Supporting Document 1-1

Air Quality and Odour Existing Conditions Report

Eastern Ontario Waste Handling Facility Future Development Environmental Assessment

GFL Environmental Inc.

Moose Creek, Ontario

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1 Introduction

GFL Environmental Inc. (GFL), is undertaking an Environmental Assessment (EA) for additional landfill disposal capacity as part of the future development of its Eastern Ontario Waste Handling Facility (EOWHF).

The approved Terms of Reference (ToR) for the EA [1] included a preliminary description of the existing environmental conditions within the area surrounding the EOWHF, and committed to preparing a more detailed description of existing conditions as part of the EA.

The purpose of this report is to provide a detailed description of air quality, including odour, associated with the existing and approved operations of the EOWHF, and with the existing activities on the future development area.

2 Background

The approved existing EOWHF encompasses a site area of 189 hectares which includes the following waste management related activities and services:

- 112 hectare landfill site;
- composting facility;
- waste water treatment facility;
- small vehicle waste drop off;
- landfill gas (LFG) utilization facility;
- enclosed flares and natural gas fired comfort heating equipment;
- Resource Productivity & Recovery Authority (RPRA) – Tires; and
- supporting facilities (office, vehicle maintenance building).

The existing EOWHF landfill was previously approved under the *Ontario Environmental Assessment Act* (*OEAA*) in 1999 and 2019 and is operated by GFL under the Ministry of Environment, Conservation and Parks (MECP) Environmental Compliance Approval (ECA) A420018. Air emissions from the LFG utilization facility and the composting facility are approved under ECAs (Air and Noise) No. 8583-B9ZRZ8, 5665-8STRV7 and 9112-9DMTGX, respectively.

The purpose of this report is to describe the air quality, including odour, in the vicinity of the EOWHF. The generation of LFG is an important factor in the assessment of air quality around a landfill. The LFG generation rate at the EOWHF will increase until just after the landfill reaches its currently approved capacity, which is predicted to occur around 2025. After closure of the landfill, LFG generation will fall off slowly with time. The LFG generation rate has not yet reached peak levels at the time of this report, but the peak LFG generation rate will coincide with the implementation of the future

development; therefore, for the purpose of this report, the peak LFG generation rate (~2025) has been considered as part of the existing condition.

GFL is planning to relocate the compost curing and storage pad areas to an area south of the existing EOWHF. It is currently anticipated that the new compost pads will be constructed and operational during the life of the future development. Therefore, for the purpose of this report, the pads have been included in this area as part of the existing condition.

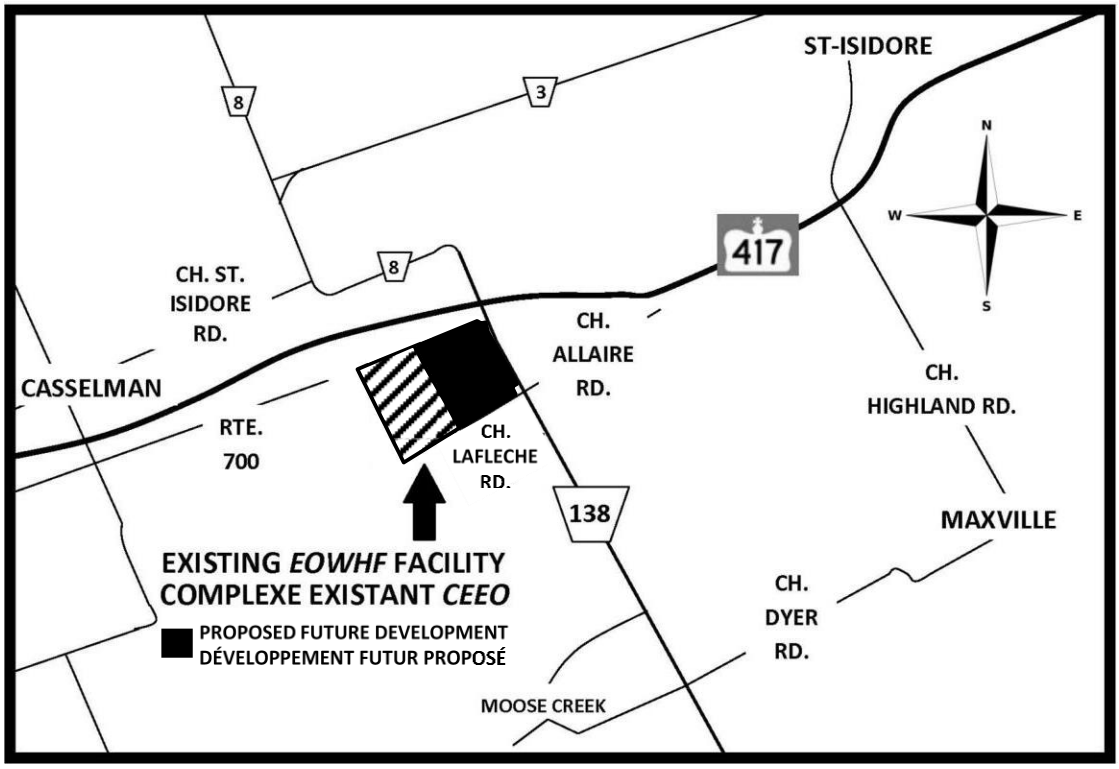
3 Study Area

The existing EOWHF is located on the western half of Lot 16 and Lots 17 and 18, Concession 10, Township of North Stormont, United Counties of Stormont, Dundas and Glengarry, near the intersection of Highway 417 and Highway 138. The municipal street address for the facility is 17125 Laflèche Road, Moose Creek, Ontario. The lands to the east of the existing EOWHF being considered for future development include the eastern half of Lot 16, Lots 14 and 15, and the majority of Lot 13 of Concession 10.

The lands considered for future development consist of about 240 hectares that are currently used for raising sod, or turf grass, and some additional agricultural uses.

The location of the existing EOWHF, including the future development area is shown on Figure 1.

Figure 1. Location of the EOWHF and potential future development



The ToR defined the study areas for the EA as shown on Figure 2:

- On-site Study Area – the existing EOWHF, and the future development area comprising the eastern half of Lot 16, Lots 14 and 15, and the majority of Lot 13 of Concession 10 east of the EOWHF; and
- Off-site Study Area – the lands in the vicinity of the future development extending approximately 1 kilometre from the On-site Study Area.

For this Air Quality and Odour Existing Conditions Report, the Off-site Study Area was increased to extend approximately 4 kilometres from the On-site Study Area (i.e., the Extended Off-site Study Area, shown on Figure 3).

Figure 2. On-site and off-site study areas as defined in the ToR

The area surrounding the EOWHF comprises mostly agricultural lands as well as portions of the Trans-Canada Highway (Highway 417), Highway 138, and a number of businesses including Champion Mushrooms, Calco Soils Inc., Moose Creek Tire Recycling Inc., A.L. Blair Construction Ltd., Agro Culture, Supreme Seeds, and Casselman Performance.

There are six (6) residences located within the general Off-site Study Area, as shown on Figure 3. There are a total of 81 residences within the Extended Off-site Study Area. Air and odour impacts are specifically assessed at these residential locations, which have been referred to as sensitive receptors for this report.

Figure 3. Air Quality and Odour Study Areas

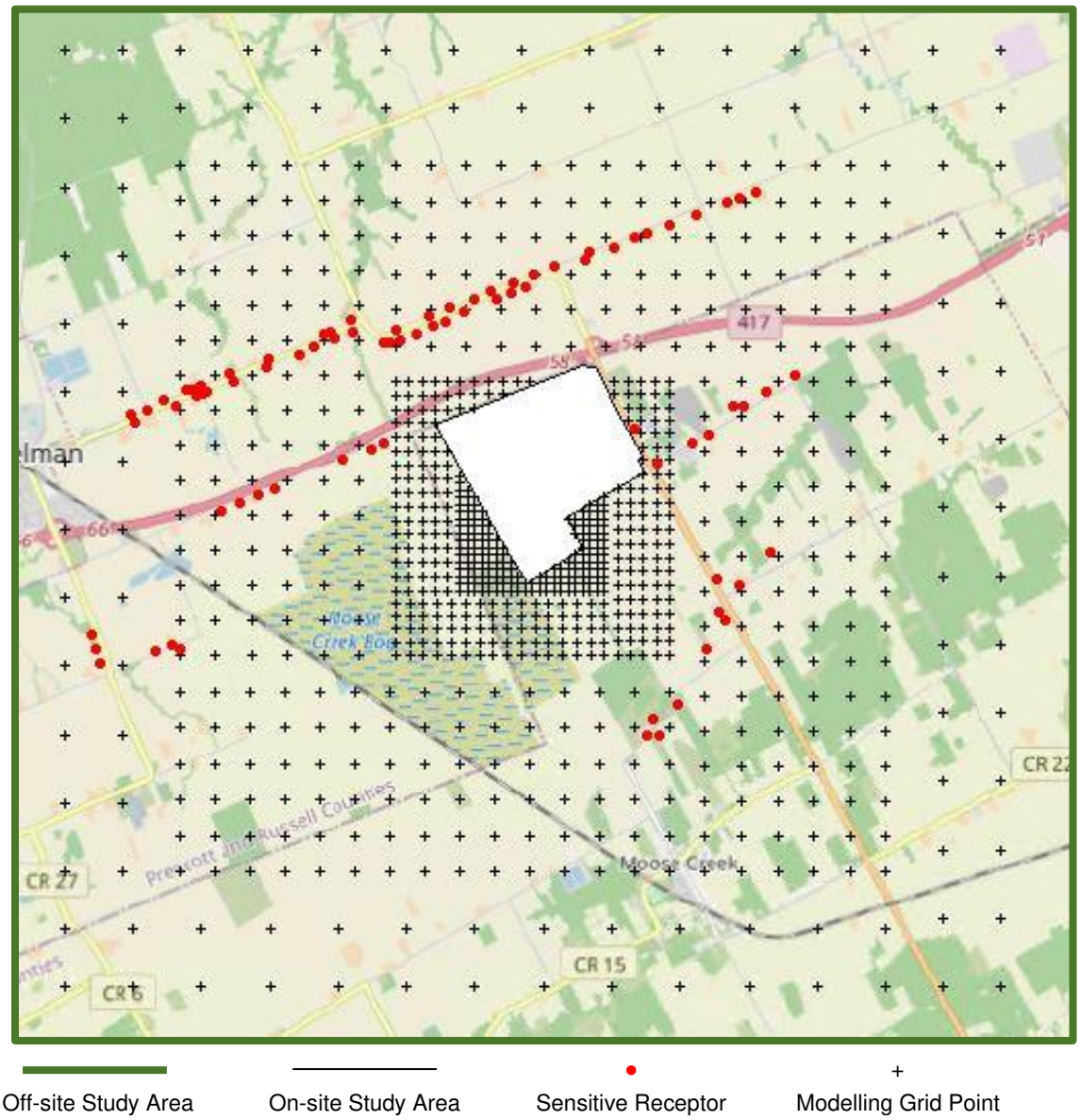
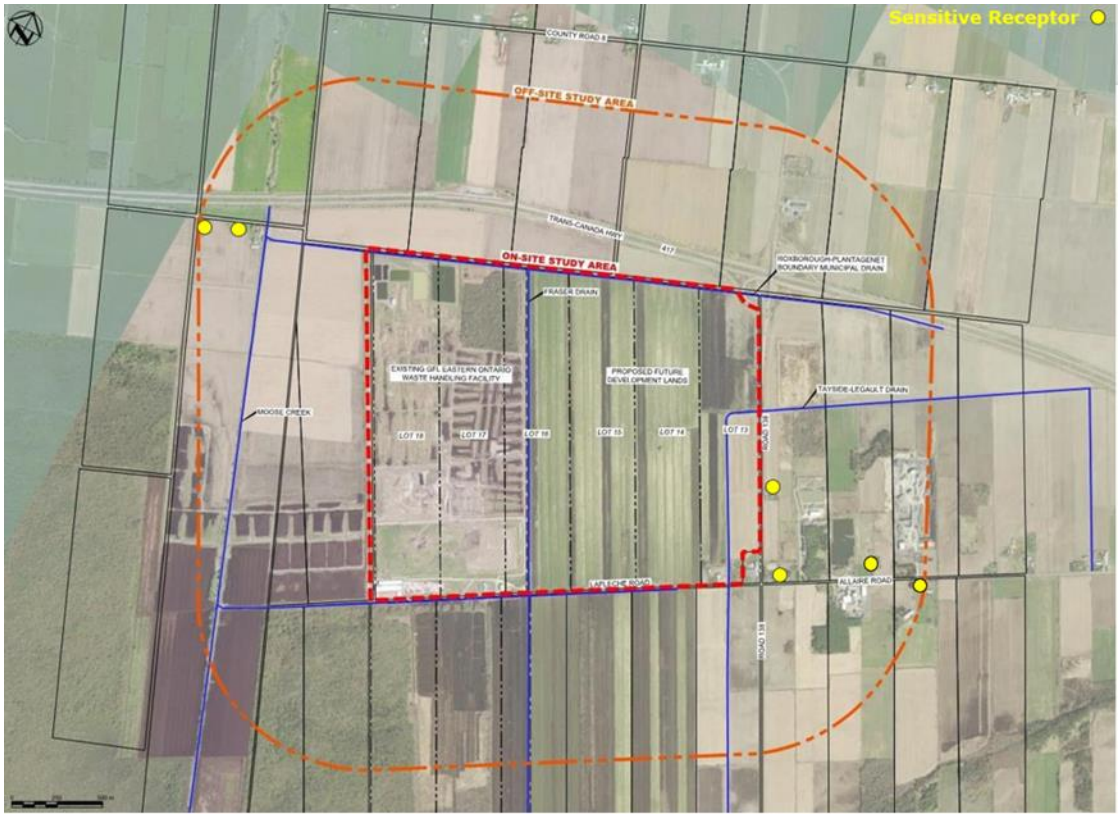


