56.78	m	Q4=	30.651	m³/day	Q4=	21.284	L/min	Q4=	4.6818	gal/min
Ro5=	91.16	m	Q5=	125.566	m³/day	Q5=	87.193	L/min	Q5=	19.1797	gal/min
Ro6=	199.88	m	Q6=	634.507	m³/day	Q6=	440.602	L/min	Q6=	96.9188	gal/min
Ro7=	543.68	m	Q7=	3891.503	m³/day	Q7=	2702.260	L/min	Q7=	594.4134	gal/min
Ro8=	1630.88	m	Q8=	27318.257	m³/day	Q8=	18969.797	L/min	Q8=	4172.7674	gal/min
Ro9=	5068.90	m	Q9=	208914.090	m³/day	Q9=	145069.944	L/min	Q9=	31910.8905	gal/min
R10=	15940.88	m	Q10=	1687925.039	m³/day	Q10=	1172095.147	L/min	Q10=	257824.5974	gal/min

TABLE D.2

ALL LINES - TOTAL EXCAVATON
ESTIMATED WATER TAKINGS AND AREA OF INFLUENCE (STEADY STATE)
SCREENING AND ECA AMENDMENT
GEOLOGY AND HYDROGEOLOGICAL ASSESSMENT REPORT
EMERALD ENERGY FROM WASTE INC.

Flow to a Shaft in an *Confined Aquifer*

Information

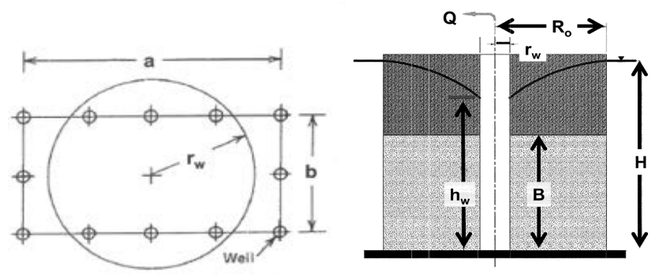
Steady State flow to a shaft within a confined aquifer.
Use this equation when a/b < 1.5.
Equation 2.0

$$Q = \frac{2\pi KB(H - h_w)}{\ln R_0 / r_w}$$

Equation 2.1

$$r_w = \sqrt{\frac{ab}{\pi}}$$

Ro is deterined by the Siechardt Equation: Ro = 3000(H-hw)K^0.5 when K is in m/s



Input Parameters

Shaft or Trench Eq'n Check:	**1.05**		This number **must be less than 1.5**; if not, then use a Trench equation.
K=	**1.00E-03**	cm/s	Input Hydraulic Conductivity in cm/s
=>	0.864	m/day	Hydraulic Conductivity converted to m/day
H=	**5.3**	m	Input height of groundwater pressure
h_w=	**0**	m	Input dewatering height
B=	**3.5**	m	Input height of aquifer
a=	**105**	m	Input length of excavation
b=	**100**	m	Input width of excavation
rw=	**57.81**	m	Input/calculate radius of shaft
π=	3.141592654		Pi

Note: Height measurements are relative to base of active groundwater

Calculating Ro using: $R_o = 1.5(Tt/S)^{0.5}$

T=	3.024	m²/day	Input transmissivity in m²/day
t=	30	days	Input pumping duration in days
S=	0.3		Input storage coefficient
Ro=	26.08	m	Radius of Influence

Alternative equation by Bear (Bear, J., 1979. **Hydraulics of Groundwater**, McGraw-Hill, New York, 569p) $R_o = 1.5(Tt/S)^{0.5}$ where **T** is transmissivity in **m²/day**, **t** is pumping duration in **days.** **R_o** will be in **metres.**

*Note: The above Ro is not the Ro used to calculate Q below.

Input additional K values (optional)

K=	**1.00E-03**	**cm/s**	**K=**	**0.864**	**m/day**
K2=	1.00E-06	cm/s	K2=	0.000864	m/day
K3=	1.00E-05	cm/s	K3=	0.00864	m/day
K4=	1.00E-04	cm/s	K4=	0.0864	m/day
K5=	1.00E-03	cm/s	K5=	0.864	m/day
K6=	1.00E-02	cm/s	K6=	8.64	m/day
K7=	1.00E-01	cm/s	K7=	86.4	m/day
K8=	1.00E+00	cm/s	K8=	864	m/day
K9=	1.00E+01	cm/s	K9=	8640	m/day
K10=	1.00E+02	cm/s	K10=	86400	m/day

Calculated Flow Rate using Equation 2.0 and 2.1

Results for Ro (radius of influence)			Flow Results in m³/day			Flow Results in L/min			Flow Results in gal/min		
Ro=	**108.09**	**m**	**Q=**	**160.920**	**m³/day**	**Q=**	**111.743**	**L/min**	**Q=**	**24.5800**	**gal/min**
Ro2=	59.40	m	Q2=	3.712	m³/day	Q2=	2.577	L/min	Q2=	0.5669	gal/min
Ro3=	62.84	m	Q3=	12.075	m³/day	Q3=	8.385	L/min	Q3=	1.8444	gal/min
Ro4=	73.71	m	Q4=	41.446	m³/day	Q4=	28.780	L/min	Q4=	6.3308	gal/min
Ro5=	108.09	m	Q5=	160.920	m³/day	Q5=	111.743	L/min	Q5=	24.5800	gal/min
Ro6=	216.81	m	Q6=	761.836	m³/day	Q6=	529.019	L/min	Q6=	116.3678	gal/min
Ro7=	560.61	m	Q7=	4432.626	m³/day	Q7=	3078.016	L/min	Q7=	677.0681	gal/min
Ro8=	1647.81	m	Q8=	30060.228	m³/day	Q8=	20873.822	L/min	Q8=	4591.5938	gal/min
Ro9=	5085.83	m	Q9=	224930.879	m³/day	Q9=	156192.002	L/min	Q9=	34357.3985	gal/min
R10=	15957.81	m	Q10=	1791687.672	m³/day	Q10=	1244147.919	L/min	Q10=	273673.9737	gal/min



ghd.com

→ The Power of Commitment

Appendix B.3

Land Use and Socio-Economic Assessment Report

Land Use and Socio-Economic Assessment Report

Emerald Energy from Waste Environmental Screening & ECA Amendment

Emerald Energy from Waste Inc.

January 29, 2024

→ The Power of Commitment

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1. Introduction

This report documents the Land Use and Socio-Economic Assessment carried out as part of the Environmental Assessment Screening for the Emerald Energy from Waste Facility.

The Emerald Energy from Waste facility (Site) is located at 7656 Bramalea Road, in Brampton, Ontario and is owned and operated by Emerald Energy from Waste Inc, herein referred to as Emerald EFW (Emerald EFW, Owner, Proponent). The location of the Site is shown in **Figure 1.1.**



Figure 1.1 Location of the Proposed Undertaking

The Site received a Certificate of Approval (CofA, now referred to as an Environmental Compliance Approval [ECA]) (Air) in 1991 and has accepted municipal solid waste since 1992. The Site, which operates under ECA No. 0264-BFGQFY, has approved waste processing rates of 546 tonnes per day and 182,000 tonnes per year. The Site is currently approved for a total of six 2-stage gasification units (five units are currently installed) by Consumat System Inc., each having a nominal design Waste Processing Rate of 91 tonnes per day of municipal solid waste. Under the current ECA, the Site is licensed to receive solid non-hazardous waste from domestic, commercial, industrial and institutional sources and waste designated for thermal treatment by the Canadian Food Inspection Agency and/or Health Canada, from the province of Ontario, as well as solid non-hazardous waste limited to international waste, arriving in the province of Ontario.

Any proposed change to the waste processing limits requires a modification to several conditions of the approved ECA, which specifies the maximum amount of waste to be processed daily and annually as well as the allowable number of equipment units. The proposed Project would amend the approved ECA to allow for up to 900,000 tonnes

of non-hazardous residual waste processing capacity annually. It is intended that staged decommissioning of the existing five units would take place as the proposed new units are brought online, such that the annual processing capacity of the entire facility would not exceed 900,000 tonnes at any time. Changes to the current approved size and footprint of the Emerald EFW Facility will also be required in order to accommodate the proposed new gasification units.

The proposed change to the annual waste processing capacity will allow Emerald EFW to positively respond to reducing Ontario's reliance on landfill disposal (both Canada and USA) while recovering energy from residual materials and reducing greenhouse-gas emission. This includes diverting a significant amount of Ontario's total residual waste going to landfill (currently 97 percent)[1] while ensuring the longevity of landfill disposal capacity. The proposed facility expansion is expected to have an operating life of at least 20 years. Between 1997 and 2000, Emerald EFW completed an Environmental Assessment (EA) for expansion of the facility by 25 percent. A CofA was issued in 2009. The Site also conducted and Environmental Screening for service area expansion and was approved between 2011-2012. The amendments to the ECA were approved in 2010, 2012, and 2020 by the Ministry of Environment, Conservation and Parks.

In order to meet the growing demand from waste generators and customer for a safe and reliable waste management facility for their post diversion solid non-hazardous Residential and Industrial, Commercial & Institutional waste, Emerald Energy from Waste Inc. is proposing to redevelop and expand the processing capacity of their existing facility from 500 tonnes/day to up to 2,500 tonnes/day and increase the energy recovery from 10 MW to up to 100 MW. This redevelopment will be implemented in 3 phases. During Phase 1, the existing facility will remain operational while the first new processing line is constructed **(See Figure 1.2)**. Phase 2 and 3 will installed and commissioned in response to market demand. The existing facility would be removed as shown in **Figure 1.3.**



Figure 1.2 Proposed Redevelopment Phase 1

[1] Solid Waste in Ontario: Landfill Report, Ontario Waste Management Association, January 2021.



Figure 1.3 Proposed Redevelopment Phase 2 & 3

This ECA amendment is subject to the Environmental Screening Process in accordance with Section 16 of Ontario Regulation 101/07 – Waste Management Projects Regulation of the Ontario *Environmental Assessment Act*, as follows:

> *A change to a thermal treatment site described in section 11 is defined as a major commercial or business enterprise or activity and is designated as an undertaking to which the Act applies, if the amount of waste that would be subject to thermal treatment at the site on any day after the change would exceed the amount of waste that was authorized under the Environmental Protection Act to be subject to thermal treatment at the site before the change. O. Reg. 101/07, s. 16; O. Reg. 389/22, s. 9.*

Section 16 of Ontario Regulation 101/07 – Waste Management Projects Regulation exempts this Project from Part II of the *EA Act*, subject to fulfilling the Environmental Screening Process. The Screening will be conducted in accordance with the planning and design process outlined in MECP "*Guide to Environmental Assessment Requirements for Waste Management Projects.*" The Environmental Screening process includes identifying and applying screening criteria to determine and describe potential environmental effects, public/external agency consultation, and the development of measures to mitigate identified environmental effects. The results of the Study will be documented in an Environmental Screening Report (ESR), which will be released for review to Stakeholders including Indigenous communities, the public, and government agencies. Upon completion of the Environmental Screening Process an application will be made to amend the existing ECA No. 0264-BFGQFY.

The Environmental Screening Process is described further in **Section 2** including the application of the Screening Criteria Checklist. The existing, planned and future land uses within the study area were confirmed through background research and a site visit are documented in **Section 3**. In general, the predominant existing land use within the Study Area is Industrial with Spring Creek located to the west, which is anticipated to remain that way for the foreseeable future based on current municipal planning policy.

The effects assessment carried out for the Land Use and Socio-Economic conditions is documented in **Section 4**. The identification of potential effects of the proposed project, mitigation measures to address the effects and the resultant net effects are described in Section 4. Lastly the monitoring requirements and additional approvals required are detailed in **Section 5**.

The Study Areas reviewed for the Land Use and Socio-Economic assessment was as follows (see **Figure 4**):

From a Land Use and Socio-Economic perspective, the characterization of existing conditions within the following study areas are appropriate to this Environmental Screening:

– **On-Site Study Area**, including all lands within the existing, approved boundaries of the Emerald EFW, as defined by Environmental Compliance Approval (ECA) No. 4591-56VSTN, as amended;

– **Site Vicinity Study Area**, An Inventory of sensitive uses within 500 m of the Site Study Area will also be examined; and
– **Local Study Area**, including all lands within a 1 Kilometres (km) radius of the Site Study Area boundaries.

2. Screening Criteria Checklist

At the beginning of the Environmental Screening, the Screening Criteria Checklist (provided as Schedule I, pp 62 – 64, to the "Guide to Environmental Assessment Requirements for Waste Management Projects") is to be completed based on the information provided in the Project Description. The Screening Criteria reflect the broad definition of "environment" contained in the *Ontario Environmental Assessment Act*

As noted in the Guide:

*"The Screening Criteria are presented in the form of a checklist with the option of a "Yes" or "No" response. Mitigation measures **are not** to be considered in concluding whether there is "No" potential environmental effect. That is, the proponent is required to answer "Yes" even if the proponent believes that a potential environmental effect could likely be mitigated. The reason for requiring a "Yes" is to ensure that mitigation measures are open to discussion and review. Another reason for this approach is that further discussion and review of a potential effect may reveal that there is no actual effect, in which case no mitigation is required. Where a "yes' has been identified, the proponent is to provide additional information in the Environmental Screening Report, explaining the potential effect(s), methods to mitigate or address the effect(s), any net effects that are anticipated and if so, their significance. Even where the proponent indicates that no environmental effects are anticipated, it is recommended that additional information is provided in the Environmental Screening Report in order to support the "no effects" conclusion"*.

Each criterion is based on a question which is prefaced with the phrase, "Might the Project…" Table 2.1 was completed as the first step of the Environmental Screening Process and is a summary of the criteria for the Land Use and Socio-Economic discipline. Further descriptions of the criteria for which a "Yes" response was indicated in the Screening table are discussed in **Section 4** of this report.

Table 2.1 Screening Criteria Checklist

	Criterion	YES	NO	Additional Information
	Might the project			
Land				
2.1	Cause negative effects on residential, commercial, institutional, or other sensitive land uses within 500 metres from the site boundary?	X		Potential effects during the construction and operational phase may include impacts related to dust, noise and traffic that are addressed in subsequent sections of this Screening Table and can be mitigated.
2.2	Not be consistent with the Provincial Policy Statement, provincial land use or resource management plans?		X	No effects on provincial land-use or resource management plans are anticipated. The proposed EFW Facility expansion aligns with the goals and policies contained in the PPS 2020, provincial land use and resource management plan.
2.3	Be inconsistent with municipal land use policies, plans and zoning bylaws (including municipal setbacks)?	X		The proposed EFW Facility is permitted in the existing zoning (M1 Industrial). However, in October 2022, the City of Brampton approved a site plan application for land swap between Emerald and the City. The acquired parcel of land within the subject site is currently zoned as Floodplain and regulated under the Toronto and Region Conservation Authority (TRCA). The site may require a zoning by-law amendment and permit from the TRCA.

	Criterion	YES	NO	Additional Information
2.4	Use lands not zoned as industrial, heavy industrial or waste disposal?	X		The proposed EFW Facility expansion would not require new lands, but the site includes a portion of land currently zoned as Floodplain (F) and regulated by the TRCA that may require permit.
2.5	Use hazard lands or unstable lands subject to erosion?	X		The proposed EFW Facility expansion may require the use of hazard lands or unstable lands subject to erosion on the newly acquired western portion of the site.
2.6	Cause negative effects related to the remediation of contaminated land?		X	The proposed EFW Facility expansion would not cause negative effects related to the remediation of contaminated land.
Socio-Economic				
6.1	Cause negative effects on neighbourhood or community character?		X	The proposed EFW Facility fits with the surrounding land uses.
6.2	Result in aesthetics impacts (e.g., visual and litter impacts)?		X	The proposed EFW Facility will not result in aesthetic impacts.
6.3	Cause negative effects on local businesses, institutions or public facilities?		X	The proposed EFW Facility will not result in negative effects on local businesses, institutions or public facilities.
6.4	Cause negative effects on recreation, cottaging or tourism?		X	The proposed EFW Facility will not result in negative effects on recreation, cottaging or tourism.
6.5	Cause negative effects related to increases in the demands on community services and infrastructure?		X	The proposed EFW Facility expansion will not cause negative effects related to increases in the demands on community services and infrastructure.
6.6	Cause negative effects on the economic base of a municipality or community?		X	The proposed EFW Facility expansion would cause positive financial impacts during construction and operations phases.
6.7	Cause negative effects on local employment and labour supply?		X	The proposed EFW Facility expansion would cause positive financial impacts during construction and operations phases.
6.8	Cause negative effects related to traffic?	X		The proposed EFW Facility expansion would increase the traffic beyond the existing levels and is expected to be acceptable relative to local traffic volumes.
6.9	Be located within 8 km of an aerodrome/airport reference point?	X		The nearest Airport is Toronto Pearson International Airport, located approximately 2 km away.
6.10	Interfere with flight paths due to the construction of facilities with height (i.e. stacks)?		X	Stack height will remain within the permitted limits and will not interfere with flight paths.
6.11	Cause negative effects on public health and safety?	X		Negative effects could occur in a failure of all emission control system. Sufficient safeguards and backups are inherent to the facility design to eliminate this risk.

3. Existing Conditions

The following subsections describe the existing conditions that are found within the On-Site, Site Vicinity and Local Study Areas for land use (**Section 3.1**) and the socio-economic environment (**Section 3.2**) of the proposed project.

3.1 Land Use Existing Conditions

3.1.1 Methodology

3.1.1.1 Available Secondary Source Information Collection and Review

Available secondary sources of information were collected and reviewed by the Land Use Study Team to determine existing Land Use conditions within the study area(s). The following sources of secondary information were collected and reviewed:

- Field Observations
- Review of current zoning plans, definitions, and land use designations
- Ontario Planning Act
- Provincial Policy Statement (2020)
- Provincial Guideline D-1: Land Use Compatibility
- City of Brampton Official Plan (2020)
- City of Brampton Zoning By-Law 270 – 2004
- City of Mississauga Official Plan 2015: Office Consolidation August 2022
- City of Mississauga Zoning By-Law NO. 0225-2007
- A Place to Grow: Growth Plan for the Greater Golden Horseshoe (2020).
- Oak Ridges Moraine Conservation Plan (2017)
- Niagara Escarpment Plan (2017).
- Greenbelt Plan (2017).
- Toronto and Region Conservation Authority (TRCA)
- Review results of other work plans such as noise, air quality, surface water and traffic for example
- MECP technical guidelines and standards
- Amended Environmental Compliance Approval #4591-56VSTN (Waste), Issued March 18, 2021
- Amended Environmental Compliance Approval #0264-BFGQFY (Air), Issued March 19, 2021
- Amended Environmental Compliance Approval #5175-83WSB3 (Industrial Sewage Works), issued May 13, 2010
- Storm Drainage and Storm Water Design Brief document prepared by Candevecon Limited,
- Land Exchange Restoration and Enhancement Plan prepared by Palmer Environmental Consulting Group Inc.
- Design and Operations Report, Emerald Energy from Waste Facility, Emerald Energy from Waste Inc., Prepared by GHD, November 23, 2018 to add an additional processing unit to operations

3.1.2 Description of Existing Conditions

3.1.2.1 Existing Land Uses

The existing land uses around the Site are primarily industrial. The Site Study Area is bordered by Highway 407 to the Northwest, Spring Creek to the Southwest, a Transformer Station and Hydro Corridor to the Southeast and Bramalea Road to the Northeast.

Sensitive Uses Within 500 Metres

Sensitive land uses are defined in the Provincial Policy Statement (PPS), 2020 as “buildings, amenity areas, or outdoor spaces where routine or normal activities occurring at reasonably expected times would experience one or more adverse effects from contaminant discharges generated by a nearby major facility. Sensitive land uses may be a part of the natural or built environment. Examples may include, but are not limited to residences, day care centers, and educational and health facilities.”

The Existing Emerald EFW Facility is located at 7656 Bramalea Road, in Brampton, Ontario. The proposed expansion will take place within the site boundaries and will not require use of any new lands. There are no residential, institutional, or recreational lands designated in a 500 metres (m) radius of the site boundary from the proposed EFW Facility. There are however, a wide range of businesses located within the vicinity of Emerald EFW Facility, the following of which are situated within a 500 m radius of the site boundary. These lands are designated as Industrial and Open Space.

- **Business Services**
  - Del Industrial Metals
  - Algonquin Power Systems
  - CN Misc Yard
  - Raghav Dhir Real Estate
  - Remax Paramount Realty
  - Simyard Logistics Solution
  - Cascades EC Mississauga
  - Steven’s C/OP Proactive
  - Curtiss-Wright Surface Technilogies
  - Indigo Online Distribution Centre
- **Transportation Services**
  - Farrex Freight Systems Ltd
  - F1 Freight Systems
  - Vision Transportation
  - TForce Logistics – Toronto
  - XTL Distribution
  - Loomis Express
- **Industrial /Manufacturing Services**
  - Matsu Manufacturing
  - Matcor Metal Fabrication Inc
  - Massive Die-Form
  - Sonoco

– **Religious Services**
  - Shirdi Saibaba Temple

Local Study Area

Industrial and Employment Uses

Within the Local Study Area are several large distribution centres to the North side of Highway 407. These distribution centres are connected to Steeles Avenue East and Dixie Road.

A Canadian National (CN) Rail line is located on the in the Local Study Area including the Bramalea Go Station. The Bramalea Go Station has associated commuter parking lots on both sides of the rail line. On Bramalea Road there is a CN Railyard

3.1.2.2 Provincial Policy Statement

The Provincial Policy Statement (PPS), 2020[2] provides clear policy direction on land use planning to promote strong communities, a strong economy, and a clean and healthy environment. In terms of land use compatibility, the PPS 2020 (Section 1.2.6.1) states that "major facilities and sensitive land uses should be planned to ensure they are appropriately designed, buffered and/or separated from each other to prevent or mitigate adverse effects from odour, noise and other contaminants, minimize risk to public health and safety, and to ensure the long-term viability of major facilities." The PPS 2020 defines 'major facilities' as facilities which may require separation from sensitive land uses (as defined in Section 3.1.2.1, above) and include waste management systems and energy generation facilities. Section 1.6.10.1 of the PPS 2020 notes that "waste management systems need to be provided that are of an appropriate size and type to accommodate present and future requirements, and facilitate, encourage and promote reduction, reuse and recycling objectives… [and that] waste management systems shall be located and designed in accordance with provincial legislation and standards." In terms of energy supply, Section 1.6.11.2 states that planning authorities should promote renewable energy systems and alternative energy systems, where feasible, in accordance with provincial and federal requirements[3].

The On-Site and Site-Vicinity Study Areas are currently in compliance with the policies contained in the PPS 2020.

3.1.2.3 Toronto Region and Conservation Authority (TRCA) Regulation

In accordance with *Ontario Regulation 166/06*, TRCA regulates areas where development could be subject to flooding, erosion or dynamic beaches, and where interference with wetlands and alterations to shorelines and watercourses might adversely affect those environmental features. Any of these activities within the Regulated Area may require a permit from TRCA[4].

The City of Brampton approved a site plan application from Emerald to permit the exchange of lands with the City at the rear of the property, on the east side of Spring Creek, to facilitate the construction of a driveway extension (Ring Road) required to accommodate the efficient expansion of the existing energy from waste facility in October 2022. Emerald acquired Parts 2, 3 and 4 Plan 43R-37782 from the City in exchange of Parts 1 and 5 Plan 43R-37782.

The acquired parcel of land within the subject site is currently zoned as Floodplain by the city of Brampton Zoning By-Law 2004 and is regulated by the TRCA (see **Figure 5**). The site may require a zoning by-law amendment and permit from the TRCA.

3.1.2.4 Planned Land Uses

In addition to these existing land uses, there are presently five potential or planned developments/redevelopments within the Study Area[5]. These developments including their location and status under the Planning Act are presented

[2] It should be noted that the PPS was recently updated and the proposed changes (PPS, 2023) are out for public consultation until August 4, 2023.
[3] **Provincial Policy Statement, 2020 - Under the Planning Act (ontario.ca)**
[4] **Regulated Area Search - Toronto and Region Conservation Authority (TRCA)**
[5] **PlanningViewer (brampton.ca) and Lewis, Eills, Planning Department, July 10, 2023, email**

in Table 3.1 and shown in **Figure 6**. With only five potential or planned development currently within the Study Area, it can be concluded that the existing land use fabric is relatively stable without significant development pressures.

Table 3.1 Developments including their Location and status under the Planning Act

Potential/ Planned Development	Location	*Planning Act* Status
Redevelopment of existing site to add 15 trailer parking spaces	North-west of Emerald EFW facility	Closed/Approved
Phase 1 of Canadian Tire Warehouse Redevelopment	North of Emerald EFW facility	Received/In review
Redevelopment of a commercial building to residential condominium building	West of Emerald EFW facility	Pre-Consultation closed
Additional industrial building	West of Emerald EFW facility	Closed/Approved
Commercial building	South of Emerald EFW facility	Closed/Approved

3.1.2.5 Municipal Land Use Policies, Plans, Zoning Bylaws

The Study Areas are situated within the Regional Municipality of Peel, the City of Brampton, and City of Mississauga (See **figures 7 and 8**). In light of this, both the Region's and the two City's Official Plans along with the two City's Zoning By-Laws were reviewed to determine how the land in the Study Areas is to be used in the future based on municipal planning policy.

The predominance of industrial as the primary existing land use in the Study Areas is expected to remain for the foreseeable future with very little change based on current municipal planning policy espoused by the Region of Peel, City of Brampton, and City of Mississauga.

Region of Peel Official Plan

The Study Area is designated as Urban System by Schedule E-1 and as Employment Areas by Schedule E-4 within the Region of Peel Official Plan 2022 (Regional OP). Section 5.6 of the Regional OP details the objectives and policies for the *Urban System*. One of the primary objectives is to provide for and facilitate a wide range of goods and services to meet the needs of those living and working in the *Urban System*. Urban development and redevelopment are permitted within the Urban System areas.

Section 5.8 of the Regional OP outlines the objectives and policies for the *Employment Areas*. The primary objective for these areas is to provide the infrastructure and services required for the development of the employment areas and support to further economic development goals of the local municipalities.

The study area also falls under the Provincial Plan - *Parkway Belt West Plan*. The purpose of this plan is to link urban areas with other areas, providing a system of linked open spaces and lands for future linear facilities.

City of Brampton Official Plan (September 2020 Office Consolidation)

The City of Brampton Official Plan was adopted in 2006 and approved by the Ontario Municipal Board (OMB) in October 2008. The 2006 OP has been modified since the OBM decision through the September 2020 Office Consolidation. A draft Official Plan 2022 is currently in the review and comment stage.

The On-site Study Area is designated as *Industrial* and *Open Space* under Employment Lands by Schedule A-General Land Use Designations of the Brampton's current Official Plan 2020 (Current BOP). The lands under *Industrial* designation are permitted for light to heavy industrial uses such as manufacturing, processing, repair and service, warehousing, and distribution. Offices and high-performance industrial uses such as research and development are also permitted in this designation. Section 4.4.2.1 of the Current BOP details the policies for *Industrial* designation. The lands under *Open Space* designation indicates major open space features including public and private open space, valleylands /watercourse corridors, wetlands, and woodlands.

The Local Study Areas include lands designated as *Business corridor* and *office.* A broad range of employment and employment-related uses are permitted in this designation. Certain lands within the Business Corridor designation are

planned to accommodate a broad range of business, service, and institutional uses to serve the general public and adjacent employment areas.

The City of Brampton is presently in the process of renewing their Current BOP and has released a second draft of the new Official Plan for review and comment. According to second draft of the Brampton Official Plan 2022 (Draft BOP), the On-site Study Area is designated as *Employment Areas and Natural Heritage System* by Schedule 2 – Designations and *Provincial Significant Employment Zones* (PSEZ) by Schedule 5 – Provincial Plans & Policy Areas, of the Draft BOP.

The goal of the *Employment Areas* is to create productive and desirable places to attract and retain investment along with protecting the employment lands and promoting employment growth. Waste management facilities are permitted use within this designation. The *Provincially Significant Employment Zones* are identified by the key employment areas for the purpose of long-term planning for job creation and economic development. The policy of *Natural Heritage System* is to protect, enhance, and restore linkages within the natural heritage systems.

City of Mississauga Official Plan (March 2023 Office Consolidation)

The On-Site and Site Vicinity Study Areas are not part of the City of Mississauga Official Plan 2023 (MOP). However, part of the Local Study Area falls under the limits of the City of Mississauga and are designated as *Industrial* by Schedule 10-Land Use Designations of the MOP.

City of Brampton Zoning By-Law

The city of Brampton Zoning By-Law 2004 zones the subject site as Industrial (M1) and. The City of Brampton approved a site plan application for land swap between Emerald EFW Inc. and the City in October 2022. The acquired parcel of land within the subject site is currently zoned as Floodplain (F) and regulated under the TRCA. The Proposed Site is subject to Zoning By-Law Amendments in the City of Brampton and TRCA permit. Other lands within the local study areas are zoned as Agricultural, Floodplain, Commercial, and Institutional.

Industrial

There are five zoned industrial areas within the Study Area. The first is the Site itself located on the southeast quadrant of Highway 407 and Bramalea Road zoned as M1 Industrial. The second area is on the northeast quadrant of Highway 407 and Bramalea Road zoned as M3 Industrial. The third industrial area is north of Bramalea Road zoned as M2 Industrial. The fourth industrial area south of the Bramalea Road is zoned as M1 & M2 Industrial. The fifth area is at the western site of the Highway 407 and at the eastern end of the Study Area zoned as M1 and M2 Industrial.

Agricultural

Area adjacent to the Site boundary northwest along highway 407 and to the east is zoned as Agricultural (A). Permitted uses under this zone are limited to agricultural uses and non-agricultural uses such as residential, a cemetery, an animal hospital, a kennel, and a home occupation.

Floodplain

The Site boundary includes recently acquired land currently zoned as Floodplain and share boundaries with areas zoned as Floodplain (F). The lands zoned as F can only be used as flood and erosion control and conservation area or for public parks and golf courses. The Proposed Site is subject to Zoning By-Law Amendments in the City of Brampton.

Commercial

Two properties within the Study Area are zoned as Highway Commercial One (HC1). The permitted uses are limited to commercial and other uses such as a lodging house or a place of worship.

Institutional

One property at the northwest corner of the Study Area is zoned as Institutional Two (I2). Permitted uses include institutional and non-institutional such as a park/playground or a place of worship.

City of Mississauga's Zoning By-Law

Some of the Local Study Areas are zoned under the City if Mississauga's Zoning By-Law 2007. Most of these areas are zoned as Employment Areas (E1 & E3). The permitted uses are limited to employment, business activities, commercial and hospitality uses.

3.2 Socio-Economic Existing Conditions

3.2.1 Methodology

3.2.1.1 Available Secondary Source Information Collection and Review

Available secondary sources of information were collected and reviewed by the Socio-Economic Study Team to determine existing Socio-Economic conditions within the study area(s). The following sources of secondary information were collected and reviewed:

– Field Observations
– Review of current zoning plans, definitions, and land use designations
– City of Brampton Official Plan (2020)
– City of Brampton Zoning By-Law 270 – 2004
– City of Mississauga Official Plan 2015: Office Consolidation August 2022
– City of Mississauga Zoning By-Law NO. 0225-2007
– Statistics Canada
– Brampton Geohub.ca
– Brampton Economic Development
– Review results of other work plans such as noise, air quality, surface water and traffic for example
– MECP technical guidelines and standards

3.2.2 Description of Existing Conditions

3.2.2.1 Neighbourhood & Community Character

The proposed redevelopment site is located within the City of Brampton close to the boundaries of the City of Mississauga. The proposed site is designated as Industrial Area within the City of Brampton's Official Plan and Zoned Industrial (M1) and Floodplain (F) according to the City of Brampton Zoning By-Law 2004.

The proposed Emerald EFW Facility is part of the Census Tract 0561.0 and is located within the boundaries of Ward 7, which consist of an established neighbourhood community Bramalea.

According to the 2016 Census, the total population of Ward 7 was 56,750, comprising of 51% females and 49% males together making 9.60% of the total Brampton population. Half of the population of Ward 7 was between the ages of 25 to 64 and about 48% of the Ward 7 population graduated from a post-secondary certificate, degree or diploma. The average household income in 2015 was $88,246 and 72% of the residents were property owners. The employment rate in 2016 was 60% in this ward. The immigration population in Ward 7 comprised of 45.2%, making approximately 10% share of Brampton.

Census Tract 0561.0

– The total population recorded in Census 2016 was 6,450

– 28.87% of population are between the age of 0-19 years. There are slightly more seniors (65+) in this neighbourhood (13.10%) in comparison to the City wide average (11.165).
– 29.10% of owners and renters in this neighbourhood spend 30% or more of their income on shelter cost.
– The unemployment rate was 6.77% accounting for the population 25 years and over in the labour force who reported that they were unemployed in the reference period.
– More than half of the population completed a postsecondary certificate, diploma, or degree.

Bramalea Neighbourhood

– Bramalea neighborhood was Canada's first satellite city, a master planned development designed as a self-contained community with places to live, work and play. Built in the 70s, Bramalea embodies a perfect example of a complete community with desired amenities within walking distance from its residential areas.
– The total population as of 2016 Census was approximately 19,777 citizens.
– The age group distribution had the highest percentage in the 25-54 years old rage (working class) followed by children from 0-14 years of age. There are relatively less seniors (65+) in the Bramalea Neighborhood in comparison to the City wide range.
– The average age of men is 36 and the average age of women is 38.
– The average household size in the neighbourhood is approximately 3 people per household, about 15% lower than the City Average. 20.6% of the private dwelling inventory were single-detached houses, 49.9% apartments, 15% semi-detached houses, and 14.5% were row houses.
– Majority (86%) of the Bramalea residents are happy living in this neighborhood.
– The average household income was $73,845 in 2016 and approximately 31% of private households reported having a household income of $80,000 and over.
– 19.2% of the population aged 15 and over completed a University certificate, diploma or degree at a bachelor level or above.

3.2.2.2 Visual

The existing visual landscape within the On-Site and Site-Vicinity Study Areas can be classified as industrial, including warehouses, stacks, railway lines, transmission towers, Highways and truck and trailers storage yards. Moving southwest from the proposed facility, the visual landscape changes to light industrial / commercial within approximately the nearest 500 m of the Local Study Area, shifting to residential between 1.5 and 2 km. Directly west of the proposed site, the visual landscape remains light industrial/commercial for approximately 2 km at which point it becomes residential. To the east, the visual landscape remains commercial to the extent of the Local Study Area.

3.2.2.3 Local Businesses, Institutions or Public Facilities

There are several businesses and a range of industries located within the Local Study Area. The range of businesses includes metal production, transportation, environmental services, industrial products, food processing and many more. There are a number of Local Businesses, Institutions and Public Facilities within the Local Study Areas listed in categories below:

– **Business Services**
  - Del Industrial Metals
  - Algonquin Power Systems
  - CN Misc Yard
  - Raghav Dhir Real Estate
  - Remax Paramount Realty
  - Simyard Logistics Solution
  - Cascades EC Mississauga

- Steven's C/OP Proactive
- Curtiss-Wright Surface Technilogies
- Indigo Online Distribution Centre
- Big Guy Electric Inc.
- Doortek Inc.
- MJ Truck and Trailer Repair
- CARSTAR Brampton
- Crown Auto Repair
- Khan Brothers Auto Ltd
- GG Fabrication Inc.
- Ontario Heating
- Furnace Filter.ca
- Alora Beddings
- KJ Designers
- C. G. Needle Arts Ltd
- ACCO Brands Canada Inc
- Canadian Tire
- Purolator Quick Pick-up
- Public Storage
- IH Case Décor
- Vasai: The Furniture Gallery
- My Storage
- Ecolab
- Form and Build Supply
- Newpall Pallets
- Dufferin Aggregates Malton

– **Transportation Services**

- Farrex Freight Systems Ltd
- F1 Freight Systems
- Vision Transportation
- TForce Logistics – Toronto
- XTL Distribution
- Loomis Express
- ABF Freight
- Greenway Collision Centre
- Bramalea GO Station
- Aviall, A Boeing Company
- Spartan Freight System
- Red Rock Haulage

- **Industrial /Manufacturing /Construction Supplies & Services**
  - Matsu Manufacturing
  - Matcor Metal Fabrication Inc
  - Massive Die-Form
  - Sonoco
  - Asco Manufacturing
  - Altra Tech Auto Collision & Service
  - BigGuy Electric Inc.
  - Norampac Inc.
  - Person Doors
- **Food Retail and Services**
  - Pier 120 Restaurant and Venue
  - Peggy's Café
  - Brar's Grand Buffet
  - Bombay Place Restaurants and Banquets
  - Yummy Punjabi Flavours
  - Punjabi Chaap Corner Bramalea
  - Paragh Foods
  - Bikaner Sweets Factory
- **Parks and Institutions**
  - Wildfield Parks
  - Dixie Cricket Ground Brampton
  - Dixie – 407 Cricket Ground
  - Cricket Batting Cage
  - Dixie – 407 Sports Fields
  - Moga Truck Driving School
  - VM Truck Academy
- **Waste Management Facility**
  - Power Metal Recycling Inc
- **Religions Services**
  - Shirdi Saibaba Temple
  - New Birth Tabernacle Church
  - Peel Arya Samaj Vedic Cultural Centre
  - Believers House of Hope Church
  - ISKON Brampton
  - Sant Shri Asharamji

3.2.2.4 Local Employment & labor supply

According to Census 2016, there are total 30,650 residents in the labor force, of which 28,210 were employed and 2,440 were unemployed. Majority of those employed were in sales and service occupation (approx.23%), trade,

transport and equipment operators and related occupation (20%), followed by business, finance, and administration occupations (18%), and occupation in manufacturing and utilities (9%).[6]

The surrounding neighborhoods are comprised of a primarily younger population. Bramalea Neighborhood has approximately 41% of the population in the working age of 25-54 years old and Census tract 0561.0 has roughly 44.7 in the working-class age group.

3.2.2.5 Traffic

Traffic within the Local Study Area is consistent with industrial operations. The movement of trucks within the Study Areas destined for the subject site is limited to designated haul routes along major arterial roads (i.e., Highway 407, Bramalea Road, Dixie Road, and Steels Ave E). Further details on traffic (existing conditions and potential effects) are included in the Traffic Assessment Report, prepared concurrently with this report by GHD.

3.2.2.6 Airport

The closest airport to the proposed facility is the Toronto Pearson International Airport, approximately 2 km away.

3.2.2.7 Flight Paths

The proposed site is located approximately 2 km away from the Toronto Pearson International Airport. The site is within the Lester B. Pearson International Airport (LBPIA) Operating Area as identified in Schedule 12 to the City of Brampton Official Plan 2022 (Draft). Development and redevelopment for certain noise sensitive community service uses such as day care centres, nursing homes, schools, and hospitals will not be permitted within the LBPIA Operation Areas.

4. Description of Project Components and Activities

A Project Description, which includes a Site Plan, was prepared so that potential environmental effects and mitigation measures could be identified. The following subsections provide a general summary of the proposed undertaking:

Ontario disposes over 97 percent of its residual materials in landfills. The remaining three percent is managed through Energy from Waste (EFW [7]). Of the 97 percent directed to landfill disposal, 70 percent is disposed of within Ontario and 27 percent in Michigan and New York [8]. Based on the current disposal rate of 97%, Ontario's landfill capacity is projected to be exhausted in 11 to16 years[9]. In order to address the compounding issues of growing population and diminishing landfill capacity in southern Ontario, Emerald EFW has identified an opportunity to develop new EFW capacity at their existing facility in Brampton.

The purpose of this Project is to provide additional processing capacity at the Emerald EFW Facility in Brampton, Ontario in order to divert a portion of the non-hazardous residual materials produced by Ontario residents and businesses from landfills, thereby recovering energy for use within the community. The proposed Project would allow for three new gasification units, each capable of processing up to 300,000 tonnes of residual waste per year, for a total processing capacity at the facility of 900,000 tonnes annually. This would increase the permitted annual waste processing amount from 182,000 to 900,000 tonnes. The proposed change in the annual processing capacity requires additional facility infrastructure and a change to the Site footprint.

The project for which the Environmental Screening Process is being undertaken is a proposed redevelopment of the existing site and involves a change to the final site capacity and footprint. A high level of construction & demolition will

[6] **2016 CENSUS & NATIONAL HOUSEHOLD SURVEY CITY OF BRAMPTON - WARD 1 PROFILE (investbrampton.ca)**
[7] Solid Waste in Ontario: Landfill Report, Ontario Waste Management Association, January 2021.
[8] Ibid.
[9] Ibid.

be required to implement the proposal. The redevelopment will be implemented in 3 phases. In phase 1, the existing facility will remain operational while the first new processing line is constructed. Phases 2 and 3 will be installed and commissioned in response to market demand. The existing facility would be removed. Emerald EfW will undergo an ECA amendment for changes to approved processing capacity and other operational activities. From a traffic perspective there will be no changes to existing haul routes or Site entrance. Increasing the annual processing capacity will result in increased truck traffic on the haul route from Highway 407 along Bramalea Road on an annual basis. This is expected to be acceptable relative to local traffic volumes.

A summary of the key elements of the proposed capacity expansion compared to the existing approved Site is provided in Table 4.1.

Table 4.1 Summary of Proposed Emerald EFW Facility Design vs Existing Facility

Design Component	Existing EFW Facility	Proposed Redevelopment
Waste Processing Capacity (tonnes per annum)	150,000	900,000
Number of Operation Lines	1	3

5. Potential Effects, Mitigation Measures & Net Effects

There is no significant impact to the predominantly industrial and agricultural land uses within the Study Area as the proposed undertaking will not be acquiring any new lands. The potential impacts are primarily associated with the construction and operational phase, which may include impacts related to dust, noise and traffic that are addressed in subsequent sections.

5.1 Methodology and Investigations

The assessment of effects associated with the proposed undertaking was carried out through a series of steps that is based, in part, on the description of existing conditions as well as the Project Description and Site Plan. The assessment of effects was also undertaken within the context of the previously completed Screening Criteria Checklist, as summarized in **Section 2** of this report.

The land use and socio-economic existing conditions characterized for each criterion identified in the Screening Criteria Checklist were assessed taking into consideration the Project Description and Site Plan in order to identify potential effects that may result from the proposed undertaking. Following the determination of potential effects, measures required to mitigate any potential effects were developed and the resulting net effects (with the application of mitigation measures) were determined.

5.2 Land Use Net Effects

This Section provides an assessment of the potential negative environmental effects (i.e., those for which a “Yes” answer was given in the Screening Criteria Checklist) for those Land Use criteria which might be affected by the project as identified in **Section 2**. The effects assessment describes how existing environmental conditions in the Study Area(s) would change as a result of the construction and operation of the proposed undertaking.

As described in **Section 2**, a “Yes” was applied to the following Land Use criteria:

	Criterion	YES	NO	Additional Information
	Might the project			
Land				
2.1	Cause negative effects on residential, commercial, institutional, or other sensitive land uses within 500 metres from the site boundary?	X		Potential effects during the construction and operational phase may include impacts related to dust, noise and traffic that can be mitigated.
2.3	Be inconsistent with municipal land use policies, plans and zoning bylaws (including municipal setbacks)?	X		The proposed EFW Facility is permitted in the existing zoning (M1 Industrial). However, in October 2022, the City of Brampton approved a site plan application for land swap between Emerald and the City. The acquired parcel of land within the subject site is currently zoned as Floodplain and regulated under the Toronto and Region Conservation Authority (TRCA). The site may require a zoning by-law amendment and permit from the TRCA.
2.4	Use lands not zoned as industrial, heavy industrial or waste disposal?	X		The proposed EFW Facility expansion would not require new lands, but the site includes a portion of land currently zoned as Floodplain (F) and regulated by the TRCA that may require permit.
2.5	Use hazard lands or unstable lands subject to erosion?	X		The proposed EFW Facility expansion may require the use of hazard lands or unstable lands subject to erosion on the newly acquired western portion of the site.

With respect to the above criteria/criterion, a description of the potential negative environmental effects, necessary mitigation measures and the resultant net effects on the environment are discussed. Studies conducted during the screening showed that the anticipated effects will be much less than expected or will not occur at all. In all cases, impact management (mitigation) measures have been identified that, when applied, will eliminate the potential environmental effects, or reduce them to acceptable levels.

5.2.1 Potential Effects in Land Use Environment

As identified in Section 3.1, there are no potential effects anticipated in terms of incompatibility of the proposed undertaking with the Provincial Policy Statement. The site location for the proposed EFW Facility is also consistent with the Official Plans of Region of Peel, City of Brampton, City of Mississauga, and the Zoning By-laws of both the City of Brampton and City of Mississauga. The Emerald EFW Facility is operating and will continue to operate within the lands zoned as ‘M1’ Industrial under City of Brampton Zoning By-Law, which permits a waste processing facility and there is no potential for negative effects related to the Remediation of Contaminated Land as the existing property is currently used as an industrial site.

As noted in Section 3.1.2.3, above, the On-site study area includes the parcel of land acquired from the City of Brampton and regulated by the TRCA which is currently zoned as Floodplain (F). The lands zoned as F can only be used as flood and erosion control and conservation area or for public parks and golf courses. The proposed expansion will require Zoning By-Law Amendments in the City of Brampton.

A Storm Drainage and Storm Water Design Brief document prepared by Candevecon Limited, and a Land Exchange Restoration and Enhancement Plan was prepared by Palmer Environmental Consulting Group Inc. to obtain a site plan approval under the conditions of the land exchange agreement between Emerald and the City of Brampton. A portion of the site is included within the TRCA regulated areas (as shown in **Figure 5**) and will require a TRCA permit.

As identified in the Screening Criteria Checklist, in the absence of mitigation measures, the construction phase of the proposed undertaking may include impacts related to dust, noise and traffic for commercial sensitive uses within 500 m (see **Section 3.1.2.1** for the businesses located within the Site-Vicinity Study Area).

The operation of the proposed EFW Facility will not affect land uses (sensitive or otherwise) within 500 m as all operations (with the exception of weighing of the in- and out-bound trucks) will take place indoors within the buildings housing the tipping floor and the three waste processing lines. The results of the Traffic Assessment Report conducted as part of this Environmental Screening Process indicate that the combination of projected future background traffic growth to 2029 for line 1 commencement and 2034 for line 2 and 3 commencement plus the estimated proposed EFW Facility generated trips can be adequately accommodated on the existing road network with marginal impact resulting predominately from the increase in corridor growth along Bramalea Road.

On-Site lighting and truck traffic to and from the Facility may cause potential light pollution on surrounding area.

5.2.2 Mitigation Measures

Potential construction-related negative environmental effects associated with dust, noise and traffic for commercial uses within 500 m of the proposed EFW Facility will be mitigated through the use of best management practices.

Once operational, the Facility will implement, as appropriate, fugitive dust and odour management plans to ensure that the emissions of these contaminants are well controlled within the daily operations at the Site. In addition, combustion air will to be taken from the waste bunker to avoid odor from this area of the plant.

As noted above, the operation of the proposed EFW Facility will not affect land uses (sensitive or otherwise) within 500 m, as potential effects related to dust and noise have been mitigated through design (i.e., all operations - with the exception of weighing of the in- and out-bound trucks - will take place indoors) and there will be no adverse impacts related to traffic at the existing road network. A sensitivity analysis was completed for the Bramalea Rd and Site access/Private Road intersection which included traffic signals which confirmed that the signalization of the intersection would mitigate the large delays critical movements for the eastbound and westbound left turn onto Bramalea Road during the a.m. and p.m. peak hours (as described in the Traffic Assessment Report).

Notwithstanding this, best management practices will be employed at the proposed EFW Facility, as described in the traffic assessment report.

5.2.3 Net Effects

The proposed EFW Facility site is in an industrial area in the City of Brampton and is surrounded by other industrial operations. Potential negative environmental effects during construction related to dust, odour, noise, and traffic will be mitigated through the use of best management practices; therefore, no net negative environmental effects related to Land Use are anticipated for construction of the proposed redevelopment. As the hours of truck traffic are limited, there will be no net effects relating to light pollution.

There are no net negative land use environment effects anticipated with respect to Land Use for the operation of the proposed EFW Facility.

5.3 Socio-Economic Net Effects

This section provides an assessment of the potential negative environmental effects (i.e., those for which a “Yes” answer was given in the Screening Criteria Checklist) for those Socio-Economic criteria which might be affected by the project as identified in **Section 2**. The effects assessment describes how existing environmental conditions in the Study Area(s) would change as a result of the construction and operation of the proposed undertaking.

As described in **Section 2**, a “Yes” was applied to the following Socio-Economic criteria:

	Criterion	YES	NO	Additional Information
	Might the project			
Socio-Economic				
6.8	Cause negative effects related to traffic?	X		The proposed EFW Facility expansion would increase the traffic beyond the existing levels and is expected to be acceptable relative to local traffic volumes.

	Criterion	YES	NO	Additional Information
6.9	Be located within 8 km of an aerodrome/airport reference point?	X		The nearest Airport is Toronto Pearson International Airport, located approximately 2 km away.
6.11	Cause negative effects on public health and safety?	X		Negative effects could occur in a failure of all emission control system. Sufficient safeguards and backups are inherent to the facility design to eliminate this risk.

With respect to the above criteria/criterion, a description of the potential negative environmental effects, necessary mitigation measures and the resultant net effects on the environment are discussed. Studies conducted during the screening showed that the anticipated effects will be much less than expected or will not occur at all. In all cases, impact management (mitigation) measures have been identified that, when applied, will eliminate the potential environmental effects, or reduce them to acceptable levels.

5.3.1 Potential Effects in Socio-Economic Environment

As identified in Section 3.2, there are no potential effects anticipated in terms of negative effects on the neighbourhood or community character as the proposed EFW Facility site is located within an area currently zoned as Industrial and fits with the surrounding land uses. There will be no aesthetic impacts within the Study Areas as all material will be stored indoors within the facility buildings. There are predicted positive financial impacts for the surrounding area during construction and operation phases and the proposed EFW Facility fits with the surrounding land uses; therefore, no negative effects on local businesses, institutions or public facilities are anticipated. There will be no negative impacts to recreation, cottaging, and tourism as there are no recreational lands designated in the On-Site or Site-Vicinity Study Areas. There will be no increase in the demand for community services and/or infrastructure as a result of the proposed EFW facility and the predicted positive financial impacts for the surrounding area during construction and operation phases will have a positive effect on the economic base of the surrounding community, local employment and labour supply.

The proposed EFW Facility is located within 8km of aerodrome or airport reference point. But will not interfere with flight paths as the three stacks at the facility will be designed to be lower in height (approx.46m).

The results of the Traffic Assessment Report conducted as part of this Environmental Screening Process indicate that the combination of projected future background traffic growth to 2029 for line 1 commencement and 2034 for line 2 and 3 commencement plus the estimated proposed EFW Facility generated trips can be adequately accommodated on the existing road network with marginal impact resulting predominately from the increase in corridor growth along Bramalea Road. Therefore, there are marginal anticipated potential negative impacts for the socio-economic environment related to traffic.

Potential effects on Public Health and Safety are addressed in the Human Health Technical Report.

It should be noted that there will be a number of direct and indirect jobs created as a result of the proposed facility, both from a construction and operation perspective. This will include jobs associated with construction, operation of the plant, suppliers, and maintenance.

5.3.2 Mitigation Measures

Impacts from the traffic on existing road network can be mitigated by signalization at the Bramalea Rd and Site access/Private Road intersection for the eastbound and westbound left turn onto Bramalea Road during the a.m. and p.m. peak hours (as described in the Traffic Assessment Report).

5.3.3 Net Effects

Based on the mitigation measures proposed, there will be no impacts from a traffic perspective or to the existing operations at the GTAA. Human Health net effects are addressed in a separate Technical Report.

6. Monitoring Requirements and Additional Approvals

To ensure that the mitigation measures identified in **Section 4** are implemented as envisioned, a strategy and schedule was developed for monitoring environmental effects. With these mitigation measures and monitoring requirements in mind, commitments have also been proposed for ensuring that they are carried out as part of the construction, operation, and maintenance of the proposed undertaking.

6.1 Monitoring Requirements

There are no requirements for monitoring specifically related to land use or the socio-economic environment for the proposed EFW Facility expansion.

6.2 Additional Approvals

The proposed undertaking is subject to the City of Brampton Zoning By-Law amendment and a permit application approval from the TRCA.

Apart from these, there are no additional approvals required for land use or the socio-economic environment for the proposed EFW Facility expansion.

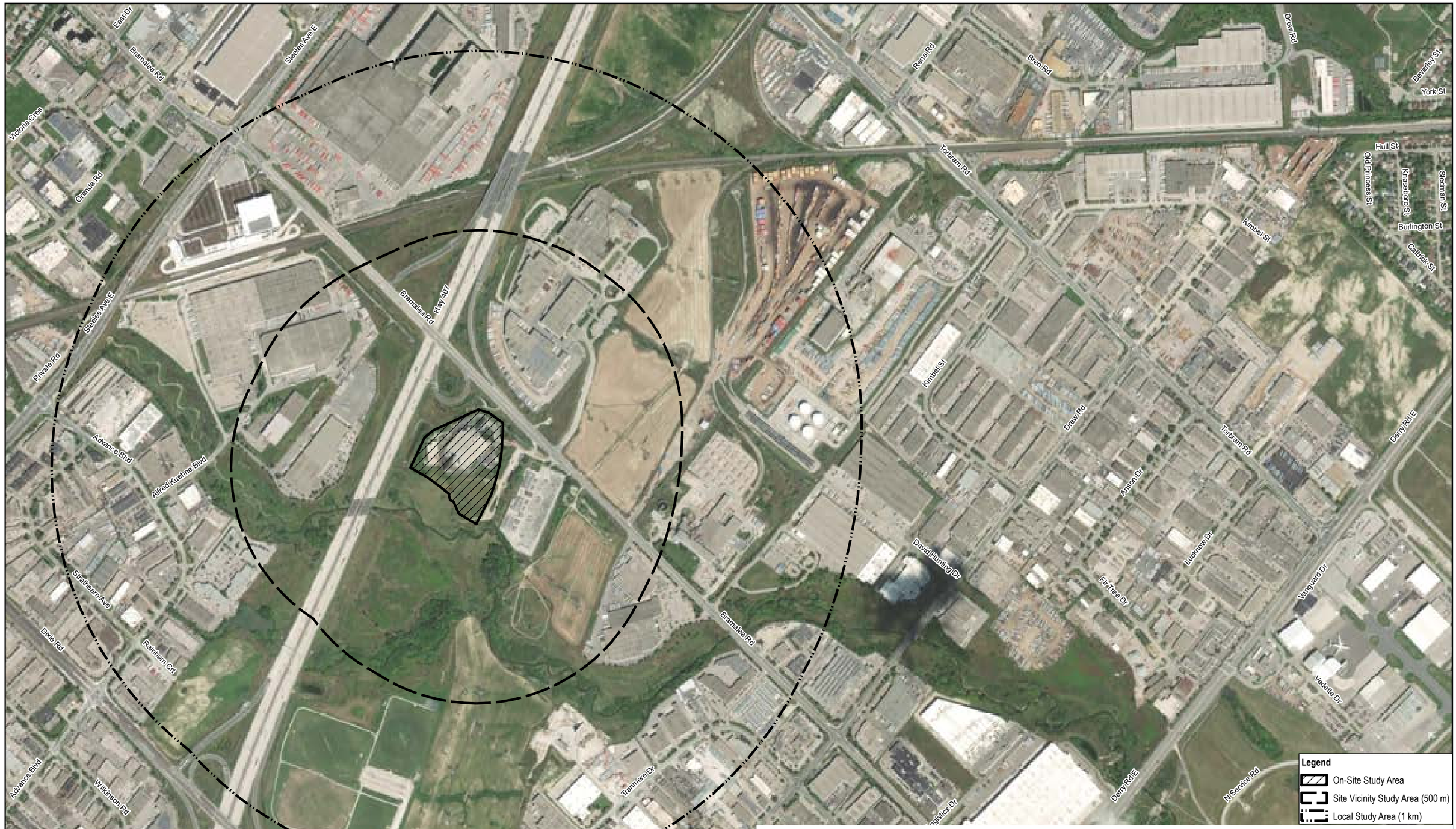
7. Conclusion

Application of the Screening Criteria Checklist identified the potential for negative effects on industrial land uses within 500 m from the site boundary during construction in the absence of mitigation measures. Construction-related potential negative effects will be mitigated through the employment of best management practices and potential negative effects associated with site operation will be mitigated through the design of the proposed EFW Facility.

Application of the Screening Criteria Checklist identified the potential for negative effects related to traffic in the absence of mitigation measures. The results of the Traffic Assessment Report conducted as part of this Environmental Screening Process indicate that the combination of projected future background traffic growth to 2029 for line 1 commencement and 2034 for line 2 and 3 commencement plus the estimated proposed EFW Facility generated trips can be adequately accommodated on the existing road network with marginal impact resulting predominately from the increase in corridor growth along Bramalea Road. Therefore, there are marginal anticipated potential negative impacts for the socio-economic environment related to traffic.

Application of the Screening Criteria Checklist identified the potential for negative effects related to public health and safety in the absence of mitigation measures. Potential negative effects associated with public health and safety will be mitigated through the design of the proposed EFW Facility, including sufficient safeguards and backup systems to eliminate risk in the event of a major failure of emission control systems. Human Health mitigation measures are provided in a separate Technical Report

In conclusion, the results of the Land Use and Socio-Economic Assessment indicate that there are no net effects anticipated for land use or the socio-economic environment. It should be noted that there will be a number of direct and indirect jobs created as a result of the proposed facility, both from a construction and operation perspective. This will include jobs associated with construction, operation of the plant, suppliers, and maintenance.



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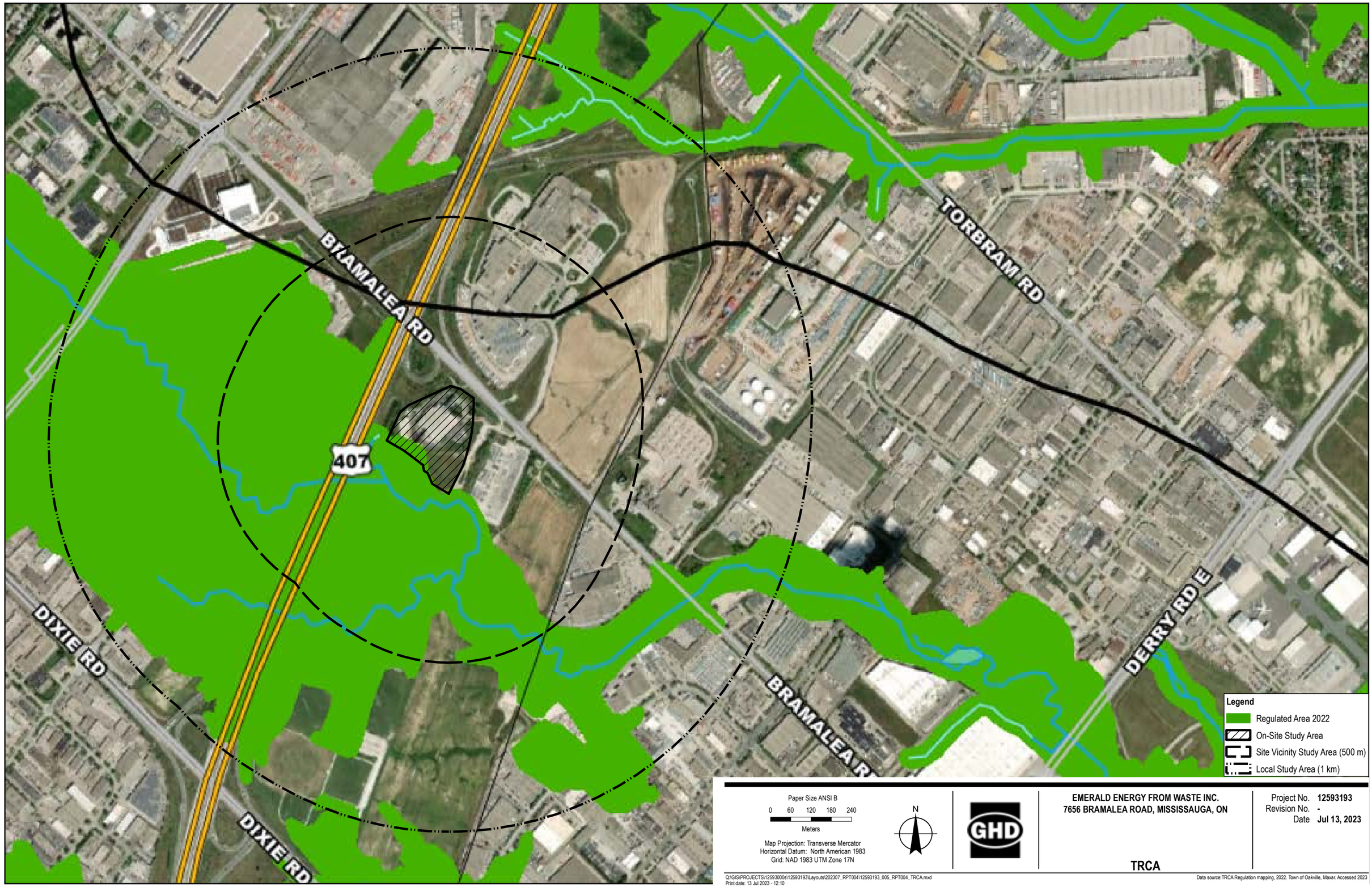
EMERALD ENERGY FROM WASTE INC.
7656 BRAMALEA ROAD, MISSISSAUGA, ON

Project No. **12593193**
Revision No. **-**
Date **Jul 13, 2023**

STUDY AREAS

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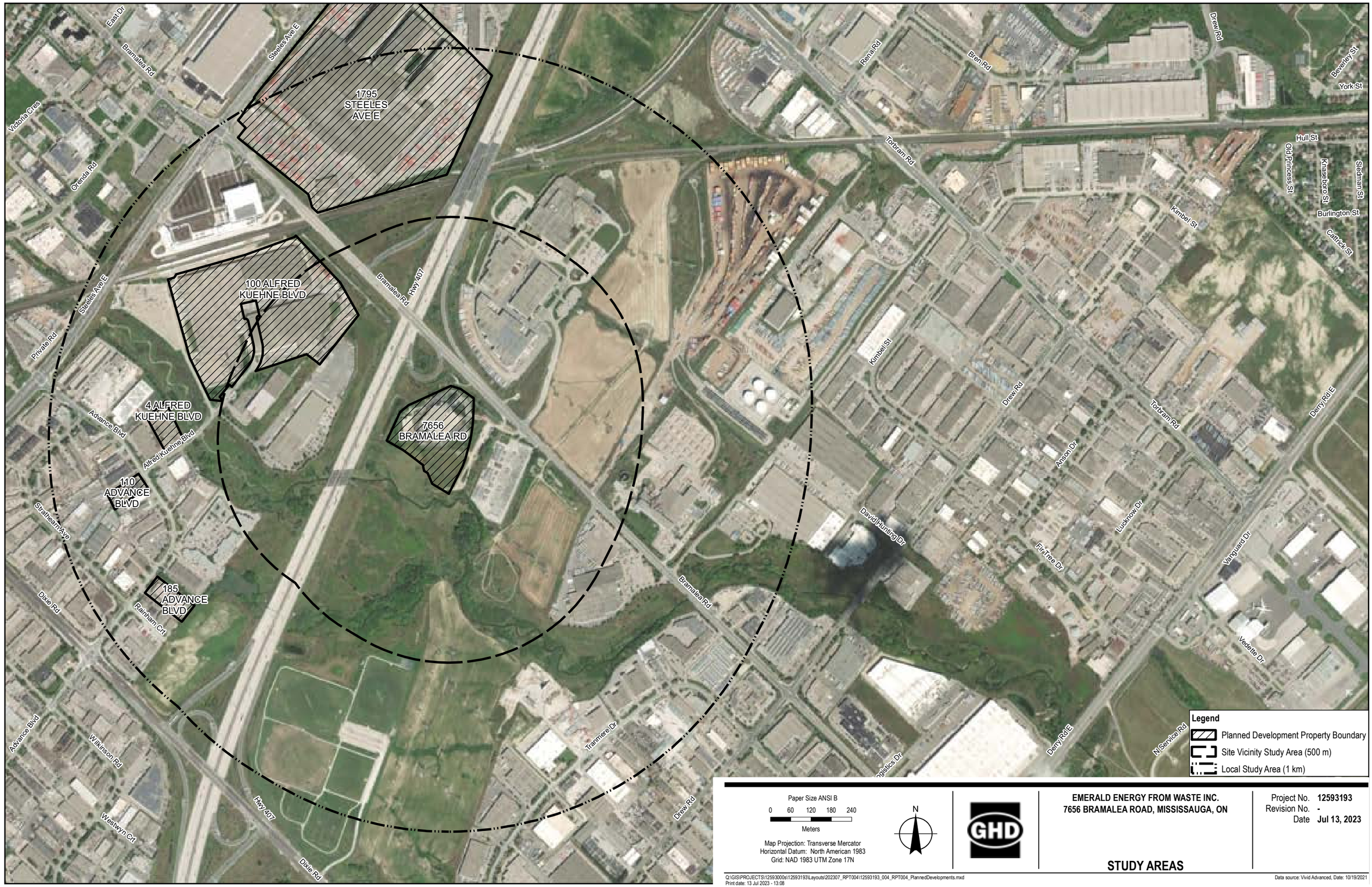
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7656 BRAMALEA ROAD, MISSISSAUGA, ON

TRCA

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Revision No. **-**
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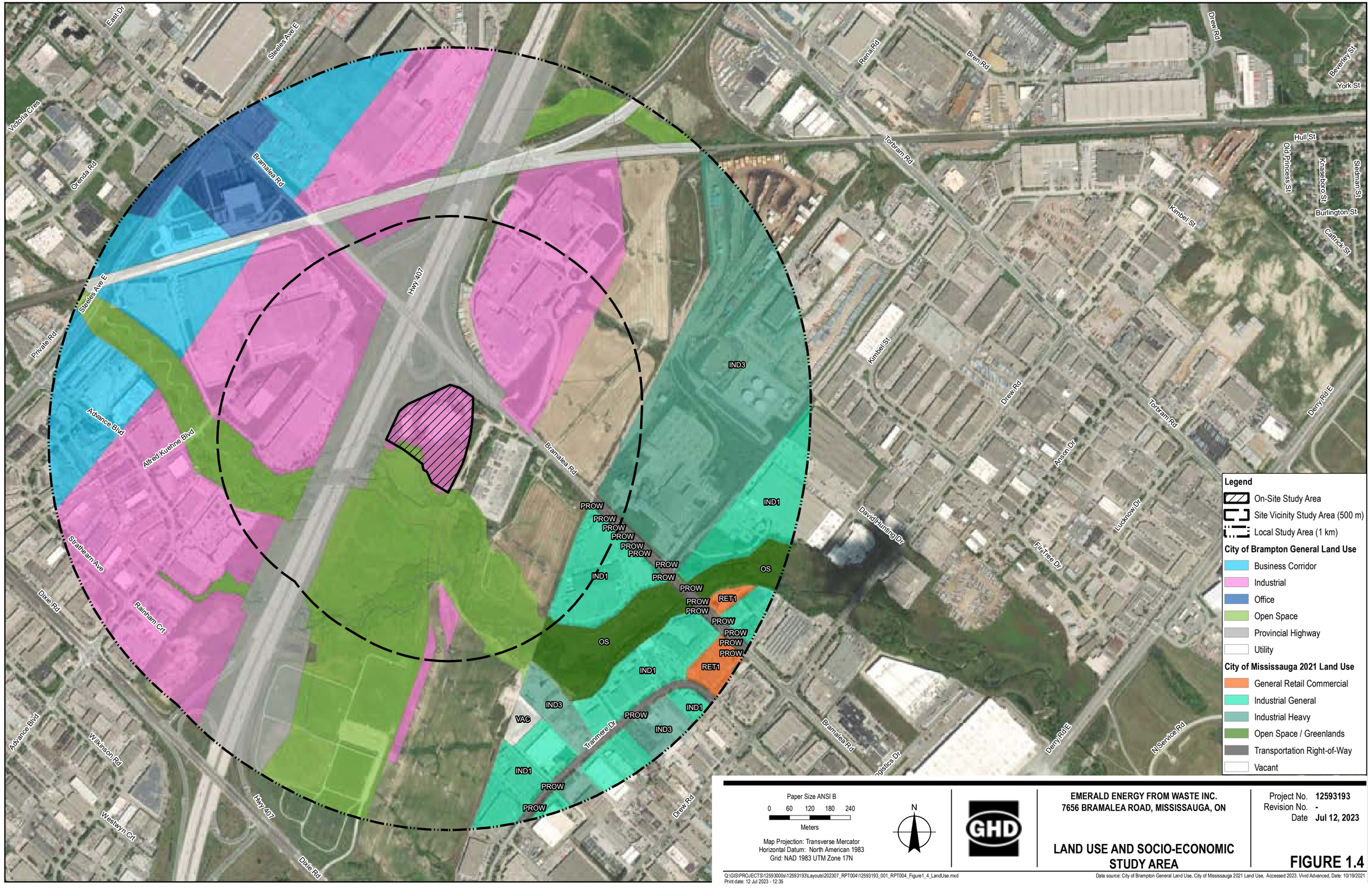
EMERALD ENERGY FROM WASTE INC.
7656 BRAMALEA ROAD, MISSISSAUGA, ON

STUDY AREAS

Project No. **12593193**
Revision No. **-**
Date **Jul 13, 2023**

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7656 BRAMALEA ROAD, MISSISSAUGA, ON

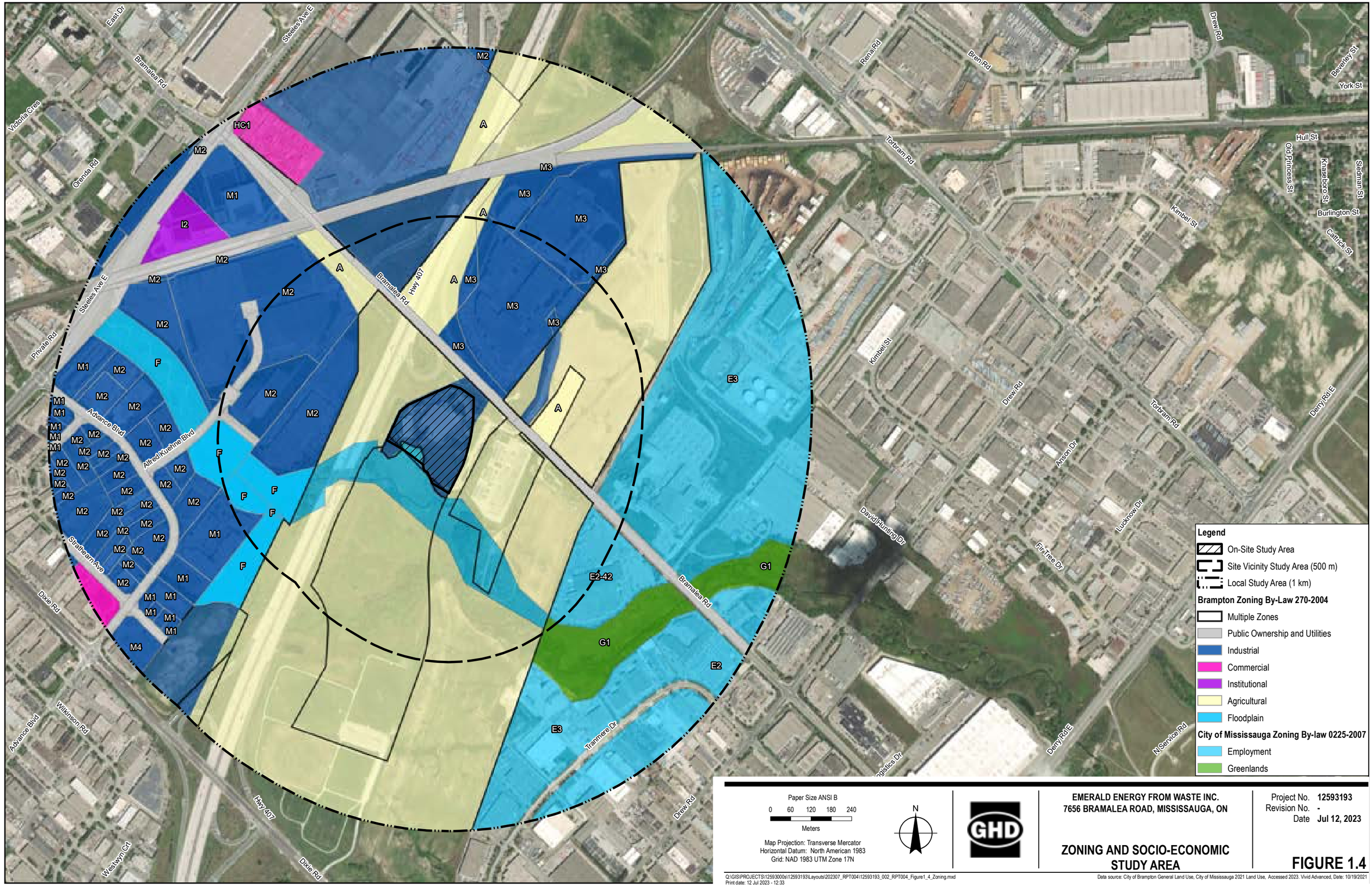
LAND USE AND SOCIO-ECONOMIC STUDY AREA

Project No. **12593193**
Revision No. **-**
Date **Jul 12, 2023**

FIGURE 1.4

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EMERALD ENERGY FROM WASTE INC.
7656 BRAMALEA ROAD, MISSISSAUGA, ON

ZONING AND SOCIO-ECONOMIC STUDY AREA

Project No. **12593193**
Revision No. **-**
Date **Jul 12, 2023**

FIGURE 1.4

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Appendix B.4

Air Quality Impact Assessment Report (Revised October 2024)

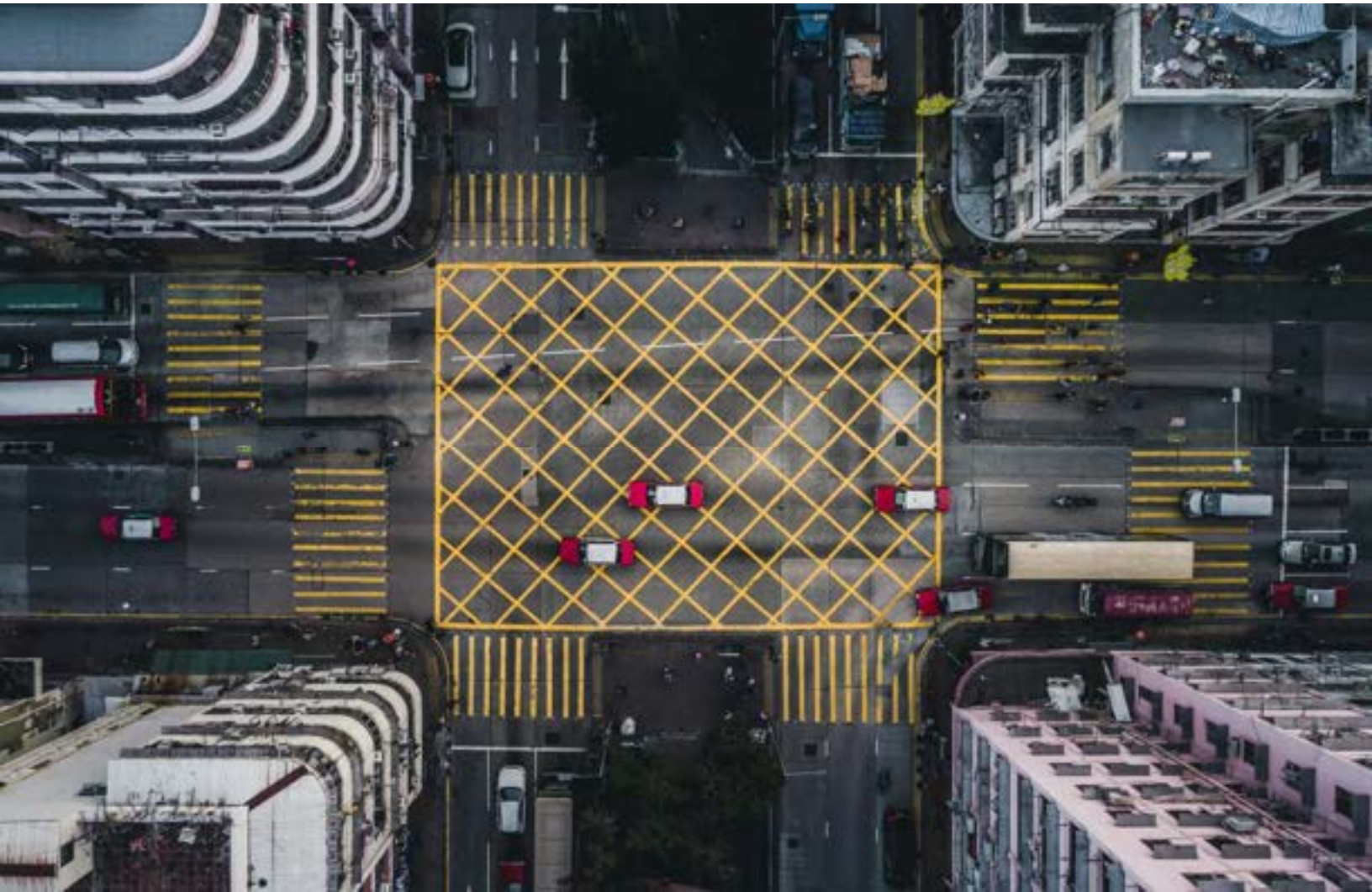
Air Quality Impact Assessment

Emerald Energy from Waste Environmental Screening

Emerald Energy From Waste

October 23, 2024

→ The Power of Commitment



Project name		Emerald Energy from Waste Environmental Screening & ECA Amendment					
Document title		Air Quality Impact Assessment | Emerald Environmental Assessment					
Project number		12593193-RPT-6					
File name		12593193-RPT-6-Emerald Air Quality Impact Assessment_Rev4.docx					
Status Code	**Revision**	**Author**	**Reviewer**		**Approved for issue**		
			Name	**Signature**	**Name**	**Signature**	**Date**
S0	DRAFT	Jathiga Satguneswaran	Gordon Reusing				July 9, 2024
S2	FINAL	Jathiga Satguneswaran	Gordon Reusing				July 12, 2024
S3	DRAFT	Jathiga Satguneswaran	Gordon Reusing				Aug 28, 2024
S3	FINAL	Jathiga Satguneswaran	Gordon Reusing				Sept 20, 2024
S3	FINAL	Jathiga Satguneswaran	Gordon Reusing				October 3, 2024
S4	FINAL	Jathiga Satguneswaran	Gordon Reusing				October 23, 2024

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Executive Summary

This document provides the Air Quality Impact Assessment (Assessment) for the proposed expansion of the Emerald Energy from Waste (Emerald) facility (Facility or Site). The Assessment was originally issued in January 2024 and has been updated in July 2024 to address stakeholder and agency comments. The Assessment includes an evaluation of the air contaminants potentially emitted from the Facility with respect to the applicable air quality criteria for both existing and future operating conditions. In addition, an evaluation of dust, odour, light pollution, and greenhouse gas emissions are included.

Emerald operates an Energy from Waste (EFW) Facility at located at 7656 Bramalea Rd, Mississauga, Ontario to thermally treat municipal waste and produce electricity and steam. The Facility currently operates under ECA No. 0264-BFGQFY issued March 19, 2021, which approved waste processing rates of 546 tonnes per day (tpd) and 182,000 tonnes per annum (tpa).

In response to the increasing demand from waste generators and customers for a safe and reliable waste management facility, Emerald is proposing to redevelop its incineration capacity by replacing their existing Facility and construct and operate a new Facility on the existing property. The new Facility, which will be built in stages, will continue to be an EFW facility intended to provide a long-term, sustainable solution to manage municipal (MSW) and institutional, commercial, and industrial (IC&I) non-hazardous solid wastes and divert them from landfill while producing electricity for the grid and steam for the local industrial community.

The redevelopment will be carried out in three phases to expand the Facility's incineration capacity up to 900,000 tpa total.

The following operating scenarios were considered in this Assessment:

Existing Operations:

- **Scenario 1A**: Current Maximum Operating Conditions – Existing Main Stack operating at the maximum approved capacity (182,000 tpa)
- **Scenario 1B**: Current Maximum Operating Conditions, Existing Main Stack operating at the maximum approved capacity (182,000 tpa) plus a 5.2MW gas turbine generator
- **Scenario 1C**: Natural Gas Fired Boiler for Steam Production operating when the Existing Main Stack is down
- **Scenario 1D**: Bypass Stack operating when the selective catalytic reduction (SCR) control system for nitrogen oxides (NO_x) is experiencing malfunction, resulting in elevated NO_x emissions

Phase 1 to Phase 3 Expansion:

- **Scenario 2**: Maximum Operating Conditions at Phase 1 Expansion – One new stack operating at 300,000 tpa, Upon the completion of the new unit, the existing line will be decommissioned. This scenario occurs when both the new Phase 1 building, and the existing buildings are on site.
- **Scenario 3**: Maximum Operating Conditions at Phase 2 Expansion – Two new stacks operating at 600,000 tpa with the new Phase 2 building and the existing building removed.
- **Scenario 4**: Maximum Operating Conditions at Phase 3 Expansion – Three new stacks operating at the maximum capacity of 900,000 tpa with the new Phase 3 building.
- **Scenario 5**: Maximum Operating Conditions at Phase 3 Expansion during Upset Conditions– Three new stacks operating at the maximum capacity of 900,000 tpa with the new Phase 3 building under upset conditions.

Emissions from the existing and expanded Emerald Facility were calculated by utilizing a combination of source testing data, in-stack emission limits, and emission factors. The United States Environmental Protection Agency (USEPA) air dispersion model, AERMOD, was used with site-specific meteorological data provided by the Ontario Ministry of the Environment, Conservation and Parks (MECP). The AERMOD model considers local meteorology,

topography, buildings, and source parameters to predict the concentrations of contaminants at receptors specified by the user. Modelling grid receptors located at the Facility's fence line and extending up to 5 km, and sensitive locations such as schools, residential areas, sports fields, hotels, and commercial zones, were identified and modelled.

Cumulative air quality concentrations at both the worst-case offsite receptor and worst-case sensitive receptors were derived by adding the predicted AERMOD model concentrations and the representative background air quality concentrations. The background air quality concentrations are documented in the Background Ambient Air Quality Assessment Report (GHD, September 2024).

The resulting cumulative air quality concentrations are conservative estimates, encompassing concentrations at the worst-case locations during the expanded Facility's operation at its maximum capacity, coupled with meteorological conditions leading to worst-case dispersion. Furthermore, it considers conservative background ambient air concentrations at the 90th percentile, for which pollutant concentrations are lower 90 percent of the time. The likelihood of these conditions occurring simultaneously is very low.

The results of the Assessment demonstrate that the expansion of the Emerald Facility is not anticipated to have a significant impact on local air quality and greenhouse gas emissions across any of the proposed expansion phases.

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1. Introduction

This report documents the Air Quality Impact Assessment (Assessment) carried out as part of the Environmental Assessment Screening for the Emerald Energy from Waste Facility (Facility or Site).

The Facility is located at 7656 Bramalea Road, in Brampton, Ontario and is owned and operated by Emerald Energy from Waste Inc, herein referred to as Emerald EFW (Emerald EFW, Owner, Proponent). The location of the Facility is shown in Figure 1**.**



Figure 1 Location of the Proposed Undertaking

The Site received a Certificate of Approval (C of A), now referred to as an Environmental Compliance Approval [ECA]) (Air) in 1991 and has accepted municipal solid waste since 1992. The Site, which operates under ECA No. 0264-BFGQFY issued March 19, 2021, has approved waste processing rates of 546 tonnes per day and 182,000 tonnes per year. The Site is currently approved for a total of six 2-stage gasification units (five units are currently installed) by Consumat System Inc., each having a nominal design Waste Processing Rate of 91 tonnes per day of municipal solid waste. Under the current ECA, the Site is licensed to receive solid non-hazardous waste from domestic, commercial, industrial and institutional sources and waste designated for thermal treatment by the Canadian Food Inspection Agency and/or Health Canada, from the province of Ontario, as well as solid non-hazardous waste limited to international waste, arriving in the province of Ontario.

Any proposed change to the waste processing limits requires a modification to several conditions of the approved ECA, which specifies the maximum amount of waste to be processed daily and annually as well as the allowable number of equipment units. The proposed Project would amend the approved ECA to allow for up to 900,000 tonnes of non-hazardous residual waste processing capacity annually. It is intended that staged decommissioning of the existing five units would take place as the proposed new units are brought online, such that the annual processing capacity of the entire Facility would not exceed 900,000 tonnes at any time. Changes to the current approved size and footprint of the Emerald EFW Facility will also be required in order to accommodate the proposed new gasification units.

The proposed change to the annual waste processing capacity will allow Emerald EFW to positively respond to reducing Ontario's reliance on landfill disposal (both Canada and USA) while recovering energy from residual materials and reducing greenhouse-gas emission. This includes diverting a significant amount of Ontario's total residual waste going to landfill (currently 97 percent)[1] while ensuring the longevity of landfill disposal capacity. The proposed facility expansion is expected to have an operating life of at least 20 years. Between 1997 and 2000, Emerald EFW completed an Environmental Assessment (EA) for expansion of the Facility by 25 percent. A C of A was issued in 2009. The Facility also conducted and Environmental Screening for service area expansion and was approved between 2011-2012. The amendments to the ECA were approved in 2010, 2012, and 2020 by the Ministry of Environment, Conservation and Parks.

In order to meet the growing demand from waste generators and customers for a safe and reliable waste management facility for their post diversion solid non-hazardous Residential and Industrial, Commercial & Institutional waste, Emerald Energy from Waste Inc. is proposing to redevelop and expand the processing capacity of their existing Facility from 500 tonnes/day to up to 2,500 tonnes/day and increase the energy recovery from 10 MW to up to 100 MW. This redevelopment will be implemented in 3 phases. During Phase 1, the existing Facility will remain operational while the first new processing line is constructed (See Figure 2). Phase 2 and 3 will be installed and commissioned in response to market demand. The existing Facility would be removed as shown in Figure 3.

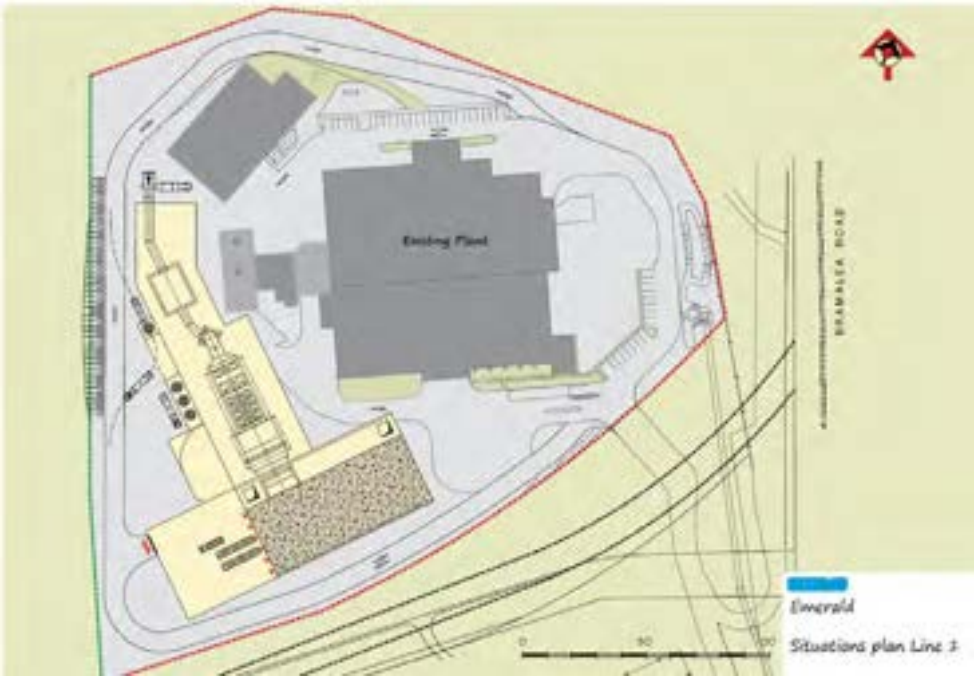


Figure 2 Proposed Redevelopment Phase 1

[1] Solid Waste in Ontario: Landfill Report, Ontario Waste Management Association, January 2021.

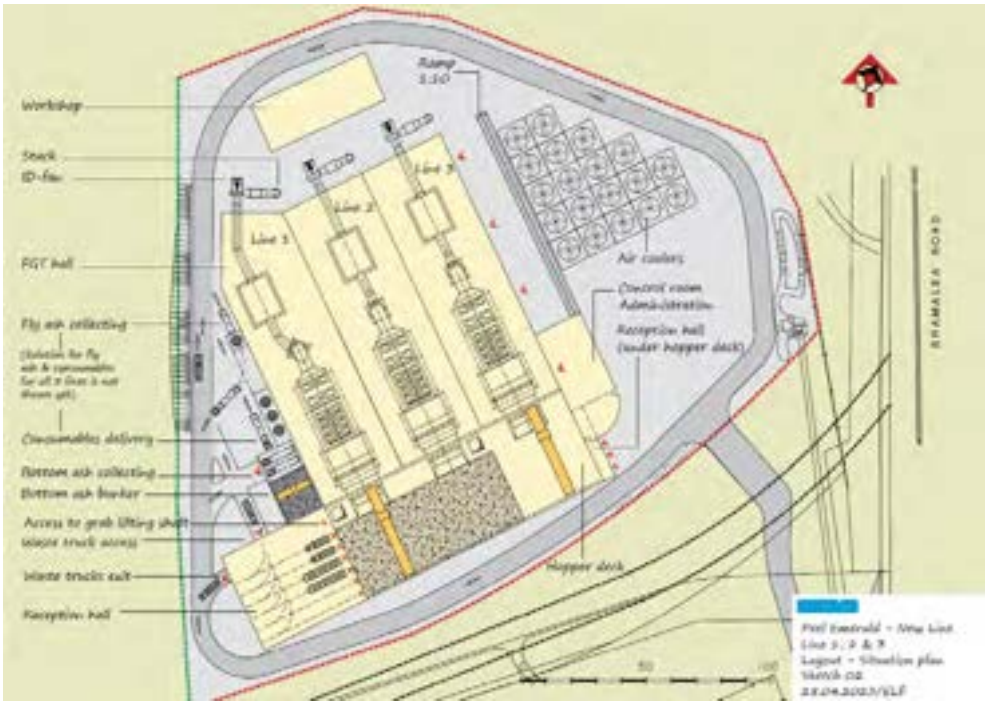


Figure 3 Proposed Redevelopment Phase s 2 & 3

1.1 Purpose of this Report

This Air Quality Impact Assessment report was developed to support an ECA amendment and the Environmental Screening Process. The proposed expansion of the Facility is subject to the Environmental Screening Process in accordance with Section 16 of Ontario Regulation 101/07 – Waste Management Projects Regulation of the Ontario *Environmental Assessment Act*, as follows:

> *A change to a thermal treatment site described in section 11 is defined as a major commercial or business enterprise or activity and is designated as an undertaking to which the Act applies, if the amount of waste that would be subject to thermal treatment at the site on any day after the change would exceed the amount of waste that was authorized under the Environmental Protection Act to be subject to thermal treatment at the site before the change. O. Reg. 101/07, s. 16; O. Reg. 389/22, s. 9.*

Section 16 of Ontario Regulation 101/07 – Waste Management Projects Regulation exempts this Project from Part II of the *EA Act*, subject to fulfilling the Environmental Screening Process. The Screening is conducted in accordance with the planning and design process outlined in MECP "*Guide to Environmental Assessment Requirements for Waste Management Projects.*" The Environmental Screening process includes identifying and applying screening criteria to determine and describe potential environmental effects, public/external agency consultation, and the development of measures to mitigate identified environmental effects. The results of the Assessment will be documented in an Environmental Screening Report (ESR), which will be released for review to Stakeholders including Indigenous communities, the public, and government agencies. Upon completion of the Environmental Screening Process an application will be made to amend the existing ECA No. 0264-BFGQFY.

The Environmental Screening Process is described further in Section 2 including the application of the Screening Criteria Checklist.

From an air quality and greenhouse gas perspective, the characterization of existing conditions within the following study areas are appropriate to this Environmental Screening:

– **Site Boundary**, including all lands within the existing, approved boundaries of the Emerald EFW, as defined by Environmental Compliance Approval (ECA) No. 4591-56VSTN, as amended.

– **Local Study Area**, including all lands within a 5 Kilometer (km) radius of the Site Study Area boundaries. For the air quality impact assessment, a nested receptor grid was placed at the Facility fence line and extend out to 5 km. In addition, sensitive uses (e.g., playground, daycare, commercial site, etc.) around the Site Study Area were also examined.



Figure 4 Site Boundary and Local Study Area

For this Assessment GHD has completed the following:

– Reviewed pollutants of concern and applicable regulatory requirements.
– Reviewed background air quality surrounding the Facility, as documented in a separate report “Background Ambient Air Quality Assessment Report (GHD, August 2024).
– Estimated the maximum air emissions from the existing Facility operations, and the Phase 1, Phase 2. and Phase 3 expansions at their respective maximum operation capacities.
– Conducted air dispersion modelling using the USEPA AERMOD model for each operating scenario.
– Determined the cumulative air contaminant concentrations, which included adding the modelled Facility concentrations to the estimated background local air quality concentrations.
– Compared the cumulative air concentrations to the applicable air quality criteria.
– Assessed greenhouse gas emissions from the Facility’s operation.
– Evaluated odour and construction emissions qualitatively.
– Evaluated upset and start-up/shut-down emissions quantitively
– Generated air contaminant concentration and deposition data for a human health risk assessment report prepared by Intrinsik.

The Assessment was originally issued in January 2024. Revision 1 of the assessment has been updated to address stakeholder and agency comments and includes the following revisions:

1. Textual edits to the report addressing new background air monitoring data as well as comments received from the Region of Peel, the Ontario Ministry of the Environment, Conservation and Parks (MECP) and other stakeholders.
2. Updated background ambient air concentrations (50^{th} and 90^{th} percentile) obtained from the revised Background Ambient Air Quality report. 50^{th} and 90^{th} percentile background ambient air concentrations can be found in Table D.1 and Table D.2, respectively.
3. Revised Section 4.2 to include best practices listed in the *Best Practices for the Reduction of Air Emissions from Construction and Demolition Activities* (Cheminfo, 2005).
4. Modelled start-up/shutdown and upset conditions and included discussion of results within Section 4.4.4.
5. Updated urban roughness and population value in dispersion modelling. Section 6.3 and 6.4 were updated with this information.
6. Revised wind rose map within Section 6.6 (Figure 7).
7. Updated section 6.6 to discuss the removal of meteorological anomalies for pollutants with 8-hour averaging
8. Deposition modelling was revised to include both dry and wet deposition, and particulate based deposition modelling was revised to Method 1. Results are presented in Section 6.10.
9. Included discussion of contaminants with predicted percent increases (above 200%). Results are presented in Section 7.3.1.
10. Re-assessed ozone emissions using the methodology described in Guidance on the Development of Modelled Emission Rates for Precursors (MERPs) as a Tier 1 Demonstration Tool for Ozone and PM2.5 under the PSD Permitting Program (US EPA, April 2024). Results are presented in Section 8.1.
11. Modelled truck idling emissions and included discussion of results within Section 8.2.

Revision 1 of the assessment was originally issued in July 2024. Revision 2 has been updated to address agency comments and includes the following revisions:

12. Revised 1-hour and annual hour averaging period estimates for startup/shutdown/upset conditions in Section 4.4.4 and Appendix G.
13. Updated Section 6.10 to add clarification regarding particulate size fraction, and the data source.
14. Revised Section 7.1 to clarify removal of meteorological anomalies for pollutants with 8-hour averaging.
15. Modelled particulate matter and benzo(a)pyrene (BaP) truck idling emissions and included discussion of results within Section 8.2, Section 8.2.2 and Appendix H. Appendix J was added to the report, which contains the US EPA's MOtor Vehicle Emission Simulator (MOVES) dataset used to obtain the Benzo(a)pyrene truck idling emission factor.

Revision 3 includes revised Dioxins and Furans background ambient air concentrations, an additional upset condition scenario where the backup generator is deployed, and revised truck idling emission estimates. PM and NOx truck idling emissions rates have been calculated and presented in the report, however, since the idling emissions are captured in the building and vented through the APC and main stacks, there is no change to the dispersion modelling since the emissions from the stack for NOX and PM are based maximum in stack limits.

Revision 3 of the assessment was originally issued in September 2024. Revision 4 has been updated to address agency comments and includes the following revisions:

16. Updated truck traffic data: there was an increase in the previous estimate of 41 trucks per peak hour to 54 trucks per peak hour.
17. Included on-site truck traffic tailpipe emissions to the total Facility emissions and modelled in AERMOD as a line volume source.
18. Tables E.5 (Phase 3), E.4 (Phase 2) and E.3 (Phase 1) were updated to present the emissions from on-site truck traffic and truck idling for BaP, PM and NOx.

19. Revised particle sizing distribution estimate from the main stack to 90% PM2.5 and 10% PM10. Included additional clarification regarding particle sizing distribution in Section 6.10.
20. Clarification added to Section 4.3 regarding natural gas burner emissions.
21. Revised raw concentration data for the NOx frequency analysis used in the HHRA Report.

2. Screening Criteria Checklist

At the beginning of the Environmental Screening, the Screening Criteria Checklist (provided as Schedule I, pp 62 – 64, to the "Guide to Environmental Assessment Requirements for Waste Management Projects") is to be completed based on the information provided in the Project Description. The Screening Criteria reflect the broad definition of "environment" contained in the *Ontario Environmental Assessment Act*

As noted in the Guide:

*"The Screening Criteria are presented in the form of a checklist with the option of a "Yes" or "No" response. Mitigation measures **are not** to be considered in concluding whether there is "No" potential environmental effect. That is, the proponent is required to answer "Yes" even if the proponent believes that a potential environmental effect could likely be mitigated. The reason for requiring a "Yes" is to ensure that mitigation measures are open to discussion and review. Another reason for this approach is that further discussion and review of a potential effect may reveal that there is no actual effect, in which case no mitigation is required. Where a "yes" has been identified, the proponent is to provide additional information in the Environmental Screening Report, explaining the potential effect(s), methods to mitigate or address the effect(s), any net effects that are anticipated and if so, their significance. Even where the proponent indicates that no environmental effects are anticipated, it is recommended that additional information is provided in the Environmental Screening Report in order to support the "no effects" conclusion"*.

Each criterion is based on a question which is prefaced with the phrase, "Might the Project…" Table 2 was completed as the first step of the Environmental Screening Process and is a summary of the criteria for the Air and Greenhouse Gases discipline. Further descriptions of the criteria for which a "Yes" response was indicated in the Screening table are discussed in the following sections.

Table 1 Screening Criteria Checklist for Air and Greenhouse Gases

	Criterion Might the project…	YES	NO	Additional Information
Air and Greenhouse Gases				
3.1	Cause negative effects on air quality due to emissions (for parameters such as temperature, thermal treatment exhaust flue gas volume, nitrogen dioxide, sulphur dioxide, residual oxygen, opacity, hydrogen chloride, suspended particulates, or other contaminants)?	X		The proposed EFW Facility expansion would result in changes to the existing site footprint and on-site operations and may cause potential effects on air quality due to emissions.
3.2	Cause negative effects from the emission of greenhouse gases (e.g., carbon dioxide, carbon monoxide, methane)?	X		The proposed EFW Facility expansion would result in changes to the existing site footprint and on-site operations and may result in a potential increase in greenhouse gas emissions associated with continued operation of the Site.
3.3	Cause negative effects from the emission of dust or odour?	X		The proposed EFW Facility expansion would result in changes to the existing site footprint and on-site operations and may result in a potential effect from dust

	Criterion Might the project…	YES	NO	Additional Information
				and odour emissions associated with continued operation of the Site.
3.5	Cause light pollution from trucks or other operational activities at the site?	X		The proposed EFW Facility expansion would result in changes to the existing site footprint and on-site operations and may result in light pollution from trucks or other operational activities at the Site.

3. Air Contaminants and Criteria

3.1 Contaminants of Potential Concern

This Assessment focuses on predicting changes in concentrations of pollutants as a result of the Facility's expansion. The pollutants being assessed include the criteria air contaminants (particulate fractions, nitrogen oxides, sulphur dioxide, carbon monoxide, ozone), volatile organic compounds (VOCs), polycyclic aromatic hydrocarbons (PAHs), metals, acids and dioxins and furans.

The air contaminants that may be emitted from the Facility operations are summarized in Table 2. These compounds include all contaminants identified in previous Emission Summary and Dispersion Modelling (ESDM) Reports for the Facility, and compounds for which source testing data is collected as required by the Facility's ECA. The list also includes air contaminants that are in the Ontario "Guideline A-7: Air Pollution Control, Design and Operation Guidelines for Municipal Waste Thermal" (Guideline A-7, MECP, October 2010), as discussed in Section 3.2.4.

Table 2 List of Pollutants of Concern for the Project

Pollutants of Concern				
1,1,1-Trichloroethane	1,1,2-Trichloroethylene	1,1-Dichloroethane5	1,2,3,4-Tetrachlorobenzene	1,2,3,5/1,2,4,5-Tetrachlorobenzene
1,2,3-Trichlorobenzene	1,2,4-Trichlorobenzene	1,2-Dichlorobenzene	1,2-Dichloroethane	1,2-Dichloropropane
1,3,5-Trichlorobenzene	1,3,5-Trimethylbenzene	1,3-Butadiene	1,3-Dichlorobenzene	1,4-Dichlorobenzene
1-Methylnaphthalene	1-Methylphenanthrene	2,3,4,5-Tetrachlorophenol	2,3,4-Trichlorophenol	2,3,5,6/2,3,4,6-Tetrachlorophenol
2,3,5-Trichlorophenol	2,3,6-Trichlorophenol	2,3-Dichlorophenol	2,4,5-Trichlorophenol	2,4,6-Trichlorophenol
2,4/2,5-Dichlorophenol	2,6-Dichlorophenol	2-Butanone	2-Chloronaphthalene	2-methylanthracene
2-Methylnaphthalene	3,4,5-Trichlorophenol	3,4-Dichlorophenol	3,5-Dichlorophenol	3-Methylcholanthrene
7,12-Dimethylbenzo(a)anthracene	7H-Dibenzo(c,g)carbazole	9,10-dimethylanthracene	9-Methylphenanthrene	Acenaphthene
Acenaphthylene	Acetaldehyde	Acetone	Acrolein	Aluminum
Aluminum Oxide	Anthracene	Antimony	Arsenic	Barium
Benzene	Benzo(a)Anthracene	Benzo(a)fluorene	Benzo(a)Pyrene	Benzo(b)Fluoranthene
Benzo(b)fluorene	Benzo(e)Pyrene	Benzo(g,h,i)Perylene	Benzo(j / k)Fluoranthene	Beryllium
Biphenyl	Boron	Bromodichloromethane	Bromoform	Bromomethane
Cadmium	Calcium	Calcium Oxide	Carbon Monoxide	Carbon Tetrachloride

Pollutants of Concern				
Chlorodibromomethane	Chloroform	Chromium	Chrysene	Cobalt
Copper	Coronene	Dibenzo(a,c/a,h) Anthracene	Dibenzo(a,e)pyrene	Dichlorofluoromethane
Dioxin and Furans	Ethylbenzene	Ethylene Dibromide	Fluoranthene	Fluorene
Formaldehyde	Hexachlorobenzene	Hydrogen Chloride	Hydrogen Fluoride	Indeno(1,2,3-cd)Pyrene
Iron	Isopropylbenzene	Lead	Lithium	Magnesium
Magnesium oxide	Manganese	Mercury	Mercury (as Hg) – alkyl compounds	Methylene Chloride
Molybdenum	m-terphenyl	Naphthalene	Nickel	Nitrogen Oxides (NO_x)
Organic matter (expressed as equivalent methane)	o-Terphenyl	Ozone	Pentachlorobenzene	Pentachlorophenol
Perylene	Phenanthrene	Phosphorous pentachloride	Phosphorus	Picene
Particulate less than 10 microns (PM10)	Particulate less than 2.5 microns (PM2.5)	p-terphenyl	Pyrene	Quinoline
Selenium	Silica	Silicon	Silver	Sodium
Sodium hydroxide	Strontium	Styrene	Sulphur Dioxide	Suspended Particulate Matter (Total Particulate)
Tetrachloroethene	Tetralin	Tin	Titanium	Toluene
trans,1,2-Dichloroethane	Trichlorofluoromethane	Trichlorotrifluoroethane	Triphenylene	Vanadium
Vinyl Chloride	Xylenes	Zinc	Polychlorinated Biphenyls (PCBs)	

3.2 Project Criteria

To evaluate the impact of Emerald's operations on air quality, applicable Ontario and Federal air quality criteria were applied, as detailed below.

3.2.1 Ontario's Ambient Air Quality Criteria (AAQC)

The MECP's Ambient Air Quality Criteria (AAQC) provide a list of concentrations of contaminants in the air that is protective against adverse health and environmental effects. AAQCs are utilized to assess general (ambient) air quality resulting from all sources of a contaminant, independent of location or source. AAQCs are commonly used in environmental assessments, special studies using ambient air monitoring data, assessment of general air quality in a community and annual reporting on air quality across the province.

AAQCs are derived from the most sensitive effect identified during the review conducted at the time of AAQC development. The basis of AAQC include considerations related to health, corrosion, effects on animals, odours, particulates, soiling, and vegetation, with emphasis on acute and chronic health impacts.

A criteria from Ontario AAQCs is not a regulatory value; rather, it is a target air quality criteria and a desirable concentration level for a contaminant in air that is protective against adverse effects. Consequently, measured concentrations may exceed the criteria values at different locations across Ontario, influenced by factors such as weather conditions and transportation emissions sources. The AAQC applied in this Assessment was last updated on September 21, 2023."

3.2.2 Federal Air Quality Criteria

The Canadian Council of Ministers of the Environment (CCME) has developed the Canadian Ambient Air Quality Standards (CAAQS). CAAQS plays a part of a collaborative national Air Quality Management System (AQMS), aiming to better protect the human health and the environment. The CAAQS specifically address four substances: fine particulate matter (PM 2.5), ozone (O_3), sulphur dioxide (SO_2), and nitrogen dioxide (NO_2).

CAAQs are set with three effective dates: 2015, 2020, and 2025. Notably, the 2025 standards for O_3, NO_2, and SO_2 are more stringent compared to the 2020 standards. The 2025 standards were used in this Assessment.

The CAAQs are intended as targets for air quality to determine appropriate air quality management. For example, surpassing the standards triggers a red management level, signifying the need for progressive air quality management actions to lower pollutant levels below the CAAQS. Note that the CAAQS should not be treated as pollute-up-to levels - actions will be taken to keep clean areas clean.

CAAQS compliance is determined by the measured air pollutant concentrations within an air zone, utilizing data from multiple monitoring stations across a broader region. Emerald is located in the air zone within the East Central Airsheds of Southern Ontario, covering major cities like Windsor, Toronto, and Ottawa. Note that the ambient air quality around Emerald may experience higher pollution levels due to the urban environment, high traffic flow, and presence of surrounding industrial facilities. However, stations in areas within the same air zone may have better ambient air quality resulting in an overall compliance with CAAQS.

3.2.3 Ontario Regulation 419/05

In addition to ambient air quality criteria, Emerald is also required to demonstrate compliance with O. Reg. 419/05 air quality limits, as outlined in “Air Contaminants Benchmarks (ACB) List: Standards, Guidelines and Screening Levels for Assessing Point of Impingement (POI) Concentrations of Air Contaminants” (April 2023). The most recent ACB list contains approximately 5,200 contaminants with corresponding benchmarks. The ACB list is used primarily to assess air concentrations in an ESDM report.

The ACB list contains two types of benchmarks:

– Benchmark 1 (B1) values (standards and guidelines) – not to exceed values:
  - Benchmark 2 (B2) values (screening levels) – conservative benchmarks below which adverse health effects from air emissions are not expected. Screening values include jurisdictional screening levels (SLs-JSL) derived from a single jurisdictional limit, previously accepted screening levels (SLs-PA), and screening levels derived by the ministry (SLs-MD).

If a B1 value is exceeded, the Facility is required to carry out specific actions. If a B2 value is exceeded, or if no B2 value is available, the regulations require potential adverse effects to be assessed. Note that many compounds that meet the definition do not have ministry POI limits. Where applicable, de minimus or threshold concentrations can be used to screen out contaminants that are emitted in negligible amounts.

Given that the ACB list is designed for assessing POI concentrations located at or beyond the Facility’s property line that are caused by emissions from the Facility only, background air quality is generally not considered when comparing concentrations with the ACB list to demonstrate compliance with O. Reg 419/05.

While the ACB list is not designed for assessing ambient air quality, it is used as a screening tool in this Assessment when the pollutants of concern lack corresponding Ontario AAQC or CAAQS standards.

3.2.4 Ontario Guideline A-7

Ontario Guideline A-7 is applicable to new publicly or privately-owned incinerator systems designed to combust municipal waste, as well as to the expansion or modification of existing incinerators. The guideline outlines concentration emission limits inside the stack for various pollutants, including particulate matter (PM), cadmium, lead,

mercury, dioxins and furans, hydrochloric acid (HCl), sulphur dioxide (SO_2), nitrogen oxides (NO_x), organic matter (undiluted, expressed as equivalent methane), carbon monoxide, and opacity.

In addition, Guideline A-7 sets out requirements for control, monitoring, and source testing to indicate and confirm the incinerators' compliance with the limits of the guideline.

3.2.5 Project Criteria

Ambient Air Criteria

The predicted cumulative pollutant concentrations are compared to the lower of either the Ontario AAQC, Federal CCAQS and NAAQO, or the limits specified on the ACB list in cases where ambient standards are not available The cumulative concentrations are determined by adding modelled concentrations from Emerald's maximum operation to the corresponding background air quality concentrations obtaining from the Background Ambient Air Quality Assessment Report.

A summary of all applicable standards and project criteria for each pollutant are presented in Appendix A, Comparison of Applicable Air Quality Criteria. In addition, the data in Appendix A includes any Upper Risk Threshold (Regulation 419/05, Schedule 6) and the limits specified in the current ECA, where applicable. However, these values are not used as the project criteria, as they are either higher or equal to the values from the Ontario AAQC, Federal CAAQS, or ACB limits.

In-Stack Criteria

Incinerator systems to combust municipal waste are required to follow the environmental performance requirements outlined in the Ontario Guideline A-7. A previously approved energy from waste project (Durham York Energy Center, DYEC) followed stricter emission requirements for certain compounds that have also been adopted by Emerald.

In addition, the design engineering firm, Ramboll Danmark A/S (Ramboll), has indicated that starting in 2023, a European Union (EU) standard has set the in-stack emission limit for total particulate emissions in new municipal waste incinerators to 5 mg/Nm³ under reference conditions, which corresponds to 4.6 mg/Rm³ (reference dry gas, 11% O_2, 101.3 kPa, and 25°C). Suppliers for Emerald's new incinerators will guarantee the in-stack total particulate limit that complies with the EU standard.

The manufacturer's guaranteed exhaust emission concentrations were applied to calculate the maximum emission rates for particulate matter (PM2.5, PM10, Total Suspended Particulate Matter). For the other pollutants where in-stack limits apply, the emission rates for the expansion have been calculated based on either Guideline A-7 or the DYEC project's in-stack criteria, whichever is lower. Table 3 presents the in-stack limits from Guideline A-7, DYEC, and the manufacturer's guarantees.

Table 3 In Stack Emission Limits

Parameter	Unit	Ontario A7	DYEC	Manufacturer's Guarantee
Total Suspended Particulate Matter	mg/Rm^3	14	9	4.6
Hydrochloric acid (HCl)	mg/Rm^3	27	9	9
Sulphur dioxide (SO_2)	mg/Rm^3	56	35	35
Nitrogen oxides (NO_x)	mg/Rm^3	198	121	121
Organic matter	mg/Rm^3	33	33	33
Carbon monoxide	mg/Rm^3	40	40	40
Cadmium	µg/Rm^3	7	7	7
Lead	µg/Rm^3	60	50	50
Mercury	µg/Rm^3	20	15	15

Parameter	Unit	Ontario A7	DYEC	Manufacturer's Guarantee
Dioxins and furans	ng/Rm^3	0.08	0.06	0.06

Note: Refence conditions are based on dry at 25°C and 101.3 kPa, corrected to 11% O2.

4. Facility Description and Emission Sources

Emerald operates an energy from waste Facility to thermally treat municipal waste and produce electricity and steam. The Facility currently operates under ECA No. 0264-BFGQFY issued March 19, 2021, which approved waste processing rates of 546 tonnes per day (tpd) and 182,000 tonnes per annum (tpa).

In response to the increasing demand from waste generators and customers for a safe and reliable waste management facility for their post diversion solid non-hazardous residential and IC&I waste, Emerald plans to expand the incineration capacity. This expansion will result in a total capacity of up to 900,000 (tpa), carried out in three phases.

4.1 Process Description

The operation of the Emerald Facility comprises several key components, outlined as follows:

– Waste Receiving and Processing:
  - This process involves various activities such as truck weighing, dumping, waste storage, and the processing of waste. Oversized or unacceptable materials are removed using grapples, excavators and front-end loaders.
– Thermal Technologies:
  - Processing waste through thermal technologies (incineration) is the main component of the Facility's operation.
– Ash Handling and Disposal:
  - The ash exiting the lower chamber of the furnaces is directed into a quench tank and subsequently conveyed up a sloped ramp before being discharged into piles in the ash storage building. The processed ash material (<25mm) can be used as fillers in concrete and asphalt paving material or as the daily cover for landfills.
– Steam, Feedwater, and Condensate System:
  - The hot flue gases from the incinerators are fed to individual waste heat boilers to produce steam.
– Air Pollution Control System.
– Control and Monitoring Systems:
  - The monitoring systems are used for process control to ensure appropriate operating conditions. The Facility is equipped with continuous Emission Monitoring System (CEMS) for air emission parameters.

Components pertinent to this Assessment, specifically the thermal technologies and the air pollution control system, are discussed below with greater details for both the existing Facility and future Phase 1 to Phase 3 expansions.

4.1.1 Existing Facility

Emerald's current operations involves thermally treating approximately 150,000 tonnes per annum of MSW on five lines. There is limited variability from year to year. Tonnage has ranged from 152,717 tpa in 2019 to 149,282 tpa in 2021.

Under the current ECA, the Facility is licensed to receive solid non-hazardous waste from domestic, IC&I sources, waste designated for thermal treatment by the Canadian Food Inspection Agency, and/or Health Canada from the

province of Ontario, as well as solid non-hazardous waste limited to international waste arriving in the province of Ontario.

Thermal Technologies (Incinerators)

Emerald's existing Facility includes five 2-stage controlled air incinerators. Each is approved to process 100 tonnes/day of solid waste, resulting in a combined incineration capacity of 500 tonnes/day or 182,500 tonnes per year. The incinerators and the associated waste heat recovery boilers provide power to a steam turbine-generator set having a nominal capacity of 9,700 kW. Note that Emerald's most recent ECA provides approval for the operation of six 2-stageincinerators, however there are currently only five incinerators operational at the Facility.

The incinerators are Consumat designed modular type units operating on the two-stage combustion principle with controlled air supplied to each stage. The units are designed to run on processed waste with a heating value of approximately 4,500 Btu/lb to 5,500 Btu/lb.

Air Pollution Control

In general, the air pollution control system (APC system) consists of a common powdered activated carbon (PAC) mercury control system, two parallel trains (each train comprising a conditioning tower, and a dry-lime scrubber, a baghouse and an induced draft ("ID") fan) followed by a common Selective Catalytic Reduction (SCR) system. The entire APC system is designed to remove mercury, acid gases, particulate matter, NO_x and dioxin/furans. Most of the acid gas present is in the form of hydrochloric acid (HCl).

The APC ensures compliance within stack emission limits per Ontario A7 guideline "Air Pollution Control, Design and Operation Guidelines for Municipal Waste Thermal", as well as the performance criteria listed under the Section 7.2 of the current ECA. Each component of the APC train is briefly described below, organized in the sequence of pollution control:

– Powdered Activated Carbon System:
  - The reduction of mercury in the stack gases is accomplished by injecting powdered activated carbon (PAC) into the dry lime scrubber.
– Conditioning Tower:
  - The conditioning unit consists of a vertical tower that sprays water into the gas stream to reduce gas temperature and increase gas humidity, which gives more effective operation of the dry-lime scrubber.
– Dry-Lime Scrubber:
  - Dry lime (CaO) is fed into the scrubber and combines with the acid gases in the flue gas stream to form various compounds of calcium.
– Baghouse:
  - The gas stream is filtered by a pulse-jet baghouse to remove the particulate matter, including unreacted lime. The bags are capable of operating during upset conditions when the scrubber is not operating.
– Induced Draft Fan:
  - A direct coupled motor driven induced draft (ID) fan is provided for each APC train with a cross connection between the trains upstream of the fans.
– Stack and Bypass Stack:
  - A full capacity bypass duct is provided around the entire air pollution control system, including the ID fans. This permits emergency shutdown of the plant at (a) Facility start up (2) a total power failure (3) when the SCR is out of service.
  - The existing and bypass stack heights are 35.18 meters above ground.
– Selective Catalytic Reduction System (SCR):
  - Oxides of nitrogen (NO_x) are controlled in the SCR by adding the reducing agent ammonia (NH_3) to the flue gases after they have been heated to the required operating temperature. The supplemental heat to the

incinerator flue gases is provided by two natural gas fired duct burners. The reducing reaction that converts NO_x to N_2 and H_2O occurs in the presence of the catalyst housed in the reactor located downstream of the ID fans. The catalyst also serves to oxidize the dioxins and furans in the stack gases to form HCl, CO_2 and water vapour.

4.1.2 Phase 1 to Phase 3 Project Expansions

Emerald plans to expand the incineration capacity with new treatment lines up to 900,000 tpa in total, implemented in multiple stages. Phase 1 is the establishment of one line with a capacity of 300,000 tpa, constructed while the existing incinerators remain in operation. With the completion of Phase 1, the existing incinerators will be decommissioned to make way for the installation of two additional identical lines for Phase 2 and 3, resulting in a combined treatment capacity of 3×300,000 tpa.

Phase 1will be designed as a single unit with a capacity of 37.5 t/h, equal to 300,000 tpa. The unit will be equipped with a steam turbine to produce electricity, as well as export high pressure steam. Phase s 2 and 3 may be designed as 2 units each with a capacity of 37.5 t/h, with a common steam turbine.

For the Phase 1 expansion of the waste incineration Facility, 300,000 tpa will be immediately available.

To fit Phase 1 next to the existing plant and minimize the total footprint of the redeveloped Facility, the existing workshop building will be shortened by 7 m, and one catalyst/stack unit will be moved as part of the works for Phase 1. Additionally, a minor expansion of the plant boundary will be required to accommodate Phase 1.

Thermal Technologies

The screening of thermal technologies in the ‘Emerald Energy from Waste Project Definition Brief (Ramboll, June 2023)’ indicates that various thermal technologies including (1) moving gate combustion (2) fluidized bed combustion (3) gasification, and (4) pyrolysis were evaluated for the Emerald expansion.

Moving grate combustion is proposed by the design engineering firm (Ramboll) as the most beneficial thermal treatment technology for the redeveloped Emerald Facility as it is by far the most well-proven and reliable technology for thermal treatment of MSW. None of the competing technologies offer obvious advantages for the treatment of the foreseen waste streams. Moving grate combustion offers both the most economical, most energy efficient and robust technology for energy recovery of these waste streams.

The recommended boiler concept is a horizontal layout with three vertical empty radiation passes. Flue gas recirculation is not recommended. Ramboll recommended to design the plant to maintain the flue gasses above 850 °C for at least 2 seconds in the furnace to meet the Facility’s environmental performance requirements.

Flue Gas Treatment

The environmental performance requirements for incinerator systems to burn municipal waste are outlined Emerald’s ECA, which follows the Ontario Guideline A-7. However, a previously approved energy from waste project (Durham York Energy Center, DYEC) followed stricter emission requirements. Emerald will use flue gas treatment technologies that ensures the expanded Facility will meet the lower in-stack limits where applicable.

Ramboll recommended the flue gas treatment system to be a semi-dry flue gas cleaning system that includes baghouse filters for the removal of particles and heavy metals, upstream lime reagent injection for removing acid gases, and activated carbon for capturing volatile mercury, and dioxin and furans. For Phase 1, the reduction of NO_x will be achieved through Selective Non-Catalytic Reaction (SNCR) in the post-combustion zone. For Phase s 2 and 3, technologies that achieve higher NO_x reduction, such as Tail End Selective Catalytic Reduction (SCR) will be used.

A Flow Chart of the Proposed Semi-Dry Flue Gas Treatment System, provided by Ramboll, is presented on Figure 5:

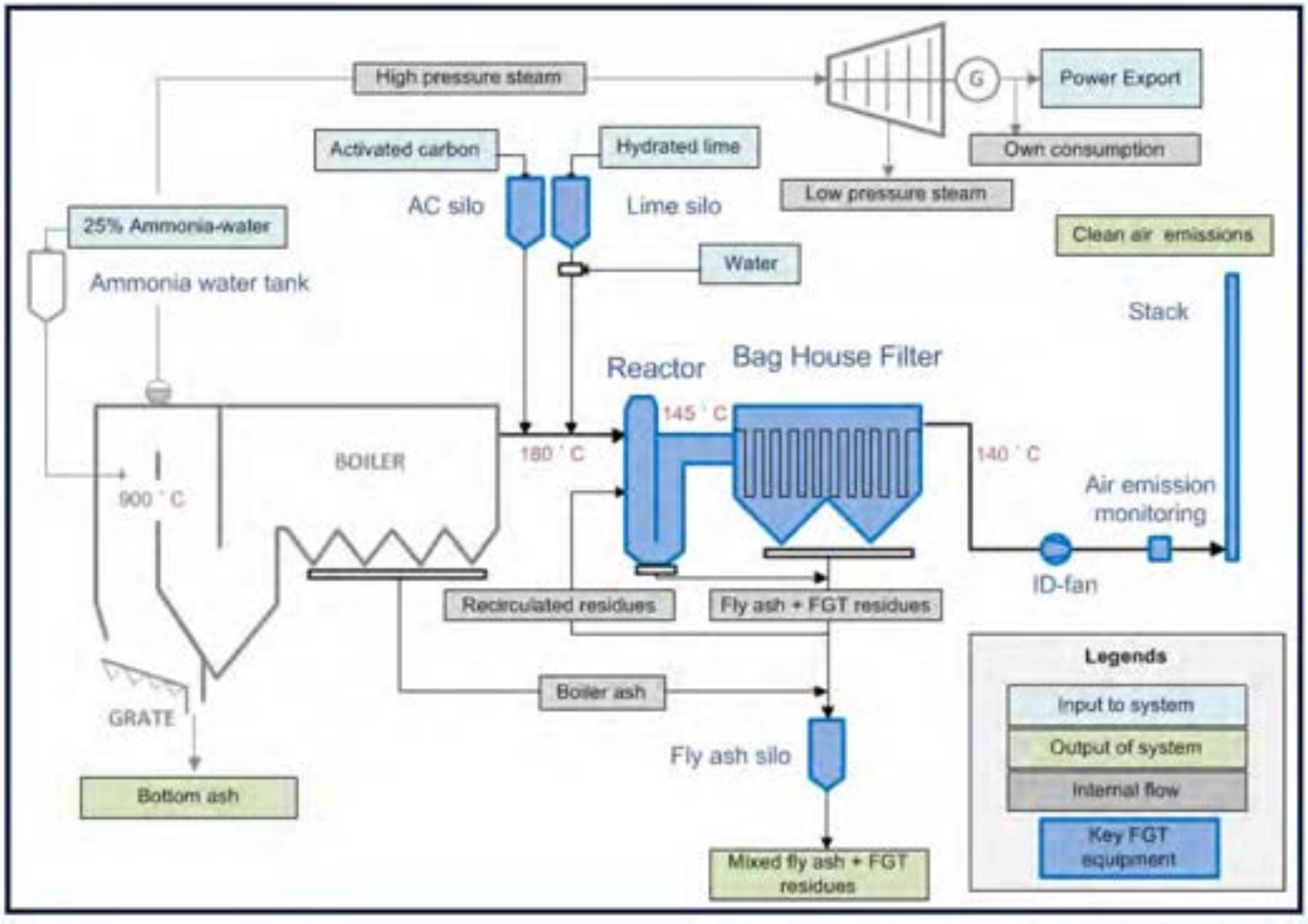


Figure 5 Flow Chart of the Proposed Semi-Dry Flue Gas Treatment System

The semi dry system is similar to a dry system but is optimized to allow part recirculation of the residue from the bag house filter in order to allow reuse of the unspent lime within the residue. Secondly, the semi-dry system injects water to the process to improve the reaction kinetics between lime and the acidic gases (HCl and SO_2) by reducing the flue gas temperature from around 170 ˚C to 140 ˚C. This temperature is optimal for efficient lime consumption.

The new stacks for Phase s 1, 2 and 3 will be 70 meters above grade.

4.2 Emission Sources and Source Parameters

The following significant sources of emissions were identified based on the process descriptions for both the existing and planned expansion. The existing emission sources and the corresponding source parameters are presented in Table 4. The modelled scenarios for the existing conditions are the same as the approved ESDM report. The existing scenarios model the emissions at current capacity, having the waste processing rate of 22.75 tonnes/hr.

Table 4 Existing Emission Sources and Source Parameters

Source	Emission Sources	Expected Emissions	Stack Height (m)	Stack Diameters (m)	Exit Velocity (m/s)	Exhaust Temperature (K)
Main Stack (S1)	Main Stack that discharges emissions from the six (6) incinerators after those emissions have been controlled by the Air Pollution Control Trains and the selective catalytic reduction unit (SCR). Only 5 incinerators are currently operational, however, the worst-case emissions scenario for the existing condition included the 6th incinerators that have been approved in the ECA. Under maximum operating conditions, the Facility processes 546 tonnes of waste per day (182,000 tpa) and provides power to a steam turbine generator set with a nominal capacity of 9,700 kW.	CACs, Aldehydes, Metals, Acid, Dioxin and Furans, VOCs, PAHs	35.18	2.3	17.282	505.05
Gas Turbine Generator (S2)	Gas Turbine Generator fueled by natural gas with a maximum heat input rating of 65.3 million kilojoules per hour to assist power generation during periods of low waste throughput.	PM, CO, NO_x, SO_2	10.97	1.067	54.8	758
Natural Gas Fired Steam Boiler (S3)	Natural Gas Fired Steam Boiler (S3) with a maximum heat input rating of 118.66 million kilojoules per hour to assist generating steam when the plant is down	PM, CO, NO_x, SO_2	22.5	1.17	22.79	422
Bypass stack (S4)	The Bypass stack (S4) is for short-term use when it becomes necessary to release emissions that have not been subject to control by the Air Pollution Control Equipment. Bypass stack may be used on a short-term basis during (a) Facility start-up, (b) Total Power Failure, or (c) when the SCR reactor is out of service.	CACs, Aldehydes, Particulates and Metals, Acid, Dioxin and Furans, VOCs, PAHs	35.18	1.65	19.49	438.15

The Phase s 1, 2 and 3 emissions sources and source parameters are based on the expanded Facility design brief document and information provided by Ramboll, as presented in Table 5. As previously discussed, Phase 1 will involve the operation of a single line with a capacity of 300,000 tpa (37.5 tonnes/hr), and the existing incinerators will be inactive by the time the new line becomes operational. In Phase 2, an identical unit to the first line will be added, bringing the total treatment capacity to 600,000 tpa (75 tonnes/hr). Phase 3 will have three identical units, resulting in a combined treatment capacity of 900,000 tpa (112.5 tonnes/hr).

The Natural Gas Fired Steam Boiler (S3) will no longer be present at the Facility, as it will have reached the end of its lease. The Gas Turbine Generators are anticipated to be utilized only for testing at a capacity of 1MW, and this usage is not considered a component of the maximum operating scenario. In addition, the design for expansion will not include any bypass stacks. All emissions are anticipated to be released from the three new main stacks S-1a to S-1c, as detailed in Table 5.

Table 5 Phase s 1-3 Expansions Emission Sources and Source Parameters

Source	Emission Sources	Expected Emissions	Stack Height (m)	Stack Diameters (m)	Exit Velocity (m/s)	Exhaust Temperature (K)	Dry Reference Flow Rate (DRm3/s)	Actual Flow Rate (Am3/s)
Unit 1 Stack (S1a)	Three identical Main Stacks (S-1a-S1c) serves as the exhaust of the new Lines 1 to 3, respectively, with each line having a capacity to process 300,000 tpa of waste. One stack will be added for each Phase. Without steam export, the plant will be able to produce 36.7 MW electricity in Phase 1. When Phase s 2 and 3 are implemented, the two additional boiler lines will supply one common turbine with steam, producing an additional 73.7 MW electricity, which results in approximately 102-110 MWe of net power to the grid. Each line will be equipped with a flue gas treatment system designed to meet in-stack emission limits and air quality standards.	CACs, Aldehydes, Metals, Acid, Dioxin and Furans, VOCs, PAHs	70	2.4	19.956	413.15	69.17	90.28
Unit 2 Stack (S1b)			70	2.4	19.956	413.15	69.17	90.28
Unit 3 Stack (S1c)			70	2.4	19.956	413.15	69.17	90.28

Construction Air Quality Impacts

During the construction and demolition activities for the Facility expansion, dust and emissions from construction equipment may temporarily affect local air quality. These emissions are expected to be localized within the construction area and limited to the days when construction activities are in progress.

Construction phase air emissions will be minimized by following the best practices outlined in *Best Practices for the Reduction of Air Emissions from Construction and Demolition Activities* (Cheminfo, 2005). This includes best practices such as:

– Dust Control: Implementing measures like water spraying, using non-chloride dust suppressants, and erecting barriers to minimize dust generation.
– Equipment Maintenance: Regularly maintaining and servicing machinery to ensure efficient operation and reduced emissions.
– Traffic Management: Planning site access and haul routes to reduce congestion and idling emissions from vehicles.
– Site Planning: Strategically planning construction phases and activities to minimize the impact on air quality.
– Public Communication: Keeping the local community informed about construction activities and potential air quality impacts.

With proper best management practices in place, dust and construction equipment emissions are considered to be insignificant. In addition, given that the land surrounding Emerald is predominantly industrial or open space, and the closest sensitive receptor (a sports facility) is situated 590 meters away from the Facility, the construction emissions are expected to have minimal impact to the community and therefore are not included in the quantitative modelling in this Assessment.

4.3 Operating Conditions

Emerald will be designed for an annual availability of 8,000 hours, ensuring that the plant is designed in line with best practice. Each unit, which correspond to a single stack, is expected to undergo a 10-day shutdown per year, with only one unit offline at a time. For a conservative estimate, emission rates and dispersion modelling for all pollutants were calculated assuming the Facility runs at its maximum treatment capacity continuously all year.

For the existing scenario, a steam turbine generator can run simultaneously with all incinerators for power generation. Meanwhile, the natural gas boiler will operate only when a unit is undergoing scheduled maintenance and is temporarily offline. With the commencement of the expansion project, the turbine generator and natural gas boiler will no longer be operational except for generator testing at a 1MW capacity, much lower than its rated capacity.

Startup, Shutdown, and Upset Conditions

Ensuring proper incineration process operating conditions is crucial for achieving adequate combustion and minimizing air emissions. Therefore, appropriate measures are required to maintain combustion conditions, such as temperature and residence time, during the Facility's start-ups, shutdowns, and malfunctions of the combustion units or flue gas treatment equipment.

For the temperature retention requirement, natural gas fired auxiliary burners will be used during start-up and shutdown, and periods of lower waste input or when processing low-calorific waste. In the current ECA, there are design requirements to ensure temperature reaches design conditions before introducing waste or waste derived fuel into the primary chamber during the start up and the shutdown period until all waste combustion is completed.

The natural gas auxiliary burner emissions will not add more NOx emissions to the combustion exhaust because natural gas will only be used during periods when waste combustion is reduced or not occurring. During normal operations, natural gas is not used because the waste has sufficient energy content to maintain the combustion temperature. During an upset condition, waste feed would stop or be curtailed, and natural gas may then be used to maintain the combustion chamber temperature. Since the NOx emission factor for waste combustion on an energy

basis is about three times higher than the NOx emissions factor for natural gas combustion, the use of the natural gas burners instead of waste combustion will produce less NOx emissions. Any NOx from natural gas burners in the combustion system would be controlled by the APC and there will be no changes to the maximum emission estimates and the dispersion modelling results due to the use of natural gas burners in the combustion system.

In the event of upset conditions, such as a power failure leading to the shutdown of the APC, Emerald will use backup generators to sustain power for the APC until self-generated power is restored or until the units can be safely shut down to prevent unexpected emissions. Backup generators will be used to sustain power for the air APC to prevent unexpected emissions.

In addition, based on the Facility's current ECA approval, the APC must be designed to maintain design treatment conditions before waste is introduced during the in the start up and after waste processing has stopped in the shutdown procedure. As a result, emissions during start-up, shutdown, and upset conditions are not expected to exceed those during regular operations at maximum Facility capacity, given the reduced quantity of waste being burned.

4.4 Emission Calculations

Emission rates under worst-case conditions from the main stacks were determined through a combination of in-stack emission limits, manufacturer-provided guarantees, historical stack test data (2018-2022), and established emission factors.

4.4.1 Emission Rates Based on In-Stack Limits and Manufacturer's Guarantees

Estimated emission rates for Phase s 1, 2 and 3 of the expanded Emerald Facility were determined using the lower of Guideline A7, the DYEC project's in-stack criteria, and the manufacturer's guaranteed exhaust emission concentrations. In stack limits were used to determine emission rates for suspended particulate matter (filterable), hydrogen chloride, sulphur dioxide, nitrogen oxides, organic matter (expressed as equivalent methane), carbon monoxide, cadmium, lead, mercury, PM_{10} and $PM_{2.5}$.

The in-stack criteria (Guideline A-7 and DYEC) for dioxins and furans were not used to estimate the Facility expansion emission rates of dioxins and furans. Instead, historical stack testing data was used to determine the dioxin and furans emission rate for plant expansions. Dioxins and furans emissions rates from historical stack testing data are significantly lower than the in-stack criteria. If the in-stack criteria was used as the dioxins and furans emission rate estimate, the cumulative maximum concentration at the worst case receptors would exceed the project criteria and this is not considered to be a realistic emission scenario. The expanded Facility will have in-stack dioxins and furans concentrations that are similar or lower than the existing concentrations, since more modern emissions controls will be used. For a conservative estimate, it was assumed that all particulate matter is PM 2.5 (thus also PM10). As a result, the in-stack limit of 4.6 mg/Rm³ was applied to PM2.5, PM10, and total PM.

Sample Calculation: Nitrogen Oxides Emissions from Main Stacks for Phase 3 Plant Expansion (Per Stack):

At 11% O_2, the dry reference flow rate at 11% O_2 for each stack is 69.17 m^3/s. This corresponds to an air excess ratio of 2.1.

$$ER_{NOx} = In\ Stack\ Concentration\ Limit\ \times Dry\ Flow\ Rate\ at\ Reference\ Condition$$
$$= \frac{121\ mg}{Rm^3} \times \frac{69.17\ m^3}{s} \times \frac{g}{1000\ mg} = 8.37\frac{g}{s}$$

4.4.2 Emission Rates Based on Historical Source Tests

For Emerald's existing Facility, source testing has been conducted annually at the main stack. Additionally, the Gas Turbine has been source tested every two years, in accordance with Emerald's current ECA requirements.

To calculate emission rates for air contaminants without in-stack limits for both the existing Facility scenarios, specific emission factors were derived from source tests conducted between 2018 and 2022. For each pollutant, the emission rate (ER) obtained from each stack test (in g/s) was divided by the waste processing rate (PR) during the testing to establish an ER/PR ratio expressed in grams of emissions per second per tonne of waste processed. The average of these ER/PR ratios was then multiplied by the maximum waste processing capacity for each phase to estimate the emissions for both the existing and future expansion phases.

In each source test, there are some pollutants that were not detected (below the detection limit). For values reported below the detection limits, the respective detection limit itself was used for emission estimation, resulting in a conservative estimate.

For some metals, the sampling and analysis methods used in the stack tests provided total metal emission rates. Where a metal compound is the compound of concern for the air quality criteria (e.g. aluminum oxide), it was conservatively assumed that all of the metal detected was emitted as the metal compound.

A summary of the stack test data for the existing plant is provided in Appendix B, Summary of 2018-2022 Stack Tests. Appendix B includes the stack test parameters, emission rates, and the average of the ER/PR ratios used for the estimated emission rates.

Sample Calculation: Calcium Oxide Emissions from Main Stacks for Phase 3 Plant Expansion (Per Stack):

The nominal waste processing rate for each unit is 37.5 tonne/hr. The conversion factor from Calcium to Calcium Oxide is 1.4.

$$R_{Ca} = Average\ ER\ to\ PR\ Ratio \times Nominal\ Waste\ Processing\ Rate\ of\ the\ Unit$$

$$= 2.23 \times 10^{-3} \frac{g\ (emissions) \cdot hr}{s \cdot tonne\ (waste\ processing)} \times \frac{37.5\ tonne}{hr} = 8.38 \times 10^{-2} \frac{g}{s}$$

$$ER_{CaO} = ER_{Ca} \times \frac{MW_{CaO}}{MW_{Ca}} = 8.38 \times 10^{-2} \frac{g}{s} \times 1.4 = 1.17 \times 10^{-1} \frac{g}{s}$$

4.4.3 Emission Rates Based on Emission Factors

The estimated maximum emission rates from auxiliary combustion equipment are based on the boiler's maximum heat input capacity. Emission factors from USEPA AP-42 Chapter 1.4, Natural Gas Combustion, for uncontrolled large boilers (>100 MMBtu) (post-NSPS) were utilized to calculate boiler emissions.

The maximum heat input capacity for the steam boiler is 188,664,500 kJ (178.82 MMBTU/hr). Pollutants assessed for the boiler include Carbon Monoxide, Nitrogen Oxides, Particulate Matter, and Sulphur Dioxide.

Sample Calculation: Nitrogen Oxides Emissions from the Natural Gas Boiler Exhaust:

$$ER_{NOx} = \frac{178.82\ MMBTU}{hr} \times \frac{190\ lb}{1020\ MMBTU} \times \frac{hr}{3600\ s} \times \frac{453.59\ g}{lb} = 4.197 \frac{g}{s}$$

4.4.4 Estimated Emission Rates for Startup, Shutdown and Upset Conditions

The US EPA Guidance Document on Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities (US EPA, 2005b) recommends that process upsets, such as startup, shutdown, and malfunctions, should be evaluated using a method based on the work by California Air Resources Board (CARB) (1990). The 24 hour and annual averaging period factors are derived under the assumption that process upsets are 10 times greater than normal operation conditions. It is assumed, very conservatively, that the Facility operates under upset conditions 4% of the year, and normally the rest of the year. Based on historical operations, it is expected that upset conditions will occur much less than 4% of the year.

Since upset conditions are brief, the factor was adjusted to account for only the project criteria time. For contaminants with a 24-hour averaging period, it was assumed that the Facility will operate under upset conditions for 1 hour during the day, and normal conditions for the rest of the day, i.e. 23 hours. Due to the various monitors and controls at the Facility, it is reasonable to assume that the upset conditions will be eliminated within one hour.

Sample Calculation: Unitized Emission Rate (24-hour averaging period) under Upset Conditions:

$$Multiplier_{Upset} = \left(\frac{23}{24} \times 1\right) + \left(\frac{1}{24} \times 10\right) = 1.375$$

For contaminants with an annual averaging period, it was assumed that the Facility will operate under upset conditions for 350 hours of the year, and normal conditions for the remainder of the year, i.e. 8410 hours.

Sample Calculation: Unitized Emission Rate (Annual averaging period) under Upset Conditions:

$$Multiplier_{Upset} = \left(\frac{8410}{8760} \times 1\right) + \left(\frac{350}{8760} \times 10\right) = 1.360$$

For the expanded Facility, the upset condition emission rate estimates and concentrations are summarized in Table G.

4.4.5 Estimated Emission Rates for Startup, Shutdown and Upset Conditions – Backup Generator

In the event of upset conditions, such as a power failure leading to the shutdown of the APC, Emerald will use backup generators to sustain power for the APC until power is restored or until the units can be safely shut down to prevent unexpected emissions. This scenario is the same as Scenario 4 with an addition of a backup generator. The backup emissions rates for a 600 kW Tier 4 diesel backup generator have been calculated based on US EPA emission limits. However, there are no changes to the dispersion modelling compared to Scenario 4 because the emissions from the backup generator are vented through the APC and main stacks that have been modelled with in-stack emission limits.

Sample Calculation: Nitrogen Dioxide Emission Rate (24-hour averaging period) from the Backup Generator:

$$ER_{NO_2} = 600\ kW\ \times 0.67 \frac{g}{kW.hr} \times \frac{1\ hour}{3600\ seconds} = 1.12\ \times 10^{-1}\ \frac{g}{s}$$

4.4.6 Estimated Emission Rates

The estimated emission rates for the existing and future operating conditions for the Facility are provided in Appendix C. For the existing conditions, Table C.1 summarizes the emission rates for the gas turbine generator (S2) and the natural gas fired boiler exhaust (S3). Table C.2 provides a summary of the emission rates for the existing Facility's main stack for various scenarios, including: (1) emissions rates for normal operating conditions calculated based on stack test results and the approved maximum waste processing rate (22.75 tonnes/hr); (2) emission rates for normal operating conditions plus the steam turbine generator operating at its maximum capacity; (3) stack bypass scenario, as evaluated in the approved ESDM report, where the SCR is experiencing malfunction, affecting the emissions of NO_x.

For the expanded Facility, the emission rate estimates for pollutants based on in-stack emission limits and stack test data are summarized in Table C.3 and Table C.4, respectively for each stack (S1a, S1b, S1c). Table C.5 provides a summary of the total emissions for Phase s 1, 2 and 3 respectively.

5. Background Air Quality

GHD completed a background air quality assessment as documented in the Background Ambient Air Quality Assessment Report (GHD, issued originally January 2024, and updated July 2024).

The background air quality assessment considered air monitoring data collected from several sources, including an ambient air monitoring program (AAMP) by the Region of Peel in 2013/2014 and an AAMP by Emerald in 2023. In addition, data from the federal and Ontario governments air monitoring stations located in the airshed near Emerald were considered.

Two AAMPs were conducted using the same air monitoring station locations at 185 Central Park Drive in Brampton, upwind of Emerald (Upwind Station), and Carterm Intermodal Logistics located at 2700 Drew Rd, in Mississauga, downwind of Emerald (Downwind Station), to estimate ambient air quality conditions near the Emerald Facility. Both the Upwind and Downwind monitoring stations are in primarily industrial/commercial areas that are adjacent to residential communities and fell within the targeted upwind and downwind monitoring locations.

The first AAMP was undertaken in 2013/2014 by the Region of Peel for a proposed waste to energy facility. The second AAMP was completed by Emerald and started in September 2023 for the Upwind Station and in June 2023 for the Downwind Station and completed in March 2024.

The air monitoring data available for 2021, 2022 and 2023 from the federal National Air Pollution Surveillance (NAPS) monitoring stations and the Ontario Air Quality (AQ) monitoring stations located near Emerald were also reviewed to estimate the ambient air quality near the Emerald Facility. The detailed monitoring instrumentation and methodologies, the monitoring results for each parameter, NAPS and Ontario AQ monitoring station data, as well as associated assumptions and discussions, are presented in the Background Ambient Air Quality Assessment Report (July 2024). A summary of the background air quality concentrations is provided in Appendix D.

6. Dispersion Modelling

The United States Environmental Protection Agency (USEPA) air dispersion model, AERMOD, was used with site-specific meteorological data provided by the MECP.

The AERMOD model considers local meteorology, topography, buildings, and source parameters to predict the concentration of contaminants at receptors specified by the user. The AERMOD modelling system has been identified by the MECP as one of the approved dispersion models under O. Reg. 419/05 and includes algorithms for assessing the effects of buildings on air dispersion.

The AERMOD modelling system is made up of the AERMOD dispersion model, the AERMET meteorological pre-processor and the AERMAP terrain pre-processor. The following approved dispersion model and pre-processors was used in the assessment:

– AERMOD dispersion model (v. 22112)
– AERMAP surface pre-processor (v. 18081)
– BPIP building downwash pre-processor (v. 04274)

AERMET was not used in this assessment, as a pre-processed site-specific MECP meteorological dataset for Emerald was used.

Same structure contamination was not considered. General building vents, roof exhausts, building heating, ventilation, and air conditioning was considered negligible sources and not included as part of this modelling Assessment.

6.1 Modelling Scenarios

Existing Conditions

The existing conditions scenarios were modelled consistent with the worst-case scenarios in the approved ESDM report. The latest approved version of the AERMOD model and the site-specific meteorology data provided by the MECP was used.

Future Conditions

The future emission rates are directly related to the number of lines/stacks and the amount of waste material being processed. Phase 1, Phase 2, and Phase 3 of the Facility expansion were individually modelled under the corresponding maximum processing rates.

The modeling scenarios for the existing and future conditions are presented below in Table 6.

Table 6 Modelling Scenarios for Existing Conditions and Facility Expansion

Operation	Scenario No.	Emission Sources	Description
Existing	Scenario 1A	S1	Facility operates at 100% approved capacity based on the current approved ECA.
	Scenario 1B	S1, S2	Facility operates at 100% capacity plus a 5.2MW gas turbine generator run at its maximum capacity. For this scenario, only NO_x was evaluated as this is the primary contaminant from the gas turbine.
	Scenario 1C	S3	Natural Gas Fired Boiler for Steam Production operating when the Existing Main Stack is down.
	Scenario 1D	S1-Bypass	Short-term release of emissions when the SCR is out of service. Emission estimate consistent with approved methodology in the current ESDM and ECA.
Phase 1 Expansion	Scenario 2	S1a	The new unit 1 stack operates at 100% capacity, processing 300,000 tpa waste material. The decommissioning of the existing line has been started but both the new Facility building and the existing buildings are on site.
Phase 2 Expansion	Scenario 3	S1a, S1b	Both unit 1 and unit 2 stacks operate at 100% capacity, processing 600,000 tpa waste material. The decommissioning of the existing line has been completed.
Phase 3 Expansion	Scenario 4	S1a, S1b, S1c	Unit 1, 2 and 3 stacks operate at 100% capacity, processing 900,000 tpa waste material. This scenario represents the maximum emission and worst case scenario for the future operating conditions.
Upset Condition	Scenario 5	S1a, S1b, S1c	Unit 1, 2 and 3 stacks operate under upset conditions, at 100% capacity, processing 900,000 tpa waste material. The upset condition emissions rates are estimated using the methodology described in Section 4.4.4. This scenario represents the maximum and worst-case emission for the future upset operating condition.

Upset Condition with Backup Generator

In the event of upset conditions, such as a power failure leading to the shutdown of the APC, Emerald will use backup generators to sustain power for the APC until power is restored or until the units can be safely shut down to prevent unexpected emissions. This scenario is the same as Scenario 4 with an addition of a backup generator. The backup emissions rates for the backup generator have been calculated in Section 4.4.5, however, there are no changes to the dispersion modelling compared to Scenario 4 because the emissions from the backup generator are vented through the APC and main stacks that have been modelled with in-stack emission limits.

Facility Operating at Reduced Capacity

Additionally, a scenario involving the expanded Facility operating at a reduced rate of 70% nominal throughput for all three production lines was assessed. This rate aligns with the industry's best practice for minimum waste throughput. While operating under reduced rates, emissions are lower, but the stack flow rates are also reduced proportionally. The exhaust temperature remains constant under reduced rates. In the current ECA, there are design requirements to ensure temperature reaches design conditions prior before to introducing waste or waste derived fuel into the primary chamber during the start up and the shutdown period until all waste combustion is completed.

In the event of upset conditions, such as a power failure leading to the shutdown of the APC, Emerald will use backup generators to sustain power for the APC until self-generated power is restored or until the units can be safely shut down to prevent unexpected emissions.

To assess the impact of reduced throughput, which is associated with decreasing emission rates and flow rates, two scenarios were compared. The first scenario involved a unitized emission rate of 1 g/s for the Facility (0.333 g/s from each stack) with exhausts at the maximum flow rate of 90.28 m3/s. The second scenario had a Facility-wide emission rate of 0.7 g/s (0.233 g/s for each stack) at a flow rate of 64.2 m3/s (70% of the maximum). The results showed that the Facility operating at reduced throughput would result in lower maximum off-site air contaminant concentrations for the 1-hour, 24-hour, and annual averaging periods. Therefore, a reduced capacity operating scenario was excluded from further evaluation, as operating at a reduced rate is not considered part of the worst-case operating scenario.

6.2 Land Use Classification

The selection of urban or rural land use is a critical step as it determines which dispersion coefficients will be used in AERMOD calculations. The area surrounding Emerald includes a mix of agricultural, industrial, commercial, employment, floodplain, greenlands, and residential land uses. An initial analysis of the site and its surroundings shows that more than 50% of the land use within 3 km radius of the Facility is categorized as urban. Therefore, it is appropriate to use 'urban' dispersion coefficients for the modelling.

To demonstrate that the urban option is appropriate for modelling Emerald's location, a land use assessment has been conducted using the method outlined in Auer, A. H. 1978. Titled *“Correlation of Land Use and Cover with Meteorological Anomalies”* from Journal of Applied Meteorology (Auer Method). The study quantitatively classified the land use within the total area circumscribed by a 3 km radius circle around the Facility.

US EPA document Guideline on Air Quality Models (40 CFR Part 51, Appendix W) Section 7.2.1.1 outlines the land use procedure to be used for determining ‘urban’ or ‘rural’ classification which involves the following steps:

1. Classify the land use within the total area, Ao, circumscribed by a 3 km radius circle about the source using the meteorological land use typing scheme proposed by Auer.
2. If land use types I1, I2, C1, R2, and R3 account for 50 percent or more of Ao, use urban dispersion coefficients; otherwise, use appropriate rural dispersion coefficients.

To classify the Auer land use, zoning and land use information was first obtained for 3 km radius around the Facility based on the Brampton Zoning By-Law 270-2004 and City of Mississauga Zoning By-law 0225-2007. The zoning categories from the Brampton zoning information includes Public Ownership and Utilities, Industrial, Open Space, Commercial, Institutional, Agricultural, Residential, Split Zones, and Floodplain. Mississauga zoning information include Airport, Commercial, Development, Employment, Greenlands, Open Space. Parkway Belt, Residential, and Utility, as presented in Figure 6.

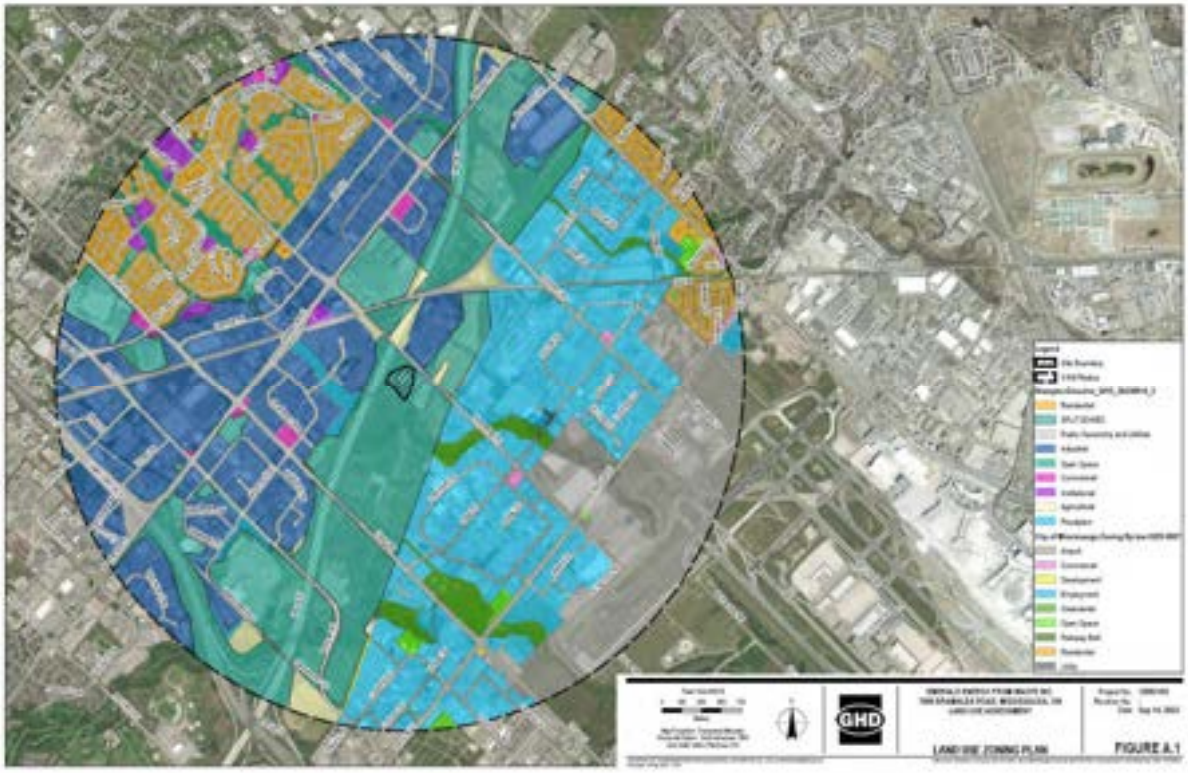


Figure 6 Land Use Zoning Plan

Auer Type was then assigned to each zoning categories by comparing the permitted land uses outlined in the zoning bylaw and examining the structures of buildings and the vegetation coverage for each parcel using Google Earth. Note that Auer classification does not provide a specific category for areas with over 30% to 35% vegetation but less than 70% vegetation. For the purposes of this assessment, these lands are conservatively classified as 'rural'.

Based on this designation, it is estimated that 57.66% of the land use within 3 kilometres of the Facility can be classified as urban for modelling purposes. The area and percentage covered based on Auer Classification are presented in Table 7:

Table 7 Auer Classifications for Areas Surrounding Emerald

Auer Class	Area (m2)	Percent Covered
A1	9,606,747	33.08%
C1	3,360,252	11.57%
I2	12,802,765	44.09%
R1	3,271,316	11.26%
Sum of I2 and C1 (Urban)	16,163,017	55.66%

55.66% of land use within the total area circumscribed by a 3 km radius circle around the Facility are I2 and C1. As a result, the urban dispersion coefficient should be used in AERMOD for modelling purposes.

Details of the land use assessment and supporting materials are provided in Appendix I.

6.3 Urban Population Calculation

As the use of the urban dispersion coefficient is valid, the total urban population for the purposes of estimating the urban heat island effects was estimated. The population value used was based on the total area surrounding Emerald to a distance of 3 km, and the average population density of both Mississauga and Brampton (2021 census) as the area encompassed by the 3 km distance extended over both cities. Based on this information, the total population within 3 km of the Facility was estimated at 69,790 persons.

6.4 Urban Surface Roughness Length

The minimum surface roughness length in the meteorological dataset was used for the urban surface roughness. The urban surface roughness value was determined to be 0.052 m. To use this value to replace the USEPA default value of 1 m, the AERMOD regulatory options was set to non-default.

6.5 Coordinate System

The Universal Transverse Mercator (UTM) coordinate system, as per Section 5.2.2 of the ADMGO, was used to specify source locations, model object sources, buildings and receptors. All coordinates were defined in the North American Datum of 1983 (NAD83).

6.6 Meteorological Data

On August 18, 2023, the MECP issued approval under O. Reg. 419/05 Paragraph 3 of section 13(1) along with the pre-processed 5 year site specific meteorological data set (2018 – 2022) prepared with AERMET 22112. The upper air and surface data are from the U.S. National Weather Service's Buffalo and the NAV Canada's Toronto International Airport stations respectively, with missing data filled with those of the MECP prognostic dataset for the Toronto International Airport station from the advanced research version of the Weather Research and Forecasting (WRF ARW) model.

The January 2024 version removed 8 meteorological anomalies per year for the 8-hour averaging period. The report has been revised to only discard a single 8-hour period per year.

Elevation above mean sea level (MSL) of the Toronto international airport station, 173 metres, was be used for the model.

The wind rose (blowing from) generated from MECP pre-processed 5-year site-specific meteorological data set (2018 – 2022) is presented below in Figure 7.

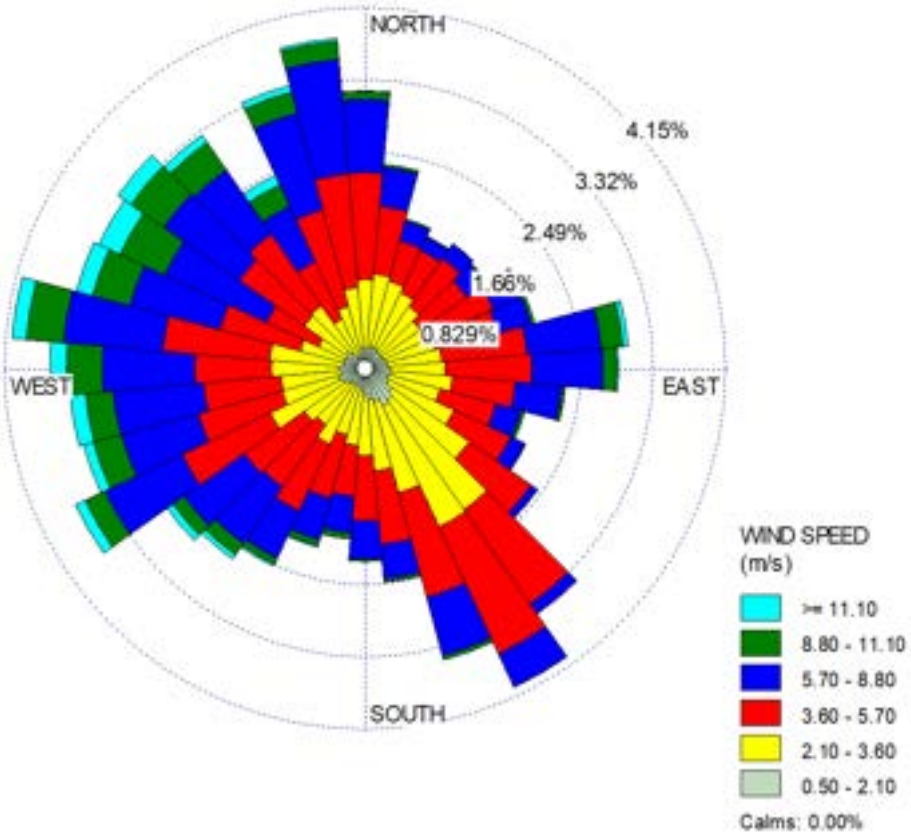


Figure 7 Wind Rose (blowing from) for Emerald

6.7 Terrain

AERMOD captures the essential physics of dispersion in complex terrain though the use of a separate height scale factor for each receptor (USEPA, 1998 – AERMAP UG). The highest scale factor represents the terrain that would dominate flow in the vicinity of the receptor. The height scale factor that is used by AERMOD is generated by a AERMAP terrain pre-processor. AERMAP utilizes terrain data, or Digital Elevation Model (DEM) data in conjunction with a layout of receptors and sources to height scale factors that can be directly used in AERMOD. Terrain data used in this assessment was obtained from MECP (7.5-minute format).

Canadian Digital Elevation Model terrain data that includes Mississauga and Brampton area (cdem_030M) was used.

6.8 Receptors

Receptors were chosen based on recommendations provided in Section 7.1 of the ADMGO, which is in accordance with s.14 of O. Reg. 419/05.

Multi-Tier Grids

A multi-tier, uniform Cartesian grid centered on the Facility was established. The receptor grid was placed at the facility fence line and extend out to 5 km. The multi-tier grid includes receptor spacing as follows:

– 20 m spacing within 200 m of the edge of the bounding box
– 50 m spacing from 200 to 500 m
– 100 m spacing from 500 to 1,000 m
– 200 m spacing from 1,000 to 2,000 m
– 500 m spacing from 2,000 to 5,000 m

Fenceline Receptors

A property line ground level receptor grid with 10 m spacing was used to evaluate the maximum property boundary concentration. No receptors were placed inside the Facility's property line.

Discrete Receptors

Discrete receptors were selected to represent both current and proposed worst-case sensitive receptors. The nearby commercial/industrial areas, residential zones, recreational areas, places of worship, hotels, healthcare facilities, senior citizens' residences, long-term care facilities, childcare facilities, and educational institutions were examined using AERMOD discrete receptors for the respective worst-case location.

GHD conducted a review of sensitive receptors surrounding the Emerald. In general, most of the properties adjacent to the Facility are commercial or industrial properties. The Dixie – 407 Sports field is the nearest identified sensitive receptor which is 500 m southwest of the Facility. The sports field includes a cricket batting cage, cricket grounds and a walking pathway. The nearest residential areas are located on Avondale Boulevard (Avondale Blvd and Bramalea Rd), approximately 1.5 km north-west of the Facility. There are various commercial buildings, places of worship, and parks that are located in between the sports field and the residential area.

In addition, discrete elevated receptors were be placed at 3-meter intervals along the façades facing Emerald for the 19-storey and 12-storey apartments at 64 Bramalea Road, respectively. Flagpole receptors, representing apartment windows and balconies, were placed at the height of each storey, which ranges from 3 meters to 52 meters. Additionally, to simulate rooftop air intakes, two receptors were set at a height of 59 meters for the 19-story building and at a height of 43 meters for the 12-story building.

The locations of worst-case sensitive receptors are presented in Figure 8. Although the figure shows only a limited number of locations for each sensitive receptor type, all sensitive receptors including commercial, schools, daycares, parks and sports field, etc. within a 3 km radius were identified. For residential areas, several grids with 20 x 20 m spacing were used to pinpoint the 'worst-case' location within each residential area. This approach ensures that the selected 'worst-case' locations represent the maximum pollution concentrations.



Figure 8 Worst Case Sensitive Receptors

6.9 Building Downwash

The Facility buildings were entered into the model using the USEPA Building Profile Input Program (BPIP PRIME). The inputs into this pre-processor include the coordinates and heights of the buildings and stacks. The BPIP program was executed to evaluate any building cavity downwash effects. Cavity downwash can result in air contaminants being forced to ground level prematurely under certain meteorological conditions. The onsite buildings and structures were modelled with their respective average roof heights.

The PRIME plume rise algorithms include vertical wind shear calculations (important for buoyant releases from short stacks (i.e., stacks at release heights within the recirculation zones of the buildings). The PRIME algorithm also allows for the wind speed deficit factors to improve the accuracy of predicted concentrations within building wake zones that form in the lee of buildings.

6.10 Deposition

AERMOD has the ability to predict total deposition for the purposes of the human health risk assessment (HHRA). Total deposition is the result of two deposition mechanisms: dry deposition and wet deposition.

Dry deposition results from the formation and settling of air contaminant particles due to gravity (e.g., dust fall) and is subject to re-entrainment into the atmosphere depending on particle size and wind speed.

Wet deposition results from air contaminants being washed out of the atmosphere due to precipitation (rainfall, sleet, snow, etc.). These contaminants are not typically re-entrained into the atmosphere unless they are also part of a dry particle's composition.

For the purposes of the deposition modelling, both dry and wet plume depletion algorithms were not enabled. Plume depletion typically occurs as a result of deposition; that is, as the air contaminant is deposited, the concentration of the contaminant lowers in the plume during its downwind travel. Depletion generally results in higher concentrations and deposition results predicted in the near-field, and lower concentrations and deposition results in the far-field. As depletion options were not enabled, the deposition and concentration results are expected to be conservative.

MECP provided a deposition-ready meteorological dataset for the purposes of deposition modelling based on the previously provided meteorological dataset described in Section 6.4. The dataset included precipitation data, which is required for the prediction of wet deposition, and therefore total deposition.

Deposition modelling used Method 1 for particulate information as follows:

– Particle size fraction equal to or less than 2.5 microns = 0.9
– Particle size fraction between 2.5 and 10 microns = 0.1
– Estimated density of incinerator fly ash = 2.8 g/cm^3

Deposition from particles greater than 2.5 micrometers was assessed in the latest revision of the HHRA. As indicated in Appendix K of the AQIA report, a minimum of 90% of the particulate matter emitted will be less than PM2.5. To account for the 10% of the particulate that could be larger particle size than PM2.5, GHD reviewed information provided by USEPA for municipal waste combustors. Based on Appendix B.1, Section 2.1 of US EPA AP 42, only particle sizes less than PM10 are presented, therefore it is a reasonable assumption to assume that the remaining 10% of particles emitted will be between PM2.5 and PM10.

As noted in Section 6.14, deposition estimates were completed for selected compounds for use in the human health risk assessment.

6.11 NO_x to NO_2 Conversion

NO_x emissions are composed of Nitric Oxide (NO) and Nitrogen dioxide (NO_2) with NO dominating the composition. When NO_x is emitted to the atmosphere, NO begins to react with other contaminants (primarily ground-level ozone - O_3) to produce NO_2. Depending on the amount of ozone present, only a portion of NO_x will be converted to NO_2.

Adverse health effects result from NO_2 at much lower concentrations than NO.

The NO_x emissions from Emerald are estimated to be about 98% NO. However, GHD has conservatively assumed that all NO_x emitted from the Emerald stacks is NO_2 as the worst case.

6.12 Averaging Time and Conversions

The shortest time scale that AERMOD predicts is a 1-hour average value. Many of the standards are based on 1-hour, 24-hour, and annual averaging times, which are averaging times that can also be calculated by AERMOD. In cases where a standard has an averaging period less than 1-hour (e.g., 10-minute), a conversion to the appropriate averaging period was completed using the Ontario's Ministry of the Environment, Conservation and Parks recommended conversion factors, as documented in the Air Dispersion Modelling Guideline for Ontario (Guideline A-11) Version 3.0.

6.13 Dispersion Modelling Options

The options used in the AERMOD dispersion model are summarized as follows:

Table 8 Dispersion Modelling Options

Modelling Parameter	Description	Used in the Assessment?
DFAULT	Specifies that regulatory default options will be used	Yes
ADJ_U	Specifies that AERMET is pre-processed to adjust friction velocity for low wind speed conditions	Yes
CONC	Specifies that concentration values will be calculated	Yes
DEPOS	Specifies that total (wet + dry) deposition will be calculated	Yes, HHRA models only
DRYDPLTE	Specifies that dry depletion will be calculated	No
WETDPLTE	Specifies that wet depletion will be calculated	No
FLAT	Specifies that the non-default option of assuming flat terrain will be used	No, the model used elevated terrain as detailed in the AERMAP output
NOSTD	Specifies that the non-default option of no stack-tip downwash will be used	No
AVERTIME	Time averaging periods calculated	10-min, 0.5-hr,1-hr, 8-hr 24-hr, 30-day, annual
URBANOPT	Allows model to incorporate the effects of increased surface heating from an urban area on pollutant dispersion under stable atmospheric conditions	Yes
URBANROUGHNESS	Specifies the urban roughness length (m)	0.052 m
FLAGPOLE	Specifies that receptor heights above local ground level is allowed on the receptors	Yes

6.14 Dispersion Modelling Completed for the Human Health Risk Assessment

Deposition

While plume deposition is not factored into the dispersion modelling to obtain ambient air concentrations at the worst-case receptors for the air quality assessment, it is essential to assess the potential deposition for contaminants of concern as part of the human health risk assessment (HHRA). The evaluation of deposition is used for determining whether emissions over the Facility's lifetime would affect soil quality in the surrounding community, as the community can be exposed to chemicals deposited in the soil through incidental ingestion and dermal contact of the soil, inhalation of resuspended dust, and ingestion of homegrown produce containing chemicals from the soil.

AERMOD model runs were completed to project the total (wet + dry) deposition of particulate and gaseous contaminants from the atmosphere onto ground-level surfaces. The results, presented in grams per square meter (g/m2), were generated for Phase 1, Phase 2, and Phase 3 expansions, respectively, for both the worst-case sensitive receptor and the worst-case ground-level residential building. Contaminants assessed included Nickel, Lead, Manganese, Cobalt, Iron, Chromium III, Mercury, Arsenic, Benzo(a)Pyrene, and Dioxin and Furans. These predicted annual deposition values were subsequently utilized by Intrinsik to estimate the contribution of chemical-specific deposition to surface soil concentrations at each receptor location based on a 20-year operating lifespan of the

Emerald Facility. For the deposition of metals, a unitary model for particle deposition was prepared using the AERMOD Deposition Algorithm as described in Section 6.10. Method 1.

The particle fraction attribution was used for the deposition runs only. The annual deposition results from this unitary model were then multiplied by the respective emission rates at each expansion phase to determine the overall g/m2 annual deposition for each metal.

Gas deposition for each gaseous containment of concern was modelled using the estimated emission rate from Phase s 1 to 3, and gas deposition parameters including pollutant diffusivity in air (cm2/s), pollutant diffusivity in water (cm2s), cuticular resistance (s/cm), and Henry's Law Constant (Pa-m3/mol) obtained from the 'Deposition Parameterizations for the Industrial Source Complex (ISC3) Model' (Wesely et al., 2001) for each pollutant of concern accordingly.

The deposition results are documented and discussed further in the Human Health Risk Assessment Report (Intrinsik, July 2024).

Models for Frequency Analysis

In addition, GHD generated raw concentration data for the frequency analysis used in the HHRA Report. For each pollutant of concern, data sets were compiled for 1-hour averaging (43824 data points), 24-hour averaging (1826 data points), and annual averaging (5 data points) for both the worst-case community receptor and worst-case residential receptors for Phase 1, Phase 2, and Phase 3 expansion, respectively. This data was used by Intrinsik in the Human Health Risk Assessment Report.

7. Air Quality Impact Assessment

7.1 Predicted Cumulative Concentrations

The AERMOD model provided the highest predicted contaminant concentrations, for the applicable averaging periods, for the existing condition, and the Phase s 1 to 3 expansions.

To establish concentrations for 10 minutes and 0.5 hours, the 1-hour concentration was used, along with the appropriate conversion factor as outlined in the Air Dispersion Modelling Guideline for Ontario (ADMGO) (MECP, 2016). For pollutants with annual averaging, the maximum concentration for each year from 2017 to 2022 was obtained from the model, and the highest values was selected.

For the determination of the concentration at the worst-case location off-site, meteorological anomalies were excluded per the ADMGO. This involves the removal of the highest 24-hour concentration in each single meteorological year for pollutants with 24-hour averaging period and the removal of eight hours for the highest 1-hour average predicted concentrations in each meteorological year for pollutants with 1 hour or 8 hour averaging periods. The January 2024 version removed 8 meteorological anomalies per year for the 8-hour averaging period. The report has been revised to only discard a single 8-hour period per year.

Cumulative concentrations for all contaminants were obtained by adding the AERMOD results to the ambient air background concentrations in Appendix D. It is noted that for some compounds that were modelled, there are no ambient air background concentrations. These compounds were not detected in the stack testing but are modelled at laboratory detection level, and the potential background concentrations of these compounds are assumed to be negligible.

Data tables summarizing the results of the dispersion modelling, including the cumulative concentrations with background, are provided in Appendix E, Dispersion Modelling Results Tables. For each pollutant, the cumulative concentrations for the existing conditions and the expansion Phase s 1 to 3 are presented in Appendix E. Tables E.1

through E.5. Any predicted exceedances of air quality criteria are highlighted in red, and are discussed below in more detail.

The tables in Appendix E provide the “worst-case receptor” and “worst-case sensitive receptor” concentrations. The worst case receptor is any location outside the Facility property, as determined by the modelling grid concentration results. The maximum concentrations for the worst-case receptor occurred very close to the Facility property line for all of the AERMOD model runs. The maximum concentrations for the worst-case sensitive receptor are always much lower than the maximum worst-case receptor concentrations and the maximum sensitive receptor concentrations occurred at a sports field located 590 metres southwest of the Facility for all of the AERMOD model runs.

As Phase 3 will have three stacks operating and a processing capacity of 900,000 tons per annum, it represents the worst-case future operating conditions. Phase s 1 and Phase 2, with considerably lower emission rates, will have lower concentrations predictions than Phase 3.

7.1.1 Current Maximum Operating Conditions

Tables E.1 and E.2 in Appendix E present the cumulative concentrations for the current maximum operating conditions scenarios. The contaminants which are predicted to exceed their associated criteria are as follows:

Benzo(a)pyrene (annual, 24-hr): The Ontario 24-hour AAQC for BaP is 0.00005 ug/m^3.and the annual AAQC is 0.00001 ug/m^3. There are no federal criteria. The estimated background concentration for BaP is 183.43% of the annual criteria and 210.88% of the 24-hour criteria. The background BaP concentrations are based on data from the federal NAPS monitoring stations near Emerald. The cumulative BaP concentrations at the worst-case receptor are 183.79% and 212.14% of the criteria for annual and 24-hour averaging periods, respectively (see Table E.1). These exceedances are predominantly attributed to the background BaP concentrations.

Nitrogen Dioxide (1-hr, where Main Stack is operating at the maximum approved capacity (182,000 tpa) plus a 5.2MW gas turbine generator):

The Ontario 1-hour standard for NO_2 is 400 µg/m^3 and the federal CAAQS is 79 µg/m^3. The cumulative concentration of NO_2 at the worst-case receptor is below the Ontario criteria and is 193.26% of the CAAQS (see Table E.2). When assessing the worst-case sensitive receptors, the maximum NO_2 concentration decreases below the CAAQS criteria. Note that the occurrence of the scenario where both the main stack and the gas turbine generator operate simultaneously is unlikely as the gas turbine generator typically functions at a much lower capacity than its maximum.

7.1.2 Maximum Operating Conditions for Expansion Phases

Tables E.3 to E.5 present the cumulative concentrations for the future expansion Phases 1, 2 and 3 respectively.

The contaminants which are predicted to exceed their associated criteria in one or more of the future expansion phases are as follows:

Benzo(a)pyrene (annual, 24-hr): The Ontario 24-hour AAQC for BaP is 0.00005 ug/m^3.and the annual AAQC is 0.00001 ug/m^3. There are no federal criteria. The estimated background concentration for BaP is 183.43% of the annual criteria and 210.88% of the 24-hour criteria. The background BaP concentrations are based on data from the federal NAPS monitoring stations near Emerald. The cumulative BaP concentrations at the worst-case receptor are 184.69% and 214.67% of the criteria for annual and 24-hour averaging periods, respectively (see Table E.5). These exceedances are predominantly attributed to the background BaP concentrations, whereas emissions from the Emerald’s stacks contribute to less than 4% of the criteria.

Nitrogen Dioxide (1-hr): The Ontario 1-hour standard for NO_2 is 400 µg/m^3 and the federal CAAQS is 79 µg/m^3.

The results for the Phase 1 expansion indicate compliance with the Ontario and CAAQS criteria for NO_2 (see Table E.3). In Phase 2, the NO_2 maximum concentrations are below the Ontario criteria and have an exceedance of the CAAQS criteria at the worst-case receptor (see Table E.4). The cumulative concentration of NO_2 for the Phase 3 expansion at the worst-case receptor is approximately 25% of the Ontario criteria and approximately 129% of the federal CAAQS criteria (see Table E.5).

CAAQS were not developed as Facility level regulatory standards (CCME, 2019). Consequently, provinces interpret CAAQS as regional criteria rather than Facility-specific criteria. For example, Ontario and Alberta currently has NO_2 criteria that exceed the CAAQS for both hourly and annual averaging periods.

7.2 Cumulative Frequency Analysis for Nitrogen Dioxide

As shown in Table E.5, the predicted NO_2 cumulative worst-case concentrations never exceeds the Ontario 1-hour NO_2 criteria of 400 ug/m^3, however there is a predicted exceedance of the federal CAAQS of 79 µg/m^3.

A cumulative frequency analysis was conducted to estimate the potential exposure for the 1-hour averaged NO_2 concentrations for the worst-case receptor for the Phase 3 expansion, which is the worst-case emissions scenario.

As shown in Figure 9, the Phase 3 NO_2 emissions result in a slight increase in overall NO_2 concentrations at the worst-case receptor over a five-year period, with only 138 of the 43,826 hours (0.32%) analyzed indicating a potential CAAQS exceedance. Additionally, given that the background concentration was estimated by obtaining the 90th percentile data, and that the Emerald stack emissions have been assumed to be 100% NO_2 when in fact the stack gas is 98% NO, is reasonable to estimate that the expansion of the Emerald Facility will not result in a significant number of NO_2 exceedances of the federal CAAQS. This could be confirmed by future ambient air monitoring.

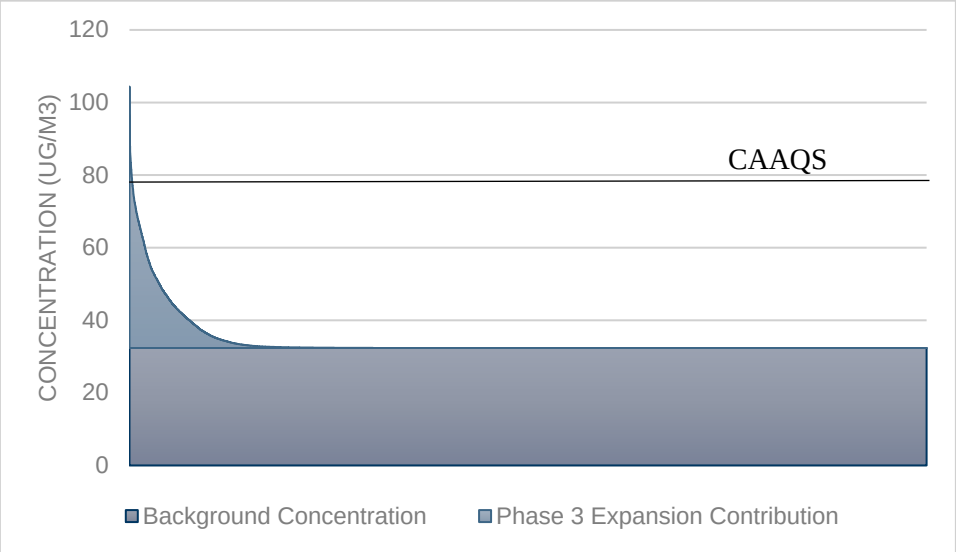


Figure 9 Frequency Analysis of Cumulative 1-hr NO_2 Concentrations

7.3 Comparison of Existing and Expanded Facility

A comparison the modelling results from the existing maximum operation scenarios and the future Phase 3 expansion, which is the worst case emissions scenario, is presented in Appendix F, Comparison of Existing Facility and Phase 3 Expansion.

Despite an overall increase in emissions due to the higher processing capacity from Emerald's expansions, the cumulative ambient air concentrations at both the worst-case off-site and worst-case sensitive receptors consistently remain well below ambient air quality criteria for most of the contaminants of concern as shown in Tables E.1 to E.5 in Appendix E. Instances of exceedance are limited and attributed to existing background concentrations as discussed in Section 7.1.

It is estimated that air emissions from the expansions scenarios will have a minimal air quality impact for the following reasons: (1) The selection of higher stacks (70 m versus the existing 46 m) for the expanded Facility to enhance contaminant dispersion. (2) Emerald's commitment to adopting lower in-stack emission limits for the new units. (3) Many pollutants are emitted in negligible amounts (below detection limits) during the waste incineration process, as

indicated in previous annual source tests, and it is not expected that the increased capacity will result in any significant increase in emissions of these compounds. This could be confirmed by future ambient air monitoring.

7.3.1 Contaminants with Notable Predicted Increases in Concentrations (above 200%)

The following contaminants have predicted increases in maximum modelled concentrations above 200%:

Sulphur Dioxide (10-minute,1-hour, Annual): The percent increases in concentrations at the worst-case receptor are 271.10%, 330.04% and 330.04% for annual, 1-hour and 10-minute averaging periods, respectively (see Table F.1). However, the Phase 3 cumulative concentration at the worst-case receptor is 9.61%, 21.01%, and 19.45% of the annual, 1-hour and 10-minute project criteria.

Cadmium (24-hour): The percent increase in concentrations at the worst-case receptor is 202.09% for the 24-hour averaging periods (see Table F.1). However, the Phase 3 cumulative concentration at the worst-case receptor is 15.58% of the 24-hour project criteria.

Mercury and Mercury (as Hg) – (24-hour): The percent increases in concentrations at the worst-case receptor for mercury and mercury (as Hg) is 4962.38% (see Table F.1). However, the Phase 3 cumulative concentration at the worst-case receptor is 0.29% and 1.16% for mercury and mercury (as Hg), respectively.

The following contaminants have an 206.17% increase in concentration at the worst-case receptor. However, the Phase 3 cumulative concentrations at the worst-case receptor for all the contaminants are well below the project criteria (see Table F.1).

Table 9 Pollutants with an 206.17% Increase in Concentration

2,6-Dichlorophenol	3,4,5-Trichlorophenol	7H-Dibenzo(c,g)carbazole
2,4/2,5-Dichlorophenol	2,3,4,6-Tetrachlorophenol	Polychlorinated Biphenyls (PCBs) (24-hour)
3,5-Dichlorophenol	2,3,4,5-Tetrachlorophenol	Hexachlorobenzene
2,3-Dichlorophenol	Pentachlorophenol	Acrolein (1-hour, 24-hour)
3,4-Dichlorophenol	1,3,5-Trichlorobenzene	Acetaldehyde (0.5-hour, 24-hour)
2,4,6-Trichlorophenol	1,2,3-Trichlorobenzene	Formaldehyde
2,3,6-Trichlorophenol	1,2,3,5/1,2,4,5-Tetrachlorobenzene	Hydrogen Fluoride
2,3,5-Trichlorophenol	1,2,3,4-Tetrachlorobenzene	Isopropylbenzene
2,4,5-Trichlorophenol	Pentachlorobenzene	Chlorodibromomethane
2,3,4-Trichlorophenol	Hexachlorobenzene	

8. Additional Air Quality Considerations

8.1 Ozone Formation

While Emerald does not directly generate ozone as a byproduct of its operations, ozone is produced as a secondary pollutant through the chemical reaction of NO_x and VOCs in the presence of sunlight. Although the expected levels of NO_x and VOCs are not anticipated to impact regional ozone levels, a high-level, conservative screening assessment was still completed to understand the potential impact of Emerald's operations on ozone levels. For this purpose, the methodology described in the *'Guidance on the Development of Modeled Emission Rates for Precursors (MERPs) as a Tier 1 Demonstration Tool for Ozone and PM2.5 under the PSD Permitting Program*' (US EPA, April 2024) was

used, considering some conservative assumptions. The assessment showed that no potential impact is expected due to emissions from the operations. Below is a summary of the methodology and assumptions used for the assessment.

Photochemical modelling results from a representative source, as included in the US EPA methodology, were applied to the operations to estimate its ozone emission rates. Canadian sites are not included in the US EPA's MERP ozone guidance document. Therefore, the modelled results from the closest and most geographically representative site, Marquette, Michigan (Upper Midwest), were used to assess the ozone impacts from Emerald's facility. The Marquette facility is considered climatically similar to Emerald's facility because it is situated in a neighbouring state and adjacent to a large water body. Since multiple hypothetical sources were modelled at this location with an elevated release, the source with the most conservative MERP was selected for comparison with the Facility. The Facility's ozone impact was determined using the normalized emission rate for a stack with the closest stack height at the Marquette, Michigan site. The expanded Emerald facility has three stacks, each 70 meters tall. The MERP listed for a 90-meter stack in Table 10 is the most representative.

Table 10 MERPS Selected from US EPA's Methodology

State	County	Metric	Precursor	Emission Rate (tpy)	Stack Height (m)	Modelled Concentration (ppb)	Normalized Emission Rate (tpy/ppb)
Michigan	Marquette	8-hr Ozone	NO_x	500	90	0.522304	957.30
Michigan	Marquette	8-hr Ozone	VOC	500	90	0.317085	1560.01

Sample Calculation: Ozone Impact from Main Stacks for Phase 3 Plant Expansion:

$$Impact_{Ozone} = \frac{Emerald\ Emission\ Rate_{NOx}\ (typ)}{Normalized\ Emission\ Rate_{Marquette,NOx}\ (typ/ppb)} + \frac{Emerald\ Emission\ Rate_{VOC}\ (typ)}{Normalized\ Emission\ Rate_{Marquette,VOC}\ (typ/ppb)}$$

$$Impact_{Ozone} = \frac{797.08}{957.30}\ ppb + \frac{8.42}{1560.01}\ ppb = 0.84\ ppb$$

The absolute emissions would have an impact of 84%. A value less than 100% indicates that the O_3 significant impact levels (SIL) would not be exceeded. Thus, the project level O3 impacts associated with both NO_X and VOC precursor emissions from this source would be expected to be below the EPA recommended 8-hour O_3 SIL.

8.2 Truck Traffic and Idling

8.2.1 Truck Traffic

Trucks are used to transport waste to the Facility and transport out ash. These trucks are expected to emit air pollutants such as NO_x, PM, CO, SO_2, and VOCs resulting from fuel combustion.

Despite the increase in truck trips resulting from the Emerald's expansion, it is essential to recognize that the trucks will be used for transporting materials from Emerald are not newly introduced. They are already actively traveling on nearby roads for their unloading trips to southwestern Ontario or Michigan, contributing to the emissions of air pollutants in the region. As a result, the increase in truck trip generation does not necessarily translate to an overall increase in on road air emissions in the study area. By managing waste at Emerald instead of alternative disposal locations, which are likely further away, a part of transportation related emissions is avoided.

According to the Traffic Assessment Report (GHD, January 2024), the proposed expansion of the Facility has a marginal impact on the operation of the nearby intersections with the capacity issues identified at the Facility access and the access to 7653-7639 Bramalea Road resulting predominately from the increase in corridor growth along Bramalea Road. This assessment is based on detailed road capacity and traffic analysis that covers (1) Bramalea

Road and the Highway 407 Westbound Off-Ramp, (2) Bramalea Road and the right-in site access, and (3) Bramalea Road and the full-moves site access/private access. Therefore, there is not expected to be any truck traffic congestion. Truck air emissions are deemed directly proportional to driving distance, which remains relatively consistent, assuming all trucks are travelling on nearby roads, just to a different destination.

The continuous movement of truck traffic in and out of the facility is likely to contribute to particle emissions from tire and brake wear. The California Air Resource Board (CARB)[2] resource states that vehicle-level brake wear PM emission rates can range from 3.3 to 13.6 mg/mile, which is insignificant when compared to the overall emissions generated by the trucks or the Facility itself.

Similarly, idling time is expected to show no significant difference based on the findings of the traffic study. Emissions from truck idling and truck traffic on-site is further analyzed in section 8.2.2 and 8.2.3, respectively

8.2.2 Truck Idling

Truck idling emissions are dependent on the quantity of trucks, unloading times, truck mix and receiving capacity. The following table shows the number of trucks and unloading capacity for truck mixes ranging from 100% tractor trailers to 100% straight trucks.

Table 11 Truck Trips

TRUCK MIX		TRUCKS		UNLOADING	
Tractor	**Straight**	**Avg Wt**	**Arrivals**	**Time**	**Capacity**
Trailers	**Trucks**	**(t)**	**(ea/hr)**	**(min)**	**(Trucks/hr)**
100%	0%	34	16	19	28
90%	10%	31.6	17	18	30
80%	20%	29.2	19	17	32
70%	30%	26.8	20	16	34
60%	40%	24.4	22	15	36
50%	50%	22	25	14	39
40%	60%	19.6	28	13	42
30%	70%	17.2	32	12	45
20%	80%	14.8	37	11	49
10%	90%	12.4	44	10	54
0%	100%	10	54	9	60

As seen in Table 11, there will be a maximum of 16 to 54 trucks per hour. It was conservatively estimated that Phase 3 will have a truck volume of 54 trucks per hour, Phase 2 will have 36 trucks per hour, and Phase 1 will have 18 trucks per hour. Two conservative assumptions were used to calculate the maximum number of trucks per hour for the Phase 3 modelling scenario, as follows:

1- Truck arrivals were calculated based on a conservative peak daily receipt for Phase 3 of 6,535 tonnes over 12 hours, which is 2.4 times the maximum design combustion capacity of Phase 3 (2,700 tonnes per day based on 37.5 tonnes per hour per combustor at 24 hours per day)

[2] Brake and Tire Wear Emissions - Project 17RD016 (February 2021), prepared by Eastern Research Group, for the California Air Resources Board (CARB)

2- All trucks received at the Facility were assumed to be straight trucks, which maximizes the truck traffic.

GHD has used the 54 trucks per peak hour to calculate emissions from the following two truck emission activities: truck idling inside the reception hall, and on-site truck traffic.

Truck Idling Inside the Reception Hall

There is a potential for truck idling emissions to occur within the tipping bay while trucks are unloading the payload. The negative pressure system, used to control odour emissions in the tipping bay, will also collect truck idling emissions. Air from the negative pressure system is routed to the incinerators and emitted through the incinerator stacks.

BaP, PM and NOx emissions from trucks idling inside the Reception Hall were considered. The emissions of PM and NOx from truck idling are about 0.8% and 1% of the main stack emissions respectively, as shown on Tables E.5 (Phase 3), E.4 (Phase 2) and E.3 (Phase 1).

All truck idling emissions are captured by the air pollution control system (APC) system because the Reception Hall is under negative pressure, exhausted through the APC. The APC ensures compliance within stack emission limits per Ontario A7 guideline. The emissions of PM and NOx from the APC/main stacks are conservatively based on in-stack concentration limits. The in-stack concentration limits for PM and NOx are based on those used by the EU and DYEC respectively, which are both lower than the Guideline A-7 limits. Adding PM and NOx emissions from idling trucks in the Reception Hall will not change the estimated maximum PM and NOx emission estimates from the stacks since these emission estimates are based on in-stack limits. Therefore, there are no changes to the estimated maximum off-site concentrations in the dispersion modelling due to the addition of idling trucks in the Reception Hall.

BaP truck idling emissions were calculated using US EPA's MOtor Vehicle Emission Simulator (MOVES) data and were added to the main stack emissions, conservatively assuming that there is no removal of the BaP from the truck emissions by the APC. Refuse trucks are included in the BaP MOVES dataset; however, the emission factor query returned values of zero. Instead, single-unit short and long-haul trucks (the closest equivalents) were used, and the emission factors were averaged between the two. The emission factor is measured in g/VKT. The dataset used for the MOVES model can be found in Appendix J.

Conservative NOx and PM truck idling emission rates were calculated based on truck volume and US EPA emission factors for heavy-duty diesel vehicles (US EPA-F-98-014), with a gross vehicle weight (GVW) of over 8,500 lbs. Sample calculations are provided below.

Sample Calculation: NO_X Truck Idling Emission Rate (1-hr averaging period) from Main Stacks for Phase 3 Plant Expansion:

$$ER_{truck,NO_X} = number\ of\ trucks\ in\ one\ hour\ \times \frac{g\ NO_X}{hour\ \times truck} \times \frac{1\ hr}{3600\ seconds} \times \frac{19\ minutes\ of\ idling}{60\ minutes}$$

$$= 54\ trucks\ \times 56.7\ \frac{g\ NO_X}{hour\ \times truck} \times \frac{1\ hr}{3600\ seconds} \times \frac{19\ minutes\ of\ idling}{60\ minutes}$$

$$= 2.72\ \times 10^{-1}\ \frac{g}{s}$$

Sample Calculation: NO_X Truck Idling Emission Rate (24-hr averaging period) from Main Stacks for Phase 3 Plant Expansion:

$$ER_{truck,NO_X} = number\ of\ trucks\ in\ one\ hour\ \times \frac{g\ NO_X}{hour\ \times truck} \times \frac{1\ hr}{3600\ seconds} \times \frac{19\ minutes\ of\ idling}{60\ minutes} \times \frac{16\ hours\ of\ operation}{24\ hours}$$

$$= 54\ trucks\ \times 56.7\ \frac{g\ NO_X}{hour\ \times truck} \times \frac{1\ hr}{3600\ seconds} \times \frac{19\ minutes\ of\ idling}{60\ minutes} \times \frac{16\ hours\ of\ operation}{24\ hours}$$

$$= 1.81\ \times 10^{-1}\ \frac{g}{s}$$

8.2.3 On-site Truck Traffic

BaP, PM and NOx tailpipe emissions from trucks driving on site at 25 kilometers per hour were calculated using emission factors developed with the USEPA MOVES model (see Appendix J). The figure below illustrates the road used to deliver waste to the tipping hall. The trucks travel 712 m roundtrip: 493 km from the entrance to the tipping hall, and 219 km from the tipping hall to the exit. The on-site road was modelled as a line volume source in AERMOD.

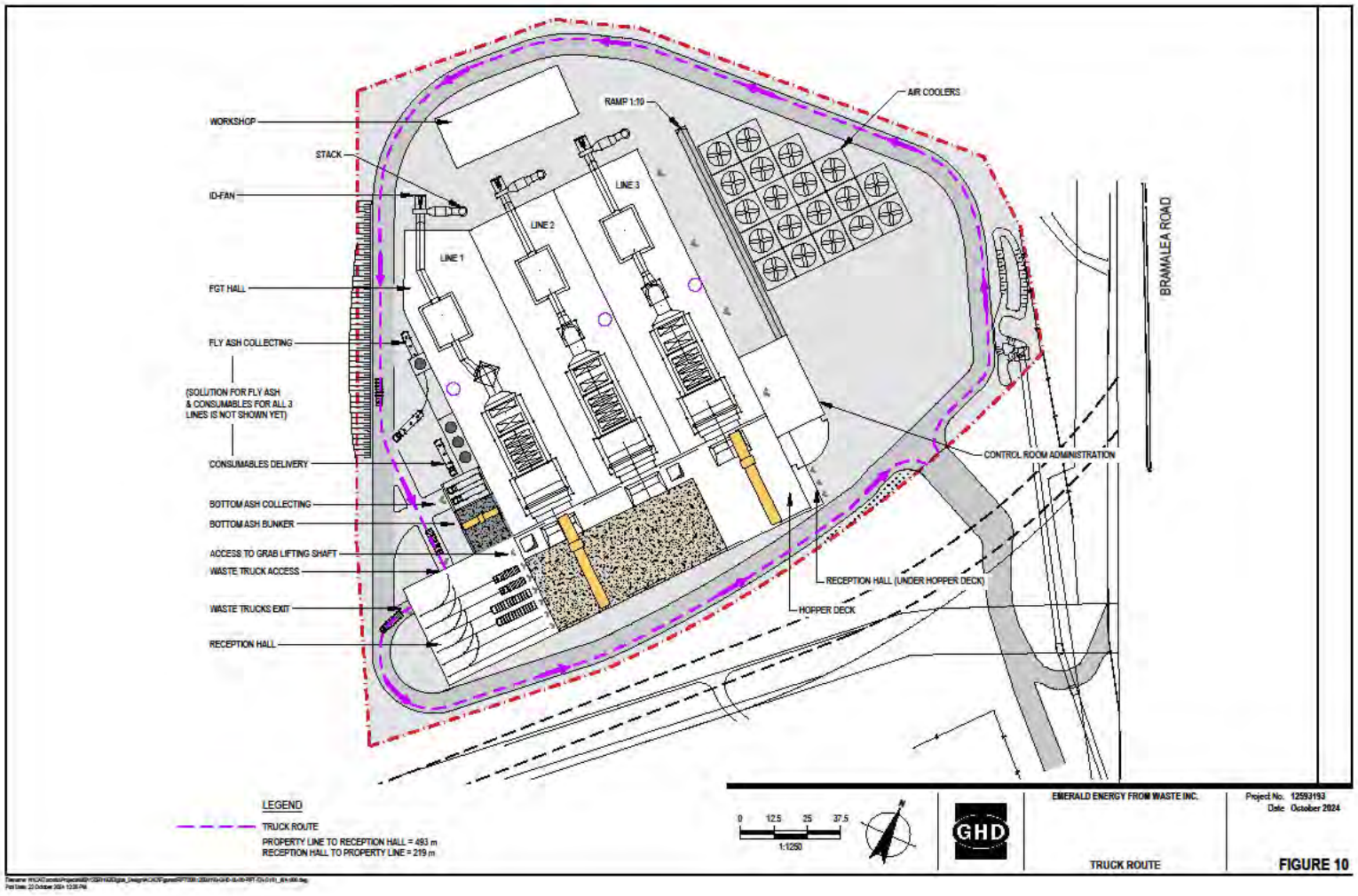


Figure 10 Haul Roads for Refuse Trucks Travelling On-Site

Tables E.5 (Phase 3), E.4 (Phase 2) and E.3 (Phase 1) present the emissions from on-site truck traffic for BaP, PM and NOx. The emissions of BaP, PM and NOx from truck traffic tailpipe emissions are about 0.01%, 0.02% and 0.07% of the main stack emissions respectively.

Truck traffic emissions were added to the total Facility emissions and modelled in AERMOD. The predicted maximum off-site concentrations of BaP, PM and NOx did not change materially because the truck emissions are relatively insignificant in comparison to the combustor emissions.

8.3 Dust

8.3.1 Dust from Construction and Demolition

Dust emissions resulting from construction activities may have a temporary impact on local air quality, especially during land clearing, ground excavation, and equipment traffic. These emissions are expected to be localized to the construction area and confined to the days when construction activities are ongoing potential change to truck routes and installation of barriers or berms are considered for dust mitigation.

Emissions from the construction associated with the Emerald expansion are anticipated to be in line with the emissions from construction activities of a similar scale. Best Practices will be implemented for reducing dust emissions during construction and demolition. During dry and windy conditions especially, water application and non-chloride suppressants are expected to be applied to effectively mitigate dust emissions.

Dust generated during Facility operations is considered negligible, given that material loading and unloading take place within enclosed buildings. In addition, the roads within the Emerald Facility are paved, and therefore road dust emissions can be considered as negligible per Section 7.4 of the MECP ESDM procedure document.

A Best Management Practice Plan will be developed following the completion of the detailed design of the Facility. This plan aims to minimize odour emissions and impact to the surrounding community and environment during Facility's regular operations, start-up, shutdown, and process upsets.

8.3.2 Fugitive Dust Emissions During Operation

Fugitive dust emissions may occur during the handling of fine-grained materials being delivered to or removed from the Facility or from operations at the Facility. Fugitive dust emissions could arise from the handling of lime, powder activated carbon, APC residue, fly ash and bottom ash.

Materials being delivered to the Facility (lime and powdered activated carbon) will be managed in sealed pneumatic systems to prevent fugitive emissions. Truck unloading will be directly supervised by the driver following unloading procedures developed by Emerald.

The APC residue and fly ash will also be managed using a pneumatic system. Pneumatics will be used to transfer the dust from the baghouse to storage silos and from the storage silos to trucks for removal from the Facility. The truck loading system will be designed to direct the air back into the silo to prevent fugitive dust emissions. Truck loading will be directly supervised. If any material is spilled during unloading, it will be swept or vacuumed to prevent tracking.

The bottom ash will typically be moist and not contribute to fugitive dust emissions. However, to prevent dust emissions from bottom ash as it dries, all bottom ash handling will be restricted to within the processing building. Trucks will be loaded using a crane system and be covered when they leave the Facility. Any ash that is dragged out of the loading area will be swept to prevent tracking.

The control of fugitive emissions, including sweeping of spilled materials and ash, will be documented in a Fugitive Dust Best Management Practices Plan (FDBMP). The FDBMP will document the methods and procedures to minimize and control fugitive dust.

8.4 Odour

Emerald's operation includes processing solid, non-hazardous residential, industrial, commercial, and institutional waste. Emerald Facility has not received any odour complaints in the past 10 years. Given its comparable design and management practices, the Facility expansion is not expected to result in a significant adverse odour impact to the ambient air outside the Facility's property.

Potential sources of odor emissions linked to Emerald's core operations include:

– Truck transportation for waste
– Waste handling and storage
– Waste Processing

Truck Transportation

There is minimal odour potential as trucks drive around the exterior of the Facility. As the truck will be enclosed before any loading/unloading activities, the odour will be comparable to those from a garbage truck on a residential street.

Waste Handling and Storage

Currently, odours are not an issue outside the Facility building, and a similar design approach will be adopted for the expansions. Line 1 will involve the construction of a new enclosed tipping hall with 6 unloading bays. For the Phases 2 and 3 expansions, lines 2 and 3, a second tipping hall with 5 unloading bays will be built on the eastern side of the plant, connecting to the bunker constructed for line 1. The enclosed tipping halls are under negative pressure, maintained even when the doors are opened for truck delivery, to ensure that odours are contained within the building and not released to offsite locations.

Waste Processing

The Facility design includes drawing combustion air for the incinerator from the waste bunker to avoid odours, thereby reducing the potential for fugitive odours escaping the building.

The odour emissions from the main stack are not expected to be significant, as the gas goes through the incineration process, reaching temperatures up to 1000°C, is designed to ensuring complete destruction of organic matter. Subsequently, the gases go through various air pollution control equipment, including scrubbers, to further reduce pollutant levels.

This has been validated through dispersion modeling, where all applicable contaminants, including those with odour-limiting effects from the Emerald stack, were modeled and demonstrated compliance with ambient air quality criteria, as discussed in previous sections.

A Best Management Practice Plan for odour will be developed at the ECA permitting stage for MECP review. This plan aims to minimize odour emissions impact to the surrounding community and environment during Facility's regular operations, start-up, shutdown, and process upsets.

8.5 Light Pollution

There will be additional trucks on-site at night, however, this is negligible compared to the overall traffic volume on nearby Highway 407, Highway 15, and Bramalea Road. It is also important to acknowledge that the trucks used to transport materials to/from Emerald are not newly introduced; they are already actively traveling on nearby roads.

The Facility expansion is not anticipated to introduce many outdoor lighting fixtures.

In addition, given the considerable distance and the use of surrounding area, it is not expected that the construction and operation of the expanded Emerald Facility will contribute significantly to light pollution to the community. The Facility is surrounded by open space, and commercial and industrial areas with existing night lighting. Moreover, the

nearest sensitive receptors are located 590 m away at a sports field, while the closest residential building is an apartment complex on Bramalea Road, approximately 1390 m away from Emerald.

9. Greenhouse Gas Emissions Assessment

Emerald is subject to Ontario Regulation 390/18 (O. Reg. 390/18) and Environment Canada's Greenhouse Gas Reporting Program (GHGRP). GHG quantification for Emerald covers emissions from the following:

– Electricity Generation, Biomass Fuels (Biomass CO_2)
– Electricity Generation, Non-Biomass Fuels (CO_2, CH_4, N_2O)
– Natural Gas and Diesel Stationary Combustion (CO_2, CH_4, N_2O)
– On-site transportation (CO_2, CH_4, N_2O).

9.1 GHG Emissions from Emerald

For the existing Facility, the primary source of emissions is from electricity generation through the combustion of municipal solid waste (MSW), from both biomass and non-biomass combustion. The total emissions of CO_2, CH_4, and N_2O from the electricity generation are calculated based on the steam generation quantity (assuming 98% originates from MSW), the Boiler's design-rated input/output capacity (in GJ/tonne of steam), and the emission factors (g/GJ) for Municipal Solid Waste from the Western Climate Initiative (WCI) Guidance. Additionally, a 44% removal efficiency from the selective catalytic reduction (SCR) system is applied to N_2O emissions.

The allocation of the Biomass CO_2 and the CO_2 from non-biomass combustion are based on quarterly radiocarbon (C14) reports, which report quarterly '% Biogenic Carbon' that indicates carbon from 'renewable' (biomass or animal by-product) sources versus petroleum (or otherwise fossil) sources. For reference, 100% Biogenic Carbon indicates that a material is entirely sourced from plants or animal by-products and 0% Biogenic Carbon indicates that a material did not contain any carbon from plants or animal by-products. Note that CO_2 emitted from the combustion of biomass is not included in the 'reporting amount' for Ontario and Federal GHG reporting program.

Additional GHG emissions are emitted as a result of using natural gas for stationary combustion at Building 2 and the Auxiliary Boiler, as well as for electricity generation through Selective Catalytic Reduction (SCR), incinerators, and the Gas turbine generator. In addition, diesel gas is predominantly used for on-site transportation, with a minor portion dedicated to stationary diesel combustion. These GHG emissions are determined by fuel consumption quantity, carbon content of the fuel (for CO2 emissions from Natural Gas), high heating values, and CH_4 and N_2O emission factors outlined in Canada's Greenhouse Gas Quantification Requirements for 'industrial' and 'electricity utilities'.

As each GHG has a unique atmospheric lifetime and heat-trapping potential, GHG emissions are converted to carbon dioxide equivalent (CO_2e) amount based on the 100-year global warming potentials (GWP), as specified under O. Reg. 390/18 and the GHGRP.

The waste processing rates and GHG emissions reported to the federal program are presented in In certain years, the GHG emissions reported under the federal program are higher than those reported in Ontario due to slight difference in requirements for reporting on-site transportation. Generally, numbers in the Federal Program tend to be higher, and therefore used for further comparison and proration. In general, the combustion of one ton of municipal waste releases about one ton of CO2.

In certain years, the GHG emissions reported under the federal program are higher than those reported in Ontario due to slight difference in requirements for reporting on-site transportation. Generally, numbers in the Federal Program tend to be higher, and therefore used for further comparison and proration. In general, the combustion of one ton of municipal waste releases about one ton of CO_2.

Table 12 GHG Emissions from Emerald's Existing Facility from 2018-2022

Reporting Year	Annual Waste Processed (tonnes)	Total GHG Emissions (tonnes CO2e)	Total Reportable Emissions (excluding Biomass) (tonnes CO2e)
2018	151,096	142,610	**83,948**
2019	148,097	140,199	**82,615**
2020	151,096	148,331	**91,115**
2021	142,561	156,732	**95,820**
2022	141,865	145,477	**92,015**

The expansion of Emerald will lead to increased GHG emissions due to the higher waste processing capacity. For the Facility expansion, it is assumed that GHG emissions will be directly proportional to the waste processing rate. GHG emissions are calculated based on the average GHG-to-waste processed ratio from 2018 to 2022, prorated to 300,000 tpa, 600,000 tpa, and 900,000 tpa for Phase 1, Phase 2, and Phase 3, respectively. Actual GHG emissions are expected to be lower, as the expanded Facility will no longer actively use the auxiliary boiler and gas turbine generator on-site.

Table 13 below presents the estimated GHG emissions resulting from Emerald's expansion:

Table 13 Estimated Emerald Greenhouse Gas Emissions from Expansion Phase s 1-3

Phase	Waste Processed Rate (tpa)	Estimated Total GHG Emissions (tonnes CO2e)	Estimated Total Reportable Emissions (excluding Biomass) (tonnes CO2e)
Existing (Average from 2018-2022)	145,904.75	146,669.8	**89,102.6**
Phase 1 (2029)	300,000	301,573.05	**183,207.06**
Phase 2 (2029-2034)	600,000	603,146.09	**366,414.12**
Phase 3 (2029-2034)	900,000	904,719.14	**549,621.17**

9.2 Contribution to Overall Canada and Ontario Emissions

To benchmark Emerald's GHG emissions against the broader context of Canada and Ontario, the total GHG emissions from Ontario and Federal from 2017 to 2021, were obtained from the 'National Inventory Report: Greenhouse Gas Sources and Sinks in Canada.', as shown in Table 14:

Table 14 Greenhouse Gas Emissions for Ontario and Canada (2017-2021)

Year	Ontario Total CO2e (kt CO2 eq)	Canadian Total CO2e (kt CO2 eq)
2017	156,146,000	712,232,000
2018	162,866,000	724,615,000
2019	163,252,000	723,679,000
2020	146,567,000	658,788,000
2021	150,562,000	670,428,000
Average	**155,878,600**	**697,948,400**

The percentage contribution of Emerald's existing and projected operations to Provincial and Federal greenhouse gas GHG emissions was calculated and is presented below in Table 15. The calculation was derived from the Estimated

Total Reportable Emissions as shown in Table 13, divided by the average total GHG emissions for Ontario and Canada, as presented on Table 15 respectively:

Table 15 Annual GHG Contribution from Emerald

Phase	% Contribution to Ontario GHG Emissions	% Contribution to Federal GHG Emissions
Existing (Average from 2018-2022)	0.057%	0.013%
Phase 1 (2029)	0.118%	0.026%
Phase 2 (2029-2034	0.235%	0.052%
Phase 3 (2029-2034)	0.353%	0.079%

As shown in Table 15, when compared to provincial and federal total GHG emissions contributions, the Facility's percentage contribution remains marginal, indicating its limited impact on overall GHG emissions.

9.3 Potential GHG Emissions Reductions

In addition, while the emissions from Emerald increase accordingly with the increasing of waste processed, this project also contributes to the reduction and avoidance of greenhouse gas (GHG) emissions in the following aspects:

– Potentially reduce GHG emissions from truck transportation:
  - As Emerald is located in an urban area surrounded by industrial, commercial, residential areas, and an airport, it is expected that the truck distance to Emerald will be shorter than transporting the same waste to landfills. The increase in Emerald's capacity will redirect waste and has the potential to reduce truck trips, resulting in a decrease in GHG emissions associated with waste transportation.
– Avoid CH_4 Emissions generated from the Landfill Operations
  - By diverting waste from landfills, Emerald also avoids CH4 emissions associated with landfill operations., Landfills emit CH_4, which has a 28 times 100-year Global Warming Potential compared to CO_2, per the Fifth Assessment Report of the International Intergovernmental Panel on Climate Change. According to 'Reducing methane emissions from Canada's municipal solid waste landfills' (ECCC, 2022), waste management approaches that prioritize waste reduction, recycling, and energy generation are preferred over landfilling in the waste hierarchy.

When considering the life cycle perspective and taking into account specific material categories processed, the net greenhouse gas (GHG) emissions from waste-to-energy facilities in some cases are lower than the GHG emissions from landfills. For example, in 'Solid Waste Management and Greenhouse Gases, A Life Cyle Assessment of Emissions and Sinks' (USEPA, 2006), the combustion option shows lower GHG emissions comparing the landfill for many types of waste materials such as food discards, mixed paper, mixed organics, and mixed metals.

Emerald is currently conducting assessments on pilot renewable energy project, including a Hydrogen Project. Additionally, there is ongoing consideration for CO_2 capture. Ramboll has provided a preliminary evaluation for CO_2 capture, using an absorption process where CO_2 is removed from the flue gas through washing in an amine scrubber. Depending on the intended destination and subsequent use, the captured CO_2 will be compressed and transported either through a pipeline or by truck.

10. Conclusions

This Air Quality Impact Assessment was conducted for the proposed expansion of the Emerald Energy from Waste Facility to increase the incineration capacity up to 900,000 tpa total. The Assessment included an evaluation of the air contaminants potentially emitted from the Facility with respect to the applicable ambient air quality criteria for both

existing and future operating conditions. In addition, evaluation of dust, odour, light pollution, and greenhouse gas emissions were included.

Emissions from the existing and expanded Emerald Facility were calculated by utilizing a combination of source testing data, in-stack emission limits, and emission factors. Subsequently, these emission estimates were modeled using the USEAP AERMOD dispersion model for both off-site grid receptors and worst-case sensitive receptors in the Study Area. Cumulative air quality concentrations at both the maximum off-site receptors and worst-case sensitive receptors were determined by adding the predicted AERMOD model concentrations to the representative background air quality concentrations documented in the Background Ambient Air Quality Assessment Report (GHD, September 2024).

The resulting cumulative air quality concentrations are conservative estimates, encompassing concentrations at the worst-case locations during the expanded Facility's operation at its maximum capacity, coupled with meteorological conditions leading to worst-case dispersion. Furthermore, it considers conservative background ambient air concentrations at the 90th percentile. The likelihood of these conditions occurring simultaneously is very low.

The Assessment demonstrated that the estimated worst-case concentrations of all potential air contaminants will be well below the applicable ambient air quality criteria for all future expansion scenarios (Phase s 1, 2 and 3), with the exception of nitrogen dioxide and benzo(a)pyrene. As discussed in Section 7.1 of this Report, the predicted air quality criteria exceedances for benzo(a)pyrene are primarily due to the estimated background air concentrations of these compounds. The contribution to the maximum ambient air concentrations of these compounds from the Facility are very small.

The predicted maximum nitrogen dioxide concentration never exceeded the applicable Ontario nitrogen dioxide concentration criteria, which is used as an indicator of good air quality. A cumulative frequency analysis showed that under very conservative assumptions, there is a very small potential (0.32% of the time) when the federal CAAQS nitrogen dioxide criteria could be exceeded.

The results of the Assessment demonstrate that the expansion of the Emerald Facility is not anticipated to have a significant impact on local air quality and greenhouse gas emissions across any of the proposed expansion phases.