Figure 4. Sensitive Receptor Locations within the General Off-site Study Area



4 Overview of Methods

The approved ToR for the EA include evaluation criteria, indicators and data sources that were developed in consultation with government agencies and other stakeholders. This Existing Conditions Report was developed based on those indicators and data sources identified for Air Quality and Odour. The basic methodology used to assess and describe air quality and odour within the study areas include the following basic steps:

1. Identify sensitive receptors within the off-site study area, and in the general vicinity of the development (see Section 3).
2. Develop an Emission Summary and Dispersion Modelling (ESDM) report following MECP guidelines to identify contaminants of concern (CoC), quantify emissions of CoC, and predict the EOWHF's contribution to air concentrations of CoC (see Section 5). CoC concentrations were predicted in the off-site study area using site-specific meteorological data. The guidelines that were followed and the key documents referenced include:
    - Procedure for Preparing an ESDM Report [Guideline A-10], Version 4.1, MECP, March 2018 [2];
    - Air Dispersion Modelling Guideline for Ontario [Guideline A-11], Version 3.0, MECP, February 2017 [3];

- Technical Bulletin: Methodology for Modeling Assessments of Contaminants with 10 Minute Average Standards and Guidelines under O. Reg. 419/05, MECP, September 2016 [4];
- Air Contaminants Benchmarks (ACB) List: Standards, guidelines and screening levels for assessing point of impingement concentrations of air contaminants, Version 2.0, MECP, April 2018 [5].

3. Identify and summarize relevant historic ambient air monitoring data on the identified CoC recorded at appropriate ambient air quality monitoring stations (see Section 6). This involved review and analysis of data from the Cornwall and Ottawa (Downtown) monitoring stations operated by the MECP.
4. Identify applicable provincial and federal ambient air quality objectives and summarize those relevant to the identified contaminants of concern (see Section 7). These are documented in:
   - Ontario Ambient Air Quality Criteria (AAQC), MECP, May 1 2020;
   - Canadian Ambient Air Quality Standards (CAAQS), Canadian Council of Ministers of the Environment (CCME).
5. Summarize the modelled and monitored concentrations of CoC in the off-site study area and at sensitive receptors, and compare to provincial and federal standards and limits (see Section 8).

5 Air Quality and Odour Impact of Existing Activities

The existing activities within the on-site study area involve the operations of the EOWHF as it is currently approved, and agricultural operations (a sod or turf farm and crop farming) on the future development lands.

In general terms, air emissions result from a number of processes and activities that occur on the site. These include:

1. Odour and dust emitted from receiving, placing, and compacting of solid waste;
2. Landfill Gas (LFG) consisting of volatile contaminants and odour, generated from decomposition of waste within the landfill;
3. Combustion gases and particulate matter from combustion of LFG in flares and in stationary engines driving electrical generators;
4. Odour from an organic composting facility;
5. Dust from on-site haul roads, various material handling activities, and construction activities;
6. Tailpipe emissions from mobile equipment including the waste delivery truck fleet, material handling equipment, and construction equipment; and
7. Dust from agricultural activities.

Leachate from the landfill is collected, treated in aeration ponds, treated in the leachate treatment building, and stored in effluent holding ponds until discharge. These sources are expected to emit contaminants, including odour, in negligible quantities under normal aerobic conditions.

An Emission Summary and Dispersion Modelling (ESDM) Report was prepared to document these operations and their impacts on the surrounding community, and a copy is attached (see Attachment A). The ESDM report was developed following the requirements of Ontario Regulation 419/05 “Air Pollution - Local Air Quality” and MECP guidelines, and includes the following key sections:

Information	**Section of ESDM Report**
Detailed descriptions of all processes and activities that emit air contaminants on the site, including odour	Section 1
Estimates of the emission rates of all air contaminants from each source at the site	Section 4
Estimates of maximum concentrations of air contaminants that may occur off-site due to the facility emissions, developed using an approved atmospheric dispersion model	Section 6
A comparison of those off-site concentrations to MECP air contaminant benchmarks	Section 7

The MECP guidance specifies the sources of emissions that must be included in an ESDM report, as well as sources which may be deemed negligible or not included. However, because this report is intended to support an EA and a cumulative assessment is required, the list of activities to be included in the ESDM report was expanded to include sources of emissions that would normally not be considered. Including these additional sources resulted in higher emission estimates, and provided a more comprehensive and conservative assessment of impacts. These additional sources included:

1. Road dust from truck traffic over on-site haul roads;
2. Dust from construction activities;
3. Tailpipe emissions from mobile equipment (trucks, material handling equipment, construction equipment); and
4. Agricultural activities.

The ESDM report identifies over 180 contaminants that may be emitted from landfill facilities and includes an evaluation of significant air contaminant concentrations at the Point of Impingement (POI), which is the off-site location where the highest concentration occurs. These POI concentrations were compared to applicable limits. In addition, concentrations were evaluated at sensitive receptors (i.e., residences) around the facility, and the highest concentrations at a sensitive receptor were also reported and compared to the same applicable limits.

Of the over 180 contaminants that were considered, 149 were found to be present in negligible quantities. Table A3, Emission Summary Table (see Appendix A of the ESDM

report) compares the maximum predicted concentrations of the remainder of the contaminants to MECP air contaminant benchmarks and to ambient air quality objectives. Appendix D of the ESDM report includes graphical outputs of the dispersion modelling that illustrate concentration contours over the study area and beyond.

The table shows that concentrations of total suspended particulate matter (SPM) and odour exceed MECP air standards and guidelines. In addition, the EOWHF's contribution to ambient air concentrations of particulate matter <10 µm aerodynamic diameter (PM_{10}) exceed the AAQC.

Several other contaminants emitted from the EOWHF have ambient air quality criteria or objectives in the form of AAQC or CAAQS. These criteria or objectives are intended to apply to the cumulative impact of the facility and background concentrations, but the ESDM report describes only the contribution of the EOWHF and adjacent agricultural operations to maximum concentrations of these contaminants. Background concentrations and maximum cumulative concentrations are considered in the following sections, and detailed discussion of any contaminants that exceed a limit or objective is provided in Section 8.

Table A3 shows that concentrations of two potential constituents of LFG (1,1,2,2-tetracloroethane and 3,6-dimethyloctane) are predicted to exceed screening levels or de minimus concentrations at the western property line. Concentrations of these contaminants fall off quickly with distance from the property line, and do not exceed 30% of the screening level or de minimus concentration at any sensitive receptor. As a result, these contaminants have not been considered further in this report. Exceeding a screening level or the de minimus concentration does not necessarily indicate that a health risk threshold has been exceeded. Under normal circumstances any application for an Environmental Compliance Approval would include a maximum ground level concentration acceptability request for these contaminants, which would trigger evaluation of the risk associated with the modelled concentrations.

6 Regional Ambient Air Quality Monitoring

The cumulative air pollutant impacts in the Off-site Study Area are dependent on both the direct impact of emissions from the EOWHF, and regional background air pollutant concentrations. Regional background concentrations result from other sources of pollutant emissions in the region, as well as long-range transport from other areas.

The MECP monitors and records ambient air concentrations of key pollutants at numerous monitoring stations across the province. The two stations closest to the EOWHF, Ottawa (Downtown) and Cornwall, were selected as most representative of the regional background concentration in the Off-site Study Area.

The Ottawa (Downtown) station is at an urban location within the City of Ottawa, about 55 km west-northwest of the EOWHF. The Cornwall station is at an urban location within the City of Cornwall, about 38 km south-southeast of the EOWHF. Contaminants of concern that are monitored at each station are identified in Table 1.

Table 1. Monitored Contaminants

Contaminant of Concern	Cornwall	Ottawa (Downtown)
Nitrogen oxides (NO_X)	X	X
Nitrogen dioxide (NO_2)	X	X
Fine particulate matter ($PM_{2.5}$)	X	X
Sulphur dioxide (SO_2)		X
Carbon monoxide (CO)		X
Benzene		X
1,3-butadiene		X

Other contaminants of concern are not monitored in the region and, with the exception of PM_{10}, are not expected to be present in significant quantities unless emitted from local sources. Background concentrations of COCs are far below the odour thresholds of these contaminants. As a result, odour is not expected to be present unless emitted from local sources.

The MECP publishes annual reports summarizing monitored concentrations at each station. In addition, annual monitored datasets are available for selected contaminants. Reports and datasets for years up to and including 2019 are available at this time. Data from the most recent three years (2017 to 2019) were used in the following analysis.

The MECP has not established guidance for the use of ambient monitoring data for cumulative analysis.

In the absence of Ontario guidance, the applicable metrics were extracted from the monitored data files following the methodology specified in the Alberta Air Quality Model Guideline [6]. The MECP does not post monitored data files for benzene and 1,3-butadiene, so the metrics were extracted from the summarized information available in the annual reports. The resulting background concentrations are listed in Table 2

Table 2. Monitored Background Concentrations

Contaminant	Averaging Period	Maximum Concentration		Overall Maximum Concentration
		Cornwall (µg/m³)	Ottawa (µg/m³)	(µg/m³)
Nitrogen dioxide (NO_2)	Annual	7.0	10	10
	24-hour	19	27	27
	1-hour	19	25	25
Fine particulate matter ($PM_{2.5}$)	Annual	5.2	5.2	5.2
	24-hour	11	11	11
Sulphur dioxide (SO2)	Annual	---	0	0
	24-hour	---	1	1
	1-hour	---	0.79	0.79
Carbon monoxide (CO)	1 hour	---	0.28	0.28
Benzene	Annual	---	0.39	0.39
1,3-butadiene	Annual	---	0.037	0.037

7 Assessment Criteria for the Evaluation of Existing Conditions

This section identifies the criteria used to evaluate the existing air quality conditions in the study area.