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Appendices

Appendix A

Comparison of Applicable Air Quality Criteria

Table A.1

Comparison of Applicable Air Quality Criteria

Pollutant	CAS No.	Averaging Period	Ontario AAQC	Ontario Regulation 419/05 (ug/m3)					CAAQS (CCME)		Project Criteria (ug/m3)	Source of the Project Criteria (1)
			(ug/m3)	Schedule 3	ECA Schedule B	Schedule 6 POI	Benchmark	Limiting Effect	(ppb)	(ug/m3)		
			Ontario AAQC	Schedule 3 POI	ECA Schedule B	Schedule 6 POI				CAAQS		
Suspended Particulate Matter	NA-PM	24-Hour	120	120	-	-	Standard-B1	Visibility	-	-	120	Ontario AAQC
Suspended Particulate Matter	NA-PM	Annual	60	-	-	-	-		-	-	60	Ontario AAQC
Nitrogen Dioxide	10102-44-0	1-Hour	-	-	-	-	-	-	42	79.02	79.02	CAAQS
Nitrogen Dioxide	10102-44-0	1-Hour	400	400	-	-	Standard-B1	Health			400	Ontario AAQC
Nitrogen Dioxide	10102-44-0	24-Hour	200	200	-	-	Standard-B1	Health	-	-	200	Ontario AAQC
Nitrogen Dioxide	10102-44-0	Annual	-	-	-	-	-	-	12.0	22.58	22.58	CAAQS
Carbon Monoxide	630-08-0	½-Hour	-	6000	-	-	Standard-B1	Health	-	-	6000	Schedule 3 POI
Carbon Monoxide	630-08-0	1-Hour	36200	-	-	-	-	-	-	-	36200	Ontario AAQC
Carbon Monoxide	630-08-0	8-Hour	15700	-	-	-	-	-	-	-	15700	Ontario AAQC
Sulphur Dioxide	7446-09-5	Annual	10.64	10	-	-	Standard-B1	Health & Vegetation	4	10.48	10	Schedule 3 POI
Sulphur Dioxide	7446-09-5	1-Hour	106.40	100	-	-	Standard-B1	Health & Vegetation	65	170.32	100	Schedule 3 POI
Sulphur Dioxide	7446-09-5	10-minute	178.22		-	-	-	-	-	-	178.22	Ontario AAQC
Organic matter (expressed as equivalent methane)	74-82-8	24-Hour	-	37330	-	-	SL-PA-B2	Health	-	-	37330	Schedule 3 POI
Ozone	10028-15-6	1-Hour	165	165	-	-	Standard-B1	Health		-	165	Ontario AAQC
Ozone	10028-15-6	8-Hour	-	-	-	-	-	-	60	117.79	117.79	CAAQS
PM10	NA-PM10	24-Hour	50	-	-	-	-	-		-	50	Ontario AAQC
PM2.5	NA-PM2.5	24-Hour	27	-	-	-	-	-	-	27.00	27	Ontario AAQC
PM2.5	NA-PM2.5	Annual	8.8	-	-	-	-	-	-	8.80	8.8	Ontario AAQC
Aluminum	7429-90-5	24-Hour	-	12	-	-	SL-JSL-B2	Health		-	12	Schedule 3 POI
Aluminum Oxide	1344-28-1	24-Hour	120	120	120	-	Guideline-B1	Particulate		-	120	Ontario AAQC
Antimony	7440-36-0	24-Hour	25	25	-	-	Standard-B1	Health		-	25	Ontario AAQC
Arsenic	7440-38-2	24-Hour	0.3	0.3	0.3	-	Guideline-B1	Health		-	0.3	Ontario AAQC
Barium	7440-39-3	24-Hour	10	10	10	-	Guideline-B1	Health		-	10	Ontario AAQC
Beryllium	7440-41-7	24-Hour	0.01	0.01	-	-	Standard-B1	Health		-	0.01	Ontario AAQC
Boron	7440-42-8	24-Hour	120	120	-	-	Standard-B1	Particulate		-	120	Ontario AAQC
Cadmium	7440-43-9	24-Hour	0.025	0.025	-	-	Standard-B1	Health		-	0.025	Ontario AAQC
Cadmium	7440-43-9	Annual	0.005	-	-	-	-	Health		-	0.005	Ontario AAQC
Calcium	7440-70-2	24-Hour	10 (1)	-	-	-	-			-	10	Ontario AAQC
Calcium Oxide	1305-78-8	24-Hour	10	10	-	-	Standard-B1	Corrosion		-	10	Ontario AAQC
Chromium	7440-47-3	24-Hour	0.5	0.5	-	-	Standard-B1	Health		-	0.5	Ontario AAQC
Cobalt	7440-48-4	24-Hour	0.1	0.1	-	-	Guideline-B1	Health		-	0.1	Ontario AAQC
Copper	7440-50-8	24-Hour	50	50	-	-	Standard-B1	Health		-	50	Ontario AAQC
Iron	7439-89-6	24-Hour	4	4	-	-	Standard-B1	Health & Soiling		-	4	Ontario AAQC
Lead	7439-92-1	30-Day	0.2	0.2	-	-	Standard-B1	Health		-	0.2	Ontario AAQC
Lead	7439-92-1	24-Hour	0.5	0.5	-	2	Standard-B1	Health		-	0.5	Ontario AAQC
Lithium	7439-93-2	24-Hour	20	20	-	-	Standard-B1	Health		-	20	Ontario AAQC
Magnesium	7439-95-4	24-Hour	-	72	-	-	SL-MD-B2	Health		-	72	Schedule 3 POI
Magnesium oxide	1309-48-4	24-Hour	120	120	-	-	Standard-B1	Particulate		-	120	Ontario AAQC
Manganese	7439-96-5	24-Hour	0.4 (as SPM)	0.4	-	-	Standard-B1	Health		-	0.4	Ontario AAQC
Manganese	7439-96-5	24-Hour	0.1 (as PM2.5)	-	-	-	-	-		-	0.1	Ontario AAQC
Manganese	7439-96-5	24-Hour	0.2 (as PM10)	-	-	-	-	-		-	0.2	Ontario AAQC
Molybdenum	7439-98-7	24-Hour	120	120	-	-	Guideline-B1	Particulate		-	120	Ontario AAQC
Nickel	7440-02-0	Annual	0.02 (as PM10)	2	-	-	AAV	Health		-	0.02 (as PM10)	Ontario AAQC
Nickel	7440-02-0	Annual	0.04 (as SPM)	0.04	-	-	Standard-B1	Health		-	0.04 (as SPM)	Ontario AAQC
Nickel	7440-02-0	24-Hour	0.1 (as PM10)	-	-	-	-	Health		-	0.10 (as SPM)	Ontario AAQC
Nickel	7440-02-0	24-Hour	0.2 (as SPM)	2	-	-	DAV	Health		-	0.20 (as SPM)	Ontario AAQC
Phosphorus	7723-14-0	24-Hour	-	0.5	-	-	SL-MD-B2	Health		-	0.5	Schedule 3 POI
Phosphorous pentachloride	10026-13-8	24-Hour	10	10	10	-	Guideline-B1	Health		-	10	Ontario AAQC
Selenium	7782-49-2	24-Hour	10	10	10	-	Guideline-B1	Health		-	10	Ontario AAQC
Silver	7440-22-4	24-Hour	1	1	-	-	Standard-B1	Health		-	1	Ontario AAQC
Sodium	7440-23-5	24-Hour	10 (2)	10 (2)	-	-	-			-	10	Ontario AAQC
Sodium hydroxide	1310-73-2	24-Hour	10	10	-	-	Guideline-B1	Corrosion		-	10	Ontario AAQC
Strontium	7440-24-6	24-Hour	120	120	-	-	Guideline-B1	Particulate		-	120	Ontario AAQC
Tin	7440-31-5	24-Hour	10	10	-	-	Standard-B1	Health		-	10	Ontario AAQC
Titanium	7440-32-6	24-Hour	120	120	-	-	Standard-B1	Particulate		-	120	Ontario AAQC
Vanadium	7440-62-2	24-Hour	2	2	-	-	Standard-B1	Health		-	2	Ontario AAQC
Zinc	7440-66-6	24-Hour	120	120	-	-	Standard-B1	Particulate		-	120	Ontario AAQC
Silicon	7440-21-3	24-Hour	-	27	-	-	SL-PA-B2	Health		-	27	Schedule 3 POI

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Pollutant	CAS No.	Averaging Period	Ontario AAQC	Ontario Regulation 419/05 (ug/m3)					CAAQS (CCME)		Project Criteria (ug/m3)	Source of the Project Criteria (1)
			(ug/m3)	Schedule 3	ECA Schedule B	Schedule 6 POI	Benchmark	Limiting Effect	(ppb)	(ug/m3)		
Silica	14464-46-1	24-Hour	5	5	-	-	Guideline-B1	Health		-	5	Ontario AAQC
Mercury	7439-97-6	24-Hour	2	2	-	-	Standard-B1	Health		-	2	Ontario AAQC
Mercury (as Hg) – alkyl compounds	7439-97-6	24-Hour	0.5	0.5	-	-	Standard-B1	Health		-	0.5	Ontario AAQC
Hydrogen Chloride	7647-01-0	24-Hour	20	20	-	-	Standard-B1	Health		-	20	Ontario AAQC
Hydrogen Fluoride	7664-39-3	24-Hour	1.72	1.72	-	-	Standard-B1	Health		-	1.72	Ontario AAQC
Hydrogen Fluoride	7664-39-3	30-Day	0.69	0.69	-	-	Standard-B1	Health		-	0.69	Ontario AAQC
1,1,1-Trichloroethane	71-55-6	24-Hour	115000	115000	-	-	Standard-B1	Health		-	115000	Ontario AAQC
1,1-Dichloroethane	75-34-3	24-Hour	165	165	-	1650	Standard-B1	Health		-	165	Ontario AAQC
1,2-Dichloroethane	107-06-2	24-Hour	2	2	-	200	Standard-B1	Health		-	2	Ontario AAQC
1,2-Dichloroethane	107-06-2	Annual	0.4	-	-		Standard-B1	Health		-	0.4	Ontario AAQC
1,2-Dichloropropane	78-87-5	24-Hour	2400	2400	-	-	Guideline-B1	Odour		-	2400	Ontario AAQC
1,3,5-Trimethylbenzene	108-67-8	24-Hour	220	220	-	2200	Standard-B1	Health		-	220	Ontario AAQC
1,3-Butadiene	106-99-0	24-Hour	10	10	-	300	Standard-B1	Health		-	10	Ontario AAQC
1,3-Butadiene	106-99-0	Annual	2	2	-		Standard-B1	Health		-	2	Ontario AAQC
2-Butanone	78-93-3	24-Hour	1000	1000	-	10000	Standard-B1	Health		-	1000	Ontario AAQC
Acetone	67-64-1	24-Hour	11880	11880	-	118800	Standard-B1	Health		-	11880	Ontario AAQC
Benzene	71-43-2	Annual	0.45	0.45	-	-	Standard-B1	Health		-	0.45	Ontario AAQC
Benzene	71-43-2	24-Hour	2.3	100	-	100	DAV	-		-	2.3	Ontario AAQC
Bromodichloromethane	75-27-4	24-Hour	-	350	-	-	SL-JSL-B2	Health		-	350	Schedule 3 POI
Bromoform	75-25-2	24-Hour	55	55	-	-	Guideline-B1	Health		-	55	Ontario AAQC
Bromomethane	74-83-9	24-Hour	1350	1350	-	-	Guideline-B1	Health		-	1350	Ontario AAQC
Carbon Tetrachloride	56-23-5	24-Hour	2.4	2.4	-	24	Standard-B1	Health		-	2.4	Ontario AAQC
Chlorodibromomethane	124-48-1	24-Hour	-	0.2	-	-	SL-JSL-B2	Health		-	0.2	Schedule 3 POI
Chloroform	67-66-3	24-Hour	1	1	-	100	Standard-B1	Health		-	1	Ontario AAQC
Chloroform	67-66-3	Annual	0.2		-	-	-			-	0.2	Ontario AAQC
Dichlorofluoromethane	75-43-4	24-Hour	-	500	-	-	SL-JSL-B2	Health		-	500	Schedule 3 POI
Ethylbenzene	100-41-4	24-Hour	1000	1000	-	10000	Standard-B1	Health		-	1000	Ontario AAQC
Ethylbenzene	100-41-4	10-minute	1900	1900	-	-	Guideline-B1	Odour		-	1900	Ontario AAQC
Ethylene Dibromide	106-93-4	24-Hour	3	3	-	-	Guideline-B1	Health		-	3	Ontario AAQC
Isopropylbenzene	98-82-8	24-Hour	400	400	-	-	Standard-B1	Health		-	400	Ontario AAQC
Xylenes	1330-20-7	24-Hour	730	730	-	7300	Standard-B1	Health		-	730	Ontario AAQC
Xylenes	1330-20-7	10-minute	3000	3000	-	-	Guideline-B1	Odour		-	3000	Ontario AAQC
Methylene Chloride	75-09-2	24-Hour	220	220	-	22000	Standard-B1	Health		-	220	Ontario AAQC
Methylene Chloride	75-09-2	Annual	44	-	-		-	-		-	44	Ontario AAQC
Styrene	100-42-5	24-Hour	400	400	-	-	Standard-B1	Health		-	400	Ontario AAQC
Tetrachloroethene	127-18-4	24-Hour	360	360	-	3600	Standard-B1	Health		-	360	Ontario AAQC
Toluene	108-88-3	24-Hour	2000	2000	-	-	Guideline-B1	Odour		-	2000	Ontario AAQC
Trichloroethylene	79-01-6	24-Hour	12	12							12	Ontario AAQC
Trichloroethylene	79-01-6	Annual	2.3		-	1200	Standard-B1	Health		-	2.3	Ontario AAQC
Trichlorofluoromethane	75-69-4	24-Hour	-	6000	-	-	Guideline-B1	Health		-	6000	Schedule 3 POI
Trichlorotrifluoroethane	76-13-1	24-Hour	800000	800000	-	-	Standard-B1	Health		-	800000	Ontario AAQC
Vinyl Chloride	75-01-4	24-Hour	1	1	-	100	Standard-B1	Health			1	Ontario AAQC
Vinyl Chloride	75-01-4	Annual	0.2	-	-	-	Standard-B1	Health		-	0.2	Ontario AAQC
Formaldehyde	50-00-0	24-Hour	65	65	-	-	Standard-B1	Health		-	65	Ontario AAQC
Acetaldehyde	75-07-0	½-Hour	500	500	-	-	Standard-B1	Health		-	500	Ontario AAQC
Acetaldehyde	75-07-0	24-Hour	500	500	-	5000	Standard-B1	Health		-	500	Ontario AAQC
Acrolein	107-02-8	24-Hour	0.4	0.4	-	4	Standard-B1	Health		-	0.4	Ontario AAQC
Acrolein	107-02-8	1-Hour	4.5	4.5	-	-	Standard-B1	Health		-	4.5	Ontario AAQC
1-Methylnaphthalene	90-12-0	24-Hour	-	0.1 (De Minimis)	-	-	-	-		-	0.1	De Minimis
1-Methylphenanthrene	832-69-9	24-Hour	-	0.1 (De Minimis)	-	-	-	-		-	0.1	De Minimis
2-Chloronaphthalene	91-58-7	24-Hour	-	1	-	-	SL-JSL-B2	Health		-	1	Schedule 3 POI
2-methylanthracene	613-12-7	24-Hour	-	0.1 (De Minimis)	-	-	-	-		-	0.1	De Minimis
2-Methylnaphthalene	91-57-6	24-Hour	-	35.5		-	SL-JSL-B2	Health		-	35.5	Schedule 3 POI
3-Methylcholanthrene	56-49-5	24-Hour	-	0.1 (De Minimis)	-	-	-	-		-	0.1	De Minimis
7,12-Dimethylbenzo(a)anthracene	57-97-6	24-Hour	-	0.1 (De Minimis)	-	-	-	-		-	0.1	De Minimis
9,10-dimethylanthracene	781-43-1	24-Hour	-	0.1 (De Minimis)	-	-	-	-		-	0.1	De Minimis
9-Methylphenanthrene	883-20-5	24-Hour	-	0.1 (De Minimis)	-	-	-	-		-	0.1	De Minimis
Acenaphthene	83-32-9	24-Hour	-	0.1 (De Minimis)	-	-	-	-		-	0.1	De Minimis
Acenaphthylene	208-96-8	24-Hour	-	0.1 (De Minimis)	-	-	-	-		-	0.1	De Minimis
Anthracene	120-12-7	24-Hour	-	0.1 (De Minimis)	-	-	-	-		-	0.1	De Minimis

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Pollutant	CAS No.	Averaging Period	Ontario AAQC	Ontario Regulation 419/05 (ug/m3)					CAAQS (CCME)		Project Criteria (ug/m3)	Source of the Project Criteria (1)
			(ug/m3)	Schedule 3	ECA Schedule B	Schedule 6 POI	Benchmark	Limiting Effect	(ppb)	(ug/m3)		
Benzo(a)Anthracene	56-55-3	24-Hour	-	0.1 (De Minimis)	-	-	-	-		-	0.1	De Minimis
Benzo(a)fluorene	238-84-6	24-Hour	-	0.1 (De Minimis)		-	-			-	0.1	De Minimis
Benzo(a)Pyrene	50-32-8	Annual	0.00001	0.00001	0.00001	-	Standard-B1	Health		-	0.00001	Ontario AAQC
Benzo(a)Pyrene	50-32-8	Annual	0.00001	0.0001	-		AAV	Health			0.00001	Ontario AAQC
Benzo(a)Pyrene	50-32-8	24-Hour	0.00005	0.005	-	0.005	DAV	-		-	0.00005	Ontario AAQC
Benzo(b)Fluoranthene	205-99-2	24-Hour	-	0.1 (De Minimis)		-	-	-		-	0.1	De Minimis
Benzo(b)fluorene	243-17-4	24-Hour	-	0.1 (De Minimis)	-	-	-	-		-	0.1	De Minimis
Benzo(e)Pyrene	192-97-2	24-Hour	-	0.1 (De Minimis)	-	-	-	-		-	0.1	De Minimis
Benzo(g,h,i)Perylene	191-24-2	24-Hour	-	0.1 (De Minimis)	-	-	-	-		-	0.1	De Minimis
Benzo(j / k)Fluoranthene	76774-50-0	24-Hour	-	0.1 (De Minimis)	-	-	-	-		-	0.1	De Minimis
Biphenyl	92-52-4	1-Hour	60	60	-	-	Guideline-B1	Odour		-	60	Ontario AAQC
Chrysene	218-01-9	24-Hour	-	0.1 (De Minimis)	-	-	-	-		-	0.1	De Minimis
Triphenylene	217-59-4	24-Hour	-	0.1 (De Minimis)	-	-	-	-		-	0.1	De Minimis
Coronene	191-07-1	24-Hour	-	0.1 (De Minimis)	-	-	-	-		-	0.1	De Minimis
Dibenzo(a,c/a,h)Anthracene	53-70-3	24-Hour	-	0.1 (De Minimis)	-	-	-	-		-	0.1	De Minimis
Dibenzo(a,e)pyrene	192-65-4	24-Hour	-	0.1 (De Minimis)	-	-	-	-		-	0.1	De Minimis
Fluoranthene	206-44-0	24-Hour	-	0.1 (De Minimis)	-	-	-	-		-	0.1	De Minimis
Fluorene	86-73-7	24-Hour	-	0.1 (De Minimis)	-	-	-	-		-	0.1	De Minimis
Indeno(1,2,3-cd)Pyrene	193-39-5	24-Hour	-	0.1 (De Minimis)	-	-	-	-		-	0.1	De Minimis
m-terphenyl	92-06-8	24-Hour	-	0.1 (De Minimis)	-	-	-	-		-	0.1	De Minimis
Naphthalene	91-20-3	24-Hour	22.5	22.5	-	-	Guideline-B1	Health		-	22.5	Ontario AAQC
Naphthalene	91-20-3	10-minute	50	50	50	-	Guideline-B1	Odour		-	50	Ontario AAQC
o-Terphenyl	84-15-1	24-Hour	-	0.1 (De Minimis)	-	-	-	-		-	0.1	De Minimis
Perylene	198-55-0	24-Hour	-	0.1 (De Minimis)	-	-	-	-		-	0.1	De Minimis
Phenanthrene	85-01-8	24-Hour	-	0.1 (De Minimis)	-	-	-	-		-	0.1	De Minimis
Picene	213-46-7	24-Hour	-	0.1 (De Minimis)	-	-	-	-		-	0.1	De Minimis
p-terphenyl	92-94-4	24-Hour	-	0.1 (De Minimis)	-	-	-	-		-	0.1	De Minimis
Pyrene	129-00-0	24-Hour	-	0.1 (De Minimis)	-	-	-	-		-	0.1	De Minimis
Quinoline	91-22-5	24-Hour	-	0.005	-	-	SL-JSL-B2	Health		-	0.005	Schedule 3 POI
Tetralin	119-64-2	24-Hour	-	151.5	-	-	SL-JSL-B2	Health		-	151.5	Schedule 3 POI
2,6-Dichlorophenol	87-65-0	24-Hour	-	19	-	-	SL-JSL-B2	Health		-	19	Schedule 3 POI
2,4/2,5-Dichlorophenol	120-83-2	24-Hour	-	33.5	-	-	-	-		-	33.5	Schedule 3 POI
3,5-Dichlorophenol	591-35-5	24-Hour	-	0.1 (De Minimis)	-	-	-	-		-	0.1	De Minimis

Table A.1

Comparison of Applicable Air Quality Criteria

Pollutant	CAS No.	Averaging Period	Ontario AAQC	Ontario Regulation 419/05 (ug/m3)					CAAQS (CCME)		Project Criteria (ug/m3)	Source of the Project Criteria (1)
			(ug/m3)	Schedule 3	ECA Schedule B	Schedule 6 POI	Benchmark	Limiting Effect	(ppb)	(ug/m3)		
2,3-Dichlorophenol	576-24-9	24-Hour	-	0.1 (De Minimis)	-	-	-	-		-	0.1	De Minimis
3,4-Dichlorophenol	95-77-2	24-Hour	-	0.1 (De Minimis)	-	-	-	-		-	0.1	De Minimis
2,4,6-Trichlorophenol	88-06-2	24-Hour	-	1.5	-	-	SL-JSL-B2	Health		-	1.5	Schedule 3 POI
2,3,6-Trichlorophenol	933-75-5	24-Hour	-	0.1 (De Minimis)	-	-	-	-		-	0.1	De Minimis
2,3,5-Trichlorophenol	933-78-8	24-Hour	-	0.1 (De Minimis)	-	-	-	-		-	0.1	De Minimis
2,4,5-Trichlorophenol	95-95-4	24-Hour	-	220	-	-	SL-JSL-B2	Health		-	220	Schedule 3 POI
2,3,4-Trichlorophenol	15950-66-0	24-Hour	-	0.1 (De Minimis)	-	-	-	-		-	0.1	De Minimis
3,4,5-Trichlorophenol	609-19-8	24-Hour	-	0.1 (De Minimis)	-	-	-	-		-	0.1	De Minimis
2,3,5,6/2,3,4,6-Tetrachlorophenol	58-90-2	24-Hour	-	0.75	-	-	SL-JSL-B2	Health		-	0.75	Schedule 3 POI
2,3,4,5-Tetrachlorophenol	4901-51-3	24-Hour	-	0.1 (De Minimis)	-	-	-	-		-	0.1	De Minimis
Pentachlorophenol	87-86-5	24-Hour	-	20	20	-	Guideline-B1	Health		-	20	Schedule 3 POI
1,3-Dichlorobenzene	541-73-1	24-Hour	-	50	-	-	SL-JSL-B2	Health		-	50	Schedule 3 POI
1,4-Dichlorobenzene	106-46-7	24-Hour	95	95	-	950	Standard-B1	Health		-	95	Ontario AAQC
1,2-Dichlorobenzene	95-50-1	1-Hour	30500	30500	-	-	Guideline-B1	Health		-	30500	Ontario AAQC
1,3,5-Trichlorobenzene	108-70-3	24-Hour	-	3.6	-	-	SL-JSL-B2	Health		-	3.6	Schedule 3 POI
1,2,4-Trichlorobenzene	120-82-1	24-Hour	400	400	400	-	Guideline-B1	Health		-	400	Ontario AAQC
1,2,3-Trichlorobenzene	87-61-6	24-Hour	-	135	-	-	SL-JSL-B2	Health		-	135	Schedule 3 POI
1,2,3,5/1,2,4,5-Tetrachlorobenzene	95-94-3	24-Hour	-	1		-	SL-JSL-B2	Health		-	1	Schedule 3 POI
1,2,3,4-Tetrachlorobenzene	634-66-2	24-Hour	-	600	-	-	SL-JSL-B2	Health		-	600	Schedule 3 POI
Pentachlorobenzene	608-93-5	24-Hour	-	80	-	-	SL-JSL-B2	Health		-	80	Schedule 3 POI
Hexachlorobenzene	118-74-1	24-Hour	-	0.011	-	-	SL-JSL-B2	Health		-	0.011	Schedule 3 POI
Dioxin and Furans	NA-DFPCB	24-Hour	0.1 pg TEQ/m3	0.1 pg TEQ/m3	0.1 pg TEQ/m3	1 pg TEQ/m3	Standard-B1	Health		-	0.0000001	Ontario AAQC
7H-Dibenzo(c,g)carbazole	194592	24-Hour	-	0.1 (De Minimis)	-	-	-	-		-	0.1	De Minimis
trans,1,2-Dichloroethene	156-60-5	24-Hour	105	105	-	-	Guideline-B1	Health		-	105	Ontario AAQC
Polychlorinated Biphenyls	1336-36-3	24-Hour	0.15	0.15			Guideline-B1	Health		-	0.15	Ontario AAQC
Polychlorinated Biphenyls	1336-36-3	Annual	0.035	-	-	-	-	-	-	-	0.035	Ontario AAQC

Notes:
CAAQSs: Canadian Ambient Air Quality Standards, Canadian Council of Ministers of the Environment; Numerical Value for 2020 for PM2.5, and Numerical Value for 2025 for Ozone, Nitrogen Dioxide, and Sulphur Dioxide
AAQC: Ontario's Ambient Air Quality Criteria, Ministry of the Environment, Conservation and Parks (last updated Sept 21, 2023)
Schedule 3 of Oreg 419/05: standards listed in Schedule 3 of O. Reg. 419/05 and thePOI limits in the MECP's "Air Contaminants Benchmarks (ACB) List: Standards, guidelines, and screening levels for assessing point of impingement concentrations of air contaminants", dated April 2023 (ACB List).
Standard - Standard under Ontario Regulation 419/05 - Air Pollution – Local Air Quality.
Guideline - Guideline value previously set out in Summary of Standards and Guidelines to support Ontario Regulation 419/05 - Air Pollution – Local Air Quality (PIBS 6569e01) document.
B1: Benchmark 1 values (standards and guidelines). If a B1 value is exceeded, the facility is required to carry out specific actions.
B2: Benchmark 2 values (screening levels). If a B2 value is exceeded, or if no B2 value is available, the regulations require potential adverse effects to be assessed.
SL: Screening Level (SL) set by the ministry based on a review of toxicity information and/or other jurisdictional levels.
JSL: Jurisdictional Screening Level. The JSL screening levels are based on a review of air quality values available in other jurisdictions

(1) Emission Limit for Calcium Oxide (CAS 1305-78-8) as Calcium is highly reactive and will not remain metallic after emission.
(2) Emission Limit for Sodium Hydroxide (CAS 1310-46-1) as Sodium is highly reactive and will not remain metallic after emission

Appendix B

Summary of Historical Stack Tests

Table B.1

Summary of Historical Stack Tests

Stack Test Parameters	Unit	2018 Stack Test	2019 Stack Test	2020 Stack Test	2021 Stack Test	2022 Stack Test
Average Waste Processing Rate (PR)(1)	(tonnes/hr)	14.77	14.18	18.18	16.88	17.85
Average Dry Reference Flow Rate (2)	(DRm^3/s)	28.5	27.3	31.7	33.1	34.5
Average Actual Flow Rate (1)	(Am^3/s)	58.4	55.6	59.8	68.0	68.6
Stack Diameter	(m)	2.3	2.3	2.3	2.3	2.3
Gas Exit Velocity (1)	(m/s)	14.1	13.4	14.4	16.4	16.5
Average Gas Exit Temperature (1)	(°C)	231.0	230.6	230.8	237.8	232.5

Pollutant	CAS Number	Emission Rates (ER)	Ratio ER/PR	Emission Rates	Ratio ER/PR	Emission Rates	Ratio ER/PR	Emission Rates	Ratio ER/PR	Emission Rates	Ratio ER/PR	Min ER/PR Ratio	Maximum ER/PR Ratio	Average ER/PR Ratio
		g/s	(g*hr)/(s*tonne)	g/s	(g*hr)/(s*tonne)	g/s	(g*hr)/(s*tonne)	g/s	(g*hr)/(s*tonne)	g/s	(g*hr)/(s*tonne)	(g*hr)/(s*tonne)	(g*hr)/(s*tonne)	(g*hr)/(s*tonne)
Particulate Matter	NA-PM	1.60E-01	1.08E-02	1.17E-01	8.28E-03	2.13E-01	1.17E-02	1.08E-01	6.43E-03	1.39E-01	7.79E-03	6.43E-03	1.17E-02	9.01E-03
Nitrogen Oxides	10102-44-0	2.88E+00	1.95E-01	3.11E+00	2.19E-01	3.44E+00	1.89E-01	4.02E+00	2.38E-01	3.98E+00	2.23E-01	1.89E-01	2.38E-01	2.13E-01
Carbon Monoxide	630-08-0	1.57E-01	1.07E-02	2.93E-01	2.07E-02	2.72E-01	1.49E-02	7.33E-01	4.34E-02	3.70E-01	2.07E-02	1.07E-02	4.34E-02	2.21E-02
Sulphur Dioxide	7446-09-5	8.55E-01	5.79E-02	7.18E-01	5.07E-02	8.16E-01	4.49E-02	8.12E-01	4.81E-02	4.20E-01	2.35E-02	2.35E-02	5.79E-02	4.50E-02
Aluminum	7429-90-5	5.86E-04	3.97E-05	1.00E-03	7.07E-05	8.65E-04	4.76E-05	1.42E-03	8.42E-05	1.80E-04	1.01E-05	1.01E-05	8.42E-05	5.05E-05
Aluminum oxide	1344-28-1	1.11E-03	7.50E-05	1.90E-03	1.34E-04	1.63E-03	8.99E-05	2.69E-03	1.59E-04	3.40E-04	1.91E-05	1.91E-05	1.59E-04	9.54E-05
Antimony	7440-36-0	4.54E-05	3.08E-06	1.86E-05	1.31E-06	4.78E-05	2.63E-06	2.60E-05	1.54E-06	6.10E-05	3.42E-06	1.31E-06	3.42E-06	2.40E-06
Arsenic	7440-38-2	4.67E-06	3.16E-07	3.37E-06	2.38E-07	2.15E-05	1.18E-06	2.50E-04	1.48E-05	5.80E-06	3.25E-07	2.38E-07	1.48E-05	3.38E-06
Barium	7440-39-3	8.09E-05	5.48E-06	1.69E-04	1.19E-05	6.95E-05	3.82E-06	8.27E-05	4.90E-06	1.60E-04	8.97E-06	3.82E-06	1.19E-05	7.02E-06
Beryllium	7440-41-7	8.76E-07	5.94E-08	6.49E-07	4.57E-08	2.42E-06	1.33E-07	1.91E-06	1.13E-07	1.10E-06	6.16E-08	4.57E-08	1.33E-07	8.26E-08
Boron	7440-42-8	2.86E-03	1.94E-04	3.07E-03	2.17E-04	4.66E-03	2.56E-04	3.66E-03	2.17E-04	3.95E-03	2.21E-04	1.94E-04	2.56E-04	2.21E-04
Cadmium	7440-43-9	2.36E-05	1.60E-06	9.99E-06	7.04E-07	2.57E-05	1.42E-06	2.19E-05	1.30E-06	2.00E-05	1.12E-06	7.04E-07	1.60E-06	1.23E-06
Calcium	7440-70-2	3.03E-02	2.05E-03	2.13E-02	1.50E-03	5.83E-02	3.21E-03	3.16E-02	1.87E-03	4.52E-02	2.53E-03	1.50E-03	3.21E-03	2.23E-03
Calcium oxide	1305-78-8	4.25E-02	2.87E-03	2.99E-02	2.11E-03	8.16E-02	4.49E-03	4.42E-02	2.62E-03	6.33E-02	3.55E-03	2.11E-03	4.49E-03	3.13E-03
Chromium	7440-47-3	7.68E-05	5.20E-06	2.01E-04	1.42E-05	3.36E-05	1.85E-06	3.49E-04	2.07E-05	3.40E-05	1.91E-06	1.85E-06	2.07E-05	8.76E-06
Cobalt	7440-48-4	6.42E-06	4.35E-07	5.55E-04	3.91E-05	2.71E-06	1.49E-07	1.57E-05	9.32E-07	7.20E-07	4.03E-08	4.03E-08	3.91E-05	8.14E-06
Copper	7440-50-8	6.36E-03	4.31E-04	1.10E-04	7.79E-06	2.17E-04	1.19E-05	1.50E-04	8.91E-06	5.30E-05	2.97E-06	2.97E-06	4.31E-04	9.24E-05
Iron	7439-89-6	1.30E-03	8.82E-05	3.10E-03	2.19E-04	1.92E-03	1.06E-04	4.67E-03	2.76E-04	9.20E-04	5.16E-05	5.16E-05	2.76E-04	1.48E-04
Lead	7439-92-1	1.57E-04	1.06E-05	1.07E-04	7.57E-06	2.39E-04	1.31E-05	3.12E-04	1.85E-05	1.50E-04	8.40E-06	7.57E-06	1.85E-05	1.16E-05
Lithium	7439-93-2	5.54E-06	3.75E-07	1.80E-06	1.27E-07	6.06E-06	3.33E-07	4.76E-06	2.82E-07	3.60E-05	2.02E-06	1.27E-07	2.02E-06	6.27E-07
Magnesium	7439-95-4	7.10E-04	4.81E-05	9.35E-04	6.59E-05	1.13E-03	6.21E-05	1.74E-03	1.03E-04	5.10E-04	2.86E-05	2.86E-05	1.03E-04	6.15E-05
Magnesium oxide	1309-48-4	1.18E-03	7.98E-05	1.55E-03	1.09E-04	1.87E-03	1.03E-04	2.88E-03	1.71E-04	8.47E-04	4.74E-05	4.74E-05	1.71E-04	1.02E-04
Manganese	7439-96-5	3.20E-04	2.17E-05	1.50E-03	1.06E-04	2.88E-04	1.58E-05	3.01E-04	1.78E-05	5.60E-05	3.14E-06	3.14E-06	1.06E-04	3.29E-05
Molybdenum	7439-98-7	4.72E-05	3.20E-06	4.93E-05	3.47E-06	8.80E-05	4.84E-06	1.14E-04	6.73E-06	2.60E-04	1.46E-05	3.20E-06	1.46E-05	6.56E-06
Nickel	7440-02-0	4.01E-04	2.72E-05	1.47E-04	1.04E-05	4.43E-05	2.44E-06	5.41E-04	3.20E-05	5.70E-05	3.19E-06	2.44E-06	3.20E-05	1.50E-05
Phosphorus	7723-14-0	5.04E-04	3.41E-05	3.00E-04	2.11E-05	1.01E-03	5.56E-05	8.44E-04	5.00E-05	5.40E-04	3.03E-05	2.11E-05	5.56E-05	3.82E-05
Phosphorous pentachloride	10026-13-8	3.39E-03	2.30E-04	2.02E-03	1.42E-04	6.79E-03	3.73E-04	5.67E-03	3.36E-04	3.63E-03	2.04E-04	1.42E-04	3.73E-04	2.57E-04
Selenium	7782-49-2	1.63E-05	1.11E-06	7.20E-06	5.08E-07	2.42E-05	1.33E-06	2.12E-05	1.26E-06	6.00E-06	3.36E-07	3.36E-07	1.33E-06	9.08E-07
Silver	7440-22-4	1.16E-05	7.85E-07	2.18E-06	1.54E-07	5.31E-06	2.92E-07	7.01E-06	4.15E-07	1.60E-06	8.97E-08	8.97E-08	7.85E-07	3.47E-07
Sodium	7440-23-5	4.49E-03	3.04E-04	5.47E-03	3.86E-04	8.68E-03	4.78E-04	2.95E-02	1.75E-03	1.59E-02	8.91E-04	3.04E-04	1.75E-03	7.61E-04
Sodium hydroxide	1310-73-2	7.81E-03	5.29E-04	9.52E-03	6.72E-04	1.51E-02	8.31E-04	5.13E-02	3.04E-03	2.77E-02	1.55E-03	5.29E-04	3.04E-03	1.32E-03
Strontium	7440-24-6	1.82E-05	1.23E-06	2.40E-05	1.69E-06	3.72E-05	2.04E-06	4.16E-05	2.46E-06	2.20E-05	1.23E-06	1.23E-06	2.46E-06	1.73E-06
Tin	7440-31-5	1.90E-04	1.29E-05	8.03E-05	5.67E-06	1.59E-04	8.76E-06	2.02E-04	1.20E-05	5.00E-04	2.80E-05	5.67E-06	2.80E-05	1.35E-05
Titanium	7440-32-6	1.05E-04	7.11E-06	5.38E-05	3.79E-06	9.13E-05	5.02E-06	9.12E-05	5.40E-06	1.40E-04	7.84E-06	3.79E-06	7.84E-06	5.83E-06
Vanadium	7440-62-2	3.44E-06	2.33E-07	4.68E-06	3.30E-07	8.89E-06	4.89E-07	9.48E-06	5.62E-07	3.60E-06	2.02E-07	2.02E-07	5.62E-07	3.63E-07
Zinc	7440-66-6	5.34E-03	3.62E-04	7.75E-04	5.47E-05	1.15E-03	6.34E-05	8.95E-04	5.30E-05	1.85E-03	1.04E-04	5.30E-05	3.62E-04	1.27E-04
Silicon	7440-21-3	1.60E-03	1.08E-04	2.38E-03	1.68E-04	3.36E-03	1.85E-04	6.58E-03	3.90E-04	3.90E-03	2.19E-04	1.08E-04	3.90E-04	2.14E-04
Silica	14464-46-1	3.42E-03	2.31E-04	5.09E-03	3.59E-04	7.18E-03	3.95E-04	1.41E-02	8.34E-04	8.35E-03	4.68E-04	2.31E-04	8.34E-04	4.57E-04
Mercury	7439-97-6	2.28E-05	1.55E-06	1.54E-05	1.08E-06	4.73E-05	2.60E-06	9.28E-07	5.50E-08	1.60E-05	8.97E-07	5.50E-08	2.60E-06	1.24E-06
Hydrogen Chloride	7647-01-0	4.82E-01	3.27E-02	1.89E-01	1.33E-02	1.40E-01	7.71E-03	2.58E-01	1.53E-02	1.40E-01	7.84E-03	7.71E-03	3.27E-02	1.54E-02
Hydrogen Fluoride	7664-39-3	3.01E-02	2.04E-03	5.98E-03	4.22E-04	8.56E-03	4.71E-04	9.83E-03	5.83E-04	5.00E-03	2.80E-04	2.80E-04	2.04E-03	7.58E-04
1,1,1-Trichloroethane	71-55-6	1.36E-05	9.23E-07	7.21E-05	5.08E-06	1.54E-05	8.47E-07	1.64E-05	9.70E-07	7.70E-05	4.31E-06	8.47E-07	5.08E-06	2.43E-06
1,1-Dichloroethane	75-34-3	1.36E-05	9.19E-07	1.06E-04	7.49E-06	1.54E-05	8.47E-07	1.64E-05	9.70E-07	7.70E-05	4.31E-06	8.47E-07	7.49E-06	2.91E-06
1,2-Dichloroethane	107-06-2	1.36E-05	9.19E-07	7.24E-05	5.11E-06	1.54E-05	8.47E-07	1.64E-05	9.70E-07	3.60E-04	2.02E-05	8.47E-07	2.02E-05	5.60E-06
1,2-Dichloropropane	78-87-5	1.36E-05	9.19E-07	7.21E-05	5.08E-06	1.54E-05	8.47E-07	1.64E-05	9.70E-07	7.70E-05	4.31E-06	8.47E-07	5.08E-06	2.43E-06
1,3,5-Trimethylbenzene	108-67-8	2.72E-05	1.84E-06	1.44E-04	1.02E-05	3.08E-05	1.69E-06	3.27E-05	1.94E-06	7.70E-05	4.31E-06	1.69E-06	1.02E-05	3.99E-06
1,3-Butadiene	106-99-0	2.72E-05	1.84E-06	1.44E-04	1.02E-05	3.08E-05	1.69E-06	3.27E-05	1.94E-06	7.70E-05	4.31E-06	1.69E-06	1.02E-05	3.99E-06
2-Butanone	78-93-3	1.90E-05	1.29E-06	1.08E-03	7.63E-05	2.87E-05	1.58E-06	4.42E-05	2.62E-06	7.70E-05	4.31E-06	1.29E-06	7.63E-05	1.72E-05
Acetone	67-64-1	2.19E-04	1.48E-05	9.77E-04	6.89E-05	3.37E-04	1.85E-05	1.64E-04	9.73E-06	2.80E-04	1.57E-05	9.73E-06	6.89E-05	2.55E-05
Benzene	71-43-2	8.45E-05	5.72E-06	1.70E-02	1.20E-03	1.26E-04	6.93E-06	3.36E-04	1.99E-05	5.90E-04	3.31E-05	5.72E-06	1.20E-03	2.53E-04
Bromodichloromethane	75-27-4	1.36E-05	9.19E-07	7.21E-05	5.08E-06	1.54E-05	8.47E-07	1.64E-05	9.70E-07	7.70E-05	4.31E-06	8.47E-07	5.08E-06	2.43E-06
Bromoform	75-25-2	2.72E-05	1.84E-06	1.45E-04	1.02E-05	3.13E-05	1.72E-06	5.02E-05	2.98E-06	7.70E-05	4.31E-06	1.72E-06	1.02E-05	4.22E-06
Bromomethane	74-83-9	1.22E-04	8.27E-06	6.49E-04	4.58E-05	1.39E-04	7.64E-06	1.47E-04	8.73E-06	5.60E-04	3.14E-05	7.64E-06	4.58E-05	2.04E-05
Carbon Tetrachloride	56-23-5	1.36E-05	9.19E-07	7.21E-05	5.08E-06	1.54E-05	8.47E-07	1.64E-05	9.70E-07	7.70E-05	4.31E-06	8.47E-07	5.08E-06	2.43E-06
Chlorodibromomethane	124-48-1	1.36E-05	9.19E-07	7.21E-05	5.08E-06	1.54E-05	8.47E-07	2.57E-05	1.52E-06	7.70E-05	4.31E-06	8.47E-07	5.08E-06	2.54E-06
Chloroform	67-66-3	1.36E-05	9.19E-07	7.21E-05	5.08E-06	1.54E-05	8.47E-07	2.84E-05	1.68E-06	7.70E-05	4.31E-06	8.47E-07	5.08E-06	2.57E-06
Dichlorofluoromethane	75-43-4	4.26E-05	2.89E-06	1.44E-04	1.02E-05	3.08E-05	1.69E-06	3.27E-05	1.94E-06	7.70E-05	4.31E-06	1.69E-06	1.02E-05	4.20E-06
Ethylbenzene	100-41-4	2.72E-05	1.84E-06	1.44E-04	1.02E-05	3.08E-05	1.69E-06	3.27E-05	1.94E-06	7.70E-05	4.31E-06	1.69E-06	1.02E-05	3.99E-06

Table B.1

Summary of Historical Stack Tests

Stack Test Parameters	Unit	2018 Stack Test	2019 Stack Test	2020 Stack Test	2021 Stack Test	2022 Stack Test
Average Waste Processing Rate (PR)(1)	(tonnes/hr)	14.77	14.18	18.18	16.88	17.85
Average Dry Reference Flow Rate (2)	(DRm^3/s)	28.5	27.3	31.7	33.1	34.5
Average Actual Flow Rate (1)	(Am^3/s)	58.4	55.6	59.8	68.0	68.6
Stack Diameter	(m)	2.3	2.3	2.3	2.3	2.3
Gas Exit Velocity (1)	(m/s)	14.1	13.4	14.4	16.4	16.5
Average Gas Exit Temperature (1)	(°C)	231.0	230.6	230.8	237.8	232.5

Pollutant	CAS Number	Emission Rates (ER)	Ratio ER/PR	Emission Rates	Ratio ER/PR	Emission Rates	Ratio ER/PR	Emission Rates	Ratio ER/PR	Emission Rates	Ratio ER/PR	Min ER/PR Ratio	Maximum ER/PR Ratio	Average ER/PR Ratio
		g/s	(g*hr)/(s*tonne)	g/s	(g*hr)/(s*tonne)	g/s	(g*hr)/(s*tonne)	g/s	(g*hr)/(s*tonne)	g/s	(g*hr)/(s*tonne)	(g*hr)/(s*tonne)	(g*hr)/(s*tonne)	(g*hr)/(s*tonne)
Ethylene Dibromide	106-93-4	1.36E-05	9.19E-07	7.21E-05	5.08E-06	1.54E-05	8.47E-07	1.64E-05	9.70E-07	7.70E-05	4.31E-06	8.47E-07	5.08E-06	2.43E-06
Isopropylbenzene	98-82-8	1.36E-05	9.19E-07	7.21E-05	5.08E-06	1.54E-05	8.47E-07	1.64E-05	9.70E-07	7.70E-05	4.31E-06	8.47E-07	5.08E-06	2.43E-06
Xylene (Total)	1330-20-7	5.43E-05	3.68E-06	3.22E-04	2.27E-05	6.16E-05	3.39E-06	1.55E-04	9.16E-06	2.40E-04	1.34E-05	3.39E-06	2.27E-05	1.05E-05
Methylene Chloride	75-09-2	1.63E-03	1.10E-04	5.74E-03	4.05E-04	6.38E-04	3.51E-05	2.72E-04	1.61E-05	7.70E-05	4.31E-06	4.31E-06	4.05E-04	1.14E-04
Styrene	100-42-5	1.36E-05	9.19E-07	7.21E-05	5.08E-06	1.54E-05	8.47E-07	3.11E-05	1.85E-06	7.70E-05	4.31E-06	8.47E-07	5.08E-06	2.60E-06
Tetrachloroethene	127-18-4	2.72E-05	1.84E-06	1.44E-04	1.02E-05	3.08E-05	1.69E-06	3.27E-05	1.94E-06	1.00E-04	5.60E-06	1.69E-06	1.02E-05	4.25E-06
Toluene	108-88-3	6.79E-05	4.60E-06	3.60E-04	2.54E-05	7.70E-05	4.23E-06	1.36E-04	8.08E-06	3.25E-03	1.82E-04	4.23E-06	1.82E-04	4.49E-05
trans,1,2-Dichloroethene	156-60-5	1.36E-05	9.19E-07	7.21E-05	5.08E-06	1.54E-05	8.47E-07	1.64E-05	9.70E-07	3.60E-04	2.02E-05	8.47E-07	2.02E-05	5.60E-06
Trichloroethylene	79-01-6	1.36E-05	9.19E-07	7.21E-05	5.08E-06	1.54E-05	8.47E-07	1.64E-05	9.70E-07	7.70E-05	4.31E-06	8.47E-07	5.08E-06	2.43E-06
Trichlorofluoromethane	75-69-4	2.72E-05	1.84E-06	1.44E-04	1.02E-05	3.18E-05	1.75E-06	3.27E-05	1.94E-06	7.70E-05	4.31E-06	1.75E-06	1.02E-05	4.00E-06
Trichlorotrifluoroethane	76-13-1	2.72E-05	1.84E-06	1.44E-04	1.02E-05	3.08E-05	1.69E-06	3.27E-05	1.94E-06	7.70E-05	4.31E-06	1.69E-06	1.02E-05	3.99E-06
Vinyl Chloride	75-01-4	2.72E-05	1.84E-06	1.44E-04	1.02E-05	3.08E-05	1.69E-06	3.27E-05	1.94E-06	7.70E-05	4.31E-06	1.69E-06	1.02E-05	3.99E-06
Formaldehyde	50-00-0	4.66E-02	3.16E-03	3.66E-03	2.58E-04	4.61E-03	2.54E-04	5.43E-04	3.21E-05	1.29E-02	7.23E-04	3.21E-05	3.16E-03	8.85E-04
Acetaldehyde	75-07-0	4.14E-02	2.80E-03	4.94E-03	3.48E-04	2.06E-02	1.13E-03	1.67E-03	9.88E-05	2.62E-03	1.47E-04	9.88E-05	2.80E-03	9.06E-04
Acrolein	107-02-8	9.26E-05	6.27E-06	3.76E-05	2.65E-06	1.10E-04	6.05E-06	2.58E-05	1.53E-06	1.30E-04	7.28E-06	1.53E-06	7.28E-06	4.76E-06
1-Methylnaphthalene	90-12-0	3.83E-07	2.59E-08	1.16E-06	8.15E-08	3.87E-07	2.13E-08	3.69E-07	2.18E-08	1.26E-05	7.06E-07	2.13E-08	7.06E-07	1.71E-07
1-Methylphenanthrene	832-69-9	3.87E-07	2.62E-08	4.75E-07	3.35E-08	7.12E-08	3.92E-09	9.37E-08	5.55E-09	1.84E-06	1.03E-07	3.92E-09	1.03E-07	3.45E-08
2-Chloronaphthalene	91-58-7	1.39E-07	9.40E-09	3.56E-08	2.51E-09	7.12E-08	3.92E-09	1.23E-07	7.29E-09	1.84E-06	1.03E-07	2.51E-09	1.03E-07	2.52E-08
2-methylanthracene	613-12-7	1.08E-07	7.32E-09	2.15E-07	1.51E-08	1.53E-07	8.41E-09	2.92E-07	1.73E-08	1.84E-06	1.03E-07	7.32E-09	1.03E-07	3.03E-08
2-Methylnaphthalene	91-57-6	5.45E-07	3.69E-08	1.92E-06	1.35E-07	2.37E-06	1.30E-07	5.88E-07	3.48E-08	2.40E-05	1.34E-06	3.48E-08	1.34E-06	3.36E-07
3-Methylcholanthrene	56-49-5	3.61E-08	2.45E-09	1.78E-07	1.26E-08	3.56E-07	1.96E-08	6.63E-08	3.93E-09	1.84E-06	1.03E-07	2.45E-09	1.03E-07	2.83E-08
7,12-Dimethylbenzo(a)anthracene	57-97-6	7.02E-08	4.75E-09	3.56E-08	2.51E-09	7.12E-08	3.92E-09	1.02E-07	6.07E-09	7.36E-06	4.12E-07	2.51E-09	4.12E-07	8.59E-08
7H-Dibenzo(c,g)carbazole	194-59-2			1.78E-07	1.26E-08	7.12E-08	3.92E-09					3.92E-09	1.26E-08	8.23E-09
9,10-dimethylanthracene	781-43-1	2.57E-07	1.74E-08	3.56E-08	2.51E-09	7.12E-08	3.92E-09	5.35E-08	3.17E-09	1.84E-06	1.03E-07	2.51E-09	1.03E-07	2.60E-08
9-Methylphenanthrene	883-20-5	3.59E-07	2.43E-08	9.77E-08	6.89E-09	7.12E-08	3.92E-09	1.22E-07	7.25E-09	1.84E-06	1.03E-07	3.92E-09	1.03E-07	2.91E-08
Acenaphthene	83-32-9	1.69E-06	1.14E-07	2.66E-07	1.88E-08	5.73E-07	3.15E-08	7.90E-08	4.68E-09	1.84E-06	1.03E-07	4.68E-09	1.14E-07	5.45E-08
Acenaphthylene	208-96-8	2.25E-08	1.52E-09	1.57E-07	1.11E-08	1.92E-07	1.06E-08	5.93E-08	3.51E-09	9.29E-06	5.21E-07	1.52E-09	5.21E-07	1.09E-07
Anthracene	120-12-7	1.69E-06	1.14E-07	3.21E-07	2.26E-08	7.91E-08	4.35E-09	7.90E-08	4.68E-09	1.84E-06	1.03E-07	4.35E-09	1.14E-07	4.98E-08
Benzo(a)Anthracene	56-55-3	2.25E-08	1.52E-09	2.83E-07	1.99E-08	7.63E-08	4.20E-09	5.93E-08	3.51E-09	1.84E-06	1.03E-07	1.52E-09	1.03E-07	2.65E-08
Benzo(a)fluorene	238-84-6	2.25E-08	1.52E-09	1.02E-07	7.20E-09	7.12E-08	3.92E-09	6.36E-08	3.77E-09	1.84E-06	1.03E-07	1.52E-09	1.03E-07	2.39E-08
Benzo(a)Pyrene	50-32-8	2.25E-08	1.52E-09	4.15E-07	2.93E-08	7.32E-08	4.03E-09	3.51E-08	2.08E-09	9.20E-07	5.16E-08	1.52E-09	2.93E-08	9.22E-09
Benzo(b)Fluoranthene	205-99-2	1.06E-07	7.15E-09	2.68E-07	1.89E-08	9.51E-08	5.23E-09	1.16E-07	6.85E-09	1.84E-06	1.03E-07	5.23E-09	1.03E-07	2.82E-08
Benzo(b)fluorene	243-17-4	2.25E-08	1.52E-09	1.02E-07	7.20E-09	7.12E-08	3.92E-09	7.12E-08	4.22E-09	1.84E-06	1.03E-07	1.52E-09	1.03E-07	2.40E-08
Benzo(e)Pyrene	192-97-2	2.25E-08	1.52E-09	2.27E-07	1.60E-08	6.63E-07	3.65E-08	2.36E-07	1.40E-08	1.84E-06	1.03E-07	1.52E-09	1.03E-07	3.42E-08
Benzo(g,h,i)Perylene	191-24-2	1.48E-07	1.00E-08	3.77E-07	2.66E-08	1.48E-07	8.14E-09	1.77E-07	1.05E-08	1.84E-06	1.03E-07	8.14E-09	1.03E-07	3.17E-08
Benzo(j / k)Fluoranthene	76774-50-0	1.17E-07	7.93E-09	3.08E-07	2.17E-08	7.12E-08	3.92E-09	1.04E-07	6.14E-09	1.84E-06	1.03E-07	3.92E-09	1.03E-07	2.86E-08
Biphenyl	92-52-4	5.87E-06	3.98E-07	2.52E-05	1.78E-06	7.12E-08	3.92E-09			3.83E-06	2.15E-07	3.92E-09	1.78E-06	5.99E-07
Chrysene	218-01-9	3.84E-08	2.60E-09	4.13E-07	2.92E-08	7.32E-08	4.03E-09	1.35E-07	8.03E-09	1.84E-06	1.03E-07	2.60E-09	1.03E-07	2.94E-08
Triphenylene	217-59-4					7.32E-08	4.03E-09	1.35E-07	8.03E-09	1.84E-06	1.03E-07	4.03E-09	1.03E-07	3.84E-08
Coronene	191-07-1	1.52E-07	1.03E-08	1.78E-07	1.26E-08	3.68E-07	2.02E-08	1.76E-07	1.04E-08	1.84E-06	1.03E-07	1.03E-08	1.03E-07	3.13E-08
Dibenzo(a,c/a,h)Anthracene	53-70-3	8.46E-08	5.73E-09	6.03E-08	4.25E-09	7.12E-08	3.92E-09	3.51E-08	2.08E-09	1.84E-06	1.03E-07	2.08E-09	1.03E-07	2.38E-08
Dibenzo(a,e)pyrene	192-65-4	1.12E-07	7.60E-09	1.78E-07	1.26E-08	3.56E-07	1.96E-08	1.76E-07	1.04E-08	1.84E-06	1.03E-07	7.60E-09	1.03E-07	3.06E-08
Fluoranthene	206-44-0	5.19E-07	3.52E-08	1.11E-06	7.85E-08	1.17E-06	6.43E-08	9.54E-07	5.65E-08	1.84E-06	1.03E-07	3.52E-08	1.03E-07	6.75E-08
Fluorene	86-73-7	2.25E-08	1.52E-09	1.55E-06	1.09E-07	3.67E-06	2.02E-07	5.87E-08	3.48E-09	2.46E-06	1.38E-07	1.52E-09	2.02E-07	9.08E-08
Indeno(1,2,3-cd)Pyrene	193-39-5	7.02E-08	4.75E-09	2.06E-07	1.45E-08	7.12E-08	3.92E-09	3.51E-08	2.08E-09	1.84E-06	1.03E-07	2.08E-09	1.03E-07	2.57E-08
m-terphenyl	92-06-8	2.35E-06	1.59E-07	1.95E-07	1.38E-08	7.67E-08	4.22E-09	3.10E-06	1.84E-07	1.84E-06	1.03E-07	4.22E-09	1.84E-07	9.27E-08
Naphthalene	91-20-3	1.77E-07	1.20E-08	4.05E-06	2.85E-07	3.86E-06	2.12E-07	3.51E-08	2.08E-09	7.99E-05	4.48E-06	2.08E-09	4.48E-06	9.98E-07
o-Terphenyl	84-15-1	1.77E-07	1.20E-08	3.49E-07	2.46E-08	7.12E-08	3.92E-09	3.51E-08	2.08E-09	1.84E-06	1.03E-07	2.08E-09	1.03E-07	2.91E-08
Perylene	198-55-0	2.25E-08	1.52E-09	5.16E-08	3.64E-09	7.12E-08	3.92E-09	3.51E-08	2.08E-09	1.84E-06	1.03E-07	1.52E-09	1.03E-07	2.29E-08
Phenanthrene	85-01-8	1.91E-06	1.29E-07	3.71E-06	2.62E-07	1.64E-06	9.02E-08	1.19E-06	7.04E-08	3.20E-06	1.79E-07	7.04E-08	2.62E-07	1.46E-07
Picene	213-46-7	1.12E-07	7.60E-09	6.03E-08	4.25E-09	3.56E-07	1.96E-08	1.76E-07	1.04E-08	1.84E-06	1.03E-07	4.25E-09	1.03E-07	2.90E-08
p-terphenyl	92-94-4	2.25E-08	1.52E-09	1.78E-07	1.26E-08	7.12E-08	3.92E-09	3.51E-08	2.08E-09	1.84E-06	1.03E-07	1.52E-09	1.03E-07	2.46E-08
Pyrene	129-00-0	3.10E-07	2.10E-08	7.96E-07	5.62E-08	1.83E-06	1.01E-07	2.00E-06	1.18E-07	1.84E-06	1.03E-07	2.10E-08	1.18E-07	7.98E-08
Quinoline	91-22-5	5.22E-08	3.54E-09	8.42E-07	5.94E-08	5.48E-06	3.01E-07	2.38E-07	1.41E-08	4.08E-06	2.29E-07	3.54E-09	3.01E-07	1.21E-07
Tetralin	119-64-2	1.04E-05	7.02E-07	2.10E-06	1.48E-07	1.94E-06	1.07E-07	1.53E-06	9.05E-08	1.84E-06	1.03E-07	9.05E-08	7.02E-07	2.30E-07
2,6-Dichlorophenol	87-65-0	2.37E-07	1.60E-08	1.77E-07	1.25E-08	3.56E-07	1.96E-08	8.78E-07	5.20E-08	1.84E-06	1.03E-07	1.25E-08	1.03E-07	4.07E-08
2,4/2,5-Dichlorophenol	120-83-2	2.37E-07	1.60E-08	1.77E-07	1.25E-08	3.56E-07	1.96E-08	8.78E-07	5.20E-08	1.86E-06	1.04E-07	1.25E-08	1.04E-07	4.09E-08
3,5-Dichlorophenol	591-35-5	3.20E-07	2.17E-08	1.77E-07	1.25E-08	3.56E-07	1.96E-08	8.78E-07	5.20E-08	1.84E-06	1.03E-07	1.25E-08	1.03E-07	4.18E-08

Table B.1

Summary of Historical Stack Tests

Stack Test Parameters	Unit	2018 Stack Test		2019 Stack Test		2020 Stack Test		2021 Stack Test		2022 Stack Test				
Average Waste Processing Rate (PR)(1)	(tonnes/hr)	14.77		14.18		18.18		16.88		17.85				
Average Dry Reference Flow Rate (2)	(DRm^3/s)	28.5		27.3		31.7		33.1		34.5				
Average Actual Flow Rate (1)	(Am^3/s)	58.4		55.6		59.8		68.0		68.6				
Stack Diameter	(m)	2.3		2.3		2.3		2.3		2.3				
Gas Exit Velocity (1)	(m/s)	14.1		13.4		14.4		16.4		16.5				
Average Gas Exit Temperature (1)	(°C)	231.0		230.6		230.8		237.8		232.5				
Pollutant	**CAS Number**	**Emission Rates (ER) g/s**	**Ratio ER/PR (g*hr)/(s*tonne)**	**Emission Rates g/s**	**Ratio ER/PR (g*hr)/(s*tonne)**	**Emission Rates g/s**	**Ratio ER/PR (g*hr)/(s*tonne)**	**Emission Rates g/s**	**Ratio ER/PR (g*hr)/(s*tonne)**	**Emission Rates g/s**	**Ratio ER/PR (g*hr)/(s*tonne)**	**Min ER/PR Ratio (g*hr)/(s*tonne)**	**Maximum ER/PR Ratio (g*hr)/(s*tonne)**	**Average ER/PR Ratio (g*hr)/(s*tonne)**
2,3-Dichlorophenol	576-24-9	2.37E-07	1.60E-08	1.77E-07	1.25E-08	3.56E-07	1.96E-08	8.78E-07	5.20E-08	1.84E-06	1.03E-07	1.25E-08	1.03E-07	4.07E-08
3,4-Dichlorophenol	95-77-2	2.37E-07	1.60E-08	1.77E-07	1.25E-08	3.56E-07	1.96E-08	8.78E-07	5.20E-08	1.84E-06	1.03E-07	1.25E-08	1.03E-07	4.07E-08
2,4,6-Trichlorophenol	88-06-2	2.37E-07	1.60E-08	1.77E-07	1.25E-08	3.56E-07	1.96E-08	8.78E-07	5.20E-08	1.84E-06	1.03E-07	1.25E-08	1.03E-07	4.07E-08
2,3,6-Trichlorophenol	933-75-5	2.37E-07	1.60E-08	1.77E-07	1.25E-08	3.56E-07	1.96E-08	8.78E-07	5.20E-08	1.84E-06	1.03E-07	1.25E-08	1.03E-07	4.07E-08
2,3,5-Trichlorophenol	933-78-8	2.37E-07	1.60E-08	1.77E-07	1.25E-08	3.56E-07	1.96E-08	8.78E-07	5.20E-08	1.84E-06	1.03E-07	1.25E-08	1.03E-07	4.07E-08
2,4,5-Trichlorophenol	95-95-4	2.37E-07	1.60E-08	1.77E-07	1.25E-08	3.56E-07	1.96E-08	8.78E-07	5.20E-08	1.84E-06	1.03E-07	1.25E-08	1.03E-07	4.07E-08
2,3,4-Trichlorophenol	15950-66-0	2.37E-07	1.60E-08	1.77E-07	1.25E-08	3.56E-07	1.96E-08	8.78E-07	5.20E-08	1.84E-06	1.03E-07	1.25E-08	1.03E-07	4.07E-08
3,4,5-Trichlorophenol	609-19-8	2.37E-07	1.60E-08	1.77E-07	1.25E-08	3.56E-07	1.96E-08	8.78E-07	5.20E-08	1.84E-06	1.03E-07	1.25E-08	1.03E-07	4.07E-08
2,3,5,6/2,3,4,6-Tetrachlorophenol	58-90-2	2.37E-07	1.60E-08	1.77E-07	1.25E-08	3.56E-07	1.96E-08	8.78E-07	5.20E-08	1.84E-06	1.03E-07	1.25E-08	1.03E-07	4.07E-08
2,3,4,5-Tetrachlorophenol	4901-51-3	2.37E-07	1.60E-08	1.77E-07	1.25E-08	3.56E-07	1.96E-08	8.78E-07	5.20E-08	1.84E-06	1.03E-07	1.25E-08	1.03E-07	4.07E-08
Pentachlorophenol	87-86-5	2.37E-07	1.60E-08	1.77E-07	1.25E-08	3.56E-07	1.96E-08	8.78E-07	5.20E-08	1.84E-06	1.03E-07	1.25E-08	1.03E-07	4.07E-08
1,3-Dichlorobenzene	541-73-1	3.57E-07	2.42E-08	5.92E-07	4.18E-08	9.61E-07	5.29E-08	6.15E-07	3.64E-08	1.84E-06	1.03E-07	2.42E-08	1.03E-07	5.17E-08
1,4-Dichlorobenzene	106-46-7	1.79E-06	1.21E-07	3.68E-06	2.60E-07	1.62E-05	8.91E-07	4.03E-06	2.39E-07	4.33E-06	2.43E-07	1.21E-07	8.91E-07	3.51E-07
1,2-Dichlorobenzene	95-50-1	9.01E-07	6.10E-08	6.76E-07	4.77E-08	1.49E-06	8.19E-08	1.40E-06	8.29E-08	1.84E-06	1.03E-07	4.77E-08	1.03E-07	7.53E-08
1,3,5-Trichlorobenzene	108-70-3	3.54E-08	2.40E-09	7.96E-08	5.62E-09	8.57E-08	4.71E-09	1.04E-07	6.16E-09	1.84E-06	1.03E-07	2.40E-09	1.03E-07	2.44E-08
1,2,4-Trichlorobenzene	120-82-1	2.00E-07	1.36E-08	2.49E-07	1.75E-08	1.17E-06	6.43E-08	2.96E-07	1.75E-08	1.84E-06	1.03E-07	1.36E-08	1.03E-07	4.32E-08
1,2,3-Trichlorobenzene	87-61-6	1.66E-07	1.13E-08	1.90E-07	1.34E-08	4.58E-07	2.52E-08	2.09E-07	1.24E-08	1.84E-06	1.03E-07	1.13E-08	1.03E-07	3.31E-08
1,2,3,5/1,2,4,5-Tetrachlorobenzene	95-94-3	1.09E-07	7.37E-09	9.05E-08	6.38E-09	1.49E-06	8.19E-08	5.46E-08	3.24E-09	1.84E-06	1.03E-07	3.24E-09	1.03E-07	4.04E-08
1,2,3,4-Tetrachlorobenzene	634-66-2	9.62E-08	6.51E-09	1.46E-07	1.03E-08	5.25E-07	2.89E-08	4.07E-08	2.41E-09	1.84E-06	1.03E-07	2.41E-09	1.03E-07	3.02E-08
Pentachlorobenzene	608-93-5	1.32E-07	8.94E-09	1.29E-07	9.12E-09	8.29E-07	4.56E-08	4.07E-08	2.41E-09	1.84E-06	1.03E-07	2.41E-09	1.03E-07	3.38E-08
Hexachlorobenzene	118-74-1	1.22E-07	8.24E-09	4.87E-08	3.43E-09	1.01E-07	5.55E-09	4.07E-08	2.41E-09	1.84E-06	1.03E-07	2.41E-09	1.03E-07	2.45E-08
Total Average Dioxin/Furan and PCB Like Congeners	NA-DFPCB	3.97E-11	2.69E-12	1.88E-10	1.33E-11	9.74E-11	5.35E-12	6.89E-11	4.08E-12	1.80E-10	1.01E-11	2.69E-12	1.33E-11	7.10E-12
Polychlorinated Biphenyls (Total PCB)	1336-36-3									8.00E-07	4.48E-08	4.48E-08	4.48E-08	4.48E-08

Notes:

(1) Average waste processing rate, dry reference flow rate, actual flow rate, gas exit velocity and temperature for the period of the stack test

(2) Dry Reference flow rate at 25°C and 101.3 kPa

(3) Emission Rates for Metal Compounds, including aluminum oxide, calcium oxide, magnesium oxide, phosphorus pentachloride, silica, and soidium hydroxide are calculated based on concentrations of metals and conversion factor assuming all of the metals emitted were present as these metal compounds

Appendix C

Estimated Existing and Future Facility Emission Rates

Table C.1

Emissions for Existing Facility Natural Gas Turbine and Boiler

Source ID	Source Description	Maximum Heat Input (MMBTU/hr)	Contaminant	CAS No.	US EPA Emission Factor (lb/MMBtu)	Maximum Emission Rate (g/s)
S2	Gas Turbine Generator	61.89	Carbon Monoxide	630-08-0	-	0.7226
			Nitrogen Oxides	10102-44-0	-	0.9340
			Particulate Matter	NA-PM	-	0.0560
			Sulphur Dioxide	7446-09-5	-	0.1373
S3	Natural Gas Fired Boiler Exhaust	178.82	Carbon Monoxide	630-08-0	0.0824	1.8555
			Nitrogen Oxides	10102-44-0	0.1863	4.1969
			Particulate Matter	NA-PM	0.0075	0.1679
			Sulphur Dioxide	7446-09-5	0.0006	0.0133

Note:
(1) Maximum Stack Test Result from 2017-2021. The capacity of the equipment is 5MW and the gas turbine was operated at or very close to capacity for each source test.
(2) USEPA AP-42 Chapter 1.4, Natural Gas Combustion, emission factors for uncontrolled large boilers (>100 MMBtu)(post-NSPS)
(3) The Gas Turbine and Generator and Natural Gas Fired Boiler will not operate for the expanded plant

Table C.2

Emissions for Existing Facility - Main Stack

Existing Unit	**Unit**	**Main Stack**
Nominal Waste Processing Rate	(tonnes/hr)	22.75

Pollutant	**CAS Number**	**Emission Rate (g/s) (1)(2)**		
		Normal Operation	**Normal Operation Plus Turbine Operation**	**Stack Bypass**
Particulate Matter	NA-PM	2.05E-01	2.61E-01 (2)	2.05E-01
PM10	NA-PM10	2.05E-01	2.61E-01	2.05E-01
PM2.5	NA-PM2.5	2.05E-01	2.61E-01	2.05E-01
Nitrogen Oxides	10102-44-0	4.84E+00	5.78E+00 (2)	8.36E+00 (3)
Carbon Monoxide	630-08-0	5.02E-01	1.22E+00 (2)	5.02E-01
Sulphur Dioxide	7446-09-5	1.02E+00	1.16E+00 (2)	1.02E+00
Aluminum	7429-90-5	1.15E-03	1.15E-03	1.15E-03
Aluminum oxide	1344-28-1	2.17E-03	2.17E-03	2.17E-03
Antimony	7440-36-0	5.45E-05	5.45E-05	5.45E-05
Arsenic	7440-38-2	7.69E-05	7.69E-05	7.69E-05
Barium	7440-39-3	1.60E-04	1.60E-04	1.60E-04
Beryllium	7440-41-7	1.88E-06	1.88E-06	1.88E-06
Boron	7440-42-8	5.03E-03	5.03E-03	5.03E-03
Cadmium	7440-43-9	2.79E-05	2.79E-05	2.79E-05
Calcium	7440-70-2	5.08E-02	5.08E-02	5.08E-02
Calcium oxide	1305-78-8	7.11E-02	7.11E-02	7.11E-02
Chromium	7440-47-3	1.99E-04	1.99E-04	1.99E-04
Cobalt	7440-48-4	1.85E-04	1.85E-04	1.85E-04
Copper	7440-50-8	2.10E-03	2.10E-03	2.10E-03
Iron	7439-89-6	3.37E-03	3.37E-03	3.37E-03
Lead	7439-92-1	2.65E-04	2.65E-04	2.65E-04
Lithium	7439-93-2	1.43E-05	1.43E-05	1.43E-05
Magnesium	7439-95-4	1.40E-03	1.40E-03	1.40E-03
Magnesium oxide	1309-48-4	2.32E-03	2.32E-03	2.32E-03
Manganese	7439-96-5	7.48E-04	7.48E-04	7.48E-04
Molybdenum	7439-98-7	1.49E-04	1.49E-04	1.49E-04
Nickel	7440-02-0	3.42E-04	3.42E-04	3.42E-04
Phosphorus	7723-14-0	8.69E-04	8.69E-04	8.69E-04
Phosphorous pentachloride	10026-13-8	5.85E-03	5.85E-03	5.85E-03
Selenium	7782-49-2	2.07E-05	2.07E-05	2.07E-05
Silver	7440-22-4	7.90E-06	7.90E-06	7.90E-06
Sodium	7440-23-5	1.73E-02	1.73E-02	1.73E-02
Sodium hydroxide	1310-73-2	3.01E-02	3.01E-02	3.01E-02
Strontium	7440-24-6	3.94E-05	3.94E-05	3.94E-05
Tin	7440-31-5	3.06E-04	3.06E-04	3.06E-04
Titanium	7440-32-6	1.33E-04	1.33E-04	1.33E-04
Vanadium	7440-62-2	8.26E-06	8.26E-06	8.26E-06
Zinc	7440-66-6	2.90E-03	2.90E-03	2.90E-03
Silicon	7440-21-3	4.86E-03	4.86E-03	4.86E-03
Silica	14464-46-1	1.04E-02	1.04E-02	1.04E-02
Mercury	7439-97-6	2.81E-05	2.81E-05	2.81E-05
Hydrogen Chloride	7647-01-0	3.50E-01	3.50E-01	3.50E-01
Hydrogen Fluoride	7664-39-3	1.72E-02	1.72E-02	1.72E-02
1,1,1-Trichloroethane	71-55-6	5.52E-05	5.52E-05	5.52E-05
1,1-Dichloroethane	75-34-3	6.62E-05	6.62E-05	6.62E-05
1,2-Dichloroethane	107-06-2	1.27E-04	1.27E-04	1.27E-04
1,2-Dichloropropane	78-87-5	5.52E-05	5.52E-05	5.52E-05
1,3,5-Trimethylbenzene	108-67-8	9.08E-05	9.08E-05	9.08E-05
1,3-Butadiene	106-99-0	9.08E-05	9.08E-05	9.08E-05

Table C.2

Emissions for Existing Facility - Main Stack

Existing Unit	**Unit**	**Main Stack**
Nominal Waste Processing Rate	(tonnes/hr)	22.75

Pollutant	**CAS Number**	**Emission Rate (g/s) (1)(2)**		
		Normal Operation	**Normal Operation Plus Turbine Operation**	**Stack Bypass**
2-Butanone	78-93-3	3.92E-04	3.92E-04	3.92E-04
Acetone	67-64-1	5.81E-04	5.81E-04	5.81E-04
Benzene	71-43-2	5.76E-03	5.76E-03	5.76E-03
Bromodichloromethane	75-27-4	5.52E-05	5.52E-05	5.52E-05
Bromoform	75-25-2	9.60E-05	9.60E-05	9.60E-05
Bromomethane	74-83-9	4.63E-04	4.63E-04	4.63E-04
Carbon Tetrachloride	56-23-5	5.52E-05	5.52E-05	5.52E-05
Chlorodibromomethane	124-48-1	5.77E-05	5.77E-05	5.77E-05
Chloroform	67-66-3	5.84E-05	5.84E-05	5.84E-05
Dichlorofluoromethane	75-43-4	9.56E-05	9.56E-05	9.56E-05
Ethylbenzene	100-41-4	9.08E-05	9.08E-05	9.08E-05
Ethylene Dibromide	106-93-4	5.52E-05	5.52E-05	5.52E-05
Isopropylbenzene	98-82-8	5.52E-05	5.52E-05	5.52E-05
Xylene (Total)	1330-20-7	2.39E-04	2.39E-04	2.39E-04
Methylene Chloride	75-09-2	2.60E-03	2.60E-03	2.60E-03
Styrene	100-42-5	5.92E-05	5.92E-05	5.92E-05
Tetrachloroethene	127-18-4	9.67E-05	9.67E-05	9.67E-05
Toluene	108-88-3	1.02E-03	1.02E-03	1.02E-03
trans,1,2-Dichloroethene	156-60-5	1.27E-04	1.27E-04	1.27E-04
Trichloroethylene	79-01-6	5.52E-05	5.52E-05	5.52E-05
Trichlorofluoromethane	75-69-4	9.10E-05	9.10E-05	9.10E-05
Trichlorotrifluoroethane	76-13-1	9.08E-05	9.08E-05	9.08E-05
Vinyl Chloride	75-01-4	9.08E-05	9.08E-05	9.08E-05
Formaldehyde	50-00-0	2.01E-02	2.01E-02	2.01E-02
Acetaldehyde	75-07-0	2.06E-02	2.06E-02	2.06E-02
Acrolein	107-02-8	1.08E-04	1.08E-04	1.08E-04
1-Methylnaphthalene	90-12-0	3.90E-06	3.90E-06	3.90E-06
1-Methylphenanthrene	832-69-9	7.84E-07	7.84E-07	7.84E-07
2-Chloronaphthalene	91-58-7	5.74E-07	5.74E-07	5.74E-07
2-methylanthracene	613-12-7	6.88E-07	6.88E-07	6.88E-07
2-Methylnaphthalene	91-57-6	7.65E-06	7.65E-06	7.65E-06
3-Methylcholanthrene	56-49-5	6.44E-07	6.44E-07	6.44E-07
7,12-Dimethylbenzo(a)anthracene	57-97-6	1.95E-06	1.95E-06	1.95E-06
7H-Dibenzo(c,g)carbazole	194-59-2	1.87E-07	1.87E-07	1.87E-07
9,10-dimethylanthracene	781-43-1	5.92E-07	5.92E-07	5.92E-07
9-Methylphenanthrene	883-20-5	6.62E-07	6.62E-07	6.62E-07
Acenaphthene	83-32-9	1.24E-06	1.24E-06	1.24E-06
Acenaphthylene	208-96-8	2.49E-06	2.49E-06	2.49E-06
Anthracene	120-12-7	1.13E-06	1.13E-06	1.13E-06
Benzo(a)Anthracene	56-55-3	6.02E-07	6.02E-07	6.02E-07
Benzo(a)fluorene	238-84-6	5.44E-07	5.44E-07	5.44E-07
Benzo(a)Pyrene	50-32-8	2.10E-07	2.10E-07	2.10E-07
Benzo(b)Fluoranthene	205-99-2	6.43E-07	6.43E-07	6.43E-07
Benzo(b)fluorene	243-17-4	5.46E-07	5.46E-07	5.46E-07
Benzo(e)Pyrene	192-97-2	7.78E-07	7.78E-07	7.78E-07
Benzo(g,h,i)Perylene	191-24-2	7.20E-07	7.20E-07	7.20E-07
Benzo(j / k)Fluoranthene	76774-50-0	6.50E-07	6.50E-07	6.50E-07
Biphenyl	92-52-4	1.36E-05	1.36E-05	1.36E-05
Chrysene	218-01-9	6.68E-07	6.68E-07	6.68E-07

Table C.2

Emissions for Existing Facility - Main Stack

Existing Unit	**Unit**	**Main Stack**
Nominal Waste Processing Rate	(tonnes/hr)	22.75

Pollutant	**CAS Number**	**Emission Rate (g/s) (1)(2)**		
		Normal Operation	**Normal Operation Plus Turbine Operation**	**Stack Bypass**
Triphenylene	217-59-4	8.73E-07	8.73E-07	8.73E-07
Coronene	191-07-1	7.12E-07	7.12E-07	7.12E-07
Dibenzo(a,c/a,h)Anthracene	53-70-3	5.42E-07	5.42E-07	5.42E-07
Dibenzo(a,e)pyrene	192-65-4	6.97E-07	6.97E-07	6.97E-07
Fluoranthene	206-44-0	1.54E-06	1.54E-06	1.54E-06
Fluorene	86-73-7	2.07E-06	2.07E-06	2.07E-06
Indeno(1,2,3-cd)Pyrene	193-39-5	5.84E-07	5.84E-07	5.84E-07
m-terphenyl	92-06-8	2.11E-06	2.11E-06	2.11E-06
Naphthalene	91-20-3	2.27E-05	2.27E-05	2.27E-05
o-Terphenyl	84-15-1	6.63E-07	6.63E-07	6.63E-07
Perylene	198-55-0	5.20E-07	5.20E-07	5.20E-07
Phenanthrene	85-01-8	3.33E-06	3.33E-06	3.33E-06
Picene	213-46-7	6.59E-07	6.59E-07	6.59E-07
p-terphenyl	92-94-4	5.60E-07	5.60E-07	5.60E-07
Pyrene	129-00-0	1.82E-06	1.82E-06	1.82E-06
Quinoline	91-22-5	2.76E-06	2.76E-06	2.76E-06
Tetralin	119-64-2	5.24E-06	5.24E-06	5.24E-06
2,6-Dichlorophenol	87-65-0	9.25E-07	9.25E-07	9.25E-07
2,4/2,5-Dichlorophenol	120-83-2	9.30E-07	9.30E-07	9.30E-07
3,5-Dichlorophenol	591-35-5	9.51E-07	9.51E-07	9.51E-07
2,3-Dichlorophenol	576-24-9	9.25E-07	9.25E-07	9.25E-07
3,4-Dichlorophenol	95-77-2	9.25E-07	9.25E-07	9.25E-07
2,4,6-Trichlorophenol	88-06-2	9.25E-07	9.25E-07	9.25E-07
2,3,6-Trichlorophenol	933-75-5	9.25E-07	9.25E-07	9.25E-07
2,3,5-Trichlorophenol	933-78-8	9.25E-07	9.25E-07	9.25E-07
2,4,5-Trichlorophenol	95-95-4	9.25E-07	9.25E-07	9.25E-07
2,3,4-Trichlorophenol	15950-66-0	9.25E-07	9.25E-07	9.25E-07
3,4,5-Trichlorophenol	609-19-8	9.25E-07	9.25E-07	9.25E-07
2,3,5,6/2,3,4,6-Tetrachlorophenol	58-90-2	9.25E-07	9.25E-07	9.25E-07
2,3,4,5-Tetrachlorophenol	4901-51-3	9.25E-07	9.25E-07	9.25E-07
Pentachlorophenol	87-86-5	9.25E-07	9.25E-07	9.25E-07
1,3-Dichlorobenzene	541-73-1	1.18E-06	1.18E-06	1.18E-06
1,4-Dichlorobenzene	106-46-7	7.98E-06	7.98E-06	7.98E-06
1,2-Dichlorobenzene	95-50-1	1.71E-06	1.71E-06	1.71E-06
1,3,5-Trichlorobenzene	108-70-3	5.55E-07	5.55E-07	5.55E-07
1,2,4-Trichlorobenzene	120-82-1	9.83E-07	9.83E-07	9.83E-07
1,2,3-Trichlorobenzene	87-61-6	7.52E-07	7.52E-07	7.52E-07
1,2,3,5/1,2,4,5-Tetrachlorobenzene	95-94-3	9.19E-07	9.19E-07	9.19E-07
1,2,3,4-Tetrachlorobenzene	634-66-2	6.88E-07	6.88E-07	6.88E-07
Pentachlorobenzene	608-93-5	7.70E-07	7.70E-07	7.70E-07
Hexachlorobenzene	118-74-1	5.58E-07	5.58E-07	5.58E-07
Total Average Dioxin/Furan and PCB Like Congeners	NA-DFPCB	1.61E-10	1.61E-10	1.61E-10

Table C.2

Emissions for Existing Facility - Main Stack

Existing Unit	**Unit**	**Main Stack**
Nominal Waste Processing Rate	(tonnes/hr)	22.75

Pollutant	**CAS Number**	**Emission Rate (g/s) (1)(2)**		
		Normal Operation	**Normal Operation Plus Turbine Operation**	**Stack Bypass**

Notes:

(1) Emissions calculated using the maximum Emission Rate to Waste Processing Rate Ratio obtained from 2018-2022 stack tests and multiplied by the nominal capacity of the existing facility.

(2) For the existing scenario, a steam turbine generator can run simultaneously with all incinerators for power generation. Meanwhile, the natural gas boiler will operate only when a unit is undergoing scheduled maintenance and is temporarily offline.

Table App C.3

Emission Rates for Compounds with In-Stack Emission Limits for Plant Expansions - Main Stacks

Stack Parameters (1)	**Unit**	**Stack 1 (S1a)**	**Stack 2 (S1b)**	**Stack 3 (S1c)**
Waste Processing Rate	(tonne/hr)	37.50	37.50	37.50
Dry Reference Flow Rate (2)	(DRm^3/s)	69.17	69.17	69.17
Actual Flow Rate (3)	(Am^3/s)	90.28	90.28	90.28
Pollutant	**In-Stack Emission Limit (2)(5)**	**Emission Rate (g/s)**		
Suspended Particulate Matter (Filterable)	5 (4)	0.35	0.35	0.35
Hydrogen Chloride	9 mg/Rm^3	0.62	0.62	0.62
Sulphur Dioxide	35 mg/Rm3	2.42	2.42	2.42
Nitrogen Oxides	121 mg/Rm3	8.37	8.37	8.37
Organic Matter (expressed as equivalent methane)	33 mg/Rm3	2.28	2.28	2.28
Carbon Monoxide	40 mg/Rm3	2.77	2.77	2.77
Cadmium	7 ug/Rm3	4.84E-04	4.84E-04	4.84E-04
Lead	50 ug/Rm3	3.46E-03	3.46E-03	3.46E-03
Mercury	15 ug/Rm3	1.04E-03	1.04E-03	1.04E-03
Dioxins and furans, and Dioxin like PCBs	60 pg/Rm3 TEQ	4.15E-09	4.15E-09	4.15E-09
PM10 (5)	-	0.35	0.35	0.35
PM2.5 (5)	-	0.35	0.35	0.35

Notes:

(1) Provided by Ramboll.
In Phase 1, only S1a is operational. Phase 2 involves the operation of both S1a and S1b, while Phase 3 invovles the simultaneous operation of S1a, S1b, and S1c

(2) Reference Condition of 11% oxygen, 0% moisture, 11% oxygen and 25°C.

(3) Determined based on the flow rate and stack diameter data provided by Ramboll; The gas exit velocity ranges from 8 m/s (minimum) to 20 m/s (maximum) according to Ramboll.

(4) The environmental performance requirements for incinerator systems to burn municipal waste are outlined in the Ontario A7 guideline “Air Pollution Control, Design and Operation Guidelines for Municipal Waste Thermal”. A previously approved energy from waste project (Durham York Energy Center, DYEC) followed stricter emission requirements. In addition,
Emission rates for the new Emerald expanded facility lines stacks have been calculated as the Guideline A7 or the DYEC project's in-stack criteria, or manufactuer guarantee whichever is lower, as a conservative approach.

(5) From this year (2023) it is tightened within the EU to 5 mg/Nm^3 for new plants. Hence, suppliers must be willing to guarantee 5 mg/Nm^3 (at ref. conditions) – this corresponds to around 4.6 mg/Rm^3 (ref. dry gas, 11% O2, 101.3 kPa and 25°C).

(6) PM10 and PM2.5 do not have a in-stack emission limits and also were not included in the stack test. However, based on 'Size Distribution and number concentration of particles at the stack of a municipal waste incinerator' (Buonanno et al. (2009), there are evidence on particle size distributions that suggests that almost all PM emitted from EFW is likely to be in the form of PM2.5 (thus also PM10).

Table C.4

Emission Rates for Compounds Bbased on Stack Test Data for Plant Expansions - Main Stacks

Stack Test Parameters	**Unit**	**Stack 1 (S1a)**	**Stack 2 (S1b)**	**Stack 3 (S1c)**
Waste Processing Rate	(tonnes/hr)	37.5	37.5	37.5
Pollutant	**CAS Number**	**Emission Rate - Normal Operation (g/s) (1)**		
Particulate Matter	NA-PM	3.38E-01	3.38E-01	3.38E-01
Nitrogen Oxides	10102-44-0	8.93E+00	8.93E+00	8.93E+00
Carbon Monoxide	630-08-0	1.63E+00	1.63E+00	1.63E+00
Sulphur Dioxide	7446-09-5	2.17E+00	2.17E+00	2.17E+00
Aluminum	7429-90-5	1.89E-03	1.89E-03	1.89E-03
Aluminum oxide	1344-28-1	3.58E-03	3.58E-03	3.58E-03
Antimony	7440-36-0	8.98E-05	8.98E-05	8.98E-05
Arsenic	7440-38-2	1.27E-04	1.27E-04	1.27E-04
Barium	7440-39-3	2.63E-04	2.63E-04	2.63E-04
Beryllium	7440-41-7	3.10E-06	3.10E-06	3.10E-06
Boron	7440-42-8	8.29E-03	8.29E-03	8.29E-03
Cadmium	7440-43-9	6.00E-05	6.00E-05	6.00E-05
Calcium	7440-70-2	8.38E-02	8.38E-02	8.38E-02
Calcium oxide	1305-78-8	1.17E-01	1.17E-01	1.17E-01
Chromium	7440-47-3	3.28E-04	3.28E-04	3.28E-04
Cobalt	7440-48-4	3.05E-04	3.05E-04	3.05E-04
Copper	7440-50-8	3.47E-03	3.47E-03	3.47E-03
Iron	7439-89-6	5.55E-03	5.55E-03	5.55E-03
Lead	7439-92-1	6.92E-04	6.92E-04	6.92E-04
Lithium	7439-93-2	2.35E-05	2.35E-05	2.35E-05
Magnesium	7439-95-4	2.31E-03	2.31E-03	2.31E-03
Magnesium oxide	1309-48-4	3.83E-03	3.83E-03	3.83E-03
Manganese	7439-96-5	1.23E-03	1.23E-03	1.23E-03
Molybdenum	7439-98-7	2.46E-04	2.46E-04	2.46E-04
Nickel	7440-02-0	5.64E-04	5.64E-04	5.64E-04
Phosphorus	7723-14-0	1.43E-03	1.43E-03	1.43E-03
Phosphorous pentachloride	10026-13-8	9.64E-03	9.64E-03	9.64E-03
Selenium	7782-49-2	3.41E-05	3.41E-05	3.41E-05
Silver	7440-22-4	1.30E-05	1.30E-05	1.30E-05
Sodium	7440-23-5	2.85E-02	2.85E-02	2.85E-02
Sodium hydroxide	1310-73-2	4.97E-02	4.97E-02	4.97E-02
Strontium	7440-24-6	6.50E-05	6.50E-05	6.50E-05
Tin	7440-31-5	5.05E-04	5.05E-04	5.05E-04
Titanium	7440-32-6	2.19E-04	2.19E-04	2.19E-04
Vanadium	7440-62-2	1.36E-05	1.36E-05	1.36E-05
Zinc	7440-66-6	4.77E-03	4.77E-03	4.77E-03
Silicon	7440-21-3	8.02E-03	8.02E-03	8.02E-03
Silica	14464-46-1	1.72E-02	1.72E-02	1.72E-02
Mercury	7439-97-6	9.76E-05	9.76E-05	9.76E-05
Hydrogen Chloride	7647-01-0	1.23E+00	1.23E+00	1.23E+00
Hydrogen Fluoride	7664-39-3	2.84E-02	2.84E-02	2.84E-02
1,1,1-Trichloroethane	71-55-6	9.10E-05	9.10E-05	9.10E-05
1,1-Dichloroethane	75-34-3	1.09E-04	1.09E-04	1.09E-04
1,2-Dichloroethane	107-06-2	2.10E-04	2.10E-04	2.10E-04
1,2-Dichloropropane	78-87-5	9.10E-05	9.10E-05	9.10E-05
1,3,5-Trimethylbenzene	108-67-8	1.50E-04	1.50E-04	1.50E-04

Table C.4

Emission Rates for Compounds Bbased on Stack Test Data for Plant Expansions - Main Stacks

Stack Test Parameters	**Unit**	**Stack 1 (S1a)**	**Stack 2 (S1b)**	**Stack 3 (S1c)**
Waste Processing Rate	(tonnes/hr)	37.5	37.5	37.5
Pollutant	**CAS Number**	**Emission Rate - Normal Operation (g/s) (1)**		
1,3-Butadiene	106-99-0	1.50E-04	1.50E-04	1.50E-04
2-Butanone	78-93-3	6.46E-04	6.46E-04	6.46E-04
Acetone	67-64-1	9.58E-04	9.58E-04	9.58E-04
Benzene	**71-43-2**	**9.50E-03**	**9.50E-03**	**9.50E-03**
Bromodichloromethane	75-27-4	9.10E-05	9.10E-05	9.10E-05
Bromoform	75-25-2	1.58E-04	1.58E-04	1.58E-04
Bromomethane	74-83-9	7.63E-04	7.63E-04	7.63E-04
Carbon Tetrachloride	56-23-5	9.10E-05	9.10E-05	9.10E-05
Chlorodibromomethane	124-48-1	9.52E-05	9.52E-05	9.52E-05
Chloroform	67-66-3	9.63E-05	9.63E-05	9.63E-05
Dichlorofluoromethane	75-43-4	1.58E-04	1.58E-04	1.58E-04
Ethylbenzene	100-41-4	1.50E-04	1.50E-04	1.50E-04
Ethylene Dibromide	106-93-4	9.10E-05	9.10E-05	9.10E-05
Isopropylbenzene	98-82-8	9.10E-05	9.10E-05	9.10E-05
Xylene (Total)	1330-20-7	3.93E-04	3.93E-04	3.93E-04
Methylene Chloride	75-09-2	4.28E-03	4.28E-03	4.28E-03
Styrene	100-42-5	9.76E-05	9.76E-05	9.76E-05
Tetrachloroethene	127-18-4	1.59E-04	1.59E-04	1.59E-04
Toluene	108-88-3	1.68E-03	1.68E-03	1.68E-03
trans,1,2-Dichloroethene	156-60-5	2.10E-04	2.10E-04	2.10E-04
Trichloroethylene	79-01-6	9.10E-05	9.10E-05	9.10E-05
Trichlorofluoromethane	75-69-4	1.50E-04	1.50E-04	1.50E-04
Trichlorotrifluoroethane	76-13-1	1.50E-04	1.50E-04	1.50E-04
Vinyl Chloride	75-01-4	1.50E-04	1.50E-04	1.50E-04
Formaldehyde	50-00-0	3.32E-02	3.32E-02	3.32E-02
Acetaldehyde	75-07-0	3.40E-02	3.40E-02	3.40E-02
Acrolein	107-02-8	1.78E-04	1.78E-04	1.78E-04
1-Methylnaphthalene	90-12-0	6.42E-06	6.42E-06	6.42E-06
1-Methylphenanthrene	832-69-9	1.29E-06	1.29E-06	1.29E-06
2-Chloronaphthalene	91-58-7	9.47E-07	9.47E-07	9.47E-07
2-methylanthracene	613-12-7	1.13E-06	1.13E-06	1.13E-06
2-Methylnaphthalene	91-57-6	1.26E-05	1.26E-05	1.26E-05
3-Methylcholanthrene	56-49-5	1.06E-06	1.06E-06	1.06E-06
7,12-Dimethylbenzo(a)anthracene	57-97-6	3.22E-06	3.22E-06	3.22E-06
7H-Dibenzo(c,g)carbazole	194-59-2	3.09E-07	3.09E-07	3.09E-07
9,10-dimethylanthracene	781-43-1	9.76E-07	9.76E-07	9.76E-07
9-Methylphenanthrene	883-20-5	1.09E-06	1.09E-06	1.09E-06
Acenaphthene	83-32-9	2.04E-06	2.04E-06	2.04E-06
Acenaphthylene	208-96-8	4.10E-06	4.10E-06	4.10E-06
Anthracene	120-12-7	1.87E-06	1.87E-06	1.87E-06
Benzo(a)Anthracene	56-55-3	9.92E-07	9.92E-07	9.92E-07
Benzo(a)fluorene	238-84-6	8.96E-07	8.96E-07	8.96E-07
Benzo(a)Pyrene	50-32-8	3.46E-07	3.46E-07	3.46E-07
Benzo(b)Fluoranthene	205-99-2	1.06E-06	1.06E-06	1.06E-06
Benzo(b)fluorene	243-17-4	9.00E-07	9.00E-07	9.00E-07
Benzo(e)Pyrene	192-97-2	1.28E-06	1.28E-06	1.28E-06

Table C.4

Emission Rates for Compounds Bbased on Stack Test Data for Plant Expansions - Main Stacks

Stack Test Parameters	**Unit**	**Stack 1 (S1a)**	**Stack 2 (S1b)**	**Stack 3 (S1c)**
Waste Processing Rate	(tonnes/hr)	37.5	37.5	37.5
Pollutant	**CAS Number**	**Emission Rate - Normal Operation (g/s) (1)**		
Benzo(g,h,i)Perylene	191-24-2	1.19E-06	1.19E-06	1.19E-06
Benzo(j / k)Fluoranthene	76774-50-0	1.07E-06	1.07E-06	1.07E-06
Biphenyl	92-52-4	2.24E-05	2.24E-05	2.24E-05
Chrysene	218-01-9	1.10E-06	1.10E-06	1.10E-06
Triphenylene	217-59-4	1.44E-06	1.44E-06	1.44E-06
Coronene	191-07-1	1.17E-06	1.17E-06	1.17E-06
Dibenzo(a,c/a,h)Anthracene	53-70-3	8.93E-07	8.93E-07	8.93E-07
Dibenzo(a,e)pyrene	192-65-4	1.15E-06	1.15E-06	1.15E-06
Fluoranthene	206-44-0	2.53E-06	2.53E-06	2.53E-06
Fluorene	86-73-7	3.40E-06	3.40E-06	3.40E-06
Indeno(1,2,3-cd)Pyrene	193-39-5	9.63E-07	9.63E-07	9.63E-07
m-terphenyl	92-06-8	3.48E-06	3.48E-06	3.48E-06
Naphthalene	91-20-3	3.74E-05	3.74E-05	3.74E-05
o-Terphenyl	84-15-1	1.09E-06	1.09E-06	1.09E-06
Perylene	198-55-0	8.57E-07	8.57E-07	8.57E-07
Phenanthrene	85-01-8	5.48E-06	5.48E-06	5.48E-06
Picene	213-46-7	1.09E-06	1.09E-06	1.09E-06
p-terphenyl	92-94-4	9.24E-07	9.24E-07	9.24E-07
Pyrene	129-00-0	2.99E-06	2.99E-06	2.99E-06
Quinoline	91-22-5	4.55E-06	4.55E-06	4.55E-06
Tetralin	119-64-2	8.63E-06	8.63E-06	8.63E-06
2,6-Dichlorophenol	87-65-0	1.52E-06	1.52E-06	1.52E-06
2,4/2,5-Dichlorophenol	120-83-2	1.53E-06	1.53E-06	1.53E-06
3,5-Dichlorophenol	591-35-5	1.57E-06	1.57E-06	1.57E-06
2,3-Dichlorophenol	576-24-9	1.52E-06	1.52E-06	1.52E-06
3,4-Dichlorophenol	95-77-2	1.52E-06	1.52E-06	1.52E-06
2,4,6-Trichlorophenol	88-06-2	1.52E-06	1.52E-06	1.52E-06
2,3,6-Trichlorophenol	933-75-5	1.52E-06	1.52E-06	1.52E-06
2,3,5-Trichlorophenol	933-78-8	1.52E-06	1.52E-06	1.52E-06
2,4,5-Trichlorophenol	95-95-4	1.52E-06	1.52E-06	1.52E-06
2,3,4-Trichlorophenol	15950-66-0	1.52E-06	1.52E-06	1.52E-06
3,4,5-Trichlorophenol	609-19-8	1.52E-06	1.52E-06	1.52E-06
2,3,5,6/2,3,4,6-Tetrachlorophenol	58-90-2	1.52E-06	1.52E-06	1.52E-06
2,3,4,5-Tetrachlorophenol	4901-51-3	1.52E-06	1.52E-06	1.52E-06
Pentachlorophenol	87-86-5	1.52E-06	1.52E-06	1.52E-06
1,3-Dichlorobenzene	541-73-1	1.94E-06	1.94E-06	1.94E-06
1,4-Dichlorobenzene	106-46-7	1.31E-05	1.31E-05	1.31E-05
1,2-Dichlorobenzene	95-50-1	2.83E-06	2.83E-06	2.83E-06
1,3,5-Trichlorobenzene	108-70-3	9.15E-07	9.15E-07	9.15E-07
1,2,4-Trichlorobenzene	120-82-1	1.62E-06	1.62E-06	1.62E-06
1,2,3-Trichlorobenzene	87-61-6	1.24E-06	1.24E-06	1.24E-06
1,2,3,5/1,2,4,5-Tetrachlorobenzene	95-94-3	1.52E-06	1.52E-06	1.52E-06
1,2,3,4-Tetrachlorobenzene	634-66-2	1.13E-06	1.13E-06	1.13E-06
Pentachlorobenzene	608-93-5	1.27E-06	1.27E-06	1.27E-06
Hexachlorobenzene	118-74-1	9.21E-07	9.21E-07	9.21E-07

Table C.4

Emission Rates for Compounds Bbased on Stack Test Data for Plant Expansions - Main Stacks

Stack Test Parameters	**Unit**	**Stack 1 (S1a)**	**Stack 2 (S1b)**	**Stack 3 (S1c)**
Waste Processing Rate	(tonnes/hr)	37.5	37.5	37.5
Pollutant	**CAS Number**	**Emission Rate - Normal Operation (g/s) (1)**		
Total Average Dioxin/Furan and PCB Like Congeners	NA-DFPCB	4.98E-10	4.98E-10	4.98E-10
Polychlorinated Biphenyls (Total PCB)	1336-36-3	1.68E-06	1.68E-06	1.68E-06

Notes:

(1) Emissions calculated using the maximum Emission Rate to Waste Processing Rate Ratio obtained from 2018-2022 stack tests for the existing facility and multiplied by the nominal capacity of the new lines

Table C.5

Total Emission Rates for Plant Expansions

Pollutant	CAS Number	Emission Rates (g/s)(1)(2) Phase 1 100% Capacity Operation 1 Unit (300,000 tpa)	Phase 2 100% Capacity Operation 2 Unit (600,000 tpa)	Phase 3 100% Capacity Operation 3 Unit (900,000 tpa)
Suspended Particulate Matter	NA-PM	3.46E-01	6.92E-01	1.04E+00
Nitrogen Oxides (NOx)	10102-44-0	8.37E+00	1.67E+01	2.51E+01
Carbon Monoxide	630-08-0	2.77E+00	5.53E+00	8.30E+00
Sulphur Dioxide	7446-09-5	2.42E+00	4.84E+00	7.26E+00
Organic matter (expressed as equivalent methane)	74-82-8	2.28E+00	4.57E+00	6.85E+00
Ozone	10028-15-6	-	-	-
PM10	NA-PM10	3.46E-01	6.92E-01	1.04E+00
PM2.5	NA-PM2.5	3.46E-01	6.92E-01	1.04E+00
Aluminum	7429-90-5	1.89E-03	3.78E-03	5.68E-03
Aluminum Oxide	1344-28-1	3.58E-03	7.15E-03	1.07E-02
Antimony	7440-36-0	8.98E-05	1.80E-04	2.70E-04
Arsenic	7440-38-2	1.27E-04	2.53E-04	3.80E-04
Barium	7440-39-3	2.63E-04	5.27E-04	7.90E-04
Beryllium	7440-41-7	3.10E-06	6.19E-06	9.29E-06
Boron	7440-42-8	8.29E-03	1.66E-02	2.49E-02
Cadmium	7440-43-9	4.84E-04	9.68E-04	1.45E-03
Calcium	7440-70-2	8.38E-02	1.68E-01	2.51E-01
Calcium Oxide	1305-78-8	1.17E-01	2.34E-01	3.52E-01
Chromium	7440-47-3	3.28E-04	6.57E-04	9.85E-04
Cobalt	7440-48-4	3.05E-04	6.11E-04	9.16E-04
Copper	7440-50-8	3.47E-03	6.93E-03	1.04E-02
Iron	7439-89-6	5.55E-03	1.11E-02	1.67E-02
Lead	7439-92-1	3.46E-03	6.92E-03	1.04E-02
Lithium	7439-93-2	2.35E-05	4.70E-05	7.05E-05
Magnesium	7439-95-4	2.31E-03	4.61E-03	6.92E-03
Magnesium oxide	1309-48-4	3.83E-03	7.65E-03	1.15E-02
Manganese	7439-96-5	1.23E-03	2.47E-03	3.70E-03
Molybdenum	7439-98-7	2.46E-04	4.92E-04	7.38E-04
Nickel	7440-02-0	5.64E-04	1.13E-03	1.69E-03
Phosphorus	7723-14-0	1.43E-03	2.87E-03	4.30E-03
Phosphorous pentachloride	10026-13-8	9.64E-03	1.93E-02	2.89E-02
Selenium	7782-49-2	3.41E-05	6.81E-05	1.02E-04
Silver	7440-22-4	1.30E-05	2.60E-05	3.91E-05
Sodium	7440-23-5	2.85E-02	5.71E-02	8.56E-02
Sodium hydroxide	1310-73-2	4.97E-02	9.93E-02	1.49E-01
Strontium	7440-24-6	6.50E-05	1.30E-04	1.95E-04
Tin	7440-31-5	5.05E-04	1.01E-03	1.51E-03
Titanium	7440-32-6	2.19E-04	4.38E-04	6.56E-04
Vanadium	7440-62-2	1.36E-05	2.72E-05	4.09E-05
Zinc	7440-66-6	4.77E-03	9.55E-03	1.43E-02
Silicon	7440-21-3	8.02E-03	1.60E-02	2.41E-02
Silica	14464-46-1	1.72E-02	3.43E-02	5.15E-02
Mercury	7439-97-6	1.04E-03	2.08E-03	3.11E-03
Mercury (as Hg) – alkyl compounds	7439-97-6	1.04E-03	2.08E-03	3.11E-03
Hydrogen Chloride	7647-01-0	6.23E-01	1.25E+00	1.87E+00
Hydrogen Fluoride	7664-39-3	2.84E-02	5.69E-02	8.53E-02
1,1,1-Trichloroethane	71-55-6	9.10E-05	1.82E-04	2.73E-04
1,1-Dichloroethane	75-34-3	1.09E-04	2.18E-04	3.27E-04
1,2-Dichloroethane	107-06-2	2.10E-04	4.20E-04	6.30E-04
1,2-Dichloropropane	78-87-5	9.10E-05	1.82E-04	2.73E-04
1,3,5-Trimethylbenzene	108-67-8	1.50E-04	2.99E-04	4.49E-04
1,3-Butadiene	106-99-0	1.50E-04	2.99E-04	4.49E-04
2-Butanone	78-93-3	6.46E-04	1.29E-03	1.94E-03
Acetone	67-64-1	9.58E-04	1.92E-03	2.87E-03
Benzene	71-43-2	9.50E-03	1.90E-02	2.85E-02
Bromodichloromethane	75-27-4	9.10E-05	1.82E-04	2.73E-04
Bromoform	75-25-2	1.58E-04	3.16E-04	4.75E-04
Bromomethane	74-83-9	7.63E-04	1.53E-03	2.29E-03
Carbon Tetrachloride	56-23-5	9.10E-05	1.82E-04	2.73E-04
Chlorodibromomethane	124-48-1	9.52E-05	1.90E-04	2.85E-04
Chloroform	67-66-3	9.63E-05	1.93E-04	2.89E-04
Dichlorofluoromethane	75-43-4	1.58E-04	3.15E-04	4.73E-04
Ethylbenzene	100-41-4	1.50E-04	2.99E-04	4.49E-04
Ethylene Dibromide	106-93-4	9.10E-05	1.82E-04	2.73E-04
Isopropylbenzene	98-82-8	9.10E-05	1.82E-04	2.73E-04
Xylenes	1330-20-7	3.93E-04	7.86E-04	1.18E-03
Methylene Chloride	75-09-2	4.28E-03	8.56E-03	1.28E-02
Styrene	100-42-5	9.76E-05	1.95E-04	2.93E-04
Tetrachloroethene	127-18-4	1.59E-04	3.19E-04	4.78E-04
Toluene	108-88-3	1.68E-03	3.37E-03	5.05E-03
Trichloroethylene	79-01-6	9.10E-05	1.82E-04	2.73E-04
Trichlorofluoromethane	75-69-4	1.50E-04	3.00E-04	4.50E-04
Trichlorotrifluoroethane	76-13-1	1.50E-04	2.99E-04	4.49E-04
Vinyl Chloride	75-01-4	1.50E-04	2.99E-04	4.49E-04
Formaldehyde	50-00-0	3.32E-02	6.64E-02	9.95E-02
Acetaldehyde	75-07-0	3.40E-02	6.79E-02	1.02E-01
Acrolein	107-02-8	1.78E-04	3.57E-04	5.35E-04

Table C.5

Total Emission Rates for Plant Expansions

Pollutant	CAS Number	Emission Rates (g/s)(1)(2) Phase 1 100% Capacity Operation 1 Unit (300,000 tpa)	Phase 2 100% Capacity Operation 2 Unit (600,000 tpa)	Phase 3 100% Capacity Operation 3 Unit (900,000 tpa)
1-Methylnaphthalene	90-12-0	6.42E-06	1.28E-05	1.93E-05
1-Methylphenanthrene	832-69-9	1.29E-06	2.58E-06	3.88E-06
2-Chloronaphthalene	91-58-7	9.47E-07	1.89E-06	2.84E-06
2-methylanthracene	613-12-7	1.13E-06	2.27E-06	3.40E-06
2-Methylnaphthalene	91-57-6	1.26E-05	2.52E-05	3.79E-05
3-Methylcholanthrene	56-49-5	1.06E-06	2.12E-06	3.19E-06
7,12-Dimethylbenzo(a)anthracene	57-97-6	3.22E-06	6.44E-06	9.67E-06
9,10-dimethylanthracene	781-43-1	9.76E-07	1.95E-06	2.93E-06
9-Methylphenanthrene	883-20-5	1.09E-06	2.18E-06	3.27E-06
Acenaphthene	83-32-9	2.04E-06	4.08E-06	6.13E-06
Acenaphthylene	208-96-8	4.10E-06	8.21E-06	1.23E-05
Anthracene	120-12-7	1.87E-06	3.73E-06	5.60E-06
Benzo(a)Anthracene	56-55-3	9.92E-07	1.98E-06	2.98E-06
Benzo(a)fluorene	238-84-6	8.96E-07	1.79E-06	2.69E-06
Benzo(a)Pyrene	50-32-8	3.46E-07	6.92E-07	1.04E-06
Benzo(b)Fluoranthene	205-99-2	1.06E-06	2.12E-06	3.18E-06
Benzo(b)fluorene	243-17-4	9.00E-07	1.80E-06	2.70E-06
Benzo(e)Pyrene	192-97-2	1.28E-06	2.57E-06	3.85E-06
Benzo(g,h,i)Perylene	191-24-2	1.19E-06	2.37E-06	3.56E-06
Benzo(j / k)Fluoranthene	76774-50-0	1.07E-06	2.14E-06	3.21E-06
Biphenyl	92-52-4	2.24E-05	4.49E-05	6.73E-05
Chrysene	218-01-9	1.10E-06	2.20E-06	3.31E-06
Triphenylene	217-59-4	1.44E-06	2.88E-06	4.32E-06
Coronene	191-07-1	1.17E-06	2.35E-06	3.52E-06
Dibenzo(a,c/a,h)Anthracene	53-70-3	8.93E-07	1.79E-06	2.68E-06
Dibenzo(a,e)pyrene	192-65-4	1.15E-06	2.30E-06	3.45E-06
Fluoranthene	206-44-0	2.53E-06	5.06E-06	7.60E-06
Fluorene	86-73-7	3.40E-06	6.81E-06	1.02E-05
Indeno(1,2,3-cd)Pyrene	193-39-5	9.63E-07	1.93E-06	2.89E-06
m-terphenyl	92-06-8	3.48E-06	6.95E-06	1.04E-05
Naphthalene	91-20-3	3.74E-05	7.48E-05	1.12E-04
o-Terphenyl	84-15-1	1.09E-06	2.18E-06	3.28E-06
Perylene	198-55-0	8.57E-07	1.71E-06	2.57E-06
Phenanthrene	85-01-8	5.48E-06	1.10E-05	1.64E-05
Picene	213-46-7	1.09E-06	2.17E-06	3.26E-06
p-terphenyl	92-94-4	9.24E-07	1.85E-06	2.77E-06
Pyrene	129-00-0	2.99E-06	5.99E-06	8.98E-06
Quinoline	91-22-5	4.55E-06	9.11E-06	1.37E-05
Tetralin	119-64-2	8.63E-06	1.73E-05	2.59E-05
2,6-Dichlorophenol	87-65-0	1.52E-06	3.05E-06	4.57E-06
2,4/2,5-Dichlorophenol	120-83-2	1.53E-06	3.07E-06	4.60E-06
3,5-Dichlorophenol	591-35-5	1.57E-06	3.13E-06	4.70E-06
2,3-Dichlorophenol	576-24-9	1.52E-06	3.05E-06	4.57E-06
3,4-Dichlorophenol	95-77-2	1.52E-06	3.05E-06	4.57E-06
2,4,6-Trichlorophenol	88-06-2	1.52E-06	3.05E-06	4.57E-06
2,3,6-Trichlorophenol	933-75-5	1.52E-06	3.05E-06	4.57E-06
2,3,5-Trichlorophenol	933-78-8	1.52E-06	3.05E-06	4.57E-06
2,4,5-Trichlorophenol	95-95-4	1.52E-06	3.05E-06	4.57E-06
2,3,4-Trichlorophenol	15950-66-0	1.52E-06	3.05E-06	4.57E-06
3,4,5-Trichlorophenol	609-19-8	1.52E-06	3.05E-06	4.57E-06
2,3,5,6/2,3,4,6-Tetrachlorophenol	58-90-2	1.52E-06	3.05E-06	4.57E-06
2,3,4,5-Tetrachlorophenol	4901-51-3	1.52E-06	3.05E-06	4.57E-06
Pentachlorophenol	87-86-5	1.52E-06	3.05E-06	4.57E-06
1,3-Dichlorobenzene	541-73-1	1.94E-06	3.88E-06	5.81E-06
1,4-Dichlorobenzene	106-46-7	1.31E-05	2.63E-05	3.94E-05
1,2-Dichlorobenzene	95-50-1	2.83E-06	5.65E-06	8.48E-06
1,3,5-Trichlorobenzene	108-70-3	9.15E-07	1.83E-06	2.74E-06
1,2,4-Trichlorobenzene	120-82-1	1.62E-06	3.24E-06	4.86E-06
1,2,3-Trichlorobenzene	87-61-6	1.24E-06	2.48E-06	3.72E-06
1,2,3,5/1,2,4,5-Tetrachlorobenzene	95-94-3	1.52E-06	3.03E-06	4.55E-06
1,2,3,4-Tetrachlorobenzene	634-66-2	1.13E-06	2.27E-06	3.40E-06
Pentachlorobenzene	608-93-5	1.27E-06	2.54E-06	3.81E-06
Hexachlorobenzene	118-74-1	9.21E-07	1.84E-06	2.76E-06
Dioxin and Furans	NA-DFPCB	4.98E-10	9.96E-10	1.49E-09
7H-Dibenzo(c,g)carbazole	194-59-2	3.09E-07	6.18E-07	9.26E-07
trans,1,2-Dichloroethene	156-60-5	2.10E-04	4.20E-04	6.30E-04
Polychlorinated Biphenyls (Total PCB)	1336-36-3	1.68E-06	3.36E-06	5.04E-06

Notes:

(1) It is assumed the emission rates for 1-hr averaging, 24-hr averaging, and annual averaging period are the same; this assumption aligns with the system's design for an annual operational availability of 8000 hours per year.

(2) For any pollutants with In-Stack Emission Limits, the emission rates are calculated based on the in-stack limits and reference flow rate of the stack

(3) Historical stack testing data was used to determine the dioxin and furans emission rate for plant expansions. Dioxins and furans emissions rates from stack testing data is roughly a magnitude lower than the in-stack emission limits.

Appendix D

Background Ambient Air Quality Concentrations

Table D.1
Summary of 90th Percentile Background Ambient Air Concentrations
Emerald Energy from Waste
Brampton, Ontario

Pollutants	CAS No.	Project Criteria (ug/m3)	Averaging Period	Criteria Source	Upwind Station (µg/m3)			Downwind Station (µg/m3)			NAPS Data (µg/m3)			Provincial Data (µg/m3)			York University [5] (µg/m3)	Background Concentration [1,2] (µg/m3)	% of Criteria
					Peel AAMP	Emerald AAMP [6]	Max	Peel AAMP	Emerald AAMP [6]	Max	2013/14	2021	2022	2013/14	2022	2023			
Suspended Particulate Matter	NA-PM	120	24-Hour	Ontario AAQC	59.61	102.66	102.66	164.80	104.82	164.80	NA	NA	NA	NA	NA	NA		104.82	87.35%
Suspended Particulate Matter	NA-PM	60	Annual	Ontario AAQC	11.43	26.41	26.41	30.76	24.12	30.76	NA	NA	NA	NA	NA	NA		24.12	40.20%
Nitrogen Dioxides	10102-44-0	79.018	1-Hour	Ontario AAQC	42.07	94.20	94.20	63.37	85.45	85.45	39.51	28.22	33.87	39.51	33.87	32.36		32.36	40.95%
Nitrogen Dioxides	10102-44-0	400	1-Hour	Ontario AAQC	42.07	94.20	94.20	63.37	85.45	85.45	39.51	28.22	33.87	39.51	33.87	32.36		32.36	8.09%
Nitrogen Dioxides	10102-44-0	200	24-Hour	Ontario AAQC	34.82	87.70	87.70	34.13	87.84	87.84	15.80	11.29	13.55	15.80	13.55	12.94		12.94	6.47%
Nitrogen Dioxides	10102-44-0	22.577	Annual	CAAQS	6.67	4.08	6.67	9.75	3.69	9.75	3.11	2.22	2.67	3.11	2.67	2.55		2.55	11.28%
Carbon Monoxide	630-08-0	6000	½-Hour	Schedule 3 POI	531.71	1208.65	1208.65	700.32	965.27	965.27	522.21	480.98	494.72	522.21	494.72	522.21		522.21	8.70%
Carbon Monoxide	630-08-0	36200	1-Hour	Ontario AAQC	437.91	1007.21	1007.21	576.77	804.39	804.39	435.17	400.82	412.27	435.17	412.27	435.17		435.17	1.20%
Carbon Monoxide	630-08-0	15700	8-Hour	Ontario AAQC	422.83	910.05	910.05	477.89	792.34	792.34	58.02	53.44	54.97	58.02	54.97	58.02		58.02	0.37%
Sulphur Dioxide	7446-09-5	10	Annual	Schedule 3 POI	1.40	0.26	1.40	1.45	0.44	1.45	0.41	0.10	0.12	0.41	0.12	0.082		0.08	0.82%
Sulphur Dioxide	7446-09-5	100	1-Hour	Schedule 3 POI	8.20	3.35	8.20	8.60	5.62	8.60	5.24	1.31	1.57	5.24	1.57	1.05		1.05	1.05%
Sulphur Dioxide	7446-09-5	178.220	10-minute	Ontario AAQC	13.55	5.53	13.55	14.20	9.27	14.20	8.64	2.16	2.59	8.64	2.59	1.73		1.73	0.97%
Organic matter (expressed as equivalent methane)	74-82-8	37330	24-Hour	Schedule 3 POI	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	not measured
Ozone	10028-15-6	165	1-Hour	Ontario AAQC	134.40	75.54	134.40	93.17	63.45	93.17	84.42	84.42	82.45	84.42	82.45	86.38		86.38	52.35%
Ozone	10028-15-6	117.791	8-Hour	CAAQS	124.19	71.76	124.19	87.46	60.38	87.46	11.26	11.26	10.99	11.26	10.99	11.52		11.52	9.78%
PM10	NA-PM10	50	24-Hour	Ontario AAQC	42.95	27.98	42.95	39.11	51.66	51.66	14.07	10.37	9.63	14.07	9.63	11.11		11.11	22.22%
PM2.5	NA-PM2.5	27	24-Hour	Ontario AAQC	23.11	14.88	23.11	21.04	25.17	25.17	7.60	5.60	5.20	7.60	5.20	6.00		6.00	22.22%
PM2.5	NA-PM2.5	8.8	Annual	Ontario AAQC	4.43	1.23	4.43	4.03	2.10	4.03	1.50	1.10	1.34	1.50	1.02	1.18		1.18	13.42%
Aluminum	7429-90-5	12	24-Hour	Schedule 3 POI	0.26	0.26	0.26	0.65	0.45	0.65	NA	NA	NA	NA	NA	NA		0.65	5.40%
Aluminum Oxide[4]	1344-28-1	120	24-Hour	Ontario AAQC	0.49	0.49	0.49	1.23	0.85	1.23	NA	NA	NA	NA	NA	NA		1.23	1.02%
Antimony	7440-36-0	25	24-Hour	Ontario AAQC	0.0059	0.0060	0.0060	0.0059	0.0060	0.0060	NA	NA	NA	NA	NA	NA		0.0060	0.02%
Arsenic	7440-38-2	0.3	24-Hour	Ontario AAQC	0.0035	0.0036	0.0036	0.0035	0.0036	0.0036	NA	NA	NA	NA	NA	NA		0.0036	1.20%
Barium	7440-39-3	10	24-Hour	Ontario AAQC	0.039	0.045	0.045	0.032	0.039	0.039	NA	NA	NA	NA	NA	NA		0.045	0.45%
Beryllium	7440-41-7	0.01	24-Hour	Ontario AAQC	0.00059	0.00060	0.00060	0.00059	0.00060	0.00060	NA	NA	NA	NA	NA	NA		0.00060	6.02%
Boron	7440-42-8	120	24-Hour	Ontario AAQC	0.0070	0.0061	0.0070	0.0065	0.0079	0.0079	NA	NA	NA	NA	NA	NA		0.0079	0.01%
Cadmium	7440-43-9	0.025	24-Hour	Ontario AAQC	0.0012	0.0012	0.0012	0.0012	0.0012	0.0012	NA	NA	NA	NA	NA	NA		0.0012	4.82%
Cadmium	7440-43-9	0.005	Annual	Ontario AAQC	0.00022	0.00023	0.00023	0.00023	0.00023	0.00023	NA	NA	NA	NA	NA	NA		0.0002	4.62%
Calcium	7440-70-2	10	24-Hour	Ontario AAQC	NA	4.47	4.47	NA	12.59	12.59	NA	NA	NA	NA	NA	NA		4.47	44.66%
Calcium Oxide[4]	1305-78-8	10	24-Hour	Ontario AAQC	NA	6.25	6.25	NA	17.62	17.62	NA	NA	NA	NA	NA	NA		6.25	62.53%
Chromium	7440-47-3	0.5	24-Hour	Ontario AAQC	0.0041	0.0039	0.0041	0.0050	0.0050	0.0050	NA	NA	NA	NA	NA	NA		0.0050	1.01%
Cobalt	7440-48-4	0.1	24-Hour	Ontario AAQC	0.0012	0.0012	0.0012	0.0012	0.0012	0.0012	NA	NA	NA	NA	NA	NA		0.0012	1.20%
Copper	7440-50-8	50	24-Hour	Ontario AAQC	0.23	0.21	0.23	0.11	0.58	0.58	NA	NA	NA	NA	NA	NA		0.58	1.17%
Iron	7439-89-6	4	24-Hour	Ontario AAQC	0.97	1.01	1.01	2.19	1.59	2.19	NA	NA	NA	NA	NA	NA		2.19	54.78%
Lead	7439-92-1	0.2	30-Day	Ontario AAQC	0.0026	0.0020	0.0026	0.0046	0.0032	0.0046	NA	NA	NA	NA	NA	NA		0.005	2.31%
Lead	7439-92-1	0.5	24-Hour	Ontario AAQC	0.0069	0.0052	0.0069	0.012	0.0082	0.012	NA	NA	NA	NA	NA	NA		0.012	2.40%
Lithium	7439-93-2	20	24-Hour	Ontario AAQC	NA	0.016	0.016	NA	0.016	0.016	NA	NA	NA	NA	NA	NA		0.016	0.08%
Magnesium	7439-95-4	72	24-Hour	Schedule 3 POI	1.06	1.00	1.06	6.46	3.48	6.46	NA	NA	NA	NA	NA	NA		6.46	8.98%
Magnesium oxide[4]	1309-48-4	120	24-Hour	Ontario AAQC	1.76	1.67	1.76	10.73	5.78	10.73	NA	NA	NA	NA	NA	NA		10.73	8.94%
Manganese	7439-96-5	0.4 (as SPM)	24-Hour	Ontario AAQC	NA	0.028	0.028	NA	0.061	0.061	NA	NA	NA	NA	NA	NA		0.061	15.25%
Manganese	7439-96-5	0.1 (as PM2.5)	24-Hour	Ontario AAQC	NA	0.028	0.028	NA	0.061	0.061	NA	NA	NA	NA	NA	NA		0.061	60.99%
Manganese	7439-96-5	0.2 (as PM10)	24-Hour	Ontario AAQC	NA	0.028	0.028	NA	0.061	0.061	NA	NA	NA	NA	NA	NA		0.061	30.49%
Molybdenum	7439-98-7	120	24-Hour	Ontario AAQC	0.0018	0.0104	0.0104	0.0018	0.018	0.018	NA	NA	NA	NA	NA	NA		0.018	0.01%
Nickel	7440-02-0	0.02 (as PM10)	Annual	Ontario AAQC	0.00066	0.00037	0.00066	0.00077	0.00059	0.00077	NA	NA	NA	NA	NA	NA		0.0008	3.83%
Nickel	7440-02-0	0.04 (as SPM)	Annual	Ontario AAQC	0.00066	0.00037	0.00066	0.00077	0.00059	0.00077	NA	NA	NA	NA	NA	NA		0.0008	1.92%
Nickel	7440-02-0	0.1 (as PM10)	24-Hour	Ontario AAQC	0.0034	0.0019	0.0034	0.0040	0.0031	0.0040	NA	NA	NA	NA	NA	NA		0.0040	4.00%
Nickel	7440-02-0	0.2 (as SPM)	24-Hour	Ontario AAQC	0.0034	0.0019	0.0034	0.0040	0.0031	0.0040	NA	NA	NA	NA	NA	NA		0.0040	2.00%
Phosphorus	7723-14-0	0.5	24-Hour	Schedule 3 POI	0.051	0.044	0.051	0.079	0.063	0.079	NA	NA	NA	NA	NA	NA		0.079	15.81%
Phosphorous pentachloride[4]	10026-13-8	10	24-Hour	Ontario AAQC	0.34	0.29	0.34	0.53	0.42	0.53	NA	NA	NA	NA	NA	NA		0.53	5.32%
Selenium	7782-49-2	10	24-Hour	Ontario AAQC	0.0061	0.0061	0.0061	0.0059	0.0060	0.0060	NA	NA	NA	NA	NA	NA		0.0061	0.06%
Silver	7440-22-4	1	24-Hour	Ontario AAQC	0.0029	0.0030	0.0030	0.0030	0.0030	0.0030	NA	NA	NA	NA	NA	NA		0.0030	0.30%
Sodium	7440-23-5	10	24-Hour	Ontario AAQC	NA	3.83	3.83	NA	1.76	1.76	NA	NA	NA	NA	NA	NA		3.83	38.27%
Sodium hydroxide[4]	1310-73-2	10	24-Hour	Ontario AAQC	NA	6.66	6.66	NA	3.05	3.05	NA	NA	NA	NA	NA	NA		6.66	66.59%
Strontium	7440-24-6	120	24-Hour	Ontario AAQC	0.0090	0.0113	0.0113	0.028	0.022	0.028	NA	NA	NA	NA	NA	NA		0.028	0.02%
Tin	7440-31-5	10	24-Hour	Ontario AAQC	0.0059	0.0082	0.0082	0.0059	0.0060	0.0060	NA	NA	NA	NA	NA	NA		0.0082	0.08%
Titanium	7440-32-6	120	24-Hour	Ontario AAQC	0.017	0.021	0.021	0.033	0.025	0.033	NA	NA	NA	NA	NA	NA		0.033	0.03%
Vanadium	7440-62-2	2	24-Hour	Ontario AAQC	0.0029	0.0030	0.0030	0.0036	0.0030	0.0036	NA	NA	NA	NA	NA	NA		0.0036	0.18%
Zinc	7440-66-6	120	24-Hour	Ontario AAQC	0.066	0.09	0.09	0.16	0.12	0.16	NA	NA	NA	NA	NA	NA		0.16	0.13%
Silicon	7440-21-3	27	24-Hour	Schedule 3 POI	NA	0.17	0.17	NA	0.20	0.20	NA	NA	NA	NA	NA	NA		0.20	0.76%
Silica[4]	14464-46-1	5	24-Hour	Ontario AAQC	NA	0.36	0.36	NA	0.44	0.44	NA	NA	NA	NA	NA	NA		0.44	8.73%
Mercury	7439-97-6	2	24-Hour	Ontario AAQC	0.000017	0.000017	0.000017	0.000030	0.000030	0.000030	NA	NA	NA	NA	NA	NA		0.000030	0.0015%
Mercury (as Hg) – alkyl compounds	7439-97-6	0.5	24-Hour	Ontario AAQC	0.000017	0.000017	0.000017	0.000030	0.000030	0.000030	NA	NA	NA	NA	NA	NA		0.000030	0.0061%
Hydrogen Chloride	7647-01-0	20	24-Hour	Ontario AAQC	NA	84.58	84.58	NA	137.12	137.12	NA	NA	NA	NA	NA	NA	3	3.00	15.00%
Hydrogen Fluoride	7664-39-3	1.72	24-Hour	Ontario AAQC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	not measured
Hydrogen Fluoride	7664-39-3	0.69	30-Day	Ontario AAQC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	not measured
1,1,1-Trichloroethane	71-55-6	115000	24-Hour	Ontario AAQC	0.30	0.57	0.57	0.28	0.71	0.71	0.033	0.010	0.0090	NA	NA	NA		0.71	0.00062%
1,1-Dichloroethane	75-34-3	165	24-Hour	Ontario AAQC	0.20	0.42	0.42	0.20	0.42	0.42	0.00	0.0087	0.0060	NA	NA	NA		0.42	0.26%
1,2-Dichloroethane	107-06-2	2	24-Hour	Ontario AAQC	0.20	0.42	0.42	0.13	0.42	0.42	0.076	0.079	0.062	NA	NA	NA		0.42	21.22%
1,2-Dichloroethane	107-06-2	0.4	Annual	Ontario AAQC	0.039	0.081	0.081	0.024	0.081	0.081	0.015	0.014	0.012	NA	NA	NA		0.08	20.34%
1,2-Dichloropropane	78-87-5	2400	24-Hour	Ontario AAQC	0.40	0.49	0.49	0.23	0.49	0.49	0.023	0.021	0.023	NA	NA	NA		0.49	0.020%
1,3,5-Trimethylbenzene	108-67-8	220	24-Hour	Ontario AAQC	NA	2.58	2.58	NA	2.58	2.58	0.13	0.063	0.068	NA	NA	NA		2.58	1.17%
1,3-Butadiene	106-99-0	10	24-Hour	Ontario AAQC	NA	1.16	1.16	NA	1.16	1.16	0.079	0.066	0.076	NA	NA	NA		1.16	11.61%
1,3-Butadiene	106-99-0	2	Annual	Ontario AAQC	NA	0.22	0.22	NA	0.22	0.22	0.015	0.015	0.014	NA	NA	NA		0.22	11.13%
2-Butanone	78-93-3	1000	24-Hour	Ontario AAQC	3.00	2.84	3.00	8.70	2.63	8.70	NA	NA	NA	NA	NA	NA		8.70	0.87%
Acetone	67-64-1	11880	24-Hour	Ontario AAQC	18.45	NA	18.45	12.61	NA	12.61	NA	NA	NA	NA	NA	NA		18.45	0.16%
Benzene	71-43-2	0.45	Annual	Ontario AAQC	0.18	0.20	0.20	0.20	0.17	0.20	0.15	0.13	0.11	NA	NA	NA		0.20	45.41%
Benzene	71-43-2	2.3	24-Hour	Ontario AAQC	0.93	1.05	1.05	1.07	0.88	1.07	0.79	0.66	0.63	NA	NA	NA		1.07	46.35%
Bromodichloromethane	75-27-4	350	24-Hour	Schedule 3 POI	0.34	1.41	1.41	0.34	1.41	1.41	0.018	NA	NA	NA	NA	NA		1.41	0.40%
Bromoform	75-25-2	55	24-Hour	Ontario AAQC	1.05	2.17	2.17	1.05	2.17	2.17	0.022	0.025	0.027	NA	NA	NA		2.17	3.95%
Bromomethane	74-83-9	1350	24-Hour	Ontario AAQC	0.20	0.41	0.41	0.20	0.41	0.41	0.060	0.038	0.033	NA	NA	NA		0.41	0.030%
Carbon Tetrachloride	56-23-5	2.4	24-Hour	Ontario AAQC	0.68	0.66	0.68	0.68	0.66	0.68	0.62	0.55	0.47	NA	NA	NA		0.68	28.42%
Chlorodibromomethane	124-48-1	0.2	24-Hour	Schedule 3 POI	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	not measured
Chloroform	67-66-3	1	24-Hour	Ontario AAQC	0.20	0.26	0.26	0.20	0.26	0.26	0.19	0.15	0.15	NA	NA	NA		0.26	25.62%
Chloroform	67-66-3	0.2	Annual	Ontario AAQC	0.038	0.098	0.098	0.038	0.098	0.10	0.036	0.029	0.028	NA	NA	NA		0.10	49.11%
Dichlorofluoromethane	75-43-4	500	24-Hour	Schedule 3 POI	NA	2.85	2.85	NA	2.84	2.84	NA	NA	NA	NA	NA	NA		2.85	0.57%

Table D.1
Summary of 90th Percentile Background Ambient Air Concentrations
Emerald Energy from Waste
Brampton, Ontario

Pollutants	CAS No.	Project Criteria (ug/m3)	Averaging Period	Criteria Source	Upwind Station (µg/m3)			Downwind Station (µg/m3)			NAPS Data (µg/m3)			Provincial Data (µg/m3)			York University [5] (µg/m3)	Background Concentration [1,2] (µg/m3)	% of Criteria
					Peel AAMP	Emerald AAMP [6]	Max	Peel AAMP	Emerald AAMP [6]	Max	2013/14	2021	2022	2013/14	2022	2023			
Ethylbenzene	100-41-4	1000	24-Hour	Ontario AAQC	0.58	1.49	1.49	1.16	0.81	1.16	0.41	0.27	0.31	NA	NA	NA		1.49	0.15%
Ethylbenzene	100-41-4	1900	10-minute	Ontario AAQC	2.32	6.17	6.17	4.65	3.35	4.65	1.70	1.11	1.29	NA	NA	NA		6.17	0.32%
Ethylene Dibromide	106-93-4	3	24-Hour	Ontario AAQC	0.17	0.81	0.81	0.078	0.81	0.81	NA	NA	NA	NA	NA	NA		0.81	26.88%
Isopropylbenzene	98-82-8	400	24-Hour	Ontario AAQC	NA	NA	NA	NA	NA	NA	0.031	0.019	0.018	NA	NA	NA		NA	not measured
Xylenes	1330-20-7	730	24-Hour	Ontario AAQC	2.36	4.58	4.58	5.05	2.50	5.05	NA	NA	NA	NA	NA	NA		5.05	0.69%
Xylenes	1330-20-7	3000	10-minute	Ontario AAQC	9.48	18.88	18.88	20.31	10.33	20.31	NA	NA	NA	NA	NA	NA		20.31	0.68%
Methylene Chloride	75-09-2	220	24-Hour	Ontario AAQC	1.17	2.94	2.94	0.96	2.93	2.93	NA	NA	NA	NA	NA	NA		2.94	1.34%
Methylene Chloride	75-09-2	44	Annual	Ontario AAQC	0.22	0.56	0.56	0.18	0.56	0.56	NA	NA	NA	NA	NA	NA		0.56	1.28%
Styrene	100-42-5	400	24-Hour	Ontario AAQC	0.25	0.45	0.45	0.31	2.02	2.02	0.13	0.30	0.32	NA	NA	NA		2.02	0.51%
Tetrachloroethene	127-18-4	360	24-Hour	Ontario AAQC	0.34	NA	0.34	0.64	NA	0.64	0.17	0.11	0.13	NA	NA	NA		0.64	0.18%
Toluene	108-88-3	2000	24-Hour	Ontario AAQC	3.85	5.42	5.42	4.80	3.79	4.80	3.00	2.05	2.12	NA	NA	NA		5.42	0.27%
Trichloroethylene	79-01-6	12	24-Hour	Ontario AAQC	0.30	2.76	2.76	0.30	2.14	2.14	0.10	0.085	0.066	NA	NA	NA		2.76	22.99%
Trichloroethylene	79-01-6	2.3	Annual	Ontario AAQC	0.066	0.53	0.53	0.06	0.41	0.41	0.020	0.028	0.013	NA	NA	NA		0.53	22.99%
Trichlorofluoromethane	75-69-4	6000	24-Hour	Schedule 3 POI	2.05	1.53	2.05	2.02	1.57	2.02	1.79	1.42	1.35	NA	NA	NA		2.05	0.034%
Trichlorotrifluoroethane	76-13-1	800000	24-Hour	Ontario AAQC	NA	1.21	1.21	NA	1.21	1.21	NA	NA	NA	NA	NA	NA		1.21	0.00015%
Vinyl Chloride	75-01-4	1	24-Hour	Ontario AAQC	0.18	0.27	0.27	0.052	0.27	0.27	0.0040	0.0024	0.0030	NA	NA	NA		0.27	26.83%
Vinyl Chloride	75-01-4	0.2	Annual	Ontario AAQC	0.035	0.051	0.051	0.010	0.051	0.051	0.00077	0.00044	0.00038	NA	NA	NA		0.05	25.71%
Formaldehyde	50-00-0	65	24-Hour	Ontario AAQC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	not measured
Acetaldehyde	75-07-0	500	½-Hour	Ontario AAQC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	not measured
Acetaldehyde	75-07-0	500	24-Hour	Ontario AAQC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	not measured
Acrolein	107-02-8	4.5	1-Hour	Ontario AAQC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	not measured
Acrolein	107-02-8	0.4	24-Hour	Ontario AAQC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	not measured
1-Methylnaphthalene	90-12-0	35.5	24-Hour	De Minimis	0.00095	0.011	0.011	0.0029	0.014	0.014	NA	NA	NA	NA	NA	NA		0.014	0.041%
1-Methylphenanthrene	832-69-9	0.1	24-Hour	De Minimis	0.00077	0.0012	0.0012	0.00078	0.0010	0.0010	NA	NA	NA	NA	NA	NA		0.0012	1.22%
2-Chloronaphthalene	91-58-7	1	24-Hour	Schedule 3 POI	0.00050	0.00057	0.00057	0.00050	0.00057	0.00057	NA	NA	NA	NA	NA	NA		0.00057	0.057%
2-methylanthracene	613-12-7	0.1	24-Hour	De Minimis	0.00050	0.00057	0.00057	0.00051	0.00057	0.00057	NA	NA	NA	NA	NA	NA		0.00057	0.57%
2-Methylnaphthalene	91-57-6	35.5	24-Hour	Schedule 3 POI	0.0017	0.022	0.022	0.0055	0.026	0.026	NA	NA	NA	NA	NA	NA		0.026	0.07%
3-Methylcholanthrene	56-49-5	0.1	24-Hour	De Minimis	0.010	0.00057	0.010	0.010	0.00057	0.010	0.00	0.00	0.00	NA	NA	NA		0.010	10.07%
7,12-Dimethylbenzo(a)anthracene	57-97-6	0.1	24-Hour	De Minimis	0.00050	0.0022	0.0022	0.00050	0.0022	0.0022	NA	NA	NA	NA	NA	NA		0.0022	2.24%
9,10-dimethylanthracene	781-43-1	0.1	24-Hour	De Minimis	0.0020	0.0008	0.0020	0.0020	0.0010	0.0020	NA	NA	NA	NA	NA	NA		0.0020	2.01%
9-Methylphenanthrene	883-20-5	0.1	24-Hour	De Minimis	NA	0.0031	0.0031	NA	0.008	0.008	NA	NA	NA	NA	NA	NA		0.008	8.06%
Acenaphthene	83-32-9	0.1	24-Hour	De Minimis	0.00030	0.0026	0.0026	0.0058	0.008	0.008	0.0014	0.0013	0.0020	NA	NA	NA		0.008	7.94%
Acenaphthylene	208-96-8	0.1	24-Hour	De Minimis	0.00039	0.00067	0.00067	0.0018	0.00136	0.0018	0.00056	0.00071	0.0011	NA	NA	NA		0.0018	1.85%
Anthracene	120-12-7	0.1	24-Hour	De Minimis	0.00025	0.00092	0.00092	0.0010	0.0011	0.0011	0.00030	0.00081	0.00099	NA	NA	NA		0.0011	1.11%
Benzo(a)Anthracene	56-55-3	0.1	24-Hour	De Minimis	0.00025	0.00057	0.00057	0.00026	0.00057	0.00057	NA	NA	NA	NA	NA	NA		0.00057	0.57%
Benzo(a)fluorene	238-84-6	0.1	24-Hour	De Minimis	0.00050	0.00057	0.00057	0.00050	0.00060	0.00060	0.000055	0.00008	0.000082	NA	NA	NA		0.00060	0.60%
Benzo(a)Pyrene[3]	50-32-8	0.00001	Annual	Ontario AAQC	0.0000078	0.000022	0.000022	0.000031	0.000025	0.000031	0.000016	0.000011	0.000018	NA	NA	NA		0.000018	183.43%
Benzo(a)Pyrene[3]	50-32-8	0.00005	24-Hour	Ontario AAQC	0.000041	0.00012	0.0001	0.00018	0.00013	0.00018	0.000084	0.000062	0.00011	NA	NA	NA		0.00011	210.88%
Benzo(b)Fluoranthene	205-99-2	0.1	24-Hour	De Minimis	0.00028	0.00057	0.00057	0.00039	0.00057	0.00057	0.00025	0.000171	0.00016	NA	NA	NA		0.00057	0.57%
Benzo(b)fluorene	243-17-4	0.1	24-Hour	De Minimis	0.00050	0.00057	0.00057	0.00050	0.00057	0.00057	0.000034	0.00005164	0.000048	NA	NA	NA		0.00057	0.57%
Benzo(e)Pyrene	192-97-2	0.1	24-Hour	De Minimis	0.00050	0.00056	0.00056	0.00050	0.00057	0.00057	0.00013	0.000134	0.00014	NA	NA	NA		0.00057	0.57%
Benzo(g,h,i)Perylene	191-24-2	0.1	24-Hour	De Minimis	0.00027	0.00057	0.00057	0.00032	0.00057	0.00057	0.00016	0.00017	0.00020	NA	NA	NA		0.00057	0.57%
Benzo(j / k)Fluoranthene	76774-50-0	0.1	24-Hour	De Minimis	0.00025	0.00057	0.00057	0.00026	0.00057	0.00057	NA	NA	NA	NA	NA	NA		0.00057	0.57%
Biphenyl	92-52-4	60	1-Hour	Ontario AAQC	0.0019	0.011	0.011	0.011	0.016	0.016	NA	NA	NA	NA	NA	NA		0.016	0.027%
Chrysene	218-01-9	0.1	24-Hour	De Minimis	0.00025	0.00057	0.00057	0.00039	0.00073	0.00073	0.00018	0.00017	0.00018	NA	NA	NA		0.00073	0.73%
Triphenylene	217-59-4	0.1	24-Hour	De Minimis	0.00033	0.00057	0.00057	0.00050	0.00057	0.00057	0.000064	0.000067	0.000070	NA	NA	NA		0.00057	0.57%
Coronene	191-07-1	0.1	24-Hour	De Minimis	0.00050	0.00057	0.00057	0.00050	0.00057	0.00057	NA	NA	NA	NA	NA	NA		0.00057	0.57%
Dibenzo(a,c/a,h)Anthracene	53-70-3	0.1	24-Hour	De Minimis	0.00025	0.00056	0.00056	0.00025	0.00056	0.00056	NA	NA	NA	NA	NA	NA		0.00056	0.56%
Dibenzo(a,e)pyrene	192-65-4	0.1	24-Hour	De Minimis	0.0010	0.00057	0.0010	0.0010	0.00057	0.0010	NA	NA	NA	NA	NA	NA		0.0010	1.01%
Fluoranthene	206-44-0	0.1	24-Hour	De Minimis	0.0019	0.0011	0.0019	0.0044	0.0051	0.0051	0.0020	0.0028	0.0021	NA	NA	NA		0.0051	5.12%
Fluorene	86-73-7	0.1	24-Hour	De Minimis	0.00099	0.0036	0.0036	0.0084	0.0060	0.0084	0.0035	0.0028	0.0028	NA	NA	NA		0.0084	8.42%
Indeno(1,2,3-cd)Pyrene	193-39-5	0.1	24-Hour	De Minimis	0.00025	0.00057	0.00057	0.00029	0.00057	0.00057	0.00012	0.000103	0.00012	NA	NA	NA		0.00057	0.57%
m-terphenyl	92-06-8	0.1	24-Hour	De Minimis	0.00050	0.00057	0.00057	0.00050	0.00057	0.00057	NA	NA	NA	NA	NA	NA		0.00057	0.57%
Naphthalene	91-20-3	22.5	24-Hour	Ontario AAQC	0.0078	0.061	0.061	0.0058	0.064	0.064	0.21	0.12	0.10	NA	NA	NA		0.064	0.28%
Naphthalene	91-20-3	50	10-minute	Ontario AAQC	0.032	0.25	0.25	0.024	0.26	0.26	0.85	0.50	0.41	NA	NA	NA		0.26	0.53%
o-Terphenyl	84-15-1	0.1	24-Hour	De Minimis	0.00050	0.00057	0.00057	0.00050	0.00057	0.00057	NA	NA	NA	NA	NA	NA		0.00057	0.57%
Perylene	198-55-0	0.1	24-Hour	De Minimis	0.00050	0.00057	0.00057	0.00050	0.00057	0.00057	0.000020	0.000018	0.000024	NA	NA	NA		0.00057	0.57%
Phenanthrene	85-01-8	0.1	24-Hour	De Minimis	0.0073	0.010	0.010	0.034	0.020	0.034	0.013	0.012	0.012	NA	NA	NA		0.034	33.90%
Picene	213-46-7	0.1	24-Hour	De Minimis	0.00050	0.00056	0.00056	0.00050	0.00056	0.00056	NA	NA	NA	NA	NA	NA		0.00056	0.56%
p-terphenyl	92-94-4	0.1	24-Hour	De Minimis	0.00050	0.00057	0.00057	0.00050	0.00057	0.00057	NA	NA	NA	NA	NA	NA		0.00057	0.57%
Pyrene	129-00-0	0.1	24-Hour	De Minimis	0.0013	0.0012	0.0013	0.0026	0.0041	0.0041	0.0012	0.0019	0.0018	NA	NA	NA		0.0041	4.08%
Quinoline	91-22-5	0.005	24-Hour	Schedule 3 POI	0.0020	0.0010	0.0020	0.0020	0.0014	0.0020	NA	NA	NA	NA	NA	NA		0.0020	40.26%
Tetralin	119-64-2	151.5	24-Hour	Schedule 3 POI	0.00050	0.0073	0.0073	0.00051	0.012	0.012	NA	NA	NA	NA	NA	NA		0.012	0.0077%
2,6-Dichlorophenol	87-65-0	19	24-Hour	Schedule 3 POI	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	not measured
2,4/2,5-Dichlorophenol	120-83-2	33.5	24-Hour	Schedule 3 POI	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	not measured
3,5-Dichlorophenol	591-35-5	0.1	24-Hour	De Minimis	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	not measured
2,3-Dichlorophenol	576-24-9	0.1	24-Hour	De Minimis	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	not measured
3,4-Dichlorophenol	95-77-2	0.1	24-Hour	De Minimis	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	not measured
2,4,6-Trichlorophenol	88-06-2	1.5	24-Hour	Schedule 3 POI	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	not measured
2,3,6-Trichlorophenol	933-75-5	0.1	24-Hour	De Minimis	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	not measured
2,3,5-Trichlorophenol	933-78-8	0.1	24-Hour	De Minimis	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	not measured
2,4,5-Trichlorophenol	95-95-4	220	24-Hour	Schedule 3 POI	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	not measured
2,3,4-Trichlorophenol	15950-66-0	0.1	24-Hour	De Minimis	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	not measured
3,4,5-Trichlorophenol	609-19-8	0.1	24-Hour	De Minimis	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	not measured
2,3,4,6-Tetrachlorophenol	58-90-2	0.75	24-Hour	Schedule 3 POI	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	not measured
2,3,4,5-Tetrachlorophenol	4901-51-3	0.1	24-Hour	De Minimis	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	not measured
Pentachlorophenol	87-86-5	20	24-Hour	Schedule 3 POI	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	not measured
1,3-Dichlorobenzene	541-73-1	50	24-Hour	Schedule 3 POI	NA	2.52	2.52	NA	2.52	2.52	0.0042	0.0026	0.0020	NA	NA	NA		2.52	5.05%
1,4-Dichlorobenzene	106-46-7	95	24-Hour	Ontario AAQC	0.40	0.63	0.63	0.35	0.85	0.85	0.085	0.083	0.067	NA	NA	NA		0.85	0.90%
1,2-Dichlorobenzene	95-50-1	30500	1-Hour	Ontario AAQC	0.97	1.58	1.58	0.74	1.58	1.58	0.010	0.0105	0.0040	NA	NA	NA		1.58	0.0052%
1,3,5-Trichlorobenzene	108-70-3	3.6	24-Hour	Schedule 3 POI	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	not measured
1,2,4-Trichlorobenzene	120-82-1	400	24-Hour	Ontario AAQC	2.00	3.89	3.89	0.75	3.89	3.89	0.010	0.020	0.012	NA	NA	NA		3.89	0.97%
1,2,3-Trichlorobenzene	87-61-6	135	24-Hour	Schedule 3 POI	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	not measured
1,2,3,5/1,2,4,5-Tetrachlorobenzene	95-94-3	1	24-Hour	Schedule 3 POI	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	not measured
1,2,3,4-Tetrachlorobenzene	634-66-2	600	24-Hour	Schedule 3 POI	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	not measured
Pentachlorobenzene	608-93-5	80	24-Hour	Schedule 3 POI	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	not measured
Hexachlorobenzene	118-74-1	0.011	24-Hour	Schedule 3 POI	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	not measured

Table D.1
Summary of 90th Percentile Background Ambient Air Concentrations
Emerald Energy from Waste
Brampton, Ontario

Pollutants	CAS No.	Project Criteria (ug/m3)	Averaging Period	Criteria Source	Upwind Station (µg/m3)			Downwind Station (µg/m3)			NAPS Data (µg/m3)			Provincial Data (µg/m3)			York University [5] (µg/m3)	Background Concentration [1,2] (µg/m3)	% of Criteria
					Peel AAMP	Emerald AAMP [6]	Max	Peel AAMP	Emerald AAMP [6]	Max	2013/14	2021	2022	2013/14	2022	2023			
Dioxin and Furans	NA-DFPCB	0.0000001	24-Hour	Ontario AAQC	2.783E-08	3.938E-08	3.938E-08	4.625E-08	4.960E-08	4.960E-08	NA	NA	NA	NA	NA	NA		4.960E-08	49.60%
7H-Dibenzo(c,g)carbazole	194-59-2	0.1	24-Hour	De Minimis	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	not measured
trans,1,2-Dichloroethene	156-60-5	105	24-Hour	Ontario AAQC	0.40	0.54	0.54	0.94	0.65	0.94	NA	NA	NA	NA	NA	NA		0.94	0.89%

Notes:
(1) Seasonal outliers were removed from the SPM dataset for both stations, and the concentration from the Downwind Station was chosen as the Background concentration
(2) Prinvicial data was chosen as the Background Concentration for all Criteria Air Contaminants (CACs), while NAPS data was selected for Benzo(a)pyrene
(3) All non-detections were removed from the Benzo(a)pyrene dataset before the switch to hi-res technology in January 2024 for both stations
(4) All metal oxide values are based on a conversion factor derived from the molecular weight of the metal
(5) The maximum value recorded by York University was chosen as the Background Concentration instead of the 90th percentile value, as explained in section 2.4.1 of the Ambient Air Quality Report
(6) The sampling locations for the Emerald ambient air monitoring program did not meet the siting criteria in the Operations Manual for Air Quality Monitoring in Ontario (MECP, 2018) (the Operations Manual) due to the presence of trees and buildings which act as obstacles.

Table D.2
Summary of 50th Percentile Background Ambient Air Concentrations
Emerald Energy from Waste
Brampton, Ontario

Pollutants	CAS No.	Project Criteria (ug/m3)	Averaging Period	Criteria Source	Upwind Station (µg/m3)			Downwind Station (µg/m3)			NAPS Data (µg/m3)			Provincial Data (µg/m3)			Background Concentration [1,2,5] (µg/m3)	% of Criteria
					Peel AAMP	Emerald AAMP	Max	Peel AAMP	Emerald AAMP	Max	2013/14	2021	2022	2013/14	2022	2023		
Suspended Particulate Matter	NA-PM	120	24-Hour	Ontario AAQC	34.65	50.18	50.18	93.71	63.00	93.71	NA	NA	NA	NA	NA	NA	63.00	52.50%
Suspended Particulate Matter	NA-PM	60	Annual	Ontario AAQC	6.64	10.91	10.91	17.66	13.83	17.66	NA	NA	NA	NA	NA	NA	13.83	23.05%
Nitrogen Dioxides	10102-44-0	79.018	1-Hour	Ontario AAQC	20.26	46.10	46.10	32.25	39.78	39.78	18.03	12.04	13.47	18.13	13.48	13.49	13.49	17.07%
Nitrogen Dioxides	10102-44-0	400	1-Hour	Ontario AAQC	20.26	46.10	46.10	32.25	39.78	39.78	18.03	12.04	13.47	18.13	13.48	13.49	13.49	3.37%
Nitrogen Dioxides	10102-44-0	200	24-Hour	Ontario AAQC	21.69	39.62	39.62	15.38	40.76	40.76	7.21	4.82	5.39	7.25	5.39	5.40	5.40	2.70%
Nitrogen Dioxides	10102-44-0	22.577	Annual	CAAQS	4.16	1.92	4.16	4.16	1.77	4.16	1.42	0.95	1.06	1.43	1.06	1.06	1.06	4.70%
Carbon Monoxide	630-08-0	6000	½-Hour	Schedule 3 POI	350.95	805.92	805.92	383.34	592.00	592.00	354.07	329.11	321.84	354.06	321.31	346.04	346.04	5.77%
Carbon Monoxide	630-08-0	36200	1-Hour	Ontario AAQC	289.04	671.60	671.60	315.71	493.33	493.33	295.05	274.26	268.20	295.05	267.76	288.36	288.36	0.80%
Carbon Monoxide	630-08-0	15700	8-Hour	Ontario AAQC	305.73	621.95	621.95	299.74	457.07	457.07	39.34	36.57	35.76	39.34	35.70	38.45	38.45	0.24%
Sulphur Dioxide	7446-09-5	10	Annual	Schedule 3 POI	0.68	0.12	0.68	0.68	0.28	0.68	0.12	0.05	0.06	0.12	0.058	0.031	0.031	0.31%
Sulphur Dioxide	7446-09-5	100	1-Hour	Schedule 3 POI	3.25	1.56	3.25	4.02	3.55	4.02	1.52	0.61	0.74	1.52	0.73	0.39	0.39	0.39%
Sulphur Dioxide	7446-09-5	178.220	10-minute	Ontario AAQC	5.36	2.57	5.36	6.64	5.86	6.64	2.51	1.01	1.22	2.51	1.21	0.64	0.64	0.36%
Organic matter (expressed as equivalent methane)	74-82-8	37330	24-Hour	Schedule 3 POI	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	not measured
Ozone	10028-15-6	165	1-Hour	Ontario AAQC	91.38	44.71	91.38	52.46	39.61	52.46	51.85	55.00	52.60	51.81	52.57	54.72	54.72	33.16%
Ozone	10028-15-6	117.791	8-Hour	CAAQS	88.59	44.19	88.59	51.27	39.81	51.27	6.91	7.33	7.01	6.91	7.01	7.30	7.30	6.19%
PM10	NA-PM10	50	24-Hour	Ontario AAQC	22.96	17.53	22.96	21.35	31.51	31.51	6.97	5.28	4.59	6.96	5.34	6.09	6.09	12.17%
PM2.5	NA-PM2.5	27	24-Hour	Ontario AAQC	12.35	8.35	12.35	11.49	16.28	16.28	3.76	2.85	2.83	3.76	2.88	3.29	3.29	12.17%
PM2.5	NA-PM2.5	8.8	Annual	Ontario AAQC	2.37	0.63	2.37	2.37	1.27	2.37	0.74	0.56	0.70	0.74	0.57	0.65	0.65	7.35%
Aluminum	7429-90-5	12	24-Hour	Schedule 3 POI	0.14	0.15	0.15	0.36	0.26	0.36	NA	NA	NA	NA	NA	NA	0.26	2.13%
Aluminum Oxide[4]	1344-28-1	120	24-Hour	Ontario AAQC	0.26	0.29	0.29	0.67	0.48	0.67	NA	NA	NA	NA	NA	NA	0.48	0.40%
Antimony	7440-36-0	25	24-Hour	Ontario AAQC	0.0058	0.0059	0.0059	0.0063	0.0058	0.0063	NA	NA	NA	NA	NA	NA	0.0059	0.02%
Arsenic	7440-38-2	0.3	24-Hour	Ontario AAQC	0.0035	0.0035	0.0035	0.0034	0.0035	0.0035	NA	NA	NA	NA	NA	NA	0.0035	1.18%
Barium	7440-39-3	10	24-Hour	Ontario AAQC	0.025	0.03	0.027	0.019	0.023	0.023	NA	NA	NA	NA	NA	NA	0.027	0.27%
Beryllium	7440-41-7	0.01	24-Hour	Ontario AAQC	0.00057	0.00059	0.00059	0.00057	0.00058	0.00058	NA	NA	NA	NA	NA	NA	0.00059	5.91%
Boron	7440-42-8	120	24-Hour	Ontario AAQC	0.0047	0.0042	0.0047	0.0046	0.0049	0.0049	NA	NA	NA	NA	NA	NA	0.0049	0.00%
Cadmium	7440-43-9	0.025	24-Hour	Ontario AAQC	0.0011	0.0012	0.0012	0.0062	0.0012	0.0062	NA	NA	NA	NA	NA	NA	0.0012	4.73%
Cadmium	7440-43-9	0.005	Annual	Ontario AAQC	0.00022	0.00022	0.00022	0.00116	0.00022	0.00116	NA	NA	NA	NA	NA	NA	0.0002	4.48%
Calcium	7440-70-2	10 (1)	24-Hour	Ontario AAQC	NA	2.61	2.61	NA	6.22	6.22	NA	NA	NA	NA	NA	NA	2.61	26.15%
Calcium Oxide[4]	1305-78-8	10	24-Hour	Ontario AAQC	NA	3.66	3.66	NA	8.71	8.71	NA	NA	NA	NA	NA	NA	3.66	36.61%
Chromium	7440-47-3	0.5	24-Hour	Ontario AAQC	0.0026	0.0031	0.0031	0.0034	0.0036	0.0036	NA	NA	NA	NA	NA	NA	0.0036	0.71%
Cobalt	7440-48-4	0.1	24-Hour	Ontario AAQC	0.0012	0.0012	0.0012	0.0012	0.0012	0.0012	NA	NA	NA	NA	NA	NA	0.0012	1.18%
Copper	7440-50-8	50	24-Hour	Ontario AAQC	0.15	0.13	0.15	0.066	0.33	0.33	NA	NA	NA	NA	NA	NA	0.33	0.66%
Iron	7439-89-6	4	24-Hour	Ontario AAQC	0.54	0.57	0.57	1.10	0.95	1.10	NA	NA	NA	NA	NA	NA	0.95	23.71%
Lead	7439-92-1	0.2	30-Day	Ontario AAQC	0.0015	0.0012	0.0015	0.0029	0.0021	0.0029	NA	NA	NA	NA	NA	NA	0.002	1.05%
Lead	7439-92-1	0.5	24-Hour	Ontario AAQC	0.0038	0.0032	0.0038	0.0077	0.0054	0.008	NA	NA	NA	NA	NA	NA	0.005	1.09%
Lithium	7439-93-2	20	24-Hour	Ontario AAQC	NA	0.016	0.016	NA	0.016	0.016	NA	NA	NA	NA	NA	NA	0.016	0.08%
Magnesium	7439-95-4	72	24-Hour	Schedule 3 POI	0.51	0.59	0.59	2.94	1.60	2.94	NA	NA	NA	NA	NA	NA	1.60	2.22%
Magnesium oxide[4]	1309-48-4	120	24-Hour	Ontario AAQC	0.85	0.98	0.98	4.87	2.65	4.87	NA	NA	NA	NA	NA	NA	2.65	2.21%
Manganese	7439-96-5	0.4 (as SPM)	24-Hour	Ontario AAQC	NA	0.016	0.016	NA	0.033	0.033	NA	NA	NA	NA	NA	NA	0.033	8.13%
Manganese	7439-96-5	0.1 (as PM2.5)	24-Hour	Ontario AAQC	NA	0.016	0.016	NA	0.033	0.033	NA	NA	NA	NA	NA	NA	0.033	32.51%
Manganese	7439-96-5	0.2 (as PM10)	24-Hour	Ontario AAQC	NA	0.016	0.016	NA	0.033	0.033	NA	NA	NA	NA	NA	NA	0.033	16.26%
Molybdenum	7439-98-7	120	24-Hour	Ontario AAQC	0.0017	0.0072	0.0072	0.0017	0.011	0.011	NA	NA	NA	NA	NA	NA	0.011	0.01%
Nickel	7440-02-0	0.02 (as PM10)	Annual	Ontario AAQC	0.00045	0.00034	0.00045	0.00049	0.00042	0.00049	NA	NA	NA	NA	NA	NA	0.0004	2.09%
Nickel	7440-02-0	0.04 (as SPM)	Annual	Ontario AAQC	0.00045	0.00034	0.00045	0.00049	0.00042	0.00049	NA	NA	NA	NA	NA	NA	0.0004	1.05%
Nickel	7440-02-0	0.1 (as PM10)	24-Hour	Ontario AAQC	0.0024	0.0018	0.0024	0.0026	0.0022	0.0026	NA	NA	NA	NA	NA	NA	0.0022	2.18%
Nickel	7440-02-0	0.2 (as SPM)	24-Hour	Ontario AAQC	0.0024	0.0018	0.0024	0.0026	0.0022	0.0026	NA	NA	NA	NA	NA	NA	0.0022	1.09%
Phosphorus	7723-14-0	0.5	24-Hour	Schedule 3 POI	0.032	0.026	0.032	0.048	0.036	0.048	NA	NA	NA	NA	NA	NA	0.036	7.29%
Phosphorous pentachloride[4]	10026-13-8	10	24-Hour	Ontario AAQC	0.22	0.17	0.22	0.32	0.25	0.32	NA	NA	NA	NA	NA	NA	0.25	2.45%
Selenium	7782-49-2	10	24-Hour	Ontario AAQC	0.0062	0.0060	0.0062	0.0058	0.0059	0.0059	NA	NA	NA	NA	NA	NA	0.0060	0.06%
Silver	7440-22-4	1	24-Hour	Ontario AAQC	0.0014	0.0030	0.0030	0.0022	0.0029	0.0029	NA	NA	NA	NA	NA	NA	0.0030	0.30%
Sodium	7440-23-5	10 (2)	24-Hour	Ontario AAQC	NA	1.98	1.98	NA	0.94	0.94	NA	NA	NA	NA	NA	NA	1.98	19.76%
Sodium hydroxide[4]	1310-73-2	10	24-Hour	Ontario AAQC	NA	3.44	3.44	NA	1.64	1.64	NA	NA	NA	NA	NA	NA	3.44	34.38%
Strontium	7440-24-6	120	24-Hour	Ontario AAQC	0.0047	0.0068	0.0068	0.016	0.012	0.016	NA	NA	NA	NA	NA	NA	0.012	0.01%
Tin	7440-31-5	10	24-Hour	Ontario AAQC	0.0062	0.0065	0.0065	0.0059	0.0058	0.0059	NA	NA	NA	NA	NA	NA	0.0065	0.06%
Titanium	7440-32-6	120	24-Hour	Ontario AAQC	0.010	0.012	0.012	0.019	0.015	0.019	NA	NA	NA	NA	NA	NA	0.015	0.01%
Vanadium	7440-62-2	2	24-Hour	Ontario AAQC	0.0024	0.0030	0.0030	0.0030	0.0030	0.0030	NA	NA	NA	NA	NA	NA	0.0030	0.15%
Zinc	7440-66-6	120	24-Hour	Ontario AAQC	0.044	0.050	0.05	0.088	0.086	0.09	NA	NA	NA	NA	NA	NA	0.09	0.07%
Silicon	7440-21-3	27	24-Hour	Schedule 3 POI	NA	0.11	0.11	NA	0.13	0.13	NA	NA	NA	NA	NA	NA	0.13	0.46%
Silica[4]	14464-46-1	5	24-Hour	Ontario AAQC	NA	0.23	0.23	NA	0.27	0.27	NA	NA	NA	NA	NA	NA	0.27	5.35%
Mercury	7439-97-6	2	24-Hour	Ontario AAQC	0.000013	0.000014	0.000014	0.000019	0.000029	0.000029	NA	NA	NA	NA	NA	NA	0.000029	0.0015%
Mercury (as Hg) – alkyl compounds	7439-97-6	0.5	24-Hour	Ontario AAQC	0.000013	0.000014	0.000014	0.000019	0.000029	0.000029	NA	NA	NA	NA	NA	NA	0.000029	0.0058%
Hydrogen Chloride	7647-01-0	20	24-Hour	Ontario AAQC	NA	49.28	49.28	NA	76.70	76.70	NA	NA	NA	NA	NA	NA	0.13	0.67%
Hydrogen Fluoride	7664-39-3	1.72	24-Hour	Ontario AAQC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	not measured
Hydrogen Fluoride	7664-39-3	0.69	30-Day	Ontario AAQC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	not measured
1,1,1-Trichloroethane	71-55-6	115000	24-Hour	Ontario AAQC	0.20	0.60	0.60	0.24	0.61	0.61	0.027	0.0087	0.0075	NA	NA	NA	0.61	0.00053%
1,1-Dichloroethane	75-34-3	165	24-Hour	Ontario AAQC	0.15	0.45	0.45	0.18	0.44	0.44	0.00	0.0066	0.0048	NA	NA	NA	0.45	0.27%
1,2-Dichloroethane	107-06-2	2	24-Hour	Ontario AAQC	0.073	0.45	0.45	0.089	0.44	0.44	0.065	0.066	0.048	NA	NA	NA	0.45	22.36%
1,2-Dichloroethane	107-06-2	0.4	Annual	Ontario AAQC	0.029	0.086	0.086	0.017	0.084	0.08	0.013	0.0094	0.0083	NA	NA	NA	0.09	21.43%
1,2-Dichloropropane	78-87-5	2400	24-Hour	Ontario AAQC	0.19	0.51	0.51	0.21	0.50	0.50	0.017	0.017	0.014	NA	NA	NA	0.51	0.021%
1,3,5-Trimethylbenzene	108-67-8	220	24-Hour	Ontario AAQC	NA	2.72	2.72	NA	2.66	2.66	0.053	0.039	0.041	NA	NA	NA	2.72	1.24%
1,3-Butadiene	106-99-0	10	24-Hour	Ontario AAQC	NA	1.22	1.22	NA	1.20	1.20	0.044	0.045	0.047	NA	NA	NA	1.22	12.23%
1,3-Butadiene	106-99-0	2	Annual	Ontario AAQC	NA	0.23	0.23	NA	0.23	0.23	0.0083	0.0084	0.0081	NA	NA	NA	0.23	11.72%
2-Butanone	78-93-3	1000	24-Hour	Ontario AAQC	1.075	1.44	1.44	3.73	1.50	3.73	NA	NA	NA	NA	NA	NA	1.50	0.15%

Table D.2
Summary of 50th Percentile Background Ambient Air Concentrations
Emerald Energy from Waste
Brampton, Ontario

Pollutants	CAS No.	Project Criteria (ug/m3)	Averaging Period	Criteria Source	Upwind Station (µg/m3)			Downwind Station (µg/m3)			NAPS Data (µg/m3)			Provincial Data (µg/m3)			Background Concentration [1,2,5] (µg/m3)	% of Criteria
					Peel AAMP	Emerald AAMP	Max	Peel AAMP	Emerald AAMP	Max	2013/14	2021	2022	2013/14	2022	2023		
Acetone	67-64-1	11880	24-Hour	Ontario AAQC	12.80	NA	12.80	8.50	NA	8.50	NA	NA	NA	NA	NA	NA	0.00	0.00%
Benzene	71-43-2	0.45	Annual	Ontario AAQC	0.092	0.12	0.12	0.14	0.11	0.14	0.10	0.080	0.076	NA	NA	NA	0.12	25.79%
Benzene	71-43-2	2.3	24-Hour	Ontario AAQC	0.48	0.54	0.54	0.71	0.52	0.71	0.53	0.44	0.44	NA	NA	NA	0.54	23.49%
Bromodichloromethane	75-27-4	350	24-Hour	Schedule 3 POI	0.23	1.48	1.48	0.29	1.45	1.45	0.010	NA	NA	NA	NA	NA	1.48	0.42%
Bromoform	75-25-2	55	24-Hour	Ontario AAQC	0.62	2.29	2.29	0.83	2.24	2.24	0.017	0.020	0.021	NA	NA	NA	2.29	4.16%
Bromomethane	74-83-9	1350	24-Hour	Ontario AAQC	0.15	0.43	0.43	0.17	0.42	0.42	0.052	0.032	0.030	NA	NA	NA	0.43	0.032%
Carbon Tetrachloride	56-23-5	2.4	24-Hour	Ontario AAQC	0.42	0.70	0.70	0.52	0.68	0.68	0.54	0.49	0.41	NA	NA	NA	0.70	28.99%
Chlorodibromomethane	124-48-1	0.2	24-Hour	Schedule 3 POI	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	not measured
Chloroform	67-66-3	1	24-Hour	Ontario AAQC	0.15	0.27	0.27	0.18	0.26	0.26	0.11	0.11	0.10	NA	NA	NA	0.27	27.00%
Chloroform	67-66-3	0.2	Annual	Ontario AAQC	0.029	0.10	0.10	0.035	0.101	0.10	0.022	0.019	0.017	NA	NA	NA	0.10	51.75%
Dichlorofluoromethane	75-43-4	500	24-Hour	Schedule 3 POI	NA	2.56	2.56	NA	2.49	2.49	NA	NA	NA	NA	NA	NA	2.56	0.51%
Ethylbenzene	100-41-4	1000	24-Hour	Ontario AAQC	0.34	0.67	0.67	0.54	0.56	0.56	0.21	0.17	0.18	NA	NA	NA	0.67	0.07%
Ethylbenzene	100-41-4	1900	10-minute	Ontario AAQC	1.38	2.78	2.78	2.16	2.32	2.32	0.85	0.71	0.76	NA	NA	NA	2.78	0.15%
Ethylene Dibromide	106-93-4	3	24-Hour	Ontario AAQC	0.068	0.85	0.85	0.073	0.83	0.83	NA	NA	NA	NA	NA	NA	0.85	28.32%
Isopropylbenzene	98-82-8	400	24-Hour	Ontario AAQC	NA	NA	NA	NA	NA	NA	0.019	0.012	0.012	NA	NA	NA	NA	not measured
Xylenes	1330-20-7	730	24-Hour	Ontario AAQC	1.42	1.72	1.72	2.25	1.40	2.25	NA	NA	NA	NA	NA	NA	1.72	0.24%
Xylenes	1330-20-7	3000	10-minute	Ontario AAQC	5.70	7.08	7.08	9.05	5.79	9.05	NA	NA	NA	NA	NA	NA	7.08	0.24%
Methylene Chloride	75-09-2	220	24-Hour	Ontario AAQC	0.67	2.50	2.50	0.75	2.49	2.49	NA	NA	NA	NA	NA	NA	2.50	1.14%
Methylene Chloride	75-09-2	44	Annual	Ontario AAQC	0.13	0.48	0.48	0.14	0.48	0.48	NA	NA	NA	NA	NA	NA	0.48	1.09%
Styrene	100-42-5	400	24-Hour	Ontario AAQC	0.18	0.47	0.47	0.31	1.24	1.24	0.052	0.14	0.15	NA	NA	NA	1.24	0.31%
Tetrachloroethene	127-18-4	360	24-Hour	Ontario AAQC	0.23	NA	0.23	0.34	NA	0.34	0.084	0.071	0.073	NA	NA	NA	0.00	0.00%
Toluene	108-88-3	2000	24-Hour	Ontario AAQC	2.16	2.20	2.20	2.83	7.27	7.27	1.44	1.14	1.24	NA	NA	NA	7.27	0.36%
Trichloroethylene	79-01-6	12	24-Hour	Ontario AAQC	0.22	1.31	1.31	0.26	1.04	1.04	0.050	0.044	0.031	NA	NA	NA	1.31	10.91%
Trichloroethylene	79-01-6	2.3	Annual	Ontario AAQC	0.044	0.25	0.25	0.051	0.20	0.20	0.0093	0.013	0.0054	NA	NA	NA	0.25	10.91%
Trichlorofluoromethane	75-69-4	6000	24-Hour	Schedule 3 POI	1.25	1.37	1.37	1.52	1.37	1.52	1.61	1.34	1.22	NA	NA	NA	1.37	0.023%
Trichlorotrifluoroethane	76-13-1	800000	24-Hour	Ontario AAQC	NA	1.27	1.27	NA	1.24	1.24	NA	NA	NA	NA	NA	NA	1.27	0.00016%
Vinyl Chloride	75-01-4	1	24-Hour	Ontario AAQC	0.059	0.28	0.28	0.056	0.28	0.28	0.0014	0.0016	0.0037	NA	NA	NA	0.28	28.27%
Vinyl Chloride	75-01-4	0.2	Annual	Ontario AAQC	0.011	0.054	0.054	0.011	0.053	0.053	0.00027	0.00027	0.00064	NA	NA	NA	0.05	27.09%
Formaldehyde	50-00-0	65	24-Hour	Ontario AAQC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	not measured
Acetaldehyde	75-07-0	500	½-Hour	Ontario AAQC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	not measured
Acetaldehyde	75-07-0	500	24-Hour	Ontario AAQC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	not measured
Acrolein	107-02-8	4.5	1-Hour	Ontario AAQC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	not measured
Acrolein	107-02-8	0.4	24-Hour	Ontario AAQC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	not measured
1-Methylnaphthalene	90-12-0	35.5	24-Hour	De Minimis	0.00119	0.01	0.007	0.0039	0.011	0.011	NA	NA	NA	NA	NA	NA	0.011	0.030%
1-Methylphenanthrene	832-69-9	0.1	24-Hour	De Minimis	0.00060	0.00072	0.0007	0.00060	0.00071	0.0007	NA	NA	NA	NA	NA	NA	0.0007	0.72%
2-Chloronaphthalene	91-58-7	1	24-Hour	Schedule 3 POI	0.00048	0.00058	0.00058	0.00049	0.00058	0.00058	NA	NA	NA	NA	NA	NA	0.00058	0.058%
2-methylanthracene	613-12-7	0.1	24-Hour	De Minimis	0.00048	0.00058	0.00058	0.00051	0.00058	0.00058	NA	NA	NA	NA	NA	NA	0.00058	0.58%
2-Methylnaphthalene	91-57-6	35.5	24-Hour	Schedule 3 POI	0.0019	0.013	0.013	0.0072	0.019	0.019	NA	NA	NA	NA	NA	NA	0.019	0.05%
3-Methylcholanthrene	56-49-5	0.1	24-Hour	De Minimis	0.010	0.00058	0.010	0.010	0.00058	0.010	0.00	0.00	0.00	NA	NA	NA	0.001	0.58%
7,12-Dimethylbenzo(a)anthracene	57-97-6	0.1	24-Hour	De Minimis	0.00048	0.0021	0.0021	0.00049	0.0021	0.0021	NA	NA	NA	NA	NA	NA	0.0021	2.14%
9,10-dimethylanthracene	781-43-1	0.1	24-Hour	De Minimis	0.0019	0.00067	0.0019	0.0019	0.00069	0.0019	NA	NA	NA	NA	NA	NA	0.0007	0.69%
9-Methylphenanthrene	883-20-5	0.1	24-Hour	De Minimis	NA	0.0015	0.0015	NA	0.0024	0.002	NA	NA	NA	NA	NA	NA	0.002	2.39%
Acenaphthene	83-32-9	0.1	24-Hour	De Minimis	0.00026	0.0012	0.0012	0.0057	0.0040	0.006	0.00083	0.00070	0.00093	NA	NA	NA	0.004	4.03%
Acenaphthylene	208-96-8	0.1	24-Hour	De Minimis	0.00029	0.00060	0.00060	0.0010	0.00076	0.0010	0.00030	0.00038	0.00048	NA	NA	NA	0.0008	0.76%
Anthracene	120-12-7	0.1	24-Hour	De Minimis	0.00025	0.00062	0.00062	0.00052	0.00073	0.0007	0.00031	0.00047	0.00043	NA	NA	NA	0.0007	0.73%
Benzo(a)Anthracene	56-55-3	0.1	24-Hour	De Minimis	0.00024	0.00058	0.00058	0.00028	0.00058	0.00058	NA	NA	NA	NA	NA	NA	0.00058	0.58%
Benzo(a)fluorene	238-84-6	0.1	24-Hour	De Minimis	0.00048	0.00058	0.00058	0.00049	0.00058	0.00058	0.000026	0.000050	0.000043	NA	NA	NA	0.00058	0.58%
Benzo(a)Pyrene[3]	50-32-8	0.00001	Annual	Ontario AAQC	0.0000043	0.000012	0.000012	0.000020	0.000012	0.000020	0.0000089	0.0000074	0.0000094	NA	NA	NA	0.0000094	93.77%
Benzo(a)Pyrene[3]	50-32-8	0.00005	24-Hour	Ontario AAQC	0.000026	0.00063	0.0006	0.00011	0.00080	0.0008	0.000046	0.000043	0.000058	NA	NA	NA	0.000058	115.01%
Benzo(b)Fluoranthene	205-99-2	0.1	24-Hour	De Minimis	0.00025	0.00058	0.00058	0.00032	0.00058	0.00058	0.00014	0.000086	0.00010	NA	NA	NA	0.00058	0.58%
Benzo(b)fluorene	243-17-4	0.1	24-Hour	De Minimis	0.00048	0.00058	0.00058	0.00049	0.00058	0.00058	0.000013	0.000030	0.000026	NA	NA	NA	0.00058	0.58%
Benzo(e)Pyrene	192-97-2	0.1	24-Hour	De Minimis	0.00048	0.00053	0.00053	0.00050	0.00058	0.00058	0.000072	0.000077	0.000091	NA	NA	NA	0.00058	0.58%
Benzo(g,h,i)Perylene	191-24-2	0.1	24-Hour	De Minimis	0.00025	0.00058	0.00058	0.00029	0.00058	0.00058	0.000087	0.00011	0.00014	NA	NA	NA	0.00058	0.58%
Benzo(j / k)Fluoranthene	76774-50-0	0.1	24-Hour	De Minimis	0.00024	0.00058	0.00058	0.00026	0.00058	0.00058	NA	NA	NA	NA	NA	NA	0.00058	0.58%
Biphenyl	92-52-4	60	1-Hour	Ontario AAQC	0.00059	0.0066	0.007	0.0069	0.011	0.011	NA	NA	NA	NA	NA	NA	0.011	0.018%
Chrysene	218-01-9	0.1	24-Hour	De Minimis	0.00024	0.00058	0.00058	0.00031	0.00060	0.00060	0.00011	0.00010	0.00011	NA	NA	NA	0.00060	0.60%
Triphenylene	217-59-4	0.1	24-Hour	De Minimis	0.00026	0.00058	0.00058	0.00043	0.00058	0.00058	0.000041	0.000042	0.000043	NA	NA	NA	0.00058	0.58%
Coronene	191-07-1	0.1	24-Hour	De Minimis	0.00048	0.00058	0.00058	0.00049	0.00058	0.00058	NA	NA	NA	NA	NA	NA	0.00058	0.58%
Dibenzo(a,c/a,h)Anthracene	53-70-3	0.1	24-Hour	De Minimis	0.00024	0.00055	0.00055	0.00024	0.00054	0.00054	NA	NA	NA	NA	NA	NA	0.00055	0.55%
Dibenzo(a,e)pyrene	192-65-4	0.1	24-Hour	De Minimis	0.0010	0.00058	0.0010	0.0010	0.00058	0.0010	NA	NA	NA	NA	NA	NA	0.0006	0.58%
Fluoranthene	206-44-0	0.1	24-Hour	De Minimis	0.0011	0.00076	0.0011	0.0024	0.0023	0.0024	0.0011	0.0014	0.0011	NA	NA	NA	0.0023	2.32%
Fluorene	86-73-7	0.1	24-Hour	De Minimis	0.00067	0.0018	0.0018	0.0055	0.0037	0.0055	0.0017	0.0016	0.0016	NA	NA	NA	0.0037	3.67%
Indeno(1,2,3-cd)Pyrene	193-39-5	0.1	24-Hour	De Minimis	0.00025	0.00058	0.00058	0.00027	0.00058	0.00058	0.000078	0.000055	0.000068	NA	NA	NA	0.00058	0.58%
m-terphenyl	92-06-8	0.1	24-Hour	De Minimis	0.00048	0.00058	0.00058	0.00049	0.00058	0.00058	NA	NA	NA	NA	NA	NA	0.00058	0.58%
Naphthalene	91-20-3	22.5	24-Hour	Ontario AAQC	0.0011	0.036	0.036	0.0094	0.044	0.044	0.082	0.077	0.058	NA	NA	NA	0.044	0.20%
Naphthalene	91-20-3	50	10-minute	Ontario AAQC	0.0045	0.15	0.15	0.039	0.18	0.18	0.34	0.32	0.24	NA	NA	NA	0.18	0.36%
o-Terphenyl	84-15-1	0.1	24-Hour	De Minimis	0.00048	0.00058	0.00058	0.00049	0.00058	0.00058	NA	NA	NA	NA	NA	NA	0.00058	0.58%
Perylene	198-55-0	0.1	24-Hour	De Minimis	0.00048	0.00058	0.00058	0.00049	0.00058	0.00058	0.0000085	0.000011	0.000014	NA	NA	NA	0.00058	0.58%
Phenanthrene	85-01-8	0.1	24-Hour	De Minimis	0.0039	0.0044	0.004	0.013	0.009	0.013	0.0059	0.0056	0.0051	NA	NA	NA	0.009	8.92%
Picene	213-46-7	0.1	24-Hour	De Minimis	0.00048	0.00053	0.00053	0.00049	0.00052	0.00052	NA	NA	NA	NA	NA	NA	0.00053	0.53%
p-terphenyl	92-94-4	0.1	24-Hour	De Minimis	0.00048	0.00058	0.00058	0.00049	0.00058	0.00058	NA	NA	NA	NA	NA	NA	0.00058	0.58%
Pyrene	129-00-0	0.1	24-Hour	De Minimis	0.00084	0.00079	0.0008	0.0017	0.0019	0.0019	0.00066	0.0011	0.0010	NA	NA	NA	0.0019	1.94%
Quinoline	91-22-5	0.005	24-Hour	Schedule 3 POI	0.0019	0.00067	0.0019	0.0020	0.0011	0.0020	NA	NA	NA	NA	NA	NA	0.0011	21.88%
Tetralin	119-64-2	151.5	24-Hour	Schedule 3 POI	0.00080	0.0043	0.0043	0.00076	0.0065	0.007	NA	NA	NA	NA	NA	NA	0.007	0.0043%

Table D.2
Summary of 50th Percentile Background Ambient Air Concentrations
Emerald Energy from Waste
Brampton, Ontario

Pollutants	CAS No.	Project Criteria (ug/m3)	Averaging Period	Criteria Source	Upwind Station (µg/m3)			Downwind Station (µg/m3)			NAPS Data (µg/m3)			Provincial Data (µg/m3)			Background Concentration (1,2,5) (µg/m3)	% of Criteria
					Peel AAMP	Emerald AAMP	Max	Peel AAMP	Emerald AAMP	Max	2013/14	2021	2022	2013/14	2022	2023		
2,6-Dichlorophenol	87-65-0	19	24-Hour	Schedule 3 POI	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	not measured
2,4/2,5-Dichlorophenol	120-83-2	33.5	24-Hour	Schedule 3 POI	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	not measured
3,5-Dichlorophenol	591-35-5	0.1	24-Hour	De Minimis	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	not measured
2,3-Dichlorophenol	576-24-9	0.1	24-Hour	De Minimis	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	not measured
3,4-Dichlorophenol	95-77-2	0.1	24-Hour	De Minimis	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	not measured
2,4,6-Trichlorophenol	88-06-2	1.5	24-Hour	Schedule 3 POI	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	not measured
2,3,6-Trichlorophenol	933-75-5	0.1	24-Hour	De Minimis	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	not measured
2,3,5-Trichlorophenol	933-78-8	0.1	24-Hour	De Minimis	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	not measured
2,4,5-Trichlorophenol	95-95-4	220	24-Hour	Schedule 3 POI	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	not measured
2,3,4-Trichlorophenol	15950-66-0	0.1	24-Hour	De Minimis	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	not measured
3,4,5-Trichlorophenol	609-19-8	0.1	24-Hour	De Minimis	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	not measured
2,3,4,6-Tetrachlorophenol	58-90-2	0.75	24-Hour	Schedule 3 POI	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	not measured
2,3,4,5-Tetrachlorophenol	4901-51-3	0.1	24-Hour	De Minimis	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	not measured
Pentachlorophenol	87-86-5	20	24-Hour	Schedule 3 POI	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	not measured
1,3-Dichlorobenzene	541-73-1	50	24-Hour	Schedule 3 POI	NA	2.66	2.66	NA	2.60	2.60	0.0027	0.0015	0.00093	NA	NA	NA	2.66	5.32%
1,4-Dichlorobenzene	106-46-7	95	24-Hour	Ontario AAQC	0.23	0.66	0.66	0.28	0.68	0.68	0.040	0.048	0.034	NA	NA	NA	0.68	0.72%
1,2-Dichlorobenzene	95-50-1	30500	1-Hour	Ontario AAQC	0.57	1.66	1.66	0.65	1.63	1.63	0.0061	0.011	0.001	NA	NA	NA	1.66	0.0054%
1,3,5-Trichlorobenzene	108-70-3	3.6	24-Hour	Schedule 3 POI	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	not measured
1,2,4-Trichlorobenzene	120-82-1	400	24-Hour	Ontario AAQC	0.70	4.10	4.10	0.73	4.01	4.01	0.0053	0.010	0.005	NA	NA	NA	4.10	1.03%
1,2,3-Trichlorobenzene	87-61-6	135	24-Hour	Schedule 3 POI	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	not measured
.,2,3,5/1,2,4,5-Tetrachlorobenzen	95-94-3	1	24-Hour	Schedule 3 POI	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	not measured
1,2,3,4-Tetrachlorobenzene	634-66-2	600	24-Hour	Schedule 3 POI	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	not measured
Pentachlorobenzene	608-93-5	80	24-Hour	Schedule 3 POI	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	not measured
Hexachlorobenzene	118-74-1	0.011	24-Hour	Schedule 3 POI	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	not measured
Dioxin and Furans	NA-DFPCB	0.0000001	24-Hour	Ontario AAQC	1.822E-08	2.238E-08	2.238E-08	5.854E-08	2.540E-08	5.854E-08	NA	NA	NA	NA	NA	NA	2.540E-08	25.40%
7H-Dibenzo(c,g)carbazole	194-59-2	0.1	24-Hour	De Minimis	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	not measured
trans,1,2-Dichloroethene	156-60-5	105	24-Hour	Ontario AAQC	0.27	0.47	0.47	0.92	0.64	0.92	NA	NA	NA	NA	NA	NA	0.64	0.61%

Notes:
(1) Seasonal outliers were removed from the SPM dataset for both stations, and the concentration from the Downwind Station was chosen as the Background concentration
(2) 2023 Provincial AQ data was chosen as the Background Concentration for all Criteria Air Contaminants (CACs), while NAPS data was selected for Benzo(a)pyrene
(3) All non-detections were removed from the Benzo(a)pyrene dataset before the switch to hi-res technology in January 2024 for both stations
(4) All metal oxide values are based on a conversion determined using a ratio based the molecular weight of the metal and the metal oxide.
(5) The maximum of the York University study was chosen as the Background Concentration.

Appendix E

Dispersion Modelling Results Tables

Table E.1

Maximum Concentration at Worst Case Receptor and Worst-Case Sensitive Receptor for Existing Facility Operations (Scenario 1A)

Pollutants	CAS No.	Project Criteria (ug/m3)	Averaging Period	Criteria Source	Total Facility Emission Rate	Maximum Concentration at Worst Case Receptor (ug/m3)	Percent of Project Criteria (%) at Worst Case Receptor	Maximum Concentration at Worst Case Sensitive Receptor (Sportsfield) (ug/m3)	Percent of Project Criteria at Sportsfield (%)	Background Concentration (ug/m3)	Percent of Project Criteria Contributed by Background (%)	Cumulative Maximum Concentration at Worst Case Receptor (ug/m3)	% of the Criteria at Worst Case Receptor	Cumulative Maximum Concentration at Sportsfield (ug/m3)	% of the Criteria at Sportsfield
Suspended Particulate Matter	NA-PM	120	24-Hour	Ontario AAQC	0.205	6.13E-01	0.51%	0.281	0.23%	104.823	87.35%	105.44	87.86%	105.10	87.59%
Suspended Particulate Matter	NA-PM	60	Annual	Ontario AAQC	0.205	3.53E-02	0.06%	0.023	0.04%	24.121	40.20%	24.16	40.26%	24.14	40.24%
Nitrogen Dioxide	10102-44-0	79.018	1-Hour	CAAQS	4.842	1.81E+01	22.96%	10.838	13.72%	32.360	40.95%	50.50	63.91%	43.20	54.67%
Nitrogen Dioxide	10102-44-0	400	1-Hour	Ontario AAQC	4.842	1.81E+01	4.54%	11.509	2.88%	32.360	8.09%	50.50	12.63%	43.87	10.97%
Nitrogen Dioxide	10102-44-0	200	24-Hour	Ontario AAQC	4.842	1.45E+01	7.24%	6.636	3.32%	12.944	6.47%	27.43	13.71%	19.58	9.79%
Nitrogen Dioxide	10102-44-0	22.577	Annual	CAAQS	4.842	8.34E-01	3.70%	0.554	2.45%	2.547	11.28%	3.38	14.98%	3.10	13.74%
Carbon Monoxide	630-08-0	6000	½-Hour	Schedule 3 POI	0.502	2.26E+00	0.04%	1.433	0.02%	522.209	8.70%	524.47	8.74%	523.64	8.73%
Carbon Monoxide	630-08-0	36200	1-Hour	Ontario AAQC	0.502	1.88E+00	<0.01%	1.194	<0.01%	435.174	1.20%	437.06	1.21%	436.37	1.21%
Carbon Monoxide	630-08-0	15700	8-Hour	Ontario AAQC	0.502	1.72E+00	0.01%	0.909	<0.01%	58.023	0.37%	59.74	0.38%	58.93	0.38%
Sulphur Dioxide	7446-09-5	10	Annual	Schedule 3 POI	1.024	1.76E-01	1.76%	0.117	1.17%	0.082	0.82%	0.26	2.59%	0.20	1.99%
Sulphur Dioxide	7446-09-5	100	1-Hour	Schedule 3 POI	1.024	3.84E+00	3.84%	2.434	2.43%	1.047	1.05%	4.88	4.88%	3.48	3.48%
Sulphur Dioxide	7446-09-5	178.220	10-minute	Ontario AAQC	1.024	6.33E+00	3.55%	4.017	2.25%	1.728	0.97%	8.06	4.52%	5.74	3.22%
Organic matter (expressed as equivalent methane)	74-82-8	37330	24-Hour	Schedule 3 POI	-	0.00E+00	<0.01%	-	<0.01%	NA	NA	0.00	<0.01%	0.00	<0.01%
Ozone	10028-15-6	165	1-Hour	Ontario AAQC	-	0.00E+00	<0.01%	-	<0.01%	86.380	52.35%	86.38	52.35%	86.38	52.35%
Ozone	10028-15-6	117.791	8-Hour	CAAQS	-	0.00E+00	<0.01%	-	<0.01%	11.517	9.78%	11.52	9.78%	11.52	9.78%
PM10	NA-PM10	50	24-Hour	Ontario AAQC	0.205	6.13E-01	1.23%	2.81E-01	0.56%	11.111	22.22%	11.72	23.45%	11.39	22.78%
PM2.5	NA-PM2.5	27	24-Hour	Ontario AAQC, CAAQS	0.205	6.13E-01	2.27%	1.34E-01	0.50%	6.000	22.22%	6.61	24.49%	6.13	22.72%
PM2.5	NA-PM2.5	8.8	Annual	Ontario AAQC, CAAQS	0.205	3.53E-02	0.40%	2.03E-02	0.23%	1.181	13.42%	1.22	13.82%	1.20	13.65%
Aluminum	7429-90-5	12	24-Hour	Schedule 3 POI	1.15E-03	3.43E-03	0.03%	1.57E-03	0.01%	0.648	5.40%	6.52E-01	5.43%	6.50E-01	5.41%
Aluminum Oxide	1344-28-1	120	24-Hour	Ontario AAQC	2.17E-03	6.49E-03	<0.01%	2.97E-03	<0.01%	1.225	1.02%	1.23E+00	1.03%	1.23E+00	1.02%
Antimony	7440-36-0	25	24-Hour	Ontario AAQC	5.45E-05	1.63E-04	<0.01%	7.47E-05	<0.01%	0.006	0.02%	6.21E-03	0.02%	6.12E-03	0.02%
Arsenic	7440-38-2	0.3	24-Hour	Ontario AAQC	7.69E-05	2.30E-04	0.08%	1.05E-04	0.04%	0.004	1.20%	3.84E-03	1.28%	3.72E-03	1.24%
Barium	7440-39-3	10	24-Hour	Ontario AAQC	1.60E-04	4.78E-04	<0.01%	2.19E-04	<0.01%	0.045	0.45%	4.56E-02	0.46%	4.53E-02	0.45%
Beryllium	7440-41-7	0.01	24-Hour	Ontario AAQC	1.88E-06	5.62E-06	0.06%	2.57E-06	0.03%	0.001	6.02%	6.08E-04	6.08%	6.05E-04	6.05%
Boron	7440-42-8	120	24-Hour	Ontario AAQC	5.03E-03	1.50E-02	0.01%	6.89E-03	<0.01%	0.008	0.01%	2.29E-02	0.02%	1.48E-02	0.01%
Cadmium	7440-43-9	0.025	24-Hour	Ontario AAQC	2.79E-05	8.35E-05	0.33%	3.83E-05	0.15%	0.001	4.82%	1.29E-03	5.16%	1.24E-03	4.98%
Cadmium	7440-43-9	0.005	Annual	Ontario AAQC	2.79E-05	4.81E-06	0.10%	3.18E-06	0.06%	0.000	4.62%	2.36E-04	4.72%	2.34E-04	4.69%
Calcium	7440-70-2	10 (1)	24-Hour	Ontario AAQC	5.08E-02	1.52E-01	1.52%	6.96E-02	0.70%	4.466	44.66%	4.62E+00	46.18%	4.54E+00	45.36%
Calcium Oxide	1305-78-8	10	24-Hour	Ontario AAQC	7.11E-02	2.13E-01	2.13%	9.75E-02	0.97%	6.253	62.53%	6.47E+00	64.66%	6.35E+00	63.50%
Chromium	7440-47-3	0.5	24-Hour	Ontario AAQC	1.99E-04	5.96E-04	0.12%	2.73E-04	0.05%	0.005	1.01%	5.63E-03	1.13%	5.31E-03	1.06%
Cobalt	7440-48-4	0.1	24-Hour	Ontario AAQC	1.85E-04	5.54E-04	0.55%	2.54E-04	0.25%	0.001	1.20%	1.76E-03	1.76%	1.46E-03	1.46%
Copper	7440-50-8	50	24-Hour	Ontario AAQC	2.10E-03	6.29E-03	0.01%	2.88E-03	<0.01%	0.583	1.17%	5.89E-01	1.18%	5.86E-01	1.17%
Iron	7439-89-6	4	24-Hour	Ontario AAQC	3.37E-03	1.01E-02	0.25%	4.62E-03	0.12%	2.191	54.78%	2.20E+00	55.03%	2.20E+00	54.89%
Lead	7439-92-1	0.2	30-Day	Ontario AAQC	2.65E-04	1.36E-04	0.07%	7.73E-05	0.04%	0.005	2.31%	4.75E-03	2.37%	4.69E-03	2.34%
Lead	7439-92-1	0.5	24-Hour	Ontario AAQC	2.65E-04	7.92E-04	0.16%	3.63E-04	0.07%	0.012	2.40%	1.28E-02	2.56%	1.24E-02	2.48%
Lithium	7439-93-2	20	24-Hour	Ontario AAQC	1.43E-05	4.27E-05	<0.01%	1.95E-05	<0.01%	0.016	0.08%	1.63E-02	0.08%	1.63E-02	0.08%
Magnesium	7439-95-4	72	24-Hour	Schedule 3 POI	1.40E-03	4.19E-03	<0.01%	1.92E-03	<0.01%	6.462	8.98%	6.47E+00	8.98%	6.46E+00	8.98%
Magnesium oxide	1309-48-4	120	24-Hour	Ontario AAQC	2.32E-03	6.94E-03	<0.01%	3.18E-03	<0.01%	10.727	8.94%	1.07E+01	8.95%	1.07E+01	8.94%
Manganese	7439-96-5	0.4 (as SPM)	24-Hour	Ontario AAQC	7.48E-04	2.24E-03	0.56%	1.03E-03	0.26%	0.061	15.25%	6.32E-02	15.81%	6.20E-02	15.50%
Manganese	7439-96-5	0.1 (as PM2.5)	24-Hour	Ontario AAQC	7.48E-04	2.24E-03	2.24%	1.03E-03	1.03%	0.061	60.99%	6.32E-02	63.23%	6.20E-02	62.01%
Manganese	7439-96-5	0.2 (as PM10)	24-Hour	Ontario AAQC	7.48E-04	2.24E-03	1.12%	1.03E-03	0.51%	0.061	30.49%	6.32E-02	31.61%	6.20E-02	31.01%
Molybdenum	7439-98-7	120	24-Hour	Ontario AAQC	1.49E-04	4.47E-04	<0.01%	2.05E-04	<0.01%	0.018	0.01%	1.80E-02	0.02%	1.78E-02	0.01%
Nickel	7440-02-0	0.02 (as PM10)	Annual	Ontario AAQC	3.42E-04	5.90E-05	0.29%	3.90E-05	0.19%	0.001	3.83%	8.26E-04	4.13%	8.06E-04	4.03%
Nickel	7440-02-0	0.04 (as SPM)	Annual	Ontario AAQC	3.42E-04	5.90E-05	0.15%	3.90E-05	0.10%	0.001	1.92%	8.26E-04	2.06%	8.06E-04	2.01%
Nickel	7440-02-0	0.1 (as PM10)	24-Hour	Ontario AAQC	3.42E-04	1.02E-03	1.02%	4.69E-04	0.47%	0.004	4.00%	5.03E-03	5.03%	4.47E-03	4.47%
Nickel	7440-02-0	0.2 (as SPM)	24-Hour	Ontario AAQC	3.42E-04	1.02E-03	0.51%	4.69E-04	0.23%	0.004	2.00%	5.03E-03	2.51%	4.47E-03	2.24%
Phosphorus	7723-14-0	0.5	24-Hour	Schedule 3 POI	8.69E-04	2.60E-03	0.52%	1.19E-03	0.24%	0.079	15.81%	8.17E-02	16.33%	8.03E-02	16.05%
Phosphorous pentachloride	10026-13-8	10	24-Hour	Ontario AAQC	5.85E-03	1.75E-02	0.17%	8.01E-03	0.08%	0.532	5.32%	5.50E-01	5.50%	5.40E-01	5.40%
Selenium	7782-49-2	10	24-Hour	Ontario AAQC	2.07E-05	6.18E-05	<0.01%	2.83E-05	<0.01%	0.006	0.06%	6.18E-03	0.06%	6.14E-03	0.06%
Silver	7440-22-4	1	24-Hour	Ontario AAQC	7.90E-06	2.36E-05	<0.01%	1.08E-05	<0.01%	0.003	0.30%	3.03E-03	0.30%	3.02E-03	0.30%
Sodium	7440-23-5	10 (2)	24-Hour	Ontario AAQC	1.73E-02	5.18E-02	0.52%	2.37E-02	0.24%	3.827	38.27%	3.88E+00	38.79%	3.85E+00	38.51%
Sodium hydroxide	1310-73-2	10	24-Hour	Ontario AAQC	3.01E-02	9.01E-02	0.90%	4.13E-02	0.41%	6.659	66.59%	6.75E+00	67.49%	6.70E+00	67.00%
Strontium	7440-24-6	120	24-Hour	Ontario AAQC	3.94E-05	1.18E-04	<0.01%	5.40E-05	<0.01%	0.028	0.02%	2.77E-02	0.02%	2.76E-02	0.02%
Tin	7440-31-5	10	24-Hour	Ontario AAQC	3.06E-04	9.16E-04	<0.01%	4.20E-04	<0.01%	0.008	0.08%	9.11E-03	0.09%	8.62E-03	0.09%
Titanium	7440-32-6	120	24-Hour	Ontario AAQC	1.33E-04	3.97E-04	<0.01%	1.82E-04	<0.01%	0.033	0.03%	3.38E-02	0.03%	3.36E-02	0.03%
Vanadium	7440-62-2	2	24-Hour	Ontario AAQC	8.26E-06	2.47E-05	<0.01%	1.13E-05	<0.01%	0.004	0.18%	3.60E-03	0.18%	3.59E-03	0.18%
Zinc	7440-66-6	120	24-Hour	Ontario AAQC	2.90E-03	8.66E-03	<0.01%	3.97E-03	<0.01%	0.157	0.13%	1.66E-01	0.14%	1.61E-01	0.13%
Silicon	7440-21-3	27	24-Hour	Schedule 3 POI	4.86E-03	1.45E-02	0.05%	6.67E-03	0.02%	0.204	0.76%	2.18E-01	0.81%	2.11E-01	0.78%
Silica	14464-46-1	5	24-Hour	Ontario AAQC	1.04E-02	3.11E-02	0.62%	1.43E-02	0.29%	0.436	8.73%	4.68E-01	9.35%	4.51E-01	9.01%
Mercury	7439-97-6	2	24-Hour	Ontario AAQC	2.81E-05	8.42E-05	<0.01%	3.86E-05	<0.01%	0.000	0.00%	1.14E-04	<0.01%	6.89E-05	<0.01%
Mercury (as Hg) – alkyl compounds	7439-97-6	0.5	24-Hour	Ontario AAQC	2.81E-05	8.42E-05	0.02%	3.86E-05	<0.01%	0.000	0.01%	1.14E-04	0.02%	6.89E-05	0.01%
Hydrogen Chloride	7647-01-0	20	24-Hour	Ontario AAQC	3.50E-01	1.05E+00	5.23%	4.79E-01	2.40%	3.000	15.00%	4.05E+00	20.23%	3.48E+00	17.40%
Hydrogen Fluoride	7664-39-3	1.72	24-Hour	Ontario AAQC	1.72E-02	5.16E-02	3.00%	2.36E-02	1.37%	NA	NA	5.16E-02	3.00%	2.36E-02	1.37%
Hydrogen Fluoride	7664-39-3	0.69	30-Day	Ontario AAQC	1.72E-02	8.87E-03	1.29%	5.04E-03	0.73%	NA	NA	8.87E-03	1.29%	5.04E-03	0.73%
1,1,1-Trichloroethane	71-55-6	115000	24-Hour	Ontario AAQC	5.52E-05	1.65E-04	<0.01%	7.57E-05	<0.01%	0.713	0.00%	7.14E-01	<0.01%	7.14E-01	<0.01%
1,1-Dichloroethane	75-34-3	165	24-Hour	Ontario AAQC	6.62E-05	1.98E-04	<0.01%	9.07E-05	<0.01%	0.424	0.26%	4.25E-01	0.26%	4.24E-01	0.26%
1,2-Dichloroethane	107-06-2	2	24-Hour	Ontario AAQC	1.27E-04	3.81E-04	0.02%	1.75E-04	<0.01%	0.424	21.22%	4.25E-01	21.24%	4.25E-01	21.23%
1,2-Dichloroethane	107-06-2	0.4	Annual	Ontario AAQC	1.27E-04	2.20E-05	<0.01%	1.45E-05	<0.01%	0.081	20.34%	8.14E-02	20.34%	8.14E-02	20.34%
1,2-Dichloropropane	78-87-5	2400	24-Hour	Ontario AAQC	5.52E-05	1.65E-04	<0.01%	7.57E-05	<0.01%	0.485	0.02%	4.85E-01	0.02%	4.85E-01	0.02%
1,3,5-Trimethylbenzene	108-67-8	220	24-Hour	Ontario AAQC	9.08E-05	2.72E-04	<0.01%	1.24E-04	<0.01%	2.580	1.17%	2.58E+00	1.17%	2.58E+00	1.17%
1,3-Butadiene	106-99-0	10	24-Hour	Ontario AAQC	9.08E-05	2.72E-04	<0.01%	1.24E-04	<0.01%	1.161	11.61%	1.16E+00	11.61%	1.16E+00	11.61%
1,3-Butadiene	106-99-0	2	Annual	Ontario AAQC	9.08E-05	1.56E-05	<0.01%	1.03E-05	<0.01%	0.223	11.13%	2.23E-01	11.13%	2.23E-01	11.13%
2-Butanone	78-93-3	1000	24-Hour	Ontario AAQC	3.92E-04	1.17E-03	<0.01%	5.37E-04	<0.01%	8.698	0.87%	8.70E+00	0.87%	8.70E+00	0.87%
Acetone	67-64-1	11880	24-Hour	Ontario AAQC	5.81E-04	1.74E-03	<0.01%	7.96E-04	<0.01%	18.446	0.16%	1.84E+01	0.16%	1.84E+01	0.16%
Benzene	71-43-2	0.45	Annual	Ontario AAQC	5.76E-03	9.93E-04	0.22%	6.57E-04	0.15%	0.204	45.41%	2.05E-01	45.63%	2.05E-01	45.56%
Benzene	71-43-2	2.3	24-Hour	Ontario AAQC	5.76E-03	1.72E-02	0.75%	7.90E-03	0.34%	1.066	46.35%	1.08E+00	47.10%	1.07E+00	46.70%
Bromodichloromethane	75-27-4	350	24-Hour	Schedule 3 POI	5.52E-05	1.65E-04	<0.01%	7.57E-05	<0.01%	1.407	0.40%	1.41E+00	0.40%	1.41E+00	0.40%
Bromoform	75-25-2	55	24-Hour	Ontario AAQC	9.60E-05	2.87E-04	<0.01%	1.32E-04	<0.01%	2.170	3.95%	2.17E+00	3.95%	2.17E+00	3.95%
Bromomethane	74-83-9	1350	24-Hour	Ontario AAQC	4.63E-04	1.39E-03	<0.01%	6.35E-04	<0.01%	0.408	0.03%	4.09E-01	0.03%	4.08E-01	0.03%
Carbon Tetrachloride	56-23-5	2.4	24-Hour	Ontario AAQC	5.52E-05	1.65E-04	<0.01%	7.57E-05	<0.01%	0.682	28.42%	6.82E-01	28.42%	6.82E-01	28.42%
Chlorodibromomethane	124-48-1	0.2	24-Hour	Schedule 3 POI	5.77E-05	1.73E-04	0.09%	7.91E-05	0.04%	NA	NA	1.73E-04	0.09%	7.91E-05	0.04%
Chloroform	67-66-3	1	24-Hour	Ontario AAQC	5.84E-05	1.75E-04	0.02%	8.01E-05	<0.01%	0.256	25.62%	2.56E-01	25.64%	2.56E-01	25.63%
Chloroform	67-66-3	0.2	Annual	Ontario AAQC	5.84E-05	1.01E-05	<0.01%	6.66E-06	<0.01%	0.098	49.11%	9.82E-02	49.12%	9.82E-02	49.12%
Dichlorofluoromethane	75-43-4	500	24-Hour	Schedule 3 POI	9.56E-05	2.86E-04	<0.01%	1.31E-04	<0.01%	2.849	0.57%	2.85E+00	0.57%	2.85E+00	0.57%
Ethylbenzene	100-41-4	1000	24-Hour	Ontario AAQC	9.08E-05	2.72E-04	<0.01%	1.24E-04	<0.01%	1.495	0.15%	1.50E+00	0.15%	1.49E+00	0.15%
Ethylbenzene	100-41-4	1900	10-minute	Ontario AAQC	9.08E-05	5.61E-04	<0.01%	3.56E-04	<0.01%	6.166	0.32%	6.17E+00	0.32%	6.17E+00	0.32%
Ethylene Dibromide	106-93-4	3	24-Hour	Ontario AAQC	5.52E-05	1.65E-04	<0.01%	7.57E-05	<0.01%	0.806	26.88%	8.07E-01	26.89%	8.07E-01	26.88%
Isopropylbenzene	98-82-8	400	24-Hour	Ontario AAQC	5.52E-05	1.65E-04	<0.01%	7.57E-05	<0.01%	NA	NA	1.65E-04	<0.01%	7.57E-05	<0.01%
Xylenes	1330-20-7	730	24-Hour	Ontario AAQC	2.39E-04	7.13E-04	<0.01%	3.27E-04	<0.01%	5.050	0.69%	5.05E+00	0.69%	5.05E+00	0.69%
Xylenes	1330-20-7	3000	10-minute	Ontario AAQC	2.39E-04	1.47E-03	<0.01%	9.35E-04	<0.01%	20.305	0.68%	2.03E+01	0.68%	2.03E+01	0.68%
Methylene Chloride	75-09-2	220	24-Hour	Ontario AAQC	2.60E-03	7.77E-03	<0.01%	3.56E-03	<0.01%	2.938	1.34%	2.95E+00	1.34%	2.94E+00	1.34%
Methylene Chloride	75-09-2	44	Annual	Ontario AAQC	2.60E-03	4.48E-04	<0.01%	2.96E-04	<0.01%	0.563	1.28%	5.64E-01	1.28%	5.63E-01	1.28%
Styrene	100-42-5	400	24-Hour	Ontario AAQC	5.92E-05	1.77E-04	<0.01%	8.11E-05	<0.01%	2.020	0.51%	2.02E+00	0.51%	2.02E+00	0.51%
Tetrachloroethene	127-18-4	360	24-Hour	Ontario AAQC	9.67E-05	2.89E-04	<0.01%	1.32E-04	<0.01%	0.641	0.18%	6.41E-01	0.18%	6.41E-01	0.18%
Toluene	108-88-3	2000	24-Hour	Ontario AAQC	1.02E-03	3.05E-03	<0.01%	1.40E-03	<0.01%	5.420	0.27%	5.42E+00	0.27%	5.42E+00	0.27%
Trichloroethylene	79-01-6	12	24-Hour	Ontario AAQC	5.52E-05	1.65E-04	<0.01%	7.57E-05	<0.01%	2.758	22.99%	2.76E+00	22.99%	2.76E+00	22.99%

Table E.1

Maximum Concentration at Worst Case Receptor and Worst-Case Sensitive Receptor for Existing Facility Operations (Scenario 1A)

Pollutants	CAS No.	Project Criteria (ug/m3)	Averaging Period	Criteria Source	Total Facility Emission Rate	Maximum Concentration at Worst Case Receptor (ug/m3)	Percent of Project Criteria (%) at Worst Case Receptor	Maximum Concentration at Worst Case Sensitive Receptor (Sportsfield) (ug/m3)	Percent of Project Criteria at Sportsfield (%)	Background Concentration (ug/m3)	Percent of Project Criteria Contributed by Background (%)	Cumulative Maximum Concentration at Worst Case Receptor (ug/m3)	% of the Criteria at Worst Case Receptor	Cumulative Maximum Concentration at Sportsfield (ug/m3)	% of the Criteria at Sportsfield
Trichloroethylene	79-01-6	2.3	Annual	Ontario AAQC	5.52E-05	9.51E-06	<0.01%	6.29E-06	<0.01%	0.529	22.99%	5.29E-01	22.99%	5.29E-01	22.99%
Trichlorofluoromethane	75-69-4	6000	24-Hour	Schedule 3 POI	9.10E-05	2.72E-04	<0.01%	1.25E-04	<0.01%	2.049	0.03%	2.05E+00	0.03%	2.05E+00	0.03%
Trichlorotrifluoroethane	76-13-1	800000	24-Hour	Ontario AAQC	9.08E-05	2.72E-04	<0.01%	1.24E-04	<0.01%	1.206	0.00%	1.21E+00	<0.01%	1.21E+00	<0.01%
Vinyl Chloride	75-01-4	1	24-Hour	Ontario AAQC	9.08E-05	2.72E-04	0.03%	1.24E-04	0.01%	0.268	26.83%	2.69E-01	26.86%	2.68E-01	26.84%
Vinyl Chloride	75-01-4	0.2	Annual	Ontario AAQC	9.08E-05	1.56E-05	<0.01%	1.03E-05	<0.01%	0.051	25.71%	5.14E-02	25.72%	5.14E-02	25.72%
Formaldehyde	50-00-0	65	24-Hour	Ontario AAQC	2.01E-02	6.02E-02	0.09%	2.76E-02	0.04%	NA	NA	6.02E-02	0.09%	2.76E-02	0.04%
Acetaldehyde	75-07-0	500	½-Hour	Ontario AAQC	2.06E-02	9.27E-02	0.02%	5.88E-02	0.01%	NA	NA	9.27E-02	0.02%	5.88E-02	0.01%
Acetaldehyde	75-07-0	500	24-Hour	Ontario AAQC	2.06E-02	6.16E-02	0.01%	2.82E-02	<0.01%	NA	NA	6.16E-02	0.01%	2.82E-02	<0.01%
Acrolein	107-02-8	4.5	1-Hour	Ontario AAQC	1.08E-04	4.06E-04	<0.01%	2.57E-04	<0.01%	NA	NA	4.06E-04	<0.01%	2.57E-04	<0.01%
Acrolein	107-02-8	0.4	24-Hour	Ontario AAQC	1.08E-04	3.24E-04	0.08%	1.48E-04	0.04%	NA	NA	3.24E-04	0.08%	1.48E-04	0.04%
1-Methylnaphthalene	90-12-0	35.5	24-Hour	De Minimis	3.90E-06	1.17E-05	<0.01%	5.34E-06	<0.01%	0.014	0.04%	1.44E-02	0.04%	1.44E-02	0.04%
1-Methylphenanthrene	832-69-9	0.1	24-Hour	De Minimis	7.84E-07	2.34E-06	<0.01%	1.07E-06	<0.01%	0.001	1.22%	1.22E-03	1.22%	1.22E-03	1.22%
2-Chloronaphthalene	91-58-7	1	24-Hour	Schedule 3 POI	5.74E-07	1.72E-06	<0.01%	7.87E-07	<0.01%	0.001	0.06%	5.70E-04	0.06%	5.69E-04	0.06%
2-methylanthracene	613-12-7	0.1	24-Hour	De Minimis	6.88E-07	2.06E-06	<0.01%	9.43E-07	<0.01%	0.001	0.57%	5.70E-04	0.57%	5.69E-04	0.57%
2-Methylnaphthalene	91-57-6	35.5	24-Hour	Schedule 3 POI	7.65E-06	2.29E-05	<0.01%	1.05E-05	<0.01%	0.026	0.07%	2.61E-02	0.07%	2.61E-02	0.07%
3-Methylcholanthrene	56-49-5	0.1	24-Hour	De Minimis	6.44E-07	1.93E-06	<0.01%	8.83E-07	<0.01%	0.010	10.07%	1.01E-02	10.07%	1.01E-02	10.07%
7,12-Dimethylbenzo(a)anthracene	57-97-6	0.1	24-Hour	De Minimis	1.95E-06	5.85E-06	<0.01%	2.68E-06	<0.01%	0.002	2.24%	2.25E-03	2.25%	2.24E-03	2.24%
9,10-dimethylanthracene	781-43-1	0.1	24-Hour	De Minimis	5.92E-07	1.77E-06	<0.01%	8.11E-07	<0.01%	0.002	2.01%	2.01E-03	2.01%	2.01E-03	2.01%
9-Methylphenanthrene	883-20-5	0.1	24-Hour	De Minimis	6.62E-07	1.98E-06	<0.01%	9.07E-07	<0.01%	0.008	8.06%	8.06E-03	8.06%	8.06E-03	8.06%
Acenaphthene	83-32-9	0.1	24-Hour	De Minimis	1.24E-06	3.71E-06	<0.01%	1.70E-06	<0.01%	0.008	7.94%	7.95E-03	7.95%	7.95E-03	7.95%
Acenaphthylene	208-96-8	0.1	24-Hour	De Minimis	2.49E-06	7.45E-06	<0.01%	3.41E-06	<0.01%	0.002	1.85%	1.86E-03	1.86%	1.85E-03	1.85%
Anthracene	120-12-7	0.1	24-Hour	De Minimis	1.13E-06	3.39E-06	<0.01%	1.55E-06	<0.01%	0.001	1.11%	1.11E-03	1.11%	1.11E-03	1.11%
Benzo(a)Anthracene	56-55-3	0.1	24-Hour	De Minimis	6.02E-07	1.80E-06	<0.01%	8.25E-07	<0.01%	0.001	0.57%	5.70E-04	0.57%	5.69E-04	0.57%
Benzo(a)fluorene	238-84-6	0.1	24-Hour	De Minimis	5.44E-07	1.63E-06	<0.01%	7.45E-07	<0.01%	0.001	0.60%	6.04E-04	0.60%	6.03E-04	0.60%
Benzo(a)Pyrene	50-32-8	0.00001	Annual	Ontario AAQC	2.10E-07	3.61E-08	0.36%	2.39E-08	0.24%	0.000	183.43%	1.84E-05	183.79%	1.84E-05	183.67%
Benzo(a)Pyrene	50-32-8	0.00005	24-Hour	Ontario AAQC	2.10E-07	6.28E-07	1.26%	2.88E-07	0.58%	0.000	210.88%	1.06E-04	212.14%	1.06E-04	211.46%
Benzo(b)Fluoranthene	205-99-2	0.1	24-Hour	De Minimis	6.43E-07	1.92E-06	<0.01%	8.81E-07	<0.01%	0.001	0.57%	5.70E-04	0.57%	5.69E-04	0.57%
Benzo(b)fluorene	243-17-4	0.1	24-Hour	De Minimis	5.46E-07	1.63E-06	<0.01%	7.48E-07	<0.01%	0.001	0.57%	5.70E-04	0.57%	5.69E-04	0.57%
Benzo(e)Pyrene	192-97-2	0.1	24-Hour	De Minimis	7.78E-07	2.33E-06	<0.01%	1.07E-06	<0.01%	0.001	0.57%	5.68E-04	0.57%	5.66E-04	0.57%
Benzo(g,h,i)Perylene	191-24-2	0.1	24-Hour	De Minimis	7.20E-07	2.15E-06	<0.01%	9.87E-07	<0.01%	0.001	0.57%	5.71E-04	0.57%	5.69E-04	0.57%
Benzo(j / k)Fluoranthene	76774-50-0	0.1	24-Hour	De Minimis	6.50E-07	1.94E-06	<0.01%	8.90E-07	<0.01%	0.001	0.57%	5.70E-04	0.57%	5.69E-04	0.57%
Biphenyl	92-52-4	60	1-Hour	Ontario AAQC	1.36E-05	5.10E-05	<0.01%	3.24E-05	<0.01%	0.016	0.03%	1.61E-02	0.03%	1.61E-02	0.03%
Chrysene	218-01-9	0.1	24-Hour	De Minimis	6.68E-07	2.00E-06	<0.01%	9.16E-07	<0.01%	0.001	0.73%	7.30E-04	0.73%	7.29E-04	0.73%
Triphenylene	217-59-4	0.1	24-Hour	De Minimis	8.73E-07	2.61E-06	<0.01%	1.20E-06	<0.01%	0.001	0.57%	5.71E-04	0.57%	5.70E-04	0.57%
Coronene	191-07-1	0.1	24-Hour	De Minimis	7.12E-07	2.13E-06	<0.01%	9.76E-07	<0.01%	0.001	0.57%	5.70E-04	0.57%	5.69E-04	0.57%
Dibenzo(a,c/a,h)Anthracene	53-70-3	0.1	24-Hour	De Minimis	5.42E-07	1.62E-06	<0.01%	7.43E-07	<0.01%	0.001	0.56%	5.62E-04	0.56%	5.61E-04	0.56%
Dibenzo(a,e)pyrene	192-65-4	0.1	24-Hour	De Minimis	6.97E-07	2.09E-06	<0.01%	9.56E-07	<0.01%	0.001	1.01%	1.01E-03	1.01%	1.01E-03	1.01%
Fluoranthene	206-44-0	0.1	24-Hour	De Minimis	1.54E-06	4.60E-06	<0.01%	2.11E-06	<0.01%	0.005	5.12%	5.13E-03	5.13%	5.13E-03	5.13%
Fluorene	86-73-7	0.1	24-Hour	De Minimis	2.07E-06	6.18E-06	<0.01%	2.83E-06	<0.01%	0.008	8.42%	8.43E-03	8.43%	8.43E-03	8.43%
Indeno(1,2,3-cd)Pyrene	193-39-5	0.1	24-Hour	De Minimis	5.84E-07	1.75E-06	<0.01%	8.00E-07	<0.01%	0.001	0.57%	5.70E-04	0.57%	5.69E-04	0.57%
m-terphenyl	92-06-8	0.1	24-Hour	De Minimis	2.11E-06	6.31E-06	<0.01%	2.89E-06	<0.01%	0.001	0.57%	5.75E-04	0.57%	5.71E-04	0.57%
Naphthalene	91-20-3	22.5	24-Hour	Ontario AAQC	2.27E-05	6.79E-05	<0.01%	3.11E-05	<0.01%	0.064	0.28%	6.38E-02	0.28%	6.38E-02	0.28%
Naphthalene	91-20-3	50	10-minute	Ontario AAQC	2.27E-05	1.40E-04	<0.01%	8.90E-05	<0.01%	0.263	0.53%	2.63E-01	0.53%	2.63E-01	0.53%
o-Terphenyl	84-15-1	0.1	24-Hour	De Minimis	6.63E-07	1.98E-06	<0.01%	9.08E-07	<0.01%	0.001	0.57%	5.70E-04	0.57%	5.69E-04	0.57%
Perylene	198-55-0	0.1	24-Hour	De Minimis	5.20E-07	1.56E-06	<0.01%	7.12E-07	<0.01%	0.001	0.57%	5.70E-04	0.57%	5.69E-04	0.57%
Phenanthrene	85-01-8	0.1	24-Hour	De Minimis	3.33E-06	9.95E-06	<0.01%	4.56E-06	<0.01%	0.034	33.90%	3.39E-02	33.91%	3.39E-02	33.90%
Picene	213-46-7	0.1	24-Hour	De Minimis	6.59E-07	1.97E-06	<0.01%	9.04E-07	<0.01%	0.001	0.56%	5.62E-04	0.56%	5.61E-04	0.56%
p-terphenyl	92-94-4	0.1	24-Hour	De Minimis	5.60E-07	1.68E-06	<0.01%	7.68E-07	<0.01%	0.001	0.57%	5.70E-04	0.57%	5.69E-04	0.57%
Pyrene	129-00-0	0.1	24-Hour	De Minimis	1.82E-06	5.43E-06	<0.01%	2.49E-06	<0.01%	0.004	4.08%	4.08E-03	4.08%	4.08E-03	4.08%
Quinoline	91-22-5	0.005	24-Hour	Schedule 3 POI	2.76E-06	8.26E-06	0.17%	3.79E-06	0.08%	0.002	40.26%	2.02E-03	40.43%	2.02E-03	40.34%
Tetralin	119-64-2	151.5	24-Hour	Schedule 3 POI	5.24E-06	1.57E-05	<0.01%	7.18E-06	<0.01%	0.012	0.01%	1.17E-02	<0.01%	1.17E-02	<0.01%
2,6-Dichlorophenol	87-65-0	19	24-Hour	Schedule 3 POI	9.25E-07	2.77E-06	<0.01%	1.27E-06	<0.01%	NA	NA	2.77E-06	<0.01%	1.27E-06	<0.01%
2,4/2,5-Dichlorophenol	120-83-2	33.5	24-Hour	Schedule 3 POI	9.30E-07	2.78E-06	<0.01%	1.27E-06	<0.01%	NA	NA	2.78E-06	<0.01%	1.27E-06	<0.01%
3,5-Dichlorophenol	591-35-5	0.1	24-Hour	De Minimis	9.51E-07	2.84E-06	<0.01%	1.30E-06	<0.01%	NA	NA	2.84E-06	<0.01%	1.30E-06	<0.01%
2,3-Dichlorophenol	576-24-9	0.1	24-Hour	De Minimis	9.25E-07	2.77E-06	<0.01%	1.27E-06	<0.01%	NA	NA	2.77E-06	<0.01%	1.27E-06	<0.01%
3,4-Dichlorophenol	95-77-2	0.1	24-Hour	De Minimis	9.25E-07	2.77E-06	<0.01%	1.27E-06	<0.01%	NA	NA	2.77E-06	<0.01%	1.27E-06	<0.01%
2,4,6-Trichlorophenol	88-06-2	1.5	24-Hour	Schedule 3 POI	9.25E-07	2.77E-06	<0.01%	1.27E-06	<0.01%	NA	NA	2.77E-06	<0.01%	1.27E-06	<0.01%
2,3,6-Trichlorophenol	933-75-5	0.1	24-Hour	De Minimis	9.25E-07	2.77E-06	<0.01%	1.27E-06	<0.01%	NA	NA	2.77E-06	<0.01%	1.27E-06	<0.01%
2,3,5-Trichlorophenol	933-78-8	0.1	24-Hour	De Minimis	9.25E-07	2.77E-06	<0.01%	1.27E-06	<0.01%	NA	NA	2.77E-06	<0.01%	1.27E-06	<0.01%
2,4,5-Trichlorophenol	95-95-4	220	24-Hour	Schedule 3 POI	9.25E-07	2.77E-06	<0.01%	1.27E-06	<0.01%	NA	NA	2.77E-06	<0.01%	1.27E-06	<0.01%
2,3,4-Trichlorophenol	15950-66-0	0.1	24-Hour	De Minimis	9.25E-07	2.77E-06	<0.01%	1.27E-06	<0.01%	NA	NA	2.77E-06	<0.01%	1.27E-06	<0.01%
3,4,5-Trichlorophenol	609-19-8	0.1	24-Hour	De Minimis	9.25E-07	2.77E-06	<0.01%	1.27E-06	<0.01%	NA	NA	2.77E-06	<0.01%	1.27E-06	<0.01%
2,3,4,6-Tetrachlorophenol	58-90-2	0.75	24-Hour	Schedule 3 POI	9.25E-07	2.77E-06	<0.01%	1.27E-06	<0.01%	NA	NA	2.77E-06	<0.01%	1.27E-06	<0.01%
2,3,4,5-Tetrachlorophenol	4901-51-3	0.1	24-Hour	De Minimis	9.25E-07	2.77E-06	<0.01%	1.27E-06	<0.01%	NA	NA	2.77E-06	<0.01%	1.27E-06	<0.01%
Pentachlorophenol	87-86-5	20	24-Hour	Schedule 3 POI	9.25E-07	2.77E-06	<0.01%	1.27E-06	<0.01%	NA	NA	2.77E-06	<0.01%	1.27E-06	<0.01%
1,3-Dichlorobenzene	541-73-1	50	24-Hour	Schedule 3 POI	1.18E-06	3.52E-06	<0.01%	1.61E-06	<0.01%	2.524	5.05%	2.52E+00	5.05%	2.52E+00	5.05%
1,4-Dichlorobenzene	106-46-7	95	24-Hour	Ontario AAQC	7.98E-06	2.39E-05	<0.01%	1.09E-05	<0.01%	0.853	0.90%	8.53E-01	0.90%	8.53E-01	0.90%
1,2-Dichlorobenzene	95-50-1	30500	1-Hour	Ontario AAQC	1.71E-06	6.42E-06	<0.01%	4.07E-06	<0.01%	1.578	0.01%	1.58E+00	<0.01%	1.58E+00	<0.01%
1,3,5-Trichlorobenzene	108-70-3	3.6	24-Hour	Schedule 3 POI	5.55E-07	1.66E-06	<0.01%	7.61E-07	<0.01%	NA	NA	1.66E-06	<0.01%	7.61E-07	<0.01%
1,2,4-Trichlorobenzene	120-82-1	400	24-Hour	Ontario AAQC	9.83E-07	2.94E-06	<0.01%	1.35E-06	<0.01%	3.895	0.97%	3.89E+00	0.97%	3.89E+00	0.97%
1,2,3-Trichlorobenzene	87-61-6	135	24-Hour	Schedule 3 POI	7.52E-07	2.25E-06	<0.01%	1.03E-06	<0.01%	NA	NA	2.25E-06	<0.01%	1.03E-06	<0.01%
1,2,3,5/1,2,4,5-Tetrachlorobenzene	95-94-3	1	24-Hour	Schedule 3 POI	9.19E-07	2.75E-06	<0.01%	1.26E-06	<0.01%	NA	NA	2.75E-06	<0.01%	1.26E-06	<0.01%
1,2,3,4-Tetrachlorobenzene	634-66-2	600	24-Hour	Schedule 3 POI	6.88E-07	2.06E-06	<0.01%	9.43E-07	<0.01%	NA	NA	2.06E-06	<0.01%	9.43E-07	<0.01%
Pentachlorobenzene	608-93-5	80	24-Hour	Schedule 3 POI	7.70E-07	2.30E-06	<0.01%	1.05E-06	<0.01%	NA	NA	2.30E-06	<0.01%	1.05E-06	<0.01%
Hexachlorobenzene	118-74-1	0.011	24-Hour	Schedule 3 POI	5.58E-07	1.67E-06	0.02%	7.65E-07	<0.01%	NA	NA	1.67E-06	0.02%	7.65E-07	<0.01%
Dioxin and Furans	NA-DFPCB	0.0000001	24-Hour	Ontario AAQC	1.61E-10	4.83E-10	0.48%	2.21E-10	0.22%	0.000	49.60%	5.01E-08	50.09%	4.98E-08	49.83%
7H-Dibenzo(c,g)carbazole	194-59-2	0.1	24-Hour	De Minimis	1.87E-07	5.60E-07	<0.01%	2.57E-07	<0.01%	NA	NA	5.60E-07	<0.01%	2.57E-07	<0.01%
trans,1,2-Dichloroethene	156-60-5	105	24-Hour	Ontario AAQC	1.27E-04	3.81E-04	<0.01%	1.75E-04	<0.01%	0.936	0.89%	9.36E-01	0.89%	9.36E-01	0.89%
Polychlorinated Biphenyls (PCBs)	1336-36-3	0.15	24-Hour	Ontario AAQC	1.02E-06	3.05E-06	<0.01%	1.40E-06	<0.01%	-	0.00%	3.05E-06	<0.01%	1.40E-06	<0.01%
Polychlorinated Biphenyls (PCBs)	1336-36-3	0.035	Annual	Ontario AAQC	1.02E-06	1.76E-07	<0.01%	1.16E-07	<0.01%	-	0.00%	1.76E-07	<0.01%	1.16E-07	<0.01%

Note:
(1) Emission Limit for Calcium Oxide (CAS 1305-78-8) as Calcium is highly reactive and will not remain metallic after emission.
(2) Emission Limit for Sodium Hydroxide (CAS 1310-46-1) as Sodium is highly reactive and will not remain metallic after emission

Table E.2

Maximum Concentration at Worst Case Receptor and Worst Case Sensitive Receptor for Existing Ancillary Sources (Scenario 1B - Scenario 1D)

Scenario	Pollutants	CAS No.	Project Criteria (ug/m3)	Averaging Period	Criteria Source	Facility Emission Rate (g/s)	Maximum Concentration (ug/m3)	Percent of Project Criteria (%)	Maximum Concentration at Worst Case Sensitive Receptor (Sportsfield) (ug/m3)	Percent of Project Criteria at Sportsfield (%)	Background Concentration (ug/m3)	Percent of Project Criteria at Contributed by Background (%)	Cumulative Maximum Concentration (ug/m3)	% of the Criteria	Cumulative Maximum Concentration at Sportsfield (ug/m3)	% of the Criteria at Sportsfield
Main Stack operating at the maximum approved capacity (182,000 tpa) plus a 5.2MW gas turbine generator (Scenario 1B)	Suspended Particulate Matter	NA-PM	120	24-Hour	Ontario AAQC	0.261	3.524	2.94%	0.381	0.32%	104.823	87.35%	108.35	90.29%	105.20	87.67%
	Suspended Particulate Matter	NA-PM	60	Annual	Ontario AAQC	0.261	0.357	0.59%	0.034	0.06%	24.121	40.20%	24.48	40.80%	24.15	40.26%
	Nitrogen Dioxides	10102-44-0	79.018	1-Hour	CAAQS	5.776	120.353	152.31%	13.433	17.00%	32.360	40.95%	152.71	193.26%	45.79	57.95%
	Nitrogen Dioxides	10102-44-0	400	1-Hour	Ontario AAQC	5.776	135.852	33.96%	13.433	3.36%	32.360	8.09%	168.21	42.05%	45.79	11.45%
	Nitrogen Dioxides	10102-44-0	200	24-Hour	Ontario AAQC	5.776	58.767	29.38%	8.235	4.12%	12.944	6.47%	71.71	35.86%	21.18	10.59%
	Nitrogen Dioxides	10102-44-0	22.577	Annual	CAAQS	5.776	5.965	26.42%	0.723	3.20%	2.547	11.28%	8.51	37.70%	3.27	14.49%
	Carbon Monoxide	630-08-0	6000	½-Hour	Schedule 3 POI	1.225	126.176	2.10%	4.018	0.07%	522.209	8.70%	648.38	10.81%	526.23	8.77%
	Carbon Monoxide	630-08-0	36200	1-Hour	Ontario AAQC	1.225	105.146	0.29%	3.309	<0.01%	435.174	1.20%	540.32	1.49%	438.48	1.21%
	Carbon Monoxide	630-08-0	15700	8-Hour	Ontario AAQC	1.225	76.166	0.49%	2.785	0.02%	58.023	0.37%	134.19	0.85%	60.81	0.39%
	Sulphur Dioxide	7446-09-5	10	Annual	Schedule 3 POI	1.161	0.879	8.79%	0.143	1.43%	0.082	0.82%	0.96	9.62%	0.23	2.26%
	Sulphur Dioxide	7446-09-5	100	1-Hour	Schedule 3 POI	1.161	19.971	19.97%	2.695	2.70%	1.047	1.05%	21.02	21.02%	3.74	3.74%
	Sulphur Dioxide	7446-09-5	178.220	10-minute	Ontario AAQC	1.161	32.951	18.49%	4.451	2.50%	1.728	0.97%	34.68	19.46%	6.18	3.47%
	PM10	NA-PM10	50	24-Hour	Ontario AAQC	0.261	3.524	7.05%	0.381	0.76%	11.111	22.22%	14.63	29.27%	11.49	22.98%
	PM2.5	NA-PM2.5	27	24-Hour	Ontario AAQC, CAAQS	0.261	1.206	4.47%	1.93E-01	0.71%	6.000	22.22%	7.21	26.69%	6.19	22.94%
	PM2.5	NA-PM2.5	8.8	Annual	Ontario AAQC, CAAQS	0.261	0.218	2.48%	3.36E-02	0.38%	1.181	13.42%	1.40	15.90%	1.21	13.80%
Natural Gas Fired Boiler for Steam Production operating when the Existing Main Stack is down (Scenario 1C)	Suspended Particulate Matter	NA-PM	120	24-Hour	Ontario AAQC	0.168	3.553	2.96%	4.27E-01	0.36%	104.823	87.35%	108.38	90.31%	105.25	87.71%
	Suspended Particulate Matter	NA-PM	60	Annual	Ontario AAQC	0.168	0.550	0.92%	5.17E-02	0.09%	24.121	40.20%	24.67	41.12%	24.17	40.29%
	Nitrogen Dioxides	10102-44-0	79.018	1-Hour	CAAQS	4.197	38.154	48.28%	4.28E+00	5.42%	32.360	40.95%	70.51	89.24%	36.64	46.37%
	Nitrogen Dioxides	10102-44-0	400	1-Hour	Ontario AAQC	4.197	168.316	42.08%	1.86E+01	4.64%	32.360	8.09%	200.68	50.17%	50.92	12.73%
	Nitrogen Dioxides	10102-44-0	200	24-Hour	Ontario AAQC	4.197	88.818	44.41%	1.07E+01	5.34%	12.944	6.47%	101.76	50.88%	23.62	11.81%
	Nitrogen Dioxides	10102-44-0	22.577	Annual	CAAQS	4.197	3.278	14.52%	3.10E-01	1.37%	2.547	11.28%	5.83	25.80%	2.86	12.66%
	Carbon Monoxide	630-08-0	6000	½-Hour	Schedule 3 POI	1.855	89.296	1.49%	9.85E+00	0.16%	522.209	8.70%	611.50	10.19%	532.05	8.87%
	Carbon Monoxide	630-08-0	36200	1-Hour	Ontario AAQC	1.855	74.413	0.21%	8.21E+00	0.02%	435.174	1.20%	509.59	1.41%	443.38	1.22%
	Carbon Monoxide	630-08-0	15700	8-Hour	Ontario AAQC	1.855	55.481	0.35%	6.52E+00	0.04%	58.023	0.37%	113.50	0.72%	64.54	0.41%
	Sulphur Dioxide	7446-09-5	10	Annual	Schedule 3 POI	0.013	0.043	0.43%	4.08E-03	0.04%	0.082	0.82%	0.13	1.26%	0.09	0.87%
	Sulphur Dioxide	7446-09-5	100	1-Hour	Schedule 3 POI	0.013	0.532	0.53%	5.86E-02	0.06%	1.047	1.05%	1.58	1.58%	1.11	1.11%
	Sulphur Dioxide	7446-09-5	178.220	10-minute	Ontario AAQC	0.013	0.877	0.49%	9.67E-02	0.05%	1.728	0.97%	2.60	1.46%	1.82	1.02%
	PM10	NA-PM10	50	24-Hour	Ontario AAQC	0.168	3.553	7.11%	4.27E-01	0.85%	11.111	22.22%	14.66	29.33%	11.54	23.08%
	PM2.5	NA-PM2.5	27	24-Hour	Ontario AAQC, CAAQS	0.168	2.675	9.91%	2.52E-01	0.93%	6.000	22.22%	8.68	32.13%	6.25	23.15%
	PM2.5	NA-PM2.5	8.8	Annual	Ontario AAQC, CAAQS	0.168	0.504	5.72%	4.72E-02	0.54%	1.181	13.42%	1.68	19.14%	1.23	13.95%
Bypass Stack operating when the SCR experiencing malfunction (Scenario 1D)	Nitrogen Dioxides	10102-44-0	79.018	1-Hour	CAAQS	8.364	35.153	44.49%	2.37E+01	30.03%	32.360	40.95%	67.51	85.44%	56.09	70.98%
	Nitrogen Dioxides	10102-44-0	400	1-Hour	Ontario AAQC	8.364	36.965	9.24%	2.49E+01	6.21%	32.360	8.09%	69.32	17.33%	57.21	14.30%
	Nitrogen Dioxides	10102-44-0	200	24-Hour	Ontario AAQC	8.364	29.105	14.55%	1.57E+01	7.86%	12.944	6.47%	42.05	21.02%	28.67	14.34%
	Nitrogen Dioxides	10102-44-0	22.577	Annual	CAAQS	8.364	2.445	10.83%	1.47E+00	6.49%	2.547	11.28%	4.99	22.11%	4.01	17.78%

Note:
It is assumed PM emitted from natural gas turbine are all in the form of PM2.5 (thus also PM10).