Ontario Regulation 419/05 sets out air standards which are upper limits on a facility's contribution to ambient air concentrations. The MECP has also established a list of guidelines and screening levels to be used as limits to evaluate a facility's contribution to ambient air concentrations for regulatory approval purposes. These values are identified and used in the assessment documented in the ESDM report, described in Section 5.

The MECP has established Ambient Air Quality Criteria (AAQC) that are intended to be used to assess general (ambient) air quality resulting from all sources of a contaminant to air. An AAQC is not a regulatory value. It is a concentration of a contaminant in air that is protective against adverse effects on health and/or the environment.

The Canadian Council of Ministers of the Environment (CCME) have established Canadian Ambient Air Quality Standards (CAAQS). The CAAQS are health and environmental-based air quality objectives to further protect human health and the environment and to provide the drivers for air quality improvement across the country. For nitrogen dioxide and sulphur dioxide, the existing CAAQS objectives will become more stringent as of 2025.

The AAQC and the CAAQS are summarized in Table 3. Both the current (2020) and future (2025) CAAQS are included in the table.

Table 3. Ambient Air Criteria and Standards

Contaminant of Concern	Averaging Period	Criteria		
		Concentration (µg/m³)	Source	Basis
Nitrogen dioxide (NO_2)	Annual	32	CAAQS (2020)	n/a
	Annual	23	CAAQS (2025)	n/a
	24-hour	200	AAQC	Health
	1-hour	113	CAAQS (2020)	n/a
	1-hour	79	CAAQS (2025)	n/a
	1-hour	400	AAQC	Health
Fine particulate matter ($PM_{2.5}$)	Annual	8.8	AAQC and CAAQS(2020)	Health
	24-hour	27	AAQC and CAAQS(2020)	Health
Inhalable particulate matter (PM_{10})	24-hour	50	AAQC	Health
Sulphur dioxide (SO_2)	Annual	13.1	CAAQS (2020)	n/a
	Annual	10.5	CAAQS (2025)	n/a
	Annual	10.5	AAQC	Vegetation
	1-hour	183	CAAQS (2020)	n/a
	1-hour	170	CAAQS (2025)	n/a
	1-hour	105	AAQC	Health
	10-minute	175	AAQC	Health
Carbon monoxide (CO)	8-hour	15,700	AAQC	Health
	1-hour	36,200	AAQC	Health
Hydrogen chloride (HCl)	24-hour	20	AAQC	Health
Ethylene dichloride	Annual	0.4	AAQC	Health
	24-hour	2	AAQC	Health
Dichloroethylene	24-hour	105	AAQC	Health
1,3-butadiene	Annual	2	AAQC	Health
	24-hour	10	AAQC	Health
Acetaldehyde	24-hour	500	AAQC	Health
	0.5 hour	500	AAQC	Health
Benzene	Annual	0.45	AAQC	Health
	24-hour	2.3	AAQC	Health
Formaldehyde	24-hour	65	AAQC	Health
Naphthalene	24-hour	22.5	AAQC	Health
	10-minute	50	AAQC	Odour
Trichloroethylene	Annual	2.3	AAQC	Health
	24-hour	12	AAQC	Health
Chloroform	Annual	0.2	AAQC	Health
	24-hour	1	AAQC	Health
Vinyl chloride	Annual	0.2	AAQC	Health
	24-hour	1	AAQC	Health
Total Reduced Sulphur (TRS)	24-hour	7	AAQC	Health
	10-minute	13	AAQC	Odour

8 Comparison of Existing Conditions to Criteria

This section summarizes the impacts of the EOWHF and adjacent agricultural operations on air quality and odour in the off-site study area in comparison to assessment criteria.

Table 4 compares impacts of air COC for which regional air monitoring data is available. The sum of the maximum background concentration and the EOWHF contribution is compared to ambient air criteria. Values are compared at both the POI (maximum off-site concentration) and at sensitive receptors (residences).

For other contaminants, regional air monitoring data is not available. However, in most cases these contaminants are not expected to be present in significant quantities unless emitted from local sources. As a result, total concentrations in the study area will not be significantly greater than the concentrations resulting from EOWHF operation, as detailed in the ESDM report. These concentrations are compared to AAQC in the ESDM report (Attachment A, Table A3 Emission Summary Table).

Table 4, below, together with Table A3 of the ESDM report show that, of the over 180 contaminants that could potentially be emitted from the EOWHF, only four (4) were predicted to exceed AAQC, CAAQS, MECP air standards or guidelines:NO_2; SPM; PM_{10}; and odour. At sensitive receptors, cumulative concentrations of all compounds except odour were below the applicable criteria.

Each contaminant that is predicted to exceed an ambient air quality objective or MECP limit is discussed in the following sections.

Table 4. Cumulative Impact Comparison

Contaminant	Averaging Period	Criteria			Monitored Background Concentration	Modelled Concentration		Total Concentration		Percent of Criteria	
		Conc. (µg/m³)	Source	Basis	(µg/m³)	POI (µg/m³)	Sensitive Receptor (µg/m³)	POI (µg/m³)	Sensitive Receptor (µg/m³)	POI	Sensitive Receptor
Nitrogen dioxide (NO_2)	Annual	32	CAAQS (2020)		10	5.8	0.7	16	11	50.0%	34.0%
	Annual	23	CAAQS (2025)		10	5.8	0.7	16	11	70.8%	48.1%
	24-hour	200	AAQC	Health	27	45	7	72	34	36.1%	16.8%
	1-hour	113	CAAQS (2020)		25	91	24	116	49	103.1%	43.8%
	1-hour	79	CAAQS (2025)		25	91	24.1	116	49	147.3%	62.5%
	1-hour	400	AAQC	Health	25	151	34	176	59	44.1%	14.8%
Fine particulate matter ($PM_{2.5}$)	Annual	8.8	AAQC and CAAQS (2020)	Health	5.2	2.6	0.9	8	6	89.4%	70.0%
	24-hour	27	AAQC and CAAQS (2020)	Health	11	10.4	3.4	21	14	79.4%	53.5%
Sulphur dioxide (SO2)	Annual	13.1	CAAQS (2020)		0.34	0.3	0.03	0.64	0.375	4.9%	2.9%
	Annual	10.5	CAAQS (2025)		0.34	0.3	0.03	0.64	0.375	6.1%	3.6%
	Annual	10.5	AAQC	Vegetation	0.34	0.3	0.03	0.64	0.375	6.1%	3.6%
	1-hour	183	CAAQS (2020)		0.79	4.6	1.4	5.4	2.2	3.0%	1.2%
	1-hour	170	CAAQS (2025)		0.79	4.6	1.4	5.4	2.1	3.2%	1.3%
	1-hour	105	AAQC	Health	0.79	4.7	1.6	5.5	2.4	5.3%	2.2%
Carbon monoxide (CO)	1-hour	36,200	AAQC	Health	0.28	1,281	266	1,281	267	3.5%	0.7%
1,3-butadiene	Annual	2	AAQC	Health	0.037	0.001	0.000	0.0	0.0	1.9%	1.9%
Benzene	Annual	0.45	AAQC	Health	0.388	0.031	0.004	0.4	0.4	93.1%	87.0%

Nitrogen Dioxide (NO_2)

Nitrogen dioxide is a product of combustion, and is emitted from the LFG Utilization Facility (engines and flares) as well as from mobile sources (trucks, material handling equipment, construction equipment) on the EOWHF. High NO_2 concentrations are predicted at the western on-site property line due to compost material handling equipment, and at the southeast on-site property line due to the LFG Utilization Facility. The concentration falls off quickly with distance from the property line.

Table 4 indicates that concentrations are not predicted to exceed 44% of the 1-hour or 24-hour Ontario AAQC for NO_2, and do not exceed the current (2020) or future (2025) annual CAAQS at any location. However, NO_2 concentrations may exceed the 1-hour CAAQS.

Maximum NO_2 concentrations are predicted to reach 103% of the current 1-hour CAAQS (2020) at the on-site property line, but will not exceed the CAAQS at a sensitive receptor. The concentration falls off quickly with distance from the on-site property line, and falls to less than the 1-hour CAAQS within 30 m of the property line. The future 1-hour CAAQS (2025) is more stringent, and concentrations are predicted to reach 147% of the new objective at the on-site property line, but again concentrations fall off quickly with distance from the on-site property line, and do not exceed the CAAQS at any sensitive receptor. The sensitive receptor exposed to the highest NO_2 concentration is located east of the facility, along Highway 138. This receptor location is currently vacant and will be demolished.

The 1-hour CAAQS for NO_2, is defined with the statistical form of “the 3 year average of the annual 98th percentile of the daily-maximum 1-hour average concentrations”. Due to this statistical form, the frequency that the CAAQS is exceeded cannot be reported.

Fine Particulate Matter <2.5 µm diameter ($PM_{2.5}$)

Fine particulate matter <2.5 µm diameter ($PM_{2.5}$) is emitted in exhaust from combustion sources (engines, flares), and as dust from roads, material handling, and agricultural activities. The highest concentrations occur on the western property line, adjacent to the paved haul road. Dust from on-site haul roads is the major contributor to the $PM_{2.5}$ concentration at this location.

Table 4 shows the maximum concentration of $PM_{2.5}$ are below the Ontario AAQC and the CAAQS, which are regional air quality objectives. Maximum $PM_{2.5}$ concentration is predicted to reach 89% or 79% of these criteria for annual and 24-hour averaging periods, respectively. Concentrations fall off quickly with distance from the property line, and do not exceed 70% of the annual and 54% of the 24-hour criteria at sensitive receptors. The sensitive receptor exposed to the highest $PM_{2.5}$ concentration is located east of the facility, along Highway 138. This receptor location is currently vacant and will be demolished.

Fine Particulate Matter <10 µm diameter (PM_{10})

Particulate matter <10 µm diameter (PM_{10}) is emitted in exhaust from combustion sources (engines, flares), and as dust from roads, material handling, and agricultural activities. The highest concentrations occur on the western property line, adjacent to the

paved haul road. Dust from on-site haul roads is the major contributor to the PM_{10} concentration at this location.

Table A3 of the ESDM report shows that the EOWHF's contribution to ambient air concentration exceeds the interim AAQC for PM_{10}, with a maximum 24-hour concentration that is 129% of this criteria. The concentration falls off quickly with distance from the on-site property line. At sensitive receptors, the EOWHF's contribution does not exceed 41% of the AAQC. The sensitive receptor exposed to the highest PM_{10} concentration is located east of the facility, along Highway 138. This receptor location is currently vacant and will be demolished.

There is no monitored ambient air quality data available to describe regional background concentration of PM_{10}, so cumulative ambient air concentration cannot be quantified for comparison to AAQC. Background concentrations will not be negligible and will be at least as high as that of $PM_{2.5}$ (a subset of PM_{10}), so cumulative concentrations may approach the AAQC at a sensitive receptor.

Suspended Particulate Matter (SPM)

Table A3 of the ESDM report shows that the maximum concentration of total suspended particulate matter (SPM) exceeds the MECP air standard, with a maximum 24-hour concentration that is 257% of the limit. The air standard for SPM is based on visibility effects. The highest concentration occurs on the western property line, adjacent to the paved haul road. Dust from on-site haul roads is the major contributor to the SPM concentration at this location. The concentration falls off quickly with distance from the property line. At sensitive receptors, the SPM concentration does not exceed 52% of the limit. The sensitive receptor exposed to the highest SPM concentration is located east of the facility, along Highway 138. This receptor location is currently vacant and will be demolished. It is notable that to assess compliance with Ontario Regulation 419/05, dust from the haul road would not be included, and the air standard would not be exceeded.

Odour

There are several contaminants emitted from the EOWHF that have odour-effects based air standards or guidelines. Table A3 of the ESDM report indicates that concentrations of these contaminants do not exceed the standards or guidelines at any location.

There is no air standard or formal guideline for odour. However, a guideline value of 1 odour unit per cubic metre (OU/m^3) at a sensitive receptor is often used for assessment purposes. Similar to contaminants with odour-effects based air standards, odour is evaluated on a 10-minute average, and the 99.5^{th} percentile concentration at a sensitive receptor is compared to the guideline.

Table A3 of the ESDM report shows that the highest 99.5^{th} percentile concentration at a sensitive receptor is 1.47 ou/m^3, or 147% of the guideline. The sensitive receptor exposed to the highest odour concentration is located southeast of the facility at the intersection of Sandringham Road and Hwy 138. The odour concentration is predicted to exceed the guideline level of 1 ou/m^3 at a sensitive receptor about 336 times (10 minute occurrences) in the five year (43,800 hour) modelling period, or about 0.8% of the time.

9 Conclusions

This report describes the air quality, including odour, in the area around the existing EOWHF, as it is currently approved. Emissions of contaminants to air are expected to increase until just after the landfill reaches its approved capacity, which is predicted to occur about 2025. After closure of the landfill, LFG generation will fall off slowly with time. As a result, the maximum air quality impacts from the currently approved EOWHF will occur near the time of landfill closure (~2025), and these maximum impacts have been considered in this assessment of existing conditions.

Based on a detailed assessment of the facility that considered emissions of over 180 contaminants, and the air quality monitoring data available for the surrounding region, air quality in the study area meets provincial standards and federal objectives for all contaminants of concern with the exception of nitrogen dioxide (NO_2), total suspended particulate matter (SPM), and fine particulate matter (PM_{10}).

Maximum concentrations of all contaminants with odour-effects based air standards or limits do not exceed those limits at any location. However, odour concentration is predicted to exceed the guideline of 1 ou/m³ (10-minute average) at sensitive receptors. The 99.5th percentile odour concentration is predicted to reach 1.47 ou/m³ at a sensitive receptor, and the odour concentration is predicted to exceed 1 ou/m³ about 0.8% of the time at a sensitive receptor.

10 Abbreviations and Definitions

AAQC, Ambient Air Quality Criteria, as set out in the MECP document “Ambient Air Quality Criteria”, dated May 1, 2020.

ACB, Air Contaminants Benchmarks which consist of standards, guidelines, and screening levels for assessing point of impingement concentrations of air contaminants in Ontario.

ADMGO, the Air Dispersion Modeling Guideline for Ontario, MECP Guideline A-11, which sets out guidance for meeting the air dispersion modelling requirements of O.Reg. 419/05.

Air Standard, an air standard set out in Schedule 3 of O.Reg. 419/05.

CCME, Canadian Council of Ministers of the Environment

CAAQS, Canadian Ambient Air Quality Standards established by the CCME

CoC, Contaminants of Concern.

EA, Environmental Assessment

ECA, Environmental Compliance Approval – approval under the EPA for discharges to the environment.

EOWHF, Eastern Ontario Waste Handling Facility

EPA, Ontario’s Environmental Protection Act

ESDM report, an Emission Summary and Dispersion Modelling report, as defined by O.Reg. 419/05 and Procedure for Preparing an ESDM Report, MECP Guideline A-10.

JSL, jurisdictional screening level.

MECP, Ontario Ministry of the Environment, Conservation and Parks

O.Reg. 419/05, Ontario Regulation 419/05 “Air Pollution – Local Air Quality”.

ou/m³, odour units per cubic meter – units of odour concentration

POI, Point of impingement

ToR, Terms of Reference

US EPA, United States Environmental Protection Agency

11 References

1. Terms of Reference, Eastern Ontario Waste Handling Facility, Future Development Environmental Assessment, GFL Environmental Inc., Moose Creek, Ontario, Prepared by HDR Corporation, September 11, 2020
2. Procedure for Preparing an ESDM Report [Guideline A-10], Version 4.1, MECP, March 2018, https://www.ontario.ca/document/guideline-10-procedure-preparing-emission-summary-and-dispersion-modelling-esdm-report
3. Air Dispersion Modelling Guideline for Ontario [Guideline A-11], Version 3.0, MECP, February 2017, https://www.ontario.ca/document/guideline-11-air-dispersion-modelling-guideline-ontario-0
4. Technical Bulletin: Methodology for Modeling Assessments of Contaminants with 10 Minute Average Standards and Guidelines under O. Reg. 419/05, MECP, September 2016 https://www.ontario.ca/page/methodology-modeling-assessments-contaminants-10-minute-average-standards-and-guidelines-under-o-reg
5. Air Contaminants Benchmarks (ACB) List: Standards, guidelines and screening levels for assessing point of impingement concentrations of air contaminants, Version 2.0, MECP, April 2018, https://www.ontario.ca/page/air-contaminants-benchmarks-list-standards-guidelines-and-screening-levels-assessing-point
6. Alberta Air Quality Model Guideline, 2021, https://open.alberta.ca/publications/air-quality-model-guideline-2021

Appendix A. Emission Summary and Dispersion Modelling Report

Prepared for

GFL Environmental Inc.

Moose Creek, Ontario

Document type

Emission Summary and Dispersion Modelling Report

Date

June 2023

EMISSION SUMMARY AND DISPERSION MODELLING REPORT

EASTERN ONTARIO WASTE HANDLING FACILITY

FUTURE DEVELOPMENT ENVIRONMENTAL ASSESSMENT

RAMBOLL

Project name	**GFL: EOWHF Existing Conditions Report**
Project no.	**324000731**
Recipient	**GFL Environmental Inc.**
Document type	**Emission Summary and Dispersion Modelling Report**
Version	**2**
Date	**June 2, 2023**
Prepared by	**Deanne Durward**
Checked by	**Taylor Roumeliotis**
Approved by	**Deanne Durward**
Description	**Eastern Ontario Waste Handling Facility: Emission Summary and Dispersion Modelling Report**

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VERSION CONTROL

Emission Summary and Dispersion Modelling Report

GFL Environmental Inc., Eastern Ontario Waste Handling Facility

Rev.	Date	Description	Authors
-	March 2022	Emission Summary and Dispersion Modelling Report to support Existing Conditions Report	PEG
1	June 2022	Updated with revised receiving rate and road surfaces	PEG
2	June 2023	Revisions to ESDM report based on comments originally received from MECP on February 13, 2023	DMD

EXECUTIVE SUMMARY

GFL Environmental Inc. (GFL) operates the Eastern Ontario Waste Handling Facility (EOWHF) at 17125 Laflèche Road, North Stormont, Ontario. The EOWHF includes a landfill, a landfill gas to energy facility, and an organics composting facility. The facility is located approximately 5 km north-northwest from Moose Creek, Ontario and 5 km east of Casselman, Ontario.

GFL is undertaking an Environmental Assessment for additional landfill capacity as part of future development of the EOWHF. GFL contracted Ramboll Canada Inc. to prepare an Air Quality and Odour Existing Conditions Report to support the Environmental Assessment.

The EOWHF landfill is projected to reach its currently approved capacity in 2025. The purpose of this Emission Summary and Dispersion Modelling (ESDM) report is to document air and odour impacts of the EOWHF that are expected as the landfill nears that approved capacity (i.e., around 2025). This report will feed into and support the Air Quality and Odour Existing Conditions Report.

This ESDM report has been prepared mainly in accordance with the "Procedure for Preparing an Emission Summary and Dispersion Modelling Report", published by the Ministry of the Environment, Conservation and Parks (MECP) in March 2018 (the "ESDM Guidance"). However, because this report is intended to support an Environmental Assessment, additional emission sources and contaminants that are not normally considered in an ESDM report have been included to provide a more comprehensive analysis. These sources include fugitive dust from roadways and material handling, tailpipe emissions from onsite vehicles, and existing agricultural activities on the portion of the property where landfill expansion is proposed.

Facility Description

The approved existing EOWHF encompasses a site area of 189 hectares which includes the following waste management related activities and services:

- 112 hectare landfill site;
- waste water (leachate) treatment facility;
- landfill gas (LFG) utilization facility;
- composting facility;
- waste transfer and processing station;
- small vehicle waste drop off;
- enclosed flare and natural gas fired comfort heating equipment;
- Resource Productivity & Recovery Authority (RPRA) – Scrap Tires Collector; and
- supporting facilities (office, vehicle maintenance building).

The facility boundary and site layout are illustrated in Figures B1 and B2, Appendix B.

Landfill

The facility receives up to 755,000 tonnes per year, or 3,100 tonnes per day, of waste including:

- Municipal solid waste;
- Construction & Demolition Waste;
- Institutional, Commercial & Industrial Waste; and
- Specified Risk Material.

The landfill is configured in four (4) stages, with each stage divided into eight (8) cells, as shown in Figure B2. At the time of this report, cells 1 and 2 of Stage 4 are being filled (the "active cells"), while

cells 3 to 5 of Stage 4 are being developed for future filling. At current and projected fill rates, the final cells of Stage 4 are expected to be filled by the end of 2025.

Landfill gas (LFG) is generated by the decomposition of organic and inorganic waste materials within the cells. LFG is roughly 50% methane, with the remainder mainly carbon dioxide and nitrogen gas, with trace but significant quantities of a long list of other contaminants. As a result of the trace contaminants, LFG is odorous.

LFG Utilization

LFG is captured and collected through a complex network of LFG wells and collection ductwork embedded within the cells. When the facility reaches the currently approved capacity (in 2025), a total of 306 wells are expected to be in operation. LFG is drawn from the wells, through an underground collection network to the Landfill Gas Utilization Facility. The collection system is estimated to have a capture efficiency of 75%, in that 75% of LFG generated within the cells is captured and conveyed to the LFG Utilization Facility, while the remaining 25% will be emitted from the surface of landfill cells.

At the LFG Utilization Facility, LFG is used to fuel four (4) Jenbacher reciprocating engines, each coupled to a 1MW generator. Siloxanes are removed from the LFG fueling the engines by passing the stream through a two-bed adsorption filter, and combusted with additional LFG in an enclosed flare (Flare 3).

The remaining LFG that is not processed in the reciprocating engines or the siloxane flare, is combusted in one of two enclosed flares, identified as Flares 1 and 2. These flares are sized to provide redundancy, and have the capacity to combust all LFG if the engines are not operating for any reason. Under normal conditions when engines are operating near capacity, Flares 1 and 2 will operate well below rated capacity.

Compost Plant

Organic waste is composted in a bunker system within two closed buildings. Raw organic waste is dumped directly onto the tipping floor of the buildings through truck doors. Additional bulking agent (wood chips, shredded leaf and yard waste) is stockpiled outdoors, shredded and added as needed to obtain the required mix of materials. The compost buildings are maintained under negative pressure, and the total exhaust from the buildings is treated in a biofilter for odour control. On completion of composting, the material is transferred by conveyor to trucks for transfer to the remote curing windrows.

Compost from the plant is initially screened and placed into windrows for curing on the Windrow Curing Pad, where the windrows are turned about once per week, weather permitting. On completion of curing, the material is considered finished compost, and is screened, stockpiled, and shipped off-site.

Agricultural Activities

The existing landfill intends to expand into the eastern portion of the study area, which is currently being used for agricultural purposes. The 230 hectare farm grows turf, which is harvested and sold as commercial sod.

Assessment

Emission estimates have been developed for all sources at the facility, based on emission factors, measurements, or published literature. Some sources at the facility have been considered negligible.

Section 20 of O.Reg. 419/05 applies to the facility. As a result, off property concentrations of contaminants were estimated using the AERMOD dispersion model (version 19191), and site-specific meteorological data following the methods prescribed in the Air Dispersion Modelling Guideline for Ontario (ADMGO). Contaminant concentrations were predicted at Point of Impingement (POI) and at sensitive receptors (residences) around the facility. Resulting concentrations are compared to the

standards, guidelines and screening levels provided in the MECP's Air Contaminants Benchmarks (ACB) list, Version 2, dated April 2018 in Table 1, Emission Summary Table.