Table E.3

Maximum Concentrations at Worst Case Receptor and Worst-Case Sensitive Receptor for Phase 1 Expansion (Scenario 2)

Pollutants	CAS No.	Project Criteria(ug/m3)	Averaging Period	Criteria Source	Incinerator Stack Emission Rate (g/s)	Truck Idling Emission Rate (g/s)	Truck Traffic Tailpipe Emission Rate (g/s)	Total Facility Emission Rate (g/s)	Maximum Concentration at Worst Case Receptor ((ug/m3))	Percent (%) of Project Criteria at Worst Case Receptor	Maximum Concentration at Worst Case Sensitive Receptor (Sportsfield) (ug/m3)	Percent of Project Criteria at Sportsfield (%)	Background Concentration (ug/m3)	Percent (%) of Project Criteria Contributed by Background	Cumulative Maximum Concentration at Worst Case Receptor (ug/m3)	% of the Criteria at Worst Case Receptor	Cumulative Maximum Concentration at Sportsfield (ug/m3)	% of the Criteria at Sportsfield
Suspended Particulate Matter	NA-PM	120	24-Hour	Ontario AAQC	0.35	2.74E-03 (4)	4.03E-05	0.35	0.24	0.20%	0.23	0.19%	104.82	0.87	105.06	0.88	105.05	0.88
Suspended Particulate Matter	NA-PM	60	Annual	Ontario AAQC	0.35	2.74E-03 (4)	4.03E-05	0.35	0.03	0.05%	0.02	0.04%	24.12	0.40	24.15	0.40	24.14	0.40
Nitrogen Dioxide	10102-44-0	79.018	1-Hour	CAAQS	8.37	9.05E-02 (4)	3.64E-03	8.37	17.99	0.23	13.53	0.17	32.36	0.41	50.35	0.64	45.89	0.58
Nitrogen Dioxide	10102-44-0	400	1-Hour	Ontario AAQC	8.37	9.05E-02 (4)	3.64E-03	8.37	19.56	0.05	15.62	0.04	32.36	0.08	51.92	0.13	47.98	0.12
Nitrogen Dioxide	10102-44-0	200	24-Hour	Ontario AAQC	8.37	6.04E-02 (4)	1.82E-03	8.37	5.76	0.03	5.54	0.03	12.94	0.06	18.70	0.09	18.48	0.09
Nitrogen Dioxide	10102-44-0	22.577	Annual	CAAQS	8.37	6.04E-02 (4)	1.82E-03	8.37	0.79	0.04	0.57	0.03	2.55	0.11	3.34	0.15	3.12	0.14
Carbon Monoxide	630-08-0	6000	½-Hour	Schedule 3 POI	2.77	-	-	2.77	7.72	0.13%	4.36	0.07%	522.21	0.09	529.93	0.09	526.57	0.09
Carbon Monoxide	630-08-0	36200	1-Hour	Ontario AAQC	2.77	-	-	2.77	6.43	0.02%	3.64	0.01%	435.17	0.01	441.61	0.01	438.81	0.01
Carbon Monoxide	630-08-0	15700	8-Hour	Ontario AAQC	2.77	-	-	2.77	3.80	0.02%	2.56	0.02%	58.02	0.37%	61.83	0.39%	60.58	0.39%
Sulphur Dioxide	7446-09-5	10	Annual	Schedule 3 POI	2.42	-	-	2.42	0.23	0.02	0.12	0.01	0.08	0.82%	0.31	0.03	0.20	0.02
Sulphur Dioxide	7446-09-5	100	1-Hour	Schedule 3 POI	2.42	-	-	2.42	5.63	0.06	3.18	0.03	1.05	0.01	6.68	0.07	4.23	0.04
Sulphur Dioxide	7446-09-5	178.220	10-minute	CAAQS	2.42	-	-	2.42	9.29	0.05	5.25	0.03	1.73	0.97%	11.02	0.06	6.98	0.04
Organic matter (expressed as equivalent methane)	74-82-8	37330	24-Hour	Schedule 3 POI	2.28	-	-	2.28	1.56	<0.01%	1.51	<0.01%	NA	NA	1.56	<0.01%	1.51	<0.01%
Ozone	10028-15-6	165	1-Hour	Ontario AAQC	0.00E+00	-	-	0.00E+00	0.00E+00	<0.01%	0.00E+00	<0.01%	86.38	0.52	86.38	0.52	86.38	0.52
Ozone	10028-15-6	117.791	8-Hour	CAAQS	0.00E+00	-	-	0.00E+00	0.00E+00	<0.01%	0.00E+00	<0.01%	11.52	0.10	11.52	0.10	11.52	0.10
PM10	NA-PM10	50	24-Hour	Ontario AAQC	0.35	2.74E-03 (4)	4.03E-05	0.35	0.24	0.48%	0.23	0.46%	11.11	0.22	11.35	0.23	11.34	0.23
PM2.5	NA-PM2.5	27	24-Hour	Ontario AAQC; CAAQS	0.35	2.74E-03 (4)	4.032E-05	0.35	0.24	0.88%	0.10	0.38%	6.00	0.22	6.24	0.23	6.10	0.23
PM2.5	NA-PM2.5	8.8	Annual	Ontario AAQC; CAAQS	0.35	2.74E-03 (4)	4.032E-05	0.35	0.03	0.37%	0.02	0.17%	1.18	0.13	1.21	0.14	1.20	0.14
Aluminum	7429-90-5	12	24-Hour	Schedule 3 POI	1.89E-03	-	-	1.89E-03	1.29E-03	0.01%	1.25E-03	0.01%	0.65	0.05	0.65	0.05	0.65	0.05
Aluminum Oxide	1344-28-1	120	24-Hour	Ontario AAQC	3.58E-03	-	-	3.58E-03	2.45E-03	<0.01%	2.36E-03	<0.01%	1.23	0.01	1.23	0.01	1.23	0.01
Antimony	7440-36-0	25	24-Hour	Ontario AAQC	8.98E-05	-	-	8.98E-05	6.14E-05	<0.01%	5.93E-05	<0.01%	6.05E-03	0.02%	6.11E-03	0.02%	6.11E-03	0.02%
Arsenic	7440-38-2	0.3	24-Hour	Ontario AAQC	1.27E-04	-	-	1.27E-04	8.66E-05	0.03%	8.36E-05	0.03%	3.61E-03	0.01	3.70E-03	0.01	3.70E-03	0.01
Barium	7440-39-3	10	24-Hour	Ontario AAQC	2.63E-04	-	-	2.63E-04	1.80E-04	<0.01%	1.74E-04	<0.01%	0.05	0.45%	0.05	0.45%	0.05	0.45%
Beryllium	7440-41-7	0.01	24-Hour	Ontario AAQC	3.10E-06	-	-	3.10E-06	2.12E-06	0.02%	2.04E-06	0.02%	6.02E-04	0.06	6.04E-04	0.06	6.04E-04	0.06
Boron	7440-42-8	120	24-Hour	Ontario AAQC	8.29E-03	-	-	8.29E-03	5.67E-03	<0.01%	5.47E-03	<0.01%	7.67E-03	6.56E-05	0.01	0.01%	0.01	0.01%
Cadmium	7440-43-9	0.025	24-Hour	Ontario AAQC; CAAQS	4.84E-04	-	-	4.84E-04	3.31E-04	0.01	3.19E-04	0.01	1.21E-03	0.05	1.54E-03	0.06	1.53E-03	0.06
Cadmium	7440-43-9	0.005	Annual	Ontario AAQC	4.84E-04	-	-	4.84E-04	4.56E-05	0.91%	2.43E-05	0.49%	2.31E-04	0.05	2.77E-04	0.06	2.55E-04	0.05
Calcium	7440-70-2	10 (1)	24-Hour	Ontario AAQC	0.08	-	-	0.08	0.06	0.57%	0.06	0.55%	4.47	0.45	4.52	0.45	4.52	0.45
Calcium Oxide	1305-78-8	10	24-Hour	Ontario AAQC	0.12	-	-	0.12	0.08	0.80%	0.08	0.77%	6.25	0.63	6.33	0.63	6.33	0.63
Chromium	7440-47-3	0.5	24-Hour	Ontario AAQC	3.28E-04	-	-	3.28E-04	2.25E-04	0.04%	2.17E-04	0.04%	5.03E-03	0.01	5.26E-03	0.01	5.25E-03	0.01
Cobalt	7440-48-4	0.1	24-Hour	Ontario AAQC	3.05E-04	-	-	3.05E-04	2.09E-04	0.21%	2.01E-04	0.20%	1.20E-03	0.01	1.41E-03	0.01	1.41E-03	0.01
Copper	7440-50-8	50	24-Hour	Ontario AAQC	3.47E-03	-	-	3.47E-03	2.37E-03	<0.01%	2.29E-03	<0.01%	0.58	0.01	0.59	0.01	0.59	0.01
Iron	7439-89-6	4	24-Hour	Ontario AAQC	5.55E-03	-	-	5.55E-03	3.80E-03	0.09%	3.66E-03	0.09%	2.19	0.55	2.19	0.55	2.19	0.55
Lead	7439-92-1	0.2	30-Day	Ontario AAQC	3.46E-03	-	-	3.46E-03	7.00E-04	0.35%	4.27E-04	0.21%	4.61E-03	0.02	5.31E-03	0.03	5.04E-03	0.03
Lead	7439-92-1	0.5	24-Hour	Ontario AAQC	1.30E-05	-	-	1.30E-05	8.90E-06	<0.01%	8.59E-06	<0.01%	0.02	0.02	0.01	0.03	0.01	0.03
Lithium	7439-93-2	20	24-Hour	Ontario AAQC	2.35E-05	-	-	2.35E-05	1.61E-05	<0.01%	1.55E-05	<0.01%	0.02	0.08%	0.02	0.08%	0.02	0.08%
Magnesium	7439-95-4	72	24-Hour	Schedule 3 POI	2.31E-03	-	-	2.31E-03	1.58E-03	<0.01%	1.52E-03	<0.01%	6.46	0.09	6.46	0.09	6.46	0.09
Magnesium oxide	1309-48-4	120	24-Hour	Ontario AAQC	3.83E-03	-	-	3.83E-03	2.62E-03	<0.01%	2.52E-03	<0.01%	10.73	0.09	10.73	0.09	10.73	0.09
Manganese	7439-96-5	0.4 (as SPM)	24-Hour	Ontario AAQC	1.23E-03	-	-	1.23E-03	8.44E-04	0.21%	8.14E-04	0.20%	0.06	0.15	0.06	0.15	0.06	0.15
Manganese	7439-96-5	0.1 (as PM2.5)	24-Hour	Ontario AAQC	1.23E-03	-	-	1.23E-03	8.44E-04	0.84%	8.14E-04	0.81%	0.06	0.61	0.06	0.62	0.06	0.62
Manganese	7439-96-5	0.2 (as PM10)	24-Hour	Ontario AAQC	1.23E-03	-	-	1.23E-03	8.44E-04	0.42%	8.14E-04	0.41%	0.06	0.30	0.06	0.31	0.06	0.31
Molybdenum	7439-98-7	120	24-Hour	Ontario AAQC	2.46E-04	-	-	2.46E-04	1.68E-04	<0.01%	1.62E-04	<0.01%	0.02	0.01%	0.02	0.01%	0.02	0.01%
Nickel	7440-02-0	0.02 (as PM10)	Annual	Ontario AAQC	5.64E-04	-	-	5.64E-04	5.31E-05	0.27%	2.83E-05	0.14%	7.67E-04	0.04	8.20E-04	0.04	7.95E-04	0.04
Nickel	7440-02-0	0.04 (as SPM)	Annual	Ontario AAQC	5.64E-04	-	-	5.64E-04	5.31E-05	0.13%	2.83E-05	0.07%	7.67E-04	0.02	8.20E-04	0.02	7.95E-04	0.02
Nickel	7440-02-0	0.1 (as PM10)	24-Hour	Ontario AAQC	5.64E-04	-	-	5.64E-04	3.86E-04	0.39%	3.72E-04	0.37%	4.00E-03	0.04	4.39E-03	0.04	4.37E-03	0.04
Nickel	7440-02-0	0.2 (as SPM)	24-Hour	Ontario AAQC	5.64E-04	-	-	5.64E-04	3.86E-04	0.19%	3.72E-04	0.19%	4.00E-03	0.02	4.39E-03	0.02	4.37E-03	0.02
Phosphorus	7723-14-0	0.5	24-Hour	Schedule 3 POI	1.43E-03	-	-	1.43E-03	9.80E-04	0.20%	9.45E-04	0.19%	0.08	0.16	0.08	0.16	0.08	0.16
Phosphorous pentachloride	10026-13-8	10	24-Hour	Ontario AAQC	9.64E-03	-	-	9.64E-03	6.59E-03	0.07%	6.36E-03	0.06%	0.53	0.05	0.54	0.05	0.54	0.05
Selenium	7782-49-2	10	24-Hour	Ontario AAQC	3.41E-05	-	-	3.41E-05	2.33E-05	<0.01%	2.25E-05	<0.01%	6.12E-03	0.06%	6.14E-03	0.06%	6.14E-03	0.06%
Silver	7440-22-4	1	24-Hour	Ontario AAQC	1.30E-05	-	-	1.30E-05	8.90E-06	<0.01%	8.59E-06	<0.01%	3.01E-03	0.30%	3.02E-03	0.30%	3.02E-03	0.30%
Sodium	7440-23-5	10 (2)	24-Hour	Ontario AAQC	0.03	-	-	0.03	0.02	0.20%	0.02	0.19%	3.83	0.38	3.85	0.38	3.85	0.38
Sodium hydroxide	1310-73-2	10	24-Hour	Ontario AAQC	0.05	-	-	0.05	0.03	0.34%	0.03	0.33%	6.66	0.67	6.69	0.67	6.69	0.67
Strontium	7440-24-6	120	24-Hour	Ontario AAQC	6.50E-05	-	-	6.50E-05	4.44E-05	<0.01%	4.29E-05	<0.01%	0.03	0.02%	0.03	0.02%	0.03	0.02%
Tin	7440-31-5	10	24-Hour	Ontario AAQC	5.05E-04	-	-	5.05E-04	3.45E-04	<0.01%	3.33E-04	<0.01%	8.20E-03	0.08%	8.54E-03	0.09%	8.53E-03	0.09%
Titanium	7440-32-6	120	24-Hour	Ontario AAQC	2.19E-04	-	-	2.19E-04	1.50E-04	<0.01%	1.44E-04	<0.01%	0.03	0.03%	0.03	0.03%	0.03	0.03%
Vanadium	7440-62-2	2	24-Hour	Ontario AAQC	1.36E-05	-	-	1.36E-05	9.31E-06	<0.01%	8.98E-06	<0.01%	3.58E-03	0.18%	3.59E-03	0.18%	3.59E-03	0.18%
Zinc	7440-66-6	120	24-Hour	Ontario AAQC	4.77E-03	-	-	4.77E-03	3.27E-03	<0.01%	3.15E-03	<0.01%	0.16	0.13%	0.16	0.13%	0.16	0.13%
Silicon	7440-21-3	27	24-Hour	Schedule 3 POI	8.02E-03	-	-	8.02E-03	5.48E-03	0.02%	5.29E-03	0.02%	0.20	0.76%	0.21	0.78%	0.21	0.77%
Silica	14464-46-1	5	24-Hour	Ontario AAQC	0.02	-	-	0.02	0.01	0.23%	0.01	0.23%	0.44	0.09	0.45	0.09	0.45	0.09
Mercury	7439-97-6	2	24-Hour	Ontario AAQC	1.04E-03	-	-	1.04E-03	7.09E-04	0.04%	6.84E-04	0.03%	3.03E-05	1.51E-05	7.40E-04	0.04%	7.15E-04	0.04%
Mercury (as Hg) – alkyl compounds	7439-97-6	0.5	24-Hour	Ontario AAQC	1.04E-03	-	-	1.04E-03	7.09E-04	0.14%	6.84E-04	0.14%	3.03E-05	6.06E-05	7.40E-04	0.15%	7.15E-04	0.14%
Hydrogen Chloride	7647-01-0	20	24-Hour	Ontario AAQC	0.62	-	-	0.62	0.43	0.02	0.41	0.02	3.00	0.15	3.43	0.17	3.41	0.17
Hydrogen Fluoride	7664-39-3	1.72	24-Hour	Ontario AAQC	0.03	-	-	0.03	0.02	0.01	0.02	0.01	NA	NA	0.02	0.01	0.02	0.01
Hydrogen Fluoride	7664-39-3	0.69	30-Day	Ontario AAQC	0.03	-	-	0.03	5.76E-03	0.83%	3.51E-03	0.51%	NA	NA	5.76E-03	0.83%	3.51E-03	0.51%
1,1,1-Trichloroethane	71-55-6	115000	24-Hour	Ontario AAQC	9.10E-05	-	-	9.10E-05	6.23E-05	<0.01%	6.00E-05	<0.01%	0.71	6.20E-06	0.71	<0.01%	0.71	<0.01%
1,1-Dichloroethane	75-34-3	165	24-Hour	Ontario AAQC	1.09E-04	-	-	1.09E-04	7.46E-05	<0.01%	7.19E-05	<0.01%	0.42	0.26%	0.42	0.26%	0.42	0.26%
1,2-Dichloroethane	107-06-2	2	24-Hour	Ontario AAQC	2.10E-04	-	-	2.10E-04	1.44E-04	<0.01%	1.38E-04	<0.01%	0.42	0.02%	0.42	0.02%	0.42	0.02%
1,2-Dichloroethane	107-06-2	0.4	Annual	Ontario AAQC	2.10E-04	-	-	2.10E-04	1.98E-05	<0.01%	1.05E-05	<0.01%	0.08	0.20	0.08	0.20	0.08	0.20
1,2-Dichloropropane	78-87-5	2400	24-Hour	Ontario AAQC	9.10E-05	-	-	9.10E-05	6.22E-05	<0.01%	6.00E-05	<0.01%	0.49	0.02%	0.49	0.02%	0.49	0.02%
1,3,5-Trimethylbenzene	108-67-8	220	24-Hour	Ontario AAQC	1.50E-04	-	-	1.50E-04	1.02E-04	<0.01%	9.87E-05	<0.01%	2.58	0.01	2.58	0.01	2.58	0.01
1,3-Butadiene	106-99-0	10	24-Hour	Ontario AAQC	1.50E-04	-	-	1.50E-04	1.02E-04	<0.01%	9.87E-05	<0.01%	1.16	0.12	1.16	0.12	1.16	0.12
1,3-Butadiene	106-99-0	2	Annual	Ontario AAQC	1.50E-04	-	-	1.50E-04	1.41E-05	<0.01%	7.51E-06	<0.01%	0.22	0.11	0.22	0.11	0.22	0.11
2-Butanone	78-93-3	1000	24-Hour	Ontario AAQC	6.44E-04	-	-	6.44E-04	4.42E-04	<0.01%	4.26E-04	<0.01%	8.70	0.87%	8.70	0.87%	8.70	0.87%
Acetone	67-64-1	11880	24-Hour	Ontario AAQC	9.58E-04	-	-	9.58E-04	6.55E-04	<0.01%	6.32E-04	<0.01%	18.45	0.16%	18.45	0.16%	18.45	0.16%
Benzene	71-43-2	0.45	Annual	Ontario AAQC	9.50E-03	-	-	9.50E-03	8.95E-04	0.20%	4.77E-04	0.11%	0.20	0.45	0.21	0.46	0.20	0.46
Benzene	71-43-2	2.3	24-Hour	Ontario AAQC	9.50E-03	-	-	9.50E-03	6.50E-03	0.28%	6.27E-03	0.27%	1.07	0.46	1.07	0.47	1.07	0.47
Bromodichloromethane	75-27-4	350	24-Hour	Schedule 3 POI	9.10E-05	-	-	9.10E-05	6.22E-05	<0.01%	6.00E-05	<0.01%	1.41	0.40%	1.41	0.40%	1.41	0.40%
Bromoform	75-25-2	55	24-Hour	Ontario AAQC	1.58E-04	-	-	1.58E-04	1.08E-04	<0.01%	1.04E-04	<0.01%	2.17	0.04	2.17	0.04	2.17	0.04
Bromomethane	74-83-9	1350	24-Hour	Ontario AAQC	7.63E-04	-	-	7.63E-04	5.22E-04	<0.01%	5.03E-04	<0.01%	0.41	0.03%	0.41	0.03%	0.41	0.03%
Carbon Tetrachloride	56-23-5	2.4	24-Hour	Ontario AAQC	9.10E-05	-	-	9.10E-05	6.22E-05	<0.01%	6.00E-05	<0.01%	0.68	0.28	0.68	0.28	0.68	0.28
Chlorodibromomethane	124-48-1	0.2	24-Hour	Schedule 3 POI	9.52E-05	-	-	9.52E-05	6.51E-05	0.03%	6.28E-05	0.03%	NA	NA	6.51E-05	0.03%	6.28E-05	0.03%
Chloroform	67-66-3	1	24-Hour	Ontario AAQC	9.63E-05	-	-	9.63E-05	6.58E-05	<0.01%	6.35E-05	<0.01%	0.26	0.26	0.26	0.26	0.26	0.26
Chloroform	67-66-3	0.2	Annual	Ontario AAQC	9.63E-05	-	-	9.63E-05	9.08E-06	<0.01%	4.84E-06	<0.01%	0.10	0.49	0.10	0.49	0.10	0.49
Dichlorofluoromethane	75-43-4	500	24-Hour	Schedule 3 POI	1.58E-04	-	-	1.58E-04	1.08E-04	<0.01%	1.04E-04	<0.01%	2.85	0.57%	2.85	0.57%	2.85	0.57%
Ethylbenzene	100-41-4	1000	24-Hour	Ontario AAQC	1.50E-04	-	-	1.50E-04	1.02E-04	<0.01%	9.87E-05	<0.01%	1.49	0.15%	1.49	0.15%	1.49	0.15%
Ethylbenzene	100-41-4	1900	10-minute	Ontario AAQC	1.50E-04	-	-	1.50E-04	5.74E-04	<0.01%	3.25E-04	<0.01%	6.17	0.32%	6.17	0.32%	6.17	0.32%
Ethylene Dibromide	106-93-4	3	24-Hour	Ontario AAQC	9.10E-05	-	-	9.10E-05	6.22E-05	<0.01%	6.00E-05	<0.01%	0.81	0.27	0.81	0.27	0.81	0.27
Isopropylbenzene	98-82-8	400	24-Hour	Ontario AAQC	9.10E-05	-	-	9.10E-05	6.22E-05	<0.01%	6.00E-05	<0.01%	NA	NA	6.22E-05	<0.01%	6.00E-05	<0.01%
Xylenes	1330-20-7	730	24-Hour	Ontario AAQC	3.93E-04	-	-	3.93E-04	2.69E-04	<0.01%	2.59E-04	<0.01%	5.05	0.69%	5.05	0.69%	5.05	0.69%
Xylenes	1330-20-7	3000	10-minute	Ontario AAQC	3.93E-04	-	-	3.93E-04	1.51E-03	<0.01%	8.53E-04	<0.01%	20.31	0.68%	20.31	0.68%	20.31	0.68%
Methylene Chloride	75-09-2	220	24-Hour	Ontario AAQC	4.28E-03	-	-	4.28E-03	2.93E-03	<0.01%	2.82E-03	<0.01%	2.94	0.01	2.94	0.01	2.94	0.01
Methylene Chloride	75-09-2	44	Annual	Ontario AAQC	4.28E-03	-	-	4.28E-03	4.03E-04	<0.01%	2.15E-04	<0.01%	0.56	0.01	0.56	0.01	0.56	0.01
Styrene	100-42-5	400	24-Hour	Ontario AAQC	9.76E-05	-	-	9.76E-05	6.67E-05	<0.01%	6.43E-05	<0.01%	2.02	0.51%	2.02	0.51%	2.02	0.51%
Tetrachloroethene	127-18-4	360	24-Hour	Ontario AAQC	1.58E-04	-	-	1.58E-04	1.08E-04	<0.01%	1.05E-04	<0.01%	0.64	0.18%	0.64	0.18%	0.64	0.18%
Toluene	108-88-3	2000	24-Hour	Ontario AAQC	1.68E-03	-	-	1.68E-03	1.15E-03	<0.01%	1.11E-03	<0.01%	5.42	0.27%	5.42	0.27%	5.42	0.27%
Trichloroethylene	79-01-6	12	24-Hour	Ontario AAQC	9.10E-05	-	-	9.10E-05	6.22E-05	<0.01%	6.00E-05	<0.01%	2.76	0.23	2.76	0.23	2.76	0.23
Trichloroethylene	79-01-6	2.3	Annual	Ontario AAQC	9.10E-05	-	-	9.10E-05	8.57E-06	<0.01%	4.57E-06	<0.01%	0.53	0.23	0.53	0.23	0.53	0.23
Trichlorofluoromethane	75-69-4	6000	24-Hour	Schedule 3 POI	1.50E-04	-	-	1.50E-04	1.03E-04	<0.01%	9.90E-05	<0.01%	2.05	0.03%	2.05	0.03%	2.05	0.03%
Trichlorotrifluoroethane	76-13-1	800000	24-Hour	Ontario AAQC	1.50E-04	-	-	1.50E-04	1.02E-04	<0.01%	9.87E-05	<0.01%	1.21	1.51E-06	1.21	<0.01%	1.21	<0.01%
Vinyl Chloride	75-01-4	1	24-Hour	Ontario AAQC	1.50E-04	-	-	1.50E-04	1.02E-04	0.01%	9.87E-05	<0.01%	0.27	0.27	0.27	0.27	0.27	0.27
Vinyl Chloride	75-01-4	0.2	Annual	Ontario AAQC	1.50E-04	-	-	1.50E-04	1.41E-05	<0.01%	7.51E-06	<0.01%	0.05	0.26	0.05	0.26	0.05	0.26
Formaldehyde	50-00-0	65	24-Hour	Ontario AAQC	0.03	-	-	0.03	0.02	0.03%	0.02	0.03%	NA	NA	0.02	0.03%	0.02	0.03%
Acetaldehyde	75-07-0	500	½-Hour	Ontario AAQC	0.03	-	-	0.03	0.09	0.02%	0.05	0.01%	NA	NA	0.09	0.02%	0.05	0.01%
Acetaldehyde	75-07-0	500	24-Hour	Ontario AAQC	0.03	-	-	0.03	0.02	<0.01%	0.02	<0.01%	NA	NA	0.02	<0.01%	0.02	<0.01%
Acrolein	107-02-8	4.5	1-Hour	Ontario AAQC	1.78E-04	-	-	1.78E-04	4.15E-04	<0.01%	2.34E-04	<0.01%	NA	NA	4.15E-04	<0.01%	2.34E-04	<0.01%
Acrolein	107-02-8	0.4	24-Hour	Ontario AAQC	1.78E-04	-	-	1.78E-04	1.22E-04	0.03%	1.18E-04	0.03%	NA	NA	1.22E-04	0.03%	1.18E-04	0.03%
1-Methylnaphthalene	90-12-0	35.5	24-Hour	De Minimis	6.42E-06	-	-	6.42E-06	4.39E-06	<0.01%	4.24E-06	<0.01%	0.01	0.04%	0.01	0.04%	0.01	0.04%
1-Methylphenanthrene	832-69-9	0.1	24-Hour	De Minimis	1.29E-06	-	-	1.29E-06	8.84E-07	<0.01%	8.52E-07	<0.01%	1.22E-03	0.01	1.22E-03	0.01	1.22E-03	0.01
2-Chloronaphthalene	91-58-7	1	24-Hour	Schedule 3 POI	9.47E-07	-	-	9.47E-07	6.47E-07	<0.01%	6.24E-07	<0.01%	5.68E-04	0.06%	5.69E-04	0.06%	5.69E-04	0.06%
2-methylanthracene	613-12-7	0.1	24-Hour	De Minimis	1.13E-06	-	-	1.13E-06	7.76E-07	<0.01%	7.48E-07	<0.01%	5.68E-04	0.57%	5.69E-04	0.57%	5.69E-04	0.57%
2-Methylnaphthalene	91-57-6	35.5	24-Hour	Schedule 3 POI	1.26E-05	-	-	1.26E-05	8.63E-06	<0.01%	8.32E-06	<0.01%	0.03	0.07%	0.03	0.07%	0.03	0.07%
3-Methylcholanthrene	56-49-5	0.1	24-Hour	De Minimis	1.06E-06	-	-	1.06E-06	7.26E-07	<0.01%	7.00E-07	<0.01%	0.01	0.10	0.01	0.01	0.01	0.10
7,12-Dimethylbenz(a)anthracene	57-97-6	0.1	24-Hour	De Minimis	3.22E-06	-	-	3.22E-06	2.20E-06	<0.01%	2.13E-06	<0.01%	2.24E-03	0.02	2.24E-03	0.02	2.24E-03	0.02
9,10-dimethylanthracene	781-43-1	0.1	24-Hour	De Minimis	9.76E-07	-	-	9.76E-07	6.67E-07	<0.01%	6.43E-07	<0.01%	2.01E-03	0.02	2.01E-03	0.02	2.01E-03	0.02
9-Methylphenanthrene	883-20-5	0.1	24-Hour	De Minimis	1.09E-06	-	-	1.09E-06	7.46E-07	<0.01%	7.20E-07	<0.01%	8.06E-03	0.08	8.06E-03	0.08	8.06E-03	0.08
Acenaphthene	83-32-9	0.1	24-Hour	De Minimis	2.04E-06	-	-	2.04E-06	1.40E-06	<0.01%	1.35E-06	<0.01%	7.94E-03	0.08	7.95E-03	0.08	7.95E-03	0.08
Acenaphthylene	208-96-8	0.1	24-Hour	De Minimis	4.10E-06	-	-	4.10E-06	2.81E-06	<0.01%	2.71E-06	<0.01%	1.85E-03	0.02	1.85E-03	0.02	1.85E-03	0.02
Anthracene	120-12-7	0.1	24-Hour	De Minimis	1.87E-06	-	-	1.87E-06	1.28E-06	<0.01%	1.23E-06	<0.01%	1.11E-03	0.01	1.11E-03	0.01	1.11E-03	0.01
Benzo(a)Anthracene	56-55-3	0.1	24-Hour	De Minimis	9.92E-07	-	-	9.92E-07	6.78E-07	<0.01%	6.54E-07	<0.01%	5.68E-04	0.57%	5.69E-04	0.57%	5.69E-04	0.57%
Benzo(a)fluorene	238-84-6	0.1	24-Hour	De Minimis	8.96E-07	-	-	8.96E-07	6.13E-07	<0.01%	5.91E-07	<0.01%	6.02E-04	0.60%	6.03E-04	0.60%	6.03E-04	0.60%
Benzo(a)Pyrene	50-32-8	0.00001	Annual	Ontario AAQC	3.46E-07	4.69E-10

Table E.4

Maximum Concentrations at Worst Case Receptor and Worst-Case Sensitive Receptor for Phase 2 Expansion (Scenario 3)

Pollutants	CAS No.	Project Criteria(ug/m3)	Averaging Period	Criteria Source	Incinerator Stack Emission Rate (g/s)	Truck Idling Emission Rate (g/s)	Truck Traffic Tailpipe Emission Rate (g/s)	Total Facility Emission Rate (g/s)	Maximum Concentration at Worst Case Receptor (ug/m3)	Percent (%) of Project Criteria at Worst Case Receptor	Maximum Concentration at Worst Case Sensitive Receptor (Sports/field) (ug/m3)	Percent of Project Criteria at Sports/field (%)	Background Concentration (ug/m3)	Percent (%) of Project Criteria Contributed by Background	Cumulative Maximum Concentration at Worst Case Receptor (ug/m3)	% of the Criteria at Worst Case Receptor	Cumulative Maximum Concentration at Sports/field (ug/m3)	% of the Criteria at Sports/field
Suspended Particulate Matter	NA-PM	120	24-Hour	Ontario AAQC	0.69	5.47E-03 (4)	1.21E-04	0.69	1.16	0.97%	0.764	0.64%	1.05E+02	87.35%	105.98	88.32%	105.59	87.99%
Suspended Particulate Matter	NA-PM	60	Annual	Ontario AAQC	0.69	5.47E-03 (4)	1.21E-04	0.69	0.10	0.17%	0.058	0.10%	2.41E+01	40.20%	24.22	40.37%	24.18	40.30%
Nitrogen Dioxide	10102-44-0	79.018	1-Hour	CAAQS	16.74	1.81E-01 (4)	1.09E-02	16.74	43.91	55.57%	27.267	34.51%	3.24E+01	40.95%	76.27	96.52%	59.63	75.46%
Nitrogen Dioxide	10102-44-0	400	1-Hour	Ontario AAQC	16.74	1.81E-01 (4)	1.09E-02	16.74	52.48	13.12%	30.173	7.54%	3.24E+01	8.09%	84.84	21.21%	62.53	15.63%
Nitrogen Dioxide	10102-44-0	200	24-Hour	Ontario AAQC	16.74	1.21E-01 (4)	5.46E-03	16.74	28.12	14.06%	18.483	9.24%	1.29E+01	6.47%	41.07	20.53%	31.43	15.71%
Nitrogen Dioxide	10102-44-0	22.577	Annual	CAAQS	16.74	1.21E-01 (4)	5.46E-03	16.74	2.52	11.17%	1.399	6.19%	2.55E+00	11.28%	5.07	22.45%	3.95	17.48%
Carbon Monoxide	630-08-0	6000	½-Hour	Schedule 3 POI	5.53	-	-	5.53	20.64	0.34%	11.799	0.20%	5.22E+02	8.70%	542.85	9.05%	534.01	8.90%
Carbon Monoxide	630-08-0	36200	1-Hour	Ontario AAQC	5.53	-	-	5.53	17.20	0.05%	9.833	0.03%	4.35E+02	1.20%	452.37	1.25%	445.01	1.23%
Carbon Monoxide	630-08-0	15700	8-Hour	Ontario AAQC	5.53	-	-	5.53	12.80	0.08%	7.430	0.05%	5.80E+01	0.37%	70.82	0.45%	65.46	0.42%
Sulphur Dioxide	7446-09-5	10	Annual	Ontario AAQC	4.84	-	-	4.84	0.71	7.14%	0.382	3.82%	8.24E-02	0.82%	0.80	7.96%	0.46	4.65%
Sulphur Dioxide	7446-09-5	100	1-Hour	Schedule 3 POI	4.84	-	-	4.84	15.05	15.05%	8.604	8.60%	1.05E+00	1.05%	16.09	16.09%	9.65	9.65%
Sulphur Dioxide	7446-09-5	178.220	10-minute	Ontario AAQC	4.84	-	-	4.84	24.83	13.93%	14.196	7.97%	1.73E+00	0.97%	26.56	14.90%	15.92	8.93%
Organic matter (expressed as equivalent methane)	74-82-8	37330	24-Hour	Schedule 3 POI	4.57	-	-	4.57	7.68	0.02%	5.024	0.01%	NA	NA	7.68	0.02%	5.02	0.01%
Ozone	10028-15-6	165	1-Hour	Ontario AAQC	0.00E+00	-	-	0.00E+00	0.00E+00	<0.01%	-	<0.01%	8.64E+01	52.35%	86.38	52.35%	86.38	52.35%
Ozone	10028-15-6	117.791	8-Hour	CAAQS	0.00E+00	-	-	0.00E+00	0.00E+00	<0.01%	-	<0.01%	1.15E+01	9.78%	11.52	9.78%	11.52	9.78%
PM10	NA-PM10	50	24-Hour	Ontario AAQC	0.69	5.47E-03 (4)	1.21E-04	0.69	1.16	2.32%	1.164	1.53%	1.11E+01	22.22%	12.27	24.54%	11.88	23.75%
PM2.5	NA-PM2.5	27	24-Hour	Ontario AAQC, CAAQS	0.69	5.47E-03 (4)	1.21E-04	0.69	1.16	4.31%	3.24E-01	1.20%	6.00E+00	22.22%	7.16	26.53%	6.32	23.42%
PM2.5	NA-PM2.5	8.8	Annual	Ontario AAQC, CAAQS	0.69	5.47E-03 (4)	1.21E-04	0.69	0.10	1.16%	4.78E-02	0.54%	1.18E+00	13.42%	1.28	14.58%	1.23	13.96%
Aluminum	7429-90-5	12	24-Hour	Schedule 3 POI	3.78E-03	-	-	3.78E-03	6.37E-03	0.05%	4.17E-03	0.03%	6.48E-01	5.40%	6.55E-01	5.45%	6.52E-01	5.44%
Aluminum Oxide	1344-28-1	120	24-Hour	Ontario AAQC	7.15E-03	-	-	7.15E-03	0.01	0.01%	7.87E-03	<0.01%	1.23E+00	1.02%	1.24E+00	1.03%	1.23E+00	1.03%
Antimony	7440-36-0	25	24-Hour	Ontario AAQC	1.80E-04	-	-	1.80E-04	3.02E-04	<0.01%	1.98E-04	<0.01%	6.05E-03	0.02%	6.35E-03	0.03%	6.24E-03	0.02%
Arsenic	7440-38-2	0.3	24-Hour	Ontario AAQC	2.53E-04	-	-	2.53E-04	4.26E-04	0.14%	2.79E-04	0.09%	3.61E-03	1.20%	4.04E-03	1.35%	3.89E-03	1.30%
Barium	7440-39-3	10	24-Hour	Ontario AAQC	5.27E-04	-	-	5.27E-04	8.86E-04	<0.01%	5.79E-04	<0.01%	4.51E-02	0.45%	4.60E-02	0.46%	4.57E-02	0.46%
Beryllium	7440-41-7	0.01	24-Hour	Ontario AAQC	6.19E-06	-	-	6.19E-06	1.04E-05	0.10%	6.82E-06	0.07%	6.02E-04	6.02%	6.12E-04	6.12%	6.09E-04	6.09%
Boron	7440-42-8	120	24-Hour	Ontario AAQC	0.02	-	-	0.02	0.03	0.02%	1.82E-02	0.02%	7.87E-03	0.01%	3.58E-02	0.03%	2.61E-02	0.02%
Cadmium	7440-43-9	0.025	24-Hour	Ontario AAQC	9.68E-04	-	-	9.68E-04	1.63E-03	6.52%	1.07E-03	4.26%	1.21E-03	4.82%	2.84E-03	11.34%	2.27E-03	9.09%
Cadmium	7440-43-9	0.005	Annual	Ontario AAQC	9.68E-04	-	-	9.68E-04	1.43E-04	2.85%	7.65E-05	1.53%	2.31E-04	4.62%	3.74E-04	7.48%	3.08E-04	6.15%
Calcium	7440-70-2	10 (1)	24-Hour	Ontario AAQC	0.17	-	-	0.17	0.28	2.82%	1.84E-01	1.84%	4.47E+00	44.66%	4.75E+00	47.48%	4.65E+00	46.51%
Calcium Oxide	1305-78-8	10	24-Hour	Ontario AAQC	0.23	-	-	0.23	0.39	3.94%	2.58E-01	2.58%	6.25E+00	62.53%	6.65E+00	66.47%	6.51E+00	65.11%
Chromium	7440-47-3	0.5	24-Hour	Ontario AAQC	6.57E-04	-	-	6.57E-04	1.10E-03	0.22%	7.23E-04	0.14%	5.03E-03	1.01%	6.14E-03	1.23%	5.76E-03	1.15%
Cobalt	7440-48-4	0.1	24-Hour	Ontario AAQC	6.11E-04	-	-	6.11E-04	1.03E-03	1.03%	6.72E-04	0.67%	1.20E-03	1.20%	2.23E-03	2.23%	1.88E-03	1.88%
Copper	7440-50-8	50	24-Hour	Ontario AAQC	6.93E-03	-	-	6.93E-03	0.01	0.02%	7.63E-03	0.02%	5.83E-01	1.17%	5.95E-01	1.19%	5.91E-01	1.18%
Iron	7439-89-6	4	24-Hour	Ontario AAQC	0.01	-	-	0.01	0.02	0.47%	1.22E-02	0.31%	2.19E+00	54.78%	2.21E+00	55.25%	2.20E+00	55.08%
Lead	7439-92-1	0.2	30-Day	Ontario AAQC	6.92E-03	-	-	6.92E-03	2.48E-03	1.24%	1.52E-03	0.65%	4.61E-03	2.31%	7.09E-03	3.55%	5.90E-03	2.95%
Lead	7439-92-1	0.5	24-Hour	Ontario AAQC	6.92E-03	-	-	6.92E-03	0.01	2.33%	7.61E-03	1.52%	1.20E-02	2.40%	2.37E-02	4.73%	1.96E-02	3.93%
Lithium	7439-93-2	20	24-Hour	Ontario AAQC	4.70E-05	-	-	4.70E-05	7.91E-05	<0.01%	5.18E-05	<0.01%	1.63E-02	0.08%	1.63E-02	0.08%	1.63E-02	0.08%
Magnesium	7439-95-4	72	24-Hour	Ontario AAQC	4.61E-03	-	-	4.61E-03	7.76E-03	0.01%	5.08E-03	<0.01%	6.46E+00	8.98%	6.47E+00	8.99%	6.47E+00	8.98%
Magnesium oxide	1309-48-4	120	24-Hour	Ontario AAQC	7.65E-03	-	-	7.65E-03	0.01	0.01%	8.42E-03	<0.01%	1.07E+01	8.94%	1.07E+01	8.95%	1.07E+01	8.95%
Manganese	7439-96-5	0.4 (as SPM)	24-Hour	Ontario AAQC	2.47E-03	-	-	2.47E-03	4.15E-03	1.04%	2.72E-03	0.68%	6.10E-02	15.25%	6.51E-02	16.28%	6.37E-02	15.93%
Manganese	7439-96-5	0.1 (as PM2.5)	24-Hour	Ontario AAQC	2.47E-03	-	-	2.47E-03	4.15E-03	4.15%	2.72E-03	2.72%	6.10E-02	60.99%	6.51E-02	65.14%	6.37E-02	63.70%
Manganese	7439-96-5	0.2 (as PM10)	24-Hour	Ontario AAQC	2.47E-03	-	-	2.47E-03	4.15E-03	2.08%	2.72E-03	1.36%	6.10E-02	30.49%	6.51E-02	32.57%	6.37E-02	31.85%
Molybdenum	7439-98-7	120	24-Hour	Ontario AAQC	4.92E-04	-	-	4.92E-04	8.28E-04	<0.01%	5.42E-04	<0.01%	1.76E-02	0.01%	1.84E-02	0.02%	1.81E-02	0.02%
Nickel	7440-02-0	0.02 (as PM10)	Annual	Ontario AAQC	1.13E-03	-	-	1.13E-03	1.66E-04	0.83%	8.91E-05	0.45%	7.67E-04	3.83%	9.33E-04	4.66%	8.56E-04	4.28%
Nickel	7440-02-0	0.04 (as SPM)	Annual	Ontario AAQC	1.13E-03	-	-	1.13E-03	1.66E-04	0.42%	8.91E-05	0.22%	7.67E-04	1.92%	9.33E-04	2.33%	8.56E-04	2.14%
Nickel	7440-02-0	0.1 (as PM10)	24-Hour	Ontario AAQC	1.13E-03	-	-	1.13E-03	1.90E-03	1.90%	1.24E-03	1.24%	4.00E-03	4.00%	5.90E-03	5.90%	5.24E-03	5.24%
Nickel	7440-02-0	0.2 (as SPM)	24-Hour	Ontario AAQC	1.13E-03	-	-	1.13E-03	1.90E-03	0.95%	1.24E-03	0.62%	4.00E-03	2.00%	5.90E-03	2.95%	5.24E-03	2.62%
Phosphorus	7723-14-0	0.5	24-Hour	Schedule 3 POI	2.87E-03	-	-	2.87E-03	4.82E-03	0.96%	3.15E-03	0.63%	7.91E-02	15.81%	8.38E-02	16.78%	8.22E-02	16.44%
Phosphorous pentachloride	10026-13-8	10	24-Hour	Ontario AAQC	0.02	-	-	0.02	0.03	0.32%	2.12E-02	0.21%	5.32E-01	5.32%	5.65E-01	5.65%	5.53E-01	5.53%
Selenium	7782-49-2	10	24-Hour	Ontario AAQC	6.81E-05	-	-	6.81E-05	1.15E-04	<0.01%	7.50E-05	<0.01%	6.12E-03	0.06%	6.23E-03	0.06%	6.19E-03	0.06%
Silver	7440-22-4	1	24-Hour	Ontario AAQC	2.60E-05	-	-	2.60E-05	4.38E-05	<0.01%	2.87E-05	<0.01%	3.01E-03	0.30%	3.05E-03	0.31%	3.04E-03	0.30%
Sodium	7440-23-5	10 (2)	24-Hour	Ontario AAQC	0.06	-	-	0.06	0.10	0.96%	6.28E-02	0.63%	3.83E+00	38.27%	3.92E+00	39.23%	3.89E+00	38.90%
Sodium hydroxide	1310-73-2	10	24-Hour	Ontario AAQC	0.10	-	-	0.10	0.17	1.67%	1.09E-01	1.09%	6.66E+00	66.59%	6.83E+00	68.26%	6.77E+00	67.68%
Strontium	7440-24-6	120	24-Hour	Ontario AAQC	1.30E-04	-	-	1.30E-04	2.19E-04	<0.01%	1.43E-04	<0.01%	2.76E-02	0.02%	2.78E-02	0.02%	2.77E-02	0.02%
Tin	7440-31-5	10	24-Hour	Ontario AAQC	1.01E-03	-	-	1.01E-03	1.70E-03	0.02%	1.11E-03	0.01%	8.20E-03	0.08%	9.90E-03	0.10%	9.31E-03	0.09%
Titanium	7440-32-6	120	24-Hour	Ontario AAQC	4.38E-04	-	-	4.38E-04	7.36E-04	<0.01%	4.82E-04	<0.01%	3.34E-02	0.03%	3.42E-02	0.03%	3.39E-02	0.03%
Vanadium	7440-62-2	2	24-Hour	Ontario AAQC	2.72E-05	-	-	2.72E-05	4.58E-05	<0.01%	3.00E-05	<0.01%	3.58E-03	0.18%	3.62E-03	0.18%	3.61E-03	0.18%
Zinc	7440-66-6	120	24-Hour	Ontario AAQC	9.55E-03	-	-	9.55E-03	0.02	0.01%	1.05E-02	<0.01%	1.57E-01	0.13%	1.73E-01	0.14%	1.68E-01	0.14%
Silicon	7440-21-3	27	24-Hour	Schedule 3 POI	0.02	-	-	0.02	0.03	0.10%	1.76E-02	0.07%	2.04E-01	0.76%	2.31E-01	0.86%	2.22E-01	0.82%
Silica	14464-46-1	5	24-Hour	Ontario AAQC	0.03	-	-	0.03	0.06	1.15%	3.78E-02	0.76%	4.36E-01	8.73%	4.94E-01	9.88%	4.74E-01	9.48%
Mercury	7439-97-6	2	24-Hour	Ontario AAQC	2.08E-03	-	-	2.08E-03	3.49E-03	0.17%	2.28E-03	0.11%	3.03E-05	0.00%	3.52E-03	0.18%	2.31E-03	0.12%
Mercury (as Hg) – alkyl compounds	7439-97-6	0.5	24-Hour	Ontario AAQC	2.08E-03	-	-	2.08E-03	3.49E-03	0.70%	2.28E-03	0.46%	3.03E-05	0.01%	3.52E-03	0.70%	2.31E-03	0.46%
Hydrogen Chloride	7647-01-0	20	24-Hour	Ontario AAQC	1.25	-	-	1.25	2.09	10.47%	1.37E+00	6.85%	3.00E+00	15.00%	5.09E+00	25.47%	4.37E+00	21.85%
Hydrogen Fluoride	7664-39-3	1.72	24-Hour	Ontario AAQC	0.06	-	-	0.06	0.10	5.56%	6.26E-02	3.64%	NA	NA	9.57E-02	5.56%	6.26E-02	3.64%
Hydrogen Fluoride	7664-39-3	0.69	30-Day	Ontario AAQC	0.06	-	-	0.06	0.02	2.96%	1.06E-02	1.54%	NA	NA	2.04E-02	2.96%	1.06E-02	1.54%
1,1,1-Trichloroethane	71-55-6	115000	24-Hour	Ontario AAQC	1.82E-04	-	-	1.82E-04	3.06E-04	<0.01%	2.00E-04	<0.01%	7.13E-01	0.00%	7.14E-01	<0.01%	7.14E-01	<0.01%
1,1-Dichloroethane	75-34-3	165	24-Hour	Ontario AAQC	2.18E-04	-	-	2.18E-04	3.67E-04	<0.01%	2.40E-04	<0.01%	4.24E-01	0.26%	4.25E-01	0.26%	4.25E-01	0.26%
1,2-Dichloroethane	107-06-2	2	24-Hour	Ontario AAQC	4.20E-04	-	-	4.20E-04	7.07E-04	0.04%	4.62E-04	0.02%	4.24E-01	21.22%	4.25E-01	21.25%	4.25E-01	21.24%
1,2-Dichloroethane	107-06-2	0.4	Annual	Ontario AAQC	4.20E-04	-	-	4.20E-04	6.16E-05	0.02%	3.32E-05	<0.01%	8.13E-02	20.34%	8.14E-02	20.35%	8.14E-02	20.34%
1,2-Dichloropropane	78-87-5	2400	24-Hour	Ontario AAQC	1.82E-04	-	-	1.82E-04	3.06E-04	<0.01%	2.00E-04	<0.01%	4.85E-01	0.02%	4.85E-01	0.02%	4.85E-01	0.02%
1,3,5-Trimethylbenzene	108-67-8	220	24-Hour	Ontario AAQC	2.99E-04	-	-	2.99E-04	5.04E-04	<0.01%	3.29E-04	<0.01%	2.58E+00	1.17%	2.58E+00	1.17%	2.58E+00	1.17%
1,3-Butadiene	106-99-0	10	24-Hour	Ontario AAQC	2.99E-04	-	-	2.99E-04	5.04E-04	<0.01%	3.29E-04	<0.01%	1.16E+00	11.61%	1.16E+00	11.61%	1.16E+00	11.61%
1,3-Butadiene	106-99-0	2	Annual	Ontario AAQC	2.99E-04	-	-	2.99E-04	4.41E-05	<0.01%	2.36E-05	<0.01%	2.23E-01	11.13%	2.23E-01	11.13%	2.23E-01	11.13%
2-Butanone	78-93-3	1000	24-Hour	Ontario AAQC	1.29E-03	-	-	1.29E-03	2.17E-03	<0.01%	1.42E-03	<0.01%	8.70E+00	0.87%	8.70E+00	0.87%	8.70E+00	0.87%
Acetone	67-64-1	11880	24-Hour	Ontario AAQC	1.92E-03	-	-	1.92E-03	3.22E-03	<0.01%	2.11E-03	<0.01%	1.84E+01	0.16%	1.84E+01	0.16%	1.84E+01	0.16%
Benzene	71-43-2	0.45	Annual	Ontario AAQC	0.02	-	-	0.02	2.80E-03	0.62%	1.50E-03	0.33%	2.04E-01	45.41%	2.07E-01	46.03%	2.06E-01	45.74%
Benzene	71-43-2	2.3	24-Hour	Ontario AAQC	0.02	-	-	0.02	0.03	1.39%	2.00E-02	0.91%	1.07E+00	46.35%	1.10E+00	47.74%	1.08E+00	47.26%
Bromodichloromethane	75-27-4	350	24-Hour	Schedule 3 POI	1.82E-04	-	-	1.82E-04	3.06E-04	<0.01%	2.00E-04	<0.01%	1.41E+00	0.40%	1.41E+00	0.40%	1.41E+00	0.40%
Bromoform	75-25-2	55	24-Hour	Ontario AAQC	3.16E-04	-	-	3.16E-04	5.32E-04	<0.01%	3.48E-04	<0.01%	2.17E+00	3.95%	2.17E+00	3.95%	2.17E+00	3.95%
Bromomethane	74-83-9	1350	24-Hour	Ontario AAQC	1.53E-03	-	-	1.53E-03	2.57E-03	<0.01%	1.68E-03	<0.01%	4.08E-01	0.03%	4.10E-01	0.03%	4.09E-01	0.03%
Carbon Tetrachloride	56-23-5	2.4	24-Hour	Ontario AAQC	1.82E-04	-	-	1.82E-04	3.06E-04	0.01%	2.00E-04	<0.01%	6.82E-01	28.42%	6.82E-01	28.43%	6.82E-01	28.42%
Chlorodibromomethane	124-48-1	0.2	24-Hour	Schedule 3 POI	1.90E-04	-	-	1.90E-04	3.20E-04	0.16%	2.09E-04	0.10%	NA	NA	3.20E-04	0.16%	2.09E-04	0.10%
Chloroform	67-66-3	1	24-Hour	Ontario AAQC	1.93E-04	-	-	1.93E-04	3.24E-04	0.03%	2.12E-04	0.02%	2.56E-01	25.62%	2.57E-01	25.66%	2.56E-01	25.64%
Chloroform	67-66-3	0.2	Annual	Ontario AAQC	1.93E-04	-	-	1.93E-04	2.84E-05	0.01%	1.52E-05	<0.01%	9.82E-02	49.11%	9.83E-02	49.13%	9.82E-02	49.12%
Dichlorofluoromethane	75-43-4	500	24-Hour	Schedule 3 POI	3.15E-04	-	-	3.15E-04	5.30E-04	<0.01%	3.47E-04	<0.01%	2.85E+00	0.57%	2.85E+00	0.57%	2.85E+00	0.57%
Ethylbenzene	100-41-4	1000	24-Hour	Ontario AAQC	2.99E-04	-	-	2.99E-04	5.04E-04	<0.01%	3.29E-04	<0.01%	1.49E+00	0.15%	1.50E+00	0.15%	1.50E+00	0.15%
Ethylbenzene	100-41-4	1900	10-minute	Ontario AAQC	2.99E-04	-	-	2.99E-04	5.04E-04	<0.01%	8.78E-04	<0.01%	6.17E+00	0.32%	6.17E+00	0.32%	6.17E+00	0.32%
Ethylene Dibromide	106-93-4	3	24-Hour	Ontario AAQC	1.82E-04	-	-	1.82E-04	3.06E-04	0.01%	2.00E-04	<0.01%	8.06E-01	26.88%	8.07E-01	26.89%	8.07E-01	26.89%
Isopropylbenzene	98-82-8	400	24-Hour	Ontario AAQC	1.82E-04	-	-	1.82E-04	3.06E-04	<0.01%	2.00E-04	<0.01%	NA	NA	3.06E-04	<0.01%	2.00E-04	<0.01%
Xylenes	1330-20-7	730	24-Hour	Ontario AAQC	7.86E-04	-	-	7.86E-04	1.32E-03	<0.01%	8.65E-04	<0.01%	5.05E+00	0.69%	5.05E+00	0.69%	5.05E+00	0.69%
Xylenes	1330-20-7	3000	10-minute	Ontario AAQC	7.86E-04	-	-	7.86E-04	4.03E-03	<0.01%	2.31E-03	<0.01%	2.03E+01	0.68%	2.03E+01	0.68%	2.03E+01	0.68%
Methylene Chloride	75-09-2	220	24-Hour	Ontario AAQC	8.56E-03	-	-	8.56E-03	0.01	<0.01%	9.42E-03	<0.01%	2.94E+00	1.34%	2.95E+00	1.34%	2.95E+00	1.34%
Methylene Chloride	75-09-2	44	Annual	Ontario AAQC	8.56E-03	-	-	8.56E-03	1.26E-03	0.01%	6.76E-04	<0.01%	5.63E-01	1.28%	5.64E-01	1.28%	5.64E-01	1.28%
Styrene	100-42-5	400	24-Hour	Ontario AAQC	1.95E-04	-	-	1.95E-04	3.28E-04	<0.01%	2.15E-04	<0.01%	2.02E+00	0.51%	2.02E+00	0.51%	2.02E+00	0.51%
Tetrachloroethene	127-18-4	360	24-Hour	Ontario AAQC	3.18E-04	-	-	3.18E-04	5.35E-04	<0.01%	3.51E-04	<0.01%	6.41E-01	0.18%	6.41E-01	0.18%	6.41E-01	0.18%
Toluene	108-88-3	2000	24-Hour	Ontario AAQC	3.37E-03	-	-	3.37E-03	5.66E-03	<0.01%	3.71E-03	<0.01%	5.42E+00	0.27%	5.43E+00	0.27%	5.42E+00	0.27%
Trichloroethylene	79-01-6	12	24-Hour	Ontario AAQC	1.82E-04	-	-	1.82E-04	3.06E-04	<0.01%	2.00E-04	<0.01%	2.76E+00	22.99%	2.76E+00	22.99%	2.76E+00	22.99%
Trichlorofluoromethane	79-01-6	2.3	Annual	Ontario AAQC	1.82E-04	-	-	1.82E-04	2.68E-05	<0.01%	1.44E-05	<0.01%	5.23E-01	22.99%	5.23E-01	22.99%	5.23E-01	22.99%
Trichlorofluoromethane	75-69-4	6000	24-Hour	Schedule 3 POI	3.00E-04	-	-	3.00E-04	5.05E-04	<0.01%	3.30E-04	<0.01%	2.05E+00	0.03%	2.05E+00	0.03%	2.05E+00	0.03%
Trichlorotrifluoroethane	76-13-1	800000	24-Hour	Ontario AAQC	2.99E-04	-	-	2.99E-04	5.04E-04	<0.01%	3.29E-04	<0.01%	1.21E+00	0.00%	1.21E+00	<0.01%	1.21E+00	<0.01%
Vinyl Chloride	75-01-4	1	24-Hour	Ontario AAQC	2.99E-04	-	-	2.99E-04	5.04E-04	0.05%	3.29E-04	0.03%	2.68E-01	26.83%	2.69E-01	26.88%	2.69E-01	26.86%
Vinyl Chloride	75-01-4	0.2	Annual	Ontario AAQC	2.99E-04	-	-	2.99E-04	4.41E-05	0.02%	2.36E-05	0.01%	5.14E-02	25.71%	5.15E-02	25.73%	5.14E-02	25.72%
Formaldehyde	50-00-0	65	24-Hour	Ontario AAQC	0.07	-	-	0.07	0.11	0.17%	7.30E-02	0.11%	NA	NA	1.12E-01	0.17%	7.30E-02	0.11%
Acetaldehyde	75-07-0	500	½-Hour	Ontario AAQC	0.07	-	-	0.07	0.25	0.05%	1.45E-01	0.03%	NA	NA	2.53E-01	0.05%	1.45E-01	0.03%
Acetaldehyde	75-07-0	500	24-Hour	Ontario AAQC	0.07	-	-	0.07	0.11	0.02%	7.48E-02	0.01%	NA	NA	1.14E-01	0.02%	7.48E-02	0.01%
Acrolein	107-02-8	4.5	1-Hour	Ontario AAQC	3.57E-04	-	-	3.57E-04	1.11E-03	0.02%	6.34E-04	0.01%	NA	NA	1.11E-03	0.02%	6.34E-04	0.01%
Acrolein	107-02-8	0.4	24-Hour	Ontario AAQC	3.57E-04	-	-	3.57E-04	6.00E-04	0.15%	3.93E-04	0.10%	NA	NA	6.00E-04	0.15%	3.93E-04	0.10%
1-Methylnaphthalene	90-12-0	35.5	24-Hour	De Minimis	1.28E-05	-	-	1.28E-05	2.16E-05	<0.01%	1.41E-05	<0.01%	1.44E-02	0.04%	1.44E-02	0.04%	1.44E-02	0.04%
1-Methylphenanthrene	832-69-9	0.1	24-Hour	De Minimis	2.58E-06	-	-	2.58E-06	4.35E-06	<0.01%	2.84E-06	<0.01%	1.22E-03	1.22%	1.22E-03	1.22%	1.22E-03	1.22%
2-Chloronaphthalene	91-58-7	1	24-Hour	Schedule 3 POI	1.89E-06	-	-	1.89E-06	3.19E-06	<0.01%	2.08E-06	<0.01%	5.68E-04	0.06%	5.72E-04	0.06%	5.70E-04	0.06%
2-methylanthracene	613-12-7	0.1	24-Hour	De Minimis	2.27E-06	-	-	2.27E-06	3.82E-06	<0.01%	2.50E-06	<0.01%	5.68E-04	0.57%	5.72E-04	0.57%	5.71E-04	0.57%
2-Methylnaphthalene	91-57-6	35.5	24-Hour	Schedule 3 POI	2.52E-05	-	-	2.52E-05	4.25E-05	<0.01%	2.78E-05	<0.01%	2.61E-02	0.07%	2.61E-02	0.07%	2.61E-02	0.07%
3-Methylcholanthrene	56-49-5	0.1	24-Hour	De Minimis	2.12E-06	-	-	2.12E-06	3.57E-06	<0.01%	2.34E-06	<0.01%	1.01E-02	10.07%	1.01E-02	10.07%	1.01E-02	10.07%
7,12-Dimethylbenz(a)anthracene	57-97-6	0.1	24-Hour	De Minimis	6.44E-06	-	-	6.44E-06	1.08E-05	0.01%	7.09E-06	<0.01%	2.24E-03	2.24%	2.25E-03	2.25%	2.25E-03	2.25%
9,10-dimethylanthracene	781-43-1	0.1	24-Hour	De Minimis	1.95E-06	-	-	1.95E-06	3.28E-06	<0.01%	2.15E-06	<0.01%	2.01E-03	2.01%	2.02E-03	2.02%	2.02E-03	2.02%
9-Methylphenanthrene	883-20-5	0.1	24-Hour	De Minimis	2.18E-06	-	-	2.18E-06	3.67E-06	<0.01%	2.40E-06	<0.01%	8.06E-03	8.06%	8.08E-03	8.08%	8.06E-03	8.06%
Acenaphthene	83-32-9	0.1	24-Hour	De Minimis	4.08E-06	-	-	4.08E-06	6.87E-06	<0.01%	4.49E-06	<0.01%	7.94E-03	7.94%	7.95E-03	7.95%	7.95E-03	7.95%
Acenaphthylene	208-96-8	0.1	24

Table E.5

Maximum Concentrations at Worst Case Receptor and Worst-Case Sensitive Receptor for Phase 3 Expansion (Scenario 4)

Pollutants	CAS No.	Project Criteria (ug/m3)	Averaging Period	Criteria Source	Incinerator Stack Emission Rate (g/s)	Truck Idling Emission Rate (g/s)	Truck Traffic Tailpipe Emission Rate (g/s)	Total Facility Emission Rate (g/s)	Maximum Concentration at Worst Case Receptor (ug/m3)	Percent of Project Criteria (%) at Worst Case Receptor	Maximum Concentration at Worst Case Sensitive Receptor (Sportsfield) (ug/m3)	Percent of Project Criteria at Sportsfield (%)	Background Concentration (ug/m3)	Percent of Project Criteria Contributed by Background (%)	Cumulative Maximum Concentration at Worst Case Receptor (ug/m3)	% of the Criteria at Worst Case Receptor	Cumulative Maximum Concentration at Sportsfield (ug/m3)	% of the Criteria at Sportsfield
Suspended Particulate Matter	NA-PM	120	24-Hour	Ontario AAQC	1.04	8.21E-03 (4)	1.81E-04	1.04	1.90	1.58%	1.05	0.88%	104.82	87.35%	106.72	88.93%	105.87	88.23%
Suspended Particulate Matter	NA-PM	60	Annual	Ontario AAQC	1.04	8.21E-03 (4)	1.81E-04	1.04	0.13	0.21%	0.08	0.14%	24.12	40.20%	24.25	40.41%	24.20	40.34%
Nitrogen Dioxide	10102-44-0	79.018	1-Hour	CAAQS	25.11	2.72E-01 (4)	1.64E-02	25.12	69.71	88.22%	41.24	52.18%	32.36	40.95%	102.07	129.18%	73.60	93.14%
Nitrogen Dioxide	10102-44-0	400	1-Hour	Ontario AAQC	25.11	2.72E-01 (4)	1.64E-02	25.12	69.71	17.43%	48.44	12.11%	32.36	8.09%	102.07	25.52%	80.80	20.20%
Nitrogen Dioxide	10102-44-0	200	24-Hour	Ontario AAQC	25.11	1.81E-01 (4)	8.19E-03	25.12	45.98	22.99%	25.45	12.72%	12.94	6.47%	58.93	29.46%	38.39	19.20%
Nitrogen Dioxide	10102-44-0	22.577	Annual	CAAQS	25.11	1.81E-01 (4)	8.19E-03	25.12	3.85	16.17%	2.00	8.85%	2.55	11.28%	6.20	27.45%	4.55	20.14%
Carbon Monoxide	630-08-0	6000	1-Hour	Schedule 3 POI	8.30	-	-	8.30	27.37	0.46%	19.20	0.32%	522.21	8.70%	549.58	9.16%	541.41	9.02%
Carbon Monoxide	630-08-0	36200	1-Hour	Ontario AAQC	8.30	-	-	8.30	22.81	0.06%	16.00	0.04%	435.17	1.20%	457.99	1.27%	451.18	1.25%
Carbon Monoxide	630-08-0	15700	8-Hour	Ontario AAQC	8.30	-	-	8.30	16.25	0.10%	10.38	0.07%	58.02	0.37%	74.28	0.47%	68.40	0.44%
Sulphur Dioxide	7446-09-5	10	Annual	Schedule 3 POI	7.26	-	-	7.26	0.88	8.78%	0.52	5.21%	0.08	0.82%	0.96	9.61%	0.60	6.03%
Sulphur Dioxide	7446-09-5	100	1-Hour	Schedule 3 POI	7.26	-	-	7.26	19.96	19.96%	14.00	14.00%	1.05	1.05%	21.01	21.01%	15.05	15.05%
Sulphur Dioxide	7446-09-5	178.220	10-minute	Ontario AAQC	7.26	-	-	7.26	32.93	18.48%	23.10	12.96%	1.73	0.97%	34.66	19.45%	24.83	13.93%
Organic matter (expressed as equivalent methane)	74-82-8	37330	24-Hour	Schedule 3 POI	6.85	-	-	6.85	12.68	0.03%	6.92	0.02%	NA	NA	12.68	0.03%	6.92	0.02%
Ozone	10028-15-6	165	1-Hour	Ontario AAQC	-	-	-	0.00E+00	0.00E+00	<0.01%	0.00E+00	<0.01%	86.38	52.35%	86.38	52.35%	86.38	52.35%
Ozone	10028-15-6	117.791	8-Hour	CAAQS	-	-	-	0.00E+00	0.00E+00	<0.01%	0.00E+00	<0.01%	11.52	9.78%	11.52	9.78%	11.52	9.78%
PM10	NA-PM10	50	24-Hour	Ontario AAQC	1.04	8.21E-03 (4)	1.81E-04	1.04	1.90	3.80%	1.05	2.10%	11.11	22.22%	13.01	26.02%	12.16	24.33%
PM2.5	NA-PM2.5	27	24-Hour	Ontario AAQC, CAAQS	1.04	8.21E-03 (4)	1.81E-04	1.04	1.92	7.12%	0.44	1.62%	6.00	22.22%	7.92	29.34%	6.44	23.84%
PM2.5	NA-PM2.5	8.8	Annual	Ontario AAQC, CAAQS	1.04	8.21E-03 (4)	1.81E-04	1.04	0.13	1.43%	0.07	0.74%	1.18	13.42%	1.31	14.84%	1.25	14.16%
Aluminum	7429-90-5	12	24-Hour	Schedule 3 POI	5.68E-03	-	-	5.68E-03	0.01	0.09%	5.73E-03	0.05%	0.65	5.40%	0.66	5.49%	0.65	5.49%
Aluminum Oxide	1344-28-1	120	24-Hour	Ontario AAQC	0.01	-	-	0.01	0.02	0.02%	0.01	<0.01%	1.23	1.02%	1.24	1.04%	1.24	1.03%
Antimony	7440-36-0	25	24-Hour	Ontario AAQC	2.70E-04	-	-	2.70E-04	4.99E-04	<0.01%	2.72E-04	<0.01%	6.05E-03	0.02%	6.55E-03	0.03%	6.32E-03	0.03%
Arsenic	7440-38-2	0.3	24-Hour	Ontario AAQC	3.88E-04	-	-	3.88E-04	7.04E-04	0.23%	3.84E-04	0.13%	3.61E-03	1.20%	4.32E-03	1.44%	4.00E-03	1.33%
Barium	7440-39-3	10	24-Hour	Ontario AAQC	7.90E-04	-	-	7.90E-04	1.46E-03	0.01%	7.98E-04	<0.01%	0.05	0.45%	0.05	0.47%	0.05	0.46%
Beryllium	7440-41-7	0.01	24-Hour	Ontario AAQC	9.29E-05	-	-	9.29E-05	1.72E-05	0.17%	9.38E-05	0.09%	6.02E-04	6.02%	6.19E-04	6.19%	6.11E-04	6.11%
Boron	7440-42-8	120	24-Hour	Ontario AAQC	0.02	-	-	0.02	0.05	0.04%	0.03	0.02%	7.87E-03	6.56E-05	0.05	0.04%	0.03	0.03%
Cadmium	7440-43-9	0.025	24-Hour	Ontario AAQC	1.45E-03	-	-	1.45E-03	2.69E-03	10.76%	1.47E-03	5.87%	1.21E-03	4.82%	3.96E-03	15.58%	2.67E-03	10.69%
Cadmium	7440-43-9	0.005	Annual	Ontario AAQC	1.45E-03	-	-	1.45E-03	1.76E-04	3.51%	1.04E-04	2.08%	2.31E-04	4.62%	4.07E-04	8.14%	3.35E-04	6.71%
Calcium	7440-70-2	10 (1)	24-Hour	Ontario AAQC	0.25	-	-	0.25	0.47	4.65%	0.25	2.54%	4.47	44.66%	4.93	49.32%	4.72	47.20%
Calcium Oxide	1305-78-8	10	24-Hour	Ontario AAQC	0.35	-	-	0.35	0.65	6.51%	0.36	3.55%	6.25	62.53%	6.90	69.04%	6.61	66.08%
Chromium	7440-47-3	0.5	24-Hour	Ontario AAQC	9.85E-04	-	-	9.85E-04	1.82E-03	0.36%	9.95E-04	0.20%	5.03E-03	1.01%	6.86E-03	1.37%	6.03E-03	1.21%
Cobalt	7440-48-4	0.1	24-Hour	Ontario AAQC	9.18E-04	-	-	9.18E-04	1.70E-03	1.70%	9.25E-04	0.93%	1.2E-03	1.20%	2.90E-03	2.90%	2.13E-03	2.13%
Copper	7440-50-8	50	24-Hour	Ontario AAQC	0.01	-	-	0.01	0.02	0.04%	0.01	0.02%	0.58	1.17%	0.60	1.20%	0.59	1.19%
Iron	7439-89-6	4	24-Hour	Ontario AAQC	0.02	-	-	0.02	0.03	0.77%	0.02	0.42%	2.19	54.78%	2.22	55.55%	2.21	55.30%
Lead	7439-92-1	0.2	30-Day	Ontario AAQC	0.01	-	-	0.01	3.16E-03	1.58%	1.74E-03	0.87%	4.61E-03	2.31%	7.77E-03	3.89%	6.35E-03	3.18%
Lead	7439-92-1	0.5	24-Hour	Ontario AAQC	0.01	-	-	0.01	0.02	3.84%	0.01	2.10%	0.01	2.40%	0.03	6.25%	0.02	4.50%
Lithium	7439-93-2	20	24-Hour	Ontario AAQC	7.05E-05	-	-	7.05E-05	1.31E-04	<0.01%	7.12E-05	<0.01%	0.02	0.08%	0.02	0.08%	0.02	0.08%
Magnesium	7439-95-4	72	24-Hour	Schedule 3 POI	6.92E-03	-	-	6.92E-03	0.01	0.02%	6.99E-03	<0.01%	6.46	8.98%	6.47	8.99%	6.47	8.98%
Magnesium oxide	1309-48-4	120	24-Hour	Ontario AAQC	0.01	-	-	0.01	0.02	0.02%	0.01	<0.01%	10.73	8.94%	10.75	8.96%	10.74	8.95%
Manganese	7439-96-5	0.4 (as SPM)	24-Hour	Ontario AAQC	3.70E-03	-	-	3.70E-03	6.85E-03	1.71%	3.74E-03	0.93%	0.06	15.25%	0.07	16.98%	0.06	16.18%
Manganese	7439-96-5	0.1 (as PM2.5)	24-Hour	Ontario AAQC	3.70E-03	-	-	3.70E-03	6.85E-03	6.85%	3.74E-03	3.74%	0.06	60.99%	0.07	67.84%	0.06	64.73%
Manganese	7439-96-5	0.2 (as PM10)	24-Hour	Ontario AAQC	3.70E-03	-	-	3.70E-03	6.85E-03	3.43%	3.74E-03	1.87%	0.06	30.49%	0.07	33.92%	0.06	32.36%
Molybdenum	7439-98-7	120	24-Hour	Ontario AAQC	7.38E-04	-	-	7.38E-04	1.37E-03	<0.01%	7.46E-04	<0.01%	0.02	0.01%	0.02	0.02%	0.02	0.02%
Nickel	7440-02-0	0.02 (as PM10)	24-Hour	Ontario AAQC	1.69E-03	-	-	1.69E-03	2.95E-04	1.02%	1.21E-04	0.61%	7.67E-04	3.83%	9.71E-04	4.86%	8.88E-04	4.44%
Nickel	7440-02-0	0.04 (as SPM)	24-Hour	Ontario AAQC	1.69E-03	-	-	1.69E-03	2.05E-04	0.51%	1.21E-04	0.30%	7.67E-04	1.92%	9.71E-04	2.43%	8.88E-04	2.22%
Nickel	7440-02-0	0.1 (as PM10)	24-Hour	Ontario AAQC	1.69E-03	-	-	1.69E-03	3.13E-03	3.13%	1.71E-03	1.71%	4.00E-03	4.00%	7.14E-03	7.14%	5.71E-03	5.71%
Nickel	7440-02-0	0.2 (as SPM)	24-Hour	Ontario AAQC	1.69E-03	-	-	1.69E-03	3.13E-03	1.57%	1.71E-03	0.85%	4.00E-03	2.00%	7.14E-03	3.57%	5.71E-03	2.86%
Phosphorus	7723-14-0	0.5	24-Hour	Schedule 3 POI	4.30E-03	-	-	4.30E-03	7.96E-03	1.59%	4.34E-03	0.87%	0.08	15.81%	0.09	17.40%	0.08	16.68%
Phosphorous pentachloride	10026-13-8	10	24-Hour	Ontario AAQC	0.03	-	-	0.03	0.05	0.54%	0.03	0.29%	0.53	5.32%	0.59	5.86%	0.56	5.61%
Selenium	7782-49-2	10	24-Hour	Ontario AAQC	1.02E-04	-	-	1.02E-04	1.89E-04	<0.01%	1.03E-04	<0.01%	6.12E-03	0.06%	6.30E-03	0.06%	6.22E-03	0.06%
Silver	7440-22-4	1	24-Hour	Ontario AAQC	3.91E-05	-	-	3.91E-05	7.23E-05	<0.01%	3.95E-05	<0.01%	3.01E-03	0.30%	3.08E-03	0.31%	3.05E-03	0.30%
Sodium	7440-23-5	10 (2)	24-Hour	Ontario AAQC	0.09	-	-	0.09	0.16	1.59%	0.09	0.87%	3.83	38.27%	3.99	39.86%	3.91	39.13%
Sodium hydroxide	1310-73-2	10	24-Hour	Ontario AAQC	0.15	-	-	0.15	0.28	2.76%	0.15	1.51%	6.66	66.59%	6.93	69.35%	6.81	68.09%
Strontium	7440-24-6	120	24-Hour	Ontario AAQC	1.95E-04	-	-	1.95E-04	3.61E-04	<0.01%	1.97E-04	<0.01%	0.03	0.02%	0.03	0.02%	0.03	0.02%
Tin	7440-31-5	10	24-Hour	Ontario AAQC	1.51E-03	-	-	1.51E-03	2.80E-03	0.03%	1.53E-03	0.02%	8.23E-03	0.08%	0.01	0.11%	9.73E-03	0.10%
Titanium	7440-32-6	120	24-Hour	Ontario AAQC	6.56E-04	-	-	6.56E-04	1.22E-03	<0.01%	6.63E-04	<0.01%	0.03	0.03%	0.03	0.03%	0.03	0.03%
Vanadium	7440-62-2	2	24-Hour	Ontario AAQC	4.09E-05	-	-	4.09E-05	7.57E-05	<0.01%	4.13E-05	<0.01%	3.58E-03	0.18%	3.65E-03	0.18%	3.62E-03	0.18%
Zinc	7440-66-6	120	24-Hour	Ontario AAQC	0.01	-	-	0.01	0.03	0.02%	0.01	0.01%	0.16	0.13%	0.18	0.15%	0.17	0.14%
Silicon	7440-21-3	27	24-Hour	Schedule 3 POI	0.02	-	-	0.02	0.04	0.16%	0.02	0.09%	0.20	0.76%	0.25	0.92%	0.23	0.85%
Silica	14464-46-1	5	24-Hour	Ontario AAQC	0.05	-	-	0.05	0.10	1.91%	0.05	1.04%	0.44	8.73%	0.53	10.63%	0.49	9.77%
Mercury	7439-97-6	2	24-Hour	Ontario AAQC	3.11E-03	-	-	3.11E-03	5.76E-03	0.29%	3.14E-03	0.16%	3.03E-05	1.51E-05	5.79E-03	0.29%	3.17E-03	0.16%
Mercury (as Hg) – alkyl compounds	7439-97-6	0.5	24-Hour	Ontario AAQC	3.11E-03	-	-	3.11E-03	5.76E-03	1.15%	3.14E-03	0.63%	3.03E-05	6.06E-05	5.79E-03	1.16%	3.17E-03	0.63%
Hydrogen Chloride	7647-01-0	20	24-Hour	Ontario AAQC	1.87	-	-	1.87	3.46	17.29%	1.89	9.43%	3.00	15.00%	6.46	32.29%	4.89	24.43%
Hydrogen Fluoride	7664-39-3	1.72	24-Hour	Ontario AAQC	0.09	-	-	0.09	0.16	9.18%	0.09	5.01%	NA	NA	0.16	9.18%	0.09	5.01%
Hydrogen Fluoride	7664-39-3	0.69	30-Day	Ontario AAQC	0.09	-	-	0.09	0.03	3.76%	0.01	2.08%	NA	NA	0.03	3.76%	0.01	2.08%
1,1,1-Trichloroethane	71-55-6	115000	24-Hour	Ontario AAQC	2.73E-04	-	-	2.73E-04	5.06E-04	<0.01%	2.76E-04	<0.01%	0.71	6.20E-06	0.71	<0.01%	0.71	<0.01%
1,1-Dichloroethane	75-34-3	165	24-Hour	Ontario AAQC	3.27E-04	-	-	3.27E-04	6.06E-04	<0.01%	3.31E-04	<0.01%	0.42	0.26%	0.42	0.26%	0.42	0.26%
1,2-Dichloroethane	107-06-2	2	24-Hour	Ontario AAQC	6.30E-04	-	-	6.30E-04	1.17E-03	0.06%	6.37E-04	0.03%	0.42	21.22%	0.43	21.28%	0.43	21.25%
1,2-Dichloroethene	107-06-2	0.4	Annual	Ontario AAQC	6.30E-04	-	-	6.30E-04	7.62E-05	0.02%	4.52E-05	0.01%	0.08	20.34%	0.08	20.35%	0.08	20.35%
1,2-Dichloropropane	78-87-5	2400	24-Hour	Ontario AAQC	2.73E-04	-	-	2.73E-04	5.06E-04	<0.01%	2.76E-04	<0.01%	0.49	0.02%	0.49	0.02%	0.49	0.02%
1,3,5-Trimethylbenzene	108-67-8	220	24-Hour	Ontario AAQC	4.46E-04	-	-	4.46E-04	8.32E-04	<0.01%	4.54E-04	<0.01%	2.58	1.17%	2.58	1.17%	2.58	1.17%
1,3-Butadiene	106-99-0	10	24-Hour	Ontario AAQC	4.49E-04	-	-	4.49E-04	8.32E-04	<0.01%	4.54E-04	<0.01%	1.16	11.61%	1.16	11.62%	1.16	11.61%
1,3-Butadiene	106-99-0	2	Annual	Ontario AAQC	4.49E-04	-	-	4.49E-04	5.43E-05	<0.01%	3.22E-05	<0.01%	0.22	11.13%	0.22	11.13%	0.22	11.13%
2-Butanone	78-93-3	1000	24-Hour	Ontario AAQC	1.94E-03	-	-	1.94E-03	3.59E-03	<0.01%	1.96E-03	<0.01%	8.70	0.87%	8.70	0.87%	8.70	0.87%
Acetone	67-64-1	11880	24-Hour	Ontario AAQC	2.87E-03	-	-	2.87E-03	5.32E-03	<0.01%	2.90E-03	<0.01%	18.45	0.16%	18.45	0.16%	18.45	0.16%
Benzene	71-43-2	0.45	Annual	Ontario AAQC	0.03	-	-	0.03	3.45E-03	0.77%	2.04E-03	0.45%	0.20	45.41%	0.21	46.18%	0.21	45.88%
Benzene	71-43-2	2.3	24-Hour	Ontario AAQC	0.03	-	-	0.03	0.05	2.30%	0.03	1.25%	1.07	46.35%	1.12	48.65%	1.09	47.60%
Bromochloromethane	75-27-4	350	24-Hour	Schedule 3 POI	2.73E-04	-	-	2.73E-04	5.06E-04	<0.01%	2.76E-04	<0.01%	1.41	0.40%	1.41	0.40%	1.41	0.40%
Bromoform	75-25-2	55	24-Hour	Ontario AAQC	4.75E-04	-	-	4.75E-04	8.79E-04	<0.01%	4.79E-04	<0.01%	2.17	3.95%	2.17	3.95%	2.17	3.95%
Bromomethane	74-83-9	1350	24-Hour	Ontario AAQC	2.29E-03	-	-	2.29E-03	4.24E-03	<0.01%	2.31E-03	<0.01%	0.41	0.03%	0.41	0.03%	0.41	0.03%
Carbon Tetrachloride	56-23-5	2.4	24-Hour	Ontario AAQC	2.73E-04	-	-	2.73E-04	5.06E-04	0.02%	2.76E-04	0.01%	0.68	28.42%	0.68	28.44%	0.68	28.43%
Chlorodibromomethane	124-48-1	0.2	24-Hour	Schedule 3 POI	2.85E-04	-	-	2.85E-04	5.29E-04	0.26%	2.88E-04	0.14%	NA	NA	5.29E-04	0.26%	2.88E-04	0.14%
Chloroform	67-66-3	1	24-Hour	Ontario AAQC	2.89E-04	-	-	2.89E-04	5.35E-04	0.05%	2.92E-04	0.03%	0.26	25.62%	0.26	25.68%	0.26	25.65%
Chloroform	67-66-3	0.2	Annual	Ontario AAQC	2.89E-04	-	-	2.89E-04	3.50E-05	0.02%	2.07E-05	0.01%	0.10	49.11%	0.10	49.13%	0.10	49.12%
Dichlorofluoromethane	75-43-4	500	24-Hour	Schedule 3 POI	4.73E-04	-	-	4.73E-04	8.75E-04	<0.01%	4.77E-04	<0.01%	2.85	0.57%	2.85	0.57%	2.85	0.57%
Ethylbenzene	100-41-4	1000	24-Hour	Ontario AAQC	4.49E-04	-	-	4.49E-04	8.32E-04	<0.01%	4.54E-04	<0.01%	1.49	0.15%	1.50	0.15%	1.50	0.15%
Ethylbenzene	100-41-4	1900	10-minute	Ontario AAQC	4.49E-04	-	-	4.49E-04	2.04E-03	<0.01%	1.43E-03	<0.01%	6.17	0.32%	6.17	0.32%	6.17	0.32%
Ethylene Dibromide	106-93-4	3	24-Hour	Ontario AAQC	2.73E-04	-	-	2.73E-04	5.06E-04	0.02%	2.76E-04	<0.01%	0.81	26.88%	0.81	26.90%	0.81	26.89%
Isopropylbenzene	98-82-8	400	24-Hour	Ontario AAQC	2.73E-04	-	-	2.73E-04	5.06E-04	<0.01%	2.76E-04	<0.01%	NA	NA	5.06E-04	<0.01%	2.76E-04	<0.01%
Xylenes	1330-20-7	730	24-Hour	Ontario AAQC	1.18E-03	-	-	1.18E-03	2.18E-03	<0.01%	1.19E-03	<0.01%	5.05	0.69%	5.05	0.69%	5.05	0.69%
Xylenes	1330-20-7	3000	10-minute	Ontario AAQC	1.18E-03	-	-	1.18E-03	5.35E-03	<0.01%	3.75E-03	<0.01%	20.31	0.68%	20.31	0.68%	20.31	0.68%
Methylene Chloride	75-09-2	220	24-Hour	Ontario AAQC	0.01	-	-	0.01	0.02	0.01%	0.01	<0.01%	2.94	1.34%	2.96	1.35%	2.95	1.34%
Methylene Chloride	75-09-2	44	Annual	Ontario AAQC	0.01	-	-	0.01	1.55E-03	<0.01%	9.21E-04	<0.01%	0.56	1.28%	0.56	1.28%	0.56	1.28%
Styrene	100-42-5	400	24-Hour	Ontario AAQC	2.93E-04	-	-	2.93E-04	5.42E-04	<0.01%	2.96E-04	<0.01%	2.02	0.51%	2.02	0.51%	2.02	0.51%
Tetrachloroethene	127-18-4	360	24-Hour	Ontario AAQC	4.78E-04	-	-	4.78E-04	8.85E-04	<0.01%	4.83E-04	<0.01%	0.64	0.18%	0.64	0.18%	0.64	0.18%
Toluene	108-88-3	2000	24-Hour	Ontario AAQC	5.05E-03	-	-	5.05E-03	9.35E-03	<0.01%	5.10E-03	<0.01%	5.42	0.27%	5.43	0.27%	5.43	0.27%
Trichloroethylene	79-01-6	12	24-Hour	Ontario AAQC	2.73E-04	-	-	2.73E-04	5.06E-04	<0.01%	2.76E-04	<0.01%	2.76	22.99%	2.76	22.99%	2.76	22.99%
Trichloroethylene	79-01-6	2.3	Annual	Ontario AAQC	2.73E-04	-	-	2.73E-04	3.30E-05	<0.01%	1.96E-05	<0.01%	0.53	22.99%	0.53	22.99%	0.53	22.99%
Trichlorofluoromethane	75-69-4	6000	24-Hour	Schedule 3 POI	4.50E-04	-	-	4.50E-04	8.34E-04	<0.01%	4.55E-04	<0.01%	2.05	0.03%	2.05	0.03%	2.05	0.03%
Trichlorotrifluoroethane	76-13-1	8000000	24-Hour	Ontario AAQC	4.49E-04	-	-	4.49E-04	8.32E-04	<0.01%	4.54E-04	<0.01%	1.21	1.51E-05	1.21	<0.01%	1.21	<0.01%
Vinyl Chloride	75-01-4	1	24-Hour	Ontario AAQC	4.49E-04	-	-	4.49E-04	8.32E-04	0.08%	4.54E-04	0.05%	0.27	26.83%	0.27	26.91%	0.27	26.87%
Vinyl Chloride	75-01-4	0.2	Annual	Ontario AAQC	4.49E-04	-	-	4.49E-04	4.43E-05	0.03%	3.22E-05	0.02%	0.05	25.71%	0.05	25.74%	0.05	25.73%
Formaldehyde	50-00-0	65	24-Hour	Ontario AAQC	0.10	-	-	0.10	0.18	0.28%	0.10	0.15%	NA	NA	0.18	0.28%	0.10	0.15%
Acetaldehyde	75-07-0	500	1-Hour	Ontario AAQC	0.10	-	-	0.10	0.34	0.07%	0.24	0.05%	NA	NA	0.34	0.07%	0.24	0.05%
Acetaldehyde	75-07-0	500	24-Hour	Ontario AAQC	0.10	-	-	0.10	0.19	0.04%	0.10	0.02%	NA	NA	0.19	0.04%	0.10	0.02%
Acrolein	107-02-8	4.5	1-Hour	Ontario AAQC	5.35E-04	-	-	5.35E-04	1.47E-03	1.03E-03	0.02%	NA	NA	NA	1.47E-03	0.03%	1.03E-03	0.02%
Acrolein	107-02-8	0.4	24-Hour	Ontario AAQC	5.35E-04	-	-	5.35E-04	9.91E-04	0.25%	5.41E-04	0.14%	NA	NA	9.91E-04	0.25%	5.41E-04	0.14%
1-Methylnaphthalene	90-12-0	35.5	24-Hour	De Minimis	1.93E-05	-	-	1.93E-05	3.57E-05	<0.01%	1.95E-05	<0.01%	0.01	0.04%	0.01	0.04%	0.01	0.04%
1-Methylphenanthrene	832-69-9	0.1	24-Hour	De Minimis	3.88E-06	-	-	3.88E-06	7.18E-06	<0.01%	3.92E-06	<0.01%	1.22E-03	1.22%	1.22E-03	1.22%	1.22E-03	1.22%
2-Chloronaphthalene	91-58-7	1	24-Hour	Schedule 3 POI	2.84E-06	-	-	2.84E-06	5.26E-06	<0.01%	2.87E-06	<0.01%	5.68E-04	0.06%	5.74E-04	0.06%	5.72E-04	0.06%
2-methylanthracene	613-12-7	0.1	24-Hour	De Minimis	3.40E-06	-	-	3.40E-06	6.30E-06	<0.01%	3.44E-06	<0.01%	5.68E-04	0.57%	5.75E-04	0.57%	5.72E-04	0.57%
2-Methylnaphthalene	91-57-6	35.5	24-Hour	Schedule 3 POI	3.79E-05	-	-	3.79E-05	7.01E-05	<0.01%	3.82E-05	<0.01%	0.03	0.07%	0.03	0.07%	0.03	0.07%
3-Methylcholanthrene	56-49-5	0.1	24-Hour	De Minimis	3.13E-06	-	-	3.13E-06	5.79E-06	<0.01%	3.16E-06	<0.01%	0.01	10.07%	0.01	10.07%	0.01	10.07%
7,12-Dimethylbenz(a)anthracene	57-97-6	0.1	24-Hour	De Minimis	9.67E-06	-	-	9.67E-06	1.79E-05	0.02%	9.76E-06	<0.01%	2.24E-03	2.24%	2.26E-03	2.26%	2.25E-03	2.25%
9,10-dimethylanthracene	781-43-1	0.1	24-Hour	De Minimis	2.93E-06	-	-	2.93E-06	5.42E-06	<0.01%	2.96E-06	<0.01%	2.01E-03	2.01%	2.02E-03	2.02%	2.02E-03	2.02%
9-Methylphenanthrene	883-20-5	0.1	24-Hour	De Minimis	3.27E-06	-	-	3.27E-06	6.06E-06	<0.01%	3.31E-06	<0.01%	8.06E-03	8.06%	8.06E-03	8.06%	8.06E-03	8.06%
Acenaphthene	83-32-9	0.1	24-Hour	De Minimis	6.13E-06	-	-	6.13E-06	1.13E-05	0.01%	6.19E-06	<0.01%	7.94E-03	7.94%	7.95E-03	7.96%	7.95E-03	7.95%
Acenaphthylene	208-96-8	0.1	24-Hour	De Minimis	1.23E-05	-	-	1.23E-05	2.28E-05	0.02%	1.24E-05	0.01%	1.85E-03	1.85%	1.87E-03	1.87%	1.86E-03	1.86%
Anthracene	120-12-7	0.1	24-Hour	De Minimis	5.60E-06	-	-	5.60E-06	1.04E-05	0.01%	5.66E-06	<0.01%	1.11E-03	1.11%	1.12E-03	1.12%	1.12E-03	1.12%
Benzo(a)Anthracene	56-55-3	0.1	24-Hour	De Minimis	2.98E-06	-	-	2.98E-06	5.51E-06	<0.01%	3.01E-06	<0.01%	5.68E-04	0.57%	5.74E-04	0.57%	5.72E-04	0.57%
Benzo(a)fluorene	238-84-6	0.1	24-Hour	De Minimis	2.69E-06	-	-	2.69E-06	4.98E-06	<0.01%	2.72E-06	<0.01%	6.02E-04	0.60%	6.07E-04	0.61%	6.05E-04	0.60%
Benzo(a)Pyrene	50-32-8	0.00001	Annual	Ontario AAQC	1.04E-06	1.41E-09	6.32E-11	1.04E-06	1.26E-07	1.26%	8.23E-08	0.82%	1.83E-05	183.43%	1.85E-05	184.69%	1.84E-05	184.25%
Benzo(a)Pyrene	50-32-8	0.00005	24-Hour	Ontario AAQC	1.04E-06	1.41E-09	6.32E-11	1.04E-06	1.96E-06

Appendix F

Comparison of Existing Facility and Phase 3 Expansion

Table F.1

Comparison of Existing Facility and Phase 3 Expansion

				Total Facility Emission Rate Existing (g/s)	Total Facility Emission Rate Phase 3 (g/s)	Percent Increase in Emission Rate from Existing to Phase 3	Maximum Concentration at Worst Case Receptor Existing (ug/m3)	Maximum Concentration at Worst Case Receptor - Phase 3 (ug/m3)	% of the Criteria at Worst Case Receptor for Phase 3	Percent Increase in Concentration from Existing to Phase 3 for Worst Case Receptor	Maximum Concentration at Worst Case Sensitive Receptor Existing (ug/m3)	Maximum Concentration at Worst Case Sensitive Receptor - Phase 3 (ug/m3)	Percent Increase in Concentration from Existing to Phase 3 for Worst Case Sensitive Receptor
Suspended Particulate Matter	NA-PM	120	24-Hour	0.20	1.04	406.15%	105.44	106.74	88.95%	1.24%	105.10	105.87	0.73%
Suspended Particulate Matter	NA-PM	60	Annual	0.20	1.04	406.15%	24.16	24.25	40.41%	0.37%	24.14	24.20	0.21%
Nitrogen Dioxide	10102-44-0	79.018	1-Hour	4.84	25.11	418.55%	50.50	101.36	128.28%	100.70%	43.20	68.77	59.21%
Nitrogen Dioxide	10102-44-0	400	1-Hour	4.84	25.11	418.55%	50.50	101.36	25.34%	100.70%	43.87	80.76	84.10%
Nitrogen Dioxide	10102-44-0	200	24-Hour	4.84	25.11	418.55%	27.43	59.44	29.72%	116.73%	19.58	38.31	95.64%
Nitrogen Dioxide	10102-44-0	22.577	Annual	4.84	25.11	418.55%	3.39	5.58	24.73%	65.12%	3.10	4.36	40.47%
Carbon Monoxide	630-08-0	6000	1-Hour	0.50	8.30	1552.26%	524.47	549.58	9.16%	4.79%	523.64	541.41	3.39%
Carbon Monoxide	630-08-0	36200	1-Hour	0.50	8.30	1552.26%	437.06	457.99	1.27%	4.79%	436.37	451.18	3.39%
Carbon Monoxide	630-08-0	15700	8-Hour	0.50	8.30	1552.26%	59.74	74.28	0.47%	24.34%	58.93	68.40	16.07%
Sulphur Dioxide	7446-09-5	10	Annual	1.02	7.26	609.15%	0.26	0.96	9.61%	271.10%	0.20	0.60	203.03%
Sulphur Dioxide	7446-09-5	100	1-Hour	1.02	7.26	609.15%	4.88	21.01	21.01%	330.04%	3.48	15.05	332.25%
Sulphur Dioxide	7446-09-5	178.220	10-minute	1.02	7.26	609.15%	8.06	34.66	19.45%	330.04%	5.74	24.83	332.25%
Organic matter (expressed as equivalent methane)	74-82-8	37330	24-Hour	-	6.85	-	-	12.68	0.03%	-	-	6.92	-
Ozone	10028-15-6	165	1-Hour	-	-	-	86.38	86.38	52.35%	0.00%	86.38	86.38	0.00%
Ozone	10028-15-6	117.791	8-Hour	-	-	-	11.52	11.52	9.78%	0.00%	11.52	11.52	0.00%
PM10	NA-PM10	50	24-Hour	0.20	1.04	406.15%	11.72	13.03	26.07%	11.16%	11.39	12.16	6.73%
PM2.5	NA-PM2.5	27	24-Hour	0.20	1.04	406.15%	6.61	7.92	29.34%	19.78%	6.13	6.44	4.96%
PM2.5	NA-PM2.5	8.8	Annual	0.20	1.04	406.15%	1.22	1.31	14.84%	7.41%	1.20	1.25	3.73%
Aluminum	7429-90-5	12	24-Hour	1.15E-03	5.68E-03	394.51%	0.65	0.66	5.49%	1.09%	0.65	0.65	0.64%
Aluminum Oxide	1344-28-1	120	24-Hour	2.17E-03	0.01	394.51%	1.23	1.24	1.04%	1.09%	1.23	1.24	0.64%
Antimony	7440-36-0	25	24-Hour	5.45E-05	2.70E-04	394.51%	6.21E-03	6.55E-03	0.03%	5.41%	6.12E-03	6.32E-03	3.23%
Arsenic	7440-38-2	0.3	24-Hour	7.69E-05	3.80E-04	394.51%	3.84E-03	4.32E-03	1.44%	12.34%	3.72E-03	4.00E-03	7.50%
Barium	7440-39-3	10	24-Hour	1.60E-04	7.90E-04	394.51%	0.05	0.05	0.47%	2.16%	0.05	0.05	1.28%
Beryllium	7440-41-7	0.01	24-Hour	1.88E-06	9.29E-06	394.51%	6.08E-04	6.19E-04	6.19%	1.91%	6.05E-04	6.11E-04	1.13%
Boron	7440-42-8	120	24-Hour	5.03E-03	0.02	394.51%	0.02	0.05	0.04%	135.34%	0.01	0.03	123.46%
Cadmium	7440-43-9	0.025	24-Hour	2.79E-05	1.45E-03	5100.94%	1.29E-03	3.90E-03	15.58%	202.09%	1.24E-03	2.67E-03	114.82%
Cadmium	7440-43-9	0.005	Annual	2.79E-05	1.45E-03	5100.94%	2.36E-04	4.07E-04	8.14%	72.39%	2.34E-04	3.35E-04	43.08%
Calcium	7440-70-2	10 (1)	24-Hour	0.05	0.25	394.51%	4.62	4.93	49.32%	6.79%	4.54	4.72	4.06%
Calcium Oxide	1305-78-8	10	24-Hour	0.07	0.35	394.51%	6.47	6.90	69.04%	6.78%	6.35	6.61	4.06%
Chromium	7440-47-3	0.5	24-Hour	1.99E-04	9.85E-04	394.51%	5.63E-03	6.86E-03	1.37%	21.82%	5.31E-03	6.03E-03	13.60%
Cobalt	7440-48-4	0.1	24-Hour	1.85E-04	9.16E-04	394.51%	1.76E-03	2.90E-03	2.90%	64.97%	1.46E-03	2.13E-03	46.05%
Copper	7440-50-8	50	24-Hour	2.10E-03	0.01	394.51%	0.59	0.60	1.20%	2.20%	0.59	0.59	1.30%
Iron	7439-89-6	4	24-Hour	3.37E-03	0.02	394.51%	2.20	2.22	55.55%	0.94%	2.20	2.21	0.56%
Lead	7439-92-1	0.2	30-Day	2.65E-04	0.01	3819.57%	4.75E-03	7.77E-03	3.89%	63.71%	4.69E-03	6.35E-03	35.53%
Lead	7439-92-1	0.5	24-Hour	2.65E-04	0.01	3819.57%	0.01	0.03	6.25%	143.88%	0.01	0.02	81.74%
Lithium	7439-93-2	20	24-Hour	1.43E-05	7.05E-05	394.51%	0.02	0.02	0.08%	0.54%	0.02	0.02	0.32%
Magnesium	7439-95-4	72	24-Hour	1.40E-03	6.92E-03	394.51%	6.47	6.47	8.99%	0.13%	6.46	6.47	0.08%
Magnesium oxide	1309-48-4	120	24-Hour	2.32E-03	0.01	394.51%	10.73	10.75	8.96%	0.13%	10.73	10.74	0.08%
Manganese	7439-96-5	0.4 (as SPM)	24-Hour	7.48E-04	3.70E-03	394.51%	0.06	0.07	16.96%	7.30%	0.06	0.06	4.37%
Manganese	7439-96-5	0.1 (as PM2.5)	24-Hour	7.48E-04	3.70E-03	394.51%	0.06	0.07	67.84%	7.30%	0.06	0.06	4.37%
Manganese	7439-96-5	0.2 (as PM10)	24-Hour	7.48E-04	3.70E-03	394.51%	0.06	0.07	33.92%	7.30%	0.06	0.06	4.37%
Molybdenum	7439-98-7	120	24-Hour	1.49E-04	7.38E-04	394.51%	0.02	0.02	0.02%	5.11%	0.02	0.02	3.05%
Nickel	7440-02-0	0.02 (as PM10)	Annual	3.42E-04	1.69E-03	394.51%	8.26E-04	9.71E-04	4.86%	17.65%	8.06E-04	8.88E-04	10.23%
Nickel	7440-02-0	0.04 (as SPM)	Annual	3.42E-04	1.69E-03	394.51%	8.26E-04	9.71E-04	2.43%	17.65%	8.06E-04	8.88E-04	10.23%
Nickel	7440-02-0	0.1 (as PM10)	24-Hour	3.42E-04	1.69E-03	394.51%	5.03E-03	7.14E-03	7.14%	41.99%	4.47E-03	5.71E-03	27.74%
Nickel	7440-02-0	0.2 (as SPM)	24-Hour	3.42E-04	1.69E-03	394.51%	5.03E-03	7.14E-03	3.57%	41.99%	4.47E-03	5.71E-03	27.74%
Phosphorus	7723-14-0	0.5	24-Hour	8.69E-04	4.30E-03	394.51%	0.08	0.09	17.40%	6.57%	0.08	0.08	3.93%
Phosphorous pentachloride	10026-13-8	10	24-Hour	5.85E-03	0.03	394.51%	0.55	0.59	5.86%	6.56%	0.54	0.56	3.92%
Selenium	7782-49-2	10	24-Hour	2.07E-05	1.02E-04	394.51%	6.18E-03	6.30E-03	0.06%	2.06%	6.14E-03	6.22E-03	1.22%
Silver	7440-22-4	1	24-Hour	7.90E-06	3.91E-05	394.51%	3.03E-03	3.08E-03	0.31%	1.61%	3.02E-03	3.05E-03	0.95%
Sodium	7440-23-5	10 (2)	24-Hour	0.02	0.09	394.51%	3.88	3.99	39.86%	2.75%	3.85	3.91	1.63%
Sodium hydroxide	1310-73-2	10	24-Hour	0.03	0.15	394.51%	6.75	6.93	69.35%	2.75%	6.70	6.81	1.63%
Strontium	7440-24-6	120	24-Hour	3.94E-05	1.95E-04	394.51%	0.03	0.03	0.02%	0.88%	0.03	0.03	0.52%
Tin	7440-31-5	10	24-Hour	3.06E-04	1.51E-03	394.51%	9.11E-03	0.01	0.11%	20.72%	8.62E-03	9.73E-03	12.88%
Titanium	7440-32-6	120	24-Hour	1.33E-04	6.58E-04	394.51%	0.03	0.03	0.03%	2.42%	0.03	0.03	1.43%
Vanadium	7440-62-2	2	24-Hour	8.26E-06	4.09E-05	394.51%	3.60E-03	3.65E-03	0.18%	1.41%	3.59E-03	3.62E-03	0.83%
Zinc	7440-66-6	120	24-Hour	2.90E-03	0.01	394.51%	0.17	0.18	0.15%	10.77%	0.16	0.17	6.52%
Silicon	7440-21-3	27	24-Hour	4.86E-03	0.02	394.51%	0.22	0.25	0.92%	13.73%	0.21	0.23	8.37%
Silica	14464-46-1	5	24-Hour	0.01	0.05	394.51%	0.47	0.53	10.63%	13.73%	0.45	0.49	8.37%
Mercury	7439-97-6	2	24-Hour	2.81E-05	3.11E-03	10960.77%	1.14E-04	5.79E-03	0.29%	4962.38%	6.89E-05	3.17E-03	4510.04%
Mercury (as Hg) – alkyl compounds	7439-97-6	0.5	24-Hour	2.81E-05	3.11E-03	10960.77%	1.14E-04	5.79E-03	1.16%	4962.38%	6.89E-05	3.17E-03	4510.04%
Hydrogen Chloride	7647-01-0	20	24-Hour	0.35	1.87	434.29%	4.05	6.46	32.29%	59.65%	3.48	4.89	40.45%
Hydrogen Fluoride	7664-39-3	1.72	24-Hour	0.02	0.09	394.51%	0.05	0.16	9.18%	206.17%	0.02	0.09	264.48%
Hydrogen Fluoride	7664-39-3	0.69	30-Day	0.02	0.09	394.51%	8.87E-03	0.03	3.76%	192.85%	5.04E-03	0.01	184.48%
1,1,1-Trichloroethane	71-55-6	115000	24-Hour	5.52E-05	2.73E-04	394.51%	0.71	0.71	<0.01%	0.05%	0.71	0.71	0.03%
1,1-Dichloroethane	75-34-3	165	24-Hour	6.62E-05	3.27E-04	394.51%	0.42	0.42	0.26%	0.10%	0.42	0.42	0.06%
1,2-Dichloroethane	107-06-2	2	24-Hour	1.27E-04	6.30E-04	394.51%	0.42	0.43	21.28%	1.97%	0.42	0.43	0.11%
1,2-Dichloroethane	107-06-2	0.4	Annual	1.27E-04	6.30E-04	394.51%	0.08	0.08	20.35%	0.07%	0.08	0.08	0.04%
1,2-Dichloropropane	78-87-5	2400	24-Hour	5.52E-05	2.73E-04	394.51%	0.49	0.49	0.02%	0.07%	0.49	0.49	0.04%
1,3,5-Trimethylbenzene	108-67-8	220	24-Hour	9.08E-05	4.49E-04	394.51%	2.58	2.58	1.17%	0.02%	2.58	2.58	0.01%
1,3-Butadiene	106-99-0	10	24-Hour	9.08E-05	4.49E-04	394.51%	1.16	1.16	11.62%	0.05%	1.16	1.16	0.03%
1,3-Butadiene	106-99-0	2	Annual	9.08E-05	4.49E-04	394.51%	0.22	0.22	11.13%	0.02%	0.22	0.22	0.01%
2-Butanone	78-93-3	1000	24-Hour	3.92E-04	1.94E-03	394.51%	8.70	8.70	0.87%	0.03%	8.70	8.70	0.02%
Acetone	67-64-1	11880	24-Hour	5.81E-04	2.87E-03	394.51%	18.45	18.45	0.16%	0.02%	18.45	18.45	0.01%
Benzene	71-43-2	0.45	Annual	5.76E-03	0.03	394.51%	0.21	0.21	46.18%	1.20%	0.20	0.21	0.68%
Benzene	71-43-2	2.3	24-Hour	5.76E-03	0.03	394.51%	1.08	1.12	48.65%	3.28%	1.07	1.09	1.95%
Bromodichloromethane	75-27-4	350	24-Hour	5.52E-05	2.73E-04	394.51%	1.41	1.41	0.40%	0.02%	1.41	1.41	0.01%
Bromoform	75-25-2	55	24-Hour	9.80E-05	4.75E-04	394.51%	2.17	2.17	3.95%	0.03%	2.17	2.17	0.02%
Bromomethane	74-83-9	1350	24-Hour	4.63E-04	2.29E-03	394.51%	0.41	0.41	0.03%	0.70%	0.41	0.41	0.04%
Carbon Tetrachloride	56-23-5	2.4	24-Hour	5.52E-05	2.73E-04	394.51%	0.68	0.68	28.44%	0.05%	0.68	0.68	0.03%
Chlorodibromomethane	124-48-1	0.2	24-Hour	5.77E-05	2.85E-04	394.51%	1.73E-04	5.29E-04	0.26%	206.17%	7.91E-05	2.88E-04	264.48%
Chloroform	67-66-3	1	24-Hour	5.84E-05	2.89E-04	394.51%	0.26	0.26	25.68%	0.14%	0.26	0.26	0.08%
Chloroform	67-66-3	0.2	Annual	5.84E-05	2.89E-04	394.51%	0.10	0.10	49.13%	0.03%	0.10	0.10	0.01%
Dichlorofluoromethane	75-43-4	500	24-Hour	9.56E-05	4.73E-04	394.51%	2.85	2.85	0.57%	0.02%	2.85	2.85	0.01%
Ethylbenzene	100-41-4	1000	24-Hour	9.08E-05	4.49E-04	394.51%	1.50	1.50	0.15%	0.04%	1.49	1.50	0.02%
Ethylbenzene	100-41-4	1900	10-minute	9.08E-05	4.49E-04	394.51%	6.17	6.17	0.32%	0.02%	6.17	6.17	0.02%
Ethylene Dibromide	106-93-4	3	24-Hour	5.52E-05	2.73E-04	394.51%	0.81	0.81	26.90%	0.04%	0.81	0.81	0.02%
Isopropylbenzene	98-82-8	400	24-Hour	5.52E-05	2.73E-04	394.51%	1.65E-04	5.06E-04	<0.01%	206.17%	7.57E-05	2.76E-04	264.48%
Xylenes	1330-20-7	730	24-Hour	2.39E-04	1.18E-03	394.51%	5.05	5.05	0.69%	0.03%	5.05	5.05	0.02%
Xylenes	1330-20-7	3000	10-minute	2.39E-04	1.18E-03	394.51%	20.31	20.31	0.68%	0.02%	20.31	20.31	0.01%
Methylene Chloride	75-09-2	220	24-Hour	2.60E-03	0.01	394.51%	2.95	2.96	1.35%	0.54%	2.94	2.95	0.32%
Methylene Chloride	75-09-2	44	Annual	2.60E-03	0.01	394.51%	0.56	0.56	1.28%	0.20%	0.56	0.56	0.11%
Styrene	100-42-5	400	24-Hour	5.92E-05	2.93E-04	394.51%	2.02	2.02	0.51%	0.02%	2.02	2.02	0.01%
Tetrachloroethene	127-18-4	360	24-Hour	9.67E-05	4.78E-04	394.51%	0.64	0.64	0.18%	0.09%	0.64	0.64	0.05%
Toluene	108-88-3	2000	24-Hour	1.02E-03	5.05E-03	394.51%	5.42	5.43	0.27%	0.12%	5.42	5.43	0.07%
Trichloroethylene	79-01-6	12	24-Hour	5.52E-05	2.73E-04	394.51%	2.76	2.76	22.99%	0.01%	2.76	2.76	0.01%
Trichloroethylene	79-01-6	2.3	Annual	5.52E-05	2.73E-04	394.51%	0.53	0.53	22.99%	0.00%	0.53	0.53	0.00%
Trichlorofluoromethane	75-69-4	6000	24-Hour	9.10E-05	4.50E-04	394.51%	2.05	2.05	0.03%	0.03%	2.05	2.05	0.02%
Trichlorotrifluoroethane	76-13-1	800000	24-Hour	9.08E-05	4.49E-04	394.51%	1.21	1.21	<0.01%	0.05%	1.21	1.21	0.03%
Vinyl Chloride	75-01-4	1	24-Hour	9.08E-05	4.49E-04	394.51%	0.27	0.27	26.91%	0.21%	0.27	0.27	0.12%
Vinyl Chloride	75-01-4	0.2	Annual	9.08E-05	4.49E-04	394.51%	0.05	0.05	25.74%	0.08%	0.05	0.05	0.04%
Formaldehyde	50-00-0	65	24-Hour	0.02	0.10	394.51%	0.06	0.18	0.28%	206.17%	0.03	0.10	264.48%
Acetaldehyde	75-07-0	500	½-Hour	0.02	0.10	394.51%	0.09	0.34	0.07%	262.67%	0.06	0.24	301.07%
Acetaldehyde	75-07-0	500	24-Hour	0.02	0.10	394.51%	0.06	0.19	0.04%	206.17%	0.03	0.10	264.48%
Acrolein	107-02-8	4.5	1-Hour	1.08E-04	5.35E-04	394.51%	4.06E-04	1.47E-03	0.03%	262.67%	2.57E-04	1.03E-03	301.07%
Acrolein	107-02-8	0.4	24-Hour	1.08E-04	5.35E-04	394.51%	3.24E-04	9.91E-04	0.25%	206.17%	1.48E-04	5.41E-04	264.48%
1-Methylnaphthalene	90-12-0	35.5	24-Hour	3.90E-06	1.93E-05	394.51%	0.01	0.01	0.04%	0.17%	0.01	0.01	0.10%
1-Methylphenanthrene	832-69-9	0.1	24-Hour	7.84E-07	3.88E-06	394.51%	1.22E-03	1.22E-03	1.22%	0.40%	1.22E-03	1.22E-03	0.23%
2-Chloronaphthalene	91-58-7	1	24-Hour	5.74E-07	2.84E-06	394.51%	5.70E-04	5.74E-04	0.06%	0.62%	5.69E-04	5.71E-04	0.37%
2-methylanthracene	613-12-7	0.1	24-Hour	6.88E-07	3.40E-06	394.51%	5.70E-04	5.75E-04	0.57%	0.74%	5.69E-04	5.72E-04	0.44%
2-Methylnaphthalene	91-57-6	35.5	24-Hour	7.65E-06	3.79E-05	394.51%	0.03	0.03	0.07%	0.18%	0.03	0.03	0.11%
3-Methylcholanthrene	56-49-5	0.1	24-Hour	6.44E-07	3.18E-06	394.51%	0.01	0.01	10.07%	0.04%	0.01	0.01	0.02%
7,12-Dimethylbenz(a)anthracene	57-97-6	0.1	24-Hour	1.95E-06	9.67E-06	394.51%	2.25E-03	2.29E-03	2.26%	0.54%	2.24E-03	2.25E-03	0.32%
9,10-dimethylanthracene	781-43-1	0.1	24-Hour	5.92E-07	2.93E-06	394.51%	2.01E-03	2.02E-03	2.02%	0.18%	2.01E-03	2.02E-03	0.11%
9-Methylphenanthrene	883-20-5	0.1	24-Hour	6.62E-07	3.27E-06	394.51%	8.06E-03	8.09E-03	8.06%	0.35%	8.06E-03	8.06E-03	0.03%
Acenaphthene	83-32-9	0.1	24-Hour	1.24E-06	6.13E-06	394.51%	7.95E-03	7.99E-03	7.96%	0.10%	7.95E-03	7.95E-03	0.06%
Acenaphthylene	208-96-8	0.1	24-Hour	2.49E-06	1.23E-05	394.51%	1.86E-03	1.87E-03	1.87%	0.83%	1.85E-03	1.86E-03	0.49%
Anthracene	120-12-7	0.1	24-Hour	1.13E-06	5.60E-06	394.51%	1.11E-03	1.12E-03	1.12%	0.63%	1.11E-03	1.12E-03	0.37%
Benzo(a)Anthracene	56-55-3	0.1	24-Hour	6.02E-07	2.98E-06	394.51%	5.70E-04	5.74E-04	0.57%	0.65%	5.69E-04	5.71E-04	0.38%
Benzo(a)fluorene	238-84-6	0.1	24-Hour	5.44E-07	2.69E-06	394.51%	6.04E-04	6.07E-04	0.61%	0.58%	6.03E-04	6.05E-04	0.33%
Benzo(a)Pyrene	50-32-8	0.00001	Annual	2.10E-07	1.04E-06	395.01%	1.84E-05	1.85E-05	184.69%	0.49%	1.84E-05	1.84E-05	0.28%
Benzo(a)Pyrene	50-32-8	0.00005	24-Hour	2.10E-07	1.04E-06	394.51%	1.06E-04	1.07E-04	214.72%	1.22%	1.06E-04	1.06E-04	0.72%
Benzo(b)Fluoranthene	205-99-2	0.1	24-Hour	6.43E-07	3.18E-06	394.51%	5.70E-04	5.74E-04	0.57%	0.69%	5.69E-04	5.72E-04	0.41%
Benzo(b)fluorene	243-17-4	0.1	24-Hour	5.46E-07	2.70E-06	394.51%	5.70E-04	5.73E-04	0.57%	0.59%	5.69E-04	5.71E-04	0.35%
Benzo(e)Pyrene	192-97-2	0.1	24-Hour	7.78E-07	3.85E-06	394.51%	5.68E-04	5.72E-04	0.57%	0.85%	5.66E-04	5.69E-04	0.50%
Benzo(g,h,i)Perylene	191-24-2	0.1	24-Hour	7.20E-07	3.56E-06	394.51%	5.71E-04	5.75E-04	0.57%	0.78%	5.69E-04	5.72E-04	0.46%
Benzo[j /k]Fluoranthene	76774-50-0	0.1	24-Hour	6.50E-07	3.21E-06	394.51%	5.70E-04	5.74E-04	0.57%	0.70%	5.69E-04	5.72E-04	0.41%
Biphenyl	92-52-4	60	1-Hour	1.36E-05	6.73E-05	394.51%	0.02	0.02	0.03%	0.83%	0.02	0.02	0.60%
Chrysene	218-01-9	0.1	24-Hour	6.68E-07	3.31E-06	394.51%	7.30E-04	7.34E-04	0.73%	0.56%	7.29E-04	7.32E-04	0.33%
Triphenylene	217-59-4	0.1	24-Hour	8.73E-07	4.32E-06	394.51%	5.71E-04	5.76E-04	0.58%	0.94%	5.70E-04	5.73E-04	0.56%
Coronene	191-07-1	0.1	24-Hour	7.12E-07	3.52E-06	394.51%	5.70E-04	5.75E-04	0.57%	0.77%	5.69E-04	5.72E-04	0.45%
Dibenz(a,c/a,h)Anthracene	53-70-3	0.1	24-Hour	5.42E-07	2.68E-06	394.51%	5.62E-04	5.65E-04	0.57%	0.59%	5.61E-04	5.63E-04	0.35%
Dibenzo(a,e)pyrene	192-65-4	0.1	24-Hour	6.97E-07	3.45E-06	394.51%	1.01E-03	1.01E-03	1.01%	0.43%	1.01E-03	1.01E-03	0.25%
Fluoranthene	206-44-0	0.1	24-Hour	1.54E-06	7.60E-06	394.51%	5.13E-03	5.14E-03	5.14%	0.18%	5.13E-03	5.13E-03	0.11%
Fluorene	86-73-7	0.1	24-Hour	2.07E-06	1.02E-05	394.51%	8.43E-03	8.44E-03	8.44%	0.15%	8.43E-03	8.43E-03	0.09%
Indeno(1,2,3-cd)Pyrene	193-39-5	0.1	24-Hour	5.84E-07	2.89E-06	394.51%	5.70E-04	5.74E-04	0.57%	0.63%	5.69E-04	5.71E-04	0.37%
m-terphenyl	92-06-8	0.1	24-Hour	2.11E-06	1.04E-05	394.51%	5.75E-04	5.88E-04	0.59%	2.26%	5.71E-04	5.79E-04	1.34%
Naphthalene	91-20-3	22.5	24-Hour	2.27E-05	1.12E-04	394.51%	0.06	0.06	0.28%	0.22%	0.06	0.06	0.13%
Naphthalene	91-20-3	50	10-minute	2.27E-05	1.12E-04	394.51%	0.26	0.26	0.53%	0.14%	0.26	0.26	0.10%
o-Terphenyl	84-15-1	0.1	24-Hour	6.63E-07	3.28E-06	394.51%	5.70E-04	5.74E-04	0.57%	0.72%	5.69E-04	5.72E-04	0.42%
Perylene	198-55-0	0.1	24-Hour	5.20E-07	2.57E-06	394.51%	5.70E-04	5.73E-04	0.57%	0.56%	5.69E-04	5.71E-04	0.33%
Phenanthrene	85-01-8	0.1	24-Hour	3.33E-06	1.64E-05	394.51%	0.03	0.03	33.93%	0.06%	0.03	0.03	0.04%
Picene	213-46-7	0.1	24-Hour	6.59E-07	3.26E-06	394.51%	5.62E-04	5.66E-04	0.57%	0.72%	5.61E-04	5.63E-04	0.43%
p-terphenyl	92-94-4	0.1	24-Hour	5.60E-07	2.77E-06	394.51%	5.70E-04	5.73E-04	0.57%	0.61%	5.69E-04	5.71E-04	0.36%
Pyrene	129-00-0	0.1	24-Hour	1.82E-06	8.98E-06	394.51%	4.08E-03	4.09E-03	4.09%	0.27%	4.08E-03	4.09E-03	0.16%
Quinoline	91-22-5	0.005	24-Hour	2.76E-06	1.37E-05	394.51%	2.02E-03	2.04E-03	40.77%	0.84%	2.02E-03	2.03E-03	0.50%
Tetralin	119-64-2	151.5	24-Hour	5.24E-06	2.59E-05	394.51%	0.01	0.01	<0.01%	0.28%	0.01	0.01	0.16%
2,6-Dichlorophenol	87-65-0	19	24-Hour	9.25E-07	4.57E-06	394.51%	2.77E-06	8.47E-06	<0.01%	206.17%	1.27E-06	4.62E-06	264.48%
2,4/2,5-Dichlorophenol	120-83-2	33.5	24-Hour	9.30E-07	4.60E-06	394.51%	2.78E-06	8.52E-06	<0.01%	206.17%	1.27E-06	4.65E-06	264.48%
3,5-Dichlorophenol	591-35-5	0.1	24-Hour	9.51E-07	4.70E-06	394.51%	2.84E-06	8.71E-06	<0.01%	206.17%	1.30E-06	4.75E-06	264.48%
2,3-Dichlorophenol	576-24-9	0.1	24-Hour	9.25E-07	4.57E-06	394.51%	2.77E-06	8.47E-06	<0.01%	206.17%	1.27E-06	4.62E-06	264.48%
3,4-Dichlorophenol	95-77-2	0.1	24-Hour	9.25E-07	4.57E-06	394.51%	2.77E-06	8.47E-06	<0.01%	206.17%	1.27E-06	4.62E-06	264.48%
2,4,6-Trichlorophenol	88-06-2	1.5	24-Hour	9.25E-07	4.57E-06	394.51%	2.77E-06	8.47E-06	<0.01%	206.17%	1.27E-06	4.62E-06	264.48%
2,3,6-Trichlorophenol	933-75-5	0.1	24-Hour	9.25E-07	4.57E-06	394.51%	2.77E-06	8.47E-06	<0.01%	206.17%	1.27E-06	4.62E-06	264.48%
2,3,5-Trichlorophenol	933-78-8	0.1	24-Hour	9.25E-07	4.57E-06

Appendix G

Dispersion Modelling Results Table for Startup, Shutdown and Upset Conditions

Table G

Start-up, Shutdown and Upset Condition Modeling Results for Expansion Phase 3 - Scenario 5 - Time Averaged Upset Condition

Pollutants	CAS No.	Project Criteria (ug/m3)	Averaging Period	Criteria Source	Upset Emission Rate	Maximum Concentration at Worst Case Receptor (ug/m3)	Percent of Project Criteria (%) at Worst Case Receptor	Maximum Concentration at Worst Case Sensitive Receptor (Sportsfield) (ug/m3)	Percent of Project Criteria at Sportsfield (%)	Background Concentration (ug/m3)	Percent of Project Criteria Contributed by Background (%)	Cumulative Maximum Concentration at Worst Case Receptor (ug/m3)	% of the Criteria at Worst Case Receptor	Cumulative Maximum Concentration at Sportsfield (ug/m3)	% of the Criteria at Sportsfield
Suspended Particulate Matter	NA-PM	120	24-Hour	Ontario AAQC	1.43E+00	2.64E+00	2.20%	1.44	1%	104.82	87%	107.47	89.55%	105.87	0.88
Suspended Particulate Matter	NA-PM	60	Annual	Ontario AAQC	1.41E+00	1.71E-01	0.28%	0.11	0%	24.12	40%	24.29	40.49%	24.20	0.40
Nitrogen Dioxide	10102-44-0	79.01840491	1-Hour	CAAQS	2.51E+02	6.90E+02	873.27%	453.76	574%	32.36	41%	722.40	914.22%	68.77	0.87
Nitrogen Dioxide	10102-44-0	400	1-Hour	Ontario AAQC	2.51E+02	6.90E+02	172.51%	453.76	113%	32.36	8%	722.40	180.60%	80.76	0.20
Nitrogen Dioxide	10102-44-0	200	24-Hour	Ontario AAQC	3.45E+01	6.39E+01	31.97%	34.87	17%	12.94	6%	76.88	38.44%	38.31	0.19
Nitrogen Dioxide	10102-44-0	22.57668712	Annual	CAAQS	3.41E+01	4.13E+00	18.29%	2.69	12%	2.55	11%	6.68	29.57%	4.36	0.19
Carbon Monoxide	630-08-0	6000	½-Hour	Schedule 3 POI	8.30E+01	2.74E+02	4.56%	180.00	3%	522.21	9%	795.95	13.27%	541.41	0.09
Carbon Monoxide	630-08-0	36200	1-Hour	Ontario AAQC	8.30E+01	2.28E+02	0.63%	150.00	0%	435.17	1%	663.29	1.83%	451.18	0.01
Carbon Monoxide	630-08-0	15700	8-Hour	Ontario AAQC	8.30E+01	1.63E+02	1.04%	103.81	1%	58.02	0%	220.57	1.40%	68.40	4.36E-03
Sulphur Dioxide	7446-09-5	10	Annual	Schedule 3 POI	9.87E+00	1.19E+00	11.94%	0.78	8%	0.08	1%	1.28	12.77%	0.60	0.06
Sulphur Dioxide	7446-09-5	100	1-Hour	Schedule 3 POI	7.26E+01	2.00E+02	199.60%	131.25	131%	1.05	1%	200.65	200.65%	15.05	0.15
Sulphur Dioxide	7446-09-5	178.22	10-minute	Ontario AAQC	7.26E+01	3.29E+02	184.79%	216.57	122%	1.73	1%	331.07	185.76%	24.83	0.14
Organic matter (expressed as equivalent methane)	74-82-8	37330	24-Hour	Schedule 3 POI	9.42E+00	1.74E+01	0.05%	9.51	0%	NA	NA	17.44	0.05%	6.92	1.85E-04
Ozone	10028-15-6	165	1-Hour	Ontario AAQC	-	2.75E+00	1.67%	1.81	1%	86.38	52%	89.13	54.02%	86.38	0.52
Ozone	10028-15-6	117.791411	8-Hour	CAAQS	-	1.96E+00	1.66%	1.25	1%	11.52	10%	13.48	11.44%	11.52	0.10
PM10	NA-PM10	50	24-Hour	Ontario AAQC	1.43E+00	2.64E+00	5.28%	1.44	3%	11.11	22%	13.75	27.51%	12.16	0.24
PM2.5	NA-PM2.5	27	24-Hour	Ontario AAQC, CAAQS	1.43E+00	2.64E+00	9.79%	1.44	5%	6.00	22%	8.64	32.01%	6.44	0.24
PM2.5	NA-PM2.5	8.8	Annual	Ontario AAQC, CAAQS	1.41E+00	1.71E-01	1.94%	0.11	1%	1.18	13%	1.35	15.36%	1.25	0.14
Aluminum	7429-90-5	12	24-Hour	Schedule 3 POI	7.81E-03	1.45E-02	0.12%	7.88E-03	0%	0.65	5%	0.66	5.52%	0.65	0.05
Aluminum Oxide	1344-28-1	120	24-Hour	Ontario AAQC	1.47E-02	2.73E-02	0.02%	0.01	0%	1.23	1%	1.25	1.04%	1.24	0.01
Antimony	7440-36-0	25	24-Hour	Ontario AAQC	3.71E-04	6.86E-04	<0.01%	3.74E-04	<0.01%	6.05E-03	0%	6.73E-03	0.03%	6.32E-03	2.53E-04
Arsenic	7440-38-2	0.3	24-Hour	Ontario AAQC	5.23E-04	9.68E-04	0.32%	5.28E-04	0%	3.61E-03	1%	4.58E-03	1.53%	4.00E-03	0.01
Barium	7440-39-3	10	24-Hour	Ontario AAQC	1.09E-03	2.01E-03	0.02%	1.10E-03	0%	0.05	0%	0.05	0.47%	0.05	4.59E-03
Beryllium	7440-41-7	0.01	24-Hour	Ontario AAQC	1.28E-05	2.37E-05	0.24%	1.29E-05	0%	6.02E-04	6%	6.26E-04	6.26%	6.11E-04	0.06
Boron	7440-42-8	120	24-Hour	Ontario AAQC	3.42E-02	6.33E-02	0.05%	0.03	0%	7.87E-03	<0.01%	0.07	0.06%	0.03	2.75E-04
Cadmium	7440-43-9	0.025	24-Hour	Ontario AAQC	2.00E-03	3.70E-03	14.80%	2.02E-03	8%	1.21E-03	5%	4.90E-03	19.62%	2.67E-03	0.11
Cadmium	7440-43-9	0.005	Annual	Ontario AAQC	1.97E-03	2.39E-04	4.78%	1.55E-04	3%	2.31E-04	5%	4.70E-04	9.40%	3.35E-04	0.07
Calcium	7440-70-2	10	24-Hour	Ontario AAQC	3.45E-01	6.40E-01	6.40%	0.35	3%	4.47	45%	5.11	51.06%	4.72	0.47
Calcium Oxide	1305-78-8	10	24-Hour	Ontario AAQC	4.84E-01	8.95E-01	8.95%	0.49	5%	6.25	63%	7.15	71.48%	6.61	0.66
Chromium	7440-47-3	0.5	24-Hour	Ontario AAQC	1.35E-03	2.51E-03	0.50%	1.37E-03	0%	5.03E-03	1%	7.54E-03	1.51%	6.03E-03	0.01
Cobalt	7440-48-4	0.1	24-Hour	Ontario AAQC	1.26E-03	2.33E-03	2.33%	1.27E-03	1%	1.20E-03	1%	3.54E-03	3.54%	2.13E-03	0.02
Copper	7440-50-8	50	24-Hour	Ontario AAQC	1.43E-02	2.65E-02	0.05%	0.01	0%	0.58	1%	0.61	1.22%	0.59	0.01
Iron	7439-89-6	4	24-Hour	Ontario AAQC	2.29E-02	4.24E-02	1.06%	0.02	1%	2.19	55%	2.23	55.84%	2.21	0.55
Lead	7439-92-1	0.2	30-Day	Ontario AAQC	1.04E-01	3.16E-02	15.80%	0.02	9%	4.61E-03	2%	0.04	18.10%	6.35E-03	0.03
Lead	7439-92-1	0.5	24-Hour	Ontario AAQC	1.43E-02	2.64E-02	5.28%	0.01	3%	0.01	2%	0.04	7.69%	0.02	0.04
Lithium	7439-93-2	20	24-Hour	Ontario AAQC	9.70E-05	1.80E-04	<0.01%	9.80E-05	<0.01%	0.02	0%	0.02	0.08%	0.02	8.16E-04
Magnesium	7439-95-4	72	24-Hour	Schedule 3 POI	9.51E-03	1.76E-02	0.02%	9.61E-03	0%	6.46	9%	6.48	9.00%	6.47	0.09
Magnesium oxide	1309-48-4	120	24-Hour	Ontario AAQC	1.58E-02	2.92E-02	0.02%	0.02	0%	10.73	9%	10.76	8.96%	10.74	0.09
Manganese	7439-96-5	0.4	24-Hour	Ontario AAQC	5.09E-03	9.42E-03	2.36%	5.14E-03	1%	0.06	15%	0.07	17.60%	0.06	0.16
Manganese	7439-96-5	0.1	24-Hour	Ontario AAQC	5.09E-03	9.42E-03	9.42%	5.14E-03	5%	0.06	61%	0.07	70.41%	0.06	0.65
Manganese	7439-96-5	0.2	24-Hour	Ontario AAQC	5.09E-03	9.42E-03	4.71%	5.14E-03	3%	0.06	30%	0.07	35.21%	0.06	0.32
Molybdenum	7439-98-7	120	24-Hour	Ontario AAQC	1.02E-03	1.88E-03	<0.01%	1.03E-03	<0.01%	0.02	0%	0.02	0.02%	0.02	1.53E-04
Nickel	7440-02-0	0.02	Annual	Ontario AAQC	2.30E-03	2.78E-04	1.39%	1.81E-04	1%	7.67E-04	4%	1.04E-03	5.22%	8.88E-04	0.04
Nickel	7440-02-0	0.04	Annual	Ontario AAQC	2.30E-03	2.78E-04	0.70%	1.81E-04	0%	7.67E-04	2%	1.04E-03	2.61%	8.88E-04	0.02
Nickel	7440-02-0	0.1	24-Hour	Ontario AAQC	2.33E-03	4.31E-03	4.31%	2.35E-03	2%	4.00E-03	4%	8.31E-03	8.31%	5.71E-03	0.06
Nickel	7440-02-0	0.2	24-Hour	Ontario AAQC	2.33E-03	4.31E-03	2.15%	2.35E-03	1%	4.00E-03	2%	8.31E-03	4.16%	5.71E-03	0.03
Phosphorus	7723-14-0	0.5	24-Hour	Schedule 3 POI	5.91E-03	1.09E-02	2.19%	5.97E-03	1%	0.08	16%	0.09	18.00%	0.08	0.17
Phosphorous pentachloride	10026-13-8	10	24-Hour	Ontario AAQC	3.98E-02	7.36E-02	0.74%	0.04	0%	0.53	5%	0.61	6.06%	0.56	0.06
Selenium	7782-49-2	10	24-Hour	Ontario AAQC	1.40E-04	2.60E-04	<0.01%	1.42E-04	<0.01%	6.12E-03	0%	6.38E-03	0.06%	6.22E-03	6.22E-04
Silver	7440-22-4	1	24-Hour	Ontario AAQC	5.37E-05	9.95E-05	<0.01%	5.43E-05	<0.01%	3.01E-03	0%	3.11E-03	0.31%	3.05E-03	3.05E-03
Sodium	7440-23-5	10	24-Hour	Ontario AAQC	1.18E-01	2.18E-01	2.18%	0.12	1%	3.83	38%	4.05	40.45%	3.91	0.39
Sodium hydroxide	1310-73-2	10	24-Hour	Ontario AAQC	2.05E-01	3.79E-01	3.79%	0.21	2%	6.66	67%	7.04	70.38%	6.81	0.68
Strontium	7440-24-6	120	24-Hour	Ontario AAQC	2.68E-04	4.96E-04	<0.01%	2.71E-04	<0.01%	0.03	0%	0.03	0.02%	0.03	2.32E-04
Tin	7440-31-5	10	24-Hour	Ontario AAQC	2.08E-03	3.86E-03	0.04%	2.10E-03	0%	8.20E-03	0%	0.01	0.12%	9.73E-03	9.73E-04
Titanium	7440-32-6	120	24-Hour	Ontario AAQC	9.02E-04	1.67E-03	<0.01%	9.12E-04	<0.01%	0.03	0%	0.04	0.03%	0.03	2.84E-04
Vanadium	7440-62-2	2	24-Hour	Ontario AAQC	5.62E-05	1.04E-04	<0.01%	5.67E-05	<0.01%	3.58E-03	0%	3.68E-03	0.18%	3.62E-03	1.81E-03
Zinc	7440-66-6	120	24-Hour	Ontario AAQC	1.97E-02	3.65E-02	0.03%	0.02	0%	0.16	0%	0.19	0.16%	0.17	1.43E-03
Silicon	7440-21-3	27	24-Hour	Schedule 3 POI	3.31E-02	6.13E-02	0.23%	0.03	0%	0.20	1%	0.27	0.98%	0.23	8.45E-03
Silica	14464-46-1	5	24-Hour	Ontario AAQC	7.08E-02	1.31E-01	2.62%	0.07	1%	0.44	9%	0.57	11.35%	0.49	0.10
Mercury	7439-97-6	2	24-Hour	Ontario AAQC	4.28E-03	7.93E-03	0.40%	4.32E-03	0%	3.03E-05	<0.01%	7.96E-03	0.40%	3.17E-03	1.59E-03
Mercury (as Hg) – alkyl compounds	7439-97-6	0.5	24-Hour	Ontario AAQC	4.28E-03	7.93E-03	1.59%	4.32E-03	1%	3.03E-05	<0.01%	7.96E-03	1.59%	3.17E-03	6.35E-03
Hydrogen Chloride	7647-01-0	20	24-Hour	Ontario AAQC	2.57E+00	4.76E+00	23.78%	2.59	13%	3.00	15%	7.76	38.78%	4.89	0.24
Hydrogen Fluoride	7664-39-3	1.72	24-Hour	Ontario AAQC	1.17E-01	2.17E-01	12.63%	0.12	7%	NA	NA	0.22	12.63%	0.09	0.05
Hydrogen Fluoride	7664-39-3	0.69	30-Day	Ontario AAQC	8.53E-01	2.60E-01	37.64%	0.14	21%	NA	NA	0.26	37.64%	0.01	0.02
1,1,1-Trichloroethane	71-55-6	115000	24-Hour	Ontario AAQC	3.76E-04	6.95E-04	<0.01%	3.79E-04	<0.01%	0.71	<0.01%	0.71	<0.01%	0.71	<0.01%
1,1-Dichloroethane	75-34-3	165	24-Hour	Ontario AAQC	4.50E-04	8.33E-04	<0.01%	4.55E-04	<0.01%	0.42	0%	0.43	0.26%	0.42	2.57E-03
1,2-Dichloroethane	107-06-2	2	24-Hour	Ontario AAQC	8.67E-04	1.61E-03	0.08%	8.75E-04	0%	0.42	21%	0.43	21.30%	0.43	0.21
1,2-Dichloroethane	107-06-2	0.4	Annual	Ontario AAQC	8.57E-04	1.04E-04	0.03%	6.74E-05	0%	0.08	20%	0.08	20.36%	0.08	0.20
1,2-Dichloropropane	78-87-5	2400	24-Hour	Ontario AAQC	3.75E-04	6.95E-04	<0.01%	3.79E-04	<0.01%	0.49	0%	0.49	0.02%	0.49	2.02E-04
1,3,5-Trimethylbenzene	108-67-8	220	24-Hour	Ontario AAQC	6.17E-04	1.14E-03	<0.01%	6.24E-04	<0.01%	2.58	1%	2.58	1.17%	2.58	0.01
1,3-Butadiene	106-99-0	10	24-Hour	Ontario AAQC	6.17E-04	1.14E-03	0.01%	6.24E-04	<0.01%	1.16	12%	1.16	11.62%	1.16	0.12
1,3-Butadiene	106-99-0	2	Annual	Ontario AAQC	6.10E-04	7.38E-05	<0.01%	4.80E-05	<0.01%	0.22	11%	0.22	11.13%	0.22	0.11
2-Butanone	78-93-3	1000	24-Hour	Ontario AAQC	2.66E-03	4.93E-03	<0.01%	2.69E-03	<0.01%	8.70	1%	8.70	0.87%	8.70	8.70E-03
Acetone	67-64-1	11880	24-Hour	Ontario AAQC	3.95E-03	7.32E-03	<0.01%	3.99E-03	<0.01%	18.45	0%	18.45	0.16%	18.45	1.55E-03
Benzene	71-43-2	0.45	Annual	Ontario AAQC	3.88E-02	4.69E-03	1.04%	3.05E-03	1%	0.20	45%	0.21	46.45%	0.21	0.46
Benzene	71-43-2	2.3	24-Hour	Ontario AAQC	3.92E-02	7.26E-02	3.16%	0.04	2%	1.07	46%	1.14	49.51%	1.09	0.48
Bromodichloromethane	75-27-4	350	24-Hour	Schedule 3 POI	3.75E-04	6.95E-04	<0.01%	3.79E-04	<0.01%	1.41	0%	1.41	0.40%	1.41	4.02E-03
Bromoform	75-25-2	55	24-Hour	Ontario AAQC	6.52E-04	1.21E-03	<0.01%	6.59E-04	<0.01%	2.17	4%	2.17	3.95%	2.17	0.04
Bromomethane	74-83-9	1350	24-Hour	Ontario AAQC	3.15E-03	5.83E-03	<0.01%	3.18E-03	<0.01%	0.41	0%	0.41	0.03%	0.41	3.04E-04
Carbon Tetrachloride	56-23-5	2.4	24-Hour	Ontario AAQC	3.75E-04	6.95E-04	0.03%	3.79E-04	0%	0.68	28%	0.68	28.44%	0.68	0.28
Chlorodibromomethane	124-48-1	0.2	24-Hour	Schedule 3 POI	3.93E-04	7.27E-04	0.36%	3.96E-04	0%	NA	NA	7.27E-04	0.36%	2.88E-04	1.44E-03

Table G

Start-up, Shutdown and Upset Condition Modeling Results for Expansion Phase 3 - Scenario 5 - Time Averaged Upset Condition

Pollutants	CAS No.	Project Criteria (ug/m3)	Averaging Period	Criteria Source	Upset Emission Rate	Maximum Concentration at Worst Case Receptor (ug/m3)	Percent of Project Criteria (%) at Worst Case Receptor	Maximum Concentration at Worst Case Sensitive Receptor (Sportsfield) (ug/m3)	Percent of Project Criteria at Sportsfield (%)	Background Concentration (ug/m3)	Percent of Project Criteria Contributed by Background (%)	Cumulative Maximum Concentration at Worst Case Receptor (ug/m3)	% of the Criteria at Worst Case Receptor	Cumulative Maximum Concentration at Sportsfield (ug/m3)	% of the Criteria at Sportsfield
Chloroform	67-66-3	1	24-Hour	Ontario AAQC	3.97E-04	7.36E-04	0.07%	4.01E-04	0%	0.26	26%	0.26	25.70%	0.26	0.26
Chloroform	67-66-3	0.2	Annual	Ontario AAQC	3.93E-04	4.75E-05	0.02%	3.09E-05	0%	0.10	49%	0.10	49.14%	0.10	0.49
Dichlorofluoromethane	75-43-4	500	24-Hour	Schedule 3 POI	6.50E-04	1.20E-03	<0.01%	6.56E-04	<0.01%	2.85	1%	2.85	0.57%	2.85	5.70E-03
Ethylbenzene	100-41-4	1000	24-Hour	Ontario AAQC	6.17E-04	1.14E-03	<0.01%	6.24E-04	<0.01%	1.49	0%	1.50	0.15%	1.50	1.50E-03
Ethylbenzene	100-41-4	1900	10-minute	Ontario AAQC	4.49E-03	2.04E-02	<0.01%	0.01	<0.01%	6.17	0%	6.19	0.33%	6.17	3.25E-03
Ethylene Dibromide	106-93-4	3	24-Hour	Ontario AAQC	3.75E-04	6.95E-04	0.02%	3.79E-04	0%	0.81	27%	0.81	26.90%	0.81	0.27
Isopropylbenzene	98-82-8	400	24-Hour	Ontario AAQC	3.75E-04	6.95E-04	<0.01%	3.79E-04	<0.01%	NA	NA	6.95E-04	<0.01%	2.76E-04	<0.01%
Xylenes	1330-20-7	730	24-Hour	Ontario AAQC	1.62E-03	3.00E-03	<0.01%	1.64E-03	<0.01%	5.05	1%	5.05	0.69%	5.05	6.92E-03
Xylenes	1330-20-7	3000	10-minute	Ontario AAQC	1.18E-02	5.35E-02	<0.01%	0.04	<0.01%	20.31	1%	20.36	0.68%	20.31	6.77E-03
Methylene Chloride	75-09-2	220	24-Hour	Ontario AAQC	1.77E-02	3.27E-02	0.01%	0.02	<0.01%	2.94	1%	2.97	1.35%	2.95	0.01
Methylene Chloride	75-09-2	44	Annual	Ontario AAQC	1.75E-02	2.11E-03	<0.01%	1.37E-03	<0.01%	0.56	1%	0.57	1.28%	0.56	0.01
Styrene	100-42-5	400	24-Hour	Ontario AAQC	4.02E-04	7.45E-04	<0.01%	4.07E-04	<0.01%	2.02	1%	2.02	0.51%	2.02	5.05E-03
Tetrachloroethene	127-18-4	360	24-Hour	Ontario AAQC	6.57E-04	1.22E-03	<0.01%	6.64E-04	<0.01%	0.64	0%	0.64	0.18%	0.64	1.78E-03
Toluene	108-88-3	2000	24-Hour	Ontario AAQC	6.94E-03	1.29E-02	<0.01%	7.01E-03	<0.01%	5.42	0%	5.43	0.27%	5.43	2.71E-03
Trichloroethylene	79-01-6	12	24-Hour	Ontario AAQC	3.75E-04	6.95E-04	<0.01%	3.79E-04	<0.01%	2.76	23%	2.76	22.99%	2.76	0.23
Trichloroethylene	79-01-6	2.3	Annual	Ontario AAQC	3.71E-04	4.49E-05	<0.01%	2.92E-05	<0.01%	0.53	23%	0.53	22.99%	0.53	0.23
Trichlorofluoromethane	75-69-4	6000	24-Hour	Schedule 3 POI	6.19E-04	1.15E-03	<0.01%	6.25E-04	<0.01%	2.05	0%	2.05	0.03%	2.05	3.42E-04
Trichlorotrifluoroethane	76-13-1	800000	24-Hour	Ontario AAQC	6.17E-04	1.14E-03	<0.01%	6.24E-04	<0.01%	1.21	<0.01%	1.21	<0.01%	1.21	<0.01%
Vinyl Chloride	75-01-4	1	24-Hour	Ontario AAQC	6.17E-04	1.14E-03	0.11%	6.24E-04	0%	0.27	27%	0.27	26.94%	0.27	0.27
Vinyl Chloride	75-01-4	0.2	Annual	Ontario AAQC	6.10E-04	7.38E-05	0.04%	4.80E-05	0%	0.05	26%	0.05	25.75%	0.05	0.26
Formaldehyde	50-00-0	65	24-Hour	Ontario AAQC	1.37E-01	2.53E-01	0.39%	0.14	0%	NA	NA	0.25	0.39%	0.10	1.55E-03
Acetaldehyde	75-07-0	500	½-Hour	Ontario AAQC	1.02E+00	3.36E+00	0.67%	2.21	0%	NA	NA	3.36	0.67%	0.24	4.71E-04
Acetaldehyde	75-07-0	500	24-Hour	Ontario AAQC	1.40E-01	2.59E-01	0.05%	0.14	0%	NA	NA	0.26	0.05%	0.10	2.06E-04
Acrolein	107-02-8	4.5	1-Hour	Ontario AAQC	5.35E-03	1.47E-02	0.33%	9.67E-03	0%	NA	NA	0.01	0.33%	1.03E-03	2.29E-04
Acrolein	107-02-8	0.4	24-Hour	Ontario AAQC	7.36E-04	1.36E-03	0.34%	7.43E-04	0%	NA	NA	1.36E-03	0.34%	5.41E-04	1.35E-03
1-Methylnaphthalene	90-12-0	35.5	24-Hour	De Minimis	2.65E-05	4.91E-05	<0.01%	2.68E-05	<0.01%	0.01	0%	0.01	0.04%	0.01	4.06E-04
1-Methylphenanthrene	832-69-9	0.1	24-Hour	De Minimis	5.33E-06	9.87E-06	<0.01%	5.38E-06	<0.01%	1.22E-03	1%	1.23E-03	1.23%	1.22E-03	0.01
2-Chloronaphthalene	91-58-7	1	24-Hour	Schedule 3 POI	3.90E-06	7.23E-06	<0.01%	3.94E-06	<0.01%	5.68E-04	0%	5.76E-04	0.06%	5.71E-04	5.71E-04
2-methylanthracene	613-12-7	0.1	24-Hour	De Minimis	4.68E-06	8.67E-06	<0.01%	4.73E-06	<0.01%	5.68E-04	1%	5.77E-04	0.58%	5.72E-04	5.72E-03
2-Methylnaphthalene	91-57-6	35.5	24-Hour	Schedule 3 POI	5.20E-05	9.64E-05	<0.01%	5.26E-05	<0.01%	0.03	0%	0.03	0.07%	0.03	7.35E-04
3-Methylcholanthrene	56-49-5	0.1	24-Hour	De Minimis	4.38E-06	8.11E-06	<0.01%	4.43E-06	<0.01%	0.01	10%	0.01	10.07%	0.01	0.10
7,12-Dimethylbenzo(a)anthracene	57-97-6	0.1	24-Hour	De Minimis	1.33E-05	2.46E-05	0.02%	1.34E-05	0%	2.24E-03	2%	2.27E-03	2.27%	2.25E-03	0.02
9,10-dimethylanthracene	781-43-1	0.1	24-Hour	De Minimis	4.02E-06	7.45E-06	<0.01%	4.07E-06	<0.01%	2.01E-03	2%	2.02E-03	2.02%	2.02E-03	0.02
9-Methylphenanthrene	883-20-5	0.1	24-Hour	De Minimis	4.50E-06	8.33E-06	<0.01%	4.55E-06	<0.01%	8.06E-03	8%	8.07E-03	8.07%	8.06E-03	0.08
Acenaphthene	83-32-9	0.1	24-Hour	De Minimis	8.42E-06	1.56E-05	0.02%	8.51E-06	<0.01%	7.94E-03	8%	7.96E-03	7.96%	7.95E-03	0.08
Acenaphthylene	208-96-8	0.1	24-Hour	De Minimis	1.69E-05	3.14E-05	0.03%	1.71E-05	0%	1.85E-03	2%	1.88E-03	1.88%	1.86E-03	0.02
Anthracene	120-12-7	0.1	24-Hour	De Minimis	7.70E-06	1.43E-05	0.01%	7.78E-06	<0.01%	1.11E-03	1%	1.13E-03	1.13%	1.12E-03	0.01
Benzo(a)Anthracene	56-55-3	0.1	24-Hour	De Minimis	4.09E-06	7.58E-06	<0.01%	4.13E-06	<0.01%	5.68E-04	1%	5.76E-04	0.58%	5.71E-04	5.71E-03
Benzo(a)fluorene	238-84-6	0.1	24-Hour	De Minimis	3.70E-06	6.85E-06	<0.01%	3.73E-06	<0.01%	6.02E-04	1%	6.09E-04	0.61%	6.05E-04	6.05E-03
Benzo(a)Pyrene	50-32-8	0.00001	Annual	Ontario AAQC	1.41E-06	1.71E-07	1.71%	1.11E-07	1%	1.83E-05	183%	1.85E-05	185.14%	1.84E-05	1.84
Benzo(a)Pyrene	50-32-8	0.00005	24-Hour	Ontario AAQC	1.43E-06	2.64E-06	5.28%	1.44E-06	3%	1.05E-04	211%	1.08E-04	216.16%	1.06E-04	2.13
Benzo(b)Fluoranthene	205-99-2	0.1	24-Hour	De Minimis	4.37E-06	8.09E-06	<0.01%	4.41E-06	<0.01%	5.68E-04	1%	5.76E-04	0.58%	5.72E-04	5.72E-03
Benzo(b)fluorene	243-17-4	0.1	24-Hour	De Minimis	3.71E-06	6.87E-06	<0.01%	3.75E-06	<0.01%	5.68E-04	1%	5.75E-04	0.58%	5.71E-04	5.71E-03
Benzo(e)Pyrene	192-97-2	0.1	24-Hour	De Minimis	5.29E-06	9.80E-06	<0.01%	5.34E-06	<0.01%	5.65E-04	1%	5.75E-04	0.58%	5.69E-04	5.69E-03
Benzo(g,h,i)Perylene	191-24-2	0.1	24-Hour	De Minimis	4.90E-06	9.07E-06	<0.01%	4.95E-06	<0.01%	5.68E-04	1%	5.77E-04	0.58%	5.72E-04	5.72E-03
Benzo(j / k)Fluoranthene	76774-50-0	0.1	24-Hour	De Minimis	4.42E-06	8.18E-06	<0.01%	4.46E-06	<0.01%	5.68E-04	1%	5.77E-04	0.58%	5.72E-04	5.72E-03
Biphenyl	92-52-4	60	1-Hour	Ontario AAQC	6.73E-04	1.85E-03	<0.01%	1.22E-03	<0.01%	0.02	0%	0.02	0.03%	0.02	2.70E-04
Chrysene	218-01-9	0.1	24-Hour	De Minimis	4.55E-06	8.42E-06	<0.01%	4.59E-06	<0.01%	7.28E-04	1%	7.37E-04	0.74%	7.32E-04	7.32E-03
Triphenylene	217-59-4	0.1	24-Hour	De Minimis	5.94E-06	1.10E-05	0.01%	6.00E-06	<0.01%	5.68E-04	1%	5.79E-04	0.58%	5.73E-04	5.73E-03
Coronene	191-07-1	0.1	24-Hour	De Minimis	4.84E-06	8.97E-06	<0.01%	4.89E-06	<0.01%	5.68E-04	1%	5.77E-04	0.58%	5.72E-04	5.72E-03
Dibenzo(a,c/a,h)Anthracene	53-70-3	0.1	24-Hour	De Minimis	3.68E-06	6.82E-06	<0.01%	3.72E-06	<0.01%	5.60E-04	1%	5.67E-04	0.57%	5.63E-04	5.63E-03
Dibenzo(a,e)pyrene	192-65-4	0.1	24-Hour	De Minimis	4.74E-06	8.78E-06	<0.01%	4.79E-06	<0.01%	1.01E-03	1%	1.02E-03	1.02%	1.01E-03	0.01
Fluoranthene	206-44-0	0.1	24-Hour	De Minimis	1.04E-05	1.93E-05	0.02%	1.06E-05	0%	5.12E-03	5%	5.14E-03	5.14%	5.13E-03	0.05
Fluorene	86-73-7	0.1	24-Hour	De Minimis	1.40E-05	2.60E-05	0.03%	1.42E-05	0%	8.42E-03	8%	8.45E-03	8.45%	8.43E-03	0.08
Indeno(1,2,3-cd)Pyrene	193-39-5	0.1	24-Hour	De Minimis	3.97E-06	7.35E-06	<0.01%	4.01E-06	<0.01%	5.68E-04	1%	5.76E-04	0.58%	5.71E-04	5.71E-03
m-terphenyl	92-06-8	0.1	24-Hour	De Minimis	1.43E-05	2.66E-05	0.03%	1.45E-05	0%	5.68E-04	1%	5.95E-04	0.59%	5.79E-04	5.79E-03
Naphthalene	91-20-3	22.5	24-Hour	Ontario AAQC	1.54E-04	2.86E-04	<0.01%	1.56E-04	<0.01%	0.06	0%	0.06	0.28%	0.06	2.84E-03
Naphthalene	91-20-3	50	10-minute	Ontario AAQC	1.12E-03	5.09E-03	0.01%	3.35E-03	<0.01%	0.26	1%	0.27	0.54%	0.26	5.27E-03
o-Terphenyl	84-15-1	0.1	24-Hour	De Minimis	4.51E-06	8.35E-06	<0.01%	4.55E-06	<0.01%	5.68E-04	1%	5.77E-04	0.58%	5.72E-04	5.72E-03
Perylene	198-55-0	0.1	24-Hour	De Minimis	3.53E-06	6.55E-06	<0.01%	3.57E-06	<0.01%	5.68E-04	1%	5.75E-04	0.57%	5.71E-04	5.71E-03
Phenanthrene	85-01-8	0.1	24-Hour	De Minimis	2.26E-05	4.19E-05	0.04%	2.28E-05	0%	0.03	34%	0.03	33.94%	0.03	0.34
Picene	213-46-7	0.1	24-Hour	De Minimis	4.48E-06	8.30E-06	<0.01%	4.53E-06	<0.01%	5.60E-04	1%	5.68E-04	0.57%	5.63E-04	5.63E-03
p-terphenyl	92-94-4	0.1	24-Hour	De Minimis	3.81E-06	7.06E-06	<0.01%	3.85E-06	<0.01%	5.68E-04	1%	5.75E-04	0.58%	5.71E-04	5.71E-03
Pyrene	129-00-0	0.1	24-Hour	De Minimis	1.23E-05	2.29E-05	0.02%	1.25E-05	0%	4.08E-03	4%	4.10E-03	4.10%	4.09E-03	0.04
Quinoline	91-22-5	0.005	24-Hour	Schedule 3 POI	1.88E-05	3.48E-05	0.70%	1.90E-05	0%	2.01E-03	40%	2.05E-03	40.96%	2.03E-03	0.41
Tetralin	119-64-2	151.5	24-Hour	Schedule 3 POI	3.56E-05	6.59E-05	<0.01%	3.60E-05	<0.01%	0.01	<0.01%	0.01	<0.01%	0.01	<0.01%
2,6-Dichlorophenol	87-65-0	19	24-Hour	Schedule 3 POI	6.29E-06	1.16E-05	<0.01%	6.35E-06	<0.01%	NA	NA	1.16E-05	<0.01%	4.62E-06	<0.01%
2,4/2,5-Dichlorophenol	120-83-2	33.5	24-Hour	Schedule 3 POI	6.32E-06	1.17E-05	<0.01%	6.39E-06	<0.01%	NA	NA	1.17E-05	<0.01%	4.65E-06	<0.01%
3,5-Dichlorophenol	591-35-5	0.1	24-Hour	De Minimis	6.46E-06	1.20E-05	0.01%	6.53E-06	<0.01%	NA	NA	1.20E-05	0.01%	4.75E-06	<0.01%
2,3-Dichlorophenol	576-24-9	0.1	24-Hour	De Minimis	6.29E-06	1.16E-05	0.01%	6.35E-06	<0.01%	NA	NA	1.16E-05	0.01%	4.62E-06	<0.01%
3,4-Dichlorophenol	95-77-2	0.1	24-Hour	De Minimis	6.29E-06	1.16E-05	0.01%	6.35E-06	<0.01%	NA	NA	1.16E-05	0.01%	4.62E-06	<0.01%
2,4,6-Trichlorophenol	88-06-2	1.5	24-Hour	Schedule 3 POI	6.29E-06	1.16E-05	<0.01%	6.35E-06	<0.01%	NA	NA	1.16E-05	<0.01%	4.62E-06	<0.01%
2,3,6-Trichlorophenol	933-75-5	0.1	24-Hour	De Minimis	6.29E-06	1.16E-05	0.01%	6.35E-06	<0.01%	NA	NA	1.16E-05	0.01%	4.62E-06	<0.01%
2,3,5-Trichlorophenol	933-78-8	0.1	24-Hour	De Minimis	6.29E-06	1.16E-05	0.01%	6.35E-06	<0.01%	NA	NA	1.16E-05	0.01%	4.62E-06	<0.01%
2,4,5-Trichlorophenol	95-95-4	220	24-Hour	Schedule 3 POI	6.29E-06	1.16E-05	<0.01%	6.35E-06	<0.01%	NA	NA	1.16E-05	<0.01%	4.62E-06	<0.01%
2,3,4-Trichlorophenol	15950-66-0	0.1	24-Hour	De Minimis	6.29E-06	1.16E-05	0.01%	6.35E-06	<0.01%	NA	NA	1.16E-05	0.01%	4.62E-06	<0.01%
3,4,5-Trichlorophenol	609-19-8	0.1	24-Hour	De Minimis	6.29E-06	1.16E-05	0.01%	6.35E-06	<0.01%	NA	NA	1.16E-05	0.01%	4.62E-06	<0.01%
2,3,4,6-Tetrachlorophenol	58-90-2	0.75	24-Hour	Schedule 3 POI	6.29E-06	1.16E-05	<0.01%	6.35E-06	<0.01%	NA	NA	1.16E-05	<0.01%	4.62E-06	<0.01%
2,3,4,5-Tetrachlorophenol	4901-51-3	0.1	24-Hour	De Minimis	6.29E-06	1.16E-05	0.01%	6.35E-06	<0.01%	NA	NA	1.16E-05	0.01%	4.62E-06	<0.01%
Pentachlorophenol	87-86-5	20	24-Hour	Schedule 3 POI	6.29E-06	1.16E-05	<0.01%	6.35E-06	<0.01%	NA	NA	1.16E-05	<0.01%	4.62E-06	<0.01%
1,3-Dichlorobenzene	541-73-1	50	24-Hour	Schedule 3 POI	7.99E-06	1.48E-05	<0.01%	8.07E-06	<0.01%	2.52	5%	2.52	5.05%	2.52	0.05
1,4-Dichlorobenzene	106-46-7	95	24-Hour	Ontario AAQC	5.42E-05	1.00E-04	<0.01%	5.48E-05	<0.01%	0.85	1%	0.85	0.90%	0.85	8.98E-03
1,2-Dichlorobenzene	95-50-1	30500	1-Hour	Ontario AAQC	8.48E-05	2.33E-04	<0.01%	1.53E-04	<0.01%	1.58	<0.01%	1.58	<0.01%	1.58	<0.01%

Table G

Start-up, Shutdown and Upset Condition Modeling Results for Expansion Phase 3 - Scenario 5 - Time Averaged Upset Condition

Pollutants	CAS No.	Project Criteria (ug/m3)	Averaging Period	Criteria Source	Upset Emission Rate	Maximum Concentration at Worst Case Receptor (ug/m3)	Percent of Project Criteria (%) at Worst Case Receptor	Maximum Concentration at Worst Case Sensitive Receptor (Sportsfield) (ug/m3)	Percent of Project Criteria at Sportsfield (%)	Background Concentration (ug/m3)	Percent of Project Criteria Contributed by Background (%)	Cumulative Maximum Concentration at Worst Case Receptor (ug/m3)	% of the Criteria at Worst Case Receptor	Cumulative Maximum Concentration at Sportsfield (ug/m3)	% of the Criteria at Sportsfield
1,3,5-Trichlorobenzene	108-70-3	3.6	24-Hour	Schedule 3 POI	3.77E-06	6.99E-06	<0.01%	3.81E-06	<0.01%	NA	NA	6.99E-06	<0.01%	2.77E-06	<0.01%
1,2,4-Trichlorobenzene	120-82-1	400	24-Hour	Ontario AAQC	6.68E-06	1.24E-05	<0.01%	6.75E-06	<0.01%	3.89	1%	3.89	0.97%	3.89	9.74E-03
1,2,3-Trichlorobenzene	87-61-6	135	24-Hour	Schedule 3 POI	5.12E-06	9.47E-06	<0.01%	5.17E-06	<0.01%	NA	NA	9.47E-06	<0.01%	3.76E-06	<0.01%
1,2,3,5/1,2,4,5-Tetrachlorobenzene	95-94-3	1	24-Hour	Schedule 3 POI	6.25E-06	1.16E-05	<0.01%	6.31E-06	<0.01%	NA	NA	1.16E-05	<0.01%	4.59E-06	<0.01%
1,2,3,4-Tetrachlorobenzene	634-66-2	600	24-Hour	Schedule 3 POI	4.68E-06	8.66E-06	<0.01%	4.72E-06	<0.01%	NA	NA	8.66E-06	<0.01%	3.44E-06	<0.01%
Pentachlorobenzene	608-93-5	80	24-Hour	Schedule 3 POI	5.23E-06	9.69E-06	<0.01%	5.29E-06	<0.01%	NA	NA	9.69E-06	<0.01%	3.84E-06	<0.01%
Hexachlorobenzene	118-74-1	0.011	24-Hour	Schedule 3 POI	3.80E-06	7.03E-06	0.06%	3.84E-06	0%	NA	NA	7.03E-06	0.06%	2.79E-06	2.54E-04
Dioxin and Furans (3)	NA-DFPCB	0.0000001	24-Hour	Ontario AAQC	2.05E-09	3.80E-09	3.80%	2.07E-09	2%	4.96E-08	50%	5.34E-08	53.41%	5.11E-08	0.51
7H-Dibenzo(c,g)carbazole	194592	0.1	24-Hour	De Minimis	1.27E-06	2.36E-06	<0.01%	1.29E-06	<0.01%	NA	NA	2.36E-06	<0.01%	9.36E-07	<0.01%
trans,1,2-Dichloroethene	156-60-5	105	24-Hour	Ontario AAQC	8.66E-04	1.60E-03	<0.01%	8.75E-04	<0.01%	0.94	1%	0.94	0.89%	0.94	8.92E-03
Polychlorinated Biphenyls (PCBs)	1336-36-3	0.15	24-Hour	Ontario AAQC	6.93E-06	1.28E-05	<0.01%	7.00E-06	<0.01%	0.00E+00	0	1.28E-05	<0.01%	5.09E-06	<0.01%
Polychlorinated Biphenyls (PCBs)	1336-36-3	0.035	Annual	Ontario AAQC	6.86E-06	8.29E-07	<0.01%	5.39E-07	<0.01%	0.00E+00	0	8.29E-07	<0.01%	3.62E-07	<0.01%

Note:
(1) Emission Limit for Calcium Oxide (CAS 1305-78-8) as Calcium is highly reactive and will not remain metallic after emission.
(2) Emission Limit for Sodium Hydroxide (CAS 1310-46-1) as Sodium is highly reactive and will not remain metallic after emission
(3) Historical stack testing data was used to determine the dioxin and furans emission rate for plant expansions. Dioxins and furans emissions rates from stack testing data is roughly a magnitude lower than the in-stack emission limits. If the in-stack emission limit is used to calculate the dioxins and furans emission rate, the cumulative maximum concentration at worst case receptor exceeds the project criteria.

Appendix H

Truck Idling Emission Rate and Concentrations

Table H.2

Truck Traffic Emission Rates for Phase 3

Pollutants	CAS No.	Project Criteria (ug/m3)	Averaging Period	Criteria Source	Incinerator Stack Emission Rate (g/s)	Truck Traffic Emission Rate (g/s)	Total Facility Emission Rate (g/s)	Ratio of Truck Idling to Facility Stack Emissions
Suspended Particulate Matter	NA-PM	120	24-Hour	Ontario AAQC	1.04	1.81E-04	1.04	0.02%
Suspended Particulate Matter	NA-PM	60	Annual	Ontario AAQC	1.04	1.81E-04	1.04	0.02%
Nitrogen Dioxide	10102-44-0	79.018	1-Hour	CAAQS	25.11	1.64E-02	25.12	0.07%
Nitrogen Dioxide	10102-44-0	400	1-Hour	Ontario AAQC	25.11	1.64E-02	25.12	0.07%
Nitrogen Dioxide	10102-44-0	200	24-Hour	Ontario AAQC	25.11	8.19E-03	25.12	0.03%
Nitrogen Dioxide	10102-44-0	22.577	Annual	CAAQS	25.11	8.19E-03	25.12	0.03%
Benzo(a)Pyrene	50-32-8	0.00001	Annual	Ontario AAQC	1.0374E-06	6.32E-11	1.04E-06	0.01%
Benzo(a)Pyrene	50-32-8	0.00005	24-Hour	Ontario AAQC	1.0374E-06	6.32E-11	1.04E-06	0.01%

Table H.1

Truck Idling Emission Rates for Phase 3

Pollutants	CAS No.	Project Criteria (ug/m3)	Averaging Period	Criteria Source	Incinerator Stack Emission Rate (g/s)	Truck Idling Emission Rate (g/s)	Total Facility Emission Rate (g/s)	Ratio of Truck Idling to Facility Stack Emissions
Suspended Particulate Matter	NA-PM	120	24-Hour	Ontario AAQC	1.0375	8.21E-03	1.04	0.8%
Suspended Particulate Matter	NA-PM	60	Annual	Ontario AAQC	1.0375	8.21E-03	1.04	0.8%
Nitrogen Dioxide	10102-44-0	79.018	1-Hour	CAAQS	25.1075	2.72E-01	25.11	1.1%
Nitrogen Dioxide	10102-44-0	400	1-Hour	Ontario AAQC	25.1075	2.72E-01	25.11	1.1%
Nitrogen Dioxide	10102-44-0	200	24-Hour	Ontario AAQC	25.1075	1.81E-01	25.11	0.7%
Nitrogen Dioxide	10102-44-0	22.577	Annual	CAAQS	25.1075	1.81E-01	25.11	0.7%
Benzo(a)Pyrene	50-32-8	0.00001	Annual	Ontario AAQC	1.0374E-06	1.41E-09	1.04E-06	0.1%
Benzo(a)Pyrene	50-32-8	0.00005	24-Hour	Ontario AAQC	1.0374E-06	1.41E-09	1.04E-06	0.1%

Appendix I

Land Use Classification Assessment

455 Phillip Street, Unit 100A
Waterloo, Ontario N2L 3X2
Canada
www.ghd.com

Our ref: 12593193-LTR-1

13 March 2024

Environmental Permissions Branch
Ministry of the Environment, Conservation and Parks

Auer Land Use Assessment in Support of ECA Amendment Application
Emerald Energy From Waste, Mississauga, Ontario

Dear Sir/Madam

1. Introduction

The following Auer Land Use Assessment was prepared to support an Amendment to Environmental Compliance Approval (Air & Noise) 0264 BFGQFY for Emerald Energy From Waste located at 7656 Bramalea Road in Mississauga, Ontario (Facility).

Assessment of compliance for Emerald was performed using the AERMOD v.22112 and the standards listed in Schedule 3 of O. Reg. 419/05, as well as the applicable Ministry limits listed in the version 3.0 of the *Air* Contaminants Benchmarks List, dated November 2023 (ACB List). Given the Facility's location, the urban dispersion option from the AERMOD control pathway was selected.

In order to demonstrate that the urban option is appropriate for modeling Emerald's location, a land use assessment was conducted using the method outlined in Auer, A. H. 1978. Titled *"Correlation of Land Use and Cover with Meteorological Anomalies"* from Journal of Applied Meteorology (Auer Method). The study classified the land use within the total area circumscribed by a 3 km radius circle around the Facility. It was concluded that land use types I2 and C1 account for more than 50 percent of the study area. As a result, the urban dispersion coefficient should be used in AERMOD for modeling purposes.

2. Land Use Classification

US EPA document Guideline on Air Quality Models (40 CFR Part 51, Appendix W) Section 7.2.1.1 outlines the land use procedure to be used for determining 'urban' or 'rural' classification which involves the following step:

1. Classify the land use within the total area, Ao, circumscribed by a 3 km radius circle about the source using the meteorological land use typing scheme proposed by Auer
2. If land use types I1, I2, C1, R2, and R3 account for 50 percent or more of Ao, use urban dispersion coefficients; otherwise, use appropriate rural dispersion coefficients.

Land use typing scheme from Auer Method are as follows:

Table 1 Identification and Classification of Land Use (Auer, 1978)

Auer Type	Use and Structures	Vegetations
I1	Heavy Industrial: Major chemical, steel, and fabrication industries; generally 3-5 story buildings, flat roofs	Grass and tree growth extremely rare; <5% vegetation
I2	Light-moderate industrial: Rail yards, truck depots, warehouses, industrial parks, minor fabrications; generally 1-3 story buildings, flat roofs	Very limited grass, trees almost total absent; <5% vegetation
C1	Commercial: Office and apartment buildings, hotels; > 10 story heights, flat roofs	Limited grass and trees; <15% vegetation
R1	Common residential: Single family dwelling with normal easements; generally one story, pitched roof structures; frequent driveways	Abundant grass lawns and light-moderately wooded; >70% vegetation
R2	Compact residential: Single, some multiple, family dwelling with close spacing; generally <2 story, pitched roof structures; garages (via alley), no driveways	Limited lawn sizes and shade trees; <30% vegetation
R3	Compact residential: Old multi-family dwellings with close (<2 m) lateral separation; generally 2 story, flat roof structures; garages (via alley) and ashpits, no driveways	Limited lawn sizes, old established shade trees; < 35% vegetation
R4	Estate residential: Expansive family dwelling on multi-acre tracts	Abundant grass lawns and lightly wooded; >95% vegetation
A1	Metropolitan natural: Major municipal, state, or federal parks, golf courses, cemeteries, campuses; occasional single story structures	Nearly total grass and lightly wooded; >95% vegetation
A2	Agricultural rural	Local crops (e.g. corn, soybean); >95% vegetation
A3	Undeveloped: Uncultivated; wasteland	Mostly wild grasses and weeds, lightly wooded; > 90% vegetation
A4	Undeveloped rural	Heavily wooded; > 95% vegetation
A5	Water surfaces: Rivers, lakes	

To classify the Auer land use, zoning and land use information was first obtained for 3 km radius around the Facility based on the Zoning information from City of Mississauga (By-law 0225-2007) and City of Brampton (Zoning By-Law 270-2004). The zoning categories from the Mississauga zoning information include Airport, Commercial, Development, Employment, Greenlands, Open Space. Parkway Belt, Residential, and Utility. The zoning categories from the Brampton zoning information include Agricultural, Commercial, Floodplain, Industrial, Open Space, Public Ownership and Utilities, Residential, Split Zoned, and Institutional. A detailed zoning figure that presents land use 3-km radius around the Facility are presented in Attachment 1. The shape files are provided digitally.

We then assigned classifications to the Auer Type by comparing the permitted land uses outlined in the zoning bylaw for Mississauga and Brampton, respectively, and examining the structures of buildings and

the vegetation coverage for each parcel. The Auer Assignment and the area correspond to each assignment is presented in Table 2:

Table 2 Zoning Data, Auer Land Use Assignment and the Area of Each Parcel

Mississauga Zoning Category	Auer Class	Area (Square Meters)	Comments
Airport	C1	785,794.81	aircraft maintenance centers and transit centers that has very little vegetation coverage - around 1/3 of the airport
	A1	2,415,543.24	Land within the Airport zone that is not buildings is conservatively considered as A1 based on high vegetation coverage
Commercial	C1	49,648.66	
Development	A1	17,889.94	
	C1	22,286.38	South of the site, which is used for commercial purpose
Employment	I2	6,224,501.74	
Greenlands	A1	591,278.12	
Open Space	A1	128,926.15	
Parkway Belt	A1	166,935.71	
Residential	R1	478,537.84	
Utility	A1	4,042.32	

Brampton Zoning Category	Auer Class	Area (Square Meters)	Comments
Agricultural	A1	394,212.89	
Commercial	C1	127,975.98	
Floodplain	A1	234,435.28	
Industrial	I2	6,578,262.78	
Open Space	A1	471,678.12	
Public Ownership And Utilities	C1	1,768,110.52	Public Ownership and Utilities lands that are adjacent to industrial/employment/commercial land
	R1	900,639.90	Public Ownership and Utilities lands that are adjacent to residential area/open space
Residential	R1	1,892,138.51	
Split Zoned	C1	1,108,443.13	Refer to Attachment 2; Commercial land with minimum vegetation coverage
	A1	5,199,694.98	
Institutional	C1	306,074.16	

A land use Figure based on the Auer assignment above is presented in Attachment 2. Based on this designation, it is estimated that 55.7 % of the land use within 3 kilometres of the Facility can be conservatively classified as urban for modelling purposes. The area and percentage covered based on

Auer Classification are presented in Table 3. A more detailed parcel area determination is provided in spreadsheet.

Table 3 Auer Classification and Area for Areas Surrounding Emerald

Auer Class	Area (m2)	Percent Covered
A1	9,606,747	33.08%
C1	3,360,252	11.57%
I2	12,802,765	44.09%
R1	3,271,316	11.26%
Total Area	29,041,080	
Sum of I2 and C1 (Urban)	16,163,017	55.66%

3. Conclusion

GHD conducted a land use assessment using Auer Method for Emerald Energy From Waste. Based on GHD's evaluation, 55.7% of land use within the total area circumscribed by a 3 km radius circle around the Facility are I2 and C1, which account for more than 50 percent of the study area. As a result, the urban dispersion coefficient should be used in AERMOD for modelling purposes.

Should you have any questions, please let us know.

Regards



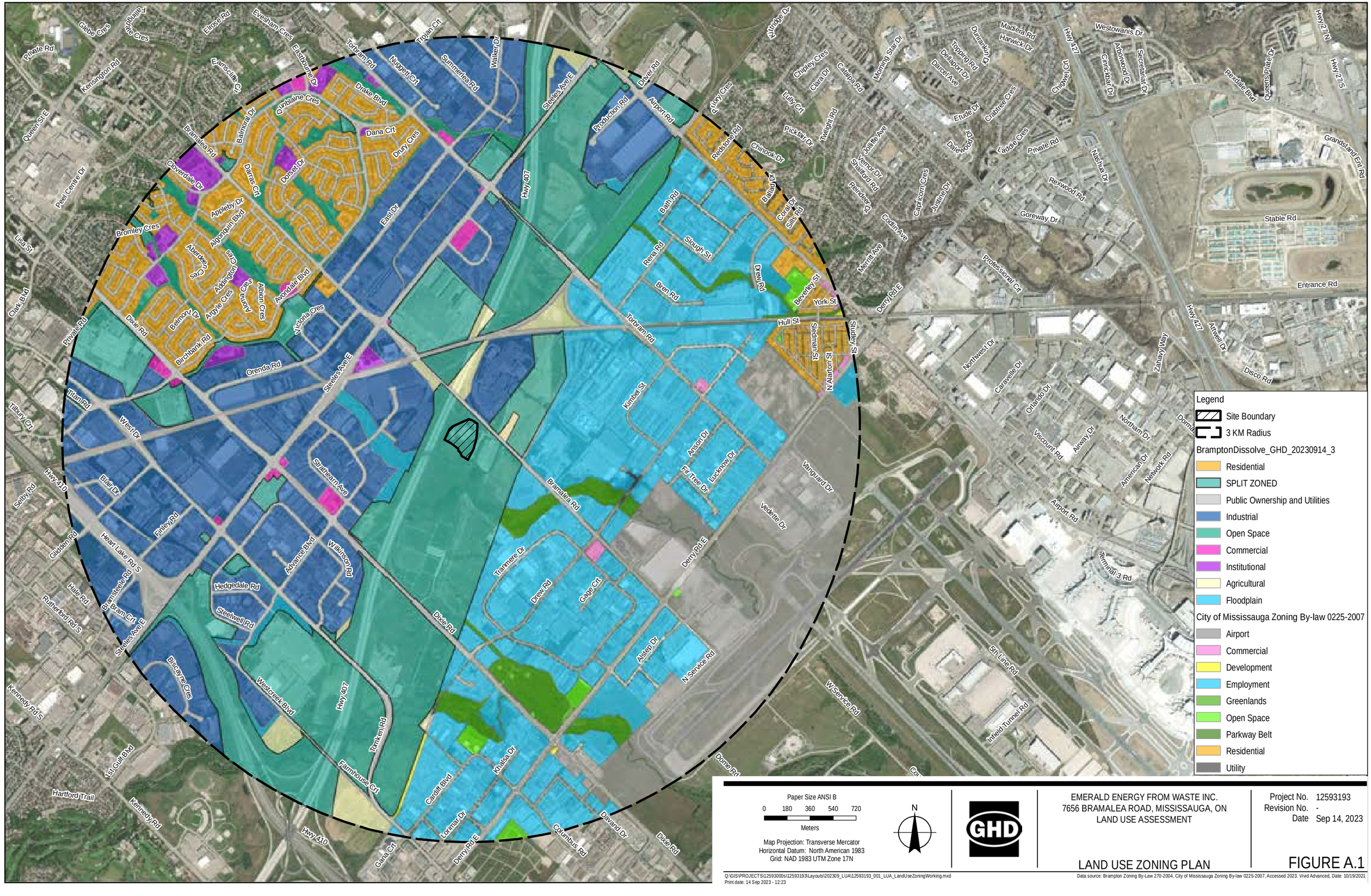
Gord Reusing
Technical Director

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Encl.

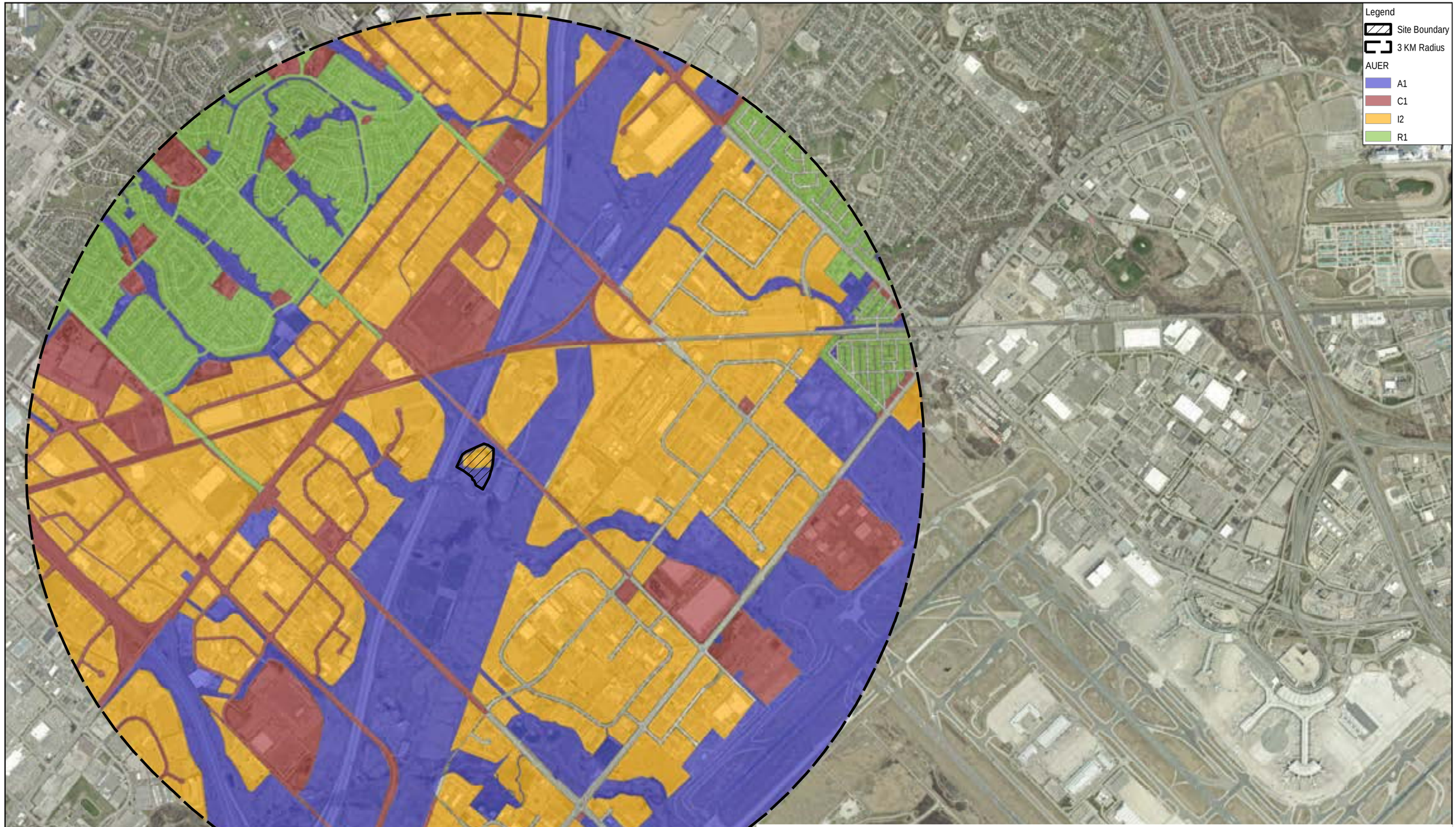
Attachment 1

City of Mississauga Zoning Figure


Legend
Site Boundary
3 KM Radius
BramptonDissolve_GHD_20230914_3
Residential
SPLIT ZONED
Public Ownership and Utilities
Industrial
Open Space
Commercial
Institutional
Agricultural
Floodplain
City of Mississauga Zoning By-law 0225-2007
Airport
Commercial
Development
Employment
Greenlands
Open Space
Parkway Belt
Residential
Utility
Paper Size ANSI B
0 180 360 540 720
Meters
Map Projection: Transverse Mercator
Horizontal Datum: North American 1983
Grid: NAD 1983 UTM Zone 17N
N
GHD
EMERALD ENERGY FROM WASTE INC.
7656 BRAMALEA ROAD, MISSISSAUGA, ON
LAND USE ASSESSMENT
Project No. 12593193
Revision No. -
Date Sep 14, 2023
LAND USE ZONING PLAN
FIGURE A.1
Q:\GIS\PROJECTS\12593000s\12593193\Layouts\202309_LUA\12593193_001_LUA_LandUseZoningWorking.mxd
Print date: 14 Sep 2023 - 12:23
Data source: Brampton Zoning By-Law 270-2004, City of Mississauga Zoning By-law 0225-2007, Accessed 2023. Vivid Advanced, Date: 10/19/2021

Attachment 2

Auer Land Use Classes Figure



Paper Size ANSI B

0 250 500 750

Meters

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983
Grid: NAD 1983 UTM Zone 17N

N

GHD

EMERALD ENERGY FROM WASTE INC.
7656 BRAMALEA ROAD, MISSISSAUGA, ON
LAND USE ASSESSMENT

AUER

Project No. 12593193
Revision No. -
Date Mar 11, 2024

FIGURE A.2

Q:\GIS\PROJECTS\12593000s\12593193\Layouts\202309_LUA\12593193_002_LUA_AUER.mxd
Print date: 11 Mar 2024 - 14:54

Data source: AUER: derived from GHD observations of Brampton Zoning By-Law 270-2004, City of Mississauga Zoning By-law 0225-2007, Accessed 2023. Imagery: Vivid Advanced, Date: 10/19/2021

Appendix J

BaP MOVES Dataset

Table J.1

Truck Idling MOVES Data

Benzo(a)Pyrene

single unit short haul trucks

MOVESRunID	yearID	monthID	pollutantID	sourceType	roadTypeID	avgSpeedB	AVG(rateperdistance)
1	2022	1	174	52	2	1	3.5E-08
1	2022	1	174	52	3	1	3.5E-08
1	2022	1	174	52	4	1	3.5E-08
1	2022	1	174	52	5	1	3.5E-08

single unit long haul trucks

MOVESRunID	yearID	monthID	pollutantID	sourceType	roadTypeID	avgSpeedB	AVG(rateperdistance)
1	2022	1	174	53	2	1	3.44E-08
1	2022	1	174	53	3	1	3.44E-08
1	2022	1	174	53	4	1	3.44E-08
1	2022	1	174	53	5	1	3.44E-08

Average of Onroad Single Unit Short/Long Haul Trucks

Emission Factor	3.4703E-08	g/VKT
Vehicle Kilometres Travelled	4.02336	kph
Emission Factor, per truck	1.39623E-07	g/hr BaP
Emission Factor, per truck	3.87841E-11	g/s BaP

Table J.2

On-site Truck Traffic MOVES Data

monthID	1, 7	jan, jul
pollutantID	3, 100, 174	NOx, primary exhaust PM10 total, benzo(a)pyrene gas
sourceTypeID	51, 52, 53	refuse truck, single unit short-haul truck, single unit long-haul truck
roadTypeID	5	urban unrestricted access
avgSpeedBinID	4	12.5 mph <= speed <= 17.5 mph

	Emission Factors, g/VKT						
	refuse truck		short-haul truck		long-haul truck		avg EF
	Jan	Jul	Jan	Jul	Jan	Jul	g/VKT
NOx	0.000E+00	0.000E+00	1.650E+00	1.419E+00	1.619E+00	1.392E+00	**1.520E+00**
PM10	0.000E+00	0.000E+00	3.512E-02	3.529E-02	3.206E-02	3.222E-02	**3.367E-02**
BaP	0.000E+00	0.000E+00	1.075E-08	1.328E-08	1.032E-08	1.256E-08	**1.173E-08**

Appendix K

Particle Size Distribution

From: Jathiga Satguneswaran
To: Jathiga Satguneswaran
Subject: PM Size Distribution - Emerald Energy - 12593193
Date: Thursday, October 3, 2024 11:45:59 AM
Attachments: image001.png
image002.png
image003.png
Sensitivity: Confidential

Fra: Tore Hulgaard <TOH@ramboll.com>
Sendt: onsdag, oktober 2, 2024 13:44
Til: Jørgen Haukohl <JH@ramboll.com>
Emne: RE: Emission requirements

It appears from field studies where PM2.5 and the total suspended solids (TSP) have been measured simultaneously that the majority of TSP of is present as PM2.5. One example from a Danish study is presented below.
As an average it seems a good approximation to assume that PM2.5 makes up 90% of the TSP although there are variations between plants, applied air pollution control technologies, nature of input waste and over time.

Table 5.16 Emission factors for particulate matter.

Plant type	Unit	O_2 , %	$PM_{0.1}$	PM_1	$PM_{2.5}$	TSP
Waste, plant A2 (ESP+WET)	mg/Nm^3 (ref)	11	0.0008	0.060	0.065	0.070

Tore

Classification: Confidential

From: Tore Hulgaard <TOH@ramboll.com>
Sent: 30. september 2024 16:16
To: Jørgen Haukohl <JH@ramboll.com>; 'Joe Lyng' <JoeLyng@emeraldefw.com>
Cc: Jacob Volden Paaske <JVPE@ramboll.com>
Subject: RE: Emission requirements
Sensitivity: Confidential

Hi Joe,

In the EU dust emissions are regulated by the Industrial Emissions Directive in combination with BREF2019, i.e. BAT reference note of 2019 (BAT is 'best available technique'),
link to document: https://eippcb.jrc.ec.europa.eu/sites/default/files/2020-01/JRC118637_WI_Bref_2019_published_0.pdf.

In the BREF2019, the BAT-associated emission level (BAT-AEL) for dust is listed as <2-5 mg/Nm³ (dry flue gas at 11% O2), where Nm³ is normal cubic metres, referring to standard temperature (0 °C) and pressure (101.325 kPa).
The BAT-AELs shall be used as limit values (daily average) by the permitting authority. Usually the upper BAT-AEL value is used as limit value, i.e. 5 mg/Nm³ for dust emission. Note for comparison with limit values applicable in Ontario, the values shall be converted to the applicable reference conditions. From the planned WtE facility, we expect the emission to be well below 2 mg/Nm³ (dry flue gas at 11% O2) except in case of damaged filter bags or similar disturbances, and we expect the supplier would be willing to guarantee 5 mg/Nm³ (as daily average limit value).

Table from the BAT-conclusions of the BREF2019:



In the EU no limit value exist for PM2.5, only total dust. The dust emission is measured continuously, and the instrument is calibrated against a standard reference method.
For this reason, few PM2.5 measurements are available.

We can however, refer to a report, where dust emissions have been measured from three Waste-to-Energy plants. The report is attached and the relevant table is copied below. I also attached what looks like an article on the original measurement campaign – as the reference indicated below the table was not found.

Table 5.16 Emission factors for particulate matter.

Plant type	Unit	O_2 , %	$PM_{0.1}$	PM_1	$PM_{2.5}$	TSP
Waste, plant A2 (ESP+WET)	mg/Nm^3 (ref)	11	0.0008	0.060	0.065	0.070
Waste, plant A3 (SD+FB (+CYK))	mg/Nm^3 (ref)	11	0.0001	1.287	2.360	1.600
Waste, plant A1 (ESP+WET+FB)	mg/Nm^3 (ref)	11	0.000003	0.0001	0.0021	0.004
Straw, plant B1	mg/Nm^3 (ref)	10	0.049	3.3	-	0.030
Straw, plant B2	mg/Nm^3 (ref)	10	0.0031	0.86	-	0.030
Wood, plant B3	mg/Nm^3 (ref)	10	0.073	4.5	6.116	0.900
Natural gas, engine	mg/Nm^3 (ref)	5	0.0640	0.352	-	-
Natural gas, engine during start-up	mg/Nm^3 (ref)	5	0.0544	1.856	-	-
Biogas (Landfill), engine	mg/Nm^3 (ref)	5	0.0032	0.064	0.112	-
Gas oil	mg/Nm^3 (ref)	5	0.0800	0.928	1.024	-

Data for fine and ultrafine particles refer to Energinet.dk (2009).

'TSP' refers to total suspended particulates'

In connection with the table the adjoining text should be noted,

'For some plants a higher emission of $PM_{2.5}$ and PM_1 was measured than the TSP measurement. The results are shown in Table 5.16.
The table shows that the TSP measurement is lower than the $PM_{2.5}$ or PM_1 measurement for one of the waste incineration plants and for all three biomass fired plants.
The different results for the TSP measurement and the fine and ultrafine particles emission are due to different measurement techniques.'

It appears from the table (Table 5.16) that the low emission level indicated by the BAT-AEL intervals is confirmed.
It further shows that the TSP emission and PM2.5 are within a factor 2 of each other, meaning that it is a rough approximation to assume that 50% of the TSP is present as PM2.5.

You may alternatively use the conservative approach by which the proportion of PM2.5 is chosen to either 0% or 100% of the total dust, depending on the purpose of the analysis. 0% may be chosen when the purpose is to assess the impact for the area near the plant, and 100% may be chosen in some other cases.

Kind regards

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Appendix B.5

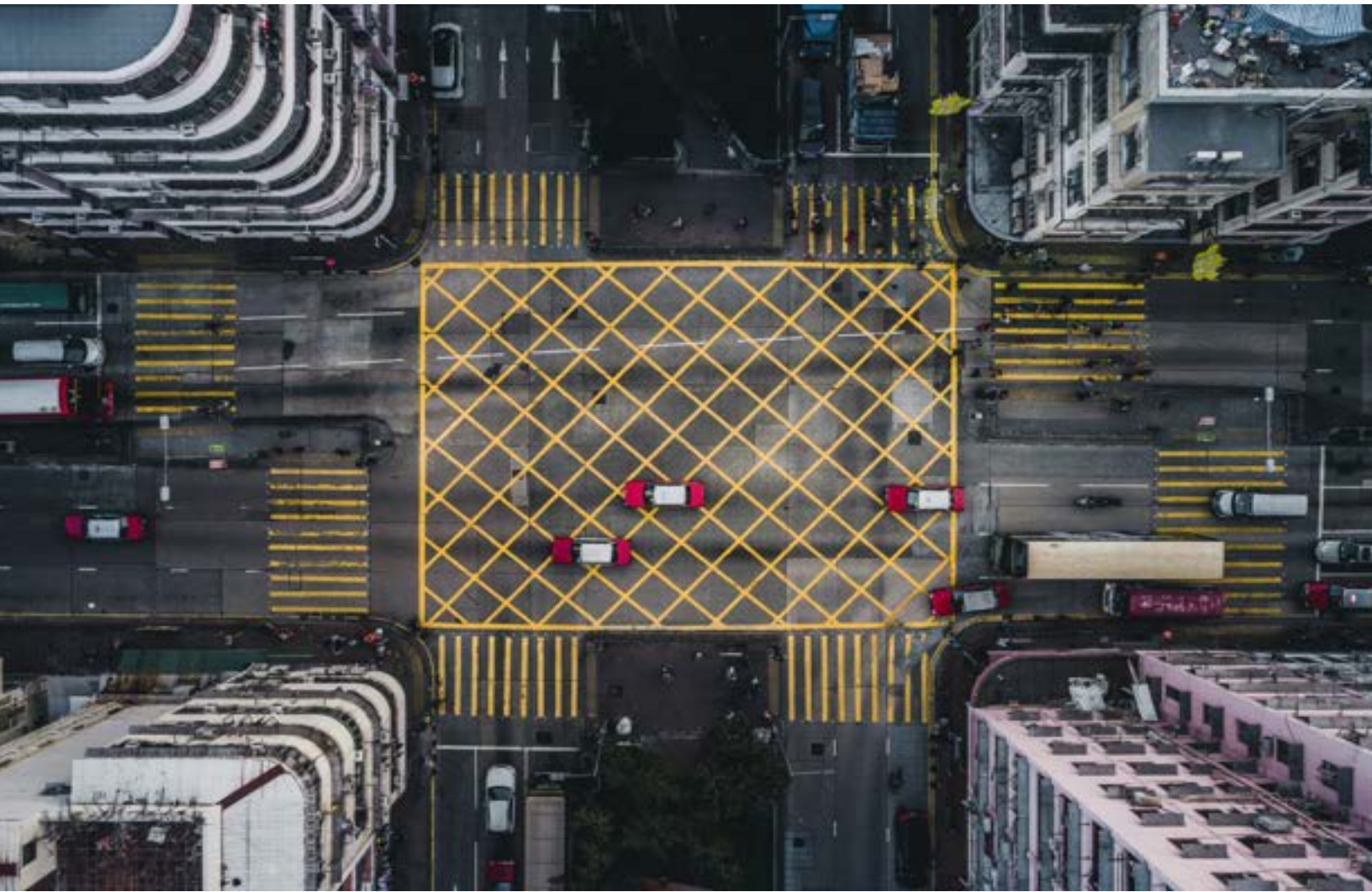
Ambient Air Monitoring Report
(Revised September 2024)

Revised Background Ambient Air Quality Assessment Report

Emerald Energy From Waste

19 September 2024

→ The Power of Commitment



Project name		Emerald Energy from Waste Environmental Screening & ECA Amendment					
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Figure 1 Local Air Monitoring Stations

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Table 1 Summary of 90th Percentile Background Ambient Air Concentrations
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Appendices

Appendix A Ambient Air Monitoring Plan (May, 2023)

1. Introduction

Emerald Energy from Waste (Emerald) is proposing to redevelop their existing facility (Facility) on the existing property located at 7656 Bramalea Rd, Mississauga, Ontario. The redeveloped Facility, which will be built in stages, will continue to be an Energy from Waste (EFW) facility intended to provide a long-term, sustainable solutions to manage municipal solid waste (MSW) and institutional, commercial, and industrial (IC&I) non-hazardous solid wastes and divert them from landfill while producing electricity for the grid and steam for the local industrial community.

1.1 Purpose of this Report

This Background Ambient Air Quality Assessment Report (. Report) was developed to assess the background air quality in the airshed near the Facility. The background air quality was assessed based on the results of two (2) ambient air monitoring programs that were completed in locations upwind and downwind of the Facility. One program was completed in 2013/2014, and the second program, conducted at the same monitoring station locations, was conducted in 2023. In addition, ambient air data from federal and provincial air quality stations in the vicinity of the Facility were reviewed, including data from National Air Pollution Surveillance (NAPS) stations and local Ontario Air Quality (AQ) stations. The Report was originally completed in January 2024.

This Revised Report includes new information based on new data available after the January 2024 version. The revisions to the original Report include the following:

1. Updated background ambient air concentrations based on data collected and/or received from the lab between January 2024 and March 2024 from the Emerald air monitoring stations located upwind and downwind of the Emerald facility.
2. Updated background ambient air concentrations based on new data for 2022 and 2023 that became available in March 2024 for the National Air Pollution Surveillance (NAPS) and Ontario AQ ambient air monitoring stations, respectively.
3. Updated information and background ambient air concentrations for hydrogen chloride (HCl) compiled from York University.
4. Edits to the Report addressing the new data as well as comments on the January 2024 Report received from stakeholders.
5. Revisions to the text in Section 2.4.1, 5th paragraph replacing “Cl_2“ with “chlorine” based on MECP comments from July, 2024.
6. Revisions to text in Section 3.1 based on MECP comments in July, 2024 regarding the detection limits for dioxins and furans.
7. Notes in Tables 1 and 2 clarifying that the HCl 90th percentile background values from York University study are conservatively based on the maximum instantaneous value measured from unpublished data, and the 50th percentile is the average value in the published 2019 dataset from York University.
8. Revisions made to the 90th percentile and 50th percentile concentrations for dioxins and furans in Tables 1 and 2 respectively based on feedback from MECP on the calculation methodology for the reporting of dioxins and furans and dioxin-like PCBs.

The estimated background air concentrations as determined in this Report have been added to the predicted concentrations of air contaminants emitted from the future Emerald Facility expansion phases, as documented in the Air Quality Impact Assessment (AQIA) Report, to determine the cumulative air contaminant concentrations and compare them to applicable Ontario ambient air quality criteria (AAQC) and federal CAAQS.

1.2 Sources of Local Air Monitoring Data

An ambient air monitoring program (AAMP) was completed in 2013/2014 by the Region of Peel (Peel). GHD obtained the raw data and monthly data summaries from the two monitoring locations used in the Peel AAMP. These two sites monitored a list of air contaminants known to be emitted from energy from waste facilities. The monitoring sites used in the Peel study were located upwind and downwind of the Emerald Facility and were therefore applicable for consideration in this Report.

Emerald implemented an AAMP at the same monitoring station locations used by Peel. Emerald prepared an AAMP Plan that was submitted to the Ontario Ministry of the Environmental, Conservation and Parks (MECP) for comments prior to the initiation of the monitoring, as provided in Appendix A.

It should be noted that finding and accessing appropriate monitoring sites in an urban environment with appropriate power is very difficult. Access to the Peel AAMP monitoring sites used in 2013/2014 was still possible in 2023. Emerald therefore decided to use the same two sites to measure background concentrations for the Emerald AAMP. Using the same monitoring station locations for the Emerald and Peel AAMPs provides some consistency and the possibility of comparing the two data sets.

1.2.1 Monitored Parameters

The list of parameters monitored in the Emerald AAMP includes the compounds that are potentially emitted from EFW facilities. The list includes all compounds that are monitored annually from the main stack at the Emerald Facility as part of their Environmental Compliance Approval (ECA) No. 0264-BFGQF. Compounds were included in this list even if the annual results show that the presence of these compounds in the Emerald emissions are negligible, such as Volatile Organic Compounds (VOC) and Polycyclic Aromatic Compounds (PAH). Compounds that were consistently not detected from the Emerald source tests were not included, such as carbonyls, chlorobenzenes and chlorophenols. The list of parameters in Ontario Guideline A-7 and the list of parameters measured in the York/Durham project in Ontario were also considered.

The following is the list of parameters that were measured at the two stations for the Emerald AAMP:

- Particulate Matter (<2.5 micrometres) (PM2.5)
- Particulate Matter (<10 micrometres) (PM10)
- Total Suspended Particulate (TSP)
- Sulphur Dioxide (SO_2)
- Nitrogen Oxide (NO)
- Carbon Monoxide (CO)
- Ozone (O_3)
- Polycyclic Aromatic Hydrocarbons (PAHs)
- Dioxins and Furans
- Metals (including cadmium, lead and mercury)
- Hydrochloric Acid (HCl)
- Volatile Organic Compounds (VOCs)
- Included also are ozone, particulate matter less than 10 microns (PM10) and Hydrogen Chloride (HCl), that were added after input from MECP

The lists of individual metals, PAHs and VOCs are provided in Section 2.2.

1.2.2 Air Monitoring Data

The individual parameters monitored during the Emerald AAMP were very similar to the Facility's ECA list of parameters required for annual stack testing. GHD compared the parameters monitored in the Peel AAMP with the ECA list of parameters from the Emerald annual source tests. All parameters were the same except for the following:

Metals: Bismuth and Thallium were not monitored in 2013/2014.

PAHs: 9-Methylphenanthrene, Dibenzo(a,c)anthracene and Picene were not monitored in 2013/14.

VOCs: All the VOCs monitored in 2013/2014 were monitored in the Emerald AAMP. Numerous individual VOCs are being analyzed in the Emerald AAMP that were not monitored in 2013/2014.

1.2.3 Background Monitoring Locations

The two monitoring locations used in the Peel and Emerald AAMPs are located in a vacant parking lot at 185 Central Park Drive in Brampton (Upwind Station) and at the Carterm Intermodal Logistics located facility at 2700 Drew Rd, in Mississauga (Downwind Station). Both sites are in primarily industrial/commercial areas that are adjacent to residential communities and are within the targeted upwind and downwind monitoring locations for Emerald as noted in the AAMP Plan (see Appendix A).

For the Peel AAMP, there is approximately 6 months of background data that was collected from the Upwind Station from June 2013 to November 2013 and approximately one year of background data from the Downwind Station from June 2013 to May 2014.

Data compiled from the Emerald AAMP for this Report includes approximately 7 months of upwind data (from August 25, 2023 to March 25, 2024) and approximately 9.5 months of downwind data (from June 15, 2023 to March 26, 2024). The durations of the Emerald and Peel AAMPs are comparable and includes data from all four seasons at both upwind and downwind locations.

1.3 Federal and Provincial Data

Local federal NAPS and Ontario AQ stations with data from 2013/2014 (NAPS and AQ), 2021 and 2022 (NAPS) and 2022 and 2023 (AQ) were also assessed for background concentrations of available air contaminants that could be compared with the Peel and Emerald AAMP data. The 2022 NAPS and 2023 AQ stations data became available in March, 2024.

The stations considered in this Report for 2013/2014 are as follows:

- NAPS Station 60430 located at 125 Resources Rd. in Mississauga (Downwind) was used to assess CO and SO2 background concentrations
- NAPS Station 60428 located at 525 Main Street N. in Brampton (Upwind) was used to assess for the rest of the CACs and VOCs
- NAPS Station 60427 located at 223 College St, Toronto was used to assess PAHs
- Ontario AQ Station 35125 located at 125 Resources Rd. in Mississauga (Downwind) was used to assess CO and SO2
- Ontario AQ Station 46089 located at 525 Main Street N. in Brampton (Upwind) was used to assess the rest of the CACs

For 2021 and 2022 data, the following NAPS stations were considered:

- NAPS Station 60450 located at 109 Mclaughlin Rd. S. in Brampton (Upwind) (CACs excl. CO and SO2)
- NAPS Station 60430 located at 125 Resources Rd. in Mississauga (Downwind) (CO and SO2)
- NAPS Station 60438 located at 125 Resources Rd. in Mississauga (Downwind) (PAHs and VOCs)
- NAPS Station 60428 located at 525 Main Street N. in Brampton (Upwind)

For 2022 and 2023 data, the following Ontario AQ stations were considered:

– Ontario AQ Station 35125 located at 125 Resources Rd. in Mississauga (Downwind) (CO and SO2)
– Ontario AQ Station 46090 at 109 Mclaughlin Rd. S. in Brampton (Upwind) (for the rest of the CACs

1.3.1 Duration of Federal and Provincial Data

Provincial AQ data and Federal NAPS data was collected for the same period in 2013/2014 as the Peel AAMP from June 15, 2013 to May 31, 2014.

Federal NAPS data from 2021 and 2022 was collected from January 1, 2021 to December 31, 2022.

Provincial AQ data from 2022 and 2023 was collected from January 1, 2022 to December 31, 2023.

2. Emerald AAMP Summary

The Emerald AAMP was completed at the same monitoring station locations as the Peel AAMP conducted in 2013/2014, including both continuous and non-continuous monitors to sample ambient air concentrations of the list of parameters noted Section 1.2.1. Monitoring for criteria air contaminants (CACs) such as PM2.5, PM10, nitrogen oxides (NOx), sulphur dioxide (SO_2), carbon monoxide (CO) and ozone was conducted at both stations on a continuous basis. Monitoring for metals in total suspended particulates (TSP), polycyclic aromatic hydrocarbons (PAHs), VOC, HCl and dioxins and furans (PCDD/DF) were conducted at both stations with non-continuous monitors, per the methodology and analysis recommended in the Operations Manual for Air Quality Monitoring in Ontario, 2021 (Manual). TSP, metals, HCl and VOC are being monitored for 24 hours every 6 days according to the NAPS schedule. PAHs and dioxins and furans were monitored for 24 hours every 12 days.

2.1 Continuous Ambient Monitors

2.1.1 Particulate Matter less than 2.5 Microns (PM2.5)

The PM2.5 continuous sampler consists of a BAM 1020. The sampler operates using beta radiation attenuation for continuous PM2.5 measurement using a PM2.5 cut cyclone inlet system:

– Principle of Operation: Beta Attenuation
– Minimum Detection Level: 1 µg/m3
– Range: 0-10 mg/m3
– Time interval: 1 hour

2.1.2 Particulate Matter less than 10 microns (PM10)

The PM10 continuous sampler consists of a BAM 1020. The sampler operates using beta radiation attenuation for continuous PM10 measurement using a PM10 cut cyclone inlet system:

– Principle of Operation: Beta Attenuation
– Minimum Detection Level: 1 µg/m3
– Range: 0-10 mg/m3
– Time interval: 1 hour

2.1.3 Nitrogen Oxides (NOx)

The NOx sampling system consists of an API Model 200E Chemiluminescence Analyzer to measure continuous concentrations of nitric oxide (NO), nitrogen dioxide (NO_2) and nitrogen oxides (NOx). The analyzer operates on the principle of chemiluminescence, where the amount of light given off during a chemical reaction is measured. An NO_2 to NO converter is used to measure the amount of NOx (NO + NO_2) in the sample. The analyzer has internal NOx permeation tube and access to zero gas generation for daily zero/span checks:

– Principle of Operation: Chemiluminescence
– Minimum Detection Limit: 1 part per billion (ppb)
– Range: 0-1000 ppb
– Time interval: 1 second averaged every minute, including hourly and daily averages

2.1.4 Sulphur Dioxide (SO_2)

The SO_2 analyzer consists of a Teledyne API Sulphur Dioxide Analyzer. The analyzer operates using the principle of Pulsed Fluorescence". Sulphur dioxide molecules absorb fluorescent energy, producing electronically excited SO_2 molecule with a known spectral decay rate to the ground state. The fluorescence emitted by the reaction is detected by a photo multiplier tube and the signal is converted proportionally to an electronic output signal which is then captured by a data logger. The analyzer has an internal SO_2 permeation tube and access to zero gas generation for daily zero/span checks:

– Principle of Operation: Pulsed Florescence
– Minimum Detection Limit: 1 ppb
– Range: 0-1000 ppb
– Time interval: 1 second averaged every minute, including hourly and daily averages

2.1.5 Carbon Monoxide (CO)

The CO analyzer consists of a Teledyne API T300 CO Analyzer. The T300 measures low ranges of carbon monoxide through IR absorption and gas filter correlation by comparing IR energy absorbed by the sample to that absorbed by a reference gas according to the Beer-Lambert law. The signal is converted proportionally to an electronic output signal which is then captured by the data logger:

– Principle of Operation: Gas Filter Correlation
– Range: 0-1000 ppm
– Minimum Detection Limit: 1 ppm
– Time interval: 1 second averaged every minute, including hourly and daily averages

2.1.6 Ozone

The ozone analyzer consists of a Teledyne API T400 Ozone Analyzer (or equivalent). The T400 measures low ranges of ozone in ambient air through ultraviolet (UV) absorption according to the Beer-Lambert law. The signal is converted proportionally to an electronic output signal which is then captured by the data logger:

– Principle of Operation: UV Absorption
– Minimum Detection Limit: 1ppb
– Range: 0-1000 ppb
– Time interval: 1 second averaged every minute, including hourly and daily averages

2.1.7 Meteorological Tower

Horizontal wind speed, wind direction, ambient temperature, relative humidity, and barometric pressure are collected at each station. The meteorological sensors are mounted on an external telescoping 10 m aluminum tower. Meteorological sensor measurement data is logged using a data acquisition system (DAS) mentioned below. The meteorological equipment consists of:

– Wind Speed/Wind Direction: Met One Instruments Inc. Model 034B (or equivalent)
– Temperature: Campbell Scientific Model 107 (or equivalent)
– Relative Humidity: Campbell Scientific Model HMP60 (or equivalent)
– Atmospheric Pressure: Campbell Scientific Model CS106 (or equivalent)

2.1.8 Data Acquisition System

A rack mounted data acquisition system (DAS) installed to record the concentrations from all the analyzers and the meteorological towers. A Campbell Scientific CRX1000 station data acquisition system (or equivalent) is used to collect the ambient analyzer data and status codes from the ambient air monitors. All the continuous station data is maintained in the data loggers, and data is viewed locally using a laptop and the relevant DAS software applications.

2.2 Non-Continuous Ambient Monitors

2.2.1 TSP/Metals

TSP and metals are collected onto pre-weighed, conditioned Teflon coated quartz filters for a 24-hour period using a high volume sampler (or equivalent). This monitor operates by continuously drawing a sample of ambient air through a filter onto which particulate matter is deposited. The filters are subsequently weighed for particulate mass and analyzed using the Atomic Emission Spectroscopy/Inductively Coupled Plasma (AES/ICP) technique to determine the mass of metals collected. Analysis of the TSP/metals samples will be conducted by a Canadian Assurance for Laboratory Accreditation (CALA) accredited laboratory following the Manual.

The list of metals analyzed from each filter are as follows:

Aluminum, antimony, arsenic, barium, beryllium, boron, cadmium, calcium, chromium, cobalt, copper, iron, lead, lithium, magnesium, manganese, mercury, molybdenum, nickel, phosphorous, selenium, silicon, silver, sodium, strontium, tin, titanium, vanadium, and zinc.

2.2.2 PAHs, Dioxins and Furans and dioxin-like PCBs

PAHs and dioxins and furans are collected with a medium volume air sampler (or equivalent). The samplers are located on the roof of the instrumentation shelter to meet the required MECP siting characteristics. Each sampler is equipped with a dual chambered sampling module to contain a Teflon-coated glass fibre filter and a Poly-Urethane Foam (PUF) cartridge. PAHs are collected according to the NAPS schedule for a 24-hour period at 12-day intervals and dioxins and furans are collected, also for a 24-hour period, at 24-day intervals.

The samples are submitted to an accredited laboratory for analysis. PAHs and dioxins/furans are analyzed using Gas Chromatography/Mass Spectrometry (GC/MS) as per the protocols defined by US EPA Compendium Method TO-13A (for PAHs) and Compendium Method TO-9A (for dioxins and furans).

The list of PAHs are as follows:

Acenaphthylene, acenaphthene, anthracene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)fluorene, benzo(b)fluorene, benzo(ghi)perylene, benzo(a)pyrene, benzo(e)pyrene, 2-chloronaphthalene, chrysene, coronene, dibenzo(a,c)anthracene, 9,10-dimethylanthracene, 7,12-dimethylbenzo(a)anthracene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, 2-methylanthracene, 3-methylcholanthrene, 1-methylnaphthalene,

2-methylnaphthalene ,1-methylphenanthrene, 9-methylphenanthrene, naphthalene, perylene, phenanthrene, picene, pyrene, tetralin, triphenylene ,dibenzo(a,h)anthracene, dibenzo(a,e)pyrene quinoline, biphenyl, o-terphenyl, m-terphenyl, p-terphenyl.

2.2.3 HCl

The methodology used for monitoring of HCL, was replaced with an existing data set from York University, as described in Section 2.4.1.

2.2.4 VOCs

A non-continuous method for measurement of VOCs in ambient air is provided in the USEPA Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air: Method TO-15 Determination of Volatile Organic Compounds (VOCs) in Air Collected in Specially Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS). This non-continuous method uses evacuated canisters to collect VOCs in ambient air and analyzes a specific list (TO-15) of toxic organic VOCs.

The list of VOCs collected and analyzed for the Program is as follows:

Acetone, benzene, bromodichloromethane, bromoform, bromomethane, butadiene, 1,3-Butanone, 2-Carbon tetrachloride, chloroform, cumene, dibromochloromethane, dichlorodifluoromethane, dichloroethane, 1,2-Dichloroethene, trans - 1,2-Dichloroethene, 1,1-Dichloropropane, 1,2-Ethylbenzene, ethylene dibromide, mesitylene, methylene chloride, styrene, tetrachloroethene, toluene, trichloroethane, 1,1,1-Trichloroethene, trichloroethylene, 1,1,2-Trichlorofluoromethane, trichlorotrifluoroethane, vinyl chloride, xylenes, m-, p- and o.

2.3 Laboratory Analytical Procedures

All samples are analyzed following US EPA reference or equivalent methods as per the Manual. A summary of the parameters to be assessed by laboratory analytical procedures and their laboratory reference methods is provided below:

Parameter	Laboratory Reference Method
Total Suspended Particulate (TSP) and Metals	US EPA Manual Reference Method: 40 CFR Part 50, Appendix B Compendium Method IO-3 with Atomic Emission Spectroscopy/ Inductively Coupled Plasma (AES/ICP)
Polycyclic Aromatic Hydrocarbons (PAHs)	Gas Chromatography/Mass Spectrometry (GC/MS) following US EPA Method TO-13A
Dioxins and Furans	Gas Chromatography/Mass Spectrometry (GC/MS) following US EPA Method TO-9A
Hydrogen Chloride	Ion Chromatography (IC) UK Environmental Agency Technical Guidance Note (Monitoring) M8 (May,2011
Volatile Organic Compounds	Gas Chromatography/Mass Spectrometry (GC/MS) USEPA Method TO-15

2.4 Summary of Issues and/or Changes to the AAMP

2.4.1 HCl

HCl was included in the 2023/2024 background ambient air monitoring program based on comments from the MECP at the outset of the project. For HCl, there is no published reference sampling methodology available in the Operations Manual for Air Quality Monitoring in Ontario (Manual, MECP, 2021). In addition, no publicly available datasets are available in Ontario for the determination of background ambient air concentrations of HCl.

After researching various approaches for the monitoring of HCl for the project, it was evident that HCl measurements in ambient air using annular denuders would be the most practical approach, however the supply and analysis of denuders in Canada was not available in environmental laboratories. It was therefore decided to use an approach published for the collection and analysis of HCl in the UK Environmental Agency Technical Guidance Note (Monitoring) M8 (May,2011).[1] This approach utilized pumped (active) sampling through a midget impinger with dilute alkaline absorbent solution and analysis by ion chromatography. For the sampling, the pump was set to 2 L/min and collection was completed over 24 hours. A membrane filter was placed upstream of the midget impinger, to decrease the interferences of other chlorides in ambient air, since this method collects the chlorine atom and is not HCl specific. Other gas phase chemicals containing the chlorine atom that exist in the urban ambient air in the local environment are particulate and condensed salts (NaCl)[2] among others.

From the outset of the HCl sampling using this method there were issues in obtaining a method detection limit (MDL) below 40 µg/m^3. This value is already double the Ontario AAQC for HCl of 20 µg/m3. The sampling company worked with the laboratory to try to reduce the MDL to 12 µg/m3 that was proposed in the ambient air monitoring plan (AAMP), without success.

At the time of completion of the January 2024 Report the background value for HCl was based on the maximum 90th percentile value obtained from the upwind location from the data analyzed to that point. Between November 14, 2023 and January 31, 2024, both upwind and downwind monitoring stations had consistently higher values of HCl from a wide range of wind directions and wind speeds, indicating that no specific source was causing these elevated concentrations and that compounds containing the chlorine atom had become prevalent in the local ambient air. The interference of road salt, road spray aerosols, road salt brine on HCl measurements is discussed in the literature[3] and the timing of the elevated values in the winter months leads to the belief that these activities are the major cause of elevated chlorine readings (reported as HCl). This is supported by higher sodium values captured in the Emerald data during the winter months, especially at the upwind location that is located close to major roadways.

Therefore, the values measured for HCl by the UK method are not expected to be indicative of the actual background HCl concentrations. They are more representative of cumulatively quantified values of sodium chloride and other sources of chlorine in ambient air.

To further understand the actual ambient air concentrations of HCl in Ontario, GHD contacted Professor Cora Young[4] who is a Professor in the Department of Chemistry at York University and is an author of a recent study using HCl data collected at York University in 2019[5].

Continuous data for HCl was collected by York University using a Picarro Cavity Ring-down Spectrometer that can measure HCl specific data in the low part per trillion (ppt) range. The HCl data was collected on the roof of the Petrie Science and Engineering Building located on the York Campus. This is a local urban environment relatively close to the Emerald Facility and close to Highway 407.

The data was collected between April 3 and 11, 2019, and the highest HCl value recorded in the study was approximately 0.6ppbv (0.89 µg/m3). In a follow-up conversation with Professor Young, she mentioned that other measurements were taken after 2019 for a yet unpublished study and stated that the highest HCl value they have measured is 2ppbv (3 µg/m3). The methodology, QA and validation data for this study is available online[6].

GHD therefore replaced the data collected from the previous method with the maximum value measured in the York University studies noted above. The background value for HCl based on the York University study and presented in Table 1 is 3 µg/m3. Using this data, the background concentration of HCl is approximately 15% of the AAQC criteria for HCl of 20 µg/m3. In determining the 50th percentile concentrations for HCl, the average of the 2019 data set was used.

1 **https://assets.publishing.service.gov.uk/media/5a7da2e040f0b635051d05ff/TGN_M8_Monitoring_Ambient_Air.pdf**, Page 53
2 ACS Earth Space Chem. 2021, 5, 2507−2516, **https://doi.org/10.1021/acsearthspacechem.1c00193**
3 IBID
4 youngcj@yorku.ca
5 **https://www.frdr-dfdr.ca/repo/dataset/40bdff66-b522-4abe-b042-217785c9c4ca**
6 **https://amt.copernicus.org/articles/14/5859/2021/amt-14-5859-2021-discussion.html**

2.4.2 Sampling Locations

The sampling locations used in the Peel and Emerald AAMPs did not fully meet the siting criteria in the Manual due to the presence of trees and buildings. However, the sampling stations were in the same locations as the Peel AAMP and were in industrial/commercial areas close to residential areas upwind and downwind of Emerald. The locations therefore provided reasonable background data that may be representative of the areas around Emerald. Monitoring locations that will be used in any future monitoring of ambient air concentrations of air contaminants produced by the new Emerald Facility will need to be located such that all the siting criteria in the Manual are met.

The sampling locations used in the Peel and Emerald AAMPs may produce more conservative values for most compounds due to the sampling locations that are close to major roadways, and industrial and commercial sources.

3. Results and Discussion

3.1 Summary of Background Air Concentrations

A summary of the background air concentrations based on the sampling results of the multiple data sources is provided in Table 1. Generally, the 90th percentile of the measured background concentrations of each parameter at each station was used as a conservative estimate of the background. The maximum 90th percentile value of the upwind or downwind monitoring stations for the Peel and Emerald AQMPs was used as a conservative estimate of the background concentration. The exception to this was HCl, which used the York University maximum HCl concentration value as discussed in Section 2.4.1. For parameters with annual averaging times, each data point (1 hour or 24 hour) was converted to the annual value using MECP methodology before calculating the 90th percentile values.

For comparison, Table 2 shows the 50th percentile ambient air concentrations, which are significantly lower than the 90th percentile values in Table 1, and provides a more representative estimate of typical background concentrations.