The table indicates that predicted concentrations of all contaminants comply with the applicable limits, with the exceptions noted below.

The maximum concentration of suspended particulate matter (SPM) exceeds the applicable air standard, with a maximum 24-hour concentration that is 257% of the limit. The highest concentration occurs on the western property line, adjacent to a paved haul road. Dust from the adjacent haul is the major contributor to the SPM concentration at this location. The concentrations fall off quickly with distance from the property line. At sensitive receptors, SPM concentration does not exceed 52% of the limit. It is notable that to assess compliance with Ontario Regulation 419/05, dust from the haul road would not be included, and the air standard would not be exceeded.

Two constituents of LFG exceeds screening levels or de minimus concentrations on the western property line. Concentration of these compounds fall off quickly with distance from the property line, and these levels are not exceeded at any sensitive receptor. Exceeding a screening level or the de minimus concentration does not necessarily indicate that a health risk threshold has been exceeded. Under normal circumstances any application for an Environmental Compliance Approval would include a maximum ground level concentration acceptability request for these contaminants, which would trigger evaluation of the risk associated with the modelled concentrations.

Odour, quantified in odour units per cubic meter (ou/m^3) is compared to a guideline of 1 ou/m^3 that is often applied in Ontario. Similar to contaminants with 10-minute average standards, odour is evaluated on a 10-minute average, and the 99.5th percentile concentration at a sensitive receptor is compared to the guideline. The highest concentration at a sensitive receptor reaches 1.47 ou/m^3 or 147% of the guideline. The sensitive receptor exposed to the highest odour concentration is located southeast of the facility at the intersection of Sandringham Road and Hwy 138. The dispersion model predicts odour concentration will exceed a level of 1 ou/m^3 at a sensitive receptor about 336 times in the five-year modelling period (10-minute occurrences) or 0.8% of the time.

Table 1. Emission Summary Table

Contaminant	CAS Number	Total Facility Emission Rate [g/s]	Dispersion Model Used	Max. POI Conc. [µg/m³]	Max. at Sensitive Receptor [µg/m³]	MECP Limit					Percent of POI Limit [%]	Percent of Limit at Receptor [%]
						Avg. Period [hr]	Limit [µg/m³]	Limiting Effect	ACB Source[1]	Category[2]		
Nitrogen Oxides	10102-44-0	2.1	AERMOD	45	6.9	24 hr	200	Health	Standard	B1	23%	3%
(as NO_2)				151	33.9	1 hr	400	Health	Standard	B1	38%	8%
Nitrogen Dioxide	10102-44-0	2.1	AERMOD	45	6.9	24 hr	200	Health	AAQC	n/a	23%	3%
				151	33.9	1 hr	400	Health	AAQC	n/a	38%	8%
				91.1	24.1	1-hr	113	n/a	CAAQS	n/a	81%	21%
				5.81	0.68	Annual	32	n/a	CAAQS	n/a	18%	2%
Suspended particulate matter	n/a	10.2	AERMOD	308	63	24 hr	120	Visibility	Standard	B1	257%	52%
Particulate matter (< 10 µm dia.)	n/a	3.3	AERMOD	65	20	24 hr	50	Health	AAQC	n/a	129%	41%
Particulate matter (< 2.5 µm dia.)	n/a	1.1	AERMOD	10.4	3.4	24 hr	27	Health	AAQC	n/a	39%	13%
				2.63	0.92	annual	8.8	Health	AAQC	n/a	30%	10%
Carbon Monoxide	630-08-0	12.7	AERMOD	1537	320	0.5 hr	6000	Health	Standard	B1	26%	5%
				1281	266	1 hr	36,200	Health	AAQC	n/a	4%	<1%
				715	149	8 hr	15,700	Health	AAQC	n/a	5%	<1%
Sulfur Dioxide	7446-09-5	0.2	AERMOD	7.80	2.59	10 min	178	Health	AAQC	n/a	4%	1%
				4.73	1.57	1 hr	100	Health & Veg.	Standard	B1	5%	2%
				0.295	0.030	annual	10	Health & Veg.	Standard	B1	3%	<1%
				4.63	1.35	1 hr	173	n/a	CAAQS	n/a	n/a	n/a
Hydrogen Chloride	7647-01-0	0.189	AERMOD	2.32	0.33	24 hr	20	Health	Standard	B1	12%	2%
Odour[3] (units: ou/s, or ou/m³)	n/a	83,091 (Max seasons)	AERMOD	n/a	1.47	10 min	1	---	Guideline	---	n/a	147%
LFG Contaminants												
LFG Unit Emission Run		1.0E+00	AERMOD	112.0	49.3	1 hr						
				49.9	9.69	24 hr						
				6.30	0.740	annual						
				185	81.4	10 min						
1,1,2,2-Tetrachloroethane	79-34-5	2.4E-03	AERMOD	0.118	0.023	24 hr	0.1	Health	SL-JSL	B2	118%	23%
1,1,2-Trichloroethane	79-00-5	5.6E-04	AERMOD	0.028	0.005	24 hr	0.3	Health	SL-JSL	B2	9%	2%
1,2-Dichloroethane (Ethylene dichloride)	107-06-2	4.1E-04	AERMOD	0.021	0.004	24 hr	2	Health	Standard	B1	1%	<1%

Contaminant	CAS Number	Total Facility Emission Rate [g/s]	Dispersion Model Used	Max. POI Conc. [µg/m³]	Max. at Sensitive Receptor [µg/m³]	MECP Limit					Percent of POI Limit [%]	Percent of Limit at Receptor [%]
						Avg. Period [hr]	Limit [µg/m³]	Limiting Effect	ACB Source[1]	Category[2]		
				0.003	0.000	Annual	0.4	Health	AAQC	n/a	<1%	<1%
1,2-Dichloroethene	540-59-0	2.9E-02	AERMOD	1.451	0.282	24 hr	105	Health	Guideline	B1	1%	<1%
1,3-Butadiene (Vinyl ethylene)	106-99-0	2.4E-04	AERMOD	0.001	0.0002	Annual	2	Health	Standard	B1	<1%	<1%
				0.012	0.002	24 hr	10	Health	AAQC	n/a	<1%	<1%
2-Ethyltoluene	611-14-3	1.0E-03	AERMOD	0.051	0.010	24 hr	0.5	Health	SL-JSL	B2	10%	2%
Acetaldehyde	75-07-0	9.0E-05	AERMOD	0.004	0.001	24 hr	500	Health	Standard	B1	<1%	<1%
				0.012	0.005	0.5 hr	500	Health	Standard	B1	<1%	<1%
Benzene	71-43-2	4.9E-03	AERMOD	0.031	0.004	Annual	0.45	Health	Standard	B1	7%	<1%
				0.246	0.048	24 hr	2.3	Health	AAQC	n/a	11%	2%
Benzyl chloride	100-44-7	6.0E-05	AERMOD	0.003	0.001	24 hr	0.1	Health	SL-JSL	B2	3%	<1%
cis-2-Pentene	627-20-3	8.8E-05	AERMOD	0.004	0.001	24 hr	0.5	Health	SL-JSL	B2	<1%	<1%
Dibromochloromethane	124-48-1	8.3E-05	AERMOD	0.004	0.001	24 hr	0.2	Health	SL-JSL	B2	2%	<1%
Formaldehyde	50-00-0	9.3E-06	AERMOD	0.000	0.0001	24 hr	65	Health	Standard	B1	<1%	<1%
Isoprene (2-Methyl-1,3-butadiene)	78-79-5	3.0E-05	AERMOD	0.001	0.0003	24 hr	0.1	Health	SL-JSL	B2	1%	<1%
Naphthalene	91-20-3	3.6E-04	AERMOD	0.018	0.004	24 hr	22.5	Health	Guideline	B1	<1%	<1%
					0.029	10 min	50	Odour	Guideline	B1	---	<1%
p-Cymene (1-Methyl-4-Isopropylbenzene)	99-87-6	1.3E-02	AERMOD	0.631	0.123	24 hr	50	Health	SL-JSL	B2	1%	<1%
Trichloroethylene (Trichloroethene)	79-01-6	2.9E-03	AERMOD	0.143	0.028	24 hr	12	Health	Standard	B1	1%	<1%
				0.018	0.0021	Annual	2.3	Health	AAQC	n/a	<1%	<1%
Trichloromethane (Chloroform)	67-66-3	2.2E-04	AERMOD	0.011	0.002	24 hr	1	Health	Standard	B1	1%	<1%
				0.001	0.0002	Annual	0.2	Health	AAQC	n/a	<1%	<1%
Vinyl chloride (Chloroethene)	75-01-4	2.3E-03	AERMOD	0.117	0.023	24 hr	1	Health	Standard	B1	12%	2%
				0.015	0.002	Annual	0.2	Health	AAQC	n/a	7%	<1%
Total Reduced Sulphur Compounds	NA	4.4E-02	AERMOD	2.176	0.423	24 hr	7	Health	Guideline	B1	31%	6%
					3.551	10 min	13	Odour	Guideline	B1	---	27%
1-Methylcyclohexene	591-49-1	5.7E-05	AERMOD	0.003	0.001	24 hr	0.1	de minimus	Table B-2A	n/a	3%	<1%
2,4-Dimethylhexane	589-43-5	6.7E-04	AERMOD	0.033	0.006	24 hr	0.1	de minimus	Table B-2A	n/a	33%	6%
2,5-Dimethylhexane	592-13-2	5.0E-04	AERMOD	0.025	0.005	24 hr	0.1	de minimus	Table B-2A	n/a	25%	5%
2-Ethyl-1-butene	760-21-4	3.9E-05	AERMOD	0.002	0.000	24 hr	0.1	de minimus	Table B-2A	n/a	2%	<1%
3,6-Dimethyloctane	15869-94-0	2.9E-03	AERMOD	0.147	0.029	24 hr	0.1	de minimus	Table B-2A	n/a	147%	29%
cis-1,4-Dimethylcyclohexane	624-29-3	7.3E-04	AERMOD	0.037	0.007	24 hr	0.1	de minimus	Table B-2A	n/a	37%	7%

Contaminant	CAS Number	Total Facility Emission Rate [g/s]	Dispersion Model Used	Max. POI Conc. [µg/m³]	Max. at Sensitive Receptor [µg/m³]	MECP Limit					Percent of POI Limit [%]	Percent of Limit at Receptor [%]
						Avg. Period [hr]	Limit [µg/m³]	Limiting Effect	ACB Source[1]	Category[2]		
cis-1,4-Dimethylcyclohexane/trans1,3-Dimethylcyclohexane	2207036	7.3E-04	AERMOD	0.037	0.007	24 hr	0.1	de minimus	Table B-2A	n/a	37%	7%
trans-1,4-Dimethylcyclohexane	2207047	6.1E-04	AERMOD	0.030	0.006	24 hr	0.1	de minimus	Table B-2A	n/a	30%	6%
cis-2-Heptene	6443-92-1	6.3E-05	AERMOD	0.003	0.001	24 hr	0.1	de minimus	Table B-2A	n/a	3%	<1%
cis-2-Octene	2097322	6.5E-04	AERMOD	0.032	0.006	24 hr	0.1	de minimus	Table B-2A	n/a	32%	6%
cis-3-Methyl-2-pentene	922-62-3	4.0E-05	AERMOD	0.002	0.000	24 hr	0.1	de minimus	Table B-2A	n/a	2%	<1%
Isopropyl mercaptan	75-33-2	3.5E-04	AERMOD	0.018	0.003	24 hr	0.1	de minimus	Table B-2A	n/a	18%	3%
trans-1,2-Dimethylcyclohexane	6876-23-9	1.2E-03	AERMOD	0.060	0.012	24 hr	0.1	de minimus	Table B-2A	n/a	60%	12%
trans-1,4-Dimethylcyclohexane	2207047	6.1E-04	AERMOD	0.030	0.006	24 hr	0.1	de minimus	Table B-2A	n/a	30%	6%
trans-2-Octene	13389-42-9	7.1E-04	AERMOD	0.036	0.007	24 hr	0.1	de minimus	Table B-2A	n/a	36%	7%
trans-3-Methyl-2-pentene	616-12-6	3.4E-05	AERMOD	0.002	0.000	24 hr	0.1	de minimus	Table B-2A	n/a	2%	<1%
Trichlorofluoromethane (Freon 11)	91315-61-6	9.0E-04	AERMOD	0.045	0.009	24 hr	0.1	de minimus	Table B-2A	n/a	45%	9%
Siloxanes												
Siloxanes Unit Emission Run		1.0E+00	AERMOD	13.0	2.73	24 hr						
Trimethylsilanol	1066-40-6	2.6E-02	AERMOD	0.340	0.071	24 hr	32.5	Health	SL-JSL	B2	1%	0%
Trimethylsilyl Fluoride	420-56-4	1.4E-03	AERMOD	0.018	0.004	24 hr	0.1	de minimus	Table B-2A	n/a	18%	4%
Methoxytrimethylsilane	1825-61-2	8.7E-04	AERMOD	0.011	0.002	24 hr	0.1	de minimus	Table B-2A	n/a	11%	2%
Ethoxytrimethylsilane	1825-62-3	5.0E-04	AERMOD	0.007	0.001	24 hr	0.1	de minimus	Table B-2A	n/a	7%	1%
Propoxytrimethylsilane	1825-63-4	3.9E-04	AERMOD	0.005	0.001	24 hr	0.1	de minimus	Table B-2A	n/a	5%	1%
Isopropoxytrimethylsilane	1825-64-5	4.5E-04	AERMOD	0.006	0.001	24 hr	0.1	de minimus	Table B-2A	n/a	6%	1%
Butoxytrimethylsilane	1825-65-6	2.2E-04	AERMOD	0.003	0.001	24 hr	0.1	de minimus	Table B-2A	n/a	3%	1%
1-methylbutoxytrimethylsilane	1825-67-8	4.8E-04	AERMOD	0.006	0.001	24 hr	0.1	de minimus	Table B-2A	n/a	6%	1%

Note:

[1] ACB Source: "S" - Standard (for Section 20), "G" - Guideline (for Section 20), "SL-JSL" - Screening Level (SL) set by the MECP based on a review of toxicity information and/or other jurisdictional levels (JSL)

[2] Category: "B1" - Benchmark 1 , "B2" - Benchmark 2.

[3] The 1-hr air dispersion modelling output units were adjusted in AERMOD to reflect the expected peak 10-min average values using the MECP recommended standard conversion factor of 1.65.

EMISSION SUMMARY AND DISPERSION MODELLING REPORT CHECKLIST

Company Name: GFL Environmental Inc.

Company Address: 17125 Laflèche Road,
North Stormont, Ontario, K0C 1W0

Location of Facility: 17125 Laflèche Road,
North Stormont, Ontario, K0C 1W0

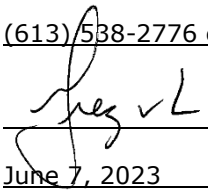
The attached Emission Summary and Dispersion Modeling Report was prepared in accordance with s.26 of O. Reg.419/05 and the guidance in the Ministry of Environment, Conservation and Parks (MECP) documents "Procedure for Preparing an Emission Summary and Dispersion Modelling Report" dated March 2018 and "Air Dispersion Modelling Guideline for Ontario" (ADMGO) dated February 2017 and the minimum required information identified in the check-list on the following page has been submitted.

Company Contact

Name: Greg van Loenen, P.Eng.

Title: Environmental Compliance Officer, GFL Environmental Inc.

Phone Number: (613) 538-2776 ext. 2223

Signature: 

Date: June 7, 2023

Technical Contact

Name: Deanne Durward, P.Eng.

Representing: Ramboll Canada Inc.

Phone Number: (289) 290-0607

Signature: 

Date: June 7, 2023

EMISSION SUMMARY AND DISPERSION MODELLING REPORT CHECKLIST

	Required Information	Submitted	Explanation/Reference
	Executive Summary and Emission Summary Table		
	Overview of ESDM Report	☒Yes	Executive Summary
	Emission Summary Table	☒Yes	Executive Summary
1.0	**Introduction and Facility Description**		
1.1	Purpose and Scope of ESDM Report (when report only represents a portion of facility)	☒Yes	Section 1.0
1.2	Description of Processes and NAICS code(s)	☒Yes	Section 1.0
1.3	Description of Products and Raw Materials	☒Yes	Section 1.0
1.4	Process Flow Diagram	☒Yes	Appendix B, Figure B3
1.5	Operating Schedule	☒Yes	Section 1.0
2.0	**Initial Identification of Sources and Contaminants**		
2.1	Sources and Contaminants Identification Table	☒Yes	Section 2, Table A1
3.0	**Assessment of the Significance of Contaminants and Sources**		
3.1	Identification of Negligible Contaminants and Sources	☒Yes	Section 3
3.2	Rationale for Assessment	☒Yes	Section 3
4.0	**Operating Conditions, Emission Estimating and Data Quality**		
4.1	Description of operating conditions, for each significant contaminant that results in the maximum POI concentration for that contaminant	☒Yes	Section 4.1
4.2	Explanation of Method used to calculate the emission rate for each contaminant	☒Yes	Section 4.2, Appendix E
4.3	Sample calculation for each method	☒Yes	Appendix E
4.4	Assessment of Data Quality for each emission rate	☒Yes	Appendix A, Table A2
5.0	**Source Summary Table and Property Plan**		
5.1	Source Summary Table – Sorted by source	☒Yes	Appendix A, Table A2
5.2	Source Summary Table – Sorted by contaminant	☐Yes	n/a
5.3	Site Plan (scalable)	☒Yes	Appendix B, Figure B1
5.4	A scalable roof layout indicating discharge locations and air intakes	☒Yes	Appendix B, Figure B1 & B2
6.0	**Dispersion Modelling**		
6.1	Dispersion Modelling Input Summary Table	☒Yes	Appendix D
6.2	Land Use Zoning Designation Plan	☐Yes	n/a
6.3	Dispersion Modelling Input and Output Files	☒Yes	Appendix D
7.0	**Emission Summary Table and Conclusions**		
7.1	Emission Summary Table	☒Yes	Appendix A, Table A3
7.2	Assessment of Contaminants with no MOECC POI Limits	☐Yes	N/A
7.3	Assessment Values (if contaminants with Annual Standards are emitted – see Technical Bulletin - Methodology For Using "Assessment Values" For Contaminants With Annual Air Standards under O. Reg. 419/05)	☒Yes	Appendix A, Table A3
7.4	Conclusions	☒Yes	Section 7

1. INTRODUCTION AND FACILITY DESCRIPTION

GFL Environmental Inc. (GFL) operates the Eastern Ontario Waste Handling Facility (EOWHF) at 17125 Laflèche Road, North Stormont, Ontario. The EOWHF includes a landfill, a landfill gas to energy facility, and an organics composting facility. The facility is located approximately 5 km north-northwest from Moose Creek, Ontario and 5 km east of Casselman, Ontario.

1.1 Purpose and Scope of ESDM Report

GFL is undertaking an Environmental Assessment for additional landfill capacity as part of future development of the EOWHF. GFL contracted Ramboll Canada Inc. to prepare an Air Quality and Odour Existing Conditions Report to support the Environmental Assessment.

The EOWHF landfill is projected to reach its currently approved capacity in 2025. The purpose of this Emission Summary and Dispersion Modelling (ESDM) report is to document air and odour impacts of the EOWHF. This report will feed into and support the Air Quality and Odour Existing Conditions Report.

The generation of LFG is an important factor in the assessment of air quality around a landfill. The LFG generation rate at the EOWHF will increase until just after the landfill reaches its currently approved capacity, which is predicted to occur around 2025. After closure of the landfill, LFG generation will fall off slowly with time. The LFG generation rate has not yet reached peak levels at the time of this report, but will reach peak prior to the future landfill development project being implemented. Therefore, for the purpose of this report, the peak LFG generation rate (~2025) has been considered.

This ESDM report has been prepared mainly in accordance with the "Procedure for Preparing an Emission Summary and Dispersion Modelling Report", published by the Ministry of the Environment, Conservation and Parks (MECP) in March 2018 (the "ESDM Guidance"). The report includes all air emissions from the subject facility, upgrades currently underway and planned, and considers activities during landfilling of the final stage of the existing site.

GFL is planning to relocate compost curing and storage pad areas. It is currently anticipated that the new compost pads will be constructed and operational during the life of the future development. Therefore, for the purpose of this report, the pads have been included in this area as part of the existing condition.

However, because this report is intended to support an Environmental Assessment, additional emission sources and contaminants that are not normally considered in an ESDM report have been included to provide a more comprehensive analysis. These sources include fugitive dust from roadways and material handling, tailpipe emissions from onsite vehicles, and existing agricultural activities on the portion of the property where landfill expansion is proposed.

1.2 Description of Current Process and NAICS Code

The EOWHF is described by the North American Industrial Classification system (NAICS) code 562210, "Waste treatment and disposal".

The approved existing EOWHF encompasses a site area of 189 hectares which includes the following waste management related activities and services:

- 112 hectare landfill site;
- Waste water (leachate) treatment facility;

- Landfill gas (LFG) utilization facility;
- Composting facility;
- Waste transfer and processing station;
- Small vehicle waste drop off;
- Enclosed flare and natural gas fired comfort heating equipment;
- Resource Productivity & Recovery Authority (RPRA) – Scrap Tires Collector; and
- Supporting facilities (office, vehicle maintenance building).

1.2.1 Landfill Activities

The facility receives up to 755,000 tonnes per year, or 3,100 tonnes per day, of waste including:

- Municipal solid waste;
- Construction & Demolition Waste;
- Institutional, Commercial & Industrial Waste; and
- Specified Risk Material.

The landfill is configured in four (4) stages, with each stage divided into eight (8) cells, as shown in Figure B1. At the time of this report, cells 1 and 2 of Stage 4 are being filled (the "active cells"), while cells 3 to 5 of Stage 4 are being developed for future filling. At current and projected fill rates, the final cells of Stage 4 are expected to be filled by the end of 2025.

Truck loads of waste are scaled at entrance to the property on Laflèche Road. The trucks then travel over a network of paved and unpaved on-site haul roads, and waste is dumped on the active cells. The trucks leave by return route. The waste is spread and compacted on the active cells continuously through the day. At the end of each day, all exposed waste is covered by a 0.15m layer of cover materials as allowed by the facility's ECA (waste). This daily cover reduces wind-blown trash, birds and pests, and odour emissions.

When cells reach capacity, the cells are covered with a thicker layer (0.3m) of materials as allowed by the facility's ECA (waste) as intermediate cover. Eventually, the cells are covered by another layer, including a geosynthetic membrane as final cover. Final cover is intended to provide an impervious barrier to limit leachate generation and reduce emissions of landfill gas (LFG) generated within the landfill as waste materials decompose over time.

As cells are being filled, the next cells to be filled are developed. Development includes construction of temporary and permanent drainage features and berms, excavation to the base elevation of initial landfilling, construction of a Leachate Collection System within the excavation, and possibly extension/construction of facility roads to access the cells. Transition of landfilling activities to new cells includes removal of temporary berms.

The facility maintains a fleet of mobile equipment for spreading and compacting waste, hauling, spreading, compacting cover, and excavating/constructing cells.

Air emissions from the landfill activities include suspended particulate matter (SPM, or dust) from material handling and on-site roads, tailpipe emissions from onsite traffic and mobile equipment, and fugitive landfill gas (LFG) not captured in the LFG Collection System.