In calculating the background concentrations for the Peel and Emerald AAMPs data, if the compound was not detected at the method detection limit (DL), the detection limit was used. This is a very conservative approach. This approach was used for all compounds except dioxins and furans, dioxin-like PCBs and benzo (a) pyrene. For dioxins and furans and dioxin-like PCBs the following methodology was used:

– For a positively identified target, the concentration was multiplied by the toxic equivalency factor (TEF) (WHO, 2005) for each target.
– For a non-detected compound (down to the DL), then the DL was multiplied by 0.5 and then multiplied by the TEF for each target.
– After these calculations were completed, the 90th percentile of the total TEQ values was determined.

In general, the detection limit for dioxins and furans was slightly below the AAQC limit of 0.1 pgTEQ/m3 and varied based on the analysis date and the sample volume collected.

Benzo(a)pyrene was also assessed at 0.5 of the DL for non-detects.

3.1.1 Representative Background Concentrations

In determining representative background concentrations for CACs, the 90th percentile 2023 Provincial AQ station data was used for those measured compounds as the Provincial data is considered the most accurate for these parameters.

In determining the representative background concentrations for most other parameters, the maximum of the 90th percentile concentrations of the Peel or Emerald AAMPs was generally used. The exception to this was HCl, which used the York University maximum HCl concentration value as discussed in Section 2.4.1.

The monitoring data sets estimated to provide the most representative background concentrations for total particulate matter (TSP), calcium, calcium oxide, and benzo(a)pyrene were as follows:

– Particulate TSP - maximum downwind 2023 90th percentile concentration excluding 5 outliers that were measured during the winter season. The outliers were removed because the meteorological data indicated higher than average winds were occurring during periods of road salt/fine gravel applications at the upwind and downwind locations and confirmed by higher sodium concentrations at both locations for these days.
– Calcium - maximum upwind Emerald 2023 90th percentile concentration due to evidence that calcium chloride was used as a dust suppressant at the downwind location.
– Calcium Oxide - maximum upwind Emerald 2023 90th percentile concentration which was derived from the calcium concentration.
– Benzo(a)Pyrene - 2023 NAPS 90th percentile concentration, which is indicative of the urban environment adjacent to a major 4 series highway.

3.1.2 Compounds with Values that Exceed the AAQC

There is one compound, benzo (a) pyrene, for which the estimated background concentrations exceed the AAQC limits.

The benzo(a)pyrene exceedance is based on the federal NAPS monitoring station data. The federal NAPS monitoring station data was used since the type of laboratory analysis used for the federal NAPS monitoring of benzo(a)pyrene, GC/MS, resulted in lower detection limits and more accurate results than the laboratory analysis method used for the Peel and Emerald AAMPs and is indicative of the urban environment adjacent to a major 4 series highway.

It should be noted that Emerald is a very small contributor to the overall benzo (a) pyrene background based on many years of stack test data that shows consistently low analytical results either at, or very slightly above the DL. Benzo (a) pyrene is a province-wide concern with background concentrations detected over the AAQC at multiple monitoring stations, particularly in urban areas with heavy commercial, industrial and road traffic emissions sources.

4. Conclusions

In determining representative ambient air background concentrations to be used for the airshed near the Emerald Facility, multiple data sources were examined. The data sources consisted of independently monitored data from locations upwind and downwind of the Emerald Facility in 2013/2014 by Peel and in 2023/2024 by Emerald at the same monitoring locations. Local federal NAPS and Ontario AQ stations were reviewed for the most recent data available publicly for 2013/2014 and 2021/2022/2023 to supplement the data collected from the independent monitoring undertaken by Peel and Emerald. Data collected by York University was used to estimate the background concentration of HCl.

The representative ambient air background concentrations are shown in Table 1 (90thpercentile except where noted) and Table 2 (50th percentile except where noted). The values in Table 1 were used as conservative estimates of the background air concentrations and added to the modelled concentrations for the Emerald facility expansion phases, to obtain estimates of the cumulative air contaminant concentrations, as documented in the Air Quality Impact Assessment Report.

This report: has been prepared by GHD for Emerald Energy From Waste and may only be used and relied on by Emerald Energy From Waste for the purpose agreed between GHD and Emerald Energy From Waste as set out in section [00] of this report.

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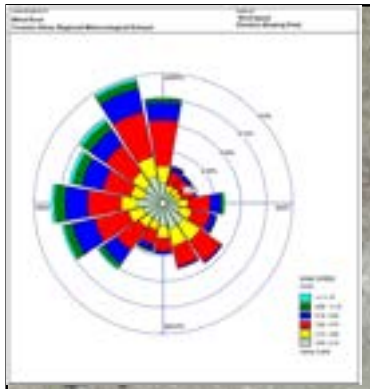
The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer section(s) [00] of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

Accessibility of documents

If this report is required to be accessible in any other format, this can be provided by GHD upon request and at an additional cost if necessary.



Legend

Monitoring Locations

525 Main St. N.

Upwind Station

Downwind Station

Emerald Site Location

109 Mclaughlin Rd. S.

125 Resources Rd.

2013/14, 2022 and 2023 Provincial Data (Station ID 35125 - Measured SO2 and CO)

2013/14, 2021 and 2022 Federal Data (NAPS ID 60430 - Measured SO2 and CO)

2021 and 2022 Federal Data (NAPS ID 60438 Measured PAHs and VOCs)

223 College Street Toronto

2013/14 Federal Data (NAPS ID 60427 - Measured PAHs)

2022 and 2023 Provincial Data (Station ID 46090 - Measured NO,NO2, NOx, O3 and PM 2.5)

2021 and 2022 Federal Data (NAPS ID 60450 - Measured NO,NO2, NOx, O3 and PM 2.5)

2013/14, 2022 and 2023 Provincial Data (Station ID 46089 - Measured NO,NO2, NOx, O3 and PM 2.5)

2013/14, 2021 and 2022 Federal Data (NAPS ID 60428 - Measured NO,NO2, NOx, O3 and PM 2.5)

2013/14 Federal Data (NAPS ID 60428 - Measured VOCs)

Note:

SO2 - Sulphur dioxide
CO - Carbon monoxide
NO - Nitric oxide
NO2 - Nitrogen dioxide
NOx - Nitrogen oxides
O3 - Ozone
PM 2.5 - Particulate matter 2.5

Scale 1:150,000

0 1,500 3,000 4,500

Meters

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983
Grid: NAD 1983 UTM Zone 17N

N

GHD

EMERALD ENERGY FROM WASTE INC.
MISSISSAUGA, ON

Project No. **12593193**
Revision No. **-**
Date **Jun 25, 2024**

LOCATIONS OF AMBIENT AIR MONITORING STATIONS

FIGURE 1

Q:\GIS\PROJECTS\12593000s\12593193\Layouts\202401_MISC001\12593193_202401_MISC001_GIS001.mxd
Print date: 25 Jun 2024 - 12:22

Data source: Image: © Municipality of Peel (Peel Region), 2020; Wind Rose: Created by GHD on October 17, 2022 using the Toronto Urban Regional Meteorological Dataset from January 1, 1996 - December 31, 2000; Ambient Air Monitoring Locations: Created by GHD April 28, 2023

Table 1

Summary of 90th Percentile Background Ambient Air Concentrations
Emerald Energy from Waste
Brampton, Ontario

Pollutants	CAS No.	Project Criteria (ug/m3)	Averaging Period	Criteria Source	Upwind Station (µg/m3)			Downwind Station (µg/m3)			NAPS Data (µg/m3)			Provincial Data (µg/m3)			York University [5] (µg/m3)	Background Concentration [1,2] (µg/m3)	% of Criteria
					Peel AAMP	Emerald AAMP	Max	Peel AAMP	Emerald AAMP	Max	2013/14	2021	2022	2013/14	2022	2023			
Suspended Particulate Matter	NA-PM	120	24-Hour	Ontario AAQC	59.61	102.66	102.66	164.80	104.82	164.80	NA	NA	NA	NA	NA	NA		104.82	87.35%
Suspended Particulate Matter	NA-PM	60	Annual	Ontario AAQC	11.43	26.41	26.41	30.76	24.12	30.76	NA	NA	NA	NA	NA	NA		24.12	40.20%
Nitrogen Dioxides	10102-44-0	79.018	1-Hour	Ontario AAQC	42.07	94.20	94.20	63.37	85.45	85.45	39.51	28.22	33.87	39.51	33.87	32.36		32.36	40.95%
Nitrogen Dioxides	10102-44-0	400	1-Hour	Ontario AAQC	42.07	94.20	94.20	63.37	85.45	85.45	39.51	28.22	33.87	39.51	33.87	32.36		32.36	8.09%
Nitrogen Dioxides	10102-44-0	200	24-Hour	Ontario AAQC	34.82	87.70	87.70	34.13	87.84	87.84	15.80	11.29	13.55	15.80	13.55	12.94		12.94	6.47%
Nitrogen Dioxides	10102-44-0	22.577	Annual	CAAQS	6.67	4.08	6.67	9.75	3.69	9.75	3.11	2.22	2.67	3.11	2.67	2.55		2.55	11.28%
Carbon Monoxide	630-08-0	6000	½-Hour	Schedule 3 POI	531.71	1208.65	1208.65	700.32	965.27	965.27	522.21	480.98	494.72	522.21	494.72	522.21		522.21	8.70%
Carbon Monoxide	630-08-0	36200	1-Hour	Ontario AAQC	437.91	1007.21	1007.21	576.77	804.39	804.39	435.17	400.82	412.27	435.17	412.27	435.17		435.17	1.20%
Carbon Monoxide	630-08-0	15700	8-Hour	Ontario AAQC	422.83	910.05	910.05	477.89	792.34	792.34	58.02	53.44	54.97	58.02	54.97	58.02		58.02	0.37%
Sulphur Dioxide	7446-09-5	10	Annual	Schedule 3 POI	1.40	0.26	1.40	1.45	0.44	1.45	0.41	0.10	0.12	0.41	0.12	0.082		0.08	0.82%
Sulphur Dioxide	7446-09-5	100	1-Hour	Schedule 3 POI	8.20	3.35	8.20	8.60	5.62	8.60	5.24	1.31	1.57	5.24	1.57	1.05		1.05	1.05%
Sulphur Dioxide	7446-09-5	178.220	10-minute	Ontario AAQC	13.55	5.53	13.55	14.20	9.27	14.20	8.64	2.16	2.59	8.64	2.59	1.73		1.73	0.97%
Organic matter (expressed as equivalent methane)	74-82-8	37330	24-Hour	Schedule 3 POI	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	not measured
Ozone	10028-15-6	165	1-Hour	Ontario AAQC	134.40	75.54	134.40	93.17	63.45	93.17	84.42	84.42	82.45	84.42	82.45	86.38		86.38	52.35%
Ozone	10028-15-6	117.791	8-Hour	CAAQS	124.19	71.76	124.19	87.46	60.38	87.46	11.26	11.26	10.99	11.26	10.99	11.52		11.52	9.78%
PM10	NA-PM10	50	24-Hour	Ontario AAQC	42.95	27.98	42.95	39.11	51.66	51.66	14.07	10.37	9.63	14.07	9.63	11.11		11.11	22.22%
PM2.5	NA-PM2.5	27	24-Hour	Ontario AAQC	23.11	14.88	23.11	21.04	25.17	25.17	7.60	5.60	5.20	7.60	5.20	6.00		6.00	22.22%
PM2.5	NA-PM2.5	8.8	Annual	Ontario AAQC	4.43	1.23	4.43	4.03	2.10	4.03	1.50	1.10	1.34	1.50	1.02	1.18		1.18	13.42%
Aluminum	7429-90-5	12	24-Hour	Schedule 3 POI	0.26	0.26	0.26	0.65	0.45	0.65	NA	NA	NA	NA	NA	NA		0.65	5.40%
Aluminum Oxide[4]	1344-28-1	120	24-Hour	Ontario AAQC	0.49	0.49	0.49	1.23	0.85	1.23	NA	NA	NA	NA	NA	NA		1.23	1.02%
Antimony	7440-36-0	25	24-Hour	Ontario AAQC	0.0059	0.0060	0.0060	0.0059	0.0060	0.0060	NA	NA	NA	NA	NA	NA		0.0060	0.02%
Arsenic	7440-38-2	0.3	24-Hour	Ontario AAQC	0.0035	0.0036	0.0036	0.0035	0.0036	0.0036	NA	NA	NA	NA	NA	NA		0.0036	1.20%
Barium	7440-39-3	10	24-Hour	Ontario AAQC	0.039	0.045	0.045	0.032	0.039	0.039	NA	NA	NA	NA	NA	NA		0.045	0.45%
Beryllium	7440-41-7	0.01	24-Hour	Ontario AAQC	0.00059	0.00060	0.00060	0.00059	0.00060	0.00060	NA	NA	NA	NA	NA	NA		0.00060	6.02%
Boron	7440-42-8	120	24-Hour	Ontario AAQC	0.0070	0.0061	0.0070	0.0065	0.0079	0.0079	NA	NA	NA	NA	NA	NA		0.0079	0.01%
Cadmium	7440-43-9	0.025	24-Hour	Ontario AAQC	0.0012	0.0012	0.0012	0.0012	0.0012	0.0012	NA	NA	NA	NA	NA	NA		0.0012	4.82%
Cadmium	7440-43-9	0.005	Annual	Ontario AAQC	0.00022	0.00023	0.00023	0.00023	0.00023	0.00023	NA	NA	NA	NA	NA	NA		0.0002	4.62%
Calcium	7440-70-2	10	24-Hour	Ontario AAQC	NA	4.47	4.47	NA	12.59	12.59	NA	NA	NA	NA	NA	NA		4.47	44.66%
Calcium Oxide[4]	1305-78-8	10	24-Hour	Ontario AAQC	NA	6.25	6.25	NA	17.62	17.62	NA	NA	NA	NA	NA	NA		6.25	62.53%
Chromium	7440-47-3	0.5	24-Hour	Ontario AAQC	0.0041	0.0039	0.0041	0.0050	0.0050	0.0050	NA	NA	NA	NA	NA	NA		0.0050	1.01%
Cobalt	7440-48-4	0.1	24-Hour	Ontario AAQC	0.0012	0.0012	0.0012	0.0012	0.0012	0.0012	NA	NA	NA	NA	NA	NA		0.0012	1.20%
Copper	7440-50-8	50	24-Hour	Ontario AAQC	0.23	0.21	0.23	0.11	0.58	0.58	NA	NA	NA	NA	NA	NA		0.58	1.17%
Iron	7439-89-6	4	24-Hour	Ontario AAQC	0.97	1.01	1.01	2.19	1.59	2.19	NA	NA	NA	NA	NA	NA		2.19	54.78%
Lead	7439-92-1	0.2	30-Day	Ontario AAQC	0.0026	0.0020	0.0026	0.0046	0.0032	0.0046	NA	NA	NA	NA	NA	NA		0.005	2.31%
Lead	7439-92-1	0.5	24-Hour	Ontario AAQC	0.0069	0.0052	0.0069	0.012	0.0082	0.012	NA	NA	NA	NA	NA	NA		0.012	2.40%
Lithium	7439-93-2	20	24-Hour	Ontario AAQC	NA	0.016	0.016	NA	0.016	0.016	NA	NA	NA	NA	NA	NA		0.016	0.08%
Magnesium	7439-95-4	72	24-Hour	Schedule 3 POI	1.06	1.00	1.06	6.46	3.48	6.46	NA	NA	NA	NA	NA	NA		6.46	8.98%
Magnesium oxide[4]	1309-48-4	120	24-Hour	Ontario AAQC	1.76	1.67	1.76	10.73	5.78	10.73	NA	NA	NA	NA	NA	NA		10.73	8.94%
Manganese	7439-96-5	0.4 (as SPM)	24-Hour	Ontario AAQC	NA	0.028	0.028	NA	0.061	0.061	NA	NA	NA	NA	NA	NA		0.061	15.25%
Manganese	7439-96-5	0.1 (as PM2.5)	24-Hour	Ontario AAQC	NA	0.028	0.028	NA	0.061	0.061	NA	NA	NA	NA	NA	NA		0.061	60.99%
Manganese	7439-96-5	0.2 (as PM10)	24-Hour	Ontario AAQC	NA	0.028	0.028	NA	0.061	0.061	NA	NA	NA	NA	NA	NA		0.061	30.49%
Molybdenum	7439-98-7	120	24-Hour	Ontario AAQC	0.0018	0.0104	0.0104	0.0018	0.018	0.018	NA	NA	NA	NA	NA	NA		0.018	0.01%
Nickel	7440-02-0	0.02 (as PM10)	Annual	Ontario AAQC	0.00066	0.00037	0.00066	0.00077	0.00059	0.00077	NA	NA	NA	NA	NA	NA		0.0008	3.83%
Nickel	7440-02-0	0.04 (as SPM)	Annual	Ontario AAQC	0.00066	0.00037	0.00066	0.00077	0.00059	0.00077	NA	NA	NA	NA	NA	NA		0.0008	1.92%
Nickel	7440-02-0	0.1 (as PM10)	24-Hour	Ontario AAQC	0.0034	0.0019	0.0034	0.0040	0.0031	0.0040	NA	NA	NA	NA	NA	NA		0.0040	4.00%
Nickel	7440-02-0	0.2 (as SPM)	24-Hour	Ontario AAQC	0.0034	0.0019	0.0034	0.0040	0.0031	0.0040	NA	NA	NA	NA	NA	NA		0.0040	2.00%
Phosphorus	7723-14-0	0.5	24-Hour	Schedule 3 POI	0.051	0.044	0.051	0.079	0.063	0.079	NA	NA	NA	NA	NA	NA		0.079	15.81%
Phosphorous pentachloride[4]	10026-13-8	10	24-Hour	Ontario AAQC	0.34	0.29	0.34	0.53	0.42	0.53	NA	NA	NA	NA	NA	NA		0.53	5.32%
Selenium	7782-49-2	10	24-Hour	Ontario AAQC	0.0061	0.0061	0.0061	0.0059	0.0060	0.0060	NA	NA	NA	NA	NA	NA		0.0061	0.06%
Silver	7440-22-4	1	24-Hour	Ontario AAQC	0.0029	0.0030	0.0030	0.0030	0.0030	0.0030	NA	NA	NA	NA	NA	NA		0.0030	0.30%
Sodium	7440-23-5	10	24-Hour	Ontario AAQC	NA	3.83	3.83	NA	1.76	1.76	NA	NA	NA	NA	NA	NA		3.83	38.27%
Sodium hydroxide[4]	1310-73-2	10	24-Hour	Ontario AAQC	NA	6.66	6.66	NA	3.05	3.05	NA	NA	NA	NA	NA	NA		6.66	66.59%
Strontium	7440-24-6	120	24-Hour	Ontario AAQC	0.0090	0.0113	0.0113	0.028	0.022	0.028	NA	NA	NA	NA	NA	NA		0.028	0.02%
Tin	7440-31-5	10	24-Hour	Ontario AAQC	0.0059	0.0082	0.0082	0.0059	0.0060	0.0060	NA	NA	NA	NA	NA	NA		0.0082	0.08%
Titanium	7440-32-6	120	24-Hour	Ontario AAQC	0.017	0.021	0.021	0.033	0.025	0.033	NA	NA	NA	NA	NA	NA		0.033	0.03%
Vanadium	7440-62-2	2	24-Hour	Ontario AAQC	0.0029	0.0030	0.0030	0.0036	0.0030	0.0036	NA	NA	NA	NA	NA	NA		0.0036	0.18%
Zinc	7440-66-6	120	24-Hour	Ontario AAQC	0.066	0.09	0.09	0.16	0.12	0.16	NA	NA	NA	NA	NA	NA		0.16	0.13%
Silicon	7440-21-3	27	24-Hour	Schedule 3 POI	NA	0.17	0.17	NA	0.20	0.20	NA	NA	NA	NA	NA	NA		0.20	0.76%
Silica[4]	14464-46-1	5	24-Hour	Ontario AAQC	NA	0.36	0.36	NA	0.44	0.44	NA	NA	NA	NA	NA	NA		0.44	8.73%
Mercury	7439-97-6	2	24-Hour	Ontario AAQC	0.000017	0.000017	0.000017	0.000030	0.000030	0.000030	NA	NA	NA	NA	NA	NA		0.000030	0.0015%
Mercury (as Hg) – alkyl compounds	7439-97-6	0.5	24-Hour	Ontario AAQC	0.000017	0.000017	0.000017	0.000030	0.000030	0.000030	NA	NA	NA	NA	NA	NA		0.000030	0.0061%
Hydrogen Chloride	7647-01-0	20	24-Hour	Ontario AAQC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3	3.00	15.00%
Hydrogen Fluoride	7664-39-3	1.72	24-Hour	Ontario AAQC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	not measured
Hydrogen Fluoride	7664-39-3	0.69	30-Day	Ontario AAQC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	not measured
1,1,1-Trichloroethane	71-55-6	115000	24-Hour	Ontario AAQC	0.30	0.57	0.57	0.28	0.71	0.71	0.033	0.010	0.0090	NA	NA	NA		0.71	0.00062%
1,1-Dichloroethane	75-34-3	165	24-Hour	Ontario AAQC	0.20	0.42	0.42	0.20	0.42	0.42	0.00	0.0087	0.0060	NA	NA	NA		0.42	0.26%
1,2-Dichloroethane	107-06-2	2	24-Hour	Ontario AAQC	0.20	0.42	0.42	0.13	0.42	0.42	0.076	0.079	0.062	NA	NA	NA		0.42	21.22%
1,2-Dichloroethane	107-06-2	0.4	Annual	Ontario AAQC	0.039	0.081	0.081	0.024	0.081	0.081	0.015	0.014	0.012	NA	NA	NA		0.08	20.34%
1,2-Dichloropropane	78-87-5	2400	24-Hour	Ontario AAQC	0.40	0.49	0.49	0.23	0.49	0.49	0.023	0.021	0.023	NA	NA	NA		0.49	0.020%
1,3,5-Trimethylbenzene	108-67-8	220	24-Hour	Ontario AAQC	NA	2.58	2.58	NA	2.58	2.58	0.13	0.063	0.068	NA	NA	NA		2.58	1.17%
1,3-Butadiene	106-99-0	10	24-Hour	Ontario AAQC	NA	1.16	1.16	NA	1.16	1.16	0.079	0.066	0.076	NA	NA	NA		1.16	11.61%
1,3-Butadiene	106-99-0	2	Annual	Ontario AAQC	NA	0.22	0.22	NA	0.22	0.22	0.015	0.015	0.014	NA	NA	NA		0.22	11.13%
2-Butanone	78-93-3	1000	24-Hour	Ontario AAQC	3.00	2.84	3.00	8.70	2.63	8.70	NA	NA	NA	NA	NA	NA		8.70	0.87%
Acetone	67-64-1	11880	24-Hour	Ontario AAQC	18.45	NA	18.45	12.61	NA	12.61	NA	NA	NA	NA	NA	NA		18.45	0.16%
Benzene	71-43-2	0.45	Annual	Ontario AAQC	0.18	0.20	0.20	0.20	0.17	0.20	0.15	0.13	0.11	NA	NA	NA		0.20	45.41%
Benzene	71-43-2	2.3	24-Hour	Ontario AAQC	0.93	1.05	1.05	1.07	0.88	1.07	0.79	0.66	0.63	NA	NA	NA		1.07	46.35%
Bromodichloromethane	75-27-4	350	24-Hour	Schedule 3 POI	0.34	1.41	1.41	0.34	1.41	1.41	0.018	NA	NA	NA	NA	NA		1.41	0.40%
Bromoform	75-25-2	55	24-Hour	Ontario AAQC	1.05	2.17	2.17	1.05	2.17	2.17	0.022	0.025	0.027	NA	NA	NA		2.17	3.95%
Bromomethane	74-83-9	1350	24-Hour	Ontario AAQC	0.20	0.41	0.41	0.20	0.41	0.41	0.060	0.038	0.033	NA	NA	NA		0.41	0.030%
Carbon Tetrachloride	56-23-5	2.4	24-Hour	Ontario AAQC	0.68	0.66	0.68	0.68	0.66	0.68	0.62	0.55	0.47	NA	NA	NA		0.68	28.42%
Chlorodibromomethane	124-48-1	0.2	24-Hour	Schedule 3 POI	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	not measured
Chloroform	67-66-3	1	24-Hour	Ontario AAQC	0.20	0.26	0.26	0.20	0.26	0.26	0.19	0.15	0.15	NA	NA	NA		0.26	25.62%
Chloroform	67-66-3	0.2	Annual	Ontario AAQC	0.038	0.098	0.098	0.038	0.098	0.10	0.036	0.029	0.028	NA	NA	NA		0.10	49.11%
Dichlorofluoromethane	75-43-4	500	24-Hour	Schedule 3 POI	NA	2.85	2.85	NA	2.84	2.84	NA	NA	NA	NA	NA	NA		2.85	0.57%
Ethylbenzene	100-41-4	1000	24-Hour	Ontario AAQC	0.58	1.49	1.49	1.16	0.81	1.16	0.41	0.27	0.31	NA	NA	NA		1.49	0.15%
Ethylbenzene	100-41-4	1900	10-minute	Ontario AAQC	2.32	6.17	6.17	4.65	3.35	4.65	1.70	1.11	1.29	NA	NA	NA		6.17	0.32%
Ethylene Dibromide	106-93-4	3	24-Hour	Ontario AAQC	0.17	0.81	0.81	0.078	0.81	0.81	NA	NA	NA	NA	NA	NA		0.81	26.88%
Isopropylbenzene	98-82-8	400	24-Hour	Ontario AAQC	NA	NA	NA	NA	NA	NA	0.031	0.019	0.018	NA	NA	NA		NA	not measured
Xylenes	1330-20-7	730	24-Hour	Ontario AAQC	2.36	4.58	4.58	5.05	2.50	5.05	NA	NA	NA	NA	NA	NA		5.05	0.69%
Xylenes	1330-20-7	3000	10-minute	Ontario AAQC	9.48	18.88	18.88	20.31	10.33	20.31	NA	NA	NA	NA	NA	NA		20.31	0.68%
Methylene Chloride	75-09-2	220	24-Hour	Ontario AAQC	1.17	2.94	2.94	0.96	2.93	2.93	NA	NA	NA	NA	NA	NA		2.94	1.34%
Methylene Chloride	75-09-2	44	Annual	Ontario AAQC	0.22	0.56	0.56	0.18	0.56	0.56	NA	NA	NA	NA	NA	NA		0.56	1.28%
Styrene	100-42-5	400	24-Hour	Ontario AAQC	0.25	0.45	0.45	0.31	2.02	2.02	0.13	0.30	0.32	NA	NA	NA		2.02	0.51%
Tetrachloroethene	127-18-4	360	24-Hour	Ontario AAQC	0.34	NA	0.34	0.64	NA	0.64	0.17	0.11	0.13	NA	NA	NA		0.64	0.18%
Toluene	108-88-3	2000	24-Hour	Ontario AAQC	3.85	5.42	5.42	4.80	3.79	4.80	3.00	2.05	2.12	NA	NA	NA		5.42	0.27%
Trichloroethylene	79-01-6	12	24-Hour	Ontario AAQC	0.30	2.76	2.76	0.30	2.14	2.14	0.10	0.085	0.066	NA	NA	NA		2.76	22.99%
Trichloroethylene	79-01-6	2.3	Annual	Ontario AAQC	0.066	0.53	0.53	0.06	0.41	0.41	0.020	0.028	0.013	NA	NA	NA		0.53	22.99%

Table 1

Summary of 90th Percentile Background Ambient Air Concentrations
Emerald Energy from Waste
Brampton, Ontario

Pollutants	CAS No.	Project Criteria (ug/m3)	Averaging Period	Criteria Source	Upwind Station (µg/m3)			Downwind Station (µg/m3)			NAPS Data (µg/m3)			Provincial Data (µg/m3)			York University [5] (µg/m3)	Background Concentration [1,2] (µg/m3)	% of Criteria
					Peel AAMP	Emerald AAMP	Max	Peel AAMP	Emerald AAMP	Max	2013/14	2021	2022	2013/14	2022	2023			
Trichlorofluoromethane	75-69-4	6000	24-Hour	Schedule 3 POI	2.05	1.53	2.05	2.02	1.57	2.02	1.79	1.42	1.35	NA	NA	NA		2.05	0.034%
Trichlorotrifluoroethane	76-13-1	800000	24-Hour	Ontario AAQC	NA	1.21	1.21	NA	1.21	1.21	NA	NA	NA	NA	NA	NA		1.21	0.00015%
Vinyl Chloride	75-01-4	1	24-Hour	Ontario AAQC	0.18	0.27	0.27	0.052	0.27	0.27	0.0040	0.0024	0.0030	NA	NA	NA		0.27	26.83%
Vinyl Chloride	75-01-4	0.2	Annual	Ontario AAQC	0.035	0.051	0.051	0.010	0.051	0.051	0.00077	0.00044	0.00038	NA	NA	NA		0.05	25.71%
Formaldehyde	50-00-0	65	24-Hour	Ontario AAQC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	not measured
Acetaldehyde	75-07-0	500	½-Hour	Ontario AAQC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	not measured
Acetaldehyde	75-07-0	500	24-Hour	Ontario AAQC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	not measured
Acrolein	107-02-8	4.5	1-Hour	Ontario AAQC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	not measured
Acrolein	107-02-8	0.4	24-Hour	Ontario AAQC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	not measured
1-Methylnaphthalene	90-12-0	35.5	24-Hour	De Minimis	0.00095	0.011	0.011	0.0029	0.014	0.014	NA	NA	NA	NA	NA	NA		0.014	0.041%
1-Methylphenanthrene	832-69-9	0.1	24-Hour	De Minimis	0.00077	0.0012	0.0012	0.00078	0.0010	0.0010	NA	NA	NA	NA	NA	NA		0.0012	1.22%
2-Chloronaphthalene	91-58-7	1	24-Hour	Schedule 3 POI	0.00050	0.00057	0.00057	0.00050	0.00057	0.00057	NA	NA	NA	NA	NA	NA		0.00057	0.057%
2-methylanthracene	613-12-7	0.1	24-Hour	De Minimis	0.00050	0.00057	0.00057	0.00051	0.00057	0.00057	NA	NA	NA	NA	NA	NA		0.00057	0.57%
2-Methylnaphthalene	91-57-6	35.5	24-Hour	Schedule 3 POI	0.0017	0.022	0.022	0.0055	0.026	0.026	NA	NA	NA	NA	NA	NA		0.026	0.07%
3-Methylcholanthrene	56-49-5	0.1	24-Hour	De Minimis	0.010	0.00057	0.010	0.010	0.00057	0.010	0.00	0.00	0.00	NA	NA	NA		0.010	10.07%
7,12-Dimethylbenzo(a)anthracene	57-97-6	0.1	24-Hour	De Minimis	0.00050	0.0022	0.0022	0.00050	0.0022	0.0022	NA	NA	NA	NA	NA	NA		0.0022	2.24%
9,10-dimethylanthracene	781-43-1	0.1	24-Hour	De Minimis	0.0020	0.0008	0.0020	0.0020	0.0010	0.0020	NA	NA	NA	NA	NA	NA		0.0020	2.01%
9-Methylphenanthrene	883-20-5	0.1	24-Hour	De Minimis	NA	0.0031	0.0031	NA	0.008	0.008	NA	NA	NA	NA	NA	NA		0.008	8.06%
Acenaphthene	83-32-9	0.1	24-Hour	De Minimis	0.00030	0.0026	0.0026	0.0058	0.008	0.008	0.0014	0.0013	0.0020	NA	NA	NA		0.008	7.94%
Acenaphthylene	208-96-8	0.1	24-Hour	De Minimis	0.00039	0.00067	0.00067	0.0018	0.00136	0.0018	0.00056	0.00071	0.0011	NA	NA	NA		0.0018	1.85%
Anthracene	120-12-7	0.1	24-Hour	De Minimis	0.00025	0.00092	0.00092	0.0010	0.0011	0.0011	0.00030	0.00081	0.00099	NA	NA	NA		0.0011	1.11%
Benzo(a)Anthracene	56-55-3	0.1	24-Hour	De Minimis	0.00025	0.00057	0.00057	0.00026	0.00057	0.00057	NA	NA	NA	NA	NA	NA		0.00057	0.57%
Benzo(a)fluorene	238-84-6	0.1	24-Hour	De Minimis	0.00050	0.00057	0.00057	0.00050	0.00060	0.00060	0.000055	0.00008	0.000082	NA	NA	NA		0.00060	0.60%
Benzo(a)Pyrene[3]	50-32-8	0.00001	Annual	Ontario AAQC	0.0000078	0.000022	0.000022	0.000031	0.000025	0.000031	0.000016	0.000011	0.000018	NA	NA	NA		0.000018	183.43%
Benzo(a)Pyrene[3]	50-32-8	0.00005	24-Hour	Ontario AAQC	0.000041	0.00012	0.0001	0.00018	0.00013	0.00018	0.000084	0.000062	0.00011	NA	NA	NA		0.00011	210.88%
Benzo(b)Fluoranthene	205-99-2	0.1	24-Hour	De Minimis	0.00028	0.00057	0.00057	0.00039	0.00057	0.00057	0.00025	0.000171	0.00016	NA	NA	NA		0.00057	0.57%
Benzo(b)fluorene	243-17-4	0.1	24-Hour	De Minimis	0.00050	0.00057	0.00057	0.00050	0.00057	0.00057	0.000034	0.00005164	0.000048	NA	NA	NA		0.00057	0.57%
Benzo(e)Pyrene	192-97-2	0.1	24-Hour	De Minimis	0.00050	0.00056	0.00056	0.00050	0.00057	0.00057	0.00013	0.000134	0.00014	NA	NA	NA		0.00057	0.57%
Benzo(g,h,i)Perylene	191-24-2	0.1	24-Hour	De Minimis	0.00027	0.00057	0.00057	0.00032	0.00057	0.00057	0.00016	0.00017	0.00020	NA	NA	NA		0.00057	0.57%
Benzo(j / k)Fluoranthene	76774-50-0	0.1	24-Hour	De Minimis	0.00025	0.00057	0.00057	0.00026	0.00057	0.00057	NA	NA	NA	NA	NA	NA		0.00057	0.57%
Biphenyl	92-52-4	60	1-Hour	Ontario AAQC	0.0019	0.011	0.011	0.011	0.016	0.016	NA	NA	NA	NA	NA	NA		0.016	0.027%
Chrysene	218-01-9	0.1	24-Hour	De Minimis	0.00025	0.00057	0.00057	0.00039	0.00073	0.00073	0.00018	0.00017	0.00018	NA	NA	NA		0.00073	0.73%
Triphenylene	217-59-4	0.1	24-Hour	De Minimis	0.00033	0.00057	0.00057	0.00050	0.00057	0.00057	0.000064	0.000067	0.000070	NA	NA	NA		0.00057	0.57%
Coronene	191-07-1	0.1	24-Hour	De Minimis	0.00050	0.00057	0.00057	0.00050	0.00057	0.00057	NA	NA	NA	NA	NA	NA		0.00057	0.57%
Dibenzo(a,c/a,h)Anthracene	53-70-3	0.1	24-Hour	De Minimis	0.00025	0.00056	0.00056	0.00025	0.00056	0.00056	NA	NA	NA	NA	NA	NA		0.00056	0.56%
Dibenzo(a,e)pyrene	192-65-4	0.1	24-Hour	De Minimis	0.0010	0.00057	0.0010	0.0010	0.00057	0.0010	NA	NA	NA	NA	NA	NA		0.0010	1.01%
Fluoranthene	206-44-0	0.1	24-Hour	De Minimis	0.0019	0.0011	0.0019	0.0044	0.0051	0.0051	0.0020	0.0028	0.0021	NA	NA	NA		0.0051	5.12%
Fluorene	86-73-7	0.1	24-Hour	De Minimis	0.00099	0.0036	0.0036	0.0084	0.0060	0.0084	0.0035	0.0028	0.0028	NA	NA	NA		0.0084	8.42%
Indeno(1,2,3-cd)Pyrene	193-39-5	0.1	24-Hour	De Minimis	0.00025	0.00057	0.00057	0.00029	0.00057	0.00057	0.00012	0.000103	0.00012	NA	NA	NA		0.00057	0.57%
m-terphenyl	92-06-8	0.1	24-Hour	De Minimis	0.00050	0.00057	0.00057	0.00050	0.00057	0.00057	NA	NA	NA	NA	NA	NA		0.00057	0.57%
Naphthalene	91-20-3	22.5	24-Hour	Ontario AAQC	0.0078	0.061	0.061	0.0058	0.064	0.064	0.21	0.12	0.10	NA	NA	NA		0.064	0.28%
Naphthalene	91-20-3	50	10-minute	Ontario AAQC	0.032	0.25	0.25	0.024	0.26	0.26	0.85	0.50	0.41	NA	NA	NA		0.26	0.53%
o-Terphenyl	84-15-1	0.1	24-Hour	De Minimis	0.00050	0.00057	0.00057	0.00050	0.00057	0.00057	NA	NA	NA	NA	NA	NA		0.00057	0.57%
Perylene	198-55-0	0.1	24-Hour	De Minimis	0.00050	0.00057	0.00057	0.00050	0.00057	0.00057	0.000020	0.000018	0.000024	NA	NA	NA		0.00057	0.57%
Phenanthrene	85-01-8	0.1	24-Hour	De Minimis	0.0073	0.010	0.010	0.034	0.020	0.034	0.013	0.012	0.012	NA	NA	NA		0.034	33.90%
Picene	213-46-7	0.1	24-Hour	De Minimis	0.00050	0.00056	0.00056	0.00050	0.00056	0.00056	NA	NA	NA	NA	NA	NA		0.00056	0.56%
p-terphenyl	92-94-4	0.1	24-Hour	De Minimis	0.00050	0.00057	0.00057	0.00050	0.00057	0.00057	NA	NA	NA	NA	NA	NA		0.00057	0.57%
Pyrene	129-00-0	0.1	24-Hour	De Minimis	0.0013	0.0012	0.0013	0.0026	0.0041	0.0041	0.0012	0.0019	0.0018	NA	NA	NA		0.0041	4.08%
Quinoline	91-22-5	0.005	24-Hour	Schedule 3 POI	0.0020	0.0010	0.0020	0.0020	0.0014	0.0020	NA	NA	NA	NA	NA	NA		0.0020	40.26%
Tetralin	119-64-2	151.5	24-Hour	Schedule 3 POI	0.00050	0.0073	0.0073	0.00051	0.012	0.012	NA	NA	NA	NA	NA	NA		0.012	0.0077%
2,6-Dichlorophenol	87-65-0	19	24-Hour	Schedule 3 POI	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	not measured
2,4/2,5-Dichlorophenol	120-83-2	33.5	24-Hour	Schedule 3 POI	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	not measured
3,5-Dichlorophenol	591-35-5	0.1	24-Hour	De Minimis	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	not measured
2,3-Dichlorophenol	576-24-9	0.1	24-Hour	De Minimis	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	not measured
3,4-Dichlorophenol	95-77-2	0.1	24-Hour	De Minimis	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	not measured
2,4,6-Trichlorophenol	88-06-2	1.5	24-Hour	Schedule 3 POI	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	not measured
2,3,6-Trichlorophenol	933-75-5	0.1	24-Hour	De Minimis	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	not measured
2,3,5-Trichlorophenol	933-78-8	0.1	24-Hour	De Minimis	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	not measured
2,4,5-Trichlorophenol	95-95-4	220	24-Hour	Schedule 3 POI	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	not measured
2,3,4-Trichlorophenol	15950-66-0	0.1	24-Hour	De Minimis	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	not measured
3,4,5-Trichlorophenol	609-19-8	0.1	24-Hour	De Minimis	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	not measured
2,3,4,6-Tetrachlorophenol	58-90-2	0.75	24-Hour	Schedule 3 POI	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	not measured
2,3,4,5-Tetrachlorophenol	4901-51-3	0.1	24-Hour	De Minimis	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	not measured
Pentachlorophenol	87-86-5	20	24-Hour	Schedule 3 POI	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	not measured
1,3-Dichlorobenzene	541-73-1	50	24-Hour	Schedule 3 POI	NA	2.52	2.52	NA	2.52	2.52	0.0042	0.0026	0.0020	NA	NA	NA		2.52	5.05%
1,4-Dichlorobenzene	106-46-7	95	24-Hour	Ontario AAQC	0.40	0.63	0.63	0.35	0.85	0.85	0.085	0.083	0.067	NA	NA	NA		0.85	0.90%
1,2-Dichlorobenzene	95-50-1	30500	1-Hour	Ontario AAQC	0.97	1.58	1.58	0.74	1.58	1.58	0.010	0.0105	0.0040	NA	NA	NA		1.58	0.0052%
1,3,5-Trichlorobenzene	108-70-3	3.6	24-Hour	Schedule 3 POI	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	not measured
1,2,4-Trichlorobenzene	120-82-1	400	24-Hour	Ontario AAQC	2.00	3.89	3.89	0.75	3.89	3.89	0.010	0.020	0.012	NA	NA	NA		3.89	0.97%
1,2,3-Trichlorobenzene	87-61-6	135	24-Hour	Schedule 3 POI	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	not measured
1,2,3,5/1,2,4,5-Tetrachlorobenzene	95-94-3	1	24-Hour	Schedule 3 POI	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	not measured
1,2,3,4-Tetrachlorobenzene	634-66-2	600	24-Hour	Schedule 3 POI	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	not measured
Pentachlorobenzene	608-93-5	80	24-Hour	Schedule 3 POI	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	not measured
Hexachlorobenzene	118-74-1	0.011	24-Hour	Schedule 3 POI	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	not measured
Dioxin and Furans	NA-DFPCB	0.0000001	24-Hour	Ontario AAQC	2.783E-08	3.938E-08	3.938E-08	4.625E-08	4.960E-08	4.960E-08	NA	NA	NA	NA	NA	NA		4.960E-08	49.60%
7H-Dibenzo(c,g)carbazole	194-59-2	0.1	24-Hour	De Minimis	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	not measured
trans,1,2-Dichloroethene	156-60-5	105	24-Hour	Ontario AAQC	0.40	0.54	0.54	0.94	0.65	0.94	NA	NA	NA	NA	NA	NA		0.94	0.89%

Notes:

(1) Seasonal outliers were removed from the SPM dataset for both stations, and the concentration from the Downwind Station was chosen as the Background concentration.
(2) Provicial data was chosen as the Background Concentration for all Criteria Air Contaminants (CACs), while NAPS data was selected for Benzo(a)pyrene
(3) All non-detections were removed from the Benzo(a)pyrene dataset before the switch to hi-res technology in January 2024 for both stations.
(4) All metal oxide values are based on a conversion determined using a ratio based the molecular weight of the metal and the metal oxide.
(5) The maximum of the York University study was chosen as the Background Concentration.

Table 2

Summary of 50th Percentile Background Ambient Air Concentrations
Emerald Energy from Waste
Brampton, Ontario

Pollutants	CAS No.	Project Criteria (ug/m3)	Averaging Period	Criteria Source	Upwind Station (µg/m3)			Downwind Station (µg/m3)		NAPS Data (µg/m3)		Provincial Data (µg/m3)			Background Concentration [1,2,5] (µg/m3)	% of Criteria
					Peel AAMP	Emerald AAMP	Max	Peel AAMP	Emerald AAMP	2013/14	2022	2013/14	2022	2023		
Suspended Particulate Matter	NA-PM	120	24-Hour	Ontario AAQC	34.65	50.18	50.18	93.71	63.00	NA	NA	NA	NA	NA	63.00	52.50%
Suspended Particulate Matter	NA-PM	60	Annual	Ontario AAQC	6.64	10.91	10.91	17.66	13.83	NA	NA	NA	NA	NA	13.83	23.05%
Nitrogen Dioxides	10102-44-0	79.018	1-Hour	Ontario AAQC	20.26	46.10	46.10	32.25	39.78	18.03	13.47	18.13	13.48	13.49	13.49	17.07%
Nitrogen Dioxides	10102-44-0	400	1-Hour	Ontario AAQC	20.26	46.10	46.10	32.25	39.78	18.03	13.47	18.13	13.48	13.49	13.49	3.37%
Nitrogen Dioxides	10102-44-0	200	24-Hour	Ontario AAQC	21.69	39.62	39.62	15.38	40.76	7.21	5.39	7.25	5.39	5.40	5.40	2.70%
Nitrogen Dioxides	10102-44-0	22.577	Annual	CAAQS	4.16	1.92	4.16	4.16	1.77	1.42	1.06	1.43	1.06	1.06	1.06	4.70%
Carbon Monoxide	630-08-0	6000	½-Hour	Schedule 3 POI	350.95	805.92	805.92	383.34	592.00	354.07	321.84	354.06	321.31	346.04	346.04	5.77%
Carbon Monoxide	630-08-0	36200	1-Hour	Ontario AAQC	289.04	671.60	671.60	315.71	493.33	295.05	268.20	295.05	267.76	288.36	288.36	0.80%
Carbon Monoxide	630-08-0	15700	8-Hour	Ontario AAQC	305.73	621.95	621.95	299.74	457.07	39.34	35.76	39.34	35.70	38.45	38.45	0.24%
Sulphur Dioxide	7446-09-5	10	Annual	Schedule 3 POI	0.68	0.12	0.68	0.68	0.28	0.12	0.06	0.12	0.058	0.031	0.031	0.31%
Sulphur Dioxide	7446-09-5	100	1-Hour	Schedule 3 POI	3.25	1.56	3.25	4.02	3.55	1.52	0.74	1.52	0.73	0.39	0.39	0.39%
Sulphur Dioxide	7446-09-5	178.220	10-minute	Ontario AAQC	5.36	2.57	5.36	6.64	5.86	2.51	1.22	2.51	1.21	0.64	0.64	0.36%
Organic matter (expressed as equivalent methane)	74-82-8	37330	24-Hour	Schedule 3 POI	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	not measured
Ozone	10028-15-6	165	1-Hour	Ontario AAQC	91.38	44.71	91.38	52.46	39.61	51.85	52.60	51.81	52.57	54.72	54.72	33.16%
Ozone	10028-15-6	117.791	8-Hour	CAAQS	88.59	44.19	88.59	51.27	39.81	6.91	7.01	6.91	7.01	7.30	7.30	6.19%
PM10	NA-PM10	50	24-Hour	Ontario AAQC	22.96	17.53	22.96	21.35	31.51	6.97	4.59	6.96	5.34	6.09	6.09	12.17%
PM2.5	NA-PM2.5	27	24-Hour	Ontario AAQC	12.35	8.35	12.35	11.49	16.28	3.76	2.83	3.76	2.88	3.29	3.29	12.17%
PM2.5	NA-PM2.5	8.8	Annual	Ontario AAQC	2.37	0.63	2.37	2.37	1.27	0.74	0.70	0.74	0.57	0.65	0.65	7.35%
Aluminum	7429-90-5	12	24-Hour	Schedule 3 POI	0.14	0.15	0.15	0.36	0.26	NA	NA	NA	NA	NA	0.26	2.13%
Aluminum Oxide[4]	1344-28-1	120	24-Hour	Ontario AAQC	0.26	0.29	0.29	0.67	0.48	NA	NA	NA	NA	NA	0.48	0.40%
Antimony	7440-36-0	25	24-Hour	Ontario AAQC	0.0058	0.0059	0.0059	0.0063	0.0058	NA	NA	NA	NA	NA	0.0059	0.02%
Arsenic	7440-38-2	0.3	24-Hour	Ontario AAQC	0.0035	0.0035	0.0035	0.0034	0.0035	NA	NA	NA	NA	NA	0.0035	1.18%
Barium	7440-39-3	10	24-Hour	Ontario AAQC	0.025	0.03	0.027	0.019	0.023	NA	NA	NA	NA	NA	0.027	0.27%
Beryllium	7440-41-7	0.01	24-Hour	Ontario AAQC	0.00057	0.00059	0.00059	0.00057	0.00058	NA	NA	NA	NA	NA	0.00059	5.91%
Boron	7440-42-8	120	24-Hour	Ontario AAQC	0.0047	0.0042	0.0047	0.0046	0.0049	NA	NA	NA	NA	NA	0.0049	0.00%
Cadmium	7440-43-9	0.025	24-Hour	Ontario AAQC	0.0011	0.0012	0.0012	0.0062	0.0012	NA	NA	NA	NA	NA	0.0012	4.73%
Cadmium	7440-43-9	0.005	Annual	Ontario AAQC	0.00022	0.00022	0.00022	0.00116	0.00022	NA	NA	NA	NA	NA	0.0002	4.48%
Calcium	7440-70-2	10 (1)	24-Hour	Ontario AAQC	NA	2.61	2.61	NA	6.22	NA	NA	NA	NA	NA	2.61	26.15%
Calcium Oxide[4]	1305-78-8	10	24-Hour	Ontario AAQC	NA	3.66	3.66	NA	8.71	NA	NA	NA	NA	NA	3.66	36.61%
Chromium	7440-47-3	0.5	24-Hour	Ontario AAQC	0.0026	0.0031	0.0031	0.0034	0.0036	NA	NA	NA	NA	NA	0.0036	0.71%
Cobalt	7440-48-4	0.1	24-Hour	Ontario AAQC	0.0012	0.0012	0.0012	0.0012	0.0012	NA	NA	NA	NA	NA	0.0012	1.18%
Copper	7440-50-8	50	24-Hour	Ontario AAQC	0.15	0.13	0.15	0.066	0.33	NA	NA	NA	NA	NA	0.33	0.66%
Iron	7439-89-6	4	24-Hour	Ontario AAQC	0.54	0.57	0.57	1.10	0.95	NA	NA	NA	NA	NA	0.95	23.71%
Lead	7439-92-1	0.2	30-Day	Ontario AAQC	0.0015	0.0012	0.0015	0.0029	0.0021	NA	NA	NA	NA	NA	0.002	1.05%
Lead	7439-92-1	0.5	24-Hour	Ontario AAQC	0.0038	0.0032	0.0038	0.0077	0.0054	NA	NA	NA	NA	NA	0.005	1.09%
Lithium	7439-93-2	20	24-Hour	Ontario AAQC	NA	0.016	0.016	NA	0.016	NA	NA	NA	NA	NA	0.016	0.08%
Magnesium	7439-95-4	72	24-Hour	Schedule 3 POI	0.51	0.59	0.59	2.94	1.60	NA	NA	NA	NA	NA	1.60	2.22%
Magnesium oxide[4]	1309-48-4	120	24-Hour	Ontario AAQC	0.85	0.98	0.98	4.87	2.65	NA	NA	NA	NA	NA	2.65	2.21%
Manganese	7439-96-5	0.4 (as SPM)	24-Hour	Ontario AAQC	NA	0.016	0.016	NA	0.033	NA	NA	NA	NA	NA	0.033	8.13%
Manganese	7439-96-5	0.1 (as PM2.5)	24-Hour	Ontario AAQC	NA	0.016	0.016	NA	0.033	NA	NA	NA	NA	NA	0.033	32.51%
Manganese	7439-96-5	0.2 (as PM10)	24-Hour	Ontario AAQC	NA	0.016	0.016	NA	0.033	NA	NA	NA	NA	NA	0.033	16.26%
Molybdenum	7439-98-7	120	24-Hour	Ontario AAQC	0.0017	0.0072	0.0072	0.0017	0.011	NA	NA	NA	NA	NA	0.011	0.01%
Nickel	7440-02-0	0.02 (as PM10)	Annual	Ontario AAQC	0.00045	0.00034	0.00045	0.00049	0.00042	NA	NA	NA	NA	NA	0.0004	2.09%
Nickel	7440-02-0	0.04 (as SPM)	Annual	Ontario AAQC	0.00045	0.00034	0.00045	0.00049	0.00042	NA	NA	NA	NA	NA	0.0004	1.05%
Nickel	7440-02-0	0.1 (as PM10)	24-Hour	Ontario AAQC	0.0024	0.0018	0.0024	0.0026	0.0022	NA	NA	NA	NA	NA	0.0022	2.18%
Nickel	7440-02-0	0.2 (as SPM)	24-Hour	Ontario AAQC	0.0024	0.0018	0.0024	0.0026	0.0022	NA	NA	NA	NA	NA	0.0022	1.09%
Phosphorus	7723-14-0	0.5	24-Hour	Schedule 3 POI	0.032	0.026	0.032	0.048	0.036	NA	NA	NA	NA	NA	0.036	7.29%
Phosphorous pentachloride[4]	10026-13-8	10	24-Hour	Ontario AAQC	0.22	0.17	0.22	0.32	0.25	NA	NA	NA	NA	NA	0.25	2.45%
Selenium	7782-49-2	10	24-Hour	Ontario AAQC	0.0062	0.0060	0.0062	0.0058	0.0059	NA	NA	NA	NA	NA	0.0060	0.06%
Silver	7440-22-4	1	24-Hour	Ontario AAQC	0.0014	0.0030	0.0030	0.0022	0.0029	NA	NA	NA	NA	NA	0.0030	0.30%
Sodium	7440-23-5	10 (2)	24-Hour	Ontario AAQC	NA	1.98	1.98	NA	0.94	NA	NA	NA	NA	NA	1.98	19.76%
Sodium hydroxide[4]	1310-73-2	10	24-Hour	Ontario AAQC	NA	3.44	3.44	NA	1.64	NA	NA	NA	NA	NA	3.44	34.38%
Strontium	7440-24-6	120	24-Hour	Ontario AAQC	0.0047	0.0068	0.0068	0.016	0.012	NA	NA	NA	NA	NA	0.012	0.01%
Tin	7440-31-5	10	24-Hour	Ontario AAQC	0.0062	0.0065	0.0065	0.0059	0.0058	NA	NA	NA	NA	NA	0.0065	0.06%
Titanium	7440-32-6	120	24-Hour	Ontario AAQC	0.010	0.012	0.012	0.019	0.015	NA	NA	NA	NA	NA	0.015	0.01%
Vanadium	7440-62-2	2	24-Hour	Ontario AAQC	0.0024	0.0030	0.0030	0.0030	0.0030	NA	NA	NA	NA	NA	0.0030	0.15%
Zinc	7440-66-6	120	24-Hour	Ontario AAQC	0.044	0.050	0.05	0.088	0.086	NA	NA	NA	NA	NA	0.09	0.07%
Silicon	7440-21-3	27	24-Hour	Schedule 3 POI	NA	0.11	0.11	NA	0.13	NA	NA	NA	NA	NA	0.13	0.46%
Silica[4]	14464-46-1	5	24-Hour	Ontario AAQC	NA	0.23	0.23	NA	0.27	NA	NA	NA	NA	NA	0.27	5.35%
Mercury	7439-97-6	2	24-Hour	Ontario AAQC	0.000013	0.000014	0.000014	0.000019	0.000029	NA	NA	NA	NA	NA	0.000029	0.0015%
Mercury (as Hg) – alkyl compounds	7439-97-6	0.5	24-Hour	Ontario AAQC	0.000013	0.000014	0.000014	0.000019	0.000029	NA	NA	NA	NA	NA	0.000029	0.0058%
Hydrogen Chloride	7647-01-0	20	24-Hour	Ontario AAQC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.13	0.67%
Hydrogen Fluoride	7664-39-3	1.72	24-Hour	Ontario AAQC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	not measured
Hydrogen Fluoride	7664-39-3	0.69	30-Day	Ontario AAQC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	not measured
1,1,1-Trichloroethane	71-55-6	115000	24-Hour	Ontario AAQC	0.20	0.60	0.60	0.24	0.61	0.027	0.0075	NA	NA	NA	0.61	0.00053%
1,1-Dichloroethane	75-34-3	165	24-Hour	Ontario AAQC	0.15	0.45	0.45	0.18	0.44	0.00	0.0048	NA	NA	NA	0.45	0.27%
1,2-Dichloroethane	107-06-2	2	24-Hour	Ontario AAQC	0.073	0.45	0.45	0.089	0.44	0.065	0.048	NA	NA	NA	0.45	22.36%
1,2-Dichloroethane	107-06-2	0.4	Annual	Ontario AAQC	0.029	0.086	0.086	0.017	0.084	0.013	0.0083	NA	NA	NA	0.09	21.43%
1,2-Dichloropropane	78-87-5	2400	24-Hour	Ontario AAQC	0.19	0.51	0.51	0.21	0.50	0.017	0.014	NA	NA	NA	0.51	0.021%
1,3,5-Trimethylbenzene	108-67-8	220	24-Hour	Ontario AAQC	NA	2.72	2.72	NA	2.66	0.053	0.041	NA	NA	NA	2.72	1.24%
1,3-Butadiene	106-99-0	10	24-Hour	Ontario AAQC	NA	1.22	1.22	NA	1.20	0.044	0.047	NA	NA	NA	1.22	12.23%
1,3-Butadiene	106-99-0	2	Annual	Ontario AAQC	NA	0.23	0.23	NA	0.23	0.0083	0.0081	NA	NA	NA	0.23	11.72%
2-Butanone	78-93-3	1000	24-Hour	Ontario AAQC	1.075	1.44	1.44	3.73	1.50	NA	NA	NA	NA	NA	1.50	0.15%
Acetone	67-64-1	11880	24-Hour	Ontario AAQC	12.80	NA	12.80	8.50	NA	NA	NA	NA	NA	NA	0.00	0.00%
Benzene	71-43-2	0.45	Annual	Ontario AAQC	0.092	0.12	0.12	0.14	0.11	0.10	0.076	NA	NA	NA	0.12	25.79%
Benzene	71-43-2	2.3	24-Hour	Ontario AAQC	0.48	0.54	0.54	0.71	0.52	0.53	0.44	NA	NA	NA	0.54	23.49%
Bromochloromethane	75-27-4	350	24-Hour	Schedule 3 POI	0.23	1.48	1.48	0.29	1.45	0.010	NA	NA	NA	NA	1.48	0.42%
Bromoform	75-25-2	55	24-Hour	Ontario AAQC	0.62	2.29	2.29	0.83	2.24	0.017	0.021	NA	NA	NA	2.29	4.16%
Bromomethane	74-83-9	1350	24-Hour	Ontario AAQC	0.15	0.43	0.43	0.17	0.42	0.052	0.030	NA	NA	NA	0.43	0.032%
Carbon Tetrachloride	56-23-5	2.4	24-Hour	Ontario AAQC	0.42	0.70	0.70	0.52	0.68	0.54	0.41	NA	NA	NA	0.70	28.99%
Chlorodibromomethane	124-48-1	0.2	24-Hour	Schedule 3 POI	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	not measured
Chloroform	67-66-3	1	24-Hour	Ontario AAQC	0.15	0.27	0.27	0.18	0.26	0.11	0.10	NA	NA	NA	0.27	27.00%
Chloroform	67-66-3	0.2	Annual	Ontario AAQC	0.029	0.10	0.10	0.035	0.101	0.022	0.017	NA	NA	NA	0.10	51.75%
Dichlorofluoromethane	75-43-4	500	24-Hour	Schedule 3 POI	NA	2.56	2.56	NA	2.49	NA	NA	NA	NA	NA	2.56	0.51%
Ethylbenzene	100-41-4	1000	24-Hour	Ontario AAQC	0.34	0.67	0.67	0.54	0.56	0.21	0.18	NA	NA	NA	0.67	0.07%
Ethylbenzene	100-41-4	1900	10-minute	Ontario AAQC	1.38	2.78	2.78	2.16	2.32	0.85	0.76	NA	NA	NA	2.78	0.15%
Ethylene Dibromide	106-93-4	3	24-Hour	Ontario AAQC	0.068	0.85	0.85	0.073	0.83	NA	NA	NA	NA	NA	0.85	28.32%
Isopropylbenzene	98-82-8	400	24-Hour	Ontario AAQC	NA	NA	NA	NA	NA	0.019	0.012	NA	NA	NA	NA	not measured
Xylenes	1330-20-7	730	24-Hour	Ontario AAQC	1.42	1.72	1.72	2.25	1.40	NA	NA	NA	NA	NA	1.72	0.24%
Xylenes	1330-20-7	3000	10-minute	Ontario AAQC	5.70	7.08	7.08	9.05	5.79	NA	NA	NA	NA	NA	7.08	0.24%
Methylene Chloride	75-09-2	220	24-Hour	Ontario AAQC	0.67	2.50	2.50	0.75	2.49	NA	NA	NA	NA	NA	2.50	1.14%
Methylene Chloride	75-09-2	44	Annual	Ontario AAQC	0.13	0.48	0.48	0.14	0.48	NA	NA	NA	NA	NA	0.48	1.09%
Styrene	100-42-5	400	24-Hour	Ontario AAQC	0.18	0.47	0.47	0.31	1.24	0.052	0.15	NA	NA	NA	1.24	0.31%
Tetrachloroethene	127-18-4	360	24-Hour	Ontario AAQC	0.23	NA	0.23	0.34	NA	0.084	0.073	NA	NA	NA	0.00	0.00%
Toluene	108-88-3	2000	24-Hour	Ontario AAQC	2.16	2.20	2.20	2.83	7.27	1.44	1.24	NA	NA	NA	7.27	0.36%
Trichloroethylene	79-01-6	12	24-Hour	Ontario AAQC	0.22	1.31	1.31	0.26	1.04	0.050	0.031	NA	NA	NA	1.31	10.91%

Table 2

Summary of 50th Percentile Background Ambient Air Concentrations
Emerald Energy from Waste
Brampton, Ontario

Pollutants	CAS No.	Project Criteria (ug/m3)	Averaging Period	Criteria Source	Upwind Station (µg/m3)			Downwind Station (µg/m3)		NAPS Data (µg/m3)		Provincial Data (µg/m3)			Background Concentration [1,2,5] (µg/m3)	% of Criteria
					Peel AAMP	Emerald AAMP	Max	Peel AAMP	Emerald AAMP	2013/14	2022	2013/14	2022	2023		
Trichloroethylene	79-01-6	2.3	Annual	Ontario AAQC	0.044	0.25	0.25	0.051	0.20	0.0093	0.0054	NA	NA	NA	0.25	10.91%
Trichlorofluoromethane	75-69-4	6000	24-Hour	Schedule 3 POI	1.25	1.37	1.37	1.52	1.37	1.61	1.22	NA	NA	NA	1.37	0.023%
Trichlorotrifluoroethane	76-13-1	800000	24-Hour	Ontario AAQC	NA	1.27	1.27	NA	1.24	NA	NA	NA	NA	NA	1.27	0.00016%
Vinyl Chloride	75-01-4	1	24-Hour	Ontario AAQC	0.059	0.28	0.28	0.056	0.28	0.0014	0.0037	NA	NA	NA	0.28	28.27%
Vinyl Chloride	75-01-4	0.2	Annual	Ontario AAQC	0.011	0.054	0.054	0.011	0.053	0.00027	0.00064	NA	NA	NA	0.05	27.09%
Formaldehyde	50-00-0	65	24-Hour	Ontario AAQC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	not measured
Acetaldehyde	75-07-0	500	½-Hour	Ontario AAQC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	not measured
Acetaldehyde	75-07-0	500	24-Hour	Ontario AAQC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	not measured
Acrolein	107-02-8	4.5	1-Hour	Ontario AAQC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	not measured
Acrolein	107-02-8	0.4	24-Hour	Ontario AAQC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	not measured
1-Methylnaphthalene	90-12-0	35.5	24-Hour	De Minimis	0.00119	0.01	0.007	0.0039	0.011	NA	NA	NA	NA	NA	0.011	0.030%
1-Methylphenanthrene	832-69-9	0.1	24-Hour	De Minimis	0.00060	0.00072	0.0007	0.00060	0.00071	NA	NA	NA	NA	NA	0.0007	0.72%
2-Chloronaphthalene	91-58-7	1	24-Hour	Schedule 3 POI	0.00048	0.00058	0.00058	0.00049	0.00058	NA	NA	NA	NA	NA	0.00058	0.058%
2-methylanthracene	613-12-7	0.1	24-Hour	De Minimis	0.00048	0.00058	0.00058	0.00051	0.00058	NA	NA	NA	NA	NA	0.00058	0.58%
2-Methylnaphthalene	91-57-6	35.5	24-Hour	Schedule 3 POI	0.0019	0.013	0.013	0.0072	0.019	NA	NA	NA	NA	NA	0.019	0.05%
3-Methylcholanthrene	56-49-5	0.1	24-Hour	De Minimis	0.010	0.00058	0.010	0.010	0.00058	0.00	0.00	NA	NA	NA	0.001	0.58%
7,12-Dimethylbenzo(a)anthracene	57-97-6	0.1	24-Hour	De Minimis	0.00048	0.0021	0.0021	0.00049	0.0021	NA	NA	NA	NA	NA	0.0021	2.14%
9,10-dimethylanthracene	781-43-1	0.1	24-Hour	De Minimis	0.0019	0.00067	0.0019	0.0019	0.00069	NA	NA	NA	NA	NA	0.0007	0.69%
9-Methylphenanthrene	883-20-5	0.1	24-Hour	De Minimis	NA	0.0015	0.0015	NA	0.0024	NA	NA	NA	NA	NA	0.002	2.39%
Acenaphthene	83-32-9	0.1	24-Hour	De Minimis	0.00026	0.0012	0.0012	0.0057	0.0040	0.00083	0.00093	NA	NA	NA	0.004	4.03%
Acenaphthylene	208-96-8	0.1	24-Hour	De Minimis	0.00029	0.00060	0.00060	0.0010	0.00076	0.00030	0.00048	NA	NA	NA	0.0008	0.76%
Anthracene	120-12-7	0.1	24-Hour	De Minimis	0.00025	0.00062	0.00062	0.00052	0.00073	0.00031	0.00043	NA	NA	NA	0.0007	0.73%
Benzo(a)Anthracene	56-55-3	0.1	24-Hour	De Minimis	0.00024	0.00058	0.00058	0.00028	0.00058	NA	NA	NA	NA	NA	0.00058	0.58%
Benzo(a)fluorene	238-84-6	0.1	24-Hour	De Minimis	0.00048	0.00058	0.00058	0.00049	0.00058	0.000026	0.000043	NA	NA	NA	0.00058	0.58%
Benzo(a)Pyrene[3]	50-32-8	0.00001	Annual	Ontario AAQC	0.0000043	0.000012	0.000012	0.000020	0.000012	0.0000089	0.0000094	NA	NA	NA	0.0000094	93.77%
Benzo(a)Pyrene[3]	50-32-8	0.00005	24-Hour	Ontario AAQC	0.000026	0.00063	0.0006	0.00011	0.00080	0.000046	0.000058	NA	NA	NA	0.000058	115.01%
Benzo(b)Fluoranthene	205-99-2	0.1	24-Hour	De Minimis	0.00025	0.00058	0.00058	0.00032	0.00058	0.00014	0.00010	NA	NA	NA	0.00058	0.58%
Benzo(b)fluorene	243-17-4	0.1	24-Hour	De Minimis	0.00048	0.00058	0.00058	0.00049	0.00058	0.000013	0.000026	NA	NA	NA	0.00058	0.58%
Benzo(e)Pyrene	192-97-2	0.1	24-Hour	De Minimis	0.00048	0.00053	0.00053	0.00050	0.00058	0.000072	0.000091	NA	NA	NA	0.00058	0.58%
Benzo(g,h,i)Perylene	191-24-2	0.1	24-Hour	De Minimis	0.00025	0.00058	0.00058	0.00029	0.00058	0.000087	0.00014	NA	NA	NA	0.00058	0.58%
Benzo(j / k)Fluoranthene	76774-50-0	0.1	24-Hour	De Minimis	0.00024	0.00058	0.00058	0.00026	0.00058	NA	NA	NA	NA	NA	0.00058	0.58%
Biphenyl	92-52-4	60	1-Hour	Ontario AAQC	0.00059	0.0066	0.007	0.0069	0.011	NA	NA	NA	NA	NA	0.011	0.018%
Chrysene	218-01-9	0.1	24-Hour	De Minimis	0.00024	0.00058	0.00058	0.00031	0.00060	0.00011	0.00011	NA	NA	NA	0.00060	0.60%
Triphenylene	217-59-4	0.1	24-Hour	De Minimis	0.00026	0.00058	0.00058	0.00043	0.00058	0.000041	0.000043	NA	NA	NA	0.00058	0.58%
Coronene	191-07-1	0.1	24-Hour	De Minimis	0.00048	0.00058	0.00058	0.00049	0.00058	NA	NA	NA	NA	NA	0.00058	0.58%
Dibenzo(a,c/a,h)Anthracene	53-70-3	0.1	24-Hour	De Minimis	0.00024	0.00055	0.00055	0.00024	0.00054	NA	NA	NA	NA	NA	0.00055	0.55%
Dibenzo(a,e)pyrene	192-65-4	0.1	24-Hour	De Minimis	0.0010	0.00058	0.0010	0.0010	0.00058	NA	NA	NA	NA	NA	0.0006	0.58%
Fluoranthene	206-44-0	0.1	24-Hour	De Minimis	0.0011	0.00076	0.0011	0.0024	0.0023	0.0011	0.0011	NA	NA	NA	0.0023	2.32%
Fluorene	86-73-7	0.1	24-Hour	De Minimis	0.00067	0.0018	0.0018	0.0055	0.0037	0.0017	0.0016	NA	NA	NA	0.0037	3.67%
Indeno(1,2,3-cd)Pyrene	193-39-5	0.1	24-Hour	De Minimis	0.00025	0.00058	0.00058	0.00027	0.00058	0.000078	0.000068	NA	NA	NA	0.00058	0.58%
m-terphenyl	92-06-8	0.1	24-Hour	De Minimis	0.00048	0.00058	0.00058	0.00049	0.00058	NA	NA	NA	NA	NA	0.00058	0.58%
Naphthalene	91-20-3	22.5	24-Hour	Ontario AAQC	0.0011	0.036	0.036	0.0094	0.044	0.082	0.058	NA	NA	NA	0.044	0.20%
Naphthalene	91-20-3	50	10-minute	Ontario AAQC	0.0045	0.15	0.15	0.039	0.18	0.34	0.24	NA	NA	NA	0.18	0.36%
o-Terphenyl	84-15-1	0.1	24-Hour	De Minimis	0.00048	0.00058	0.00058	0.00049	0.00058	NA	NA	NA	NA	NA	0.00058	0.58%
Perylene	198-55-0	0.1	24-Hour	De Minimis	0.00048	0.00058	0.00058	0.00049	0.00058	0.0000085	0.000014	NA	NA	NA	0.00058	0.58%
Phenanthrene	85-01-8	0.1	24-Hour	De Minimis	0.0039	0.0044	0.004	0.013	0.009	0.0059	0.0051	NA	NA	NA	0.009	8.92%
Picene	213-46-7	0.1	24-Hour	De Minimis	0.00048	0.00053	0.00053	0.00049	0.00052	NA	NA	NA	NA	NA	0.00053	0.53%
p-terphenyl	92-94-4	0.1	24-Hour	De Minimis	0.00048	0.00058	0.00058	0.00049	0.00058	NA	NA	NA	NA	NA	0.00058	0.58%
Pyrene	129-00-0	0.1	24-Hour	De Minimis	0.00084	0.00079	0.0008	0.0017	0.0019	0.00066	0.0010	NA	NA	NA	0.0019	1.94%
Quinoline	91-22-5	0.005	24-Hour	Schedule 3 POI	0.0019	0.00067	0.0019	0.0020	0.0011	NA	NA	NA	NA	NA	0.0011	21.88%
Tetralin	119-64-2	151.5	24-Hour	Schedule 3 POI	0.00080	0.0043	0.0043	0.00076	0.0065	NA	NA	NA	NA	NA	0.007	0.0043%
2,6-Dichlorophenol	87-65-0	19	24-Hour	Schedule 3 POI	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	not measured
2,4/2,5-Dichlorophenol	120-83-2	33.5	24-Hour	Schedule 3 POI	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	not measured
3,5-Dichlorophenol	591-35-5	0.1	24-Hour	De Minimis	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	not measured
2,3-Dichlorophenol	576-24-9	0.1	24-Hour	De Minimis	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	not measured
3,4-Dichlorophenol	95-77-2	0.1	24-Hour	De Minimis	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	not measured
2,4,6-Trichlorophenol	88-06-2	1.5	24-Hour	Schedule 3 POI	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	not measured
2,3,6-Trichlorophenol	933-75-5	0.1	24-Hour	De Minimis	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	not measured
2,3,5-Trichlorophenol	933-78-8	0.1	24-Hour	De Minimis	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	not measured
2,4,5-Trichlorophenol	95-95-4	220	24-Hour	Schedule 3 POI	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	not measured
2,3,4-Trichlorophenol	15950-66-0	0.1	24-Hour	De Minimis	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	not measured
3,4,5-Trichlorophenol	609-19-8	0.1	24-Hour	De Minimis	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	not measured
2,3,4,6-Tetrachlorophenol	58-90-2	0.75	24-Hour	Schedule 3 POI	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	not measured
2,3,4,5-Tetrachlorophenol	4901-51-3	0.1	24-Hour	De Minimis	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	not measured
Pentachlorophenol	87-86-5	20	24-Hour	Schedule 3 POI	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	not measured
1,3-Dichlorobenzene	541-73-1	50	24-Hour	Schedule 3 POI	NA	2.66	2.66	NA	2.60	0.0027	0.00093	NA	NA	NA	2.66	5.32%
1,4-Dichlorobenzene	106-46-7	95	24-Hour	Ontario AAQC	0.23	0.66	0.66	0.28	0.68	0.040	0.034	NA	NA	NA	0.68	0.72%
1,2-Dichlorobenzene	95-50-1	30500	1-Hour	Ontario AAQC	0.57	1.66	1.66	0.65	1.63	0.0061	0.001	NA	NA	NA	1.66	0.0054%
1,3,5-Trichlorobenzene	108-70-3	3.6	24-Hour	Schedule 3 POI	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	not measured
1,2,4-Trichlorobenzene	120-82-1	400	24-Hour	Ontario AAQC	0.70	4.10	4.10	0.73	4.01	0.0053	0.005	NA	NA	NA	4.10	1.03%
1,2,3-Trichlorobenzene	87-61-6	135	24-Hour	Schedule 3 POI	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	not measured
1,2,3,5/1,2,4,5-Tetrachlorobenzen	95-94-3	1	24-Hour	Schedule 3 POI	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	not measured
1,2,3,4-Tetrachlorobenzene	634-66-2	600	24-Hour	Schedule 3 POI	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	not measured
Pentachlorobenzene	608-93-5	80	24-Hour	Schedule 3 POI	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	not measured
Hexachlorobenzene	118-74-1	0.011	24-Hour	Schedule 3 POI	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	not measured
Dioxin and Furans	NA-DFPCB	0.0000001	24-Hour	Ontario AAQC	1.822E-08	2.238E-08	2.238E-08	5.854E-08	2.540E-08	NA	NA	NA	NA	NA	2.540E-08	25.40%
7H-Dibenzo(c,g)carbazole	194-59-2	0.1	24-Hour	De Minimis	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	not measured
trans,1,2-Dichloroethene	156-60-5	105	24-Hour	Ontario AAQC	0.27	0.47	0.47	0.92	0.64	NA	NA	NA	NA	NA	0.64	0.61%

Notes:

(1) Seasonal outliers were removed from the SPM dataset for both stations, and the concentration from the Downwind Station was chosen as the Background concentration.
(2) 2023 Provincial AQ data was chosen as the Background Concentration for all Criteria Air Contaminants (CACs), while NAPS data was selected for Benzo(a)pyrene.
(3) All non-detections were removed from the Benzo(a)pyrene dataset before the switch to hi-res technology in January 2024 for both stations.
(4) All metal oxide values are based on a conversion determined using a ratio based the molecular weight of the metal and the metal oxide.
(5) The average value from the 2019 York University data set was used for the 50th percentile HCl value.

Appendix A

Ambient Air Monitoring Plan (May, 2023)

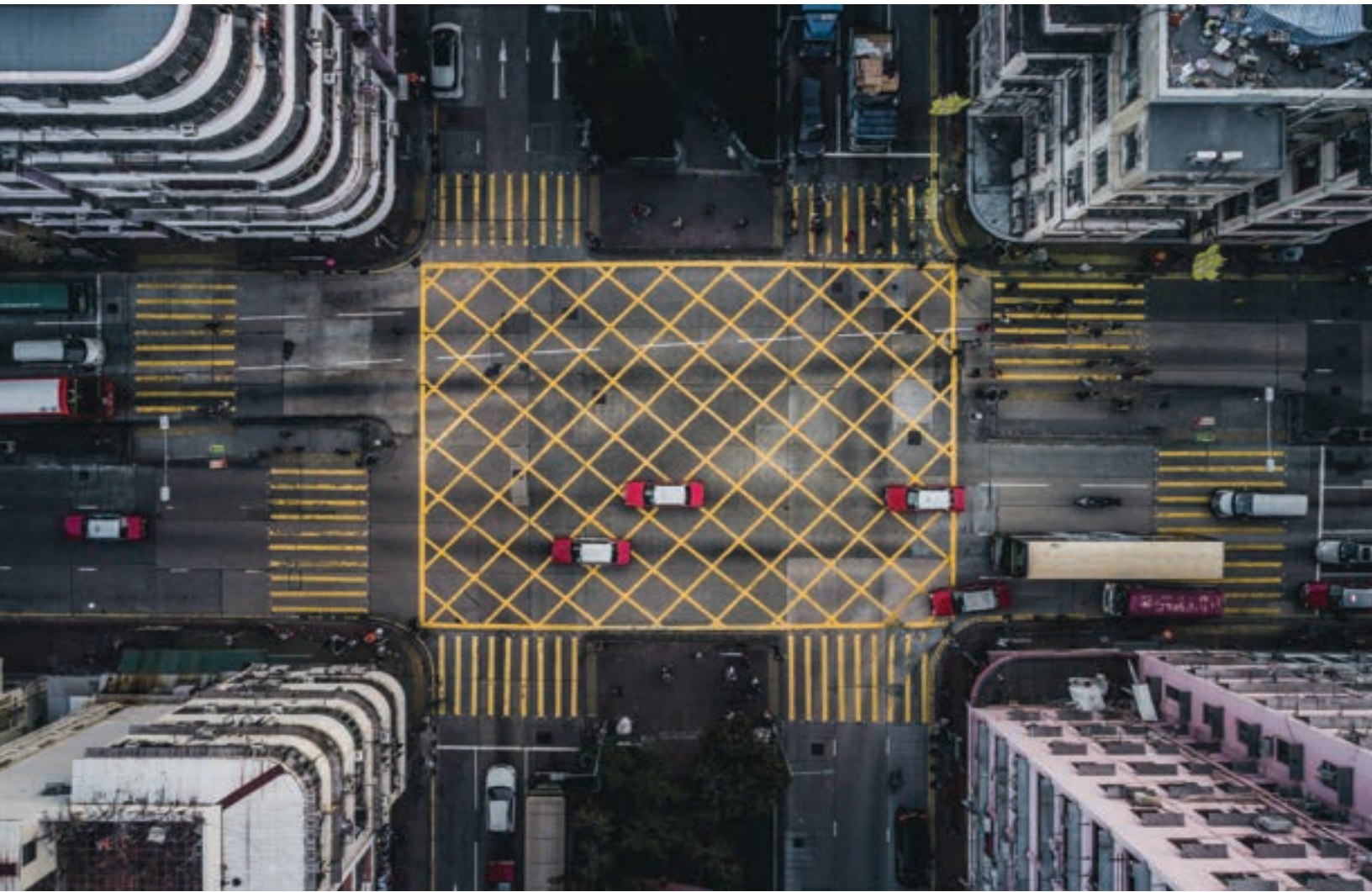
Ambient Air Monitoring Plan

Emerald EA

Emerald Energy From Waste

15 May 2023

→ The Power of Commitment



Project name		Emerald Energy from Waste Environmental Screening & ECA Amendment					
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1. Introduction

Emerald Energy from Waste (Emerald) is proposing to replace their existing facility and construct and operate a new facility on the existing property located at 7656 Bramalea Rd, Mississauga, Ontario. The new facility, which will be built in stages, will continue to be an Energy from Waste (EFW) Facility intended to provide a long-term, sustainable solution to manage municipal (MSW) and institutional, commercial, and industrial (IC&I) non-hazardous solid wastes and divert them from landfill while producing electricity for the grid and steam for the local industrial community.

This ambient air monitoring plan (AAMP) was developed based on the requirement to obtain accurate background ambient air monitoring data in the area of the Facility in support of an Air Quality Study as part of an Environmental Screening Report (ESR) for an Environmental Assessment (EA) for the new facility. The purpose of the ambient air monitoring program (Program) will be to accurately quantify background ambient concentrations of EFW-related air contaminants upwind and downwind of the current facility. The measured background levels of these air contaminants will be added to the predicted concentrations of contaminants emitted from the new facility to determine the cumulative effects on local air quality.

1.1 Purpose of this Report

The AAMP is intended to communicate all aspects of the monitoring program to be carried out in support of the ESR following the Ministry of the Environment, Conservation and Parks (MECP) guidance document entitled **Operations Manual for Air Quality Monitoring in Ontario (MOECC, 2018)** (Manual)**,** that requires a monitoring plan to include the following sections:

– Objectives of the monitoring program
– Air quality parameters to be measured and the monitoring frequency
– Monitoring methods/instruments and procedures
– Duration of the monitoring program
– Expected or suspected sources of air pollution
– Expected or suspected receptors
– Number and location of monitoring stations
– Analytical methods/procedures
– Analytical laboratory to be used
– Quality assurance/quality control activities
– Data reporting procedures

2. General Siting Considerations

2.1 Site Characteristics

The Facility is located at 7656 Bramalea Road, Brampton, Ontario. The site is located south of Highway 407 and west of Bramalea Road. There are recreational areas on west side of the facility, and commercial properties to the north, east and south. Toronto Pearson International Airport is located approximately 3 km to the south of the facility. The nearest major intersection is Derry Road East and Bramalea Road, which is 2 km from the Facility. The location of the Facility is provided in Figure 1.

The expansion will take place on the west side of the Facility, adjacent to the recreational areas. A recreational trail is approximately 70 m southwest of the Facility property, and outdoor sport fields are approximately 450 m southwest of the expansion.

GHD conducted a review of sensitive receptors surrounding the Facility. The sensitive receptors include commercial/industrial, residential, and recreational areas. Figure 2 highlights the nearby sensitive receptors in the area. In general, most of the properties adjacent to the facility are commercial or industrial properties. The Dixie – 407 Sports field is the nearest identified sensitive receptor which is 450 m southwest of the facility; the sports field includes a cricket batting cage, cricket grounds and a walking pathway. The nearest residential areas are located on Avondale Boulevard (Avondale Blvd and Bramalea Rd), approximately 1.5 km north-west of the facility. Another residential area to the northeast is approximately 2.3 km away from the Facility.

2.2 Dispersion Modelling Predictions

Dispersion modelling was used to generate informative contour plots to describe the existing Facility's emissions profile. the downwind concentrations of air contaminants emitted by current Emerald Facility. The dispersion modelling was conducted in accordance with the MECP publication "Air Dispersion Modelling Guideline for Ontario" (ADMGO).

The Facility's selective catalytic reduction (SCR) stack is the primary source of emissions at this Facility. This stack controls nitrogen oxide, dioxins, furans and dioxin-like PCBs emissions produced from the six incinerators at the Facility. The SCR stack is 35.18 m in height, with an exhaust temperature of 237 degrees Celsius and an exhaust velocity of 16 meters per second. Other sources at the Facility include the gas turbine generator, natural gas fired boiler exhaust, bypass stack, and road dust. For the purposes of generating Figures 2 and 3, below, the smaller sources are not considered in the ambient air modelling plan because the SCR stack emissions are much larger than the sum of the small sources.

Figure 2 shows the concentration profile of a unitized emission rate of 1 g/s, not representing any contaminant, for a 1-hr period. It can be seen in this Figure that the maximum off-site concentration from the SCR stack occurs relatively close to the property line. As seen in Figure 2, the highest concentrations occur north of Emerald, on Highway 407, which is approximately 50 m north of the property boundary. The concentration gradually decreases past this point. The maximum ground level concentration is lower for receptors near the facility, in comparison to the receptors along Highway 407. This is attributed to the tall stack height (35.18 m), which results in plume impingement at distance further away.

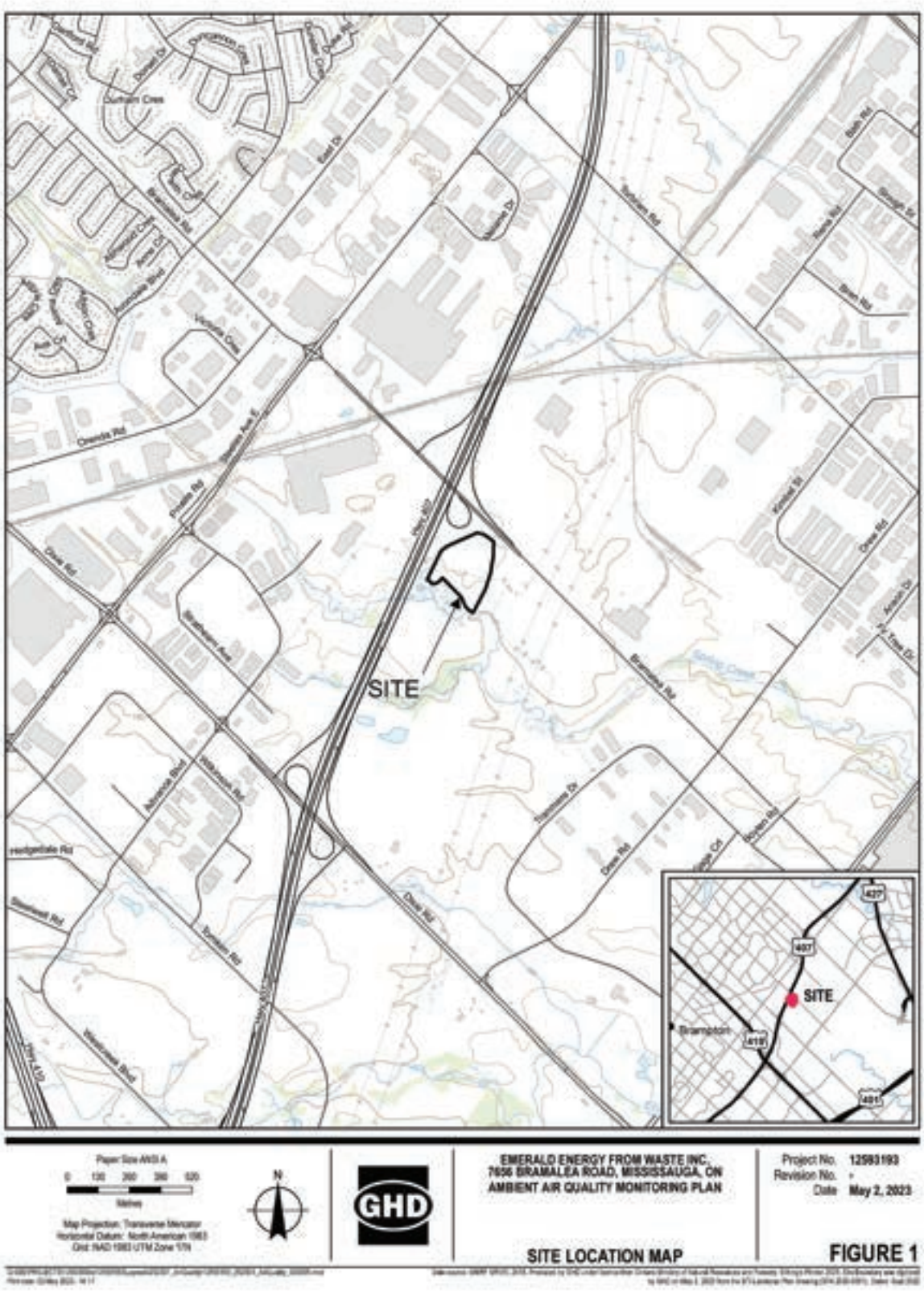


Figure 1 Site Location Map

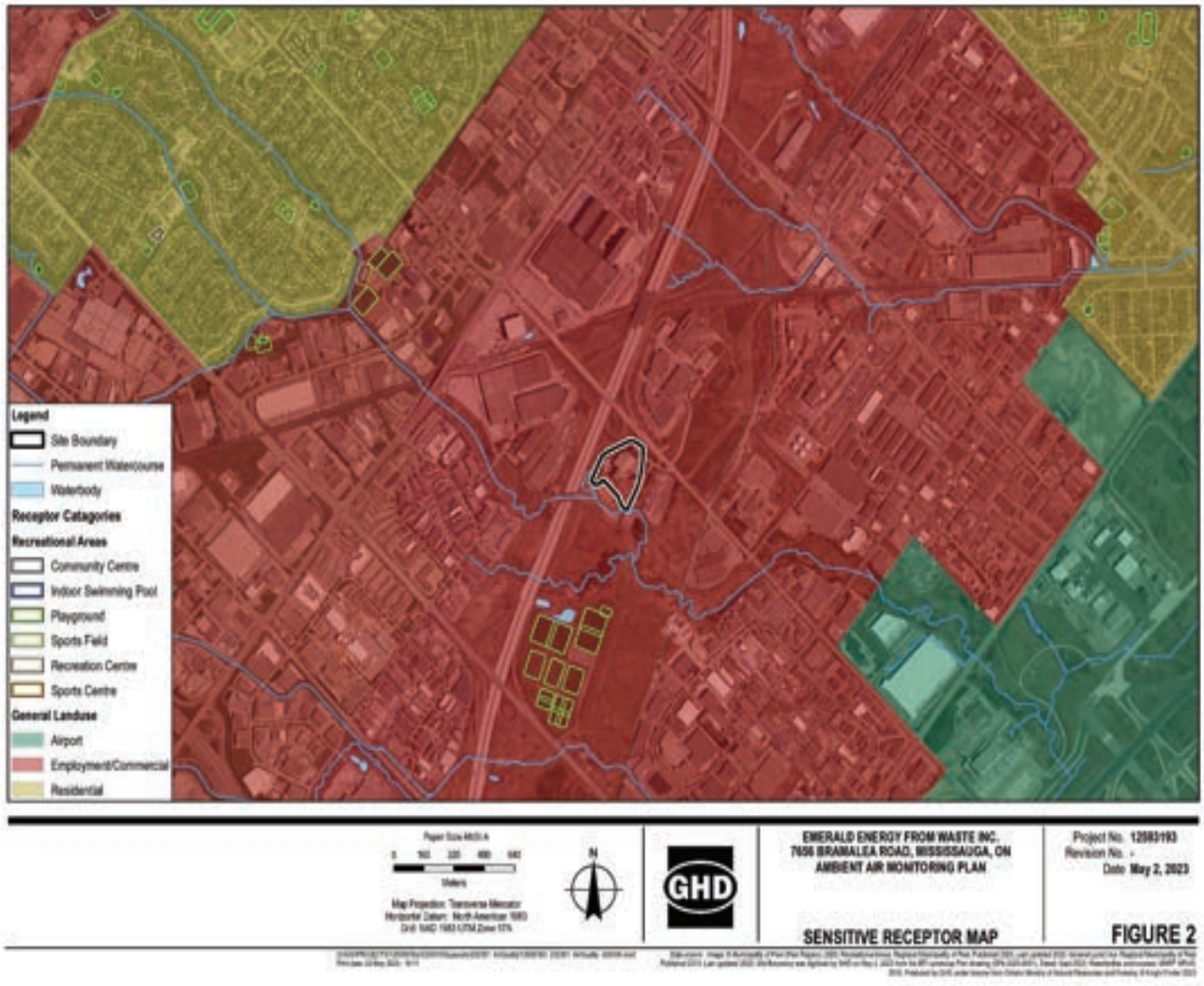


Figure 2 *Sensitive Receptor Map*

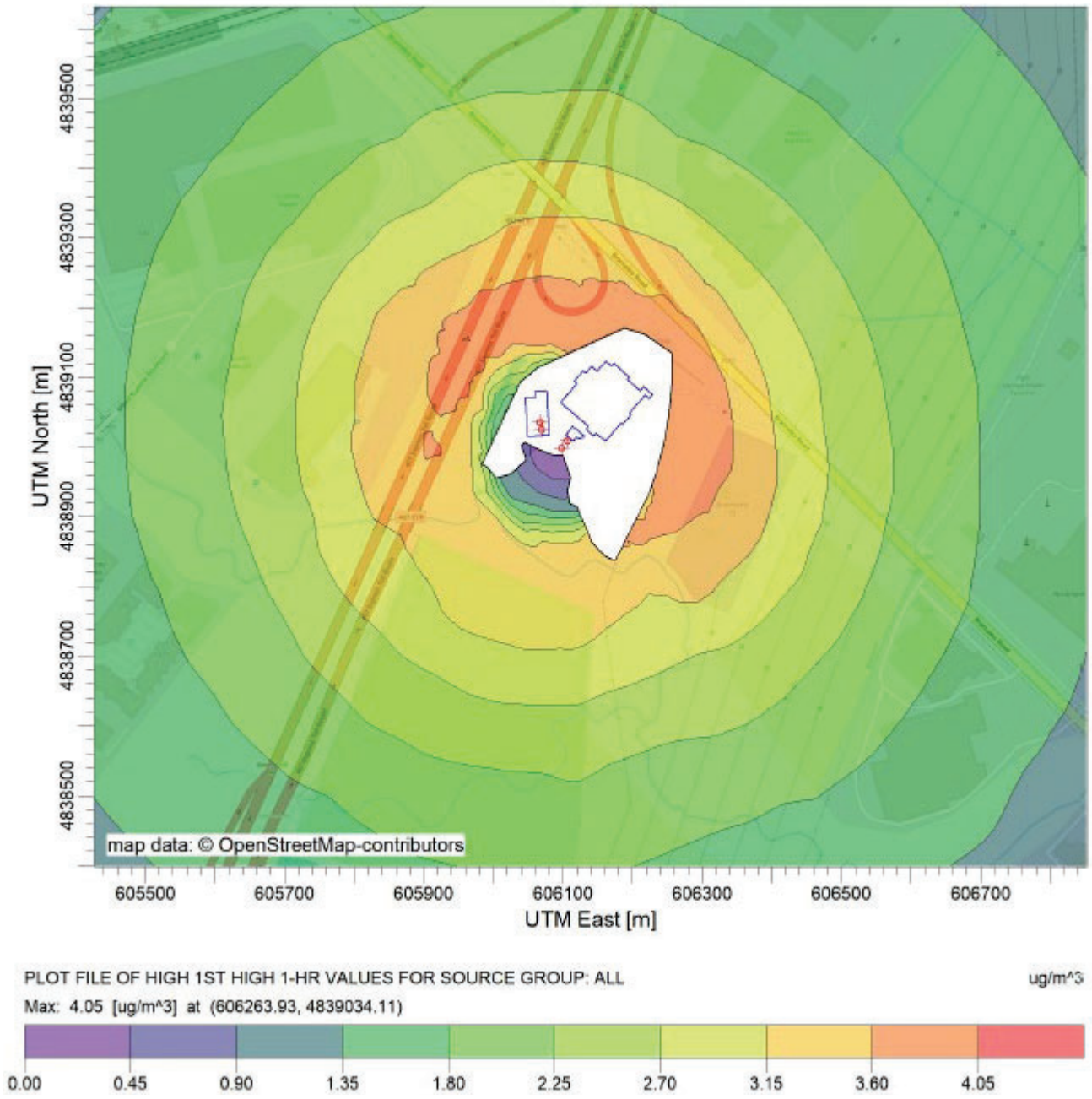
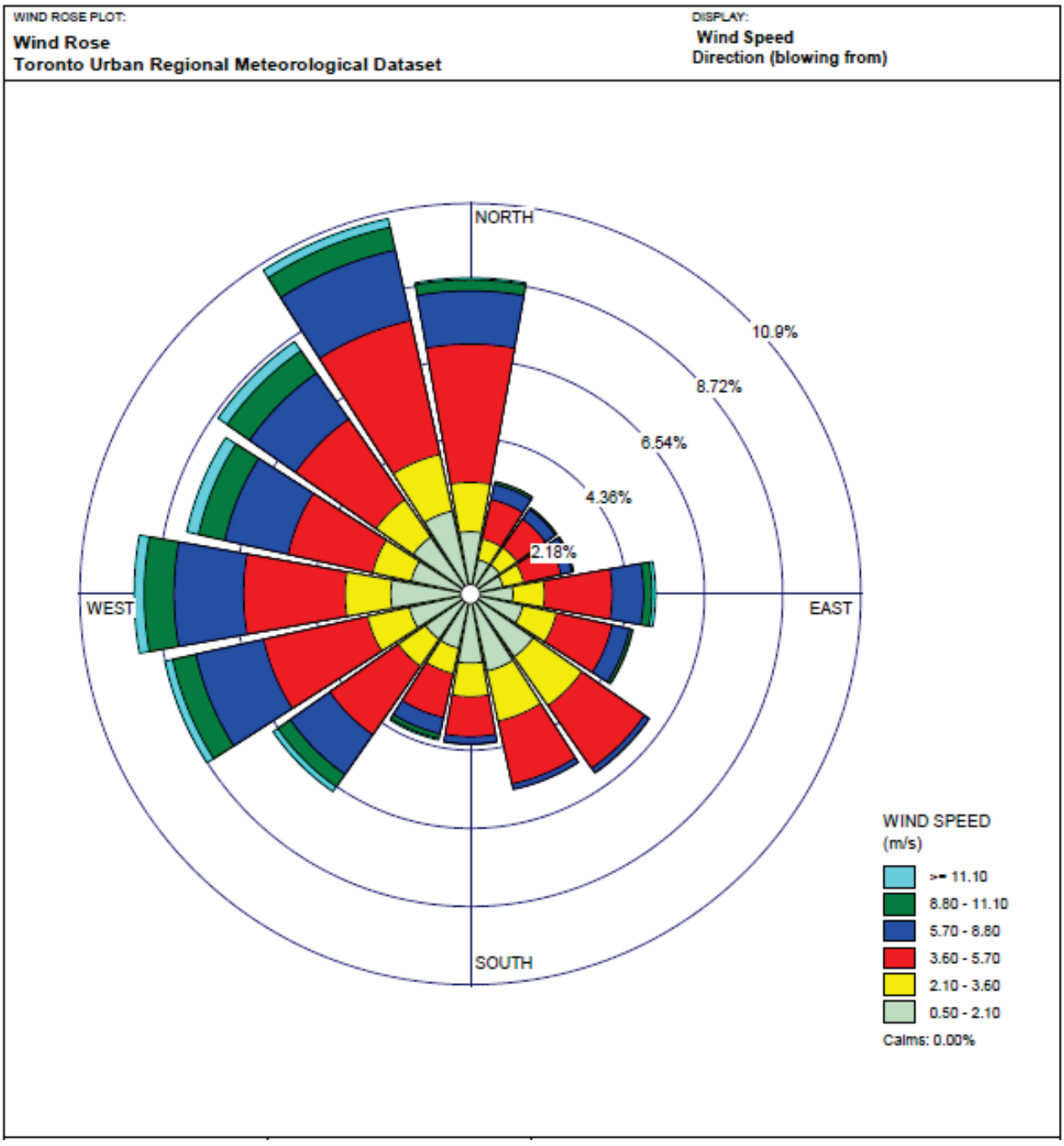


Figure 3 *Unitized Emission Rate Contours*

2.3 Windrose

The windrose generated from publicly available data from Environment Canada showing the general direction of prevailing winds are blowing from the north westerly direction, with a lesser component blowing from the south.



2.4 Scale of Representativeness

Proper siting of monitoring stations requires a precise specification of the monitoring objective, which usually includes a desired spatial scale of representativeness.

The scales of representativeness of most interest for local air monitoring are:

– Microscale – defines concentrations in air volumes associated with area dimensions ranging from several metres up to about 100 m
– Middle Scale – defines the concentration typical of areas ranging in size from about 100 m to 0.5 km
– Neighbourhood Scale – defines concentrations within extended areas with relatively uniform land use with dimensions of 0.5 to 4.0 km
– Urban Scale – defines overall city-wide conditions with dimensions on the order of 4 to 50 km

The generally accepted spatial scale for monitoring background concentrations for EA purposes is the neighbourhood scale of representativeness. Based on this scale, two (2) broad locations were targeted in finding upwind and downwind monitoring locations that would represent reasonable background concentrations as shown below.



Figure 4 Targeted Monitoring Areas

2.5 Monitoring Locations

Based on conversations between Emerald and the Region of Peel, it was identified that two specific monitoring locations were used in 2013/2014 to collect background concentrations for a similar project that was not undertaken. The two locations shown in Figure 5 are185 Central Park Drive in Brampton (Upwind) and Carterm Intermodal

Logistics located at 2700 Drew Rd, in Mississauga (downwind). Both sites are in primarily industrial/commercial areas that are adjacent to residential communities and fall within the targeted upwind and downwind monitoring locations.

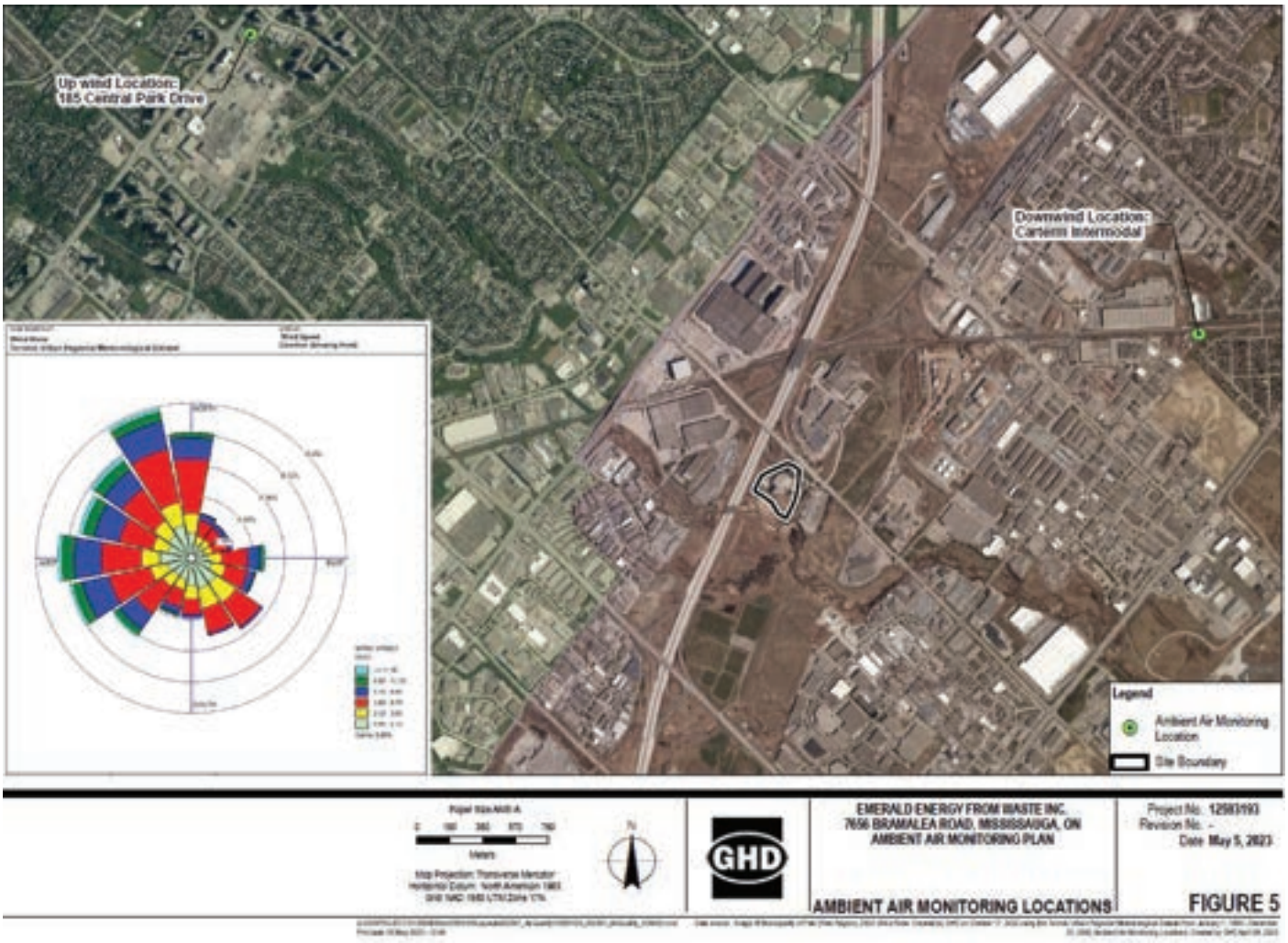


Figure 5 Ambient Air Monitoring Locations

185 Central Park Dr. is primarily upwind from the Emerald Facility surrounded by residential and commercial land use:

– 4.07 km from Facility
– 3.65 km from HWY407
– 2.18 km from HWY410

Carterm Intermodal is primarily downwind from the Emerald facility and other industrial land use, adjacent to residential land use to the east:

– 2.41 km from Facility
– 1.98 km from HWY407
– 1.85 km from Pearson Airport runway

Both locations are large properties that provide space to locate the stations according to Section 5.2 of the Manual. During final setup of the locations, strict adherence to the probe siting criteria for each air contaminant in Section 5.2

will be followed closely. Emerald and GHD will ensure that the probe or inlet siting at both monitoring stations that are located on these properties will adhere to the following Section 5.2 conditions at a minimum:

– Greater than 20 m horizontally from trees
– Greater than 2× height (above inlet) of any nearby obstacle
– Less than 26.5° from inlet to top of any obstacle
– Air flow unrestricted in 3 of the 4 wind quadrants
– 3-15 m above ground (as low as 2 m for PM/PAH/PCDD/DF/Metals)
– Greater than 2 m vertically and horizontally from supporting structures
– Greater than 10 m from roads (with traffic < 10,000 vehicles per day)

At the upwind location shown below in Figure 6, the monitoring station will be strategically located on the property according to the siting criteria noted above.



Figure 6 Upwind Monitoring Location

At the downwind location, which is a container shipping yard shown below in Figure 7, the site owner has agreed to ensure that all container storage other that flat bed trailers will be stored away from the monitoring location. Therefore, the three containers noted in Figure 5 below near the monitoring location will be removed for the duration of the program.



Figure 7 Downwind Monitoring Location

2.6 Duration of the Program

The monitoring Program will begin in May 2023 and continue for approximately six months. GHD and Emerald agree that 6 months of background data collection is reasonable to determine accurate background concentrations to support the EA. In addition, it is anticipated that Emerald will be granted access to the background concentrations of a study completed in 2013/2014 by the Region of Peel at the same two sites for direct comparison and support of this data as noted above. There is approximately 6 months of background data that exists from 185 Central Park Drive and one (1) year of background data from Carterm Intermodal from 2013/2014.

3. Monitoring Instrumentation and Methodology

3.1 Program Summary

The measurement program at the monitoring sites will include both continuous and non-continuous monitors to sample ambient air concentrations of the entire list of parameters. Monitoring for PM2.5, PM10, nitrogen oxides (NOx),

sulphur dioxide (SO_2), carbon monoxide (CO) and ozone will be conducted on a continuous basis over the duration of the ambient air monitoring program. Monitoring for metals in total suspended particulates (TSP), polycyclic aromatic hydrocarbons (PAHs), VOC, HCl and dioxins and furans (PCDD/DF) will be conducted at both stations with non-continuous monitors, per the methodology and analysis recommended by the in the Manual.

3.2 Parameters to be Monitored

The list of parameters to be monitored for the Program include the compounds that are usually found from emissions of EFW facilities. The list includes all compounds that are monitored annually from the SCR stack as part of Emerald's Environmental Compliance Approval (ECA) No. 0264-BFGQF. All compounds were included in this list even if the annual results show that the presence of these compounds in the Emerald emissions are negligible, such as Volatile Organic Compounds (VOC) and Polycyclic Aromatic Compounds (PAH). Included also are ozone, particulate matter less than 10 microns (PM10) that were added after discussions with MECP. The following is the list of parameters that will be measured for the Program:

– Particulate Matter (<2.5 micrometres) (PM2.5)
– Particulate Matter (<10 micrometres) (PM10)
– Total Suspended Particulate (TSP)
– Sulphur Dioxide (SO_2)
– Nitrogen Oxide (NO)
– Carbon Monoxide (CO)
– Ozone
– Polycyclic Aromatic Hydrocarbons (PAHs)
– Dioxins and Furans and Dioxin-like PCBs
– Metals (including cadmium, lead and mercury)
– Hydrochloric Acid
– Volatile Organic Compounds (VOCs).

The lists of individual metals, PAHs and VOCs to be analyzed are provided further in Section 3.4.

3.2.1 Equipment Enclosure and Sampling Manifold

A custom instrumentation shelter will be used to store the monitoring equipment. The shelter will have a steel frame structure covered in a weatherproof exterior. A rooftop guardrail and accompanying ladder will be installed to provide access to the hi-volume samplers that will be located on the roof. A wall mounted HVAC unit will be installed to provide adequate heating and cooling to the shelter during different weather conditions, which will ensure stable temperature and stability for the analyzers.

A shelter temperature of 20-25°C will be maintained to within +/- 1°C by an automatic heat/cool thermostat with adjustable hysteresis. The shelter temperature will be measured and collected along with the pollutant and meteorological data. Out-of-limit shelter temperature conditions will be immediately flagged and communicated to maintenance technicians via telemetry.

Ambient air will be drawn into the station using an insulated 6" Teflon lined stainless steel sampling cane and, 4 port manifold (or equivalent). The manifold flow rate will be approximately 60 cubic feet per meter (cfm) to ensure an adequate ambient air exchange rate. The temperature control on the manifold will be automatically adjusted to ensure that the manifold temperature is at least 10°C above the ambient dew point to prevent the formation of condensation or water droplets.

A 10-m meteorological tower will be installed at each station to continuously monitor wind speed, wind direction, atmospheric temperature and relative humidity. Barometric pressure will be measured at one station.

The following sections detail the continuous and non-continuous monitoring equipment that will be used for the Program which conform to the requirements in the Manual.

3.3 Continuous Ambient Monitors

3.3.1 Particulate Matter less than 2.5 Microns (PM2.5)

The PM2.5 continuous sampler will consist of a BAM 1020 (or equivalent). The sampler operates using beta radiation attenuation for continuous PM2.5 measurement using a PM2.5 cut cyclone inlet system:

Principle of Operation: Beta Attenuation

Minimum Detection Level: 1 µg/m3

Range: 0-10 mg/m3

Time interval: 1 hour

3.3.2 Particulate Matter less than 10 microns (PM10)

The PM10 continuous sampler will consist of a BAM 1020 (or equivalent). The sampler operates using beta radiation attenuation for continuous PM10 measurement using a PM10 cut cyclone inlet system:

Principle of Operation: Beta Attenuation

Minimum Detection Level: 1 µg/m3

Range: 0-10 mg/m3

Time interval: 1 hour

3.3.3 Nitrogen Oxides (NOx)

The NOx sampling system will consist of an API Model 200E Chemiluminescence Analyzer (or equivalent) to measure continuous concentrations of nitric oxide (NO), nitrogen dioxide (NO_2) and nitrogen oxides (NOx). The analyzer operates on the principle of chemiluminescence, where the amount of light given off during a chemical reaction is measured. An NO_2 to NO converter will be used to measure the amount of NOx (NO + NO_2) in the sample. The analyzer will have internal NOx permeation tube and access to zero gas generation for daily zero/span checks:

Principle of Operation: Chemiluminescence

Minimum Detection Limit: 1 part per billion (ppb)

Range: 0-1000 ppb

Time interval: 1 second averaged every minute, including hourly and daily averages

3.3.4 Sulphur Dioxide (SO_2)

The SO_2 analyzer will consist of a Teledyne API Sulphur Dioxide Analyzer (or equivalent). The analyzer operates using the principle of Pulsed Fluorescence". Sulphur dioxide molecules absorb fluorescent energy, producing electronically excited SO_2 molecule with a known spectral decay rate to the ground state. The fluorescence emitted by the reaction is detected by a photo multiplier tube and the signal is converted proportionally to an electronic output signal which is then captured by a data logger. The analyzer will have an internal SO_2 permeation tube and access to zero gas generation for daily zero/span checks:

Principle of Operation: Pulsed Florescence

Minimum Detection Limit: 1 ppb

Range: 0-1000 ppb

Time interval: 1 second averaged every minute, including hourly and daily averages

3.3.5 Carbon Monoxide (CO)

The CO analyzer will consist of a Teledyne API T300 CO Analyzer (or equivalent). The T300 measures low ranges of carbon monoxide through IR absorption and gas filter correlation by comparing IR energy absorbed by the sample to that absorbed by a reference gas according to the Beer-Lambert law. The signal is converted proportionally to an electronic output signal which is then captured by the data logger:

Principle of Operation: Gas Filter Correlation

Range: 0-1000 ppm

Minimum Detection Limit: 1 ppm

Time interval: 1 second averaged every minute, including hourly and daily averages

3.3.6 Ozone

The ozone analyzer will consist of a Teledyne API T400 Ozone Analyzer (or equivalent). The T400 measures low ranges of ozone in ambient air through ultra violet (UV) absorption according to the Beer-Lambert law. The signal is converted proportionally to an electronic output signal which is then captured by the data logger:

Principle of Operation: UV Absorption

Minimum Detection Limit: 1ppb

Range: 0-1000 ppb

Time interval: 1 second averaged every minute, including hourly and daily averages

3.3.7 Meteorological Tower

Horizontal wind speed, wind direction, ambient temperature, relative humidity, and barometric pressure, will be collected at each station. The meteorological sensors will be mounted on an external telescoping 10 m aluminum tower. Meteorological sensor measurement data will be logged using the DAS mentioned above. The meteorological equipment will be:

– Wind Speed/Wind Direction: Met One Instruments Inc. Model 034B (or equivalent)
– Temperature: Campbell Scientific Model 107 (or equivalent)
– Relative Humidity: Campbell Scientific Model HMP60 (or equivalent)
– Atmospheric Pressure: Campbell Scientific Model CS106 (or equivalent)

3.3.8 Data Acquisition System

A rack mounted data acquisition system (DAS) will be installed to lo the concentrations from all the analyzers. A Campbell Scientific CRX1000 station data acquisition system (or equivalent) will be used to collect the ambient analyzer data and status codes from the ambient air monitors. Typically, continuous station data will be maintained in the data loggers, and data will be viewed locally and remotely using a laptop and the relevant DAS software applications. If possible, the DAS will acquire data and control the ambient analyzers via serial communication. Remote data transmission will be accomplished by the periodic transmission of collected station air quality data by telemetry.

3.4 Non-Continuous Ambient Monitors

3.4.1 TSP/Metals

TSP and metals will be collected onto pre-weighed, conditioned Teflon coated glass fibre filters for a 24-hour period using a high volume sampler (or equivalent). This monitor operates by continuously drawing a sample of ambient air

through a filter onto which particulate matter is deposited. The filters will be subsequently weighed for particulate mass and analyzed using the Atomic Emission Spectroscopy/Inductively Coupled Plasma (AES/ICP) technique to determine the mass of metals collected. Analysis of the TSP/metals samples will be conducted by a Canadian Assurance for Laboratory Accreditation (CALA) accredited laboratory following the Manual. The sampling schedule will correspond with the National Air Pollution Surveillance (NAPS) schedule for TSP/Metals (one sample taken every six days).

The list of metals that will be analyzed from each filter are as follows:

Aluminum, antimony, arsenic, barium, beryllium, boron, cadmium, calcium, chromium, cobalt, copper, iron, lead, lithium, magnesium, manganese, mercury, molybdenum, nickel, phosphorous, selenium, silicon, silver, sodium, strontium, tin, titanium, vanadium, and zinc.

3.4.2 PAHs, Dioxins and Furans and dioxin-like PCBs

PAHs and dioxins and furans will be collected with a high volume air sampler (or equivalent). The samplers will be located on the roof of the instrumentation shelter to meet the required MECP siting characteristics. Each sampler is equipped with a dual chambered sampling module to contain a Teflon-coated glass fibre filter and a Poly-Urethane Foam (PUF) cartridge. PAHs will be collected according to the NAPS schedule for a 24-hour period at 12-day intervals and dioxins and furans will be collected, also for a 24-hour period, at 24-day intervals.

The samples will be submitted to an accredited laboratory for analysis. PAHs and dioxins/furans will be analyzed using Gas Chromatography/Mass Spectrometry (GC/MS) as per the protocols defined by US EPA Compendium Method TO-13A (for PAHs) and Compendium Method TO 9A (for dioxins and furans).

The list of PAHs are as follows:

Acenaphthylene, acenaphthene, anthracene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)fluorene, benzo(b)fluorene, benzo(ghi)perylene, benzo(a)pyrene, benzo(e)pyrene, 2-chloronaphthalene, chrysene, coronene, dibenzo(a,c)anthracene, 9,10-dimethylanthracene, 7,12-dimethylbenzo(a)anthracene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, 2-methylanthracene, 3-methylcholanthrene, 1-methylnaphthalene, 2-methylnaphthalene ,1-methylphenanthrene, 9-methylphenanthrene, naphthalene, perylene, phenanthrene, picene, pyrene, tetralin, triphenylene ,dibenzo(a,h)anthracene, dibenzo(a,e)pyrene quinoline, biphenyl, o-terphenyl, m-terphenyl, p-terphenyl.

3.4.3 HCl

The determination of HCl is difficult in ambient air. Although denuders and candles are supported in the Manual, no environmental laboratory offers the media or analysis from these techniques.

The methodology to be used will be a modified Method 26, which is a stack testing approach modified for ambient concentrations. This approach ahs been used successfully by GHD in previous ambient air application. Midget impingers are filled with approximately 20mls of 0.1 N H_2SO_4. Ambient air is collected by a mass flow controlled pump at approximately 20 mls/min over a 6 day to collect approximately 2 m^3 of sample volume. Analysis of the 0.1 N H_2SO_4 using Ion Chromatography to determine the mass of chloride ions in the solution after the sample period.

3.4.4 VOCs

A non-continuous method for measurement of VOCs in ambient air is provided in the USEPA **Compendium of**

Methods for the Determination of Toxic Organic Compounds in Ambient Air: Method TO-15 Determination of Volatile Organic Compounds (VOCs) in Air Collected in Specially Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS). This non-continuous method uses evacuated canisters to collect VOCs in ambient air and analyzes a specific list (TO-15) of toxic organic VOCs.

The list of VOCs to be collected and analyzed for the Program is as follows:

Acetone, benzene, bromodichloromethane, bromoform, bromomethane, butadiene, 1,3-Butanone, 2-Carbon tetrachloride, chloroform, cumene, dibromochloromethane, dichlorodifluoromethane, dichloroethane, 1,2-Dichloroethene, trans - 1,2-Dichloroethene, 1,1-Dichloropropane, 1,2-Ethylbenzene, ethylene dibromide, mesitylene, methylene chloride, styrene, tetrachloroethene, toluene, trichloroethane, 1,1,1-Trichloroethene, trichloroethylene, 1,1,2-Trichlorofluoromethane, trichlorotrifluoroethane, vinyl chloride, xylenes, m-, p- and o.

3.5 Laboratory Analytical Procedures

All samples will be obtained and analyzed following US EPA reference or equivalent methods as per the Manual. In addition to the descriptions in Section 3.3 above, a summary of the parameters to be assessed by laboratory analytical procedures during the Program and their laboratory reference methods is provided below:

Parameter	Laboratory Reference Method
Total Suspended Particulate (TSP) and Metals	US EPA Manual Reference Method: 40 CFR Part 50, Appendix B Compendium Method IO-3 with Atomic Emission Spectroscopy/ Inductively Coupled Plasma (AES/ICP)
Polycyclic Aromatic Hydrocarbons (PAHs)	Gas Chromatography/Mass Spectrometry (GC/MS) following US EPA Method TO-13A
Dioxins and Furans	Gas Chromatography/Mass Spectrometry (GC/MS) following US EPA Method TO-9A
Hydrogen Chloride	Ion Chromatography (IC) USEPA Method 26 Modified
Volatile Organic Compounds	Gas Chromatography/Mass Spectometry (GC/MS) USEPA Method TO-15

4. Quality Assurance Procedures

4.1 Operator and General Consultant Requirements

The Program will be operated by a third-party air monitoring consultant hired directly by Emerald EFW. The air monitoring consultant will be responsible for provision all equipment required for the monitoring program at both sample locations, the calibration and maintenance of continuous and non-continuous sample equipment as well as the procurement, collection and transport of samples to the accredited laboratory for analysis.

GHD will be the general consultant for the air monitoring program. GHD's responsibilities will include ensuring QA/QC by providing and reviewing the standardized sampling forms, performing periodic instrument performance and site audits as well as receiving and reviewing the continuous and non-continuous monitoring data.

GHD will provide and/or review standard operating procedure (SOPs) and a quality plan for operating and maintaining the monitoring program, which will include the following general provisions:

– All field activities will be recorded in standardized field records. Non-continuous data sheets will include initial and final flow measurements for each sample.
– Chain of custody forms will be completed and submitted along with exposed samples to the accredited laboratory used for analysis.
– All original containers will be used when submitting filters for analysis to avoid cross-contamination of samples, which will be recorded in the chain of custody forms.
– Preparing both quarterly reports summarizing the monitoring to date.
– Maintaining training records for all personnel involved in the project.

4.2 Instrumentation Calibration

All sample equipment will be bench-tested and calibrated prior to their installation in the field. If required, the samplers will be re-calibrated once installed before their first use. On-going calibration of the samplers will follow the recommended calibration schedule listed in the Manual and full calibration will be completed on a quarterly basis at a minimum.

It is anticipated that MECP will conduct periodic audits of the monitoring stations and equipment including prior to commencement of the monitoring program.

4.3 Accuracy Checks of Analysis Techniques

Periodic travel and field blank samples will be submitted to the accredited laboratory to ensure the accuracy of the analytical techniques used. Blank samples will account for ten percent (10%) of total submitted samples.

4.4 Sample Collection and Transportation

Samples will be properly handled to ensure that there is no contamination. For filters this entails the use of surgical gloves and tweezers to avoid contamination. All samples will be carefully removed from the monitoring device by a trained operator, and placed in sealed, non-reactive containers. All samples will be placed in protective cases for protection from breakage, contamination or loss during transportation.

An individual quality record in the form of a standardized data sheet for manual entry will be maintained for sample collection of non-continuous (PM/Metals, PAH/PCDD/F/PCB, and HCl) samples. The quality record will include the following information at a minimum:

- Station ID
- Station name/location
- Filter/canister ID
- Unique Sample number
- Sample start date/time
- Sample end date/time or elapsed time
- Sample Volume Calculation
- Technician name
- Meteorological conditions during sampling
- Comments and/or pictures on visual inspection of filters/canisters prior to and after sampling

4.5 Data Review and Validation

Data collected from the continuous monitors will be screened for any suspicious data including outliers, instrumentation drift and missing data following MECP protocols given in the Manual. In general, the Manual states that at a minimum, the required rate of recovery of valid data for both continuous and non-continuous monitors is 75% (both seasonally and annually). In addition, for NOx and SO_2 sampling, zero drifts beyond 5 parts per billion (ppb) require an off-set adjustment.

A final data screening of all measurement data will be performed at the end of the monitoring program to examine overall trends and to identify and correct any suspect data following MECP protocols in the Manual.

5. Final Reporting

At the end of the monitoring period, a final report will be compiled that will detail the monitoring methods, and results. The final report will compile all the data and determine the maximum, minimum, average and 90th percentile concentrations of all parameters. For the purposes of determining background concentrations, the 90th percentile 1-hour concentrations be used for continuous data and 90th percentile 24-hour concentrations for non-continuous data.



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Appendix B.6

Noise Assessment Report

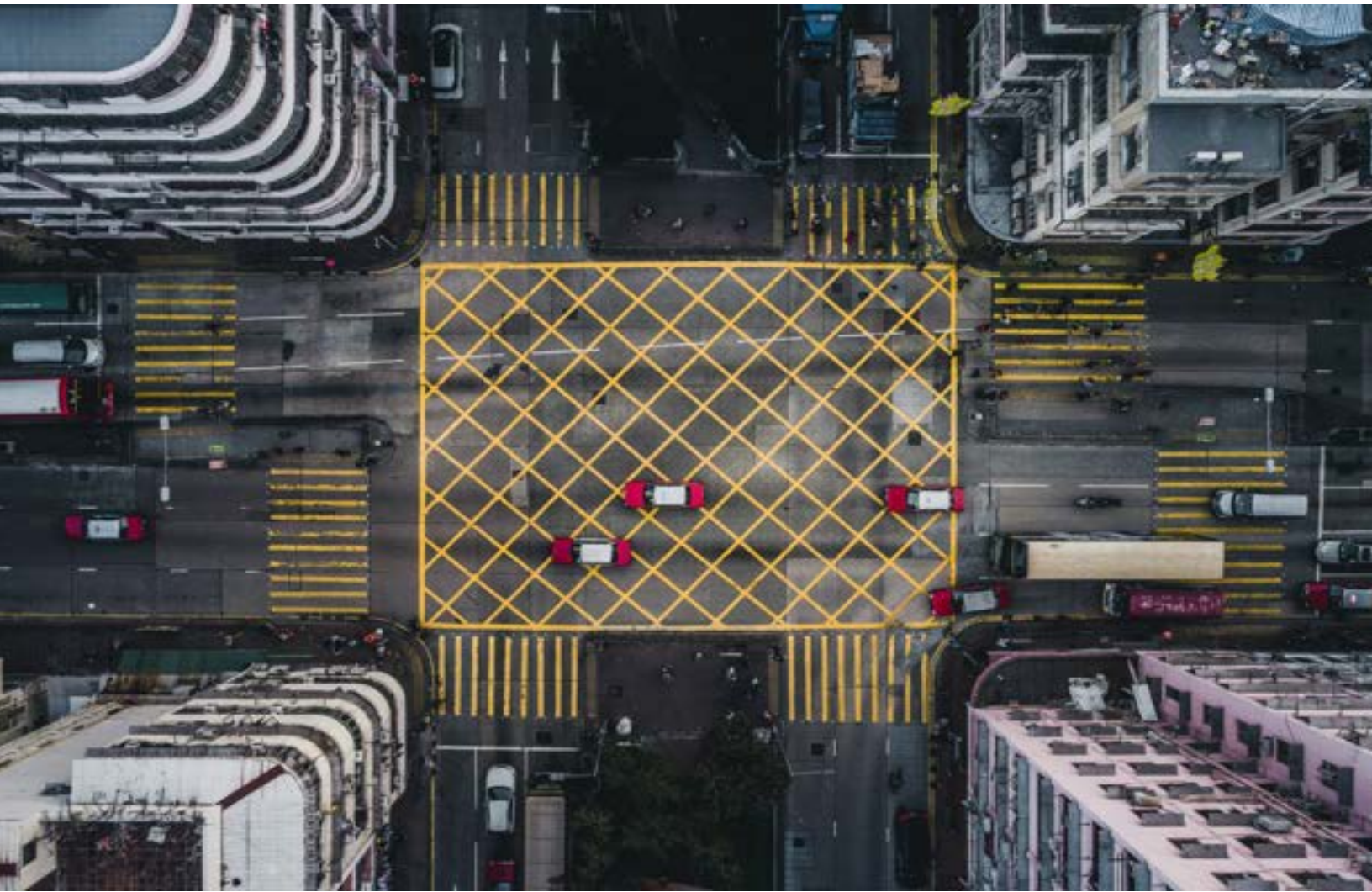
Noise Assessment Report

Emerald Energy from Waste Environmental Screening & ECA Amendment

Emerald Energy From Waste Inc.

26 January 2024

→ The Power of Commitment



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1. Introduction

This report documents the Noise Assessment carried out as part of the Environmental Assessment Screening for the Emerald Energy from Waste Facility.

The Emerald Energy from Waste facility (Site) is located at 7656 Bramalea Road, in Brampton, Ontario and is owned and operated by Emerald Energy from Waste Inc, herein referred to as Emerald EFW (Emerald EFW, Owner, Proponent). The location of the Site is shown in **Figure 1.**



Figure 1 Location of the Proposed Undertaking

The Site received a Certificate of Approval (CofA, now referred to as an Environmental Compliance Approval [ECA]) (Air) in 1991 and has accepted municipal solid waste since 1992. The Site, which operates under ECA No. 0264-BFGQFY issued March 19, 2021, has approved waste processing rates of 546 tonnes per day and 182,000 tonnes per year. The Site is currently approved for a total of six 2-stage gasification units (five units are currently installed) by Consumat System Inc., each having a nominal design Waste Processing Rate of 91 tonnes per day of municipal solid waste. Under the current ECA, the Site is licensed to receive solid non-hazardous waste from domestic, commercial, industrial and institutional sources and waste designated for thermal treatment by the Canadian Food Inspection Agency and/or Health Canada, from the province of Ontario, as well as solid non-hazardous waste limited to international waste, arriving in the province of Ontario.

Any proposed change to the waste processing limits requires a modification to several conditions of the approved ECA, which specifies the maximum amount of waste to be processed daily and annually as well as the allowable number of equipment units. The proposed Project would amend the approved ECA to allow for up to 900,000 tonnes

of non-hazardous residual waste processing capacity annually. It is intended that staged decommissioning of the existing five units would take place as the proposed new units are brought online, such that the annual processing capacity of the entire facility would not exceed 900,000 tonnes at any time. Changes to the current approved size and footprint of the Emerald EFW facility will also be required in order to accommodate the proposed new gasification units.

The proposed change to the annual waste processing capacity will allow Emerald EFW to positively respond to reducing Ontario's reliance on landfill disposal (both Canada and USA) while recovering energy from residual materials and reducing greenhouse-gas emission. This includes diverting a significant amount of Ontario's total residual waste going to landfill (currently 97 percent)[1] while ensuring the longevity of landfill disposal capacity. The proposed facility expansion is expected to have an operating life of at least 20 years. Between 1997 and 2000, Emerald EFW completed an Environmental Assessment (EA) for expansion of the facility by 25 percent. A CofA was issued in 2009. The Site also conducted and Environmental Screening for service area expansion and was approved between 2011-2012. The amendments to the ECA were approved in 2010, 2012, and 2020 by the Ministry of Environment, Conservation and Parks.

In order to meet the growing demand from waste generators and customer for a safe and reliable waste management facility for their post diversion solid non-hazardous Residential and Industrial, Commercial & Institutional waste, Emerald Energy from Waste Inc. is proposing to redevelop and expand the processing capacity of their existing facility from 500 tonnes/day to up to 2,500 tonnes/day and increase the energy recovery from 10 MW to up to 100 MW. This redevelopment will be implemented in 3 phases. During Phase 1, the existing facility will remain operational while the first new processing line is constructed (See Figure 2). Phase 2 and 3 will installed and commissioned in response to market demand. The existing facility would be removed as shown in Figure 3.



Figure 2 Proposed Redevelopment Phase 1

[1] Solid Waste in Ontario: Landfill Report, Ontario Waste Management Association, January 2021.



Figure 3 Proposed Redevelopment Phase 2 & 3

This ECA amendment is subject to the Environmental Screening Process in accordance with Section 16 of Ontario Regulation 101/07 – Waste Management Projects Regulation of the Ontario *Environmental Assessment Act*, as follows:

> *A change to a thermal treatment site described in section 11 is defined as a major commercial or business enterprise or activity and is designated as an undertaking to which the Act applies, if the amount of waste that would be subject to thermal treatment at the site on any day after the change would exceed the amount of waste that was authorized under the Environmental Protection Act to be subject to thermal treatment at the site before the change. O. Reg. 101/07, s. 16; O. Reg. 389/22, s. 9.*

Section 16 of Ontario Regulation 101/07 – Waste Management Projects Regulation exempts this Project from Part II of the *EA Act*, subject to fulfilling the Environmental Screening Process. The Screening will be conducted in accordance with the planning and design process outlined in MECP "*Guide to Environmental Assessment Requirements for Waste Management Projects.*" The Environmental Screening process includes identifying and applying screening criteria to determine and describe potential environmental effects, public/external agency consultation, and the development of measures to mitigate identified environmental effects. The results of the Study will be documented in an Environmental Screening Report (ESR), which will be released for review to Stakeholders including Indigenous communities, the public, and government agencies. Upon completion of the Environmental Screening Process an application will be made to amend the existing ECA No. 0264-BFGQFY.

The Environmental Screening Process is described further in Section 2 including the application of the Screening Criteria Checklist. The existing, planned and future Noises within the study area were confirmed through background research and a site visit are documented in Section 3. In general, the predominant existing Noise within the Study Area is Industrial with Spring Creek located to the west, which is anticipated to remain that way for the foreseeable future based on current municipal planning policy.

The effects assessment carried out for the Noise conditions is documented in Section 4. The identification of potential effects of the proposed project, mitigation measures to address the effects and the resultant net effects are described in Section 4. Lastly the monitoring requirements and additional approvals required are detailed in Section 5.

The Study Areas reviewed for the Noise assessment was as follows (see Figure 2):

From a Noise and Economic Environment perspective, the characterization of existing conditions within the following study areas are appropriate to this Environmental Screening:

– **Site Study Area**, including all lands within the existing, approved boundaries of the Emerald EFW, as defined by Environmental Compliance Approval (ECA) No. 4591-56VSTN, as amended; and
– **Local Study Area**, including all lands within a 2.5 Kilometer (km) radius of the Site Study Area boundaries. An Inventory of sensitive uses within 500 metres (m) of the Site Study Area will also be examined.



Figure 4 Site Boundary and Local Study Area

For this Noise assessment report GHD has completed the following:

– Assessed the existing conditions of the Site such as current Facility operating noise emissions
– Determined the existing ambient noise conditions at the nearest Points of Reception
– Assessed the operation of the Site while construction is taking place
– Assess the future Site operations and noise impacts.

2. Screening Criteria Checklist

At the beginning of the Environmental Screening, the Screening Criteria Checklist (provided as Schedule I, pp 62 – 64, to the "Guide to Environmental Assessment Requirements for Waste Management Projects") is to be completed based on the information provided in the Project Description. The Screening Criteria reflect the broad definition of "environment" contained in the *Ontario Environmental Assessment Act*

As noted in the Guide:

*"The Screening Criteria are presented in the form of a checklist with the option of a "Yes" or "No" response. Mitigation measures **are not** to be considered in concluding whether there is "No" potential environmental effect. That is, the proponent is required to answer "Yes" even if the proponent believes that a potential environmental effect could likely be mitigated. The reason for requiring a "Yes" is to ensure that mitigation measures are open to discussion and review. Another reason for this approach is that further discussion and review of a potential effect may reveal that there is no actual effect, in which case no mitigation is required. Where a "yes' has been identified, the proponent is to provide additional information in the Environmental Screening Report, explaining the potential effect(s), methods to*

mitigate or address the effect(s), any net effects that are anticipated and if so, their significance. Even where the proponent indicates that no environmental effects are anticipated, it is recommended that additional information is provided in the Environmental Screening Report in order to support the "no effects" conclusion".

Each criterion is based on a question which is prefaced with the phrase, "Might the Project…" Table 1 was completed as the first step of the Environmental Screening Process and is a summary of the criteria for the Noise discipline. Further descriptions of the criteria for which a "Yes" response was indicated in the Screening table are discussed in **Section 4.0** of this report.

Table 1 Screening Criteria Checklist

	Criterion	YES	NO	Additional Information
	Might the project…			
Noise				
3.4	Cause negative effects from the emission of noise?	X		The proposed EFW Facility expansion would result in changes to the existing site footprint and on-site operations and may result in a potential increase in noise emission associated with continued future operations of the Site.

3. Existing Conditions

The following subsections describe the existing conditions that are found within the On-Site, Site Vicinity and Regional Study Areas for Noise (section 3.1) of the proposed project.

3.1 Methodology

3.1.1 Available Secondary Source Information Collection and Review

Available secondary sources of information were collected and reviewed by the Noise assessment Team to determine existing noise conditions within the study area(s). The following sources of secondary information were collected and reviewed:

– Review of Historic Noise Complaints
– Review of current zoning plans, definitions, and land use designations
– Aerial photographic mapping to confirm off-Site receptors
– Site expansion design and operation data and associated topography
– Applicable MECP guidelines and technical standards (i.e.NPC-103, NPC104, NPC-207 and NPC-300)

3.1.2 Process Undertaken

GHD has described the processes and steps taken in chronological order as required to best describe the methodology used for this assessment.

3.1.3 Historic Noise Complaints

The Emerald EFW Site has not received any formal noise complaints for the existing operations on-site after a review of all formal complaint records provided.

3.1.4 Review of Zoning

The Site is located on an Industrial zoned land surrounded by Agricultural land to the northwest and southeast, Floodplain to the south and more Industrial zoned land to the north. The nearest residential area is located is a high-density zoned apartment condos 1.5 km north west of the site and a residential subdivision 2.4 km to the north east.

A zoning map is provided as Figure A.1 and definitions are included in Appendix A.

3.1.5 Site Review

The Site is located on the east side of Brampton next to Highway 407 along Bramalea Road and is geographically situated within the City of Brampton.

The Site is currently zoned as Industrial and the land use surrounding the Site are classified as industrial, agricultural and Floodplain.

The Site currently operates under Amended ECA No. 0264-BFGQFY issued on March 19, 2021. The Site is accessed via Bramalea Road, a 4-lane road and is adjacent to Highway 407.

GHD reviewed the closest sensitive receptors (residential buildings) within the Study Area which are approximately 1500 meters (m) and 2400 m from the Site Boundary as indicated in Figure 5.The residential dwelling to the northwest is a 19-storey apartment building and the residential subdivision to the north east includes two-storey (4.5 m above grade [AG]) houses.

The identification of appropriate sensitive point(s)-of-reception (POR) is necessary to conduct the Noise assessment for the Site. A "point-of-reception" is any point on the premises of a person where sound, originating from other than those premises, is received. The point-of-reception may be located on permanent or seasonal residences, nursing/retirement homes, rental residences, hospitals, campgrounds, schools, or places of worship.

The objective of the existing conditions section is to determine the predictable worst-case 1-hour equivalent sound level (1-hour Leq) at the worst-case POR(s). The worst-case POR(s) are defined as the sensitive receptors with the greatest potential exposure to the Site noise sources due to proximity and direct line-of-sight exposure. The worst-case sensitive POR(s) are:

– POR1 – nearest façade of a 19-storey apartment at 64 Bramalea Road northwest of the site (26 m AG)
– POR2 – nearest façade of a two-storey residence at 58 Cattrick Street east of the site (4.5 m AG)

GHD also evaluated the zoning surrounding the Site to identify any potential vacant lots that permit a residential build and has included all relevant POR's.



Figure 5 Point of Reception Location Plan

3.2 Description of Existing Conditions

The Site currently operates a waste disposal site (an energy-from-waste Site) to thermally treat the following categories of solid waste and produce electricity and steam:

– Solid non-hazardous waste from domestic, commercial, industrial and institutional sources and waste designated for thermal treatment by the Canadian Food Inspection Agency and/or Health Canada, from the province of Ontario
– Solid non-hazardous waste, limited to International Waste

The Site operates 24 hours a day, 5 days a week, 52 weeks a year under the North American Industry Classification System (NAICS) Code 562213 - Solid Waste Combustors and Incinerators.

3.2.1 Ambient Background Noise Monitoring

GHD selected the most appropriate locations to deploy sound level meter systems (SLMs) to capture the site-specific ambient sound level conditions in the areas adjacent to the sensitive residential PORs as shown on Figure 5.

The SLM equipment was deployed at two (2) monitoring locations adjacent to POR1 and POR2 at a minimum height of 1.5m. The sound level measurements were taken using 2 Larson Davis LxT Systems which includes a Type 1 Precision Sound Level Meter (SLM), Model LxT (Serial Numbers 0002683, 0004812) and a 1/2-inch free field condenser microphone. The SLMs were calibrated and checked at 114 decibels (dBA) before and after each measurement period using a Larson Davis CAL200 Acoustic Calibrator.

The sound level measurements were collected for one-week from June 8 to June 13, 2023, to include weekdays and weekend noise levels. This ensures that the ambient background is representative of typical noise levels around the nearest worst-case receptors.

Meteorological weather conditions during the noise monitoring period were obtained from Environment Canada's Toronto International A Climate Station operated by NAV Canada in order to validate the data and to evaluate adverse weather conditions that could have affected the sound level measurements. Elevated sound levels that may have been influenced by high winds and/or rain were removed from the data set where appropriate.

During the measurement period, two quantities of note were recorded: the Leq, and L90 sound levels, over a one-hour time interval with minute-by-minute resolution with the detectors set to slow response. The Leq sound level is the energy equivalent sound level and represents the integrated sound exposure level of both steady and time varying sounds over the duration of the measurement. L90 represents the sound level which is exceeded 90 percent of the time over the duration of the measurement, and is therefore useful in identifying the contribution of other sound emissions in the area as detailed in Tables B.1 and B.2 of Appendix B.

The lowest daytime Leq measured at POR1 was 50 dBA, measured at 07:00 on June 11. The lowest night sound level was 48 dBA, measured at 0:00 and 2:00 on June 13. At POR2, the lowest daytime sound level was 50 dBA, measured at 08:00 on June 11, and the lowest night sound level was 44 dBA, measured at 03:00 on June 11. These results are consistent with the characteristics of a MECP Class 1 area.

3.2.2 Existing Site – Short Term Steady State Sound Level Measurements

Short-term sound level measurements were necessary in order to assess the worst-case potential noise impact at the PORs.

Short-term sound level measurements were taken using a Larson-Davis LxT System inclusive of a Type 1 Precision Sound Level Meter (SLM), (Serial Number 0002683); and a 1/2-inch free field condenser microphone. The SLM was calibrated and checked at 114 decibels (dBA) before and after each measurement period using a Larson-Davis CAL200 Acoustic Calibrator.

The sound descriptor used in the impact evaluation for the Site noise sources is the 1-hour Leq, which is a time weighted energy average of the source. The Leq sound measurements consisted of short-term readings taken over an observation time of 15 second intervals with the detector in slow response using A-weighting, such that the sound levels are reported in units of dBA. All measurements were recorded and stored in the SLM. In accordance with NPC-103 "Procedures", August 1978 (NPC-103), at least three measurements were taken for each of the Site noise sources.

Sound level measurements were taken at a reference distance depending on the height of the source(s) being measured and proximity to other noise sources. The location and reference distance were selected to ensure that the reference measurement was a valid representation of the dominant source(s) being measured. The measurement location was selected in order to measure the sound emitted in the direction of the worst-case exposure in line with the nearby sensitive receptors wherever possible and/or to minimize the influence of other noise sources and directivity issues.

Sound level measurements were conducted by Mr. Patrick Chen and Mr. Sean Diehl from GHD on June 8, 2023. Meteorological conditions consisted of low winds (<20 km/hr), low humidity, and no precipitation during the measurement days.

3.3 Assessment Criteria

Assessment criteria may be determined for a POR based on the MECP's minimum exclusionary sound level limits, as presented in Table B 1 of NPC-300, in comparison to the background sound levels experienced in the area. The "background sound level" is defined as the sound level present in the environment that is produced by noise sources

other than those from the Site and would include traffic sound levels and sound from neighbouring industrial/commercial activity. The higher of the two assessment criteria is selected for purpose of assessment.

3.3.1 Sound Level Limits for Stationary Noise Sources

3.3.1.1 MECP Standard Limits

NPC-300 defines stationary noise sources as sound from all sources that are normally operated within the property lines of a facility. The noise impact from stationary sources is evaluated based on operations during a predictable worst-case hour. Stationary noise assessment criteria are generally determined based on the MECP's minimum exclusionary sound level limits, as presented in NPC-300, in comparison to the background sound levels experienced in the area.

Limits are provided for two main types of noise sources:

– Non-impulsive, “continuous” noise sources such as ventilation fans, mechanical equipment, and vehicles while moving within the property boundary of an industry. Continuous noise is measured using 1-hour average sound exposures (Leq (1-hr) values), in dBA.
– Impulsive noise, which is a “banging” type noise characterized by rapid sound level rise time and decay. Impulsive noise is measured using a logarithmic mean (average) level (LLM) of the impulses in a one-hour period, in dBAI.

The guideline requires an assessment at, and provides separate guideline limits for:

– Outdoor points of reception (e.g., back yards, communal outdoor amenity areas).
– Façade points of reception such as the plane of windows on the outdoor façade which connect onto noise sensitive spaces, such as living rooms, dens, eat-in kitchens, dining rooms and bedrooms.

Acoustical Area Classification

Under the MECP Publication NPC-300 guidelines, noise sensitive receptors are defined using receptor area classifications. The receptor areas are classified as either:

– Class 1 – Urban areas
– Class 2 – Suburban / semi-rural areas
– Class 3 – Rural areas
– Class 4 – Infill areas (Subject to Municipal Planning Approval for New Developments)

Depending on the receptor area classification, different guideline limits apply. Classes 1, 2, and 3 were included in the predecessor guidelines to Publication NPC-300. The Class 4 area is intended to allow for infill and redevelopment, whilst still protecting residences from undue noise.

Tables 2 and 3 below summarizes the MECP's minimum exclusionary sound level limits for based on the Acoustical Class of the project area, which are expressed in terms of 1-hour equivalent sound levels (1-hour Leq):

Table 2 MECP Minimum Exclusionary Sound Level Limits for Steady Sound

Time of Day	Class 1 Sound Level Limits (dBA)		Class 2 Sound Level Limits (dBA)		Class 3 Sound Level Limits (dBA)		Class 4 Sound Level Limits (dBA)	
	Plane of Window	Outdoor POR	Plane of Window	Outdoor POR	Plane of Window	Outdoor POR	Plane of Window	Outdoor POR
07:00 – 19:00 (Day)	50	50	50	50	45	45	60	55
19:00 – 23:00 (Evening)	50	50	50	45	40	40	60	55
23:00 – 07:00 (Night)	45	NA	45	NA	40	NA	55	NA

Table 3 MECP Minimum Exclusionary Sound Level Limits for Impulsive Sound

Number of Impulses Per Hour	Class 1 & 2 Sound Level Limits (dBAI)		Class 3 Sound Level Limits (dBAI)		Class 4 Sound Level Limits (dBAI)	
	Plane of Window (7am – 11pm / 11pm – 7pm)	Outdoor POR (7am – 11pm)	Plane of Window (7am – 11pm / 11pm – 7pm)	Outdoor POR (7am – 11pm)	Plane of Window (7am – 11pm / 11pm – 7pm)	Outdoor POR (7am – 11pm)
9 or more	**50 / 45**	**50**	45 / 40	45	60 / 55	55
7 to 8	55 / 50	55	50 / 45	50	65 / 60	60
5 to 6	60 / 55	60	55 / 50	55	70 / 65	65
4	65 / 60	65	60 / 55	60	75 / 70	70
3	70 / 65	70	65 / 60	65	80 / 75	75
2	75 / 70	75	70 / 65	70	85 / 80	80
1	80 / 75	80	75 / 70	75	90 / 85	85

Based on the acoustic environment at the development, it is considered to be in a Class 1 area as defined by NPC-300, as the acoustic environment is dominated by human activities (i.e., road traffic).

Class 1 noise limits appropriate for this project have been shaded for reference.

GHD has applied an impulse noise limit of 50/45 dBAI for the Silo Impulse noise (Source I01) based on a frequency of more than 9 per hour.

The applicable noise criteria at the POR(s) are based on the higher of the background sound level and the MECP's minimum sound level limits. The applicable site-specific sound level limits are summarized as follows:

Table 4 Applicable Minimum MECP Sound Level Limits or Background Sound Levels for Impulsive and Steady State Sound

POR ID	POR Description	Sound Level Limits (dBA)		
		Day (7am – 7pm)	Evening (7pm – 11pm)	Night (11pm – 7am)
POR1	Vertical midpoint on the south façade of the apartment 19 floor (26 metres above grade [m AG])	50	50	**48**
POR2	Worst-case plane of window on west façade, 2nd floor (4.5 m AG)	50	50	45

The lowest sound levels generally occur at the ground floor level (1.5 metres above grade) and increase with height due to increased line of sight exposure to the roadways. GHD has presented the lowest noise limit relative to the worst-case Site noise impact based on line-of-sight and exposure to the applicable receptor.

3.4 Existing Conditions – Noise Impact Assessment

3.4.1 Noise Source Summary

The existing significant noise sources identified at the Site with the potential to adversely impact the sensitive receptors. The significant noise sources are identified in Table C.1 of Appendix C and the locations are identified on Figure 6 below:



Figure 6 Existing Noise Source Location Plan

GHD visited the Site on June 8, 2023 to measure sound levels of the dominant noise sources.

Onsite transport truck activities for shipping and receiving is summarized below:

Type of Vehicle	Noise Source ID	Day 7a.m.- 7 p.m. (Trips/hour)	Evening 7p.m.- 11 p.m. (Trips /hour)	Night 11 p.m.- 7 a.m. (Trips /hour)
Shipping and Receiving Truck Route	TR1	15	15	15

The following equipment/operations was observed to be an impulsive noise source:

– Group of Silos with Pneumatic Baghouses (Source I01)

All impulse noise sources were evaluated based on a frequency of greater than nine per hour.

The Site is not a source of vibration.[2]

[2] Assessment of vibration if applicable is assessed according to NPC-207.

The significant equipment sources are all either trucking related activities, rooftop equipment or outdoor equipment located beside the building. The Site does not have any significant interior noise sources resulting in breakout noise anywhere from the building other than the bay doors modelled. The existing building at the Site is a made of standard industrial construction materials. The other noise sources at the Site have not been included since they are considered insignificant contributors to the overall Site noise level at the sensitive receptors.

3.4.2 Steady State Sound Levels

The worst-case assessment of steady-state noise sources at the selected points-of-reception was based on measured sound pressure levels. CadnaA Acoustical Modelling Software (CadnaA), version 2023, was used to model the potential impacts of the significant noise sources. CadnaA calculates sound level emissions based on the ISO 9613-2 standard "Acoustics – Attenuation of Sound during Propagation Outdoors".

The worst-case cumulative Site-wide attenuated sound levels estimated at the receptor(s) included attenuation affects due to geometric divergence, atmospheric attenuation, barriers/berms, ground absorption and directivity, as applicable for all significant noise sources. Off-site buildings were input as intervening structures.

CadnaA modelling assumptions used in this Noise assessment included:

- **Noise Sources:** All sources were modelled using the 1/1 octave band data
- **Reflection Order:** A maximum reflection order of 2 was used to evaluate indirect noise impact from one reflecting surface
- **Ground Absorption:** Ground absorption coefficients of 0.25 for asphalt and 1.0 for grass were used to model ground absorption around the Site and adjacent properties
- **Time-Weighted Adjustment***:* Time-weighted adjustments for sources that do not operate continuously are summarized in Table C.1
- **Receptor Elevation**: POR receptor heights were modelled appropriately to represent the worst-case elevation as detailed in Section 4
- **Tonality**: A +5 dBA adjustment was applied for tonal sources if applicable
- **Building Surfaces:** The buildings are modelled as reflective surfaces
- **Terrain:** The surrounding area was modelled based on site specific topography
- **Foliage:** No attenuation due to foliage was included to be conservative

The existing steady state sound levels estimated at the PORs is summarized in Table 5 below.

Table 5 Existing Stead State Sound Levels

POR ID	POR Description	Existing Facility Steady State Noise Impacts Day/Night 1 hr L_{Aeq}	Day/Night Sound Level Limit (dBA)	Compliance with MECP Noise Limits (Yes/No)
POR1	Vertical midpoint on the south façade of the apartment 19 floor (26 metres above grade [m AG])	37/37	50/48	Yes/Yes
POR2	Worst-case plane of window on west façade, 2nd floor (4.5 m AG)	27/27	50/45	Yes/Yes

The existing steady state sound levels estimated at the PORs is meet the limits for steady state noise sources and a noise control program is not required.

3.4.3 Impulsive Sound Levels

The worst-case assessment of impulse noise at the selected POR(s) was based on the Logarithmic Mean Impulse Sound Level from reference impulse sound pressure levels and reference distances.

The unattenuated impulse sound levels predicted at the PORs were estimated based on the A-weighted logarithmic mean of the impulses (LLM). The LLM value and reference distances were input to CadnaA and the impulse noise impact was estimated at each POR.

The unattenuated impulse noise impact at all POR's is summarized in Table 6 below.

Table 6 Existing Impulsive Sound Levels

POR ID	POR Description	Existing Facility Impulse Noise Impacts Day/Night 1 hr L_{Aeq} (dBAI)	Day/Night Sound Level Limit (dBAI)	Compliance with MECP Noise Limits (Yes/No)
POR1	Vertical midpoint on the south façade of the apartment 19 floor (26 metres above grade [m AG])	26/26	50/48	Yes/Yes
POR2	Worst-case plane of window on west façade, 2nd floor (4.5 m AG)	25/25	50/45	Yes/Yes

The existing impulsive sound levels estimated at the PORs is meet the limits for impulsive noise sources and a noise control program is not required.

4. Description of Project Components and Activities

A Project Description, which includes a Site Plan, was prepared so that potential environmental effects and mitigation measures could be identified. The following subsections provide a general summary of the proposed undertaking:

Ontario disposes over 97 percent of its residual materials in landfills. The remaining three percent is managed through Energy from Waste (EFW.[3]). Of the 97 percent directed to landfill disposal, 70 percent is disposed of within Ontario and 27 percent in Michigan and New York.[4]). Based on the current disposal rate of 97%, Ontario's landfill capacity is projected to be exhausted in 11 to16 years[5]. In order to address the compounding issues of growing population and diminishing landfill capacity in southern Ontario, Emerald EFW has identified an opportunity to develop new EFW capacity at their existing facility in Brampton.

The purpose of this Project is to provide additional processing capacity at the Emerald EFW facility in Brampton, Ontario in order to divert a portion of the non-hazardous residual materials produced by Ontario residents and businesses from landfills, thereby recovering energy for use within the community. The proposed Project would allow for three new gasification units, each capable of processing up to 300,000 tonnes of residual waste per year, for a total processing capacity at the facility of 900,000 tonnes annually. This would increase the permitted annual waste processing amount from 182,000 to 900,000 tonnes. The proposed change in the annual processing capacity requires additional facility infrastructure and a change to the Site footprint.

The project for which the Environmental Screening Process is being undertaken is a proposed redevelopment of the existing site and involves a change to the final site capacity and footprint. A high level of construction & demolition will be required to implement the proposal. The redevelopment will be implemented in 3 phases. In phase 1, the existing facility will remain operational while the first new processing line is constructed. Phases 2 and 3 will be installed and commissioned in response to market demand. The existing facility would be removed. Emerald EFW will undergo an ECA amendment for changes to approved processing capacity and other operational activities. From a traffic perspective there will be no changes to existing haul routes or Site entrance. Increasing the annual processing

3 Solid Waste in Ontario: Landfill Report, Ontario Waste Management Association, January 2021.
4 Ibid.
5 Ibid.

capacity will result in increased truck traffic on the haul route from Highway 407 along Bramalea Road on an annual basis. This is expected to be acceptable relative to local traffic volumes.

A summary of the key elements of the proposed capacity expansion compared to the existing approved Site is provided in Table 7.

Table 7 Summary of Proposed Emerald EfW Facility Design vs Existing Facility

Design Component	Existing EfW Facility	Proposed Redevelopment
Waste Processing Capacity (tonnes per annum)	150,000	900,000
Number of Operation Lines	1	3

5. Potential Effects, Mitigation Measures & Net Effects

This section documents the potential effects on the environment, mitigation measures and net environmental effects for Noise resulting from the proposed undertaking. This section of the report relies on the Project Definition Brief prepared by Ramboll (June 2023), which forms an attachment to the Environmental Screening Report.

5.1 Methodology and Investigations

The assessment of effects associated with the proposed undertaking was carried out through a series of steps that is based, in part, on the description of existing conditions as well as the Project Description and Site Plan depicted in Appendix A. The assessment of effects was also undertaken within the context of the previously completed Screening Criteria Checklist, as summarized in **Section 2.0** of this report.

5.1.1 Potential Effects Phases

The potential effects of construction and operations of the Site expansion has been assessed in 4 different phases:

1. Construction of Line 1 expansion with existing Site operational (Construction/Existing Operation Phase)
2. Operation of Line 1 expansion with demolition of existing Site (Future Operation/Demolition Phase)
3. Operation of Line 1 expansion with construction of Line 2 and Line 3 expansions (Future Operation/Construction Phase)
4. Full operation of Lines 1, 2, and 3 expansions (Future Operational Phase)

5.1.2 Construction Noise Assessment

5.1.2.1 Construction Noise Criteria

The United States Federal Transit Administration's Transit Noise and Vibration Impact Assessment guide (FTA, 2018) is widely used as a reference for construction noise and vibration impact assessment. The FTA guidance manual includes a residential daytime noise criterion of 80 dBA Leq,8hr, or a 70 dBA Leq,8hr criterion for night-time work for detailed assessment purposes. Above these levels, noise control measures are recommended. While there is no formal noise limit for construction, GHD recommend that offsite noise impacts be kept below the FTA guidance and should noise complaints occur and stepped approach may be required to adjust the noise limits towards the existing daytime ambient sound levels as well as the Class 1 daytime noise limit applied to the Industry by the MECP if required on a reactive approach.

Temporary construction noise impacts at all site locations are anticipated to be below the US FTA guideline limit of 80 dBA Leq,8hr for daytime construction work at all POR locations. Noise levels are expected to be lower because the predictions are based on the assumed equipment operating together at the same conservative set-back distance, rather than distributed around the work site. However, noise will be controlled to ensure that the guideline limits are not exceeded, where possible.

5.1.2.2 Construction Noise By-Law

The Corporation of the City of Mississauga Noise Control By-Law 360-79 states the following prohibitions by time:

No person shall emit or cause or permit the emission of sound resulting from any act listed in Column 1 to Schedule 2 to this by-law if clearly audible at a point of reception located in a residential area or quiet zone within a prohibited period of time for such an area as set out in Column 2 to Schedule 2 to this By-law.

Where “the operation of any construction equipment in connection with construction” is prohibited during time periods D and E for areas defined as a Quiet Zone, and time periods D and F for areas defined as a Residential Area:

A - 23:00 hrs. of one day to 07:00 hrs. next day (09:00 hrs. Sundays)

B - 19:00 hrs. of one day to 07:00 hrs. next day (09:00 hrs. Sundays)

C - 17:00 hrs. of one day to 07:00 hrs. next day (09:00 hrs. Sundays)

D - All Day Sundays and Statutory Holidays

E - 17:00 hrs. of one day to 07:00 hrs. next day

F - 19:00 hrs. of one day to 07:00 hrs. next day

“Quiet Zone” means those areas of the city where quiet is of particular importance and as more particularly designated in Schedule 4 to this By-law.

“Residential Area” means any area containing dwellings which are normally used for human habitation.

Construction noise monitoring is not required for by-law compliance.

In keeping with this by-law, construction is expected to occur within daytime hours only, between the hours of 07:00 and 19:00.

5.1.2.3 NPC-115 Construction Equipment Noise Limits

NPC-115 Construction Equipment requirements are detailed by the Ministry of the Environment Conservation and Parks (MECP) as follows:

	Excavation Equipment, Dozers, Loaders, Backhoes	Pneumatic Pavement Breakers – Residential / Quiet Zone	Compressors – Residential / Quiet Zone	Tracked Drills– Residential / Quiet Zone
Power Rating < 75 kW	83 dBA	85 dBA	76 dBA/70dBA	100 dBA
Power Rating > 75 kW	85 dBA			
Note: The equipment requirement is based on a January 1, 1981, date of manufacturer or later. A power rating is not applicable for pavement breakers, compressors, or tracked drills.				

Measurements are conducted at a 15 m reference distance and at the rated maximum RPM in accordance with SAE J88a procedures as referenced in NPC-103. Stationary or pass-by tests are appropriate following the procedure below:

> *3.3.6 - For stationary tests, record the sound level obtained at a distance of 15 m (50 ft.) normal to the centers of the four major surfaces of the equipment at the microphone height. Generally, four major surfaces refer to front, rear, and sides of an imaginary box that would just fit over the machine but does not include attachment items such as buckets, dozers, and booms. In the case of a crane or an excavator, the upper (revolving superstructure) fore-and-aft centerline should be in line with the lower fore-and-aft centerline.*

3.3.7 - For moving tests, take measurements at a distance of 15 m (50ft) measured in a direction normal to a major side surface which is parallel to the machine path.

3.3.8 - The final reported sound level per this SAE Recommended Practice shall be the highest of the reported values obtained in paragraphs 3.3.6 and 3.3.7; the test report shall include the test mode, the machine operating conditions during the reported test mode, the stabilized maximum governed engine speed, the location of the microphone in relation to the construction machine, the surface description over which the machine operated, and the sound level measurements were made.

The major concerns of the construction phases are human annoyances due to excessive noise and vibration levels, therefore, the applicable legislative documents that were followed relate to residential impacts and not to impacts on construction workers, which is the responsibility of contractors performing the construction operations.

5.1.2.4 Construction Noise Source Summary

Equipment and activities associated with Phases 1, 2 and 3 for the proposed Project have the potential to produce noise emissions in the vicinity of the Project above the documented baseline/limits. Changes to ambient noise levels and vibrations have the potential to impact existing sensitive receptors. The construction phase of any project is typically considered temporary or short-term relative to the entire life cycle of a project and mostly limited to daytime construction hours. It is anticipated that any construction or operational noise will be at or below either the baseline levels or the MECP noise limits at the worst-case receptor locations. This will be achieved by controlling noise with attenuation (the distance between a noise source and a receptor), vertical separation/blocked line of sight, best practices for construction/demolition and equipment design where feasible.

The following section details an updated analysis, parameters or assumptions used in the noise evaluation of the Site.

Noise Source Operating Parameters/Assumptions

In order to predict the future worst-case noise impacts from the Project activities, representative octave band noise data was used or measured from construction/processing equipment similar to what is noted to be required for the Project. This data was obtained from the United States Department of Transportation, Federal Highway Administration (FHWA) document FHWA Roadway Construction Noise Model User's Guide, 2006, with supplemental data obtained from British Standard 5228-1:2009+A1:2014 “Code of Practice for Noise and Vibration Control on Construction and Open Sites” and GHD's noise source library for equipment not listed in the FHWA document.

”Acoustic Usage Factors” from the FHWA document were used to adjust the sound power levels of equipment based on the expected percentage of time that the equipment will actually be operational and emitting significant noise. If an acoustical usage factor was not available, the default value of 50% was used.

The environmentally significant noise sources or activities occurring on Site is separated into 3 separate stages:

– Phase 1 – Construction of Line 1, concurrent with the operation of the existing Site
– Phase 2 – Demolition of the existing Site, concurrent with the operation of Line 1
– Phase 3 – Construction of Line 2 and 3, concurrent with the operation of Line 1

The equipment to be used during each phase of construction is listed in the table below, along with their sound power levels and acoustical usage factors.

Table 8 Construction Equipment Sound Power Level & Usage during Phases 1 – 3

Equipment	Sound Power Level (dBA)	Acoustical Usage Factor	Phase 1 – Construction of Line 1	Phase 2 – Demolition of Existing Building	Phase 3 – Construction of Line 2/3
Backhoe	112	40%	2	3	3
Bulldozer	117	40%	3	6	4
Compactor	112	20%	1	-	1
Concrete Saw	124	20%	2	-	2

Equipment	Sound Power Level (dBA)	Acoustical Usage Factor	Phase 1 – Construction of Line 1	Phase 2 – Demolition of Existing Building	Phase 3 – Construction of Line 2/3
Concrete Breaker	124	50%	-	3	-
Concrete Mixer (Small)	93	50%	2	-	3
Concrete Mixer (Large)	107	50%	2	-	3
Concrete Mixer Truck	111	40%	2	-	3
Core Drill	116	50%	2	2	2
Crane (Tower)	108	16%	1	1	1
Crane (Mobile)	106	16%	1	1	1
Crusher	115	50%	-	3	-
Dump Truck	116	40%	2	6	4
Dust Suppressor	93	50%	-	3	-
Excavator	117	40%	3	4	4
Excavator (Mini)	99	40%	2	3	2
Gas Cutter	110	50%	-	3	-
Generator	114	50%	4	4	5
Hammer Rig (Piling)	127	20%	2	-	3
Loader	112	40%	3	3	3
Paver	115	50%	1	-	1
Pneumatic Tool	117	50%	6	4	6
Poker Vibrator	109	50%	2	-	2
Pulverizer	112	50%	-	3	-
Road Planer	113	50%	1	-	1
Roller	117	20%	1	-	1
Shears	117	40%	-	2	-
Welder	105	40%	2	-	4
Wheel Wash Station	103	50%	1	1	1

There are no other significant noise generating activities or equipment.

Figure 7 – 9 have been created to show the noise source locations and the main haul truck route during each phase of construction.



Figure 7 *Phase 1 – Construction of Line 1 & Normal Operation of Existing Site*



Figure 8 *Phase 2 – Operation of Line 1 and Demolition of Existing Site Buildings*

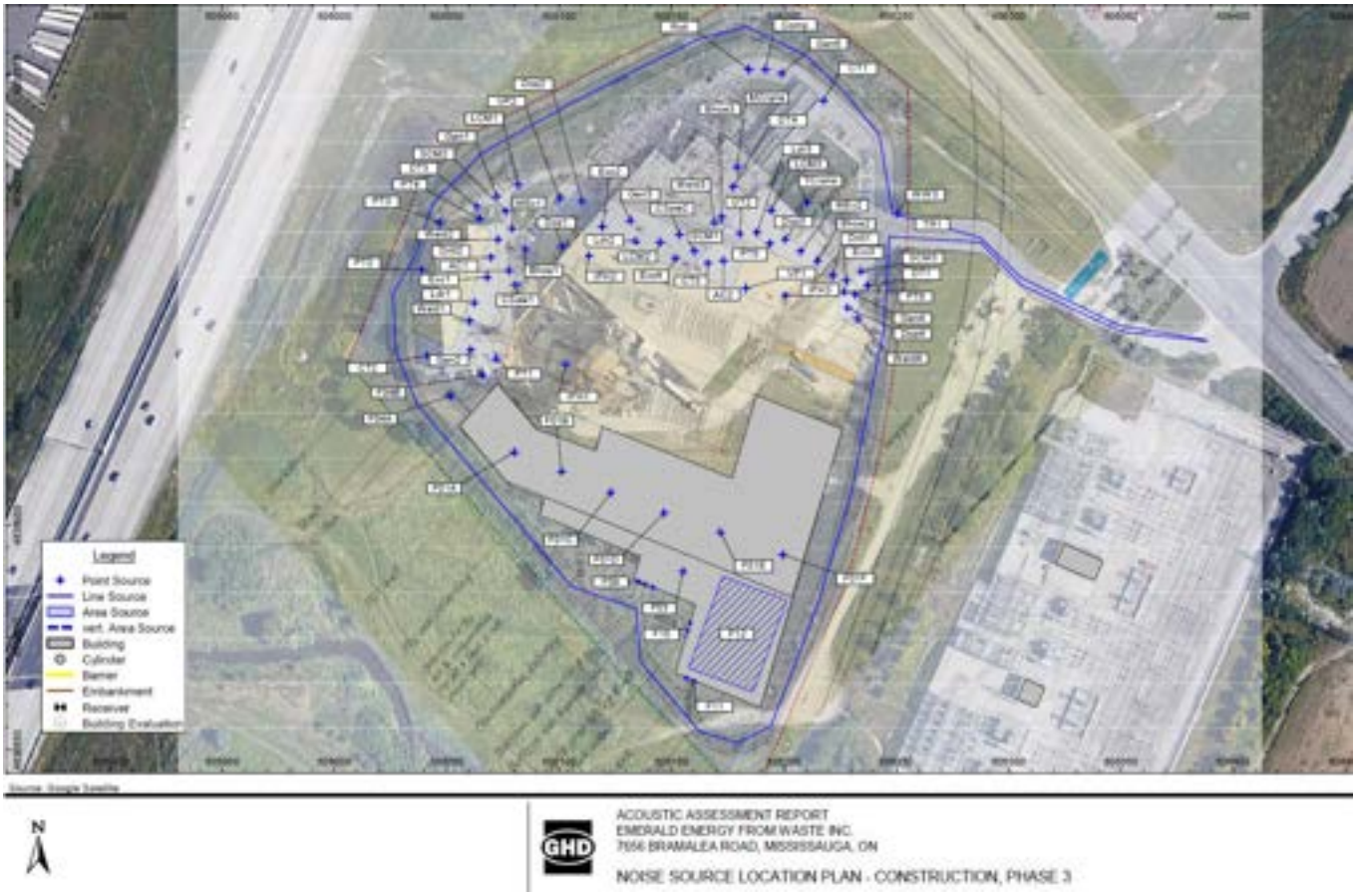


Figure 9 Phase 3 – Construction of Lines 2 & 3 with Operation of Line 1

5.1.3 Future Site Noise Assessment (Full Operation)

5.1.3.1 Noise Assessment Criteria

The Future Site noise assessment criteria is the same as the Existing criteria in Section 3.3.

The applicable noise criteria at the POR(s) are based on the higher of the background sound level and the MECP's minimum sound level limits. The applicable site-specific sound level limits are summarized as follows:

Table 9 Applicable Minimum MECP Sound Level Limits and Background Sound Levels for Impulsive and Steady State Sound

POR ID	POR Description	Sound Level Limits (dBA/dBAI)		
		Day (7am – 7pm)	Evening (7pm – 11pm)	Night (11pm – 7am)
POR1	Vertical midpoint on the south façade of the apartment 19 floor (26 metres above grade [m AG])	50	50	**48**
POR2	Worst-case plane of window on west façade, 2nd floor (4.5 m AG)	50	50	45

The lowest sound levels generally occur at the ground floor level (1.5 metres above grade) and increase with height due to increased line of sight exposure to the roadways. GHD has presented the lowest noise limit relative to the worst-case Site noise impact based on line-of-sight and exposure to the applicable receptor.

5.1.3.2 Future Noise Source Summary

Emerald is proposing to construct and operate three (3) Lines of energy from waste systems which will incorporate various on-site buildings, operations and warehouses which contain the energy from Waste systems and landfill which each have the potential to cause an adverse noise impact at receptors.

This Noise assessment focuses on the sound emissions from the significant noise sources identified at the Site with the potential to adversely impact the sensitive receptors. The significant noise sources are identified in the Noise Source Summary Table C.1 of Appendix C. The noise source locations are shown in Figure 10 below.

Figure 10 has been created to show the future noise source locations and the main haul truck route once Site is fully complete.



Figure 10 Noise Source Location Plan - Future Operations

The significant equipment sources are all either trucking related activities, building penetrations, rooftop equipment or outdoor equipment located beside the buildings. Noise predictions are based on noise data provided by the Client as detailed in Section of this report for the various processes anticipated within the Future Line 1-3 expansions.

The workshop building at the Site is made of standard industrial construction materials. The other noise sources at the Site have not been included since they are considered insignificant contributors to the overall Site noise level at the sensitive receptors which are expected to contribute less than 25 dBA at the worst-case receptor.

The proposed expansion buildings does have significant interior noise sources resulting in breakout noise from passive sidewall air intake louvres, exhaust points and open bay doors which were modelled in detail.

Noise radiating through the passive louvres or bay doors were modelled as point sources or vertical area sources. GHD expects that the Site will provide GHD with updated equipment selections and specifications following final selection of any proposed equipment to confirm that the noise levels meet the maximum not to exceed noise criteria as specified in this Noise assessment by proper selection or equivalent noise mitigation measures.

Noise level checks may be carried out regularly in operational areas where high noise levels may be present, with early warning of increasing noise levels resulting in a noise reduction or mitigation program.

Each potential source of significant operational noise is identified below for each building/operational area:

Sitewide Outdoor Truck and Heavy Equipment Volumes

Onsite outdoor truck activities for operations as well as shipping/receiving loading at a speed of 10 km/hour on site and is summarized in Table 10 below:

Table 10 Sitewide Outdoor Truck and Heavy Equipment Volumes

Type of Vehicle/Description	Noise Source ID	Day (07:00 – 19:00) Vehicles / hour	Evening (19:00 – 23:00) Vehicles / hour	Night (23:00 – 07:00) Vehicles / hour
Shipping and Receiving Truck Route	TR1	15	15	15

Vehicle deliveries and collections will also contribute to the noise climate. However, vehicle movements to and from the site are not considered to significantly impact on road traffic noise levels.

The majority of the heavy equipment usage will be located within the warehouse buildings and is included in the bay door noise sound levels.

Line 1 Noise Sources

The Line 1 expansion includes the following significant outdoor noise sources:

– 6 x Rooftop Exhaust Fans (Sound Power Level – 102 dBA)
– 1 x Line 1 Main Stack Exhaust (Sound Power Level – 104 dBA)
– 1 x Line 1 ID Fan (Sound Power Level – 104 dBA)
– 1 x De-Aerator Exhaust (Sound Power Level – 89 dBA)
– 1 x Air Cooled Condenser (Sound Power Level – 111 dBA)
– 1 x Tipping Floor – Open Bay Door (Sound Power Level – 91 dBA)
– 1 x Consumables Delivery – Open Bay Door (Sound Power Level – 90 dBA)

There are no other significant noise generating activities or equipment. All noise generating activities were assumed to operate for the full hour/100 percent load with no time weighting or other reductions which is considered conservative unless otherwise specified.

Line 2 and 3 Noise Sources

The Line 2 and 3 expansion includes the following significant outdoor noise sources:

– 12 x Rooftop Exhaust Fans (Sound Power Level – 102 dBA)
– 2 x Line 2 and Line 3, Main Stack Exhaust (Sound Power Level – 104 dBA)
– 2 x Line 2 and Line 3, ID Fan (Sound Power Level – 104 dBA)
– 1 x De-Aerator Exhaust (Sound Power Level – 89 dBA)
– 1 x Air Cooled Condenser (Sound Power Level – 111 dBA)
– 2 x Office/Admin HVAC (Sound Power Level – 87 dBA)

There are no other significant noise generating activities or equipment. All noise generating activities were assumed to operate for the full hour/100 percent load with no time weighting or other reductions which is considered conservative unless otherwise specified.

5.2 Noise Net Effects

This Section provides an assessment of the potential negative environmental effects (i.e., those for which a "Yes" answer was given in the Screening Criteria Checklist) for those Noise criteria which might be affected by the project as identified in **Section 2.0**. The effects assessment describes how existing environmental conditions in the Study Area(s) would change as a result of the construction and operation of the proposed undertaking.

As described in **Section 2.0**, a “Yes” was applied to the following Noise criteria:

	Criterion	YES	NO	Additional Information
	Might the project…			
Noise				
3.4	Cause negative effects from the emission of noise?	X		The proposed EFW Facility expansion would result in changes to the existing site footprint and on-site operations and may result in a potential increase in noise emission associated with continued operation of the Site.

With respect to the above criteria/criterion, a description of the potential negative environmental effects, necessary mitigation measures and the resultant net effects on the environment are discussed. Studies conducted during the screening showed that the anticipated effects will be much less than expected or will not occur at all. In all cases, impact management (mitigation) measures have been identified that, when applied, will eliminate the potential environmental effects, or reduce them to acceptable levels.

5.2.1 General Assumptions

The worst-case equipment locations were selected based on proximity and elevated line-of-sight exposure to the off-Site residential dwellings. The worst-case elevation was selected based on topography data.

The worst-case assessment of noise impacts at each phase of the project at the selected points-of-reception was based on FHWA provided sound power levels, client provided sound levels and GHD reference sound level data. CadnaA Acoustical Modelling Software (CadnaA), version 2023, was used to model the potential impacts of the significant noise sources. CadnaA calculates sound level emissions based on the ISO 9613-2 standard "Acoustics – Attenuation of Sound during Propagation Outdoors".

The worst-case cumulative Site-wide attenuated sound levels estimated at the receptor(s) included attenuation affects due to geometric divergence, atmospheric attenuation, barriers/berms, ground absorption and directivity, as applicable for all significant noise sources. Off-site buildings were input as intervening structures.

CadnaA modelling assumptions used in this Noise assessment included:

- **Noise Sources:** All sources were modelled using the 1/1 octave band data
- **Reflection Order:** A maximum reflection order of 2 was used to evaluate indirect noise impact from one reflecting surface
- **Ground Absorption:** Ground absorption coefficients of 0.25 for asphalt and 1.0 for grass were used to model ground absorption around the Site and adjacent properties
- **Time-Weighted Adjustment***:* Time-weighted adjustments for sources that do not operate continuously are summarized in Table C.1
- **Receptor Elevation**: POR receptor heights were modelled appropriately to represent the worst-case elevation as detailed in Section 4
- **Tonality**: A +5 dBA adjustment was applied for tonal sources if applicable
- **Building Surfaces:** The buildings are modelled as reflective surfaces
- **Terrain:** The surrounding area was modelled based on site specific topography
- **Foliage:** No attenuation due to foliage was included to be conservative

5.2.2 Potential Effects in Noise Environment

Impacts can be split into two main effects construction noise effects and Future operational impacts.

5.2.2.1 Construction Noise Effects

The magnitude of noise impacts associated with construction will be dependent upon a number of factors including:

– The intensity of construction activities
– The location of construction activities
– The type of equipment used
– Existing local noise sources
– Intervening terrain
– The prevailing weather conditions

The construction is separated into 3 phases and resulting noise levels at the PORs are shown below:

Table 11 Construction Sound Level Impacts for Phases 1-3

Point of Reception	Phase 1 – Construction of Line 1 w/ Existing Operation (dBA)	Phase 2 – Operation of Line 1 w/ Demolition of Existing Site (dBA)	Phase 3 – Operation of Line 1 w/ Construction of Line 2 & 3 (dBA)	Daytime Sound Level Limit (dBA)	Compliance with Noise Limits (Yes/No)
POR1	44	47	48	80	Yes
POR2	40	41	43	80	Yes

Estimated Noise Contours for each construction phase can be found on Figure 11-13.

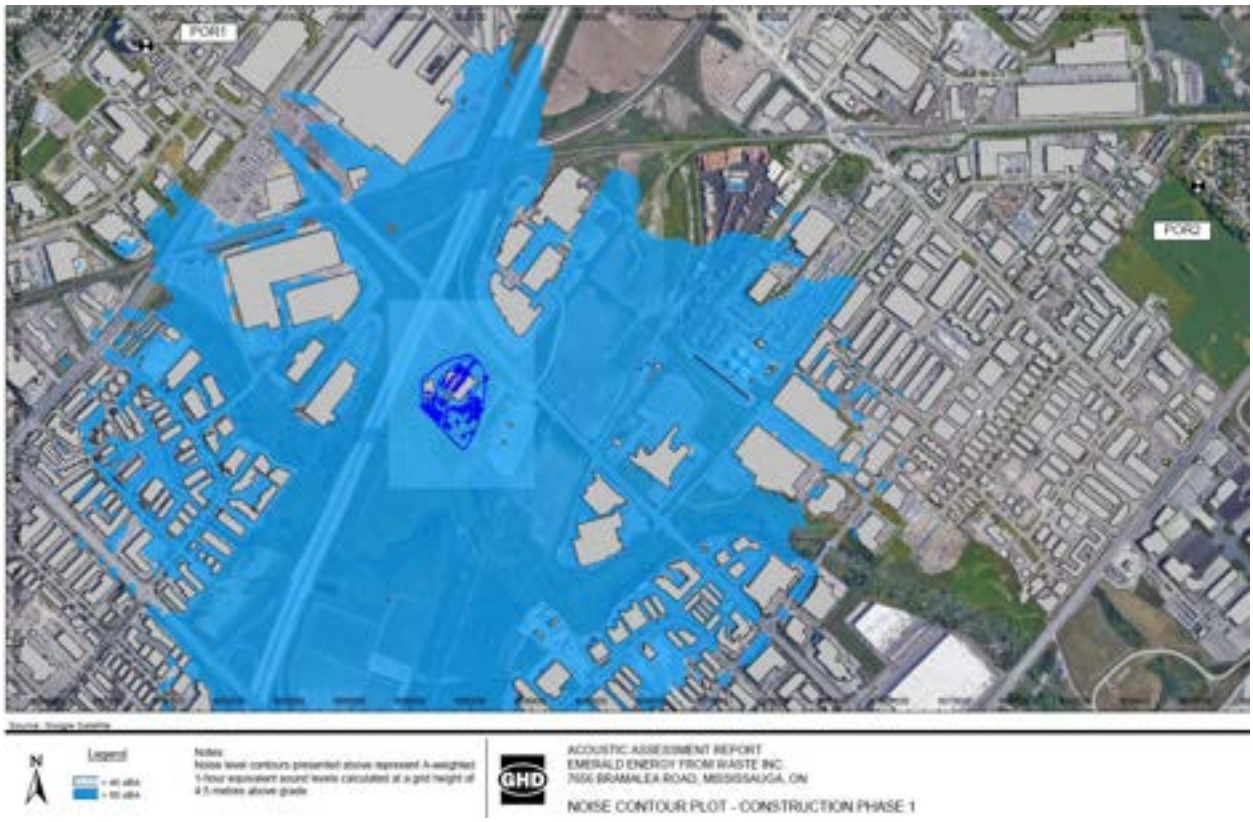


Figure 11 Noise Contour Plot – Construction Phase 1



Figure 12 Noise Contour Plot – Construction Phase 2



Figure 13 Noise Contour Plot – Construction Phase 3

5.2.2.2 Future Site Operational Noise Effects

The predicted noise impacts at the existing sensitive receptors (residential areas) range from 34 to 41 dBA. The existing residences to the northwest of the Site is the most impacted however the noise impacts are significantly below the ambient sound level limits.

The Noise Assessment is based on the worst-case cumulative Site wide sound levels estimated at each POR, based on the worst-case location of the noise sources relative to the closest POR, dependent on which phase is active. The sound levels estimated at the PORs are summarized in Table 12 and graphically on Figure 14.

Table 12 Future Operations Steady State Sound Level Impacts

POR ID	POR Description	Sound Level Impacts (dBA) 1-hour Leq		
		Future Operations Sound Level	Sound Level Limit	Compliant with Noise Limits (Yes/No)
POR1	19-storey High Rise Apartment on Bramalea Rd	41	50/48	Yes
POR2	Two-storey Residence on Cattrick St.	34	50/45	Yes

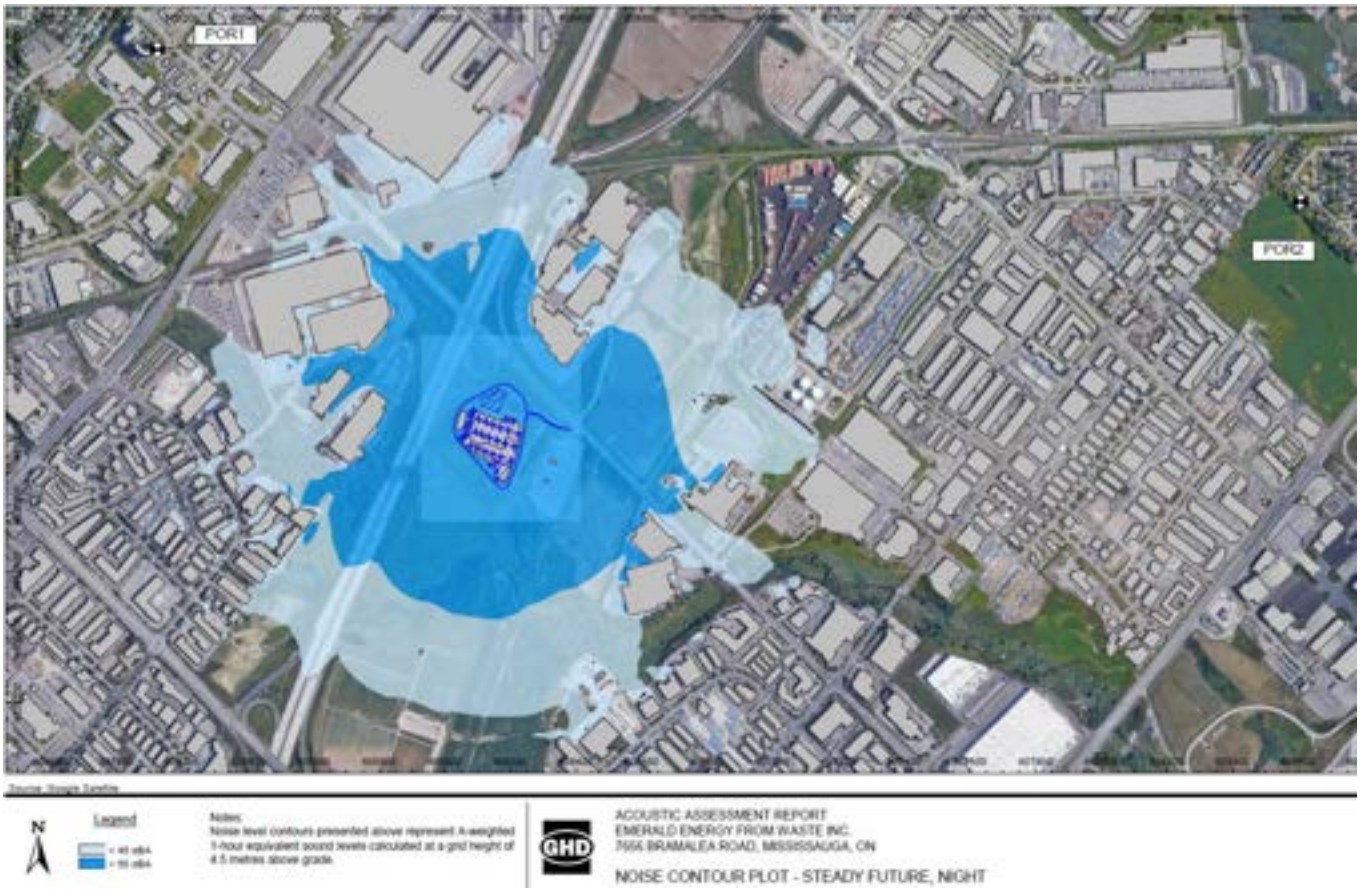


Figure 14 Noise Contour Plot – Steady State Future Operations

5.2.3 Mitigation Measures

There are no exceedances above the MECP or site-specific noise limits. Therefore, no mitigation measures are required.

5.2.4 Net Effects

Net effects from the Site activities will be based on the increases in sound pressure level above ambient levels at the nearest point of reception. Increases ranging from 0-3 dB should have no appreciable effect on receptors. Increases from 3-6 dB may have potential for adverse noise impact only in cases where the most sensitive of receptors are present. Sound pressure increases of more than 6 dB may require a closer analysis of impact potential depending on existing sound pressure levels and the character of surrounding land use and receptors. Sound pressure level increases approaching 10 dB result in a perceived doubling of sound pressure levels.

The perceived doubling of the sound pressure levels results from the fact that sound pressure levels are measured on a logarithmic scale. An increase of 10 dB(A) deserves consideration of avoidance and mitigation measures in most cases. The above thresholds as indicators of impact potential should be viewed as guidelines subject to adjustment as appropriate for the specific circumstances one encounters.

In non-industrial settings the sound pressure levels should probably not exceed ambient noise by more than 6 dB(A) at the receptor. An increase of 6 dB(A) may cause complaints. However, there may be occasions where an increase in sound pressure levels of greater than 6 dB(A) might be acceptable.

Construction Phase Net Effects

In this case none of the construction phases have an appreciable net effect on the receptors as the estimated impacts are below the existing ambient noise levels in the area. As a result, some construction activities may be audible during these Phases at times at POR1, however these sound levels are still well below the ambient sound level and should not make an appreciable effect. The worst-case evaluation shows that during Phase 1 construction the noise impact will be -2 dBA below the ambient noise level at POR 1 which is considered insignificant with no addition the existing conditions. At POR2 worst-case evaluation during Phase 3 construction shows noise impacts of -7 dBA below the ambient sound levels and is also considered an insignificant net effect.

The full range of net effects at the representative PORs are summarize in Table 13 below. As shown in the table, the relative noise impacts at the PORs will increase over the construction phases of the project however the relative noise impacts of the construction noise will always be below the existing the ambient sound levels.

Table 13 Point of Reception Construction Net Effects to Ambient Noise

Phase	POR1 Sound Level (dBA)	Net Effect relative to Existing Sound Levels	POR2 Sound Level (dBA)	Net Effect relative to Existing Sound Levels
Ambient Sound Level (Day)	50	-	50	-
Phase 1 – Construction of Line 1	44	**- 6**	40	**- 10**
Phase 2 – Demolition of Existing Building	47	**- 3**	41	**- 9**
Phase 3 – Construction of Line 2/3	48	**- 2**	43	**- 7**

Future Site Operations Net Noise Effect

Comparing the future Site operations noise sound levels with the existing sound levels the net change is considered negligible at POR1, while the net change may be significant at POR2. Even though the net change between the existing and future sounds levels may be significant, the overall net effect compared to the ambient sound level is negligible as the Future Site operations noise impact sound levels are significantly below the ambient sound level and

therefore not audible. The net change and net effect of the Future Site operations noise at the representative PORs are summarized in Table 14 below:

Table 14 Point of Reception Future Operations Net Effects

POR ID	POR Description	Sound Level Impacts (dBA) 1-hour Leq				
		Existing Site Sound Level	Future Operations Sound Level	Net Change Relative to Existing Sound Levels	Ambient Sound Level	Net Effect Relative to Ambient Sound Levels
POR1	19-storey High Rise Apartment on Bramalea Rd	36	39	+3	50	-11
POR2	Two-storey Residence on Cattrick St.	26	33	+7	50	-17

6. Best Practices and Additional Approvals

To ensure that construction noise remains within the predicted rang GHD has provided a best practices for construction noise impacts. GHD recommends that these best practice measures are carried out as part of the construction phases, and proper approvals maintained for operation, and maintenance of the proposed undertaking.

6.1 Best Practices for Construction Noise Impacts

Even though the construction noise has negligible impact receptors nearest to the Site, the following recommendations are suggested to be implemented by the contractor to minimize noise impacts due to the Project's construction equipment and activities are provided below:

– All construction equipment should be properly maintained according to manufacturer's recommendations and fitted with efficient muffling devices.
– Construction equipment and/or activities typically know to be of annoyance (e.g., piling) should consider the following options:
  - Limit operating time within the daytime period when ambient noise levels are expected to be higher. If construction needs to be undertaken outside of the normal daytime hours, local residents shall be informed beforehand of the type of construction planned and the expected duration.
  - Avoid unnecessary revving of engines and switch off equipment when not required (do not idle).
  - Minimize drop heights of materials. Administrative controls are required to eliminate uncontrolled tailgate banging and the use of experienced equipment operators.
  - Route haulage/dump trucks on main roads where possible, rather than quieter residential roads.
  - Maintain an acceptable setback distance from the identified NSAs, where practical.
  - Carry out additional noise studies or monitoring program to verify and document noise levels.
  - Use of high-capacity compressed air storage to limit compressor usage.
  - Investigate other alternative construction equipment or processes to complete the task.

During construction work adjacent to residential areas and in proximity to the grade separation work sites if it is determined that there is a need to further reduce noise effects (e.g., if persistent complaints arise), the following additional mitigation measures may be considered and implemented, where appropriate:

– Offset usage of active heavy equipment (schedule non-concurrent use).
– Implement noise compliance checks to ensure equipment levels are in compliance with recommend best practice equipment noise limits.
– Reroute construction and truck traffic, where possible.
– Coordinate 'noisy' operations such that they will not occur simultaneously, where possible.
– Where possible, investigate and implement the use of alternative construction equipment or methods to reduce noise emissions from construction. Utilize alternative equipment that generates lower noise levels, such as using an electric rather than internal combustion engine, or optimize silencer/muffler/enclosure performance.
– Use rubber linings in chutes and dumpers to reduce impact noise.
– Install acoustic enclosures, noise shrouds or noise curtains around noisy equipment.
– Install temporary noise barriers/solid construction hoarding on site boundary to screen affected locations. Sound attenuating hoarding should be constructed. Hoarding means a wall or similar structure, used as a noise control measure, and high enough to break the line-of-sight between the source and the receptor. The minimum surface density (face weight) is 20 kg/m^2. Any combination of material can be used (e.g., wood 1 to 1/2 inch thick) to construct the hoarding as long as it meets the appropriate surface density requirement and does not have any gaps, holes or other penetrations.
– Where noise levels are above 80 dBA, ensure that operators and workers in the direct surrounding areas are equipped with proper noise protection ear plugs.

The following is a summary of the items of good practice to be considered relating to construction noise according to applicable noise guidelines.

6.2 Additional Approvals

The Site is not required to register for an Environmental Activity and Sector Registry (EASR) or apply for an Environmental Compliance Approval (noise), under current regulations as receptors are likely to be screening out using the MECP primary noise screening form based on distance from the Facility (1.5km and 2.4km).

7. Conclusion

The Site-wide noise levels estimated at the points-of-reception are below the site-specific noise limits or the minimum MECP sound level limits, during all existing, construction phases and future operational scenarios (Sections 3.4, 5.2.2). Net effects compared to the ambient conditions are considered insignificant as described in Section 5.2.4.

GHD recommends that the Site ensures that any future equipment contribute less than 30 dBA at the applicable point(s)-of-reception. Where possible the construction best practices (Section 6.2) should be followed.

This is based on accepted standard engineering practices where sound levels that are a minimum of 15 dBA lower than another sound level will not have an impact on the overall noise level. Therefore, based on the MECP exclusionary sound level limit of 45 dBA a source contributing 30 dBA or less would be considered insignificant.

8. References

NPC 103, "Procedures", August 1978

NPC 233, "Information to be Submitted for Approval of Stationary Sources of Sound", October 1995

"Basic Comprehensive Certificates of Approval (Air), User Guide, Appendix A - Supporting Information for an Acoustic Assessment Report or Vibration Assessment Report Required by a Basic Comprehensive CofA prepared by the Environmental Assessment and Approvals Branch, Version 2.1, March 2011"

NPC 300, "Environmental Noise Guideline, Stationary and Transportation Sources –Approval and Planning", August 2013

Acoustics – Attenuation of sound during propagation outdoors: Part 2 General Method of Calculation, 1996 (ISO 9613-2)

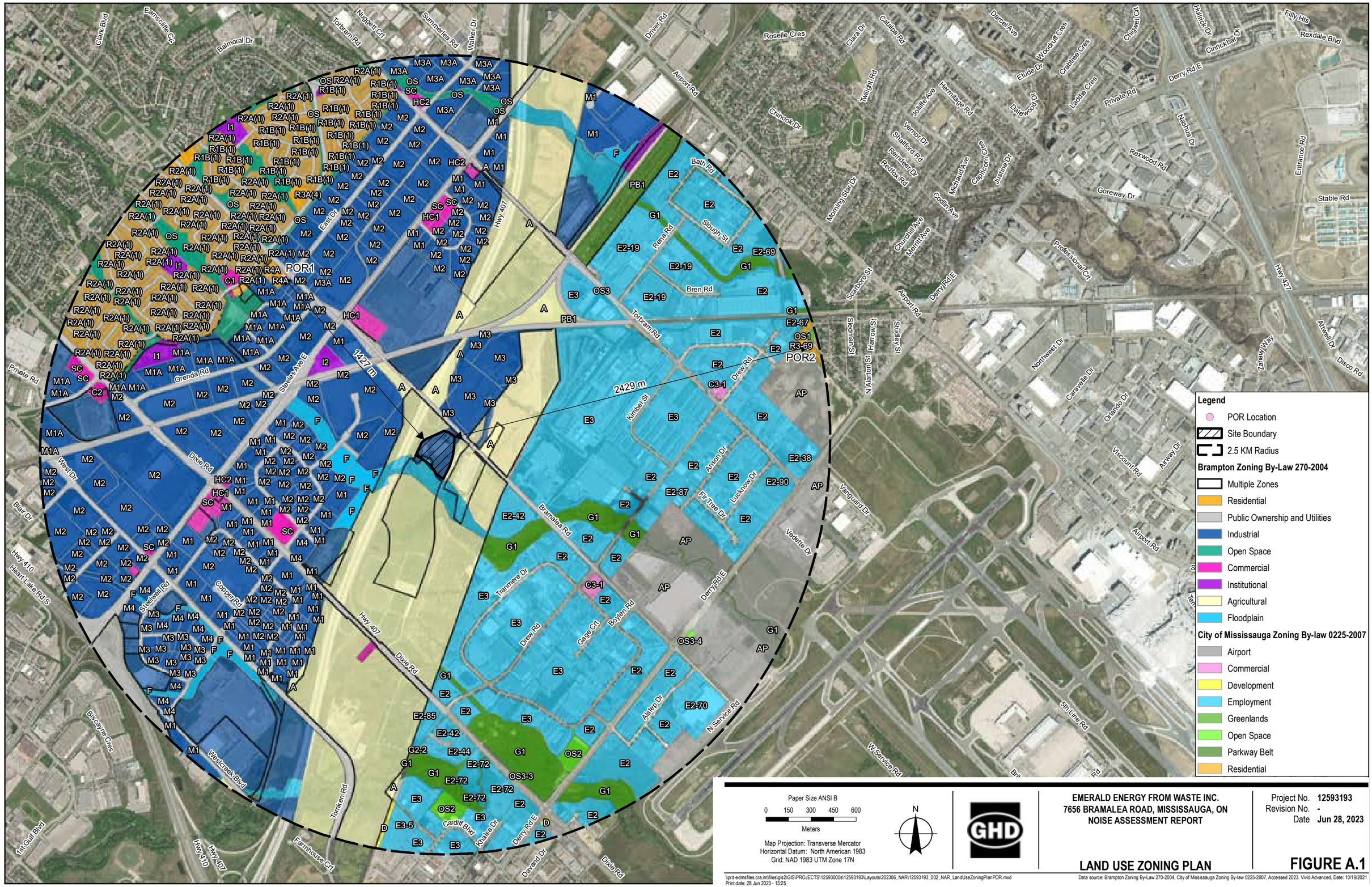
9.0 Construction Equipment Noise Levels and Ranges - Handbook - Construction Noise - Noise - Environment - FHWA. (2017). Dot.gov. **https://www.fhwa.dot.gov/Environment/noise/construction_noise/handbook/handbook09.cfm**

John A. Volpe National Transportation Systems Center (2018). *Transit Noise and Vibration Impact Assessment Manual Federal Transit Administration PREPARED BY*. https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/research-innovation/118131/transit-noise-and-vibration-impact-assessment-manual-fta-report-no-0123_0.pdf

Appendices

Appendix A

Land Use Zoning Map and Site Plans



Paper Size ANSI B

0 150 300 450 600

Meters

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983
Grid: NAD 1983 UTM Zone 17N

N

GHD

EMERALD ENERGY FROM WASTE INC.
7656 BRAMALEA ROAD, MISSISSAUGA, ON
NOISE ASSESSMENT REPORT

Project No. **12593193**
Revision No. **-**
Date **Jun 28, 2023**

LAND USE ZONING PLAN

FIGURE A.1

\\prd-edmsfiles.cra.int\files\gis2\GIS\PROJECTS\12593000s\12593193\Layouts\202306_NAR\12593193_002_NAR_LandUseZoningPlanPOR.mxd
Print date: 28 Jun 2023 - 13:25

Data source: Brampton Zoning By-Law 270-2004, City of Mississauga Zoning By-law 0225-2007, Accessed 2023. Vivid Advanced, Date: 10/19/2021

ETR 407

POND No. 2

RAMP TO EASTBOUND ETR 407

ETR 407

LAND TO BE CONVEYED BY CITY OF BRAMPTON TO EMERALD ENERGY FROM WASTE - PARTS 2,3 & 4
LAND TO BE CONVEYED BY EMERALD ENERGY FROM WASTE TO THE CITY OF BRAMPTON - PARTS 1 & 5

REFER TO SITE PLAN, SHEET 1 OF 1, PREPARED BY F.J. REINDERS AND ASSOCIATES, CANADA LIMITED, ARCHITECTS, PLANNERS, ENGINEERS AND PROJECT MANAGERS. PROJECT No. 93052, DRAWING No. 93052-01, DATED DECEMBER 9 1993.
CITY No. SP 93-34

ZONING CATEGORY:
INDUSTRIAL ONE (M1-2554)

EXISTING SITE AREA: 4.98 Ha.
FUTURE SITE AREA: 4.91 Ha.

EXISTING BUILDING AREA:

GROUND FLOOR:	9909 sq.m.
SECOND FLOOR (OFFICE):	141sq.m.
TOTAL AREA:	10050 sq.m.
BUILDING HEIGHT:	7.35m
TOTAL NUMBER OF PARKING SPACES REQUIRED AS PER APPROVED SITE PLAN (SP 03-34)	26
TOTAL NUMBER OF PARKING SPACES PROVIDED	41

PROPOSED RING ROAD

EXISTING BUILDING

EXISTING PARKING

FLOOR =182.24

EXISTING EXTERNAL EQUIPMENT AREA

EXISTING BUILDING

F.F.E.=182.95

EXISTING BUILDING

F.F.E.=184.17

EXISTING DRIVEWAY

EXISTING PARKING

EX. POND

EXISTING SCALE (TO BE RELOCATED WHEN RING ROAD CONSTRUCTED)

PART 3

EXISTING DRIVEWAY

EXISTING DRIVEWAY ELEVATION = 183.00±

ELEVATION AT UNDERSIDE OF PROPOSED 407 TRANSITWAY = 189.00±

PART 6

PART 10

PART 11

PART 12

PART 13

PART 14

PART 15

BRAMALEA ROAD

CAUT FLOOD ELEV. 179.62

PROPOSED WETLAND

PROPOSED STORMWATER MANAGEMENT POND No. 2

PROPOSED STORMWATER MANAGEMENT POND No. 1

14.0m

PROPOSED SWALE @ 0.5%

1.0m SHOULDER

PARTS 2,3,4 PLAN 43R-37762

NEW PROPERTY LINE

MATCH EXISTING GRADE

8.0m

CITY OF BRAMPTON

PROPOSED CURB AND GUTTER AS PER OPSD OPSD 600.080

PROPOSED SWALE @ 0.7%

FUTURE DEVELOPMENT AREA

EXISTING GRASS AREA TO REMAIN

PROPOSED CURB AND GUTTER AS PER OPSD OPSD 600.080

PROPOSED SWALE @ 0.5%

TEMP. BERM

PROPOSED RING ROAD

6.0m

3.0m GRASS SWALE

PROPOSED 407 TRANSIT WAY

PART 5 PLAN 43R-37762

SPRING CREEK

20.178 181.51 181.76
20.177 181.44 181.49
20.176 181.21 181.07
20.175 181.23 181.13
20.174 181.21 181.26
20.173 181.12 181.20
20.171 180.97 181.03
20.17 180.78 180.80

KEY PLAN
1:15,000

LEGEND:

- EXISTING PROPERTY LINE
- FUTURE PROPERTY LINE
- EXISTING DRIVEWAY, PAVED AND HARD SURFACE AREAS
- PROPOSED RING ROAD
- GRASSED / LANDSCAPED AREA
- TRAFFIC DIRECTION
- TRCA REGIONAL FLOOD LINE - EXISTING
- TRCA REGIONAL FLOOD LINE - PROPOSED
- REGIONAL FLOOD ELEVATION [POST DEVELOPMENT] HEC RAS
- 100 YEAR FLOOD ELEVATION [POST DEVELOPMENT] CROSS-SECTION

REFERENCE DRAWINGS:

1. LEGAL SURVEY DATA FOR EXISTING SITE BASED ON REFERENCE PLAN 43R 17659, PREPARED BY A. MIRANDA SURVEYING LTD. PROJECT No. 4815, DATED MARCH 12, 1990.
2. REFER TO DRAWING G-1 REV. 2 FOR PROPOSED GRADING AND STORM DRAINAGE.
3. REFER TO DRAWING SPP-1 REV. 2 FOR SWEPT PATH PLAN.

RING ROAD PAVEMENT STRUCTURE:

PAVEMENT LAYER	
ASPHALT TOP COURSE - HL3	40mm
ASPHALT BASE COURSE - HL8	80mm
20mm CRUSHER RUN LIMESTONE BASE	150mm
50mm CRUSHER RUN LIMESTONE SUB-BASE	300mm

NO.	DESCRIPTION	DATE	BY
3	REVISED TO ADDRESS CITY'S COMMENTS DATED SEPTEMBER 07, 2022.	SEPT. 12, 2022	D.K.H.
2	STORMWATER MANAGEMENT POND No. 2 RELOCATED AND PROPOSED 407 TRANSITWAY ADDED	MAY. 27, 2022	D.K.H.
1	REVISED TO ADDRESS CITY'S COMMENTS DATED MAY 5, 2021; AND TRCA'S COMMENTS DATED MAY 19, 2021	OCT. 15, 2021	D.K.H.

REVISIONS

CANDEVCON LIMITED
CONSULTING ENGINEERS AND PLANNERS
9358 GOREWAY DRIVE BRAMPTON, ONTARIO L6P 0M7
TEL. (905) 794-0600 FAX (905) 794-0611

CONSTRUCTION NORTH

P:\Drawings\W19195-ALSMEER-RD\SITE-DWG\W19195-1-500.dwg

ENERGY FROM WASTE

7656 BRAMALEA ROAD
CITY OF BRAMPTON

SHEET TITLE:
DRIVEWAY EXTENSION - RING ROAD
SITE PLAN
CITY FILE No. SPA-2021-0051

DRAWN BY: S.G.K.	PROJECT No. W19195
CHECKED BY: D.K.H.	DRAWING No. SP-1
SCALE: 1:500	
DATE: NOV. 18th, 2019	

Stack

ID-fan

FGT hall

Fly ash collecting

Consumables delivery

Bottom ash collecting

Bottom ash bunker

Access to grab lifting shaft

Waste truck access

Waste trucks exit

Reception hall

Existing Plant

Boiler hall

Grab lowering shaft

Waste bunker

Waste crane

BRAMALEA ROAD

0 50 100

RAMBØLL

Peel Emerald - New Line
Line 1
Layout - Situation plan
Sketch 01
28.04.2023/ELF

Workshop

Stack

ID-fan

FGT hall

Fly ash collecting

(Solution for fly ash & consumables for all 3 lines is not shown yet)

Consumables delivery

Bottom ash collecting

Bottom ash bunker

Access to grab lifting shaft

Waste truck access

Waste trucks exit

Reception hall

Ramp 1:10

Line 1

Line 2

Line 3

Air coolers

Control room Administration

Reception hall (under hopper deck)

Hopper deck

BRAMALEA ROAD

0 50 100

RAMBOLL

Peel Emerald - New Line
Line 1, 2 & 3
Layout - Situation plan
Sketch 02
28.04.2023/ELF

Appendix B

Long-Term Ambient Noise Summary

Table B.1

POR1 Environmental Sound Level Measurements, LEQ - Validated Background Measurements
Emerald Energy From Waste Inc.
Brampton, Ontario

Date	Time		Leq [2], [3]	L_{90}	Wind Spd (km/h) [1]	Temperature (^{o}C)	Weather
2023-06-09	09:00:00		56	51	13	14	
2023-06-09	10:00:00		63	50	19	15	
2023-06-09	11:00:00		61	50	18	15	
2023-06-09	12:00:00		55	49	24	17	Wind Speed >= 20 km/hr
2023-06-09	13:00:00		66	49	25	19	Wind Speed >= 20 km/hr
2023-06-09	14:00:00		53	49	24	20	Wind Speed >= 20 km/hr
2023-06-09	15:00:00		56	50	26	20	Wind Speed >= 20 km/hr
2023-06-09	16:00:00		53	49	20	21	Wind Speed >= 20 km/hr
2023-06-09	17:00:00		56	49	19	21	
2023-06-09	18:00:00		52	47	15	21	
2023-06-09	19:00:00		54	47	14	21	
2023-06-09	20:00:00		54	47	13	19	
2023-06-09	21:00:00		54	47	9	18	
2023-06-09	22:00:00		54	48	5	18	
2023-06-09	23:00:00		52	49	6	18	
2023-06-10	00:00:00		51	46	4	16	
2023-06-10	01:00:00		51	44	9	14	
2023-06-10	02:00:00		50	44	9	14	
2023-06-10	03:00:00		50	45	5	13	
2023-06-10	04:00:00		49	45	9	12	
2023-06-10	05:00:00		50	47	11	13	
2023-06-10	06:00:00		52	48	14	16	
2023-06-10	07:00:00		54	49	23	17	Wind Speed >= 20 km/hr
2023-06-10	08:00:00		52	48	21	20	Wind Speed >= 20 km/hr
2023-06-10	09:00:00		52	48	23	23	Wind Speed >= 20 km/hr
2023-06-10	10:00:00		53	49	25	24	Wind Speed >= 20 km/hr
2023-06-10	11:00:00		53	47	22	23	Wind Speed >= 20 km/hr
2023-06-10	12:00:00		52	46	8	24	
2023-06-10	13:00:00		53	47	8	25	
2023-06-10	14:00:00		53	47	8	26	
2023-06-10	15:00:00		53	47	14	25	
2023-06-10	16:00:00		53	48	18	25	
2023-06-10	17:00:00		54	51	11	23	
2023-06-10	18:00:00		59	50	10	23	
2023-06-10	19:00:00		53	48	6	23	
2023-06-10	20:00:00		54	48	10	23	
2023-06-10	21:00:00		53	47	11	23	
2023-06-10	22:00:00		53	46	14	21	
2023-06-10	23:00:00		53	45	16	20	
2023-06-11	00:00:00		52	46	16	20	
2023-06-11	01:00:00		56	47	7	19	
2023-06-11	02:00:00		50	48	4	19	
2023-06-11	03:00:00		49	47	3	19	
2023-06-11	04:00:00		50	47	9	17	
2023-06-11	05:00:00		49	45	4	17	
2023-06-11	06:00:00		49	45	1	18	
2023-06-11	07:00:00		**50**	45	4	18	
2023-06-11	08:00:00		51	46	10	18	
2023-06-11	09:00:00		52	47	6	18	
2023-06-11	10:00:00		51	45	7	19	
2023-06-11	11:00:00		51	45	16	22	
2023-06-11	12:00:00		52	46	18	22	
2023-06-11	13:00:00		53	46	11	23	
2023-06-11	14:00:00		52	46	10	23	
2023-06-11	15:00:00		57	49	16	19	
2023-06-11	16:00:00		52	48	4	20	
2023-06-11	17:00:00		53	49	12	21	
2023-06-11	18:00:00		55	52	18	19	
2023-06-11	19:00:00		54	50	5	17	
2023-06-11	20:00:00		53	49	19	17	
2023-06-11	21:00:00		55	49	8	17	
2023-06-11	22:00:00		52	49	20	16	Wind Speed >= 20 km/hr
2023-06-11	23:00:00		53	50	11	16	

Table B.1

POR1 Environmental Sound Level Measurements, LEQ - Validated Background Measurements
Emerald Energy From Waste Inc.
Brampton, Ontario

Date	Time		Leq [2], [3]	L_{90}	Wind Spd (km/h) [1]	Temperature (^{o}C)	Weather
2023-06-12	00:00:00		52	49	16	15	
2023-06-12	01:00:00		52	50	15	15	
2023-06-12	02:00:00		50	49	17	15	
2023-06-12	03:00:00		54	50	16	15	
2023-06-12	04:00:00		55	53	16	15	
2023-06-12	05:00:00		58	54	26	15	Wind Speed >= 20 km/hr
2023-06-12	06:00:00		63	55	22	16	Wind Speed >= 20 km/hr
2023-06-12	07:00:00		58	56	14	15	
2023-06-12	08:00:00		59	55	11	15	
2023-06-12	09:00:00		59	54	13	16	
2023-06-12	10:00:00		57	53	13	16	
2023-06-12	11:00:00		59	56	13	16	
2023-06-12	12:00:00		57	51	4	16	
2023-06-12	13:00:00		57	51	10	17	
2023-06-12	14:00:00		56	50	10	17	
2023-06-12	15:00:00		55	50	10	18	
2023-06-12	16:00:00		56	52	25	18	
2023-06-12	17:00:00		58	52	27	18	
2023-06-12	18:00:00		55	51	35	16	
2023-06-12	19:00:00		54	50	31	14	
2023-06-12	20:00:00		53	49	26	14	
2023-06-12	21:00:00		52	48	17	13	
2023-06-12	22:00:00		**50**	47	18	13	
2023-06-12	23:00:00		51	46	13	13	
2023-06-13	00:00:00		**48**	44	11	12	
2023-06-13	01:00:00		52	45	10	12	
2023-06-13	02:00:00		**48**	45	8	13	
2023-06-13	03:00:00		51	47	10	12	
2023-06-13	04:00:00		52	49	11	11	
2023-06-13	05:00:00		56	51	9	12	
2023-06-13	06:00:00		56	52	18	12	
2023-06-13	07:00:00		58	51	16	12	
2023-06-13	08:00:00		54	50	18	15	
2023-06-13	09:00:00		56	49	22	17	

Lowest Daytime one-hour Leq (07:00 - 19:00)	**50**	**dBA**
Lowest Evening one-hour Leq (19:00 - 23:00)	**50**	**dBA**
Lowest Nighttime one-hour Leq (23:00-07:00)	**48**	**dBA**

Notes:

(1) Weather data provided by Environment Canada's Toronto International A Climate Station
(2) Measurements recorded during inclement weather (winds speeds greater than 20 km/h and/or rain) were disregarded.
(3) Bolded data represents the lowest measured Leq during the respective monitoring time period.

Legend	
Day Time Hours	
Evening Time Hours	
Night Time Hours	

Table B.2

POR2 Environmental Sound Level Measurements, LEQ - Validated Background Measurements
Emerald Energy From Waste Inc.
Brampton, Ontario

Date	Time		Leq [2], [3]	L_{90}	Wind Spd (km/h) [1]	Temperature (°C)	Weather
2023-06-09	09:00:00		56	48	13	14	
2023-06-09	10:00:00		56	49	19	15	
2023-06-09	11:00:00		55	49	18	15	
2023-06-09	12:00:00		54	48	24	17	Wind Speed >= 20 km/hr
2023-06-09	13:00:00		54	49	25	19	Wind Speed >= 20 km/hr
2023-06-09	14:00:00		56	48	24	20	Wind Speed >= 20 km/hr
2023-06-09	15:00:00		55	47	26	20	Wind Speed >= 20 km/hr
2023-06-09	16:00:00		57	48	20	21	Wind Speed >= 20 km/hr
2023-06-09	17:00:00		56	47	19	21	
2023-06-09	18:00:00		56	44	15	21	
2023-06-09	19:00:00		52	44	14	21	
2023-06-09	20:00:00		51	44	13	19	
2023-06-09	21:00:00		55	42	9	18	
2023-06-09	22:00:00		52	43	5	18	
2023-06-09	23:00:00		54	43	6	18	
2023-06-10	00:00:00		57	41	4	16	
2023-06-10	01:00:00		61	42	9	14	
2023-06-10	02:00:00		66	44	9	14	
2023-06-10	03:00:00		60	45	5	13	
2023-06-10	04:00:00		54	47	9	12	
2023-06-10	05:00:00		50	48	11	13	
2023-06-10	06:00:00		52	50	14	16	
2023-06-10	07:00:00		54	51	23	17	Wind Speed >= 20 km/hr
2023-06-10	08:00:00		54	49	21	20	Wind Speed >= 20 km/hr
2023-06-10	09:00:00		56	49	23	23	Wind Speed >= 20 km/hr
2023-06-10	10:00:00		58	49	25	24	Wind Speed >= 20 km/hr
2023-06-10	11:00:00		55	49	22	23	Wind Speed >= 20 km/hr
2023-06-10	12:00:00		56	44	8	24	
2023-06-10	13:00:00		54	41	8	25	
2023-06-10	14:00:00		51	42	8	26	
2023-06-10	15:00:00		52	41	14	25	
2023-06-10	16:00:00		53	43	18	25	
2023-06-10	17:00:00		54	44	11	23	
2023-06-10	18:00:00		54	43	10	23	
2023-06-10	19:00:00		52	45	6	23	
2023-06-10	20:00:00		55	45	10	23	
2023-06-10	21:00:00		52	45	11	23	
2023-06-10	22:00:00		53	43	14	21	
2023-06-10	23:00:00		57	43	16	20	
2023-06-11	00:00:00		62	43	16	20	
2023-06-11	01:00:00		62	42	7	19	
2023-06-11	02:00:00		63	40	4	19	
2023-06-11	03:00:00		**44**	40	3	19	
2023-06-11	04:00:00		63	44	9	17	
2023-06-11	05:00:00		45	43	4	17	
2023-06-11	06:00:00		52	42	1	18	
2023-06-11	07:00:00		52	43	4	18	
2023-06-11	08:00:00		**50**	43	10	18	
2023-06-11	09:00:00		54	45	6	18	
2023-06-11	10:00:00		56	44	7	19	
2023-06-11	11:00:00		51	43	16	22	
2023-06-11	12:00:00		57	43	18	22	
2023-06-11	13:00:00		54	43	11	23	
2023-06-11	14:00:00		56	42	10	23	
2023-06-11	15:00:00		52	42	16	19	
2023-06-11	16:00:00		53	42	4	20	
2023-06-11	17:00:00		59	42	12	21	
2023-06-11	18:00:00		55	44	18	19	
2023-06-11	19:00:00		53	43	5	17	

Table B.2

POR2 Environmental Sound Level Measurements, LEQ - Validated Background Measurements
Emerald Energy From Waste Inc.
Brampton, Ontario

Date	Time		Leq [2], [3]	L_{90}	Wind Spd (km/h) [1]	Temperature (°C)	Weather
2023-06-11	20:00:00		53	45	19	17	
2023-06-11	21:00:00		55	46	8	17	
2023-06-11	22:00:00		52	46	20	16	Wind Speed >= 20 km/hr
2023-06-11	23:00:00		54	47	11	16	
2023-06-12	00:00:00		55	47	16	15	
2023-06-12	01:00:00		56	47	15	15	
2023-06-12	02:00:00		51	44	17	15	
2023-06-12	03:00:00		48	45	16	15	
2023-06-12	04:00:00		55	48	16	15	
2023-06-12	05:00:00		53	50	26	15	Wind Speed >= 20 km/hr
2023-06-12	06:00:00		56	51	22	16	Wind Speed >= 20 km/hr
2023-06-12	07:00:00		57	52	14	15	
2023-06-12	08:00:00		60	52	11	15	
2023-06-12	09:00:00		57	50	13	16	
2023-06-12	10:00:00		56	49	13	16	
2023-06-12	11:00:00		58	49	13	16	
2023-06-12	12:00:00		57	50	4	16	
2023-06-12	13:00:00		55	45	10	17	
2023-06-12	14:00:00		55	48	10	17	
2023-06-12	15:00:00		60	48	10	18	
2023-06-12	16:00:00		56	50	25	18	
2023-06-12	17:00:00		58	51	27	18	
2023-06-12	18:00:00		57	50	35	16	
2023-06-12	19:00:00		55	50	31	14	
2023-06-12	20:00:00		55	48	26	14	
2023-06-12	21:00:00		57	48	17	13	
2023-06-12	22:00:00		**50**	46	18	13	
2023-06-12	23:00:00		61	46	13	13	
2023-06-13	00:00:00		65	45	11	12	
2023-06-13	01:00:00		64	45	10	12	
2023-06-13	02:00:00		65	46	8	13	
2023-06-13	03:00:00		58	45	10	12	
2023-06-13	04:00:00		57	49	11	11	
2023-06-13	05:00:00		61	50	9	12	
2023-06-13	06:00:00		55	52	18	12	
2023-06-13	07:00:00		58	51	16	12	
2023-06-13	08:00:00		59	50	18	15	
2023-06-13	09:00:00		56	49	22	17	

Lowest Daytime one-hour Leq (07:00 - 19:00) **50** **dBA**
Lowest Evening one-hour Leq (19:00 - 23:00) **50** **dBA**
Lowest Nighttime one-hour Leq (23:00-07:00) **44** **dBA**

Notes:

(1) Weather data provided by Environment Canada's Toronto International A Climate Station
(2) Measurements recorded during inclement weather (winds speeds greater than 20 km/h and/or rain) were disregarded.
(3) Bolded data represents the lowest measured Leq during the respective monitoring time period.

Legend
Day Time Hours
Evening Time Hours
Night Time Hours

Appendix C

Noise Source Summary

Table C.1

Noise Source Summary
Emerald Energy From Waste
7656 Bramalea Road, Brampton, Ontario

Cadna A ID	Source Description	Sound Power Level[1] (dBA)	Source Characteristics[2]	Source Location[3]	Noise Control Measures[4]	Source Type
Steady State Sources - Existing						
S01A	Main Roof Exhaust Fan	102	S	O	U	Point
S01B	Main Roof Exhaust Fan	102	S	O	U	Point
S01C	Main Roof Exhaust Fan	102	S	O	U	Point
S01D	Main Roof Exhaust Fan	102	S	O	U	Point
S01E	Main Roof Exhaust Fan	102	S	O	U	Point
S01F	Main Roof Exhaust Fan	102	S	O	U	Point
S01G	Main Roof Exhaust Fan	102	S	O	U	Point
S01H	Main Roof Exhaust Fan	102	S	O	U	Point
S01I	Main Roof Exhaust Fan	102	S	O	U	Point
S02A	Air Cooled Condenser Fan	90	S	O	U	Area
S02B	Air Cooled Condenser Fan	90	S	O	U	Area
S02C	Air Cooled Condenser Fan	85	S	O	U	Area
S02D	Air Cooled Condenser Fan	85	S	O	U	Area
S02E	Air Cooled Condenser - Top	72	I	O	U	Area
S03	Bay Door	101	S	O	U	Vertical Area
S04	Gooseneck Exhaust	101	S	O	U	Point
S05	Bay Door	94	S	O	U	Vertical Area
S06	Gooseneck Exhaust Pipe	99	S	O	U	Point
S07	Radiator (Blue)	104	S	O	U	Point
S08	Radiator (Grey)	107	S	O	U	Point
S09	Elevated Radiator (Blue)	114	S	O	U	Point
S10	Bay Door	100	S	O	U	Vertical Area
S11A	Bay Door	70	S	O	U	Vertical Area
S11B	Bay Door	70	S	O	U	Vertical Area
S11C	Bay Door	71	S	O	U	Vertical Area
S11D	Bay Door	72	S	O	U	Vertical Area
S13	De-Aerator Exhaust	89	S	O	U	Point
S14	#6 Boiler motor	94	S	O	U	Point
S15	Boiler Pumps	100	S	O	U	Point
S16A	Sidewall Exhaust	104	S	O	U	Vertical Area
S16B	Sidewall Exhaust	104	S	O	U	Vertical Area
S17	RTO Generator Motor North	98	S	O	U	Point
S18	RTO Generator Motor South	98	S	O	U	Point
S19	RTO Blower Shed	92	S	O	U	Point
S20A	Marshalling Area Bay Door	74	S	O	U	Vertical Area
S20B	Marshalling Area Bay Door	75	S	O	U	Vertical Area
S21	Vertical Exhaust Pipe	101	S	O	U	Point
S22A	York HVAC (ZF036)	80	S	O	U	Point
S22B	York HVAC (ZJ048)	82	S	O	U	Point
S23	York HVAC	89	S	O	U	Point
S24A	Sidewall Exhaust	96	S	O	U	Vertical Area
S24B	Sidewall Exhaust	96	S	O	U	Vertical Area
S25	Vertical Pipe Exhaust	100	S	O	U	Point
S26	Water Spray Cooling Towers	100	S	O	U	Point
TR0	Existing Truck Route	110	S	O	U	Line
Impulse Sources - Exisitng						
I01	Silo Impulse	107	I	O	U	Point
Steady State Sources - Future						
F01A	Line 1 - Main Roof Exhaust Fan	102	S	O	U	Point
F01B	Line 1 - Main Roof Exhaust Fan	102	S	O	U	Point
F01C	Line 1 - Main Roof Exhaust Fan	102	S	O	U	Point
F01D	Line 1 - Main Roof Exhaust Fan	102	S	O	U	Point
F01E	Line 1 - Main Roof Exhaust Fan	102	S	O	U	Point
F01F	Line 1 - Main Roof Exhaust Fan	102	S	O	U	Point
F01G	Line 2 - Main Roof Exhaust Fan	102	S	O	U	Point
F01H	Line 2 - Main Roof Exhaust Fan	102	S	O	U	Point
F01I	Line 2 - Main Roof Exhaust Fan	102	S	O	U	Point
F01J	Line 2 - Main Roof Exhaust Fan	102	S	O	U	Point
F01K	Line 2 - Main Roof Exhaust Fan	102	S	O	U	Point
F01L	Line 2 - Main Roof Exhaust Fan	102	S	O	U	Point

Table C.1

Noise Source Summary
Emerald Energy From Waste
7656 Bramalea Road, Brampton, Ontario

Cadna A ID	Source Description	Sound Power Level[1] (dBA)	Source Characteristics[2]	Source Location[3]	Noise Control Measures[4]	Source Type
F01M	Line 3 - Main Roof Exhaust Fan	102	S	O	U	Point
F01N	Line 3 - Main Roof Exhaust Fan	102	S	O	U	Point
F01O	Line 3 - Main Roof Exhaust Fan	102	S	O	U	Point
F01P	Line 3 - Main Roof Exhaust Fan	102	S	O	U	Point
F01Q	Line 3 - Main Roof Exhaust Fan	102	S	O	U	Point
F01R	Line 3 - Main Roof Exhaust Fan	102	S	O	U	Point
F02	Air Cooled Condenser - Bottom	88	S	O	U	Area
F03	De-Aerator Exhaust	89	S	O	U	Point
F04A	Line 1 ID Fan	104	S	O	U	Point
F04B	Line 1 Stack Exhaust	104	S	O	U	Point
F05A	Line 2 ID Fan	104	S	O	U	Point
F05B	Line 2 Stack Exhaust	104	S	O	U	Point
F06A	Line 3 ID Fan	104	S	O	U	Point
F06B	Line 3 Stack Exhaust	104	S	O	U	Point
F07	Office/Admin HVAC	89	S	O	U	Point
F08	Office/Admin HVAC	89	S	O	U	Point
F09	Consumables Delivery - Open bay door	87	S	O	U	Vertical Area
F10	Waste Trucks Access - Open bay door	80	S	O	U	Vertical Area
F11	Tipping floor - Open bay door	87	S	O	U	Vertical Area
F12	Air Cooled Condenser - Bottom	101	S	O	U	Area
TR1	Future Truck Route	110	S	O	U	Line

Notes:

[1] Sound Power Level (PWL) in dBA, excludes +5 dBA total penalty if applicable.
[2] Sound characteristics:
- S – Steady
- Q – Quasi-steady impulsive
- I – Impulsive
- B – Buzzing
- T – Tonal
- C – Cyclic

[3] Source location:
- O – Outside of building
- I – Inside of building

[4] Noise control measures:
- S – Silencer, acoustic louvre, muffler
- A – Acoustic lining, plenum
- B – Barrier, berm, screening
- L – Lagging
- E – Acoustic enclosure
- O – Other
- U – Uncontrolled
- AC – Administrative control



Appendix B.7

Natural Environment Assessment Report

Natural Environment Assessment Report

Emerald Energy from Waste Environmental Screening & ECA Amendment

Emerald Energy from Waste Inc.