All leachate generated on site is collected and treated by the leachate management system as allowed by the facility's ECA (Amended ECA No. 2592-B83KSN, dated March 27, 2019 including:

- The leachate collection system at the cells, consisting of buried pipe network and collecting ditches;
- Leachate holding ponds;
- The leachate treatment facility; and

- Leachate holding / aeration pond.

1.2.2 Landfill Gas Collection and Utilization

Landfill gas (LFG) is generated by the decomposition of organic and inorganic waste materials within the cells. LFG is roughly 50% methane, with the remainder mainly carbon dioxide and nitrogen gas, with trace but significant quantities of a long list of other contaminants. As a result of the trace contaminants, LFG is odorous.

LFG is captured and collected through a complex network of LFG wells and collection ductwork embedded within the cells. Currently, a total of more than 190 wells are in place and operating in Stages 1 to 3. When the facility reaches the currently approved capacity (in 2025), a total of 306 wells are expected to be in operation. LFG is drawn from the wells, through an underground collection network to the Landfill Gas Utilization Facility.

The wells and collection ductwork/pipes are maintained under negative pressure to eliminate potential of leakage of LFG to atmosphere. However, capture within the cells is not 100% effective due to leakage in cover, around wells and other cover penetrations, or at the perimeter. The collection system is estimated to have a capture efficiency of 75%, in that 75% of LFG generated within the cells is captured and conveyed to the LFG Utilization Facility, while the remaining 25% will be emitted from the surface of landfill cells.

At the LFG Utilization Facility, LFG is used to fuel four (4) Jenbacher reciprocating engines, each coupled to a 1MW generator. Electricity generated by the gensets is stepped up and supplied to the local utility grid. The engines can each combust about 0.16 m^3/s of LFG at rated output.

LFG contains trace amounts of siloxanes (organic compounds containing silicon), which can decompose and lead to build-up of potentially damaging silicon deposits on the internal surfaces of the internal combustion engines. Siloxanes are removed from the LFG fueling the engines by passing the stream through a two-bed adsorption filter. The media in the beds is designed to selectively adsorb siloxanes, which can then be removed by heating the bed. During desorption the bed is purged with high temperature air, and the resulting siloxane containing air stream is combusted with additional LFG in an enclosed flare. This siloxane flare combusts LFG at about 0.028m^3/s when engines are operating at rated capacity.

The remaining LFG that is not processed in the reciprocating engines or the siloxane flare, is combusted in one of two enclosed flares, identified as Flares 1 and 2. Flares 1 and 2 are rated to combust up to 1.2 and 2.1 m^3/s of LFG, respectively. Note that these flares are sized to provide redundancy, and have the capacity to combust all LFG if the engines are not operating for any reason. Under normal conditions when engines are operating near capacity, Flares 1 and 2 will operate well below rated capacity.

Emissions from the engines and flares will include products of combustion, as well as small quantities of the constituents of LFG that are not fully combusted.

1.2.3 Compost Facility

The composting facility is located at the Southwestern corner of the landfill property, where organic waste is composted in a bunker system within two closed buildings. Raw organic waste is dumped directly onto the tipping floor of the buildings through truck doors. A limited quantity of additional bulking agent (wood chips, shredded leaf and yard waste) is stored in partially enclosed structures adjacent to the buildings and is moved to the tipping floor by loader as needed to obtain the required

mix of materials. All doors are kept closed to the extent practical. On completion of composting, the material is transferred by conveyor to trucks for transfer to the remote curing windrows.

The compost buildings are maintained under negative pressure, and the total exhaust from the buildings is treated in a biofilter for odour control. The open-top style, wood-based biofilter is configured in three 28 m x 28 m zones or beds supplied through a common plenum. Three fans route exhaust from the compost buildings to the common plenum.

Leaf and yard waste is used as a bulking agent for the composting process. It is received and stored outdoors on the leaf and yard waste storage pad. The material is shredded and transported to short-term covered storage close to the enclosed compost plant. The outdoor leaf and yard storage area of about 115 m x 310 m, is located south of the compost plant, as shown in Figure B2. Typically, there are about six stockpiles on the pad, each measuring about 140 m x 8 m x 4 m (height), separated by 9 m. Figure B2 shows the location of the leaf and yard waste storage pad and the typical locations of the stockpiles.

Compost from the plant is initially screened and placed into windrows for curing on the curing pad, an area of about 150 m x 250 m south of the compost plant, as shown in Figure B2. The windrows are turned about once per week, weather permitting. Typically, there are about 12 windrows are on the pad, each measuring about 75 m x 4.5 m x 2 m (height), separated by 1 m. Figure B2 shows the location of the compost curing pad and the typical locations of the windrows.

On completion of curing, the material is considered finished compost, and is moved to the Finished Compost Pad (about 120 m x 230 m) for final screening, stockpiling and shipment off-site. The material may be transferred to the Bagging Operation area (110 m x 180 m) for bagging or packaging, prior to shipment off-site.

Air emissions from the composting facility are mainly odour from the biofilter, from leaf and yard waste storage, and from curing.

1.2.4 Agricultural Activities

The eastern portion of the study area is currently being used for agricultural purposes. The 230 hectare farm grows mainly turf, which is harvested and sold as commercial sod, with a small area used for cash crops.

1.3 Modifications to Facility

Modifications have been made to the EOWHF in recent months, and other modifications are planned in the future. For clarity, the following modifications or planned modifications have been taken into account in this ESDM report:

- An additional blower skid and enclosed flare (Flare 2) have been added to the LFG Utilization Facility. This change provides improved suction and gas flow in the LFG collection system, and increased LFG combustion capacity;
- Outdoor storage and curing areas associated with the compost facility are currently located on the north portion of the facility. These areas must be relocated to allow completion of Stage 4 landfilling, and are expected to be constructional and operation during the life of the future development. The new locations south of the compost plant have been presented herein.
- The initial cells of Stage 4 of the landfill are currently being developed. The remainder of Stage 4 will be developed and filled as landfilling progresses. As stated in Section 1.1, this report addresses emissions near the completion of Stage 4 (estimated 2025). As a result, the report

accounts for emissions from the completed Stage 4, as well as the expanded infrastructure (onsite roads, etc.) required for operation at that time.

1.4 Process Flow Diagram

A process flow diagram showing the major processes is included in Appendix B, Figure B3.

1.5 Operating Schedule

The EOWHF normally accepts waste at the site, and highway trucks onsite would be limited to:

Monday to Friday 7:00 am to 6:00 pm;
Saturday 7:00 am to 5:00 pm
Sunday Normally Closed*

Onsite activities and the normal hours of operation for mobile equipment extend beyond the waste receiving hours to allow for site preparation and soil covering activities. The hours of mobile equipment operation are:

Monday to Friday 6:30 am to 6:30 pm
Saturday 6:30 am to 5:30 pm
Sunday Closed*

* Although the site is normally closed on Sundays and statutory holidays, exceptions are occasionally made when municipal contracts for waste collection are carried out on holidays.

The LFG Utilization Facility (engines and flares) and the Composting Plant operate and emit to atmosphere 24 hours per day, 7 days per week. Similarly, fugitive emissions associated with the landfill surface, compost curing, and outdoor storage of compost raw materials will continue 24 hours per day, 7 days per week.

2. INITIAL IDENTIFICATION OF SOURCES AND CONTAMINANTS

All sources and contaminants at the facility are identified in Table A1, Sources and Contaminants Identification table (See Appendix A).

3. ASSESSMENT OF THE SIGNIFICANCE OF SOURCES AND CONTAMINANTS

3.1 Identification of Negligible Sources and Contaminants

Some sources/contaminants at the facility have been deemed insignificant, and these sources/contaminants are listed in Appendix C. A brief rationale for each insignificant source/contaminant is given below.

3.1.1 Screening with an Emissions Threshold

Contaminants emitted in negligible quantities were screened out using an emission threshold as described in Section 7.1.2 of the ESDM guidance document.

For the purposes of defining the emission threshold:

- The Ministry limit used was either the benchmark in the ACB List or, in the absence of a benchmark, the de minimus concentrations given in Table B-2A of the ESDM guidance document.
- The dispersion factor used corresponded to Rural land use, at 250 m distance, from Table B1 of the ESDM guidance document.

The thresholds and a comparison of emission rates to the threshold is provided in Appendix C. A total of 149 contaminants were determined to be emitted in negligible quantities by this method.

3.1.2 Sources that are Insignificant Compared to Total Emissions

Sources that, in combination, represent less than 5% of total emissions of a contaminant have been considered negligible sources in accordance with Section 7.2.2 of the ESDM guidance document.

The siloxane flare (Flare 3) combusts about 1% of the total amount of LFG combusted at the facility. Therefore, this source was considered to emit negligible quantities of products of combustion.

The engines (Gen1 to Gen4) and siloxane flare (Flare 3) combined represent less than 5% of total LFG emitted, as indicated in the following table. Therefore, these sources were considered to emit negligible quantities of the constituents of LFG.

Source	**LFG Emission or Use Rate** (m^3/s)	**Control Efficiency** (%)	**LFG Emitted to Atmosphere** (m^3/s)	**Percent of Total** (%)
Fugitive LFG Emissions (Stg1 to Stg4)	0.62	0	0.62	94%
Engines (Gen1 to Gen 4)	0.64	98%	0.013	1.9%
Siloxane Flare (Flare3)	0.03	98%	0.0006	0.1%
Flare 1	0.43	98%	0.009	1.3%
Flare 2	0.77	98%	0.0153	2.3%
Total			0.66	100%

Road dust from paved and unpaved roads, dust from agricultural uses, and dust from material handling associated with the working face are the dominant sources of particulate matter emitted from the site. Particulate matter from compost material handling (raw materials, windrowing, packaging) has been deemed negligible due to the nature of materials (moisture levels) and very low volumes compared to landfilling activities.

Mobile farm equipment (e.g., tractors, loaders) emit products of combustion. The fleet of farm equipment is very small and operates intermittently during the year. Emissions of products of combustion from these sources have been deemed negligible in comparison to emissions from the on-road truck fleet, mobile equipment associated with landfilling and composting, and stationary engines (generator engines), all of which operate constantly during operating hours year round.

Siloxanes are trace components of LFG that contain silicon. The compounds can cause abrasive deposits within engines, which lead to premature failure. LFG that fuels the engines (Gen1 to Gen4) is passed through a siloxane filter to remove siloxanes prior to the engines. As a result, the engines have been considered a negligible source of siloxane emissions.

3.1.3 **Negligible Sources**

Maintenance welding is occasionally performed in the fleet maintenance building, and has been considered negligible in accordance with Table B-3B of the ESDM guidance document. The building is located about 15m from the property boundary, and about 1.3 km from the closest sensitive receptor (residence).

Several of the site buildings have natural gas or propane fired comfort heating systems. These systems have aggregate capacity far less than 20 GJ/hour, and all individual units are rated at far less than 10GJ/hour. These systems have been considered negligible in accordance with Table B-3B of the ESDM guidance document.

Leachate from the landfill is collected, treated in aeration ponds, treated in the leachate treatment building, and stored in effluent holding ponds until discharge. These sources are expected to emit contaminants, including odour, in negligible quantities under normal aerobic conditions, and have been considered negligible for this analysis.

Finished compost has minor, earthy odour and has been deemed a negligible source of odour in comparison to other sources at the facility. Sources associated with finished compost (screening, stockpiling, and packaging) have been deemed negligible.

4. OPERATING CONDITIONS, EMISSIONS ESTIMATES, AND DATA QUALITY

4.1 Operating Conditions for Maximum POI Concentration

For the purposes of emission calculations and dispersion modelling, all activities and production processes were assumed to be operating simultaneously, at peak acceptance or processing rates.