29 January 2024

→ **The Power of Commitment**



Project name		Emerald Energy from Waste Environmental Screening & ECA Amendment					
Document title		Natural Environment Assessment Report | Emerald Energy from Waste Environmental Screening & ECA Amendment					
Project number		12593193					
File name		12593193-RPT-Natural Environment Assessment Report					
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1. Introduction

This report documents the Natural Environment Assessment carried out as part of the Environmental Assessment Screening for the Emerald Energy from Waste Facility.

The Emerald Energy from Waste facility (Site) is located at 7656 Bramalea Road, in Brampton, Ontario and is owned and operated by Emerald Energy from Waste Inc., herein referred to as Emerald EFW (EEFW, Owner, Proponent). The location of the Site is shown in **Figure 1.1.**



Figure 1.1 Location of the Proposed Undertaking

The Site received a Certificate of Approval (CofA, now referred to as an Environmental Compliance Approval [ECA]) (Air) in 1991 and has accepted municipal solid waste since 1992. The Site, which operates under ECA No. 0264-BFGQFY, has approved waste processing rates of 546 tonnes per day and 182,000 tonnes per year. The Site is currently approved for a total of six 2-stage gasification units (five units are currently installed) by Consumat System Inc., each having a nominal design Waste Processing Rate of 91 tonnes per day of municipal solid waste. Under the current ECA, the Site is licensed to receive solid non-hazardous waste from domestic, commercial, industrial and institutional sources and waste designated for thermal treatment by the Canadian Food Inspection Agency and/or Health Canada, from the province of Ontario, as well as solid non-hazardous waste limited to international waste, arriving in the province of Ontario.

Any proposed change to the waste processing limits requires a modification to several conditions of the approved ECA, which specifies the maximum amount of waste to be processed daily and annually as well as the allowable number of equipment units. The proposed Project would amend the approved ECA to allow for up to 900,000 tonnes of non-hazardous residual waste processing capacity annually. It is intended that staged decommissioning of the existing five units would take place as the proposed new units are brought online, such that the annual processing capacity of the entire facility would not exceed 900,000 tonnes at any time. Changes to the current approved size and footprint of the EEFW facility will also be required in order to accommodate the proposed new gasification units.

The proposed change to the annual waste processing capacity will allow Emerald EFW to positively respond to reducing Ontario's reliance on landfill disposal (both Canada and USA) while recovering energy from residual materials and reducing greenhouse-gas emission. This includes diverting a significant amount of Ontario's total residual waste going to landfill (currently 97 percent)[1] while ensuring the longevity of landfill disposal capacity. The proposed facility expansion is expected to have an operating life of at least 20 years. Between 1997 and 2000, Emerald EFW completed an Environmental Assessment (EA) for expansion of the facility by 25 percent. A CofA was issued in 2009. The Site also conducted and Environmental Screening for service area expansion and was approved between 2011-2012. The amendments to the ECA were approved in 2010, 2012, and 2020 by the Ministry of Environment, Conservation and Parks (MECP).

In order to meet the growing demand from waste generators and customer for a safe and reliable waste management facility for their post diversion solid non-hazardous Residential and Industrial, Commercial & Institutional waste, Emerald Energy from Waste Inc. is proposing to redevelop and expand the processing capacity of their existing facility from 500 tonnes/day to up to 2,500 tonnes/day and increase the energy recovery from 10 MW to up to 100 MW. This redevelopment will be implemented in 3 phases. During Phase 1, the existing facility will remain operational while the first new processing line is constructed **(See Figure 1.2)**. Phase 2 and 3 will installed and commissioned in response to market demand. The existing facility would be removed as shown in **Figure 1.3.**



Figure 1.2 Proposed Redevelopment Phase 1

[1] Solid Waste in Ontario: Landfill Report, Ontario Waste Management Association, January 2021.



Figure 1.3 Proposed Redevelopment Phase 2 & 3

This ECA amendment is subject to the Environmental Screening Process in accordance with Section 16 of Ontario Regulation 101/07 – Waste Management Projects Regulation of the Ontario *Environmental Assessment Act*, as follows:

> *A change to a thermal treatment site described in section 11 is defined as a major commercial or business enterprise or activity and is designated as an undertaking to which the Act applies, if the amount of waste that would be subject to thermal treatment at the site on any day after the change would exceed the amount of waste that was authorized under the Environmental Protection Act to be subject to thermal treatment at the site before the change. O. Reg. 101/07, s. 16; O. Reg. 389/22, s. 9.*

Section 16 of Ontario Regulation 101/07 – Waste Management Projects Regulation exempts this Project from Part II of the *EA Act*, subject to fulfilling the Environmental Screening Process. The Screening will be conducted in accordance with the planning and design process outlined in MECP "*Guide to Environmental Assessment Requirements for Waste Management Projects.*" The Environmental Screening process includes identifying and applying screening criteria to determine and describe potential environmental effects, public/external agency consultation, and the development of measures to mitigate identified environmental effects. The results of the Study will be documented in an Environmental Screening Report (ESR), which will be released for review to Stakeholders including Indigenous communities, the public, and government agencies. Upon completion of the Environmental Screening Process an application will be made to amend the existing ECA No. 0264-BFGQFY.

The Environmental Screening Process is described further in **Section 2** including the application of the Screening Criteria Checklist. The existing, planned and future Natural Environments within the Site were confirmed through background research and site visits are documented in **Section 4**. In general, the predominant features within the Site is Industrial with Spring Creek located to the western property limits, which is anticipated to remain that way for the foreseeable future based on current municipal planning policy.

The effects assessment carried out for the Natural Environment existing conditions is documented in **Section 4**. The identification of potential effects of the proposed project, mitigation measures to address the effects and the resultant net effects are described. Lastly the monitoring requirements and additional approvals required are detailed in **Section 6**.

There are two Study Areas for the Site appropriate to characterize the existing conditions for the Environmental Screening including:

– **Site Study Area**, including all lands within the existing, approved boundaries of the Emerald EFW, as defined by ECA No. 4591-56VSTN, as amended; and

– **Local Study Area**, including all lands within a 120 metre (m) radius of the Site Study Area boundaries.

From a Natural Environment and Economic Environment perspective, the characterization of existing conditions the Local Study Area was considered appropriate.

The Study Areas reviewed for the Natural Environment Assessment was as follows (see **Figure 1.4**):



Data Disclaimer

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1 cm = 37 meters

0 25 50 75 100

Metres

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983
Grid: NAD 1983 UTM Zone 17N

N

GHD

Emerald Energy From Waste Inc.
7656 Bramalea Road, Brampton, ON
City of Brampton
Regional Municipality of Peel

Environmental Assessment

Natural Environment Study Area

Project No. 11203506
Revision No.
Date Jul 17, 2023

Figure 1.4

O:\GIS\PROJECTS\12593000s\12593193\Layouts\202301_NES001\12593193_202301_NES001_GIS001 - Site Location Plan.mxd
Print date: 17 Jul 2023 - 11:02

Data source: Image © Regional Municipality of Peel, 2022.

2. Screening Criteria Checklist

At the beginning of the Environmental Screening, the Screening Criteria Checklist (provided as Schedule I, pp 62 – 64, to the "*Guide to Environmental Assessment Requirements for Waste Management Projects*" (Guide)) is to be completed based on the information provided in the Project Description. The Screening Criteria reflect the broad definition of "environment" contained in the Ontario *Environmental Assessment Act.*

As noted in the Guide:

*"The Screening Criteria are presented in the form of a checklist with the option of a "Yes" or "No" response. Mitigation measures **are not** to be considered in concluding whether there is "No" potential environmental effect. That is, the proponent is required to answer "Yes" even if the proponent believes that a potential environmental effect could likely be mitigated. The reason for requiring a "Yes" is to ensure that mitigation measures are open to discussion and review. Another reason for this approach is that further discussion and review of a potential effect may reveal that there is no actual effect, in which case no mitigation is required. Where a "yes' has been identified, the proponent is to provide additional information in the Environmental Screening Report, explaining the potential effect(s), methods to mitigate or address the effect(s), any net effects that are anticipated and if so, their significance. Even where the proponent indicates that no environmental effects are anticipated, it is recommended that additional information is provided in the Environmental Screening Report in order to support the "no effects" conclusion"*.

Each criterion is based on a question which is prefaced with the phrase, "Might the Project…" **Table 1** was completed as the first step of the Environmental Screening Process and is a summary of the criteria for the Natural Environment discipline. Further descriptions of the criteria for which a "Yes" response was indicated in the Screening table are discussed in **Section 4.0** of this report.

Table 1 Screening Criteria Checklist

	Criterion	YES	NO	Additional Information
	Might the project…			
Natural Environment				
4.1	Cause negative effects on rare (vulnerable), threatened or endangered species of flora or fauna or their habitat?	X		The proposed Emerald EFW facility expansion would result in changes to the existing site footprint and on-site operations and may cause effects on rare (vulnerable), threatened or endangered species of flora or fauna or their habitat.
4.2	Cause negative effects on protected natural areas such as, areas of natural and scientific Interests (ANSIs), environmental significant areas (ESAs) or other significant natural areas?		X	As there are no known ANSIs, ESAs or other significant natural areas on-site, the proposed Emerald EFW facility expansion is not expected to cause a negative effect.
4.3	Cause negative effects on designated wetlands?	X		The proposed Emerald EFW facility expansion would result in changes to the existing site footprint and on-site operations and may cause negative effects on designated wetlands.
4.4	Cause negative effects on wildlife habitat, populations, corridors or movement?	X		The proposed Emerald EFW facility expansion would result in changes to the existing site footprint and on-site operations and may cause negative effects on wildlife habitats, populations, corridors, or movements.
4.5	Cause negative effects on fish or their habitat, spawning, movement or environmental conditions (e.g., water temperature, turbidity, etc.)?	X		The proposed Emerald EFW facility expansion would result in changes to the existing site footprint and on-site operations and may cause negative effects on fish or their habitat.

	Criterion	YES	NO	Additional Information
4.6	Cause negative effects on locally important or valued ecosystems or vegetation?	X		The proposed Emerald EFW facility expansion would result in changes to the existing site footprint and potentially result in negative effects on locally important or valued ecosystems or vegetation.
4.7	Increase bird hazards within the area that could impact surrounding land uses (e.g., airports)?		X	All waste materials will be enclosed within Facility buildings. No outdoor storage.

3. Environmental Policy

The following sections outline the legislation, policies and regulations relevant to natural heritage features and functions applicable to the Study Area.

3.1 Federal Legislation

3.1.1 Species at Risk Act

The *Species at Risk Act* (SARA, 2002) is a federal act that incorporates a number of prohibitions to protect individuals of listed threatened (THR), endangered (END) or extirpated (EXP), Species at Risk (SAR) – as designated by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Per Section 34, Section 58 and Section 61, these prohibitions apply to aquatic species (fish and mussels) and migratory birds protected by the *Migratory Birds Convention Act* (MBCA, 1994) on all lands, and any other listed wildlife species when on federal lands or any lands if recommended by the Minister of the Environment to the Governor in Council.

3.1.2 Migratory Birds Convention Act

The MBCA (1994) and Migratory Birds Regulations, (MBR; 2022) protect most species of migratory birds and their nests and eggs. Under the MBR 2022 it is now prohibited to damage, destroy, disturb or remove migratory bird nests when they contain a live bird or viable egg and prohibit the deposit of harmful substances in waters and areas frequented by them. For 18 species of migratory birds identified on Schedule 1, the MBR 2022 provide year-round nest protection until they can be deemed abandoned. The Schedule includes certain migratory birds who either re-use their own nests from one year to the next (colonial species), or whose nests are commonly re-used by other species of migratory bird species, like pileated woodpeckers (*Dryocopus pileatus*). If the nest of a Schedule 1 species has not been occupied by a migratory bird for the entirety of the waiting time indicated in the MBR 2022, it is considered to be abandoned, and to no longer have high conservation value for migratory birds.

If the proponent is not able to wait the designated period to destroy or relocate a nest of a species listed on Schedule 1 or need to destroy or relocate a nest of another species of migratory bird when it contains a live bird or viable egg, and have taken appropriate mitigation, a permit may be available. The MBR 2022 continue to allow for the issuance of Damage and Danger as well as Scientific permits, which may apply in specific limited situations. Environment and Climate Change Canada (ECCC) implements policies and guidelines to protect migratory birds, and guidance on the Environment Canada website is provided to help to minimize the risk of detrimental effects to migratory birds and to achieve compliance with the law. Compliance with the MBCA and MBR is best achieved through a due diligence approach based on a site-specific analysis in consideration of the avoidance guidelines on the ECCC website, such as the implementation of timing restrictions to ensure migratory birds and their young have left an area before it is disturbed due to construction or prior to vegetation removal.

The Study Area has been identified to be within Zone C2 (ECCC, 2019) and as such this area of southern Ontario typically has migratory birds nesting between the time period of April 1 to August 31 of every year.

3.1.3 Fisheries Act

The purpose of the *Fisheries Act* (FA, 1985) is to maintain healthy, sustainable and productive Canadian fisheries through the prevention of pollution, and the protection of fish and their habitat. The FA defines fish habitat as "spawning grounds and other areas, including nursery, rearing, food supply and migration areas, on which fish depend directly or indirectly in order to carry out their life processes" [subsection (2)1]. On August 28, 2019, changes were made to the FA, and as a result the FA prohibits the death of fish by means other than fishing [subsection 34.4 (1)] and the harmful alteration, disruption or destruction of fish habitat [HADD; subsection 35. (1)]. A HADD is defined as "any temporary or permanent change to fish habitat that directly or indirectly impairs the habitat's capacity to support one or more life processes" (DFO, 2019[2]). These changes also include new protection provisions for fish and fish habitat in the form of standards, codes of practice, and guidelines for projects in and near water. These provide guidance on how to avoid and mitigate impacts to fish and fish habitat and comply with the FA to avoid causing the death of a fish or HADD of fish habitat from your work, undertaking or activity.

Projects affecting waterbodies that support fish and fish habitat must comply with the provisions of the FA. The proponent is responsible for determining if the project is likely to cause impacts to fish and fish habitat and if these impacts can be avoided or mitigated. The proponent must gather information on the type and scale of impact on the fishery and determine if the impacts will result in the death of fish or a HADD of fish habitat. Some projects may be eligible for exemption from the Fisheries and Oceans Canada (DFO) review process, as specified under Step 3 of the DFO Fish and Fish Habitat Protection Program review process (DFO 2022[3]; e.g., clear-span bridges and bridge maintenance projects where DFO mitigation measures are applied, artificial waterbodies with no hydrological connection to occupied fish habitat, and projects that follow the standards and Codes of Practice defined by DFO). All other projects or activities that have the potential to impact fish or fish habitat should be submitted to DFO through the "Request for Review" process. DFO will review the proposed project to determine whether there is potential to (1) impact an aquatic species at risk, (2) cause the death of fish or (3) result in HADD of fish habitat. The death of fish by means other than fishing or a HADD of fish habitat can be authorized by DFO under paragraphs 34.4(2)(b) or 35(2)(b) of the FA.

A request for review should be submitted to DFO if impacts cannot fully be avoided or mitigated. Following DFO review, if it is determined that the impacts cannot be avoided or mitigated and will result in death of fish or a HADD of fish habitat, an authorization under Subsection 35 (2) of the FA must be obtained from the DFO.

Section 34 and 36, the key pollution prevention provisions, prohibits the deposit (i.e., discharging, spraying, leaking, dumpling, etc.) of deleterious substances into waters frequented by fish, unless authorized by regulations under the FA or other federal legislation. A deleterious substance can be defined as:

1. *any substance that, if added to any water, would degrade or alter or form part of a process of degradation or alteration of the quality of that water so that it is rendered or is likely to be rendered deleterious to fish or fish habitat or to the use by man of fish that frequent that water, or*
2. *any water that contains a substance in such quantity or concentration, or that has been so treated, processed or changed, by heat or other means, from a natural state that it would, if added to any other water, degrade or alter or form part of a process of degradation or alteration of the quality of that water so that it is rendered or is likely to be rendered deleterious to fish or fish habitat or to the use by man of fish that frequent that water.*

The FA includes sections that may require the provision of sufficient water and unimpeded passage for fish (Sections 3.4.3). Projects that have the potential to obstruct fish passage or affect flows needed by fish require an authorization.

[2] DFO 2019. Fish and Fish Habitat Protection Policy Statement, August 2019. 36 pp.
[3] DFO 2022. Fish and Fish Habitat Protection Program, March 2022. Request a Review of Your Project Near Water: Step 3. Check if your Project Needs a Review. Available online at: http://www.dfo-mpo.gc.ca/pnw-ppe/reviews-revues/request-review-demande-d-examen-003-eng.html

3.2 Provincial Legislation

3.2.1 Endangered Species Act

The provincial *Endangered Species Act* (ESA, 2007) provides protection for provincial SAR and their habitats. Ontario contains over 200 flora and fauna species that are at risk. SAR are classified into one of four levels of risk (EXT, END, THR, SC) through science-based assessment via the Committee on the Status of Species at Risk in Ontario (COSSARO); classification is based on best available science and Indigenous Traditional Knowledge. Species classified as THR or END on the Species at Risk in Ontario (SARO) list are afforded protection under the ESA.

Protection under the ESA prohibits the "killing, harming, harassing, possessing, buying, selling, trading, leasing or transporting species listed as THR, END or EXT". The ESA also includes preparation of recovery strategies for species ranked as THR or END, and management plans for those ranked as SC.

New regulations 829/21 and 830/21 (2022) provide additional details regarding specific species where a conservation fund options, or registration is permitted. Where a proposed activity will impact protected species or habitat, changes to timing, location and methods of the proposed activity should be considered, wherever feasible, to avoid impacts to SAR. Where impacts cannot be avoided or mitigated, a permit or authorization process can be entered into. The Ministry of Environment, Conservation and Parks (MECP) administers the ESA.

3.2.2 Provincial Policy Statement

The Provincial Policy Statement (PPS, 2019) was issued under Section 3 of the *Planning Act* and the most recent consolidation came into effect May 1, 2020 (MMAH, 2020). Policy 2.1 of the PPS provides direction to regional and local municipalities regarding planning policies for the protection and management of natural heritage features and resources. The 2020 PPS defines several natural heritage features and provides planning policies for each. The Site is located in Ecodistrict 7E.

The Natural Heritage Reference Manual (OMNR, 2010) provides guidance for implementation of the natural heritage considerations associated with the PPS. This guidance document addresses the considerations for evaluation of significance of natural features. When one or more of the criteria for Significance of a particular attribute are satisfied, the feature should be considered Significant. Municipal official plans are required to implement these PPS policies in their policies pertaining to natural heritage features.

The Provincial Government released Bill 97, the *'Helping Homebuyers Protecting Tenants Act'* in April 2023 and also released a proposed Provincial Planning Statement for public comment. The Proposed Provincial Planning Statement is intended to replace the current Provincial Policy Statement, 2020 and the Growth Plan for the Greater Golden Horseshoe, 2020 and the proposed Provincial Planning Statement will provide policy direction on matters of provincial interest related to land use planning and development.

3.2.3 A Place to Grow Act: Growth Plan for the Greater Golden Horseshoe

A Place to Grow: Growth Plan for the Greater Golden Horseshoe, came into effect on May 16, 2020, replacing the Growth Plan for the Greater Golden Horseshoe, 2017 (OMMAH, 2017). The recent revisions include minor changes to the natural heritage system policies and removing the provincial NHS mapping layers. The 2020 Growth Plan for the Greater Golden Horseshoe is a long-term plan that works with the Greenbelt Plan, the Oak Ridges Moraine Conservation Plan and the Niagara Escarpment Plan to provide a framework for growth management in the region (OMMAH, 2019). The Site is within the urban settlement area (City of Brampton). According to Section 4.2.2 (Natural Heritage System), “The Natural Heritage System mapping will exclude lands within settlement area boundaries that were approved and in effect as of July 1, 2017” (OMMAH, 2017).

3.2.4 Invasive Species Act

The provincial *Invasive Species Act* (ISA, 2015) sets out rules to prevent and control the spread of invasive species. Species regulated under the ISA pose a risk to Ontario's natural environment and are divided into two classes: prohibited and restricted. It is illegal to import, possess, deposit, release, transport, breed/grow, buy, sell, lease or trade prohibited invasive species, and it is illegal to import, deposit, release, breed/grow, buy, sell, lease or trade restricted invasive species. The ISA is administered by the Ministry of Natural Resources and Forestry (MNRF).

3.3 Local and Other Regulatory Bodies

3.3.1 Region of Peel (April 2022 Office Consolidation)

The Region of Peel Official Plan 2022 Consolidation was adopted on April 28, 2022. Natural environment policies within the Official Plan pertain to the protection of Greenlands Systems which consist of Core Areas, Natural Areas and Corridors, and Potential Natural Areas and Corridors. Of these, Core Areas represent the most important natural features that represent both provincially and regionally significant and areas, these may include:

- Significant Wetlands;
- Significant Coastal Wetlands;
- Core Woodlands;
- Environmentally Sensitive or Significant Areas;
- Provincial Life Science ANSIs;
- Escarpment Natural Areas of the Niagara Escarpment Plan; and
- Core Valley and Stream Corridors, which includes major watercourses such as the Credit River as well as other tributaries that contain habitat of END or THR aquatic species.

Schedule C-1 (Greenlands System) and Schedule C-2 (Core Areas of the Greenlands System in Peel) identifies portions of the Local Study Area surrounding Spring Creek as within the Greenland System and Core Area.

3.3.2 City of Brampton Official Plan (September 2020 Office Consolidation)

The City of Brampton Official Plan - Schedule “A” – General Land Use Designations, identifies the Local Study Area as ‘Industrial’ and ‘Open Space’.

The Official Plan – Schedule “D” – Natural Heritage Features and Areas, Identifies the Local Study Area as ‘Valleyland/Watercourse Corridor’ and containing ‘Other Wetland’.

4.6.6.8 Development and site alteration shall not be permitted on lands adjacent to the natural heritage features and areas identified on Schedule “D” unless an Environmental Implementation Report and/or Environmental Impact Study has been prepared having regard for the concerns of the relevant conservation authority, as well as other agencies, to the satisfaction of the City and the report and/or study has demonstrated that there will be no negative impacts on the significant natural features or their ecological functions.

3.3.3 Toronto and Region Conservation Authority and Ontario Regulation 166/06

The Local Study Area is located within the Toronto and Region Conservation Authority (TRCA) regulated lands. Under the *Conservation Authorities Act*, Ontario Regulation 166/06, *Regulation of Development Interference with Wetlands and Alterations to Shorelines and Watercourses* is applicable. Ontario Regulation 166/06 establishes Regulated Areas

where development could be subject to flooding, erosion or dynamic beaches, or where interference with wetlands and alterations to shorelines and watercourses might have an adverse effect on those environmental features. Under the legislative changes associated with Bill 23, TRCA's review and permitting authority will be focused on flooding and erosion hazard mitigation.

4. Existing Conditions

The following subsections describe the existing conditions that are found within the Local Study Area for Natural Environment (**Section 3.1**) of the proposed project.

4.1 Methodology

4.1.1 Secondary Source Information Review

Available secondary sources of information were collected and reviewed to determine existing Natural Environment conditions within the Local Study Area. The information sources reviewed are outlined in **Table 2**.

Table 2 Secondary Source Information Reviewed

Source	Information Reviewed
Government of Canada	– The Atlas of Canada – Toporama
Ministry of Natural Resources and Forestry (MNRF)	– Natural Heritage Features data layers from Land Information Ontario (LIO) and the Natural Heritage Information Center (NHIC) database – Aquatic Resource Area (ARA) Data
Ministry of Environment, Conservation and Parks (MECP)	– Species at Risk (SAR) records
Fisheries and Oceans Canada (DFO)	– Aquatic SAR Maps (2023)
Species at Risk in Ontario List (SARO)	– Referenced range maps for SAR species not included in other atlases
Ontario Reptile and Amphibian Atlas	– Species records for the Sites
Ontario Breeding Bird Atlas	– Breeding bird data for the Sites
Ontario Butterfly Atlas	– Species records for the Sites
Atlas of the Mammals of Ontario	– Checked for records of rare mammals in the general area
Toronto and Region Conservation Authority (TRCA)	– Applicable regulations and policies – Open data layers – Regulated Areas – *Etobicoke and Mimico Creeks Watersheds Technical Update Report* (2010) – *Etobicoke Creek Watershed Characterization Report (2021)*
City of Toronto	– Official Plans Land use designations – Natural Heritage System (NHS) mapping – Ravine and Natural Feature Protection mapping
Palmer Environmental Consulting Group Inc. (PECG)	– *Emerald Energy – Land Exchange Restoration and Enhancement Plan* (2019)

4.1.2 Field Survey Methodologies

4.1.2.1 Aquatic Assessment

A detailed fish habitat survey was conducted by a qualified GHD ecologists following a modified version of the Ontario Stream Assessment Protocol (Stanfield L. 2017). The following fish habitat parameters were collected:

- Stream channel dimensions, general gradient and profile
- Bank/shoreline characteristics (e.g., height and erosion)
- Flow characteristics, including any evidence of groundwater discharge
- Morphology and substrates
- Instream/in-water cover (e.g., woody debris, undercut banks, boulders, vegetation)
- Riparian vegetation
- Presence of physical barriers to fish movement
- Presence of potential critical or specialized habitat areas including potential spawning areas, good nursery cover and holding habitat (deeper refuge pools)
- Disturbances and evidence of past habitat alterations (e.g., channelization, potential pollutant point sources)
- Potential habitat enhancement opportunities
- Significant fish habitat (e.g., cold water stream, SAR critical habitat, fish sanctuaries, specialized habitat that commercial, recreational, and aboriginal (CRA) fish use for spawning, nursery, littoral zones in lakes, coastal wetlands, migratory corridors fish require to reach high value upstream spawning habitat and offshore spawning shoals)

Fish community sampling was not completed as sufficient background fish community information was available through background data sources.

4.1.2.2 Ecological Land Classification and Vegetation Inventory

Vegetation communities were mapped and described following the Ecological Land Classification (ELC) System for Southern Ontario (Lee *et al*. 1998). Previously mapped communities from TRCA's Terrestrial Monitoring and Inventory Group were used to augment the ELC classifications where the first edition classifications were not sufficiently descriptive of the communities. Information collected included dominant species cover, community structure, presence of indicator species, and other notable features. Botanical surveys were completed in conjunction with ELC by walking the Local Study Area and recording species observed. Representative soil sampling with a hand auger was completed to confirm community soil conditions and appropriate classifications. Provincial vegetation community status rarity was assessed through Natural Heritage Information Center (NHIC) vegetation community rankings (NHIC 2022) and the local rarity rankings of vascular plants from the Greater Toronto Area (Varga 2005).

4.1.2.3 Breeding Bird Survey

Breeding Bird Surveys (BBS) were conducted during the breeding bird season when most birds are on their territories engaged in breeding activities. The first visit was conducted between May 24 to June 15 and the second visit between June 15 and July 10. Both visits occurred within the timeframe of half hour before sunrise and the 5 hours following, in accordance with the Ontario Breeding Bird Atlas Survey protocols (Cadman *et al*. 2021). A point count methodology was utilized, where a point count location was surveyed for 10 minutes and all the species seen and heard were recorded. Survey protocols followed the guidance provided by the Ontario Breeding Bird Atlas (Cadman *et al*. 2021). Breeding evidence was recorded to determine whether the species breeding in the Local Study Area was possible, probable, or confirmed, following protocols of the Ontario Breeding Bird Atlas (Cadman *et al*. 2021). Point count locations were situated to ensure representation of all habitat types within the Local Study Area. Incidental species observations were also collected on all Site visits.

A total of three-point count locations were established on site to capture all habitat conditions. The first BBS survey was conducted on June 15, 2023, from 6:00 am until 8:30 am, the weather conditions were 10°C and sunny, 10% cloud cover with a slight breeze and no precipitation. The second survey was conducted on July 4, 2023, from 6:00 am until 9:00 am under 17°C degree weather, minimal cloud cover, zero precipitation and a gentle breeze.

4.1.2.4 Species At Risk Screening

GHD compiled a list of SAR with potential to occur within the Local Study Area based on the background data review. Habitat assessments for these species were carried out during the field visits to determine the likelihood of presence within the Local Study Area and inform the need for additional targeted surveys.

4.1.2.5 Incidental Wildlife Observations

Observations and signs of wildlife were recorded, including browse, tracks, trails, scat, burrows, remains, nests, and vocalizations.

4.1.3 Process Undertaken

Field investigations were completed by qualified GHD ecologists in the late spring and early summer of 2023, as required based on the survey protocols followed. The schedule of field investigations completed is summarized in **Table 3**.

Table 3 Field Investigation Schedule

Date	Field Investigations Completed
June 15, 2023	Breeding Bird Survey (1st Round), ELC, SAR Screening, Incidental Wildlife
July 4, 2023	Aquatic Habitat Assessment, Breeding Bird Survey (2nd round), ELC, Incidental Wildlife

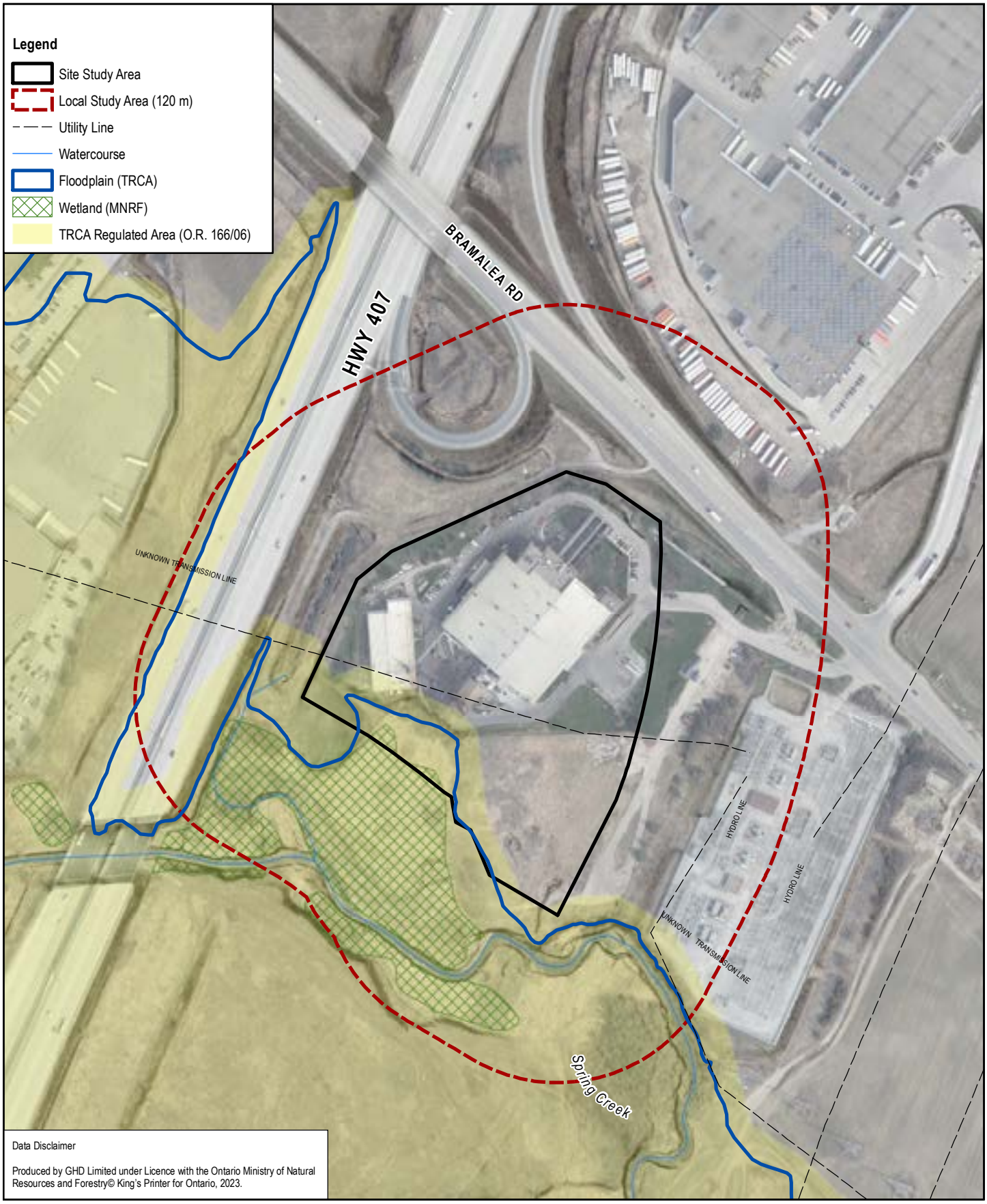
4.2 Description of Existing Conditions

4.2.1 Designated Features

A preliminary review of available background sources revealed the presence of the following features within the Local Study Area:

– An unevaluated wetland is mapped along the southern portion of the Local Study Area, associated with Spring Creek.
– Local Study Area is mapped under the Green Lands System and Core Area for the Region of Peel
– Local Study Area is mapped under Valleyland / Watercourse Corridor and containing Other Wetland for the City of Brampton
– Located within TRCA Regulated Limit

Figure 2.1 depicts provincially and locally designated features within the Local Study Area.



1 cm = 37 meters

0 25 50 75 100

Metres

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983
Grid: NAD 1983 UTM Zone 17N

N

GHD

Emerald Energy From Waste Inc.
7656 Bramalea Road, Brampton, ON
City of Brampton
Regional Municipality of Peel

Environmental Assessment

Designation Areas

Project No. 11203506
Revision No.
Date Jul 17, 2023

Figure 2.1

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Print date: 17 Jul 2023 - 10:36

Data source: Image © Regional Municipality of Peel, 2022.

4.2.2 Screening for Species at Risk

The background review identified potential SAR that could occur within the Local Study Area. All SAR identified were screened to determine the likelihood of occurrence and whether suitable habitat is present.

SAR are defined in this report to include the following provincial and federal designations:

- ***ESA (provincial):*** all provincially designated species that are listed as EXT, END, or THR on the SARO List and protected under the ESA; species listed as SC are considered a SCC, as they are not protected under the ESA.
- ***SARA (federal):*** only applies to fish and migratory birds protected under the MBCA, anywhere they occur (e.g., includes non-federal land), that are designated as EXT, END, and/or THR under the SARA. All other species are only protected if special provisions or executive orders are made.

A list of SAR with potential to occur within the Local Study Area was compiled from background review and agency consultation (**Appendix A**). To determine if suitable habitat for SAR is available within the Local Study Area, the preferred habitat requirements for potential SAR were compared to vegetation communities, aquatic habitats, and niche habitats identified during field assessments and the background review. The results of the SAR habitat screening are provided in **Section 4.2.7**

4.2.3 Watershed Characterization

One watercourse is present along the southwestern limits of the Local Study Area. This watercourse is named Spring Creek and is a tributary to Etobicoke Creek that resides within the Spring Creek subwatershed. The Spring Creek subwatershed is the second largest subwatershed, making up 22.2% of the Etobicoke Creek watershed surface area (TRCA 2021). Spring Creek subwatershed is characterized as being highly developed with 54.1% impervious cover present and relatively low natural cover throughout. As a result, Spring Creek has the highest runoff rate and is known to experience overtopping of its riverbank in numerous locations under Regulatory Storm conditions, which poses risk to adjacent developed areas. Additionally, due to the high flow conditions experienced within this subwatershed, the erosion sensitivity at all seven reaches assessed by TRCA in 2020 are classified as high (TRCA 2021).

The fish community Index of Biotic Integrity (IBI) between the assessment period of 2011 and 2020 was 23.6 which is considered to be ‘Fair’ and remains similar to the previous baseline assessment conducted between 2002 and 2010 (TRCA 2021). The benthic community health based on Family Biotic Index (FBI) between the assessment period of 2013 and 2020 was 6.71 which is considered to represent ‘Poor’ water quality (TRCA 2021).

TRCA has completed 16 restoration projects within the Spring Creek subwatershed since 2002 (TRCA 2021). Most notably, two restoration projects were completed in the vicinity of the Local Study Area. A section of concrete lined channel located approximately 900 m northeast of the Local Study Area between Steeles Avenue East and Alfred Kuehne Boulevard was restored in 2013. More recently, the section of Spring Creek located approximately 500 m northeast of the Local Study Area between Alfred Kuehne Boulevard and the Highway 407 overpass was restored in 2018. The naturalization efforts in these areas included natural channel design with meanders and riffle segments along with constructed floodplain wetland pockets. Despite the restoration efforts completed throughout the subwatershed, sections of Spring Creek approximately 1.3 kilometers (km) upstream from the Local Study Area remain artificially straightened and concrete lined, resulting in limited quality fish habitat.

4.2.4 Aquatic Habitat

Spring Creek traverse the southwestern property limits from a west to southeast direction. Upstream as the creek is situated within an anthropogenically restored river valley with surrounding land use consisting of primarily industrial properties. Spring Creek conveys permanent flow under the Highway 407 bridge overpass before entering the southwestern property limits of the Local Study Area . Upstream the watercourse exists as a uniform, shallow riffle segment under the bridge. The bridge abutments spans the watercourse which allows for natural channel flow through the structure. A stormwater management (SWM) pond is located immediately northwest of the Emerald EFW facility

within the Local Study Area, . The SWM pond outlets through a vegetated feature in a southwest direction along the perimeter of the 407 ROW and eventually discharges into Spring Creek near the bridge.

Within the Local Study area, Spring Creek flows within a well-defined meandering channel that is relatively unconfined. Approximately 115 m downstream, evidence of historical channel alignment was observed, cutting off a meander of the channel. This is a natural process which has occurred due to the erosive forces of the watercourse. Based on historic aerial imagery, the meander cutoff process occurred gradually between 2003 and 2009. The historic channel alignment at this location no longer conveys flow but a depression of the channel bed remains. As a result, surface drainage collects in the depression which now supports wetland vegetation such as European reed (*phragmites australis ssp. australis*) and cattails (*Typha* spp.). Further downstream, a number of areas with significant bank erosion was observed, resulting in sheer bank faces and slumping of soil within the watercourse. Bank erosion was most often observed along the outer bend of meanders. This observation suggests Spring Creek experiences significant flows during spring freshet and heavy rainfall events. Further downstream, at the southeast limits of the Local Study Area, a small section of gabion lined bank was observed, indicating past efforts to mitigate bank erosion. Spring Creek continues to flow in a southeast direction as a meandering channel for approximately 5.6 km before the confluence with the main branch of Etobicoke Creek which flows for and additional 16 km prior to ultimately outletting into Lake Ontario.

The channel morphology of the assessed reach consisted of alternating riffles and runs with occasional deeper pools present. A relatively wide riparian buffer exists which is vegetated with predominantly grasses and shrubs with few riparian trees. As a result, stream shading was relatively low throughout. In stream fish cover was provided by mainly large cobbles, boulders and instream and overhanging vascular macrophytes with supplemental cover provided by instream woody debris and undercut banks. Vegetation within the channel was a mix of both submergent and emergent vegetation with dense patches of pondweed (*Potamogeton* spp.) observed and sections of channel banks lined with cattails. Channel substrate was comprised of mainly cobbles followed by gravels and sands. Additionally, throughout the assessed reach areas of exposed glacial till in the form of hardpacked clay was observed.

No evidence of groundwater upwelling (i.e. springs, iron staining, watercress [*Nasturtium* spp.[) was observed throughout the assessed reach. No barriers to fish passage were observed, however, the shallow riffle segment under the Highway 407 bridge overpass may present a seasonal barrier during periods of low flow. Additional Reach characteristics are summarized in **Table 4** and aquatic constraints mapping is provided in **Figure 3.1**.

Table 4 **Aquatic Habitat and Reach Characteristics**

Reach Sub-Sections (%)	Substrate (%)	Channel Dimensions (m)	Riparian Vegetation
Riffle (30)	Cobble (90) Gravel (10)	Wetted Depth: 0.25 Wetted Width: 3.85 Bankfull Depth: 0.46 Bankfull Width: 4.20	Wide riparian buffer consisting of grasses, wetland species, shrubs and the occasional riparian tree.
Pool (15)	Cobble (30) Gravel (20) Clay (50)	Wetted Depth: 1.20 Wetted Width: 8.60 Bankfull Depth: 1.60 Bankfull Width: 9.50	
Run (55)	Cobble (70) Gravel (20) Sand (5) Clay (5)	Wetted Depth: 0.57 Wetted Width: 6.76 Bankfull Depth: 0.61 Bankfull Width: 7.15	

MNRF Aquatic Resource Area (ARA) data indicates Spring Creek to warmwater thermal regime based on the fish species present. ARA fish community records for Spring Creek included blacknose dace (*Rhinichthys atratulus*),

bluntnose minnow (*Pimephales notatus*), brook stickleback (*Culaea inconstans*), central stoneroller (*Campostoma anomalum*), common shiner (*Luxilus cornutus*), creek chub (*Semotilus atromaculatus*), emerald shiner (*Notropis atherinoides*), fathead minnow (*Pimephales promelas*), green sunfish (*Lepomis cyanellus*), Johnny darter (*Etheostoma nigrum*), tesselated darter (*Etheostoma olmstedi*), longnose dace (*Rhinichthys cataractae*), pumpkinseed (*Lepomis gibbosus*), rock bass (*Ambloplites rupestris*), and white sucker (*Catostomus commersonii*. Additionally, during the field assessment GHD aquatic ecologists observed numerous cyprinids schooling within the creek, included many young-of-year fish. This information suggests Spring Creek supports a diverse fish community consisting of primarily forage/baitfish species.

A representative photographic inventory of aquatic habitat is provided in **Appendix B**.

4.2.5 Terrestrial Habitat

4.2.5.1 Vegetation Communities

In total, ten vegetation communities were delineated within the Local Study Area (**Figure 3.2** and **Table 5**) with similar communities adjacent to the Local Study Area. Provincial vegetation community status rarity was assessed through NHIC vegetation community rankings (NHIC 2023) and at the local level (Varga 2005) and of the native vegetation communities found within the Local Study Area, all are considered to be common.

A photographic inventory of the terrestrial habitat conditions of the vegetation communities within the Local Study Area is included in **Appendix C**. Vegetation communities within the Local Study Area are further described below.

Table 5 Vegetation Communities within the Study Area

Ecological Land Classification Code	Description
Cultural Communities	
CUM1-1	Dry-Moist Old Field Meadow - Community containing sparse canopy and sub-canopy of young European buckthorn (*Rhamnus cathartica*), Manitoba maple (*Acer negundo*), and common apple (*Malus pumila*). Reed-canary gras (*Phalaris arundinacea*) and common buckthorn (*Arctium minus*) dominated the understory with Canada goldenrod (*Solidago canadensis*) and smooth brome (*Bromus inermis*) dominating the ground level.
CUM1-b	Exotic Cool-season Grass Graminoid Meadow – Community dominated by smooth brome, common Timothy (*Phleum pratense ssp. pratense*), and Kentucky bluegrass (*Poa pratensis ssp. pratensis*) with other weedy herbaceous species such as Canada thistle (*Cirsium arvense*) and tufted vetch (*Vicia cracca*) interspersed in the ground and understory level.
CUW1-b	Exotic Successional Woodland – Community dominated by Manitoba maple and Norway maple (*Acer platanoides*) in the canopy with European buckthorn, green ash (*Fraxinus pennsylvanica*), and riverbank grape (*Vitis riparia*) dominating the subcanopy.
CUP1-C	Locust Deciduous Plantation – Community dominated by black locust (*Robina pseudoacacia*), in the canopy and subcanopy with European buckthorn and multiflora rose (*Rosa multiflora*) covering the understory level.
CUP3-H	Mixed Conifer Coniferous Plantation – Community dominated by Norway spruce, white spruce (*Picea glauca*) and Manitoba maple in the canopy with European buckthorn and riverbank grape in the subcanopy.

Ecological Land Classification Code	Description
Swamp Communities	
SWT2-2	Willow Mineral Thicket Swamp – Community dominated by willow trees (*Salix sp.*). in the canopy and sub-canopy layer with red-osier dogwood (*Cornus stolonifera*) and canary-reed grass dominating the understory. Ground layer was primary dominated by Canada goldenrod and interspersed with various weedy herbaceous species such a smooth brome and tufted vetch.
Wetland Communities	
MAM2	Mineral Meadow Marsh – European reed (*Phragmites australis*), a highly invasive non-native grass species had completely dominated this marsh meadow community along the western edge of the Local Study Area.
MAM2-2	Reed-canary Grass Mineral Meadow Marsh –Community was interspersed with a sparse Manitoba maple and green ash trees in the canopy and sub-canopy layer and was primarily dominated by dense reed-canary grass in the understory.
Aquatic Communities	
OAO1-T	Turbid Open Aquatic (unvegetated) – Minimal emergent and submerged vegetation was present in this aquatic community, with sparse patches of pondweed observed.
Non ELC Code Communities	
Lawn	Mowed lawn – Maintained lawn of Kentucky bluegrass (*Poa pratensis ssp. pratensis*) dominated this community.
Hedge	Hedgerow – Dense row of Norway spruce, white spruce, and eastern white pine (*Pinus strobus*) dominated hedgerow communities.

4.2.5.2 Flora

A total of 41 vascular plants were identified to species level during field investigations full list of each species can be found in **Appendix D.**

Of the species identified, 13 (or 32%) are native, 28 (or 68%) are non-native. Of the native species, all 13 of the native species for which information is available have S-Ranks[4] of 'S5', indicating they are 'secure' in the province.

All (i.e., 13 species) of the native species (for which information is available) have co-efficient of conservatism[5] (CC) values of 0 to 6, indicating they are tolerant to moderately tolerant of disturbance. No SAR or SCC were identified during the botanical inventories. One locally and regionally rare species (Varga 2005; TRCA 2017), white spruce, was observed in the hedgerow and mixed conifer coniferous plantation (CUP3-H) vegetation communities. White spruce is considered to be generally secure in a natural matrix and able to withstand minor disturbances.

Of the non-native species identified within the Local Study Area, European reed, an extremely aggressive invasive species, was found out competing all other species within the MAM2 community.

[4] Provincial (or Subnational) ranks are used by the Natural Heritage Information Centre (NHIC) to set protection priorities for rare species and natural communities. These ranks are not legal designations. Provincial ranks are assigned in a manner similar to that described for global ranks, but consider only those factors within the political boundaries of Ontario.

[5] Rank of 0 to 10 based on plant's degree of fidelity to a range of synecological parameters: (0-3) Taxa found in a variety of plant communities; (4-6) Taxa typically associated with a specific plant community but tolerate moderate disturbance; (7-8) Taxa associated with a plant community in an advanced successional stage that has undergone minor disturbance; (9-10) Taxa with a high fidelity to a narrow range of synecological parameters (Oldham et al., 1995).



Paper Size ANSI A

0 25 50 75 100

Metres

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983
Grid: NAD 1983 UTM Zone 17N

N

GHD

EMERALD ENERGY FROM WASTE INC.
7656 BRAMALEA RD. BRAMPTON, ON
NATURAL ENVIRONMENT ASSESSMENT REPORT

Project No. **12593193**
Revision No. **-**
Date **Jul 17, 2023**

AQUATIC HABITAT ASSESSMENT

FIGURE 3.1

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Print date: 17 Jul 2023 - 10:35

Data source: MNDMNRF NRVIS, 2021. Produced by GHD under licence from Ontario Ministry of Natural Resources and Forestry, © King's Printer 2023.

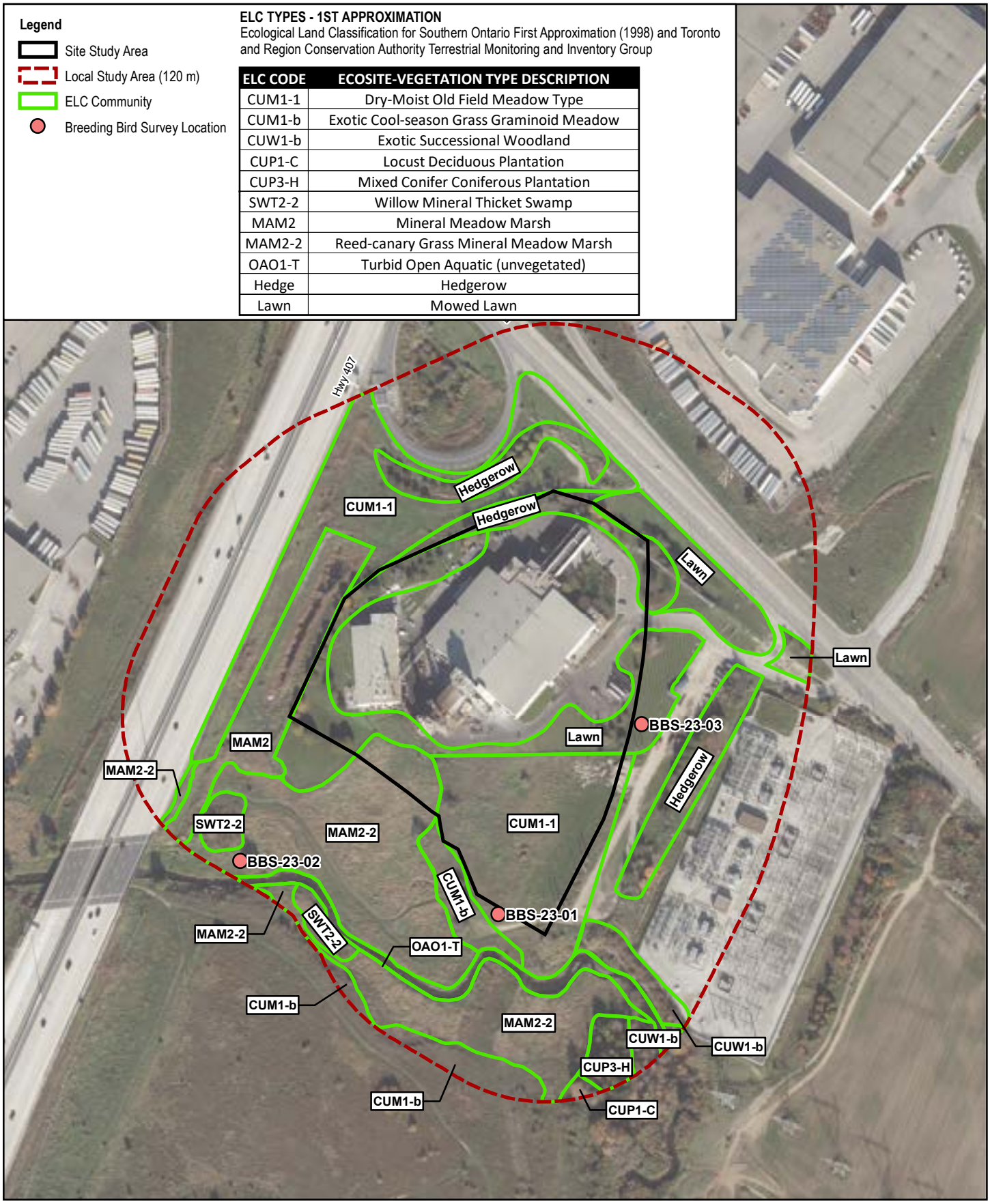
Legend

- Site Study Area
- Local Study Area (120 m)
- ELC Community
- Breeding Bird Survey Location

ELC TYPES - 1ST APPROXIMATION

Ecological Land Classification for Southern Ontario First Approximation (1998) and Toronto and Region Conservation Authority Terrestrial Monitoring and Inventory Group

ELC CODE	ECOSITE-VEGETATION TYPE DESCRIPTION
CUM1-1	Dry-Moist Old Field Meadow Type
CUM1-b	Exotic Cool-season Grass Graminoid Meadow
CUW1-b	Exotic Successional Woodland
CUP1-C	Locust Deciduous Plantation
CUP3-H	Mixed Conifer Coniferous Plantation
SWT2-2	Willow Mineral Thicket Swamp
MAM2	Mineral Meadow Marsh
MAM2-2	Reed-canary Grass Mineral Meadow Marsh
OAO1-T	Turbid Open Aquatic (unvegetated)
Hedge	Hedgerow
Lawn	Mowed Lawn



Paper Size ANSI A

0 25 50 75 100

Metres

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983
Grid: NAD 1983 UTM Zone 17N

N

GHD

EMERALD ENERGY FROM WASTE INC.
7656 BRAMALEA RD. BRAMPTON, ON
NATURAL ENVIRONMENT ASSESSMENT REPORT

Project No. **12593193**
Revision No. **-**
Date **Jul 17, 2023**

VEGETATION COMMUNITIES

FIGURE 3.2

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Print date: 17 Jul 2023 - 16:24

Data source: MNDMNRF NRVIS, 2021. Produced by GHD under licence from Ontario Ministry of Natural Resources and Forestry, © King's Printer 2023.

4.2.6 Wildlife and Wildlife Habitat

4.2.6.1 Birds

The BBSs were conducted on June 15 and July 4, 2023, on the Site. A total of 19 bird species were detected within the Local Study Area. Of the total species observed, zero species are confirmed, two are probable and 15 are possible breeders on or adjacent to the Site based on OBBA breeding evidence codes. The remaining two bird species are considered to be non-breeders, flyovers or migrants. A list of the species detected with evidence of breeding is provided in **Appendix E**.

Based on these surveys, one SAR and no SCC species or locally rare species were observed.

The one SAR species detected was barn swallow (*Hirundo rustica*) and discussed further in **Section 4.2.7**.

4.2.6.2 Incidental Wildlife and Wildlife Habitat

During site investigations, visual observations were completed of the habitat present within the Local Study Area. One bridge was observed at Highway 407 crossing over Spring Creek along the west side of the Site. Visual inspection for any avian species protected under the ESA or for any species protected under the MBCA was completed. Natural and anthropogenic habitat features have the potential to support nesting migratory birds. Multiple nests were observed on the underside of the bridge. The multiple barn swallow nests that did not appear to be active at the time of survey and two active rock pigeon (*Columbia livia*) nests were observed.

Incidental species observations are summarized in **Table 6**. No incidental observations of SAR were observed on Site.

Table 6 Incidental Species Observations

Species		ESA	SARA	S-ranks	Date Observed	Notes
Common Name	Scientific Name					
Monarch	*Danaus plexippus*	SC	SC	S2N, S4B	July 4, 2023	Flying within CUM1-1 community
Raccoon	*Procyon lotor*	-	-	S5	July 4, 2023	Track within MAM2-2 community
Eastern grey squirrel	*Sciurus carolinensis*	-	-	S5	July 4, 2023	Moving within CUM1-1 community

4.2.7 Species at Risk

The list of SAR identified through background review as having potential to occur within the Local Study Area and results of the habitat assessment is provided in **Appendix A.** Of the 15 SAR species with the potential to occur within the Local Study Area, five species had a moderate to high likelihood of occurrence and are discussed below.

4.2.7.1 Arthropods

In Ontario, monarch (*Danaus* plexippus) is listed both federally and provincially as SC and is found throughout the northern and southern regions of the province. This butterfly is found wherever there are milkweed (*Asclepias* spp.) plants for its caterpillars and wildflowers that supply a nectar source for adults. It is often found on abandoned farmland, meadows, open wetlands, prairies and roadsides, but also in city gardens and parks. Important staging areas during migration occur along the north shores of the Great Lakes (COSEWIC 2010). Common milkweed (*Asclepias* syriaca) was observed within the Local Study Area in the cultural meadow (CUM1-1 and CUM1-b) and marsh meadow (MAM2-2) communities, which would provide necessary habitat and food for monarchs. One individual

monarch was observed flying within the CUM1-1 community on the southwest side of the Local Study Area on July 4, 2023.

4.2.7.2 Birds

Bank swallow (*Riparia riparia*) are listed as THR both federally and provincially in Ontario. Bank swallow breeds in a variety of natural and anthropogenic habitats, including lake bluffs, stream and river banks, sand and gravel pits, and roadcuts. Nests are built in a vertical or near-vertical bank. Breeding sites are typically located near open foraging sites such as rivers, lakes, grasslands, agricultural fields, wetlands and riparian woods. Forested areas are generally avoided (Garrison 1999). Steep banks with exposed soil caused by channel erosion were observed along the portion of Spring Creek that runs through the southern portion of the Local Study Area. No bank swallow nests or individuals were observed during field studies.

Barn swallow (*Hirundo rustica*) is designated as THR federally and SC provincially. This species breeds in areas that contain a suitable nesting structure, open areas for foraging, and a body of water. This species nests in human made structures including barns, buildings, sheds, bridges, and culverts. Preferred foraging habitat includes grassy fields, pastures, agricultural cropland, lake and river shorelines, cleared right-of-ways, and wetlands (COSEWIC 2011). Mud nests are fastened to vertical walls or built on a ledge underneath an overhang. Suitable nests from previous years are reused (Brown and Brown 1999). Multiple barn swallows were detected flying over the Local Study Area and approximately 11 barn swallow nests were identified on the underside of the Highway 407 bridge on the western edge of the Local Study Area during field surveys.

Chimney swift (*Chaetura pelagica*) are designated as THR both federally and provincially in Ontario. Chimney swift breeding habitat is varied and includes urban, suburban, rural and wooded sites. They are most commonly associated with towns and cities with large concentrations of chimneys. Preferred nesting sites are dark, sheltered spots with a vertical surface to which the bird can grip. Unused chimneys are the primary nesting and roosting structure, but other anthropogenic structures and large diameter cavity trees are also used (COSEWIC 2007). No chimney swifts were observed during the field surveys, however the Local Study Area contained potential chimney swift nesting sites along the vertical infrastructure of the Emerald EFW facility, specifically the industrial exhaust stacks along the southern portion of the facility.

Wood thrush (*Hylocichla mustelina*) is listed as THR federally and SC provincially. This species breeds in moist, deciduous hardwood or mixed stands that are often previously disturbed, with a dense deciduous undergrowth and with tall trees for singing perches. This species selects nesting sites with the following characteristics: lower elevations with trees less than16 m in height, a closed canopy cover (>70 %), a high variety of deciduous tree species, moderate subcanopy and shrub density, shade, fairly open forest floor, moist soil, and decaying leaf litter (COSEWIC 2012). The Local Study Area contains small patches of moist deciduous thicket vegetation communities with a thick understory. Potential nesting sites for this species are minimal given size of forest patches and dense forest floor and no nesting sites were identified during field surveys.

4.2.7.3 Reptiles

Snapping turtle (*Chelydra serpentina*) is listed as SC both federally and provincially. This species utilizes a wide range of waterbodies, but shows preference for areas with shallow, slow-moving water, soft substrates and dense aquatic vegetation. Hibernation takes place in soft substrates under water. Nesting sites consist of sand or gravel banks along waterways or roadways (COSEWIC 2008). Potential nesting habitat for snapping turtle was associated with Spring Creek and given the urban surrounding area, potential to occur within the Local Study Area is moderate for this species.

5. Description of Project Components and Activities

A Project Description, which includes a Site Plan, was prepared so that potential environmental effects and mitigation measures could be identified. The following subsections provide a general summary of the proposed undertaking:

The purpose of this Project is to provide additional processing capacity at the Emerald EFW facility in Brampton, Ontario in order to divert a portion of the non-hazardous residual materials produced by Ontario residents and businesses from landfills, thereby recovering energy for use within the community. The proposed Project would allow for three new gasification units, each capable of processing up to 300,000 tonnes of residual waste per year, for a total processing capacity at the facility of 900,000 tonnes annually. This would increase the permitted annual waste processing amount from 182,000 to 900,000 tonnes. The proposed change in the annual processing capacity requires additional facility infrastructure and a change to the Site footprint.

The project for which the Environmental Screening Process is being undertaken is a proposed redevelopment of the existing site and involves a change to the final site capacity and footprint. A high level of construction & demolition will be required to implement the proposal. The redevelopment will be implemented in 3 phases. In phase 1, the existing facility will remain operational while the first new processing line is constructed. Phases 2 and 3 will be installed and commissioned in response to market demand. The existing facility would be removed. Emerald EfW will undergo an ECA amendment for changes to approved processing capacity and other operational activities. From a traffic perspective there will be no changes to existing haul routes or Site entrance. Increasing the annual processing capacity will result in increased truck traffic on the haul route from Highway 407 along Bramalea Road on an annual basis. This is expected to be acceptable relative to local traffic volumes.

A summary of the key elements of the proposed capacity expansion compared to the existing approved Site is provided in **Table 7**.

Table 7 Summary of Proposed Emerald EfW Facility Design vs Existing Facility

Design Component	Existing EfW Facility	Proposed Redevelopment
Waste Processing Capacity (tonnes per annum)	150,000	900,000

6. Potential Effects, Mitigation Measures & Net Effects

This section documents the potential effects on the environment, mitigation measures and net environmental effects for Natural Environment resulting from the proposed undertaking.

6.1 Methodology and Investigations

The assessment of effects associated with the proposed undertaking was carried out through a series of steps that is based, in part, on the description of existing conditions as well as the Project Description and Site Plan. The assessment of effects was also undertaken within the context of the previously completed Screening Criteria Checklist, as summarized in **Section 2** of this report.

To do this, the major project components are considered in context of the interactions with surrounding environmental elements. All foreseeable interrelationships between the project and environment during the construction and

operational phases are then assessed to determine the scale of environmental effects. Appropriate mitigation measures are identified and prescribed. Any impacts that persist following implementation of mitigation measures are described as net effects and are considered when determining the overall impact of the project to the natural environment.

6.2 Natural Environment Net Effects

This Section provides an assessment of the potential negative environmental effects (i.e., those for which a "Yes" answer was given in the Screening Criteria Checklist) for those Natural Environment criteria which might be affected by the project as identified in **Section 2**. The effects assessment describes how existing environmental conditions in the Study Area(s) would change as a result of the construction and operation of the proposed undertaking.

As described in **Section 2.0**, a “Yes” was applied to the following Natural Environment criteria (**Table 8**):

Table 8 Screening Criteria Checklist

	Criterion	YES	NO	Additional Information
	Might the project…			
Natural Environment				
4.1	Cause negative effects on rare (vulnerable), threatened or endangered species of flora or fauna or their habitat?	X		The proposed Emerald EFW facility expansion would result in changes to the existing site footprint and on-site operations and may cause effects on rare (vulnerable), THR or END species of flora or fauna or their habitat.
4.3	Cause negative effects on designated wetlands?	X		The proposed Emerald EFW facility expansion would result in changes to the existing site footprint and on-site operations and may cause negative effects on designated wetlands.
4.4	Cause negative effects on wildlife habitat, populations, corridors or movement?	X		The proposed Emerald EFW facility expansion would result in changes to the existing site footprint and on-site operations and may cause negative effects on wildlife habitats, populations, corridors, or movements.
4.5	Cause negative effects on fish or their habitat, spawning, movement or environmental conditions (e.g., water temperature, turbidity, etc.)?	X		The proposed Emerald EFW facility expansion would result in changes to the existing site footprint and on-site operations and may cause negative effects on fish or their habitat.
4.6	Cause negative effects on locally important or valued ecosystems or vegetation?	X		The proposed Emerald EFW facility expansion would result in changes to the existing site footprint and potentially result in negative effects on locally important or valued ecosystems or vegetation.

With respect to the above criteria/criterion, a description of the potential negative environmental effects, necessary mitigation measures and the resultant net effects on the environment are discussed. Studies conducted during the screening showed that the anticipated effects will be much less than expected or will not occur at all. In all cases, impact management (mitigation) measures have been identified that, when applied, will eliminate the potential environmental effects, or reduce them to acceptable levels.

6.2.1 Potential Effects on Natural Environment

Potential impacts to the Natural Environment may include:

– Loss of vegetation and habitat relied upon by rare (vulnerable), THR or END species.

– Loss of vegetation and habitat used for wildlife movement corridors and linkages.
– Establishment of non-native vegetation speciesAlteration of site drainage patterns, resulting in exacerbated erosion and sediment transport
– Re-entry of sediment that was removed/stockpiled into the watercourses
– Short term or chronic transport of deleterious substances, including sediment into fish habitat from construction or road drainage.

6.2.2 Mitigation Measures

6.2.2.1 Aquatic Considerations and Constraints

6.2.2.1.1 Construction Timing

In water and near water construction must be completed within designated work windows to avoid disruption of resident fish species. Spring Creek has been identified as a warmwater system with numerous spring spawning species; therefore, to protect spawning fish, their incubating eggs, and the larval life stages of fish, in water works shall only occur during the activity window of July 1 to March 31 of any given year (i.e. no in water works between April 1 to June 15).

Timing of works will also heed weather advisories with work scheduled to avoid wet, windy and rainy periods that may result in high flow volumes and/or increase erosion and sedimentation.

6.2.2.1.2 Best Management Practices

Any in water works will be inspected and approved by a qualified person with experience around watercourses. Such person may include a geomorphologist, aquatic ecologist or designer, as appropriate based on the scope of in-water works. Such experience will enable quick and appropriate response to issues that may arise and ensure that construction proceeds in accordance with the approved design and contract.

The limits of construction will be delineated to prevent unanticipated impacts to natural surroundings, including trees and the watercourse. The footprint of disturbance will be minimized to the extent feasible. Equipment and machinery will operate from the land from dry, stable areas and use the existing road to access the site and minimize disturbance to natural areas. Equipment will avoid fording of the watercourse.

Temporary fill or stockpiling of materials will not be placed below the high water mark. Streambanks will not be unnecessarily disturbed, including avoiding removing materials from the banks such as sand, rocks, aquatic vegetation, and natural woody debris.

All materials and equipment will be stored and operated in such a manner that prevents any deleterious substances from entering the water. Vehicle and equipment re fuelling and/or maintenance will be conducted away from the watercourse and be free of fluid leaks and externally cleaned/degreased to prevent the release of deleterious substances.

6.2.2.1.3 Temporary Cofferdams and Diversion Channels

Should any in-water work be required, the area will be isolated and dewatered such that construction works can proceed in the dry, while maintaining the natural flow regime to downstream habitat at all times. Considerations to the water management/dewatering plan includes the following mitigation measures:

– Limit the duration of in water works
– Screen intake pipes to prevent entrainment or impingement of fish when using pumps
– Capture and relocate fish trapped within any isolated work areas prior to dewatering under a valid MNRF Licence to Collect Fish
– Protect pump discharge areas to prevent erosion and the release of suspended sediments downstream

– Pump any residual water from the isolated work area into a filterbag located in a well vegetated area 30 m away from the watercourse

6.2.2.1.4 Interim Erosion and Sediment Control

Newly constructed channels and areas of disturbance are particularly vulnerable to erosion between the initial excavation and the establishment of vegetation along channel banks. While low flow conditions should not exacerbate erosion, higher flows and precipitation events during construction can cause erosion. To alleviate the potential for erosion, the construction design should consider ground stabilization as work progresses with a prescribed native seed mix.

An Erosion and Sediment Control (ESC) plan should be developed for the work that will prevent the entry of sediment into the watercourses. Temporary ESC measures should be included on the contract drawing and installed prior to construction and maintained throughout construction. These measures will be routinely inspected, including following storms, and repaired, as required. All erosion and sediment control measures must remain in place until restoration is complete and disturbed areas are stabilized against erosion. The ESC plan requires regularly monitoring the watercourse for signs of sedimentation during all phases of the work and taking corrective action if required.

Where applicable, guidance provided in the *Erosion and Sediment Control Guideline for Urban Construction* (TRCA 2019) should be included within the ESC Plan in order to meet the objective of effectively mitigating the offsite transport of sediment.

6.2.2.2 Terrestrial Considerations and Constraints

6.2.2.2.1 Vegetation

Vegetation impacts are anticipated during construction in the area surrounding the Site, as well as along an access route and haul load leading to the facility. Vegetation protection and Site delineation measures are to be installed prior to the commencement of any construction works.

Invasive species were identified within the Local Study Area. It is important to not further spread these species within the Local Study Area and creek as a result of the construction works, or to spread invasive species between other sites in a larger geographic area. One invasive species identified within the wetland and open water communities is European reed. GHD recommends removal using appropriate Best Management practices prior to construction to prevent further spread of this invasive species which may include herbicide treatment and/or dig and disposal. The Contractor shall be required to follow the Clean Equipment Protocol for Industry.

Temporary ESC measures will be installed prior to construction and maintained throughout construction until restoration is complete and disturbed areas are stabilized against erosion. ESC measures will be routinely inspected, including following storms, and repaired, as required.

Vegetation will be pruned or topped instead of grubbing/uprooting, where possible, to ensure root structure stability. It is anticipated that vegetation removal will be minimal and restricted to the immediate access roads and facility. Cut and grubbed (if grubbing cannot be avoided) material shall be disposed of through chipping or other appropriate means, in accordance with Ontario Provincial Standards (OPSS) 180.

Equipment maintenance and refueling will be conducted at the designated and properly contained maintenance areas located well away from creek banks and wetlands and outside retained vegetation areas. The Contractor must have a Spills Prevention Plan and required materials on Site at all times in accordance with OPSS 100.

Environmental inspections should be conducted during construction to review implemented mitigation measures, assess the need for maintenance and ensure remedial measures are initiated in a timely manner where warranted.

6.2.2.2.2 Site Restoration

All disturbed natural surfaces and regraded surfaces should be promptly stabilized upon completion of construction. Site restoration is to include the topsoil application to disturbed areas and terraseeding of native seed mix appropriate

for the localized growing conditions, along with a cover crop to ensure quick site stabilization. Where warranted, the installation of biodegradable erosion control blankets should be used. Additionally, appropriate vegetation clearing techniques are to be used (e.g., felling trees away from retained natural areas and watercourses).

6.2.2.2.3 Wildlife

The general mitigation measures outlined above propose to minimize effects to vegetation and protect adjacent vegetation areas, which will also protect the associated wildlife habitat functions and movement. However, it is also necessary to ensure the protection of breeding birds, reptiles and other wildlife that may nest or otherwise use areas where construction is proposed. The following general mitigation measures are proposed:

– Implement timing windows to avoid works during sensitive wildlife life stages.
  - No vegetation clearing will occur during the breeding bird period (April 1 to August 31). Birds may also nest outside of this time frame, and the proponent is responsible for ensuring compliance with the requirements of the MBCA.
– Where clearing cannot be avoided during the breeding bird period, nest searches of any vegetation to be cleared must be conducted by an avian specialist in advance of clearing activities during the breeding bird window. If active nests are identified, the specialist will provide recommendations to maintain compliance with the MBCA and identify an appropriate protection area around the nest, if applicable. Clearing activities may proceed outside of this protection area and as per any additional recommendations by the avian specialist.
– Spring (2023) BBSs were conducted by GHD to determine if birds such as barn swallow and/or other bird species were using the Local Study Area or Site Study Area to nest. What are believed to be historical barn swallow nests were observed within the Local Study Area. If THR or END nesting bird species are found, a qualified biologist should be consulted to determine next steps under the MBCA and ESA as applicable.
– Contractor awareness practices to minimize wildlife movement into the construction area, particularly when works must occur during wildlife active seasons should be implemented as follows:
  - Prior to works starting each day, a sweep of the construction area will be completed to ensure no wildlife has entered the work area. All equipment will be inspected daily before operating to make sure snakes or other wildlife are not using it as shelter.
  - If a nest or a bird in the process of constructing a nest is observed, all work shall be stopped to not disrupt the nesting bird and may resume after the fledglings vacate the nest. If an empty nest is observed, a qualified ecologist may be called on site to determine if the nest is being occupied and if works can resume.
  - The Contractor shall ensure all persons with any on site role shall be provided information/trained on:
    – The SAR present in the vicinity of the work area, what these species are, what these species look like, what their relevant Site use looks like (e.g. snapping turtle nesting) and how to distinguish these from other species potentially found in the vicinity.
    – General SAR awareness training including the need to avoid SAR found on site.

6.2.3 Net Effects

The proposed undertaking largely involves the redevelopment of the existing Emerald EFW facility and is expected to take place mostly within the footprint of already disturbed land. However, a portion of mapped meadow marsh wetland is proposed to be infilled to facilitate the new footprint. This will result in the loss of approximately 2,685 m^2 of wetland habitat. Emerald EFW has entered an agreement with TRCA as part of a land exchange in which the loss of wetland habitat will be compensated through the creation of swamp thicket and valleyland woodland habitat with areas consisting of 2,220 m^2 and 1,148 m^2, respectively. As a result, the total restoration area will provide 3,368 m^2 of habitat which offsets the habitat destruction and results in an overall net increase of 683 m^2 of habitat. Further enhancement will be sought through the creation of two vernal pools which is expected to introduce breeding amphibian habitat. These offsetting activities are anticipated to introduce increased diversity of both wetland and woodland habitat to the existing natural environment surrounding the facility. Further details on the restoration and enhancement plan are detailed in *Emerald Energy – Land Exchange Restoration and Enhancement Plan* (Palmer 2019)

The proposed mitigation measures have been selected to reduce and/or eliminate indirect impacts resulting from the proposed undertaking as well as the protection of species which may incidentally be encountered within the project footprint.

As such, following the implementation of the mitigation measures described in **Section 6.2.2**, the residual impacts of the project will be negligible or zero with potential for positive effects to persist beyond the completion of the project due to the proposed enhancement.

7. Monitoring Requirements and Additional Approvals

To ensure that the mitigation measures identified in **Section 6.2.2** are implemented as envisioned, a strategy and schedule was developed for monitoring environmental effects. With these mitigation measures and monitoring requirements in mind, commitments have also been proposed for ensuring that they are carried out as part of the construction, operation, and maintenance of the proposed undertaking.

7.1 Monitoring Requirements

The following monitoring requirements are proposed to ensure proper compliance and implementation with the mitigation measures identified in **Section 6.2.2**.

– The ESC plan developed for the proposed work should include regular inspections of all ESC measures to ensure timely detection of deficiencies and damages. Should the proposed undertaking include in-water or near water work with potential for sediment release into Spring Creek, water quality monitoring during construction may be warranted as part of the ESC monitoring and inspection plan.

  In conformance with the TRCA's 2019 guidance document, the following general principles for inspection and maintenance of the ESC measures includes:

  - Regular inspection as required during dry conditions
  - Weekly, before and after significant rainfall, snowmelt, windstorm, or other extreme weather events.
  - Daily during extended rain or snowmelt periods
  - During or immediately following any spill event
  - Removal of the ESC measures when ground stabilization has achieved a minimum cover of 80%

– To remain in compliance with the MBCA, nest sweeps and monitoring for nesting birds may be required should vegetation removal occur within the breeding bird nesting period of April 1 to August 31. If vegetation is required during this time a nest sweep will be required by a qualified avian biologist a maximum of 48 hours prior to the removal of vegetation.

– Contractor awareness program should be implemented such that each person on site will be informed on the following:

  - Prior to works starting each day, a sweep of the construction area will be completed to ensure no wildlife has entered the work area. All equipment will be inspected daily before operating to make sure snakes or other wildlife are not using it as shelter.
  - If a nest or a bird in the process of constructing a nest is observed, all work shall be stopped to not disrupt the nesting bird and may resume after the fledglings vacate the nest.
  - The SAR present in the vicinity of the work area, what these species are, what these species look like and how to distinguish these from other species potentially found in the vicinity. Direction on the need for avoidance of SAR encounters.

7.2 Additional Approvals

Any additional Natural Environment approvals required as part of the Emerald EFW facility Redevelopment outside of the EA process are documented below.

Toronto and Region Conservation Authority

Etobicoke Creek and its tributaries (including Spring Creek) are regulated under TRCA Ontario Regulation 166/06 for the *Development, Interference with Wetlands and Alterations to Shorelines and Watercourses*. Both the Site Study Area and Local Study Area are within the TRCA regulated area (**Figure 2.1**). Coordination with TRCA will ensure the protection of water, land, and habitats are conserved, restored, and responsibly managed throughout the proposed works and post-construction monitoring process. A permit from TRCA may be required if proposed works will occur within TRCA regulated area.

Ministry of the Environment, Conservation and Parks

SAR are protected under the ESA, which is managed by MECP. GHD's SAR screening and background review identified no SAR critical habitat and 15 SAR with the potential to occur within the Local Study Area. During field surveys, two provincial SAR, monarch (SC) and barn swallows (SC), were identified within the Local Study Area. As both SAR are designated as SC in Ontario and therefore their habitat is not protected under ESA. Minimal potential to impact SAR and SAR habitat was assessed following habitat assessment and therefore additional consulting and permitting steps are not anticipated with MECP.

Fisheries and Oceans Canada

Fish and fish habitat are protected under the *FA*, which is managed by DFO. On August 28th, 2019, changes were made to the *FA*. These changes include new protections for fish and fish habitat in the form of standards, codes of practice, and guidelines for projects in and near water. These provide guidance on how to avoid and mitigate impacts to fish and fish habitats and comply with the FA to avoid causing the death of a fish or HADD of fish habitat from your work, undertaking or activity.

Any in-water or near water work should be reviewed by an aquatic ecologist to determine if a DFO Request for Review is required. DFO will review the proposed undertaking, while considering proposed mitigation measures and determine if the work or undertaking is likely to result in the death of fish or HADD of fish habitat. If the project cannot avoid the death of fish or HADD of fish habitat, a *Fisheries Act* Authorization may be required.

Additionally, available DFO Aquatics SAR mapping did not identify aquatic SAR or their critical habitat within the Local Study Area during GHD's background review. No aquatic SAR were detected during the aquatic habitat assessment field survey. As such a SARA permit is not anticipated for the proposed works.

8. Conclusions

Through implementation of the recommended mitigation measures, potential impacts of the proposed works to terrestrial resources and fish and fish habitat can be avoided or minimized with these measures incorporated into the detailed design and contract documents.

The detailed design should be reviewed by a qualified ecologist to ensure that all relevant measures have been incorporated and to determine the extent of impacts to natural environment elements. The proposed undertaking largely involves the redevelopment of the existing Emerald EFW facility and is expected to take place within the footprint of already disturbed land. As a result, impacts to the natural environment elements are anticipated to be avoided, such that any negative effects will be negligible or zero.

A number of the recommended mitigation measures require approvals and proper monitoring requirements to ensure compliance and implementation. Such monitoring activities will enable quick and appropriate response to issues that may arise and ensure that construction proceeds in accordance with the approved design and contract. Additionally based on the regulatory framework for which the proposed undertaking will take place and the location of the work, a number of additional approvals and permits may be required.

Vegetation clearing should be minimized to the extent possible, with native vegetation used in restoration plantings. Pre-construction and construction phase management of highly invasive plant species is recommended.

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Appendices

Appendix A

SAR Screening

Appendix A
SAR Screening
Emerald Energy from Waste
Natural Environment Assessment

Common Name	Scientific Name	SARA (Sch 1)[1]	ESA [2]	Habitat Requirements	Potential to Occur within LSA	Rationale
Amphibian						
Jefferson salamander	*Ambystoma jeffersonianum*	END	END	In Ontario, Jefferson salamander is found only in southern Ontario, along southern portions of the Niagara Escarpment and western portions of the Oak Ridges Moraine. Jefferson salamander prefers moist, well-drained deciduous and mixed forests with a closed canopy. It overwinters underground in mammal burrows and rock fissures, and moves to vernal pools and ephemeral wetlands in the early spring to breed. Breeding ponds are typically located in or near to forested habitats, and contain submerged debris (i.e. sticks, vegetation) for egg attachment sites. Ephemeral breeding pools need to have water until at least mid-summer (mid to late July) (Jefferson Salamander Recovery Team 2010).	Low	Closed canopy forested areas not present within LSA, wetlands present.
Arthropod						
Monarch	*Danaus plexippus*	SC	SC	In Ontario, monarch is found throughout the northern and southern regions of the province. This butterfly is found wherever there are milkweed (Asclepias spp.) plants for its caterpillars and wildflowers that supply a nectar source for adults. It is often found on abandoned farmland, meadows, open wetlands, prairies and roadsides, but also in city gardens and parks. Important staging areas during migration occur along the north shores of the Great Lakes (COSEWIC 2010).	High	Meadows, open wetlands, and roadsides present within LSA.
Bird						
Bank swallow	*Riparia riparia*	THR	THR	In Ontario, the bank swallow breeds in a variety of natural and anthropogenic habitats, including lake bluffs, stream and river banks, sand and gravel pits, and roadcuts. Nests are built in a vertical or near-vertical bank. Breeding sites are typically located near open foraging sites such as rivers, lakes, grasslands, agricultural fields, wetlands and riparian woods. Forested areas are generally avoided (Garrison 1999).	Moderate	Eroded river banks and vertical exhaust stacks present within LSA.

Common Name	Scientific Name	SARA (Sch 1)[1]	ESA [2]	Habitat Requirements	Potential to Occur within LSA	Rationale
Barn swallow	*Hirundo rustica*	SC	THR	In Ontario, barn swallow breeds in areas that contain a suitable nesting structure, open areas for foraging, and a body of water. This species nests in human made structures including barns, buildings, sheds, bridges, and culverts. Preferred foraging habitat includes grassy fields, pastures, agricultural cropland, lake and river shorelines, cleared right-of-ways, and wetlands (COSEWIC 2011). Mud nests are fastened to vertical walls or built on a ledge underneath an overhang. Suitable nests from previous years are reused (Brown and Brown 1999).	High	Bridge, grassy fields, meadow, and wetlands present within LSA.
Bobolink	*Dolichonyx oryzivorus*	THR	THR	In Ontario, bobolink breeds in grasslands or graminoid dominated hayfields with tall vegetation (Gabhauer 2007). Bobolink prefers grassland habitat with a forb component and a moderate litter layer. They have low tolerance for presence of woody vegetation and are sensitive to frequent mowing within the breeding season. They are most abundant in established, but regularly maintained, hayfields, but also breed in lightly grazed pastures, old or fallow fields, cultural meadows and newly planted hayfields. Their nest is woven from grasses and forbs. It is built on the ground, in dense vegetation, usually under the cover of one or more forbs (Martin and Gavin 1995).	Low	Forb thatch layer not present, old field meadow insufficient size for breeding habitat within LSA.
Chimney swift	*Chaetura pelagica*	THR	THR	In Ontario, chimney swift breeding habitat is varied and includes urban, suburban, rural and wooded sites. They are most commonly associated with towns and cities with large concentrations of chimneys. Preferred nesting sites are dark, sheltered spots with a vertical surface to which the bird can grip. Unused chimneys are the primary nesting and roosting structure, but other anthropogenic structures and large diameter cavity trees are also used (COSEWIC 2007).	Moderate	Urban and wooded areas within LSA, chimney structures for nesting present on facily building.

Common Name	Scientific Name	SARA (Sch 1)[1]	ESA [2]	Habitat Requirements	Potential to Occur within LSA	Rationale
Common nighthawk	*Chordeiles minor*	THR	SC	These aerial foragers require areas with large open habitat. This includes farmland, open woodlands, clearcuts, burns, rock outcrops, alvars, bog ferns, prairies, gravel pits and gravel rooftops in cities (Sandilands 2007)	Low	No farmland, open woodland, clearcuts, outcrops, prairie or gravel areas present within LSA.
Eastern meadowlark	*Sturnella magna*	THR	THR	In Ontario, the eastern meadowlark breeds in pastures, hayfields, meadows and old fields. Eastern meadowlark prefers moderately tall grasslands with abundant litter cover, high grass proportion, and a forb component (Hull 2003). They prefer well drained sites or slopes, and sites with different cover layers (Roseberry and Klimstra 1970)	Low	Meadow and old field not large enough area within LSA for suitable nesting habitat.
Eastern wood-pewee	*Contopus virens*	SC	SC	The eastern wood-pewee inhabits a wide variety of wooded upland and lowland habitats but is most commonly associated with the mid-canopy of forest clearings, and edge habitat in deciduous and mixed forests. It also occurs in anthropogenic habitats that provide an open forested aspect such as parks and suburban neighborhoods. It prefers intermediate-age mature forest stands with little understory vegetation (COSEWIC 2012).	Low	Young thicket and woodland present on site, not sufficient area for breeding habitat within LSA.
Wood thrush	*Hylocichla mustelina*	THR	SC	In Ontario, wood thrush breeds in moist, deciduous hardwood or mixed stands that are often previously disturbed, with a dense deciduous undergrowth and with tall trees for singing perches. This species selects nesting sites with the following characteristics: lower elevations with trees less than16 m in height, a closed canopy cover (>70 %), a high variety of deciduous tree species, moderate subcanopy and shrub density, shade, fairly open forest floor, moist soil, and decaying leaf litter (COSEWIC 2012).	Moderate	Forested areas not suitable for breeding habitat within LSA.

Common Name	Scientific Name	SARA (Sch 1)[1]	ESA [2]	Habitat Requirements	Potential to Occur within LSA	Rationale
Mammal						
Eastern small-footed myotis	*Myotis leibii*	—	END	This species is not known to roost within trees, but there is very little known about its roosting habits. The species generally roosts on the ground under rocks, in rock crevices, talus slopes, or rock piles, and occasionally inhabits buildings. Areas near the entrances of caves or abandoned mines may be used for hibernaculum, where the conditions are drafty with low humidity, and may be subfreezing (Humphrey 2017).	Low	No rocks, crevices or slopes present within LSA.
Little brown myotis	*Myotis lucifugus*	END	END	In Ontario, this species range is extensive and covers much of the province. It will roost in both natural and man-made structures. They require a number of large dead trees, in specific stages of decay and that project above the canopy in relatively open areas (Lacki, 2007). May form nursery colonies in the attics of buildings within 1 km of water. Caves or abandoned mines may be used for hibernaculum, but high humidity and stable above freezing temperatures are required.	Low	Minimal dead trees or open canopy forest within LSA.
Tri-colored bat	*Perimyotis subflavus*	END	END	In Ontario, tri-colored bat may roost in foliage, in clumps of old leaves, hanging moss or squirrel nests. They are occasionally found in buildings although there are no records of this in Canada (Poissant et al, 2010). They typically feed over aquatic areas with an affinity to large-bodied water and will likely roost in close proximity to these. Hibernation sites are found deep within caves or mines in areas of relatively warm temperatures. These bats have strong roost fidelity to their winter hibernation sites and may choose the exact same spot in a cave or mine from year to year.	Low	No foliage clumps, squirrel nests or caves present within LSA.
Northern myotis	*Myotis septentrionalis*	END	END	In Ontario, this species range is extensive and covers much of the province. It will usually roost in hollows, crevices, and under loose bark of mature trees. Roosts may be established in the main trunk or a large branch of either living or dead trees. Caves or abandoned mines may be used for hibernaculum, but high humidity and stable above freezing temperatures are required (COSSARO 2012).	Low	No hollows, crevices or potential roosting sites present within LSA.

Appendix A
SAR Screening
Emerald Energy from Waste
Natural Environment Assessment

Common Name	Scientific Name	SARA (Sch 1)[1]	ESA [2]	Habitat Requirements	Potential to Occur within LSA	Rationale
Reptile						
Snapping turtle	*Chelydra serpentina*	SC	SC	In Ontario, snapping turtle utilizes a wide range of waterbodies, but shows preference for areas with shallow, slow-moving water, soft substrates and dense aquatic vegetation. Hibernation takes place in soft substrates under water. Nesting sites consist of sand or gravel banks along waterways or roadways (COSEWIC 2008).	Moderate	Slow-moving creek with soft substrate present within LSA.

[1] Species at Risk Act (SARA), 2002. Schedule 1; Part 1 (Extirpated), Part 2 (Endangered), Part 3 (Threatened), Part 4 (Special Concern)

[2] Endangered Species Act (ESA), 2007. Schedule 1 (Extirpated - EXP), Schedule 2 (Endangered - END), Schedule 3 (Threatened - THR), Schedule 4 (Special Concern - SC)

LSA - Local Study Area

Appendix B

Aquatic Photographic Record



Photo 1 - July 4, 2023. View of a small center island feature that splits flow into two riffles.



Photo 2 - July 4, 2023. Representative photo of a riffle feature and course stream bed characteristics. Gabion basket armoring can be observed along far bank.

Aquatic Photographic Record



Photo 3 - July 4, 2023. Representative photo of a channel run.



Photo 4 - July 4, 2023. Representative photo of a channel riffle.



Photo 5 - July 4, 2023. View of wide meander, along with overhang of riparian vegetation.



Photo 6 - July 4, 2023. Representative photo of a pool.



Photo 7 - July 4, 2023. View of severe bank erosion resulting in steep face with exposed soils and bank slumping.



Photo 8 - July 4, 2023. View of run/riffle sequence that passes through the Highway 407 overpass.



Photo 9 - July 4, 2023. View of wide and shallow riffle sequence that passes through the Highway 407 overpass.



Photo 10 - July 4, 2023. View of channel at the exit point of the riffle sequence that passes through the Highway 407 overpass. Well defined channel is formed.



Photo 11 - July 4, 2023. Representative photo of bank conditions showing emergent grasses and dense patches of submergent vegetation.



Photo 12 - July 4, 2023. Representative photo of immediate riparian characteristics.



Photo 13 - July 4, 2023. View of a seasonal side channel.



Photo 14 - July 4, 2023. Representative photo of bank conditions showing cattails and dense patches of submergent vegetation.

Appendix C

Terrestrial Photographic Record



Photo 1 - July 4, 2023. View of mowed lawn under pipeline leading to Emerald EfW facility. Photo facing north.



Photo 2 - July 4, 2023. View of old field meadow (CUM1-1) and hedgerow along northern Site boundary. Photo facing east.

Terrestrial Photographic Record



Photo 3 - June 15, 2023. View of Reed-canary Grass Mineral Meadow Marsh (MAM2-2). Photo facing south.



Photo 4 - July 4, 2023. View of Reed-canary Grass Mineral Meadow Marsh (MAM2-2) and Willow Mineral Thicket Swamp (SWT2-2). Photo facing southwest.



Photo 5 - June 15, 2023. View of Willow Mineral Thicket Swamp (SWT2-2) and Reed-canary Grass Mineral Meadow Marsh (MAM2-2) communities surrounding Spring Creek (OAO1-T). Photo facing southwest.



Photo 6 - July 4, 2023. View of Dry-Moist Old Field Meadow (CUM1-1) community within southwest portion of Study Area. Photo facing northwest.



Photo 7 - July 4, 2023. View of Mineral Meadow Marsh (MAM2) dominated by. European reed (*Phragmites australis*). Photo facing west.



Photo 8 - July 4, 2023. View of Willow Mineral Thicket Swamp (SWT2-2) dominated by Manitoba maple (*Acer negundo*), willow species (*Salix sp.*) and riverbank grape (*Vitis riparia*). Photo facing south.



Photo 9 - June 15, 2023. View of Highway 407 bridge over Spring Creek and surrounding Reed-canary Grass Mineral Meadow Marsh (MAM2-2).



Photo 10 - July 4, 2023. View of active rock pigeon nest bird nest located under Highway 407 bridge over Spring Creek.



Photo 11 - June 15, 2023. View of four barn swallow nests located under Highway 407 bridge over Spring Creek.



Photo 12 - June 15, 2023. View of mowed lawn and hedgerow communities adjacent to facility Site boundary. Photo facing southwest.



Photo 13 - July 4, 2023. View of Dry-Moist Old Field Meadow (CUM1-1) community dense grass dominated ground layer and sparse canopy layer. Photo facing southwest.



Photo 14 - June 15, 2023. View of mowed lawn adjacent to northeast Site boundary and proposed access road. Photo facing north.

Appendix D

Vascular Plant List

Appendix D
Vascular Plant List
Emerlad Energy from Waste
Natural Environment Assessment

Scientific Name	Common Name	Coefficient of Conservatism (CC)	Wetness Index	Weediness Index	Provincial Status (S-Rank)	ESA Status	SARA Status	Local Status Peel (Varga 2005)	Local Status TRCA Ranking (2017)
Pinaceae	**Pine Family**								
Picea abies	Norway Spruce		5	-1	SNA			X	L+
Picea glauca	White Spruce	6	3		S5			R3	L3
Pinus strobus	Eastern White Pine	4	3		S5			X	L4
Anacardiaceae	**Cashew Family**								
Rhus typhina	Staghorn Sumac	1	5		S5			X	L5
Pastinaca sativa	Wild Parsnip		5	-3	SNA			X	L+
Apocynaceae	**Milkweed Family**								
Asclepias syriaca	Common Milkweed	0	5		S5			X	L5
Asteraceae	**Aster Family**								
Arctium minus	Common Burdock		3	-2	SNA			X	L+
Cichorium intybus	Wild Chicory		5	-1	SNA			X	L+
Cirsium arvense	Canada Thistle		3	-1	SNA			X	L+
Matricaria discoidea	Pineappleweed		3		SNA			X	L+
Solidago canadensis	Canada Goldenrod	1	3		S5			X	L5
Solidago juncea	Early Goldenrod	3	5		S5			U	L4
Brassicaceae	**Mustard Family**								
Brassica rapa	Field Mustard		5	-1	SNA			X	L+
Caprifoliaceae	**Honeysuckle Family**								
Dipsacus fullonum	Common Teasel		3	-1	SNA			X	L+
Convolvulaceae	**Bindweed Family**								
Convolvulus arvensis	Field Bindweed		5	-1	SNA			X	L+
Cornaceae	**Dogwood Family**								
Cornus stolonifera	Red-Osier Dogwood	2	-3		S5			X	L5
Fabaceae	**Legume Family**								
Gleditsia triacanthos	Honey Locust	3	0		S5			X	L+
Melilotus officinalis	Yellow Sweet-Clover		3	-1	SNA			X	L+
Robinia pseudoacacia	Black Locust		3	-3	SNA			X	L+
Trifolium pratense	Red Clover		3	-2	SNA			X	L+
Vicia cracca	Tufted Vetch		5	-1	SNA			X	L+
Hypericaceae	**St. John's-Wort Family**								
Hypericum perforatum ssp. perforatum	Common St. John's-Wort		5	-3	SNA			X	L+
Oleaceae	**Olive Family**								
Fraxinus pennsylvanica	Green Ash	3	-3		S4			X	L5
Plantaginaceae	**Plantain Family**								
Linaria vulgaris	Butter-And-Eggs		5	-1	SNA			X	L+
Plantago major	Common Plantain		3	-1	SNA			X	L+
Rhamnaceae	**Buckthorn Family**								
Rhamnus cathartica	European Buckthorn		0	-3	SNA			X	L+
Rosaceae	**Rose Family**								
Malus pumila	Common Apple		5	-1	SNA			X	L+
Rosa multiflora	Multiflora Rose		3	-3	SNA			X	L+
Salicaceae	**Willow Family**								
Salix sp.	Willow species	4	-4		S5			X	L4
Sapindaceae	**Maple Family**								

Appendix D
Vascular Plant List
Emerlad Energy from Waste
Natural Environment Assessment

Scientific Name	Common Name	Coefficient of Conservatism (CC)	Wetness Index	Weediness Index	Provincial Status (S-Rank)	ESA Status	SARA Status	Local Status Peel (Varga 2005)	Local Status TRCA Ranking (2017)
Acer negundo	Manitoba Maple	0	-2		S5			X	L+?
Urticaceae	**Nettle Family**								
Urtica dioica ssp. dioica	European Stinging Nettle		0	-1	SNA			XSR	L+
Vitaceae	**Grape Family**								
Vitis riparia	Riverbank Grape	0	-2		S5			X	L5
Poaceae	**Grass Family**								
Bromus inermis	Smooth Brome		5	-3	SNA			X	L+
Dactylis glomerata	Orchard Grass		3	-1	SNA			X	L+
Elymus repens	Quackgrass		3	-3	SNA			X	L+
Lolium perenne	Perennial Ryegrass		3	-1	SNA			X	L+
Phalaris arundinacea var. arundinacea	Reed Canary Grass	0	-3		S5			X	L+?
Phleum pratense ssp. pratense	Common Timothy		3	-1	SNA			X	L+
Phragmites australis ssp. australis	European Reed		-3		SNA			X	L+
Poa pratensis ssp. pratensis	Kentucky Bluegrass		3		SNA			X	L+
Typhaceae	**Cattail Family**								
Typha angustifolia	Narrow-Leaved Cattail	3	-5		SNA			X	L+

Notes

Co-efficient of Conservatism: This value, ranging from 0 (low) to 10 (high), is based on a species tolerance of disturbance and fidelity to a specific habitat integrity.

Weediness Index: This value, ranging from -1 (low) to -3 (high) quantifies the potential invasiveness of non-native plants. In combination with the percentage of non-native plants, it can be used as an indicator of disturbance.

Wetness Index: This value, ranging from -5 (obligate wetland) to 5 (upland) provides the probability of a species occurring in wetland or upland habitats.

S-Ranks-

S1: Critically Imperiled - Critically imperiled in the nation or state/province because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the state/province.

S2: Imperiled - Imperiled in the nation or state/province because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the nation or state/province.

S3: Vulnerable - Vulnerable in the nation or state/province due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.

S4: Apparently Secure - Uncommon but not rare; some cause for long-term concern due to declines or other factors.

S5: Secure - Common, widespread, and abundant in the nation or state/province.

SH: Possibly Extirpated (Historical)—Species or community occurred historically in the nation or state/province, and there is some possibility that it may be rediscovered. Its presence may not have been verified in the past 20-40 years. A species or community could become NH or SH without such a 20-40 year delay if the only known occurrences in a nation or state/province were destroyed or if it had been extensively and unsuccessfully looked for. The NH or SH rank is reserved for species or communities for which some effort has been made to relocate occurrences, rather than simply using this status for all elements not known from verified extant occurrences.

SR: Reported in Ontario, but without persuasive documentation.

SX: Presumed Extirpated—Species or community is believed to be extirpated from the nation or state/province. Not located despite intensive searches of historical sites and other appropriate habitat, and virtually no likelihood that it will be rediscovered.

SE: Exotic; not believed to be a native component of Ontario's flora. Numerical rankings after SE follow designations described above for native species.

SNA: Unranked — Status not assigned.

SU: Unranked — Nation or state/province conservation status not yet assessed.

ESA Status

Endangered Species Act (ESA), 2007. Extirpated - EXP, Endangered - END, Threatened - THR, Special Concern - SC

SARA Status

Species at Risk Act (SARA), 2002. Extirpated - EXP, Endangered - END, Threatened - THR, Special Concern - SC

Appendix D
Vascular Plant List
Emerlad Energy from Waste
Natural Environment Assessment

Scientific Name	Common Name	Coefficient of Conservatism (CC)	Wetness Index	Weediness Index	Provincial Status (S-Rank)	ESA Status	SARA Status	Local Status Peel (Varga 2005)	Local Status TRCA Ranking (2017)
VARGA 2005 Rankings: *Varga, S., editor. 2005. Distribution and status of the vascular plants of the Greater Toronto Area. Ontario Ministry of Natural Resources, Aurora District. 96 pp.* + Introduced species X+ Native species that is introduced in that municipality (+) Possibly introduced species or a native species that is introduced in some municipalities X Common native species or an introduced species that is present R Rare native species E Extirpated native species that has not been refound at its known locations or its habitat is gone SR Species record based on a sight record (all other species records based on herbarium collections) LR Species record based on a literature record U Uncommon native species R6 Number of stations for a rare native species H Historical species not seen since 1950, however its habitat is still present X Species that occur only in the portion of site district 6E7 outside of the Greater Toronto Area									
TRCA Rankings (2017): *Toronto and Region Conservation Authority (TRCA). 2017. Annual local occurrence and local rank update for 2017: terrestrial species and vegetation communities* **L5**: able to withstand high levels of disturbance; generally secure throughout the jurisdiction, including the urban matrix. May be of very localized concern in highly degraded areas **L4**: able to withstand some disturbance; generally secure in rural matrix; of concern in urban matrix **L3**: able to withstand minor disturbance; generally secure in natural matrix; considered to be of regional concern. **L2**: unable to withstand disturbance; some criteria are very limiting factors; generally occur in high-quality natural areas, in natural matrix; probably rare in the TRCA jurisdiction; of concern regionally **L1**: unable to withstand disturbance; many criteria are limiting factors; generally occur in high-quality natural areas in natural matrix; almost certainly rare in the TRCA jurisdiction; of concern regionally **LX**: extirpated from our region with remote chance of rediscovery. Presumably highly sensitive **LH**: hybrid between two native species. Usually not scored unless highly stable and behaves like a species (e.g. *Equisetum x nelsonii*) **L+**: exotic. Not native to TRCA jurisdiction. Includes hybrids between a native species and an exotic **L+?**: origin uncertain or disputed, i.e. may or may not be native **pL** : found in natural cover, but only as planted, not regenerating								

Appendix E

Bird Species List

Appendix E
Bird Species List
Emerald Energy from Waste
Natural Environment Assessment

Common Name	Scientific Name	S-Rank	ESA	SARA	Breeding Evidence
American Goldfinch	*Carduelis tristis*	S5B			P:S
American Robin	*Turdus migratorius*	S5B			P:S
Barn Swallow	*Hirundo rustica*	S4B	SC	THR	P:H
Black-capped Chickadee	*Poecile atricapillus*	S5			P:H
Common Yellowthroat	*Geothlypis trichas*	S5B			P:S
Eastern Kingbird	*Tyrannus tyrannus*	S4B			P:S
European Starling	*Sturnus vulgaris*	SNA			PR:M
Gray Catbird	*Dumetella carolinensis*	S4B			P:S
House Sparrow	*Passer domesticus*	SNA			P:S
House Wren	*Troglodytes aedon*	S5B			P:S
Mallard	*Anas platyrhynchos*	S5			O:X
Mourning Dove	*Zenaida macroura*	S5			P:S
Northern Cardinal	*Cardinalis cardinalis*	S5			P:S
Ring-billed Gull	*Larus delawarensis*	S5B,S4N			O:X
Rock Pigeon	*Columbia livia*	SNA			PR:V
Red-winged Blackbird	*Agelaius phoeniceus*	S4			P:S
Song Sparrow	*Melospiza melodia*	S5B			P:S
Willow Flycatcher	*Empidonax traillii*	S5B			P:H
Yellow Warbler	*Dendroica petechia*	S5B			P:S

Appendix E
Bird Species List
Emerald Energy from Waste
Natural Environment Assessment

Notes:
S-Ranks- S1: Critically Imperiled - Critically imperiled in the nation or state/province because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the state/province. S2: Imperiled - Imperiled in the nation or state/province because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the nation or state/province. S3: Vulnerable - Vulnerable in the nation or state/province due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation. S4: Apparently Secure - Uncommon but not rare; some cause for long-term concern due to declines or other factors. S5: Secure - Common, widespread, and abundant in the nation or state/province. SH: Possibly Extirpated (Historical)—Species or community occurred historically in the nation or state/province, and there is some possibility that it may be rediscovered. Its presence may not have been verified in the past 20-40 years. A species or community could become NH or SH without such a 20-40 year delay if the only known occurrences in a nation or state/province were destroyed or if it had been extensively and unsuccessfully looked for. The NH or SH rank is reserved for species or communities for which some effort has been made to relocate occurrences, rather than simply using this status for all elements not known from verified extant occurrences. SR: Reported in Ontario, but without persuasive documentation. SX: Presumed Extirpated—Species or community is believed to be extirpated from the nation or state/province. Not located despite intensive searches of historical sites and other appropriate habitat, and virtually no likelihood that it will be rediscovered. SE: Exotic; not believed to be a native component of Ontario's flora. Numerical rankings after SE follow designations described above for native species. SNA: Unranked — Status not assigned. SU: Unranked — Nation or state/province conservation status not yet assessed.
ESA Status Endangered Species Act (ESA), 2007. Extirpated - EXP, Endangered - END, Threatened - THR, Special Concern - SC
SARA Status Species at Risk Act (SARA), 2002. Extirpated - EXP, Endangered - END, Threatened - THR, Special Concern - SC
All species listed were identified by song/vocalizations unless otherwise noted O: Species observed ('X': observed during breeding season but no evidence of breeding) P: Possible breeding ('S': singing male present; 'H': species observed in breeding season in suitable nesting habitat) PR: Probable breeding ('P': Pair observed; 'T': Permanent territory presumed through territorial behavior on both visits; 'D': Courtship or display; 'V': visiting probable nest site; 'A': Agitated behavior or anxiety calls of an adult; 'B': Brood Patch; 'N': Nest-building)


GHD

Appendix B.8

Screening Checklist for Built Heritage Resources and Cultural Heritage Landscapes

Ministry of Tourism, Culture and Sport

Programs & Services Branch
401 Bay Street, Suite 1700
Toronto ON M7A 0A7

Criteria for Evaluating Potential for Built Heritage Resources and Cultural Heritage Landscapes

A Checklist for the Non-Specialist

The **purpose of the checklist** is to determine:

- if a property(ies) or project area:
  - is a recognized heritage property
  - may be of cultural heritage value
- it includes all areas that may be impacted by project activities, including – but not limited to:
  - the main project area
  - temporary storage
  - staging and working areas
  - temporary roads and detours

Processes covered under this checklist, such as:

- *Planning Act*
- *Environmental Assessment Act*
- *Aggregates Resources Act*
- *Ontario Heritage Act* – Standards and Guidelines for Conservation of Provincial Heritage Properties

Cultural Heritage Evaluation Report (CHER)

If you are not sure how to answer one or more of the questions on the checklist, you may want to hire a qualified person(s) (see page 5 for definitions) to undertake a cultural heritage evaluation report (CHER).

The CHER will help you:

- identify, evaluate and protect cultural heritage resources on your property or project area
- reduce potential delays and risks to a project

Other checklists

Please use a separate checklist for your project, if:

- you are seeking a Renewable Energy Approval under Ontario Regulation 359/09 – separate checklist
- your Parent Class EA document has an approved screening criteria (as referenced in Question 1)

Please refer to the Instructions pages for more detailed information and when completing this form.

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Project or Property Name

Emerald Energy from Waste Inc. Facility Expansion Environmental Screening

Project or Property Location (upper and lower or single tier municipality)

7656 Bramalea Road, Brampton, Ontario, L5S 1C4, Region of Peel

Proponent Name

Emerald Energy from Waste Inc.

Proponent Contact Information

Joseph P Lyng General Manager - Tel: (416) 550 7092 Email: joelyng@emeraldefw.com

Screening Questions

	Yes	No
1. Is there a pre-approved screening checklist, methodology or process in place?	☐	☑

If Yes, please follow the pre-approved screening checklist, methodology or process.

If No, continue to Question 2.

Part A: Screening for known (or recognized) Cultural Heritage Value

	Yes	No
2. Has the property (or project area) been evaluated before and found **not** to be of cultural heritage value?	☐	☑

If Yes, do **not** complete the rest of the checklist.

The proponent, property owner and/or approval authority will:

- summarize the previous evaluation and
- add this checklist to the project file, with the appropriate documents that demonstrate a cultural heritage evaluation was undertaken

The summary and appropriate documentation may be:

- submitted as part of a report requirement
- maintained by the property owner, proponent or approval authority

If No, continue to Question 3.

	Yes	No
3. Is the property (or project area):		
a. identified, designated or otherwise protected under the *Ontario Heritage Act* as being of cultural heritage value?	☐	☑
b. a National Historic Site (or part of)?	☐	☑
c. designated under the *Heritage Railway Stations Protection Act*?	☐	☑
d. designated under the *Heritage Lighthouse Protection Act*?	☐	☑
e. identified as a Federal Heritage Building by the Federal Heritage Buildings Review Office (FHBRO)?	☐	☑
f. located within a United Nations Educational, Scientific and Cultural Organization (UNESCO) World Heritage Site?	☐	☑

If Yes to any of the above questions, you need to hire a qualified person(s) to undertake:

- a Cultural Heritage Evaluation Report, if a Statement of Cultural Heritage Value has not previously been prepared or the statement needs to be updated

If a Statement of Cultural Heritage Value has been prepared previously and if alterations or development are proposed, you need to hire a qualified person(s) to undertake:

- a Heritage Impact Assessment (HIA) – the report will assess and avoid, eliminate or mitigate impacts

If No, continue to Question 4.

Part B: Screening for Potential Cultural Heritage Value

	Yes	No
4. Does the property (or project area) contain a parcel of land that:		
a. is the subject of a municipal, provincial or federal commemorative or interpretive plaque?	☐	☑
b. has or is adjacent to a known burial site and/or cemetery?	☐	☑
c. is in a Canadian Heritage River watershed?	☐	☑
d. contains buildings or structures that are 40 or more years old?	☐	☑

Part C: Other Considerations

	Yes	No
5. Is there local or Aboriginal knowledge or accessible documentation suggesting that the property (or project area):		
a. is considered a landmark in the local community or contains any structures or sites that are important in defining the character of the area?	☐	☑
b. has a special association with a community, person or historical event?	☐	☑
c. contains or is part of a cultural heritage landscape?	☐	☑

If Yes to one or more of the above questions (Part B and C), there is potential for cultural heritage resources on the property or within the project area.

You need to hire a qualified person(s) to undertake:

- a Cultural Heritage Evaluation Report (CHER)

If the property is determined to be of cultural heritage value and alterations or development is proposed, you need to hire a qualified person(s) to undertake:

- a Heritage Impact Assessment (HIA) – the report will assess and avoid, eliminate or mitigate impacts

If No to all of the above questions, there is low potential for built heritage or cultural heritage landscape on the property.

The proponent, property owner and/or approval authority will:

- summarize the conclusion
- add this checklist with the appropriate documentation to the project file

The summary and appropriate documentation may be:

- submitted as part of a report requirement e.g. under the *Environmental Assessment Act, Planning Act* processes
- maintained by the property owner, proponent or approval authority

Instructions

Please have the following available, when requesting information related to the screening questions below:

- a clear map showing the location and boundary of the property or project area
    - large scale and small scale showing nearby township names for context purposes
- the municipal addresses of all properties within the project area
- the lot(s), concession(s), and parcel number(s) of all properties within a project area

For more information, see the Ministry of Tourism, Culture and Sport's Ontario Heritage Toolkit or Standards and Guidelines for Conservation of Provincial Heritage Properties.

In this context, the following definitions apply:

- **qualified person(s)** means individuals – professional engineers, architects, archaeologists, etc. – having relevant, recent experience in the conservation of cultural heritage resources.
- **proponent** means a person, agency, group or organization that carries out or proposes to carry out an undertaking or is the owner or person having charge, management or control of an undertaking.

1. Is there a pre-approved screening checklist, methodology or process in place?

An existing checklist, methodology or process may already be in place for identifying potential cultural heritage resources, including:

- one endorsed by a municipality
- an environmental assessment process e.g. screening checklist for municipal bridges
- one that is approved by the Ministry of Tourism, Culture and Sport (MTCS) under the Ontario government's Standards & Guidelines for Conservation of Provincial Heritage Properties [s.B.2.]

Part A: Screening for known (or recognized) Cultural Heritage Value

2. Has the property (or project area) been evaluated before and found not to be of cultural heritage value?

Respond 'yes' to this question, if all of the following are true:

A property can be considered not to be of cultural heritage value if:

- a Cultural Heritage Evaluation Report (CHER) - or equivalent - has been prepared for the property with the advice of a qualified person and it has been determined not to be of cultural heritage value and/or
- the municipal heritage committee has evaluated the property for its cultural heritage value or interest and determined that the property is not of cultural heritage value or interest

A property may need to be re-evaluated, if:

- there is evidence that its heritage attributes may have changed
- new information is available
- the existing Statement of Cultural Heritage Value does not provide the information necessary to manage the property
- the evaluation took place after 2005 and did not use the criteria in Regulations 9/06 and 10/06

Note: Ontario government ministries and public bodies [prescribed under Regulation 157/10] may continue to use their existing evaluation processes, until the evaluation process required under section B.2 of the Standards & Guidelines for Conservation of Provincial Heritage Properties has been developed and approved by MTCS.

To determine if your property or project area has been evaluated, contact:

- the approval authority
- the proponent
- the Ministry of Tourism, Culture and Sport

3a. Is the property (or project area) identified, designated or otherwise protected under the *Ontario Heritage Act* as being of cultural heritage value e.g.:

i. designated under the *Ontario Heritage Act*

- individual designation (Part IV)
- part of a heritage conservation district (Part V)

Individual Designation – Part IV

A property that is designated:

- by a municipal by-law as being of cultural heritage value or interest [s.29 of the *Ontario Heritage Act*]
- by order of the Minister of Tourism, Culture and Sport as being of cultural heritage value or interest of provincial significance [s.34.5]. **Note**: To date, no properties have been designated by the Minister.

Heritage Conservation District – Part V

A property or project area that is located within an area designated by a municipal by-law as a heritage conservation district [s. 41 of the *Ontario Heritage Act*].

For more information on Parts IV and V, contact:

- municipal clerk
- Ontario Heritage Trust
- local land registry office (for a title search)

---

ii. subject of an agreement, covenant or easement entered into under Parts II or IV of the *Ontario Heritage Act*

An agreement, covenant or easement is usually between the owner of a property and a conservation body or level of government. It is usually registered on title.

The primary purpose of the agreement is to:

- preserve, conserve, and maintain a cultural heritage resource
- prevent its destruction, demolition or loss

For more information, contact:

- Ontario Heritage Trust - for an agreement, covenant or easement [clause 10 (1) (c) of the *Ontario Heritage Act*]
- municipal clerk – for a property that is the subject of an easement or a covenant [s.37 of the *Ontario Heritage Act*]
- local land registry office (for a title search)

---

iii. listed on a register of heritage properties maintained by the municipality

Municipal registers are the official lists - or record - of cultural heritage properties identified as being important to the community.

Registers include:

- all properties that are designated under the *Ontario Heritage Act* (Part IV or V)
- properties that have not been formally designated, but have been identified as having cultural heritage value or interest to the community

For more information, contact:

- municipal clerk
- municipal heritage planning staff
- municipal heritage committee

---

iv. subject to a notice of:

- intention to designate (under Part IV of the *Ontario Heritage Act*)
- a Heritage Conservation District study area bylaw (under Part V of the *Ontario Heritage Act*)

A property that is subject to a **notice of intention to designate** as a property of cultural heritage value or interest and the notice is in accordance with:

- section 29 of the *Ontario Heritage Act*
- section 34.6 of the *Ontario Heritage Act.* **Note**: To date, the only applicable property is Meldrum Bay Inn, Manitoulin Island. [s.34.6]

An area designated by a municipal by-law made under section 40.1 of the *Ontario Heritage Act* as a **heritage conservation district study area**.

For more information, contact:

- municipal clerk – for a property that is the subject of notice of intention [s. 29 and s. 40.1]
- Ontario Heritage Trust

---

v. included in the Ministry of Tourism, Culture and Sport's list of provincial heritage properties

Provincial heritage properties are properties the Government of Ontario owns or controls that have cultural heritage value or interest.

The Ministry of Tourism, Culture and Sport (MTCS) maintains a list of all provincial heritage properties based on information provided by ministries and prescribed public bodies. As they are identified, MTCS adds properties to the list of provincial heritage properties.

For more information, contact the MTCS Registrar at registrar@ontario.ca.

3b. Is the property (or project area) a National Historic Site (or part of)?

National Historic Sites are properties or districts of national historic significance that are designated by the Federal Minister of the Environment, under the *Canada National Parks Act*, based on the advice of the Historic Sites and Monuments Board of Canada.

For more information, see the National Historic Sites website.

3c. Is the property (or project area) designated under the *Heritage Railway Stations Protection Act*?

The *Heritage Railway Stations Protection Act* protects heritage railway stations that are owned by a railway company under federal jurisdiction. Designated railway stations that pass from federal ownership may continue to have cultural heritage value.

For more information, see the Directory of Designated Heritage Railway Stations.

3d. Is the property (or project area) designated under the *Heritage Lighthouse Protection Act*?

The *Heritage Lighthouse Protection Act* helps preserve historically significant Canadian lighthouses. The Act sets up a public nomination process and includes heritage building conservation standards for lighthouses which are officially designated.

For more information, see the Heritage Lighthouses of Canada website.

3e. Is the property (or project area) identified as a Federal Heritage Building by the Federal Heritage Buildings Review Office?

The role of the Federal Heritage Buildings Review Office (FHBRO) is to help the federal government protect the heritage buildings it owns. The policy applies to all federal government departments that administer real property, but not to federal Crown Corporations.

For more information, contact the Federal Heritage Buildings Review Office.

See a directory of all federal heritage designations.

3f. Is the property (or project area) located within a United Nations Educational, Scientific and Cultural Organization (UNESCO) World Heritage Site?

A UNESCO World Heritage Site is a place listed by UNESCO as having outstanding universal value to humanity under the Convention Concerning the Protection of the World Cultural and Natural Heritage. In order to retain the status of a World Heritage Site, each site must maintain its character defining features.

Currently, the Rideau Canal is the only World Heritage Site in Ontario.

For more information, see Parks Canada – World Heritage Site website.

Part B: Screening for potential Cultural Heritage Value

4a. Does the property (or project area) contain a parcel of land that has a municipal, provincial or federal commemorative or interpretive plaque?

Heritage resources are often recognized with formal plaques or markers.

Plaques are prepared by:

- municipalities
- provincial ministries or agencies
- federal ministries or agencies
- local non-government or non-profit organizations

For more information, contact:

- municipal heritage committees or local heritage organizations – for information on the location of plaques in their community
- Ontario Historical Society's Heritage directory – for a list of historical societies and heritage organizations
- Ontario Heritage Trust – for a list of plaques commemorating Ontario's history
- Historic Sites and Monuments Board of Canada – for a list of plaques commemorating Canada's history

4b. Does the property (or project area) contain a parcel of land that has or is adjacent to a known burial site and/or cemetery?

For more information on known cemeteries and/or burial sites, see:

- Cemeteries Regulations, Ontario Ministry of Consumer Services – for a database of registered cemeteries
- Ontario Genealogical Society (OGS) – to locate records of Ontario cemeteries, both currently and no longer in existence; cairns, family plots and burial registers
- Canadian County Atlas Digital Project – to locate early cemeteries

In this context, adjacent means contiguous or as otherwise defined in a municipal official plan.

4c. Does the property (or project area) contain a parcel of land that is in a Canadian Heritage River watershed?

The Canadian Heritage River System is a national river conservation program that promotes, protects and enhances the best examples of Canada's river heritage.

Canadian Heritage Rivers must have, and maintain, outstanding natural, cultural and/or recreational values, and a high level of public support.

For more information, contact the Canadian Heritage River System.

If you have questions regarding the boundaries of a watershed, please contact:

- your conservation authority
- municipal staff

4d. Does the property (or project area) contain a parcel of land that contains buildings or structures that are 40 or more years old?

A 40 year 'rule of thumb' is typically used to indicate the potential of a site to be of cultural heritage value. The approximate age of buildings and/or structures may be estimated based on:

- history of the development of the area
- fire insurance maps
- architectural style
- building methods

Property owners may have information on the age of any buildings or structures on their property. The municipality, local land registry office or library may also have background information on the property.

Note: 40+ year old buildings or structure do not necessarily hold cultural heritage value or interest; their age simply indicates a higher potential.

A building or structure can include:

- residential structure
- farm building or outbuilding
- industrial, commercial, or institutional building
- remnant or ruin
- engineering work such as a bridge, canal, dams, etc.

For more information on researching the age of buildings or properties, see the Ontario Heritage Tool Kit Guide Heritage Property Evaluation.

Part C: Other Considerations

5a. Is there local or Aboriginal knowledge or accessible documentation suggesting that the property (or project area) is considered a landmark in the local community or contains any structures or sites that are important to defining the character of the area?

Local or Aboriginal knowledge may reveal that the project location is situated on a parcel of land that has potential landmarks or defining structures and sites, for instance:

- buildings or landscape features accessible to the public or readily noticeable and widely known
- complexes of buildings
- monuments
- ruins

5b. Is there local or Aboriginal knowledge or accessible documentation suggesting that the property (or project area) has a special association with a community, person or historical event?

Local or Aboriginal knowledge may reveal that the project location is situated on a parcel of land that has a special association with a community, person or event of historic interest, for instance:

- Aboriginal sacred site
- traditional-use area
- battlefield
- birthplace of an individual of importance to the community

5c. Is there local or Aboriginal knowledge or accessible documentation suggesting that the property (or project area) contains or is part of a cultural heritage landscape?

Landscapes (which may include a combination of archaeological resources, built heritage resources and landscape elements) may be of cultural heritage value or interest to a community.

For example, an Aboriginal trail, historic road or rail corridor may have been established as a key transportation or trade route and may have been important to the early settlement of an area. Parks, designed gardens or unique landforms such as waterfalls, rock faces, caverns, or mounds are areas that may have connections to a particular event, group or belief.

For more information on Questions 5.a., 5.b. and 5.c., contact:

- Elders in Aboriginal Communities or community researchers who may have information on potential cultural heritage resources. Please note that Aboriginal traditional knowledge may be considered sensitive.
- municipal heritage committees or local heritage organizations
- Ontario Historical Society's "Heritage Directory" - for a list of historical societies and heritage organizations in the province

An internet search may find helpful resources, including:

- historical maps
- historical walking tours
- municipal heritage management plans
- cultural heritage landscape studies
- municipal cultural plans

Information specific to trails may be obtained through Ontario Trails.

Appendix B.9

Screening Checklist for Archaeological Potential

Ministry of Tourism, Culture and Sport

Programs & Services Branch
401 Bay Street, Suite 1700
Toronto ON M7A 0A7

Criteria for Evaluating Archaeological Potential

A Checklist for the Non-Specialist

The **purpose of the checklist** is to determine:

- if a property(ies) or project area may contain archaeological resources i.e., have archaeological potential
- it includes all areas that may be impacted by project activities, including – but not limited to:
  - the main project area
  - temporary storage
  - staging and working areas
  - temporary roads and detours

Processes covered under this checklist, such as:

- *Planning Act*
- *Environmental Assessment Act*
- *Aggregates Resources Act*
- *Ontario Heritage Act* – Standards and Guidelines for Conservation of Provincial Heritage Properties

Archaeological assessment

If you are not sure how to answer one or more of the questions on the checklist, you may want to hire a licensed consultant archaeologist (see page 4 for definitions) to undertake an archaeological assessment.

The assessment will help you:

- identify, evaluate and protect archaeological resources on your property or project area
- reduce potential delays and risks to your project

Note: By law, archaeological assessments **must** be done by a licensed consultant archaeologist. Only a licensed archaeologist can assess – or alter – an archaeological site.

What to do if you:

- **find an archaeological resource**

  If you find something you think may be of archaeological value during project work, you must – by law – stop all activities immediately and contact a licensed consultant archaeologist

  The archaeologist will carry out the fieldwork in compliance with the *Ontario Heritage Act* [s.48(1)].

- **unearth a burial site**

  If you find a burial site containing human remains, you must immediately notify the appropriate authorities (i.e., police, coroner's office, and/or Registrar of Cemeteries) and comply with the *Funeral, Burial and Cremation Services Act*.

Other checklists

Please use a separate checklist for your project, if:

- you are seeking a Renewable Energy Approval under Ontario Regulation 359/09 – separate checklist
- your Parent Class EA document has an approved screening criteria (as referenced in Question 1)

Please refer to the Instructions pages when completing this form.

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Project or Property Name

Emerald Energy from Waste Inc. Facility Expansion Environmental Screening

Project or Property Location (upper and lower or single tier municipality)

7656 Bramalea Road, Brampton, Ontario, L5S 1C4, Region of Peel

Proponent Name

Emerald Energy from Waste Inc.

Proponent Contact Information

Joseph P Lyng General Manager - Tel: (416) 550 7092 Email: joelyng@emeraldefw.com

Screening Questions

	Yes	No
1. Is there a pre-approved screening checklist, methodology or process in place?	☐	☑

If Yes, please follow the pre-approved screening checklist, methodology or process.

If No, continue to Question 2.

	Yes	No
2. Has an archaeological assessment been prepared for the property (or project area) and been accepted by MTCS?	☑	☐

If Yes, do **not** complete the rest of the checklist. You are expected to follow the recommendations in the archaeological assessment report(s).

The proponent, property owner and/or approval authority will:

- summarize the previous assessment
- add this checklist to the project file, with the appropriate documents that demonstrate an archaeological assessment was undertaken e.g., MTCS letter stating acceptance of archaeological assessment report

The summary and appropriate documentation may be:

- submitted as part of a report requirement e.g., environmental assessment document
- maintained by the property owner, proponent or approval authority

If No, continue to Question 3.

	Yes	No
3. Are there known archaeological sites on or within 300 metres of the property (or the project area)?	☐	☐
4. Is there Aboriginal or local knowledge of archaeological sites on or within 300 metres of the property (or project area)?	☐	☐
5. Is there Aboriginal knowledge or historically documented evidence of past Aboriginal use on or within 300 metres of the property (or project area)?	☐	☐
6. Is there a known burial site or cemetery on the property or adjacent to the property (or project area)?	☐	☐
7. Has the property (or project area) been recognized for its cultural heritage value?	☐	☐

If Yes to any of the above questions (3 to 7), do **not** complete the checklist. Instead, you need to hire a licensed consultant archaeologist to undertake an archaeological assessment of your property or project area.

If No, continue to question 8.

	Yes	No
8. Has the entire property (or project area) been subjected to recent, extensive and intensive disturbance?	☐	☐

If Yes to the preceding question, do **not** complete the checklist. Instead, please keep and maintain a summary of documentation that provides evidence of the recent disturbance.

An archaeological assessment is not required.

If No, continue to question 9.

	Yes	No
9. Are there present or past water sources within 300 metres of the property (or project area)?	☐	☐

If Yes, an archaeological assessment is required.

If No, continue to question 10.

	Yes	No
10. Is there evidence of two or more of the following on the property (or project area)?	☐	☐

- elevated topography
- pockets of well-drained sandy soil
- distinctive land formations
- resource extraction areas
- early historic settlement
- early historic transportation routes

If Yes, an archaeological assessment is required.

If No, there is low potential for archaeological resources at the property (or project area).

The proponent, property owner and/or approval authority will:

- summarize the conclusion
- add this checklist with the appropriate documentation to the project file

The summary and appropriate documentation may be:

- submitted as part of a report requirement e.g., under the *Environmental Assessment Act, Planning Act* processes
- maintained by the property owner, proponent or approval authority

Instructions

Please have the following available, when requesting information related to the screening questions below:

- a clear map showing the location and boundary of the property or project area
  - large scale and small scale showing nearby township names for context purposes
- the municipal addresses of all properties within the project area
- the lot(s), concession(s), and parcel number(s) of all properties within a project area

In this context, the following definitions apply:

- **consultant archaeologist** means, as defined in Ontario regulation as an archaeologist who enters into an agreement with a client to carry out or supervise archaeological fieldwork on behalf of the client, produce reports for or on behalf of the client and provide technical advice to the client. In Ontario, these people also are required to hold a valid professional archaeological licence issued by the Ministry of Tourism, Culture and Sport.
- **proponent** means a person, agency, group or organization that carries out or proposes to carry out an undertaking or is the owner or person having charge, management or control of an undertaking.

1. Is there a pre-approved screening checklist, methodology or process in place?

An existing checklist, methodology or process may be already in place for identifying archaeological potential, including:

- one prepared and adopted by the municipality e.g., archaeological management plan
- an environmental assessment process e.g., screening checklist for municipal bridges
- one that is approved by the Ministry of Tourism, Culture and Sport under the Ontario government's Standards & Guidelines for Conservation of Provincial Heritage Properties [s. B.2.]

2. Has an archaeological assessment been prepared for the property (or project area) and been accepted by MTCS?

Respond 'yes' to this question, if all of the following are true:

- an archaeological assessment report has been prepared and is in compliance with MTCS requirements
  - a letter has been sent by MTCS to the licensed archaeologist confirming that MTCS has added the report to the Ontario Public Register of Archaeological Reports (Register)
- the report states that there are no concerns regarding impacts to archaeological sites

Otherwise, if an assessment has been completed and deemed compliant by the MTCS, and the ministry recommends further archaeological assessment work, this work will need to be completed.

For more information about archaeological assessments, contact:

- approval authority
- proponent
- consultant archaeologist
- Ministry of Tourism, Culture and Sport at archaeology@ontario.ca

3. Are there known archaeological sites on or within 300 metres of the property (or project area)?

MTCS maintains a database of archaeological sites reported to the ministry.

For more information, contact MTCS Archaeological Data Coordinator at archaeology@ontario.ca.

4. Is there Aboriginal or local knowledge of archaeological sites on or within 300 metres of the property?

Check with:

- Aboriginal communities in your area
- local municipal staff

They may have information about archaeological sites that are not included in MTCS' database.

Other sources of local knowledge may include:

- property owner
- local heritage organizations and historical societies
- local museums
- municipal heritage committee
- published local histories

5. Is there Aboriginal knowledge or historically documented evidence of past Aboriginal use on or within 300 metres of the property (or property area)?

Check with:

- Aboriginal communities in your area
- local municipal staff

Other sources of local knowledge may include:

- property owner
- local heritage organizations and historical societies
- local museums
- municipal heritage committee
- published local histories

6. Is there a known burial site or cemetery on the property or adjacent to the property (or project area)?

For more information on known cemeteries and/or burial sites, see:

- Cemeteries Regulation Unit, Ontario Ministry of Consumer Services – for database of registered cemeteries
- Ontario Genealogical Society (OGS) – to locate records of Ontario cemeteries, both currently and no longer in existence; cairns, family plots and burial registers
- Canadian County Atlas Digital Project – to locate early cemeteries

In this context, 'adjacent' means 'contiguous', or as otherwise defined in a municipal official plan.

7. Has the property (or project area) been recognized for its cultural heritage value?

There is a strong chance there may be archaeological resources on your property (or immediate area) if it has been listed, designated or otherwise identified as being of cultural heritage value by:

- your municipality
- Ontario government
- Canadian government

This includes a property that is:

- designated under *Ontario Heritage Act* (the OHA), including:
  - individual designation (Part IV)
  - part of a heritage conservation district (Part V)
  - an archaeological site (Part VI)
- subject to:
  - an agreement, covenant or easement entered into under the OHA (Parts II or IV)
  - a notice of intention to designate (Part IV)
  - a heritage conservation district study area by-law (Part V) of the OHA
- listed on:
  - a municipal register or inventory of heritage properties
  - Ontario government's list of provincial heritage properties
  - Federal government's list of federal heritage buildings
- part of a:
  - National Historic Site
  - UNESCO World Heritage Site
- designated under:
  - *Heritage Railway Station Protection Act*
  - *Heritage Lighthouse Protection Act*
- subject of a municipal, provincial or federal commemorative or interpretive plaque.

To determine if your property or project area is covered by any of the above, see:

- Part A of the MTCS Criteria for Evaluating Potential for Built Heritage and Cultural Heritage Landscapes

Part VI – Archaeological Sites

Includes five sites designated by the Minister under Regulation 875 of the Revised Regulation of Ontario, 1990 (Archaeological Sites) and 3 marine archaeological sites prescribed under Ontario Regulation 11/06.

For more information, check Regulation 875 and Ontario Regulation 11/06.

8. Has the entire property (or project area) been subjected to recent extensive and intensive ground disturbance?

Recent: after-1960

Extensive: over all or most of the area

Intensive: thorough or complete disturbance

Examples of ground disturbance include:

- quarrying
- major landscaping – involving grading below topsoil
- building footprints and associated construction area
  - where the building has deep foundations or a basement
- infrastructure development such as:
  - sewer lines
  - gas lines
  - underground hydro lines
  - roads
  - any associated trenches, ditches, interchanges. **Note**: this applies only to the excavated part of the right-of-way; the remainder of the right-of-way or corridor may not have been impacted.

A ground disturbance does **not** include:

- agricultural cultivation
- gardening
- landscaping

Site visits

You can typically get this information from a site visit. In that case, please document your visit in the process (e.g., report) with:

- photographs
- maps
- detailed descriptions

If a disturbance isn't clear from a site visit or other research, you need to hire a licensed consultant archaeologist to undertake an archaeological assessment.

9. Are there present or past water bodies within 300 metres of the property (or project area)?

Water bodies are associated with past human occupations and use of the land. About 80-90% of archaeological sites are found within 300 metres of water bodies.

Present

- Water bodies:
  - primary - lakes, rivers, streams, creeks
  - secondary - springs, marshes, swamps and intermittent streams and creeks
- accessible or inaccessible shoreline, for example:
  - high bluffs
  - swamps
  - marsh fields by the edge of a lake
  - sandbars stretching into marsh

Water bodies not included:

- man-made water bodies, for example:
  - temporary channels for surface drainage
  - rock chutes and spillways
  - temporarily ponded areas that are normally farmed
  - dugout ponds
- artificial bodies of water intended for storage, treatment or recirculation of:
  - runoff from farm animal yards
  - manure storage facilities
  - sites and outdoor confinement areas

Past

Features indicating past water bodies:

- raised sand or gravel beach ridges – can indicate glacial lake shorelines
- clear dip in the land – can indicate an old river or stream
- shorelines of drained lakes or marshes
- cobble beaches

You can get information about water bodies through:

- a site visit
- aerial photographs
- 1:10,000 scale Ontario Base Maps - or equally detailed and scaled maps.

10. Is there evidence of two or more of the following on the property (or project area)?

- elevated topography
- pockets of well-drained sandy soil
- distinctive land formations
- resource extraction areas
- early historic settlement
- early historic transportation routes

- **Elevated topography**

  Higher ground and elevated positions - surrounded by low or level topography - often indicate past settlement and land use.

  Features such as eskers, drumlins, sizeable knolls, plateaus next to lowlands, or other such features are a strong indication of archaeological potential.

  Find out if your property or project area has elevated topography, through:

  - site inspection
  - aerial photographs
  - topographical maps

- **Pockets of well-drained sandy soil, especially within areas of heavy soil or rocky ground**

  Sandy, well-drained soil - in areas characterized by heavy soil or rocky ground - may indicate archaeological potential

  Find out if your property or project area has sandy soil through:

  - site inspection
  - soil survey reports

- **Distinctive land formations**

  Distinctive land formations include – but are not limited to:

  - waterfalls
  - rock outcrops
  - rock faces
  - caverns
  - mounds, etc.

  They were often important to past inhabitants as special or sacred places. The following sites may be present – or close to – these formations:

  - burials
  - structures
  - offerings
  - rock paintings or carvings

  Find out if your property or project areas has a distinctive land formation through:

  - a site visit
  - aerial photographs
  - 1:10,000 scale Ontario Base Maps - or equally detailed and scaled maps.

- **Resource extraction areas**

  The following resources were collected in these extraction areas:

  - food or medicinal plants e.g., migratory routes, spawning areas, prairie
  - scarce raw materials e.g., quartz, copper, ochre or outcrops of chert
  - resources associated with early historic industry e.g., fur trade, logging, prospecting, mining

  Aboriginal communities may hold traditional knowledge about their past use or resources in the area.

- **Early historic settlement**

  Early Euro-Canadian settlement include – but are not limited to:

  - early military or pioneer settlement e.g., pioneer homesteads, isolated cabins, farmstead complexes
  - early wharf or dock complexes
  - pioneers churches and early cemeteries

  For more information, see below – under the early historic transportation routes.

- **Early historic transportation routes** - such as trails, passes, roads, railways, portage routes, canals.

  For more information, see:

  - historical maps and/or historical atlases
    - for information on early settlement patterns such as trails (including Aboriginal trails), monuments, structures, fences, mills, historic roads, rail corridors, canals, etc.
    - Archives of Ontario holds a large collection of historical maps and historical atlases
    - digital versions of historic atlases are available on the Canadian County Atlas Digital Project
  - commemorative markers or plaques such as local, provincial or federal agencies
  - municipal heritage committee or other local heritage organizations
    - for information on early historic settlements or landscape features (e.g., fences, mill races, etc.)
    - for information on commemorative markers or plaques

Appendix B.10

Traffic Assessment Report

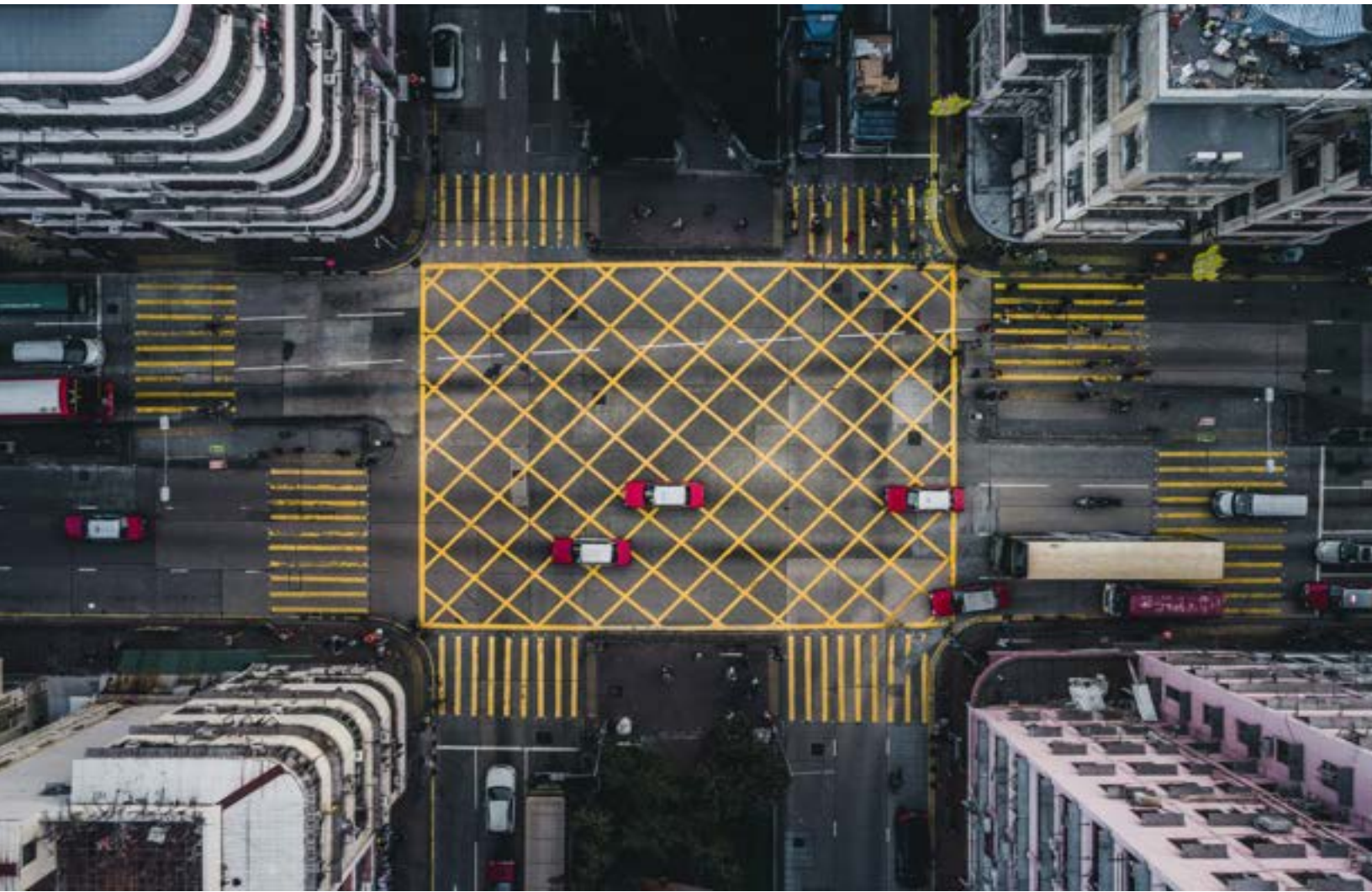
Traffic Assessment Report

Emerald Energy from Waste Environmental Screening & ECA Amendment

Emerald Energy From Waste

January 26, 2024

→ **The Power of Commitment**



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1. Introduction

This report documents the Traffic Assessment carried out as part of the Environmental Assessment Screening for the Emerald Energy from Waste Facility

The Emerald Energy from Waste facility (Site) is located at 7656 Bramalea Road, in Brampton, Ontario and is owned and operated by Emerald Energy from Waste Inc, herein referred to as Emerald EFW (EEFW, Owner, Proponent). The location of the Site is shown in **Figure 1.1.**



Figure 1.1 Location of the Proposed Undertaking

The Site received a Certificate of Approval (CofA, now referred to as an Environmental Compliance Approval [ECA]) (Air) in 1991 and has accepted municipal solid waste since 1992. The Site, which operates under ECA No. 0264-BFGQFY, has approved waste processing rates of 546 tonnes per day and 182,000 tonnes per year. The Site is currently approved for a total of six 2-stage gasification units (five units are currently installed) by Consumat System Inc., each having a nominal design Waste Processing Rate of 91 tonnes per day of municipal solid waste. Under the current ECA, the Site is licensed to receive solid non-hazardous waste from domestic, commercial, industrial and institutional sources and waste designated for thermal treatment by the Canadian Food Inspection Agency and/or Health Canada, from the province of Ontario, as well as solid non-hazardous waste limited to international waste, arriving in the province of Ontario.

Any proposed change to the waste processing limits requires a modification to several conditions of the approved ECA, which specifies the maximum amount of waste to be processed daily and annually as well as the allowable number of equipment units. The proposed Project would amend the approved ECA to allow for up to 900,000 tonnes

of non-hazardous residual waste processing capacity annually. It is intended that staged decommissioning of the existing five units would take place as the proposed new units are brought online, such that the annual processing capacity of the entire facility would not exceed 900,000 tonnes at any time. Changes to the current approved size and footprint of the EEFW facility will also be required in order to accommodate the proposed new gasification units.

The proposed change to the annual waste processing capacity will allow Emerald EFW to positively respond to reducing Ontario's reliance on landfill disposal (both Canada and USA) while recovering energy from residual materials and reducing greenhouse-gas emission. This includes diverting a significant amount of Ontario's total residual waste going to landfill (currently 97 percent)[1] while ensuring the longevity of landfill disposal capacity. The proposed facility expansion is expected to have an operating life of at least 20 years. Between 1997 and 2000, Emerald EFW completed an Environmental Assessment (EA) for expansion of the facility by 25 percent. A CofA was issued in 2009. The Site also conducted and Environmental Screening for service area expansion and was approved between 2011-2012. The amendments to the ECA were approved in 2010, 2012, and 2020 by the Ministry of Environment, Conservation and Parks.

In order to meet the growing demand from waste generators and customer for a safe and reliable waste management facility for their post diversion solid non-hazardous Residential and Industrial, Commercial & Institutional waste, Emerald Energy from Waste Inc. is proposing to redevelop and expand the processing capacity of their existing facility from 500 tonnes/day to up to 2,500 tonnes/day and increase the energy recovery from 10 MW to up to 100 MW. This redevelopment will be implemented in 3 phases. During Phase 1, the existing facility will remain operational while the first new processing line is constructed **(See Figure 1.2)**. Phase 2 and 3 will installed and commissioned in response to market demand. The existing facility would be removed as shown in **Figure 1.3.**



Figure 1.2 Proposed Redevelopment Phase 1

[1] Solid Waste in Ontario: Landfill Report, Ontario Waste Management Association, January 2021.



Figure 1.3 Proposed Redevelopment Phase 2 & 3

This ECA amendment is subject to the Environmental Screening Process in accordance with Section 16 of Ontario Regulation 101/07 – Waste Management Projects Regulation of the Ontario *Environmental Assessment Act*, as follows:

> *A change to a thermal treatment site described in section 11 is defined as a major commercial or business enterprise or activity and is designated as an undertaking to which the Act applies, if the amount of waste that would be subject to thermal treatment at the site on any day after the change would exceed the amount of waste that was authorized under the Environmental Protection Act to be subject to thermal treatment at the site before the change. O. Reg. 101/07, s. 16; O. Reg. 389/22, s. 9.*

Section 16 of Ontario Regulation 101/07 – Waste Management Projects Regulation exempts this Project from Part II of the *EA Act*, subject to fulfilling the Environmental Screening Process. The Screening will be conducted in accordance with the planning and design process outlined in MECP "*Guide to Environmental Assessment Requirements for Waste Management Projects*." The Environmental Screening process includes identifying and applying screening criteria to determine and describe potential environmental effects, public/external agency consultation, and the development of measures to mitigate identified environmental effects. The results of the Study will be documented in an Environmental Screening Report (ESR), which will be released for review to Stakeholders including Indigenous communities, the public, and government agencies. Upon completion of the Environmental Screening Process an application will be made to amend the existing ECA No. 0264-BFGQFY.

The Environmental Screening Process is described further in **Section 2** including the application of the Screening Criteria Checklist. The existing, planned and future Traffics within the study area were confirmed through background research and a site visit are documented in **Section 3**. In general, the predominant existing Traffic within the Study Area is Industrial with Spring Creek located to the west, which is anticipated to remain that way for the foreseeable future based on current municipal planning policy.

The effects assessment carried out for the Traffic conditions is documented in Section 4. The identification potential effects of the proposed project, mitigation measures to address the effects and the resultant net effects are described. Lastly the monitoring requirements and additional approvals required are detailed in **Section 5**.

The Study Areas reviewed for the Traffic assessment was as follows (see **Figure 1.2**):

From a Traffic and Economic Environment perspective, the characterization of existing conditions within the following study areas are appropriate to this Environmental Screening:

– **Site Study Area**, including all lands within the existing, approved boundaries of the Emerald EFW, as defined by Environmental Compliance Approval (ECA) No. 4591-56VSTN, as amended; and

– **Local Study Area**, including all lands within a 1 Kilometer (km) radius of the Site Study Area boundaries. An Inventory of sensitive uses within 500 m of the Site Study Area will also be examined.

The following intersections were included in the study:

– Bramalea Road and the Highway 407 Westbound Off-Ramp
– Bramalea Road and the right-in site access
– Bramalea Road and the full-moves site access/private access

The site location is illustrated in the figure below.



Figure 1.4 Site Location

2. Screening Criteria Checklist

At the beginning of the Environmental Screening, the Screening Criteria Checklist (provided as Schedule I, pp 62 – 64, to the "Guide to Environmental Assessment Requirements for Waste Management Projects") is to be completed based on the information provided in the Project Description. The Screening Criteria reflect the broad definition of "environment" contained in the *Ontario Environmental Assessment Act*

As noted in the Guide:

*"The Screening Criteria are presented in the form of a checklist with the option of a "Yes" or "No" response. Mitigation measures **are not** to be considered in concluding whether there is "No" potential environmental effect. That is, the proponent is required to answer "Yes" even if the proponent believes that a potential environmental effect could likely be mitigated. The reason for requiring a "Yes" is to ensure that mitigation measures are open to discussion and review. Another reason for this approach is that further discussion and review of a potential effect may reveal that there is no actual effect, in which case no mitigation is required. Where a "yes' has been identified, the proponent is to provide additional information in the Environmental Screening Report, explaining the potential effect(s), methods to mitigate or address the effect(s), any net effects that are anticipated and if so, their significance. Even where the proponent indicates that no environmental effects are anticipated, it is recommended that additional information is provided in the Environmental Screening Report in order to support the "no effects" conclusion"*.

Each criterion is based on a question which is prefaced with the phrase, "Might the Project…" **Table 2.1** was completed as the first step of the Environmental Screening Process and is a summary of the criteria for the Traffic discipline. Further descriptions of the criteria for which a "Yes" response was indicated in the Screening table are discussed in **Section 4** of this report.

Table 2.1 Screening Criteria Checklist

	Criterion	YES	NO	Additional Information
	Might the project…			
Traffic				
6.8	Cause negative effects related to traffic?	X		The proposed EFW Facility expansion would increase the traffic beyond the existing levels and is expected to be acceptable relative to local traffic volumes.

3. Existing Conditions

The following subsections describe the existing conditions that are found within the On-Site, Site Vicinity and Regional Study Area for Traffic (Section 3.1) of the proposed project.

3.1 Methodology

3.1.1 Available Secondary Source Information Collection and Review

Available secondary sources of information were collected and reviewed by the Traffic Study Team to determine existing traffic conditions within the study area(s). The following sources of secondary information were collected and reviewed:

– Turning movement counts for the study intersections, dated July 2023 and conducted by Spectrum Traffic Data Inc.

– Historic turning movement counts
    - Bramalea Road and Highway 407 Westbound Off-Ramp, October 2012, Spectrum Traffic Data Inc.
    - Bramalea Road and Steeles Avenue, June 2015 and March 2018, Spectrum Traffic Data Inc.

3.1.2 Process Undertaken

Information on the Transportation Existing Conditions within the Study Area was gathered from a combination of secondary source research, field investigations and discussions with Region of Peel staff.

3.1.3 Field Investigations

Turning movement counts were conducted at the intersection of Highway 407 Westbound Off-Ramp and Bramalea Road, Bramalea Road and the right-in site access, and Bramalea Road at the site access/7653-7639 Bramalea Road during the weekday a.m. and p.m. peak periods. These counts were completed on Tuesday, July 4, 2023.

3.1.4 Agency Consultation

As part of the study, Regional of Peel and City staff where circulated a Terms of Reference and comments were received from Region staff.

3.2 Description of Existing Conditions

ROAD NETWORK

The following two major roads provide access to the existing Emerald Energy-from-Waste facility:

Highway 407 is a Class 1A – Freeway under the jurisdiction of the Ministry of Transportation (MTO). Within the study area, there is a westbound off-ramp at Bramalea Road in addition to two-free flow on-ramps for the eastbound direction only. The westbound off-ramp at Bramalea Road is a signalized intersection with a left-turn and a right-turn lane.

Bramalea Road is a north/south minor arterial road under the jurisdiction of the City of Brampton. Within the study area, it has a four-lane cross-section. Its intersection with the Highway 407 westbound off-ramp is signalized, while its intersections with the right-in site access and the full-moves access/private access are both unsignalized with the stop-control only along the site accesses. The posted speed limit along Bramalea Road is 60 km/h.

Field observations were completed for the study intersections to review and identify any existing issues or constraints. Based on the review of the operation of the intersection of Bramalea Road and the site access/private access, the westbound approach was observed to be operating as a two lane approach (one westbound right-turn and one westbound left-turn lane). As a result, the Synchro was modeled with the observed operation of the eastern leg of the intersection.

TRAFFIC DATA

GHD contracted Spectrum Traffic Data Inc. to conduct updated turning movement counts at all the existing study intersections in July 2023. The baseline 2023 traffic volumes for the a.m. and p.m. peak hours are summarized below with the full turning movement counts provided in the **Appendix A.**

Historical data was also obtained from Spectrum Traffic Data Inc. for the Highway 407 Westbound Off-Ramp at Bramalea Road, dated October 2012, in addition to the intersection of Bramalea Road and Steeles Avenue (north of the study area), dated June 2015 and March 2018. Detailed turning movement data sheets are found in **Appendix A**.

The resulting 2023 weekday a.m. and p.m. peak hours are summarized in **Figure 3.1**.

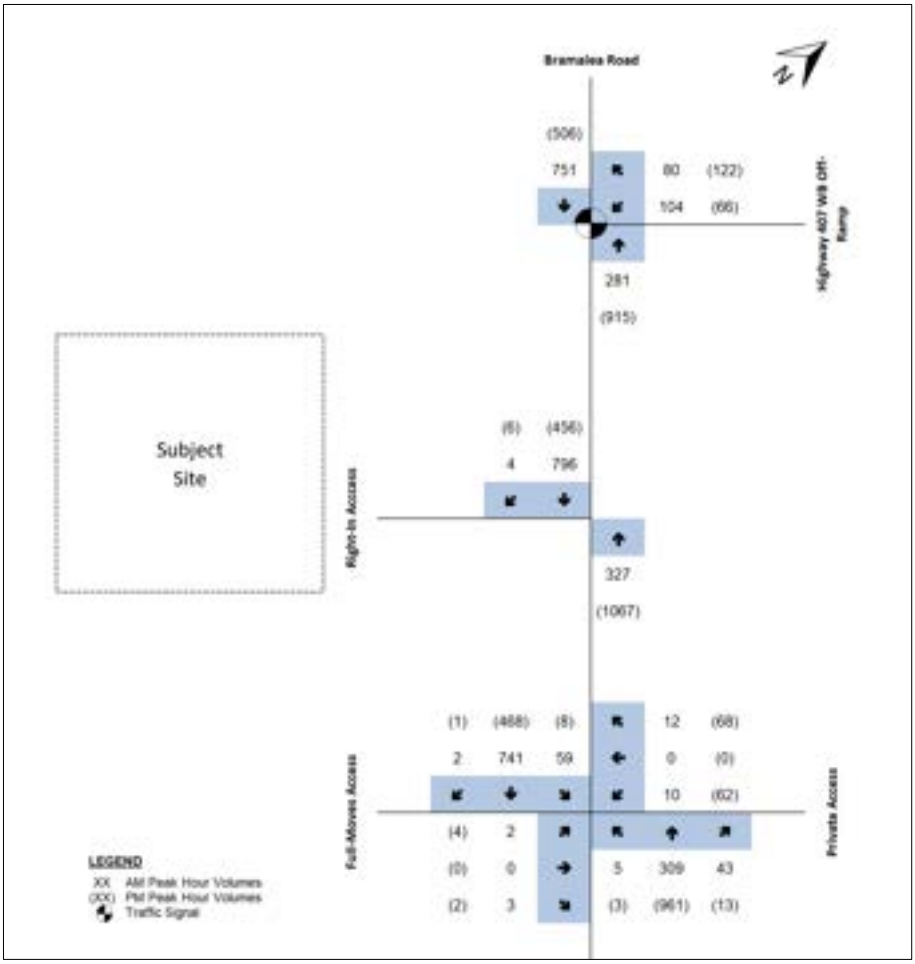


Figure 3.1 2023 Existing Peak Hour Volumes

EXISTING FACILITY

The Emerald Energy-from-Waste facility is currently operational and has a capacity of 150,000 tonnes of material per year with the site open to receive waste every day of the year between 6:00 a.m. to 7:00 p.m.

There are a total of 43 staff employed at the facility consisting of the following:

Weekdays

– Dayshift: 12 Managers, 10 maintenance staff and 7 operations staff
– Nightshift: 1 manager, 6 operations staff

Weekends/Holidays

– Dayshift: 1 Manager and 4 operations staff
– Nightshift: 1 Manager and 4 operations staff

There are two 12 hour operating shifts from 6:00 a.m. to 6:00 p.m. however, maintenance staff generally work from 6:30 a.m. to 3:00 p.m. and managers from 7:00 a.m. to 3:00 p.m.

The site currently accepts material using the following truck configurations:

– Walking floor – can handle 25 to 40 metric tonnes per load
– Roll-off – can handle 0.5 to 10 metric tonnes per load
– Front End – can handle 3 to 12 metric tonnes per load

– Tri-axle – can handle 14 to 22 metric tonnes per load
– Dump trailer – can handle 34 to 42 metric tonnes per load

Daily truck data provided by the operator of the Site confirms that the current maximum daily truck traffic generated by the Site assuming delivery of 150,000 tonnes of material per year is a maximum total of 80 to 95 trucks over the period of a weekday day or 160 to 190 two-way truck trips a day. The facility accepts much less material over the weekends.

The site's existing trip generation during the a.m. and p.m. peak hours were derived from the updated turning movement count on Tuesday, July 4, 2023, and is summarized in the table below. It includes the inbound and outbound volumes for both the right-in site access and the full-moves site access.

Table 3.1 Existing Trip Generation

Capacity	A.M. Peak Hour			P.M. Peak Hour		
	In	Out	Total	In	Out	Total
150,000 tonnes/year	11	5	16	9	6	15

Based on a total annual capacity of 150,000 tonnes of waste per year, the subject site generates approximately 16 two-way trips consisting of 11 inbound and 5 outbound trips during weekday a.m. peak hour and 15 two-way trips consisting of 9 inbound and 6 outbound trips during the weekday p.m. peak hour.

In reviewing the captured volume of site traffic during the survey period, it was noted that the majority of in/out traffic at the site driveways during the a.m. and p.m. peak hours was truck traffic from accepting waste material. This is expected considering that staff is on-site before 6 or 7 a.m. i.e. before the a.m. peak hour and leaves at 3:00 p.m. before the p.m. peak hour. Assuming a maximum of 190 two-way truck trips per day during a 13-hour window (6:00 a.m. to 7:00 p.m.), the average number of trucks per hour is approximately 15 two-way trips per hour generated by the facility.

The average peak hour site volumes is consistent with the survey conducted on July 4, 2023 where a total of 16 two-way trips were observed during the a.m. peak hour and 15 during the p.m. peak hour and confirms that the surveyed site traffic is representative of the maximum expected peak hour site trip generation based on the existing capacity of 150,000 tonnes of waste per year.

CAPACITY ANALYSIS

As a measure of the existing capacity on the adjacent road network surrounding the facility, both the site access on Bramalea Road and the signalized off-ramp of Hwy 407 and Bramalea Road was analyzed using the existing 2023 turning movement volumes for the weekday am, and pm peak hours.

A summary of the capacity analysis using Synchro version 10 is summarized in the following table with detailed reports provided in **Appendix A**.

Table 3.2 2023 Existing Capacity Analysis

Scenario	AM Peak Hour		PM Peak Hour	
	V/C (LOS) seconds	95th % Que.	V/C (LOS) seconds	95th % Que
Hwy 407 and Bramalea Road	Overall: 0.39 (B) 12 WBL = 0.16 (A) 10 WBR = 0.06 (A) 9 NBT = 0.28 (B) 10 SBT = 0.61 (B) 13	 WBL = 15 m WBR = 5 m NBT = 15 m SBT = 40 m	Overall: 0.45 (B) 12 WBL = 0.13 (B) 10 WBR = 0.19 (B) 11 NBT = 0.67 (B) 13 SBT = 0.39 (A) 10	 WBL = 10 m WBR = 15 m NBT = 45 m SBT = 25 m

Scenario	AM Peak Hour		PM Peak Hour	
	V/C (LOS) seconds	95th % Que.	V/C (LOS) seconds	95th % Que
Bramalea Road and Site Access/7653-7639 Bramalea Road	EBTLR = 0.02 (C) 19 WBL = 0.08 (C) 32 WBR = 0.02 (A) 9 NBL = 0.01 (A) 13 NBT = 0.1 (A) 0 NBT = 0.1 (A) 0 NBR = 0.03 (A) 0 SBL = 0.06 (A) 8 SBT = 0.32 (A) 0 SBTR = 0.16 (A) 0	EBTLR = 5 m WBL = 5 m WBR = 5 m NBL = 5 m NBT = 0 m NBT = 0 m NBR = 0 m SBL = 5 m SBT = 0 m SBTR = 0 m	EBTLR = 0.04 (D) 32 WBL = 0.57 (E) 73 WBR = 0.14 (A) 13 NBL = 0 (A) 10 NBT = 0.29 (A) 0 NBT = 0.29 (A) 0 NBR = 0.01 (A) 0 SBL = 0.01 (A) 11 SBT = 0.19 (A) 0 SBTR = 0.1 (A) 0	EBTLR = 5 m WBL = 20 m WBR = 5 m NBL = 5 m NBT = 0 m NBT = 0 m NBR = 0 m SBL = 5 m SBT = 0 m SBTR = 0 m

The turning movements at both study intersections currently operate with levels of service ‘E’ or better during the weekday am and, pm peak hours.

The analysis of existing conditions confirms no current capacity constraints at either study however the existing westbound left turn from the development at 7653-7639 Bramalea Road is approaching critical with a LOS of E during the p.m. peak hour.

4. Description of Project Components and Activities

A Project Description, which includes a Site Plan, was prepared so that potential environmental effects and mitigation measures could be identified. The following subsections provide a general summary of the proposed undertaking:

Ontario disposes over 97 percent of its residual materials in landfills. The remaining three percent is managed through Energy from Waste (EFW [2]). Of the 97 percent directed to landfill disposal, 70 percent is disposed of within Ontario and 27 percent in Michigan and New York [3]). Based on the current disposal rate of 97%, Ontario’s landfill capacity is projected to be exhausted in 11 to16 years[4]. In order to address the compounding issues of growing population and diminishing landfill capacity in southern Ontario, Emerald EFW has identified an opportunity to develop new EFW capacity at their existing facility in Brampton.

The purpose of this Project is to provide additional processing capacity at the Emerald EFW facility in Brampton, Ontario in order to divert a portion of the non-hazardous residual materials produced by Ontario residents and businesses from landfills, thereby recovering energy for use within the community. The proposed Project would allow for three new gasification units, each capable of processing up to 300,000 tonnes of residual waste per year, for a total processing capacity at the facility of 900,000 tonnes annually. This would increase the permitted annual waste processing amount from 182,000 to 900,000 tonnes. The proposed change in the annual processing capacity requires additional facility infrastructure and a change to the Site footprint.

The project for which the Environmental Screening Process is being undertaken is a proposed redevelopment of the existing site and involves a change to the final site capacity and footprint. A high level of construction & demolition will be required to implement the proposal. The redevelopment will be implemented in 3 phases. In phase 1, the existing facility will remain operational while the first new processing line is constructed. Phases 2 and 3 will be installed and commissioned in response to market demand. The existing facility would be removed. Emerald EFW will undergo an ECA amendment for changes to approved processing capacity and other operational activities. From a traffic perspective there will be no changes to existing haul routes or Site entrance. Increasing the annual processing

[2] Solid Waste in Ontario: Landfill Report, Ontario Waste Management Association, January 2021.
[3] Ibid.
[4] Ibid.

capacity will result in increased truck traffic on the haul route from Highway 407 along Bramalea Road on an annual basis. This is expected to be acceptable relative to local traffic volumes.

A summary of the key elements of the proposed capacity expansion compared to the existing approved Site is provided in Table 4.1.

Table 4.1 Summary of Proposed Emerald EfW Facility Design vs Existing Facility

Design Component	Existing EfW Facility	Proposed Redevelopment
Waste Processing Capacity (tonnes per annum)	150,000	900,000

5. Potential Effects, Mitigation Measures & Net Effects

This section documents the potential effects on the environment, mitigation measures and net environmental effects for Traffic resulting from the proposed undertaking.

5.1 Methodology and Investigations

The assessment of effects associated with the proposed undertaking was carried out through a series of steps that is based, in part, on the description of existing conditions as well as the Project Description and Site Plan. The assessment of effects was also undertaken within the context of the previously completed Screening Criteria Checklist, as summarized in **Section 2** of this report.

FUTURE HORIZON YEARS

The two future horizon years were assessed based on the anticipated build-out of Line 1 and full build-out of the facility that includes Lines 1, 2 and 3.

Line 1 is anticipated to be completed based on a 5-year timeline with 2024 being established as the first year of the project, resulting in a first horizon year of 2029. The construction and opening of Lines 2 and 3 are assumed to take another five years to complete, resulting in a second horizon year of 2034.

To establish the future 2029 and 2034 future traffic conditions and capture any expected background growth in traffic volumes at the study area intersections, the available historic counts were reviewed to establish annual growth rates in both the northbound and southbound directions along Bramalea Road. The growth rates are summarized in the table below and are based on the northbound and southbound link volumes in the south approach at Bramalea Road and Steeles Avenue.

A 2% per annum growth rate was applied to the off-ramp volumes, the typical growth rate used for MTO roadways.

Table 5.1 Corridor Growth Rates

Road	Direction	A.M. Peak Hour	P.M. Peak Hour
Hwy 407 Off-ramp	NB	2%	2%
	SB	2%	2%
Bramalea Road	NB	5.0%	1.3%
	SB	3.6%	4.3%

The future background 2029 and 2034 volumes are summarized in the figures below.

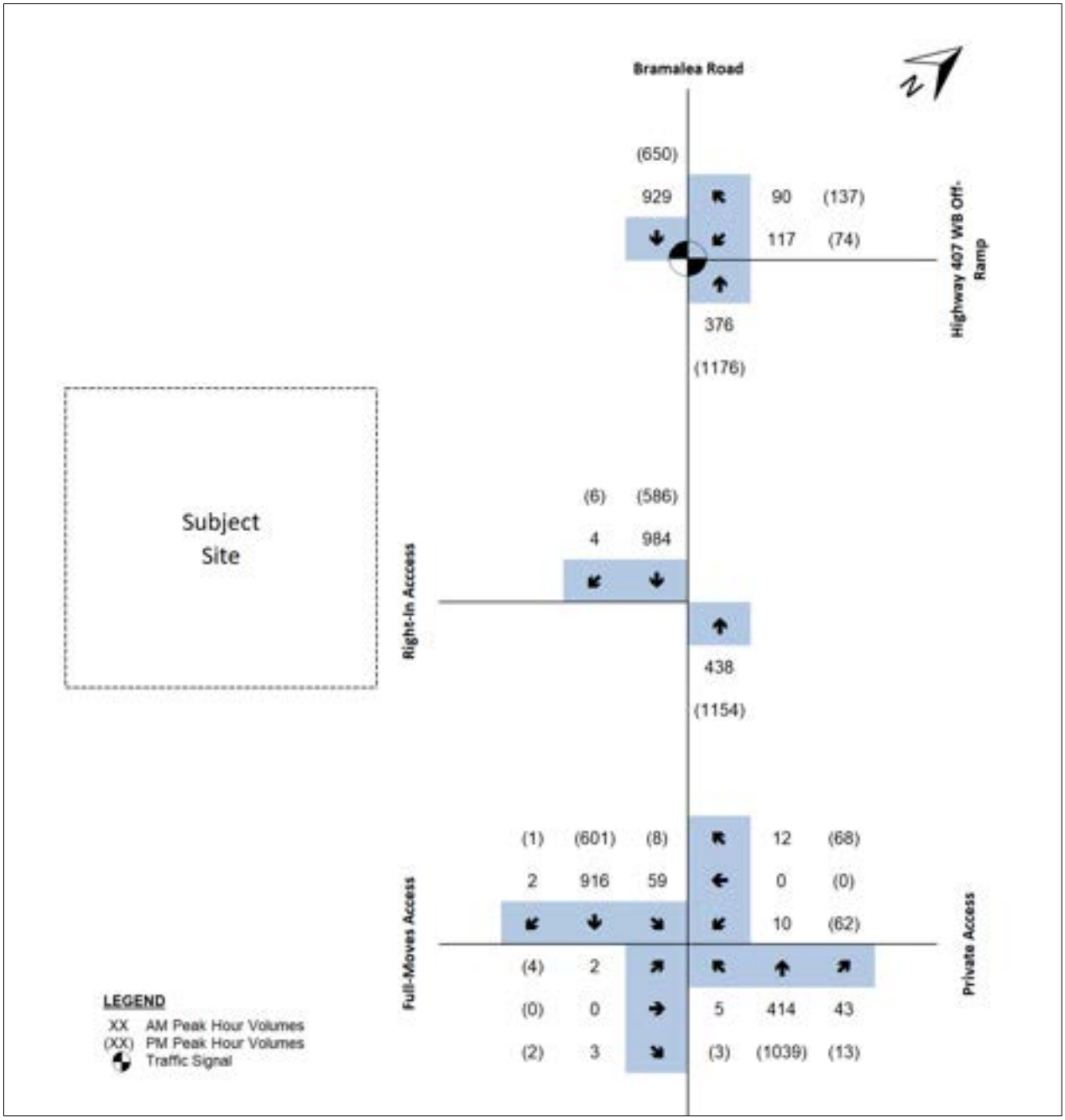


Figure 5.1 Future Background 2029 Volumes

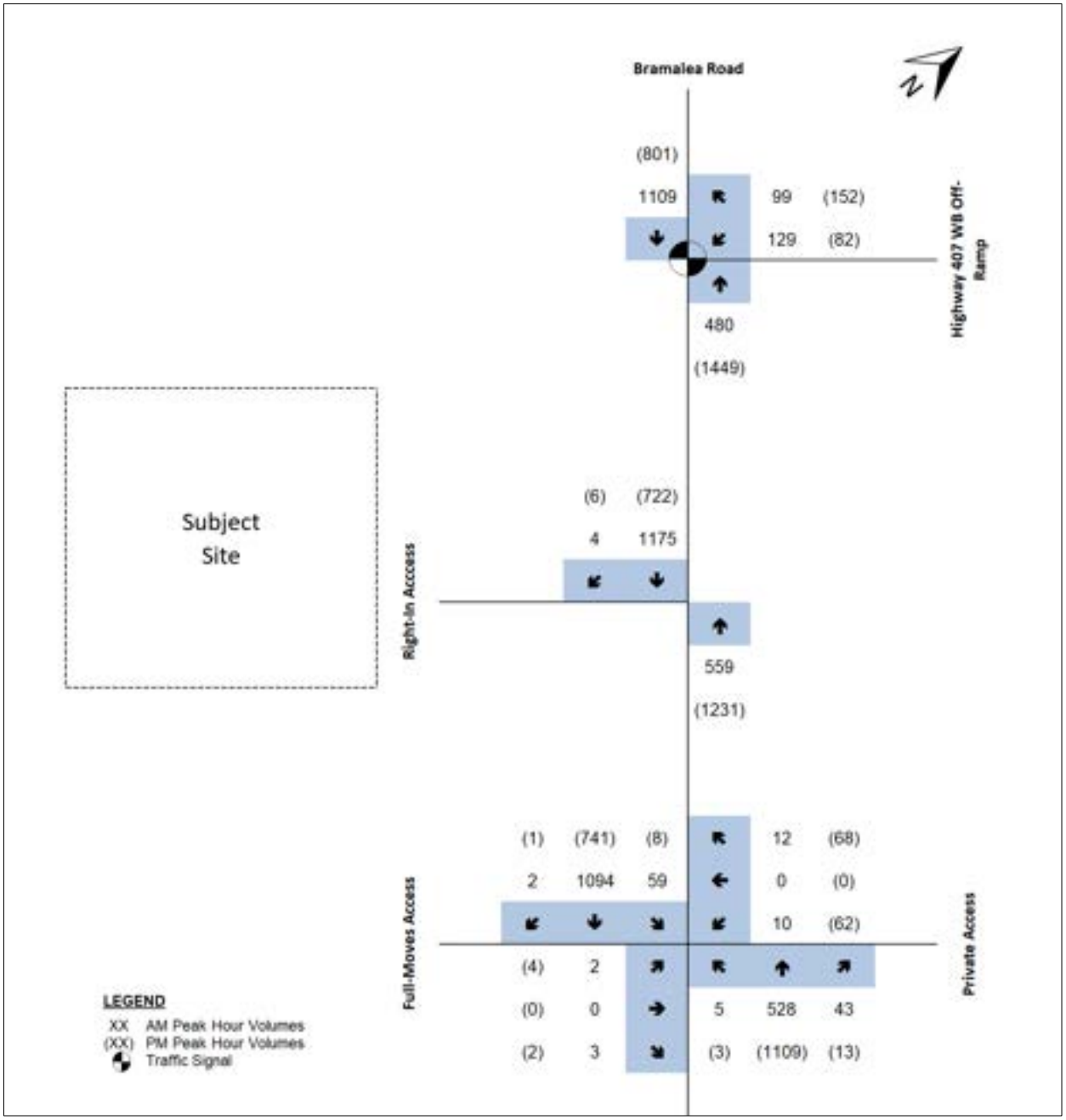


Figure 5.2 Future Background 2029 Volumes

FUTURE FACILITY OPERATIONS

Expansion of the Emerald facility will be completed in two Phases. In the first phase, it is assumed that Line 1 will be completed, and the existing facility will be shut down. The second phase of the project assumed the full build-out of the two remaining lines (Line 2 and 3).

Each line is anticipated to have an annual capacity of 300,000 tonnes. Under the first horizon year (2029) the site will have a capacity of 300,000 tonnes, with the full build-out of the site in 2034 resulting in a total capacity of 900,000 tonnes per year for the site.

The site's trip generation is summarized in the table below and is based on the doubling of the site's capacity by 2029 (from 150,000 tonne to 300,000 tonne yearly capacity) and sextupling of the existing site's capacity by 2034 (from 150,000 tonnes to a 900,000 tonnes yearly capacity).

Table 5.2 Future Trip Generation

Horizon Year (Capacity)	A.M. Peak Hour			P.M. Peak Hour		
	In	Out	Total	In	Out	Total
Existing (150,000 tonnes/year)	11	5	16	9	6	15
2029 (300,000 tonnes/year)	22	10	32	18	12	30
2034 (900,000 tonnes/year)	66	30	96	54	36	90

The subject site is anticipated to generate a total of 32 two-way trips consisting of 22 inbound and 10 outbound trips during weekday a.m. peak hour and 30 two-way trips consisting of 18 inbound and 12 outbound trips during the weekday p.m. peak hour under the 2029 horizon year with the opening of Line 1.

With the opening of Lines 1, 2 and 3, the subject site is anticipated to generate a total of 96 two-way trips consisting of 66 inbound and 30 outbound trips during weekday a.m. peak hour and 90 two-way trips consisting of 54 inbound and 36 outbound trips during the weekday p.m. peak hour under the 2034 horizon year.

The additional site traffic was distributed to/from the site accesses based on the existing travel patterns, with the site traffic under the 2029 and 2034 horizon years provided in the figures below.

For a conservative analysis, it was assumed that all site traffic arriving from the north originating from the Hwy 407 off-ramp resulting in the maximum volume of additional left turns at the ramp. Similarly, it was assumed that all site traffic heading north of the site is destined for Steeles Avenue which maximizes the volumes of traffic through the intersection.

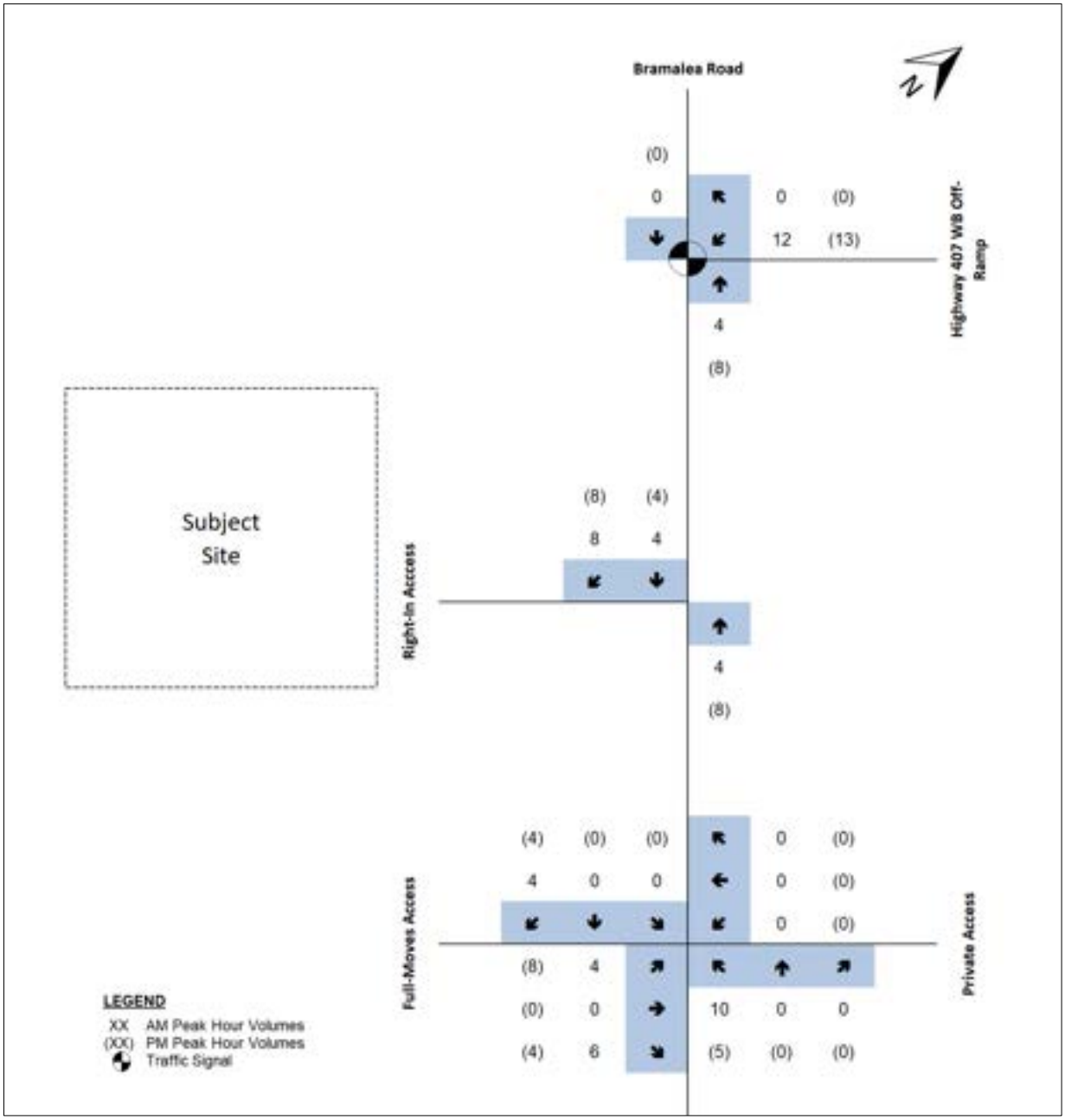


Figure 5.3 Site Trips (2029)

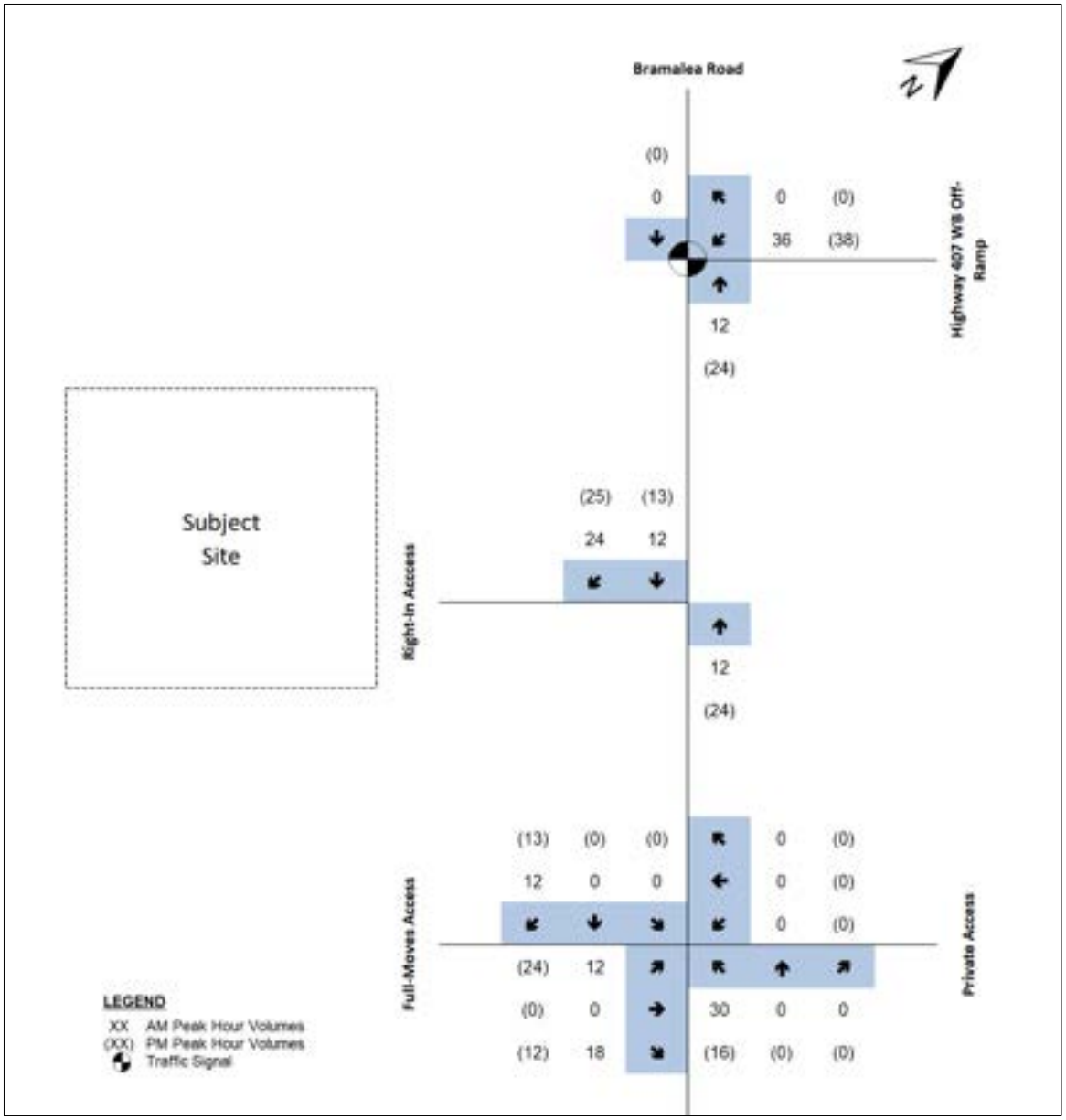


Figure 5.4 Site Trips (2034)

The future total traffic conditions in the weekday a.m. and p.m. peak hours for the 2029 2034 planning horizons were derived by combining the projected future background traffic with the corresponding estimated site generated traffic. The resulting traffic volumes are presented in the figures below.

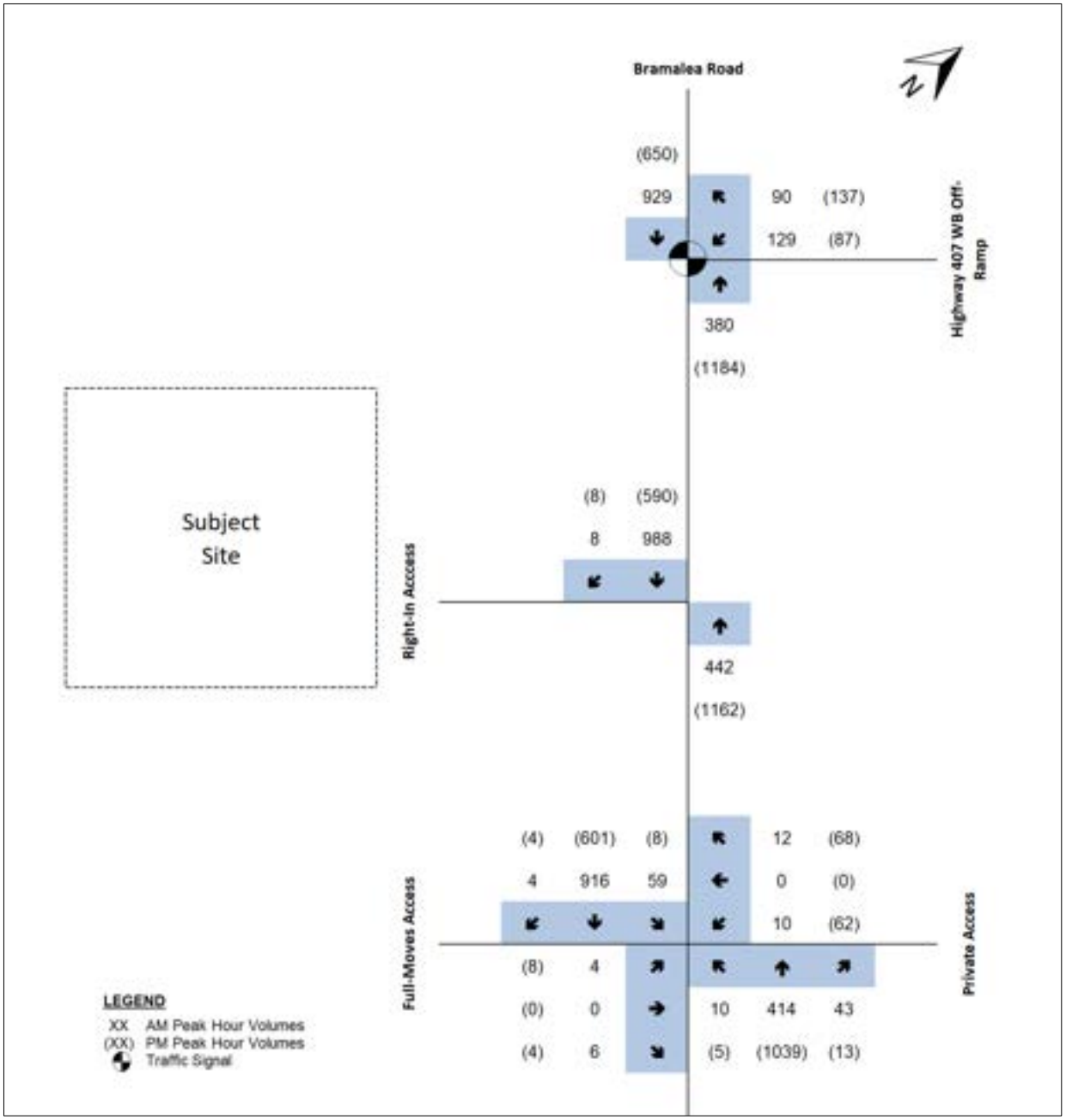


Figure 5.5 Future Total 2029 Volumes

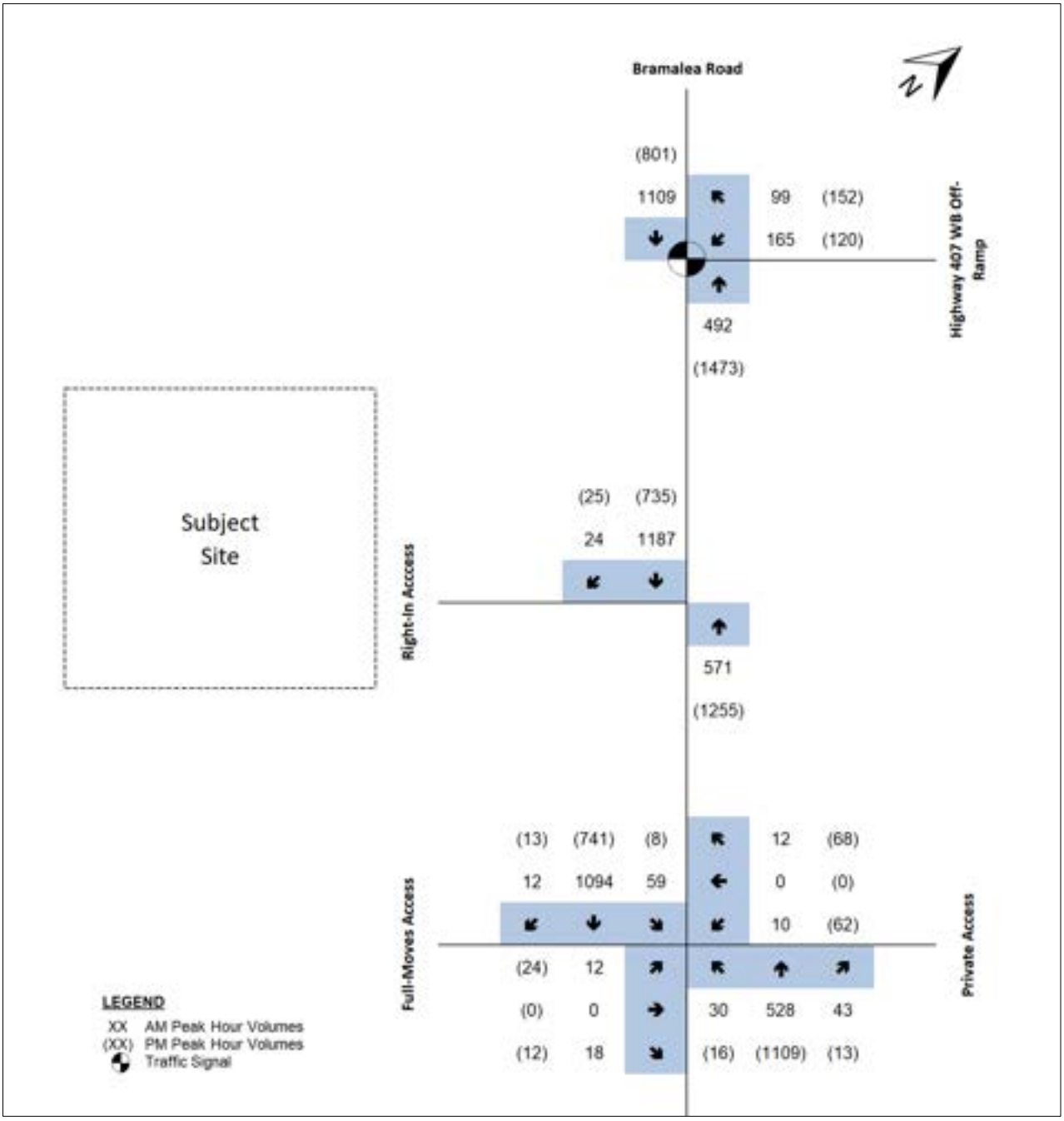


Figure 5.6 Future Total 2034 Volumes

CAPACITY ANALYSIS

As a measure of the existing capacity on the adjacent road network surrounding the Emerald facility, the Highway 407 Westbound Off-Ramp at Bramalea Road and the outbound site access along Bramalea Road were analyzed for the future background (2029 and 2034), and future total (2029 and 2034) turning movement volumes during the weekday a.m. and p.m. peak hours. A summary of the capacity analysis using Synchro version 11 is summarized in the following table with detailed reports provided in **Appendix A**.

Bramalea Road and Highway 407 Westbound Off-Ramp

Capacity analysis at this intersection during the weekday a.m. and p.m. peak hours for the existing, future background, and future total traffic conditions are summarized in the following table.

Table 5.3 Capacity analysis of Bramalea Road and Highway 407 Westbound Off-Ramp

Scenario	Am Peak Hour		PM Peak Hour	
	V/C (LOS) seconds	95th % Que.	V/C (LOS) seconds	95th % Que
Future Background 2029	Overall: 0.47 (B) 13 WBL = 0.19 (B) 10 WBR = 0.07 (A) 9 NBT = 0.37 (B) 11 SBT = 0.73 (B) 15	 WBL = 15 m WBR = 10 m NBT = 20 m SBT = 50 m	Overall: 0.54 (A) 8 WBL = 0.3 (B) 19 WBR = 0.33 (B) 20 NBT = 0.61 (A) 7 SBT = 0.35 (A) 5	 WBL = 15 m WBR = 20 m NBT = 40 m SBT = 20 m
Future Total 2029	Overall: 0.48 (B) 13 WBL = 0.21 (B) 10 WBR = 0.07 (A) 9 NBT = 0.37 (B) 11 SBT = 0.73 (B) 15	 WBL = 15 m WBR = 10 m NBT = 20 m SBT = 50 m	Overall: 0.55 (A) 8 WBL = 0.35 (B) 20 WBR = 0.34 (B) 20 NBT = 0.61 (A) 7 SBT = 0.35 (A) 5	 WBL = 15 m WBR = 20 m NBT = 40 m SBT = 20 m
Future Background 2034	Overall: 0.55 (B) 17 WBL = 0.21 (B) 10 WBR = 0.08 (A) 9 NBT = 0.47 (B) 12 SBT = 0.87 (C) 21	 WBL = 15 m WBR = 10 m NBT = 25 m SBT = 80 m	Overall: 0.7 (A) 9 WBL = 0.33 (B) 20 WBR = 0.51 (C) 24 NBT = 0.75 (A) 9 SBT = 0.43 (A) 6	 WBL = 15 m WBR = 30 m NBT = 60 m SBT = 25 m
Future Total 2034	Overall: 0.58 (B) 17 WBL = 0.27 (B) 11 WBR = 0.08 (A) 9 NBT = 0.48 (B) 12 SBT = 0.87 (C) 21	 WBL = 20 m WBR = 10 m NBT = 25 m SBT = 80 m	Overall: 0.71 (A) 10 WBL = 0.48 (C) 23 WBR = 0.52 (C) 24 NBT = 0.76 (A) 10 SBT = 0.43 (A) 6	 WBL = 20 m WBR = 30 m NBT = 60 m SBT = 25 m

Under existing traffic conditions, the overall intersection has a reported v/c ratio of 0.39 LOS B and 0.45 LOS B during the a.m. and p.m. peak hours respectively. The intersection is operating with acceptable levels of delay for all individual movements during both peak hours.

With the addition of corridor growth and signal optimization during the 2029 future background horizon period, the overall reported v/c of the intersection is reported to increase to 0.47 LOS B during the a.m. peak hour and 0.54 LOS A during the p.m. peak. The intersection and all approaches continue to operate without any critical movements during both peak hours.

Under the 2029 future total traffic condition, with the addition of site generated traffic, the intersection continues to operate at satisfactory levels with the overall v/c ratio of the intersection increasing to 0.48 LOS B during the a.m. peak hour and at 0.55 LOS A during the p.m. peak hour.

With the addition of corridor growth and signal optimization during the 2034 future background horizon period, the overall reported v/c of the intersection is expected to increase to 0.55 LOS B and 0.70 LOS A during the a.m. peak and p.m. peak hour, respectively. The intersection begins to operate with a critical approach in the southbound through lanes during the a.m. peak hour and northbound through lanes during the p.m. peak hour.

Under the 2034 future total traffic condition, with the addition of site generated traffic, the intersection continues to operate at satisfactory levels with the overall v/c ratio of the intersection increasing to 0.58 LOS B during the a.m. peak hour and to 0.71 LOS A during the p.m. peak hour. The southbound through movement during the a.m. peak hour and the northbound through movement during the p.m. peak hour continue to operate at a critical level. Both movements continue to operate below the theoretical capacity level of 1.00

No geometric improvements are recommended at this intersection as a result of the proposed development, the site generated traffic from the subject site has a marginal impact on the operation of this intersection.

Bramalea Road and the Full-Moves Access/Private Access

Capacity analysis at this intersection during the weekday a.m. and p.m. peak hours for the existing, future background, and future total traffic conditions are summarized in the following table.

Table 5.4 Capacity analysis of Bramalea Road and the Site Access/7653-7639 Bramalea Road Access

Scenario	Am Peak Hour		PM Peak Hour	
	V/C (LOS) seconds	95th % Que.	V/C (LOS) seconds	95th % Que
Future Background 2029	EBTLR = 0.03 (C) 25 WBL = 0.12 (D) 49 WBR = 0.02 (A) 10 NBL = 0.01 (A) 15 NBT = 0.13 (A) 0 NBT = 0.13 (A) 0 NBR = 0.03 (A) 0 SBL = 0.06 (A) 9 SBT = 0.39 (A) 0 SBTR = 0.2 (A) 0	EBTLR = 5 m WBL = 5 m WBR = 5 m NBL = 5 m NBT = 0 m NBT = 0 m NBR = 0 m SBL = 5 m SBT = 0 m SBTR = 0 m	EBTLR = 0.06 (E) 43 WBL = 0.74 (F) 121 WBR = 0.15 (A) 14 NBL = 0 (A) 10 NBT = 0.32 (A) 0 NBT = 0.32 (A) 0 NBR = 0.01 (A) 0 SBL = 0.01 (A) 11 SBT = 0.24 (A) 0 SBTR = 0.12 (A) 0	EBTLR = 5 m WBL = 30 m WBR = 5 m NBL = 5 m NBT = 0 m NBT = 0 m NBR = 0 m SBL = 5 m SBT = 0 m SBTR = 0 m
Future Total 2029	EBTLR = 0.06 (C) 25 WBL = 0.12 (D) 51 WBR = 0.02 (A) 10 NBL = 0.03 (A) 15 NBT = 0.13 (A) 0 NBT = 0.13 (A) 0 NBR = 0.03 (A) 0 SBL = 0.06 (A) 9 SBT = 0.39 (A) 0 SBTR = 0.2 (A) 0	EBTLR = 5 m WBL = 5 m WBR = 5 m NBL = 5 m NBT = 0 m NBT = 0 m NBR = 0 m SBL = 5 m SBT = 0 m SBTR = 0 m	EBTLR = 0.12 (E) 46 WBL = 0.76 (F) 125 WBR = 0.15 (A) 14 NBL = 0.01 (A) 10 NBT = 0.32 (A) 0 NBT = 0.32 (A) 0 NBR = 0.01 (A) 0 SBL = 0.01 (A) 11 SBT = 0.24 (A) 0 SBTR = 0.12 (A) 0	EBTLR = 5 m WBL = 30 m WBR = 5 m NBL = 5 m NBT = 0 m NBT = 0 m NBR = 0 m SBL = 5 m SBT = 0 m SBTR = 0 m
Future Background 2034	EBTLR = 0.04 (D) 35 WBL = 0.19 (E) 80 WBR = 0.02 (A) 10 NBL = 0.02 (A) 17 NBT = 0.17 (A) 0 NBT = 0.17 (A) 0 NBR = 0.03 (A) 0 SBL = 0.07 (A) 9 SBT = 0.47 (A) 0 SBTR = 0.24 (A) 0	EBTLR = 5 m WBL = 5 m WBR = 5 m NBL = 5 m NBT = 0 m NBT = 0 m NBR = 0 m SBL = 5 m SBT = 0 m SBTR = 0 m	EBTLR = 0.06 (E) 44 WBL = 0.83 (F) 151 WBR = 0.15 (A) 14 NBL = 0 (A) 10 NBT = 0.34 (A) 0 NBT = 0.34 (A) 0 NBR = 0.01 (A) 0 SBL = 0.01 (A) 12 SBT = 0.23 (A) 0 SBTR = 0.12 (A) 0	EBTLR = 5 m WBL = 35 m WBR = 5 m NBL = 5 m NBT = 0 m NBT = 0 m NBR = 0 m SBL = 5 m SBT = 0 m SBTR = 0 m
Future Total 2034	EBTLR = 0.3 (F) 51 WBL = 0.24 (F) 109 WBR = 0.02 (A) 10 NBL = 0.11 (A) 19 NBT = 0.17 (A) 0 NBT = 0.17 (A) 0 NBR = 0.03 (A) 0 SBL = 0.07 (A) 9 SBT = 0.47 (A) 0 SBTR = 0.24 (A) 0	EBTLR = 10 m WBL = 10 m WBR = 5 m NBL = 5 m NBT = 0 m NBT = 0 m NBR = 0 m SBL = 5 m SBT = 0 m SBTR = 0 m	EBTLR = 0.56 (F) 114 WBL = 1.07 (F) 253 WBR = 0.15 (A) 14 NBL = 0.03 (A) 11 NBT = 0.34 (A) 0 NBT = 0.34 (A) 0 NBR = 0.01 (A) 0 SBL = 0.01 (A) 12 SBT = 0.3 (A) 0 SBTR = 0.16 (A) 0	EBTLR = 20 m WBL = 40 m WBR = 5 m NBL = 5 m NBT = 0 m NBT = 0 m NBR = 0 m SBL = 5 m SBT = 0 m SBTR = 0 m

Under existing traffic conditions, the intersection operates at a satisfactory level with the highest delay occurring in the westbound left-turn movement. During the a.m. peak hour, the movement operates with a 32 second delay and with a 73 second delay during the p.m. peak hour.

With the addition of corridor growth under the 2029 future background traffic scenario, the highest delay continues to be reported in the westbound left-turn movement with a 49 second delay during the a.m. peak hour and 121 second delay during the p.m. peak hour which increases due to the additional volume of traffic along Bramalea Road.

Under the 2029 future total traffic condition, with the addition of site generated traffic from Line 1 of the facility and closure of the existing building, the intersection continues to operate at mostly satisfactory levels however the eastbound left/right turn out of the facility is reported to operate at LOS E during the p.m. peak hour and the westbound left turn at LOS F as a result of the volume of through traffic along Bramalea Road and availability of gaps in the traffic flow.

With the addition of corridor growth during the 2034 future background horizon period, the westbound left-turn movement continues to report the highest delay with an 80 second delay (LOS E) during the a.m. peak hour and 151 second delay (LOS F) during the p.m. peak hour. The outbound movement from the facility is reported to also reported to operate with increased delays, however, considerably less with a delay of 35 seconds (LOS D) during the a.m. peak hour and 44 seconds (LOS E) during the p.m. peak hour.

Under the 2034 future total traffic condition, with the addition of site generated traffic from Lines 1, 2 and 3, the intersection is reported critical movements for the eastbound left/right out of the site with a 51 second delay (LOS F) during the a.m. peak hour and 114 seconds (LOS F) during the p.m. peak hour. The westbound left at the intersection is reporting considerably higher delays with a delay of 109 seconds (LOS F) during the a.m. peak hour and 253 seconds (LOS F) during the p.m. peak hour.

The high delays are a result of through traffic on Bramalea Road and mitigation measures are limited considering the intersection geometry already provides turning lanes on Bramalea Road. No geometric improvements are recommended at this intersection as a result of the proposed development; however, a traffic signal warrant and sensitivity analysis were completed in **Section 5.2.2** based on the signalization of the intersection.

5.2 Traffic Net Effects

This Section provides an assessment of the potential negative environmental effects (i.e., those for which a “Yes” answer was given in the Screening Criteria Checklist) for those Traffic criteria which might be affected by the project as identified in **Section 2**. The effects assessment describes how existing environmental conditions in the Study Area(s) would change as a result of the construction and operation of the proposed undertaking.

As described in **Section 2**, a “Yes” was applied to the following Traffic criteria:

Table 5.5 Screening Criteria Checklist

	Criterion	YES	NO	Additional Information
	Might the project…			
Transportation				
6.8	Cause negative effects related to traffic?	X		The proposed EFW Facility expansion would increase the traffic beyond the existing levels and is expected to be acceptable relative to local traffic volumes.

With respect to the above criteria/criterion, a description of the potential negative environmental effects, necessary mitigation measures and the resultant net effects on the environment are discussed. Studies conducted during the screening showed that the anticipated effects will be much less than expected or will not occur at all. In all cases, impact management (mitigation) measures have been identified that, when applied, will eliminate the potential environmental effects, or reduce them to acceptable levels.

5.2.1 Potential Effects in Traffic Environment

The proposed expansion to the facility is not expected to increase traffic to a point where operations of the study intersections would be unacceptable. The increase in site traffic due to the opening of Line 1 in 2029 and of Lines 2 and 3 in 2034 can be accommodated at the study intersections. The mitigation measure identified for the outbound site driveway from the facility which is opposite the access to 7653-7639 Bramalea Road has been identified to mitigate potential capacity issues for the existing developments at 7653-7639 Bramalea Road and are required whether or not the Emerald Facility expansion proceeds. The access to 7653-7639 Bramalea Road is reported to operate with a v/c ratio of 0.83 LOS F and a 151 second delay during the p.m. peak hour under the 2034 Background traffic scenario.

5.2.2 Mitigation Measures

A signal warrant analysis was completed based on the 2034 future total volumes and concluded that traffic signals are not warranted. However, a sensitivity analysis was completed for the 2034 Future Total scenario assuming the intersection was signalized. The results of the analysis are provided below.

Bramalea Road and the Site Access/Private Access

Capacity analysis at this intersection during the weekday a.m. and p.m. peak hours for the future total traffic conditions are summarized in the following table.

Table 5.6 Capacity analysis of Bramalea Road and the Site Access/Private Access (Sensitivity Analysis)

Scenario	Am Peak Hour		PM Peak Hour	
	V/C (LOS) seconds	95th % Que.	V/C (LOS) seconds	95th % Que
Future Total 2034	Overall: 0.44 (A) 3 EBTLR = 0.02 (C) 25 WBL = 0.18 (C) 27 WBR = 0.01 (C) 25 NBL = 0.18 (A) 4 NBT = 0.28 (A) 2 NBR = 0.04 (A) 2 SBL = 0.11 (A) 2 SBTR = 0.46 (A) 3	 EBTLR = 5 m WBL = 5 m WBR = 5 m NBL = 5 m NBT = 15 m NBR = 5 m SBL = 5 m SBTR = 40 m	Overall: 0.48 (A) 6 EBTLR = 0.04 (C) 21 WBL = 0.41 (C) 24 WBR = 0.08 (C) 21 NBL = 0.05 (A) 3 NBT = 0.5 (A) 5 NBR = 0.01 (A) 3 SBL = 0.03 (A) 3 SBTR = 0.36 (A) 4	 EBTLR = 5 m WBL = 15 m WBR = 10 m NBL = 5 m NBT = 45 m NBR = 5 m SBL = 5 m SBTR = 30 m

Under the 2034 future condition, the intersection of Bramalea Road with the site access and the access to 7653-7639 Bramalea Road was assumed to be signalized with a 60 second cycle length. As a signalized intersection, it operates with an overall v/c ratio of 0.44 LOS A during the a.m. peak hour and 0.48 LOS A during the p.m. peak hour. The westbound left-turn movement operates below capacity during both peak hours (operated over capacity during the p.m. peak hour as an unsignalized intersection) with a delay of 27 seconds during the a.m. peak hour and 24 seconds during the p.m. peak hour.

It is recommended that the City continue to monitor this access and review the operation of the intersection under future conditions to determine if/when signalization of the intersection is warranted to mitigate delays.

5.2.3 Collision Data

GHD requested collision data from the City of Brampton for the last 5 years along Bramalea Road from Steeles Avenue to Derry Road. The collision data was reviewed to determine the number of and type of collisions that have occurred along Bramalea Road and to determine if the proposed increase in site generated traffic would result in an increase in the number of collisions in the future.

The City of Brampton provided two sets of data, which were labelled Bramalea Road - 407 E and Bramalea Road - 407 W. As confirmed with City staff, this is all of the available collision history data available along Bramalea Road from Steeles Avenue and Derry Road and it is limited to several collisions at the two Highway 407 off-ramp intersections.

A summary of the data is provided in **Figure 5.7**for the eastbound Highway 407 off-ramp and in **Figure 5.8** for the westbound Highway 407 off-ramp.

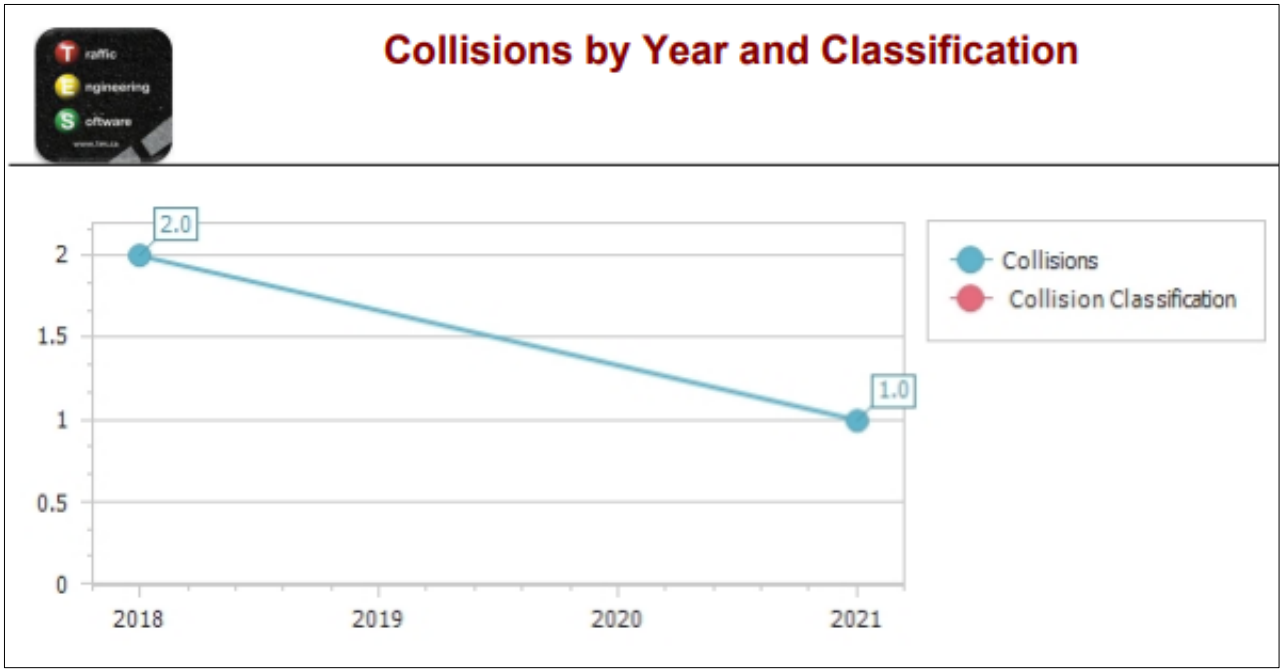


Figure 5.7 Highway 407 Eastbound Off-Ramp at Bramalea Road Collision History

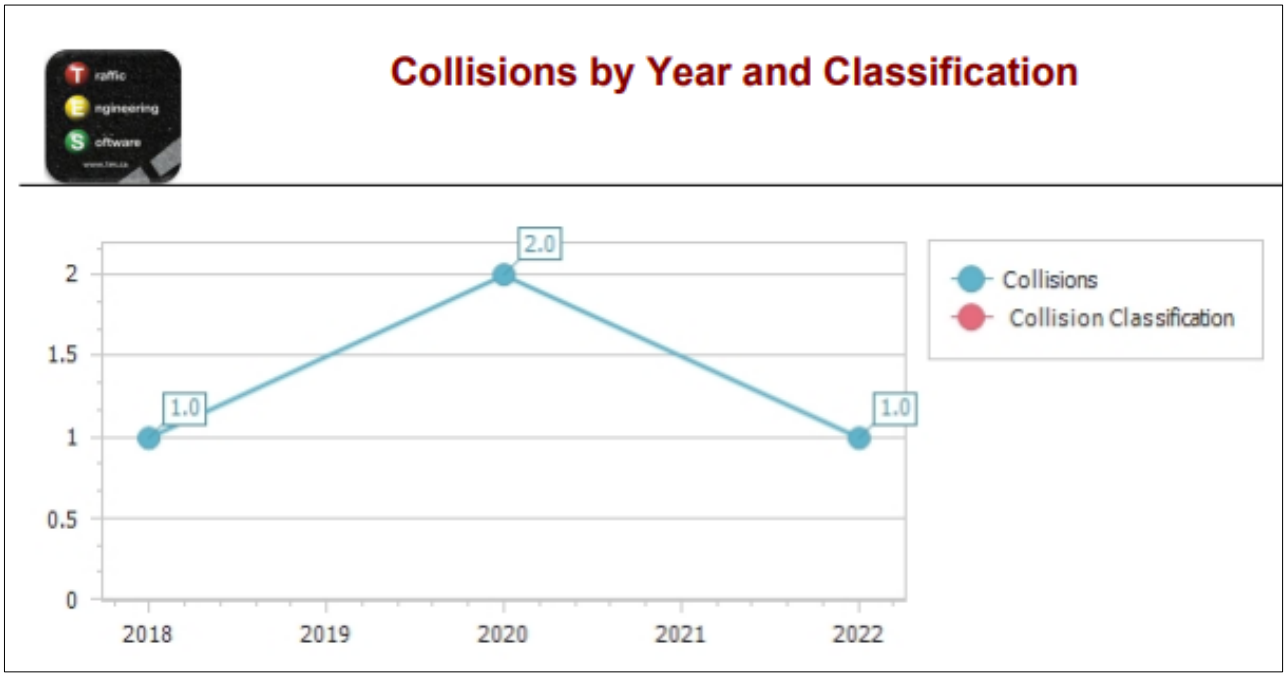


Figure 5.8 Highway 407 Westbound Off-Ramp at Bramalea Road Collision History

As shown in the figures above, the highest number of recorded collisions occurring over a single year is 2 collisions, which occurred in 2018 for the eastbound off-ramp and in 2020 for the westbound off-ramp. Over the five year period there has only been three reported collisions at the Highway 407 eastbound off-ramp and four reported collisions at the Highway 407 westbound off-ramp. A detailed summary of the collisions is provided in the **Appendix C**.

In reviewing the details of each collision, it was noted that all of the recorded collisions involved passenger vehicles and not trucks. Additionally, in most cases the collisions were a result of driver error, and all resulted in only property damage or non-fatal injuries.

The subject site is anticipated to generate an additional 80 and 75 new two-way trips during the a.m. and p.m. peak hours, respectively, under the full build-out year. The historical collision data suggests that the road has been accommodating truck traffic safely along Bramalea Road and existing intersections and driveways. Consequently, while we acknowledge the increase in truck trips due to the facility expansion, the data would suggest that the projected increase in truck traffic of approximately one inbound and one outbound truck per minutes over the peak hours will not lead to any noticeable increase in collision frequency rates in the area as a proportion of the yearly traffic volumes.

5.2.4 Net Effects

The proposed expansion to the subject site has a marginal impact on the operation of the study intersections with the capacity issues identified at the site access and the access to 7653-7639 Bramalea Road resulting predominately from the increase in corridor growth along Bramalea Road.

A signal warrant for the intersection was completed, however traffic signals were not warranted based on the 2034 future total volumes. A sensitivity analysis was completed for the intersection which included traffic signals which confirmed that the signalization of the intersection would mitigate the large delays critical movements for the eastbound and westbound left turn onto Bramalea Road during the a.m. and p.m. peak hours.

6. Monitoring Requirements and Additional Approvals

To ensure that the potential mitigation measures identified in **Section 5.2** are implemented as envisioned, a strategy and schedule should be developed for monitoring environmental effects. With these mitigation measures and monitoring requirements in mind, commitments have also been proposed for ensuring that they are carried out as part of the construction, operation, and maintenance of the proposed undertaking.

6.1 Monitoring Requirements

The only mitigation measure identified in **Section 4.5** is the signalization of the site access if/when the City is satisfied that warrants are met. It is recommended that the City monitor the transportation effects at the site driveway under future traffic conditions and implement the improvements when they are warranted.

6.2 Additional Approvals

No additional approvals are required for transportation.

7. Conclusion

The subject site consists of a waste-to-energy facility with a current annual capacity of 150,000 tonnes of waste.

Access to the subject site is provided via a right-in access and a full-moves access, both located along Bramalea Road.

Based on current operations, the subject site generates a total of 16 two-way trips consisting of 11 inbound and 5 outbound trips during weekday a.m. peak hour and 15 two-way trips consisting of 9 inbound and 6 outbound trips during the weekday p.m. peak hour.

The subject site is anticipated to generate a total of 32 two-way trips consisting of 22 inbound and 10 outbound trips during weekday a.m. peak hour and 30 two-way trips consisting of 18 inbound and 12 outbound trips during the weekday p.m. peak hour under the 2029 horizon year.

The subject site is anticipated to generate a total of 96 two-way trips consisting of 66 inbound and 30 outbound trips during weekday a.m. peak hour and 90 two-way trips consisting of 54 inbound and 36 outbound trips during the weekday p.m. peak hour under the 2034 horizon year.

Under existing traffic conditions, all intersections are operating at acceptable v/c ratios and levels of service during the a.m. peak and p.m. peak hours.

Under the 2029 future background conditions, all intersections are reported to continue to operate with acceptable v/c ratios, delays and queuing.

With the addition of site generated traffic under the 2029 future total condition, all intersections are reported to continue to operate with acceptable v/c ratios, delays and queuing.

Under the 2034 future background conditions, all intersections are reported to continue to operate with acceptable v/c ratios, delays and queuing.

With the addition of site generated traffic under the 2034 future total condition, the following intersection movements are reported as critical.

– Bramalea Road and the full-moves site access/private access
    - The westbound left-turn movement with a v/c ratio of 1.07 LOS F and a 253 second delay during the p.m. peak hour

The collision data provided by the City of Brampton was reviewed for the section of Bramalea Road from Steeles Avenue to Derry Road. The data suggests that only seven collisions were reported over the last five years and all of them were at the Highway 407 ramp terminals.

The historical collision data suggests that the road has been accommodating truck traffic safely along Bramalea Road and existing intersections and driveways. Consequently, while we acknowledge the increase in truck trips due to the facility expansion, the data would suggest that the projected increase in truck traffic will not lead to any noticeable increase in the frequency of collisions in the area as a proportion of the yearly traffic volumes.

A signal warrant was completed for the site access and confirmed that traffic signals are not warranted for the intersection. However, a sensitivity analysis was completed for the intersection despite not meeting the signal warrant and resulted in a reduction of delays along the minor approach in addition to all movements operating below capacity.

The traffic study confirms that the proposed waste-to-energy facility can be accommodated on the existing road network.

Appendices

Appendix A

Traffic Data

GHD
UNIT 1 705 MILLCREEK DRIVE
MISSISSAUGA ONTARIO, L5N 5M4
CANADA

Turning Movement Count (1 . BRAMALEA RD & HIGHWAY 407 WB OFF RAMP)

Start Time	N Approach BRAMALEA RD					E Approach HWY 407 WB OFF RAMP					S Approach BRAMALEA RD					Int. Total (15 min)	Int. Total (1 hr)
	Thru N:S	Left N:E	UTurn N:N	Peds N:	Approach Total	Right E:N	Left E:S	UTurn E:E	Peds E:	Approach Total	Right S:E	Thru S:N	UTurn S:S	Peds S:	Approach Total		
07:00:00	160	0	1	0	161	14	15	0	0	29	0	59	0	0	59	249	
07:15:00	147	0	0	0	147	11	26	0	0	37	0	71	0	0	71	255	
07:30:00	191	0	1	0	192	14	31	0	0	45	0	67	0	0	67	304	
07:45:00	192	0	0	0	192	20	27	0	1	47	0	63	0	0	63	302	1110
08:00:00	198	0	0	0	198	21	35	0	0	56	0	67	0	0	67	321	1182
08:15:00	177	0	2	0	179	15	17	0	0	32	0	78	0	0	78	289	1216
08:30:00	182	0	0	0	182	24	25	0	1	49	0	73	0	0	73	304	1216
08:45:00	174	0	0	0	174	16	33	0	0	49	0	65	0	0	65	288	1202
BREAK																	
16:00:00	126	0	1	0	127	29	18	0	0	47	0	228	0	0	228	402	
16:15:00	125	0	1	0	126	30	17	1	0	48	0	220	0	0	220	394	
16:30:00	125	0	0	0	125	29	15	0	0	44	0	244	0	0	244	413	
16:45:00	128	0	0	0	128	34	16	0	1	50	0	223	0	0	223	401	1610
17:00:00	109	0	0	0	109	25	11	0	0	36	0	240	1	0	241	386	1594
17:15:00	115	0	1	0	116	26	14	0	0	40	0	197	0	0	197	353	1553
17:30:00	103	0	0	0	103	24	6	0	0	30	0	213	0	0	213	346	1486
17:45:00	99	0	0	0	99	22	15	0	0	37	0	193	0	0	193	329	1414
Grand Total	2351	0	7	0	2358	354	321	1	3	676	0	2301	1	0	2302	**5336**	-
Approach%	99.7%	0%	0.3%		-	52.4%	47.5%	0.1%		-	0%	100%	0%		-	**-**	-
Totals %	44.1%	0%	0.1%		44.2%	6.6%	6%	0%		12.7%	0%	43.1%	0%		43.1%	**-**	-
Heavy	269	0	0		-	72	52	1		-	0	373	0		-	**-**	-
Heavy %	11.4%	0%	0%		-	20.3%	16.2%	100%		-	0%	16.2%	0%		-	**-**	-
Bicycles	-	-	-		-	-	-	-		-	-	-	-		-	**-**	-
Bicycle %	-	-	-		-	-	-	-		-	-	-	-		-	**-**	-

GHD
UNIT 1 705 MILLCREEK DRIVE
MISSISSAUGA ONTARIO, L5N 5M4
CANADA

Peak Hour: 07:45 AM - 08:45 AM Weather: Few Clouds (18.58 °C)

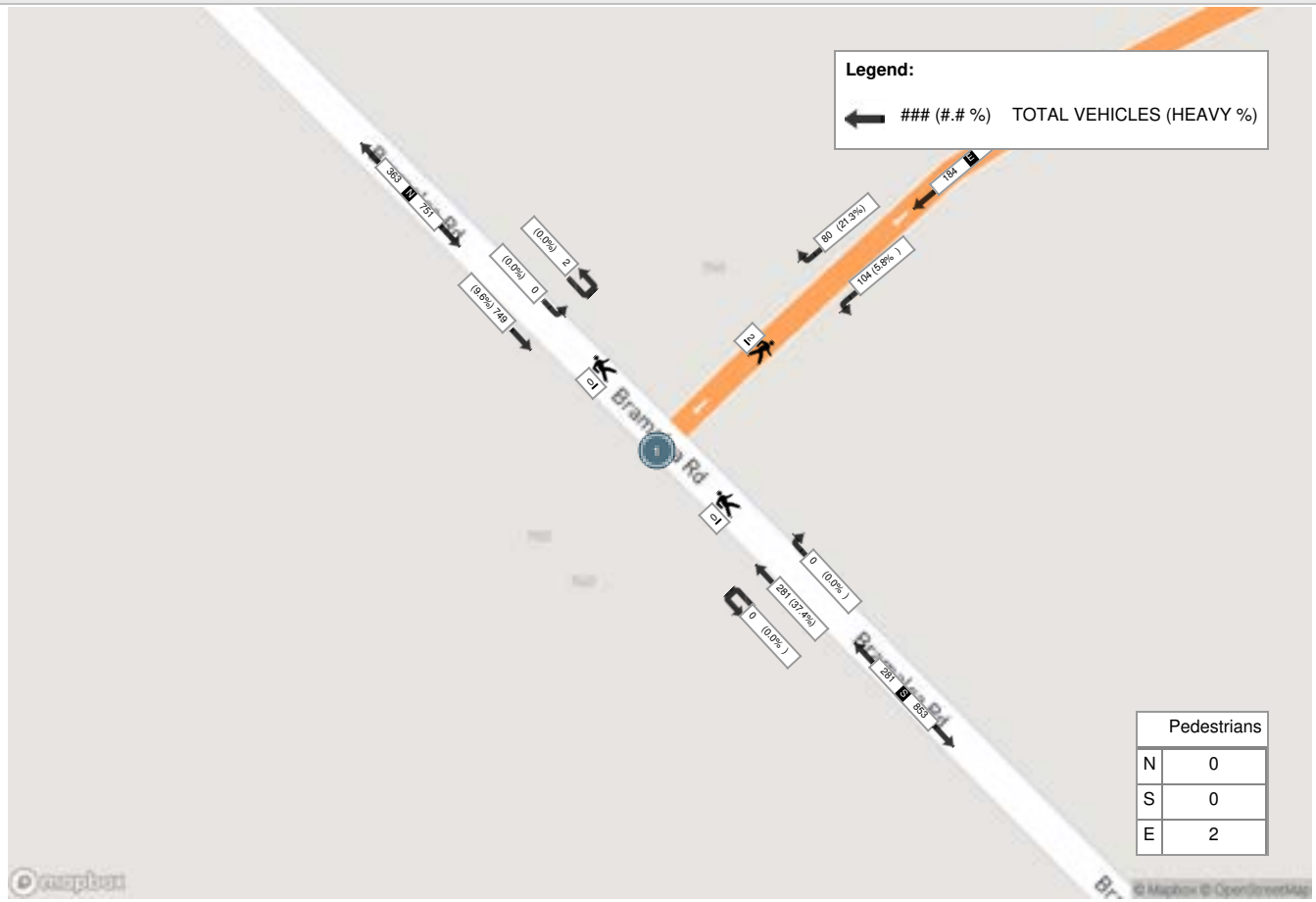
Start Time	N Approach BRAMALEA RD					E Approach HWY 407 WB OFF RAMP					S Approach BRAMALEA RD					Int. Total (15 min)
	Thru	Left	UTurn	Peds	Approach Total	Right	Left	UTurn	Peds	Approach Total	Right	Thru	UTurn	Peds	Approach Total	
07:45:00	192	0	0	0	192	20	27	0	1	47	0	63	0	0	63	302
08:00:00	198	0	0	0	198	21	35	0	0	56	0	67	0	0	67	321
08:15:00	177	0	2	0	179	15	17	0	0	32	0	78	0	0	78	289
08:30:00	182	0	0	0	182	24	25	0	1	49	0	73	0	0	73	304
Grand Total	749	0	2	0	751	80	104	0	2	184	0	281	0	0	281	**1216**
Approach%	99.7%	0%	0.3%		-	43.5%	56.5%	0%		-	0%	100%	0%		-	**-**
Totals %	61.6%	0%	0.2%		61.8%	6.6%	8.6%	0%		15.1%	0%	23.1%	0%		23.1%	**-**
PHF	0.95	0	0.25		0.95	0.83	0.74	0		0.82	0	0.9	0		0.9	**-**
Heavy	72	0	0		72	17	6	0		23	0	105	0		105	**-**
Heavy %	9.6%	0%	0%		9.6%	21.3%	5.8%	0%		12.5%	0%	37.4%	0%		37.4%	**-**
Lights	677	0	2		679	63	98	0		161	0	176	0		176	**-**
Lights %	90.4%	0%	100%		90.4%	78.8%	94.2%	0%		87.5%	0%	62.6%	0%		62.6%	**-**
Single-Unit Trucks	23	0	0		23	3	2	0		5	0	22	0		22	**-**
Single-Unit Trucks %	3.1%	0%	0%		3.1%	3.8%	1.9%	0%		2.7%	0%	7.8%	0%		7.8%	**-**
Buses	22	0	0		22	14	0	0		14	0	6	0		6	**-**
Buses %	2.9%	0%	0%		2.9%	17.5%	0%	0%		7.6%	0%	2.1%	0%		2.1%	**-**
Articulated Trucks	27	0	0		27	0	4	0		4	0	77	0		77	**-**
Articulated Trucks %	3.6%	0%	0%		3.6%	0%	3.8%	0%		2.2%	0%	27.4%	0%		27.4%	**-**
Bicycles on Road	0	0	0		0	0	0	0		0	0	0	0		0	**-**
Bicycles on Road %	0%	0%	0%		0%	0%	0%	0%		0%	0%	0%	0%		0%	**-**
Pedestrians	-	-	-	0	-	-	-	-	2	-	-	-	-	0	-	**-**
Pedestrians%	-	-	-	0%		-	-	-	100%		-	-	-	0%		**-**

GHD
UNIT 1 705 MILLCREEK DRIVE
MISSISSAUGA ONTARIO, L5N 5M4
CANADA

Peak Hour: 04:00 PM - 05:00 PM Weather: Broken Clouds (28.85 °C)

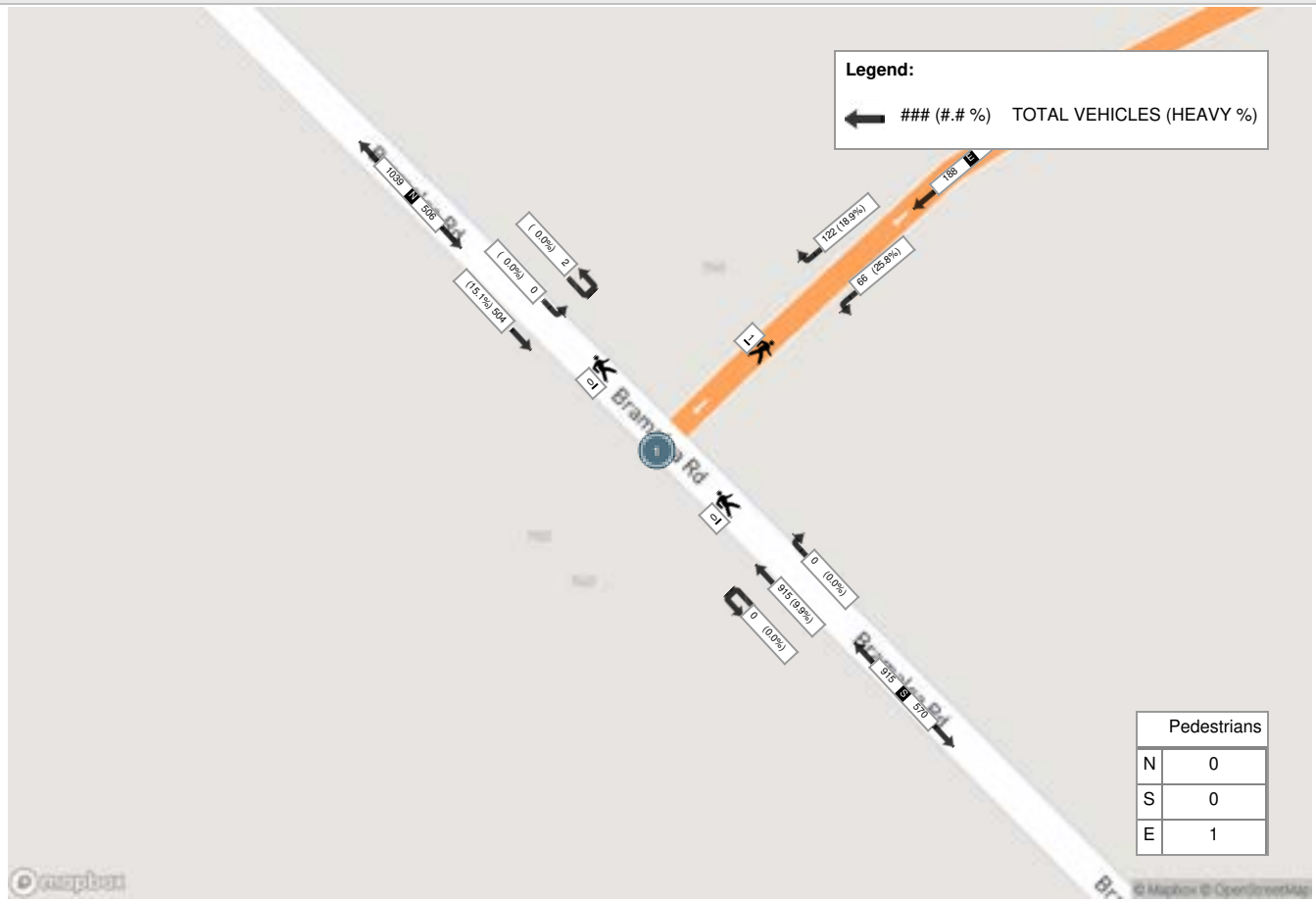
Start Time	N Approach BRAMALEA RD					E Approach HWY 407 WB OFF RAMP					S Approach BRAMALEA RD					Int. Total (15 min)
	Thru	Left	UTurn	Peds	Approach Total	Right	Left	UTurn	Peds	Approach Total	Right	Thru	UTurn	Peds	Approach Total	
16:00:00	126	0	1	0	127	29	18	0	0	47	0	228	0	0	228	402
16:15:00	125	0	1	0	126	30	17	1	0	48	0	220	0	0	220	394
16:30:00	125	0	0	0	125	29	15	0	0	44	0	244	0	0	244	413
16:45:00	128	0	0	0	128	34	16	0	1	50	0	223	0	0	223	401
Grand Total	504	0	2	0	506	122	66	1	1	189	0	915	0	0	915	**1610**
Approach%	99.6%	0%	0.4%		-	64.6%	34.9%	0.5%		-	0%	100%	0%		-	**-**
Totals %	31.3%	0%	0.1%		31.4%	7.6%	4.1%	0.1%		11.7%	0%	56.8%	0%		56.8%	**-**
PHF	0.98	0	0.5		0.99	0.9	0.92	0.25		0.95	0	0.94	0		0.94	**-**
Heavy	76	0	0		76	23	17	1		41	0	91	0		91	**-**
Heavy %	15.1%	0%	0%		15%	18.9%	25.8%	100%		21.7%	0%	9.9%	0%		9.9%	**-**
Lights	428	0	2		430	99	49	0		148	0	823	0		823	**-**
Lights %	84.9%	0%	100%		85%	81.1%	74.2%	0%		78.3%	0%	89.9%	0%		89.9%	**-**
Single-Unit Trucks	39	0	0		39	3	10	1		14	0	31	0		31	**-**
Single-Unit Trucks %	7.7%	0%	0%		7.7%	2.5%	15.2%	100%		7.4%	0%	3.4%	0%		3.4%	**-**
Buses	14	0	0		14	17	0	0		17	0	3	0		3	**-**
Buses %	2.8%	0%	0%		2.8%	13.9%	0%	0%		9%	0%	0.3%	0%		0.3%	**-**
Articulated Trucks	23	0	0		23	3	7	0		10	0	57	0		57	**-**
Articulated Trucks %	4.6%	0%	0%		4.5%	2.5%	10.6%	0%		5.3%	0%	6.2%	0%		6.2%	**-**
Bicycles on Road	0	0	0		0	0	0	0		0	0	1	0		1	**-**
Bicycles on Road %	0%	0%	0%		0%	0%	0%	0%		0%	0%	0.1%	0%		0.1%	**-**
Pedestrians	-	-	-	0	-	-	-	-	1	-	-	-	-	0	-	**-**
Pedestrians%	-	-	-	0%		-	-	-	100%		-	-	-	0%		**-**

Peak Hour: 07:45 AM - 08:45 AM Weather: Few Clouds (18.58 °C)



GHD
UNIT 1 705 MILLCREEK DRIVE
MISSISSAUGA ONTARIO, L5N 5M4
CANADA

Peak Hour: 04:00 PM - 05:00 PM Weather: Broken Clouds (28.85 °C)



GHD
UNIT 1 705 MILLCREEK DRIVE
MISSISSAUGA ONTARIO, L5N 5M4
CANADA

Turning Movement Count (2 . BRAMALEA RD & RIGHT-IN ACCESS)

Start Time	N Approach BRAMALEA RD					S Approach BRAMALEA RD					W Approach 7656 BRAMALEA RD ACCESS					Int. Total (15 min)	Int. Total (1 hr)
	Right N:W	Thru N:S	UTurn N:N	Peds N:	Approach Total	Thru S:N	Left S:W	UTurn S:S	Peds S:	Approach Total	Right W:S	Left W:N	UTurn W:W	Peds W:	Approach Total		
07:00:00	0	172	0	0	172	68	0	0	0	68	0	0	0	0	0	240	
07:15:00	1	143	0	0	144	72	0	0	0	72	0	0	0	0	0	216	
07:30:00	2	214	0	0	216	77	0	0	0	77	0	0	0	1	0	293	
07:45:00	0	184	0	0	184	74	0	0	0	74	0	0	0	0	0	258	1007
08:00:00	0	224	0	0	224	88	0	0	1	88	0	0	0	1	0	312	1079
08:15:00	2	174	0	0	176	88	0	0	0	88	0	0	0	0	0	264	1127
08:30:00	3	180	0	0	183	84	0	0	0	84	0	0	0	0	0	267	1101
08:45:00	0	197	0	0	197	77	0	0	0	77	0	0	0	1	0	274	1117
BREAK																	
16:00:00	0	128	0	0	128	256	0	1	0	257	0	0	0	2	0	385	
16:15:00	1	117	3	0	121	244	0	0	0	244	0	0	0	0	0	365	
16:30:00	1	122	0	0	123	275	0	0	0	275	0	0	0	0	0	398	
16:45:00	1	115	3	0	119	258	0	0	0	258	0	0	0	0	0	377	1525
17:00:00	3	95	1	0	99	290	0	0	0	290	0	0	0	0	0	389	1529
17:15:00	0	106	0	0	106	209	0	0	0	209	0	0	0	0	0	315	1479
17:30:00	2	92	1	0	95	245	0	0	0	245	0	0	0	0	0	340	1421
17:45:00	2	95	0	0	97	212	0	0	0	212	0	0	0	2	0	309	1353
Grand Total	18	2358	8	0	2384	2617	0	1	1	2618	0	0	0	7	0	**5002**	-
Approach%	0.8%	98.9%	0.3%		-	100%	0%	0%		-	0%	0%	0%		-	**-**	-
Totals %	0.4%	47.1%	0.2%		47.7%	52.3%	0%	0%		52.3%	0%	0%	0%		0%	**-**	-
Heavy	7	241	0		-	433	0	0		-	0	0	0		-	**-**	-
Heavy %	38.9%	10.2%	0%		-	16.5%	0%	0%		-	0%	0%	0%		-	**-**	-
Bicycles	-	-	-		-	-	-	-		-	-	-	-		-	**-**	-
Bicycle %	-	-	-		-	-	-	-		-	-	-	-		-	**-**	-

GHD
UNIT 1 705 MILLCREEK DRIVE
MISSISSAUGA ONTARIO, L5N 5M4
CANADA

Peak Hour: 07:30 AM - 08:30 AM Weather: Few Clouds (18.58 °C)

Start Time	N Approach BRAMALEA RD					S Approach BRAMALEA RD					W Approach 7656 BRAMALEA RD ACCESS					Int. Total (15 min)
	Right	Thru	UTurn	Peds	Approach Total	Thru	Left	UTurn	Peds	Approach Total	Right	Left	UTurn	Peds	Approach Total	
07:30:00	2	214	0	0	216	77	0	0	0	77	0	0	0	1	0	293
07:45:00	0	184	0	0	184	74	0	0	0	74	0	0	0	0	0	258
08:00:00	0	224	0	0	224	88	0	0	1	88	0	0	0	1	0	312
08:15:00	2	174	0	0	176	88	0	0	0	88	0	0	0	0	0	264
Grand Total	4	796	0	0	800	327	0	0	1	327	0	0	0	2	0	**1127**
Approach%	0.5%	99.5%	0%		-	100%	0%	0%		-	0%	0%	0%		-	**-**
Totals %	0.4%	70.6%	0%		71%	29%	0%	0%		29%	0%	0%	0%		0%	**-**
PHF	0.5	0.89	0		0.89	0.93	0	0		0.93	0	0	0		0	**-**
Heavy	1	57	0		58	111	0	0		111	0	0	0		0	**-**
Heavy %	25%	7.2%	0%		7.3%	33.9%	0%	0%		33.9%	0%	0%	0%		0%	**-**
Lights	3	739	0		742	216	0	0		216	0	0	0		0	**-**
Lights %	75%	92.8%	0%		92.8%	66.1%	0%	0%		66.1%	0%	0%	0%		0%	**-**
Single-Unit Trucks	0	21	0		21	40	0	0		40	0	0	0		0	**-**
Single-Unit Trucks %	0%	2.6%	0%		2.6%	12.2%	0%	0%		12.2%	0%	0%	0%		0%	**-**
Buses	0	7	0		7	6	0	0		6	0	0	0		0	**-**
Buses %	0%	0.9%	0%		0.9%	1.8%	0%	0%		1.8%	0%	0%	0%		0%	**-**
Articulated Trucks	1	29	0		30	65	0	0		65	0	0	0		0	**-**
Articulated Trucks %	25%	3.6%	0%		3.8%	19.9%	0%	0%		19.9%	0%	0%	0%		0%	**-**
Bicycles on Road	0	0	0		0	0	0	0		0	0	0	0		0	**-**
Bicycles on Road %	0%	0%	0%		0%	0%	0%	0%		0%	0%	0%	0%		0%	**-**
Pedestrians	-	-	-	0	-	-	-	-	1	-	-	-	-	2	-	**-**
Pedestrians%	-	-	-	0%		-	-	-	33.3%		-	-	-	66.7%		**-**
Bicycles on Crosswalk	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	**-**
Bicycles on Crosswalk%	-	-	-	0%		-	-	-	0%		-	-	-	0%		**-**

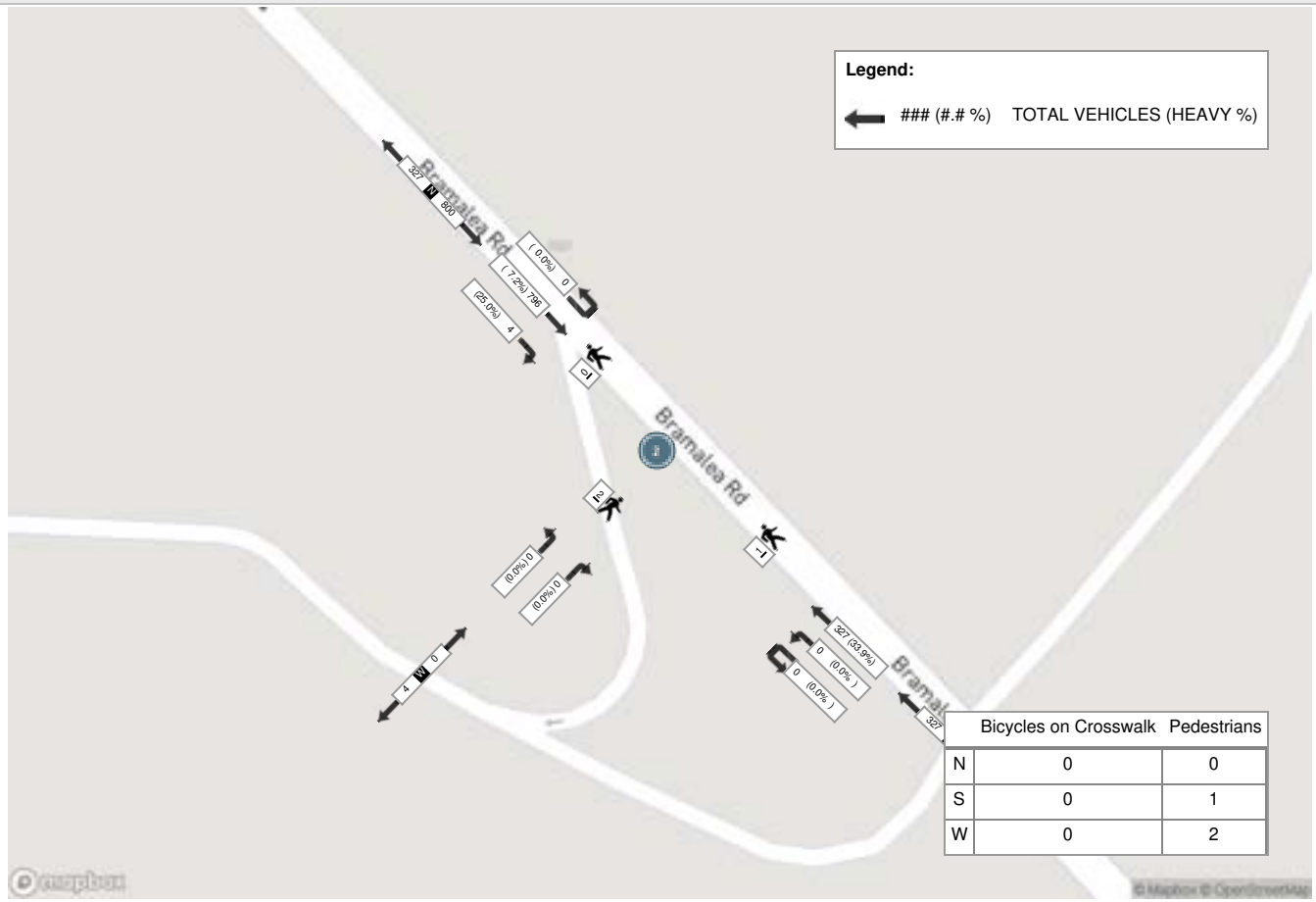
GHD
UNIT 1 705 MILLCREEK DRIVE
MISSISSAUGA ONTARIO, L5N 5M4
CANADA

Peak Hour: 04:15 PM - 05:15 PM Weather: Broken Clouds (28.85 °C)

Start Time	N Approach BRAMALEA RD					S Approach BRAMALEA RD					W Approach 7656 BRAMALEA RD ACCESS					Int. Total (15 min)
	Right	Thru	UTurn	Peds	Approach Total	Thru	Left	UTurn	Peds	Approach Total	Right	Left	UTurn	Peds	Approach Total	
16:15:00	1	117	3	0	121	244	0	0	0	244	0	0	0	0	0	365
16:30:00	1	122	0	0	123	275	0	0	0	275	0	0	0	0	0	398
16:45:00	1	115	3	0	119	258	0	0	0	258	0	0	0	0	0	377
17:00:00	3	95	1	0	99	290	0	0	0	290	0	0	0	0	0	389
Grand Total	6	449	7	0	462	1067	0	0	0	1067	0	0	0	0	0	**1529**
Approach%	1.3%	97.2%	1.5%		-	100%	0%	0%		-	0%	0%	0%		-	**-**
Totals %	0.4%	29.4%	0.5%		30.2%	69.8%	0%	0%		69.8%	0%	0%	0%		0%	**-**
PHF	0.5	0.92	0.58		0.94	0.92	0	0		0.92	0	0	0		0	**-**
Heavy	5	67	0		72	100	0	0		100	0	0	0		0	**-**
Heavy %	83.3%	14.9%	0%		15.6%	9.4%	0%	0%		9.4%	0%	0%	0%		0%	**-**
Lights	1	382	7		390	966	0	0		966	0	0	0		0	**-**
Lights %	16.7%	85.1%	100%		84.4%	90.5%	0%	0%		90.5%	0%	0%	0%		0%	**-**
Single-Unit Trucks	5	38	0		43	36	0	0		36	0	0	0		0	**-**
Single-Unit Trucks %	83.3%	8.5%	0%		9.3%	3.4%	0%	0%		3.4%	0%	0%	0%		0%	**-**
Buses	0	4	0		4	4	0	0		4	0	0	0		0	**-**
Buses %	0%	0.9%	0%		0.9%	0.4%	0%	0%		0.4%	0%	0%	0%		0%	**-**
Articulated Trucks	0	25	0		25	60	0	0		60	0	0	0		0	**-**
Articulated Trucks %	0%	5.6%	0%		5.4%	5.6%	0%	0%		5.6%	0%	0%	0%		0%	**-**
Bicycles on Road	0	0	0		0	1	0	0		1	0	0	0		0	**-**
Bicycles on Road %	0%	0%	0%		0%	0.1%	0%	0%		0.1%	0%	0%	0%		0%	**-**
Pedestrians	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	**-**
Pedestrians%	-	-	-	0%		-	-	-	0%		-	-	-	0%		**-**
Bicycles on Crosswalk	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	**-**
Bicycles on Crosswalk%	-	-	-	0%		-	-	-	0%		-	-	-	0%		**-**

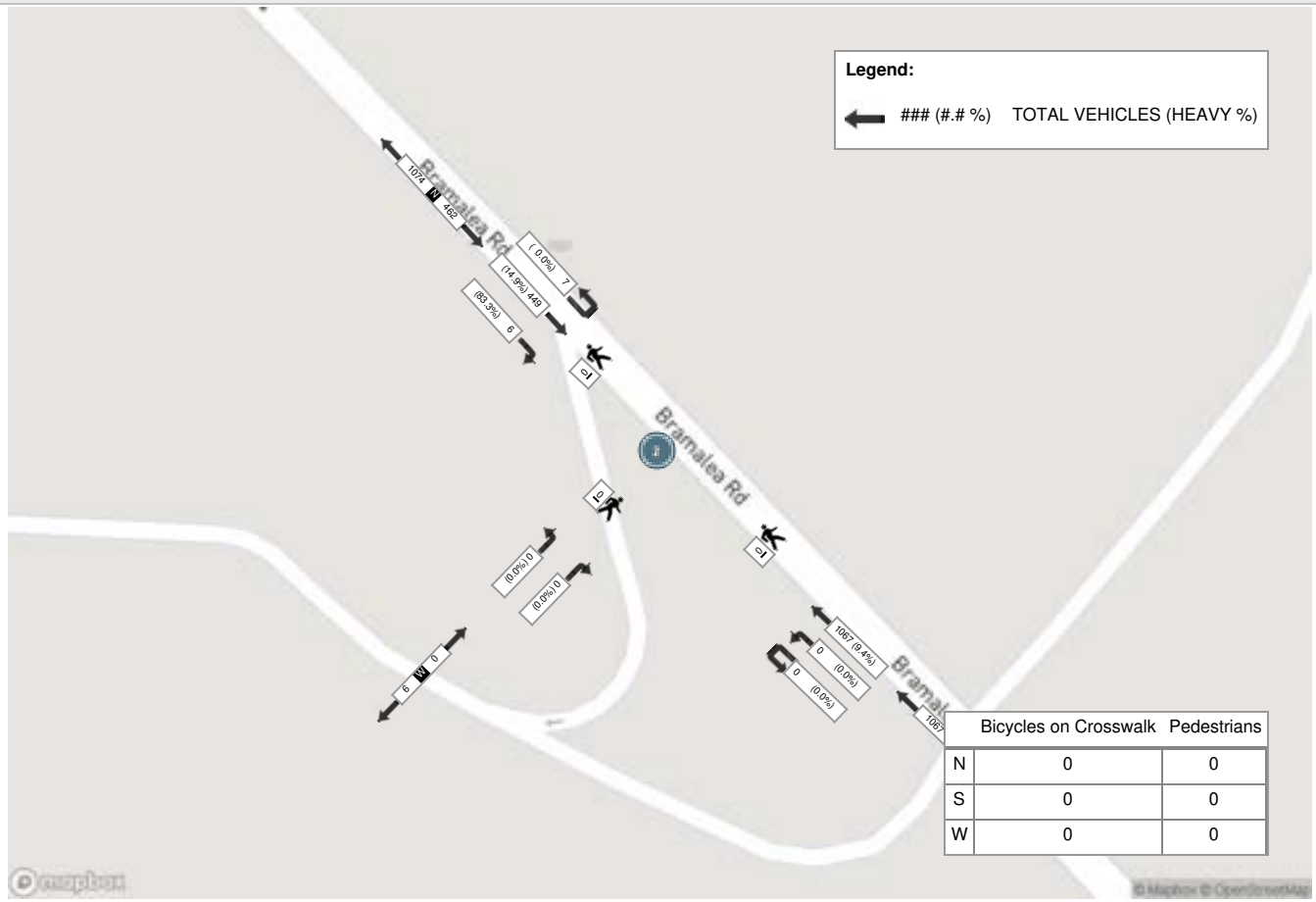
GHD
UNIT 1 705 MILLCREEK DRIVE
MISSISSAUGA ONTARIO, L5N 5M4
CANADA

Peak Hour: 07:30 AM - 08:30 AM Weather: Few Clouds (18.58 °C)



GHD
UNIT 1 705 MILLCREEK DRIVE
MISSISSAUGA ONTARIO, L5N 5M4
CANADA

Peak Hour: 04:15 PM - 05:15 PM Weather: Broken Clouds (28.85 °C)



	Bicycles on Crosswalk	Pedestrians
N	0	0
S	0	0
W	0	0

Spectrum

Turning Movement Count
Location Name: BRAMALEA RD & SITE ACCESS
Date: Tue, Jul 04, 2023 Deployment Lead: Walter Fugaj

GHD
UNIT 1 705 MILLCREEK DRIVE
MISSISSAUGA ONTARIO, L5N 5M4
CANADA

Turning Movement Count (3 . BRAMALEA RD & SITE ACCESS)

Start Time	N Approach BRAMALEA RD							E Approach EAST APPROACH (ACCESS)							S Approach BRAMALEA RD							W Approach WEST APPROACH (ACCESS)						SW Approach SOUTHWEST ACCESS						Int. Total (15 min)	Int. Total (1 hr)
	Right N:W	Bear Right N:SW	Thru N:S	Left N:E	UTurn N:N	Peds N:	Approach Total	Right E:N	Thru E:W	Bear Left E:SW	Left E:S	UTurn E:E	Peds E:	Approach Total	Right S:E	Thru S:N	Left S:W	Hard Left S:SW	UTurn S:S	Peds S:	Approach Total	Right W:S	Thru W:E	Left W:N	UTurn W:W	Peds W:	Approach Total	Hard Right SW:S	Bear Right SW:E	Bear Left SW:N	UTurn SW:SW	Peds SW:	Approach Total		
07:00:00	0	0	163	3	0	0	166	2	0	0	4	0	0	6	5	65	0	0	1	1	71	1	0	0	0	0	1	0	0	0	0	1	0	244	
07:15:00	0	0	136	4	0	0	140	3	0	0	3	0	0	6	9	68	2	0	0	0	79	1	0	0	0	1	1	0	0	0	0	0	0	226	
07:30:00	0	0	206	11	1	0	218	0	0	0	2	0	0	2	8	75	1	0	0	0	84	1	0	0	0	1	1	0	0	0	0	1	0	305	
07:45:00	0	1	166	18	0	0	185	3	0	0	2	0	0	5	13	74	0	1	0	0	88	0	0	2	0	0	2	0	0	0	0	0	0	280	1055
08:00:00	0	1	206	18	2	1	227	6	0	0	3	0	1	9	12	75	1	0	0	0	88	1	0	0	0	0	1	0	0	0	0	0	0	325	1136
08:15:00	0	0	163	9	0	0	172	3	0	0	3	0	0	6	10	85	2	0	0	0	97	1	0	0	0	0	1	0	0	0	0	0	0	276	1186
08:30:00	1	0	164	11	0	0	176	5	0	0	3	0	0	8	7	77	0	0	0	0	84	1	0	0	0	0	1	0	0	0	0	0	0	269	1150
08:45:00	0	0	188	2	0	1	190	2	0	0	5	0	0	7	6	75	0	0	0	0	81	2	0	1	0	0	3	0	0	0	0	0	0	281	1151
BREAK																																			
16:00:00	0	0	135	1	0	0	136	22	0	0	12	0	0	34	3	236	0	0	0	0	239	0	0	1	0	1	1	0	0	0	0	1	0	410	
16:15:00	0	0	110	4	0	0	114	18	0	0	24	0	0	42	4	224	1	0	1	0	230	2	0	0	0	0	2	0	0	0	0	0	0	388	
16:30:00	0	0	113	1	0	0	114	13	0	0	13	0	0	26	3	264	1	0	0	0	268	0	0	2	0	0	2	0	0	0	0	0	0	410	
16:45:00	1	0	110	2	0	0	113	15	0	0	13	0	1	28	3	237	0	0	0	0	240	0	0	1	0	0	1	0	0	0	0	0	0	382	1590
17:00:00	0	0	100	2	2	0	104	26	0	0	8	0	0	34	1	259	1	0	0	0	261	2	0	1	0	0	3	0	0	0	0	0	0	402	1582
17:15:00	0	0	90	6	1	0	97	14	0	0	2	0	0	16	7	196	0	0	0	0	203	1	0	0	0	0	1	0	0	0	0	0	0	317	1511
17:30:00	0	0	91	2	1	0	94	12	0	0	7	0	0	19	4	238	0	0	1	0	243	0	0	0	0	1	0	0	0	0	0	1	0	356	1457
17:45:00	0	0	91	1	1	0	93	5	0	0	1	0	0	6	2	195	0	0	0	0	197	2	0	1	0	3	3	0	0	0	0	3	0	299	1374
Grand Total	2	2	2232	95	8	2	2339	149	0	0	105	0	2	254	97	2443	9	1	3	1	2553	15	0	9	0	7	24	0	0	0	0	7	0	**5170**	-
Approach%	0.1%	0.1%	95.4%	4.1%	0.3%		-	58.7%	0%	0%	41.3%	0%		-	3.8%	95.7%	0.4%	0%	0.1%		-	62.5%	0%	37.5%	0%		-	0%	0%	0%	0%		-	**-**	-
Totals %	0%	0%	43.2%	1.8%	0.2%		45.2%	2.9%	0%	0%	2%	0%		4.9%	1.9%	47.3%	0.2%	0%	0.1%		49.4%	0.3%	0%	0.2%	0%		0.5%	0%	0%	0%	0%		0%	**-**	-
Heavy	2	0	230	8	0		-	11	0	0	25	0		-	28	417	5	0	3		-	13	0	4	0		-	0	0	0	0		-	**-**	-
Heavy %	100%	0%	10.3%	8.4%	0%		-	7.4%	0%	0%	23.8%	0%		-	28.9%	17.1%	55.6%	0%	100%		-	86.7%	0%	44.4%	0%		-	0%	0%	0%	0%		-	**-**	-
Bicycles	-	-	-	-	-		-	-	-	-	-	-		-	-	-	-	-	-		-	-	-	-	-		-	-	-	-	-		-	**-**	-
Bicycle %	-	-	-	-	-		-	-	-	-	-	-		-	-	-	-	-	-		-	-	-	-	-		-	-	-	-	-		-	**-**	-

Spectrum

Turning Movement Count
Location Name: BRAMALEA RD & SITE ACCESS
Date: Tue, Jul 04, 2023 Deployment Lead: Walter Fugaj

GHD
UNIT 1 705 MILLCREEK DRIVE
MISSISSAUGA ONTARIO, L5N 5M4
CANADA

Peak Hour: 07:30 AM - 08:30 AM Weather: Few Clouds (18.58 °C)

Start Time	N Approach BRAMALEA RD							E Approach EAST APPROACH (ACCESS)							S Approach BRAMALEA RD							W Approach WEST APPROACH (ACCESS)						SW Approach SOUTHWEST ACCESS						Int. Total (15 min)
	Right	Bear Right	Thru	Left	UTurn	Peds	Approach Total	Right	Thru	Bear Left	Left	UTurn	Peds	Approach Total	Right	Thru	Left	Hard Left	UTurn	Peds	Approach Total	Right	Thru	Left	UTurn	Peds	Approach Total	Hard Right	Bear Right	Bear Left	UTurn	Peds	Approach Total	
07:30:00	0	0	206	11	1	0	218	0	0	0	2	0	0	2	8	75	1	0	0	0	84	1	0	0	0	1	1	0	0	0	0	1	0	305
07:45:00	0	1	166	18	0	0	185	3	0	0	2	0	0	5	13	74	0	1	0	0	88	0	0	2	0	0	2	0	0	0	0	0	0	280
08:00:00	0	1	206	18	2	1	227	6	0	0	3	0	1	9	12	75	1	0	0	0	88	1	0	0	0	0	1	0	0	0	0	0	0	325
08:15:00	0	0	163	9	0	0	172	3	0	0	3	0	0	6	10	85	2	0	0	0	97	1	0	0	0	0	1	0	0	0	0	0	0	276
Grand Total	0	2	741	56	3	1	802	12	0	0	10	0	1	22	43	309	4	1	0	0	357	3	0	2	0	1	5	0	0	0	0	1	0	**1186**
Approach%	0%	0.2%	92.4%	7%	0.4%		-	54.5%	0%	0%	45.5%	0%		-	12%	86.6%	1.1%	0.3%	0%		-	60%	0%	40%	0%		-	0%	0%	0%	0%		-	-
Totals %	0%	0.2%	62.5%	4.7%	0.3%		67.6%	1%	0%	0%	0.8%	0%		1.9%	3.6%	26.1%	0.3%	0.1%	0%		30.1%	0.3%	0%	0.2%	0%		0.4%	0%	0%	0%	0%		0%	-
PHF	0	0.5	0.9	0.78	0.38		0.88	0.5	0	0	0.83	0		0.61	0.83	0.91	0.5	0.25	0		0.92	0.75	0	0.25	0		0.63	0	0	0	0		0	-
Heavy	0	0	53	4	0		57	0	0	0	7	0		7	9	113	3	0	0		125	3	0	0	0		3	0	0	0	0		0	-
Heavy %	0%	0%	7.2%	7.1%	0%		7.1%	0%	0%	0%	70%	0%		31.8%	20.9%	36.6%	75%	0%	0%		35%	100%	0%	0%	0%		60%	0%	0%	0%	0%		0%	-
Lights	0	2	688	52	3		745	12	0	0	3	0		15	34	196	1	1	0		232	0	0	2	0		2	0	0	0	0		0	-
Lights %	0%	100%	92.8%	92.9%	100%		92.9%	100%	0%	0%	30%	0%		68.2%	79.1%	63.4%	25%	100%	0%		65%	0%	0%	100%	0%		40%	0%	0%	0%	0%		0%	-
Single-Unit Trucks	0	0	21	0	0		21	0	0	0	1	0		1	1	40	2	0	0		43	2	0	0	0		2	0	0	0	0		0	-
Single-Unit Trucks %	0%	0%	2.8%	0%	0%		2.6%	0%	0%	0%	10%	0%		4.5%	2.3%	12.9%	50%	0%	0%		12%	66.7%	0%	0%	0%		40%	0%	0%	0%	0%		0%	-
Buses	0	0	7	0	0		7	0	0	0	0	0		0	0	6	0	0	0		6	0	0	0	0		0	0	0	0	0		0	-
Buses %	0%	0%	0.9%	0%	0%		0.9%	0%	0%	0%	0%	0%		0%	0%	1.9%	0%	0%	0%		1.7%	0%	0%	0%	0%		0%	0%	0%	0%	0%		0%	-
Articulated Trucks	0	0	25	4	0		29	0	0	0	6	0		6	8	67	1	0	0		76	1	0	0	0		1	0	0	0	0		0	-
Articulated Trucks %	0%	0%	3.4%	7.1%	0%		3.6%	0%	0%	0%	60%	0%		27.3%	18.6%	21.7%	25%	0%	0%		21.3%	33.3%	0%	0%	0%		20%	0%	0%	0%	0%		0%	-
Bicycles on Road	0	0	0	0	0		0	0	0	0	0	0		0	0	0	0	0	0		0	0	0	0	0		0	0	0	0	0		0	-
Bicycles on Road %	0%	0%	0%	0%	0%		0%	0%	0%	0%	0%	0%		0%	0%	0%	0%	0%	0%		0%	0%	0%	0%	0%		0%	0%	0%	0%	0%		0%	-
Pedestrians	-	-	-	-	-	1	-	-	-	-	-	-	1	-	-	-	-	-	-	0	-	-	-	-	1	-	-	-	-	-	1	-	-
Pedestrians%	-	-	-	-	-	25%	-	-	-	-	-	-	25%	-	-	-	-	-	-	0%	-	-	-	-	25%	-	-	-	-	-	25%	-	-

Spectrum

Turning Movement Count
Location Name: BRAMALEA RD & SITE ACCESS
Date: Tue, Jul 04, 2023 Deployment Lead: Walter Fugaj

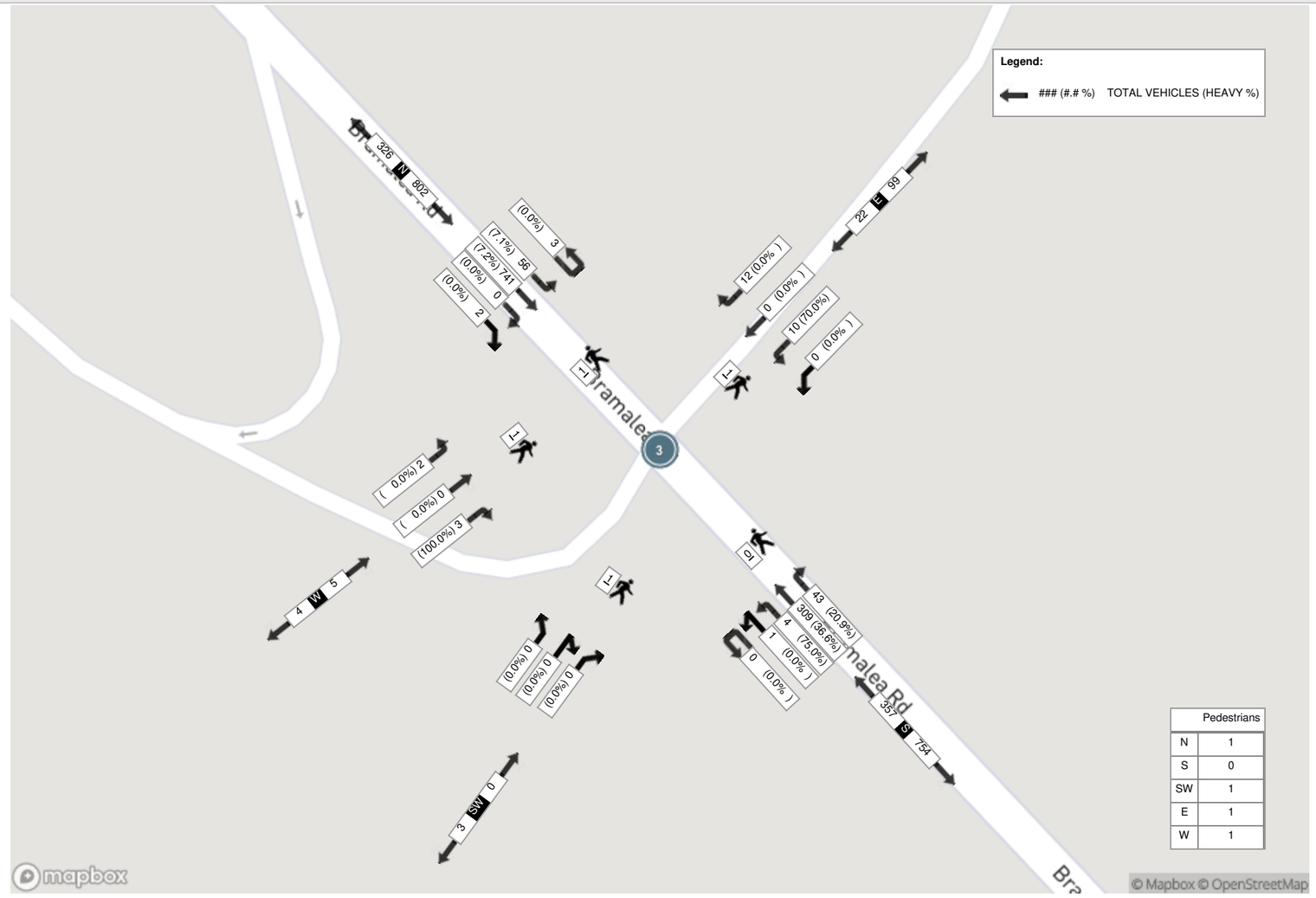
GHD
UNIT 1 705 MILLCREEK DRIVE
MISSISSAUGA ONTARIO, L5N 5M4
CANADA

Peak Hour: 04:00 PM - 05:00 PM Weather: Broken Clouds (28.85 °C)

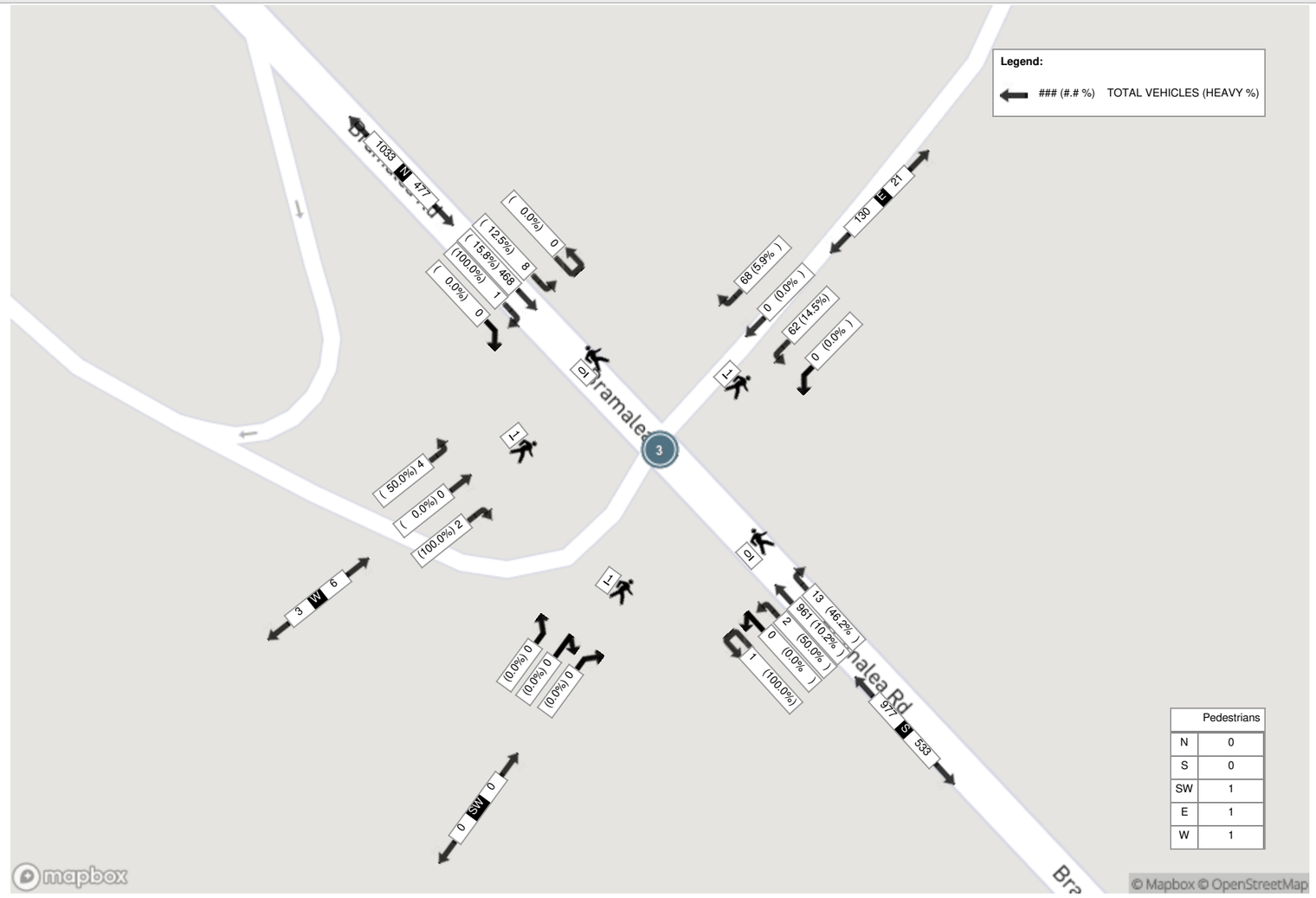
Start Time	N Approach BRAMALEA RD							E Approach EAST APPROACH (ACCESS)							S Approach BRAMALEA RD							W Approach WEST APPROACH (ACCESS)						SW Approach SOUTHWEST ACCESS						Int. Total (15 min)
	Right	Bear Right	Thru	Left	UTurn	Peds	Approach Total	Right	Thru	Bear Left	Left	UTurn	Peds	Approach Total	Right	Thru	Left	Hard Left	UTurn	Peds	Approach Total	Right	Thru	Left	UTurn	Peds	Approach Total	Hard Right	Bear Right	Bear Left	UTurn	Peds	Approach Total	
16:00:00	0	0	135	1	0	0	136	22	0	0	12	0	0	34	3	236	0	0	0	0	239	0	0	1	0	1	1	0	0	0	0	1	0	410
16:15:00	0	0	110	4	0	0	114	18	0	0	24	0	0	42	4	224	1	0	1	0	230	2	0	0	0	0	2	0	0	0	0	0	0	388
16:30:00	0	0	113	1	0	0	114	13	0	0	13	0	0	26	3	264	1	0	0	0	268	0	0	2	0	0	2	0	0	0	0	0	0	410
16:45:00	1	0	110	2	0	0	113	15	0	0	13	0	1	28	3	237	0	0	0	0	240	0	0	1	0	0	1	0	0	0	0	0	0	382
Grand Total	1	0	468	8	0	0	477	68	0	0	62	0	1	130	13	961	2	0	1	0	977	2	0	4	0	1	6	0	0	0	0	1	0	**1590**
Approach%	0.2%	0%	98.1%	1.7%	0%		-	52.3%	0%	0%	47.7%	0%		-	1.3%	98.4%	0.2%	0%	0.1%		-	33.3%	0%	66.7%	0%		-	0%	0%	0%	0%		-	-
Totals %	0.1%	0%	29.4%	0.5%	0%		30%	4.3%	0%	0%	3.9%	0%		8.2%	0.8%	60.4%	0.1%	0%	0.1%		61.4%	0.1%	0%	0.3%	0%		0.4%	0%	0%	0%	0%		0%	-
PHF	0.25	0	0.87	0.5	0		0.88	0.77	0	0	0.65	0		0.77	0.81	0.91	0.5	0	0.25		0.91	0.25	0	0.5	0		0.75	0	0	0	0		0	-
Heavy	1	0	74	1	0		76	4	0	0	9	0		13	6	98	1	0	1		106	2	0	2	0		4	0	0	0	0		0	-
Heavy %	100%	0%	15.8%	12.5%	0%		15.9%	5.9%	0%	0%	14.5%	0%		10%	46.2%	10.2%	50%	0%	100%		10.8%	100%	0%	50%	0%		66.7%	0%	0%	0%	0%		0%	-
Lights	0	0	394	7	0		401	64	0	0	53	0		117	7	862	1	0	0		870	0	0	2	0		2	0	0	0	0		0	-
Lights %	0%	0%	84.2%	87.5%	0%		84.1%	94.1%	0%	0%	85.5%	0%		90%	53.8%	89.7%	50%	0%	0%		89%	0%	0%	50%	0%		33.3%	0%	0%	0%	0%		0%	-
Single-Unit Trucks	0	0	43	1	0		44	1	0	0	2	0		3	1	37	0	0	0		38	0	0	1	0		1	0	0	0	0		0	-
Single-Unit Trucks %	0%	0%	9.2%	12.5%	0%		9.2%	1.5%	0%	0%	3.2%	0%		2.3%	7.7%	3.9%	0%	0%	0%		3.9%	0%	0%	25%	0%		16.7%	0%	0%	0%	0%		0%	-
Buses	0	0	4	0	0		4	0	0	0	0	0		0	0	3	0	0	0		3	0	0	0	0		0	0	0	0	0		0	-
Buses %	0%	0%	0.9%	0%	0%		0.8%	0%	0%	0%	0%	0%		0%	0%	0.3%	0%	0%	0%		0.3%	0%	0%	0%	0%		0%	0%	0%	0%	0%		0%	-
Articulated Trucks	1	0	27	0	0		28	3	0	0	7	0		10	5	58	1	0	1		65	2	0	1	0		3	0	0	0	0		0	-
Articulated Trucks %	100%	0%	5.8%	0%	0%		5.9%	4.4%	0%	0%	11.3%	0%		7.7%	38.5%	6%	50%	0%	100%		6.7%	100%	0%	25%	0%		50%	0%	0%	0%	0%		0%	-
Bicycles on Road	0	0	0	0	0		0	0	0	0	0	0		0	0	1	0	0	0		1	0	0	0	0		0	0	0	0	0		0	-
Bicycles on Road %	0%	0%	0%	0%	0%		0%	0%	0%	0%	0%	0%		0%	0%	0.1%	0%	0%	0%		0.1%	0%	0%	0%	0%		0%	0%	0%	0%	0%		0%	-
Pedestrians	-	-	-	-	-	0	-	-	-	-	-	-	1	-	-	-	-	-	-	0	-	-	-	-	-	1	-	-	-	-	-	1	-	-
Pedestrians%	-	-	-	-	-	0%	-	-	-	-	-	-	33.3%	-	-	-	-	-	-	0%	-	-	-	-	-	33.3%	-	-	-	-	-	33.3%	-	-

GHD
UNIT 1 705 MILLCREEK DRIVE
MISSISSAUGA ONTARIO, L5N 5M4
CANADA

Peak Hour: 07:30 AM - 08:30 AM Weather: Few Clouds (18.58 °C)



Peak Hour: 04:00 PM - 05:00 PM Weather: Broken Clouds (28.85 °C)



Spectrum

Turning Movement Count
Location Name: BRAMALEA RD & 407 WB OFF RAMP
Date: Tue, Oct 02, 2012 Deployment Lead: Peter Ilias

Turning Movement Count (5 . BRAMALEA RD & 407 WB OFF RAMP)

Start Time	N Approach SOUTHBOUND STREET				E Approach WESTBOUND STREET				S Approach NORTHBOUND STREET				W Approach EASTBOUND STREET		Int. Total (15 min)	Int. Total (1 hr)
	Thru N:S	U-Turn N:N	Peds N:	Approach Total	Right E:N	Left E:S	Peds E:	Approach Total	Thru S:N	U-Turn S:S	Peds S:	Approach Total	Peds W:	Approach Total		
06:30:00	279	0	0	279	12	21	0	33	53	0	0	53	1	0	365	
06:45:00	306	0	0	306	10	31	1	41	56	0	0	56	0	0	403	
07:00:00	228	1	0	229	12	18	0	30	56	0	0	56	0	0	315	
07:15:00	243	0	0	243	23	31	0	54	53	0	0	53	0	0	350	1433
07:30:00	284	0	0	284	29	48	0	77	79	0	0	79	0	0	440	1508
07:45:00	305	0	0	305	39	47	1	86	55	0	0	55	1	0	446	1551
08:00:00	284	0	0	284	34	49	0	83	53	0	0	53	1	0	420	1656
08:15:00	298	0	0	298	38	42	0	80	66	0	0	66	0	0	444	1750
08:30:00	279	0	0	279	39	49	0	88	59	0	0	59	0	0	426	1736
08:45:00	233	0	0	233	37	45	0	82	58	0	0	58	0	0	373	1663
BREAK																
16:00:00	117	1	0	118	25	10	1	35	235	1	0	236	0	0	389	
16:15:00	121	0	0	121	34	14	0	48	210	0	0	210	1	0	379	
16:30:00	113	0	0	113	37	9	0	46	293	0	0	293	0	0	452	
16:45:00	120	1	0	121	45	18	0	63	239	0	0	239	0	0	423	1643
17:00:00	138	0	0	138	35	16	0	51	311	0	0	311	0	0	500	1754
17:15:00	145	1	0	146	42	16	0	58	250	0	0	250	0	0	454	1829
17:30:00	119	0	0	119	42	8	0	50	222	0	0	222	0	0	391	1768
17:45:00	107	2	0	109	41	8	0	49	189	0	0	189	1	0	347	1692
18:00:00	133	4	0	137	33	16	0	49	219	0	0	219	1	0	405	1597
18:15:00	96	0	0	96	24	7	0	31	160	0	0	160	0	0	287	1430
18:30:00	101	3	0	104	22	7	0	29	147	0	0	147	0	0	280	1319
18:45:00	76	0	0	76	14	6	0	20	111	0	0	111	0	0	207	1179
Grand Total	4125	13	0	4138	667	516	3	1183	3174	1	0	3175	6	0	**8496**	-
Approach%	99.7%	0.3%		-	56.4%	43.6%		-	100%	0%		-		-	**-**	-
Totals %	48.6%	0.2%		48.7%	7.9%	6.1%		13.9%	37.4%	0%		37.4%		0%	**-**	-
Heavy	342	0		-	67	31		-	260	0		-		-	**-**	-
Heavy %	8.3%	0%		-	10%	6%		-	8.2%	0%		-		-	**-**	-
Bicycles	-	-		-	-	-		-	-	-		-		-	**-**	-
Bicycle %	-	-		-	-	-		-	-	-		-		-	**-**	-

Spectrum

Turning Movement Count
Location Name: BRAMALEA RD & 407 WB OFF RAMP
Date: Tue, Oct 02, 2012 Deployment Lead: Peter Ilias

Peak Hour: 07:30 AM - 08:30 AM Weather:

Start Time	N Approach SOUTHBOUND STREET				E Approach WESTBOUND STREET				S Approach NORTHBOUND STREET				W Approach EASTBOUND STREET		Int. Total (15 min)
	Thru	U-Turn	Peds	Approach Total	Right	Left	Peds	Approach Total	Thru	U-Turn	Peds	Approach Total	Peds	Approach Total	
07:30:00	284	0	0	284	29	48	0	77	79	0	0	79	0	0	440
07:45:00	305	0	0	305	39	47	1	86	55	0	0	55	1	0	446
08:00:00	284	0	0	284	34	49	0	83	53	0	0	53	1	0	420
08:15:00	298	0	0	298	38	42	0	80	66	0	0	66	0	0	444
Grand Total	1171	0	0	1171	140	186	1	326	253	0	0	253	2	0	**1750**
Approach%	100%	0%		-	42.9%	57.1%		-	100%	0%		-		-	**-**
Totals %	66.9%	0%		66.9%	8%	10.6%		18.6%	14.5%	0%		14.5%		0%	**-**
PHF	0.96	0		0.96	0.9	0.95		0.95	0.8	0		0.8		0	**-**
Heavy	58	0		58	12	4		16	39	0		39		0	**-**
Heavy %	5%	0%		5%	8.6%	2.2%		4.9%	15.4%	0%		15.4%		0%	**-**
Car	1082	0		1082	125	175		300	185	0		185		0	**-**
Car %	92.4%	0%		92.4%	89.3%	94.1%		92%	73.1%	0%		73.1%		0%	**-**
Medium	31	0		31	3	7		10	29	0		29		0	**-**
Medium %	2.6%	0%		2.6%	2.1%	3.8%		3.1%	11.5%	0%		11.5%		0%	**-**
Heavy	58	0		58	12	4		16	39	0		39		0	**-**
Heavy %	5%	0%		5%	8.6%	2.2%		4.9%	15.4%	0%		15.4%		0%	**-**
Ped	-	-	0	-	-	-	1	-	-	-	0	-	2	-	**-**
Ped%	-	-	0%		-	-	33.3%		-	-	0%		66.7%		**-**

Spectrum

Turning Movement Count
Location Name: BRAMALEA RD & 407 WB OFF RAMP
Date: Tue, Oct 02, 2012 Deployment Lead: Peter Ilias

Peak Hour: 04:30 PM - 05:30 PM Weather:

Start Time	N Approach SOUTHBOUND STREET				E Approach WESTBOUND STREET				S Approach NORTHBOUND STREET				W Approach EASTBOUND STREET		Int. Total (15 min)
	Thru	U-Turn	Peds	Approach Total	Right	Left	Peds	Approach Total	Thru	U-Turn	Peds	Approach Total	Peds	Approach Total	
16:30:00	113	0	0	113	37	9	0	46	293	0	0	293	0	0	452
16:45:00	120	1	0	121	45	18	0	63	239	0	0	239	0	0	423
17:00:00	138	0	0	138	35	16	0	51	311	0	0	311	0	0	500
17:15:00	145	1	0	146	42	16	0	58	250	0	0	250	0	0	454
Grand Total	516	2	0	518	159	59	0	218	1093	0	0	1093	0	0	**1829**
Approach%	99.6%	0.4%		-	72.9%	27.1%		-	100%	0%		-		-	**-**
Totals %	28.2%	0.1%		28.3%	8.7%	3.2%		11.9%	59.8%	0%		59.8%		0%	**-**
PHF	0.89	0.5		0.89	0.88	0.82		0.87	0.88	0		0.88		0	**-**
Heavy	62	0		62	14	14		28	57	0		57		0	**-**
Heavy %	12%	0%		12%	8.8%	23.7%		12.8%	5.2%	0%		5.2%		0%	**-**
Car	433	2		435	138	31		169	990	0		990		0	**-**
Car %	83.9%	100%		84%	86.8%	52.5%		77.5%	90.6%	0%		90.6%		0%	**-**
Medium	21	0		21	7	14		21	46	0		46		0	**-**
Medium %	4.1%	0%		4.1%	4.4%	23.7%		9.6%	4.2%	0%		4.2%		0%	**-**
Heavy	62	0		62	14	14		28	57	0		57		0	**-**
Heavy %	12%	0%		12%	8.8%	23.7%		12.8%	5.2%	0%		5.2%		0%	**-**
Ped	-	-	0	-	-	-	0	-	-	-	0	-	0	-	**-**
Ped%	-	-	0%		-	-	0%		-	-	0%		0%		**-**

Spectrum

Turning Movement Count
Location Name: BRAMALEA RD & 407 WB OFF RAMP
Date: Tue, Oct 02, 2012 Deployment Lead: Peter Ilias

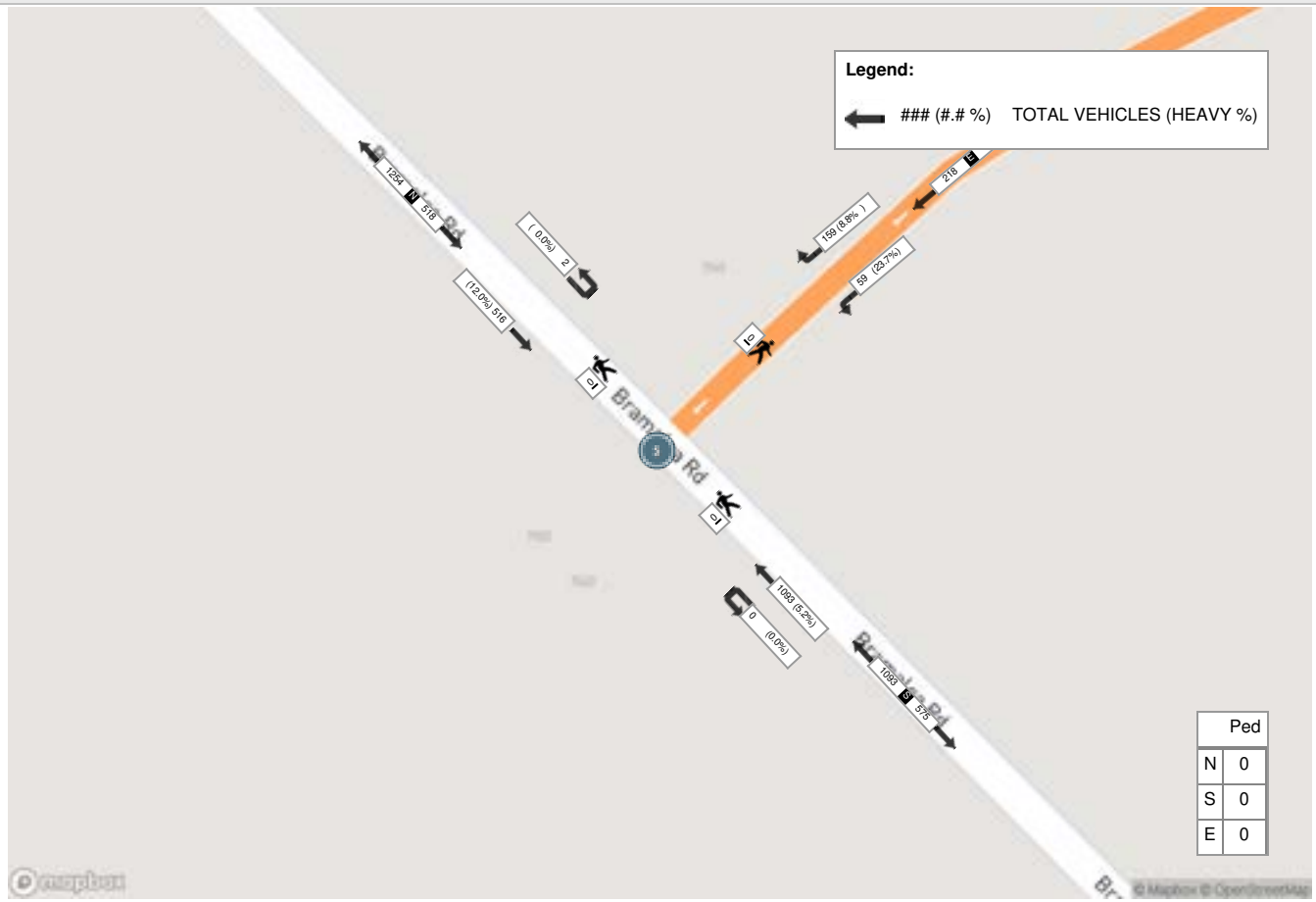
Peak Hour: 07:30 AM - 08:30 AM Weather:



Spectrum

Turning Movement Count
Location Name: BRAMALEA RD & 407 WB OFF RAMP
Date: Tue, Oct 02, 2012 Deployment Lead: Peter Ilias

Peak Hour: 04:30 PM - 05:30 PM Weather:



Spectrum

Turning Movement Count
Location Name: BRAMALEA RD & STEELES AVE
Date: Wed, Jun 24, 2015 Deployment Lead: Peter Ilias

Turning Movement Count (5 . BRAMALEA RD & STEELES AVE) CustID: 01506483 MioID: 243310

Start Time	N Approach BRAMALEA RD						E Approach STEELES AVE						S Approach BRAMALEA RD						W Approach STEELES AVE						Int. Total (15 min)	Int. Total (1 hr)
	Right N:W	Thru N:S	Left N:E	U-Turn N:N	Peds N:	Approach Total	Right E:N	Thru E:W	Left E:S	U-Turn E:E	Peds E:	Approach Total	Right S:E	Thru S:N	Left S:W	U-Turn S:S	Peds S:	Approach Total	Right W:S	Thru W:E	Left W:N	U-Turn W:W	Peds W:	Approach Total		
06:30:00	56	307	58	0	3	421	27	207	49	0	2	283	28	45	6	0	4	79	51	360	55	0	5	466	1249	
06:45:00	60	248	51	0	1	359	13	245	32	0	5	290	20	39	10	0	3	69	53	289	78	0	6	420	1138	
07:00:00	91	281	55	0	5	427	27	261	48	0	5	336	21	50	13	0	4	84	46	344	63	0	9	453	1300	
07:15:00	75	279	53	0	6	407	12	261	61	0	1	334	18	47	4	0	4	69	44	291	73	0	13	408	1218	4905
07:30:00	77	313	59	0	4	449	25	260	43	0	3	328	29	69	6	0	3	104	66	304	64	0	7	434	1315	4971
07:45:00	63	294	55	0	6	412	22	250	52	0	6	324	18	58	10	0	5	86	70	323	66	0	7	459	1281	5114
08:00:00	60	273	43	0	4	376	26	306	48	0	5	380	23	70	10	0	3	103	46	241	72	0	14	359	1218	5032
08:15:00	64	272	45	0	2	381	25	240	47	0	3	312	15	72	13	0	4	100	74	318	69	0	12	461	1254	5068
08:30:00	50	175	47	0	4	272	34	227	43	0	3	304	30	72	14	0	2	116	60	315	57	0	5	432	1124	4877
08:45:00	51	201	44	0	8	296	30	232	39	0	2	301	24	71	12	0	2	107	61	292	66	0	12	419	1123	4719
BREAK																										
16:00:00	71	96	34	0	18	201	78	355	33	0	9	466	40	215	45	1	4	301	31	300	69	0	9	400	1368	
16:15:00	47	90	32	0	17	169	69	319	26	0	5	414	37	237	36	0	6	310	28	305	140	1	9	474	1367	
16:30:00	82	101	34	0	11	217	46	286	36	0	2	368	48	217	47	0	8	312	23	325	81	1	9	430	1327	
16:45:00	73	114	48	0	3	235	51	341	24	1	6	417	38	241	45	0	5	324	25	289	101	0	5	415	1391	5453
17:00:00	61	102	28	0	10	191	76	347	18	0	3	441	50	237	35	0	5	322	27	321	140	1	17	489	1443	5528
17:15:00	56	98	41	0	20	195	60	293	27	0	3	380	44	238	46	0	1	328	12	355	104	0	5	471	1374	5535
17:30:00	58	68	40	0	7	166	60	350	26	1	13	437	45	249	33	0	8	327	16	304	129	0	15	449	1379	5587
17:45:00	37	86	47	0	12	170	70	320	28	1	3	419	41	230	31	0	3	302	16	357	151	1	7	525	1416	5612
18:00:00	41	82	35	0	13	158	85	263	17	0	7	365	37	197	30	0	13	264	17	384	147	0	10	548	1335	5504
18:15:00	65	76	43	0	12	184	78	369	23	0	5	470	38	153	26	0	2	217	20	254	83	0	3	357	1228	5358
18:30:00	48	56	44	0	6	148	57	268	24	0	1	349	40	127	13	0	8	180	13	339	134	0	13	486	1163	5142
18:45:00	36	61	21	0	2	118	56	245	12	0	4	313	24	63	20	0	3	107	10	291	70	1	5	372	910	4636
Grand Total	1440	3893	1053	0	179	6386	1086	6700	814	5	99	8605	762	3116	521	1	104	4400	897	7456	2120	5	204	10478	**29869**	-
Approach%	22.5%	61%	16.5%	0%		-	12.6%	77.9%	9.5%	0.1%		-	17.3%	70.8%	11.8%	0%		-	8.6%	71.2%	20.2%	0%		-	**-**	-
Totals %	4.8%	13%	3.5%	0%		21.4%	3.6%	22.4%	2.7%	0%		28.8%	2.6%	10.4%	1.7%	0%		14.7%	3%	25%	7.1%	0%		35.1%	**-**	-
Heavy	112	268	55	0		-	54	1188	157	0		-	281	185	112	0		-	67	1177	192	0		-	**-**	-
Heavy %	7.8%	6.9%	5.2%	0%		-	5%	17.7%	19.3%	0%		-	36.9%	5.9%	21.5%	0%		-	7.5%	15.8%	9.1%	0%		-	**-**	-
Bicycles	1	3	0	0		-	0	0	0	0		-	0	1	0	0		-	0	1	0	0		-	**-**	-
Bicycle %	0.1%	0.1%	0%	0%		-	0%	0%	0%	0%		-	0%	0%	0%	0%		-	0%	0%	0%	0%		-	**-**	-

Spectrum

Turning Movement Count
Location Name: BRAMALEA RD & STEELES AVE
Date: Wed, Jun 24, 2015 Deployment Lead: Peter Ilias

Peak Hour: 07:00 AM - 08:00 AM Weather:

Start Time	N Approach BRAMALEA RD						E Approach STEELES AVE						S Approach BRAMALEA RD						W Approach STEELES AVE						Int. Total (15 min)
	Right	Thru	Left	U-Turn	Peds	Approach Total	Right	Thru	Left	U-Turn	Peds	Approach Total	Right	Thru	Left	U-Turn	Peds	Approach Total	Right	Thru	Left	U-Turn	Peds	Approach Total	
07:00:00	91	281	55	0	5	427	27	261	48	0	5	336	21	50	13	0	4	84	46	344	63	0	9	453	1300
07:15:00	75	279	53	0	6	407	12	261	61	0	1	334	18	47	4	0	4	69	44	291	73	0	13	408	1218
07:30:00	77	313	59	0	4	449	25	260	43	0	3	328	29	69	6	0	3	104	66	304	64	0	7	434	1315
07:45:00	63	294	55	0	6	412	22	250	52	0	6	324	18	58	10	0	5	86	70	323	66	0	7	459	1281
Grand Total	306	1167	222	0	21	1695	86	1032	204	0	15	1322	86	224	33	0	16	343	226	1262	266	0	36	1754	**5114**
Approach%	18.1%	68.8%	13.1%	0%		-	6.5%	78.1%	15.4%	0%		-	25.1%	65.3%	9.6%	0%		-	12.9%	71.9%	15.2%	0%		-	**-**
Totals %	6%	22.8%	4.3%	0%		33.1%	1.7%	20.2%	4%	0%		25.9%	1.7%	4.4%	0.6%	0%		6.7%	4.4%	24.7%	5.2%	0%		34.3%	**-**
PHF	0.84	0.93	0.94	0		0.94	0.8	0.99	0.84	0		0.98	0.74	0.81	0.63	0		0.82	0.81	0.92	0.91	0		0.96	**-**
Heavy	14	53	15	0		82	8	196	22	0		226	48	24	9	0		81	11	214	30	0		255	**-**
Heavy %	4.6%	4.5%	6.8%	0%		4.8%	9.3%	19%	10.8%	0%		17.1%	55.8%	10.7%	27.3%	0%		23.6%	4.9%	17%	11.3%	0%		14.5%	**-**
Lights	292	1114	207	0		1613	78	836	182	0		1096	38	200	24	0		262	215	1048	236	0		1499	**-**
Lights %	95.4%	95.5%	93.2%	0%		95.2%	90.7%	81%	89.2%	0%		82.9%	44.2%	89.3%	72.7%	0%		76.4%	95.1%	83%	88.7%	0%		85.5%	**-**
Single-Unit Trucks	7	20	2	0		29	6	80	8	0		94	11	11	3	0		25	6	71	10	0		87	**-**
Single-Unit Trucks %	2.3%	1.7%	0.9%	0%		1.7%	7%	7.8%	3.9%	0%		7.1%	12.8%	4.9%	9.1%	0%		7.3%	2.7%	5.6%	3.8%	0%		5%	**-**
Buses	2	24	0	0		26	0	17	3	0		20	1	4	0	0		5	0	22	17	0		39	**-**
Buses %	0.7%	2.1%	0%	0%		1.5%	0%	1.6%	1.5%	0%		1.5%	1.2%	1.8%	0%	0%		1.5%	0%	1.7%	6.4%	0%		2.2%	**-**
Articulated Trucks	5	9	13	0		27	2	99	11	0		112	36	9	6	0		51	5	121	3	0		129	**-**
Articulated Trucks %	1.6%	0.8%	5.9%	0%		1.6%	2.3%	9.6%	5.4%	0%		8.5%	41.9%	4%	18.2%	0%		14.9%	2.2%	9.6%	1.1%	0%		7.4%	**-**
Pedestrians	-	-	-	-	21	-	-	-	-	-	14	-	-	-	-	-	14	-	-	-	-	-	36	-	**-**
Pedestrians%	-	-	-	-	23.9%		-	-	-	-	15.9%		-	-	-	-	15.9%		-	-	-	-	40.9%		**-**
Bicycles on Crosswalk	-	-	-	-	0	-	-	-	-	-	1	-	-	-	-	-	2	-	-	-	-	-	0	-	**-**
Bicycles on Crosswalk%	-	-	-	-	0%		-	-	-	-	1.1%		-	-	-	-	2.3%		-	-	-	-	0%		**-**
Bicycles on Road	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	1	0	0	0	-	**-**
Bicycles on Road%	-	-	-	-	0%		-	-	-	-	0%		-	-	-	-	0%		-	-	-	-	0%		**-**

Spectrum

Turning Movement Count
Location Name: BRAMALEA RD & STEELES AVE
Date: Wed, Jun 24, 2015 Deployment Lead: Peter Ilias

Peak Hour: 05:00 PM - 06:00 PM Weather:

Start Time	N Approach BRAMALEA RD						E Approach STEELES AVE						S Approach BRAMALEA RD						W Approach STEELES AVE						Int. Total (15 min)
	Right	Thru	Left	U-Turn	Peds	Approach Total	Right	Thru	Left	U-Turn	Peds	Approach Total	Right	Thru	Left	U-Turn	Peds	Approach Total	Right	Thru	Left	U-Turn	Peds	Approach Total	
17:00:00	61	102	28	0	10	191	76	347	18	0	3	441	50	237	35	0	5	322	27	321	140	1	17	489	1443
17:15:00	56	98	41	0	20	195	60	293	27	0	3	380	44	238	46	0	1	328	12	355	104	0	5	471	1374
17:30:00	58	68	40	0	7	166	60	350	26	1	13	437	45	249	33	0	8	327	16	304	129	0	15	449	1379
17:45:00	37	86	47	0	12	170	70	320	28	1	3	419	41	230	31	0	3	302	16	357	151	1	7	525	1416
Grand Total	212	354	156	0	49	722	266	1310	99	2	22	1677	180	954	145	0	17	1279	71	1337	524	2	44	1934	**5612**
Approach%	29.4%	49%	21.6%	0%		-	15.9%	78.1%	5.9%	0.1%		-	14.1%	74.6%	11.3%	0%		-	3.7%	69.1%	27.1%	0.1%		-	**-**
Totals %	3.8%	6.3%	2.8%	0%		12.9%	4.7%	23.3%	1.8%	0%		29.9%	3.2%	17%	2.6%	0%		22.8%	1.3%	23.8%	9.3%	0%		34.5%	**-**
PHF	0.87	0.87	0.83	0		0.93	0.88	0.94	0.88	0.5		0.95	0.9	0.96	0.79	0		0.97	0.66	0.94	0.87	0.5		0.92	**-**
Heavy	15	41	7	0		63	5	191	22	0		218	48	33	29	0		110	7	164	33	0		204	**-**
Heavy %	7.1%	11.6%	4.5%	0%		8.7%	1.9%	14.6%	22.2%	0%		13%	26.7%	3.5%	20%	0%		8.6%	9.9%	12.3%	6.3%	0%		10.5%	**-**
Lights	197	313	149	0		659	261	1119	77	2		1459	132	921	116	0		1169	64	1173	491	2		1730	**-**
Lights %	92.9%	88.4%	95.5%	0%		91.3%	98.1%	85.4%	77.8%	100%		87%	73.3%	96.5%	80%	0%		91.4%	90.1%	87.7%	93.7%	100%		89.5%	**-**
Single-Unit Trucks	9	4	3	0		16	1	71	6	0		78	12	10	5	0		27	2	68	6	0		76	**-**
Single-Unit Trucks %	4.2%	1.1%	1.9%	0%		2.2%	0.4%	5.4%	6.1%	0%		4.7%	6.7%	1%	3.4%	0%		2.1%	2.8%	5.1%	1.1%	0%		3.9%	**-**
Buses	1	20	0	0		21	0	16	4	0		20	0	2	0	0		2	0	20	21	0		41	**-**
Buses %	0.5%	5.6%	0%	0%		2.9%	0%	1.2%	4%	0%		1.2%	0%	0.2%	0%	0%		0.2%	0%	1.5%	4%	0%		2.1%	**-**
Articulated Trucks	5	17	4	0		26	4	104	12	0		120	36	21	24	0		81	5	76	6	0		87	**-**
Articulated Trucks %	2.4%	4.8%	2.6%	0%		3.6%	1.5%	7.9%	12.1%	0%		7.2%	20%	2.2%	16.6%	0%		6.3%	7%	5.7%	1.1%	0%		4.5%	**-**
Pedestrians	-	-	-	-	47	-	-	-	-	-	21	-	-	-	-	-	17	-	-	-	-	-	44	-	**-**
Pedestrians%	-	-	-	-	35.6%		-	-	-	-	15.9%		-	-	-	-	12.9%		-	-	-	-	33.3%		**-**
Bicycles on Crosswalk	-	-	-	-	2	-	-	-	-	-	1	-	-	-	-	-	0	-	-	-	-	-	0	-	**-**
Bicycles on Crosswalk%	-	-	-	-	1.5%		-	-	-	-	0.8%		-	-	-	-	0%		-	-	-	-	0%		**-**
Bicycles on Road	0	2	0	0	0	-	0	0	0	0	0	-	0	1	0	0	0	-	0	0	0	0	0	-	**-**
Bicycles on Road%	-	-	-	-	0%		-	-	-	-	0%		-	-	-	-	0%		-	-	-	-	0%		**-**

Spectrum

Turning Movement Count
Location Name: BRAMALEA RD & STEELES AVE
Date: Wed, Jun 24, 2015 Deployment Lead: Peter Ilias

Peak Hour: 07:00 AM - 08:00 AM Weather:



Spectrum

Turning Movement Count
Location Name: BRAMALEA RD & STEELES AVE
Date: Wed, Jun 24, 2015 Deployment Lead: Peter Ilias

Peak Hour: 05:00 PM - 06:00 PM Weather:



	Bicycles on Crosswalk	Pedestrians
N	2	47
S	0	17
E	1	21
W	0	44

Spectrum

Turning Movement Count
Location Name: BRAMALEA RD & STEELES AVE
Date: Thu, Mar 08, 2018 Deployment Lead: Theo Daglis

Turning Movement Count (30 . BRAMALEA RD & STEELES AVE) CustID: 01506483 MioID: 502140

Start Time	N Approach BRAMALEA RD						E Approach STEELES AVE						S Approach BRAMALEA RD						W Approach STEELES AVE						Int. Total (15 min)	Int. Total (1 hr)
	Left N:E	Thru N:S	Right N:W	U-Turn N:N	Peds N:	Approach Total	Left E:S	Thru E:W	Right E:N	U-Turn E:E	Peds E:	Approach Total	Left S:W	Thru S:N	Right S:E	U-Turn S:S	Peds S:	Approach Total	Left W:N	Thru W:E	Right W:S	U-Turn W:W	Peds W:	Approach Total		
07:00:00	56	292	103	0	3	451	61	238	15	0	0	314	12	49	27	0	2	88	70	284	30	0	14	384	1237	
07:15:00	50	318	75	0	3	443	69	296	34	0	4	399	8	39	20	0	7	67	71	346	41	0	15	458	1367	
07:30:00	65	376	84	0	9	525	69	229	17	0	5	315	9	69	22	0	3	100	73	329	48	0	9	450	1390	
07:45:00	62	293	60	0	15	415	62	249	33	0	2	344	6	61	33	0	6	100	61	401	64	2	16	528	1387	5381
08:00:00	64	348	73	0	5	485	55	227	28	0	3	310	8	57	29	0	0	94	61	287	72	0	24	420	1309	5453
08:15:00	60	265	76	0	2	401	62	308	30	0	2	400	9	62	32	0	1	103	68	333	62	0	16	463	1367	5453
08:30:00	59	259	78	0	0	396	44	243	25	0	2	312	17	67	30	0	0	114	56	327	52	0	12	435	1257	5320
08:45:00	53	188	58	0	0	299	46	236	36	0	2	318	15	58	23	0	3	96	67	309	57	0	6	433	1146	5079
BREAK																										
11:00:00	38	77	55	0	0	170	31	225	33	1	0	290	19	55	35	0	0	109	48	266	27	0	6	341	910	
11:15:00	30	50	34	0	9	114	28	251	38	1	1	318	11	27	30	0	1	68	37	286	19	0	2	342	842	
11:30:00	29	57	52	0	3	138	24	232	30	0	7	286	14	69	36	0	9	119	44	321	21	0	3	386	929	
11:45:00	49	69	47	0	12	165	29	214	38	0	0	281	22	60	51	0	0	133	47	312	16	0	9	375	954	3635
12:00:00	36	72	52	0	4	160	29	270	42	0	1	341	25	76	46	0	2	147	41	267	25	0	3	333	981	3706
12:15:00	48	65	46	0	3	159	31	242	25	1	1	299	23	62	30	0	0	115	48	327	21	0	4	396	969	3833
12:30:00	39	75	52	0	4	166	24	240	40	0	4	304	26	77	33	0	3	136	55	282	22	0	10	359	965	3869
12:45:00	31	71	48	0	6	150	32	274	28	1	1	335	11	52	26	0	0	89	44	321	26	1	14	392	966	3881
13:00:00	41	72	50	0	3	163	31	271	31	0	1	333	19	62	39	0	2	120	54	319	31	0	6	404	1020	3920
13:15:00	46	69	51	0	5	166	26	238	45	1	0	310	34	69	40	0	0	143	62	282	28	0	16	372	991	3942
13:30:00	37	76	59	0	10	172	27	303	48	1	2	379	12	80	42	0	2	134	56	297	28	0	13	381	1066	4043
13:45:00	35	70	62	0	5	167	30	258	35	0	4	323	24	61	32	0	6	117	63	327	37	0	6	427	1034	4111
BREAK																										
15:00:00	37	83	67	0	16	187	25	308	56	1	6	390	29	156	44	0	5	229	65	321	27	0	9	413	1219	
15:15:00	40	70	58	0	20	168	33	318	47	0	6	398	32	153	49	0	9	234	106	362	28	0	12	496	1296	
15:30:00	45	108	68	0	19	221	36	264	71	1	5	372	32	183	31	0	6	246	100	332	18	0	20	450	1289	
15:45:00	41	98	85	0	21	224	30	320	74	0	14	424	27	177	51	0	11	255	70	309	25	0	17	404	1307	5111
16:00:00	39	61	68	0	22	168	22	342	71	0	0	435	37	189	58	0	2	284	92	358	30	0	6	480	1367	5259
16:15:00	36	87	52	0	18	175	36	253	57	0	6	346	41	232	58	0	8	331	120	297	23	0	13	440	1292	5255
16:30:00	45	95	71	0	19	211	20	322	93	1	7	436	29	215	51	0	7	295	79	340	28	0	32	447	1389	5355
16:45:00	42	104	71	0	27	217	27	326	77	0	12	430	35	258	39	0	15	332	122	337	24	0	15	483	1462	5510
17:00:00	39	117	73	0	12	229	29	280	91	0	4	400	36	275	68	0	8	379	127	308	15	0	16	450	1458	5601
17:15:00	35	86	63	0	16	184	27	319	77	1	7	424	26	248	50	0	9	324	145	378	22	1	25	546	1478	5787
17:30:00	30	72	46	0	25	148	23	312	89	0	5	424	22	217	43	0	8	282	145	366	20	0	18	531	1385	5783
17:45:00	34	87	52	0	14	173	27	234	67	1	9	329	33	257	76	0	7	366	147	296	17	1	20	461	1329	5650
Grand Total	1391	4230	1989	0	330	7610	1145	8642	1521	11	123	11319	703	3772	1274	0	142	5749	2444	10227	1004	5	407	13680	**38358**	-
Approach%	18.3%	55.6%	26.1%	0%		-	10.1%	76.3%	13.4%	0.1%		-	12.2%	65.6%	22.2%	0%		-	17.9%	74.8%	7.3%	0%		-	-	-
Totals %	3.6%	11%	5.2%	0%		19.8%	3%	22.5%	4%	0%		29.5%	1.8%	9.8%	3.3%	0%		15%	6.4%	26.7%	2.6%	0%		35.7%	-	-
Heavy	100	287	174	0		-	271	1872	84	0		-	143	221	441	0		-	237	1875	126	0		-	-	-
Heavy %	7.2%	6.8%	8.7%	0%		-	23.7%	21.7%	5.5%	0%		-	20.3%	5.9%	34.6%	0%		-	9.7%	18.3%	12.5%	0%		-	-	-
Bicycles	-	-	-	-		-	-	-	-	-		-	-	-	-	-		-	-	-	-	-		-	-	-
Bicycle %	-	-	-	-		-	-	-	-	-		-	-	-	-	-		-	-	-	-	-		-	-	-

Spectrum

Turning Movement Count
Location Name: BRAMALEA RD & STEELES AVE
Date: Thu, Mar 08, 2018 Deployment Lead: Theo Daglis

Peak Hour: 07:30 AM - 08:30 AM Weather: Overcast (-3.2 °C)

Start Time	N Approach BRAMALEA RD						E Approach STEELES AVE						S Approach BRAMALEA RD						W Approach STEELES AVE						Int. Total (15 min)
	Left	Thru	Right	U-Turn	Peds	Approach Total	Left	Thru	Right	U-Turn	Peds	Approach Total	Left	Thru	Right	U-Turn	Peds	Approach Total	Left	Thru	Right	U-Turn	Peds	Approach Total	
07:30:00	65	376	84	0	9	525	69	229	17	0	5	315	9	69	22	0	3	100	73	329	48	0	9	450	1390
07:45:00	62	293	60	0	15	415	62	249	33	0	2	344	6	61	33	0	6	100	61	401	64	2	16	528	1387
08:00:00	64	348	73	0	5	485	55	227	28	0	3	310	8	57	29	0	0	94	61	287	72	0	24	420	1309
08:15:00	60	265	76	0	2	401	62	308	30	0	2	400	9	62	32	0	1	103	68	333	62	0	16	463	1367
Grand Total	251	1282	293	0	31	1826	248	1013	108	0	12	1369	32	249	116	0	10	397	263	1350	246	2	65	1861	**5453**
Approach%	13.7%	70.2%	16%	0%		-	18.1%	74%	7.9%	0%		-	8.1%	62.7%	29.2%	0%		-	14.1%	72.5%	13.2%	0.1%		-	**-**
Totals %	4.6%	23.5%	5.4%	0%		33.5%	4.5%	18.6%	2%	0%		25.1%	0.6%	4.6%	2.1%	0%		7.3%	4.8%	24.8%	4.5%	0%		34.1%	**-**
PHF	0.97	0.85	0.87	0		0.87	0.9	0.82	0.82	0		0.86	0.89	0.9	0.88	0		0.96	0.9	0.84	0.85	0.25		0.88	**-**
Heavy	12	42	13	0		67	34	200	12	0		246	9	29	52	0		90	22	205	12	0		239	**-**
Heavy %	4.8%	3.3%	4.4%	0%		3.7%	13.7%	19.7%	11.1%	0%		18%	28.1%	11.6%	44.8%	0%		22.7%	8.4%	15.2%	4.9%	0%		12.8%	**-**
Lights	239	1240	280	0		1759	214	813	96	0		1123	23	220	64	0		307	241	1145	234	2		1622	**-**
Lights %	95.2%	96.7%	95.6%	0%		96.3%	86.3%	80.3%	88.9%	0%		82%	71.9%	88.4%	55.2%	0%		77.3%	91.6%	84.8%	95.1%	100%		87.2%	**-**
Single-Unit Trucks	6	12	9	0		27	11	72	2	0		85	2	13	12	0		27	6	73	4	0		83	**-**
Single-Unit Trucks %	2.4%	0.9%	3.1%	0%		1.5%	4.4%	7.1%	1.9%	0%		6.2%	6.3%	5.2%	10.3%	0%		6.8%	2.3%	5.4%	1.6%	0%		4.5%	**-**
Buses	0	22	0	0		22	0	20	2	0		22	0	7	0	0		7	13	18	0	0		31	**-**
Buses %	0%	1.7%	0%	0%		1.2%	0%	2%	1.9%	0%		1.6%	0%	2.8%	0%	0%		1.8%	4.9%	1.3%	0%	0%		1.7%	**-**
Articulated Trucks	6	8	4	0		18	23	108	8	0		139	7	9	40	0		56	3	114	8	0		125	**-**
Articulated Trucks %	2.4%	0.6%	1.4%	0%		1%	9.3%	10.7%	7.4%	0%		10.2%	21.9%	3.6%	34.5%	0%		14.1%	1.1%	8.4%	3.3%	0%		6.7%	**-**
Pedestrians	-	-	-	-	31	-	-	-	-	-	12	-	-	-	-	-	10	-	-	-	-	-	63	-	**-**
Pedestrians%	-	-	-	-	26.3%		-	-	-	-	10.2%		-	-	-	-	8.5%		-	-	-	-	53.4%		**-**
Bicycles on Crosswalk	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	2	-	**-**
Bicycles on Crosswalk%	-	-	-	-	0%		-	-	-	-	0%		-	-	-	-	0%		-	-	-	-	1.7%		**-**

Spectrum

Turning Movement Count
Location Name: BRAMALEA RD & STEELES AVE
Date: Thu, Mar 08, 2018 Deployment Lead: Theo Daglis

Peak Hour: 01:00 PM - 02:00 PM **Weather: Overcast (0 °C)**

Start Time	N Approach BRAMALEA RD						E Approach STEELES AVE						S Approach BRAMALEA RD						W Approach STEELES AVE						Int. Total (15 min)
	Left	Thru	Right	U-Turn	Peds	Approach Total	Left	Thru	Right	U-Turn	Peds	Approach Total	Left	Thru	Right	U-Turn	Peds	Approach Total	Left	Thru	Right	U-Turn	Peds	Approach Total	
13:00:00	41	72	50	0	3	163	31	271	31	0	1	333	19	62	39	0	2	120	54	319	31	0	6	404	1020
13:15:00	46	69	51	0	5	166	26	238	45	1	0	310	34	69	40	0	0	143	62	282	28	0	16	372	991
13:30:00	37	76	59	0	10	172	27	303	48	1	2	379	12	80	42	0	2	134	56	297	28	0	13	381	1066
13:45:00	35	70	62	0	5	167	30	258	35	0	4	323	24	61	32	0	6	117	63	327	37	0	6	427	1034
Grand Total	159	287	222	0	23	668	114	1070	159	2	7	1345	89	272	153	0	10	514	235	1225	124	0	41	1584	**4111**
Approach%	23.8%	43%	33.2%	0%		-	8.5%	79.6%	11.8%	0.1%		-	17.3%	52.9%	29.8%	0%		-	14.8%	77.3%	7.8%	0%		-	**-**
Totals %	3.9%	7%	5.4%	0%		16.2%	2.8%	26%	3.9%	0%		32.7%	2.2%	6.6%	3.7%	0%		12.5%	5.7%	29.8%	3%	0%		38.5%	**-**
PHF	0.86	0.94	0.9	0		0.97	0.92	0.88	0.83	0.5		0.89	0.65	0.85	0.91	0		0.9	0.93	0.94	0.84	0		0.93	**-**
Heavy	18	34	30	0		82	43	298	6	0		347	22	23	62	0		107	37	283	28	0		348	**-**
Heavy %	11.3%	11.8%	13.5%	0%		12.3%	37.7%	27.9%	3.8%	0%		25.8%	24.7%	8.5%	40.5%	0%		20.8%	15.7%	23.1%	22.6%	0%		22%	**-**
Lights	141	253	192	0		586	71	772	153	2		998	67	249	91	0		407	198	942	96	0		1236	**-**
Lights %	88.7%	88.2%	86.5%	0%		87.7%	62.3%	72.1%	96.2%	100%		74.2%	75.3%	91.5%	59.5%	0%		79.2%	84.3%	76.9%	77.4%	0%		78%	**-**
Single-Unit Trucks	10	13	17	0		40	13	113	1	0		127	9	7	19	0		35	13	116	15	0		144	**-**
Single-Unit Trucks %	6.3%	4.5%	7.7%	0%		6%	11.4%	10.6%	0.6%	0%		9.4%	10.1%	2.6%	12.4%	0%		6.8%	5.5%	9.5%	12.1%	0%		9.1%	**-**
Buses	0	11	0	0		11	0	15	0	0		15	0	2	0	0		2	11	15	0	0		26	**-**
Buses %	0%	3.8%	0%	0%		1.6%	0%	1.4%	0%	0%		1.1%	0%	0.7%	0%	0%		0.4%	4.7%	1.2%	0%	0%		1.6%	**-**
Articulated Trucks	8	10	13	0		31	30	170	5	0		205	13	14	43	0		70	13	152	13	0		178	**-**
Articulated Trucks %	5%	3.5%	5.9%	0%		4.6%	26.3%	15.9%	3.1%	0%		15.2%	14.6%	5.1%	28.1%	0%		13.6%	5.5%	12.4%	10.5%	0%		11.2%	**-**
Pedestrians	-	-	-	-	23	-	-	-	-	-	7	-	-	-	-	-	10	-	-	-	-	-	41	-	**-**
Pedestrians%	-	-	-	-	28.4%		-	-	-	-	8.6%		-	-	-	-	12.3%		-	-	-	-	50.6%		**-**
Bicycles on Crosswalk	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	**-**
Bicycles on Crosswalk%	-	-	-	-	0%		-	-	-	-	0%		-	-	-	-	0%		-	-	-	-	0%		**-**

Spectrum

Turning Movement Count
Location Name: BRAMALEA RD & STEELES AVE
Date: Thu, Mar 08, 2018 Deployment Lead: Theo Daglis

Peak Hour: 04:30 PM - 05:30 PM Weather: Snow (-0.4 °C)

Start Time	N Approach BRAMALEA RD						E Approach STEELES AVE						S Approach BRAMALEA RD						W Approach STEELES AVE						Int. Total (15 min)
	Left	Thru	Right	U-Turn	Peds	Approach Total	Left	Thru	Right	U-Turn	Peds	Approach Total	Left	Thru	Right	U-Turn	Peds	Approach Total	Left	Thru	Right	U-Turn	Peds	Approach Total	
16:30:00	45	95	71	0	19	211	20	322	93	1	7	436	29	215	51	0	7	295	79	340	28	0	32	447	1389
16:45:00	42	104	71	0	27	217	27	326	77	0	12	430	35	258	39	0	15	332	122	337	24	0	15	483	1462
17:00:00	39	117	73	0	12	229	29	280	91	0	4	400	36	275	68	0	8	379	127	308	15	0	16	450	1458
17:15:00	35	86	63	0	16	184	27	319	77	1	7	424	26	248	50	0	9	324	145	378	22	1	25	546	1478
Grand Total	161	402	278	0	74	841	103	1247	338	2	30	1690	126	996	208	0	39	1330	473	1363	89	1	88	1926	**5787**
Approach%	19.1%	47.8%	33.1%	0%		-	6.1%	73.8%	20%	0.1%		-	9.5%	74.9%	15.6%	0%		-	24.6%	70.8%	4.6%	0.1%		-	**-**
Totals %	2.8%	6.9%	4.8%	0%		14.5%	1.8%	21.5%	5.8%	0%		29.2%	2.2%	17.2%	3.6%	0%		23%	8.2%	23.6%	1.5%	0%		33.3%	**-**
PHF	0.89	0.86	0.95	0		0.92	0.89	0.96	0.91	0.5		0.97	0.88	0.91	0.76	0		0.88	0.82	0.9	0.79	0.25		0.88	**-**
Heavy	7	39	13	0		59	25	194	7	0		226	13	26	47	0		86	31	215	9	0		255	**-**
Heavy %	4.3%	9.7%	4.7%	0%		7%	24.3%	15.6%	2.1%	0%		13.4%	10.3%	2.6%	22.6%	0%		6.5%	6.6%	15.8%	10.1%	0%		13.2%	**-**
Lights	154	363	265	0		782	78	1053	331	2		1464	113	970	161	0		1244	442	1148	80	1		1671	**-**
Lights %	95.7%	90.3%	95.3%	0%		93%	75.7%	84.4%	97.9%	100%		86.6%	89.7%	97.4%	77.4%	0%		93.5%	93.4%	84.2%	89.9%	100%		86.8%	**-**
Single-Unit Trucks	4	9	7	0		20	11	60	5	0		76	5	13	11	0		29	6	101	4	0		111	**-**
Single-Unit Trucks %	2.5%	2.2%	2.5%	0%		2.4%	10.7%	4.8%	1.5%	0%		4.5%	4%	1.3%	5.3%	0%		2.2%	1.3%	7.4%	4.5%	0%		5.8%	**-**
Buses	0	16	0	0		16	0	19	0	0		19	0	2	0	0		2	15	17	0	0		32	**-**
Buses %	0%	4%	0%	0%		1.9%	0%	1.5%	0%	0%		1.1%	0%	0.2%	0%	0%		0.2%	3.2%	1.2%	0%	0%		1.7%	**-**
Articulated Trucks	3	14	6	0		23	14	115	2	0		131	8	11	36	0		55	10	97	5	0		112	**-**
Articulated Trucks %	1.9%	3.5%	2.2%	0%		2.7%	13.6%	9.2%	0.6%	0%		7.8%	6.3%	1.1%	17.3%	0%		4.1%	2.1%	7.1%	5.6%	0%		5.8%	**-**
Pedestrians	-	-	-	-	74	-	-	-	-	-	30	-	-	-	-	-	38	-	-	-	-	-	85	-	**-**
Pedestrians%	-	-	-	-	32%		-	-	-	-	13%		-	-	-	-	16.5%		-	-	-	-	36.8%		**-**
Bicycles on Crosswalk	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	1	-	-	-	-	-	3	-	**-**
Bicycles on Crosswalk%	-	-	-	-	0%		-	-	-	-	0%		-	-	-	-	0.4%		-	-	-	-	1.3%		**-**

Spectrum

Turning Movement Count
Location Name: BRAMALEA RD & STEELES AVE
Date: Thu, Mar 08, 2018 Deployment Lead: Theo Daglis

Peak Hour: 07:30 AM - 08:30 AM **Weather: Overcast (-3.2 °C)**



Spectrum

Turning Movement Count
Location Name: BRAMALEA RD & STEELES AVE
Date: Thu, Mar 08, 2018 Deployment Lead: Theo Daglis

Peak Hour: 01:00 PM - 02:00 PM **Weather: Overcast (0 °C)**



Spectrum

Turning Movement Count
Location Name: BRAMALEA RD & STEELES AVE
Date: Thu, Mar 08, 2018 Deployment Lead: Theo Daglis

Peak Hour: 04:30 PM - 05:30 PM **Weather: Snow (-0.4 °C)**



	Bicycles on Crosswalk	Pedestrians
N	0	74
S	1	38
E	0	30
W	3	85

Appendix B

Synchro Outputs

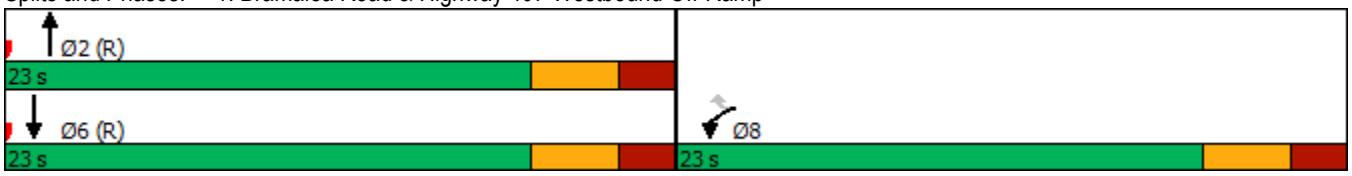


Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	104	80	281	0	0	751
Future Volume (vph)	104	80	281	0	0	751
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Ped Bike Factor						
Frt		0.850				
Flt Protected	0.950					
Satd. Flow (prot)	1722	1350	2664	0	0	3318
Flt Permitted	0.950					
Satd. Flow (perm)	1722	1350	2664	0	0	3318
Right Turn on Red		Yes		Yes		
Satd. Flow (RTOR)		84				
Link Speed (k/h)	48		48			48
Link Distance (m)	423.3		562.0			214.4
Travel Time (s)	31.7		42.2			16.1
Confl. Peds. (#/hr)				2	2	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles (%)	6%	21%	37%	0%	0%	10%
Adj. Flow (vph)	109	84	296	0	0	791
Shared Lane Traffic (%)						
Lane Group Flow (vph)	109	84	296	0	0	791
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.7		0.0			0.0
Link Offset(m)	0.0		0.0			0.0
Crosswalk Width(m)	1.6		1.6			1.6
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24	14		14	24	
Turn Type	Prot	Perm	NA			NA
Protected Phases	8		2			6
Permitted Phases		8				
Minimum Split (s)	22.5	22.5	23.0			23.0
Total Split (s)	23.0	23.0	23.0			23.0
Total Split (%)	50.0%	50.0%	50.0%			50.0%
Maximum Green (s)	18.0	18.0	18.0			18.0
Yellow Time (s)	3.0	3.0	3.0			3.0
All-Red Time (s)	2.0	2.0	2.0			2.0
Lost Time Adjust (s)	0.0	0.0	0.0			0.0
Total Lost Time (s)	5.0	5.0	5.0			5.0
Lead/Lag						
Lead-Lag Optimize?						
Walk Time (s)			7.0			7.0
Flash Dont Walk (s)			11.0			11.0
Pedestrian Calls (#/hr)			0			0
Act Effct Green (s)	18.0	18.0	18.0			18.0
Actuated g/C Ratio	0.39	0.39	0.39			0.39
v/c Ratio	0.16	0.15	0.28			0.61

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Control Delay	9.9	3.6	10.5			13.7
Queue Delay	0.0	0.0	0.0			0.0
Total Delay	9.9	3.6	10.5			13.7
LOS	A	A	B			B
Approach Delay	7.2		10.5			13.7
Approach LOS	A		B			B

Intersection Summary			
Area Type:	Other		
Cycle Length: 46			
Actuated Cycle Length: 46			
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green			
Natural Cycle: 50			
Control Type: Pretimed			
Maximum v/c Ratio: 0.61			
Intersection Signal Delay: 12.0		Intersection LOS: B	
Intersection Capacity Utilization 34.9%		ICU Level of Service A	
Analysis Period (min) 15			

Splits and Phases: 1: Bramalea Road & Highway 407 Westbound Off-Ramp





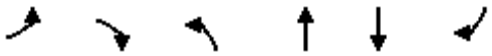
Lane Group	WBL	WBR	NBT	SBT
Lane Group Flow (vph)	109	84	296	791
v/c Ratio	0.16	0.15	0.28	0.61
Control Delay	9.9	3.6	10.5	13.7
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	9.9	3.6	10.5	13.7
Queue Length 50th (m)	5.4	0.0	8.1	25.3
Queue Length 95th (m)	12.7	5.6	14.7	39.2
Internal Link Dist (m)	399.3		538.0	190.4
Turn Bay Length (m)				
Base Capacity (vph)	673	579	1042	1298
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.16	0.15	0.28	0.61

Intersection Summary



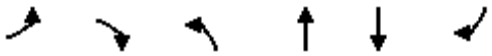
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	104	80	281	0	0	751
Future Volume (vph)	104	80	281	0	0	751
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0			5.0
Lane Util. Factor	1.00	1.00	0.95			0.95
Frpb, ped/bikes	1.00	1.00	1.00			1.00
Flpb, ped/bikes	1.00	1.00	1.00			1.00
Frt	1.00	0.85	1.00			1.00
Flt Protected	0.95	1.00	1.00			1.00
Satd. Flow (prot)	1722	1350	2664			3318
Flt Permitted	0.95	1.00	1.00			1.00
Satd. Flow (perm)	1722	1350	2664			3318
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	109	84	296	0	0	791
RTOR Reduction (vph)	0	51	0	0	0	0
Lane Group Flow (vph)	109	33	296	0	0	791
Confl. Peds. (#/hr)				2	2	
Heavy Vehicles (%)	6%	21%	37%	0%	0%	10%
Turn Type	Prot	Perm	NA			NA
Protected Phases	8		2			6
Permitted Phases		8				
Actuated Green, G (s)	18.0	18.0	18.0			18.0
Effective Green, g (s)	18.0	18.0	18.0			18.0
Actuated g/C Ratio	0.39	0.39	0.39			0.39
Clearance Time (s)	5.0	5.0	5.0			5.0
Lane Grp Cap (vph)	673	528	1042			1298
v/s Ratio Prot	c0.06		0.11			c0.24
v/s Ratio Perm		0.02				
v/c Ratio	0.16	0.06	0.28			0.61
Uniform Delay, d1	9.1	8.7	9.6			11.2
Progression Factor	1.00	1.00	1.00			1.00
Incremental Delay, d2	0.5	0.2	0.7			2.1
Delay (s)	9.6	9.0	10.3			13.3
Level of Service	A	A	B			B
Approach Delay (s)	9.3		10.3			13.3
Approach LOS	A		B			B

Intersection Summary			
HCM 2000 Control Delay	12.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.39		
Actuated Cycle Length (s)	46.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	34.9%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	0	0	0	327	796	4
Future Volume (vph)	0	0	0	327	796	4
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0	0.0	0.0			80.0
Storage Lanes	0	0	0			1
Taper Length (m)	2.5		2.5			
Lane Util. Factor	1.00	1.00	1.00	0.91	0.95	1.00
Ped Bike Factor						
Frt						0.850
Flt Protected						
Satd. Flow (prot)	0	0	0	3914	3411	1306
Flt Permitted						
Satd. Flow (perm)	0	0	0	3914	3411	1306
Link Speed (k/h)	48			48	48	
Link Distance (m)	62.7			94.3	562.0	
Travel Time (s)	4.7			7.1	42.2	
Confl. Peds. (#/hr)		1	2			2
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	0%	0%	0%	34%	7%	25%
Adj. Flow (vph)	0	0	0	363	884	4
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	0	0	363	884	4
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	0.0			3.7	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24	14	24			14
Sign Control	Stop			Free	Free	

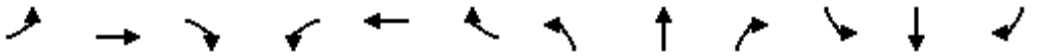
Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 32.3%		ICU Level of Service A	
Analysis Period (min) 15			



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations				↑↑↑	↑↑	↱
Traffic Volume (veh/h)	0	0	0	327	796	4
Future Volume (Veh/h)	0	0	0	327	796	4
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	0	0	0	363	884	4
Pedestrians	2			1		
Lane Width (m)	0.0			3.7		
Walking Speed (m/s)	1.1			1.1		
Percent Blockage	0			0		
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1007	445	890			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1007	445	890			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	100	100			
cM capacity (veh/h)	241	566	770			

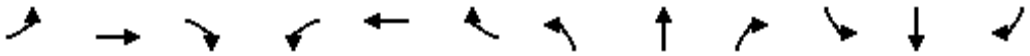
Direction, Lane #	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	121	121	121	442	442	4
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	0	4
cSH	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.07	0.07	0.07	0.26	0.26	0.00
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS						
Approach Delay (s)	0.0			0.0		
Approach LOS						

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	32.3%	ICU Level of Service	A
Analysis Period (min)	15		



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	2	0	3	10	0	12	5	309	43	59	741	2
Future Volume (vph)	2	0	3	10	0	12	5	309	43	59	741	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	0.0		0.0	35.0		45.0	60.0		0.0
Storage Lanes	0		0	1		1	1		1	1		0
Taper Length (m)	2.5			2.5			2.5			2.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	0.95
Ped Bike Factor												
Frt		0.919				0.850			0.850			
Flt Protected		0.980		0.950			0.950			0.950		
Satd. Flow (prot)	0	1730	0	1074	0	1633	1043	2664	1350	1706	3412	0
Flt Permitted		0.980		0.950			0.950			0.950		
Satd. Flow (perm)	0	1730	0	1074	0	1633	1043	2664	1350	1706	3412	0
Link Speed (k/h)		48			48			48			48	
Link Distance (m)		41.2			83.9			158.4			94.3	
Travel Time (s)		3.1			6.3			11.9			7.1	
Confl. Peds. (#/hr)	1					1	1		1	1		1
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Heavy Vehicles (%)	0%	0%	0%	70%	0%	0%	75%	37%	21%	7%	7%	0%
Adj. Flow (vph)	2	0	3	11	0	13	5	340	47	65	814	2
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	5	0	11	0	13	5	340	47	65	816	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.7			3.7			3.7			3.7	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		1.6			1.6			1.6			1.6	
Two way Left Turn Lane												
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24		14	24		14	24		14	24		14
Sign Control		Stop			Stop			Free			Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 37.5%		ICU Level of Service A	
Analysis Period (min) 15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	2	0	3	10	0	12	5	309	43	59	741	2
Future Volume (Veh/h)	2	0	3	10	0	12	5	309	43	59	741	2
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Hourly flow rate (vph)	2	0	3	11	0	13	5	340	47	65	814	2
Pedestrians		1			1						1	
Lane Width (m)		3.7			3.7						3.7	
Walking Speed (m/s)		1.1			1.1						1.1	
Percent Blockage		0			0						0	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	1140	1344	409	891	1298	172	817			388		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1140	1344	409	891	1298	172	817			388		
tC, single (s)	7.5	6.5	6.9	8.9	6.5	6.9	5.6			4.2		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	4.2	4.0	3.3	3.0			2.3		
p0 queue free %	99	100	99	92	100	98	99			94		
cM capacity (veh/h)	147	142	597	143	152	846	469			1131		

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3
Volume Total	5	11	13	5	170	170	47	65	543	273
Volume Left	2	11	0	5	0	0	0	65	0	0
Volume Right	3	0	13	0	0	0	47	0	0	2
cSH	269	143	846	469	1700	1700	1700	1131	1700	1700
Volume to Capacity	0.02	0.08	0.02	0.01	0.10	0.10	0.03	0.06	0.32	0.16
Queue Length 95th (m)	0.4	1.9	0.4	0.2	0.0	0.0	0.0	1.4	0.0	0.0
Control Delay (s)	18.6	32.2	9.3	12.8	0.0	0.0	0.0	8.4	0.0	0.0
Lane LOS	C	D	A	B				A		
Approach Delay (s)	18.6	19.8		0.2				0.6		
Approach LOS	C	C								

Intersection Summary				
Average Delay	0.9			
Intersection Capacity Utilization	37.5%	ICU Level of Service		A
Analysis Period (min)	15			



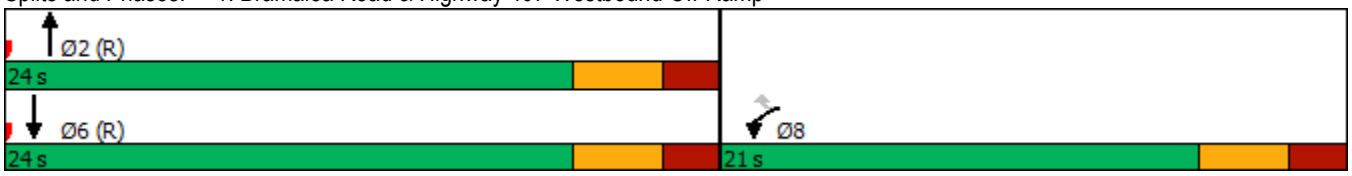
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	66	122	915	0	0	506
Future Volume (vph)	66	122	915	0	0	506
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Ped Bike Factor						
Frt		0.850				
Flt Protected	0.950					
Satd. Flow (prot)	1448	1372	3318	0	0	3174
Flt Permitted	0.950					
Satd. Flow (perm)	1448	1372	3318	0	0	3174
Right Turn on Red		Yes		Yes		
Satd. Flow (RTOR)		54				
Link Speed (k/h)	50		60			60
Link Distance (m)	423.3		562.0			214.4
Travel Time (s)	30.5		33.7			12.9
Confl. Peds. (#/hr)				1	1	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Heavy Vehicles (%)	26%	19%	10%	0%	0%	15%
Adj. Flow (vph)	68	126	943	0	0	522
Shared Lane Traffic (%)						
Lane Group Flow (vph)	68	126	943	0	0	522
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.7		0.0			0.0
Link Offset(m)	0.0		0.0			0.0
Crosswalk Width(m)	1.6		1.6			1.6
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24	14		14	24	
Turn Type	Prot	Perm	NA			NA
Protected Phases	8		2			6
Permitted Phases		8				
Minimum Split (s)	10.0	10.0	23.0			23.0
Total Split (s)	21.0	21.0	24.0			24.0
Total Split (%)	46.7%	46.7%	53.3%			53.3%
Maximum Green (s)	16.0	16.0	19.0			19.0
Yellow Time (s)	3.0	3.0	3.0			3.0
All-Red Time (s)	2.0	2.0	2.0			2.0
Lost Time Adjust (s)	0.0	0.0	0.0			0.0
Total Lost Time (s)	5.0	5.0	5.0			5.0
Lead/Lag						
Lead-Lag Optimize?						
Walk Time (s)			7.0			7.0
Flash Dont Walk (s)			11.0			11.0
Pedestrian Calls (#/hr)			0			0
Act Effct Green (s)	16.0	16.0	19.0			19.0
Actuated g/C Ratio	0.36	0.36	0.42			0.42
v/c Ratio	0.13	0.24	0.67			0.39



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Control Delay	10.7	8.0	13.5			10.1
Queue Delay	0.0	0.0	0.0			0.0
Total Delay	10.7	8.0	13.5			10.1
LOS	B	A	B			B
Approach Delay	9.0		13.5			10.1
Approach LOS	A		B			B

Intersection Summary			
Area Type:	Other		
Cycle Length: 45			
Actuated Cycle Length: 45			
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green			
Natural Cycle: 40			
Control Type: Pretimed			
Maximum v/c Ratio: 0.67			
Intersection Signal Delay: 11.9		Intersection LOS: B	
Intersection Capacity Utilization 41.2%		ICU Level of Service A	
Analysis Period (min) 15			

Splits and Phases: 1: Bramalea Road & Highway 407 Westbound Off-Ramp





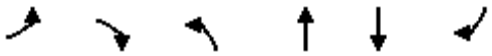
Lane Group	WBL	WBR	NBT	SBT
Lane Group Flow (vph)	68	126	943	522
v/c Ratio	0.13	0.24	0.67	0.39
Control Delay	10.7	8.0	13.5	10.1
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	10.7	8.0	13.5	10.1
Queue Length 50th (m)	3.5	3.7	29.4	13.8
Queue Length 95th (m)	9.4	11.9	45.0	22.6
Internal Link Dist (m)	399.3		538.0	190.4
Turn Bay Length (m)				
Base Capacity (vph)	514	522	1400	1340
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.13	0.24	0.67	0.39

Intersection Summary



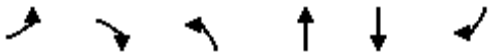
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	66	122	915	0	0	506
Future Volume (vph)	66	122	915	0	0	506
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0			5.0
Lane Util. Factor	1.00	1.00	0.95			0.95
Frpb, ped/bikes	1.00	1.00	1.00			1.00
Flpb, ped/bikes	1.00	1.00	1.00			1.00
Frt	1.00	0.85	1.00			1.00
Flt Protected	0.95	1.00	1.00			1.00
Satd. Flow (prot)	1448	1372	3318			3174
Flt Permitted	0.95	1.00	1.00			1.00
Satd. Flow (perm)	1448	1372	3318			3174
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	68	126	943	0	0	522
RTOR Reduction (vph)	0	35	0	0	0	0
Lane Group Flow (vph)	68	91	943	0	0	522
Confl. Peds. (#/hr)				1	1	
Heavy Vehicles (%)	26%	19%	10%	0%	0%	15%
Turn Type	Prot	Perm	NA			NA
Protected Phases	8		2			6
Permitted Phases		8				
Actuated Green, G (s)	16.0	16.0	19.0			19.0
Effective Green, g (s)	16.0	16.0	19.0			19.0
Actuated g/C Ratio	0.36	0.36	0.42			0.42
Clearance Time (s)	5.0	5.0	5.0			5.0
Lane Grp Cap (vph)	514	487	1400			1340
v/s Ratio Prot	0.05		c0.28			0.16
v/s Ratio Perm		c0.07				
v/c Ratio	0.13	0.19	0.67			0.39
Uniform Delay, d1	9.8	10.0	10.5			9.0
Progression Factor	1.00	1.00	1.00			1.00
Incremental Delay, d2	0.5	0.8	2.6			0.9
Delay (s)	10.3	10.9	13.1			9.8
Level of Service	B	B	B			A
Approach Delay (s)	10.7		13.1			9.8
Approach LOS	B		B			A

Intersection Summary			
HCM 2000 Control Delay	11.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.45		
Actuated Cycle Length (s)	45.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	41.2%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	0	0	0	1067	456	6
Future Volume (vph)	0	0	0	1067	456	6
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0	0.0	0.0			80.0
Storage Lanes	0	0	0			1
Taper Length (m)	2.5		2.5			
Lane Util. Factor	1.00	1.00	1.00	0.91	0.95	1.00
Frt						0.850
Flt Protected						
Satd. Flow (prot)	0	0	0	4812	3174	892
Flt Permitted						
Satd. Flow (perm)	0	0	0	4812	3174	892
Link Speed (k/h)	48			60	60	
Link Distance (m)	62.7			94.3	562.0	
Travel Time (s)	4.7			5.7	33.7	
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96
Heavy Vehicles (%)	0%	0%	0%	9%	15%	83%
Adj. Flow (vph)	0	0	0	1111	475	6
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	0	0	1111	475	6
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	0.0			3.7	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24	14	24			14
Sign Control	Stop			Free	Free	

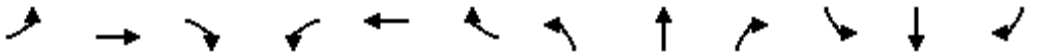
Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 23.9%		ICU Level of Service A	
Analysis Period (min) 15			



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations				↑↑↑	↑↑	↱
Traffic Volume (veh/h)	0	0	0	1067	456	6
Future Volume (Veh/h)	0	0	0	1067	456	6
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96
Hourly flow rate (vph)	0	0	0	1111	475	6
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	845	238	481			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	845	238	481			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	100	100			
cM capacity (veh/h)	306	770	1092			

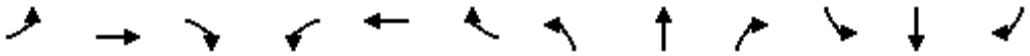
Direction, Lane #	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	370	370	370	238	238	6
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	0	6
cSH	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.22	0.22	0.22	0.14	0.14	0.00
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS						
Approach Delay (s)	0.0			0.0		
Approach LOS						

Intersection Summary				
Average Delay	0.0			
Intersection Capacity Utilization	23.9%	ICU Level of Service		A
Analysis Period (min)	15			



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	4	0	2	62	0	68	3	961	13	8	468	1
Future Volume (vph)	4	0	2	62	0	68	3	961	13	8	468	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	0.0		0.0	35.0		45.0	60.0		0.0
Storage Lanes	0		0	1		1	1		1	1		0
Taper Length (m)	2.5			2.5			2.5			2.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	0.95
Ped Bike Factor												
Frt		0.955				0.850			0.850			
Flt Protected		0.968		0.950			0.950			0.950		
Satd. Flow (prot)	0	1066	0	1587	0	1541	1217	3318	1118	1615	3142	0
Flt Permitted		0.968		0.950			0.950			0.950		
Satd. Flow (perm)	0	1066	0	1587	0	1541	1217	3318	1118	1615	3142	0
Link Speed (k/h)		48			48			60			60	
Link Distance (m)		41.2			83.9			158.4			94.3	
Travel Time (s)		3.1			6.3			9.5			5.7	
Confl. Peds. (#/hr)							2		1	1		2
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Heavy Vehicles (%)	50%	0%	100%	15%	0%	6%	50%	10%	46%	13%	16%	100%
Adj. Flow (vph)	4	0	2	64	0	70	3	991	13	8	482	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	6	0	64	0	70	3	991	13	8	483	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.7			3.7			3.7			3.7	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		1.6			1.6			1.6			1.6	
Two way Left Turn Lane												
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24		14	24		14	24		14	24		14
Sign Control		Stop			Stop			Free			Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization	44.1%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	4	0	2	62	0	68	3	961	13	8	468	1
Future Volume (Veh/h)	4	0	2	62	0	68	3	961	13	8	468	1
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	4	0	2	64	0	70	3	991	13	8	482	1
Pedestrians		2			1							
Lane Width (m)		3.7			3.7							
Walking Speed (m/s)		1.1			1.1							
Percent Blockage		0			0							
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	1072	1512	244	1257	1499	496	485			1005		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1072	1512	244	1257	1499	496	485			1005		
tC, single (s)	8.5	6.5	8.9	7.8	6.5	7.0	5.1			4.4		
tC, 2 stage (s)												
tF (s)	4.0	4.0	4.3	3.6	4.0	3.4	2.7			2.3		
p0 queue free %	96	100	100	43	100	86	100			99		
cM capacity (veh/h)	104	119	527	112	121	508	799			622		

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3
Volume Total	6	64	70	3	496	496	13	8	321	162
Volume Left	4	64	0	3	0	0	0	8	0	0
Volume Right	2	0	70	0	0	0	13	0	0	1
cSH	142	112	508	799	1700	1700	1700	622	1700	1700
Volume to Capacity	0.04	0.57	0.14	0.00	0.29	0.29	0.01	0.01	0.19	0.10
Queue Length 95th (m)	1.0	20.8	3.6	0.1	0.0	0.0	0.0	0.3	0.0	0.0
Control Delay (s)	31.5	72.9	13.2	9.5	0.0	0.0	0.0	10.9	0.0	0.0
Lane LOS	D	F	B	A				B		
Approach Delay (s)	31.5	41.7		0.0				0.2		
Approach LOS	D	E								

Intersection Summary				
Average Delay	3.6			
Intersection Capacity Utilization	44.1%	ICU Level of Service		A
Analysis Period (min)	15			

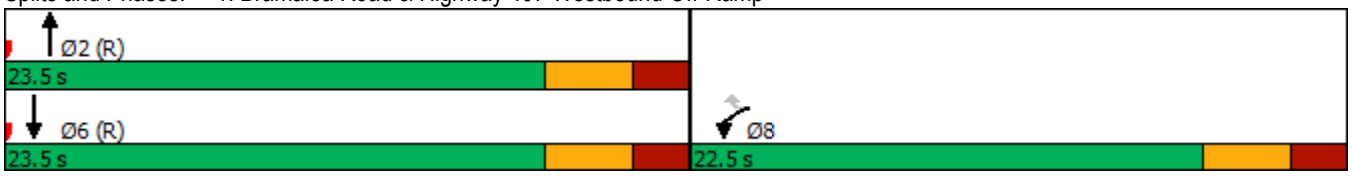


Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	117	90	376	0	0	928
Future Volume (vph)	117	90	376	0	0	928
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Ped Bike Factor						
Frt		0.850				
Flt Protected	0.950					
Satd. Flow (prot)	1722	1350	2664	0	0	3318
Flt Permitted	0.950					
Satd. Flow (perm)	1722	1350	2664	0	0	3318
Right Turn on Red		Yes		Yes		
Satd. Flow (RTOR)		95				
Link Speed (k/h)	48		48			48
Link Distance (m)	423.3		562.0			214.4
Travel Time (s)	31.7		42.2			16.1
Confl. Peds. (#/hr)				2	2	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles (%)	6%	21%	37%	0%	0%	10%
Adj. Flow (vph)	123	95	396	0	0	977
Shared Lane Traffic (%)						
Lane Group Flow (vph)	123	95	396	0	0	977
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.7		0.0			0.0
Link Offset(m)	0.0		0.0			0.0
Crosswalk Width(m)	1.6		1.6			1.6
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24	14		14	24	
Turn Type	Prot	Perm	NA			NA
Protected Phases	8		2			6
Permitted Phases		8				
Minimum Split (s)	22.5	22.5	23.0			23.0
Total Split (s)	22.5	22.5	23.5			23.5
Total Split (%)	48.9%	48.9%	51.1%			51.1%
Maximum Green (s)	17.5	17.5	18.5			18.5
Yellow Time (s)	3.0	3.0	3.0			3.0
All-Red Time (s)	2.0	2.0	2.0			2.0
Lost Time Adjust (s)	0.0	0.0	0.0			0.0
Total Lost Time (s)	5.0	5.0	5.0			5.0
Lead/Lag						
Lead-Lag Optimize?						
Walk Time (s)			7.0			7.0
Flash Dont Walk (s)			11.0			11.0
Pedestrian Calls (#/hr)			0			0
Act Effct Green (s)	17.5	17.5	18.5			18.5
Actuated g/C Ratio	0.38	0.38	0.40			0.40
v/c Ratio	0.19	0.17	0.37			0.73

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Control Delay	10.5	3.6	10.9			15.7
Queue Delay	0.0	0.0	0.0			0.0
Total Delay	10.5	3.6	10.9			15.7
LOS	B	A	B			B
Approach Delay	7.5		10.9			15.7
Approach LOS	A		B			B

Intersection Summary			
Area Type:	Other		
Cycle Length: 46			
Actuated Cycle Length: 46			
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green			
Natural Cycle: 50			
Control Type: Pretimed			
Maximum v/c Ratio: 0.73			
Intersection Signal Delay: 13.4		Intersection LOS: B	
Intersection Capacity Utilization 40.5%		ICU Level of Service A	
Analysis Period (min) 15			

Splits and Phases: 1: Bramalea Road & Highway 407 Westbound Off-Ramp





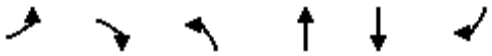
Lane Group	WBL	WBR	NBT	SBT
Lane Group Flow (vph)	123	95	396	977
v/c Ratio	0.19	0.17	0.37	0.73
Control Delay	10.5	3.6	10.9	15.7
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	10.5	3.6	10.9	15.7
Queue Length 50th (m)	6.3	0.0	11.1	33.0
Queue Length 95th (m)	14.3	6.1	19.1	50.4
Internal Link Dist (m)	399.3		538.0	190.4
Turn Bay Length (m)				
Base Capacity (vph)	655	572	1071	1334
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.19	0.17	0.37	0.73

Intersection Summary



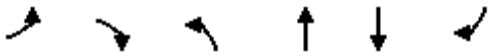
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	117	90	376	0	0	928
Future Volume (vph)	117	90	376	0	0	928
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0			5.0
Lane Util. Factor	1.00	1.00	0.95			0.95
Frpb, ped/bikes	1.00	1.00	1.00			1.00
Flpb, ped/bikes	1.00	1.00	1.00			1.00
Frt	1.00	0.85	1.00			1.00
Flt Protected	0.95	1.00	1.00			1.00
Satd. Flow (prot)	1722	1350	2664			3318
Flt Permitted	0.95	1.00	1.00			1.00
Satd. Flow (perm)	1722	1350	2664			3318
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	123	95	396	0	0	977
RTOR Reduction (vph)	0	59	0	0	0	0
Lane Group Flow (vph)	123	36	396	0	0	977
Confl. Peds. (#/hr)				2	2	
Heavy Vehicles (%)	6%	21%	37%	0%	0%	10%
Turn Type	Prot	Perm	NA			NA
Protected Phases	8		2			6
Permitted Phases		8				
Actuated Green, G (s)	17.5	17.5	18.5			18.5
Effective Green, g (s)	17.5	17.5	18.5			18.5
Actuated g/C Ratio	0.38	0.38	0.40			0.40
Clearance Time (s)	5.0	5.0	5.0			5.0
Lane Grp Cap (vph)	655	513	1071			1334
v/s Ratio Prot	c0.07		0.15			c0.29
v/s Ratio Perm		0.03				
v/c Ratio	0.19	0.07	0.37			0.73
Uniform Delay, d1	9.5	9.1	9.7			11.7
Progression Factor	1.00	1.00	1.00			1.00
Incremental Delay, d2	0.6	0.3	1.0			3.6
Delay (s)	10.1	9.3	10.6			15.2
Level of Service	B	A	B			B
Approach Delay (s)	9.8		10.6			15.2
Approach LOS	A		B			B

Intersection Summary			
HCM 2000 Control Delay	13.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	46.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	40.5%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	0	0	0	438	984	4
Future Volume (vph)	0	0	0	438	984	4
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0	0.0	0.0			80.0
Storage Lanes	0	0	0			1
Taper Length (m)	2.5		2.5			
Lane Util. Factor	1.00	1.00	1.00	0.91	0.95	1.00
Ped Bike Factor						
Frt						0.850
Flt Protected						
Satd. Flow (prot)	0	0	0	3914	3411	1306
Flt Permitted						
Satd. Flow (perm)	0	0	0	3914	3411	1306
Link Speed (k/h)	48			48	48	
Link Distance (m)	62.7			94.3	562.0	
Travel Time (s)	4.7			7.1	42.2	
Confl. Peds. (#/hr)		1	2			2
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	0%	0%	0%	34%	7%	25%
Adj. Flow (vph)	0	0	0	487	1093	4
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	0	0	487	1093	4
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	0.0			3.7	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24	14	24			14
Sign Control	Stop			Free	Free	

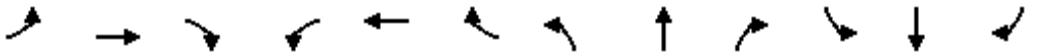
Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 37.5%		ICU Level of Service A	
Analysis Period (min) 15			



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations				↑↑↑	↑↑	↱
Traffic Volume (veh/h)	0	0	0	438	984	4
Future Volume (Veh/h)	0	0	0	438	984	4
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	0	0	0	487	1093	4
Pedestrians	2			1		
Lane Width (m)	0.0			3.7		
Walking Speed (m/s)	1.1			1.1		
Percent Blockage	0			0		
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1257	550	1099			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1257	550	1099			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	100	100			
cM capacity (veh/h)	166	484	643			

Direction, Lane #	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	162	162	162	546	546	4
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	0	4
cSH	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.10	0.10	0.10	0.32	0.32	0.00
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS						
Approach Delay (s)	0.0			0.0		
Approach LOS						

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	37.5%	ICU Level of Service	A
Analysis Period (min)	15		



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	2	0	3	10	0	12	5	413	43	59	916	2
Future Volume (vph)	2	0	3	10	0	12	5	413	43	59	916	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	0.0		0.0	35.0		45.0	60.0		0.0
Storage Lanes	0		0	1		1	1		1	1		0
Taper Length (m)	2.5			2.5			2.5			2.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	0.95
Ped Bike Factor												
Frt		0.919				0.850			0.850			
Flt Protected		0.980		0.950			0.950			0.950		
Satd. Flow (prot)	0	1730	0	1074	0	1633	1043	2664	1350	1706	3412	0
Flt Permitted		0.980		0.950			0.950			0.950		
Satd. Flow (perm)	0	1730	0	1074	0	1633	1043	2664	1350	1706	3412	0
Link Speed (k/h)		48			48			48			48	
Link Distance (m)		41.2			83.9			158.4			94.3	
Travel Time (s)		3.1			6.3			11.9			7.1	
Confl. Peds. (#/hr)	1					1	1		1	1		1
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Heavy Vehicles (%)	0%	0%	0%	70%	0%	0%	75%	37%	21%	7%	7%	0%
Adj. Flow (vph)	2	0	3	11	0	13	5	454	47	65	1007	2
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	5	0	11	0	13	5	454	47	65	1009	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.7			3.7			3.7			3.7	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		1.6			1.6			1.6			1.6	
Two way Left Turn Lane												
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24		14	24		14	24		14	24		14
Sign Control		Stop			Stop			Free			Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization	42.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	2	0	3	10	0	12	5	413	43	59	916	2
Future Volume (Veh/h)	2	0	3	10	0	12	5	413	43	59	916	2
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Hourly flow rate (vph)	2	0	3	11	0	13	5	454	47	65	1007	2
Pedestrians		1			1						1	
Lane Width (m)		3.7			3.7						3.7	
Walking Speed (m/s)		1.1			1.1						1.1	
Percent Blockage		0			0						0	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	1390	1651	506	1102	1605	229	1010			502		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1390	1651	506	1102	1605	229	1010			502		
tC, single (s)	7.5	6.5	6.9	8.9	6.5	6.9	5.6			4.2		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	4.2	4.0	3.3	3.0			2.3		
p0 queue free %	98	100	99	88	100	98	99			94		
cM capacity (veh/h)	96	92	517	93	98	778	372			1023		

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3
Volume Total	5	11	13	5	227	227	47	65	671	338
Volume Left	2	11	0	5	0	0	0	65	0	0
Volume Right	3	0	13	0	0	0	47	0	0	2
cSH	187	93	778	372	1700	1700	1700	1023	1700	1700
Volume to Capacity	0.03	0.12	0.02	0.01	0.13	0.13	0.03	0.06	0.39	0.20
Queue Length 95th (m)	0.6	2.9	0.4	0.3	0.0	0.0	0.0	1.5	0.0	0.0
Control Delay (s)	24.8	48.6	9.7	14.8	0.0	0.0	0.0	8.8	0.0	0.0
Lane LOS	C	E	A	B				A		
Approach Delay (s)	24.8	27.5		0.1				0.5		
Approach LOS	C	D								

Intersection Summary				
Average Delay	0.9			
Intersection Capacity Utilization	42.4%	ICU Level of Service	A	
Analysis Period (min)	15			



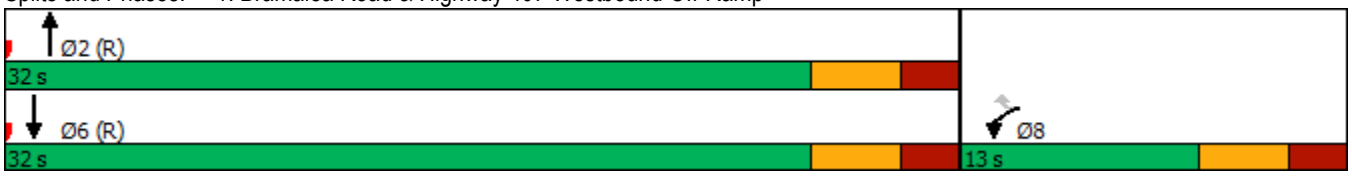
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	74	137	1175	0	0	650
Future Volume (vph)	74	137	1175	0	0	650
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Ped Bike Factor						
Frt		0.850				
Flt Protected	0.950					
Satd. Flow (prot)	1448	1372	3318	0	0	3174
Flt Permitted	0.950					
Satd. Flow (perm)	1448	1372	3318	0	0	3174
Right Turn on Red		Yes		Yes		
Satd. Flow (RTOR)		74				
Link Speed (k/h)	48		48			48
Link Distance (m)	423.3		562.0			214.4
Travel Time (s)	31.7		42.2			16.1
Confl. Peds. (#/hr)				1	1	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Heavy Vehicles (%)	26%	19%	10%	0%	0%	15%
Adj. Flow (vph)	76	141	1211	0	0	670
Shared Lane Traffic (%)						
Lane Group Flow (vph)	76	141	1211	0	0	670
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.7		0.0			0.0
Link Offset(m)	0.0		0.0			0.0
Crosswalk Width(m)	1.6		1.6			1.6
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24	14		14	24	
Turn Type	Prot	Perm	NA			NA
Protected Phases	8		2			6
Permitted Phases		8				
Minimum Split (s)	10.0	10.0	23.0			23.0
Total Split (s)	13.0	13.0	32.0			32.0
Total Split (%)	28.9%	28.9%	71.1%			71.1%
Maximum Green (s)	8.0	8.0	27.0			27.0
Yellow Time (s)	3.0	3.0	3.0			3.0
All-Red Time (s)	2.0	2.0	2.0			2.0
Lost Time Adjust (s)	0.0	0.0	0.0			0.0
Total Lost Time (s)	5.0	5.0	5.0			5.0
Lead/Lag						
Lead-Lag Optimize?						
Walk Time (s)			7.0			7.0
Flash Dont Walk (s)			11.0			11.0
Pedestrian Calls (#/hr)			0			0
Act Effct Green (s)	8.0	8.0	27.0			27.0
Actuated g/C Ratio	0.18	0.18	0.60			0.60
v/c Ratio	0.30	0.46	0.61			0.35



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Control Delay	19.6	14.9	7.3			5.2
Queue Delay	0.0	0.0	0.0			0.0
Total Delay	19.6	14.9	7.3			5.2
LOS	B	B	A			A
Approach Delay	16.5		7.3			5.2
Approach LOS	B		A			A

Intersection Summary			
Area Type:	Other		
Cycle Length: 45			
Actuated Cycle Length: 45			
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green			
Natural Cycle: 40			
Control Type: Pretimed			
Maximum v/c Ratio: 0.61			
Intersection Signal Delay: 7.6		Intersection LOS: A	
Intersection Capacity Utilization 49.3%		ICU Level of Service A	
Analysis Period (min) 15			

Splits and Phases: 1: Bramalea Road & Highway 407 Westbound Off-Ramp





Lane Group	WBL	WBR	NBT	SBT
Lane Group Flow (vph)	76	141	1211	670
v/c Ratio	0.30	0.46	0.61	0.35
Control Delay	19.6	14.9	7.3	5.2
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	19.6	14.9	7.3	5.2
Queue Length 50th (m)	5.3	4.6	25.5	11.3
Queue Length 95th (m)	13.8	16.3	38.8	18.0
Internal Link Dist (m)	399.3		538.0	190.4
Turn Bay Length (m)				
Base Capacity (vph)	257	304	1990	1904
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.30	0.46	0.61	0.35

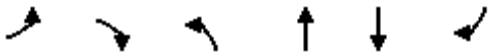
Intersection Summary



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	74	137	1175	0	0	650
Future Volume (vph)	74	137	1175	0	0	650
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0			5.0
Lane Util. Factor	1.00	1.00	0.95			0.95
Frpb, ped/bikes	1.00	1.00	1.00			1.00
Flpb, ped/bikes	1.00	1.00	1.00			1.00
Frt	1.00	0.85	1.00			1.00
Flt Protected	0.95	1.00	1.00			1.00
Satd. Flow (prot)	1448	1372	3318			3174
Flt Permitted	0.95	1.00	1.00			1.00
Satd. Flow (perm)	1448	1372	3318			3174
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	76	141	1211	0	0	670
RTOR Reduction (vph)	0	61	0	0	0	0
Lane Group Flow (vph)	76	80	1211	0	0	670
Confl. Peds. (#/hr)				1	1	
Heavy Vehicles (%)	26%	19%	10%	0%	0%	15%
Turn Type	Prot	Perm	NA			NA
Protected Phases	8		2			6
Permitted Phases		8				
Actuated Green, G (s)	8.0	8.0	27.0			27.0
Effective Green, g (s)	8.0	8.0	27.0			27.0
Actuated g/C Ratio	0.18	0.18	0.60			0.60
Clearance Time (s)	5.0	5.0	5.0			5.0
Lane Grp Cap (vph)	257	243	1990			1904
v/s Ratio Prot	0.05		c0.36			0.21
v/s Ratio Perm		c0.06				
v/c Ratio	0.30	0.33	0.61			0.35
Uniform Delay, d1	16.1	16.2	5.7			4.6
Progression Factor	1.00	1.00	1.00			1.00
Incremental Delay, d2	2.9	3.6	1.4			0.5
Delay (s)	19.0	19.8	7.1			5.1
Level of Service	B	B	A			A
Approach Delay (s)	19.5		7.1			5.1
Approach LOS	B		A			A

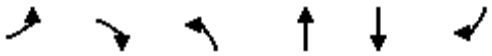
Intersection Summary			
HCM 2000 Control Delay	7.7	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	45.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	49.3%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	0	0	0	1153	585	6
Future Volume (vph)	0	0	0	1153	585	6
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0	0.0	0.0			80.0
Storage Lanes	0	0	0			1
Taper Length (m)	2.5		2.5			
Lane Util. Factor	1.00	1.00	1.00	0.91	0.95	1.00
Frt						0.850
Flt Protected						
Satd. Flow (prot)	0	0	0	4812	3174	892
Flt Permitted						
Satd. Flow (perm)	0	0	0	4812	3174	892
Link Speed (k/h)	48			48	48	
Link Distance (m)	62.7			94.3	562.0	
Travel Time (s)	4.7			7.1	42.2	
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96
Heavy Vehicles (%)	0%	0%	0%	9%	15%	83%
Adj. Flow (vph)	0	0	0	1201	609	6
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	0	0	1201	609	6
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	0.0			3.7	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24	14	24			14
Sign Control	Stop			Free	Free	

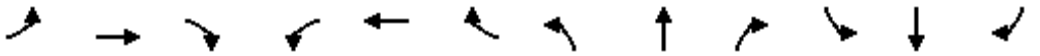
Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 25.6%		ICU Level of Service A	
Analysis Period (min) 15			



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	0	0	1153	585	6
Future Volume (Veh/h)	0	0	0	1153	585	6
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96
Hourly flow rate (vph)	0	0	0	1201	609	6
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1009	304	615			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1009	304	615			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	100	100			
cM capacity (veh/h)	240	697	974			

Direction, Lane #	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	400	400	400	304	304	6
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	0	6
cSH	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.24	0.24	0.24	0.18	0.18	0.00
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS						
Approach Delay (s)	0.0			0.0		
Approach LOS						

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	25.6%	ICU Level of Service	A
Analysis Period (min)	15		



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	4	0	2	62	0	68	3	1039	13	8	601	1
Future Volume (vph)	4	0	2	62	0	68	3	1039	13	8	601	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	0.0		0.0	35.0		45.0	60.0		0.0
Storage Lanes	0		0	1		1	1		1	1		0
Taper Length (m)	2.5			2.5			2.5			2.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	0.95
Ped Bike Factor												
Frt		0.955				0.850			0.850			
Flt Protected		0.968		0.950			0.950			0.950		
Satd. Flow (prot)	0	1066	0	1587	0	1541	1217	3318	1118	1615	3143	0
Flt Permitted		0.968		0.950			0.950			0.950		
Satd. Flow (perm)	0	1066	0	1587	0	1541	1217	3318	1118	1615	3143	0
Link Speed (k/h)		48			48			48			48	
Link Distance (m)		41.2			83.9			158.4			94.3	
Travel Time (s)		3.1			6.3			11.9			7.1	
Confl. Peds. (#/hr)							2		1	1		2
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Heavy Vehicles (%)	50%	0%	100%	15%	0%	6%	50%	10%	46%	13%	16%	100%
Adj. Flow (vph)	4	0	2	64	0	70	3	1071	13	8	620	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	6	0	64	0	70	3	1071	13	8	621	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.7			3.7			3.7			3.7	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		1.6			1.6			1.6			1.6	
Two way Left Turn Lane												
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24		14	24		14	24		14	24		14
Sign Control		Stop			Stop			Free			Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization	46.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	4	0	2	62	0	68	3	1039	13	8	601	1
Future Volume (Veh/h)	4	0	2	62	0	68	3	1039	13	8	601	1
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	4	0	2	64	0	70	3	1071	13	8	620	1
Pedestrians		2			1							
Lane Width (m)		3.7			3.7							
Walking Speed (m/s)		1.1			1.1							
Percent Blockage		0			0							
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	1250	1730	312	1406	1717	536	623			1085		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1250	1730	312	1406	1717	536	623			1085		
tC, single (s)	8.5	6.5	8.9	7.8	6.5	7.0	5.1			4.4		
tC, 2 stage (s)												
tF (s)	4.0	4.0	4.3	3.6	4.0	3.4	2.7			2.3		
p0 queue free %	95	100	100	26	100	85	100			99		
cM capacity (veh/h)	73	87	462	86	89	478	689			577		

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3
Volume Total	6	64	70	3	536	536	13	8	413	208
Volume Left	4	64	0	3	0	0	0	8	0	0
Volume Right	2	0	70	0	0	0	13	0	0	1
cSH	101	86	478	689	1700	1700	1700	577	1700	1700
Volume to Capacity	0.06	0.74	0.15	0.00	0.32	0.32	0.01	0.01	0.24	0.12
Queue Length 95th (m)	1.4	28.2	3.9	0.1	0.0	0.0	0.0	0.3	0.0	0.0
Control Delay (s)	42.7	120.6	13.8	10.2	0.0	0.0	0.0	11.3	0.0	0.0
Lane LOS	E	F	B	B				B		
Approach Delay (s)	42.7	64.8		0.0				0.1		
Approach LOS	E	F								

Intersection Summary				
Average Delay	4.9			
Intersection Capacity Utilization	46.3%	ICU Level of Service		A
Analysis Period (min)	15			



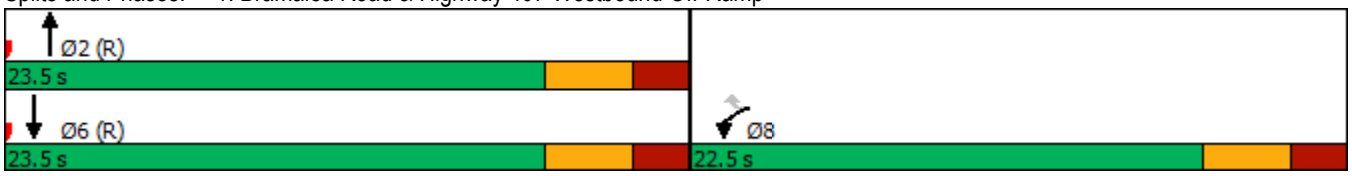
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	129	90	380	0	0	928
Future Volume (vph)	129	90	380	0	0	928
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Ped Bike Factor						
Frt		0.850				
Flt Protected	0.950					
Satd. Flow (prot)	1722	1350	2664	0	0	3318
Flt Permitted	0.950					
Satd. Flow (perm)	1722	1350	2664	0	0	3318
Right Turn on Red		Yes		Yes		
Satd. Flow (RTOR)		95				
Link Speed (k/h)	48		48			48
Link Distance (m)	423.3		562.0			214.4
Travel Time (s)	31.7		42.2			16.1
Confl. Peds. (#/hr)				2	2	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles (%)	6%	21%	37%	0%	0%	10%
Adj. Flow (vph)	136	95	400	0	0	977
Shared Lane Traffic (%)						
Lane Group Flow (vph)	136	95	400	0	0	977
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.7		0.0			0.0
Link Offset(m)	0.0		0.0			0.0
Crosswalk Width(m)	1.6		1.6			1.6
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24	14		14	24	
Turn Type	Prot	Perm	NA			NA
Protected Phases	8		2			6
Permitted Phases		8				
Minimum Split (s)	22.5	22.5	23.0			23.0
Total Split (s)	22.5	22.5	23.5			23.5
Total Split (%)	48.9%	48.9%	51.1%			51.1%
Maximum Green (s)	17.5	17.5	18.5			18.5
Yellow Time (s)	3.0	3.0	3.0			3.0
All-Red Time (s)	2.0	2.0	2.0			2.0
Lost Time Adjust (s)	0.0	0.0	0.0			0.0
Total Lost Time (s)	5.0	5.0	5.0			5.0
Lead/Lag						
Lead-Lag Optimize?						
Walk Time (s)			7.0			7.0
Flash Dont Walk (s)			11.0			11.0
Pedestrian Calls (#/hr)			0			0
Act Effct Green (s)	17.5	17.5	18.5			18.5
Actuated g/C Ratio	0.38	0.38	0.40			0.40
v/c Ratio	0.21	0.17	0.37			0.73



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Control Delay	10.7	3.6	11.0			15.7
Queue Delay	0.0	0.0	0.0			0.0
Total Delay	10.7	3.6	11.0			15.7
LOS	B	A	B			B
Approach Delay	7.8		11.0			15.7
Approach LOS	A		B			B

Intersection Summary			
Area Type:	Other		
Cycle Length: 46			
Actuated Cycle Length: 46			
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green			
Natural Cycle: 50			
Control Type: Pretimed			
Maximum v/c Ratio: 0.73			
Intersection Signal Delay: 13.4		Intersection LOS: B	
Intersection Capacity Utilization 41.1%		ICU Level of Service A	
Analysis Period (min) 15			

Splits and Phases: 1: Bramalea Road & Highway 407 Westbound Off-Ramp





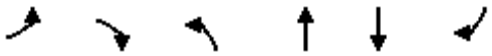
Lane Group	WBL	WBR	NBT	SBT
Lane Group Flow (vph)	136	95	400	977
v/c Ratio	0.21	0.17	0.37	0.73
Control Delay	10.7	3.6	11.0	15.7
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	10.7	3.6	11.0	15.7
Queue Length 50th (m)	7.0	0.0	11.2	33.0
Queue Length 95th (m)	15.6	6.1	19.3	50.4
Internal Link Dist (m)	399.3		538.0	190.4
Turn Bay Length (m)				
Base Capacity (vph)	655	572	1071	1334
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.21	0.17	0.37	0.73

Intersection Summary



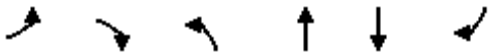
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	129	90	380	0	0	928
Future Volume (vph)	129	90	380	0	0	928
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0			5.0
Lane Util. Factor	1.00	1.00	0.95			0.95
Frpb, ped/bikes	1.00	1.00	1.00			1.00
Flpb, ped/bikes	1.00	1.00	1.00			1.00
Frt	1.00	0.85	1.00			1.00
Flt Protected	0.95	1.00	1.00			1.00
Satd. Flow (prot)	1722	1350	2664			3318
Flt Permitted	0.95	1.00	1.00			1.00
Satd. Flow (perm)	1722	1350	2664			3318
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	136	95	400	0	0	977
RTOR Reduction (vph)	0	59	0	0	0	0
Lane Group Flow (vph)	136	36	400	0	0	977
Confl. Peds. (#/hr)				2	2	
Heavy Vehicles (%)	6%	21%	37%	0%	0%	10%
Turn Type	Prot	Perm	NA			NA
Protected Phases	8		2			6
Permitted Phases		8				
Actuated Green, G (s)	17.5	17.5	18.5			18.5
Effective Green, g (s)	17.5	17.5	18.5			18.5
Actuated g/C Ratio	0.38	0.38	0.40			0.40
Clearance Time (s)	5.0	5.0	5.0			5.0
Lane Grp Cap (vph)	655	513	1071			1334
v/s Ratio Prot	c0.08		0.15			c0.29
v/s Ratio Perm		0.03				
v/c Ratio	0.21	0.07	0.37			0.73
Uniform Delay, d1	9.6	9.1	9.7			11.7
Progression Factor	1.00	1.00	1.00			1.00
Incremental Delay, d2	0.7	0.3	1.0			3.6
Delay (s)	10.3	9.3	10.7			15.2
Level of Service	B	A	B			B
Approach Delay (s)	9.9		10.7			15.2
Approach LOS	A		B			B

Intersection Summary			
HCM 2000 Control Delay	13.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	46.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	41.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	0	0	0	442	988	8
Future Volume (vph)	0	0	0	442	988	8
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0	0.0	0.0			80.0
Storage Lanes	0	0	0			1
Taper Length (m)	2.5		2.5			
Lane Util. Factor	1.00	1.00	1.00	0.91	0.95	1.00
Ped Bike Factor						
Frt						0.850
Flt Protected						
Satd. Flow (prot)	0	0	0	3914	3411	1306
Flt Permitted						
Satd. Flow (perm)	0	0	0	3914	3411	1306
Link Speed (k/h)	48			48	48	
Link Distance (m)	62.7			94.3	562.0	
Travel Time (s)	4.7			7.1	42.2	
Confl. Peds. (#/hr)		1	2			2
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	0%	0%	0%	34%	7%	25%
Adj. Flow (vph)	0	0	0	491	1098	9
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	0	0	491	1098	9
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	0.0			3.7	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24	14	24			14
Sign Control	Stop			Free	Free	

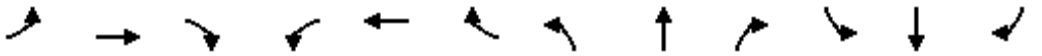
Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 37.6%		ICU Level of Service A	
Analysis Period (min) 15			



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	0	0	442	988	8
Future Volume (Veh/h)	0	0	0	442	988	8
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	0	0	0	491	1098	9
Pedestrians	2			1		
Lane Width (m)	0.0			3.7		
Walking Speed (m/s)	1.1			1.1		
Percent Blockage	0			0		
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1264	552	1109			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1264	552	1109			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	100	100			
cM capacity (veh/h)	164	482	637			

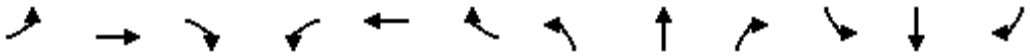
Direction, Lane #	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	164	164	164	549	549	9
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	0	9
cSH	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.10	0.10	0.10	0.32	0.32	0.01
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS						
Approach Delay (s)	0.0			0.0		
Approach LOS						

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	37.6%	ICU Level of Service	A
Analysis Period (min)	15		



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	4	0	6	10	0	12	10	413	43	59	916	4
Future Volume (vph)	4	0	6	10	0	12	10	413	43	59	916	4
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	0.0		0.0	35.0		45.0	60.0		0.0
Storage Lanes	0		0	1		1	1		1	1		0
Taper Length (m)	2.5			2.5			2.5			2.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	0.95
Ped Bike Factor												
Frt		0.914				0.850			0.850		0.999	
Flt Protected		0.982		0.950			0.950			0.950		
Satd. Flow (prot)	0	1724	0	1074	0	1633	1043	2664	1350	1706	3409	0
Flt Permitted		0.982		0.950			0.950			0.950		
Satd. Flow (perm)	0	1724	0	1074	0	1633	1043	2664	1350	1706	3409	0
Link Speed (k/h)		48			48			48			48	
Link Distance (m)		41.2			83.9			158.4			94.3	
Travel Time (s)		3.1			6.3			11.9			7.1	
Confl. Peds. (#/hr)	1					1	1		1	1		1
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Heavy Vehicles (%)	0%	0%	0%	70%	0%	0%	75%	37%	21%	7%	7%	0%
Adj. Flow (vph)	4	0	7	11	0	13	11	454	47	65	1007	4
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	11	0	11	0	13	11	454	47	65	1011	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.7			3.7			3.7			3.7	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		1.6			1.6			1.6			1.6	
Two way Left Turn Lane												
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24		14	24		14	24		14	24		14
Sign Control		Stop			Stop			Free			Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization	43.0%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	4	0	6	10	0	12	10	413	43	59	916	4
Future Volume (Veh/h)	4	0	6	10	0	12	10	413	43	59	916	4
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Hourly flow rate (vph)	4	0	7	11	0	13	11	454	47	65	1007	4
Pedestrians		1			1						1	
Lane Width (m)		3.7			3.7						3.7	
Walking Speed (m/s)		1.1			1.1						1.1	
Percent Blockage		0			0						0	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	1403	1664	506	1118	1619	229	1012			502		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1403	1664	506	1118	1619	229	1012			502		
tC, single (s)	7.5	6.5	6.9	8.9	6.5	6.9	5.6			4.2		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	4.2	4.0	3.3	3.0			2.3		
p0 queue free %	96	100	99	88	100	98	97			94		
cM capacity (veh/h)	92	89	516	89	95	778	372			1023		

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3
Volume Total	11	11	13	11	227	227	47	65	671	340
Volume Left	4	11	0	11	0	0	0	65	0	0
Volume Right	7	0	13	0	0	0	47	0	0	4
cSH	193	89	778	372	1700	1700	1700	1023	1700	1700
Volume to Capacity	0.06	0.12	0.02	0.03	0.13	0.13	0.03	0.06	0.39	0.20
Queue Length 95th (m)	1.4	3.1	0.4	0.7	0.0	0.0	0.0	1.5	0.0	0.0
Control Delay (s)	24.7	51.3	9.7	15.0	0.0	0.0	0.0	8.8	0.0	0.0
Lane LOS	C	F	A	B				A		
Approach Delay (s)	24.7	28.8		0.3				0.5		
Approach LOS	C	D								

Intersection Summary				
Average Delay	1.0			
Intersection Capacity Utilization	43.0%	ICU Level of Service	A	
Analysis Period (min)	15			

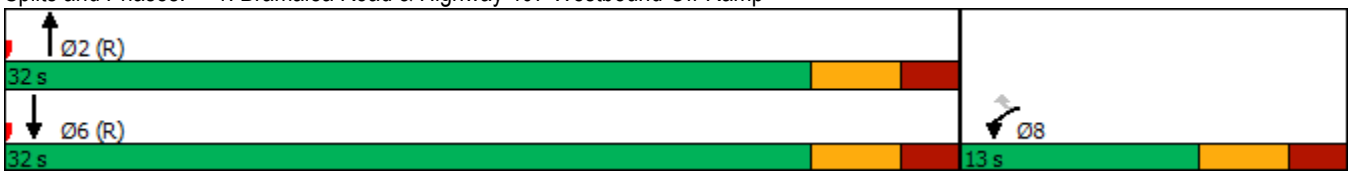


Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	86	137	1183	0	0	650
Future Volume (vph)	86	137	1183	0	0	650
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Ped Bike Factor						
Frt		0.850				
Flt Protected	0.950					
Satd. Flow (prot)	1448	1372	3318	0	0	3174
Flt Permitted	0.950					
Satd. Flow (perm)	1448	1372	3318	0	0	3174
Right Turn on Red		Yes		Yes		
Satd. Flow (RTOR)		72				
Link Speed (k/h)	48		48			48
Link Distance (m)	423.3		562.0			214.4
Travel Time (s)	31.7		42.2			16.1
Confl. Peds. (#/hr)				1	1	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Heavy Vehicles (%)	26%	19%	10%	0%	0%	15%
Adj. Flow (vph)	89	141	1220	0	0	670
Shared Lane Traffic (%)						
Lane Group Flow (vph)	89	141	1220	0	0	670
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.7		0.0			0.0
Link Offset(m)	0.0		0.0			0.0
Crosswalk Width(m)	1.6		1.6			1.6
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24	14		14	24	
Turn Type	Prot	Perm	NA			NA
Protected Phases	8		2			6
Permitted Phases		8				
Minimum Split (s)	10.0	10.0	23.0			23.0
Total Split (s)	13.0	13.0	32.0			32.0
Total Split (%)	28.9%	28.9%	71.1%			71.1%
Maximum Green (s)	8.0	8.0	27.0			27.0
Yellow Time (s)	3.0	3.0	3.0			3.0
All-Red Time (s)	2.0	2.0	2.0			2.0
Lost Time Adjust (s)	0.0	0.0	0.0			0.0
Total Lost Time (s)	5.0	5.0	5.0			5.0
Lead/Lag						
Lead-Lag Optimize?						
Walk Time (s)			7.0			7.0
Flash Dont Walk (s)			11.0			11.0
Pedestrian Calls (#/hr)			0			0
Act Effct Green (s)	8.0	8.0	27.0			27.0
Actuated g/C Ratio	0.18	0.18	0.60			0.60
v/c Ratio	0.35	0.47	0.61			0.35

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Control Delay	20.6	15.1	7.4			5.2
Queue Delay	0.0	0.0	0.0			0.0
Total Delay	20.6	15.1	7.4			5.2
LOS	C	B	A			A
Approach Delay	17.2		7.4			5.2
Approach LOS	B		A			A

Intersection Summary			
Area Type:	Other		
Cycle Length: 45			
Actuated Cycle Length: 45			
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green			
Natural Cycle: 40			
Control Type: Pretimed			
Maximum v/c Ratio: 0.61			
Intersection Signal Delay: 7.8		Intersection LOS: A	
Intersection Capacity Utilization 49.5%		ICU Level of Service A	
Analysis Period (min) 15			

Splits and Phases: 1: Bramalea Road & Highway 407 Westbound Off-Ramp





Lane Group	WBL	WBR	NBT	SBT
Lane Group Flow (vph)	89	141	1220	670
v/c Ratio	0.35	0.47	0.61	0.35
Control Delay	20.6	15.1	7.4	5.2
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	20.6	15.1	7.4	5.2
Queue Length 50th (m)	6.2	4.8	25.8	11.3
Queue Length 95th (m)	15.7	16.5	39.4	18.0
Internal Link Dist (m)	399.3		538.0	190.4
Turn Bay Length (m)				
Base Capacity (vph)	257	303	1990	1904
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.35	0.47	0.61	0.35

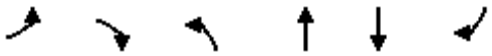
Intersection Summary



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	86	137	1183	0	0	650
Future Volume (vph)	86	137	1183	0	0	650
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0			5.0
Lane Util. Factor	1.00	1.00	0.95			0.95
Frpb, ped/bikes	1.00	1.00	1.00			1.00
Flpb, ped/bikes	1.00	1.00	1.00			1.00
Frt	1.00	0.85	1.00			1.00
Flt Protected	0.95	1.00	1.00			1.00
Satd. Flow (prot)	1448	1372	3318			3174
Flt Permitted	0.95	1.00	1.00			1.00
Satd. Flow (perm)	1448	1372	3318			3174
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	89	141	1220	0	0	670
RTOR Reduction (vph)	0	59	0	0	0	0
Lane Group Flow (vph)	89	82	1220	0	0	670
Confl. Peds. (#/hr)				1	1	
Heavy Vehicles (%)	26%	19%	10%	0%	0%	15%
Turn Type	Prot	Perm	NA			NA
Protected Phases	8		2			6
Permitted Phases		8				
Actuated Green, G (s)	8.0	8.0	27.0			27.0
Effective Green, g (s)	8.0	8.0	27.0			27.0
Actuated g/C Ratio	0.18	0.18	0.60			0.60
Clearance Time (s)	5.0	5.0	5.0			5.0
Lane Grp Cap (vph)	257	243	1990			1904
v/s Ratio Prot	c0.06		c0.37			0.21
v/s Ratio Perm		0.06				
v/c Ratio	0.35	0.34	0.61			0.35
Uniform Delay, d1	16.2	16.2	5.7			4.6
Progression Factor	1.00	1.00	1.00			1.00
Incremental Delay, d2	3.7	3.7	1.4			0.5
Delay (s)	19.9	19.9	7.1			5.1
Level of Service	B	B	A			A
Approach Delay (s)	19.9		7.1			5.1
Approach LOS	B		A			A

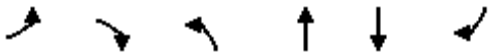
Intersection Summary			
HCM 2000 Control Delay	7.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	45.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	49.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	0	0	0	1161	590	8
Future Volume (vph)	0	0	0	1161	590	8
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0	0.0	0.0			80.0
Storage Lanes	0	0	0			1
Taper Length (m)	2.5		2.5			
Lane Util. Factor	1.00	1.00	1.00	0.91	0.95	1.00
Frt						0.850
Flt Protected						
Satd. Flow (prot)	0	0	0	4812	3174	892
Flt Permitted						
Satd. Flow (perm)	0	0	0	4812	3174	892
Link Speed (k/h)	48			48	48	
Link Distance (m)	62.7			94.3	562.0	
Travel Time (s)	4.7			7.1	42.2	
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96
Heavy Vehicles (%)	0%	0%	0%	9%	15%	83%
Adj. Flow (vph)	0	0	0	1209	615	8
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	0	0	1209	615	8
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	0.0			3.7	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24	14	24			14
Sign Control	Stop			Free	Free	

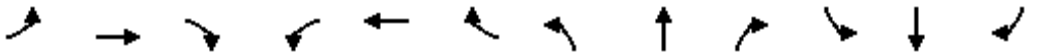
Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 25.8%		ICU Level of Service A	
Analysis Period (min) 15			



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	0	0	1161	590	8
Future Volume (Veh/h)	0	0	0	1161	590	8
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96
Hourly flow rate (vph)	0	0	0	1209	615	8
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1018	308	623			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1018	308	623			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	100	100			
cM capacity (veh/h)	237	694	968			

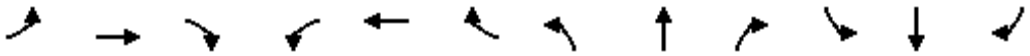
Direction, Lane #	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	403	403	403	308	308	8
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	0	8
cSH	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.24	0.24	0.24	0.18	0.18	0.00
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS						
Approach Delay (s)	0.0			0.0		
Approach LOS						

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	25.8%	ICU Level of Service	A
Analysis Period (min)	15		



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	8	0	4	62	0	68	5	1039	13	8	601	4
Future Volume (vph)	8	0	4	62	0	68	5	1039	13	8	601	4
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	0.0		0.0	35.0		45.0	60.0		0.0
Storage Lanes	0		0	1		1	1		1	1		0
Taper Length (m)	2.5			2.5			2.5			2.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	0.95
Ped Bike Factor												
Frt		0.955				0.850			0.850		0.999	
Flt Protected		0.968		0.950			0.950			0.950		
Satd. Flow (prot)	0	1066	0	1587	0	1541	1217	3318	1118	1615	3129	0
Flt Permitted		0.968		0.950			0.950			0.950		
Satd. Flow (perm)	0	1066	0	1587	0	1541	1217	3318	1118	1615	3129	0
Link Speed (k/h)		48			48			48			48	
Link Distance (m)		41.2			83.9			158.4			94.3	
Travel Time (s)		3.1			6.3			11.9			7.1	
Confl. Peds. (#/hr)							2		1	1		2
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Heavy Vehicles (%)	50%	0%	100%	15%	0%	6%	50%	10%	46%	13%	16%	100%
Adj. Flow (vph)	8	0	4	64	0	70	5	1071	13	8	620	4
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	12	0	64	0	70	5	1071	13	8	624	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.7			3.7			3.7			3.7	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		1.6			1.6			1.6			1.6	
Two way Left Turn Lane												
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24		14	24		14	24		14	24		14
Sign Control		Stop			Stop			Free			Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization	46.3%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	8	0	4	62	0	68	5	1039	13	8	601	4
Future Volume (Veh/h)	8	0	4	62	0	68	5	1039	13	8	601	4
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	8	0	4	64	0	70	5	1071	13	8	620	4
Pedestrians		2			1							
Lane Width (m)		3.7			3.7							
Walking Speed (m/s)		1.1			1.1							
Percent Blockage		0			0							
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	1256	1735	314	1412	1724	536	626			1085		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1256	1735	314	1412	1724	536	626			1085		
tC, single (s)	8.5	6.5	8.9	7.8	6.5	7.0	5.1			4.4		
tC, 2 stage (s)												
tF (s)	4.0	4.0	4.3	3.6	4.0	3.4	2.7			2.3		
p0 queue free %	89	100	99	24	100	85	99			99		
cM capacity (veh/h)	72	86	461	85	88	478	687			577		

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3
Volume Total	12	64	70	5	536	536	13	8	413	211
Volume Left	8	64	0	5	0	0	0	8	0	0
Volume Right	4	0	70	0	0	0	13	0	0	4
cSH	100	85	478	687	1700	1700	1700	577	1700	1700
Volume to Capacity	0.12	0.76	0.15	0.01	0.32	0.32	0.01	0.01	0.24	0.12
Queue Length 95th (m)	3.0	28.7	3.9	0.2	0.0	0.0	0.0	0.3	0.0	0.0
Control Delay (s)	45.8	124.9	13.8	10.3	0.0	0.0	0.0	11.3	0.0	0.0
Lane LOS	E	F	B	B				B		
Approach Delay (s)	45.8	66.9		0.0				0.1		
Approach LOS	E	F								

Intersection Summary				
Average Delay	5.2			
Intersection Capacity Utilization	46.3%	ICU Level of Service		A
Analysis Period (min)	15			



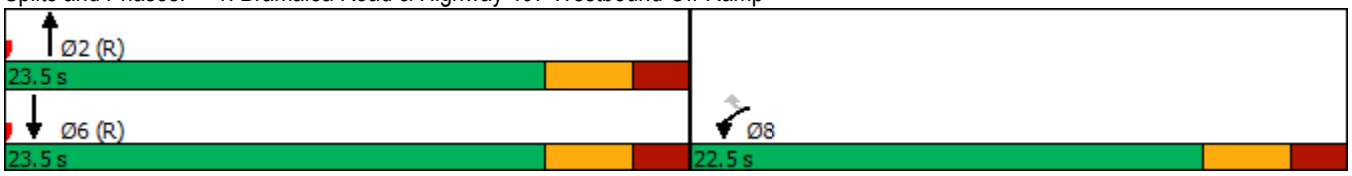
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	129	99	480	0	0	1108
Future Volume (vph)	129	99	480	0	0	1108
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Ped Bike Factor						
Frt		0.850				
Flt Protected	0.950					
Satd. Flow (prot)	1722	1350	2664	0	0	3318
Flt Permitted	0.950					
Satd. Flow (perm)	1722	1350	2664	0	0	3318
Right Turn on Red		Yes		Yes		
Satd. Flow (RTOR)		104				
Link Speed (k/h)	48		48			48
Link Distance (m)	423.3		562.0			214.4
Travel Time (s)	31.7		42.2			16.1
Confl. Peds. (#/hr)				2	2	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles (%)	6%	21%	37%	0%	0%	10%
Adj. Flow (vph)	136	104	505	0	0	1166
Shared Lane Traffic (%)						
Lane Group Flow (vph)	136	104	505	0	0	1166
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.7		0.0			0.0
Link Offset(m)	0.0		0.0			0.0
Crosswalk Width(m)	1.6		1.6			1.6
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24	14		14	24	
Turn Type	Prot	Perm	NA			NA
Protected Phases	8		2			6
Permitted Phases		8				
Minimum Split (s)	22.5	22.5	23.0			23.0
Total Split (s)	22.5	22.5	23.5			23.5
Total Split (%)	48.9%	48.9%	51.1%			51.1%
Maximum Green (s)	17.5	17.5	18.5			18.5
Yellow Time (s)	3.0	3.0	3.0			3.0
All-Red Time (s)	2.0	2.0	2.0			2.0
Lost Time Adjust (s)	0.0	0.0	0.0			0.0
Total Lost Time (s)	5.0	5.0	5.0			5.0
Lead/Lag						
Lead-Lag Optimize?						
Walk Time (s)			7.0			7.0
Flash Dont Walk (s)			11.0			11.0
Pedestrian Calls (#/hr)			0			0
Act Effct Green (s)	17.5	17.5	18.5			18.5
Actuated g/C Ratio	0.38	0.38	0.40			0.40
v/c Ratio	0.21	0.18	0.47			0.87



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Control Delay	10.7	3.6	12.0			22.7
Queue Delay	0.0	0.0	0.0			0.0
Total Delay	10.7	3.6	12.0			22.7
LOS	B	A	B			C
Approach Delay	7.6		12.0			22.7
Approach LOS	A		B			C

Intersection Summary			
Area Type:	Other		
Cycle Length: 46			
Actuated Cycle Length: 46			
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green			
Natural Cycle: 50			
Control Type: Pretimed			
Maximum v/c Ratio: 0.87			
Intersection Signal Delay: 18.0		Intersection LOS: B	
Intersection Capacity Utilization 46.1%		ICU Level of Service A	
Analysis Period (min) 15			

Splits and Phases: 1: Bramalea Road & Highway 407 Westbound Off-Ramp





Lane Group	WBL	WBR	NBT	SBT
Lane Group Flow (vph)	136	104	505	1166
v/c Ratio	0.21	0.18	0.47	0.87
Control Delay	10.7	3.6	12.0	22.7
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	10.7	3.6	12.0	22.7
Queue Length 50th (m)	7.0	0.0	14.8	43.1
Queue Length 95th (m)	15.6	6.4	24.9	#77.5
Internal Link Dist (m)	399.3		538.0	190.4
Turn Bay Length (m)				
Base Capacity (vph)	655	578	1071	1334
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.21	0.18	0.47	0.87

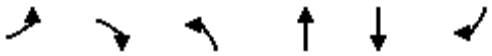
Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



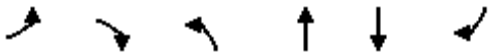
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	129	99	480	0	0	1108
Future Volume (vph)	129	99	480	0	0	1108
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0			5.0
Lane Util. Factor	1.00	1.00	0.95			0.95
Frpb, ped/bikes	1.00	1.00	1.00			1.00
Flpb, ped/bikes	1.00	1.00	1.00			1.00
Frt	1.00	0.85	1.00			1.00
Flt Protected	0.95	1.00	1.00			1.00
Satd. Flow (prot)	1722	1350	2664			3318
Flt Permitted	0.95	1.00	1.00			1.00
Satd. Flow (perm)	1722	1350	2664			3318
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	136	104	505	0	0	1166
RTOR Reduction (vph)	0	64	0	0	0	0
Lane Group Flow (vph)	136	40	505	0	0	1166
Confl. Peds. (#/hr)				2	2	
Heavy Vehicles (%)	6%	21%	37%	0%	0%	10%
Turn Type	Prot	Perm	NA			NA
Protected Phases	8		2			6
Permitted Phases		8				
Actuated Green, G (s)	17.5	17.5	18.5			18.5
Effective Green, g (s)	17.5	17.5	18.5			18.5
Actuated g/C Ratio	0.38	0.38	0.40			0.40
Clearance Time (s)	5.0	5.0	5.0			5.0
Lane Grp Cap (vph)	655	513	1071			1334
v/s Ratio Prot	c0.08		0.19			c0.35
v/s Ratio Perm		0.03				
v/c Ratio	0.21	0.08	0.47			0.87
Uniform Delay, d1	9.6	9.1	10.1			12.7
Progression Factor	1.00	1.00	1.00			1.00
Incremental Delay, d2	0.7	0.3	1.5			8.2
Delay (s)	10.3	9.4	11.6			20.9
Level of Service	B	A	B			C
Approach Delay (s)	9.9		11.6			20.9
Approach LOS	A		B			C

Intersection Summary			
HCM 2000 Control Delay	17.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	46.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	46.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	0	0	0	558	1175	4
Future Volume (vph)	0	0	0	558	1175	4
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0	0.0	0.0			80.0
Storage Lanes	0	0	0			1
Taper Length (m)	2.5		2.5			
Lane Util. Factor	1.00	1.00	1.00	0.91	0.95	1.00
Ped Bike Factor						
Frt						0.850
Flt Protected						
Satd. Flow (prot)	0	0	0	3914	3411	1306
Flt Permitted						
Satd. Flow (perm)	0	0	0	3914	3411	1306
Link Speed (k/h)	48			48	48	
Link Distance (m)	62.7			94.3	562.0	
Travel Time (s)	4.7			7.1	42.2	
Confl. Peds. (#/hr)		1	2			2
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	0%	0%	0%	34%	7%	25%
Adj. Flow (vph)	0	0	0	620	1306	4
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	0	0	620	1306	4
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	0.0			3.7	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24	14	24			14
Sign Control	Stop			Free	Free	

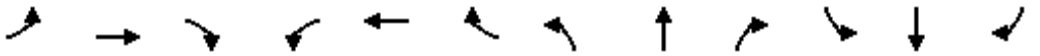
Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization	42.8%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	0	0	558	1175	4
Future Volume (Veh/h)	0	0	0	558	1175	4
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	0	0	0	620	1306	4
Pedestrians	2			1		
Lane Width (m)	0.0			3.7		
Walking Speed (m/s)	1.1			1.1		
Percent Blockage	0			0		
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1515	656	1312			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1515	656	1312			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	100	100			
cM capacity (veh/h)	112	412	534			

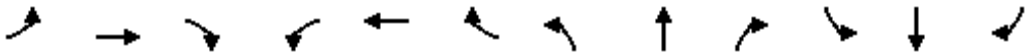
Direction, Lane #	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	207	207	207	653	653	4
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	0	4
cSH	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.12	0.12	0.12	0.38	0.38	0.00
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS						
Approach Delay (s)	0.0			0.0		
Approach LOS						

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	42.8%	ICU Level of Service	A
Analysis Period (min)	15		



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	2	0	3	10	0	12	5	528	43	59	1093	2
Future Volume (vph)	2	0	3	10	0	12	5	528	43	59	1093	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	0.0		0.0	35.0		45.0	60.0		0.0
Storage Lanes	0		0	1		1	1		1	1		0
Taper Length (m)	2.5			2.5			2.5			2.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	0.95
Ped Bike Factor												
Frt		0.919				0.850			0.850			
Flt Protected		0.980		0.950			0.950			0.950		
Satd. Flow (prot)	0	1730	0	1074	0	1633	1043	2664	1350	1706	3412	0
Flt Permitted		0.980		0.950			0.950			0.950		
Satd. Flow (perm)	0	1730	0	1074	0	1633	1043	2664	1350	1706	3412	0
Link Speed (k/h)		48			48			48			48	
Link Distance (m)		41.2			83.9			158.4			94.3	
Travel Time (s)		3.1			6.3			11.9			7.1	
Confl. Peds. (#/hr)	1					1	1		1	1		1
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Heavy Vehicles (%)	0%	0%	0%	70%	0%	0%	75%	37%	21%	7%	7%	0%
Adj. Flow (vph)	2	0	3	11	0	13	5	580	47	65	1201	2
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	5	0	11	0	13	5	580	47	65	1203	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.7			3.7			3.7			3.7	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		1.6			1.6			1.6			1.6	
Two way Left Turn Lane												
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24		14	24		14	24		14	24		14
Sign Control		Stop			Stop			Free			Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization	47.3%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	2	0	3	10	0	12	5	528	43	59	1093	2
Future Volume (Veh/h)	2	0	3	10	0	12	5	528	43	59	1093	2
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Hourly flow rate (vph)	2	0	3	11	0	13	5	580	47	65	1201	2
Pedestrians		1			1						1	
Lane Width (m)		3.7			3.7						3.7	
Walking Speed (m/s)		1.1			1.1						1.1	
Percent Blockage		0			0						0	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	1647	1971	602	1324	1925	292	1204			628		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1647	1971	602	1324	1925	292	1204			628		
tC, single (s)	7.5	6.5	6.9	8.9	6.5	6.9	5.6			4.2		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	4.2	4.0	3.3	3.0			2.3		
p0 queue free %	97	100	99	81	100	98	98			93		
cM capacity (veh/h)	61	58	447	59	62	709	295			916		

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3
Volume Total	5	11	13	5	290	290	47	65	801	402
Volume Left	2	11	0	5	0	0	0	65	0	0
Volume Right	3	0	13	0	0	0	47	0	0	2
cSH	126	59	709	295	1700	1700	1700	916	1700	1700
Volume to Capacity	0.04	0.19	0.02	0.02	0.17	0.17	0.03	0.07	0.47	0.24
Queue Length 95th (m)	0.9	4.7	0.4	0.4	0.0	0.0	0.0	1.7	0.0	0.0
Control Delay (s)	34.6	79.6	10.2	17.4	0.0	0.0	0.0	9.2	0.0	0.0
Lane LOS	D	F	B	C				A		
Approach Delay (s)	34.6	42.0		0.1				0.5		
Approach LOS	D	E								

Intersection Summary				
Average Delay	1.0			
Intersection Capacity Utilization	47.3%	ICU Level of Service		A
Analysis Period (min)	15			



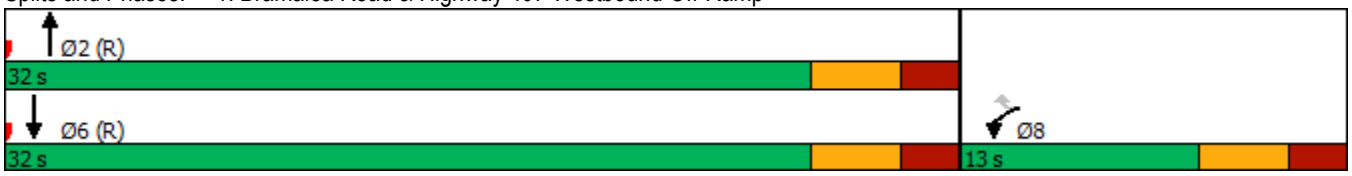
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	82	151	1449	0	0	801
Future Volume (vph)	82	151	1449	0	0	801
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Ped Bike Factor						
Frt		0.850				
Flt Protected	0.950					
Satd. Flow (prot)	1448	1372	3318	0	0	3174
Flt Permitted	0.950					
Satd. Flow (perm)	1448	1372	3318	0	0	3174
Right Turn on Red		Yes		Yes		
Satd. Flow (RTOR)		38				
Link Speed (k/h)	48		48			48
Link Distance (m)	423.3		562.0			214.4
Travel Time (s)	31.7		42.2			16.1
Confl. Peds. (#/hr)				1	1	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Heavy Vehicles (%)	26%	19%	10%	0%	0%	15%
Adj. Flow (vph)	85	156	1494	0	0	826
Shared Lane Traffic (%)						
Lane Group Flow (vph)	85	156	1494	0	0	826
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.7		0.0			0.0
Link Offset(m)	0.0		0.0			0.0
Crosswalk Width(m)	1.6		1.6			1.6
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24	14		14	24	
Turn Type	Prot	Perm	NA			NA
Protected Phases	8		2			6
Permitted Phases		8				
Minimum Split (s)	10.0	10.0	23.0			23.0
Total Split (s)	13.0	13.0	32.0			32.0
Total Split (%)	28.9%	28.9%	71.1%			71.1%
Maximum Green (s)	8.0	8.0	27.0			27.0
Yellow Time (s)	3.0	3.0	3.0			3.0
All-Red Time (s)	2.0	2.0	2.0			2.0
Lost Time Adjust (s)	0.0	0.0	0.0			0.0
Total Lost Time (s)	5.0	5.0	5.0			5.0
Lead/Lag						
Lead-Lag Optimize?						
Walk Time (s)			7.0			7.0
Flash Dont Walk (s)			11.0			11.0
Pedestrian Calls (#/hr)			0			0
Act Effct Green (s)	8.0	8.0	27.0			27.0
Actuated g/C Ratio	0.18	0.18	0.60			0.60
v/c Ratio	0.33	0.57	0.75			0.43



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Control Delay	20.3	23.4	9.6			5.8
Queue Delay	0.0	0.0	0.0			0.0
Total Delay	20.3	23.4	9.6			5.8
LOS	C	C	A			A
Approach Delay	22.3		9.6			5.8
Approach LOS	C		A			A

Intersection Summary			
Area Type:	Other		
Cycle Length: 45			
Actuated Cycle Length: 45			
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green			
Natural Cycle: 50			
Control Type: Pretimed			
Maximum v/c Ratio: 0.75			
Intersection Signal Delay: 9.6		Intersection LOS: A	
Intersection Capacity Utilization 57.7%		ICU Level of Service B	
Analysis Period (min) 15			

Splits and Phases: 1: Bramalea Road & Highway 407 Westbound Off-Ramp





Lane Group	WBL	WBR	NBT	SBT
Lane Group Flow (vph)	85	156	1494	826
v/c Ratio	0.33	0.57	0.75	0.43
Control Delay	20.3	23.4	9.6	5.8
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	20.3	23.4	9.6	5.8
Queue Length 50th (m)	5.9	8.5	36.2	14.9
Queue Length 95th (m)	15.1	#26.5	56.4	23.3
Internal Link Dist (m)	399.3		538.0	190.4
Turn Bay Length (m)				
Base Capacity (vph)	257	275	1990	1904
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.33	0.57	0.75	0.43

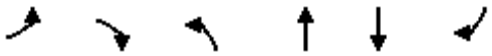
Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



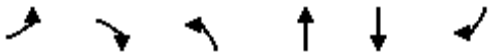
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	82	151	1449	0	0	801
Future Volume (vph)	82	151	1449	0	0	801
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0			5.0
Lane Util. Factor	1.00	1.00	0.95			0.95
Frpb, ped/bikes	1.00	1.00	1.00			1.00
Flpb, ped/bikes	1.00	1.00	1.00			1.00
Frt	1.00	0.85	1.00			1.00
Flt Protected	0.95	1.00	1.00			1.00
Satd. Flow (prot)	1448	1372	3318			3174
Flt Permitted	0.95	1.00	1.00			1.00
Satd. Flow (perm)	1448	1372	3318			3174
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	85	156	1494	0	0	826
RTOR Reduction (vph)	0	31	0	0	0	0
Lane Group Flow (vph)	85	125	1494	0	0	826
Confl. Peds. (#/hr)				1	1	
Heavy Vehicles (%)	26%	19%	10%	0%	0%	15%
Turn Type	Prot	Perm	NA			NA
Protected Phases	8		2			6
Permitted Phases		8				
Actuated Green, G (s)	8.0	8.0	27.0			27.0
Effective Green, g (s)	8.0	8.0	27.0			27.0
Actuated g/C Ratio	0.18	0.18	0.60			0.60
Clearance Time (s)	5.0	5.0	5.0			5.0
Lane Grp Cap (vph)	257	243	1990			1904
v/s Ratio Prot	0.06		c0.45			0.26
v/s Ratio Perm		c0.09				
v/c Ratio	0.33	0.51	0.75			0.43
Uniform Delay, d1	16.2	16.7	6.6			4.9
Progression Factor	1.00	1.00	1.00			1.00
Incremental Delay, d2	3.4	7.6	2.7			0.7
Delay (s)	19.6	24.3	9.2			5.6
Level of Service	B	C	A			A
Approach Delay (s)	22.6		9.2			5.6
Approach LOS	C		A			A

Intersection Summary			
HCM 2000 Control Delay	9.3	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	45.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	57.7%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	0	0	0	1231	722	6
Future Volume (vph)	0	0	0	1231	722	6
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0	0.0	0.0			80.0
Storage Lanes	0	0	0			1
Taper Length (m)	2.5		2.5			
Lane Util. Factor	1.00	1.00	1.00	0.91	0.95	1.00
Frt						0.850
Flt Protected						
Satd. Flow (prot)	0	0	0	4812	3174	892
Flt Permitted						
Satd. Flow (perm)	0	0	0	4812	3174	892
Link Speed (k/h)	48			48	48	
Link Distance (m)	62.7			94.3	562.0	
Travel Time (s)	4.7			7.1	42.2	
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96
Heavy Vehicles (%)	0%	0%	0%	9%	15%	83%
Adj. Flow (vph)	0	0	0	1282	752	6
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	0	0	1282	752	6
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	0.0			3.7	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24	14	24			14
Sign Control	Stop			Free	Free	

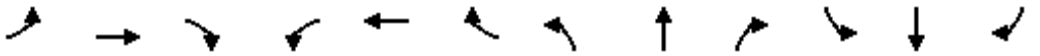
Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 27.1%		ICU Level of Service A	
Analysis Period (min) 15			



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations				↑↑↑	↑↑	↱
Traffic Volume (veh/h)	0	0	0	1231	722	6
Future Volume (Veh/h)	0	0	0	1231	722	6
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96
Hourly flow rate (vph)	0	0	0	1282	752	6
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1179	376	758			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1179	376	758			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	100	100			
cM capacity (veh/h)	186	627	862			

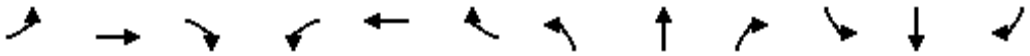
Direction, Lane #	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	427	427	427	376	376	6
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	0	6
cSH	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.25	0.25	0.25	0.22	0.22	0.00
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS						
Approach Delay (s)	0.0			0.0		
Approach LOS						

Intersection Summary				
Average Delay	0.0			
Intersection Capacity Utilization	27.1%	ICU Level of Service		A
Analysis Period (min)	15			



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	4	0	2	62	0	68	3	1109	13	8	741	1
Future Volume (vph)	4	0	2	62	0	68	3	1109	13	8	741	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	0.0		0.0	35.0		45.0	60.0		0.0
Storage Lanes	0		0	1		1	1		1	1		0
Taper Length (m)	2.5			2.5			2.5			2.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	0.95
Ped Bike Factor												
Frt		0.955				0.850			0.850			
Flt Protected		0.968		0.950			0.950			0.950		
Satd. Flow (prot)	0	1066	0	1587	0	1541	1217	3318	1118	1615	3144	0
Flt Permitted		0.968		0.950			0.950			0.950		
Satd. Flow (perm)	0	1066	0	1587	0	1541	1217	3318	1118	1615	3144	0
Link Speed (k/h)		48			48			48			48	
Link Distance (m)		41.2			83.9			158.4			94.3	
Travel Time (s)		3.1			6.3			11.9			7.1	
Confl. Peds. (#/hr)							2		1	1		2
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Heavy Vehicles (%)	50%	0%	100%	15%	0%	6%	50%	10%	46%	13%	16%	100%
Adj. Flow (vph)	4	0	2	64	0	70	3	1143	13	8	764	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	6	0	64	0	70	3	1143	13	8	765	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.7			3.7			3.7			3.7	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		1.6			1.6			1.6			1.6	
Two way Left Turn Lane												
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24		14	24		14	24		14	24		14
Sign Control		Stop			Stop			Free			Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization	48.2%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	4	0	2	62	0	68	3	1109	13	8	741	1
Future Volume (Veh/h)	4	0	2	62	0	68	3	1109	13	8	741	1
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	4	0	2	64	0	70	3	1143	13	8	764	1
Pedestrians		2			1							
Lane Width (m)		3.7			3.7							
Walking Speed (m/s)		1.1			1.1							
Percent Blockage		0			0							
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	1430	1946	384	1550	1933	572	767			1157		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1430	1946	384	1550	1933	572	767			1157		
tC, single (s)	8.5	6.5	8.9	7.8	6.5	7.0	5.1			4.4		
tC, 2 stage (s)												
tF (s)	4.0	4.0	4.3	3.6	4.0	3.4	2.7			2.3		
p0 queue free %	92	100	100	4	100	85	99			99		
cM capacity (veh/h)	51	64	403	66	65	452	590			540		

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3
Volume Total	6	64	70	3	572	572	13	8	509	256
Volume Left	4	64	0	3	0	0	0	8	0	0
Volume Right	2	0	70	0	0	0	13	0	0	1
cSH	72	66	452	590	1700	1700	1700	540	1700	1700
Volume to Capacity	0.08	0.96	0.15	0.01	0.34	0.34	0.01	0.01	0.30	0.15
Queue Length 95th (m)	2.0	36.1	4.1	0.1	0.0	0.0	0.0	0.3	0.0	0.0
Control Delay (s)	59.7	204.1	14.4	11.1	0.0	0.0	0.0	11.8	0.0	0.0
Lane LOS	F	F	B	B				B		
Approach Delay (s)	59.7	105.0		0.0				0.1		
Approach LOS	F	F								

Intersection Summary				
Average Delay	7.0			
Intersection Capacity Utilization	48.2%	ICU Level of Service		A
Analysis Period (min)	15			



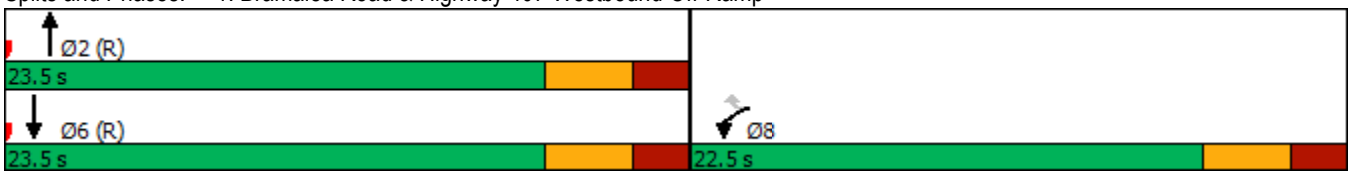
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	165	99	492	0	0	1108
Future Volume (vph)	165	99	492	0	0	1108
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Ped Bike Factor						
Frt		0.850				
Flt Protected	0.950					
Satd. Flow (prot)	1722	1350	2664	0	0	3318
Flt Permitted	0.950					
Satd. Flow (perm)	1722	1350	2664	0	0	3318
Right Turn on Red		Yes		Yes		
Satd. Flow (RTOR)		104				
Link Speed (k/h)	48		48			48
Link Distance (m)	423.3		562.0			214.4
Travel Time (s)	31.7		42.2			16.1
Confl. Peds. (#/hr)				2	2	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles (%)	6%	21%	37%	0%	0%	10%
Adj. Flow (vph)	174	104	518	0	0	1166
Shared Lane Traffic (%)						
Lane Group Flow (vph)	174	104	518	0	0	1166
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.7		0.0			0.0
Link Offset(m)	0.0		0.0			0.0
Crosswalk Width(m)	1.6		1.6			1.6
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24	14		14	24	
Turn Type	Prot	Perm	NA			NA
Protected Phases	8		2			6
Permitted Phases		8				
Minimum Split (s)	22.5	22.5	23.0			23.0
Total Split (s)	22.5	22.5	23.5			23.5
Total Split (%)	48.9%	48.9%	51.1%			51.1%
Maximum Green (s)	17.5	17.5	18.5			18.5
Yellow Time (s)	3.0	3.0	3.0			3.0
All-Red Time (s)	2.0	2.0	2.0			2.0
Lost Time Adjust (s)	0.0	0.0	0.0			0.0
Total Lost Time (s)	5.0	5.0	5.0			5.0
Lead/Lag						
Lead-Lag Optimize?						
Walk Time (s)			7.0			7.0
Flash Dont Walk (s)			11.0			11.0
Pedestrian Calls (#/hr)			0			0
Act Effct Green (s)	17.5	17.5	18.5			18.5
Actuated g/C Ratio	0.38	0.38	0.40			0.40
v/c Ratio	0.27	0.18	0.48			0.87



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Control Delay	11.2	3.6	12.1			22.7
Queue Delay	0.0	0.0	0.0			0.0
Total Delay	11.2	3.6	12.1			22.7
LOS	B	A	B			C
Approach Delay	8.4		12.1			22.7
Approach LOS	A		B			C

Intersection Summary			
Area Type:	Other		
Cycle Length: 46			
Actuated Cycle Length: 46			
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green			
Natural Cycle: 50			
Control Type: Pretimed			
Maximum v/c Ratio: 0.87			
Intersection Signal Delay: 17.9		Intersection LOS: B	
Intersection Capacity Utilization 48.1%		ICU Level of Service A	
Analysis Period (min) 15			

Splits and Phases: 1: Bramalea Road & Highway 407 Westbound Off-Ramp





Lane Group	WBL	WBR	NBT	SBT
Lane Group Flow (vph)	174	104	518	1166
v/c Ratio	0.27	0.18	0.48	0.87
Control Delay	11.2	3.6	12.1	22.7
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	11.2	3.6	12.1	22.7
Queue Length 50th (m)	9.2	0.0	15.4	43.1
Queue Length 95th (m)	19.4	6.4	25.5	#77.5
Internal Link Dist (m)	399.3		538.0	190.4
Turn Bay Length (m)				
Base Capacity (vph)	655	578	1071	1334
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.27	0.18	0.48	0.87

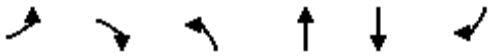
Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



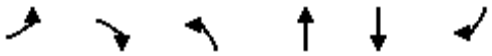
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	165	99	492	0	0	1108
Future Volume (vph)	165	99	492	0	0	1108
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0			5.0
Lane Util. Factor	1.00	1.00	0.95			0.95
Frpb, ped/bikes	1.00	1.00	1.00			1.00
Flpb, ped/bikes	1.00	1.00	1.00			1.00
Frt	1.00	0.85	1.00			1.00
Flt Protected	0.95	1.00	1.00			1.00
Satd. Flow (prot)	1722	1350	2664			3318
Flt Permitted	0.95	1.00	1.00			1.00
Satd. Flow (perm)	1722	1350	2664			3318
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	174	104	518	0	0	1166
RTOR Reduction (vph)	0	64	0	0	0	0
Lane Group Flow (vph)	174	40	518	0	0	1166
Confl. Peds. (#/hr)				2	2	
Heavy Vehicles (%)	6%	21%	37%	0%	0%	10%
Turn Type	Prot	Perm	NA			NA
Protected Phases	8		2			6
Permitted Phases		8				
Actuated Green, G (s)	17.5	17.5	18.5			18.5
Effective Green, g (s)	17.5	17.5	18.5			18.5
Actuated g/C Ratio	0.38	0.38	0.40			0.40
Clearance Time (s)	5.0	5.0	5.0			5.0
Lane Grp Cap (vph)	655	513	1071			1334
v/s Ratio Prot	c0.10		0.19			c0.35
v/s Ratio Perm		0.03				
v/c Ratio	0.27	0.08	0.48			0.87
Uniform Delay, d1	9.8	9.1	10.2			12.7
Progression Factor	1.00	1.00	1.00			1.00
Incremental Delay, d2	1.0	0.3	1.6			8.2
Delay (s)	10.8	9.4	11.8			20.9
Level of Service	B	A	B			C
Approach Delay (s)	10.3		11.8			20.9
Approach LOS	B		B			C

Intersection Summary			
HCM 2000 Control Delay	17.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	46.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	48.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	0	0	0	570	1187	24
Future Volume (vph)	0	0	0	570	1187	24
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0	0.0	0.0			80.0
Storage Lanes	0	0	0			1
Taper Length (m)	2.5		2.5			
Lane Util. Factor	1.00	1.00	1.00	0.91	0.95	1.00
Ped Bike Factor						
Frt						0.850
Flt Protected						
Satd. Flow (prot)	0	0	0	3914	3411	1306
Flt Permitted						
Satd. Flow (perm)	0	0	0	3914	3411	1306
Link Speed (k/h)	48			48	48	
Link Distance (m)	62.7			94.3	562.0	
Travel Time (s)	4.7			7.1	42.2	
Confl. Peds. (#/hr)		1	2			2
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	0%	0%	0%	34%	7%	25%
Adj. Flow (vph)	0	0	0	633	1319	27
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	0	0	633	1319	27
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	0.0			3.7	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24	14	24			14
Sign Control	Stop			Free	Free	

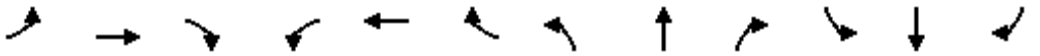
Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization	43.1%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	0	0	570	1187	24
Future Volume (Veh/h)	0	0	0	570	1187	24
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	0	0	0	633	1319	27
Pedestrians	2			1		
Lane Width (m)	0.0			3.7		
Walking Speed (m/s)	1.1			1.1		
Percent Blockage	0			0		
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1532	662	1348			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1532	662	1348			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	100	100			
cM capacity (veh/h)	110	408	517			

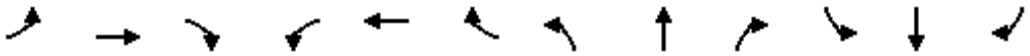
Direction, Lane #	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	211	211	211	660	660	27
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	0	27
cSH	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.12	0.12	0.12	0.39	0.39	0.02
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS						
Approach Delay (s)	0.0			0.0		
Approach LOS						

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	43.1%	ICU Level of Service	A
Analysis Period (min)	15		



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	12	0	18	10	0	12	30	528	43	59	1093	12
Future Volume (vph)	12	0	18	10	0	12	30	528	43	59	1093	12
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	0.0		0.0	35.0		45.0	60.0		0.0
Storage Lanes	0		0	1		1	1		1	1		0
Taper Length (m)	2.5			2.5			2.5			2.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	0.95
Ped Bike Factor												
Frt		0.918				0.850			0.850		0.998	
Flt Protected		0.981		0.950			0.950			0.950		
Satd. Flow (prot)	0	1730	0	1074	0	1633	1043	2664	1350	1706	3407	0
Flt Permitted		0.981		0.950			0.950			0.950		
Satd. Flow (perm)	0	1730	0	1074	0	1633	1043	2664	1350	1706	3407	0
Link Speed (k/h)		48			48			48			48	
Link Distance (m)		41.2			83.9			158.4			94.3	
Travel Time (s)		3.1			6.3			11.9			7.1	
Confl. Peds. (#/hr)	1					1	1		1	1		1
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Heavy Vehicles (%)	0%	0%	0%	70%	0%	0%	75%	37%	21%	7%	7%	0%
Adj. Flow (vph)	13	0	20	11	0	13	33	580	47	65	1201	13
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	33	0	11	0	13	33	580	47	65	1214	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.7			3.7			3.7			3.7	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		1.6			1.6			1.6			1.6	
Two way Left Turn Lane												
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24		14	24		14	24		14	24		14
Sign Control		Stop			Stop			Free			Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 52.4%		ICU Level of Service A	
Analysis Period (min) 15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	12	0	18	10	0	12	30	528	43	59	1093	12
Future Volume (Veh/h)	12	0	18	10	0	12	30	528	43	59	1093	12
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Hourly flow rate (vph)	13	0	20	11	0	13	33	580	47	65	1201	13
Pedestrians		1			1						1	
Lane Width (m)		3.7			3.7						3.7	
Walking Speed (m/s)		1.1			1.1						1.1	
Percent Blockage		0			0						0	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	1708	2032	608	1398	1992	292	1215			628		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1708	2032	608	1398	1992	292	1215			628		
tC, single (s)	7.5	6.5	6.9	8.9	6.5	6.9	5.6			4.2		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	4.2	4.0	3.3	3.0			2.3		
p0 queue free %	74	100	95	76	100	98	89			93		
cM capacity (veh/h)	51	48	443	45	50	709	291			916		

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3
Volume Total	33	11	13	33	290	290	47	65	801	413
Volume Left	13	11	0	33	0	0	0	65	0	0
Volume Right	20	0	13	0	0	0	47	0	0	13
cSH	110	45	709	291	1700	1700	1700	916	1700	1700
Volume to Capacity	0.30	0.24	0.02	0.11	0.17	0.17	0.03	0.07	0.47	0.24
Queue Length 95th (m)	8.8	6.2	0.4	2.9	0.0	0.0	0.0	1.7	0.0	0.0
Control Delay (s)	51.4	108.6	10.2	19.0	0.0	0.0	0.0	9.2	0.0	0.0
Lane LOS	F	F	B	C				A		
Approach Delay (s)	51.4	55.3		0.9				0.5		
Approach LOS	F	F								

Intersection Summary				
Average Delay	2.1			
Intersection Capacity Utilization	52.4%	ICU Level of Service		A
Analysis Period (min)	15			

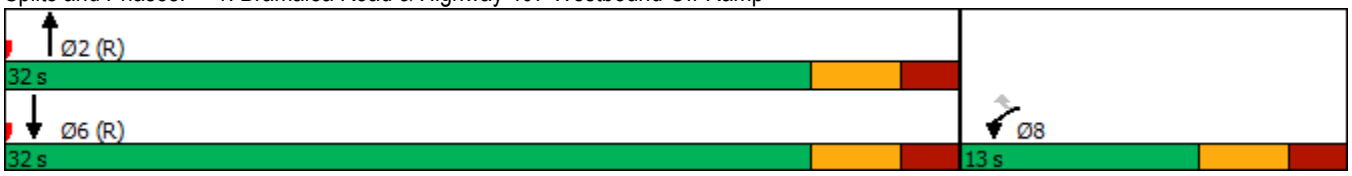


Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	119	151	1473	0	0	801
Future Volume (vph)	119	151	1473	0	0	801
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Ped Bike Factor						
Frt		0.850				
Flt Protected	0.950					
Satd. Flow (prot)	1448	1372	3318	0	0	3174
Flt Permitted	0.950					
Satd. Flow (perm)	1448	1372	3318	0	0	3174
Right Turn on Red		Yes		Yes		
Satd. Flow (RTOR)		36				
Link Speed (k/h)	48		48			48
Link Distance (m)	423.3		562.0			214.4
Travel Time (s)	31.7		42.2			16.1
Confl. Peds. (#/hr)				1	1	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Heavy Vehicles (%)	26%	19%	10%	0%	0%	15%
Adj. Flow (vph)	123	156	1519	0	0	826
Shared Lane Traffic (%)						
Lane Group Flow (vph)	123	156	1519	0	0	826
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.7		0.0			0.0
Link Offset(m)	0.0		0.0			0.0
Crosswalk Width(m)	1.6		1.6			1.6
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24	14		14	24	
Turn Type	Prot	Perm	NA			NA
Protected Phases	8		2			6
Permitted Phases		8				
Minimum Split (s)	10.0	10.0	23.0			23.0
Total Split (s)	13.0	13.0	32.0			32.0
Total Split (%)	28.9%	28.9%	71.1%			71.1%
Maximum Green (s)	8.0	8.0	27.0			27.0
Yellow Time (s)	3.0	3.0	3.0			3.0
All-Red Time (s)	2.0	2.0	2.0			2.0
Lost Time Adjust (s)	0.0	0.0	0.0			0.0
Total Lost Time (s)	5.0	5.0	5.0			5.0
Lead/Lag						
Lead-Lag Optimize?						
Walk Time (s)			7.0			7.0
Flash Dont Walk (s)			11.0			11.0
Pedestrian Calls (#/hr)			0			0
Act Effct Green (s)	8.0	8.0	27.0			27.0
Actuated g/C Ratio	0.18	0.18	0.60			0.60
v/c Ratio	0.48	0.57	0.76			0.43

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Control Delay	23.7	23.9	9.9			5.8
Queue Delay	0.0	0.0	0.0			0.0
Total Delay	23.7	23.9	9.9			5.8
LOS	C	C	A			A
Approach Delay	23.8		9.9			5.8
Approach LOS	C		A			A

Intersection Summary			
Area Type:	Other		
Cycle Length: 45			
Actuated Cycle Length: 45			
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green			
Natural Cycle: 50			
Control Type: Pretimed			
Maximum v/c Ratio: 0.76			
Intersection Signal Delay: 10.1		Intersection LOS: B	
Intersection Capacity Utilization 58.4%		ICU Level of Service B	
Analysis Period (min) 15			

Splits and Phases: 1: Bramalea Road & Highway 407 Westbound Off-Ramp





Lane Group	WBL	WBR	NBT	SBT
Lane Group Flow (vph)	123	156	1519	826
v/c Ratio	0.48	0.57	0.76	0.43
Control Delay	23.7	23.9	9.9	5.8
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	23.7	23.9	9.9	5.8
Queue Length 50th (m)	8.8	8.6	37.3	14.9
Queue Length 95th (m)	20.4	#26.8	58.2	23.3
Internal Link Dist (m)	399.3		538.0	190.4
Turn Bay Length (m)				
Base Capacity (vph)	257	273	1990	1904
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.48	0.57	0.76	0.43

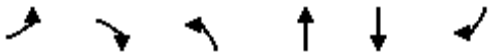
Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



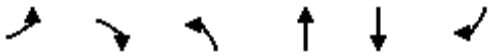
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	119	151	1473	0	0	801
Future Volume (vph)	119	151	1473	0	0	801
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0			5.0
Lane Util. Factor	1.00	1.00	0.95			0.95
Frpb, ped/bikes	1.00	1.00	1.00			1.00
Flpb, ped/bikes	1.00	1.00	1.00			1.00
Frt	1.00	0.85	1.00			1.00
Flt Protected	0.95	1.00	1.00			1.00
Satd. Flow (prot)	1448	1372	3318			3174
Flt Permitted	0.95	1.00	1.00			1.00
Satd. Flow (perm)	1448	1372	3318			3174
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	123	156	1519	0	0	826
RTOR Reduction (vph)	0	30	0	0	0	0
Lane Group Flow (vph)	123	126	1519	0	0	826
Confl. Peds. (#/hr)				1	1	
Heavy Vehicles (%)	26%	19%	10%	0%	0%	15%
Turn Type	Prot	Perm	NA			NA
Protected Phases	8		2			6
Permitted Phases		8				
Actuated Green, G (s)	8.0	8.0	27.0			27.0
Effective Green, g (s)	8.0	8.0	27.0			27.0
Actuated g/C Ratio	0.18	0.18	0.60			0.60
Clearance Time (s)	5.0	5.0	5.0			5.0
Lane Grp Cap (vph)	257	243	1990			1904
v/s Ratio Prot	0.08		c0.46			0.26
v/s Ratio Perm		c0.09				
v/c Ratio	0.48	0.52	0.76			0.43
Uniform Delay, d1	16.6	16.8	6.6			4.9
Progression Factor	1.00	1.00	1.00			1.00
Incremental Delay, d2	6.3	7.8	2.8			0.7
Delay (s)	22.9	24.5	9.5			5.6
Level of Service	C	C	A			A
Approach Delay (s)	23.8		9.5			5.6
Approach LOS	C		A			A

Intersection Summary			
HCM 2000 Control Delay	9.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	45.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	58.4%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	0	0	0	1255	734	25
Future Volume (vph)	0	0	0	1255	734	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0	0.0	0.0			80.0
Storage Lanes	0	0	0			1
Taper Length (m)	2.5		2.5			
Lane Util. Factor	1.00	1.00	1.00	0.91	0.95	1.00
Frt						0.850
Flt Protected						
Satd. Flow (prot)	0	0	0	4812	3174	892
Flt Permitted						
Satd. Flow (perm)	0	0	0	4812	3174	892
Link Speed (k/h)	48			48	48	
Link Distance (m)	62.7			94.3	562.0	
Travel Time (s)	4.7			7.1	42.2	
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96
Heavy Vehicles (%)	0%	0%	0%	9%	15%	83%
Adj. Flow (vph)	0	0	0	1307	765	26
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	0	0	1307	765	26
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	0.0			3.7	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24	14	24			14
Sign Control	Stop			Free	Free	

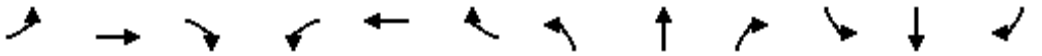
Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 27.6%		ICU Level of Service A	
Analysis Period (min) 15			



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	0	0	1255	734	25
Future Volume (Veh/h)	0	0	0	1255	734	25
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96
Hourly flow rate (vph)	0	0	0	1307	765	26
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1201	382	791			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1201	382	791			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	100	100			
cM capacity (veh/h)	180	621	838			

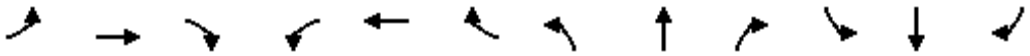
Direction, Lane #	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	436	436	436	382	382	26
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	0	26
cSH	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.26	0.26	0.26	0.23	0.23	0.02
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS						
Approach Delay (s)	0.0			0.0		
Approach LOS						

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	27.6%	ICU Level of Service	A
Analysis Period (min)	15		



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	24	0	12	62	0	68	16	1109	13	8	741	12
Future Volume (vph)	24	0	12	62	0	68	16	1109	13	8	741	12
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	0.0		0.0	35.0		45.0	60.0		0.0
Storage Lanes	0		0	1		1	1		1	1		0
Taper Length (m)	2.5			2.5			2.5			2.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	0.95
Ped Bike Factor												
Frt		0.956				0.850			0.850		0.998	
Flt Protected		0.967		0.950			0.950			0.950		
Satd. Flow (prot)	0	1068	0	1587	0	1541	1217	3318	1118	1615	3106	0
Flt Permitted		0.967		0.950			0.950			0.950		
Satd. Flow (perm)	0	1068	0	1587	0	1541	1217	3318	1118	1615	3106	0
Link Speed (k/h)		48			48			48			48	
Link Distance (m)		41.2			83.9			158.4			94.3	
Travel Time (s)		3.1			6.3			11.9			7.1	
Confl. Peds. (#/hr)							2		1	1		2
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Heavy Vehicles (%)	50%	0%	100%	15%	0%	6%	50%	10%	46%	13%	16%	100%
Adj. Flow (vph)	25	0	12	64	0	70	16	1143	13	8	764	12
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	37	0	64	0	70	16	1143	13	8	776	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.7			3.7			3.7			3.7	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		1.6			1.6			1.6			1.6	
Two way Left Turn Lane												
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24		14	24		14	24		14	24		14
Sign Control		Stop			Stop			Free			Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 48.2%		ICU Level of Service A	
Analysis Period (min) 15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	24	0	12	62	0	68	16	1109	13	8	741	12
Future Volume (Veh/h)	24	0	12	62	0	68	16	1109	13	8	741	12
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	25	0	12	64	0	70	16	1143	13	8	764	12
Pedestrians		2			1							
Lane Width (m)		3.7			3.7							
Walking Speed (m/s)		1.1			1.1							
Percent Blockage		0			0							
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	1462	1977	390	1586	1970	572	778			1157		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1462	1977	390	1586	1970	572	778			1157		
tC, single (s)	8.5	6.5	8.9	7.8	6.5	7.0	5.1			4.4		
tC, 2 stage (s)												
tF (s)	4.0	4.0	4.3	3.6	4.0	3.4	2.7			2.3		
p0 queue free %	47	100	97	0	100	85	97			99		
cM capacity (veh/h)	47	60	399	60	60	452	583			540		

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3
Volume Total	37	64	70	16	572	572	13	8	509	267
Volume Left	25	64	0	16	0	0	0	8	0	0
Volume Right	12	0	70	0	0	0	13	0	0	12
cSH	66	60	452	583	1700	1700	1700	540	1700	1700
Volume to Capacity	0.56	1.07	0.15	0.03	0.34	0.34	0.01	0.01	0.30	0.16
Queue Length 95th (m)	17.7	39.3	4.1	0.6	0.0	0.0	0.0	0.3	0.0	0.0
Control Delay (s)	114.4	252.6	14.4	11.3	0.0	0.0	0.0	11.8	0.0	0.0
Lane LOS	F	F	B	B				B		
Approach Delay (s)	114.4	128.2		0.2				0.1		
Approach LOS	F	F								

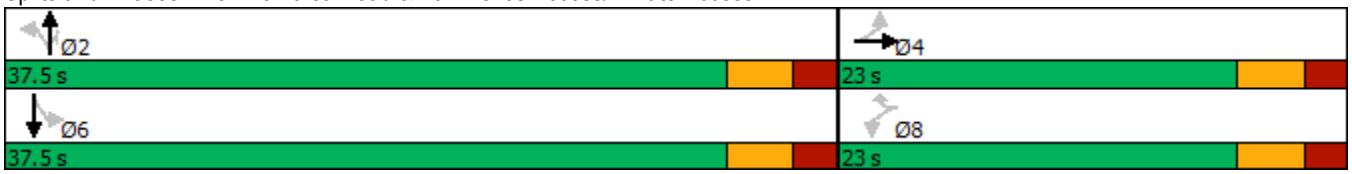
Intersection Summary				
Average Delay	10.2			
Intersection Capacity Utilization	48.2%	ICU Level of Service		A
Analysis Period (min)	15			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	12	0	18	10	0	12	30	528	43	59	1093	12
Future Volume (vph)	12	0	18	10	0	12	30	528	43	59	1093	12
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	0.0		0.0	35.0		45.0	60.0		0.0
Storage Lanes	0		0	1		1	1		1	1		0
Taper Length (m)	2.5			2.5			2.5			2.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	0.95
Ped Bike Factor		1.00				0.99	1.00		0.98	1.00	1.00	
Frt		0.918				0.850			0.850		0.998	
Flt Protected		0.981		0.950			0.950			0.950		
Satd. Flow (prot)	0	1730	0	1074	0	1633	1043	2664	1350	1706	3406	0
Flt Permitted		0.981					0.220			0.434		
Satd. Flow (perm)	0	1729	0	1130	0	1612	241	2664	1320	779	3406	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		36				36			47		3	
Link Speed (k/h)		48			48			48			48	
Link Distance (m)		41.2			83.9			158.4			94.3	
Travel Time (s)		3.1			6.3			11.9			7.1	
Confl. Peds. (#/hr)	1					1	1		1	1		1
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Heavy Vehicles (%)	0%	0%	0%	70%	0%	0%	75%	37%	21%	7%	7%	0%
Adj. Flow (vph)	13	0	20	11	0	13	33	580	47	65	1201	13
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	33	0	11	0	13	33	580	47	65	1214	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.7			3.7			3.7			3.7	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		1.6			1.6			1.6			1.6	
Two way Left Turn Lane												
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24		14	24		14	24		14	24		14
Number of Detectors	1	2		1		1	1	2	1	1	2	
Detector Template	Left	Thru		Left		Right	Left	Thru	Right	Left	Thru	
Leading Detector (m)	6.1	30.5		6.1		6.1	6.1	30.5	6.1	6.1	30.5	
Trailing Detector (m)	0.0	0.0		0.0		0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0		0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Size(m)	6.1	1.8		6.1		6.1	6.1	1.8	6.1	6.1	1.8	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0		0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0		0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0		0.0	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(m)		28.7						28.7			28.7	
Detector 2 Size(m)		1.8						1.8			1.8	
Detector 2 Type		Cl+Ex						Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0						0.0			0.0	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Turn Type	Perm	NA		Perm		Perm	Perm	NA	Perm	Perm	NA	
Protected Phases		4						2			6	
Permitted Phases	4			8		8	2		2	6		
Detector Phase	4	4		8		8	2	2	2	6	6	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0		5.0	5.0	5.0	5.0	5.0	5.0	
Minimum Split (s)	23.0	23.0		23.0		23.0	23.0	23.0	23.0	23.0	23.0	
Total Split (s)	23.0	23.0		23.0		23.0	37.5	37.5	37.5	37.5	37.5	
Total Split (%)	38.0%	38.0%		38.0%		38.0%	62.0%	62.0%	62.0%	62.0%	62.0%	
Maximum Green (s)	18.0	18.0		18.0		18.0	32.5	32.5	32.5	32.5	32.5	
Yellow Time (s)	3.0	3.0		3.0		3.0	3.0	3.0	3.0	3.0	3.0	
All-Red Time (s)	2.0	2.0		2.0		2.0	2.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)		0.0		0.0		0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)		5.0		5.0		5.0	5.0	5.0	5.0	5.0	5.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0		3.0	3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None		None		None	Max	Max	Max	Max	Max	
Walk Time (s)	7.0	7.0		7.0		7.0	7.0	7.0	7.0	7.0	7.0	
Flash Dont Walk (s)	11.0	11.0		11.0		11.0	11.0	11.0	11.0	11.0	11.0	
Pedestrian Calls (#/hr)	0	0		0		0	0	0	0	0	0	
Act Effct Green (s)		6.3		6.5		6.5	46.5	46.5	46.5	46.5	46.5	
Actuated g/C Ratio		0.12		0.12		0.12	0.87	0.87	0.87	0.87	0.87	
v/c Ratio		0.14		0.08		0.06	0.16	0.25	0.04	0.10	0.41	
Control Delay		9.4		21.5		3.6	5.1	2.4	1.3	2.8	2.9	
Queue Delay		0.0		0.0		0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay		9.4		21.5		3.6	5.1	2.4	1.3	2.8	2.9	
LOS		A		C		A	A	A	A	A	A	
Approach Delay		9.4			11.8			2.4			2.9	
Approach LOS		A			B			A			A	

Intersection Summary			
Area Type:	Other		
Cycle Length: 60.5			
Actuated Cycle Length: 53.4			
Natural Cycle: 60			
Control Type: Semi Act-Uncoord			
Maximum v/c Ratio: 0.41			
Intersection Signal Delay: 3.0		Intersection LOS: A	
Intersection Capacity Utilization 55.7%		ICU Level of Service B	
Analysis Period (min) 15			

Splits and Phases: 3: Bramalea Road & Full-Moves Access/Private Access





Lane Group	EBT	WBL	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	33	11	13	33	580	47	65	1214
v/c Ratio	0.14	0.08	0.06	0.16	0.25	0.04	0.10	0.41
Control Delay	9.4	21.5	3.6	5.1	2.4	1.3	2.8	2.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	9.4	21.5	3.6	5.1	2.4	1.3	2.8	2.9
Queue Length 50th (m)	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
Queue Length 95th (m)	5.3	4.1	1.7	4.5	15.9	2.2	5.1	36.8
Internal Link Dist (m)	17.2				134.4			70.3
Turn Bay Length (m)				35.0		45.0	60.0	
Base Capacity (vph)	607	381	568	210	2320	1156	678	2967
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.05	0.03	0.02	0.16	0.25	0.04	0.10	0.41

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	12	0	18	10	0	12	30	528	43	59	1093	12
Future Volume (vph)	12	0	18	10	0	12	30	528	43	59	1093	12
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0		5.0		5.0	5.0	5.0	5.0	5.0	5.0	
Lane Util. Factor		1.00		1.00		1.00	1.00	0.95	1.00	1.00	0.95	
Frpb, ped/bikes		1.00		1.00		0.99	1.00	1.00	0.98	1.00	1.00	
Flpb, ped/bikes		1.00		1.00		1.00	1.00	1.00	1.00	1.00	1.00	
Frt		0.92		1.00		0.85	1.00	1.00	0.85	1.00	1.00	
Flt Protected		0.98		0.95		1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1729		1074		1612	1043	2664	1320	1704	3407	
Flt Permitted		0.98		1.00		1.00	0.22	1.00	1.00	0.43	1.00	
Satd. Flow (perm)		1729		1130		1612	241	2664	1320	778	3407	
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	13	0	20	11	0	13	33	580	47	65	1201	13
RTOR Reduction (vph)	0	31	0	0	0	12	0	0	11	0	1	0
Lane Group Flow (vph)	0	2	0	11	0	1	33	580	36	65	1213	0
Confl. Peds. (#/hr)	1					1	1		1	1		1
Heavy Vehicles (%)	0%	0%	0%	70%	0%	0%	75%	37%	21%	7%	7%	0%
Turn Type	Perm	NA		Perm		Perm	Perm	NA	Perm	Perm	NA	
Protected Phases		4						2			6	
Permitted Phases	4			8		8	2		2	6		
Actuated Green, G (s)		3.0		3.0		3.0	43.5	43.5	43.5	43.5	43.5	
Effective Green, g (s)		3.0		3.0		3.0	43.5	43.5	43.5	43.5	43.5	
Actuated g/C Ratio		0.05		0.05		0.05	0.77	0.77	0.77	0.77	0.77	
Clearance Time (s)		5.0		5.0		5.0	5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)		3.0		3.0		3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		91		60		85	185	2051	1016	598	2623	
v/s Ratio Prot								0.22			c0.36	
v/s Ratio Perm		0.00		c0.01		0.00	0.14		0.03	0.08		
v/c Ratio		0.02		0.18		0.01	0.18	0.28	0.04	0.11	0.46	
Uniform Delay, d1		25.4		25.6		25.3	1.7	1.9	1.5	1.6	2.3	
Progression Factor		1.00		1.00		1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2		0.1		1.5		0.0	2.1	0.3	0.1	0.4	0.6	
Delay (s)		25.4		27.1		25.4	3.8	2.3	1.6	2.0	2.9	
Level of Service		C		C		C	A	A	A	A	A	
Approach Delay (s)		25.4			26.1			2.3			2.9	
Approach LOS		C			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	3.3	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.44		
Actuated Cycle Length (s)	56.5	Sum of lost time (s)	10.0
Intersection Capacity Utilization	55.7%	ICU Level of Service	B
Analysis Period (min)	15		

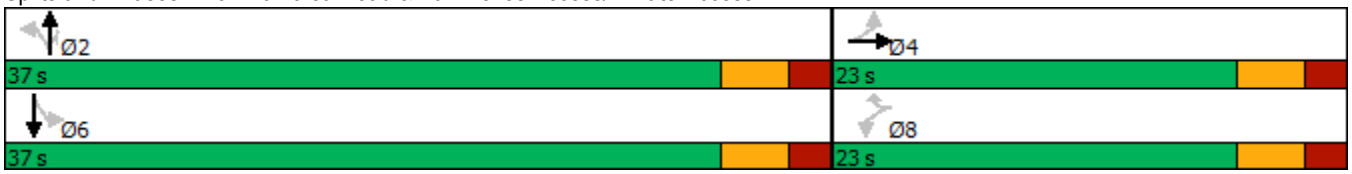
c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	24	0	12	62	0	68	16	1109	13	8	741	12
Future Volume (vph)	24	0	12	62	0	68	16	1109	13	8	741	12
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	0.0		0.0	35.0		45.0	60.0		0.0
Storage Lanes	0		0	1		1	1		1	1		0
Taper Length (m)	2.5			2.5			2.5			2.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	0.95
Ped Bike Factor							1.00		0.98	1.00	1.00	
Frt		0.956				0.850			0.850		0.998	
Flt Protected		0.967		0.950			0.950			0.950		
Satd. Flow (prot)	0	1068	0	1587	0	1541	1217	3318	1118	1615	3104	0
Flt Permitted		0.967		0.733			0.357			0.225		
Satd. Flow (perm)	0	1068	0	1224	0	1541	457	3318	1094	382	3104	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		36				62			36		4	
Link Speed (k/h)		48			48			48			48	
Link Distance (m)		41.2			83.9			158.4			94.3	
Travel Time (s)		3.1			6.3			11.9			7.1	
Confl. Peds. (#/hr)							2		1	1		2
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Heavy Vehicles (%)	50%	0%	100%	15%	0%	6%	50%	10%	46%	13%	16%	100%
Adj. Flow (vph)	25	0	12	64	0	70	16	1143	13	8	764	12
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	37	0	64	0	70	16	1143	13	8	776	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.7			3.7			3.7			3.7	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		1.6			1.6			1.6			1.6	
Two way Left Turn Lane												
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24		14	24		14	24		14	24		14
Number of Detectors	1	2		1		1	1	2	1	1	2	
Detector Template	Left	Thru		Left		Right	Left	Thru	Right	Left	Thru	
Leading Detector (m)	6.1	30.5		6.1		6.1	6.1	30.5	6.1	6.1	30.5	
Trailing Detector (m)	0.0	0.0		0.0		0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0		0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Size(m)	6.1	1.8		6.1		6.1	6.1	1.8	6.1	6.1	1.8	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0		0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0		0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0		0.0	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(m)		28.7						28.7			28.7	
Detector 2 Size(m)		1.8						1.8			1.8	
Detector 2 Type		Cl+Ex						Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0						0.0			0.0	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Turn Type	Perm	NA		Perm		Perm	Perm	NA	Perm	Perm	NA	
Protected Phases		4						2			6	
Permitted Phases	4			8		8	2		2	6		
Detector Phase	4	4		8		8	2	2	2	6	6	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0		5.0	5.0	5.0	5.0	5.0	5.0	
Minimum Split (s)	23.0	23.0		23.0		23.0	23.0	23.0	23.0	23.0	23.0	
Total Split (s)	23.0	23.0		23.0		23.0	37.0	37.0	37.0	37.0	37.0	
Total Split (%)	38.3%	38.3%		38.3%		38.3%	61.7%	61.7%	61.7%	61.7%	61.7%	
Maximum Green (s)	18.0	18.0		18.0		18.0	32.0	32.0	32.0	32.0	32.0	
Yellow Time (s)	3.0	3.0		3.0		3.0	3.0	3.0	3.0	3.0	3.0	
All-Red Time (s)	2.0	2.0		2.0		2.0	2.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)		0.0		0.0		0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)		5.0		5.0		5.0	5.0	5.0	5.0	5.0	5.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0		3.0	3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None		None		None	Max	Max	Max	Max	Max	
Walk Time (s)	7.0	7.0		7.0		7.0	7.0	7.0	7.0	7.0	7.0	
Flash Dont Walk (s)	11.0	11.0		11.0		11.0	11.0	11.0	11.0	11.0	11.0	
Pedestrian Calls (#/hr)	0	0		0		0	0	0	0	0	0	
Act Effct Green (s)		8.3		8.3		8.3	39.3	39.3	39.3	39.3	39.3	
Actuated g/C Ratio		0.15		0.15		0.15	0.72	0.72	0.72	0.72	0.72	
v/c Ratio		0.19		0.34		0.24	0.05	0.48	0.02	0.03	0.35	
Control Delay		9.9		24.5		9.1	4.6	5.6	0.8	4.5	4.7	
Queue Delay		0.0		0.0		0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay		9.9		24.5		9.1	4.6	5.6	0.8	4.5	4.7	
LOS		A		C		A	A	A	A	A	A	
Approach Delay		9.9			16.5			5.5			4.7	
Approach LOS		A			B			A			A	

Intersection Summary			
Area Type:	Other		
Cycle Length: 60			
Actuated Cycle Length: 54.4			
Natural Cycle: 50			
Control Type: Semi Act-Uncoord			
Maximum v/c Ratio: 0.48			
Intersection Signal Delay: 6.0		Intersection LOS: A	
Intersection Capacity Utilization 51.5%		ICU Level of Service A	
Analysis Period (min) 15			

Splits and Phases: 3: Bramalea Road & Full-Moves Access/Private Access





Lane Group	EBT	WBL	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	37	64	70	16	1143	13	8	776
v/c Ratio	0.19	0.34	0.24	0.05	0.48	0.02	0.03	0.35
Control Delay	9.9	24.5	9.1	4.6	5.6	0.8	4.5	4.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	9.9	24.5	9.1	4.6	5.6	0.8	4.5	4.7
Queue Length 50th (m)	0.1	5.4	0.7	0.4	23.3	0.0	0.2	13.7
Queue Length 95th (m)	5.8	13.5	8.4	2.4	43.4	0.7	1.5	26.3
Internal Link Dist (m)	17.2				134.4			70.3
Turn Bay Length (m)				35.0		45.0	60.0	
Base Capacity (vph)	379	407	554	330	2395	799	275	2242
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.10	0.16	0.13	0.05	0.48	0.02	0.03	0.35

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	24	0	12	62	0	68	16	1109	13	8	741	12
Future Volume (vph)	24	0	12	62	0	68	16	1109	13	8	741	12
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0		5.0		5.0	5.0	5.0	5.0	5.0	5.0	
Lane Util. Factor		1.00		1.00		1.00	1.00	0.95	1.00	1.00	0.95	
Frpb, ped/bikes		1.00		1.00		1.00	1.00	1.00	0.98	1.00	1.00	
Flpb, ped/bikes		1.00		1.00		1.00	1.00	1.00	1.00	1.00	1.00	
Frt		0.96		1.00		0.85	1.00	1.00	0.85	1.00	1.00	
Flt Protected		0.97		0.95		1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1069		1587		1541	1215	3318	1094	1615	3103	
Flt Permitted		0.97		0.73		1.00	0.36	1.00	1.00	0.22	1.00	
Satd. Flow (perm)		1069		1224		1541	457	3318	1094	382	3103	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	25	0	12	64	0	70	16	1143	13	8	764	12
RTOR Reduction (vph)	0	31	0	0	0	54	0	0	4	0	1	0
Lane Group Flow (vph)	0	6	0	64	0	16	16	1143	9	8	775	0
Confl. Peds. (#/hr)							2		1	1		2
Heavy Vehicles (%)	50%	0%	100%	15%	0%	6%	50%	10%	46%	13%	16%	100%
Turn Type	Perm	NA		Perm		Perm	Perm	NA	Perm	Perm	NA	
Protected Phases		4						2			6	
Permitted Phases	4			8		8	2		2	6		
Actuated Green, G (s)		7.2		7.2		7.2	38.3	38.3	38.3	38.3	38.3	
Effective Green, g (s)		7.2		7.2		7.2	38.3	38.3	38.3	38.3	38.3	
Actuated g/C Ratio		0.13		0.13		0.13	0.69	0.69	0.69	0.69	0.69	
Clearance Time (s)		5.0		5.0		5.0	5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)		3.0		3.0		3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		138		158		199	315	2289	754	263	2141	
v/s Ratio Prot								c0.34			0.25	
v/s Ratio Perm		0.01		c0.05		0.01	0.04		0.01	0.02		
v/c Ratio		0.04		0.41		0.08	0.05	0.50	0.01	0.03	0.36	
Uniform Delay, d1		21.1		22.2		21.2	2.8	4.1	2.7	2.7	3.6	
Progression Factor		1.00		1.00		1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2		0.1		1.7		0.2	0.3	0.8	0.0	0.2	0.5	
Delay (s)		21.3		23.9		21.4	3.1	4.8	2.7	2.9	4.0	
Level of Service		C		C		C	A	A	A	A	A	
Approach Delay (s)		21.3			22.6			4.8			4.0	
Approach LOS		C			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	5.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	55.5	Sum of lost time (s)	10.0
Intersection Capacity Utilization	51.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Appendix C

City of Brampton Collision Data

Collision Details Report

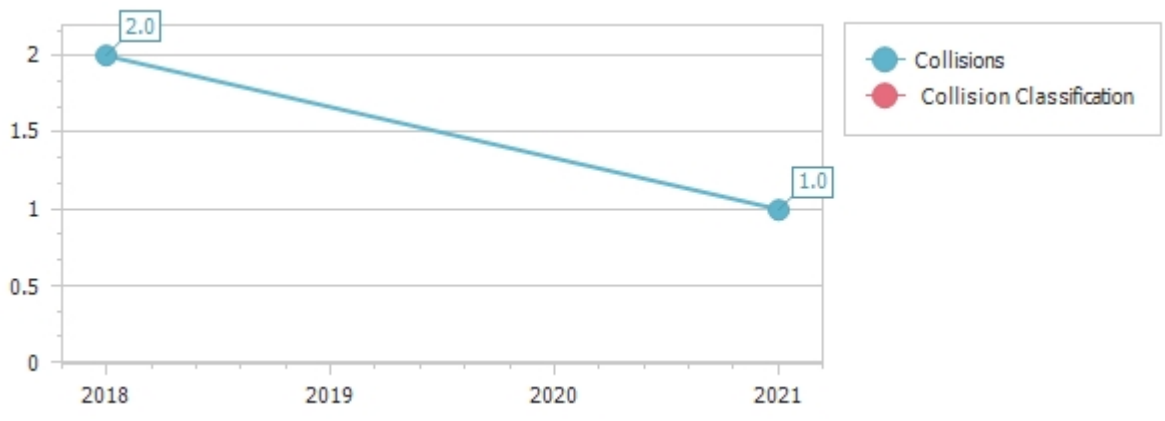
From: January 1, 2018 **To:** December 31, 2022

Location ..... BRAMALEA RD @ HIGHWAY 407 E **Municipality.....** Brampton

Traffic Control.... No control **Total Collisions....** 3

Collision ID	Date/Day/Time	Environment	Impact Type	Classification	Direction	Surface Cond'n	Vehicle Manoeuver	Vehicle type	First Event	Driver Action	No. Ped
180127986	2018-Apr-06, Fri,13:06	Snow	Turning movement	Non-fatal injury	South	Wet	Turning left	Automobile, station wagon	Other motor vehicle	Improper turn	
Comments:	Statement #1: V1 TRAVELING S/B ON BRAMALEA RD IN THRU LANE #1 AWAITING TO MAKE A LEFT TURN ONTO LOGISTICS DR. V2 TRAVELING N/B ON BRAMALEA RD IN THRU LANE #2. V1 MADE THE LEFT TURN INFRONT OF V2 CAUSING V2 TO SUBSEQUENTLY STRIKE THE FRONT RIGHT SIDE OF V1. PON #7426091B ISSUED TO D1 FOR LEFT TURN FAIL TO AFFORD REASONABLE OPPORTUNITY TO AVOID COLLISION S. 141(5) HTA.				North	Wet	Going ahead	Automobile, station wagon	Other motor vehicle	Driving properly	
180392401	2018-Oct-17, Wed,15:00	Snow	Rear end	P.D. only	North	Wet	Going ahead	Pick-up truck	Other motor vehicle	Following too close	
Comments:	Statement #1: V1 WAS N/B ON R1 V2 WAS N/B ON R1V2 STOPPED FOR TRAFFIC WHILE IN THE INTERSECTION OF R1 AND R2V1 REARENDED V2				North	Wet	Stopped	Automobile, station wagon	Other motor vehicle	Driving properly	
210107812	2021-Mar-26, Fri,01:00	Clear	Sideswipe	P.D. only	South	Dry	Going ahead	Automobile, station wagon	Other motor vehicle	Improper lane change	
Comments:	Statement #1: V2 TRAVELLING S/B ON BRAMAELEA, V1 CHANGED LANES STRIKING V2 AND V3.				South	Dry	Slowing or stopping	Automobile, station wagon	Other motor vehicle	Driving properly	

Collisions by Year and Classification



Collision Details Report

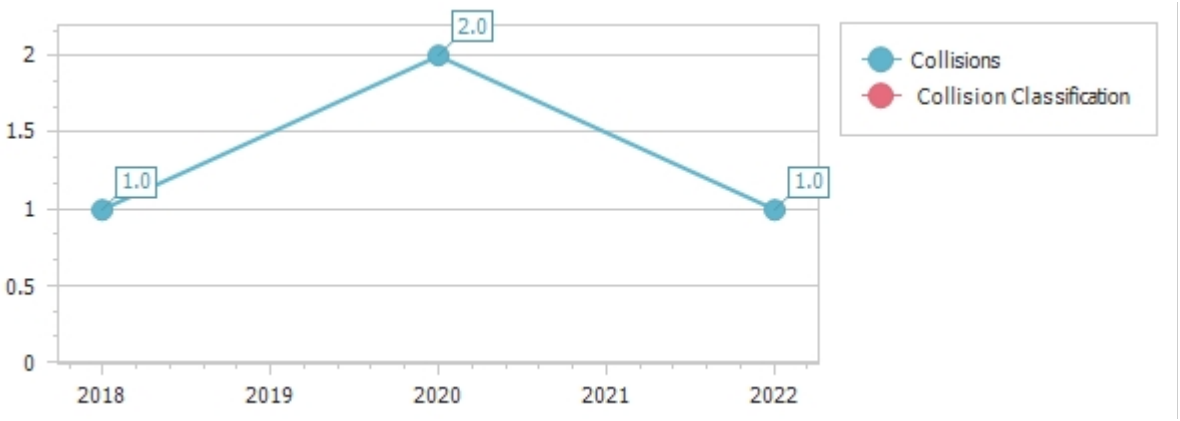
From: January 1, 2018 **To:** December 31, 2022

Location ..... BRAMALEA RD @ HIGHWAY 407 W **Municipality.....** Brampton

Traffic Control.... Traffic signal **Total Collisions....** 4

Collision ID	Date/Day/Time	Environment	Impact Type	Classification	Direction	Surface Cond'n	Vehicle Manoeuver	Vehicle type	First Event	Driver Action	No. Ped
180266681	2018-Jul-16, Mon,15:14	Clear	Rear end	Non-fatal injury	North	Dry	Going ahead	Automobile, station wagon	Other motor vehicle	Driving properly	
Comments:	Statement #1: V1 AND V2 DRIVING NORTH BOUND ON BRAMALEA ROAD APPROACHING TRAFFIC LIGHT INTERSECTION. V2 STOPS VEHICLE, V1 STRUCK V2 IN REAR				North	Dry	Slowing or stopping	Automobile, station wagon	Other motor vehicle	Driving properly	
200131166	2020-Apr-17, Fri,12:25	Clear	Rear end	Non-fatal injury	North	Dry	Going ahead	Pick-up truck	Other motor vehicle	Speed too fast for condition	
Comments:	Statement #1: v2 n/b r1 ln 1 of 2 proceeding on fresh green light.v1 n/b r1 ln 1 approaching fresh green. failed to slow for traffic ahead and rear ended v2				North	Dry	Going ahead	Automobile, station wagon	Other motor vehicle	Driving properly	
200238608	2020-Jul-28, Tue,16:32	Clear	Angle	P.D. only	North	Dry	Going ahead	Automobile, station wagon	Other motor vehicle	Disobeyed traffic control	
Comments:	Statement #1: V1 Travelling north bound on R1 L1V2 Travelling west bound on R2 exiting Hwy407 V2 Proceeds into intersection on green light commencing left turn to travel south bound on R1V1 fails to stop for red light and collides with V2				West	Dry	Turning left	Ambulance	Other motor vehicle	Driving properly	
220337581	2022-Oct-06, Thu,15:15	Clear	Rear end	P.D. only	South	Dry	Slowing or stopping	Automobile, station wagon	Other motor vehicle	Other	
Comments:					South	Dry	Stopped	Automobile, station wagon	Other motor vehicle	Driving properly	

Collisions by Year and Classification



Appendix B.11

Health Impact Assessment Report (Revised October 2024)

HEALTH IMPACT ASSESSMENT (HIA) OF THE EMERALD EFW EXPANSION PROJECT

FINAL

PROJECT # 401974

Attention:

Emerald Energy From Waste Inc.

Emerald Energy From Waste Inc.
7656 Bramalea Rd, Mississauga, ON L5S 1C4

October 22, 2024

SCIENCE INTEGRITY KNOWLEDGE

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ACRONYMS

Acronym	Definition
APC	Air Pollution Control
CEM	Continuous Emission Monitoring
EA	Environmental Assessment
ECA	Environmental Compliance Approval
EFW	Energy From Waste
EPFR	Environmentally Persistent Free Radicals
ESC	Erosion and Sediment Control Plan
FET	Full time equivalent
GHG	Greenhouse Gas Emissions
HHRA	Human Health Risk Assessment
HIA	Health Impact Assessment
LOS	Level of Service
MACT	Maximum Achievable Control Technology
MECP	Ministry of Environment, Conservation and Parks
PAH	Polycyclic Aromatic Hydrocarbons
SWB	Subjective Well-Being
US EPA	United States Environmental Protection Agency
WHO	World Health Organization

UNITS

Unit	Definition
cm	centimetre
km	kilometre
kWh	kilowatt-hour
m	metre
mamsl	metre above mean sea level
mbgs	meters below ground surface
MW	megawatt
MWh	megawatt-hour
t	tons
t/y	tons per year
v/c	volume-to-capacity ratio

1. Introduction

Intrinsik Corp. (Intrinsik) conducted a Health Impact Assessment (HIA) on behalf of Emerald Energy From Waste (EFW) Inc. (Emerald) for a proposed expansion of the existing Emerald EFW facility located at the intersection of Highway 407 and Bramalea Road in Brampton, Ontario ("the Project"). The Project is located at 7656 Bramalea Road, in Brampton, Ontario and is owned and operated by Emerald EFW. The location of the Site is shown in Figure 1-1**.** The HIA was conducted as part of the Environmental Screening Process (Ontario Regulation 101/07, *Environmental Assessment Act*).



Figure 1-1: Location of the Proposed Undertaking. Source: GHD, 2023c.

1.1. Background

In 1991, Emerald received a Certificate of Approval (now referred to as an Environmental Compliance Approval [ECA]) for the Emerald EFW facility. The facility has accepted municipal solid waste since 1992. The Emerald EFW facility has currently approved waste processing rates of 546 tonnes per day and 182,000 tonnes per year which operates under ECA No. 0264-BFGQFY. The facility is licensed to receive solid non-hazardous waste from domestic, commercial, industrial and institutional sources; solid non-hazardous international waste, arriving in Ontario; and waste designated for thermal treatment by the Canadian Food Inspection Agency and/or Health Canada, from the Province of Ontario (GHD, 2023e). Emerald undertook an Environmental Assessment for a 25% plant expansion between 1997 and 2000. In

2009, a Certificate of Approval was published. In order to expand its service area, the site also carried out an environmental screening, which was authorized in 2011–2012. The ECA's amendments were approved in 2010, 2012, and 2020 by the Ministry of Environment, Conservation and Parks (MECP). Continual investments to upgrade equipment have helped the facility keep pace with technological changes (GHD, 2023e). The existing Emerald EFW facility converts recovered thermal energy into steam and electricity from solid non-hazardous waste from municipal as well as industrial, commercial, and institutional sources. Emerald currently produces 10 MW of energy for use in the community (GHD, 2024a). Energy is recovered as heat, which can then be used directly or converted into electricity. Carbon emissions associated with waste management activities are reduced by diverting waste from landfills through energy recovery (GHD, 2024a).

1.2. Proposed Redevelopment

The Ontario Waste Management Association has predicted that Ontario's approved landfill capacity will be exhausted in the coming 9 to 13 years. Ontario's population is expected to grow by 5.2 million (i.e., a 36 per cent increase) from 2019 to 2046 (i.e., over a 27 year period) (Government of Ontario, n.d.). As the population grows, there will be an increase in demand for additional waste management infrastructure.

In order to meet the growing demand from waste generators and customers for a safe and reliable waste management facility for their post diversion solid non-hazardous Residential and Industrial, Commercial & Institutional waste, Emerald EFW is proposing to redevelop and expand the processing capacity of their current facility from 500 tonnes/day to up to 2,500 tonnes/day (or up to 900,000 tonnes per year from the current 182,000 tonnes per year), and increase the energy recovery from 10 MW to up to 100 MW. The same technology that has been shown to be successful over the course of 25 years of emissions testing results that either meet or exceed provincial regulations, would be used in this redevelopment and expansion (GHD, 2023e). The additional capacity will be attained in three stages by the installation of new processing units and as well as the rehabilitation of certain current processing units. Phase 1 will see the construction of the first new processing line while the current plant is kept operational (see Figure 1-2). Phases 2 and 3 will be installed and commissioned in response to market demand. Once redevelopment is complete, the existing facility would be removed as shown in Figure 1-3 below.



Figure 1-2: Proposed Redevelopment Phase 1. Source: GHD, 2023c.



Figure 1-3: Proposed Redevelopment Phase 2 & 3. Source: GHD, 2023c.

Several conditions of the approved ECA, which outline the maximum quantity of waste that may be processed on a daily and annual basis, as well as the maximum number of equipment units that can be used, need to be amended in order to implement any suggested amendments to the waste processing restrictions. In order to accommodate the proposed new gasification units, changes to the current approved size and footprint of the EFW facility will also be required.

With the annual waste processing capacity changes as suggested (i.e., upscaling it to up to 2,500 tonnes/day [or up to 900,000 tonnes per year]), Emerald EFW will be able to reduce greenhouse gas emissions, recover energy from leftover materials, and favorably respond to Ontario's move away from landfill disposal in both Canada and the United States. This entails preserving the landfill disposal capacity while diverting a sizable portion of Ontario's total residual waste—currently 97%—from landfills. It is anticipated that the planned facility expansion will remain operational for at least 20 years.

1.3. Using Energy From Waste

Using Energy from Waste technology, such as the Emerald EFW facility, can divert residual waste from landfill disposal, thereby extending the life of existing landfills and/or reducing the need for new landfills. Energy from Waste can recover materials that cannot be recycled such as ferrous and non-ferrous metals. Energy from Waste can be used to improve the resilience and stability of the electricity grid and is a local source of multiple types of energy (steam, heat, electricity, hydrogen).

1.4. The Environmental Screening Process

In accordance with Section 16 of Ontario Regulation 101/07 – Waste Management Projects Regulation of the Ontario *Environmental Assessment Act*, this proposed ECA amendment is subject to the Environmental Screening Process as follows:

> *"A change to a thermal treatment site described in section 11 is defined as a major commercial or business enterprise or activity and is designated as an undertaking to which the Act applies, if the amount of waste that would be subject to thermal treatment at the site on any day after the change would exceed the amount of waste that was authorized under the Environmental Protection Act to be subject to thermal treatment at the site before the change. O. Reg. 101/07, s. 16; O. Reg. 389/22, s. 9."*

This project is exempt from Part II of the *EA Act* under Section 16 of O. Reg. 101/07 – Waste Management Projects Regulation, provided that the Environmental Screening Process is completed (GHD, 2023e). The planning and design procedure described in the MECP's "*Guide to Environmental Assessment Requirements for Waste Management Projects*" shall be followed when conducting the screening. In order to identify and characterize potential environmental effects, screening criteria must be applied to the Environmental Screening process. Additionally, public and external agency consultation is required, and mitigation measures will be determined to reduce any potential environmental effects previously identified (GHD, 2023e). An Environmental Screening Report will be used to document and share Study results with stakeholders including the public, and government agencies (GHD, 2023e). An application will be made to amend the existing ECA upon completion of the Environmental Screening Process.

Although an HIA is not a required part of the Environmental Screening Process, Emerald has chosen to undertake this holistic assessment of human health in order to provide the community with a dedicated assessment that would include, consider and evaluate their human health concerns in a transparent and systematic manner (see Section 2).

2. Approach and Methodology

This HIA is based on the methods successfully employed in HIA submissions completed recently for similar waste management facilities in Ontario. Together, the HIA and a Human Health Risk Assessment (HHRA) of potential air quality impacts also undertaken for the Project, examine the potential human health effects associated with the Project and assess the potential cumulative effects of the Project in combination with other pre-existing conditions within the study area. Importantly, the HIA evaluates both the potential positive as well as the negative health outcomes associated with Project activities. The HIA uses best practices and relies on site-specific data and information collected in other studies conducted as part of the Environmental Screening Process, from the available scientific and regulatory

literature and public health information, to systematically and transparently assess any potential health outcomes.

As noted, an HIA provides a framework for evaluating potential impacts (positive and negative) on human health and well-being. It includes consideration of physical, social, and economic impacts resulting from Project activities. It takes into account existing baseline conditions and pre-determined mitigation/control measures for the Project.

The main method of evaluating the physical effects on health within the HIA is through completion of an HHRA. As a major component of the HIA, the HHRA identifies the baseline air quality conditions and then evaluates whether the additional contribution of emissions from the proposed Project could potentially adversely impact human health. The HHRA is carried out in accordance with regulatory guidance and industry best practices to evaluate whether activities associated with the Project might adversely impact health.

2.1. The HIA Framework

The World Health Organization (WHO) defines health as *"a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity"* (WHO, 1948), wherein, the holistic nature of health is recognized. Historically, health was considered secondary in development projects, if considered at all. More recently, however, there has been increasing interest in HIA and how it can be a useful tool to promote sustainable and responsible development, and also serve as a tool for identifying and addressing community concerns. The WHO (1999) defines HIA as:

> *"A combination of procedures, methods and tools by which a policy, programme or project may be judged as to its potential effects on the health of a population, and the distribution of those effects within the population."*

An HIA typically consists of a series of steps that are intended to provide a structural framework to conduct the assessment. Although guidance documents from around the world have slight variations on the process, the steps are fundamentally the same: screening, scoping, assessment, recommendations, reporting and conclusions (see Figure 2-1).

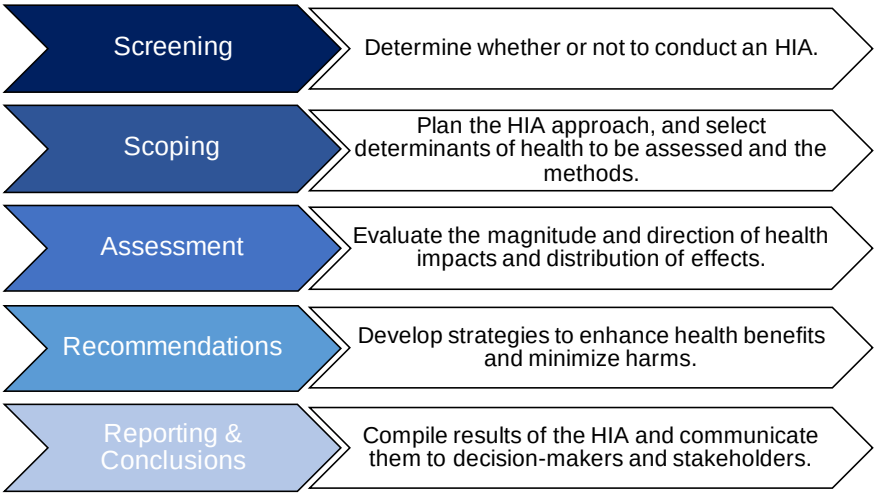


Figure 2-1: Steps of a Health Impact Assessment

The HIA conducted for the Project followed accepted best practices in the field of HIA to ensure a rigorous, systematic and transparent process.

2.1.1. Objectives of the HIA

The purpose of the HIA is to evaluate potential positive and negative impacts on health and well-being that may result from Project activities, and propose measures to either reduce or mitigate harmful effects and to enhance positive health effects, while providing a platform to address stakeholder concerns.

There are several benefits to conducting an HIA as part of the Environmental Screening Process, including:

i. Similar Approach: Aligns well with the Environmental Screening process.
   - Screening, scoping, assessment, recommendations and reporting.

ii. Highlights Positives: Unique in its ability to highlight the positive aspects of a project.
   - Typical assessments, such as HHRAs, tend to focus only on the absence or presence of negative effects. For the Emerald EFW expansion project, the potential benefits are multifaceted:
     - Management of municipal waste;
     - Creation of energy as a by-product; and
     - Increased employment and municipal revenue.

iii. Address Stakeholder Concerns: Addresses stakeholder/community concerns in an upfront and transparent manner, which can help alleviate their concerns.

iv. Efficient Process: The HIA can be completed alongside the Environmental Screening Process, relying on data and information collection in from other studies (e.g., air quality, traffic, socioeconomic, etc.) to achieve maximum efficiency in terms of time and budget.
   - Considers many of the issues in an Environmental Screening Process, but evaluates them through a health lens.

v. Feasible Recommendations: The HIA produces targeted recommendations designed to be feasible and effective in mitigating potential negative health impacts and enhancing potential positive health impacts.

vi. Enhanced Communication: The HIA process is based on open and transparent communication of issues and concerns with key stakeholders. By identifying these early in the process, and addressing them through HIA, the likelihood of last-minute complications and major setbacks with respect to understanding human health impacts is minimized.

It is important to note that HIAs are qualitative assessments, whereas HHRAs are quantitative and embody the requirements of a quantitative assessment, which includes an uncertainty analysis.

2.1.2. Effects Assessment Approach

The assessment step of the HIA evaluates the potential for positive and negative health impacts arising from Project and related activities. The Assessment step of the HIA starts with the completion of a baseline community health profile of the affected populations, which identifies the current overall health and wellness of the affected community and existing health concerns. As the name suggest, the baseline community health profile provides a baseline for comparison of Project-related specific effects on health and wellbeing. This is the Effects Assessment, during which the expected effects on health and well-being are characterized using a systematic and evidence-based approach (see below).

2.1.2.1. Characterizing Health Effects

After completion of the baseline health assessment, which provides a foundation for potential changes in community health and well-being, the assessment of project-related health impacts (both positive and negative) was conducted. Data and information from studies completed as part of the Environmental Screening Process (i.e., results from HHRA, air quality, water quality, traffic, noise and agriculture) was used, ensuring that the HIA relied on Project-specific, current and high-quality information. Effects are characterized taking into consideration mitigation strategies proposed as part of the Environmental Screening Process and assuming they will be implemented.

The project team also relied on relevant information identified in the peer-reviewed and reputable grey literature to evaluate potential health impacts. The HIA was conducted using a baseline scenario that assumes that the Environmental Screening Process mitigation measures are in place, and therefore, only assesses the potential for residual health effects, which can be managed through targeted recommendations designed to be feasible and effective.

2.1.2.2. Applying an HIA Assessment Framework

In order to ensure that the HIA was conducted in a systematic and transparent manner, an assessment framework was used in the Emerald EFW Expansion HIA. The effect characterization component of the HIA included a clear and consistent framework that determined the nature of impacts based on assessment results (Table 2-1). This assessment framework characterized impacts to determinants of health based on several criteria including magnitude and likelihood of effect.

Table 2-1: Effects Characterization Framework[1]		
Criteria	**Rating**	**Definition**
Affected populations Who is likely to experience the effect?	**Specific**	Effect is limited to certain individuals or specific groups
	Proximate	Effect may be experienced generally by those living in proximity to the facility
	Regional	Effect may be experienced generally on a broader scale (i.e., beyond the area that contains the facility)
Magnitude What is the potential severity of the effect on human health?	**Negligible**	Effects are may not occur or are too small to be noticed
	Low	Effects are small or may be experienced by a few individuals
	Medium	Effects are moderate or may be experienced by a wide range of individuals or be noticed by agencies and organizations
	High	The effects are severe or could create a change at a system level
Likelihood What is the probability of the effect occurring?	**Low**	The effect is anticipated to occur rarely, if ever. This classification is appropriate for those situations where effects are not zero but they are limited to very rare occurrences, catastrophic events, or highly unlikely system failures.
	Medium	The effect may happen, but is not certain to occur
	High	The effect will almost certainly occur
Potential Health Consequence Will the effect be helpful or harmful to human health?	**Positive**	The effect is anticipated to improve health and well-being
	Negative	The effect is anticipated to diminish health and well-being
	Mixed	The effect may both improve and diminish health and well-being
	Neutral	The effect is negligible and is anticipated to have little to no effect on health and well-being
Level of Confidence How conclusive are these predictions?	**Low**	The effect characterization based on very limited (low quality) data and/or the information is general in nature without any site-specific consideration
	Medium	The effect characterization based on some (moderate quality) data and/or the information is general in nature with limited site-specific consideration
	High	The effect characterization based on substantial (high quality) data and/or the information is site-specific in nature

Notes:

1. The HIA was conducted using a baseline scenario that assumes that the Environmental Screening Process mitigation measures are in place, and therefore, the HIA only assesses the potential for residual health effects, which can be managed through targeted recommendations designed to be feasible and effective.

3. Screening

The HIA Screening step establishes the need for and value of conducting an HIA, and evaluates at a high level the potential health impacts that can be expected due to the Project. This section provides a formalized screening process. In addition to the standard assessment criteria, Emerald reached out to the local community and Indigenous groups to determine if there are concerns about aspects of the environment not covered by the standard criteria. The Screening Criteria Checklist prescribed through the Environmental Screening Process (see Table 3-1):

- Define the Site Study Area, Local Study Area, and Regional Study Area, as appropriate, for the assessment of the potential effects of the Emerald EFW facility on human health of individuals living, working and playing in the surrounding communities.

- Compile and interpret information from existing data sources including other investigative streams of the EA.
- Consult and engage with key stakeholders and rightsholders to ensure the appropriate health concerns and determinants of health are being evaluated in the study.

Conduct necessary studies and analysis to understand the basis, extent, duration, inter-relationships, and magnitude of the potential environmental effects for those Human Health criteria identified in the screening criteria checklist by a "yes" response to the questions (see Table 3-1) and determine the mitigation measures and net effects. Record these findings in the potential effects, mitigation measures, and net effects section of the Emerald EFW Redevelopment Environmental Screening Report.

Table 3-1: Human Health Assessment Screening Criteria

Ref	Screening Criteria	Yes	No	Additional Information
Might the Project…				
1.1	Cause negative effects on human health due to emissions?	X		The proposed EFW Facility redevelopment would result in changes to the existing site footprint and on-site operations and may cause potential effects on air quality due to emissions.
1.2	Cause positive or negative effects on human health identified through the determinants of health	X		The proposed EFW Facility redevelopment will result in a number of changes which may positively or negatively affect key determinants of health important to the surrounding communities.

Hence, during Screening, initial recommendations related to the scope of the HIA, taking into account potential project-specific (i.e., EFW facilities) and location-specific (Brampton Centre health concerns were developed.

4. Scoping

The HIA scoping process is intended to provide the blueprint for the HIA. It involves identifying the populations that might be affected, identifying which determinants of health will be evaluated in the HIA, and identifies the data and methods to be used and alternatives (if any) to be assessed. The determinants of health are the conditions in which people are born, grow, live, work and age (WHO, 2012). These circumstances are shaped by the distribution of money, power and resources at global, national and local levels. An HIA evaluates a Project's impact on community-specific determinants of health to identify how the project would impact overall health in the community, and also understand how certain vulnerable population subgroups can be impacted differently.

The HIA Study Team conducted a scoping process as part of the larger Environmental Screening Process to ensure that the HIA considers those issues that are important to local stakeholders, including relevant health and regulatory authorities.

The initial task in scoping was to conduct a review of all project-related information to characterize the key issues around potential health impacts. This information was gathered from several sources including public documents and government reports, the scientific literature, assessments on similar

projects, professional judgment (based on previous similar project experience) and engagement and consultation documentation from Emerald.

There are several potential determinants of health that could be considered in the scope of the Emerald EFW Expansion HIA. The following represents assessment focus-areas identified following engagement with stakeholders as well as search of background information on health impacts of EFW facilities:

Environmental determinants of health

- Air quality (chemical pollutants, particulate matter, truck emissions, etc.) and GHG emissions
  - Odours
- Water quality (groundwater and surface water)
- Noise levels
- Agriculture

Social determinants of health

- Accidents and Injuries (from increased truck traffic)
- Social Cohesion
- Project Revenues
- Employment

Stakeholder consultation, in the form of a public open house / scoping meeting, allowed interested parties to provide input into the scoping process, and was part of the public engagement meetings during the Environmental Screening Process.

The HIA scoping process also defines the boundaries of the HIA including spatial and temporal considerations (see Sections 4.1 and 4.2). Vulnerable populations that could be disproportionately impacted by the project were identified for each of the determinants of health being assessed, and tasks were assigned to specific members of the project team to ensure efficient completion of the work. Finally, once the scope was finalized, a scoping report was created by the project team to summarize the outcome of the engagement process (Appendix 1), as well as to communicate the final scope of work for inclusion in the HIA.

4.1. Study Durations

The Environmental Screening Process has three general time frames:

Construction	The time during which the redeveloped energy from waste facility is constructed.
Operational	The time during which the facility receives and processes waste.
Closure	The time after the site no longer receives or processes waste.

In the HIA, if potential health impacts can be expected during a specific time frame/phase, i.e., construction, or operations or closure, this has been identified.

4.2. Study Areas

The Site Study Area, includes all lands within the existing, approved boundaries of the Emerald EFW facility, as defined by Environmental Compliance Approval (ECA) No. 4591-56VSTN, as amended.

For the purposes of the HIA, the study area was considered to be the ward in which the Emerald EFW facility is located, i.e., municipal Ward 7 or Brampton Centre district, which is the federal and provincial electoral district (see Section 5.1). The proposed Emerald EFW facility expansion would happen within the municipal boundaries of the City of Brampton, or the regional boundaries of the Region of Peel. Potential health impacts related to the Project would be experienced more acutely by the community immediately surrounding the Project, and to a perhaps lesser extent by the City of Brampton and the Region of Peel. Data and information to characterize current health status within the affected community was available at the level of the Brampton Centre district or at the Region of Peel (see more in Section 5.1).

5. Assessment

The assessment step of the HIA identifies and evaluates the potential for positive and negative health impacts arising from Project and Project activities. This is achieved through completion of a baseline health profile of the affected community to develop an understanding of how healthy the population is overall, and to identify the major health and other environmental issues faced by the community. Following this, the assessment of effects includes identification and characterization of the expected effects on health and well-being using a systematic and evidence-based approach.

5.1. Baseline Health Profile

The Region of Peel within Ontario is made up of the Cities of Brampton and Mississauga and the Town of Caledon. The Emerald EFW is located in Ward 7 within the City of Brampton or the electoral district of Brampton Centre. The Region of Peel has the second highest municipal population in Ontario. According to Region of Peel data, the population of the Region of Peel was 1,451,022 in 2021, which is a growth of almost 5% from 2016 (Statistics Canada, 2021). In the same period, the population of the City of Brampton grew by 10.6% (Statistics Canada, 2021). As an area that is experiencing significant population growth, locating an EFW facility within city limits makes sense from a logistics point-of-view for the disposal of the city's municipal waste. In order to prepare a baseline health profile, data was collected from:

- Region of Peel (www.peelregion.ca)
    - Public Health
    - Data Centre – Census and National Household Survey Maps, Ward Profile for Ward 7
- Statistics Canada – census data for Brampton Centre
- Canadian Institute for Health Information
- Ontario Ministry of Health and Long-Term Care
- The Environmental Screening Process for the Project

The amount of baseline health data available for Brampton Centre/Region of Peel/City of Brampton is sufficient for the purposes of the current HIA. Additional primary data collection was outside of the scope of this HIA. The types of data available from these sources include:

- Demographics
- Prevalence and incidence of chronic diseases (high blood pressure, cancer, diabetes, obesity)
- Income and Employment
- Level of education
- Housing

Specific baseline health information for the community around the Emerald EFW facility was mainly available for the Brampton Centre electoral ward (Figure 5-1) and limited information was available at the municipal ward level (i.e., Ward 7 in the City of Brampton) (Figure 5-2**Error! Reference source not found.**). Baseline information from Statistics Canada was available for sociodemographic, employment and income, affordable housing, ethnicity and immigration, language and transportation use is also available.



Figure 5-1: Location of the Emerald EFW Facility in the Brampton Centre Electoral District

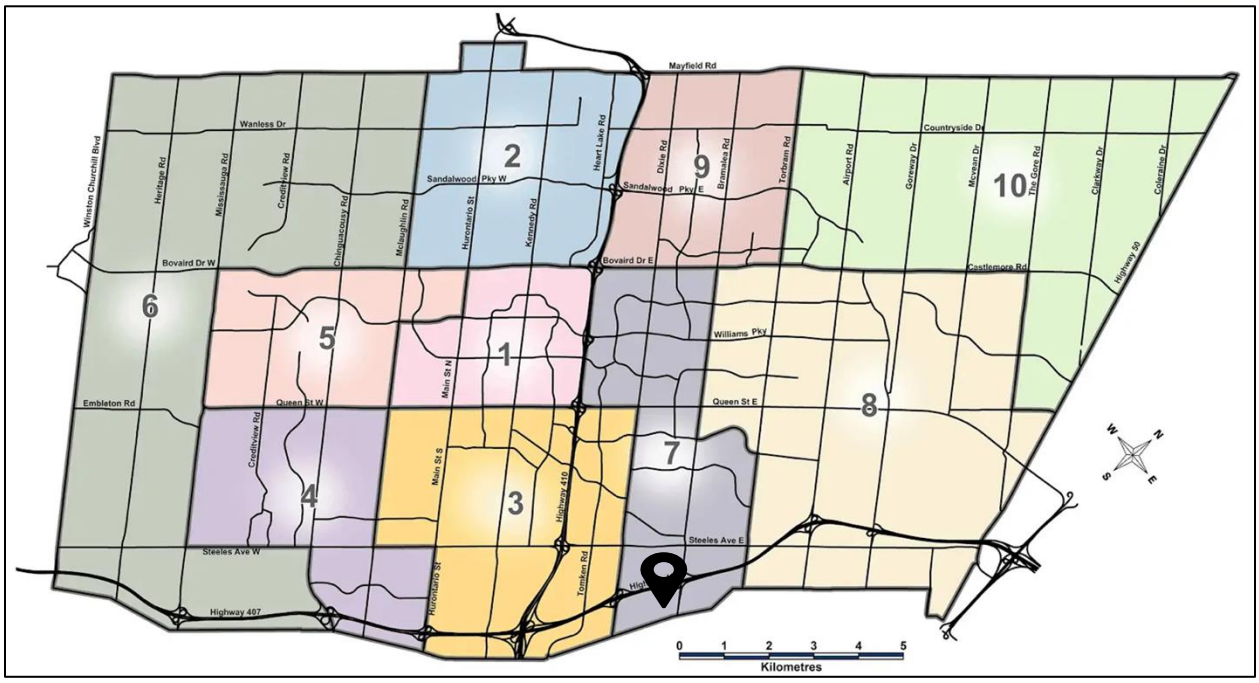


Figure 5-2: Location of the Emerald EFW Facility in Ward 7 within the City of Brampton

5.1.1. Socio-Demographic Profile

When assessing potential future health impacts, it is important to be aware of the size of a population as well as how that population is changing over time. It is also crucial to recognize and comprehend the diversity of communities since this knowledge may be used to better understand the obstacles that various groups could encounter both in their daily lives and while trying to access services. Some highlights about population changes and sociodemographic data in the study area for the HIA are provided in this section. For most of the tables presented in this sub-section, data is provided for Brampton Centre, the electoral district in which the Project is located, and compared to the City of Brampton, the Region of Peel and the province of Ontario as whole.

Table 5-1 shows population demographics of Brampton Centre (i.e., the Study Area), in comparison to the City of Brampton, the Regional Municipality of Peel (i.e., Peel), and Ontario. All locations have had positive population growth from 2016 to 2021, although Brampton Center had the smallest population growth (i.e., 2.0%). The average age of the population in Brampton Center in 2021 was 39 years old, which is about the same as the Peel (i.e., 39) and City of Brampton (i.e., 38), but less than Ontario (i.e., 42).

Table 5-1: Population Demographics

	Brampton, Centre	City of Brampton	Regional Municipality of Peel	Ontario
Population, total (2021)	104,557	656,480	1,451,022	14,223,942
Population, women+[1] (%)	50.1	50.0	50.5	51.0
Population, men+[2] (%)	49.9	50.0	49.5	49.0
Population Change (%) 2016 - 2021	2.0	11.0	5.0	5.8
Average age of the population	39	38	39	42

Source: Statistics Canada 2021 Census

Table 5-1: Population Demographics				
	Brampton, Centre	**City of Brampton**	**Regional Municipality of Peel**	**Ontario**

1) "Women+" includes women (and/or girls), as well as some non-binary persons.
2) "Men+" includes men (and/or boys), as well as some non-binary persons.

Table 5-2 shows the marital status of the populations in Brampton Centre, in comparison the City of Brampton, Peel, and Ontario. All locations have most of their population residing in marriage or are not married and not living in common-law. Although, Brampton Centre has the lowest percentage of people residing as married and the highest percentage of non-married and not living in common law people, when compared to the City of Brampton, the Regional Municipality of Peel, and Ontario.

Table 5-2: Marital status				
	Brampton, Centre	**City of Brampton**	**Regional Municipality of Peel**	**Ontario**
Married (%)	46.3	53.5	52.9	47.9
Living common-law (%)	5.4	3.3	4.0	8.6
Not married and not living common-law (%)	48.4	43.2	43.1	43.5

Source: Statistics Canada 2021 Census

The percentage of visible minorities (i.e., racialized populations) of the populations in Brampton Centre, in comparison the City of Brampton, Peel, and Ontario are shown below in Table 5-3. Visible minorities make up 68% of the population in Brampton Centre, which is about equal to Peel (i.e., 68.8%), higher than Ontario (i.e., 34.3%), and lower than the City of Brampton (i.e., 80.6%). South Asian (i.e., 32%), Black (i.e., 15%), Filipino (i.e., 5%), and Latin American (i.e., 5%) are the top visible minorities that make up Brampton, Centre. South Asian (i.e., 54.4%), Black (i.e., 13.1%), and Filipino (i.e., 3.2%) are the top visible minorities that make up the City of Brampton. South Asian (i.e., 37.4%), Black (i.e., 9.5%), Filipino (i.e., 4.2%), and Chinese (i.e., 4.2%) are the top visible minorities that make up the Regional Municipality of Peel.

Table 5-3: Population Demographics, 25% Sample Data[1]				
	Brampton, Centre	**City of Brampton**	**Regional Municipality of Peel**	**Ontario**
Total visible minority population[2] (%)	68	80.6	68.8	34.3
South Asian (%)	32	52.4	37.4	10.8
Chinese (%)	1	1.1	4.2	5.8
Black (%)	15	13.1	9.5	5.5
Filipino (%)	5	3.2	4.2	2.6
Arab (%)	1	1.0	3.5	2.0
Latin American (%)	5	2.1	2.2	1.8
Southeast Asian (%)	2	1.4	1.9	1.2
West Asian (%)	1	1.1	1.1	1.5
Korean (%)	0.1	0.1	0.4	0.7
Japanese (%)	0.1	0.1	0.2	0.2
Visible minority, n.i.e. (%)	3	3.2	2.2	0.9
Multiple visible minorities (%)	2	1.8	2.0	1.3
Not a visible minority (%)	32	19.4	31.2	65.7

Source: Statistics Canada 2021 Census
Notes: n.i.e. -- Includes respondents who reported a write-in response classified as a visible minority
These demographic categories tend to over-simplify complex identities.

Table 5-3: Population Demographics, 25% Sample Data[1]				
	Brampton, Centre	**City of Brampton**	**Regional Municipality of Peel**	**Ontario**

1) A sample of approximately 25% of Canadian households receive a long-form questionnaire. All other households receive a short-form questionnaire.
2) In 2021 Census analytical and communications products the term "visible minority" has been replaced by the terms "racialized population" or "racialized groups" reflecting the increased use of these terms in the public sphere.

Table 5-4 shows immigrant and citizenship in Brampton Centre, in comparison the City of Brampton, Peel, and Ontario. Brampton Centre has the second highest percentage of non-immigrant people (i.e., 46%), apart from Ontario (i.e., 67.3%), when compared to the City of Brampton (i.e., 41%) and Peel (i.e., 43.5%). Conversely, Brampton Centre has the second lowest percentage of immigrant people (i.e., 48.1%), again apart from Ontario (i.e., 30%), when compared to the City of Brampton (i.e., 52.9%) and Peel (i.e., 51.8%). Additionally, the great majority of the population in Brampton Centre are Canadian Citizens (i.e., 80.3%).

Table 5-5 below, shows the generational status of immigrant households. Brampton Centre's population is made up of 54.6% first generation individuals, which is less than both the City of Brampton (i.e., 59.6%) and Peel (i.e., 57.2%), but is greater than Ontario (i.e., 33.7%).

Table 5-4: Immigrant and Citizenship Status for the Population in Private Households, 25% Sample Data[1]				
	Brampton, Centre	**City of Brampton**	**Regional Municipality of Peel**	**Ontario**
Non-immigrants[2] (%)	46.0	41.0	43.5	67.3
Immigrants[3] (%)	48.1	52.9	51.8	30.0
Canadian Citizen[4] (%)	80.3	78.9	82.3	90.0
Not a Canadian Citizen (%)	19.7	21.1	17.7	10.0

Source: Statistics Canada 2021 Census

Notes: These demographic categories tend to over-simplify complex identities.

1) A sample of approximately 25% of Canadian households receive a long-form questionnaire. All other households receive a short-form questionnaire.
2) 'Non-immigrants' includes persons who are Canadian citizens by birth.
3) 'Immigrants' includes persons who are/or who have ever been landed immigrants or permanent residents. Such persons have been granted the right to live in Canada permanently by immigration authorities. Immigrants who have obtained Canadian citizenship by naturalization are included in this category. In the 2021 Census of Population 'Immigrants' includes immigrants who were admitted to Canada on or prior to May 11, 2021.
4) 'Canadian citizens' includes persons who are citizens of Canada only and persons who are citizens of Canada and at least one other country. 'Not a Canadian citizens' includes persons who are not citizens of Canada. They may be citizens of one or more other countries. Persons who are stateless are included in this category.

Table 5-5: Generation Status for the Population in Private Households, 25% Sample Data[1]				
	Brampton, Centre	**City of Brampton**	**Regional Municipality of Peel**	**Ontario**
First generation (%)	54.6	59.6	57.2	33.7
Second generation (%)	27.1	29.8	28.6	22.7
Third generation or more (%)	18.3	10.6	14.2	43.7

Source: Statistics Canada 2021 Census

Notes:

1) A sample of approximately 25% of Canadian households receive a long-form questionnaire. All other households receive a short-form questionnaire.

Figure 5-3 to Figure 5-5 demonstrate the population distribution Brampton Centre, the City of Brampton, and the Regional Municipality of Peel, by both age and sex. Brampton Centre, the City of

Brampton, and the Regional Municipality of Peel all have the greatest proportion of their populations consisting of 20- to 29-year-olds.



Figure 5-3: Brampton, Centre – Population by Age and Sex (Statistics Canada, 2021).

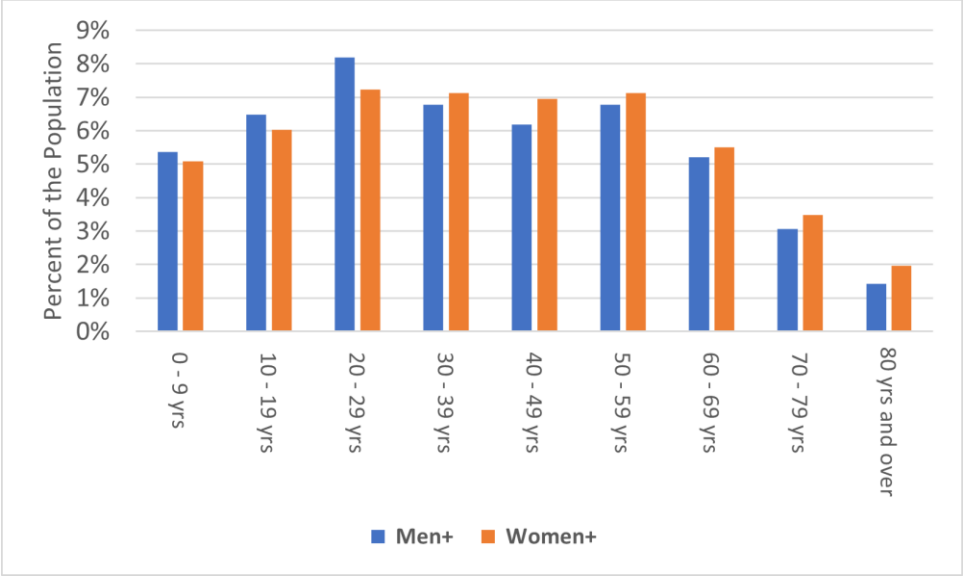


Figure 5-4: Regional Municipality of Peel – Population by Age and Sex (Statistics Canada, 2021).

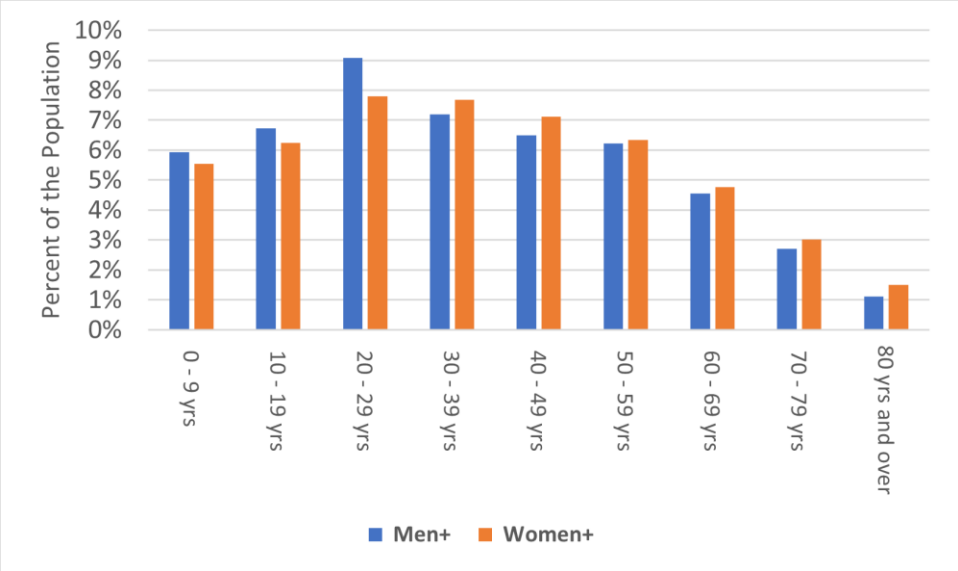


Figure 5-5: City of Brampton – Population by Age and Sex (Statistics Canada, 2021).

5.1.2. Language

Table 5-6 shows the knowledge of the official languages of Canada (i.e., French and/or English), which refers to a person's ability to conduct a conversation, in Brampton Centre, in comparison the City of Brampton, Peel, and Ontario. Additionally, Table 5-7 shows the first official language spoken in Brampton Centre, in comparison the City of Brampton, Peel, and Ontario. English is the most common official language that is both known and spoken in Brampton Centre (i.e., 92.4% & 95.7%, respectively), the City of Brampton (i.e., 90.5% & 93.8%, respectively), Peel (i.e., 90.2% & 94.4%, respectively), and Ontario (i.e., 86.5% & 93.5%, respectively).

Table 5-6: Knowledge of Official Languages for the Total Population[1]

	Brampton, Centre	City of Brampton	Regional Municipality of Peel	Ontario
English only (%)	92.4	90.5	90.2	86.5
French only (%)	0.1	0.1	0.1	0.3
English and French (%)	4.6	4.5	5.7	10.8
Neither English nor French (%)	2.9	4.9	4.0	2.4

Source: Statistics Canada 2021 Census

1) Knowledge of official languages refers to whether the person can conduct a conversation in English only French only in both or in neither language. For a child who has not yet learned to speak this includes languages that the child is learning to speak at home.

Table 5-7: First Official Language Spoken for the Total Population[1]

	Brampton, Centre	City of Brampton	Regional Municipality of Peel	Ontario
English (%)	95.7	93.8	94.4	93.5
French (%)	0.9	0.7	0.9	3.4
English and French (%)	0.5	0.7	0.8	0.7
Neither English nor French (%)	2.8	4.8	4.0	2.4

Source: Statistics Canada 2021 Census

Table 5-7: First Official Language Spoken for the Total Population[1]				
	Brampton, Centre	**City of Brampton**	**Regional Municipality of Peel**	**Ontario**

1) First official language spoken refers to the first official language (English or French) spoken by the person.

5.1.3. Education, Income & Employment

Education, income, and employment together contribute to one's socioeconomic status and are integral determinants of health that can contribute to overall health and wellbeing and determine access to services. A household's income influences physical and mental health, as it can affect access to healthy food and activity choices and impact stress levels. In general, higher income is associated with better health status, and the reverse is also accurate, whereas lower income is associated with a lower health status (Greenwood and Leeuw 2012). As such, income and employment/occupation can be important indicators of overall health and well-being.

Gender disaggregated data for this indicator was available via Statistics Canada (2021).

5.1.3.1. Education

Table 5-8 contains the highest level of education obtained in private households in Brampton Centre, in comparison the City of Brampton, Peel, and Ontario. Brampton Centre has the highest rate of the population having no certificate, diploma, or degree (i.e., 11.8%), of which is higher for men (i.e., 12.6%) than for women (i.e., 11%), when compared to the City of Brampton (i.e., 10.6%), Peel (i.e., 8.7%), and Ontario (i.e., 8.8%). Conversely, Brampton Centre has the lowest attainment rate for postsecondary certificates, diplomas, or degrees (i.e., 60.1%), of which is lower for men (57.7%) than for women (i.e., 62.4%), when compared to the City of Brampton (i.e., 64.8%), Peel (i.e., 68.9%), and Ontario (i.e., 67.8%). Additionally, Brampton Centre has the highest rate of attainment of a high school diploma or equivalent (i.e., 28.1%) when compared to the City of Brampton (i.e., 24.6%), Peel (i.e., 22.4%), and Ontario (i.e., 23.3%)

Table 5-8: Highest Level of Education in Private Household (25 – 64 yrs), 25% of Sample Data[1]				
	Brampton, Centre	**City of Brampton**	**Regional Municipality of Peel**	**Ontario**
No certificate, diploma, or degree (%)	11.8	10.6	8.7	8.8
Women+[2]	11.0	10.1	8.1	7.7
Men+[3]	12.6	11.1	9.3	9.9
High (secondary) school diploma or equivalency certificate (%)	28.1	24.6	22.4	23.3
Women+	26.6	23.1	21.1	21.4
Men+	29.6	26.2	23.7	25.3
Postsecondary certificate, diploma or degree (%)	60.1	64.8	68.9	67.8
Women+	62.4	66.8	70.8	70.8
Men+	57.7	62.7	67.0	64.7

Source: Statistics Canada 2021 Census

Notes:

1) A sample of approximately 25% of Canadian households receive a long-form questionnaire. All other households receive a short-form questionnaire.
2) "Women＋" includes women (and/or girls), as well as some non-binary persons.
3) "Men＋" includes men (and/or boys), as well as some non-binary persons.

5.1.3.2. Income

Table 5-9 shows various income statistics of economic families in Brampton Centre: median income, average family size, and prevalence of low income. Brampton Centre has the lowest median income of economic families (i.e., $102,000) when compared to the City of Brampton (i.e., $117,000), Peel (i.e., $118,000), and Ontario (i.e., $111,000). The median total income among individuals in Brampton Centre was $37,200, which is less than Peel (i.e., $48,400) and Ontario (i.e., 41,200), but greater than the City of Brampton (i.e., $36,000). Additionally, in Brampton Centre for all age groups, women (i.e., 7.2 % - 12.3%) always have higher rates of low-income prevalence when compared to men (i.e., 6.9% - 11.5%).

Table 5-9: Income Statistics of Economic Families

	Brampton, Centre	City of Brampton	Regional Municipality of Peel	Ontario
Median Income of Economic Families[1] ($) (2020)	102,000	117,000	118,000	111,000
Median total income in 2020 among recipients ($) (individual)	37,200	36,000	48,400	41,200
Women+[2]	34,400	33,600	42,000	37,200
Men+[3]	40,800	39,200	58,000	46,000
Average Family Size	3	4	3.5	3
Prevalence of low income based on the Low-income measure[4], after tax (%)				
0 to 17 years (%)	11.9	8.3	9.7	11.5
Women+	12.3	8.3	9.7	11.5
Men+	11.5	8.2	9.7	11.5
18 to 64 years (%)	7.1	5.5	6.7	9.1
Women+	7.2	5.6	6.8	9.4
Men+	6.9	5.5	6.5	8.9
65 years and over (%)	10.5	7.9	10	12.1
Women+	12.1	8.8	11.3	10.2
Men+	8.6	6.8	8.5	13.7

Source: Statistics Canada 2021 Census

Notes:

1) An economic family refers to a group of two or more persons who live in the same dwelling and are related to each other by blood, marriage, common-law union, adoption or a foster relationship.
2) "Women+" includes women (and/or girls), as well as some non-binary persons.
3) "Men+" includes men (and/or boys), as well as some non-binary persons.
4) The Low-income measure, after tax, refers to a fixed percentage (50%) of median adjusted after-tax income of private households (Statistics Canada, 2022a). Low-income status is typically presented for persons but, since the LIM-AT threshold and household income are unique and shared by all members within each household, low-income status based on LIM-AT can also be reported for households (Statistics Canada, 2022a).

5.1.3.3. Employment

Table 5-10 below shows the status of the labor force in Brampton Centre, in comparison the City of Brampton, Peel, and Ontario. Unemployment rates in Brampton Centre have increased from 8.3% in 2016 to 14% in 2021. Increased unemployment rates from 2016 to 2021 were also seen for the City of Brampton, Peel, and Ontario. Conversely, employment rates in Brampton Centre have decreased from 60.3% in 2016 to 56% in 2021. Similarly, employment rates from 2016 to 2021 also decreased for the City of Brampton, Peel, and Ontario.

Women in Brampton Centre have had higher rates of unemployment in both 2016 and 2021 (8.9% & 17%, respectively) when compared to men (i.e., 7.8% & 12%, respectively). In the City of Brampton,

Peel, and Ontario women also have had higher rates of unemployment in 2016 and 2021, expect for Ontario in 2016.

Table 5-10: Labour Force Status, 25% Sample Data[1], 2021 & 2016

	Brampton, Centre		City of Brampton		Regional Municipality of Peel		Ontario	
	2016	2021	2016	2021	2016	2021	2016	2021
Participation Rate (%)	65.8	65	67.9	67	67.3	66	64.7	63
Women+[2]	60.3	60	62.4	62	62.1	60	60.6	59
Men+[3]	71.7	70	73.6	72	72.7	71	69.1	67
Employment Rate (%)	60.3	56	62.3	58	61.8	57	59.9	55
Women+	54.9	50	56.5	64	56.6	51	56.1	51
Men+	66.1	62	68.3	52	67.3	62	63.9	60
Unemployment Rate (%)	8.3	14	8.3	13	8.2	14	7.4	12
Women+	8.9	17	9.5	16	8.9	16	7.4	13
Men+	7.8	12	7.3	11	7.5	12	7.5	11

Source: Statistics Canada 2021 Census, Statistics Canada 2016 Census

Notes:

1) A sample of approximately 25% of Canadian households receive a long-form questionnaire. All other households receive a short-form questionnaire.
2) "Women+" includes women (and/or girls), as well as some non-binary persons.
3) "Men+" includes men (and/or boys), as well as some non-binary persons.

Table 5-11 shows the division of labour force by occupation, according to the National Occupational Classification, Canada's national system for describing occupations, in Brampton Centre, in comparison the City of Brampton, Peel, and Ontario.

Table 5-11: Labour Force by Occupation (> 15 years old) National Occupational Classification, 25% of Sample Data[1]

	Brampton, Centre	City of Brampton	Regional Municipality of Peel	Ontario
Legislative and senior management occupations (%)	0.5	0.6	1.0	1.3
Women+[2]	0.4	0.4	0.6	0.8
Men+[3]	0.5	0.8	1.4	1.7
Business, finance, and administration occupations (%)	18.1	18.6	20.0	17.9
Women+	25.0	25.4	27.2	24.7
Men+	12.2	12.7	13.8	11.7
Natural and applied sciences and related occupations (%)	8.4	9.5	10.9	9.3
Women+	4.5	5.4	6.0	4.9
Men+	11.8	13.0	15.2	13.3
Health occupations (%)	4.7	5.7	5.9	7.3
Women+	8.8	10.2	10.0	12.2
Men+	1.2	1.7	2.2	2.9
Occupations in education, law and social, community and government services (%)	6.7	7.2	8.3	11.8
Women+	10.6	11.2	12.4	16.4
Men+	3.3	3.8	4.6	7.5
Occupations in art, culture, recreation, and sport (%)	1.7	1.4	2.0	3.1

Table 5-11: Labour Force by Occupation (> 15 years old) National Occupational Classification, 25% of Sample Data[1]				
	Brampton, Centre	**City of Brampton**	**Regional Municipality of Peel**	**Ontario**
Women+	1.9	1.6	2.2	3.6
Men+	1.6	1.2	1.7	2.7
Sales and service occupations (%)	23.3	22.3	22.8	23.5
Women+	30.1	27.0	26.8	26.9
Men+	17.3	18.2	19.3	20.3
Trades, transport and equipment operators and related occupations (%)	23.2	22.5	18.7	15.9
Women+	6.6	6.7	5.0	3.1
Men+	37.6	36.3	30.7	27.6
Natural resources, agriculture, and related production occupations (%)	0.7	0.5	0.6	2.0
Women+	0.3	0.7	0.3	1.0
Men+	1.0	0.3	0.9	2.9
Occupations in manufacturing and utilities (%)	9.0	8.0	6.2	5.0
Women+	7.4	7.5	5.3	3.3
Men+	10.3	8.5	7.0	6.6

Source: Statistics Canada 2021 Census
Notes:

1) A sample of approximately 25% of Canadian households receive a long-form questionnaire. All other households receive a short-form questionnaire.
2) "Women＋" includes women (and/or girls), as well as some non-binary persons.
3) "Men＋" includes men (and/or boys), as well as some non-binary persons.

5.1.4. Affordable Housing

Having access to safe and affordable housing is one of the most important determinants of health and can have a cascading impact on other determinants of health, and one's physical, mental, and social wellbeing.

Table 5-12 below shows housing status and Table 5-13 shows indicators of affordable housing. Brampton Centre has the lowest percent of the population who own homes (i.e., 69%), apart from Ontario (i.e., 68.4%), when compared to the City of Brampton (i.e. 78%) and Peel (i.e., 74.5%). Brampton Centre's percent of the population who rents is 31%, which is higher than both the City of Brampton (i.e., 22%) and Peel (i.e., 25.5%), but is slightly lower than Ontario (31.4%).

Brampton Centre, the City of Brampton, and Peel have similar percentages of the population who spend less than 30% of their income on shelter costs (i.e., 71%, 69%, & 71.1%, respectively), all of which are less than Ontario (75.8%). Additionally, 29% of the population in Brampton Centre spend greater than 30% of their income on shelter costs, which is greater than Peel (i.e., 28.9%) and Ontario (i.e., 24.2%), but less than the City of Brampton (i.e., 31%).

Table 5-12: Housing Status, 25% of Sample Data[1]				
	Brampton, Centre	**City of Brampton**	**Regional Municipality of Peel**	**Ontario**
Owner (%)	69	78	74.5	68.4
Renter (%)	31	22	25.5	31.4

Source: Statistics Canada 2021 Census
Notes:

Table 5-12: Housing Status, 25% of Sample Data[1]				
	Brampton, Centre	**City of Brampton**	**Regional Municipality of Peel**	**Ontario**

1) A sample of approximately 25% of Canadian households receive a long-form questionnaire. All other households receive a short-form questionnaire.

Table 5-13: Affordable Housing, 25% of Sample Data[1]				
	Brampton, Centre	**City of Brampton**	**Regional Municipality of Peel**	**Ontario**
Spending less than 30% of income on shelter costs (%)	71	69	71.1	75.8
Spending 30% or more of income on shelter costs (%)	29	31	28.9	24.2

Source: Statistics Canada 2021 Census

Notes:

1) A sample of approximately 25% of Canadian households receive a long-form questionnaire. All other households receive a short-form questionnaire.

Table 5-14 shows housing suitability. Brampton Centre has the lowest percentage of suitable housing (i.e., 85.7%) when compared to the City of Brampton (i.e., 86.8%), Peel (i.e., 88.3%) and Ontario (93.3%). Additionally, Brampton Centre has the highest percentage of not suitable housing (i.e., 14.3%). Brampton Centre also has the highest percentage of major repairs needed, as compared to Brampton overall and Peel Region.

Table 5-15 shows the types of dwellings that are used in Brampton Centre, in comparison the City of Brampton, Peel, and Ontario. The most common type of dwelling used in Brampton Center is single-detached houses (i.e., 32%). Brampton Centre also has a much lower percentage of single-detached house usage when compared to the City of Brampton (i.e., 52.6%), Peel (i.e., 45.7%), and Ontario (i.e., 53.6%). Additionally, Brampton Center in general, more commonly utilizes row houses (i.e., 14.5%), and different types of apartment buildings (i.e., 8.2% & 24.7%) when compared to the City of Brampton (i.e., 12.6%, 4.4%, & 10.2%, respectively), Peel (i.e., 13.2%, 5.8%, & 19%, respectively). and Ontario (i.e., 9.2%, 10%, & 17.9%, respectively).

Table 5-14: Housing Suitability, 25% of Sample Data[1]				
	Brampton, Centre	**City of Brampton**	**Regional Municipality of Peel**	**Ontario**
Suitable[2] (%)	85.7	86.8	88.3	93.3
Not suitable (%)	14.3	13.2	11.7	6.7
Dwelling Condition[3]				
Only regular maintenance and minor repairs needed	94.5	96.7	95.9	94.3
Major repairs needed	5.5	3.3	4.1	5.7

Source: Statistics Canada 2021 Census

Notes:

1) A sample of approximately 25% of Canadian households receive a long-form questionnaire. All other households receive a short-form questionnaire.
2) Housing suitability refers to whether a private household is living in suitable accommodations according to the National Occupancy Standard (NOS); that is whether the dwelling has enough bedrooms for the size and composition of the household. A household is deemed to be living in suitable accommodations if its dwelling has enough bedrooms as calculated using the NOS.
3) Dwelling condition refers to whether the dwelling is in need of repairs. This does not include desirable remodelling or additions.

Table 5-15: Dwelling Type				
	Brampton, Centre	**City of Brampton**	**Regional Municipality of Peel**	**Ontario**
Single-detached house (%)	32.0	52.6	45.7	53.6
Semi-detached house (%)	16.0	13.6	11.8	5.5
Row house (%)	14.5	12.6	13.2	9.2
Apartment or flat in a duplex (%)	4.5	6.6	4.5	3.3
Apartment in a building that has fewer than five storeys (%)	8.2	4.4	5.8	10.0
Apartment in a building that has five or more storeys (%)	24.7	10.2	19.0	17.9
Other single-attached house (%)	-	-	-	0.2
Movable dwelling (%)	-	-	0.1	0.3

Source: Statistics Canada 2021 Census

5.1.5. Health Status and Mental Health

Physical and mental health and illnesses have a significant impact on how people live their lives. As such, it is crucial to understand the prevalence and incidence of chronic diseases as well as other relevant health indicators, such as mortality, in communities. This can help local governments and organizations define priorities for community health and manage health disparities.

Health and mental health statistics were determined by either regional health unit or by public health unit. The health units that represent Brampton Centre, the City of Brampton, and the Regional Municipality of Peel are as follows:

- Peel Regional Health Unit (i.e., Statistics Canada Health Characteristics 2022); and
- Peel Public Health Unit (i.e., Publichealthontario.ca).

Table 5-16 shows the crude birth rate in Peel Region in comparison to Ontario. Table 5-17 shows mortality rates in Peel in comparison to Ontario. Peel Region has a higher birth rate per 100,000 population (i.e., 10.1) and a lower mortality rate (i.e., 519.8) when compared to Ontario (i.e., 9.2 & 642.8, respectively). Additionally, females have a lower mortality rate (i.e., 442.2) when compared to males (i.e., 617.7) within Peel Public Health.

Table 5-16: Crude Birth Rate (2021)		
	Peel Public Health	**Ontario**
Crude Birth Rate[1]	10.1	**9.2**

Source: Ontario Public Health 2021a

Notes:

1) Age standardized, crude and age-specific rates per 100,000.

Table 5-17: Age Standardized Rate, All Cause Mortality (2015)		
	Peel Public Health	**Ontario**
All Cause Mortality Rate[1]	519.8	**642.8**
Females[2]	442.4	**543.7**
Males[2]	617.7	**770.1**
Number of Deaths	5,908	**97,113**
Females[2]	2,857	**48,581**
Males[2]	3,051	**48,532**

Table 5-17: Age Standardized Rate, All Cause Mortality (2015)		
	Peel Public Health	**Ontario**

Source: Ontario Public Health 2015

Notes:

1) Age standardized, crude and age-specific rates per 100,000.
2) Terminology for 'females' and 'males' has been presented here as used in source document.

Table 5-18 contains indicators related to burden of disease within the populations in the Peel Region, in comparison to Ontario. The Peel Regional Health Unit has lower rates of disease burden when compared to Ontario. High blood pressure is the chronic illness with the highest prevalence (i.e., 15.6%) in the Peel Regional Health Unit, while the lowest is chronic obstructive pulmonary disease (i.e., 2.8%). Additionally, except for diabetes, females have higher rates for all chronic illnesses when compared to males in Peel Regional Health Unit.

Table 5-18: Burden of Disease (Percent of the Population)[1]		
	Peel Regional Health Unit[2]	**Ontario[2]**
Diabetes (%)	7.7	**8**
Females (%)*	6.7	**7.1**
Males (%)*	8.8	**9**
Asthma (%)	6.1	**8**
Females (%)*	7.4[E]	**9.1**
Males (%)*	4.8[E]	**6.8**
Chronic obstructive pulmonary disease (35 years and over) (%)	2.8	**3.8**
Females (%)*	3.0[E]	**3.8**
Males (%)*	F	**3.7**
High blood pressure (%)	15.6	**17.5**
Females (%)*	16.8	**17.1**
Males (%)*	14.4	**18**
Mood disorder[3] (12 years and over) (%)	7.2	**9.5**
Females (%)*	9.6	**11.4**
Males (%)*	4.6[E]	**7.6**

Source: Statistics Canada 2022 Health Characteristics

Notes: NA – Data not available, COPD – Chronic obstructive pulmonary disease, E – Use with caution, F – Too unreliable to be published. "—" – Data not available; "*" – In this instance StatsCan presents data as "males" & "females".

1) Terminology for 'females' and 'males' presented here as seen in data source.
2) Statistics from 2019-2020 Data: Census Profile 2022.
3) Mood disorder include diagnoses such as depression, bipolar disorder, mania, or dysthymia.

Table 5-19 shows both youth and adult obesity rates for Peel Region in comparison to Ontario. The Peel Regional Health Unit has a higher percentage of overweight adults (i.e., 36%) but a lower percentage of obese adults (i.e., 22.7%), when compared to Ontario (i.e., 35.5% & 28.1%, respectively). Peel has a lower percentage of youth who are overweight or obese (i.e., 17.6%) when compared to Ontario (i.e., 22%). In the overweight and obese indicators, males in Peel have higher percentages of being overweight, while women have higher percentages of being obese.

Table 5-19: Youth and Adult Obesity (Percent of the Population) (2020)		
	Peel Regional Health Unit[1]	**Ontario[1]**
Body mass index, adjusted self-reported, adult (18 years and over), overweight (%)	36	**35.4**
Females (%)*	27.4	**30.5**

Table 5-19: Youth and Adult Obesity (Percent of the Population) (2020)		
	Peel Regional Health Unit[1]	**Ontario[1]**
Males (%)*	44.3	**40.3**
Body mass index, adjusted self-reported, adult (18 years and over), obese (%)	22.7	**28.1**
Females (%)*	24	**27.9**
Males (%)*	21.4	**28.2**
Body mass index, self-reported, youth (12 to 17 years old), overweight or obese (%)	17.6	**22**
Females (%)*	F	**19**
Males (%)*	27.5[E]	**24.8**

Source: Statistics Canada 2022 Health Characteristics

Notes: E – Use with caution; F – too unrealistic to be published; "*" – In this instance StatsCan presents data as "males" & "females".

1) Statistics from 2019-2020 Data: Census Profile 2022.

Table 5-20 and Table 5-21 show emergency department visit rates and hospitalization rates, respectively, in Peel Region as compared to Ontario. Peel Public Health has lower rates of emergency department visits per 100,000 (i.e., 5,272) when compared to Ontario (8,527.4). Peel Public Health also has lower rates of hospitalizations for injuries (i.e., 355) when compared to Ontario (i.e., 553.3). Additionally, females have lower rates of emergency department visits and hospitalizations compared to males in Peel, which is similar to Ontario.

Table 5-20: Emergency Department Visit Rates for All Injuries (2021)		
	Peel Public Health	**Ontario**
Emergency Department Visits	5,272	**8,527.4**
Females*	4,710.5	**7,773.3**
Males*	5,799.7	**9,251.5**

Source: Ontario Public Health 2021b

Notes: "*" – In this instance StatsCan presents data as "males" & "females".

1) Age standardized, crude and age-specific rates per 100,000.

Table 5-21: Hospitalizations[1] (2021)		
	Peel Public Health	**Ontario**
Hospitalizations for All Injuries	355.7	**553.3**
Females*	340.7	**529.1**
Males*	368	**573.6**

Source: Ontario Public Health 2021c

Notes: "*" – In this instance StatsCan presents data as "males" & "females".

1) Age standardized, crude and age-specific rates per 100,000.

Table 5-22 shows the percent of the population that has health care provider and Table 5-23 shows reasons why an individual may not have a regular healthcare provider. The Peel Public Health Unit has a slightly higher percentage of the population (i.e., 91.9%) that has a regular health care provider when compared to Ontario (i.e., 90.6%). Within the Peel Public Health Unit women (i.e., 93.9%) are more likely to have a regular healthcare provider when compared to men (i.e., 90%). For Peel Public the top three reasons for not having a regular health care provider (not including "other") were "had not tried to find one" (i.e., 31.2%), "do not need one but have a usual place of care" (i.e., 30.8%), and "had one who left or retired" (i.e., 11%).

Table 5-22: Has a Regular Healthcare Provider[1] (Percent of the Population) (2020)		
	Peel Regional Health Unit[1]	**Ontario**
Has a Regular Healthcare Provider (2020) (%)	91.9	**90.6**
Females* (%)	93.9	**92.9**
Males* (%)	90	**88.2**

Source: Statistics Canada 2022 Health Characteristics

Notes: "*" – In this instance StatsCan presents data as "males" & "females".

1) Population aged 12 and over who have a health care provider they regularly see or talk to when they need normal care or advice for their health.

Table 5-23: Reasons Why They Do Not Have a Regular Health Care Provider[1] (Percent of the Population) (2015/2016)		
	Peel Public Health	**Ontario**
Have not tried to find one	31.2[a]	28.5
Do not need one in particular, but have a usual place of care	30.8[a]	27.5
Had one who left or retired	11.0[a]	20.2
No one in the area is taking new patients	7.1[a]	12.2
No one available in the area	NR	11.1
Other	38.1[a]	25.2

Source: Peel Public Health 2019

Notes: "a" = Use estimate with caution, NR = Not releasable due to small numbers.

1) Reflects respondents aged 12 years or older who do not have a regular health care provider.

Table 5-24 shows indicators of perceived health and mental health status of the population in Peel Region, compared to Ontario. The Peel Regional Health Unit reports slightly higher percentages of both perceived health (i.e., 62.1%) and mental health (i.e., 66.2%) as being "very good or excellent" when compared to Ontario (61.8% & 64.7%, respectively). Consequently, Peel has lower percentages of both perceived health (i.e., 8.4%) and mental health (i.e., 8%) being "fair or poor" when compared to Ontario (11.1% & 9.8%, respectively). Females in the Peel Region have a lower percentage of perceived health being reported as "very good or excellent" as compared to men. Consequently, higher percentages of females perceive their health as "fair or poor" when compared to males. Similarly, women in Peel report lower percent of "very good or excellent" perceived mental health, and a higher percentage of "poor or fair" perceived mental health, when compared to males.

Table 5-25 shows the sense of belonging to the community for the Peel Regional Health Unit, in comparison to Ontario. The Peel Regional Health Unit reports a slightly higher sense of belonging to the local community (i.e., 74.1%) when compared to Ontario (i.e., 71.3).

Table 5-24: Perceived Health and Mental Health (Percent of the Population)		
	Peel Regional Health Unit	**Ontario**
Perceived health, very good or excellent (%)	62.1	**61.8**
Females (%)*	60.8	**61**
Males (%)	63.3	**62.7**
Perceived health, fair or poor (%)	8.4	**11.1**
Females (%)	9	**11.6**
Males (%)	7.7[E]	**10.6**
Perceived mental health, very good or excellent (%)	66.2	**64.7**
Females (%)	64.2	**61.6**
Males (%)	68.2	**67.8**

Table 5-24: Perceived Health and Mental Health (Percent of the Population)		
	Peel Regional Health Unit	**Ontario**
Perceived mental health, fair or poor (%)	8.0	**9.8**
Females (%)	9.3	**10.6**
Males (%)	6.8[E]	**9**
Perceived life stress, most days quite a bit or extremely stressful (%)	18.1	**20.9**
Females (%)	19.4	**22.3**
Males (%)	16.8	**19.4**

Source: Statistics Canada 2022 Health Characteristics

Notes: Statistics from 2019-2020 Data: Census Profile 2022, E – Use with caution; "*" – In this instance StatsCan presents data as "males" & "females".

Table 5-25: Sense of Belonging to the Community (Percent of the Population)		
	Peel Regional Health Unit[1]	**Ontario[1]**
Sense of belonging to local community (%)	74.1	**71.3**
Females (%)*	76.2	**72.7**
Males (%)*	72	**69.9**

Source: Statistics Canada 2022 Health Characteristics; Ontario First Nations Regional Health Survey Phase III

Notes: "*" – In this instance StatsCan presents data as "males" & "females".

1) Statistics from 2019-2020 Data: Census Profile 2022. Population aged 12 and over who reported their sense of belonging to their local community as being very strong or somewhat strong.

5.1.6. Walkability Score & Transit Score

The health of communities can be improved with both active transportation methods and public transportation (Government of Canada, 2014; MTO, 2022). When communities utilize active transportation and public transit it can result in a reduction of chronic disease, increased physical activity levels, and improved mental health (Government of Canada, 2014). As such, having communities that are walkable, with easy to access transit options are vital in ensuring a productive and healthy lifestyle for the public.

Walkscore.com allows for the review of an address, neighbourhood, or city's walkability score, transit score, and bike score, which are scores ranked on a 100-point system. Walkability, transit, and bike score rankings are explained in Table 5-26 to Table 5-28, below.

Table 5-26: Walk Score Rating System		
Walk Score Rating	Walk Score Designation	Walk Score Explanation
90 to 100	Walker's Paradise	Daily errands do not require a car
70 to 89	Very Walkable	Most errands can be accomplished on foot
50 to 69	Somewhat Walkable	Some errands can be accomplished on foot
25 to 49	Car Dependent	Most errands require a car
0 to 24	Car Dependent	Almost all errands require a car

Source: Walkscore.com

Table 5-27: Transit Score Rating System		
Transit Score Rating	Transit Score Designation	Transit Score Explanation
90 to 100	Rider's Paradise	World class public transportation

Table 5-27: Transit Score Rating System		
70 to 89	Excellent Transit	Transit is convenient for most trips
50 to 69	Good Transit	Many nearby public transportation options
25 to 49	Some Transit	A few nearby public transportation options
0 to 24	Minimal Transit	It is possible to get on a bus

Source: Walkscore.com

Table 5-28: Bike Score Rating System		
Bike Score Rating	Bike Score Designation	Bike Score Explanation
90 to 100	Biker's Paradise	Daily errands can be accomplished on a bike
70 to 89	Very Bikeable	Biking is convenient for most trips
50 to 69	Bikeable	Some bike infrastructure
0 to 49	Somewhat Bikeable	Minimal bike infrastructure

Source: Walkscore.com

Table 5-29 below shows walkability, transit, and bike scores for the City of Brampton as a whole, in comparison the location of the Emerald EFW Site (i.e., 7656 Bramalea Road Brampton, Ontario, L6T 5M5) as per walkscore.com. The City of Brampton has much higher walkability and bike scores compared to the Emerald EFW Site, while the Emerald EFW Site has a slightly higher transit score.

Table 5-29: Walkability, Transit, and Bike Scores (Scores out of 100)		
	City of Brampton[1]	**Emerald EFW Site[2]**
Walkability Score	43	0
Transit Score	53	58
Bike Score	55	31

Source: www.walkscore.com

Notes: NA – Data not available.

1) City of Brampton walkscore available at: https://www.walkscore.com/CA-ON/Brampton
2) Emerald EFW Site being located at 7656 Bramalea Road Brampton, Ontario, L6T 5M5. Walkscore available at: https://www.walkscore.com/score/7656-bramalea-rd-brampton-on-canada

5.1.7. Transportation & Commuting

Understanding a community's transportation needs and modalities is critical as traffic congestion and commuting can impact road users, including truckers, businesses, and residential households (US Department of Transportation, 2020). As congestion and traffic delays can influence where individuals choose to reside and subsequently impact quality of life, it is important to consider these factors as indicators of health (US Department of Transportation, 2020).

Table 5-30 shows the different modes of transportation that are utilized in Brampton Centre, in comparison the City of Brampton, Peel, and Ontario. In Brampton Centre cars, trucks, or vans (i.e., driving) is the most used mode of transportation by the employed labour force (i.e., 82.8%), followed by public transit (i.e., 12.2%). Brampton Centre has the highest percentage of using public transit (i.e., 12.2%) and lowest percentage of driving (i.e., 82.8%) when compared to the City of Brampton (i.e., 10.3% & 85.9%, respectively), Peel (10.3% & 85%, respectively), and Ontario (8.6% & 83.6%, respectively). Furthermore, women in Brampton Centre utilize public transit (i.e., 15.5%) more than men (i.e., 9.7%), and conversely men drive more (i.e., 86.3%) than women (i.e., 77.9%). Finally, 2.4% of Brampton Centre's employed labour force walk to commute, which is greater than both the City of Brampton (i.e., 1.4%) and Peel (i.e., 2.1%), but is less than Ontario (i.e., 4.6%).

Table 5-30: Main Mode of Transportation Used to Commute by the Employed Labour Force (Ages 15 Years or Greater), 25% of Sample Data[1]				
	Brampton, Centre	**City of Brampton**	**Regional Municipality of Peel**	**Ontario**
Car, Truck, or Van (%)	82.8	85.9	85	83.6
Women+[2]	77.9	80.6	79.8	79.8
Men+[3]	86.3	89.9	88.9	86.7
Public transit (%)	12.2	10.3	10.3	8.6
Women+	15.5	14.3	13.9	11.1
Men+	9.7	7.4	7.5	6.6
Walked (%)	2.4	1.4	2.1	4.6
Women+	3.3	2.0	2.9	5.6
Men+	1.7	0.9	1.5	3.8
Bicycle (%)	0.2	0.1	0.2	0.8
Women+	0.1	0.1	0.1	0.6
Men+	0.3	0.2	0.3	1.1
Other Method (%)	2.5	2.2	2.4	2.4
Women+	2.0	3.0	3.2	2.9
Men+	3.1	1.6	1.8	1.9

Source: Statistics Canada 2021 Census

Notes:

1) A sample of approximately 25% of Canadian households receive a long-form questionnaire. All other households receive a short-form questionnaire.
2) "Women＋" includes women (and/or girls), as well as some non-binary persons.
3) "Men＋" includes men (and/or boys), as well as some non-binary persons.

Table 5-31 and Table 5-32 below provide insight into commuting durations and times for the employed labour force. Commute times in Brampton Centre are typically between 15 to 29 minutes, which is not dissimilar to Brampton or Peel.

Table 5-31: Commuting Duration for Employed Labour Force (Ages 15 Years or Greater), 25% of Sample Data[1]				
	Brampton, Centre	**City of Brampton**	**Regional Municipality of Peel**	**Ontario**
Less than 15 minutes (%)	19.4	14.4	16.7	28.3
Women+[2]	22.2	17.1	20.0	32.4
Men+[3]	17.2	12.4	14.2	24.9
15 to 29 minutes (%)	37.4	36.9	37	33.7
Women+	38.6	37.0	37.7	34.5
Men+	36.5	36.9	36.4	33.1
30 to 44 minutes (%)	24.5	28.3	26.7	20.6
Women+	21.7	25.9	23.9	18.6
Men+	26.6	30.0	28.8	22.3
45 to 59 minutes (%)	8.5	9.6	9.4	8.3
Women+	7.6	9.4	8.7	7.3
Men+	9.1	9.8	10.0	9.1
60 minutes and over (%)	10.3	10.8	10.2	9.1
Women+	9.8	10.7	9.7	7.3
Men+	10.6	10.8	10.6	10.6

Source: Statistics Canada 2021 Census

Notes:

1) A sample of approximately 25% of Canadian households receive a long-form questionnaire. All other households receive a short-form questionnaire.
2) "Women＋" includes women (and/or girls), as well as some non-binary persons.

Table 5-31: Commuting Duration for Employed Labour Force (Ages 15 Years or Greater), 25% of Sample Data[1]				
	Brampton, Centre	**City of Brampton**	**Regional Municipality of Peel**	**Ontario**

3) "Men+" includes men (and/or boys), as well as some non-binary persons.

Table 5-32: Time Leaving for Work for the Employed Labour Force (Ages 15 Years or Greater), 25% of Sample Data[1]				
	Brampton, Centre	**City of Brampton**	**Regional Municipality of Peel**	**Ontario**
Between 5 a.m. and 5:59 a.m. (%)	9.5	8.6	7.8	7.8
Women+[2]	6.5	6.0	5.1	4.6
Men+[3]	11.7	10.5	9.8	10.3
Between 6 a.m. and 6:59 a.m. (%)	17.8	17.2	16.4	17.6
Women+	13.8	15.7	14.3	14.0
Men+	20.7	18.2	18.1	20.6
Between 7 a.m. and 7:59 a.m. (%)	20.3	19.9	21.2	23.5
Women+	21.8	21.3	22.5	24.2
Men+	19.3	18.9	20.2	22.9
Between 8 a.m. and 8:59 a.m. (%)	16.3	17.2	19.5	20.7
Women+	19.6	19.6	22.3	25.1
Men+	13.8	15.4	17.3	17.1
Between 9 a.m. and 11:59 a.m. (%)	12.7	14.7	15.7	14
Women+	15.3	16.0	17.4	16.4
Men+	10.8	13.7	14.4	12.0
Between 12 p.m. and 4:59 a.m. (%)	23.5	22.4	19.5	16.5
Women+	23.1	21.4	18.5	15.7
Men+	23.7	23.3	20.2	17.1

Source: Statistics Canada 2021 Census

Notes:

1) A sample of approximately 25% of Canadian households receive a long-form questionnaire. All other households receive a short-form questionnaire.
2) "Women+" includes women (and/or girls), as well as some non-binary persons.
3) "Men+" includes men (and/or boys), as well as some non-binary persons.

Table 5-33 shows the commuting destinations of the employed labour force. Three-quarters of residents of Brampton Centre commute within the census division or census sub-division of their residence. This is slightly higher as compared to the residents of the City of Brampton and Region of Peel overall.

Table 5-33: Commuting Destination for the Employed Labour Force (Ages 15 Years or Greater), 25% of Sample Data[1]				
	Brampton, Centre	**City of Brampton**	**Regional Municipality of Peel**	**Ontario**
Commute within census subdivision of residence (%)	44.4	40.8	48.5	58.7
Women+[2]	50.3	45.3	53.0	63.2
Men+[3]	39.3	36.8	44.4	54.4
Commute to a different census subdivision within census division of residence (%)	29.3	29.7	19.6	17.3
Women+	26.1	28.3	18.3	16.9
Men+	32.0	31.0	20.8	17.8

Table 5-33: Commuting Destination for the Employed Labour Force (Ages 15 Years or Greater), 25% of Sample Data[1]

	Brampton, Centre	City of Brampton	Regional Municipality of Peel	Ontario
Commute to a different census subdivision[4] and census division[5] within province or territory of residence (%)	26.2	29.3	31.7	23.5
Women+	23.5	26.3	28.5	19.5
Men+	28.6	32.1	34.6	27.3
Commute to a different province or territory (%)	0.1	0.2	0.2	0.5
Women+	0.1	0.2	0.2	0.4
Men+	0.1	0.2	0.2	0.5

Source: Statistics Canada 2021 Census

Notes:

1) A sample of approximately 25% of Canadian households receive a long-form questionnaire. All other households receive a short-form questionnaire.
2) "Women+" includes women (and/or girls), as well as some non-binary persons.
3) "Men+" includes men (and/or boys), as well as some non-binary persons.
4) As per Statistics Canada a "census subdivision is the general term for municipalities (as determined by provincial/territorial legislation) or areas treated as municipal equivalents for statistical purposes (e.g., Indian reserves, Indian settlements and unorganized territories)".
5) As per Statistics Canada "census divisions are intermediate geographic areas between the province/territory level and the municipality (census subdivision)."

Table 5-34 shows the work environments of the employed labour force in Brampton Centre, compared to Brampton, Peel and Ontario. Across all locations shown in Table 5-32, working from home and the usual place of work are the top two places of work in 2021. Most notably, when more recent data (i.e., 2021) is compared to pre-pandemic data (i.e., 2016), there has been a large increase in those who work at home in all locations and for both women and men (i.e., 5.5% to 9.0% v. 28.2% to 38.9%). However, even with this increase across all geographic locations shown in Table 5-32, Brampton Centre has the least percentage of residents who work from home. Some of this may have to do with the types of employment residents from Brampton Centre hold, i.e., mainly sales and services occupations and trades, transport and equipment operators and related occupations, both of which categories of work are mainly carried out in-person (i.e., one's place of work).

Table 5-34: Place of Work[1] for the Employed Labour Force (Ages 15 Years or Greater), 25% of Sample Data[2]

	Brampton, Centre		City of Brampton		Regional Municipality of Peel		Ontario	
	2016	2021	2016	2021	2016	2021	2016	2021
Worked at home (%)	3.7	19.6	4.3	22.3	5.5	28.2	7.3	29.7
Women+[3]	4	24.5	4.5	26.2	5.6	32.1	7.4	33.3
Men+[4]	3.4	15.6	4.1	19.1	5.5	24.8	7.1	26.5
Usual place of work (%)	84.1	65.2	81.8	61.3	81.7	57.7	81	58
Women+	88.5	67.2	87.9	64.9	87.2	60.3	84.9	60.2
Men+	80.3	63.5	76.5	58.3	76.8	55.6	76.4	56.1
No fixed workplace address (%)	11.8	14.9	13.3	15.9	12.1	13.6	11.1	11.8
Women+	7.2	8.0	7.3	8.7	6.8	7.3	15.7	6.1
Men+	15.8	20.6	18.6	21.8	16.9	18.9	6.3	16.9
Worked outside Canada (%)	0.4	0.3	0.5	0.5	0.7	0.5	0.6	0.5
Women+	0.3	0.3	0.3	0.2	0.4	0.3	0.4	0.3
Men+	0.5	0.3	0.7	0.8	0.9	0.8	0.8	0.6

Source: Statistics Canada 2021 Census; Statistics Canada 2016 Census.

Notes:

Table 5-34: Place of Work[1] for the Employed Labour Force (Ages 15 Years or Greater), 25% of Sample Data[2]								
	Brampton, Centre		City of Brampton		Regional Municipality of Peel		Ontario	
	2016	2021	2016	2021	2016	2021	2016	2021

1) Classification of respondents according to whether they worked at home worked outside Canada had no fixed workplace address or worked at a specific address (usual place of work).

2) A sample of approximately 25% of Canadian households receive a long-form questionnaire. All other households receive a short-form questionnaire.

3) "Women+" includes women (and/or girls), as well as some non-binary persons.

4) "Men+" includes men (and/or boys), as well as some non-binary persons.

5.2. Assessment of Effects

The following environmental and social determinants of health were scoped into the HIA:

Environmental Determinants of Health

- Air quality (chemical pollutants, particulate matter, truck emissions, etc.) and GHG emissions
  - Odours
- Water quality (groundwater and surface water)
- Noise levels
- Agriculture

Social Determinants of Health

- Traffic burden, including accidents and injuries from increased truck traffic
- Social cohesion
- Project revenues
- Employment

ENVIRONMENTAL DETERMINANTS OF HEALTH

5.2.1. Air Quality and GHG Emissions

Health Linkages

Air quality is intrinsically linked to human health. Impacts to air quality, particularly related to the emission of oxides of nitrogen (NO_x), particulate matter (PM) (especially $PM_{2.5}$), carbon monoxide (CO), dioxins, and sulphur dioxide (SO_2). There are several factors which determine the kind of polluting substances, either solid or gaseous, emitted by an EFW incinerator such as the type of waste treated, the conditions of combustion, and the pollutant abatement systems (Negri et al., 2020). Common pollutants emitted include PM, metals, acid gases, NO_x, SO_2, and substances of unknown toxicity (Sharma et al., 2013). Other forms of emission can include ash, noise, odour, pests, transport-related emissions, dust, and spores (Negri et al., 2020). However, EFW facilities differ from general incinerators due to the addition of the energy recovery component in EFW (Castaldi, 2021). EFW facilities and their incinerators incorporate both the use of a high temperature combustion process and an air pollution control (APC) system (Castaldi, 2021).

Modern incineration technologies, such as waste-to-energy facilities are an effective method for eliminating a wide range of waste. For example, EFW facilities can reduce the volume of modern

municipal solid waste from landfills by 90% (ECCC, n.d.). Advanced incineration technologies (e.g., waste-to-energy facilities) used currently are able to remove 99% of dioxins and furans emitted from incineration using advanced air pollution controls (ECCC, n.d.) (Table 5-35). As well, best management practices are used in Canada to reduce emissions as developed by the Canadian Council of Ministers of the Environment (i.e., the Canada-wide Standards for the emissions of dioxins/furans and mercury from waste incineration) (Government of Canada, 2021). Therefore, to mitigate impacts to the environment or human health, it is imperative to use a preventive strategy by implementing environmental impact assessments and establishing emission standards and monitoring program (Titto and Savino, 2019).

EFW technology is the conversion of non-recyclable waste into energy (Khan et al., 2022). As previously mentioned, EFW and incinerators can share some similarities, but the EFW process differs widely from general incineration because it recovers energy from the waste materials while using APC systems (Castaldi, 2021) to meet strict regulatory emission requirements outlined by the Ontario Ministry of the Environment, Conservation and Parks (Emerald Energy from Waste, 2023). Well-designed and operated EFW reduce potential adverse health effects due to lower hazardous combustion emissions (i.e., waste incineration by-products are efficiently captured) and better quality of sorted feedstock (Cole-Hunter et al., 2020). Modern multi-stage filter systems remove fly ash and fine particulates that can impact the environment (Cucchiella et al., 2017). Additionally, ash produced during the process can be reused for other purposes, such as road construction material or for other civil projects (York Region, 2023).

It is well-documented that human health is not adversely impacted by EFW plants (Castaldi, 2021). As reported by the National Research Council, pollutants from well-run EFW facilities are expected to minimally contribute to environmental concentrations or to human health (Castaldi, 2021; National Research Council, 2000). Additionally, Foster and Hoffman (2019) used a US EPA-approved air dispersion model to investigate the relationship between nitrogen dioxide, sulfur dioxide, and fine particulate matter emissions from an EFW plant and asthma rates. The study determined there is no statistical significance between the annual average hospital discharge rates for asthma and the pollutants emitted from the facility (Foster and Hoffman, 2019). These findings align with other international reports that also demonstrate human health is not directly impacted by waste to energy facilities (Castaldi, 2021).

Moreover, there are limited epidemiological studies focused directly on the health effects of air pollution emissions specifically from waste to energy processes while accounting for confounders (Cole-Hunter et al., 2020). The majority of studies that assess the relationship between incinerators and health effects lack temporal validity by evaluating older incinerator technologies with less strict emissions standards that incinerate unsorted municipal solid waste (World Health Organization, 2015). Therefore, it is difficult to generalize the information to reflect modern incinerator standards (Negri et al., 2020).

Nitrogen Oxides (Nox)

Nitrogen oxides were included as a criteria air contaminant during the air quality assessment which focused on predicting changes in concentrations of pollutants as a result of the Facility's expansion (GHD, 2024). As identified in the Air Quality report, NOx emissions are composed of Nitric Oxide (NO) and Nitrogen dioxide (NO_2) with NO dominating the composition. When NOx is emitted to the atmosphere, NO begins to react with other contaminants (primarily ground-level ozone - O_3) to produce NO_2. Depending on the amount of ozone present, only a portion of NOx will be converted to NO_2.

Adverse health effects result from NO_2 at much lower concentrations than NO (GHD, 2024). The NOx emissions from Emerald are estimated to be about 98% NO, however, GHD has conservatively assumed that all NOx emitted from the Emerald stacks is NO_2 as the worst case (GHD, 2024).

Oxides of nitrogen (NOx) are controlled in the Selective Catalytic Reduction System (SCR) by adding the reducing agent ammonia (NH_3) to the flue gases after they have been heated to the required operating temperature. The supplemental heat to the incinerator flue gases is provided by two natural gas fired duct burners. The reducing reaction that converts NOx to N_2 and H_2O occurs in the presence of the catalyst housed in the reactor located downstream of the ID fans. The catalyst also serves to oxidize the dioxins and furans in the stack gases to form HCl, CO_2 and water vapour (GHD, 2024).

Dioxins

One of the major concerns related to incineration of mainstream waste is the combustion of plastic (composed of hydrocarbon/oil products), which emits organic and chlorinated/fluorinated compounds (e.g. dioxins), polychlorinated biphenyls, furans, chlorophenols, and mono- and polycyclic aromatic hydrocarbons (Karunathilake et al., 2016; reviewed in Cole-Hunter et al., 2020). Dioxin emissions mostly originate from high temperature processes such as combustion, gasification, and smelting (Castaldi, 2021). The scientific community has gained significant knowledge about dioxins through investigations focused on their creation, removal, fate in the environment, health implications, and mitigation strategies. As a result, most industries have adopted measures to avoid the release of dioxins into the environment (Castaldi, 2021). In the field of waste-to-energy, extensive measures have successfully achieved a decrease of over 99.5% of dioxins between 1985 and 2012 (Vehlow, 2012). As such, over time, waste-to-energy facilities have not been considered a substantial source of dioxins, dust, or heavy metal emissions (German Federal Ministry for the Environment, 2005; Castaldi, 2021; Velhow, 2012). As mentioned above, advanced incineration technologies used in waste-to-energy facilities remove 99% of dioxins and furans emitted from incineration using advanced air pollution controls (ECCC, n.d.) (Table 5-35).

A comprehensive assessment done in 2004 for a waste-to-energy facility located in Maryland, U.S., using health risk studies and ambient monitoring programs before and after the facility became operational (Rao et al., 2004). The study comprehensively tested air and non-air media (crops, farm pond surface water and fish tissue, and cow's milk) from about 2.5 miles to about 25 miles from the facility and tested for several emissions including polychlorinated dioxins and furans and selected toxic metals (arsenic, beryllium, cadmium, chromium, lead, mercury, and nickel) (Rao et al., 2004). Results from the study indicated no measurable difference compared to pre- operational ambient air quality levels and no expectation of non-carcinogenic health effects as a result of facility emissions (Rao et al., 2004). Similar biomonitoring studies in the Netherlands also showed no potential risks to humans or crops close to three waste-to-energy facilities (Van Dijk et al., 2015) and no correlation to dioxin levels in blood for residents near a Portugal waste-to-energy facility (Reis et al., 2007).

In Italy, two environmental monitoring studies reported that after upgrades to waste-to-energy facilities, which included stricter emission control measures mainly aimed at reducing dioxin emissions, also resulted in a decline in PM emissions (Buonanno et al., 2010, 2011). This suggests that regulating emissions of significant pollutants like dioxins and furans could potentially result in a decrease in PM, a standard air pollutant (Cole-Hunter et al., 2020).

Table 5-35: Summary of Air Pollutants and Air Pollutant Control Technologies (taken from Morrison Hershfield, 2023)[1]

Air Pollutant	Source in MSW & Formation	Air Pollutant Control Removal System Options	Removal Efficiency[2]	Comments
Particulate Matter (PM_{10} and $PM_{2.5}$)	• Originates from both inorganic and organic fractions of waste • Formation of PM depends on MSW characteristics and combustion conditions (air flow velocities, temperature, mixing, residence times).	• Baghouse fabric filter • Cyclones • Electrostatic precipitator • Wet scrubbers	>99.9%	• Baghouse fabric filters are most common in Canada
Dioxins and Furans	• Formed through several competing chemical reactions, however de novo synthesis is the major mechanisms. Formed in the presence of fly ash containing aromatics and metal catalysts, in presence of oxygen at temperatures between 250-450°C.	• Activated carbon injection combined with fabric filters	>99%	• Good operational controls (temperature, air controls, residence time) and ensuring complete combustion can minimize dioxin and furan generation
Organic Compounds, including Hydrocarbons	• Sources from any organic substances including hydrocarbons in residual MSW feedstock	• Activated carbon injection combined with fabric filters	>99%	• Powdered activated carbon injection most common in Canada
Metals (E.g., Mercury, Lead, Cadmium)	• Mercury from batteries, thermometers and fluorescent lights, electronic devices. Cadmium from batteries and electronics. • Formation and mobility depend on volatility of metals. Mercury is the most mobile metal.	• Activated carbon injection combined with fabric filers	Varies	
Nitrogen Oxides (NO_x)	• Formed when nitrogen containing compounds are combusted and nitrogen is oxidized. NO_x formation significantly affected by oxygen content, furnace temperature, and residence time.	• Selective non-catalytic reduction (SNCR), selective catalytic reduction (SCR) (injection of reducing agent such as ammonia)	SNCR: 30-70% SCR: >85% (typical 50-80%)	• Good operational controls (temperature and air controls) can minimize NO_x generation • SNCR typically have lower capital costs however SCR may have higher contaminant removal rates

Notes:

1 Commissioned by Environment and Climate Change Canada, this study by Morrison Hershfield (2023) is on waste to energy approaches for processing non-hazardous municipal solid waste (excluding materials diverted through recycling and composting initiatives) in Canada. This study determines the potential for large-scale waste to energy projects in Canada.

2 Removal efficiencies shown in the table are provided for reference only based on reported values for specific treatment technologies. However, actual removal efficiencies will be facility-specific and depend on several factors including the operating conditions, the overall Air Pollutant Control (APC) system and emission targets. APC systems are a combination of individual treatment processes that are designed to work together to meet the regulatory air emission limits for specific pollutants.

GHG Emissions

All waste management practices generate greenhouse gas (GHG) emissions both directly, from incinerating municipal solid waste, and indirectly, from energy consumption. Methane and carbon dioxide are the main contributors to climate change. Several studies have demonstrated that EFW facilities produce less GHG emissions than landfills (Khan et al., 2022; Castaldi, 2021). For example, the impact of 1 tonne of municipal solid waste incineration on climate change is 58 kg of carbon dioxide compared to 408 kg of carbon dioxide from a landfill (Khan et al., 2022). A study from the US EPA indicated that if the objective is to decrease GHG emissions, then EFW technology should be seen as a viable choice within the framework of renewable energy policies (Kaplan et al., 2009; US EPA, n.d.). In comparing WTE technology to landfill-gas-to-energy processes for the generation of electricity, all studied scenarios of electricity generation through landfill-gas-to-energy, exhibited greater average emissions of NOx, SOx, and PM compared to WTE (Kaplan et al., 2009). EFW facilities that typically handle municipal solid waste have shown that stack emissions routinely meet the US EPA's Maximum Achievable Control Technology (MACT) standards, and that facilities' emissions are often far below regulatory limits (Castaldi, 2021; US EPA, n.d.).

Research indicates the EFW process has the lowest environmental impact (i.e., emissions of greenhouse gases, nitrogen oxides, fine particulates, etc.) and is a favourable waste management option for energy and emissions, when compared to various other combinations of recycling and landfilling (Michael, 2013). Therefore, research and monitoring of EFW facilities demonstrate that these facilities are not likely to be hazardous to human health or the environment due to strict emission guidelines and modern engineering controls (Ollson et al., 2014).

According to Castaldi (2021), there were 76 EFW facilities in the United States in 2021 that processed almost 94,000 tons of municipal solid waste per day, which is the approximate equivalent of 13% of all MSW generated in the U.S. These facilities produced 2.5 GW of electricity and 2.7 GW of combined heat and power capable of powering and powers 2.3 million homes.

The systematic literature review conducted by Cole-Hunter and others (2020) that reviewed relevant literature published until 2020, also found that "*under normal operating conditions there is little to no evidence of an increased risk of cancer or non-cancer effects in humans, as* [EFW] *facilities are capable of lower emissions*".

EFW is acknowledged as a net reducer of greenhouse gas emissions by reputable organizations such as the Global Roundtable on Climate Change, the Intergovernmental Panel on Climate Change (IPCC), the U.S. Environmental Protection Agency (U.S. EPA), the Kyoto Protocol, and the European Union (York Region, n.d.). This recognition is based on the following reasons (York Region, n.d.):

- Diminished methane discharges originating from landfills. A single metric ton of methane in the atmosphere has a minimum global warming potential equivalent to 25 metric tons of carbon dioxide (CO_2). Waste deposited in a landfill undergoes decomposition over a span of several decades, resulting in the emission of methane gas. The EFW process produces negligible amounts of methane emissions.
- Decreased emissions of CO_2 from trucks. Utilizing local EFW (Energy from Waste) plants eliminates the need for long-distance transportation of rubbish to remote landfills, hence reducing CO_2 emissions.
- Decreased emissions of CO_2 resulting from the use of fossil fuels. When an EFW facility generates one megawatt of electricity, it prevents the release of CO_2 emissions that would have occurred if a power plant fueled by fossil fuels had been used instead.

- Decreased CO_2 emissions resulting from the process of producing metals. Recycling metals conserves energy and prevents the release of CO_2 emissions that would have occurred by mining raw materials and producing new metals.

Current Conditions

Since June 2023, air quality within the site boundary has been continuously monitored to better understand the existing air quality. This is assessed using a variety of methods including estimating air contaminant emissions based on testing data from the existing facility's operations and evaluating emissions for each phase of the facility expansion. The maximum concentrations of off-site air pollution is also estimated using MECP-approved air dispersion model AERMOD. Ambient air monitoring data is collected at stations upwind and downwind of the facility. Cumulative air concentrations are also determined by adding modelled data from facility operations to ambient air monitoring data. The modelled concentrations and cumulative air data are compared against MECP standards once the data is collected.

In order to ensure emissions from the Emerald facility comply with Ontario's conservative limits, an Air Pollution Control (APC) system is used (GHD, 2024). The flue gas from the boilers is collected in a duct and carried into the APC system. The APC system removes harmful contaminants such as acid gases, mercury, heavy metals, dioxins/furans, particulate and nitrogen oxides (GHD, 2024). The Emerald facility also has a Continuous Emission Monitoring (CEM) system that verifies that the emissions from the facility are operating in compliance with their operating licenses. The facility submits summary reports about the plant operations and emissions to the government quarterly and annually (GHD, 2024).

The primary source of emissions for the existing Facility is from electricity generation through the combustion of municipal solid waste (MSW), from both biomass and non-biomass combustion (GHD, 2024). The total emissions of CO_2, CH_4, and N_2O from the electricity generation are calculated based on the steam generation quantity (assuming 98% originates from MSW), the Boiler's design-rated input/output capacity (in GJ/tonne of steam), and the emission factors (g/GJ) for Municipal Solid Waste from the Western Climate Initiative (WCI) Guidance. Additionally, a 44% removal efficiency from the selective catalytic reduction (SCR) system is applied to N_2O emissions.

Additional GHG emissions are emitted from using natural gas for stationary combustion at Building 2 and the Auxiliary Boiler, as well as for electricity generation through Selective Catalytic Reduction (SCR), incinerators, and the Gas turbine generator (GHD, 2024). In addition, diesel gas is predominantly used for on-site transportation, with a minor portion dedicated to stationary diesel combustion. These GHG emissions are determined by fuel consumption quantity, carbon content of the fuel (for CO2 emissions from Natural Gas), high heating values, and CH4 and N2O emission factors outlined in Canada's Greenhouse Gas Quantification Requirements for 'industrial' and 'electricity utilities' (GHD, 2024).

The HHRA is an important source of information for the HIA, and the specific methodology for the HHRA is provided in a separate cover report (Intrinsik, 2024). The HHRA used data and information from the Air Quality Impact Assessment prepared by GHD (2024).

Project Impact

As mentioned above, an Air Quality Impact Assessment was conducted for the proposed expansion of the Emerald EFW Facility to increase the incineration capacity up to a total of 900,000 tonnes per year (GHD, 2024). The Assessment included an evaluation of the air contaminants potentially emitted from the Facility with respect to the applicable ambient air quality criteria for both existing and future operating conditions (GHD, 2024). In addition, evaluation of dust, odour, light pollution, and greenhouse

gas emissions were included (GHD, 2024). The Air Quality Impact Assessment demonstrated that (GHD, 2024):

> "*the estimated worst-case concentrations of all potential air contaminants will be well below the applicable ambient air quality criteria for all future expansion scenarios (Phases 1, 2 and 3), with the exception of nitrogen dioxide, benzo(a)pyrene, and dioxin and furans. As discussed in Section 7.1 of this Report, the predicted air quality criteria exceedances for benzo(a)pyrene, and dioxin and furans are primarily due to the estimated background air concentrations of these compounds. The contribution to the maximum ambient air concentrations of these compounds from the Facility are very small.*"

In addition, a cumulative frequency analysis was conducted as part of the Air Quality Impact Assessment for the Project, which showed that, for the predicted 1-hour nitrogen dioxide concentrations for the Phase 3 expansion scenario (the worst case emissions scenario) (GHD, 2024):

- the cumulative concentration of nitrogen dioxide that exceeded the federal CAAQs 1-hour nitrogen dioxide air quality criteria occurred less than 0.32% of the time;
- the predicted maximum nitrogen dioxide concentration never exceeded the applicable Ontario nitrogen dioxide concentration criteria, which is also used as an indicator of good air quality.

Hence, overall, the results of the Air Quality Impact Assessment demonstrated that the expansion of the Emerald Facility is not anticipated to have a significant impact on local air quality and greenhouse gas emissions across any of the proposed expansion phases (GHD, 2024).

As discussed in the Air Quality Impact Assessment report, the expansion of Emerald will lead to increased GHG emissions due to the higher waste processing capacity. For the Facility expansion, it is assumed that GHG emissions will be directly proportional to the waste processing rate. GHG emissions are calculated based on the average GHG-to-waste processed ratio from 2018 to 2022, prorated to 300,000 tpa, 600,000 tpa, and 900,000 tpa for Phase 1, Phase 2, and Phase 3, respectively. Actual GHG emissions are expected to be lower, as the expanded Facility will no longer actively use the auxiliary boiler and gas turbine generator on-site. When compared to provincial and federal total GHG emissions contributions, the Facility's percentage contribution remains marginal (0.353% contribution to Ontario GHG emissions in Phase 3, and 0.079% contribution to federal GHG emissions in phase 3), indicating its limited impact on overall GHG emissions (GHD, 2024).

As discussed in the Introduction, an HHRA was also conducted on the Project to determine the potential short- and long-term human health risks to individuals in the surrounding community who may be impacted by air emissions from each phase of the proposed expansion (Intrinsik, 2024). The HHRA included an evaluation of the potential health impacts related to inhalation of emissions at each expansion phase, both project-specific and in the broader cumulative context of the overall airshed (i.e., existing background conditions plus project-specific contributions). The assessment also considered the potential impacts emissions may have on soil concentrations throughout the Study Area through long-term deposition, and potential health outcomes that may arise from exposures to impacted soils, dusts, and home garden produce. The results of the HHRA, which utilized the data and information from the Air Quality Impact Assessment (GHD, 2024), indicated that emissions from the Emerald Facility under all proposed expansion phases would not result in a significantly elevated health risk to the surrounding community. There is a small possibility of an individual with asthma potentially having an asthmatic event if they happen to be exercising at the nearby Sportpark during worst-case meteorological conditions (typically a declared "bad air day") based on the cumulative impacts from NOx at the worst-case community location exceeding acute health-based benchmarks from the short-term exposure

assessment (Intrinsik, 2024). Under Phase 2 and 3 of the planned expansion, concentrations of NOx can exceed the short-term 24-hour benchmark at the closest community receptor location (*i.e.*, Sportsfield 1 approximately 720 m south of the facility) under certain limited meteorological conditions. This is confirmed by the assessment of worst-case 1-hour NOx exposures which mirrored the 24-hour NOx assessment results (see Table 6-3 of the HHRA for additional details). This indicates if an individual with asthma were present at the Sportsfield during worst-case meteorological conditions, there is the potential for an asthmatic event under certain conditions. Cumulative 24-hour NOx concentrations were only predicted to exceed the benchmark threshold approximately 1% of the time. The average contribution on a typical day from the proposed Phase 3 expansion would be 1.5 µg/m^3 leading to a cumulative concentration well below the threshold even if we are assuming the 90th percentile regional background concentration of 12.9 µg/m^3. However, if one assumes typical average regional background concentrations (*i.e.*, the 50th percentile of 5.4 µg/m^3), the cumulative 24-hour NOx concentrations were only predicted to marginally exceed the benchmark threshold at this community location once in five years of modelling or 0.05% of the time.

Additionally, mixture risks for the acute respiratory irritants mixture group exceeded the benchmark indicating potential risks arising from cumulative exposures to chemicals in this like-acting group. However, the cumulative risk for this mixture group is being driven by worst-case regional ambient concentrations of NO_x and $PM_{2.5}$, with very little contribution from predicted facility emissions in each of the expansion phases. Similarly, mixture risks for the chronic developmental toxicants mixture group marginally exceed the benchmark indicating potential risks arising from cumulative exposures to chemicals in this like-acting group. However, the cumulative risk for this mixture group is being driven by worst-case regional ambient concentrations of dioxins/furans, with negligible contributions from predicted facility emissions in each of the expansion phases.

Based on these conclusions , it is recommended that Emerald EFW consider what further operational enhancements could be made to minimize emissions of NOx, $PM_{2.5}$, and dioxins/furans given existing elevated regional background conditions within the Study Area. It is also recommended that monitoring data, particularly data from continuous emissions monitoring of criteria air contaminants like NOx and PM2.5, be made publicly available to increase transparency for the surrounding community to demonstrate that the Emerald Facility, post-expansion, continues to operate with state-of-the-art technology which minimizes its impacts on the environment and maximizes the benefits to the surrounding community.

The Project will also contribute to sustainability. The energy being produced by the facility will be going back to the Provincial grid and to local businesses such as Cascade (correspondence with Emerald EFW, December 2023). Each Phase of the project will generate 34 MW of electricity for 8,400 hours per year for a total of 285,600 MWh. An Ontario home uses 9,500 kWh annually (9.5 MWh), so each Phase of the Project will support an equivalent of 30,000 homes (correspondence with Emerald EFW, December 2023) and support sustainability. In Phase I, 7.5 MW will be sent to Cascade, which will reduce the number of households served by about 6,600 homes.

Effect Characterization

Table 5-36 outlines the effects characterization for air quality. The affected population for air quality is regional. In general, children, the elderly, chronically ill individuals, asthmatics, those with heart disease, and immunocompromised individuals would be considered a vulnerable population related to impacts to air quality. However, based on the results of the air quality impact assessment (GHD, 2024) and the HHRA (Intrinsik, 2024), little to no significant health impact is anticipated to occur from the project. the

magnitude of potential health impact is considered to be low, and the likelihood is also low (based on the frequency analysis conducted as part of the Air Quality Impact Assessment (GHD, 2024) and the HHRA (Intrinsik, 2024). Therefore, odour impacts are unlikely to occur or and would have little to no effect on health and well-being. The effect characterization is based on data that is site-specific in nature, resulting in a medium to high level of confidence in these predictions.

Table 5-36: Effects Characterization for Air Quality

Criteria	Characterization
Affected populations	**Regional**
Magnitude	**Low**
Likelihood	**Low**
Vulnerable Populations to be Considered	**Children; elderly; chronically ill individuals; asthmatics; those with heart disease; immunocompromised**
Potential Health Consequence	**Neutral-Negative**
Level of Confidence	**Medium-High**

5.2.1.1. Odour

Health Linkages

Frustration in communities can arise from odour exposure and odour complaints related to improperly managed waste management facilities. In some cases, odour has resulted in long-term conflicts in certain regions or have disproportionately impacted low-income and racialized groups (Ekyelbosh, 2021). Protests from community members as well as tension and anxiety can arise due to the unpredictability of odour annoyance, its continuous presence, and the inability to stop it (Piccardo et al., 2022). A study conducted by Baxter et al. (2016) surveyed 217 residents in the Toronto, Durham, and Peel regions to understand their attitudes towards EFW incinerators. Residents preferred an EFW facility over a landfill but only 43% were in favour of hosting said facility. Additionally, participants indicated that there was concern related to incinerators releasing unpleasant and bothersome odours (Baxter et al., 2016).

Odour-related complaints can also be accompanied by health concerns from the surrounding local communities. The reported health concerns could be a wide range of non-specific symptoms, all subjectively attributed to odour exposure including nausea, headaches, drowsiness, fatigue, and respiratory problems (DEFRA, 2004). However, these health concerns resulting from landfill odours have most often occurred because of inappropriate waste being disposed of at the site (i.e., plasterboard and other wastes containing high levels of sulphur) (DEFRA, 2004). Health symptoms related to perceived odours may be reported at olfactory detectable concentrations that are “well below the levels associated with toxic effects or thresholds for mucous membrane irritation” (HPA, 2011). Depending on an individual’s sensitivity, age and prior exposure, the response to odour may vary. Also at play are psychological and social factors, including an individual's level of concern about their health. There is a plethora of studies that have been published showing a strong correlation between annoyance related to perceived odour and subjective symptoms (Dalton et al., 1997; Dalton, 2003; HPA, 2011). Additionally, long-term exposure to odorous compounds can increase the risk of different diseases including asthma, neurological damage, and atopic dermatitis. However, the relationship between odour and toxicity is dependent on the specific kind of pollutant emitted. For example, just because a pollutant is toxic does not mean that it will release an odour and vice versa (Piccardo et al., 2022). Examples from other EFW facilities in Ontario, such as the Durham York Energy Centre, indicate that

odours are not emitted from the stack (York Region, n.d.). Due to the high combustion temperatures, all sources of odour are destroyed inside the sealed boiler (York Region, n.d.).

Current Conditions

Emerald's operation includes processing solid, non-hazardous residential, industrial, commercial, and institutional waste (GHD, 2024). The annual monitoring reports have identified that in the 30 years the Emerald EFW facility has been operational, it has never received a nuisance or odour complaint from the community (correspondence with Emerald EFW and review of annual monitoring reports).

Potential sources of odour emissions from Emerald's operations include:

- Truck transportation to waste;
- Waste handling and storage; and
- Waste processing.

Truck Transportation: As trucks drive around the exterior of the Facility, there is minimal odour potential as the truck will be enclosed before any loading/unloading activities (GHD, 2024).

Waste Handling and Storage: Odours are not an issue outside of the Facility building (GHD, 2024).

Waste Processing: In order to reduce fugitive odours escaping the building, the Facility design includes drawing combustion air for the incinerator from the waste bunker to avoid odours. In addition, the odour emissions from the main stack are not expected to be significant (GHD, 2024). To further reduce pollutant levels, the gases go through various air pollution control equipment, including scrubbers.

Project Impact

Modern incinerators (such as used in EFW facilities) are unlikely to generate unpleasant odours as waste is being incinerated, opposed to a landfill were the debris rots emitting odours and leading to air pollution (Civilbull, 2022). According to the US EPA, odour, smoke and dust issues are usually not associated with modern incinerators (US EPA, 2012).

Given its comparable design and management practices, the Facility expansion is not expected to result in a significant adverse odour impact to the ambient air outside the Facility's property (GHD, 2024).

A Best Management Practice Plan for odour will be developed following the completion of the detailed design of the Facility. This plan aims to minimize odour emissions impact to the surrounding community and environment during Facility's regular operations, start-up, shutdown, and process upsets (GHD, 2024).

Effect Characterization

Table 5-37 outlines the effects characterization for odour. The affected population for odour is at a proximate level since odour impacts may be experienced mainly by those living in proximity to the facility. Individuals who are especially sensitive to odours would be considered a vulnerable population related to impacts from odour. However, no significant impact is anticipated to occur from the project. As previously identified, the facility has ever received a nuisance or odour complaint from the community. Therefore, odour impacts are unlikely to occur or and would have little to no effect on health and well-being.

Table 5-37: Effects Characterization for Odour	
Criteria	**Characterization**
Affected populations	**Proximate**
Magnitude	**Negligible**
Likelihood	**Low**
Vulnerable Populations to be Considered	**Individuals sensitive to odours**
Potential Health Consequence	**Neutral**
Level of Confidence	**Medium-High**

5.2.2. Water Quality

Health Linkages

Municipal solid waste management incineration technology, including modern EFW technologies, can reduce solid waste volumes by up to 90% and prevent soil and water contamination (Khan et al., 2022). EFW technology uses less space than landfilling does, does not directly contaminate groundwater through leaching (Leung et al., 2015); and surprisingly, landfills are discovered to pose more environmental and health hazards through air emissions compared to incineration. In older generation incinerators, incomplete combustion of municipal solid waste generates flue gases which carry residues from the pollutants (World Bank, 1999). Older incinerators have advanced flue gas treatment systems, but residuals from the process of flue gas cleaning could potentially lead to ground and surface water pollution if not disposed of appropriately (World Bank, 1999). Hence, safely disposing of residuals from incinerators is an essential part of the waste management system.

Unlike general incineration technology, there are no viable pathways for emissions from EFW facilities to impact water bodies near the facility because of the advanced air pollution control systems and strict regulatory guidelines observed by modern EFW facilities. Other byproducts of the EFW process, such as fly ash, are treated on-site to stabilize the material and ensure it is non-hazardous (York Region, 2019).

Current Conditions

Overall, the prevailing Geology and Hydrogeology in the Study Area is industrial, with Spring Creek situated to the west (GHD, 2023f). It is expected to continue in this state for the foreseeable future, as per the existing municipal planning policy (GHD, 2023f).

Surface Water

The Project Site's topography consists of a high point near its center with associated drainage flowing both east and west from the center area (GHD, 2023f). The nearest surface water body is a tributary of Etobicoke Creek (i.e., Spring Creek) which is located approximately 130 metres west of the Site (GHD, 2023g). Drainage flowing east will drain via a storm sewer system, and west flowing drainage will meet Spring Creek (GHD, 2023f). The existing storm sewer system consists of catch basins, underground storm pipes, oil and grit separator, and a dry (surge) pond on the east side (GHD, 2023f). Drainage outflow from the storm sewer system occurs via a storm sewer concrete pipe which is located under the Bramalea Road (GHD, 2023f). The Site gradually slopes west towards Spring Creek and sits at an elevation of approximately 183 metres above mean sea level (mAMSL) (GHD, 2023g). Final stormwater outflow is connected to the existing storm sewer concrete pipe of 675 mm located under the Bramalea Road (GHD, 2023f). The existing stormwater management system has an Amended Certificate of Approval, Industrial Sewage Works, Ministry of the Environment, May 2010 (currently referred to as ECA) (GHD, 2023f).

Groundwater

Based on regional data, the depth to groundwater at the Site was generally found to be greater than 3 meters below ground surface (mbgs) (GHD, 2023g). Based on the topography, the flow of groundwater is anticipated to be west towards Spring Creek (GHD, 2023g). The secondary hydraulic conductivity of the rock mass within the top 1.5 m of rock was estimated to be 10^{-3}cm/sec and 10^{-5} and 10^{-6} cm/sec in the deeper zones of rock (GHD, 2023g). It was reported that an aquitard underlays the Site due to the local till and shale bedrock (GHD, 2023g). A piezometric surface was indicated at approximately 180 mAMSL based on groundwater levels measured from monitoring wells installed at the overburden bedrock contact (GHD, 2023g).

Project Impact

The proposed expansion of the existing Emerald EFW facility will change the existing Site footprint and increase the number of impermeable surfaces, which may cause potential negative impacts to groundwater, such as quality, quantities, or flow (GHD, 2023g).

Surface Water

There are no expected impacts within the Project study area due to the proposed oil grit separators, which would improve the quality of the stormwater discharge from the Site (GHD, 2023f). Little to no impacts to the local study area (i.e., 1 km radius of the Project boundaries) are expected due to (GHD, 2023f):

- The Site being generally higher than the surrounding area, resulting in the adequate collection of runoff from local drainage and neighboring watersheds (i.e., Spring Creek);
- The Site not receiving external storm flow;
- The Site not discharging onto any adjacent lands;
- The impacts to the floodplain being mitigated (i.e., “Land Exchange Restoration and Enhancement Plan, Emerald Energy from Waste, Palmer Environmental Consulting Group Inc., April 18th, 2019); and
- The Site delineating an updated flood plain boundary (i.e., “Land Exchange Restoration and Enhancement Plan, Emerald Energy from Waste, Palmer Environmental Consulting Group Inc., April 18th, 2019).

Additionally, there is expected to be little to no impact on the regional study area (i.e., 3 km radius from the Project boundaries) due to the storm water management measures mentioned above, as well as the installation of a sluice gate or control valve to prevent accidental spills or unplanned releases (GHD, 2023f). A temporary erosion and sediment control (ESC) plan has also been proposed during construction to ensure construction activities do not impact waters downstream from the project (GHD, 2023f).

When applied, the identified impact mitigation measures will eliminate any potential negative environmental effects and/or reduce them to acceptable levels (GHD, 2023f).

Mitigation measures such as stormwater storage, channels that concentrate and convey stormwater runoff, and stormwater management systems will eliminate or reduce surface water net effects of the expansion to acceptable levels (GHD, 2023f).

Groundwater

An increased number of impermeable surfaces on Site due to the Project expansion will result in a surplus of water which could be managed by stormwater management and low impact development

methods (GHD, 2023g). The resulting surplus of water could potentially decrease groundwater recharge and increase the amount of runoff and overwhelm adjacent surface watersheds (GHD, 2023g). However, a water tight (or 'bathtub') design is planned for the proposed development, which will minimize or eliminate the potential for any long term groundwater seepage as well as the management of any groundwater. Based on this, an MECP groundwater taking permit to take water (PTTW) would not be required for the long term operation of the facility.

Due to an accidental spill, potential contamination sources related to the Site and its maintenance activities (e.g., road salt, fuel, lubricating oils) could infiltrate and impact groundwater, but the migration of impacted groundwater would be minimal, based on the presence of thick, fine grained, low permeable overburden and bedrock beneath the Site and vicinity (GHD, 2023g). As such, groundwater within the overburden or bedrock would not be impacted (GHD, 2023g). Staff will be routinely trained in spill response and containment techniques, and proper safeguards will be implemented (GHD, 2023g). Immediate localized cleanup of any potential spill or release would be conducted and thus impact would not be an issue (GHD, 2023g). It is unlikely that there are any shallow permitted groundwater users downgradient of the Site that utilize groundwater as a source of potable drinking water in this industrial, municipally serviced area (GHD, 2023g).

Net effects on the amount and quality of groundwater at the site are expected to be minor to non-existent when mitigation measures are in place such as spill response and containment training for staff and best management practices during construction and operation (GHD, 2023g).

Therefore, overall, it is not likely that leachate or other contaminants from the facility will impact nearby water quality.

Effect Characterization

outlines the effects characterization for water quality. The affected populations for both surface water and groundwater are on a regional level since surface water and groundwater will affect the area beyond the project area.

Surface Water

As noted in GHD's Surface Water Assessment Report, mitigation measures will eliminate any potential negative environmental effects and/or reduce them to acceptable levels (2023f). Therefore, the magnitude or severity of the effect on human health ranges from may not occur or too small to be noticed or are small or may be experienced by a few individuals. These impacts are unlikely to occur due to the proposed mitigation measures, and therefore, the effect is anticipated to have little to no effect on health and well-being. The effect characterization is based on data collected by GHD that is site-specific in nature, resulting in a medium to high level of confidence in these predictions.

Groundwater

GHD's Geology and Hydrogeology Assessment Report (2023g) noted several potential environmental effects resulting from the project including an increased number of impermeable surfaces on Site, a decrease in groundwater recharge, an increase in runoff, and the potential for contamination sources to impact groundwater. However, the Report states that due to the low permeability of the Site's underlying geology, the environmental effects mentioned above are expected to be minor to non-existent when mitigation measures are in place such as spill response and containment training for staff and best management practices during construction and operation. Children 5 years old or younger are generally more vulnerable to issues related to the quality of drinking water. However, since the study area as well as the downgradient areas are unlikely to utilize groundwater as a source of potable

drinking water in this industrial, municipally serviced area, there is negligible likelihood of health impacts. The effect characterization is based on data collected by GHD that is site-specific in nature, resulting in a medium to high level of confidence in these predictions.

Table 5-38: Effects Characterization for Water Quality

Criteria	Characterization	
	Surface Water	*Groundwater*
Affected populations	**Regional**	**Regional**
Magnitude	**Negligible**	**Negligible-Low**
Likelihood	**Low**	**Low**
Vulnerable Populations to be Considered	**None**	**Children under 5 years**
Potential Health Consequence	**Neutral**	**Neutral**
Level of Confidence	**Medium-High**	**Medium-High**

5.2.3. Noise

Health Linkages

Noise is typically defined as any unpleasant or unwanted sound, and as such noise pollution is “the noise beyond the permissible limits” (Singh et al., 2017). Additionally, WHO has reported that “noise is an underestimated threat that can cause a number of short- and long-term health problems” (WHO, 2010). Depending on the sound level and exposure duration, noise can impact an individual's physical, mental, or social well-being (Government of Canada, 2023). Adverse effects of noise can include annoyance, interference with communication, disturbance of rest, sleep, and concentration, and hearing damage (Government of Canada, 2023). Research suggests that these adverse effects can cause sufficient stress on the body increasing the risk of stress-related diseases (Government of Canada, 2023).

Hazards associated with the incineration process and noise are not as easily quantifiable as air or water impacts. Potential noise impacts may be related to transportation related to the facility (i.e., road and truck traffic), and the operation of the facility itself (i.e., incinerator) (Di Girolamo et al, 2008; Jacyna et al., 2017; US EPA, 2012).

Current Conditions

Based on a review of all formal complaint records provided, it was found that the Emerald EFW site has not received any formal noise complaints for the existing operations on-site (GHD, 2023i).

The Noise Assessment Report summarizes the applicable site-specific sound level limits as well as the existing significant noise sources at the Site (GHD, 2023i). Sensitive point(s)-of-reception, such as nursing/retirement homes, rental residences, hospitals, schools, etc., were identified for the Site. Ambient background noise was collected for a week in June of 2023 and results were consistent with the characteristics of a MECP Class 1 area (i.e., urban areas) as the environment is dominated by human activities such as road traffic (GHD, 2023i). Measurements were also taken for short-term sound levels to assess worst-case potential noise impact at the previously identified sensitive point(s)-of-reception. Equipment sources were related to trucking-related activities, rooftop equipment or outdoor equipment located beside the building. Although other noise sources exist at the Site, they were deemed to be insignificant contributors to the overall noise level (GHD, 2023i).

Project Impact

Noise impacts from generating energy from waste can arise due to four scenarios: during construction of the redevelopment, during operation of the plant, with all associated activities on-site, and increased traffic along the haul route. Noise generated from long haul traffic will impact surrounding communities close to the facility and the busiest roads. Although the project will not result in any changes to existing haul routes, it is anticipated that truck traffic will increase due to an increase in annual processing (GHD, 2023i). This is expected to be acceptable relative to local traffic volumes.

Four phases were assessed for the potential effects of construction and operations-related noise impacts from the Site including the Construction/Existing Operation Phase, Future Operation/Demolition Phase, Future Operation/Construction Phase, and Future Operational Phase (GHD, 2023i). Temporary construction noise impacts at all site locations for daytime construction work at all point(s)-of-reception locations are anticipated to be below the United States Federal Transit Administration's Transit Noise and Vibration Impact Assessment guideline limit (GHD, 2023i). Construction is expected to occur within daytime hours, in accordance with the Corporation of the City of Mississauga Noise Control By-Law 360-79. Concerns related to construction such as excessive noise and vibration levels are temporary (i.e., mainly during construction) and mainly from a human annoyance perspective. Therefore, applicable regulatory guidelines used were related to residential impacts.

There is a potential for increase in noise emission associated with continued future operations of the Site since the proposed EFW facility expansion will result in changes to on-site operations and the existing site footprint (GHD, 2023i). However, even so, the Noise Assessment Report predicted that would be no exceedances of the site-specific noise limits or MECP standards (GHD, 2023i).

Estimated impacts from the construction phases are below existing ambient noise levels in the area resulting in no appreciable net effect on the receptors (GHD, 2023i). The worst-case evaluation shows that during Phase 1 construction the noise impact will be -2 dBA below the ambient noise level at point-of-reception 1, which is considered insignificant with no addition the existing conditions (GHD, 2023i). At point-of-reception 2, worst-case evaluation during Phase 3 construction shows noise impacts of -7 dBA below the ambient sound levels and is also considered an insignificant net effect (GHD, 2023i). Additionally, the net change is considered negligible when comparing future operations at the Site to the existing operations at the site.

Overall net effects of noise are minor, as sound levels for future operations are significantly below the ambient sound levels for the area, and therefore not audible. Noise levels during construction will be below existing ambient sound levels (GHD, 2023i).

Effects Characterization

Table 5-39 below outlines the effects characterization for noise. The affected population for noise is proximate since noise impacts, mainly due to the construction-related activities at the Project, may be experienced generally by those living closer to the facility. As noted in GHD's Noise Assessment Report, sound levels for future operations are significantly below the ambient sound levels for the area and overall net effects of noise are considered to be minor. Noise from construction has been identified to have negligible impacts on receptors nearest the Site (GHD, 2023i). Nearby residents, children, and/or elderly people would be considered vulnerable populations related to noise as they would be more sensitive given either age or their proximity to the Project. Since the effects from noise impacts are negligible, it is anticipated to have little to no effect on the health and well-being of receptors. Best practices for mitigating construction-related noise impacts will be implemented to minimize noise

impacts from construction equipment and activities, including movement of trucks in and out of the facility (GHD, 2023i). The effect characterization is based on data collected by GHD that is site-specific in nature, resulting in a medium to high level of confidence in these predictions.

Table 5-39: Effects Characterization for Noise	
Criteria	**Characterization**
Affected populations	**Proximate – during construction phases**
Magnitude	**Negligible – Low (during construction phases)**
Likelihood	**Medium – during construction phases**
Vulnerable Populations to be Considered	**Nearby residents, children, elderly**
Potential Health Consequence	**Neutral**
Level of Confidence	**Medium-High**

5.2.4. Agriculture

Health Linkages

Contemporary EFW facilities utilize a carefully controlled and efficient combustion system to incinerate waste, extract energy and metals from the process, and incorporate established air emission control technologies that effectively minimize emissions to meet stringent regulatory standards (York Region, n.d.). Hence, although risks to agricultural land are possible from general incineration processes, as stated in Section 5.2.1, EFW facilities employ advanced pollution control systems that regulate air emissions from the facilities. In the United States, EFW facility stack emissions not only routinely meet the US EPA's Maximum Achievable Control Technology standards, but are often far below regulated limits (Castaldi, 2021). From 2004 to 2013, multiple biomonitoring projects were established around three waste incinerators in the Netherlands for early identification of any potential impacts of stack emissions on the quality of crops and agricultural products (van Dijk et al., 2015). The results from the biomonitoring programs showed that the emissions did not affect the quality of crops and cow milk (van Dijk et al., 2015). Ambient monitoring studies that comprehensively tested air and non-air media (crops, farm pond surface water and fish tissue, and cow's milk) near a waste-to-energy facility in the United States, for several emissions including polychlorinated dioxins and furans and selected toxic metals (arsenic, beryllium, cadmium, chromium, lead, mercury, and nickel), indicated no measurable difference compared to facility pre-operational levels (Rao et al., 2004).

Current Conditions

There is land to the northwest boundary of the Site, along Highway 407 and to the east, that is zoned as agricultural (GHD, 2023c). The Emerald EFW facility has accepted and managed municipal solid waste since 1992, and in that time, no impacts to agricultural activities or agricultural lands have been reported.

Project Impact

As the Site will continue to operate and be zoned under industrial land use, there are no potential negative effects related to the remediation of contaminated land due to the land use currently being industrial (GHD, 2023c). There is not expected to be any significant impact to the agricultural land uses that are within the Project study area, as no new lands are being acquired for the purposes of the Project (GHD, 2023c).

The HHRA also evaluated potential deposition of contaminants of concern and accumulation of these chemicals in soils over the lifetime of the facility to determine whether there may be health impacts from oral/dermal exposures, or via home gardens (or theoretically agricultural crops). Results of the modelling indicated a negligible contribution from deposition of contaminants from the facility. As a result, the HHRA did not consider multi-pathway exposures due to the lack of an exposure footprint beyond inhalation.

As a part of a suite of mitigation measures, Emerald EFW will implement, as appropriate, fugitive dust and odour management to ensure potential contamination from operational emissions are properly controlled (GHD, 2023c). In relation to land use, it has been reported that there are no anticipated net negative environmental effects related to land use during the proposed development process (GHD, 2023c).

Effect Characterization

Table 5-40 outlines the effects characterization for agriculture. The affected population for agriculture regional. As noted in GHD's Land Use Assessment Report, the surrounding land uses are currently predominantly zoned industrial, and agricultural land is placed to the northwest boundary of the Site, along Highway 407 and to the east. Since 1992, no agricultural impacts due to project operations have been noted, and the proposed Project does not include acquisition of new lands (GHD, 2023c). Although dust, noise and traffic related impacts could occur during the construction and operational phase of the project, best management practices have been proposed to mitigate any potential negative environmental effects (GHD, 2023c).

Table 5-40: Effects Characterization for Agriculture

Criteria	Characterization
Affected populations	**Proximate**
Magnitude	**Negligible**
Likelihood	**Low**
Vulnerable Populations to be Considered	**None**
Potential Health Consequence	**Neutral**
Level of Confidence	**Medium-High**

SOCIAL DETERMINANTS OF HEALTH

5.2.5. Traffic burden, including accidents and injuries

Health Linkages

Traffic congestion is typically defined as "excess of vehicles on a portion of roadway at a particular time resulting in speeds that are slower and is referred to as stop-and-go traffic" (US Department of Transportation, 2020). Increase in traffic burden and congestion can increase stress and anxiety levels for commuters, which in turn can result in mental health impacts (WHO, 2000; TPH, 2006; reviewed in Cohen et al., 2014). High levels of congestion and vehicle volume on roadways, also increase commuting times for travellers, resulting in more time spent in a vehicle and less time for other, more preferred activities (Clark et al., 2019). Vehicular traffic and commuting can also add stress to travelers' daily lives which can increase overall life stress decrease mental health (Clark et al., 2019). A study conducted by Clark et al. (2019) analysed the impact of commuting on aspects of Subjective Well-Being (SWB), which

included life satisfaction, job satisfaction, health, and satisfaction with leisure. This study reported associations of longer commute times with lower job satisfaction, lower leisure time satisfaction, increased strain, and poorer mental health (Clark et al., 2019). Commuting has been shown to be viewed as a negative experience that worsens moods and happiness during the journey (Clark et al., 2019).

Increased traffic burden because of a project expansion can also have negative impacts on traffic management, as the new traffic load, if not appropriately mitigated, may not be conducive to current traffic management plans (Retallack & Ostendorf, 2019). In a literature review conducted by Retallack & Ostendorf (2019), it was reported that increased traffic density can be related to increased fatal accidents. Although, the relationship between traffic congestion and accidents is not always apparent and some studies show traffic congestion has little to no impact on the frequency of accidents (Wang et al. 2009). Additionally, it has been shown that traffic congestion can reduce driving speeds, which then can reduce accidents (Wang et al., 2009). However, left unmanaged, large and expanding waste management facilities can contribute to increased traffic burden or congestion due the facilities reliance on trucks and associated vehicles.

Current Conditions

Currently, Highway 407 and Bramalea Road are the two major roads providing access to the existing Emerald EFW facility (GHD, 2023h). The Site operates from 6:00 a.m. to 7:00 p.m. and is open to receive waste every day of the year. However, it is noted that the Site accepts much less waste material over weekend periods (GHD, 2023h).

Daily truck traffic at the Site currently sees a maximum total of 80 to 95 trucks over a period of a weekday day or 160 to 190 two-way truck trips per day (GHD, 2023h). During the peak a.m. hour on a weekday the Site typically generates approximately 16 two-way trips consisting of 11 inbound and 5 outbound trips (GHD, 2023h). Additionally, during the peak p.m. hour on a weekday the Site typically generates approximately 15 two-way trips consisting of 9 inbound and 6 outbound trips (GHD, 2023h).

The turning movements for both intersections, during peak weekday a.m. and p.m. hours, operate with levels of service “E” or better (GHD, 2023h). Regarding current capacity, there are no constraints, although the westbound left turn from the development at 7653-7639 Bramalea Road at the peak p.m. hour is approaching critical with a LOS of E (GHD, 2023h). Overall, the intersections during peak a.m. and p.m. hours, under current conditions, have a volume-to-capacity (v/c) ratio[1] of 0.39 LOS B and 0.45 LOS B, respectively (GHD, 2023h). The current reported v/c ratios indicate that during both peak hours, the intersection is operating at acceptable levels of delay for all individual movements (GHD, 2023h).

In addition, a review of all collision data obtained from the City along Bramalea Road between Derry Road and Steeles Avenue confirmed that only seven collisions have been reported since 2018 (GHD, 2023h). All of these occurred at the Highway 407 off-ramps and none involved heavy trucks (GHD, 2023h). Majority of the residents of Brampton Centre commute by car, truck or van ( ); however, a higher percentage of residents of Brampton Centre commute by public transit, as compared to the City of Brampton overall.

[1] From the Federal Highway Administration Research and Technology (n.d.): “The v/c ratio, also referred to as degree of saturation, represents the sufficiency of an intersection to accommodate the vehicular demand. A v/c ratio less than 0.85 generally indicates that adequate capacity is available and vehicles are not expected to experience significant queues and delays. As the v/c ratio approaches 1.0, traffic flow may become unstable, and delay and queuing conditions may occur. Once the demand exceeds the capacity (a v/c ratio greater than 1.0), traffic flow is unstable and excessive delay and queuing is expected.” Available: https://www.fhwa.dot.gov/publications/research/safety/04091/07.cfm

Project Impact

Two future horizon years were assessed, including 2029 which includes the build-out of Line 1 and 2034 which is the full build-out including Lines 1, 2, and 3 (GHD, 2023h). The Project Site's capacity will double by 2029 and sextuple the existing Site capacity by 2034 (GHD, 2023h).

The 2029 horizon year during the peak a.m. hour on a weekday the Site typically generates approximately 32 two-way trips consisting of 22 inbound and 10 outbound trips (GHD, 2023h). Additionally, during peak p.m. hour on a weekday the Site typically generates approximately 30 two-way trips consisting of 18 inbound and 12 outbound trips (GHD, 2023h). The 2034 horizon year during the peak a.m. hour on a weekday the Site typically generates approximately 96 two-way trips consisting of 66 inbound and 30 outbound trips (GHD, 2023h). Additionally, during peak p.m. hour on a weekday the Site typically generates approximately 90 two-way trips consisting of 54 inbound and 36 outbound trips (GHD, 2023h).

Under the future background period for 2029 the Site intersection and all related approaches are proposed to operate without any critical movements during both peak a.m. and p.m. hours (GHD, 2023h). The v/c ratios will increase to 0.47 LOS B during the peak a.m. hour and to 0.54 LOS A during the peak p.m. hour for background 2029 (GHD, 2023h). Additionally, under the future total period for 2029 the intersection will continue to operate at satisfactory levels with over all v/c ratios for peak a.m. and p.m. hours being 0.48 LOS B and 0.55 LOS A, respectively (GHD, 2023h).

Under the future background period for 2034 the Site intersection begins to operate with a critical approach in the southbound lanes during the peak a.m. hour and northbound through lanes during the peak p.m. hour (GHD, 2023h). The v/c ratios will increase to 0.55 LOS B during the peak a.m. hour and to 0.70 LOS A during the peak p.m. hour for background 2029 (GHD, 2023h). Additionally, under the future total period for 2034 the intersection will continue to operate at satisfactory levels with over all v/c ratios for peak a.m. and p.m. hours being 0.58 LOS B and 0.71 LOS A, respectively (GHD, 2023h). Although for the horizon total period for 2034, the southbound peak a.m. hour movement and the northbound peak p.m. hour movement will continue to operate at a critical level, with both movements operating at a theoretical capacity below a level of 1.0.

Overall, under both the 2029 and 2034 future background conditions all intersections will continue to operate with acceptable v/c ratios, delays, and queuing (GHD, 2023h). The 2029 future total conditions will see the same outcome as the 2029 future background conditions, with acceptable v/c ratios, delays, and queuing (GHD, 2023h). Alternatively, under the 2034 future total condition some interception movements will now be reported as critical including, the Bramalea Road and the full-moves site access/private access (GHD, 2023h).

Based on a signal warrant analysis completed based on the 2034 future total volumes, the traffic study concluded that traffic signals are not necessary for the intersection and that the Project can be accommodated on the existing road network (GHD, 2023h). The Project expansion will result in an increase of truck traffic, but there will be no changes to existing haul routes and the increased traffic is expected to be acceptable relative to local volumes of traffic (GHD, 2023f).

Trucks dropping off waste at the site are expected to complete their trips within the facility, from entry to exit, in approximately five minutes. This is due to a variety of current conditions and improvements made:

- Installing a ring road that allows trucks to quickly exit Bramalea Road and travel/queue around the facility;

- Providing at least 6 unloading bays for trucks on the tip floor;
- Using truck tippers to unload trucks faster and more efficiently than at present. A tipper is a platform that raises to empty a trailer. The truck backs in and detaches the trailer, the tipper tilts the trailer, and the load flows out. The tipper lowers, the truck reconnects the trailer and drives away.
    - Another advantage to the tipper is a truck can carry 35 t vs 32 t on a regular truck. The tipper truck doesn't need a walking floor, so the trailer is much lighter.

Based on the review of collision data obtained from the City along Bramalea Road between Derry Road and Steeles Avenue, the traffic assessment concluded that the proposed increase in truck traffic primarily along Bramalea Road between the Highway 407 interchange and the site access will not result in any significant decrease in safety or increase in collisions (GHD, 2023h).

Effect Characterization

Table 5-41 outlines the effects characterization for traffic burden. The affected population for traffic burden, including accidents and injuries, is on a proximate level. As noted in GHD's Traffic Assessment Report, the proposed expansion to the Emerald EFW facility is not expected to increase traffic to a point where operations of the study intersections would be unacceptable (2023h). However, marginal impacts on capacity issues at the Site access and the access to 7653-7639 Bramalea Road were identified due to the proposed expansion (GHD, 2023h). Therefore, the magnitude or severity of the effect on human health ranges from a few individuals experiencing effects to a wide range of individuals experiencing effects. Individuals who are required to commute locally through the Study Area during the peak traffic hours may be especially affected by increased traffic conditions, as increased traffic volumes will impact travel length and experience. The signalization of the intersection would mitigate large delays when turning onto Bramalea Road during peak hours (GHD, 2023h). Therefore, the effects on traffic previously mentioned may occur, although it is not certain. These effects are anticipated to diminish health and well-being if they were to occur. The effect characterization is based on data collected by GHD that is site-specific in nature, resulting in a medium to high level of confidence in these predictions.

Table 5-41: Effects Characterization for Traffic Burden

Criteria	Characterization
Affected populations	**Proximate**
Magnitude	**Low-Medium**
Likelihood	**Low-Medium**
Vulnerable Populations to be Considered	**Those who need to commute locally, and through the Study Area during peak hours**
Potential Health Consequence	**Neutral-Negative**
Level of Confidence	**Medium-High**

5.2.6. Social Cohesion

Health Linkages

Social cohesion refers to "the extent of connectedness and solidarity among groups in society" and is related to a sense of belonging in a community and relationships among community members (Manca, 2014). Social cohesion is an important indicator of health, as a lack of social support and increased social isolation has been shown to lead to poor physical and mental health (Stansfeld et al., 2006).

As indicated above in Section 0, large and expanding waste management facilities can be related to a high traffic burden or congestion, and as Putman (2000) has suggested, long commutes can reduce

community involvement. When travelers are spending increased time intervals commuting, it results in less time for outside activities, such as extracurriculars or community engagement (Putman, 2000). Social cohesion can also be negatively affected by high commute times due to decreasing participation in community activities. This can influence other community members to not participate due to the absence of their neighbours, thus creating a domino effect (Putman, 2000). Additionally, it has been shown that increased commuting times by car was associated with reduction in social participation (Mattison et al., 2015). Congestion and commuting can result in vehicles operating for longer periods of time and thus requiring increasing maintenance, which can lead to a decrease in available household funds for activity expenditures (US Department of Transportation, 2020), which can lead to increased social isolation and reduced social cohesion. However, positive economic benefits from projects, if of benefit to community members, can increase social cohesion.

In general the (planned) presence of an incineration plant, or even a waste management facility, can be perceived to be a potential risk by local residents (risk perception). Lima (1996) showed that risk perception can have an effect on the quality of life (health, environment, income) and mental well-being by introducing an element of uncertainty in the residential environment. This can reduce ones sense of belonging to one's community and impact social cohesion. However, according to van Dijk and others (2015), who conducted multiple biomonitoring programs around three waste incinerators in the Netherlands, the "*the predominantly positive results (no effect) from the biomonitoring programs during the past decade have contributed to less uncertainty concerning health effects by neighbouring farmers and residents*" (van Dijk et al., 2015, p. 50). Hence, open communication with the public and bringing transparency to potential effects related to EFW facility projects can reduce uncertainty for communities and increase social cohesion (see Section 6 for relevant Recommendations made).

Current Conditions

Regarding social cohesion in the study area, it was reported that 86% of Bramalea residents were happy to live in the neighbourhood (GHD, 2023c). During the time the Emerald facility has been operational in the area, no complaints regarding odour, noise, excessive traffic, or general nuisance have been received (correspondence with Emerald EFW). Hence, the facility has already been operating in the very same area for the last few decades without any noted social disruption or inconvenience and has not impacted social cohesion.

Project Impact

As the Project is an expansion within the current Site boundaries and requires no new acquisition of land, the primary impact to social cohesion could be a potential increase in truck traffic required to accommodate an increase in the facilities capacity. However, as seen in Section 5.2.5, and evaluated in the Traffic Assessment Report (GHD, 2023h), increased truck traffic will be adequately accommodated by the existing road network with no potential impacts to the socio-economic environment being anticipated (GHD, 2023c).

The proposed facility expansion will also not result in increased demand of community services or infrastructure in the study area (GHD, 2023c). The Project will ultimately result in positive financial impacts for the area as a result of increased employment and labour supply due to the construction and operations phases of the project (GHD, 2023c). Additionally, within the study area there are no predicted negative impacts related to recreation, cottaging, and tourism (GHD, 2023c).

In addition, the energy being produced by the facility will be going back to the Provincial grid and to local businesses such as Cascade (correspondence with Emerald EFW, December 2023). Each Phase of the project will generate 34 MW of electricity for 8,400 hours per year for a total of 285,600 MWh. An

Ontario home uses 9,500 kWh annually (9.5 MWh), so each Phase of the Project will support an equivalent of 30,000 homes (correspondence with Emerald EFW, December 2023) and support sustainability. In Phase I, 7.5 MW of electricity will be sent to Cascade, which will reduce the number of households served by about 6,600 homes. Hence, energy from the facility will be used to support both local business and households, and boost social cohesion. Moreover, during the four public open houses held by Emerald EFW during the course of preparation of this HIA report, members of the public registered their concerns related to the project, but strong opposition was not received.

Effect Characterization

Table 5-42 outlines the effects characterization for social cohesion. The affected population for social cohesion is regional, since social cohesion refers to the connectedness and relationships among community members and with the community. As noted in GHD's Land Use Assessment Report, the project expansion will not result in increased demand of community services or infrastructure in the study area (GHD, 2023c). Additionally, positive financial impacts are expected to occur in the area due to an increase in employment and labour supply from the construction and operations phases of the project (GHD, 2023c). Therefore, the magnitude of a potential positive effect on human health ranges from a few individuals experiencing effects to a wide range of individuals experiencing effects. However, social cohesion of those individuals who are uncertain of their approval of the Emerald EFW facility expansion may be impacted adversely as a result of the Project. The effect characterization is based on limited data collected by GHD that is site-specific in nature, resulting in a medium level of confidence in these predictions.

Table 5-42: Effects Characterization for Social Cohesion

Criteria	Characterization
Affected populations	**Regional**
Magnitude	**Low-Medium**
Likelihood	**Medium**
Vulnerable Populations to be Considered	**Those who are uncertain of their approval of the Emerald EFW facility expansion**
Potential Health Consequence	**Neutral-Positive**
Level of Confidence	**Medium**

5.2.7. Project Revenues

Health Linkages

A waste to energy facility, such as the Emerald EFW Facility, contributes to the concept of a circular economy. A circular economy can be defined as "retaining and recovering as much value as possible from resources by reusing, repairing, refurbishing, remanufacturing, repurposing, or recycling products and materials" (Government of Canada, 2022). This concept of a circular economy allows for innovations which can better both the environment and the economy (Government of Canada, 2022).

Tan et al. (2014) reported that in terms of both energy production and profit increment, incineration methods for waste to energy show the highest potential. Additionally, it has been shown that waste to energy facilities provide significant economic value in the communities in which they operate (Berenyi, 2013). These facilities provide such economic benefits by the revenue generated, by providing long-term employment, and by monetarily contributing to the local economy through the purchasing of local goods, services, and through fees and taxes payments (Berenyi, 2013).

Current Conditions

The Emerald EFW Facility produces both electricity and saturated steam, which is utilized to supply their facility and operations with any net electricity produced being fed into the Ontario grid (correspondence with Emerald EFW, December 2023).

Project Impact

Although it is difficult to estimate the additional revenue that would be generated from the proposed expansion for the municipality from property taxes, the business will be doubling in size in Phase 1 and Phase 2 of the project and Phase 3 will result in additional growth by 50% (correspondence with Emerald EFW, December 2023). This would take the business from processing 150k tonnes per year to 300k tonnes per year to 600k tonnes per year to 900k tonnes per year by the end of Phase 3 (correspondence with Emerald EFW, December 2023). Property taxes could at least triple over this period, resulting in additional revenue being generated for the municipality (correspondence with Emerald EFW, December 2023). The anticipated cost for facility maintenance is $3 million annually. The additional revenue from increased property taxes that would flow to the municipality could boost access to services and amenities in the area and positively impact health and wellbeing of community members.

Hence, there are predicted positive financial impacts to the area (economic base, job creation, labour supply).

Effect Characterization

Table 5-43 outlines the effects characterization for project revenues. The affected population is regional, as increased property taxes paid by Emerald EFW would be beneficial to the municipality. Positive financial impacts are expected to occur in the area due to an increase in employment and labour supply from the construction and operations phases of the project (GHD, 2023c). Therefore, the magnitude of the positive effect on human health ranges from a few individuals experiencing effects to a wide range of individuals experiencing effects. However, for those individuals from lower socioeconomic households, or marginalized members of the community, and those without an agency to voice their concerns may not experience the positive effects related to increased project revenues, as these individuals already experience disproportionate levels of access (i.e., poorer access) to local services and amenities. The effect characterization is based on site-specific data provided by Emerald EFW, resulting in a medium-high level of confidence in these predictions.

Table 5-43: Effects Characterization for Project Revenues

Criteria	Characterization
Affected populations	**Regional**
Magnitude	**Medium**
Likelihood	**High**
Vulnerable Populations to be Considered	**Lower socioeconomic households and marginalized members of the community, and those without an agency to voice their concerns**
Potential Health Consequence	**Positive**
Level of Confidence	**Medium-High**

5.2.8. Employment

Health Linkages

Health and wellbeing of individuals are greatly influenced by ones' income and employment. Greenwood & Leeuw (2012) found that in general, higher income is associated with a better health status, and that the reverse is also accurate, whereas lower income is associated with a lower health status. As such, income and employment/occupation can be indicators of overall health and wellbeing.

A randomized household survey of adults in six low resource communities in Connecticut, United States, showed that individuals who were working on a full-time basis exhibited the least detrimental psychological factors and health behaviours, including experiencing the lowest levels of stress and depression, engaging in the healthiest eating habits and the least unhealthy ones, participating in the highest amount of physical activity, and having the lowest rates of smoking and drinking (Rosenthal et al., 2012). The individuals who were employed part-time were situated in the intermediate range, while those who were unemployed were positioned at the unfavourable extreme in terms of psychological and behavioural aspects (Rosenthal et al., 2012). The presence of stress played a substantial role in the connections between full-time employment and the frequency of engaging in unhealthy food and physical activity, as well as in health behaviours (Rosenthal et al., 2012). Hence, the type of employment obtained makes a difference in the resulting health impacts.

Waste to energy facilities, like the Emerald EFW Facility, and other renewable energy facilities are known for stimulating employment and creating opportunities for new employment (Cucciella et al., 2014). For example, it has been reported by the European Renewable Energy Council that the renewable energy sector will employ greater than 2.7 million people in 2020 and will grow to 4.4 million in 2023 (Cucciella et al., 2014). Additionally, a typical EFW facility with a processing capacity of approximately 2,500 tons per day can create around 600 full-time permanents jobs (Castaldi, 2021).

The expansion of the Emerald EFW Facility will result in an uptick of employment related to that facility as there will be an increased need for workers to accommodate for the expansion. Additionally, the waste management field requires both skilled and unskilled employees resulting in a diversity of employment opportunities (Cucciella et al., 2014).

Current Conditions

As shown in Section 5.1.3.3 in Table 5-10 unemployment rates from 2021 range from 14% (i.e., Brampton Center and the Regional Municipality of Peel) to 13% (i.e., City of Brampton), with women (i.e., 16% to 17%) in all locations having higher unemployment rates when compared to men (i.e., 11% to 12%). Additionally, unemployment rates have increased from 2016 (i.e., 8.2% to 8.3%) to 2021 (i.e., 13% to 14%) in Brampton Centre and the City of Brampton, as well as more widely in the Region of Peel and Ontario as a whole. Brampton Centre also has the lowest attainment rate for postsecondary certificates, diplomas, or degrees, as compared to the City of Brampton, the Region of Peel and the Province as a whole (Table 5-8).

As shown in Table 5-11, the top three areas of the labour force which individuals in Brampton Center occupy include business, finance, and administration occupations, sales and service occupations, and occupations in the trades, transport, and equipment operations. The Emerald EFW facility would provide employment opportunities in several of these areas. Currently, Emerald EFW employs 43 people full time, and has no part time jobs. All current employment at the Emerald facility is full time, with pensions and benefits.

Project Impact

The expansion of the facility is predicted to create jobs directly and indirectly, from both the construction and operation phases of the Project (GHD, 2023c). Jobs related to the proposed facility would include jobs related to construction, operation, suppliers, and maintenance (GHD, 2023c). As 23.3% (Table 5-11) of individuals in Brampton Center have occupations related to the trades, transport, and equipment operations the jobs created by the proposed facility could be directly applicable and of interest to many people in the area.

In correspondence with Emerald EFW (December 2023), it was identified that construction costs for the expansion are anticipated to be $450 million over 18-24 months in each Phase of the project. It is the aim of Emerald EFW that, as much as feasible, materials and workers will be sourced from the Region. Workers will be hired from local union halls as much as possible, and recruiters will only look outside the Region when needs cannot be met locally (correspondence with Emerald EFW, December 2023). During Phase 1, Emerald expects to employ 35 individuals in full time equivalents (FTE's) positions, including:

- 14 managers,
- 18 skilled trades positions, and
- three (3) unskilled trades (i.e., loader operators) positions.

Phase 2 is expected to employ 48 people, total, which would include:

- 17 managers,
- 27 skilled trades positions, and
- four (4) unskilled trades positions.

This would increase to 60 individuals full-time total during Phase 3 of the project including:

- 19 managers,
- 36 skilled trades, and
- five (5) unskilled trades.

The positions available will all be full time with pensions and benefits. Employment opportunities will also remain available from the use of waste vehicles, with the difference being drivers would route themselves to the EFW facility rather than remote landfills. Emerald's policy is to hire locally from the community where possible, to ensure that employees remain committed to both the business and community (correspondence with Emerald EFW, December 2023). An apprenticeship program will be available to transition unskilled workers to skilled workers. This blend between the union and a formal agreement with the province already has three (3) employees currently going through the program (correspondence with Emerald EFW, December 2023). There is expected to be $2.2 million in labour hours over the course of the expansion. Each Phase of the project is expected to generate about 1,250 FTEs based on a labour spend of $225 million, and an FTE using $100 per hour (anticipated pay for trades) and 1,800 hours per year (correspondence with Emerald EFW, December 2023). With an annual wage of $85,000 (anticipated pay for skilled trades), the FTE would rise to 2,650 per phase (correspondence with Emerald EFW, December 2023).

Effect Characterization

Table 5-44 outlines the effects characterization for employment. Those living in proximity to the facility as well as in the Region of Peel more broadly, can benefit from the jobs created directly and indirectly

due to the facility expansion. As noted in GHD's Land Use Assessment Report, jobs related to construction, operation, suppliers, and maintenance could become available (GHD, 2023c). Therefore, the magnitude of the effect on human health ranges from a few individuals experiencing effects to a wide range of individuals experiencing effects, depending on whether they are able to take advantage of employment opportunities arising directly or indirectly due to the Project. Individuals from lower socioeconomic households, marginalized members of the community, and those with disabilities may experience barriers to taking advantage of the employment opportunities. These employment opportunities are anticipated to improve health and well-being in the area. The effect characterization is based on site-specific data provided by Emerald EFW, resulting in a medium to high level of confidence in these predictions.

Table 5-44: Effects Characterization for Employment

Criteria	Characterization
Affected populations	**Proximate-Regional**
Magnitude	**Low-Medium**
Likelihood	**High**
Vulnerable Populations to be Considered	**Lower socioeconomic households, marginalized members of the community, individuals with disabilities**
Potential Health Consequence	**Positive**
Level of Confidence	**Medium-High**

6. Recommendations

The baseline health assessment (Section 5), along with the assessment of potential health impacts in the HIA (Section 6), provided the foundation for the development of recommendations in order to maintain, protect and improve the community`s health and wellbeing, as it relates to the proposed Project. The baseline health profile demonstrated that compared to the City of Brampton, Peel, and Ontario, both households and individuals in Brampton Center have lower median incomes. Additionally, Brampton Centre has the highest rates of low-income prevalence in all age groups when compared to the City of Brampton and the Region of Peel. The suggested recommendations in Table 6-1 below take into consideration these baseline health conditions.

The HIA was conducted using a scenario that assumes that the mitigation measures described in the Environmental Screening Process are in place, and therefore, only assesses the potential for residual health effects, which can be managed through targeted recommendations designed to be feasible and effective. Hence, the following recommendations have been made based on the assessment of determinants of health in the HIA, and have been categorized as either:

- recommendations exclusively from the HIA, or
- measures currently being implemented or proposed by environmental studies conducted as part of the Environmental Screening Process (i.e., from the air quality assessment, noise assessment, traffic assessment, surface water assessment, etc.) and re-emphasized for the continued protection of community health and wellbeing (Table 6-1):

Table 6-1: Recommendations Based on Results of HIA				
No.	**Determinant of health assessed**	**Mitigation strategies recommended by environmental studies**	**Recommended measures based on results of the HIA**	**Responsible or Contributing Organization for HIA Recommendations**
1a	Air quality – Emissions	• Monitoring data, particularly data from continuous emissions monitoring of criteria air contaminants like NOx and PM2.5, should be made publicly available to increase transparency for the surrounding community to demonstrate that the Emerald Facility, post-expansion, continues to operate with state-of-the-art technology which minimizes its impacts on the environment and maximizes the benefits to the surrounding community. • Consider what further operational enhancements could be made to minimize the emissions of NOx, $PM_{2.5}$, and dioxins/furans given existing elevated regional background conditions within the Study Area • Potentially reduce GHG emissions from truck transportation. Reduced truck distance and trips to Emerald compared to landfills. • Avoid CH_4 Emissions generated from the Landfill Operations by diverting waste from landfills.	• Mitigation measures from the Human Health Risk Assessment are re-emphasized from a human health standpoint. • Routine monitoring of levels of criteria air contaminants, and sharing the results with the community via a monitoring report.	• Emerald EFW Inc. • Emerald EFW Inc.
1b	Air quality – Odour	• Once operational, the Facility will implement, as appropriate, fugitive dust and odour management plans (see Section 8.3 and 8.4 of the ESR for detailed management plans) to ensure that the emissions of these contaminants are well controlled within the daily operations at the Site.	• Continue using best practices, including optimal incineration techniques, to manage odours. • Continue to provide the community with means to report any odour issues and record any odour complaints in an annual monitoring report. Resolve any potential odour issues promptly.	• Emerald EFW Inc. • Emerald EFW Inc.

Table 6-1: Recommendations Based on Results of HIA				
No.	**Determinant of health assessed**	**Mitigation strategies recommended by environmental studies**	**Recommended measures based on results of the HIA**	**Responsible or Contributing Organization for HIA Recommendations**
		• Combustion air will be taken from the waste bunker to avoid odour from this area of the plant.		
2	Water Quality	• The following mitigation measures are reported in the Surface Water Assessment Report (GHD, 2023f) and briefly referenced here: use of oil and grit separators; implementing a stormwater conveyance system; stormwater storage (pond, pipe and underground cells, as needed); use of Bioswale/ Bioretention; use of Rainwater Re-use Tanks to prevent downstream stream erosion; and use to erosion and sediment control Best Management Practices. • The following mitigation measures were noted in the Geology and Hydrogeology Assessment (GHD, 2023g) and briefly highlighted here: The location, design, and construction of the stormwater management controls would be completed in accordance with best practices and MECP guidelines as described in Section 5.2.2. of the Report; additional construction measures to enhance infiltration and evapotranspiration could be required to meet required guidelines; implementation of appropriate stormwater management controls; routine training of staff in spill prevention, response and containment; proper handling and storage of fuel on site; training of operations staff in appropriate tasks related to security, operations, management, record keeping and environmental monitoring;	• Mitigation measures from the Surface Water Assessment and the Geology and Hydrogeology Assessment are re-emphasized from a human health standpoint. • Routine monitoring of water quality, including at sensitive downstream receptors, and sharing the results with the community via an annual monitoring report.	• Emerald EFW Inc.

Table 6-1: Recommendations Based on Results of HIA

No.	Determinant of health assessed	Mitigation strategies recommended by environmental studies	Recommended measures based on results of the HIA	Responsible or Contributing Organization for HIA Recommendations
		use of Best Management Practices to mitigate potential contaminant source impacts also include paving of traffic surfaces to limit infiltration.		
3	Noise levels	• Section 6.1 of the Noise Assessment Report (GHD, 2023i) provides a list of detailed recommended mitigation measures for construction-related noise impacts, as needed.	• Mitigation measures from the Noise Assessment are re-emphasized from a human health standpoint. • Address noise complaints if they occur, especially during the construction phase of the facility expansion. • Continue to provide the community with means to report any noise issues and record any complaints in an annual monitoring report. Resolve any potential noise issues promptly.	• Emerald EFW Inc. • Emerald EFW Inc. • Emerald EFW Inc.
4	Agriculture	• Potential construction-related negative environmental effects associated with dust, noise and traffic for land uses within 500 m of the proposed EFW Facility will be mitigated through the use of best management practices. • Once operational, the Facility will implement, as appropriate, fugitive dust management plans to ensure that the emissions of these contaminants are well controlled within the daily operations at the Site.	None	•
5	Traffic	• Signalization of the Bramalea Rd and Site access/Private Road intersection to mitigate the delays of critical movements for the eastbound and westbound left turn onto Bramalea Road during the a.m. and p.m. peak hours (as described in the Traffic Assessment Report (GHD, 2023h).	• Continue to provide the community with means to report any traffic issues and record any complaints in an annual monitoring report. Resolve any potential traffic issues promptly.	• Emerald EFW Inc. • City of Brampton

Table 6-1: Recommendations Based on Results of HIA

No.	Determinant of health assessed	Mitigation strategies recommended by environmental studies	Recommended measures based on results of the HIA	Responsible or Contributing Organization for HIA Recommendations
			• Regularly monitor traffic at the intersection in question to identify patterns of heavy traffic and mitigate as necessary.	
6	Social cohesion	None	• Provide regular community updates (quarterly or monthly, as appropriate) regarding expansion activities and performance of the facility, in a publicly accessible style and format to maintain and transparent relationship with the community and open lines of communication. • Continue the Emerald Public Liaison Committee, which has a mandate to provide community feedback on the operation of Emerald's energy from waste facility.	• Emerald EFW Inc.
7	Project Revenues	None	• Municipal revenues collected by the municipality due to increased property taxes paid by Emerald EFW Inc. should be prioritized to increase access to services for residents of Brampton Centre, on a service currently lacking in the community.	• City of Brampton
8	Employment	Measures to enhance potential positive effects: • It is Emerald's policy to hire locally from the community where possible. • An apprenticeship program will be available to transition unskilled workers to skilled workers.	Measures to enhance potential positive effects: • It is strongly recommended that Brampton Centre, City of Brampton and Region of Peel residents be given priority to employment opportunities arising due to the facility expansion. • Reasonable worker accommodations should be made available, where possible, to enable individuals with disabilities to gain employment. • Communicate using the company's website that Emerald EFW Inc. will continue to offer training opportunities to Brampton Centre residents to	• Emerald EFW Inc. • Emerald EFW Inc. • Emerald EFW Inc.

Table 6-1: Recommendations Based on Results of HIA				
No.	**Determinant of health assessed**	**Mitigation strategies recommended by environmental studies**	**Recommended measures based on results of the HIA**	**Responsible or Contributing Organization for HIA Recommendations**
			enable them to take advantage of job opportunities at the Emerald EFW facility.	

7. Limitations and Uncertainties

The following data gaps, limitations and uncertainties were noted as part of the HIA process:

- Data specific to Brampton Centre was not always available, especially data on current overall health and mental health status, and burden of disease. In the absence of Brampton Centre-specific health status data, information and data for Peel Region Public Health Unit was used. As such, it stands to reason that there may be differences in health status between the bigger area of Peel and Brampton Centre.
- This HIA is not a comprehensive health assessment and was not undertaken in direct consultation with relevant stakeholders and community interest groups, involving primary collection of data. As such, only the topics of most concern, as noted by Region of Peel stakeholders, and from human health-related comments received from four public open houses, were assessed. However, the scope of the HIA was prepared in collaboration with the Region of Peel.
- Data for this HIA was mainly supplied by the various environmental studies conducted as part of the Environmental Screening Process, as well as from peer-reviewed and reputable grey literatures. The HIA itself does not provide a quantitative assessment of the impacts to health, but rather uses the quantitative data from the Environmental Screening Process to qualitatively assess how the selected determinants of health would be impacted due to the Emerald EFW project.
- As mentioned above, the HIA relied on data and information from the Environmental Screening Process; therefore, this assessment is subject to the same uncertainties, limitations and assumptions as this process.

8. Conclusions

The purpose of this HIA was to evaluate the potential impacts of the expansion of the Emerald EFW facility as evaluated in the Environmental Screening Process, on the health and wellbeing of the community surrounding the facility. The HIA complements the findings of the human health risk assessment conducted on air quality impacts. During the process of the HIA, few additional measures were identified to reduce potential harmful effects and to enhance potential positive effects. The HIA also served as a platform to enhance communication with the local community and address local community concerns with respect to health, via means of public open houses.

Table 8-1 below provides an overall summary of the results of the HIA for each of the evaluated determinants of health. The majority of the determinants of health assessed indicated no substantial effects on health due to the Project.

Table 8-1: Health Impact Assessment – Summary of Results						
Determinant of Health	**Geographic Extent**	**Vulnerable Populations**	**Magnitude**	**Likelihood**	**Potential Health Consequence**	**Level of Confidence**
Air Quality						
Emissions (including traffic-related)	Regional	Children; elderly; chronically ill individuals; asthmatics; those with heart disease; immunocompromised.	Low	Low	Neutral-Negative	Medium-High
Odour	Proximate	Individuals sensitive to odours.	Negligible	Low	Neutral	Medium-High
Water Quality						
Surface water	Regional	None.	Negligible	Low	Neutral	Medium-High
Groundwater	Regional	Children under 5 years, who are more vulnerable to drinking water quality issues.	Negligible	Low	Neutral	Medium-High
Noise						
Noise levels	Proximate – during construction phases	Nearby residents, children, elderly.	Negligible – Low (during construction phases)	Medium – during construction phases	Neutral	Medium-High
Agriculture						
Impacts to agricultural activities or agricultural lands	Proximate	None	Negligible	Low	Neutral	Medium-High
Traffic burden						
Congestion, including accidents and injuries	Proximate	Those who need to commute locally, and around the study area during peak traffic hours.	Low-Medium	Low-Medium	Neutral-Negative	Medium-High
Social Cohesion						
Connectedness and sense of belonging to community	Regional	Those who are distrusting of the Emerald EFW facility expansion and feel it will have a negative health impact on them.	Low-Medium	Medium	Neutral-Positive	Low-Medium
Project Revenues						

Table 8-1: Health Impact Assessment – Summary of Results						
Determinant of Health	**Geographic Extent**	**Vulnerable Populations**	**Magnitude**	**Likelihood**	**Potential Health Consequence**	**Level of Confidence**
Contribution to the local economy and the municipality	Regional	Lower socioeconomic households and marginalized members of the community, and those without an agency to voice their concerns.	Medium	High	Positive	Medium-High
Employment						
Employment opportunities	Proximate-Regional	Lower socioeconomic households, marginalized members of the community, and those with disabilities.	Low-Medium	High	Positive	Medium-High

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Appendix 1: HIA Scoping Report for the Health Impact Assessment (HIA) of the Emerald Energy from Waste (EFW) Facility Expansion Project

BACKGROUND

This Health Impact Assessment (HIA) Scoping Report for the Emerald Energy From Waste (EFW) Inc. (Emerald) Facility Expansion Project was prepared following a Scoping Workshop held with the Region of Peel on June 27, 2023. A Scoping Tool was used during the scoping workshop, and this report summarizes the information that was collected via the Scoping Tool.

INTRODUCTION

Emerald has initiated an Environmental Screening and ECA Amendment Approval process for a Proposed Facility which would be an expansion of the current Emerald EFW Facility. Emerald is the proponent for this proposed project, and the HIA is being conducted by Intrinsik on their behalf as part of the Environmental Screening Process for a proposed expansion of the existing Emerald EFW facility located at the intersection of Highway 407 and Bramalea Road in Brampton, Ontario ("the Project"). Other studies, including air quality, socio-economic, noise, traffic, land use, natural environment, etc. will inform the Environmental Screening Process and the HIA. The aim of the HIA is to identify both, potential positive and negative impacts to human health due to the proposed project, as well as the distribution of the impacts, and provide recommendations to mitigate potential negative impacts to health and enhance any potential positive impacts. the HIA also provides a valuable platform to listen to and address stakeholder concerns.

HIA SCOPING STEP

'Scoping' is the second step in the HIA process. During the scoping step, we:

- Identify data and information that will be collected in other streams of the Environmental Screening Process, or from the available scientific/regulatory literature;
- Identify existing sensitive populations;
- Identify and engage relevant stakeholders, like local public health departments;
- Identify available information to prepare a profile of current baseline health conditions in the study area;
- Identify the determinants of health to be included in the HIA; and
- Document findings in the HIA Report.

SUMMARY OF DISCUSSION DURING THE HIA SCOPING WORKSHOP

1. **Identifying Sources of Information for Preparation of a Baseline Health Profile**

Component	Information to be Considered	Note
What is the current baseline health profile in the study area?	Collect and include publicly available statistical health-related data most relevant to the study area, which could include but not limited to: • Socio-demographic profile; and • Prevalence of respiratory ailments such as asthma; • Overall burden of disease, including heart disease, diabetes, childhood and adult obesity, cancer and mental health disorders. • Income and employment • Level of education • Housing Information at the level of Ward 7 is available from 2016, and sociodemographic (but not health) information is available for Brampton Centre.	A baseline health profile can be provided at a community level and utilize available data from Statistics Canada, local public health unit, or other publicly available open data sources.

Feedback received from workshop participants:

- Complete a comparison of the latest data (i.e., 2021) to previous census data (i.e., 2016), where applicable, for indicators related to employment (i.e., employment, unemployment, participation rate).
- Review multi-year data for the purpose of examining trends over time, where applicable.
- Include most updated information related to diabetes for the City of Brampton, including the following sources:
    - Stats Can Health Characteristics, for 2021
    - Peel Public Health: Health Status Data - - Region of Peel (peelregion.ca)
- Highlighted information to be considered:
    - Provide a socio-demographic profile that is more detailed (e.g., age groups, young population vs. old population, family composition).
    - Include information related to income levels, education levels, immigrant status, ethnic origin, language.
    - Include more detailed information related to employment (e.g., type of employment, how the employment type may affect individual health).
    - Review information related to COVID-19 data and impacts.
        - Review weekly reports & municipality dashboards which provide an analysis of individual areas/locations.
        - Complete a comparison of the latest data (i.e., 2021) to pre-COVID (i.e., 2016), where applicable.
        - Review information related to Long COVID-19.
    - Include information related to birth rates and mortality rates.
    - Expand upon information included in burden of disease sections (i.e., hospitalization rates, amount of emergency visits, etc.,).
        - Review if above information is available at a narrower geographical level.
        - Intrinsik to supply parameters (i.e., years, data fields) so a data request to the Health Department can be make:

- If the following information is available at the level of "Brampton Center" or the City of Brampton for a more recent time frame (i.e., 2021) would it be possible for it to be provided to Intrinsik?
    - Birth rate;
    - All-cause mortality;
    - Burden of disease (e.g., arthritis, diabetes, asthma, COPD, high blood pressure, and mood disorders);
    - Percentage of overweight/obesity;
    - Emergency department visits (all injuries); and
    - Hospitalizations for all injuries.

Additional information/data sources to be considered:

- Peel Public Health: Health Status Data - - Region of Peel (peelregion.ca)
- Climate Change and Health Vulnerability Report (available in 6 – 8 weeks)
- COVID-19 weekly reports & municipality dashboards

2. <u>The Social Determinants of Health to be Assessed in the HIA</u>

Component	Information to be Considered	Note
Would project-related impacts further burden or improve the local community?	List anticipated project impacts to study area, including but not limited to: • Air quality (chemical pollutants, particulate matter, truck emissions, etc.) and GHG emissions • Water quality (groundwater and surface water) • Noise levels • Accidents and Injuries (from increased truck traffic) • Odours • Social Cohesion • Project Revenues • Employment • Agriculture Review recorded concerns from stakeholders about the project and about their health to ensure these are adequately considered in the HIA.	Identify the potential positive and negative health impacts due to the proposed project.

Feedback received from workshop participants on additional information to be considered:

Determinant of Health	Potential health effect	Population that may be affected
Public transit access	Benefits of active transportation (i.e., walkscores).	Individuals who gained employment directly or indirectly due to expansion, who may now require access to public transit.
Traffic burden	Long haul traffic (traffic volume impacts and/or transit distances).	
Transportation	Safety, operations, capacity, route alteration.	

3. <u>Other Overall Considerations</u>

Additional questions from HIA Project Team:

- What are some key points to keep in mind when doing the assessment (e.g., consult key stakeholders)?
- What are some data sources to be included?
- Is there information / data that is not publicly available, but would help inform the HIA?

Feedback received from workshop participants:

- For the planned public information meeting in July, will information related to the HIA be included?
  - Some information related to other disciplines will be presented at the meeting. Further information to come.
- Inclusion of additional languages when presenting an executive summary.
  - As it can be beneficial to provide the executive summary and/or factsheet in the top 5 to 10 languages that are commonly spoken in the area of interest.
- Vulnerable populations and/or subgroups to include when possible:
  - Older adults;
  - Racialized individuals;
  - New immigrants;
  - Children;
  - Women of child bearing age.

Appendix B.12

Human Health Risk Assessment Report (Revised November 2024)

SCIENCE INTEGRITY KNOWLEDGE



EMERALD EFW EXPANSION ENVIRONMENTAL SCREENING PROCESS

HUMAN HEALTH RISK ASSESSMENT (HHRA) REPORT

REVISED FINAL REPORT

November 4, 2024

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EMERALD EFW EXPANSION ENVIRONMENTAL SCREENING PROCESS
HUMAN HEALTH RISK ASSESSMENT (HHRA) REPORT

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EMERALD EFW EXPANSION ENVIRONMENTAL SCREENING PROCESS
HUMAN HEALTH RISK ASSESSMENT (HHRA) REPORT

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LIST OF ABBREVIATIONS

AAMP	Ambient Air Monitoring Program
AAQC	Ambient Air Quality Criteria
ADI	Acceptable Daily Intake
APC	Air Pollution Control
ATSDR	Agency for Toxic Substances and Disease Registry
CACs	Criteria Air Contaminants
Cal EPA	California Environmental Protection Agency
CCME	Canadian Council of Ministers of the Environment
COC	Chemical of Concern
CR	Concentration Ratio
CSM	Conceptual Site Model
EA	Environmental Assessment
ECA	Environmental Compliance Approval
EFW	Energy from waste
EPC	Exposure Point Concentration
TEF	Toxic Equivalency Factor
HHRA	Human Health Risk Assessment
HIA	Health Impact Assessment
HQ	Hazard Quotient
ILCR	Incremental Lifetime Cancer Risk
LADD	Lifetime Average Daily Dose
MECP	Ontario Ministry of the Environment, Conservation and Parks
MPOI	Maximum Point of Impingement
MSW	Municipal solid waste
NAAQO	National Ambient Air Quality Objective
NOAEL	No Observable Adverse Effect Level
PACs	Priority Air Contaminants
PAH	Polycyclic Aromatic Hydrocarbon
PEQ	Potency Equivalence Factors
PM	Particulate Matter
RfC	Reference Concentration
RfD	Reference Dose
TCDD-TEQ	Tetrachlorodibenzo-*p*-dioxin Toxic Equivalencies
TCEQ	Texas Commission on Environmental Quality
TDI	Tolerable Daily Intake
TEQ	Toxicity Equivalence Factors
TRV	Toxicological Reference Value
UR	Unit Risk
US EPA	United States Environmental Protection Agency
WHO	World Health Organization

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HUMAN HEALTH RISK ASSESSMENT (HHRA) REPORT

EXECUTIVE SUMMARY

Intrinsik Corp. (Intrinsik) has been requested by GHD on behalf of Emerald Energy From Waste (EFW) Inc. (Emerald) to conduct a Human Health Risk Assessment (HHRA) and a Health Impact Assessment (HIA) as part of an Environmental Screening Process for a proposed expansion of the existing Emerald EFW facility located at the intersection of Highway 407 and Bramalea Road in Brampton, Ontario ("the Project"). The authors of this report have made every effort to make the HHRA as stand-alone as possible to provide as much relevant detail as they could, it is not possible to integrate all the details from the Air Quality study reports into the HHRA. As such, this HHRA, given its primarily focussed on the inhalation pathway due to the nature of facility emissions and the EA itself, should be read in conjunction with the Air Quality Impact Assessment report (GHD, 2024c) and the Revised Background Ambient Air Quality Assessment Report (GHD, 2024b).

The existing facility recovers thermal energy from solid non-hazardous waste from municipal solid waste (MSW) and industrial, commercial and institutional (IC&I) sources, with the recovered thermal energy being converted to electricity and steam. Emerald is proposing an expansion of the existing facility which would permit it to process up to 900,000 tonnes per year from the current 182,000 tonnes per year with same technology that has been demonstrated to be effective based on 25 years of emissions testing results that meet or are better than Provincial standards. The expanded capacity will be achieved through the addition of new processing units and potentially rehabilitating some existing processing units.

To address potential concerns raised at public meetings with respect to potential human health impacts related to the proposed expansion, each of the expansion phases were evaluated using the HHRA approach as part of a broader HIA framework. A key element of the proposed HIA was a quantitative evaluation of health risks related to potential exposures to chemicals released as part of standard operations expected during each of the three proposed facility expansion scenarios. The quantification of potential chemical health risks was conducted through the use of the HHRA paradigm.

This report provides detailed methodology and reports on the results of the HHRA based on a comparison of predicted health impacts for each of the phases of the proposed expansion of the Emerald EFW facility. Predicted emissions from the discrete phases were also "added" to the existing background air quality conditions to get a sense of the cumulative risks for each alternative within the Study Area. These two points of reference were used to provide context to aid in the interpretation of the results.

The HHRA was conducted according to widely accepted risk assessment methodologies and guidance documents published and endorsed by regulatory agencies including the Ontario Ministry of the Environment and Climate Change (MOE 2005; 2011), Health Canada (2009; 2010; 2021a) and the United States Environmental Protection Agency (US EPA, 2005). Intrinsik also consulted with Peel Public Health at the initial stages of the development of this HHRA.

To assess potential risks related to the projected emissions from the on-site emission sources, the project team selected key sensitive locations representative of the surrounding community. Given the land uses in the surrounding area, a mix of residential and community receptors were evaluated as the likely worst-case receptors (*i.e.*, residents are present at a home potentially 24-

hours per day, 7-days per week, and some of the community park locations are at very close proximity to the Facility). The HHRA focused on evaluation of the closest community and residential receptor locations to evaluate potential health risks related to emissions from each of the three proposed expansion phases. These locations represented the locations within the Study Area which received the worst-case contribution from facility emissions.

While the focus of the assessment was on inhalation exposures, the potential deposition of certain chemicals of concern was evaluated to determine if modelled emissions over the lifetime of the Facility would impact soil quality in the Study Area. The results of this evaluation indicated that facility emissions would have a negligible impact on soil quality.

The results of the inhalation assessment indicate that emissions from the Emerald Facility under all proposed expansion phases would not result in a significantly elevated health risk to the surrounding community. There is a small possibility of an individual with asthma potentially having an asthmatic event if they happen to be exercising at the nearby Sportpark during worst-case meteorological conditions (typically a declared “bad air day”). However, the probability of such an occurrence is very low (<1% under worst-case conditions).

Finally, mixture risks for the acute respiratory irritant mixture group exceeded the benchmark indicating potential risks arising from cumulative exposures to chemicals in this like-acting group. However, the cumulative risk for this mixture group is being driven by worst-case regional ambient concentrations of NO_x and $PM_{2.5}$, with very little contribution from predicted facility emissions in each of the expansion phases. Similarly, mixture risks for the chronic developmental toxicants mixture group marginally exceed the benchmark indicating potential risks arising from cumulative exposures to chemicals in this like-acting group. However, the cumulative risk for this mixture group is being driven by worst-case regional ambient concentrations of dioxins/furans, with negligible contributions from predicted facility emissions in each of the expansion phases.

Based on these conclusions, it is recommended that Emerald EFW consider what further operational enhancements could be made to minimize emissions of NOx, $PM_{2.5}$, and dioxins and furans given existing elevated regional background conditions within the Study Area. It is also recommended that monitoring data, particularly data from continuous emissions monitoring of criteria air contaminants like NO_x and $PM_{2.5}$, be made publicly available to increase transparency for the surrounding community to demonstrate that the Emerald Facility, post-expansion, continues to operate with state-of-the-art technology which minimizes its impact on the environment and maximizes the benefits to the surrounding community.

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1.0 INTRODUCTION

Intrinsik Corp. (Intrinsik) has been requested by GHD on behalf of Emerald Energy From Waste (EFW) Inc. (Emerald) to conduct a Human Health Risk Assessment (HHRA) and a Health Impact Assessment (HIA) as part of an Environmental Screening Process for a proposed expansion of the existing Emerald EFW facility located at the intersection of Highway 407 and Bramalea Road in Brampton, Ontario ("the Project"). The authors of this report have made every effort to make the HHRA as stand-alone as possible to provide as much relevant detail as they could, it is not possible to integrate all the details from the Air Quality study reports into the HHRA. As such, this HHRA, given its primarily focussed on the inhalation pathway due to the nature of facility emissions and the EA itself, should be read in conjunction with the Air Quality Impact Assessment report (GHD, 2024c) and the Revised Background Ambient Air Quality Assessment Report (GHD, 2024b).

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To address potential concerns raised at public meetings with respect to potential human health impacts related to the proposed expansion, each of the three expansion phases were evaluated using the HHRA approach as part of a broader HIA framework. A key element of the proposed HIA was a quantitative evaluation of health risks related to potential exposures to chemicals released as part of standard operations expected during each of the three proposed facility expansion scenarios. As such, the quantification of potential chemical health risks was conducted through the use of the HHRA paradigm.

This report provides the detailed methodology and results of the HHRA based on a comparison of predicted health impacts for each of the phases of the proposed expansion of the Emerald EFW facility. Predicted emissions from each discrete phase were also "added" to the existing background air quality conditions to get a sense of the cumulative risks arising from emissions of each expansion phase alternative. These two points of reference were used to provide context to aid in the interpretation of the results.

The HHRA was conducted according to widely accepted risk assessment methodologies and guidance documents published and endorsed by regulatory agencies including the Ontario Ministry of the Environment, Conservation and Parks (MOE 2005; 2011), Health Canada (2010; 2021a), and the United States Environmental Protection Agency (US EPA, 2005). Intrinsik also consulted with Peel Public Health at the initial stages of the methodology development of this HHRA.

2.0 REVIEW OF STUDY METHODOLOGY AND ANALYSIS

2.1 Risk Assessment Framework

In general, a human health risk assessment, or HHRA, is a scientific study that evaluates the potential for the occurrence of adverse health effects from exposures of people (receptors) to chemicals of concern (COCs) present in surrounding environmental media (*e.g.*, air, soil, sediment, surface water, groundwater, food, *etc*.), under existing or predicted exposure conditions. HHRA procedures are based on the fundamental dose-response principle of toxicology. The response of an individual to a chemical exposure typically increases in proportion to the chemical concentration in critical target tissues where adverse effects may occur. The concentrations of chemicals in the target tissues (the dose) are determined by the degree of exposure, which is proportional to the chemical concentrations in the environment where the receptor resides, works or visits.

All chemicals (anthropogenic and natural) have the potential to cause effects in people and the ecosystem. However, it is the ability of a receptor to be exposed to an elevated chemical concentration and the inherent toxicity of the chemical that determines the level of effect and potential for unacceptable risk to the exposed receptor. As illustrated in the diagram to the right, if all three components are present (*i.e.,* where the three circles intersect), the possibility of adverse risk exists.



The prediction of an individual's exposure to specific chemicals in the environment and the potential risks resulting from such exposures can be determined through the completion of a quantitative HHRA. The current HHRA follows the standard HHRA framework (see Figure 2-1) that is composed of the following steps:

i) Problem formulation;

ii) Exposure assessment;

iii) Hazard assessment; and,

iv) Risk characterization.

Typically, where potential adverse impacts are predicted through risk characterization, an additional step providing risk management and recommendations for mitigation measures to address these concerns can be added, if necessary. This risk management step is an integral to the Environmental Screening process, to ensure the mitigation of any predicted potential health risks in the surrounding community, should they be identified.

The HHRA is focused on the toxicological impacts of chemicals emitted from the Project. Any potential impacts related to odour have been identified and evaluated in the accompanying Health Impact Assessment (HIA) report (Intrinsik, 2024).

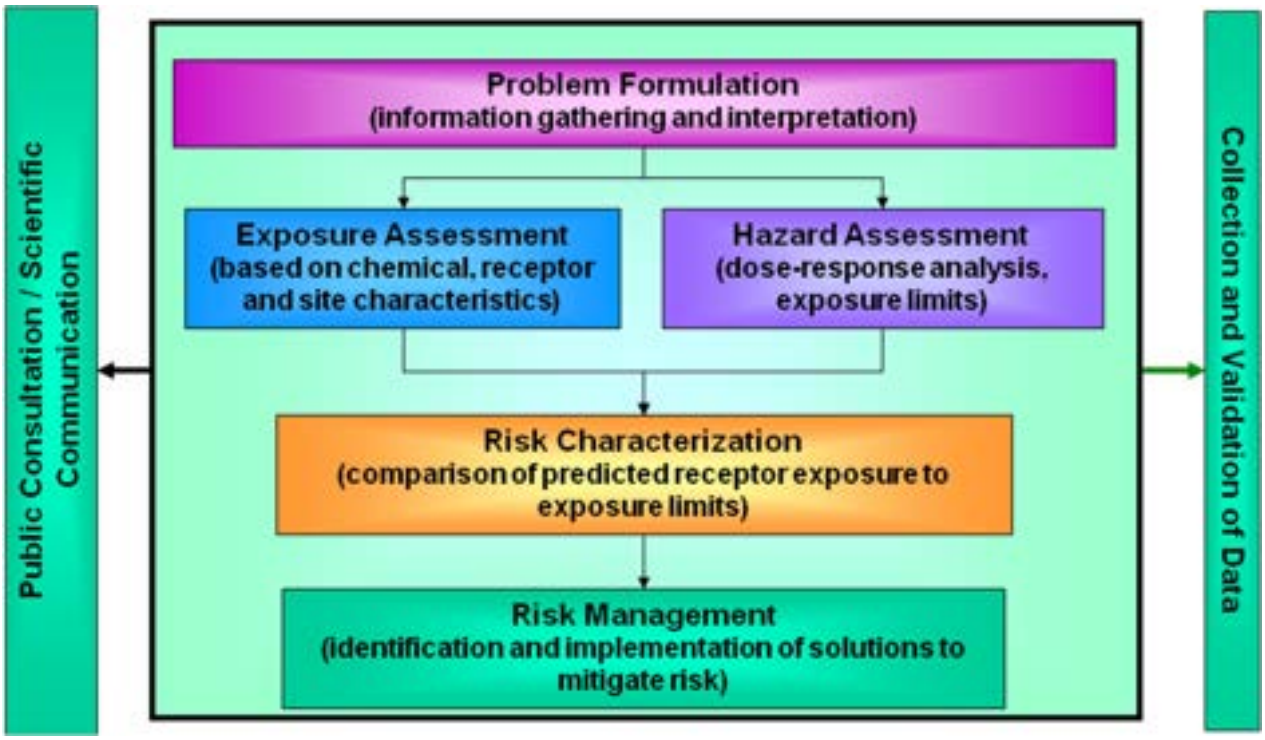


Figure 2-1 Overview of Standard HHRA Framework

2.1.1 Problem Formulation

The first step in the HHRA process is an information gathering and interpretation stage that plans and focuses the study on critical areas of concern for the Project. Problem formulation defines the nature and scope of the work to be conducted, permits practical boundaries to be placed on the overall scope of work and ensures that the assessment is directed at the key areas and issues of concern. This step is critical to the success of the HHRA as sound planning during the problem formulation step reduces the need for significant modifications once the HHRA has begun. The data gathered and evaluated in this step provides information into the physical layout and characteristics of the assessment area, possible exposure pathways, potential human receptors, COCs, and any other specific areas or issues of concern to be addressed.

The key tasks that comprise the problem formulation step of this HHRA include the following:

- **Site characterization**, which consists of a review of available project-specific data to identify factors affecting the availability of chemicals to potential receptors;
- **Chemical characterization**, which involves the identification of the chemicals requiring further study;
- **Receptor characterization** to identify “receptors of concern”, which include those individuals with the greatest probability of exposure to chemicals from the proposed facility and those that have the greatest sensitivity to these chemicals; and,
- **Identification of exposure scenarios and pathways** considers chemical-specific parameters, such as solubility and volatility, characteristics of the study area, such as physical geography, as well as the physiology and behaviour of the receptors.

The outcome of these tasks forms the basis of the approach taken in the HHRA.

2.1.2 Exposure Assessment

In an HHRA, the exposure assessment evaluates data related to all chemicals, receptors and exposure pathways and routes identified during the problem formulation phase. The assessment of potential occurrences of adverse effects from chemicals is based on the dose-response concept that is fundamental to the responses of biological systems to chemicals (Filov *et al*., 1979; Amdur *et al.*, 1991). Since it is not usually practical to measure concentrations of chemicals at the actual site where the adverse response occurs within tissues and cells, these concentrations are estimated based on either the dose of the chemical that actually enters a receptor or, more commonly, by the concentrations in various environmental media that act as pathways for exposure. The degree of exposure of individuals to chemicals from the environment therefore depends on the interactions of a number of parameters, including:

- The concentrations of chemicals in various environmental media as determined by the magnitude of point sources as well as background or ambient concentrations;
- The characteristics of the chemicals of potential concern which affect environmental fate and persistence (*e.g.*, physical-chemical properties);
- The impact of site-specific characteristics, such as geology, geography and hydrogeology, on chemical behaviour;
- The physiological and behavioural characteristics of the receptors (*e.g.,* respiration rate, soils/dusts intake, time spent at various activities and in different environmental areas); and,
- The various physical, chemical and biological factors that determine the bioavailability of chemicals from various exposure pathways.

The primary objective of the exposure assessment was to predict, using a series of conservative assumptions, the rate of exposure of individuals living in the surrounding community (residential receptors) to the COCs through various exposure scenarios and pathways identified in the problem formulation step.

Given the nature of the project under assessment, and that the primary source of COCs to the environment is *via* emissions to the atmosphere from the proposed facility expansion, the primary route of exposure for people is inhalation. However, for a subset of the COCs (*i.e.*, those considered persistent and/or bioaccumulative), there is the potential for deposition onto soils throughout the surrounding area, resulting in potential impacts to other exposure media (*e.g*., soil, house dust, locally grown produce, *etc*.). For these COCs, a multi-pathway assessment of potential risks related to oral and dermal exposures has been conducted, in addition to the inhalation assessment.

For the inhalation exposure assessment, specific rates of exposure were not calculated. Rather, human exposures have been conservatively assumed to be equal to ambient air concentrations (measured or modelled) of these substances (in $\mu g/m^3$). The inhalation assessment will evaluate health risks from short- and long-term exposures (*via* direct air inhalation only) for all the chemicals requiring further study at each of the sensitive receptor locations in the surrounding community.

For the multi-pathway assessment, the rate of exposure of the selected receptors to the COCs *via* the various exposure scenarios, pathways, and routes identified in the problem formulation step is estimated. The overall objective is to predict, using a series of health-protective assumptions, the rate of exposure (in µg chemical/kg body weight/day) to the COCs *via* the oral

and dermal exposure routes identified in the problem formulation. As air exposures are evaluated as part of the inhalation assessment, the multi-pathway assessment will focus on exposures arising from the oral and dermal pathways.

To evaluate potential exposures, it is necessary to characterize the physiological and behavioral characteristics of each receptor group. Several published sources were considered in the selection of these parameters, including:

- Federal Contaminated Sites Risk Assessment in Canada. PART I: Guidance on Human Health Risk Preliminary Quantitative Risk Assessment (PQRA) (Health Canada, 2021b);
- Rationale for the Development of Soil and Groundwater Standards for Use at Contaminated Sites in Ontario. Standards Development Branch, Ontario Ministry of the Environment. April 15th, 2011 (MOE, 2011);
- Compendium of Canadian Human Exposure Factors for Risk Assessment. O'Connor Associates Environmental Inc. 1155-2720 Queensview Dr., Ottawa, Ontario (Richardson, 1997);
- The US EPA Exposure Factors Handbook, 2011 Edition (Final). US Environmental Protection Agency, Washington, DC, EPA/600/R-09/052F (US EPA, 2011);
- Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Final. EPA/540//R/99/005. July, 2004 (US EPA, 2004); and,
- The US EPA Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities (US EPA, 2005).

These sources have been used in numerous HHRAs and have been critically reviewed and accepted by regulatory agencies across Canada and the United States. The Compendium of Canadian Human Exposure Factors for Risk Assessment (Richardson, 1997), the MOE (2011) Rationale document, and Health Canada (2021a) all rely on data from published and reliable Canadian sources, such as Health Canada, Statistics Canada, and the Canadian Fitness and Lifestyles Research Institute. Where insufficient data were available to appropriately characterize relevant activity patterns and/or behavioral/physiological characteristics, other sources such as the US EPA Exposure Factors Handbook (US EPA, 2011) were used.

2.1.3 Hazard Assessment

The hazard assessment involves identifying and understanding potential health outcomes that can result from exposure to each of the COCs and the conditions under which the outcomes might be observed. The hazard, or toxicity, assessment methodology is based on the fundamental dose response principle. That is, the response of biological systems to chemical exposures increases in proportion to the concentration of a chemical in critical target tissues where adverse health outcomes may occur.

2.1.3.1 Dose-Response Approaches

Two basic and quite different chemical categories are commonly recognized by regulatory agencies, depending on the compound's mode of toxic action, and applied when estimating toxicological criteria for humans (FDA, 1982; US EPA, 1989). These are the *threshold approach* (or the no-observed-adverse-effect levels [NOAELs]/benchmark dose with extrapolation/uncertainty factor approach) typically used to evaluate non-carcinogens, and the *non-threshold approach* (or the mathematical model-unit risk estimation approach), typically used

for carcinogenic compounds. While there are other possible dose response relationships that could be used to describe the toxicological outcome related to exposure to a given chemical (*e.g.*, a J-shaped or an inverted U-shaped dose response such as would occur under hormesis conditions), the standard threshold and non-threshold approaches are the standard dose response relationships evaluated in HHRAs of this type.

Threshold Response Chemicals: For most effects, it is thought that there is a dose-response threshold below which no adverse effects would be expected to occur. Thresholds are generally assumed for non-carcinogenic effects because, for these types of effects, it is generally believed that homeostatic, compensating, and adaptive mechanisms must be overcome before toxicity is manifested. A NOAEL can be identified for threshold chemicals, which is the dose or amount of the chemical that results in no observable response in the most sensitive test species and test endpoint. The application of uncertainty or safety factors to the NOAEL provides an added level of protection, allowing for derivation of a *toxicity reference value* (TRV) or exposure limit that is expected to be safe to sensitive individuals following exposure for a prescribed period of time. Exposure limits derived for threshold-response chemicals are called reference concentrations (RfC), reference doses (RfD), acceptable daily intakes (ADI), tolerable daily intakes (TDI) or permissible daily intakes (PDI) and are generally derived by regulatory agencies such as Health Canada and the US EPA. These values indicate doses of chemicals that individuals can be exposed to on a daily basis over an entire lifetime without appreciable risk of the occurrence of adverse health effects.

Non-threshold Response Chemicals: This means that any exposure greater than zero is assumed to have a non-zero probability of causing some type of response or damage. This relationship is typically used for chemicals that can cause cancer by damaging genetic material. Under a “non-threshold” assumption, any exposure has some potential to cause damage, so it is necessary to define an “acceptable” level of risk associated with these types of exposures.

The acceptable level of risk is an issue of policy rather than a scientific decision (CCME, 2006), and is set by regulatory agencies as opposed to risk assessors. Regulatory agencies have typically employed acceptable incremental lifetime cancer risk (ILCR) levels (*i.e.*, over and above baseline) between 1-in-100,000 and 1-in-1,000,000. An ILCR represents the incremental risk of an individual within a given population developing cancer over his or her lifetime due to exposures from a specific carcinogenic compound.

- Health Canada has specified an ILCR of 1-in-100,000, which is considered “essentially negligible” (Health Canada, 2021a).
- The Ontario MECP considers an ILCR of 1-in-1,000,000 per exposure pathway to be acceptable for human health risk assessments in the Province of Ontario.

ILCRs generally consider risks related to a particular Project (the Project alone, excluding any contribution from other background or pre-existing sources) in that the cancer risks are expressed on an incremental or additional basis as compared to cancer risks related to all sources. The current HHRA is being conducted as part of an Environmental Screening process in the Province of Ontario. As such, the ILCRs are reported relative to the Ontario acceptable ILCR of 1-in-1,000,000 (*i.e.*, one-in-one-million or 1×10^{-6}). This acceptable ILCR of 1-in-1,000,000 increases a person’s lifetime cancer risk from 0.400000 (based on the existing 40% lifetime probability of developing cancer in Canada) to 0.400001.

2.1.3.2 Exposure Limit Terminology

The terminology used to define threshold and non-threshold exposure limits differs according to the source/media and type of exposure and often varies between regulatory jurisdictions. The following terms are used to describe exposure limits in the current assessment.

Reference concentration (RfC): The US EPA defines a reference concentration as *"…an estimate (with uncertainty spanning perhaps an order of magnitude) of a continuous inhalation exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime.*" It can be derived from a NOAEL, a low-observed-adverse-effect level (LOAEL), or benchmark concentration, with uncertainty factors generally applied to reflect limitations of the data used. A reference concentration refers to the acceptable level of an airborne chemical for which the primary route of exposure is inhalation, and applies to either acute (*i.e.*, less than 24 hours) or chronic (*i.e.*, more than three months) exposure periods. The reference concentration is expressed as a concentration of the chemical in air (*i.e.,* micrograms per cubic metre, $\mu g/m^3$) and applies only to chemicals acting through a threshold mode of toxicological action.

For chemicals such as irritants and some combustion gases, short term or acute non-systemic toxicity is frequently observed at the points of entry into the body (*i.e.*, the respiratory tract, eyes, and skin, for airborne contaminants). In these cases, because the toxicity is enacted simply by direct contact between the receptor and the contaminated medium, the concentration in the air to which the receptor is exposed is the important measure of exposure, rather than the internal dose associated with multiple exposure pathways. For chemicals with these characteristics, short term RfCs are used to characterize health risk, and are intended to be protective of the general population.

Reference dose (RfD): The US EPA defines a reference dose as *"…an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily oral exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime.*" It can be derived from a NOAEL, LOAEL, or benchmark dose, with uncertainty factors generally applied to reflect limitations of the data used." The reference dose is most commonly expressed in terms of the total intake of the chemical per unit of body weight (*i.e.,* micrograms per kilogram of body weight per day, µg/kg bw/day) and applies only to chemicals acting through a threshold mode of toxicological action.

Inhalation unit risk (IUR): The US EPA defines a unit risk value as "*…the upper-bound excess lifetime cancer risk estimated to result from continuous exposure to an agent at a concentration of 1 µg/L in water, or 1 µg/m³ in air…"* The risks are referred to as "upper bound" because they are not likely to be underestimated and, in fact, may range from as low as zero to the upper bound value. A unit risk value of 3.0×10^{-5} per $\mu g/m^3$ would mean that under an upper worst-case estimate, three excess cancer cases would be expected to develop per one hundred thousand (100,000) people, if all 100,000 people were exposed every day for a lifetime to 1 µg of the chemical per m^3 of air.

Cancer slope factor (SF): The US EPA defines a cancer slope factor (SF) as *"…[a]n upper bound, approximating a 95% confidence limit, on the increased cancer risk from a lifetime exposure to an agent. This estimate, usually expressed in units of proportion (of a population) affected per mg/kg-day, is generally reserved for use in the low-dose region of the dose-response relationship, that is, for exposures corresponding to risks less than 1 in 100.*"

2.1.3.3 Exposure Duration

The toxicity of a chemical has been observed to vary between acute (short term) and chronic (long term) exposure. Thus, it is important to differentiate TRVs based on duration of exposure.

The two TRV durations used in the current assessment can be described as follows:

- ***Acute:*** the amount or dose of a chemical that can be tolerated without evidence of adverse health effects on a short-term basis. These benchmarks are routinely applied to conditions in which exposures extend from minutes through several hours or several days only (ATSDR, 2006). For the current assessment, risks were evaluated based upon 1-hour and 24-hour exposure periods, where a relevant acute TRV, based on an acute toxicity endpoint, for that time period is available. Acute exposures are really only relevant for the inhalation pathway.
- ***Chronic:*** the amount of a chemical that is expected to be without effect, even when exposure occurs continuously or regularly over extended periods, possibly lasting for periods of at least a year, and possibly extending over an entire lifetime (ATSDR, 2006). Chronic exposures are relevant for both the inhalation and oral/dermal pathways.

2.1.3.4 Benchmark Selection

For the HHRA, toxicological benchmarks were reviewed from a variety of regulatory agencies to select the most appropriate benchmark to represent the current science and relevance to the type of emissions from the proposed expansion. Many regulatory agencies recommend more than one benchmark depending on the overall chemical's toxicity and exposure duration – in other words, they may have TRVs representing threshold or non-threshold modes-of-action, and acute or chronic TRVs representing short- or long-term exposures to the contaminant.
As it would be inappropriate to establish a generic hierarchy of source agencies by which to select TRVs given the breadth of chemicals evaluated in a typical HHRA, when TRVs for one of the chemicals were available from multiple regulatory agencies, all the TRVs were reviewed, and the professional judgment of experienced toxicologists was used to select the most appropriate TRV.

The most critical considerations in selecting TRVs were the source (it must have been derived by a reputable agency), the data used to derive the benchmark (*e.g.*, does it reflect the most sensitive endpoint, protect for the most sensitive individual, *etc*.), the date the TRV was derived (it must be as up to date as possible), and its relevance in terms of duration and route of exposure. Both the MECP (MOE, 2005; 2011) and Health Canada (2021) provide lists of acceptable jurisdictions that maybe be used to determine toxicity reference values. The TRVs employed in the assessment have been obtained from regulatory agencies such as:

- MECP;
- Health Canada;
- Canadian Council of Ministers of the Environment (CCME);
- World Health Organization (WHO);
- United States Environmental Protection Agency – Integrated Risk Information System (US EPA IRIS);
- Texas Commission on Environmental Quality (TCEQ);
- California Environmental Protection Agency (Cal EPA); and,
- Agency for Toxic Substances and Disease Registry (ATSDR).

2.1.4 Risk Characterization

The final step of a risk assessment is risk characterization. This involves the estimation, description, and evaluation of risk associated with exposure to COCs by comparing the estimated exposure to the appropriate reference benchmark or TRV for a specific chemical or group of compounds. Risk characterization involves the comparison of estimated exposures (identified in the exposure assessment) with reference benchmarks or TRVs (identified during the hazard/toxicity assessment) to identify potential human health risks. This comparison is typically expressed as a Concentration Ratio (CR) or Hazard Quotient (HQ) for non-carcinogenic chemicals and is calculated by dividing the predicted exposure by the reference benchmark/TRV. In the case of direct acting non-threshold carcinogenic chemicals, potential risks are expressed as incremental lifetime cancer risks (ILCRs) and represents the incremental risk of an individual within a given population developing cancer over his or her lifetime due to exposures from a specific carcinogenic chemical of concern.

Separate assessments were completed for short term (acute) and long term (chronic) durations because the health outcomes produced by some COCs depend on the duration of exposure. It is important to distinguish between the health outcomes that might result from short-term exposures *versus* effects that may occur following long-term exposures. In the long-term exposure assessment, further distinction was made between inhalation alone (which included all emitted COCs) and multiple pathway exposures (*i.e.*, inhalation, oral and dermal together) since the pathway of exposure could also influence the potential health outcomes associated with each of the COCs.

In recognition of the influence of these exposure variables, risk estimates were segregated into:

- Short-term inhalation (24-hour durations, or 8-hour durations in the case of carbon monoxide);
- Long-term inhalation (annual average durations); and,
- Long-term multi-pathway exposures (*i.e.,* oral and dermal exposures), if required.

2.1.4.1 Concentration Ratios (CRs) and Hazard Quotients (HQs) for Non-Carcinogens

Concentration Ratios (CR)

Concentration Ratios or CR values were used to evaluate the acute and chronic health risk from exposure to chemicals *via* inhalation. CR values have been calculated by dividing the predicted air concentration (for 24-hour or annual average exposure durations) by the appropriate toxicity reference value (*i.e.*, RfC), according to the following example equation:

$$CR_{duration} = \frac{[Air]_{duration}}{RfC_{duration}}$$

Where:

$CR_{duration}$	=	the duration-specific *CR* (unitless), calculated for acute and chronic durations, as appropriate
$[Air]_{duration}$	=	the predicted air concentration (µg/m^3) for the specific time duration
$RfC_{duration}$	=	the RfC (µg/m^3) for the specific time duration

For a chemical expected to be present in a single environmental media, such as the case with many gases which occur only or predominately in ambient air, a benchmark representing the entire exposure limit (*i.e.*, a CR value of 1.0) is considered appropriate. Therefore, a CR value of 1.0 (*i.e.*, 100% of the exposure limit) was used as acceptable CR value in the inhalation assessment. Acute and chronic CR values less than the selected benchmark (*i.e.*, CR ≤1.0), indicate that predicted concentrations of the chemical in air were less than the applicable inhalation exposure limit (*e.g.*, RfC) and that adverse health effects would not be expected to occur.

When predicted risks are greater than the inhalation benchmark level (*i.e.*, CR > 1.0), this indicates the potential for adverse health outcomes may exist. This outcome is referred to as an "exceedance" (*i.e.*, the predicted ground-level air concentration is greater than, or exceeds, the corresponding inhalation exposure limit for that averaging period). Re-evaluation of such CR estimates is important since both the exposure estimates and the toxicological criteria are based on a series of conservative assumptions, particularly when considering the maximum "worst-case" exposure scenarios.

In general, interpretation of the CR values proceeded as follows:

CR ≤1:

Signifies that the estimated exposure is less than or equal to the selected benchmark (*i.e.*, the assumed safe level of exposure). This situation is generally indicative of a negligible likelihood of inhalation health effects. Typically, a significant degree of conservatism is incorporated during the derivation of a TRV and, therefore, if predicted exposures (under a worst case or highly conservative set of conditions) are less than a properly derived TRV, it can reasonably be concluded that predicted health risks are not of concern. An exception to this may be in the evaluation of certain criteria air contaminants where no threshold for effects has been identified.

CR >1:

Signifies that the exposure estimate exceeds the selected benchmark. This suggests that the potential for an elevated level of risk may be present for a particular chemical and triggers an additional evaluation. The significance of a CR above 1 must be balanced against the degree of conservatism incorporated in the risk assessment (*e.g.,* an accounting of the number of assumptions used within the risk assessment that tend to overestimate, rather than underestimate, exposure, and health risks).

Hazard Quotients (HQ)

Hazard Quotient (HQ) values were used to express risk resulting from long-term exposures to systemically acting, non-carcinogenic chemicals. This approach was used where the exposure to the chemical occurs through multiple pathways, and shows the additional risks related to the oral and dermal exposure pathways. HQ values were calculated by dividing the predicted exposure (*via* multiple pathways) by the appropriate toxicity reference value (RfD), according to the following example equation:

$$HQ = \frac{Exposure}{RfD}$$

Where:

HQ	=	the chronic Hazard Quotient (unitless), calculated for long-term exposures resulting from multiple pathways of exposure
Exposure	=	the long-term exposure estimate resulting from multiple pathways of exposure (µg/kg bodyweight/day
RfD	=	the chronic RfD (µg/kg bodyweight/day)

For long-term multi-pathway exposures, the CCME (2006) typically allocates 20% of the total exposure to any one environmental media during the derivation of its health-based soil quality criteria. This was based on the assumption that the source of exposure to a particular chemical may occur *via* five potential media: air, food, water, soil, and consumer products. A similar source attribution or allocation model has been adopted by the MOE (2011). This means that, in the absence of a multi-pathway assessment that takes into account multiple sources or media, the exposure limit should be apportioned for the single medium under consideration.

For the current assessment a benchmark of 0.2 was selected for the evaluation of the long-term multi-pathway assessment of Project alone emissions since not all potential exposure sources were considered (*i.e.*, the contribution of background sources of these chemicals will not be quantified in the multi-pathway assessment). HQ values that are less than 0.2 represent a situation in which Project-related exposures (*e.g.*, facility-related emissions) account for less than 20% of the oral exposure limit (*e.g.*, oral RfD). As a result, no adverse health risks are expected to be associated with the estimated level of exposure. When predicted health risks resulting from Project alone emissions were greater than the benchmark level (*i.e.*, HQ > 0.2), this may indicate the potential for adverse health outcomes among the most sensitive members of the population and triggers an additional evaluation. Re-evaluation of such HQs is important since both the exposure estimates and the TRV are based on a series of conservative assumptions, particularly when considering the maximum “worst-case” exposure scenarios.

In general, interpretation of the HQ values proceeded as follows:

<u>HQ ≤0.2:</u>

Signifies that the estimated exposure is less than or equal to 20% of the oral exposure limit (*i.e.*, the assumed safe level of exposure). This is generally indicative of a negligible likelihood of adverse human health effects. Typically, an added assurance of protection is provided by the significant degree of conservatism (or protection) used during the development of regulatory exposure limits and predicted exposure estimates.

<u>HQ >0.2:</u>

Signifies that an exposure estimate exceeds 20% of the of the oral exposure limit. This generally suggests that the potential for an elevated level of health risk may exist for the specific COC and triggers an additional re-evaluation. The significance of an HQ above 0.2 must be balanced against the high degree of conservatism incorporated in the risk assessment (*e.g.*, an accounting of the number of assumptions used within the risk assessment that tend to overestimate, rather than underestimate, exposure and health risks)

2.1.4.2 Incremental Lifetime Cancer Risks (ILCRs) for Carcinogens

ILCR estimates were used to evaluate the increased cancer risk resulting from a lifetime of exposure to genotoxic, typically non-threshold, carcinogenic chemicals. ILCR estimates provide the incremental lifetime cancer risk resulting from contributions from Project emissions to the surrounding community.

Direct Air Inhalation

For carcinogenic chemicals evaluated as part of the inhalation assessment, ILCR estimates resulting from direct air inhalation were calculated as follows:

$$ILCR = [Air]_{Facility} \times IUR$$

Where:

ILCR	=	the incremental (or additional) lifetime cancer risk (unitless)
$[Air]_{Facility}$	=	the predicted annual average ground-level air concentration (µg/m^3) for the specific chemical arising from facility emissions
IUR	=	the chemical-specific inhalation unit risk value (µg/m^3)$^{-1}$

Multi-Pathway Exposure

For carcinogenic chemicals evaluated as part of the multi-pathway assessment, ILCR estimates resulting from a lifetime of exposure through multiple pathways were calculated as follows:

$$ILCR = LADD \times CSF$$

Where:

ILCR	=	the incremental lifetime cancer risk (unitless)
LADD	=	the incremental Lifetime Average Daily Dose via multiple pathways resulting from facility emissions (µg/kg bodyweight/day)
CSF	=	the chemical-specific cancer slope factor (µg/kg bodyweight/day)$^{-1}$

The resulting estimated incremental lifetime cancer risk can be compared to an acceptable risk level of cancer to determine if predicted exposures pose an unacceptable health risk. In the Province of Ontario, the acceptable ILCR is one-in-one million (or 1-in-1,000,000).

In general, interpretation of the ILCR values proceeded as follows:

ILCR ≤ 1.0 x 10^{-6} (1E-06):

Signifies that the estimated exposure results in an incremental lifetime cancer risk less than or equal to 1-in-1,000,000 (*i.e.*, within the accepted level of risk set by MECP; Health Canada sets the level of essentially negligible risk at 1-in-100,000). This shows that negligible health risks are predicted. assurance of protection is provided by the high degree of conservatism (protection) incorporated in the derivation of the cancer-based unit risk and slope factor and the exposure estimate.

ILCR > 1.0 x 10^{-6} (1E-06):

Signifies the estimated exposure results in an incremental lifetime cancer risk greater than the MOECC acceptable regulatory-established cancer risk benchmark of 1-in-1,000,000. This suggests that the potential for an elevated level of risk above MECP's acceptable ILCR (of 1-in-1,000,000) may be present for some COC, the significance of which must be balanced against the high degree of conservatism incorporated in the risk assessment.

Putting Cancer Risks into Context

The evaluation of potential cancer risks from exposure to a carcinogen is completed on an incremental basis (*i.e.*, incremental risk = total risk – background cancer risk in the general population). In many cases, it is difficult to separate incremental risk from total risk. Total cancer risk is calculated by adding all exposures including background exposures.

Any level of exposure to a cancer-causing chemical is associated with some level of risk. Thus, an acceptable level of risk must be set for these chemicals. Acceptable risks are provided by regulators in the form of incremental lifetime cancer risks, which are set at risk levels considered to be negligible. Different regulatory agencies around the world have established different policies as to what is deemed an acceptable level of risk. However, the basis for these are that incremental increases in cancer at these levels of exposure would not be identifiable from typical background cancer incidences and are thus considered negligible.

In order to provide a context for the incremental risks, a framework, which has been used by recognized experts in the field of risk communication (Calman 1996; Paling 2003), was adopted. The different levels of risk are described below (Calman 1996):

- **High Risk**: These risks may be fairly regular events and would occur at a rate greater than 1 in 100. They may also be described as frequent, serious, or significant.
- **Moderate Risk**: This term relates to a risk of between 1 in 1,000 and 1 in 100. This would apply to a wide range of medical procedures (*e.g.*, whole CT scans, nuclear stress tests) and environmental events.
- **Low Risk**: This relates to a predicted increased risk of between 1 in 10,000 and 1 in 1,000. Again, many risks of clinical procedures (*e.g.*, barium enemas, partial CT scans) and environmental hazards fit into this broad category. Other words that might be used include reasonable, tolerable, and small.
- **Very Low Risk**: This describes a risk between 1 in 100,000 and 1 in 10,000; many health care interventions (*e.g.*, dental x-rays, chest x-rays, mammograms) have adverse effects that are in this range.
- **Negligible Risk**: The MECP describes this as an adverse event occurring in less than 1 per 1,000,000 people, while Health Canada describes this as an adverse event occurring in less than 1 per 100,000 people. While still important to identify and monitor, such a risk would be of little concern for normal living. Another word that could be used to describe this risk level is insignificant. Both the MECP and Health Canada typically require remediation or risk management activities be implemented to reduce risks to a negligible risk level.

These various risk descriptors are simply intended to allow qualitative context around risk predictions, and not intended to minimize any risks identified by the Study.

2.1.5 Chemical Mixtures

Concurrent exposures to more than one chemical may result in toxicological interactions which produce health outcomes; this may also result in a combined toxicity which is equal to the sum of toxicities of the individual chemicals (additivity or independence), greater than the sum (synergism or potentiation) or less than the sum (antagonism). In general, toxicological interactions depend on the chemicals present, the levels of exposure to each, their mode of action and their concentrations. Most non-additive interactions can only be demonstrated at relatively high exposures, where clear adverse health outcomes are observed. Such interactions have not been observed or quantified at the relatively low rates of exposure typical of those associated with most environmental situations (NAS, 1983; Krewski and Thomas, 1992).

Because chemical exposures rarely occur in isolation, the potential health outcomes associated with mixtures of the chemicals were evaluated in the assessment. The interaction between chemicals can take many forms, with additive interactions being generally assumed to be the default for an HHRA (Health Canada, 2021a). Additive interactions apply to chemicals that are structurally similar, act toxicologically through similar mechanisms or affect the same target tissue in the body (*i.e.,* share common health outcome) (Health Canada, 2021a; US EPA, 2023).

The evaluation of risks related to chemical exposures in mixtures is an emerging science. While some jurisdictions have provided preliminary considerations and guidance on the topic (*e.g.*, ATSDR Interaction Profiles for Toxic Substances, US EPA Supplementary Guidance for Conducting Health Risk Assessment of Chemical Mixtures, *etc.*), it is still a topic for considerable scientific debate.

One approach to consider cumulative effects is to sum CRs and ILCRs when toxicologically justified (*e.g.*, common modes of toxicological action) and when significant mixture interactions are identified that they be qualitatively discussed. This is considered a highly conservative approach, as the ILCR represents the incremental risk of an individual within a given population developing cancer over his or her lifetime due to exposures from a *specific* carcinogenic chemical and has historically not been intended for use in evaluating the risk from a mixture of chemicals. However, given community concerns related to cumulative risks raised for this and other similar projects, the HHRA has provided this analysis from a precautionary point-of-view.

3.0 PROBLEM FORMULATION

The current assessment followed standard risk assessment methods and was conducted consistent with the risk assessment procedures endorsed by regulatory agencies including Health Canada, and the US EPA, as well as guidance provided by the MECP.

3.1 Background

Intrinsik Corp. (Intrinsik) conducted a Human Health Risk Assessment (HHRA) on behalf of Emerald Energy From Waste (EFW) Inc. (Emerald) for a proposed expansion of the existing Emerald EFW facility located at the intersection of Highway 407 and Bramalea Road in Brampton, Ontario ("the Project"). The Project is located at 7656 Bramalea Road, in Brampton, Ontario and is owned and operated by Emerald EFW. The location of the Site is shown in **.** The HHRA was conducted as part of the Environmental Screening Process (Ontario Regulation 101/07, *Environmental Assessment Act*).



Figure 3-1 Location of the Proposed Undertaking. Source: GHD, 2023a

In 1991, Emerald received a Certificate of Approval (now referred to as an Environmental Compliance Approval [ECA]) for the Emerald EFW facility. The facility has accepted municipal solid waste since 1992. The Emerald EFW facility has currently approved waste processing rates of 546 tonnes per day and 182,000 tonnes per year which operates under ECA No. 0264-BFGQFY. The facility is licensed to receive solid non-hazardous waste from domestic, commercial, industrial and institutional sources; solid non-hazardous international waste, arriving

in Ontario; and waste designated for thermal treatment by the Canadian Food Inspection Agency and/or Health Canada, from the Province of Ontario (GHD, 2023b). Emerald undertook an Environmental Assessment for a 25% plant expansion between 1997 and 2000. In 2009, a Certificate of Approval was published. In order to expand its service area, the site also carried out an environmental screening, which was authorized in 2011–2012. The ECA's amendments were approved in 2010, 2012, and 2020 by the Ministry of Environment, Conservation and Parks (MECP). Continual investments to upgrade equipment have helped the facility keep pace with technological changes (GHD, 2023b). The existing Emerald EFW facility converts recovered thermal energy into steam and electricity from solid non-hazardous waste from municipal as well as industrial, commercial, and institutional sources. Emerald currently produces 10 MW of energy for use in the community (GHD, 2024a). Energy is recovered as heat, which can then be used directly or converted into electricity. Carbon emissions associated with waste management activities are reduced by diverting waste from landfills and through energy recovery (GHD, 2024a).

3.2 Proposed Expansion

The Ontario Waste Management Association has predicted that Ontario's approved landfill capacity will be exhausted in the coming 9 to 13 years. Ontario's population is expected to grow by 5.2 million (*i.e.*, a 36 per cent increase) from 2019 to 2046 (*i.e.,* over a 27-year period) (Government of Ontario, n.d.). As the population grows, there will be an increase in demand for additional waste management infrastructure.

In order to meet the growing demand from waste generators and customers for a safe and reliable waste management facility for their post diversion solid non-hazardous residential and industrial, commercial and institutional (IC&I) waste, Emerald EFW is proposing to redevelop and expand the processing capacity of their current facility from 500 tonnes/day to up to 2,500 tonnes/day (or up to 900,000 tonnes per year from the current 182,000 tonnes per year), and increase the energy recovery from 10 MW to up to 100 MW. The same technology that has been shown to be successful over the course of 25 years of emissions testing results would be used in this redevelopment and expansion (GHD, 2023b). Emissions testing results for the existing facility have met or are better than Provincial standards. The additional capacity will be attained in three stages by the installation of new processing units as the current facility is taken offline. Phase 1 will see the construction of the first new processing line while the current plant is kept operational until the first new line is fully operational at which time the current plant will be closed and decommissioned (see). Phases 2 and 3 will be installed and commissioned in response to market demand. Construction is expected to last between 18-24 months per phase. A conceptual schedule that completes the project within 5 years (~2030) is shown in Figure 3-3. The demolition/removal of the existing plant would take less than a year and likely be finished within one year of Phase 1 coming online. The building construction for Phase 2 could start as soon as the existing site has been decommissioned. Decommissioning could commence from the west to the east and build from the south to the north. Once redevelopment is complete, the existing facility would be removed as shown in .



Figure 3-2 Proposed Redevelopment Phase 1 (GHD, 2023a)

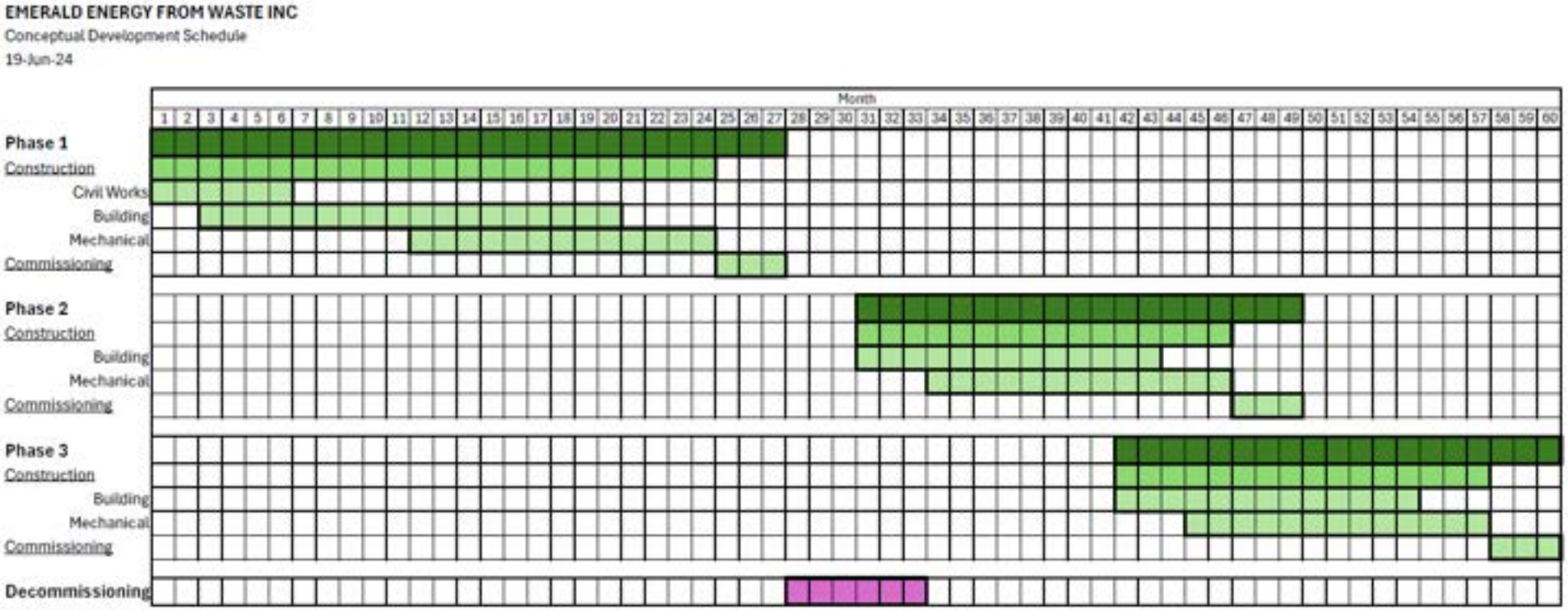


Figure 3-3 Conceptual Development Schedule



Figure 3-4 Proposed Redevelopment Phase 2 and 3 (GHD, 2023a)

Several conditions of the approved ECA, which outline the maximum quantity of waste that may be processed on a daily and annual basis, as well as the maximum number of equipment units that can be used, need to be amended in order to implement any suggested amendments to the waste processing capacity. In order to accommodate the proposed new treatment units, changes to the current approved size and footprint of the EFW facility will also be required.

With the annual waste processing capacity changes as suggested (*i.e.,* upscaling it to up to 2,500 tonnes/day [or up to 900,000 tonnes per year]), Emerald EFW will be able to reduce greenhouse gas emissions (GHG), recover energy from leftover materials, and favourably respond to Ontario's move away from landfill disposal in both Canada and the United States. This entails preserving the landfill disposal capacity while diverting a sizeable portion of Ontario's total residual waste—currently 97%—from landfills. It is anticipated that the planned facility expansion will remain operational for at least 20 years (GHD, 2023a). GHG emissions are reduced despite the increase in capacity as the burning of waste produces less CO_2e GHG emissions than landfilling the same waste (*i.e.*, landfilling waste produces methane with higher global warming potential than CO_2). Refer to Section 9.3 of the AQIA report (GHG, 2023c) for further information.

Although processing capacity will increase and vehicle emissions contribute to the COCs in this airshed, the Site is not generating truck traffic. This traffic already exists in the system as waste moves through the area for final disposal in SWO or Michigan. As identified in Section 8.2 of the Air Quality Impact Assessment Report, despite the increase in truck trips resulting from the Emerald's expansion, it is essential to recognize that the trucks will be used for transporting materials from Emerald are not newly introduced (GHD, 2024c). They are already actively traveling on nearby roads for their unloading trips to southwestern Ontario or Michigan, contributing to the emissions of air pollutants in the region. As a result, the increase in truck trip generation does not necessarily translate to an overall increase in on road air emissions in the

study area. By managing waste at Emerald instead of alternative disposal locations, which are likely further away, a part of transportation related emissions is avoided. According to the Traffic Assessment Report (GHD, 2024d), the proposed expansion of the Facility has a marginal impact on the operation of the nearby intersections with the capacity issues identified at the Facility access and the access to 7653-7639 Bramalea Road resulting predominately from the increase in corridor growth along Bramalea Road. This assessment is based on detailed road capacity and traffic analysis that covers (1) Bramalea Road and the Highway 407 Westbound Off-Ramp, (2) Bramalea Road and the right-in site access, and (3) Bramalea Road and the full-moves site access/private access. Therefore, there is not expected to be any truck traffic congestion. Truck air emissions are deemed directly proportional to driving distance, which remains relatively consistent, assuming all trucks are travelling on nearby roads, just to a different destination. Idling time is expected to show no significant difference based on the findings of the traffic study. Emissions from truck idling is further analyzed in Section 8.2.1 of the Air Quality Impact Report.

There is a potential for truck idling emissions to occur within the tipping bay while trucks are unloading the payload. The negative pressure system, used to control odour emissions in the tipping bay, will also collect truck idling emissions. Air from the negative pressure system is routed to the incinerators and emitted through the stacks.

Truck idling emissions are dependent on the quantity of trucks, unloading times, truck mix and receiving capacity. Since Jun 1, 2017 (1,460 operating days), the maximum receipt rate was recorded at 264% of the average annual receipt rate. This translates to approximately 1,090 t vs the daily average of 410 t. Applying this factor to Phase 3, the Site could expect to receive 265% of 2,466 t/d or 6,535 t/day. In Phase 3, the Site would likely receive over 2 shifts to allow the operating staff sufficient time to sort the waste in the bunker while feeding the units. Therefore, the 6,535 t would be received over 16 hours which translates to an average of ~410 t/hr.

The number of trucks, unloading times and subsequent receiving capacity will depend upon the truck mix. Tractor trailers have a payload of 34 tonnes and an unloading time of ~19 minutes (2 to maneuver into and out of position, 15 to unload their contents). Straight trucks have a payload of 10 t and an unloading time of ~ 9 minutes (2 to maneuver into and out of position, 5 minutes to unload their contents). Table 3-1 shows the number of trucks and unloading capacity for truck mixes ranging from 100% tractor trucks to 100% straight trucks. With nine (9) unloading bays available, the table shows that at no time will the truck arrivals exceed the unloading capacity.

Table 3-1 Unloading Times and Receiving Capacity for Truck Mixes

Truck Mix		Trucks		Unloading	
Tractor Trailers	Straight Trucks	Average Weight (t)	Arrivals (ea)[a]	Time (min)	Capacity (Trucks/hr)
100%	0%	34.0	12	19	28
90%	10%	31.6	13	18	30
80%	20%	29.2	14	17	32
70%	30%	26.8	15	16	34
60%	40%	24.4	17	15	36
50%	50%	22.0	19	14	39
40%	60%	19.6	21	13	42
30%	70%	17.2	24	12	45
20%	80%	14.8	28	11	49
10%	90%	12.4	33	10	54
0%	100%	10	41	9	60

Figures based on average peak daily receipt of 6,535 t received over 16 hours. The only time the peak rate becomes relevant is when the facility is receiving waste after a maintenance shutdown to build inventory for regular operations and this rate is far in excess of what would normally be expected.

[a] 'ea' means a truck. The truck arrival may be a tractor trailer or a straight truck.

As seen in Table 3-1, there will be a maximum of 12 to 41 trucks per hour. It was conservatively estimated that Phase 3 will have a truck volume of 41 trucks per hour, Phase 2 will have 21 trucks per hour, and Phase 1 will have 14 trucks per hour. Conservative truck idling emission rates were calculated based on truck volume and US EPA emission factors for heavy-duty diesel vehicles (US EPA-F-98-014), with a gross vehicle weight (GVW) of over 8,500 lbs.

For the expanded Facility, the truck idling emission rate estimates and concentrations are summarized in Appendix H of the Air Quality Impact Assessment Report (GHD, 2024c). The truck idling emissions have been added to the total Facility emission rates. The addition of the truck idling emissions did not result in a significant change in total emission rates or predicted maximum ambient concentrations of air contaminants emitted from truck idling (GHD, 2024c).

When evaluating vehicle impacts on air quality, potential wear and tear on vehicle brakes and tires are a potential source of metals and particulate matter over time. However, in the case of the current Project, braking emissions would mainly happen on public roads before the trucks enter the facility. There would not be much in the way of braking emissions on property as the trucks are going very slowly as they enter the facility and dump their loads. As such, emissions from wear and tear on tires and brakes were viewed as negligible for the purposes of the current assessment.

3.3 Using Energy From Waste Technology

Energy from Waste technology can generate multiple types of energy (steam, heat, electricity, hydrogen) from MSW and IC&I waste, as such facilities such as the Emerald EFW facility, can divert residual waste from landfill disposal, thereby extending the life of existing landfills and/or reducing the need for new landfills. Energy from Waste can also improve the resilience and stability of the electricity grid and is a local source of energy. Energy from Waste can recover materials that cannot be recycled such as ferrous and non-ferrous metals.

3.4 The Environmental Screening Process

This project was initiated under and followed the Environmental Screening Process under Ontario Regulation 101/07 – Waste Management Projects Regulation (replaced by O. Reg. 50/24 on February 22, 2024) of the Ontario *Environmental Assessment Act*, Per Section 16 of O. Reg. 101/07:

> *"A change to a thermal treatment site described in section 11 is defined as a major commercial or business enterprise or activity and is designated as an undertaking to which the Act applies, if the amount of waste that would be subject to thermal treatment at the site on any day after the change would exceed the amount of waste that was authorized under the Environmental Protection Act to be subject to thermal treatment at the site before the change. O. Reg. 101/07, s. 16; O. Reg. 389/22, s. 9."*

This project is exempt from Part II of the *EA Act* under Section 16 of O. Reg. 101/07 – Waste Management Projects Regulation, provided that the Environmental Screening Process is completed (GHD, 2023b). The planning and design procedure described in the MECP's "*Guide to Environmental Assessment Requirements for Waste Management Projects*" shall be followed when conducting the screening. In order to identify and characterize potential environmental effects, screening criteria must be applied to the Environmental Screening process. Additionally, public and external agency consultation is required, and mitigation measures will be determined

to reduce any potential environmental effects previously identified (GHD, 2023b). An Environmental Screening Report will be used to document and share Study results with stakeholders including the public, and government agencies (GHD, 2023b). An application will be made to amend the existing ECA upon completion of the Environmental Screening Process.

3.5 Site Characterization

The Emerald EFW facility is located at the intersection of Highway 407 and Bramalea Road in Brampton, Ontario ("the Project"). The Project is located at 7656 Bramalea Road, in Brampton, Ontario and is owned and operated by Emerald EFW.

The Site Study Area includes all lands within the existing, approved boundaries of the Emerald EFW facility, as defined by Environmental Compliance Approval (ECA) No. 4591-56VSTN, as amended. The Local Study Area defined for the evaluation of air quality is the surrounding area within ten kilometres of the centre of the Site (Figure 3-5).

The Air Quality Impact Assessment further defined the Site Study Area, Local Study Area, and Regional Study Area for the assessment of the potential effects of the Emerald EFW facility on air quality and odour.

3.5.1 Management of Fugitive Emissions

3.5.1.1 Odour Management

Odour emissions may occur during the operating phase of the facility. An Odour Management Plan will be prepared during the detailed design of the facility to control these emissions. Details of the plan will be determined during the design of the plant and subject to approval by the MECP through any approval process under the Environmental Protection Act. The plan will have four (4) key components:

- **Identification**: Recognizing potential odour sources under both normal and unusual operating conditions;
- **Control**: Establishing control systems to prevent odours from being emitted to the environment;
- **Monitoring**: Inspecting the site and equipment regularly to ensure all equipment is operating properly; and,
- Recording: Registering any odour incidents and complaints.

Identification

Odours sources will be identified as specific sources (point sources) or non-specific sources (fugitive emissions). The primary point source of odours will be the waste storage bunker. The facility will continuously process waste with specific masses of waste being converted to energy, but the continual replenishment of the waste will mean the waste will always be in the bunker and have the potential to produce odours. The main source of fugitive odours will be trucks delivering waste to the facility.

Control

Odours can be managed through positive controls and/or operating procedures. Positive controls are engineered systems designed to prevent odours from leaving the site. For the waste bunker, odour will be controlled by maintaining negative pressure in the building to prevent odorous air from leaving the reception hall. The negative pressure will be maintained by drawing combustion

air through the waste bunker. The negative pressure will be monitored and maintained even while the truck doors are open to allow vehicles to enter or leave the tip floor. Other positive controls that can be used include air curtains or odour suppression systems.
Operating procedures can be used to prevent fugitive odours from trucks. Ensuring trucks delivering waste are directed into the receiving hall as quickly as possible will reduce the likelihood of fugitive odours.

Monitoring
The perimeter of the facility will be monitored each shift to ensure odours are being properly managed. The positive controls and operating procedures will also be monitored to ensure they remain effective.

Recording and Reporting
The results of the inspection will be recorded in the daily logbook. Equipment inspections and maintenance will be recorded in the site maintenance logs. All odour complaints will be recorded and reported to the MECP.

The annual monitoring reports have identified that in the 30 years the Emerald EFW facility has been operational, it has never received a nuisance or odour complaint from the community (correspondence with Emerald EFW and review of annual monitoring reports). As identified in the Intrinsik Health Impact Assessment of the Emerald EFW Expansion Project (2024), modern incinerators (such as used in EFW facilities) are unlikely to generate unpleasant odours as waste is being incinerated, opposed to a landfill were the debris rots emitting odours and leading to air pollution (Civilbull, 2022). According to the US EPA, odour, smoke and dust issues are usually not associated with modern incinerators (US EPA, 2012). Examples from other EFW facilities in Ontario, such as the Durham York Energy Centre, indicate that odours are not emitted from the stack (York Region, n.d.). Due to the high combustion temperatures, all sources of odour are destroyed inside the sealed boiler (York Region, n.d.). As previously identified, the facility has never received a nuisance or odour complaint from the community. Therefore, odour impacts are unlikely to occur or and would have little to no effect on health and well-being.

3.5.1.2 Dust Management Plan

Dust emissions can occur during the construction and operating phases of the new facility. A Dust Management Plan will be prepared to control these emissions. Details of the plan will be determined during the design of the plant and subject to approval by the MECP through any approval process under the Environmental Protection Act. The plan will have four (4_ key components:

- **Identification**: Recognizing potential dust sources under both normal and unusual operating conditions. Dust sources can be specific (point sources) or non-specific (fugitive);
- **Control**: Establishing control systems to prevent dust from being emitted to the environment;
- **Monitoring**: Inspecting the site and equipment regularly to ensure all equipment is operating properly to prevent dust emissions; and ,
- Recording: Registering any odour incidents and complaints.

Identification
Dust sources will be identified as specific sources (point sources) or non-specific sources (fugitive emissions). The point sources of dust will include the Air Pollution Control (APC) system

and material storage silos (lime, Powdered Activated Carbon, APC residues). The fugitive dust emission sources include site roadways, parking lots, disturbed areas and trucks delivering waste to the facility.

Control

Dust can be managed through positive controls and/or operating procedures. Positive controls are engineered systems designed to prevent dust from leaving the site. In the APC system, dust emissions will be controlled by the baghouse filter and by maintaining negative pressure in the system until the flue gas is emitted from the stack. The negative pressure will be maintained by the induced draft fans that draw combustion air through the energy recovery process. Other positive controls that can be used include bin vents on storage silos, covered conveyor systems that handle dusty materials and paving all roads and parking areas. Operating procedures can be used to prevent fugitive dust emissions. Operating procedures include supervising dusty material loading and unloading, sweeping roads and parking areas and ensuring disturbed areas are watered as necessary to control dust until a vegetative cover can be established.

Monitoring

The facility will be monitored each shift to ensure dust in the flue gas is properly managed. The APC system will have a computerized emission monitoring system (CEM) to verify the effectiveness of the baghouse filter and the negative pressure in the system. The loading of storage silos will be supervised to ensure dust emissions are properly managed. Results of the inspection will be recorded in the daily logbook. The facility will be inspected during each shift to ensure dust is being properly managed. The results of the inspection will be recorded in the daily logbook.

Recording and Reporting

The CEM readings will be recorded and reported to the MECP quarterly. The results of the site inspections will be recorded in the daily logbook. All dust complaints will be recorded and reported to the MECP.

3.5.1.3 Residual Ash Management

Contaminant emissions from the handling and storage of residual ash (fly ash and bottom ash) will be managed to prevent emissions on and around the facility. Dusty materials will be moistened or handled using sealed containers and vehicles to prevent dust emissions during handling and storage. All trucks and containers used to handle and/or transport dusty materials will be sealed or tarped to prevent dust emissions during transportation.

Residual ash will be managed at facilities approved by appropriate jurisdiction(s) to receive and process these materials. The environmental effects of the receiving facility will be managed through the environmental controls required to be in place by the owner and/or operator of those facilities.

As such, the potential impacts of fugitive emissions from the handling and storage of residual ash on the surrounding community was assumed to be negligible for the purposes of this assessment.

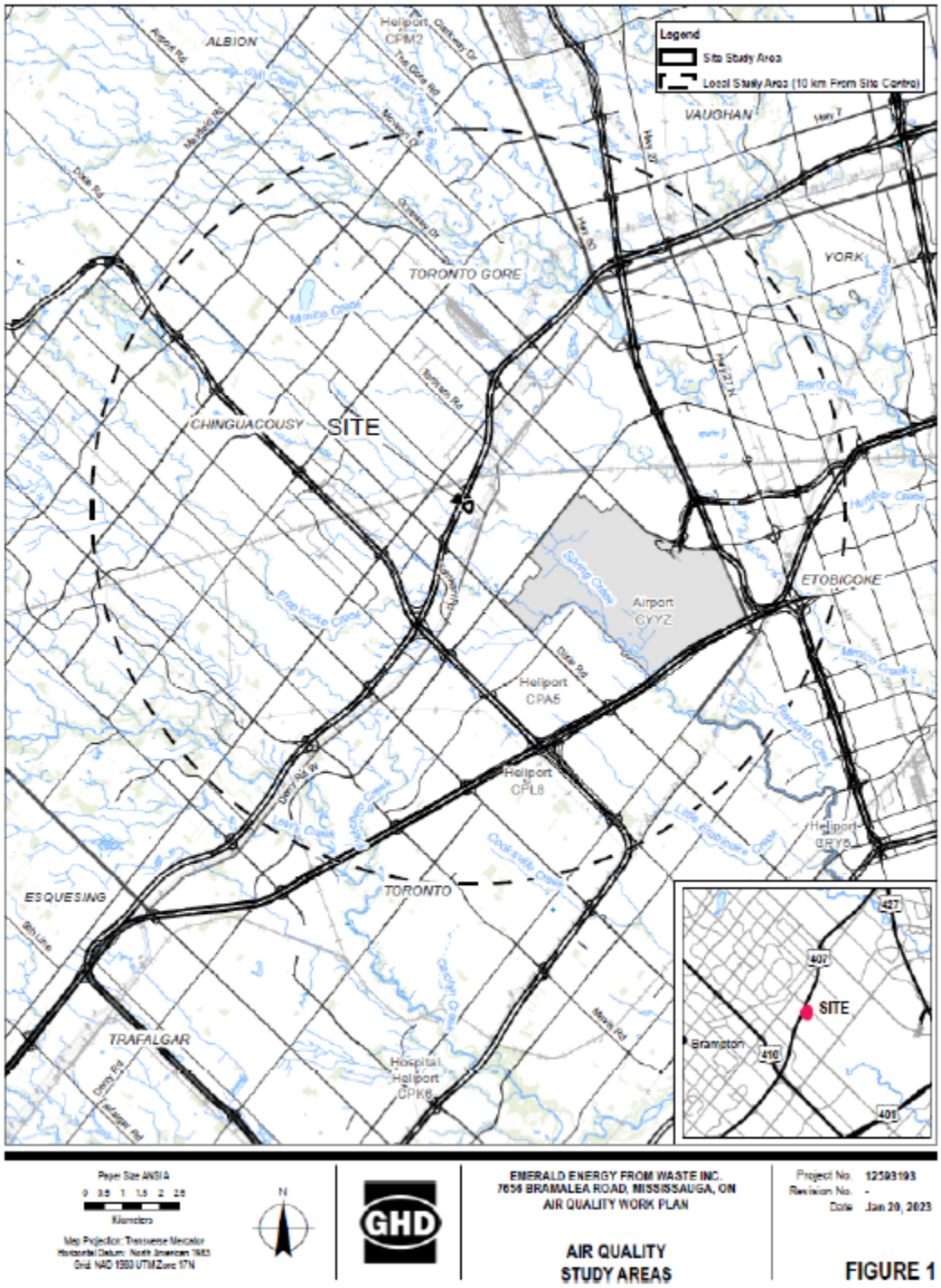


Figure 3-5 Local Study Area for Air Quality Impact Assessment (GHD, 2024c)

3.5.2 Proposed Locations for Sensitive Receptors

Relying on predicted ground-level air concentrations at the maximum point of impingement (MPOI) from a Project emission source to evaluate human health risks, particularly long-term risks, is considered a very conservative (*i.e.*, highly protective) approach. By definition, predicted ground-level air concentrations at all other locations are lower than those predicted at the MPOI. As such, the standard risk assessment approach is to also evaluate exposures and potential health risks at several specific sensitive receptor locations beyond the MPOI in the community surrounding the Project-specific emission sources.

Figure 3-6 provides an overview of the land use in the area surrounding the Emerald facility. As can be observed, the land use immediately around the Facility is zoned Employment/Commercial with no residential. It is noted that there are some community use areas in close proximity to the Facility, including playgrounds and sports fields. Residential lands are further to the northeast (approximately 2.3 km away) and northwest (approximately 1.5 km away) of the Facility.

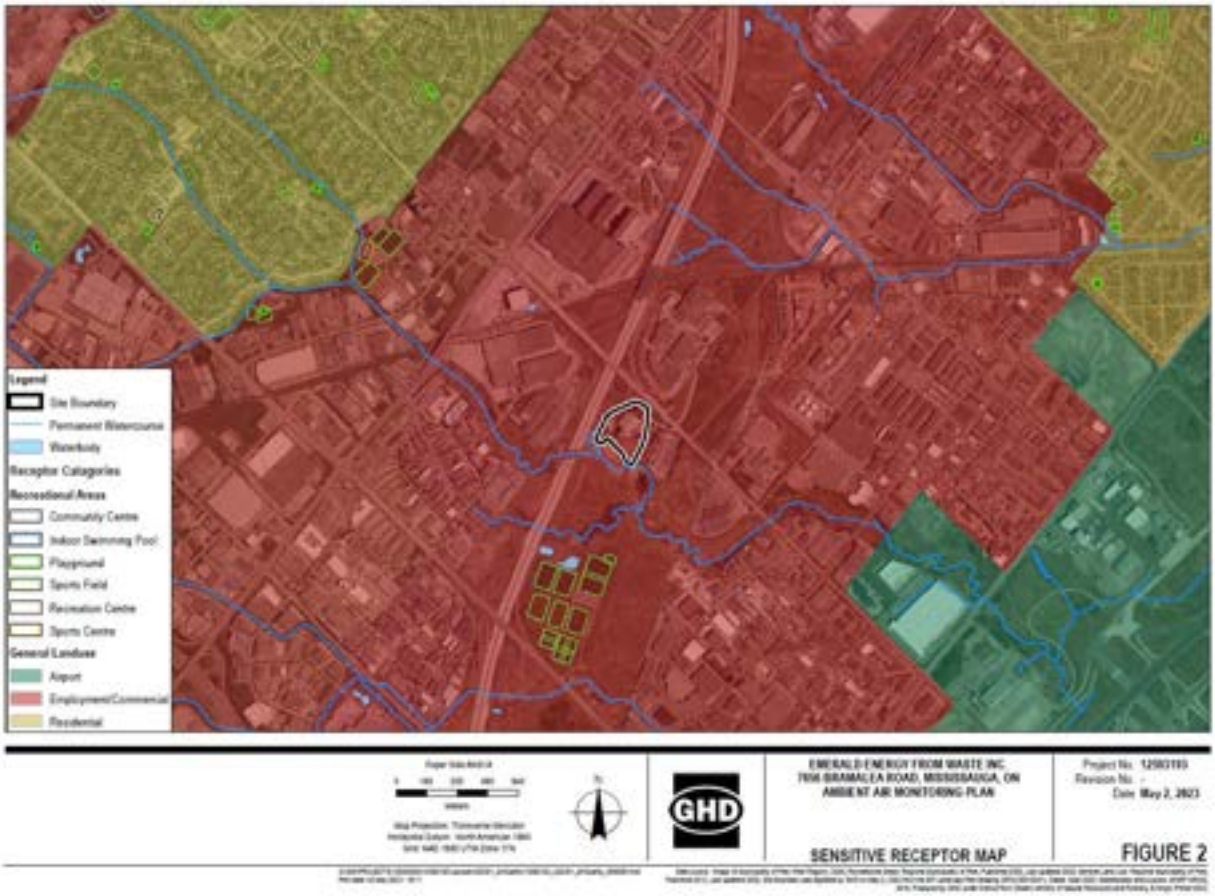


Figure 3-6 Sensitive Receptor Map from Air Quality Impact Assessment (GHD, 2024c)

To assess potential risks related to the projected emissions from the on-site emission sources, the project team selected key sensitive locations representative of the surrounding community. Given the land uses in the surrounding area, a mix of residential and community receptors were evaluated as the likely worst-case receptors (*i.e.*, residents are present at a home potentially 24-hours per day, 7-days per week, and some of the community park locations are at very close proximity to the Facility).

Figure 3-7 provides a map of the Local Study Area with the specific receptor locations modelled in the Air Quality Impact Study. A mixture of residential, commercial, and community locations were selected, with the worst-case residential and community locations carried forward in the risk assessment for health evaluation.



Figure 3-7 Map of Modelled Receptor Locations

The HHRA focused on evaluation of the closest community and residential receptor locations (See Figure 3-7 above) to evaluate potential health risks related to emissions from each of the three proposed expansion phases. These locations represented the locations within the Study Area which received the worst-case contribution from facility emissions.

The worst-case residential location is the elevated receptor at the apartment for all phases and averaging periods (labelled as “Apartment” in Figure 3-7). The worst-case community sensitive receptors were Sportsfield 1 for all expansion phases for both 24-hour and annual average exposures.

Table 3-2 Distance from Emerald EFW Facility to Closest Community and Residential Receptor Locations Identified in Figure 3-6

Category	x	y	Height	Distance to Facility (m)
Commercial 1	606640.0	4838710	0	~600
Commercial 2	606672.8	4838699	0	~950
Commercial 3	606892.2	4838482	0	~1,000
Commercial - Restaurant	607024.4	4838512	0	~700
Commercial – GO Station	605577.0	4839497	0	~840
Commercial - Gas Station	607000.7	4838163	0	~1,070
Park/Playground/Sports field 1	606055.6	4838348	0	~720
Park/Playground/Sports field 2	605990.2	4838329	0	~830
Place of Worship	604891.6	4838548	0	~ 1,380
Place of Worship	605212.7	4837872	0	~ 680

Table 3-2 Distance from Emerald EFW Facility to Closest Community and Residential Receptor Locations Identified in Figure 3-6				
Category	**x**	**y**	**Height**	**Distance to Facility (m)**
Hotel	604141.5	4837935	0	~ 2,320
Hotel	604065.6	4837921	0	~ 2,360
Residential Elevated (Apartment)	605091.6	4840183	59	~1,650
Daycare	604789.0	4840080	0	~1,700
School	604418.0	4839684	0	~1,980

Note: Blue highlighted rows indicate the worst-case community and residential receptor locations, respectively.

3.6 Identification of Chemicals of Concern

A key element for both the Air Quality Impact Assessment and HHRA components of the environmental screening process was the development of a robust and defensible list of chemicals emitted from the facility based on the proposed expansion plans and existing emissions inventories. Refer to the detailed discussion of chemical selection found in the Air Quality Impact Study report (GHD, 2024c).

Table 3-3 List of Initial Chemicals Considered in Air Quality Impact Study		
Criteria Air Contaminants		
Carbon Monoxide	Nitrogen Oxides (NOx)	Ozone
Respirable Particulate Matter (PM_{10})	Fine Particulate Matter ($PM_{2.5}$)	Sulphur Dioxide
Acids		
Hydrogen Chloride	Hydrogen Fluoride	
Aldehydes		
Acetaldehyde	Acrolein	Formaldehyde
Chlorobenzenes and Total PCBs		
1,2-Dichlorobenzene	1,3-Dichlorobenzene	1,4-Dichlorobenzene
1,2,3-Trichlorobenzene	1,2,4-Trichlorobenzene	1,3,5-Trichlorobenzene
1,2,3,4-Tetrachlorobenzene	1,2,3,5/1,2,4,5-Tetrachlorobenzene	Pentachlorobenzene
Hexachlorobenzene		
Chlorophenols		
2,6-Dichlorophenol	2,4/2,5-Dichlorophenol	3,5-Dichlorophenol
2,3-Dichlorophenol	3,4-Dichlorophenol	2,4,6-Trichlorophenol
2,3,6-Trichlorophenol	2,3,5-Trichlorophenol	2,4,5-Trichlorophenol
2,3,4-Trichlorophenol	3,4,5-Trichlorophenol	2,3,5,6/2,3,4,6-Tetrachlorophenol
2,3,4,5-Tetrachlorophenol	Pentachlorophenol	
Polychlorindated dibenzo-*p*-dioxins and dibenzofurans		
Dioxin and Furans (TCDD-TEQ)		
Inorganics		
Aluminum	Aluminum Oxide	Antimony
Arsenic	Barium	Beryllium
Boron	Cadmium	Calcium
Calcium Oxide	Chromium III	Chromium VI
Cobalt	Copper	Iron
Lead	Lithium	Magnesium
Magnesium oxide	Manganese	Molybdenum
Nickel	Phosphorus	Phosphorous pentachloride
Selenium	Silver	Sodium
Sodium hydroxide	Strontium	Tin
Titanium	Vanadium	Zinc
Silicon	Silica	Mercury
Polycyclic Aromatic Hydrocarbons		
Acenaphthene	Acenaphthylene	Anthracene
Benzo(a)anthracene	Benzo(a)fluorene	Benzo(a)pyrene
Benzo(b)fluoranthene	Benzo(b)fluorene	Benzo(e)pyrene
Benzo(g,h,i)perylene	Benzo(j / k)fluoranthene	Biphenyl
Chrysene	Chloronaphthalene (2-)	Coronene
Dibenzo(a,e)pyrene	Dibenzo(a,c/a,h)anthracene	Dibenzo(c,g)carbazole (7H-)
Dimethylanthracene (9,10-)	Dimethylbenzo(a)anthracene (7,12-)	Fluoranthene
Fluorene	Indeno(1,2,3-cd)pyrene	Methylnaphthalene (1-, 2-)
Methylcholanthrene (3-)	Methylphenanthrene (1-, 2-, 9-)	Naphthalene
Perylene	Phenanthrene	Picene
Pyrene	Quinoline	Terphenyl (m-, o-, p-)
Tetralin	Triphenylene	
Volatile Organic Chemicals (VOCs)		
Acetone	Benzene	Bromodichloromethane
Bromoform	Bromomethane	Butadiene (1,3-)
Butanone (2-)	Carbon Tetrachloride	Chlorodibromomethane
Chloroform	Dichloroethane (1,1-)	Dichloroethane (1,2-)
Dichloroethane (trans,1,2-)	Dichloropropane (1,2-)	Dichlorofluoromethane
Ethylbenzene	Ethylene Dibromide	Isopropylbenzene
Methylene Chloride	Styrene	Tetrachloroethene
Toluene	Trichloroethane (1,1,1-)	Trichloroethylene (1,1,2-)
Trichlorofluoromethane	Trimethylbenzene (1,3,5-)	Vinyl Chloride
Xylenes		

It is important to note that while these 135 contaminants are part of the existing facilities' routine stack monitoring program, many of these are emitted at negligible concentrations or are of low potential health concern based on their toxicological nature. To focus the assessment on the most significant contributors to predicted human health risk, the standard risk assessment approach is to conduct a detailed screening whereby the list of chemicals is reduced to a more manageable set of key chemicals carried forward for detailed assessment.

3.6.1 Chemical Screening

The following discussion provides an overview of the screening approaches used to select the COCs specified for detailed evaluate of inhalation and multi-pathway (*i.e.*, inhalation, oral and dermal) exposures.

3.6.1.1 Inhalation Exposures

This evaluation was conducted by assessing the relative potency based on emission factors used in the Air Quality Impact Assessment study as a basis of bulk emissions from the Facility to the surrounding environment.

A relative potency was estimated for each chemical based on a comparison of chemical-specific emission rates to inhalation toxicity reference values (TRVs). The chemicals that had the highest relative potency (up to 99% cumulative) were retained as COCs for each approach. As such, those chemicals that presented the greatest cumulative toxicological potential to result in human health effects were retained, while those with a lower degree of relevance based on their toxicity and emission rate were not considered further in the detailed assessment. Therefore, if it is demonstrated that those chemicals with the greatest toxicological potential do not pose a risk, those emitted at much lower concentrations and have lesser toxicity would also not pose a risk.

To conduct this screening, toxicity benchmarks for the relevant exposure period were selected from the MECP Air Contaminants Benchmark (ACB) table to ensure a consistent source of screening values (MECP, 2023). Where ACB values were unavailable, toxicity screening benchmarks from other reputable agencies were used. The emission rate (in grams/second) was then divided by the ACB value to provide a relative risk value for that chemical. The chemicals were then sorted by their relative risk value from highest to lowest, and the percent of overall toxic potential calculated (*i.e.*, individual relative risk value divided by the sum of all risk values). From these percent of overall toxic potential values, the cumulative percent for each subsequent chemical was calculated, and those chemicals within the top 99% of the overall toxic potential were selected to be carried forward into the detailed HHRA (*i.e.*, the top 25 chemicals).

There were also a few chemicals that may have public concern (*e.g.,* formaldehyde, acrolein, arsenic, and 1,3-butadiene) that fell just outside the top 99% ranking. To ensure completeness, these were also added to the final COC list. Although chloroform, 1,2-dichloroethane, trichloroethylene and vinyl chloride fell outside the top 99% ranking, these chemicals were also added to the final COC list as these chemicals are currently in exceedance of the Ministry's AAQC (prior to the facility's expansion) and their emission rates (following the facility's expansion) will be increased. As such, a total of thirty-three (33) of the original 135 listed chemicals were retained as COCs in the inhalation assessment, based on the key chemicals identified through the screening approach.

Table 3-4 provides the screening table used to select the final COC list, while Table 3-5 provides the full list of COCs considered in the HHRA based on the results of the above analysis step.

Table 3-4 Screening of Initial Chemicals List to Select COCs for the HHRA

	Screened Chemicals	CAS Registry Number	Averaging Period for Air Quality Assessment	Phase 3 Emission Rates (g/s)	Benchmark (Ministry ACBs) (µg/m³ unless otherwise noted)	Relative Risk Value (Emission Rate / Benchmark)	% of OVERALL TOXIC POTENTIAL	CUMULATIVE PERCENT
1	Nitrogen Oxides (NOx)	10102-43-9/ 10102-44-0	24-Hour	8.37E+00	25	1.0E+00	48.66%	48.7%
2	Perylene	198-55-0	Annual	8.57E-07	0.00001[a]	2.6E-01	12.46%	61.1%
3	Dioxin and Furans (TCDD-TEQ)	NA-DFPCB	24-Hour	4.15E-09	0.0000001	1.3E-01	6.06%	67.2%
4	Benzo(a)pyrene	50-32-8	Annual	3.46E-07	0.00001	1.0E-01	5.04%	72.2%
5	Hydrogen Fluoride	7664-39-3	24-Hour	2.84E-02	0.86[b]	9.9E-02	4.81%	77.0%
6	Hydrogen Chloride	7647-01-0	24-Hour	6.23E-01	20	9.4E-02	4.53%	81.5%
7	Benzene	71-43-2	Annual	9.50E-03	0.45	6.3E-02	3.07%	84.6%
8	Cadmium	7440-43-9	24-Hour	4.84E-04	0.025	5.8E-02	2.81%	87.4%
9	Sulphur Dioxide	7446-09-5	24-Hour	2.42E+00	170	4.3E-02	2.07%	89.5%
10	Nickel	7440-02-0	Annual	5.64E-04	0.04	4.2E-02	2.05%	91.5%
11	$PM_{2.5}$	NA-PM2.5	24-Hour	6.23E-01	27	3.9E-02	1.87%	93.4%
12	Calcium Oxide	1305-78-8	24-Hour	1.17E-01	10	3.5E-02	1.71%	95.1%
13	Lead	7439-92-1	24-Hour	3.46E-03	0.5	2.1E-02	1.01%	96.1%
14	Sodium hydroxide	1310-73-2	24-Hour	4.97E-02	10	1.5E-02	0.72%	96.8%
15	Silica	14464-46-1	24-Hour	1.72E-02	5[c]	1.0E-02	0.50%	97.3%
16	Manganese	7439-96-5	24-Hour	1.23E-03	0.4	9.3E-03	0.45%	97.8%
17	Cobalt	7440-48-4	24-Hour	3.05E-04	0.1	9.2E-03	0.44%	98.2%
18	Phosphorus	7723-14-0	24-Hour	1.43E-03	0.5	8.6E-03	0.42%	98.7%
19	Iron	7439-89-6	24-Hour	5.55E-03	4	4.2E-03	0.20%	98.9%
20	Phosphorous pentachloride	10026-13-8	24-Hour	9.64E-03	10	2.9E-03	0.14%	99.0%
21	Quinoline	91-22-5	24-Hour	4.55E-06	0.005	2.7E-03	0.13%	99.1%
22	Chromium (Total)	7440-47-3	24-Hour	3.28E-04	0.5	2.0E-03	0.10%	99.2%
23	Methylcholanthrene (3-)	56-49-5	Annual	1.06E-06	0.002 (TCEQ ESL)	1.6E-03	0.08%	99.3%
24	Mercury	7439-97-6	24-Hour	1.04E-03	2	1.6E-03	0.08%	99.4%
25	Formaldehyde	50-00-0	24-Hour	3.32E-02	65	1.5E-03	0.07%	99.5%
	Chlorodibromomethane	124-48-1	24-Hour	9.52E-05	0.2	1.4E-03	0.07%	99.5%
26	Carbon Monoxide	630-08-0	1/2-Hour	2.77E+00	6,000	1.4E-03	0.07%	99.6%
27	Acrolein	107-02-8	24-Hour	1.78E-04	0.4	1.3E-03	0.06%	99.7%
28	Arsenic	7440-38-2	24-Hour	1.27E-04	0.3	1.3E-03	0.06%	99.7%
	Beryllium	7440-41-7	24-Hour	3.10E-06	0.01	9.3E-04	0.05%	99.8%
	Silicon	7440-21-3	24-Hour	8.02E-03	27	8.9E-04	0.04%	99.8%
	Aluminum	7429-90-5	24-Hour	1.89E-03	12	4.7E-04	0.02%	99.8%
29	Vinyl Chloride	75-01-4	24-Hour	1.50E-04	1	4.5E-04	0.02%	99.9%
30	1,2-Dichloroethane	107-06-2	24-Hour	2.10E-04	2	3.2E-04	0.02%	99.9%
31	Chloroform	67-66-3	24-Hour	9.63E-05	1	2.9E-04	0.01%	99.9%
	Hexachlorobenzene	118-74-1	24-Hour	9.21E-07	0.011	2.5E-04	0.01%	99.9%
32	1,3-Butadiene	106-99-0	Annual	1.50E-04	2	2.2E-04	0.01%	99.9%
	Copper	7440-50-8	24-Hour	3.47E-03	50	2.1E-04	0.01%	99.9%
	Boron	7440-42-8	24-Hour	8.29E-03	120	2.1E-04	0.01%	99.9%
	Acetaldehyde	75-07-0	24-Hour	3.40E-02	500	2.0E-04	0.01%	99.9%
	Tin	7440-31-5	24-Hour	5.05E-04	10	1.5E-04	0.01%	99.9%
	Zinc	7440-66-6	24-Hour	4.77E-03	120	1.2E-04	0.01%	99.9%
	Carbon Tetrachloride	56-23-5	24-Hour	9.10E-05	2.4	1.1E-04	0.01%	100.0%
	Magnesium	7439-95-4	24-Hour	2.31E-03	72	9.6E-05	0.00%	100.0%

Table 3-4 Screening of Initial Chemicals List to Select COCs for the HHRA

	Screened Chemicals	CAS Registry Number	Averaging Period for Air Quality Assessment	Phase 3 Emission Rates (g/s)	Benchmark (Ministry ACBs) (µg/m³ unless otherwise noted)	Relative Risk Value (Emission Rate / Benchmark)	% of OVERALL TOXIC POTENTIAL	CUMULATIVE PERCENT
	Magnesium oxide	1309-48-4	24-Hour	3.83E-03	120	9.6E-05	0.00%	100.0%
	Ethylene Dibromide	106-93-4	24-Hour	9.10E-05	3	9.1E-05	0.00%	100.0%
	Aluminum Oxide	1344-28-1	24-Hour	3.58E-03	120	8.9E-05	0.00%	100.0%
	Barium	7440-39-3	24-Hour	2.63E-04	10	7.9E-05	0.00%	100.0%
	Benzo(e)Pyrene	192-97-2	Annual	1.28E-06	0.05 (TCEQ ESL)	7.7E-05	0.00%	100.0%
	2-methylanthracene	613-12-7	Annual	1.13E-06	0.05 (TCEQ ESL)	6.8E-05	0.00%	100.0%
	Methylene Chloride	75-09-2	24-Hour	4.28E-03	220	5.8E-05	0.00%	100.0%
	Benzo(b)fluorene	243-17-4	Annual	9.00E-07	0.05 (TCEQ ESL)	5.4E-05	0.00%	100.0%
	Benzo(a)fluorene	238-84-6	Annual	8.96E-07	0.05 (TCEQ ESL)	5.4E-05	0.00%	100.0%
	Silver	7440-22-4	24-Hour	1.30E-05	1	3.9E-05	0.00%	100.0%
33	Trichloroethylene	79-01-6	Annual	9.10E-05	12	2.3E-05	0.00%	100.0%
	Vanadium	7440-62-2	24-Hour	1.36E-05	2	2.0E-05	0.00%	100.0%
	Antimony	7440-36-0	24-Hour	8.98E-05	25	1.1E-05	0.00%	100.0%
	Selenium	7782-49-2	24-Hour	3.41E-05	10	1.0E-05	0.00%	100.0%
	Fluorene	86-73-7	Annual	3.40E-06	1 (TCEQ ESL)	1.0E-05	0.00%	100.0%
	Bromoform	75-25-2	24-Hour	1.58E-04	55	8.6E-06	0.00%	100.0%
	3,5-Dichlorophenol	591-35-5	24-Hour	1.57E-06	0.75[d]	6.3E-06	0.00%	100.0%
	Molybdenum	7439-98-7	24-Hour	2.46E-04	120	6.2E-06	0.00%	100.0%
	2,3-Dichlorophenol	576-24-9	24-Hour	1.52E-06	0.75[d]	6.1E-06	0.00%	100.0%
	3,4-Dichlorophenol	95-77-2	24-Hour	1.52E-06	0.75[d]	6.1E-06	0.00%	100.0%
	2,3,6-Trichlorophenol	933-75-5	24-Hour	1.52E-06	0.75[d]	6.1E-06	0.00%	100.0%
	2,3,5-Trichlorophenol	933-78-8	24-Hour	1.52E-06	0.75[d]	6.1E-06	0.00%	100.0%
	2,3,4-Trichlorophenol	15950-66-0	24-Hour	1.52E-06	0.75[d]	6.1E-06	0.00%	100.0%
	3,4,5-Trichlorophenol	609-19-8	24-Hour	1.52E-06	0.75[d]	6.1E-06	0.00%	100.0%
	2,3,5,6/2,3,4,6-Tetrachlorophenol	935-95-5/58-90-2	24-Hour	1.52E-06	0.75	6.1E-06	0.00%	100.0%
	2,3,4,5-Tetrachlorophenol	4901-51-3	24-Hour	1.52E-06	0.75[d]	6.1E-06	0.00%	100.0%
	trans,1,2-Dichloroethane	156-60-5	24-Hour	2.10E-04	105	6.0E-06	0.00%	100.0%
	Titanium	7440-32-6	24-Hour	2.19E-04	120	5.5E-06	0.00%	100.0%
	Naphthalene	91-20-3	24-Hour	3.74E-05	22.5	5.0E-06	0.00%	100.0%
	Lithium	7439-93-2	24-Hour	2.35E-05	20	3.5E-06	0.00%	100.0%
	2,4,6-Trichlorophenol	88-06-2	24-Hour	1.52E-06	1.5	3.0E-06	0.00%	100.0%
	2-Chloronaphthalene	91-58-7	24-Hour	9.47E-07	1	2.8E-06	0.00%	100.0%
	Toluene	108-88-3	24-Hour	1.68E-03	2,000	2.5E-06	0.00%	100.0%
	1,3,5-Trimethylbenzene	108-67-8	24-Hour	1.50E-04	220	2.0E-06	0.00%	100.0%
	1,1-Dichloroethane	75-34-3	24-Hour	1.09E-04	165	2.0E-06	0.00%	100.0%
	2-Butanone	78-93-3	24-Hour	6.46E-04	1,000	1.9E-06	0.00%	100.0%
	Bromomethane	74-83-9	24-Hour	7.63E-04	1,350	1.7E-06	0.00%	100.0%
	Strontium	7440-24-6	24-Hour	6.50E-05	120	1.6E-06	0.00%	100.0%
	Xylenes	1330-20-7	24-Hour	3.93E-04	730	1.6E-06	0.00%	100.0%
	Tetrachloroethene	127-18-4	24-Hour	1.59E-04	360	1.3E-06	0.00%	100.0%
	Biphenyl	92-52-4	1-Hour	2.24E-05	60	1.1E-06	0.00%	100.0%
	2-Methylnaphthalene	91-57-6	24-Hour	1.26E-05	35.5	1.1E-06	0.00%	100.0%
	Dichlorofluoromethane	75-43-4	24-Hour	1.58E-04	500	9.5E-07	0.00%	100.0%
	Bromodichloromethane	75-27-4	24-Hour	9.10E-05	350	7.8E-07	0.00%	100.0%

Table 3-4 Screening of Initial Chemicals List to Select COCs for the HHRA

	Screened Chemicals	CAS Registry Number	Averaging Period for Air Quality Assessment	Phase 3 Emission Rates (g/s)	Benchmark (Ministry ACBs) (µg/m³ unless otherwise noted)	Relative Risk Value (Emission Rate / Benchmark)	% of OVERALL TOXIC POTENTIAL	CUMULATIVE PERCENT
	1,3,5-Trichlorobenzene	108-70-3	24-Hour	9.15E-07	3.6	7.6E-07	0.00%	100.0%
	Styrene	100-42-5	24-Hour	9.76E-05	400	7.3E-07	0.00%	100.0%
	m-terphenyl	26140-60-3	24-hour	1.04E-05	15	6.9E-07	0.00%	100.0%
	Isopropylbenzene	98-82-8	24-Hour	9.10E-05	400	6.8E-07	0.00%	100.0%
	Ethylbenzene	100-41-4	24-Hour	1.50E-04	1,000	4.5E-07	0.00%	100.0%
	1,4-Dichlorobenzene	106-46-7	24-Hour	1.31E-05	95	4.1E-07	0.00%	100.0%
	Acetone	67-64-1	24-Hour	9.58E-04	11,880	2.4E-07	0.00%	100.0%
	2,6-Dichlorophenol	87-65-0	24-Hour	1.52E-06	19	2.4E-07	0.00%	100.0%
	Pentachlorophenol	87-86-5	24-Hour	1.52E-06	20	2.3E-07	0.00%	100.0%
	o-Terphenyl	26140-60-3	24-hour	3.28E-06	15	2.2E-07	0.00%	100.0%
	p-terphenyl	26140-60-3	24-hour	2.77E-06	15	1.8E-07	0.00%	100.0%
	Tetralin	119-64-2	Annual	8.63E-06	151.5	1.7E-07	0.00%	100.0%
	Phenanthrene	85-01-8	Annual	5.48E-06	0.00001[a]	1.6E-07	0.00%	100.0%
	2,4/2,5-Dichlorophenol	120-83-2/583-78-8	24-Hour	1.53E-06	33.5	1.4E-07	0.00%	100.0%
	1,3-Dichlorobenzene	541-73-1	24-Hour	1.94E-06	50	1.2E-07	0.00%	100.0%
	1,2-Dichloropropane	78-87-5	24-Hour	9.10E-05	2,400	1.1E-07	0.00%	100.0%
	1,2,3,5/1,2,4,5-Tetrachlorobenzene	634-90-2/95-94-3	24-Hour	1.52E-06	60	7.6E-08	0.00%	100.0%
	Trichlorofluoromethane	75-69-4	24-Hour	1.50E-04	6,000	7.5E-08	0.00%	100.0%
	Pentachlorobenzene	608-93-5	24-Hour	1.27E-06	80	4.8E-08	0.00%	100.0%
	1-Methylphenanthrene	832-69-9	Annual	1.29E-06	0.00001[a] Phenanthrene as surrogate	3.9E-08	0.00%	100.0%
	9-Methylphenanthrene	883-20-5	Annual	1.09E-06	0.00001[a] Phenanthrene as surrogate	3.3E-08	0.00%	100.0%
	1,2,3-Trichlorobenzene	87-61-6	24-Hour	1.24E-06	135	2.8E-08	0.00%	100.0%
	2,4,5-Trichlorophenol	95-95-4	24-Hour	1.52E-06	220	2.1E-08	0.00%	100.0%
	1,2,4-Trichlorobenzene	120-82-1	24-Hour	1.62E-06	400	1.2E-08	0.00%	100.0%
	1,2,3,4-Tetrachlorobenzene	634-66-2	24-Hour	1.13E-06	600	5.7E-09	0.00%	100.0%
	Coronene	191-07-1	24-Hour	1.17E-06	0.00001[a] Benzo(g,h,i)Perylene surrogate	3.5E-09	0.00%	100.0%
	1,1,1-Trichloroethane	71-55-6	24-Hour	9.10E-05	115,000	2.4E-09	0.00%	100.0%
	Trichlorotrifluoroethane	76-13-1	24-Hour	1.50E-04	800,000	5.6E-10	0.00%	100.0%
	Dichlorobenzene, 1,2-	95-50-1	1-hour	8.48E-06	30,500	2.8E-10	0.00%	100.0%
	Picene	53-70-3	24-Hour	8.93E-07	0.00001[a] Dibenz(a,h)anthracene as surrogate	3.3E-11	0.00%	100.0%
	Dimethylbenzo(a)anthracene (7,12-)	57-97-6	Annual	3.22E-06	0.00001[a]	9.7E-12	0.00%	100.0%
	TOTAL RISK					**2.1E+00**		

Note: Blue shaded cells indicate chemicals selected for further assessment in the HHRA.

PM_{10} was removed from the screening list to avoid double-counting with $PM_{2.5}$, the more relevant particulate fraction to evaluate from a health basis.

[a] Benzo[a]pyrene (B[a]P) is a surrogate for all polyaromatic hydrocarbons (PAHs).

[b] Fluorides (as HF) – Gaseous (Growing Season)

[c] Silica - respirable (<10 µm diameter), cristobalite

[d] The most conservative chlorophenol was assumed.

Table 3-5 Final List of Chemicals for the HHRA		
Criteria Air Contaminants		
Carbon Monoxide	Nitrogen Oxides	$PM_{2.5}$
Sulphur Dioxide		
Volatile Organic Chemicals		
Acrolein	Benzene	Butadiene (1,3-)
Chloroform	Dichloroethane, 1,2-	Formaldehyde
Trichloroethylene	Vinyl Chloride	
Polychlorinated dibenzo-*p*-dioxins and dibenzofurans		
Dioxins and Furans (TCDD-TEQ)		
Polycyclic Aromatic Hydrocarbons		
Benzo(a)pyrene-TEQ [a]	Quinoline	Methylcholanthrene (3-)
Perylene		
Inorganics		
Arsenic	Cadmium	Calcium Oxide
Chromium [b]	Cobalt	Hydrogen Chloride
Hydrogen Fluoride	Iron	Lead
Manganese	Mercury	Nickel
Phosphorous pentachloride	Phosphorus	Silica
Sodium hydroxide		

[a] While benzo(a)pyrene was the only carcinogenic PAH which screened onto the final list of COCs, this chemical was evaluated using toxicity equivalencies to benzo(a)pyrene representing all carcinogenic PAHs which act through a similar toxicological mechanism (*i.e.*, BAP-TEQ) using toxicity equivalency factors (TEFs). Refer to Section 5.2.2 for further discussion.

[b] Chromium will be evaluated separately as Chromium III and Chromium VI due to differing toxicological mechanisms and health risks.

3.6.1.1 Ozone

As noted in the Air Quality Impact Assessment report (GHD, 2024c), the Emerald facility does not directly generate and emit ozone as a byproduct of its operations. Ozone is produced as a secondary pollutant as a result of a chemical reaction between ambient concentrations of VOCs and NOx in the presence of sunlight. To confirm that the emissions of VOCs and NOx from the proposed Emerald expansion are not anticipated to impact regional ozone levels, GHD (2024c) completed a high-level, conservative screening assessment based on the US EPA methodology described in the “Guidance on the Development of Modeled Emission Rates for Precursors (MERPs) as a Tier 1 Demonstration Tool for Ozone and PM2.5 under the PSD Permitting Program”. The results of this screening assessment indicated that no potential impact would be expected to regional ozone levels due to emissions from projected future Emerald operations. As such, ozone was not considered further in the current HHRA. Refer to the Air Quality Impact Assessment report (GHD, 2024c) for a summary of the methodology and assumptions used in their ozone screening assessment.

3.6.1.2 Multi-Pathway Exposures

Due to the physical-chemical properties of the individual evaluated chemicals, not all COCs emitted from the facility will persist or accumulate in the environment. To identify the COCs that were considered in the multi-pathway risk assessment, the physical-chemical properties of each of the COCs were compared to accepted national and international criteria for the classification of persistent and bio-accumulative substances (Rodan *et al.,* 1999; Environment Canada, 2024).

The multi-pathway screening approach used in the current assessment was adapted based upon the methodology presented in the 2005 US EPA Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities document (US EPA, 2005) and is the standard approach in these types of assessments. The approach accounts for soil loss over time through both degradation and volatilization.

The characterization of persistence and bioaccumulation is provided in detail within Environment Canada's Existing Substances Program and the Health Canada and Environment Canada's Domestic Substances List Categorization, under the *Canadian Environmental Protection Act* (CEPA).

Persistence refers to the length of time a chemical resides in the environment and is measured by its half-life. This is the time required for the quantity of a chemical to diminish or degrade to half of its original amount within a particular environment or medium. For the purposes of this assessment, a chemical was considered persistent if its half-life in soil was greater than or equal to (≥) six months (182 days). The appropriate rate constants (or half-lives) for each of the potential COCs were taken from sources such as US EPA (2005) and Lymann *et al*. (1990), or obtained using EpiSuite from the US EPA (EpiSuite, 2007).

Bioaccumulation is a general term used to describe the process by which chemicals are accumulated in an organism directly from exposure to water, soil, or through consumption of food containing the substances. A chemical's potential to bio-accumulate is related to its octanol-water partition coefficient (K_{ow}). The K_{ow} refers to the ratio of distribution of a substance in octanol compared to that in water. For the purposes of this assessment, a chemical was considered bio-accumulative if its Log K_{ow} was greater than or equal to five.

Therefore, COCs retained for full multi-pathway assessment had:

- A half-life in soil greater than or equal to six months; and/or,
- An octanol-water partition coefficient (Log K_{ow}) greater than or equal to five.

The rationale behind this exercise was that if a chemical released to the air does not meet either of these criteria, only a limited opportunity exists for human exposure *via* secondary exposure pathways (*i.e.,* those other than inhalation), as the potential for that chemical to persist and/or accumulate in the environment is negligible. However, if a chemical meets one or both of these criteria, sufficient opportunity could be present for long term exposure. Metals/inorganics, as a group, would also qualify for the potentially to accumulate in soil should emissions be sufficiently elevated. As such, a number of inorganics on the COC screening list were evaluated (those with potentially the highest emissions) to determine whether there is a multi-pathway risk for these COCs.

Based on the results of the screening, the following COCs were carried forward to deposition screening for the multi-pathway assessment:

- Arsenic;
- Benzo(a)pyrene-TEQ (representing emissions of PAHs);
- Cadmium;
- Chromium (total);
- Cobalt
- Iron;
- Lead;
- Manganese;
- Mercury;
- Nickel and,
- Polychlorinated dibenzo-*p*-dioxins and dibenzo furans (TCDD-TEQ).

Calcium hydroxide, silica, and sodium hydroxide were also on the initial chemical screening list. However, calcium hydroxide almost immediately forms calcium carbonate when exposed to carbon dioxide in the environment. Calcium carbonate is a fairly inert substances (found in antacids) which is not a concern from a health point-of-view at the levels that theoretically could be emitted from the proposed Project. Similarly, sodium hydroxide reacts with carbon monoxide and moisture immediately upon release to form sodium carbonate and water. The sodium carbonate will then completely dissociate into sodium and hydroxide ions in water, also not a health concern at the levels that theoretically could be emitted from the proposed Project. Finally, silica is an inhalation health risk, and not a concern from a deposition to soil over time and subsequent oral or dermal exposure point-of-view. As such, these three COCs were not carried forward for the more detailed deposition analysis.

Finally, particulate matter (PM) such as PM_{10} and $PM_{2.5}$ are only relevant from an inhalation pathway and are not typically evaluated in a multi-pathway assessment due to these size fractions not being directly relevant for oral or dermal exposure pathways. Rather individual chemicals that make up the PM (such as inorganics or PAHs) are carried forward rather than these broader PM size fractionation groups.

3.7 Identification and Selection of Human Receptors

A human receptor is a hypothetical person (*e.g.*, infant, toddler, child, adolescent, adult) who resides and/or works in the area being investigated and is, or could potentially be, exposed to the chemicals identified as being of potential concern. General physical and behavioural characteristics specific to the receptor type (*e.g.*, body weight, breathing rate, food consumption rate, *etc.*) were used to determine the amount of chemical exposure received by each receptor as part of the multi-pathway assessment. The potential risks associated with chemicals of concern will be different depending on the receptor chosen for evaluation.

The HHRA must be sufficiently comprehensive to ensure inclusion of those receptors with the greatest potential for exposure to COCs, and those who have the greatest sensitivity, or potential for developing adverse health outcomes from these exposures. With this in mind, the selection of hypothetical, reasonable “worst-case” receptors, with somewhat exaggerated lifestyle habits, were used to ensure a conservative (*i.e.*, protective) assessment.

For the current assessment, two specific groups of sensitive receptors were evaluated – the residential receptor and the community-use receptor. Due to the residency time at a given receptor location (*i.e.*, conservatively assumed to be present 24-hours per day and 365 days per year), the residential receptor group is considered to have the highest potential exposure and resultant health risk from chemicals emitted from the Project. Due to this conservatism, this receptor group will also account for those sensitive individuals who may be present at other land uses throughout the Study Area (*e.g.*, hospitals, daycares, schools, retirement homes, *etc.*).

As per Health Canada (2021a) guidance, the *residential receptor* was assumed to be represented by five discrete life stages:

1. Infant (birth to 6 months of age);
2. Toddler (7 months to 4 years of age);
3. Child (5 to 11 years of age);
4. Adolescent (12 to 19 years of age); and,
5. Adult (≥ 20 years of age, assuming an 80 year lifespan).

The residential receptor was assumed to be born in the Greater Toronto Area with the facility operating, and conservatively assumed to live at that location close to the facility for their entire lifetime (*i.e.*, 80 years). The individual was assumed to be exposed *via* inhalation of ambient air to emissions from the proposed facility (and other nearby significant sources). The resident was also be assumed to be exposed to COCs through contact with contaminated soil or home-grown produce impacted by the deposition of the emitted COCs onto surface soils in the surrounding community. Predicted soil concentrations were conservatively assumed to be the maximum concentration that would be present after the facility's lifetime of deposition, taking into account degradation and soil loss over that time (US EPA, 2005).

For the community-use receptor, this individual was assumed to make use of community locations (such as the GO Train station, nearby sports fields, parks or playgrounds, *etc*.) for a few hours per day. For the purposes of the acute short-term exposure scenarios, the community-use receptor was assumed to spend 3 hours of a day at the receptor location (*e.g.,* playing a baseball game or cricket match, *etc*.), while for long-term exposures, the community-use receptor was assumed to spend 2 hours/day, 7 days/week at the receptor location (*e.g.*, walking their dog, using the park, attending a service, *etc*.). Predicted exposures and resulting risks were adjusted based upon the amount of time the individual spent at this location for both short- and long-term exposures.

For the assessment of inhalation risks, as a straight comparison between predicted short term (*i.e.*, 24-hour exposure durations) and long term (*i.e.*, annual average exposures) air concentrations and the corresponding regulatory RfC is made, the resulting CR value is receptor-independent (*i.e.*, the same value is calculated for all receptor types).

In the case of the multi-pathway assessment (if required), exposures *via* the oral and dermal pathways to the select COCs were evaluated for the most sensitive receptor groups living in the surrounding community – toddlers. In the case of carcinogenic COCs, potential incremental lifetime cancer risks were evaluated for a lifetime composite receptor, which combined predicted risks each of the life stages described above to produce an overall lifetime composite risk value.

3.8 Identification of Exposure Scenarios and Pathways

3.8.1 Exposure Scenarios

For the current assessment, three specific exposure scenarios were evaluated:

Phase 1 Expansion – construction of a new line while existing facility is operating (see Figure 3-8). Once the new Phase 1 line is operating, the existing facility with be shutdown and decommissioned (*i.e.*, they will not be operating at the same time);

Phase 2 Expansion – construction and operation of the second line and continued operation of the first new line; and,

Phase 3 Expansion – construction and operation of the third line while the other two new lines continue to operate (see Figure 3-9).

For each phase of the expansion, chemical-specific concentrations were modelled for each receptor location based upon the emission profile for that particular phase (*i.e.*, Project Alone

concentrations). Baseline concentrations for those COCs for which monitoring data was available was established to provide background conditions.

Each operational phase assessed (Phase 1, 2 and 3) used modelled data developed specifically for the HHRA receptors. The background ambient air concentrations are based on monitored data and were added to the modelled data.

Predicted concentrations were combined with measured background concentrations to estimate cumulative concentrations for a given receptor location for each evaluated chemical (*i.e.*, Cumulative concentrations).

The Air Quality Impact Assessment indicated that there would not be any air emissions of concern from either the construction or decommissioning phases of the facility. A Fugitive Dust Best Management Plan will be developed following the completion of the detailed design of the Facility. This plan will aim to minimize fugitive dust emissions impact to the surrounding community and environment during Facility's regular operations, start up, shutdown, and process upsets. As such, the construction and decommissioning phases of the project were not included as quantitative exposure scenarios in the HHRA.

As noted in the Air Quality Impact Assessment (GHD, 2024), ensuring proper incineration process operating conditions is crucial for achieving adequate combustion and minimizing air emissions. Therefore, appropriate measures are required to maintain combustion conditions, such as temperature and residence time, during the Facility's start-ups, shutdowns, and malfunctions of the combustion units or flue gas treatment equipment.

For the temperature retention requirement, natural gas fired auxiliary burners will be used during start-up and shutdown, and periods of lower waste input or when processing low-calorific waste. In the current ECA, there are design requirements to ensure temperature reaches design conditions prior before to introducing waste or waste derived fuel into the primary chamber during the start up and the shutdown period until all waste combustion is completed.

In the event of upset conditions, such as a power failure leading to the shutdown of the facility air pollution control (APC) system, Emerald will use backup generators to sustain power for the APC until self-generated power is restored or until the units can be safely shut down to prevent unexpected emissions. Based on Emerald operating experience, the backup generator would typically have to run approximately 15 minutes until self-generated power is restored.

In addition, based on the Facility's current ECA approval, the APC must be designed to maintain design treatment conditions before waste is introduced during the start up and after waste processing has stopped in the shutdown procedure. As a result of these built-in mitigation measures, emissions during start-up, shutdown, and upset conditions are not expected to exceed those during regular operations at maximum Facility capacity, given the reduced quantity of waste being burned.

Given emissions are expected to be less than the maximum facility capacity scenario evaluated in the HHRA, start-up, shutdown and upset scenarios were not included as quantitative exposure scenarios in the HHRA.

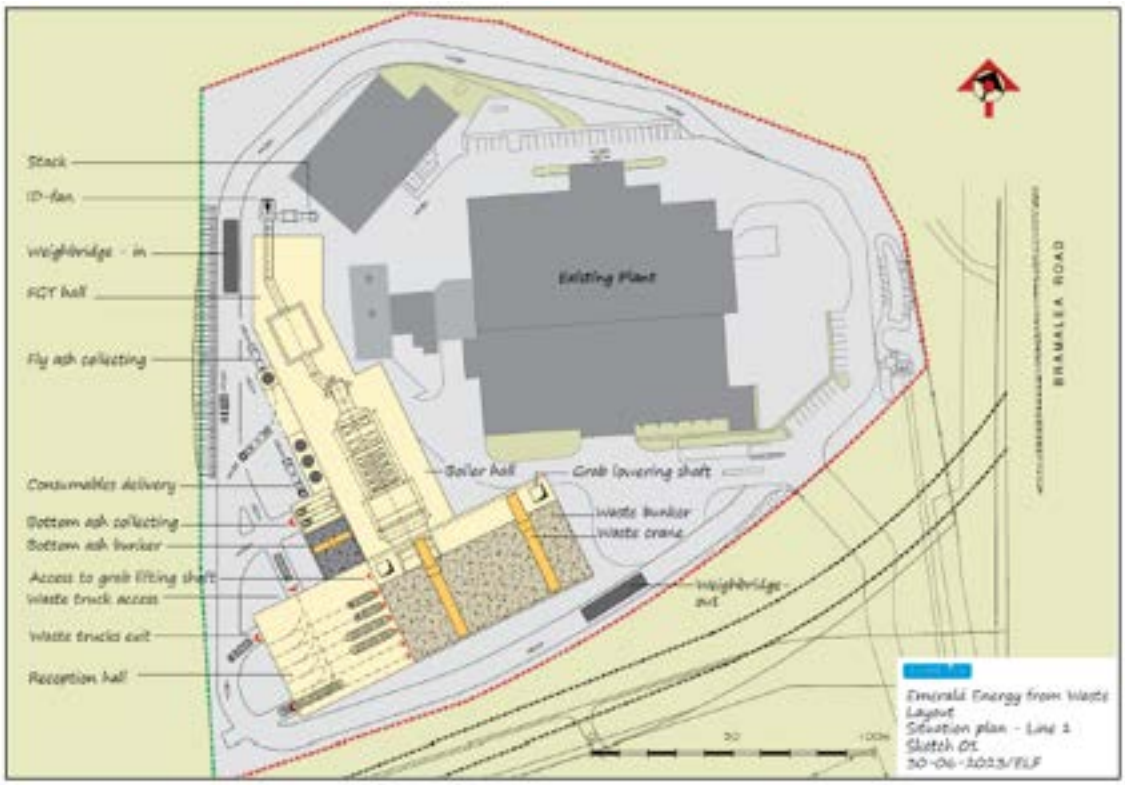


Figure 3-8 Proposed Site Map of Expansion Plan at Phase 1 (GHD, 2024a)

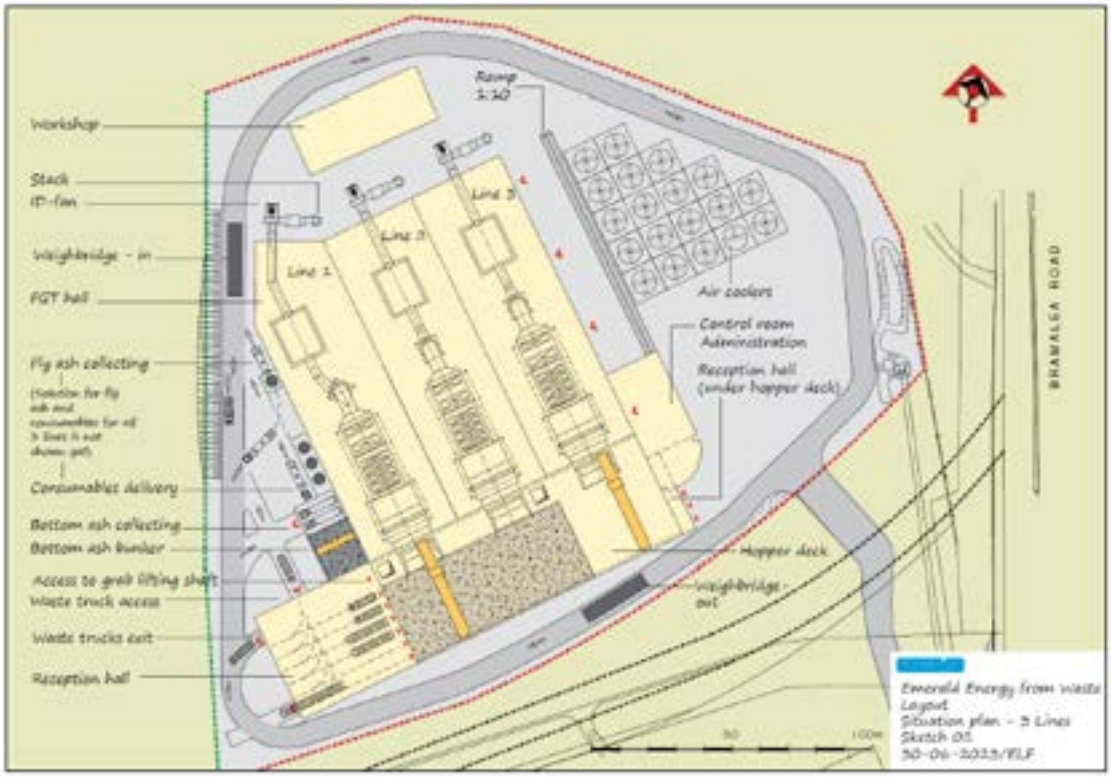


Figure 3-9 Proposed Site Map of Expansion Plan at Phase 3 (GHD, 2024a)

3.8.2 Exposure Pathways

The primary exposure pathway evaluated in the HHRA was the inhalation of the COCs by individuals living, working, or playing in the surrounding community.

Should a multi-pathway assessment be required, those COCs evaluated by the multi-pathway approach (*i.e.*, oral and dermal exposures), the following additional exposure pathways were considered concurrently:

- **Incidental Ingestion of Soil and Dust**: Through typical indoor and outdoor activities, individuals may accidentally ingest soil and/or dust particles. Children and toddlers are typically more susceptible to this exposure pathway, as they spend more time in contact with the ground, and are more likely to put soiled articles, such as toys or hands, into their mouths.
- **Incidental Inhalation of Indoor Dust**: Soils impacted by particles emitted from the Project-related sources were assumed to be carried indoors (*e.g.*, by wind, or human and/pet activities) and present as indoor suspended dust for inhalation by individuals living within the home.
- **Dermal Exposure to Soils and Dusts**: Dermal exposures of human receptors may occur in both indoor and outdoor environments, through direct dermal contact with chemically impacted soil and dust.
- **Ingestion of Locally Grown Produce**: Locally grown produce (such as vegetables and fruits grown in backyard gardens) may itself pose a source of exposure to some COCs. As chemicals are deposited from air-borne emissions, they may come into contact with leaves and fruit of crop plants. Deposition of chemicals onto soil may also result in an accumulation in plants through root uptake.

Figure 3-10 provides an overview of the residential exposure scenario, while Figure 3-11 illustrates the Conceptual Site Model (CSM) used in the assessment and provides an overview of the sources of COCs and the exposure pathways associated with these sources. It should be noted that any discussion of particulates in Figure 3-11 is assessed within the HHRA through the evaluation of $PM_{2.5}$.

As noted in the CSM, for the sake of conservatism, each of the potential pathways and exposure assumptions typically associated with a residential scenario were evaluated at all sensitive receptor locations. For example, when considering multi-pathway exposures (*i.e.*, non-inhalation), individuals at each of the assessed receptor locations were assumed to spend 24 hours per day, 7 days per week, for 50 weeks per year at this location. This is obviously an overestimation of potential exposures for the schools or other similar sensitive receptor locations (*e.g.*, retirement homes, parks, *etc.*), as well as individuals exposed while at their workplace.

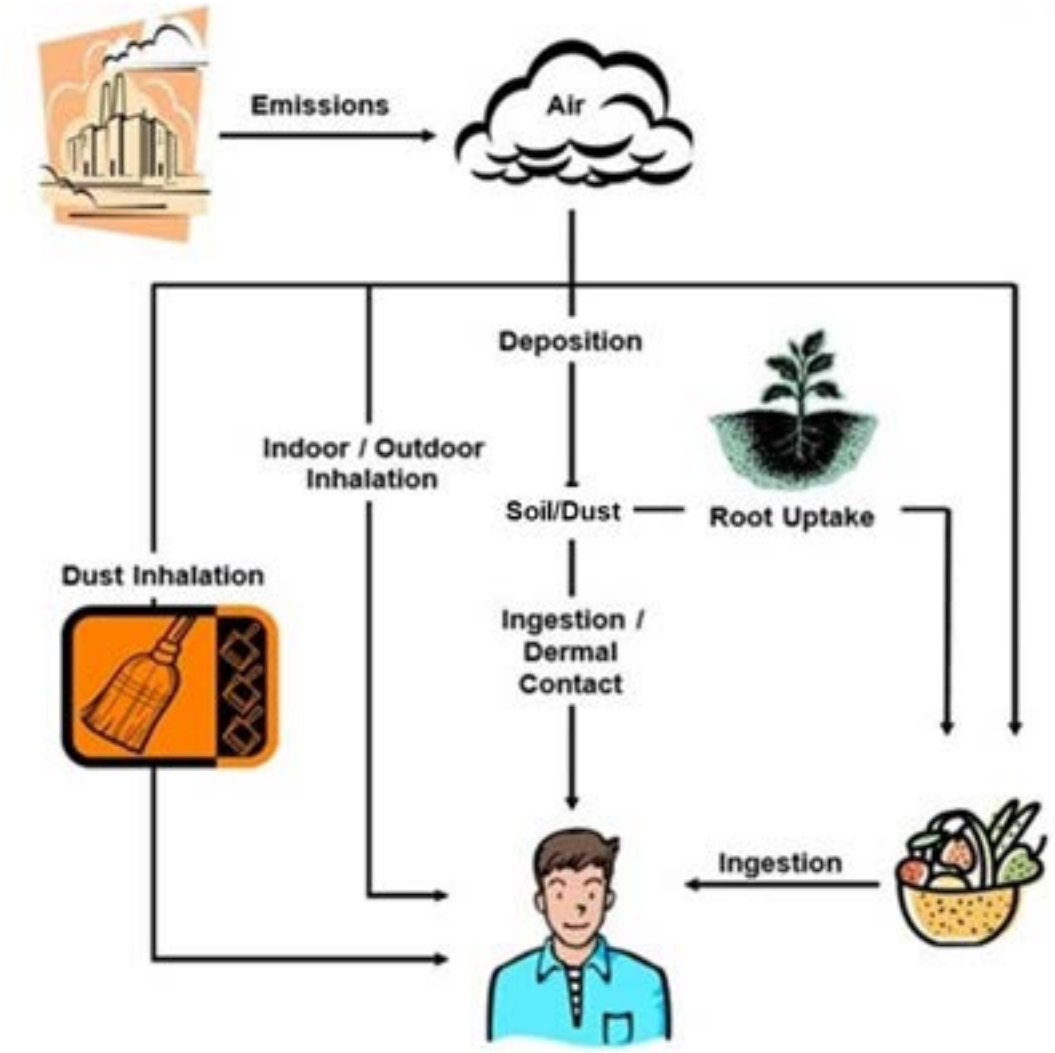


Figure 3-10 Residential Exposure Scenario

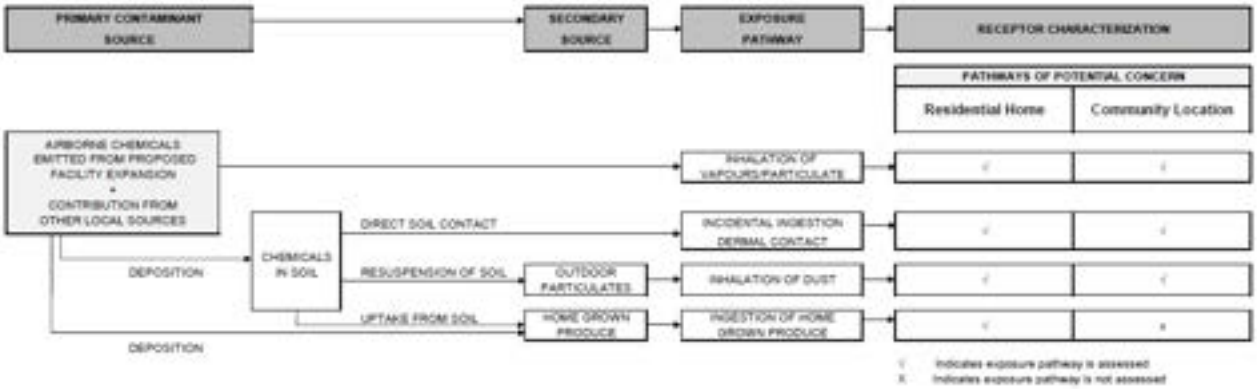


Figure 3-11 Conceptual Site Model (CSM) for Assessment

4.0 EXPOSURE ASSESSMENT

The magnitude of exposure of human receptors to chemicals in the environment typically depends on the interactions of a number of parameters, including:

- The concentrations of chemicals in various environmental media (as determined by the quantities of chemicals entering the environment from various sources, their persistence, fate and behaviour in these media, and the normal ambient, or background concentrations that exist independent of a specific source);
- The physical-chemical characteristics of the chemicals of concern, which affect their environmental fate, transport, behaviour and persistence, and determine the degree or extent by which chemicals can be absorbed into the body;
- The influence of site-specific environmental characteristics, such as geology, soil type, topography, hydrology, hydrogeology, local meteorology and climatology, *etc*., on a chemical's fate, transport and behaviour within environmental media;
- The physiological and behavioural characteristics of the receptors (*e.g.,* respiration rate, soils/dusts intake rate, food ingestion rates, time spent at various activities and in different areas); and,
- The various exposure pathways for the transfer of the chemicals from the different environmental media to humans (*e.g.,* inhalation of indoor and outdoor air, soil particles and dusts; ingestion of food items, water, soils/dusts; skin penetration of various chemicals from dermal contact with soil/dust, water, sediments).

4.1 Estimation of Local Background Conditions

GHD (2024b) completed an ambient air monitoring study in which they documented the results of two ambient air monitoring programs (AAMP) that were completed in locations upwind and downwind of the currently operating Facility. One was completed for the Region of Peel in 2013/2014, while the other is currently being undertaken by GHD as part of the ongoing Environmental Screening process. Both studies collected data from two monitoring locations near the Study Area. The first monitoring location was sited in a vacant parking lot at 185 Central Park Drive in Brampton and represented an upwind location to the Emerald facility. The second location was sited at Carterm Intermodal Logistics located at 2700 Drew Road in Mississauga and represented a downwind location from the Emerald facility. Data from these two ambient air monitoring programs was supplemented by available data from the local National Air Pollution Surveillance (NAPS) stations (i.e., 2013/2014, 2021, and 2022) and local Ontario Air Quality Stations (i.e., 2013/2014, 2022, and 2023). It is worth noting that emissions may be expected at the monitoring sites and/or the immediate vicinity which may lead to a diminishment in Emerald's contributions to overall emissions. Additional information on the background monitoring locations can be found in Section 2.5 of the Revised Background Ambient Air Quality Assessment Report (GHD, 2024b).

For the Peel AAMP, there is approximately 6 months of background data that was collected from the Upwind Station (185 Central Park Drive) from June 2013 to November 2013 and approximately one year of background data from the Downwind Station (2700 Drew Road) from June 2013 to May 2014. Data compiled from the Emerald AAMP for the Background Ambient Air Quality Assessment Report includes approximately 7 months of upwind data (from August 25, 2023 to March 25, 2024) and approximately 9.5 months of downwind data (from June 15, 2023 to March 26, 2024). The durations of the Emerald and Peel AAMPs are comparable and includes data from all four seasons at both upwind and downwind locations.

The list of parameters monitored in the Emerald AAMP includes the compounds that are potentially emitted from EFW facilities. The list includes all compounds that are monitored annually from the main stack at the Emerald Facility as part of their Environmental Compliance Approval (ECA) No. 0264-BFGQF (GHD, 2024b). Compounds were included in this list even if the annual results show that the presence of these compounds in the Emerald emissions are negligible, such as Volatile Organic Compounds (VOC) and Polycyclic Aromatic Compounds (PAH). Compounds that were consistently not detected from the Emerald source tests were not included, such as carbonyls, chlorobenzenes and chlorophenols.

The following is the list of parameters that were measured at the two stations for the Emerald AAMP:

- Particulate Matter (<2.5 micrometres) ($PM_{2.5}$)
- Particulate Matter (<10 micrometres) (PM_{10})
- Total Suspended Particulate (TSP)
- Sulphur Dioxide (SO2)
- Nitrogen Oxide (NO)
- Carbon Monoxide (CO)
- Ozone (O3)
- Polycyclic Aromatic Hydrocarbons (PAHs)
- Dioxins and Furans
- Metals (including cadmium, lead and mercury)
- Hydrochloric Acid (HCl)
- Volatile Organic Compounds (VOCs)
- Included also are ozone, particulate matter less than 10 microns (PM_{10}) and Hydrogen Chloride (HCl), that were added after input from MECP

Monitoring for criteria air contaminants such as $PM_{2.5}$, PM_{10}, nitrogen oxides (NOx), sulphur dioxide (SO2), carbon monoxide (CO) and ozone was conducted at both stations on a continuous basis. Monitoring for metals in total suspended particulates (TSP), polycyclic aromatic hydrocarbons (PAHs), VOC, HCl and dioxins and furans (PCDD/DF) were conducted at both stations with non-continuous monitors, per the methodology and analysis recommended in the Operations Manual for Air Quality Monitoring in Ontario, 2021 (Manual). TSP, metals, HCl and VOC are being monitored for 24 hours every 6 days according to the NAPS schedule. PAHs and dioxins and furans were monitored for 24 hours every 12 days.

Figure 4-1 provides a map of the Study Area, including the locations of the two primary monitoring stations (Upwind Station and Downwind Station), as well as all the secondary NAPS and Ontario AQ stations used to supplement the overall background dataset.

Data from these stations were used to calculate the chemical-specific regional background air concentrations, both 24-hour and annual average, used in the HHRA. For the 24-hour background concentration, the 90th percentile of all the background concentrations of each parameter collected from all the data sources was used as a conservative estimate of the background. The 50th percentile ambient air concentrations were also calculated which are significantly lower than the 90th percentile values and are a more representative estimate of typical background concentrations. The average of all the background concentrations from the specified period was used to calculate the annual average background concentration for each relevant COC. Refer to the Background Ambient Air Assessment Report (GHD, 2024b) for specific details on the background data collection and interpretation process.



Figure 4-1 Locations of Monitoring Sites used in Background Concentration Analysis

HCl was included in the 2023/2024 background ambient air monitoring program based on comments from the MECP at the outset of the project. For HCl, there is no published reference sampling methodology available in the Operations Manual for Air Quality Monitoring in Ontario (Manual, MECP, 2021). In addition, no publicly available datasets are available in Ontario for the determination of background ambient air concentrations of HCl. Continuous data for HCl was collected by York University. GHD replaced the data collected from the previous method with the maximum value measured in the York University studies noted in the Revised Background Ambient Air Quality Assessment Report (GHD, 2024b).

4.2 Estimation of Ambient Ground-Level Air Concentrations

Ground-level air concentrations for each of the COC at the worst-case residential and community sensitive receptor locations for each Expansion Phase was estimated by the Air Quality Assessment team for use in the HHRA. Refer to the Air Quality Assessment Study report (GHD, 2024c) for detailed information on the emissions inventory and air dispersion modelling used to predict Project Alone (*i.e.*, facility-emitted) ground-level air concentrations at the sensitive receptor locations throughout the Study Area.

Tables 4-1 and 4-3 provide the worst-case 24-hour air concentrations (background using 90th and 50th percentiles, Project Alone, and Cumulative) for each of the COC in each expansion phase with an acute health endpoint, while Tables 4-2 and 4-4 provide the worst-case annual average air concentrations (background using 90th and 50th percentiles, Project Alone, and Cumulative) for each of the COC in each expansion phase with a chronic health endpoint. Finally, due to concerns about short-term transient emissions, the worst-case 1-hour air concentrations (background using 90th and 50th percentiles, Project Alone, and Cumulative) for NOx was also presented for each expansion phase in Table 4-5.

Table 4-1 Predicted Project Alone and Cumulative 24-hour Air Concentrations for the Closest Community and Residential Receptors at each of the Three Expansion Phases using 90th %ile Regional Background

Chemical of Concern	90th Percentile Background Concentration (µg/m³)	Predicted Air Concentration (µg/m³)											
		Phase 1				Phase 2				Phase 3			
		Closest Community		Closest Residential		Closest Community		Closest Residential		Closest Community		Closest Residential	
		Project Alone	Cumulative	Project Alone	Cumulative	Project Alone	Cumulative	Project Alone	Cumulative	Project Alone	Cumulative	Project Alone	Cumulative
Criteria Air Contaminants													
Carbon Monoxide [a]	58.0	1.8	59.8	0.92	58.9	6.1	64.1	2.6	60.7	8.4	66.4	3.9	61.9
Nitrogen Oxides [b]	12.9	5.5	18.5	2.8	15.7	18.4	31.4	8.0	20.9	25.5	38.4	11.9	24.9
$PM_{2.5}$	6.0	0.23	6.2	0.12	6.1	0.7	6.7	0.33	6.3	1.1	7.1	0.52	6.5
Sulphur Dioxide	1.05	1.6	2.6	0.81	1.86	5.3	6.4	2.3	3.4	7.3	8.4	3.4	4.5
Volatile Organic Compounds													
Acrolein	0.0	0.00012	0.00012	0.000059	0.00006	0.00039	0.00039	0.00017	0.00017	0.00054	0.00054	0.00025	0.00025
Benzene	1.07	0.0063	1.08	0.0032	1.07	0.021	1.09	0.0090	1.079	0.029	1.10	0.013	1.08
Butadiene (1,3-)	1.2	0.000099	1.16	0.000050	1.16	0.00033	1.16	0.00014	1.160	0.00045	1.16	0.00021	1.16
Chloroform	0.26	0.000064	0.26	0.000032	0.26	0.00021	0.26	0.00009	0.26	0.00029	0.26	0.00014	0.26
Dichloroethane, 1,2-	0.42	0.00014	0.42	0.000070	0.42	0.00046	0.42	0.00020	0.42	0.00064	0.42	0.00030	0.42
Formaldehyde	0.0	0.022	0.022	0.011	0.011	0.073	0.073	0.032	0.032	0.10	0.10	0.047	0.047
Quinoline	0.002	0.0000030	0.002	0.0000015	0.002	0.000010	0.002	0.0000043	0.002	0.000014	0.002	0.0000065	0.002
Trichloroethylene	2.76	0.000060	2.76	0.000030	2.76	0.00020	2.76	0.000087	2.76	0.00028	2.76	0.00013	2.76
Vinyl Chloride	0.27	0.000099	0.27	0.000050	0.27	0.00033	0.27	0.00014	0.27	0.00045	0.27	0.00021	0.27
Inorganics													
Arsenic	0.0036	0.000083	0.0037	0.000043	0.0036	0.00027	0.0039	0.00012	0.0037	0.00038	0.0040	0.00018	0.0038
Cadmium	0.0012	0.00032	0.0015	0.00016	0.0014	0.0010	0.0022	0.00046	0.0017	0.0014	0.0026	0.00069	0.0019
Calcium Oxide	6.3	0.077	6.3	0.039	6.3	0.26	6.5	0.11	6.4	0.36	6.6	0.17	6.4
Chromium (Total)	0.005	0.00021	0.0052	0.00011	0.0051	0.00071	0.0057	0.00031	0.0053	0.0010	0.0060	0.00047	0.0055
Chromium VI [c]	0.0004	0.000017	0.00042	0.0000088	0.00041	0.000056	0.00046	0.000025	0.00043	0.000078	0.00048	0.00004	0.00044
Cobalt	0.0012	0.00020	0.0014	0.00010	0.0013	0.00066	0.0019	0.00029	0.0015	0.00090	0.0021	0.00044	0.0016
Hydrogen Chloride	3.0	0.41	3.4	0.21	3.2	1.4	4.37	0.59	3.6	1.9	4.9	0.88	3.9
Hydrogen Fluoride	0.0	0.019	0.019	0.009	0.009	0.063	0.063	0.027	0.027	0.086	0.086	0.040	0.040
Iron	2.19	0.0036	2.2	0.0019	2.2	0.012	2.2	0.0053	2.2	0.016	2.2	0.0079	2.2
Lead	0.012	0.0023	0.014	0.0012	0.013	0.0074	0.019	0.0033	0.015	0.010	0.022	0.0049	0.017
Manganese	0.061	0.00081	0.062	0.00041	0.061	0.0026	0.064	0.0012	0.062	0.0037	0.065	0.0018	0.063
Mercury	0.00003	0.00068	0.00071	0.00035	0.00038	0.0022	0.0023	0.00100	0.0010	0.0031	0.0031	0.0015	0.0015
Nickel	0.004	0.00037	0.0044	0.00019	0.0042	0.0012	0.0052	0.00054	0.0045	0.0017	0.0057	0.00081	0.0048
Phosphorous pentachloride	0.53	0.0064	0.54	0.0032	0.53	0.021	0.55	0.0092	0.54	0.029	0.56	0.014	0.54
Phosphorus	0.079	0.00095	0.080	0.00048	0.079	0.0032	0.082	0.0014	0.080	0.0043	0.083	0.0020	0.081
Silica	0.44	0.011	0.45	0.0057	0.45	0.038	0.48	0.016	0.46	0.052	0.49	0.024	0.46
Sodium hydroxide	6.66	0.065	6.7	0.017	6.7	0.11	6.8	0.047	6.7	0.15	6.8	0.070	6.7

[a] Carbon monoxide is evaluated on an 8-hour exposure duration.

[b] According to the combustion gas emissions data for 2022 Emerald stack testing report (ORTECH, 2023), NO emissions represented the majority (65%) of the NOx emitted from the stack. However, a majority of this NO will be converted to NO_2 in the atmosphere as it is exposed to oxygen.

[c] Chromium VI were estimated to be 8% based on experimental data showing the formation and destruction of hexavalent chromium within an operating incinerator (Linak *et al*., 1996).

Table 4-2 Predicted Project Alone and Cumulative Annual Average Air Concentrations for the Closest Community and Residential Receptors at each of the Three Expansion Phases using 90th %ile Regional Background

Chemical of Concern	90th Percentile Background Concentration (µg/m³)	Predicted Air Concentration (µg/m³)											
		Phase 1				Phase 2				Phase 3			
		Closest Community		Closest Residential		Closest Community		Closest Residential		Closest Community		Closest Residential	
		Project Alone	Cumulative	Project Alone	Cumulative	Project Alone	Cumulative	Project Alone	Cumulative	Project Alone	Cumulative	Project Alone	Cumulative
Criteria Air Contaminants													
Nitrogen Oxides	2.6	0.42	3.0	0.33	2.9	1.3	3.9	0.81	3.4	1.8	4.4	1.2	3.8
$PM_{2.5}$	1.2	0.023	1.2	0.014	1.2	0.06	1.2	0.034	1.2	0.08	1.3	0.052	1.2
Volatile Organic Compounds													
Benzene	0.20	0.00048	0.20	0.00037	0.2	0.0015	0.2	0.00092	0.20	0.0020	0.20	0.0014	0.20
Butadiene (1,3-)	0.2	0.0000075	0.22	0.0000059	0.22	0.000024	0.22	0.000014	0.22	0.000032	0.22	0.000021	0.22
Chloroform	0.1	0.0000048	0.10	0.0000038	0.10	0.000015	0.10	0.000009	0.10	0.000021	0.10	0.000014	0.10
Dichloroethane, 1,2-	0.08	0.000014	0.08	0.0000083	0.08	0.000035	0.08	0.000020	0.08	0.000050	0.08	0.000030	0.08
Formaldehyde[b]	0.0	0.0017	0.0017	0.0013	0.0013	0.0052	0.0052	0.0032	0.0032	0.0071	0.0071	0.0048	0.0048
Quinoline[b]	0.0	0.00000023	0.00000023	0.00000018	0.00000018	0.00000072	0.00000072	0.00000044	0.00000044	0.00000098	0.00000098	0.00000065	0.00000065
Trichloroethylene	0.53	0.0000046	0.53	0.0000036	0.53	0.000014	0.53	0.0000088	0.53	0.000020	0.53	0.000013	0.53
Vinyl Chloride	0.05	0.000008	0.050	0.0000059	0.050	0.000024	0.050	0.000014	0.050	0.000032	0.050	0.000021	0.050
Polychlorinated dibenzo-*p*-dioxins and dibenzofurans													
Dioxins and furans	0.0496	3.36E-11	0.050	1.99E-11	0.050	8.19E-11	0.050	4.87E-11	0.050	1.17E-10	0.050	7.23E-11	0.050
Polycyclic Aromatic Hydrocarbons													
Benzo(a)Pyrene-TEQ	0.00057	0.00000014	0.00057	0.000000083	0.00057	0.00000034	0.00057	0.00000020	0.00057	0.00000049	0.00057	0.00000030	0.00057
Methylcholanthrene (3-)[b]	0.0	0.000000053	0.000000053	0.000000042	0.000000042	0.00000017	0.00000017	0.00000010	0.00000010	0.00000023	0.00000023	0.00000015	0.00000015
Perylene[b]	0.0	0.000000043	0.000000043	0.000000034	0.000000034	0.00000014	0.00000014	0.000000083	0.000000083	0.00000018	0.00000018	0.00000012	0.00000012
Inorganics													
Arsenic[b]	0.0	0.0000085	0.0000085	0.0000050	0.0000050	0.000021	0.000021	0.000012	0.000012	0.000030	0.000030	0.000018	0.000018
Cadmium	0.0002	0.000032	0.00023	0.000019	0.00022	0.000079	0.00028	0.000047	0.00025	0.000113	0.00031	0.000070	0.00027
Calcium Oxide[b]	0.0	0.005883	0.00588	0.004621	0.00462	0.018513	0.01851	0.011309	0.01131	0.025217	0.02522	0.016795	0.01680
Chromium (Total)[b]	0.0	0.000022	0.000022	0.000013	0.000013	0.000053	0.000053	0.000032	0.000032	0.000077	0.000077	0.000047	0.000047
Chromium VI [a, b]	0.0	0.0000018	0.0000018	0.0000010	0.0000010	0.0000043	0.0000043	0.0000026	0.0000026	0.0000061	0.0000061	0.0000038	0.0000038
Cobalt[b]	0.0	0.000020	0.000020	0.000012	0.000012	0.000050	0.000050	0.000030	0.000030	0.000071	0.000071	0.000044	0.000044
Hydrogen Fluoride[b]	0.0	0.0014	0.0014	0.0011	0.0011	0.0045	0.0045	0.0027	0.0027	0.0061	0.0061	0.0041	0.0041
Lead	0.005	0.00023	0.0052	0.00014	0.0051	0.00056	0.0056	0.00034	0.0053	0.00081	0.0058	0.00050	0.0055
Manganese[b]	0.0	0.000083	0.000083	0.000049	0.000049	0.00020	0.00020	0.00012	0.00012	0.00029	0.00029	0.00018	0.00018
Mercury[b]	0.0	0.000069	0.000069	0.000041	0.000041	0.00017	0.00017	0.000101	0.000101	0.00024	0.00024	0.00015	0.00015
Nickel	0.0008	0.000038	0.00084	0.000022	0.00082	0.000092	0.0009	0.000055	0.00085	0.00013	0.00093	0.000081	0.00088
Phosphorous pentachloride[b]	0.0	0.000484	0.00048	0.000380	0.00038	0.000968	0.0010	0.000760	0.00076	0.00207	0.00207	0.001381	0.00138
Phosphorus[b]	0.0	0.000072	0.00007	0.000056	0.00006	0.000226	0.0002	0.000138	0.00014	0.00031	0.00031	0.000205	0.00021
Silica[b]	0.0	0.0009	0.0009	0.00068	0.00068	0.0027	0.0027	0.0017	0.0017	0.0037	0.0037	0.0025	0.0025
Sodium hydroxide[b]	0.0	0.065	0.065	0.0020	0.0020	0.0078	0.0078	0.0048	0.0048	0.011	0.011	0.0071	0.0071

[a] Chromium VI were estimated to be 8% based on experimental data showing the formation and destruction of hexavalent chromium within an operating incinerator (Linak *et al*., 1996).

[b] Insufficient data available for annual average.

Table 4-3 Predicted Project Alone and Cumulative 24-hour Air Concentrations for the Closest Community and Residential Receptors at each of the Three Expansion Phases using 50th %ile Regional Background

Chemical of Concern	50th Percentile Background Concentration (µg/m³)	Predicted Air Concentration (µg/m³)											
		Phase 1				Phase 2				Phase 3			
		Closest Community		Closest Residential		Closest Community		Closest Residential		Closest Community		Closest Residential	
		Project Alone	Cumulative	Project Alone	Cumulative	Project Alone	Cumulative	Project Alone	Cumulative	Project Alone	Cumulative	Project Alone	Cumulative
Criteria Air Contaminants													
Carbon Monoxide [a]	38.5	1.8	40.3	0.92	39.4	6.1	44.5	2.6	41.1	8.4	46.8	3.9	42.4
Nitrogen Oxides [b]	5.4	5.5	10.9	2.8	8.2	18.4	23.8	8.0	13.4	25.5	30.9	11.9	17.3
$PM_{2.5}$	3.3	0.23	3.5	0.12	3.4	0.7	4.0	0.33	3.6	1.1	4.4	0.52	3.8
Sulphur Dioxide	0.39	1.6	2.0	0.81	1.2	5.3	5.7	2.3	2.7	7.3	7.7	3.4	3.8
Volatile Organic Compounds													
Acrolein	0.0	0.00012	0.00012	0.000059	0.000059	0.00039	0.00039	0.00017	0.00017	0.00054	0.00054	0.00025	0.00025
Benzene	0.54	0.0063	0.55	0.0032	0.54	0.021	0.56	0.0090	0.55	0.029	0.57	0.013	0.55
Butadiene (1,3-)	1.2	0.000099	1.2	0.000050	1.2	0.00033	1.2	0.00014	1.2	0.00045	1.2	0.00021	1.2
Chloroform	0.27	0.000064	0.3	0.000032	0.3	0.00021	0.3	0.00009	0.3	0.00029	0.3	0.00014	0.3
Dichloroethane, 1,2-	0.45	0.00014	0.5	0.000070	0.5	0.00046	0.5	0.00020	0.5	0.00064	0.5	0.00030	0.5
Formaldehyde	0.0	0.022	0.022	0.011	0.011	0.073	0.073	0.032	0.032	0.10	0.10	0.047	0.047
Quinoline	0.0011	0.0000030	0.0011	0.0000015	0.0011	0.000010	0.0011	0.0000043	0.0011	0.000014	0.0011	0.0000065	0.0011
Trichloroethylene	1.31	0.000060	1.3	0.000030	1.3	0.00020	1.3	0.000087	1.3	0.00028	1.3	0.00013	1.3
Vinyl Chloride	0.28	0.000099	0.28	0.000050	0.28	0.00033	0.28	0.00014	0.28	0.00045	0.28	0.00021	0.28
Inorganics													
Arsenic	0.0035	0.000083	0.0036	0.000043	0.0035	0.00027	0.0038	0.00012	0.0036	0.00038	0.0039	0.00018	0.0037
Cadmium	0.0012	0.00032	0.0015	0.00016	0.0014	0.0010	0.0022	0.00046	0.0017	0.0014	0.0026	0.00069	0.0019
Calcium Oxide	3.7	0.077	3.7	0.039	3.7	0.26	3.9	0.11	3.8	0.36	4.0	0.17	3.8
Chromium (Total)	0.0036	0.00021	0.0038	0.00011	0.0037	0.00071	0.0043	0.00031	0.0039	0.0010	0.0046	0.00047	0.0041
Chromium VI [c]	0.00029	0.000017	0.00031	0.0000088	0.00030	0.000056	0.00034	0.000025	0.00031	0.000078	0.00037	0.00004	0.00033
Cobalt	0.0012	0.00020	0.0014	0.00010	0.0013	0.00066	0.0019	0.00029	0.0015	0.00090	0.0021	0.00044	0.0016
Hydrogen Chloride	0.1	0.41	0.54	0.21	0.34	1.4	1.5	0.59	0.72	1.9	2.0	0.88	1.0
Hydrogen Fluoride	0.0	0.019	0.019	0.009	0.009	0.063	0.063	0.027	0.027	0.086	0.086	0.040	0.040
Iron	0.95	0.0036	0.95	0.0019	0.95	0.012	0.96	0.0053	0.96	0.016	0.97	0.0079	0.96
Lead	0.005	0.0023	0.007	0.0012	0.006	0.0074	0.012	0.0033	0.008	0.010	0.015	0.0049	0.010
Manganese	0.033	0.00081	0.034	0.00041	0.033	0.0026	0.036	0.0012	0.034	0.0037	0.037	0.0018	0.035
Mercury	0.00003	0.00068	0.00071	0.00035	0.00038	0.0022	0.0023	0.00100	0.0010	0.0031	0.0031	0.0015	0.0015
Nickel	0.002	0.00037	0.0026	0.00019	0.0024	0.0012	0.0034	0.00054	0.0027	0.0017	0.0039	0.00081	0.003
Phosphorous pentachloride	0.25	0.0064	0.26	0.0032	0.25	0.021	0.27	0.0092	0.26	0.029	0.28	0.014	0.26
Phosphorus	0.036	0.00095	0.037	0.00048	0.036	0.0032	0.039	0.0014	0.037	0.0043	0.040	0.0020	0.038
Silica	0.27	0.011	0.28	0.0057	0.28	0.038	0.31	0.016	0.29	0.052	0.32	0.024	0.29
Sodium hydroxide	3.44	0.065	3.5	0.017	3.5	0.11	3.5	0.047	3.5	0.15	3.6	0.070	3.5

[a] Carbon monoxide is evaluated on an 8-hour exposure duration.

[b] According to the combustion gas emissions data for 2022 Emerald stack testing report (ORTECH, 2023), NO emissions represented the majority (65%) of the NOx emitted from the stack. However, a majority of this NO will be converted to NO_2 in the atmosphere as it is exposed to oxygen.

[c] Chromium VI were estimated to be 8% based on experimental data showing the formation and destruction of hexavalent chromium within an operating incinerator (Linak *et al*., 1996).

Table 4-4 Predicted Project Alone and Cumulative Annual Average Air Concentrations for the Closest Community and Residential Receptors at each of the Three Expansion Phases using 50th %ile Regional Background

Chemical of Concern	50th Percentile Background Concentration (µg/m³)	Predicted Air Concentration (µg/m³)											
		Phase 1				Phase 2				Phase 3			
		Closest Community		Closest Residential		Closest Community		Closest Residential		Closest Community		Closest Residential	
		Project Alone	Cumulative	Project Alone	Cumulative	Project Alone	Cumulative	Project Alone	Cumulative	Project Alone	Cumulative	Project Alone	Cumulative
Criteria Air Contaminants													
Nitrogen Oxides	1.1	0.42	1.5	0.33	1.4	1.3	2.4	0.81	1.9	1.8	2.9	1.2	2.3
$PM_{2.5}$	0.7	0.023	0.67	0.014	0.66	0.06	0.71	0.034	0.68	0.08	0.73	0.052	0.70
Volatile Organic Compounds													
Benzene	0.12	0.00048	0.12	0.00037	0.12	0.0015	0.12	0.00092	0.12	0.0020	0.12	0.0014	0.12
Butadiene (1,3-)	0.2	0.0000075	0.23	0.0000059	0.23	0.000024	0.23	0.000014	0.23	0.000032	0.23	0.000021	0.23
Chloroform	0.1	0.0000048	0.10	0.0000038	0.10	0.000015	0.10	0.000009	0.10	0.000021	0.10	0.000014	0.10
Dichloroethane, 1,2-	0.09	0.000014	0.09	0.0000083	0.09	0.000035	0.09	0.000020	0.09	0.000050	0.09	0.000030	0.09
Formaldehyde[b]	0.0	0.0017	0.0017	0.0013	0.0013	0.0052	0.0052	0.0032	0.0032	0.0071	0.0071	0.0048	0.0048
Quinoline[b]	0.0	0.00000023	0.00000023	0.00000018	0.00000018	0.00000072	0.00000072	0.00000044	0.00000044	0.00000098	0.00000098	0.00000065	0.00000065
Trichloroethylene	0.25	0.0000046	0.25	0.0000036	0.25	0.000014	0.25	0.0000088	0.25	0.000020	0.25	0.000013	0.25
Vinyl Chloride	0.05	0.000008	0.050	0.0000059	0.050	0.000024	0.050	0.000014	0.050	0.000032	0.050	0.000021	0.050
Polychlorinated dibenzo-*p*-dioxins and dibenzofurans													
Dioxins and furans	0.0254	0.00000000003	0.0254	0.00000000002	0.0254	0.00000000008	0.0254	0.00000000005	0.0254	0.00000000012	0.0254	0.00000000007	0.0254
Polycyclic Aromatic Hydrocarbons													
Benzo(a)Pyrene-TEQ	0.0000094	0.00000014	0.0000095	0.000000083	0.0000095	0.00000034	0.0000097	0.00000020	0.0000096	0.00000049	0.0000099	0.00000030	0.0000097
Methylcholanthrene (3-)[b]	0.0	0.000000053	0.000000053	0.000000042	0.000000042	0.00000017	0.00000017	0.00000010	0.00000010	0.00000023	0.00000023	0.00000015	0.00000015
Perylene[b]	0.0	0.000000043	0.000000043	0.000000034	0.000000034	0.00000014	0.00000014	0.000000083	0.000000083	0.00000018	0.00000018	0.00000012	0.00000012
Inorganics													
Arsenic[b]	0.0	0.0000085	0.0000085	0.0000050	0.0000050	0.000021	0.000021	0.000012	0.000012	0.000030	0.000030	0.000018	0.000018
Cadmium	0.0002	0.000032	0.00023	0.000019	0.00022	0.000079	0.00028	0.000047	0.00025	0.000113	0.00031	0.000070	0.00027
Calcium Oxide[b]	0.0	0.005883	0.00588	0.004621	0.00462	0.018513	0.01851	0.011309	0.01131	0.025217	0.02522	0.016795	0.01680
Chromium (Total)[b]	0.0	0.000022	0.000022	0.000013	0.000013	0.000053	0.000053	0.000032	0.000032	0.000077	0.000077	0.000047	0.000047
Chromium VI [a, b]	0.0	0.0000018	0.0000018	0.0000010	0.0000010	0.0000043	0.0000043	0.0000026	0.0000026	0.0000061	0.0000061	0.0000038	0.0000038
Cobalt[b]	0.0	0.000020	0.000020	0.000012	0.000012	0.000050	0.000050	0.000030	0.000030	0.000071	0.000071	0.000044	0.000044
Hydrogen Fluoride[b]	0.0	0.0014	0.0014	0.0011	0.0011	0.0045	0.0045	0.0027	0.0027	0.0061	0.0061	0.0041	0.0041
Lead	0.002	0.00023	0.0022	0.00014	0.0021	0.00056	0.0026	0.00034	0.0023	0.00081	0.0028	0.00050	0.0025
Manganese[b]	0.0	0.000083	0.033083	0.000049	0.033049	0.00020	0.03320	0.00012	0.03312	0.00029	0.03329	0.00018	0.03318
Mercury[b]	0.0	0.000069	0.000098	0.000041	0.000070	0.00017	0.00020	0.000101	0.000130	0.00024	0.00027	0.00015	0.00018
Nickel	0.0004	0.000038	0.00044	0.000022	0.00042	0.000092	0.00049	0.000055	0.00045	0.00013	0.00053	0.000081	0.00048
Phosphorous pentachloride[b]	0.0	0.000484	0.00048	0.000380	0.00038	0.000968	0.00097	0.000760	0.00076	0.00207	0.00207	0.001381	0.00138
Phosphorus[b]	0.0	0.000072	0.00007	0.000056	0.00006	0.000226	0.00023	0.000138	0.00014	0.00031	0.00031	0.000205	0.00021
Silica[b]	0.0	0.0009	0.00086	0.00068	0.00068	0.0027	0.00271	0.0017	0.0017	0.0037	0.0037	0.0025	0.0025
Sodium hydroxide[b]	0.0	0.065	0.065	0.0020	0.0020	0.0078	0.0078	0.0048	0.0048	0.011	0.011	0.0071	0.0071

[a] Chromium VI were estimated to be 8% based on experimental data showing the formation and destruction of hexavalent chromium within an operating incinerator (Linak *et al*., 1996).

[b] Insufficient data available for annual average.

Table 4-5 Predicted Project Alone and Cumulative 1-hour NOx Air Concentrations for the Closest Community and Residential Receptors at each of the Three Expansion Phases

Chemical of Concern	Background Concentration (µg/m³)	Predicted Air Concentration (µg/m³)											
		Phase 1				Phase 2				Phase 3			
		Closest Community		Closest Residential		Closest Community		Closest Residential		Closest Community		Closest Residential	
		Project Only	Cumulative	Project Only	Cumulative	Project Only	Cumulative	Project Only	Cumulative	Project Only	Cumulative	Project Only	Cumulative
Criteria Air Contaminants													
Nitrogen Oxides (90th%ile background)	32.4	11.0	43.4	9.8	42.2	29.7	62.1	19.7	52.1	48.8	81.2	29.9	62.3
Nitrogen Oxides (50th%ile background)	13.5	11.0	24.5	9.8	23.3	29.7	43.2	19.7	33.2	48.8	62.3	29.9	43.4

4.3 Estimation of the Impact of Deposition on Soil Concentrations

Another important element of exposure related to the emissions for the proposed Facility is the potential deposition of airborne particulate-bound (and sometimes gaseous) contaminants from the atmosphere onto ground-level surfaces (such as soil, agricultural crops, home gardens, *etc.*) in the surrounding community. Deposition (both dry and wet) can be affected by a variety of different factors, the most important of which tend to be the characteristics of the atmosphere (*e.g.*, wind speed, temperature, atmospheric stability, *etc.*), the nature of the surface (*e.g.*, its surface roughness, porosity, *etc.*), and the properties of the depositing species (*e.g.*, reactivity, diameter and shape, solubility, *etc.*). This process can be achieved through "dry" deposition where the particles or gas molecules impact upon a surface, or through "wet" deposition where rain or other precipitation scavenges particles and gas molecules from the air and deposits them on surfaces.

To address this particular exposure route, the deposition into the environment (*e.g.,* soil) was estimated at each sensitive receptor location by the air quality assessment team for key COCs representing both inorganics and organics that are typically a concern for deposition. These COCs included: arsenic, benzo(a)pyrene, cadmium, chromium (total), cobalt, dioxins and furans, iron, lead, manganese, and mercury. This data was then used to predict exposure concentrations in soil at the sensitive receptor location areas. The contribution of chemical-specific deposition to surface soil concentrations at each receptor location based on a 25-year operating lifespan of the Emerald facility was calculated based on deposition equations recommended by US EPA (2005). Refer to Appendix A for a detailed overview of the equation and approach used to calculate soil deposition contributions as well as a worked example for one of the COCs.

To capture the potential range of exposures, as no recent site-specific information was available, background soil concentrations were estimated on the MECP Table 1 Full Depth Background Site Condition Standards (SCS). The soil standards in Table 1 are background values which are derived from the Ontario Typical Range (OTR) values for the indicated land uses (*i.e.,* agricultural or other property use; residential/ parkland/institutional/industrial/ commercial/ community property use). The OTR are representative of the 97.5th percentile upper limit (OTR_{98}) of the typical province-wide background concentrations in soils that are not contaminated by point sources based on the surface soils database used as the basis of the Table 1 SCS.

Table 4-6 presents the predicted annual chemical-specific deposition contributions to surficial soil for each of the proposed expansion phases, as well as the final total soil concentration following 25 years of chemical deposition.

Table 4-6 Summary of Calculation of Facility-Specific Deposition Contribution to Long-term COC Soil Concentrations at Worst-case Residential Receptor

Chemical of Concern	Background Soil Conc [a] (mg/kg)	Phase 1			Phase 2			Phase 3		
		Soil Deposition ($mg/m^2/yr$)	Soil Deposition Contribution (mg/kg)	Total Soil Conc (mg/kg)	Soil Deposition ($mg/m^2/yr$)	Soil Deposition Contribution (mg/kg)	Total Soil Conc (mg/kg)	Soil Deposition ($mg/m^2/yr$)	Soil Deposition Contribution (mg/kg)	Total Soil Conc (mg/kg)
Arsenic	18	3.88E-03	3.23E-04	18	8.18E-03	6.82E-04	18	1.20E-02	1.00E-03	18
Benzo(a)pyrene	0.30	2.17E-06	6.94E-08	0.30	4.81E-06	1.54E-07	0.30	7.07E-06	2.26E-07	0.30
Cadmium	1.2	1.48E-02	1.23E-03	1.2	3.13E-02	2.61E-03	1.2	4.59E-02	3.82E-03	1.2
Chromium (total)	70	1.00E-02	8.33E-04	70	2.12E-02	1.77E-03	70	3.12E-02	2.60E-03	70
Cobalt	21	9.34E-03	7.78E-04	21	1.97E-02	1.64E-03	21	2.90E-02	2.42E-03	21
Dioxin and Furans	0.000007	1.13E-09	1.09E-11	0.000007	2.61E-09	2.52E-11	0.000007	3.90E-09	3.76E-11	0.000007
Iron	34000	1.70E-01	1.42E-02	34000	3.59E-01	2.99E-02	34000	5.27E-01	4.39E-02	34000

Table 4-6 Summary of Calculation of Facility-Specific Deposition Contribution to Long-term COC Soil Concentrations at Worst-case Residential Receptor

Chemical of Concern	Background Soil Conc [a] (mg/kg)	Phase 1			Phase 2			Phase 3		
		Soil Deposition ($mg/m^2/yr$)	Soil Deposition Contribution (mg/kg)	Total Soil Conc (mg/kg)	Soil Deposition ($mg/m^2/yr$)	Soil Deposition Contribution (mg/kg)	Total Soil Conc (mg/kg)	Soil Deposition ($mg/m^2/yr$)	Soil Deposition Contribution (mg/kg)	Total Soil Conc (mg/kg)
Lead	120	1.06E-01	8.83E-03	120	2.23E-01	1.86E-02	120	3.28E-01	2.73E-02	120
Manganese	1400	3.78E-02	3.15E-03	1400	7.96E-02	6.63E-03	1400	1.17E-01	9.75E-03	1400
Mercury	0.27	3.18E-02	1.27E-03	0.27	6.70E-02	2.68E-03	0.27	9.84E-02	3.94E-03	0.27
Nickel	37	1.73E-02	1.44E-03	37	3.64E-02	3.03E-03	37	5.35E-02	4.46E-03	37

[a] Background soil concentration at the worst-case residential location was assumed to be equivalent to MECP Table 1 Full Depth Background SCS, which is derived from the OTR 97.5th percentile upper limit of typical province-wide background concentrations in uncontaminated soils.

Note: Due to the 25-year expected deposition period (i.e., expected lifespan of the proposed expanded facility), deposition modelling assumed a 20 cm soil mixing depth as surface deposition is gradually covered over time as per US EPA (2005) guidance.

The result of this assessment indicates that 25 years of deposition of emissions from the proposed expanded Emerald facility would result in a negligible increase in total soil concentration for each of these assessed deposition COCs (*i.e.*, no increase in concentration over the original background soil concentration). As a result, a detailed multi-pathway (*i.e.*, oral and dermal assessment) was not deemed necessary.

4.4 Exposure Analysis of Particulate Matter

The size of the airborne particles to which people are exposed is one of the most important aspects in determining the potential for health risk resulting from PM exposure. Size is directly related to where particles will be deposited in specific parts of the respiratory tract. Particles larger than about 10 microns (*μm*) in aerodynamic diameter (>PM_{10}) are deposited almost exclusively in the nose, throat, and upper respiratory tract, and tend to be coughed out over a very short period of time. This size range is considered outside the inhalable range for people, since these particles are too large to be deposited in the lung. Health effects associated with particles greater than PM_{10} are considered less critical compared to fractions less than 10 microns in size since they are less likely to be absorbed into the body *via* inhalation. Particulate smaller than 10 μm in diameter are considered respirable and have the potential to reach the lungs and cause health impacts. Fine (<2.5 μm) and ultrafine particles (<0.1 μm) are small enough to reach the alveoli (air spaces) deep in the lungs. In general, it may be assumed that the smaller the particle, the greater the potential to reach respiratory structures such as alveoli where blood-gas exchange occurs. Inhaled fine and ultrafine particles can also carry adsorbed chemical pollutants to the deeper lung structures. Smaller particles tend to be present in greater numbers, and they possess a greater total surface area than larger particles of the same mass.

The potential impacts of human exposure to the respirable fraction of PM (*i.e.*, $PM_{2.5}$ and PM_{10}) were emphasized in the current HHRA, rather than the broader size fraction represented by total suspended particulate (*i.e.*, TSP, comprising particles ranging up to 44 μm in size). The inhalable fraction (*i.e.*, PM_{10}) is also widely used to evaluate potential health issues, since this size of particle primarily affects tissues in the upper airways but can also travel into the lung. However, when both sets of data are available (PM_{10} and $PM_{2.5}$), the $PM_{2.5}$ data tends to carry more weight in determining the potential for health risks because of the large body of scientific literature characterizing both the epidemiological and toxicological properties of the finer size fraction. The PM_{10} size fraction also contains all the smaller $PM_{2.5}$ size fraction which are generally viewed as the more toxicologically relevant size fraction for particulate inhalation health effects. Furthermore, particle size studies of PM emissions from facilities of type proposed for this Project indicate that more than 90% of the particulate matter emitted is $PM_{2.5}$

or smaller (refer to a more detailed discussion in the AQIA [GHD, 2024c]). As such, any assessment of PM_{10} would be driven by the risks associated with the $PM_{2.5}$ fraction, which is already being assessed individually.

Therefore, given the primary risk represented by the PM_{10} size fraction is the $PM_{2.5}$ fraction and the predominant size fraction emitted from the Project would be less than 2.5 µm in aerodynamic diameter, this assessment focuses on the health implications of $PM_{2.5}$ emissions from the Emerald facility and did not carry the PM_{10} size fraction forward in the detailed assessment.

5.0 HAZARD ASSESSMENT

All chemicals have the potential to cause toxicological effects; however, it is the chemical concentration, the route of exposure, the duration of exposure, and the inherent toxicity of the chemical that determines the level of effect and hence the potential for adverse health effects. The sensitivity of a person (genetic or otherwise) to a particular chemical also contributes to the effect. Toxicity Reference Values (TRVs) which incorporate all these factors are used to characterize health risks in the assessment and the values selected are presented in this Section.

As noted previously, the toxicity of a chemical has been observed to vary between acute (short term) and chronic (long term) exposure. Thus, it is important to differentiate TRVs based on duration of exposure as follows:

- ***Acute:*** the amount or dose of a chemical that can be tolerated without evidence of adverse health effects on a short-term basis. These benchmarks are routinely applied to conditions in which exposures extend from minutes through several hours or several days only (ATSDR, 2006). For the current assessment, risks were evaluated based on the 24-hour exposure period, where a relevant acute TRV, based on an acute toxicity endpoint, for that time period is available.
- ***Chronic:*** the amount of a chemical that is expected to be without effect, even when exposure occurs continuously or regularly over extended periods, possibly lasting for periods of at least a year, and possibly extending over an entire lifetime (ATSDR, 2006).

When TRVs for one of the chemicals were available from multiple regulatory agencies, all the TRVs were reviewed, and the professional judgment of experienced toxicologists was used to select the most appropriate TRV.

The most critical considerations in selecting TRVs were the source (it must have been derived by a reputable agency), the data used to derive the benchmark, the date the TRV was derived (it must be as up to date as possible), and its relevance in terms of duration and route of exposure. TRVs presented have been obtained from regulatory agencies such as:

- MECP;
- Health Canada;
- Canadian Council of the Ministers of the Environment (CCME);
- World Health Organization (WHO);
- United States Environmental Protection Agency – Integrated Risk Information System (US EPA IRIS);
- Texas Commission on Environmental Quality (TCEQ);
- California Environmental Protection Agency (Cal EPA); and,
- Agency for Toxic Substances and Disease Registry (ATSDR).

A summary of the non-carcinogenic and carcinogenic TRVs used for inhalation assessment are summarized in Table 5-1 through 5-2. A more detailed discussion of the TRVs and the rationale for their selection is provided in Appendix B.

5.1 Acute Toxicity Reference Values

The acute (*i.e.*, ≤ 24-hour exposure durations) non-carcinogenic inhalation TRVs for each of the chemicals (where they were available), as well as the key critical health outcomes and regulatory source for each TRV, are provided in Table 5-1. Where 24-hour acute benchmarks were unavailable, 1-hour TRVs were conservatively used to evaluate 24-hour exposures and are indicated based on duration in the table below.

While the MECP has established a series of 24-hour ambient air quality criteria (AAQC), many of these are not based on acute toxicological endpoints and/or outcomes. Rather, in the case of several chemicals, these 24-hour AAQC are based on chronic toxicological outcomes requiring long-term exposures which have then been adjusted to a 24-hour averaging period for regulatory compliance and enforcement purposes. Therefore, these AAQC do not represent the potential for health effects due to acute exposure.

Only those 24-hour AAQC (MECP, 2020) that were identified as health-based on an acute effect toxicological endpoint were considered. In instances where an acute-based AAQC was not available, other reputable regulatory agencies, as described above, were reviewed.

Table 5-1 Summary of Acute-Duration Inhalation TRVs and Benchmarks Selected for Use in the HHRA

Chemical of Concern	Non-Carcinogenic Inhalation TRVs (µg/m^3)			
	Duration	***Value***	***Critical Effect***	***Source***
Acrolein	24-hour	7	Nose and throat irritation and deceased respiratory rate in human subjects	ATSDR (2024)
Arsenic	1-hour	0.2	Reproductive/ development (decreased fetal weight); altered brain structure and function	Cal EPA (2008)
Benzene	1-hour [a]	27	Developmental hematotoxicity in fetal and neonatal mice (Keller and Snyder, 1988)	Cal EPA (2014)
Butadiene, 1,3-	24-hour	950	Decreased fetal body weights in males	TECQ (2015)
Cadmium	24-hour	0.03	Hyperplasia of the respiratory epithelium (LOAEL) based on a NTP (1995) study	ATSDR (2012)
Calcium Oxide	1-hour [b]	20	Health-based ESL	TCEQ (2016)
Carbon Monoxide	8-hour	15,700	Health-based AAQC	MECP (2020)
Chloroform	1-hour [b]	100	Health-based ESL	TCEQ (2016)
Chromium III	1-hour [b]	12	precursors to adverse effects	TCEQ (2009)
Chromium VI	24-hour	1.3	increase in relative lung weight in male rats	TCEQ (2014)
Cobalt	24-hour	0.095	Respiratory irritation and reduced FVC in humans	TECQ (2017)
Dichloroethane, 1,2-	24-hour	380	Very slight degeneration and necrosis of the olfactory epithelium in rats	TCEQ (2016)
Formaldehyde	1-hour [b]	50	Eye and nose irritation in human volunteers	TCEQ (2015)
Hydrogen Chloride	1-hour [b]	660	Upper respiratory symptoms (sore throat, nasal discharge) and lower respiratory symptoms (pulmonary function, cough, chest pain) in exercising asthmatics	TCEQ (2014)
Hydrogen Fluoride	1-hour [b]	60	Upper respiratory tract and eye irritation; and respiratory tract inflammation in human volunteers	TCEQ (2015)
Iron (metallic)	24-hour	15 (assumed equivalent to $PM_{2.5}$)	The only critical acute exposure pathway to humans is the inhalation of dust containing iron. There is clear evidence that any effects observed are caused by an overload effect of the lungs caused by poorly soluble particles. **The pulmonary toxicity is determined by the poorly soluble particle and not the iron content, as such, health endpoints for iron are captured in the assessment of dust ($PM_{2.5}$).**	TCEQ (2016); WHO (2021)

Table 5-1 Summary of Acute-Duration Inhalation TRVs and Benchmarks Selected for Use in the HHRA

Chemical of Concern	Non-Carcinogenic Inhalation TRVs (µg/m³)			
	Duration	*Value*	*Critical Effect*	*Source*
Lead	24-hour	15 (assumed equivalent to $PM_{2.5}$)	Must meet US EPA NAAQS so assumed equivalent to $PM_{2.5}$ 24-hour benchmark	TCEQ (2016); WHO (2021)
Manganese	24-hour	5	Inflammatory airway changes (i.e., mild bronchiolitis, alveolar duct inflammation, proliferation of BALT in monkeys)	TCEQ (2017)
Mercury	24-hour	0.25	Health-based ESL	TCEQ (2016)
Methylcholanthrene, 3-	1-hour [b]	0.02	Health-based ESL	TCEQ (2016)
Nickel	1-hour [b]	1.1	Respiratory effects, significant bronchial constriction in factory workers	TCEQ (2017)
Nitrogen Oxides (NOx)	1-hour	50	Decreased lung function and increased airway responsiveness in asthmatics	Health Canada (2015)
	24-hour	25	All-cause non-accidental mortality and asthma hospital admissions and emergency room visits	WHO (2021)
Phosphorous pentachloride	24-hour	10	Health-based AAQC	MECP (2020)
Phosphorus	1-hour [b]	1	Health-based ESL	TCEQ (2016)
$PM_{2.5}$	24-hour	15	All-cause non-accidental mortality and cause specific mortality (cardiovascular, non-malignant respiratory, cerebrovascular)	WHO (2021)
Quinoline	1-hour [b] Not cited.	260	Health-based ESL. Irritation of the eyes, nose and throat	TCEQ (2016)
Silica, Crystalline Form	24-hour	24	Pulmonary inflammation and cytotoxicity	TCEQ (2020)
Sodium hydroxide	24-hour	20	Health-based ESL	TCEQ (2016)
Sulphur Dioxide	24-hour	40	Asthma hospital admissions and emergency room visits, daily non-accidental mortality and respiratory mortality	WHO (2021)
Trichloroethylene	Intermediate	2.15	Decreased thymus weight in female mice, fetal heart malformations in rats	ATSDR (2019)
Vinyl Chloride	24-hour	1,300	Maternal and developmental toxicity, delayed ossification	ATSDR (2024)

[a] A 1-hour TRV was used for evaluating 24-hour exposures to benzene based on guidance from the MECP. Refer to the benzene toxicological profile in Appendix B.

[b] A 1-hour TRV was selected to evaluate 24-hour exposures in the absence of an accepted 24-hour benchmark.

5.2 Chronic Toxicity Reference Values

5.2.1 Inhalation Exposures

The chronic non-carcinogenic and carcinogenic inhalation TRVs for each of the COCs (where they were available), as well as the key critical health outcomes and regulatory source for each TRV, are provided in Table 5-2.

Table 5-2 Summary of Chronic-Duration Inhalation TRVs and Benchmarks Selected for Use in the HHRA

Chemical of Concern	Non-Carcinogenic Inhalation TRVs (µg/m^3)				Carcinogenic Inhalation Unit Risk ((µg/m^3)$^{-1}$)		
	Duration	*Value*	*Critical Effect*	*Source*	*Value*	*Critical Effect*	*Source*
Acrolein	Chronic	0.9	Nasal respiratory gland metaplasia in rats (Matsumoto et al. 2021)	ATSDR (2024)	NA	-	-
Arsenic	Chronic	0.015	Decreased intellectual function, and adverse effects on neurobehavioural development as critical effects (children)	Cal EPA (2008)	$1.5x10^{-4}$	Occupational lung cancer. Based on occupational exposure studies on the Tacoma smelter cohort (Enterline et al., 1995), the Swedish Ronnskar smelter cohort (Jarup et al., 1989; Viren and Silvers, 1994), and the Montana cohort (Lubin et al., 2000; 2008)	TCEQ (2012)
Benzene	Chronic	9.58	Hematological effects (statistically significantly decreased counts of Blymphocytes) (Lan et al., 2004)	ATSDR (2007)	$2.2x10^{-6}$ 7.80×10^{-6}	Leukemia (occupational exposure)	Rinsky et al. (1981; 1987); Paustenbach et al. (1993); Crump and Allen (1984); Crump (1994); MOE (2011); US EPA IRIS (2000)
Benzo(a)Pyrene	Chronic	0.002	Developmental toxicity	Health Canada (2021); US EPA (2017)	$6.0x10^{-4}$	**TEF APPROACH** Lung cancer	Thyssen et al. (1981); MECP (2019); US EPA IRIS (2017); Kalberlah et al. (1995)
Butadiene, 1,3-	Chronic	2	Ovarian atrophy; 2-year mouse inhalation study (NTP, 1993)	US EPA (2002); OEHHA (2013)	$5.0x10^{-7}$	Leukemia in occupational exposure study of styrenebutadiene synthetic rubber production workers	TCEQ (2015)
Cadmium	Chronic	0.01	Renal damage (β2-microglobulin proteinuria) (occupational exposure)	Buchet et al. (1990); Järup et al. (2000); Suwazono et al. (2006); Chen et al. (2006a, 2006b); Järup and Elinder (1994); Roels et al. (1993); ATSDR (2012)	$9.8x10^{-3}$	Lung tumours (rats)	Takenaka et al. (1983); Oldiges et al. (1984); MOE (2011); HC (2010)

Table 5-2 Summary of Chronic-Duration Inhalation TRVs and Benchmarks Selected for Use in the HHRA

Chemical of Concern	Non-Carcinogenic Inhalation TRVs (µg/m^3)				Carcinogenic Inhalation Unit Risk ((µg/m^3)$^{-1}$)		
	Duration	*Value*	*Critical Effect*	*Source*	*Value*	*Critical Effect*	*Source*
Calcium Oxide	Chronic	2	Not provided	TCEQ (2016)	NA	-	-
Carbon Monoxide	NV	NA	-	-	NA	-	-
Chloroform	Chronic	100	Liver effects (occupational exposure)	MOECC, 2017; ATSDR, 1997; Bomski et al., 1967	None selected	-	MOECC, 2017
Chromium III	Chronic	60	Not provided	MOE (2011); RIVM (2001)	NA	-	-
Chromium (VI)	Chronic	0.1	Lactate dehydrogenase in bronchioalveolar lavage fluid (rats)	Glaser et al. (1990); Malsch et al. (1994); MOE (2011); US EPA IRIS (1998)	$2.3x10^{-3}$	Not provided	Crump et al. (2003); Gibb et al. (2000); TCEQ (2014)
Cobalt	Chronic	0.063	Respiratory irritation (i.e., eye, nose, and throat irritation, cough) and reduced lung function (Nemery et al. (1992))	TCEQ (2017)	NA	-	-
Dichloroethane, 1,2-	Chronic	44	Increased ALT and uric acid in the serum, indicative of liver and kidney toxicity (Spreafico et al. 1980)	TCEQ (2017)	$2.6x10^{-5}$	Route extrapolation from US EPA IRIS (1991) oral carcinogenicity assessment	MOE, 2011; US EPA IRIS, 1991; NCI, 1978
Dioxin and Furans (TCDD-TEQ)	Chronic	0.1 pg/m^3	decreased sperm production and altered sexual behaviour in male rat offspring upon subcutaneous exposure to TCDD (Faqi *et al*., 1998), UK COT, 2001	MECP (AAQC)	NA	-	-
Formaldehyde	Chronic	7	Decreased pulmonary function, prevalence of current asthma or degree of asthma control, and allergic conditions in children	US EPA (2024)	0.000011	Nasopharyngeal cancer, sinonasal cancer, myeloid leukemia	US EPA IRIS (2024)
Hydrogen Chloride	Chronic	20	Hyperplasia of nasal mucosa larynx and trachea	Sellakumar et al. (1994); Albert et al. (1982) ; US EPA IRIS (1995)	NA	-	-
Hydrogen Fluoride	Chronic	29	increased bone density and skeletal fluorosis in workers	TCEQ (2015)	NA	-	-
Iron	NV	NA	-	-	NA	-	-

Table 5-2 Summary of Chronic-Duration Inhalation TRVs and Benchmarks Selected for Use in the HHRA

Chemical of Concern	Non-Carcinogenic Inhalation TRVs (µg/m^3)				Carcinogenic Inhalation Unit Risk ((µg/m^3)$^{-1}$)		
	Duration	*Value*	*Critical Effect*	*Source*	*Value*	*Critical Effect*	*Source*
Lead	Chronic	0.2	95th lower confidence limit of the BMD associated with a 1 IQ point decrement (intake rate associated with a drop of 1 IQ point in a population of children)	EFSA (2013) (based on Lanphear et al. (2005)); Health Canada (2021)	NA	-	-
Manganese	Chronic	0.05	Fine motor control (Luria Nebraska: thumb-fingers/non-dominant hand)	Lucchini et al. (1999); Health Canada (2010)	NA	-	-
Mercury	Chronic	0.03	Neurotoxic effects (occupational exposure)	Piikivi and Hanninen (1989); Fawer et al. (1983); Piikivi and Tolonen (1989); Piikivi (1989); Ngim et al. (1992); Cal EPA (2008)	NA	-	-
Methylcholanthrene, 3-	Chronic	0.002	Long-term health-based ESL	TCEQ (2016)	NA	-	-
Nickel	Chronic	0.06	Chronic active lung inflammation	MECP (2022)	2.4x10-4	Lung cancer (occupational study)	Chovil et al. (1981); Enterline and Marsh (1982); Peto et al. (1984); Magnus et al. (1982); MOE (2011); US EPA IRIS (1991)
Nitrogen Oxides (NOx)	Annual average	10	Based on all non-accidental mortality and causespecific, respiratory mortality	systematic review commissioned by WHO (Huangfu & Atkinson (2020)); published by Whaley et al. (2021); WHO (2021)	NA	-	-
Perylene	Annual average	0.00001	benchmarks available were suggesting the compound was a carcinogenetic PAH and therefore the ministry's standard of 0.00001 µg/m3 for B[a]P (as a surrogate to PAHs) was applied.	MECP (2020)	NA	-	-
Phosphorous Pentachloride	24-hour	10	-	MECP, 2020	NA	-	-
Phosphorus	Chronic	0.1	Long-term health-based ESL	TCEQ (2016)	NA	-	-

Table 5-2 Summary of Chronic-Duration Inhalation TRVs and Benchmarks Selected for Use in the HHRA

Chemical of Concern	Non-Carcinogenic Inhalation TRVs (µg/m^3)				Carcinogenic Inhalation Unit Risk ((µg/m^3)$^{-1}$)		
	Duration	*Value*	*Critical Effect*	*Source*	*Value*	*Critical Effect*	*Source*
$PM_{2.5}$	Annual average	5	Based on all non-accidental mortality and cause-specific mortality (circulatory, non-malignant respiratory mortality, lung cancer)	systematic review commissioned by WHO (Chen & Hoek (2020)); published by Whaley et al. (2021); WHO (2021)	NA	-	-
Quinoline	Chronic	26	Long-term health-based ESL	TCEQ (2016)	NA	-	-
Silica, Amorphous and other non-crystalline forms	Chronic	6.6	Chronic inflammation, microscopic changes in the lungs, decreases in pulmonary function	TCEQ (2011)	NA	-	-
Silica, Crystalline Forms	Chronic	0.27	lung cancer mortality in silica-exposed workers	TCEQ (2009)	NA	-	-
Sodium Hydroxide	Chronic	2	Long-term health-based ESL	TCEQ (2016)	NA	-	-
Sulphur Dioxide	NV	NA	-	-	NA	-	-
Trichloroethylene	Chronic	2	Decreased thymus weight (mice), increased fetal cardiac malformations (rats)	MOECC, 2017; US EPA IRIS, 2011; ATSDR, 2013; Keil et al., 2009; Johnson et al., 2003	$4.1x10^{-6}$	Kidney cancer risk (occupational exposure)	MOECC, 2017; US EPA IRIS, 2011; Charbotel *et al.,* 2006
Vinyl Chloride	Chronic	60	Centrilobular hypertrophy in livers (rats)	MOECC, 2017; TCEQ., 2009; Thornton *et al.,* 2002	$8.8x10^{-6}$	Liver angiosarcomas, angiomas, hepatomas, and neoplastic nodules (rats)	MOE, 2011; US EPA IRIS, 2000; Maltoni *et al*., 1981; 1984

NA Not available. No TRV or benchmark is available for this endpoint.

5.2.2 Additional Toxicological Context for PAHs

The group of polycyclic aromatic hydrocarbons (PAHs) are one of the priority sets of chemicals under study in the current assessment. They are a class of chemicals that occur naturally in coal, crude oil, gasoline, and other organic matter. They result from the incomplete combustion of these materials, such that occurs with the burning of coal, oil, gas, wood, garbage, tobacco and even the cooking of food. It is a large group of like-acting carcinogenic chemicals that is typically characterized by the keystone PAH, benzo(a)pyrene.

As indicated in Health Canada (2021), as well as most other regulatory guidance including in Ontario (MOE, 2005; 2011), the assessment of risks related to exposures to carcinogenic PAHs is typically conducted through the use of potency or toxicity equivalence factors (PEF or TEF). TEFs allow large groups of compounds with a common mechanism of action such as PAHs to be assessed when limited data is available for all but one of the compounds (*i.e.*, benzo(a)pyrene). Through this approach, exposures to each of the carcinogenic PAHs (cPAHs) are adjusted by their carcinogenic potency relative to benzo(a)pyrene. These potency-adjusted exposures can then be summed to provide an overall exposure to the group of carcinogenic PAHs, based on benzo(a)pyrene as the primary surrogate (i.e., B[a]P-TEQ equivalent).

Toxicity criteria are not available for all the carcinogenic PAHs (cPAHs). In the past, US EPA assessed risks posed by mixtures of PAHs by assuming that all carcinogenic PAHs were as potent as benzo[a]pyrene (B(a)P), one of the most potent PAHs. The available information on the toxicity of the PAHs suggests that most are considerably less potent than B(a)P. Several researchers and regulatory agencies have developed Toxic Equivalency Factors (TEFs) to allow the relative potency of the different cPAHs to be considered in a site-specific assessment. The TEFs relate the toxicity of the cPAHs to that of B(a)P. In the assessment of contaminated sites, MECP utilizes the TEFs developed by Kalberlah et al. (1995). These have been utilized in the current assessment (see Table 5-3). Where TEFs are lacking in Kalberlah et al. (1995), TEFs selected by Health Canada (2021), based on CCME (2010) and EEI (2006) have been utilized. A TEF was lacking for 7H-Dibenzo(c,g)carbazole and ATSDR (2022) has been utilized.

Table 5-3 Summary of Selected TEF values for Assessed cPAHs

PAH	Kalberlah et al. (1995)	CCME (2010)	HC (2021b)	ATSDR (2022)
Acenaphthene	0.001		-	
Acenaphthylene	0.01		-	
Anthracene	0.01		0.1	
Benzo(a)Anthracene	0.1	0.1	0.1	
Benzo(a)Pyrene	1	1	1	
Benzo(b)Fluoranthene	0.1	0.1	0.1	
Benzo(g,h,i)Perylene	0.01	0.01	0.01	
Benzo(j / k)Fluoranthene	0.1	0.1	0.1	
Chrysene	0.01	0.01	0.01	
Dibenzo(a,c/a,h)Anthracene	1	1	1	
7H-Dibenzo(c,g)carbazole			-	1
Fluoranthene	0.01		0.001	
Indeno(1,2,3-cd)Pyrene	0.1	0.1	0.1	
Pyrene	0.001		-	

For the current assessment, modelled ambient concentrations are only provided for benzo(a)pyrene and not the remainder of cPAHs in the overall family of chemicals. As such, to calculate the overall benzo(a)pyrene-TEQ exposure, so as to not underestimate health risks, Phase 3 emission factors for benzo(a)pyrene and the other cPAHs were used to calculate a TEF-adjustment factor to convert the benzo(a)pyrene modelled concentrations to

benzo(a)pyrene-TEQ concentrations. Table 5-4 provides an overview of the calculation of the TEQ Adjustment Factor used in the cPAH assessment. The TEQ Adjustment Factor appears to be consistent regardless of which phase is being assessed.

Table 5-4 Calculation of TEQ Adjustment Factor for cPAH Assessment

cPAH Constituent	Emission Factor from Phase 1 (g/s)	TEF	BAP-TEQ	Emission Factor from Phase 3 (g/s)	TEF	BAP-TEQ
Benzo(a)Pyrene	3.46E-07	1	3.46E-07	1.04E-06	1	1.04E-06
Acenaphthene	2.04E-06	0.001	2.04E-09	6.13E-06	0.001	6.13E-09
Acenaphthylene	4.10E-06	0.01	4.10E-08	1.23E-05	0.01	1.23E-07
Anthracene	1.87E-06	0.01	1.87E-08	5.60E-06	0.01	5.60E-08
Benzo(a)Anthracene	9.92E-07	0.1	9.92E-08	2.98E-06	0.1	2.98E-07
Benzo(b)Fluoranthene	1.06E-06	0.1	1.06E-07	3.18E-06	0.1	3.18E-07
Benzo(g,h,i)Perylene	1.19E-06	0.01	1.19E-08	3.56E-06	0.01	3.56E-08
Benzo(j / k)Fluoranthene	1.07E-06	0.1	1.07E-07	3.21E-06	0.1	3.21E-07
Chrysene	1.10E-06	0.01	1.10E-08	3.31E-06	0.01	3.31E-08
Dibenzo(a,c/a,h)Anthracene	8.93E-07	1	8.93E-07	2.68E-06	1	2.68E-06
7H-Dibenzo(c,g)carbazole	3.09E-07	1	3.09E-07	9.26E-07	1	9.26E-07
Fluoranthene	2.53E-06	0.01	2.53E-08	7.60E-06	0.01	7.60E-08
Indeno(1,2,3-cd)Pyrene	9.63E-07	0.1	9.63E-08	2.89E-06	0.1	2.89E-07
Pyrene	2.99E-06	0.001	2.99E-09	8.98E-06	0.001	8.98E-09
TOTAL BAP-TEQ			**2.07E-06**			**6.21E-06**
Calculated TEQ Adjustment Factor			**6.0x**			**6.0x**

This adjustment factor was then used to calculate a benzo(a)pyrene-TEQ concentration for each sensitive receptor location for each phase within the assessment (*i.e.*, B(a)P-TEQ = B(a)P * TEQ Adjustment Factor).

5.2.3 Multi-Pathway Exposures

As it was determined that deposition did not result in the accumulation of any of the COCs above typical background concentrations, a multi-pathway evaluation was not deemed required for this assessment.

5.3 Chemical Mixtures and Cumulative Effects

The evaluation of risks related to chemical exposures in mixtures is an emerging science. There are currently no accepted reference benchmarks or specific guidance (beyond those chemical groups that have established toxicity equivalency factors or TEFs such as dioxins, furans, and polycyclic aromatic hydrocarbons) by which one could evaluate whether exposure to a given mixture could pose a health concern. While there is no specific guidance on chemical mixtures assessment beyond these chemical types, discussions on acceptable benchmarks for chemical mixtures are emerging. Generally, risk estimates have been summed when toxicologically justified (*e.g.*, common modes of toxicological action) and when significant mixture interactions are identified. This is considered a conservative approach.

The four main toxicological interactions that take place between chemicals are:

- **Additivity**. Additive effects occur when the combined toxic effect of chemicals equals the sum of the effects of each individual chemical. Additivity is believed to be the most common type of chemical interaction, particularly at environmentally relevant (relatively low) concentrations and doses. Additivity often occurs when chemicals act via similar toxicological mechanisms or have similar metabolites that cause a toxic effect by a similar mode of action. The estimated response to the mixture can be predicted through the addition of the doses after adjusting for potencies (ATSDR, 2018).
- **Response addition**. Where it is assumed that chemicals act on a system independently of each other and by different modes of action (ATSDR, 2018). This approach requires the response (*e.g.*, mortality, target organ toxicity) to be expressed as a ratio with a value between 0 and 1, with the response being interpreted in relation to a population (*e.g.*, the percentage of individuals in a population) (EFSA, 2021). An example of a response addition approach is the summing of cancer risks from multiple chemicals that cause different types of cancer.
- **Synergistic/Potentiative** (Greater than Additive). Synergistic effects occur when the combined effects of two or more toxic chemicals are considerably greater than the sum of the effects of the individual chemicals; when a relatively non-toxic chemical enhances the toxicity of a second chemical, then the relationship is considered to be potentiative. Synergistic and potentiative interactions are considered to be greater than additive. These types of interactions can occur when one chemical reduces the detoxification of another, or when their interactions affect their fate within the body (ATSDR, 2018).
- **Antagonistic** (Less than Additive). Antagonistic effects occur when the combined toxic effect of chemicals is less than the sum of the toxic effects of the individual chemicals (*i.e.*, less than an additive effect). This may occur, for example, if toxic chemicals compete for the same chemical binding site (ATSDR, 2018).

Methods have been developed to assess the risks from mixtures consisting of a single class of structurally similar chemicals, where extensive toxicological information is available for one chemical (the index chemical) but less is known about the others. These methods rely on the use of scaling factors (*e.g.*, relative potency or toxic equivalency factors) to express the estimated compound-specific toxicity relative to the toxicity of the index chemical. For example, mixtures of carcinogenic PAHs are assessed using relative potency factors as described in Section 5.2.2.

Efforts have been made by several regulatory agencies and leading scientific authorities to better understand the types of interactions involved and to develop methods for assessing mixtures (Price et al. 2009; Boobis et al. 2011; Meek et al. 2011; Price and Han 2011; European Commission 2012; US EPA 2023). These efforts have led to the following observations:

- Under certain conditions, chemicals can act in combination as a mixture in a manner that affects the overall level of toxicity.
- Chemicals with common modes of action can act jointly to produce combined effects that may be greater than the effects of each of the constituents alone. These effects are additive in nature.
- For chemicals having different modes of action, there is no robust evidence available to indicate that mixtures of such substances are of health or environmental concern provided the individual chemicals are present in amounts at or below their threshold dose levels.

- Interactions (including antagonism, potentiation and synergism) usually occur only at moderate to high dose levels (relative to the lowest effect levels) and are either unlikely to occur or to be of any toxicological significance at low or “environmentally relevant” exposure levels.
- If information is lacking on the mode(s) of action of chemicals in a mixture, it should be assumed by default that they will act in an additive fashion, with the manner and extent to which they may interact are determined on a case-by-case basis using professional judgement.

For individual chemicals or groups of structurally similar chemicals that cannot be assessed using potency or equivalency factors, recent guidance for the assessment of additive interactions within chemical mixtures involve the use of a tiered approach for the assessment of chemical mixtures (ATSDR, 2018; OECD, 2018, EFSA, 2021). The lower tiers involve the use of simple but conservative methods, with higher tiers of assessment available depending on the information that is available for the chemicals in the mixture. The generic steps for each tier are the same (Figure 5-1) – different data/evidence can be considered depending on the level of detail that is feasible. The objective of using a tiered approach is to maximize efficiency.

In the first assessment tier (Tier 0), risk estimates are calculated based on TRVs that are specific to the same target organ/tissue are summed (note: process completed separately for carcinogenic and non-carcinogenic risks for each organ/tissue). Additivity is assumed. This assessment tier is intended to be conservative and to involve the use of conservative assumptions.

Based on an evaluation of the information available for the current study, mixture effects were assessed in the assessment based upon a Tier 0 assessment where risk estimates were summed where TRVs involve the same target organ or tissue, separately for carcinogenic and non-carcinogenic risks.

5.3.1 Selected Mixture Groups

For the current assessment, Common Assessment Groups (CAGs) were developed for the chemicals for quantitative and semi-quantitative assessment based on target tissues/organ systems for the Tier 0 level. CAGs were only developed for endpoints with more than one chemical in the group. Table 5-5 provides the list of key effect CAG with the chemicals assigned to each mixture group based on target organ, Adverse Outcome Pathways (AOP)[1], or Mode of Action (MOA)[2].

[1] An AOP captures the casual relationships between the initial interaction of a chemical with molecular biological (s) targets, resulting in a perturbation of impacted biological systems, leading to an adverse outcome through a sequence of key events (KEs) at the subcellular, cellular, tissue, organ, and organism level.

[2] MOA describes a biological sequence of key events leading to an observed effect.

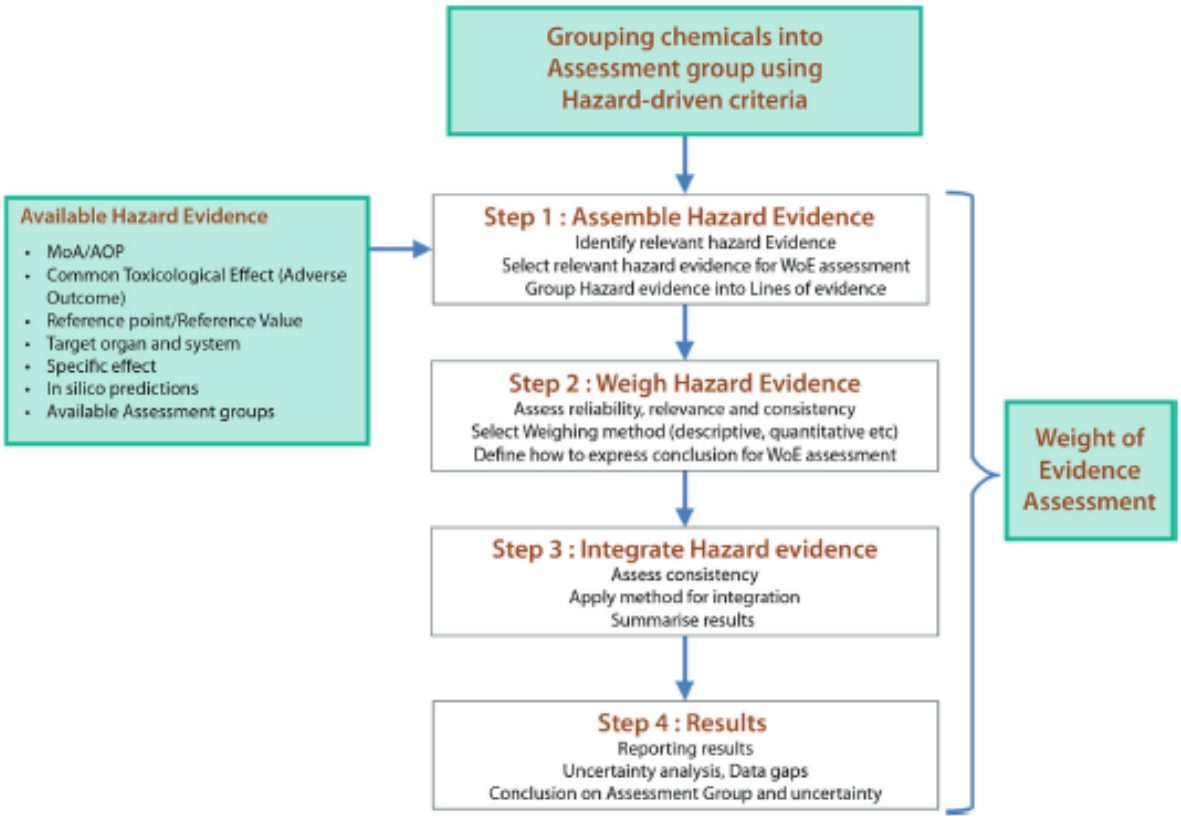


Figure 5-1 Generic Approach for Organizing Chemicals into Common Assessment Groups (EFSA, 2021)

Table 5-5 Tier 0 Common Assessment Groups for Cumulative Effects (Mixtures Assessment)

Mixture	Key effect (target organ, MOA/AOP)	Common Assessment Group Components
Acute Inhalation	Respiratory irritation	Acrolein, calcium oxide, carbon monoxide, chloroform, cobalt, 1,2-dichloroethane formaldehyde, hydrogen chloride, hydrogen fluoride, iron, lead, manganese, nickel, NO_2, phosphorus pentachloride, $PM_{2.5}$, sodium hydroxide, SO_2, trichloroethylene, vinyl chloride
Chronic Inhalation	Respiratory irritants	Acrolein, chromium (total), cobalt, formaldehyde, hydrogen chloride, nickel, NO_2, perylene, phosphorous, $PM_{2.5}$, quinoline, and silica
	Developmental toxicants	Arsenic, benzo(a)pyrene, dioxins/furans, lead, trichloroethylene
	Neurotoxicants	Manganese and Mercury
	Carcinogens – leukemia	1,3-butadiene and benzene
	Carcinogens – lung	Arsenic, benzo(a)pyrene, cadmium, 1,2-dicloroethane, chromium VI, 3-methylcholanthrene, nickel, vinyl chloride

As part of the risk characterization, summed risk predictions were provided for each of these key effect groupings to indicate the overall cumulative impacts of a given mixture group. Please see additive risk tables in Section 6.3.

6.0 RISK CHARACTERIZATION

The final step of the HHRA is risk characterization which involves the estimation, description, and evaluation of risk associated with exposure to chemicals by comparing the estimated exposure to the TRV for a specific chemical or group of compounds to identify potential human health risks. This comparison is typically expressed as a concentration ratio (CR) for non-carcinogenic chemicals and is calculated by dividing the predicted exposure by the TRV. In the case of carcinogenic chemicals, potential risks are expressed as incremental lifetime cancer risks (ILCRs) and represent the incremental risk of an individual within a given population developing cancer over their lifetime due to exposures from a specific carcinogenic chemical. As discussed in Section 2.1.4.2, it is important to always put predicted cancer risks into context as to the probability of adverse outcomes.

The following sections provide the worst-case short- and long-term human health risk estimates for both Project Alone and Cumulative conditions for each of the three proposed expansion phases of the Emerald EFW facility. In each case, the worst-case community and residential receptors are provided based on modelling conducted in the Air Quality Assessment Study.

As presented in Section 2.1.4.1, CR values were used to evaluate short- and long-term health risks resulting from exposures to COC *via* inhalation. CR values were calculated by dividing the predicted ground-level air concentration (Section 4.1) by the appropriate health-based reference benchmark (Sections 5.1 and 5.2).

In general, a CR value less than or equal to one (CR value ≤1) represents a situation where the predicted ground-level air concentration is less than a corresponding health-based reference benchmark. Considering the various assumptions used that attempt to over predict rather than under predict ground-level air concentrations and the typical uncertainty factors applied during the development of a health-based TRV, a CR value less than or equal to one (CR value ≤ 1) is a strong indicator of negligible health risks resulting from exposure to a particular COC.

A CR value greater than one (CR value > 1) is indicative of a scenario whereby the predicted ground level air concentration is greater than the corresponding health-based reference benchmark, suggesting that the potential for an adverse health effect may be present. The significance of the exceedance must be balanced against the degree of conservatism incorporated in the derivation of the TRVs as well as the predicted ground-level concentrations.

6.1 Short-Term Inhalation Assessment

Tables 6-1 and 6-2 present worst-case short-term (*i.e.*, 24-hour) inhalation risk estimates (expressed as CR values) for each of the proposed expansion phases using 90th percentile background concentrations and 50th percentile background concentrations, respectively. Predicted acute CRs are provided for regional background concentrations, the Project Alone contributions, and overall cumulative concentrations at the worst-case community and residential receptors.

It is worth noting that Section 7.1.2 of the Revised AQIA Report includes discussions of the implications of exceedances of the AAQCs as follows (GHD, 2024c):

> Benzo(a)pyrene (annual, 24-hr): The Ontario 24-hour AAQC for BaP is 0.00005 ug/m^3 and the annual AAQC is 0.00001 ug/m^3. There are no federal criteria. The estimated background concentration for BaP is 183.79% of the annual criteria and 212.14% of the 24-hour criteria. The background BaP

concentrations are based on data from the federal NAPS monitoring stations near Emerald. The cumulative BaP concentrations at the worst-case receptor are 184.68% and 214.72% of the criteria for annual and 24-hour averaging periods, respectively (see Table E.5 of the AQIA Report). These exceedances are predominantly attributed to the background BaP concentrations, whereas emissions from the Emerald's stacks contribute to less than 4% of the criteria (GHD, 2024c).

Dioxin and Furans (24-hr): The Ontario 24-hour AAQC for D/F is 0.0000001 ug/m^3. There are no federal criteria. The estimated background concentration for D/F is 97.99% of the criteria.
Within the January 2024 Assessment, GHD used the DYEC dioxins and furans in-stack limit for modelling purposes to estimate the potential worst-case emissions of dioxins and furans from the Emerald facility. The actual dioxins and furans in-stack concentrations from historical stack test data is significantly lower than the in-stack limit and represents a more accurate estimate of the actual dioxins and furans emissions that will occur from Emerald Phases 1, 2 and 3 expansions (GHD, 2024c).

The Dioxins and Furans in-stack emission rate was modified to be based on historical stack testing data. The Dioxins and Furans maximum concentration calculated using stack testing data is an order of magnitude lower than the maximum concentration estimated using DYEC in-stack limits. The estimated maximum ambient concentrations of D/F using the in-stack limit is estimated to be 23% of the Ontario AAQC. If the in-stack emission limit is used to calculate the dioxins and furans emission rate, the cumulative maximum concentration at worst case receptor exceeds the project criteria. In contrast, the estimated maximum ambient concentration of D/F using stack test data is calculated to be 2.8% of the Ontario AAQC. Using the Emerald stack test data for Dioxins and Furans, the predicted maximum ambient air concentrations, with background concentrations added, do not exceed the AAQC. With the DYEC in-stack limit, dioxins and furans predicted concentrations showed an exceedance of the AAQC (see January 2024 Assessment), however with the more realistic in-stack concentrations based on historical stack testing data, There are no exceedances of the D/F air quality criteria for Phase 1, Phase 2 expansions and only a marginal exceedance at 100.76% of the AAQC for the Phase 3 expansion (see Tables E.3, E.4 and E.5 of the AQIA Report).

The results of the short-term exposure assessment indicate concentrations of all chemicals of concern are below the corresponding acute health-based benchmarks with the exception of TCE from cumulative impacts as well as NOx at the worst-case community location. Predicted cumulative 24-hour air concentrations for all chemicals did not exceed their corresponding acute health-based benchmark under any of the proposed expansion phases (*i.e.*, CR values were all < 1) for any residential location. In most cases, concentrations were orders of magnitude below the corresponding benchmark.

As shown in Table 6-1, the cumulative risk for TCE is being driven by worst-case regional ambient background concentrations, with very little contribution from facility emissions in each of the expansion phases.

Under Phase 2 and 3 of the planned expansion, concentrations of NOx can exceed the short-term 24-hour benchmark at the closest community receptor location (*i.e.*, Sportsfield 1 approximately 720 m south of the facility) under certain limited meteorological conditions. This is confirmed by the assessment of worst-case 1-hour NOx exposures which mirrored the 24-hour NOx assessment results (see Table 6-3). This indicates if an individual with asthma were present at the Sportsfield during worst-case meteorological conditions, there is the potential for an asthmatic event under certain conditions. As shown below in Figure 6-1, cumulative 24-hour NOx concentrations were only predicted to exceed the benchmark threshold approximately 1% of the time. The average contribution on a typical day from the proposed Phase 3 expansion would be 1.5 µg/m^3 leading to a cumulative concentration well below the threshold even if we are assuming the 90th percentile regional background concentration of 12.9 µg/m^3.

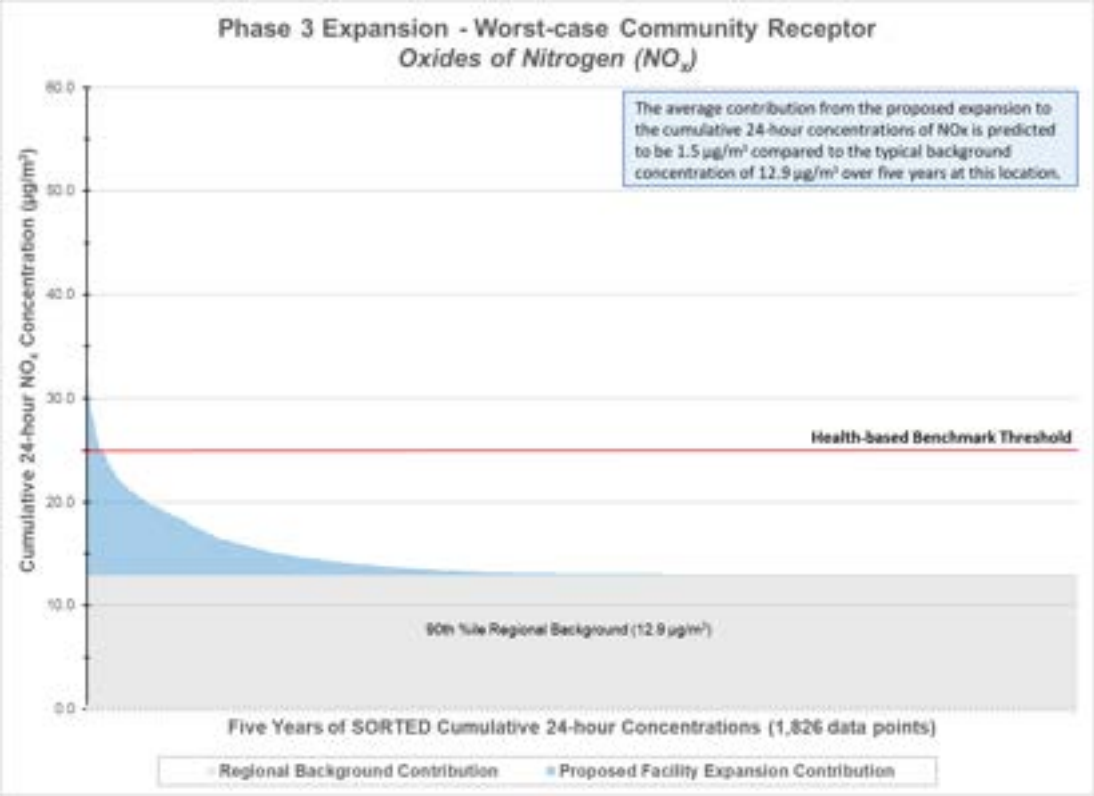


Figure 6-1 Frequency Analysis of Benchmark Exceedances over Five Years for Cumulative 24-hour NOx Concentrations with 90th %ile Regional Background

However, if one assumes typical average regional background concentrations (*i.e.*, the 50th percentile of 5.4 µg/m^3), the cumulative 24-hour NOx concentrations were only predicted to marginally exceed the benchmark threshold at this community location once in five years of modelling or 0.05% of the time (see Figure 6-2).

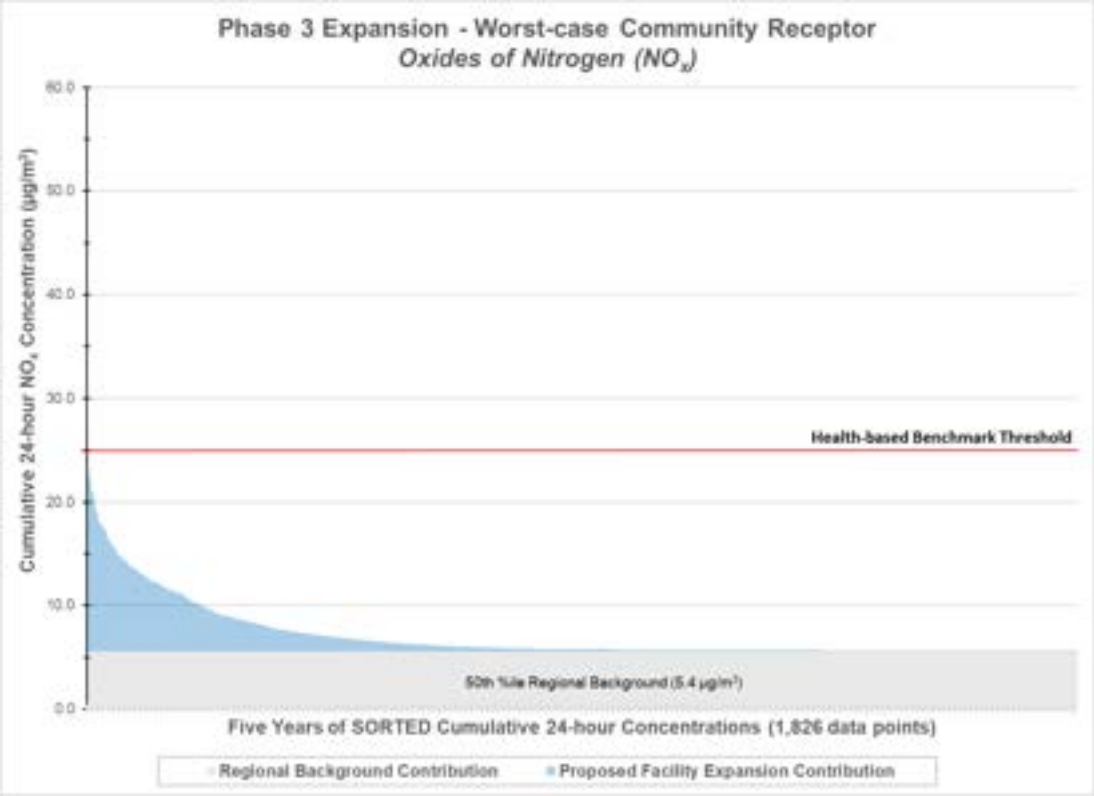


Figure 6-2 Frequency Analysis of Benchmark Exceedances over Five Years for Cumulative 24-hour NOx Concentrations with 50th %ile Regional Background

Table 6-1 Predicted Project Alone and Cumulative 24-hour Acute Concentration Ratios for the Closest Community and Residential Receptors at each of the Three Expansion Phases using 90th %ile Regional Background

Chemical of Concern	90th Percentile Background Concentration Ratio	Predicted ACUTE Concentration Ratios (CR)											
		Phase 1				Phase 2				Phase 3			
		Closest Community		Closest Residential		Closest Community		Closest Residential		Closest Community		Closest Residential	
		Project Alone	Cumulative	Project Alone	Cumulative	Project Alone	Cumulative	Project Alone	Cumulative	Project Alone	Cumulative	Project Alone	Cumulative
Criteria Air Contaminants													
Carbon Monoxide[a]	3.7E-03	1.2E-04	3.8E-03	5.9E-05	3.8E-03	3.9E-04	4.1E-03	1.7E-04	3.9E-03	5.4E-04	4.2E-03	2.5E-04	3.9E-03
Nitrogen Oxides	5.2E-01	2.2E-01	7.4E-01	1.1E-01	6.3E-01	7.4E-01	**1.3E+00**	3.2E-01	8.4E-01	1.0E+00	**1.5E+00**	4.8E-01	1.0E+00
$PM_{2.5}$	4.0E-01	1.5E-02	4.2E-01	7.7E-03	4.1E-01	5.0E-02	4.5E-01	2.2E-02	4.2E-01	7.1E-02	4.7E-01	3.4E-02	4.3E-01
Sulphur Dioxide	2.6E-02	4.0E-02	6.6E-02	2.0E-02	4.6E-02	1.3E-01	1.6E-01	5.8E-02	8.4E-02	1.8E-01	2.1E-01	8.6E-02	1.1E-01
Volatile Organic Compounds													
Acrolein	0.0E+00	1.7E-05	1.7E-05	8.5E-06	8.5E-06	5.6E-05	5.6E-05	2.4E-05	2.4E-05	7.7E-05	7.7E-05	3.6E-05	3.6E-05
Benzene	4.0E-02	2.3E-04	4.0E-02	1.2E-04	4.0E-02	7.7E-04	4.0E-02	3.4E-04	4.0E-02	1.1E-03	4.1E-02	5.0E-04	4.0E-02
Butadiene (1,3-)	1.2E-03	1.0E-07	1.2E-03	5.2E-08	1.2E-03	3.5E-07	1.2E-03	1.5E-07	1.2E-03	4.8E-07	1.2E-03	2.2E-07	1.2E-03
Chloroform	2.6E-03	6.4E-07	2.6E-03	3.2E-07	2.6E-03	2.1E-06	2.6E-03	9.2E-07	2.6E-03	2.9E-06	2.6E-03	1.4E-06	2.6E-03
Dichloroethane, 1,2-	1.1E-03	3.7E-07	1.1E-03	1.8E-07	1.1E-03	1.2E-06	1.1E-03	5.3E-07	1.1E-03	1.7E-06	1.1E-03	7.9E-07	1.1E-03
Formaldehyde	0.0E+00	4.4E-04	4.4E-04	2.2E-04	2.2E-04	1.5E-03	1.5E-03	6.3E-04	6.3E-04	2.0E-03	2.0E-03	9.4E-04	9.4E-04
Quinoline	7.7E-06	1.2E-08	7.7E-06	5.8E-09	7.7E-06	3.9E-08	7.7E-06	1.7E-08	7.7E-06	5.3E-08	7.7E-06	2.5E-08	7.7E-06
Trichloroethylene	**1.3E+00**	2.8E-05	**1.3E+00**	1.4E-05	**1.3E+00**	9.3E-05	**1.3E+00**	4.0E-05	**1.3E+00**	1.3E-04	**1.3E+00**	6.0E-05	**1.3E+00**
Vinyl Chloride	2.1E-04	7.6E-08	2.1E-04	3.8E-08	2.1E-04	2.5E-07	2.1E-04	1.1E-07	2.1E-04	3.5E-07	2.1E-04	1.6E-07	2.1E-04
Inorganics													
Arsenic	1.8E-02	4.1E-04	1.8E-02	2.1E-04	1.8E-02	1.4E-03	1.9E-02	6.1E-04	1.9E-02	1.9E-03	2.0E-02	9.1E-04	1.9E-02
Cadmium	4.0E-02	1.1E-02	5.1E-02	5.4E-03	4.5E-02	3.5E-02	7.5E-02	1.5E-02	5.5E-02	4.8E-02	8.8E-02	2.3E-02	6.3E-02
Calcium Oxide	3.1E-01	3.9E-03	3.2E-01	2.0E-03	3.1E-01	1.3E-02	3.3E-01	5.6E-03	3.2E-01	1.8E-02	3.3E-01	8.3E-03	3.2E-01
Chromium (Total)	4.2E-04	1.8E-05	4.3E-04	9.2E-06	4.3E-04	5.9E-05	4.8E-04	2.6E-05	4.4E-04	8.1E-05	5.0E-04	3.9E-05	4.6E-04
Chromium VI	3.1E-04	1.3E-05	3.2E-04	6.8E-06	3.1E-04	4.3E-05	3.5E-04	1.9E-05	3.3E-04	6.0E-05	3.7E-04	2.9E-05	3.4E-04
Cobalt	1.3E-02	2.1E-03	1.5E-02	1.1E-03	1.4E-02	6.9E-03	2.0E-02	3.1E-03	1.6E-02	9.5E-03	2.2E-02	4.6E-03	1.7E-02
Hydrogen Chloride	4.5E-03	6.2E-04	5.2E-03	3.1E-04	4.9E-03	2.1E-03	6.6E-03	9.0E-04	5.4E-03	2.9E-03	7.4E-03	1.3E-03	5.9E-03
Hydrogen Fluoride	0.0E+00	3.1E-04	3.1E-04	1.6E-04	1.6E-04	1.0E-03	1.0E-03	4.5E-04	4.5E-04	1.4E-03	1.4E-03	6.7E-04	6.7E-04
Iron	1.5E-01	2.4E-04	1.5E-01	1.2E-04	1.5E-01	8.0E-04	1.5E-01	3.6E-04	1.5E-01	1.1E-03	1.5E-01	5.3E-04	1.5E-01
Lead	8.0E-04	1.5E-04	9.5E-04	7.7E-05	8.8E-04	5.0E-04	1.3E-03	2.2E-04	1.0E-03	6.8E-04	1.5E-03	3.3E-04	1.1E-03
Manganese	1.2E-02	1.6E-04	1.2E-02	8.3E-05	1.2E-02	5.3E-04	1.3E-02	2.4E-04	1.2E-02	7.3E-04	1.3E-02	3.5E-04	1.3E-02
Mercury	1.2E-04	2.7E-03	2.8E-03	1.4E-03	1.5E-03	8.9E-03	9.0E-03	4.0E-03	4.1E-03	1.2E-02	1.2E-02	5.9E-03	6.1E-03
Nickel	3.6E-03	3.4E-04	4.0E-03	1.7E-04	3.8E-03	1.1E-03	4.7E-03	4.9E-04	4.1E-03	1.5E-03	5.2E-03	7.3E-04	4.4E-03
Phosphorous pentachloride	5.3E-02	6.4E-04	5.4E-02	3.2E-04	5.3E-02	2.1E-03	5.5E-02	9.2E-04	5.4E-02	2.9E-03	5.6E-02	1.4E-03	5.4E-02
Phosphorus	7.9E-02	9.5E-04	8.0E-02	4.8E-04	7.9E-02	3.2E-03	8.2E-02	1.4E-03	8.0E-02	4.3E-03	8.3E-02	2.0E-03	8.1E-02
Silica	1.8E-02	4.7E-04	1.9E-02	2.4E-04	1.9E-02	1.6E-03	2.0E-02	6.8E-04	1.9E-02	2.2E-03	2.0E-02	1.0E-03	1.9E-02
Sodium hydroxide	3.3E-01	3.3E-03	3.4E-01	8.3E-04	3.3E-01	5.5E-03	3.4E-01	2.4E-03	3.4E-01	7.5E-03	3.4E-01	3.5E-03	3.4E-01

Note: **Bolded and shaded cells** indicate predicted risk for that chemical of concern which exceeded the concentration ratio of 1.0.

[a] Carbon monoxide is evaluated on an 8-hour exposure duration.

Table 6-2 Predicted Project Alone and Cumulative 24-hour Acute Concentration Ratios for the Closest Community and Residential Receptors at each of the Three Expansion Phases using 50th %ile Regional Background

Chemical of Concern	50th Percentile Background Concentration Ratio	Predicted ACUTE Concentration Ratios (CR)											
		Phase 1				Phase 2				Phase 3			
		Closest Community		Closest Residential		Closest Community		Closest Residential		Closest Community		Closest Residential	
		Project Alone	Cumulative	Project Alone	Cumulative	Project Alone	Cumulative	Project Alone	Cumulative	Project Alone	Cumulative	Project Alone	Cumulative
Criteria Air Contaminants													
Carbon Monoxide[a]	2.4E-03	1.2E-04	2.6E-03	5.9E-05	2.5E-03	3.9E-04	2.8E-03	1.7E-04	2.6E-03	5.4E-04	3.0E-03	2.5E-04	2.7E-03
Nitrogen Oxides	2.2E-01	2.2E-01	4.4E-01	1.1E-01	3.3E-01	7.4E-01	9.5E-01	3.2E-01	5.3E-01	1.0E+00	**1.2E+00**	4.8E-01	6.9E-01
$PM_{2.5}$	2.2E-01	1.5E-02	2.3E-01	7.7E-03	2.3E-01	5.0E-02	2.7E-01	2.2E-02	2.4E-01	7.1E-02	2.9E-01	3.4E-02	2.5E-01
Sulphur Dioxide	9.8E-03	4.0E-02	5.0E-02	2.0E-02	3.0E-02	1.3E-01	1.4E-01	5.8E-02	6.7E-02	1.8E-01	1.9E-01	8.6E-02	9.6E-02
Volatile Organic Compounds													
Acrolein	0.0E+00	1.7E-05	1.7E-05	8.5E-06	8.5E-06	5.6E-05	5.6E-05	2.4E-05	2.4E-05	7.7E-05	7.7E-05	3.6E-05	3.6E-05
Benzene	2.0E-02	2.3E-04	2.0E-02	1.2E-04	2.0E-02	7.7E-04	2.1E-02	3.4E-04	2.0E-02	1.1E-03	2.1E-02	5.0E-04	2.0E-02
Butadiene (1,3-)	1.3E-03	1.0E-07	1.3E-03	5.2E-08	1.3E-03	3.5E-07	1.3E-03	1.5E-07	1.3E-03	4.8E-07	1.3E-03	2.2E-07	1.3E-03
Chloroform	2.7E-03	6.4E-07	2.7E-03	3.2E-07	2.7E-03	2.1E-06	2.7E-03	9.2E-07	2.7E-03	2.9E-06	2.7E-03	1.4E-06	2.7E-03
Dichloroethane, 1,2-	1.2E-03	3.7E-07	1.2E-03	1.8E-07	1.2E-03	1.2E-06	1.2E-03	5.3E-07	1.2E-03	1.7E-06	1.2E-03	7.9E-07	1.2E-03
Formaldehyde	0.0E+00	4.4E-04	4.4E-04	2.2E-04	2.2E-04	1.5E-03	1.5E-03	6.3E-04	6.3E-04	2.0E-03	2.0E-03	9.4E-04	9.4E-04
Quinoline	4.2E-06	1.2E-08	4.2E-06	5.8E-09	4.2E-06	3.9E-08	4.3E-06	1.7E-08	4.2E-06	5.3E-08	4.3E-06	2.5E-08	4.3E-06
Trichloroethylene	6.1E-01	2.8E-05	6.1E-01	1.4E-05	6.1E-01	9.3E-05	6.1E-01	4.0E-05	6.1E-01	1.3E-04	6.1E-01	6.0E-05	6.1E-01
Vinyl Chloride	2.2E-04	7.6E-08	2.2E-04	3.8E-08	2.2E-04	2.5E-07	2.2E-04	1.1E-07	2.2E-04	3.5E-07	2.2E-04	1.6E-07	2.2E-04
Inorganics													
Arsenic	1.8E-02	4.1E-04	1.8E-02	2.1E-04	1.8E-02	1.4E-03	1.9E-02	6.1E-04	1.8E-02	1.9E-03	1.9E-02	9.1E-04	1.8E-02
Cadmium	4.0E-02	1.1E-02	5.1E-02	5.4E-03	4.5E-02	3.5E-02	7.5E-02	1.5E-02	5.5E-02	4.8E-02	8.8E-02	2.3E-02	6.3E-02
Calcium Oxide	1.8E-01	3.9E-03	1.9E-01	2.0E-03	1.8E-01	1.3E-02	2.0E-01	5.6E-03	1.9E-01	1.8E-02	2.0E-01	8.3E-03	1.9E-01
Chromium (Total)	3.0E-04	1.8E-05	3.2E-04	9.2E-06	3.1E-04	5.9E-05	3.6E-04	2.6E-05	3.3E-04	8.1E-05	3.8E-04	3.9E-05	3.4E-04
Chromium VI	2.2E-04	1.3E-05	2.3E-04	6.8E-06	2.3E-04	4.3E-05	2.6E-04	1.9E-05	2.4E-04	6.0E-05	2.8E-04	2.9E-05	2.5E-04
Cobalt	1.3E-02	2.1E-03	1.5E-02	1.1E-03	1.4E-02	6.9E-03	2.0E-02	3.1E-03	1.6E-02	9.5E-03	2.2E-02	4.6E-03	1.7E-02
Hydrogen Chloride	2.0E-04	6.2E-04	8.2E-04	3.1E-04	5.1E-04	2.1E-03	2.3E-03	9.0E-04	1.1E-03	2.9E-03	3.1E-03	1.3E-03	1.5E-03
Hydrogen Fluoride	0.0E+00	3.1E-04	3.1E-04	1.6E-04	1.6E-04	1.0E-03	1.0E-03	4.5E-04	4.5E-04	1.4E-03	1.4E-03	6.7E-04	6.7E-04
Iron	6.3E-02	2.4E-04	6.4E-02	1.2E-04	6.3E-02	8.0E-04	6.4E-02	3.6E-04	6.4E-02	1.1E-03	6.4E-02	5.3E-04	6.4E-02
Lead	3.3E-04	1.5E-04	4.8E-04	7.7E-05	4.1E-04	5.0E-04	8.3E-04	2.2E-04	5.5E-04	6.8E-04	1.0E-03	3.3E-04	6.6E-04
Manganese	6.6E-03	1.6E-04	6.8E-03	8.3E-05	6.7E-03	5.3E-04	7.1E-03	2.4E-04	6.8E-03	7.3E-04	7.3E-03	3.5E-04	7.0E-03
Mercury	1.2E-04	2.7E-03	2.8E-03	1.4E-03	1.5E-03	8.9E-03	9.0E-03	4.0E-03	4.1E-03	1.2E-02	1.2E-02	5.9E-03	6.1E-03
Nickel	2.0E-03	3.4E-04	2.3E-03	1.7E-04	2.2E-03	1.1E-03	3.1E-03	4.9E-04	2.5E-03	1.5E-03	3.5E-03	7.3E-04	2.7E-03
Phosphorous pentachloride	2.5E-02	6.4E-04	2.6E-02	3.2E-04	2.5E-02	2.1E-03	2.7E-02	9.2E-04	2.6E-02	2.9E-03	2.8E-02	1.4E-03	2.6E-02
Phosphorus	3.6E-02	9.5E-04	3.7E-02	4.8E-04	3.6E-02	3.2E-03	3.9E-02	1.4E-03	3.7E-02	4.3E-03	4.0E-02	2.0E-03	3.8E-02
Silica	1.1E-02	4.7E-04	1.2E-02	2.4E-04	1.1E-02	1.6E-03	1.3E-02	6.8E-04	1.2E-02	2.2E-03	1.3E-02	1.0E-03	1.2E-02
Sodium hydroxide	1.7E-01	3.3E-03	1.8E-01	8.3E-04	1.7E-01	5.5E-03	1.8E-01	2.4E-03	1.7E-01	7.5E-03	1.8E-01	3.5E-03	1.8E-01

Note: **Bolded and shaded cells** indicate predicted risk for that chemical of concern which exceeded the concentration ratio of 1.0.

[a] Carbon monoxide is evaluated on an 8-hour exposure duration.

Table 6-3 Predicted Project Alone and Cumulative 1-hour Acute Concentration Ratios for NOx exposures at the Closest Community and Residential Receptors for each of the Three Expansion Phases

Chemical of Concern	Background Concentration Ratio	Predicted ACUTE Concentration Ratios (CR)											
		Phase 1				Phase 2				Phase 3			
		Closest Community		Closest Residential		Closest Community		Closest Residential		Closest Community		Closest Residential	
		Project Only	Cumulative	Project Only	Cumulative	Project Only	Cumulative	Project Only	Cumulative	Project Only	Cumulative	Project Only	Cumulative
Criteria Air Contaminants													
Nitrogen Oxides (90th%ile background)	6.5E-01	2.2E-01	8.7E-01	2.0E-01	8.4E-01	5.9E-01	**1.2E+00**	3.9E-01	1.0E+00	9.8E-01	**1.6E+00**	6.0E-01	**1.2E+00**
Nitrogen Oxides (50th%ile background)	2.7E-01	2.2E-01	4.9E-01	2.0E-01	4.7E-01	5.9E-01	8.6E-01	3.9E-01	6.6E-01	9.8E-01	**1.2E+00**	6.0E-01	8.7E-01

Note: **Bolded and shaded cells** indicate predicted risk for that chemical of concern which exceeded the concentration ratio of 1.0.

6.2 Long-Term Inhalation Assessment

The potential for chronic adverse health effects, for both cancer and non-cancer risks, resulting from long-term exposures (*via* inhalation) were evaluated at each of the receptor locations throughout the Study Area.

6.2.1 Non-Cancer Risks

Tables 6-4 and 6-5 present worst-case long-term (*i.e.*, annual average) inhalation non-cancer risk estimates (expressed as CR values) for each of the proposed expansion phases using 90th percentile background concentrations and 50th percentile background concentrations, respectively. Predicted chronic CRs are provided for regional background concentrations, the Project Alone contributions, and overall cumulative concentrations at the worst-case community and residential receptors.

The results of the long-term exposure assessment indicate that worst-case cumulative concentrations of chemicals of concern are below the corresponding chronic health-based benchmarks.

Predicted cumulative annual average air concentrations for all chemicals did not exceed their corresponding chronic health-based benchmark under any of the proposed expansion phases (*i.e.*, CR values were all < 1). In most cases, concentrations were orders of magnitude below the corresponding benchmark.

Thus, like the short-term 24-hour results, the proposed expansion of the Emerald EFW facility does not appear to be contributing an elevated contribution to result in a significant increase in health risk to community members.

Table 6-4 Predicted Project Alone and Cumulative Chronic Concentration Ratios for the Closest Community and Residential Receptors at each of the Three Expansion Phases using 90th %ile Regional Background

Chemical of Concern	90th Percentile Background Concentration Ratio	Predicted CHRONIC Concentration Ratios (CR)											
		Phase 1				Phase 2				Phase 3			
		Closest Community		Closest Residential		Closest Community		Closest Residential		Closest Community		Closest Residential	
		Project Alone	Cumulative	Project Alone	Cumulative	Project Alone	Cumulative	Project Alone	Cumulative	Project Alone	Cumulative	Project Alone	Cumulative
Criteria Air Contaminants													
Nitrogen Oxides	2.6E-01	4.2E-02	3.0E-01	3.3E-02	2.9E-01	1.3E-01	3.9E-01	8.1E-02	3.4E-01	1.8E-01	4.4E-01	1.2E-01	3.8E-01
$PM_{2.5}$	2.4E-01	4.6E-03	2.4E-01	2.8E-03	2.4E-01	1.1E-02	2.5E-01	6.7E-03	2.4E-01	1.7E-02	2.5E-01	1.0E-02	2.5E-01
Volatile Organic Compounds													
Benzene	2.1E-02	5.0E-05	2.1E-02	3.9E-05	2.1E-02	1.6E-04	2.1E-02	9.6E-05	2.1E-02	2.1E-04	2.1E-02	1.4E-04	2.1E-02
Butadiene (1,3-)	1.1E-01	3.8E-06	1.1E-01	2.9E-06	1.1E-01	1.2E-05	1.1E-01	7.2E-06	1.1E-01	1.6E-05	1.1E-01	1.1E-05	1.1E-01
Chloroform	1.0E-03	4.8E-08	1.0E-03	3.8E-08	1.0E-03	1.5E-07	1.0E-03	9.3E-08	1.0E-03	2.1E-07	1.0E-03	1.4E-07	1.0E-03
Dichloroethane, 1,2-	1.8E-03	3.2E-07	1.8E-03	1.9E-07	1.8E-03	8.0E-07	1.8E-03	4.5E-07	1.8E-03	1.1E-06	1.8E-03	6.8E-07	1.8E-03
Formaldehyde	0.0E+00	2.4E-04	2.4E-04	1.9E-04	1.9E-04	7.5E-04	7.5E-04	4.6E-04	4.6E-04	1.0E-03	1.0E-03	6.8E-04	6.8E-04
Quinoline	0.0E+00	8.8E-09	8.8E-09	6.9E-09	6.9E-09	2.8E-08	2.8E-08	1.7E-08	1.7E-08	3.8E-08	3.8E-08	2.5E-08	2.5E-08
Trichloroethylene	2.7E-01	1.0E-07	2.7E-01	1.8E-06	2.7E-01	7.2E-06	2.7E-01	4.4E-06	2.7E-01	9.8E-06	2.7E-01	6.5E-06	2.7E-01
Vinyl Chloride	8.3E-04	1.3E-07	8.3E-04	9.8E-08	8.3E-04	3.9E-07	8.3E-04	2.4E-07	8.3E-04	5.4E-07	8.3E-04	3.6E-07	8.3E-04
Polychlorinated dibenzo-*p*-dioxins and dibenzofurans													
Dioxins and furans	5.0E-01	3.4E-10	5.0E-01	2.0E-10	5.0E-01	8.2E-10	5.0E-01	4.9E-10	5.0E-01	1.2E-09	5.0E-01	7.2E-10	5.0E-01
Polycyclic Aromatic Hydrocarbons													
Benzo(a)Pyrene-TEQ	2.9E-01	7.0E-05	2.9E-01	4.1E-05	2.9E-01	1.7E-04	2.9E-01	1.0E-04	2.9E-01	2.4E-04	2.9E-01	1.5E-04	2.9E-01
Methylcholanthrene (3-)	0.0E+00	2.7E-05	2.7E-05	2.1E-05	2.1E-05	8.4E-05	8.4E-05	5.1E-05	5.1E-05	1.1E-04	1.1E-04	7.6E-05	7.6E-05
Perylene	0.0E+00	4.3E-03	4.3E-03	3.4E-03	3.4E-03	1.4E-02	1.4E-02	8.3E-03	8.3E-03	1.8E-02	1.8E-02	1.2E-02	1.2E-02
Inorganics													
Arsenic	0.0E+00	9.4E-06	9.4E-06	5.6E-06	5.6E-06	2.3E-05	2.3E-05	1.4E-05	1.4E-05	3.3E-05	3.3E-05	2.0E-05	2.0E-05
Cadmium	2.0E-02	3.2E-03	2.3E-02	1.9E-03	2.2E-02	7.9E-03	2.8E-02	4.7E-03	2.5E-02	1.1E-02	3.1E-02	7.0E-03	2.7E-02
Calcium Oxide	0.0E+00	2.9E-03	2.9E-03	2.3E-03	2.3E-03	9.3E-03	9.3E-03	5.7E-03	5.7E-03	1.3E-02	1.3E-02	8.4E-03	8.4E-03
Chromium (Total)	0.0E+00	3.7E-07	3.7E-07	2.2E-07	2.2E-07	8.9E-07	8.9E-07	5.3E-07	5.3E-07	1.3E-06	1.3E-06	7.9E-07	7.9E-07
Chromium VI	0.0E+00	1.8E-05	1.8E-05	1.0E-05	1.0E-05	4.3E-05	4.3E-05	2.6E-05	2.6E-05	6.1E-05	6.1E-05	3.8E-05	3.8E-05
Cobalt	0.0E+00	3.2E-04	3.2E-04	1.9E-04	1.9E-04	7.9E-04	7.9E-04	4.7E-04	4.7E-04	1.1E-03	1.1E-03	7.0E-04	7.0E-04
Hydrogen Fluoride	0.0E+00	4.9E-05	4.9E-05	3.9E-05	3.9E-05	1.5E-04	1.5E-04	9.5E-05	9.5E-05	2.1E-04	2.1E-04	1.4E-04	1.4E-04
Lead	2.5E-02	1.2E-03	2.6E-02	6.9E-04	2.6E-02	2.8E-03	2.8E-02	1.7E-03	2.7E-02	4.0E-03	2.9E-02	2.5E-03	2.7E-02
Manganese	0.0E+00	1.7E-03	1.7E-03	9.8E-04	9.8E-04	4.0E-03	4.0E-03	2.4E-03	2.4E-03	5.8E-03	5.8E-03	3.6E-03	3.6E-03
Mercury	0.0E+00	2.3E-03	2.3E-03	1.4E-03	1.4E-03	5.6E-03	5.6E-03	3.4E-03	3.4E-03	8.1E-03	8.1E-03	5.0E-03	5.0E-03
Nickel	1.3E-02	6.3E-04	1.4E-02	3.7E-04	1.4E-02	1.5E-03	1.5E-02	9.1E-04	1.4E-02	2.2E-03	1.6E-02	1.4E-03	1.5E-02
Phosphorous pentachloride	0.0E+00	4.8E-05	4.8E-05	3.8E-05	3.8E-05	9.7E-05	9.7E-05	7.6E-05	7.6E-05	2.1E-04	2.1E-04	1.4E-04	1.4E-04
Phosphorus	0.0E+00	7.2E-04	7.2E-04	5.6E-04	5.6E-04	2.3E-03	2.3E-03	1.4E-03	1.4E-03	3.1E-03	3.1E-03	2.1E-03	2.1E-03
Silica	0.0E+00	1.3E-04	1.3E-04	1.0E-04	1.0E-04	4.1E-04	4.1E-04	2.5E-04	2.5E-04	5.6E-04	5.6E-04	3.7E-04	3.7E-04
Sodium hydroxide	0.0E+00	3.3E-02	3.3E-02	9.8E-04	9.8E-04	3.9E-03	3.9E-03	2.4E-03	2.4E-03	5.3E-03	5.3E-03	3.6E-03	3.6E-03

Table 6-5 Predicted Project Alone and Cumulative Chronic Concentration Ratios for the Closest Community and Residential Receptors at each of the Three Expansion Phases using 50th %ile Regional Background

Chemical of Concern	50th Percentile Background Concentration Ratio	Predicted CHRONIC Concentration Ratios (CR)											
		Phase 1				Phase 2				Phase 3			
		Closest Community		Closest Residential		Closest Community		Closest Residential		Closest Community		Closest Residential	
		Project Alone	Cumulative	Project Alone	Cumulative	Project Alone	Cumulative	Project Alone	Cumulative	Project Alone	Cumulative	Project Alone	Cumulative
Criteria Air Contaminants													
Nitrogen Oxides	1.1E-01	4.2E-02	1.5E-01	3.3E-02	1.4E-01	1.3E-01	2.4E-01	8.1E-02	1.9E-01	1.8E-01	2.9E-01	1.2E-01	2.3E-01
$PM_{2.5}$	1.3E-01	4.6E-03	1.3E-01	2.8E-03	1.3E-01	1.1E-02	1.4E-01	6.7E-03	1.4E-01	1.7E-02	1.5E-01	1.0E-02	1.4E-01
Volatile Organic Compounds													
Benzene	1.3E-02	5.0E-05	1.3E-02	3.9E-05	1.3E-02	1.6E-04	1.3E-02	9.6E-05	1.3E-02	2.1E-04	1.3E-02	1.4E-04	1.3E-02
Butadiene (1,3-)	1.2E-01	3.8E-06	1.2E-01	2.9E-06	1.2E-01	1.2E-05	1.2E-01	7.2E-06	1.2E-01	1.6E-05	1.2E-01	1.1E-05	1.2E-01
Chloroform	1.0E-03	4.8E-08	1.0E-03	3.8E-08	1.0E-03	1.5E-07	1.0E-03	9.3E-08	1.0E-03	2.1E-07	1.0E-03	1.4E-07	1.0E-03
Dichloroethane, 1,2-	2.0E-03	3.2E-07	2.0E-03	1.9E-07	2.0E-03	8.0E-07	2.0E-03	4.5E-07	2.0E-03	1.1E-06	2.0E-03	6.8E-07	2.0E-03
Formaldehyde	0.0E+00	2.4E-04	2.4E-04	1.9E-04	1.9E-04	7.5E-04	7.5E-04	4.6E-04	4.6E-04	1.0E-03	1.0E-03	6.8E-04	6.8E-04
Quinoline	0.0E+00	8.8E-09	8.8E-09	6.9E-09	6.9E-09	2.8E-08	2.8E-08	1.7E-08	1.7E-08	3.8E-08	3.8E-08	2.5E-08	2.5E-08
Trichloroethylene	1.3E-01	2.3E-06	1.3E-01	1.8E-06	1.3E-01	7.2E-06	1.3E-01	4.4E-06	1.3E-01	9.8E-06	1.3E-01	6.5E-06	1.3E-01
Vinyl Chloride	8.3E-04	1.3E-07	8.3E-04	9.8E-08	8.3E-04	3.9E-07	8.3E-04	2.4E-07	8.3E-04	5.4E-07	8.3E-04	3.6E-07	8.3E-04
Polychlorinated dibenzo-*p*-dioxins and dibenzofurans													
Dioxins and furans	2.5E-01	3.4E-10	2.5E-01	2.0E-10	2.5E-01	8.2E-10	2.5E-01	4.9E-10	2.5E-01	1.2E-09	2.5E-01	7.2E-10	2.5E-01
Polycyclic Aromatic Hydrocarbons													
Benzo(a)Pyrene-TEQ	4.7E-03	7.0E-05	4.8E-03	4.1E-05	4.7E-03	1.7E-04	4.9E-03	1.0E-04	4.8E-03	2.4E-04	4.9E-03	1.5E-04	4.9E-03
Methylcholanthrene (3-)	0.0E+00	2.7E-05	2.7E-05	2.1E-05	2.1E-05	8.4E-05	8.4E-05	5.1E-05	5.1E-05	1.1E-04	1.1E-04	7.6E-05	7.6E-05
Perylene	0.0E+00	4.3E-03	4.3E-03	3.4E-03	3.4E-03	1.4E-02	1.4E-02	8.3E-03	8.3E-03	1.8E-02	1.8E-02	1.2E-02	1.2E-02
Inorganics													
Arsenic	0.0E+00	9.4E-06	9.4E-06	5.6E-06	5.6E-06	2.3E-05	2.3E-05	1.4E-05	1.4E-05	3.3E-05	3.3E-05	2.0E-05	2.0E-05
Cadmium	2.0E-02	3.2E-03	2.3E-02	1.9E-03	2.2E-02	7.9E-03	2.8E-02	4.7E-03	2.5E-02	1.1E-02	3.1E-02	7.0E-03	2.7E-02
Calcium Oxide	0.0E+00	2.9E-03	2.9E-03	2.3E-03	2.3E-03	9.3E-03	9.3E-03	5.7E-03	5.7E-03	1.3E-02	1.3E-02	8.4E-03	8.4E-03
Chromium (Total)	0.0E+00	3.7E-07	3.7E-07	2.2E-07	2.2E-07	8.9E-07	8.9E-07	5.3E-07	5.3E-07	1.3E-06	1.3E-06	7.9E-07	7.9E-07
Chromium VI	0.0E+00	1.8E-05	1.8E-05	1.0E-05	1.0E-05	4.3E-05	4.3E-05	2.6E-05	2.6E-05	6.1E-05	6.1E-05	3.8E-05	3.8E-05
Cobalt	0.0E+00	3.2E-04	3.2E-04	1.9E-04	1.9E-04	7.9E-04	7.9E-04	4.7E-04	4.7E-04	1.1E-03	1.1E-03	7.0E-04	7.0E-04
Hydrogen Fluoride	0.0E+00	4.9E-05	4.9E-05	3.9E-05	3.9E-05	1.5E-04	1.5E-04	9.5E-05	9.5E-05	2.1E-04	2.1E-04	1.4E-04	1.4E-04
Lead	1.0E-02	1.2E-03	1.1E-02	6.9E-04	1.1E-02	2.8E-03	1.3E-02	1.7E-03	1.2E-02	4.0E-03	1.4E-02	2.5E-03	1.2E-02
Manganese	6.6E-01	1.7E-03	6.6E-01	9.8E-04	6.6E-01	4.0E-03	6.6E-01	2.4E-03	6.6E-01	5.8E-03	6.7E-01	3.6E-03	6.6E-01
Mercury	9.7E-04	2.3E-03	3.3E-03	1.4E-03	2.3E-03	5.6E-03	6.6E-03	3.4E-03	4.3E-03	8.1E-03	9.0E-03	5.0E-03	6.0E-03
Nickel	6.7E-03	6.3E-04	7.3E-03	3.7E-04	7.0E-03	1.5E-03	8.2E-03	9.1E-04	7.6E-03	2.2E-03	8.9E-03	1.4E-03	8.0E-03
Phosphorus pentachloride	0.0E+00	4.8E-05	4.8E-05	3.8E-05	3.8E-05	9.7E-05	9.7E-05	7.6E-05	7.6E-05	2.1E-04	2.1E-04	1.4E-04	1.4E-04
Phosphorus	0.0E+00	7.2E-04	7.2E-04	5.6E-04	5.6E-04	2.3E-03	2.3E-03	1.4E-03	1.4E-03	3.1E-03	3.1E-03	2.1E-03	2.1E-03
Silica	0.0E+00	1.3E-04	1.3E-04	1.0E-04	1.0E-04	4.1E-04	4.1E-04	2.5E-04	2.5E-04	5.6E-04	5.6E-04	3.7E-04	3.7E-04
Sodium hydroxide	0.0E+00	3.3E-02	3.3E-02	9.8E-04	9.8E-04	3.9E-03	3.9E-03	2.4E-03	2.4E-03	5.3E-03	5.3E-03	3.6E-03	3.6E-03

6.2.2 Incremental Lifetime Cancer Risks

Table 6-6 presents incremental lifetime cancer risks (ILCR) arising from predicted facility emissions of carcinogenic chemicals at the worst-case community and residential locations for each of the proposed expansion phases. ILCRs represent the incremental increase in cancer risk specifically related to the proposed expansion above background conditions. As discussed in Section 2.1.4.2, predicted ILCRs above the provincial acceptable cancer risk benchmark of one-in-one-million risk (*i.e.*, 1.0E-6) would indicate an incremental increase in cancer risk above the negligible level.

Table 6-6 Predicted Incremental Lifetime Cancer Risks for the Closest Community and Residential Receptors at each of the Three Expansion Phases from Predicted Facility Emissions of Carcinogenic Chemicals

Chemical of Concern	Incremental Lifetime Cancer Risk (ILCR)					
	Phase 1		Phase 2		Phase 3	
	Closest Community [a]	Closest Residential	Closest Community [a]	Closest Residential	Closest Community [a]	Closest Residential
Volatile Organic Compounds						
Benzene	3.1E-10	2.9E-09	9.8E-10	7.2E-09	1.3E-09	1.1E-08
Butadiene (1,3-)	3.1E-13	2.9E-12	9.8E-13	7.2E-12	1.3E-12	1.1E-11
Dichloroethane, 1,2-	1.0E-11	9.9E-11	3.3E-11	2.4E-10	4.5E-11	3.6E-10
Formaldehyde	1.5E-09	1.4E-08	4.8E-09	3.5E-08	6.5E-09	5.2E-08
Trichloroethylene	1.6E-12	1.5E-11	4.9E-12	3.6E-11	6.7E-12	5.3E-11
Vinyl Chloride	5.5E-12	5.2E-11	1.7E-11	1.3E-10	2.4E-11	1.9E-10
Polycyclic Aromatic Hydrocarbons						
Benzo(a)Pyrene-TEQ	7.0E-12	5.0E-11	1.7E-11	1.2E-10	2.4E-11	1.8E-10
Inorganics						
Arsenic	1.1E-10	7.6E-10	2.6E-10	1.8E-09	3.7E-10	2.7E-09
Cadmium	2.6E-08	1.9E-07	6.4E-08	4.6E-07	9.2E-08	6.9E-07
Chromium VI	3.4E-10	2.4E-09	8.2E-10	5.9E-09	1.2E-09	8.7E-09
Nickel	7.5E-10	5.4E-09	1.8E-09	1.3E-08	2.6E-09	2.0E-08

[a] An adjustment factor of 0.083 (2 hours per day) is applied to Community Use.

The results of the long-term exposure assessment indicate that none of the predicted incremental lifetime cancer risks arising from facility emissions for each expansion phase are above the one-in-one-million ILCR regulatory benchmark.

As such, potential cancer risks related to the emissions of chemicals arising from the proposed facility expansion are negligible. In fact, many of the predicted incremental lifetime cancer risks are orders of magnitude below the regulatory threshold.

6.3 Additive Risks for Mixtures

As discussed in Section 5.3, health effects from mixtures are typically assessed by assuming additive effects of chemicals with similar exposure characteristics (*e.g.*, acute exposure; chronic exposure) and similar toxic effects (*e.g.*, respiratory irritants, nasal irritants, reproductive effects, cancer) (Health Canada, 2021a). However, there are currently no Ontario or Canadian reference benchmarks by which one could evaluate whether exposure to a given mixture from, or in isolation from, multiple sources could pose a health concern. Therefore, in the current assessment, risk estimates for each chemical in the theoretical mixture were summed to produce a cumulative risk prediction for illustrative purposes.

Table 6-7 provides a summary comparison of worst-case short- and long-term mixture risks, and incremental lifetime cancer risks for the closest community and residential receptor locations for each of the three proposed facility expansion scenarios. As noted in the table, mixture risks for background contributions for the acute respiratory irritants mixture group exceed the CR benchmark of 1.0. The cumulative risk for this mixture group is being driven by worst-case regional ambient background concentrations of NO_x and $PM_{2.5}$, with very little contribution from facility emissions in each of expansion phases. In addition, mixture risks for background contributions for the chronic developmental toxicants mixture group marginally exceed the CR benchmark of 1.0. The cumulative risk for this mixture group is being driven by worst-case regional ambient background concentrations of dioxins/furans, with very little contribution from facility emissions in each of expansion phases.

Table 6-7 Summary Comparison of Worst-Case Short- and Long-Term Mixture Risks and Predicted Incremental Lifetime Cancer Risks for the Closest Community and Residential Receptors at each of the Three Expansion Phases

Mixture Group	Background Contribution	Phase 1				Phase 2				Phase 3			
		Closest Community		Closest Residential		Closest Community		Closest Residential		Closest Community		Closest Residential	
		Project Alone	Cumulative	Project Alone	Cumulative	Project Alone	Cumulative	Project Alone	Cumulative	Project Alone	Cumulative	Project Alone	Cumulative
Acute Inhalation Mixture Groups													
Respiratory Irritants	**3.1**	0.29	**3.4**	0.14	**3.3**	1.0	**4.1**	0.41	**3.5**	**1.3**	**4.5**	0.62	**3.7**
Chronic Inhalation Mixture Groups													
Respiratory Irritants	0.50	0.048	0.55	0.037	0.54	0.15	0.65	0.09	0.59	0.20	0.71	0.13	0.64
Developmental Toxicants	**1.07**	0.0012	**1.07**	0.00074	**1.07**	0.0030	**1.07**	0.0018	**1.07**	0.0043	**1.08**	0.0027	**1.07**
Neurotoxicants	0.66	0.0040	0.66	0.0024	0.66	0.0097	0.67	0.0058	0.67	0.014	0.67	0.0086	0.67
Leukemia (cancer)	-	3.1E-10	-	2.9E-09	-	9.8E-10	-	7.2E-09	-	1.3E-09	-	1.1E-08	-
Lung Cancer	-	2.8E-08	-	2.0E-07	-	6.7E-08	-	4.8E-07	-	9.6E-08	-	7.2E-07	-

Note: **Bolded and shaded cells** indicate predicted cumulative risk for that mixture group exceeded either the benchmark of 1.0 for non-cancer groups or 1-in-1,000,000 for the cancer-based mixture groups.

7.0 UNCERTAINTY ANALYSIS

In any risk assessment, the intention is to obtain the most accurate evaluation of risk based upon the available data and state of knowledge, without underestimating the potential health risks. With any such predictive assessment, there are always a number of technical boundaries that limit the ability of the assessment to quantify risk with absolute certainty. The following section provides an overview of the key technical uncertainties inherent within the current assessment.

A quantitative HHRA involves assigning numerical values to input parameters in an appropriate exposure or risk model to obtain a quantitative estimate of risk. Numerical values are required for parameters describing chemical concentrations in environmental media, chemical fate and transport, human exposure and toxic response. These values may be measured, assumed, prescribed, or based on published literature. Variability and uncertainty in the input parameters or risk model result in variability and uncertainty in the estimate of risk. The US EPA (2005) suggests that the risk characterization process maintain transparency, clarity, consistency, and reasonableness. The goal of risk characterization is to clearly communicate the key findings of the assessment and to provide a clear and balanced assessment of the strengths and limitations of the process.

When assumptions are made during the risk assessment process, either because of data gaps or knowledge gaps, each can result in some degree of uncertainty in the overall conclusions. In order to understand the uncertainties within the assessment and to ensure that the implications of these uncertainties are understood and addressed, it is important to document and characterize them. To ensure that the risk assessment does not underestimate the potential for the occurrence of adverse effects, it is necessary to make assumptions that are conservative (protective). In other words, assumptions should be made that tend to overestimate exposure, toxicity, and risk, rather than underestimate these parameters.

A summary of the assumptions that were incorporated into the HHRA can be found in Table 7-1, arranged according to the steps of the risk assessment paradigm. Given the tendency for the assumptions described below to typically overestimate both exposure and toxicity by design, it is likely that the risk characterization errs on the side of caution and over predicts risk. Examination of the table shows that conservatism was introduced at virtually every step of the assessment, and extended to the problem formulation, exposure assessment, and toxicity assessment of the risk assessment. The degree of impact indicates whether the Study Team believes the assumption will under- or over-predict potential risks, or whether it would have a neutral impact on the results.

Table 7-1 Major Assumptions Used in the HHRA

Risk Assessment Paradigm	*Assumption*	*Discussion of Impact on Risk Characterization*	*Degree of Impact*
Problem Formulation	Selection of chemicals of concern is adequate to characterize potential facility emissions	Chemical selection and identification was based on emission stack testing for the existing Emerald facility, adjusted for expected emission rates for the new proposed incineration equipment and air pollution control system. As there is no expectation of a change in waste stream to be treated post-expansion, it is expected that this would be adequate to characterize potential facility emission.	Neutral
	Air quality impact assessment scenarios reflect realistic operating conditions of the proposed expanded facility	Careful consideration was given to the assessment scenarios evaluated in the HHRA, with reasonable worst-case operating conditions assumed for both the air quality impact assessment and ultimately the HHRA.	Over Predict
	Potential exposures were evaluated throughout the Study Area.	Care was taken to select locations in the surrounding area that would likely demonstrate the highest potential impacts from the proposed facility expansion.	Neutral
	Residential receptor locations were primarily evaluated in the HHRA.	Focus was given to areas where community residents were expected to have high occupancy (such as residential dwellings), as well as locations where sensitive individuals may be present on a frequent basis (*e.g.*, schools, retirement homes, cultural and recreational areas, etc.). It is highly unlikely that an individual will spend all their time on a daily basis at any given receptor location.	Over Predict
	Residential receptors assumed to live their entire lifespan at the same location.	The residential receptor was assumed to be born in the Study Area and conservatively assumed to live at that location for their entire lifetime (*i.e.*, 80 years).	Over Predict
Exposure Assessment	Potential 1-hour acute exposures were not evaluated in the current assessment.	Given the nature of the emission sources under consideration (*i.e.*, a municipal waste incinerator), it was determined that it is unlikely that fluctuations in 1-hour exposures would not likely significant, and that exposures and risks could be effectively captured in the 24-hour modelling.	Under Predict
	Maximum 24-hour air concentrations predicted at each of the receptor locations were used to evaluate short-term inhalation risks for a subset of COCs.	This assumption is highly improbable and represents a worst-case scenario. The frequency with which the maximum would occur at any one receptor location varies with respect to the COC and the receptor location. Individual exposure to 24-hour maximum ground-level air concentrations requires that a receptor (person) be present at the same time and duration of the maximum predicted air concentration at that particular receptor location each day that the modelled predicted concentration occurs.	Over Predict
	Maximum predicted annual average ground-level air concentrations and chemical-specific deposition rates were used to predict the incremental increase in soil concentration at each receptor location assuming that deposition had already occurred for 25 years.	As an added protective measure, the deposition assessment to evaluate whether a multi-pathway assessment was necessary assumed that maximum chemical-specific annual deposition rates would occur for 25 years (*i.e.*, the expected operating lifespan of the expanded facility) prior to exposure, resulting in receptors being exposed to maximum predicted environmental media concentrations.	Over Predict
	Ambient concentrations are assumed to represent the inhalation level by community members at that location.	Since people may live in one location and work in another, this assumption may cause exposure misclassification. However, it is expected that by evaluating constant exposures at the worst-case locations, we are not underestimating exposures and risks.	Mixed

Table 7-1 Major Assumptions Used in the HHRA			
Risk Assessment Paradigm	***Assumption***	***Discussion of Impact on Risk Characterization***	***Degree of Impact***
	Ground-level air concentrations of COCs related to emissions from the proposed expansion phases were estimated based on mathematical air dispersion models.	The HHRA relied on the results of air dispersion modelling to evaluate the health risks from direct inhalation exposure as well as to predict inhalation health risks. The MECP has discussed matters of confidence and uncertainty in the predictions of dispersion models with regard to ground level concentrations and deposition rates. This remains the best mechanism to forecast future distributions of emissions in built environments. The air dispersion models used to provide data for the current assessment are approved by the MECP and the US EPA for use on these types of emission studies. Refer to the Air Quality Impact Study for further discussion of the uncertainty inherent in the use of these models.	Mixed
	Contributions from the facility may be double-counted between background and Project Alone contributions.	Measurements of existing background concentrations for some COCs may include a contribution of the existing operating facility depending on location of the specific background monitoring station. As such, there may be a double-counting of facility contributions to the cumulative exposures as the existing facility will not be operating at the same time as any of the operating units of the proposed expansion (i.e., the existing facility will be shutdown and decommissioned as soon as the Phase 1 expansion unit is operational).	Over Predict
	No site-specific emission factors or measurement data was available to speciate the amount of hexavalent chromium is present within the modelled total chromium concentration.	For incineration scenarios, chromium VI was assumed to represent 8% of total chromium emitted based laboratory studies conducted to determine destruction and formation rates under typical incineration conditions.	Unknown
	The HHRA did not evaluate an operation upset scenario where the facility may malfunction or not work as intended.	Facility SOP indicate that the system is closely monitored and will undergo an immediate shutdown should anything unexpected occur. Backup generators will continue to power air pollution control (APC) systems to prevent unacceptable emissions due to a power failure.	Neutral
Toxicity Assessment	Toxicity reference values (TRVs) have been developed by regulatory agencies with sufficient conservatism to assure protection of the most sensitive and/or susceptible individuals within the general population (*e.g.*, infants and young children, the elderly, individuals with compromised health). Uncertainty and data gaps are addressed in the derivation of the TRVs using uncertainty factors.	A considerable amount of conservatism is incorporated in the TRVs developed by regulatory agencies. TRVs are deliberately set by regulatory agencies with the protection of the most sensitive individuals in mind. Typically, the TRVs used in the current assessment were derived from the most sensitive health-related endpoints, and then adjusted to account for differences in sensitivity to chemicals among individuals. The use of uncertainty factors (of 10- to-1,000 fold) are directed, in part, toward the protection of sensitive individuals. In most cases, the most conservative TRV was used, unless there was compelling and recent evidence to indicate that a more robust TRV was more appropriate.	Over Predict
	For genotoxic carcinogens, it was assumed that no repair of genetic lesions occurs, and therefore, no threshold can exist for chemicals that produce self-replicating lesions.	The existence of enzymes and biological pathways that routinely repair damage to genetic material (DNA) is well documented in the scientific literature. The potential adverse health outcomes arising from damage to DNA are usually observed only when the ability of these repair enzymes to "fix" the damage is blocked or exceeded. This is a conservative assumption.	Over Predict

Table 7-1 Major Assumptions Used in the HHRA			
Risk Assessment Paradigm	***Assumption***	***Discussion of Impact on Risk Characterization***	***Degree of Impact***
	Humans were assumed to be the most sensitive species with respect to toxic effects of COC.	For obvious reasons, toxicity assays are not generally conducted on humans, so toxicological data from the most sensitive laboratory species were used in the estimation of toxicological criteria for humans, as appropriate. In some cases, however, human-specific data was available and was used in the Toxicity Assessment. Uncertainty and data gaps are addressed in the derivation of the TRVs through the use of uncertainty factors. This is a conservative approach.	Over Predict
	Evaluation of chemical mixture risks were based on additive effects.	Health effects from mixtures were assessed by assuming additive effects of chemicals with similar exposure characteristics (*e.g.,* acute exposure; chronic exposure) and similar toxic effects (*e.g.,* respiratory irritants, nasal irritants, reproductive effects). For the evaluation of chemical mixtures, the health endpoint of the TRVs used in the assessment provided the basis for the inclusion of an individual chemical in a chemical mixture.	Unknown
	Mixture groups were assumed to act via an additive mode of action.	There is little evidence of synergistic effects related to chemicals exposures for the cumulative endpoints evaluated in the current study.	Mixed

8.0 OVERALL FINDINGS AND CONCLUSIONS

The purpose of this project is to address potential concerns related to potential human health impacts of the proposed facility expansion on the surrounding community. Thus, the primary objective of the HHRA was to determine the potential short- and long-term human health risks to individuals in the surrounding community who may be impacted by emissions from each phase of the proposed expansion. The HHRA involved an evaluation of the potential health impacts related to inhalation of emissions at each expansion phase, both project-specific and in the broader cumulative context of the overall airshed (*i.e.*, existing background conditions ***plus*** project-specific contributions). Finally, the assessment evaluated the potential deposition of emitted chemicals over the expected lifespan of the facility to determine what impacts they may have on soil concentrations throughout the Study Area. The assessment concluded that emissions are not expected to cause an increase in soil concentrations over the expected operating lifespan of the facility, indicating no increased risk from exposures to soil or from growing agricultural crops or home gardens within the surrounding community.

The results of the inhalation assessment indicate that emissions from the Emerald Facility under all proposed expansion phases would not result in a significantly elevated health risk to the surrounding community. There is a small possibility of an individual with asthma potentially having an asthmatic event if they happen to be exercising at the nearby Sportpark during worst-case meteorological conditions (typically a declared “bad air day”). However, the probability of such an occurrence is very low (<1% under worst-case conditions).

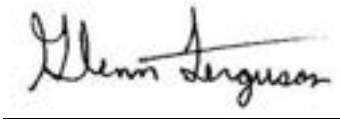
Finally, mixture risks for the acute respiratory irritants mixture group exceeded the benchmark indicating potential risks arising from cumulative exposures to chemicals in this like-acting group. However, the cumulative risk for this mixture group is being driven by worst-case regional ambient concentrations of NO_x and $PM_{2.5}$, with very little contribution from predicted facility emissions in each of the expansion phases. Similarly, mixture risks for the chronic developmental toxicants mixture group marginally exceed the benchmark indicating potential risks arising from cumulative exposures to chemicals in this like-acting group. However, the cumulative risk for this mixture group is being driven by worst-case regional ambient concentrations of dioxins/furans, with negligible contributions from predicted facility emissions in each of the expansion phases.

Based on these conclusions, it is recommended that Emerald EFW consider what further operational enhancements could be made to minimize emissions of NOx, $PM_{2.5}$, and dioxins/furans given existing elevated regional background conditions within the Study Area. It is also recommended that monitoring data, particularly data from continuous emissions monitoring of criteria air contaminants like NO_x and $PM_{2.5}$ be made publicly available to increase transparency for the surrounding community to demonstrate that the Emerald Facility, post-expansion, continues to operate with state-of-the-art technology which minimizes its impacts on the environment and maximizes the benefits to the surrounding community.

9.0 DOCUMENT SIGN-OFF

The risk assessment has been performed in accordance with accepted practice and usual standards of thoroughness and competence for the profession of toxicology and environmental RA. The information, opinions and recommendations provided within the aforementioned report have been developed using reasonable and responsible practices, and the report was completed to the best of our knowledge and ability.

Intrinsik Corp.



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