LFG quantities were estimated at the point in time that LFG generation will be at maximum level: immediately after the landfill is completely filled (at end of 2025).

The LFG Utilization Facility (engines and flares) and the Composting Plant operate and emit to atmosphere 24 hours per day, 7 days per week. Similarly, fugitive emissions associated with the landfill surface, compost curing, and outdoor storage of compost raw materials will continue 24 hours per day, 7 days per week. Accordingly, these sources were modelled as emitting constantly and continuously 24 hours per day, 7 days per week.

On-site activities (trucking, material handling, construction) emit only during operating hours. Accordingly, these sources were modelled as emitting at maximum hourly emissions rates from 7:00am to 6:00pm Monday to Friday, 7:00am to 5:00pm Saturday, and not emitting on Sunday.

Agricultural (sod farm and cash crop) sources were conservatively estimated based on tilling of 10 hectares/day, 7 days per week.

4.2 Emission Estimates

Detailed emission rate calculations for all contaminants are included in Appendix E, Tables E1 to E15. The methodology used for each type of source is summarized in the following sections.

4.2.1 Landfill Gas (LFG) Generation

Landfill gas is generated from decomposition of materials within the landfill. The maximum rate of LFG generation will occur when the landfill is completely filled, estimated as 2025.

The quantity of LFG generated was estimated using the US EPA "LandGEM – Landfill Gas Emissions Model", version 3.02. Waste acceptance rates were set equal to EOWHF annual receipts for years 2000 to 2019, and set to 755,000 tonnes/year (near maximum approved) for years 2021 until closure in 2025. Other inputs were set at default values. This results in a maximum LFG generation rate occurring immediately after closure (i.e., in 2026). The results should be conservative, in that the model does not account for trends or regulatory measures that have reduced, and will continue to reduce, the organic content of municipal waste in Ontario.

The LFG collection system is assumed to collect approximately 75% of the LFG generated, and convey it to the LFG Utilization Facility where it is combusted in engines or flares. The remainder (25%) is emitted as fugitive emission from the surface of the landfill.

The quantity of LFG generated, and distribution of the LFG is documented in Table E1.

4.2.2 LFG Fugitive Emissions

Fugitive emissions of LFG were assumed to be emitted uniformly and constantly over the total areas of Stages 1 to 4 of the landfill.

LFG is mainly methane and CO_2, with trace concentrations of a long list of compounds. Speciation of the LFG emissions was based on US EPA AP-42, chapter 2.4, Municipal Solid Waste Landfills (2008), Table 2.4-1. Default Concentrations for LFG Constituents for Landfills with Waste in Place on or After 1992.

LFG also includes trace amounts of siloxanes (compounds containing silicon). Concentrations of the siloxanes were based on previous measurements of siloxanes in LFG at the EOWHF.

Fugitive emission rates of LFG constituents are documented in Table E2.

4.2.3 LFG Combustion

At the LFG Utilization Facility, LFG is combusted in engines (Gen1 to Gen4) to generate electricity, or in enclosed flares. Preferentially, the engines are operated at capacity to maximize electricity generated. The siloxane flare (Flare 3) will also operate near capacity since it is linked to engine operation. The remainder of the LFG will be combusted in enclosed Flares 1 to 3, and was assumed to be distributed between the two, proportional to rated capacity.

The distribution of LFG to engines and flares at the time of maximum LFG generation (after 2025) is documented in Table E1.

Generator Engines

Emissions from LFG fuelled engines (Gen1 to Gen4) were estimated based on emission factors and information in US EPA AP-42, chapter 2.4, Municipal Solid Waste Landfills (1998).

Emissions of nitrogen oxides, carbon monoxide, and particulate matter were based on emission factors given in Table 2.4-4 of AP-42. Notes to the table indicate that all particulate matter can be assumed to be $PM_{2.5}$. The emission factor given for NO_2 was used as a factor for nitrogen oxides (NOx).

Emissions of sulphur dioxide (SO_2) were based on the assumption that all sulphur in the LFG fuel would be oxidized during combustion and emitted as SO_2. Emissions of hydrogen chloride (HCl) were based on the assumption that all chlorine in the LFG fuel would react and be emitted as HCl.

The engines are expected to reduce emissions of LFG with a control efficiency of 98%. Residual LFG emissions from the engines were deemed negligible (see Section 3.2.2).

Emission rates of products of combustion from the engines are documented in Table E4.

Siloxane Flare (Flare 3)

Siloxanes are filtered from the LFG fuel for the engines, and the purge gas from the filters is combusted with additional LFG in the enclosed siloxane flare (Flare 3).

Products of combustion from Flare 3 were assumed negligible as they represent less than 1% of combustion (see Section 3.1.2).

Siloxanes were assumed to be incombustible, and the emission rate was based on emission of 100% of the siloxane content in the LFG used to fuel the engines and the LFG combusted in Flare 3.

Emission rates of siloxanes are documented in Table E5.

Flares 1 and 2

Emissions from the LFG flares (Flares 1 and 2) were estimated based on emission factors and information in US EPA AP-42, chapter 2.4, Municipal Solid Waste Landfills (1998).

Emissions of nitrogen oxides, carbon monoxide, and particulate matter were based on emission factors given in Table 2.4-4 of AP-42. Notes to the table indicate that all particulate matter can be assumed to be $PM_{2.5}$. The emission factor given for NO_2 was used as a factor for nitrogen oxides (NOx).

Emissions of sulphur dioxide (SO_2) were based on the assumption that all sulphur in the LFG fuel would be oxidized and emitted as SO_2. Emissions of hydrogen chloride (HCl) were based on the assumption that all chlorine in the LFG fuel would react and be emitted as HCl.

Emission rates of products of combustion from the flares are documented in Table E4.

The flares are expected to reduce most emissions of LFG constituents with a control efficiency of 98%. However, emissions of incombustible constituents (e.g., mercury, siloxanes) will not be reduced, and a control efficiency of 0% was applied to these contaminants.

Emissions rates of constituents of LFG from the flares are documented in Table E3.

4.2.4 Mobile Equipment Combustion

Mobile equipment operating on the site includes heavy duty diesel highway trucks traveling on-site haul roads, and non-road diesel equipment used for material handling. Products of combustion from the engines were estimated based on US EPA emission factors.

On-site Haul Roads

Highway trucks will travel a total round-trip distance of just under 6 km on-site during filling of final cells of the landfill. The trucks travel a combination of paved roads (source ID Paved_Road) and unpaved roads (source ID Unpaved_Road).

Emission rates for products of combustion were based on emission factors from the US EPA MOVES2014b emission model, for the national (USA) fleet heavy duty diesel trucks in 2021 calendar year. Emission factors for NOx, CO, PM_{10} and $PM_{2.5}$ were extracted from the model. All particulate matter was assumed to be PM_{10}.

Truck traffic on haul roads is limited to 11 hours per day, and was assumed to be uniformly distributed through the day (i.e., 18.2 trucks per hour). Emission rates were calculated as 1-hour average values, for use in modelling emissions only 11 hours per day.

Details of emission factors and emission estimates for truck exhaust on haul roads are documented in Table E8.

Nonroad Mobile Equipment

Nonroad equipment at the facility includes diesel fired equipment such as bulldozers, compactors, excavators, wheel loaders, rock trucks, grinders, and screeners.

The equipment activities are concentrated in two general areas. Equipment associated with municipal waste handling and construction of the next landfill cells are generally operating near the working face of the landfill (source ID Working Face). Equipment associated with composting operates in the area of the compost plant and material stockpiles (source ID Compost_NRoad).

Emission rates for products of combustion were based on US EPA Nonroad Diesel Engine Standards. As this report is predicting emissions for the 2025 calendar year, all nonroad equipment was assumed to meet Tier 4 standards (i.e. model year 2010 or later). Load factors for each type of equipment were based on the US EPA NONROAD emission model, as documented in "Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling (NR-005d)".

Mobile activities are limited to 12 hours per day, and were assumed to be uniformly distributed through the day. Emission rates were calculated as 1-hour average values, for use in modelling emissions only 12 hours per day.

The inventory of equipment, emission factors, and estimated emission rates are documented in Table E6 for each area.

4.2.5 **Working Face Dust**

Dust associated with the working face of the landfill is generated by dumping and handling of waste and cover, spreading and compaction of waste, and spreading of daily cover. Dust associated with construction of the next cells to be filled is generated by excavation and handling of fill materials. Normally construction is near or adjacent to the working face. No construction will occur during filling of the final two cells of the landfill, but to ensure worst case emissions are identified, dust from construction was assumed to be generated, and emitted in the same location as the working face activities.

Estimates of particulate matter emission rates were based on emission factors for material handling activities from US EPA AP-42 Chapters U 13.2.4, Aggregate Handling and Storage Piles, and 11.9 Western Surface Coal Mining.

Estimates were based on handling 3,100 tonnes/day of waste and 310 tonnes/day of cover material (10:1 waste to cover ratio). Volume of construction materials (clay) moved and handled were crudely estimated at about 1,630 tonnes/day.

Working face and construction activities are limited to 12 hours per day, and were assumed to be uniformly distributed through the day. Emission rates were calculated as 1-hour average values, for use in modelling emissions only 12 hours per day.

The emission factors and estimated emission rates for working face and construction activities are documented in Table E9. All emissions were assigned to emission source ID Working Face.

4.2.6 **Road Dust**

Highway trucks travelling on-site haul roads generate dust emissions. Emission rates were based on US EPA AP-42 Chapter 13.2.1 Paved Roads for paved road segments (source ID Paved_Road) and Chapter 13.2.2 Unpaved Roads for unpaved road segments (source ID Unpaved_Road).

Estimates were based on average vehicle weight of 25 tonnes (35 tonnes loaded, 15 tonnes empty, 20 tonnes net payload) and a maximum of 200 trucks per day (round trip), corresponding to maximum waste acceptance rate of 4,000 tonnes/day. Total haul route length is about 5.8 km, round trip.

Highway truck traffic is limited to 11 hours per day, and was assumed to be uniformly distributed through the day (i.e. 18.2 trucks per hour). Emission rates were calculated as 1-hour average values, for use in modelling emissions only 12 hours per day.

The emission factors and estimated emission rates for paved and unpaved segments are documented in Table E7.

4.2.7 Agricultural Dust

Agricultural activities on the existing sod/crop farm generate emissions of particulate matter. Maximum emission rates are expected to result from tilling of the fields.

Emission Rates for the sod farm (source ID Farm) were estimated based on methodology described in US EPA report "Emission Factor Documentation for AP-42 Section 9,1 Tilling Operations, Draft Report, July 1995".

The sod farm is normally tilled in narrow strips as sod is harvested through the year. Emissions were based on tilling of a maximum of 10 hectares per day.

Emission factors an estimated emission rates are documented in Table E11.

4.2.8 Landfill Odour

Odour results from fugitive emission of LFG from the landfill surface, and exposed or partially covered waste at the working face of the landfill.

LFG Odour

The odour emission rate associated with fugitive LFG was estimated based on an emission factor of 10,000 ou/m³ of LFG, given in the Interim Guide to Estimate and Assess Landfill Air Impacts (MOE 1992).

The resulting odour was assumed to be emitted uniformly over the total area of landfill stages 1 to 4 (source ID Stg1 to Stg4).

The estimate calculation is documented in Table E12.

Working Face Odour

The odour emission rate from the working face was based on average odour flux (emission rate per m²) from literature reported values for tipping or the active face of municipal landfills. The geometric mean of the reported values was 7 ou/s/m².

On any given day, exposed waste is limited to an area of approximately 3,200 m², resulting in an odour emission rate of about 22,500 ou/s (source ID Working Face).

References and calculations are provided in Table E12.

4.2.9 Compost Odour

Odour associated with composting operations at EOWHF is emitted from the compost plant, the compost curing windrows, and from stockpiles of leaf and yard waste used as feedstock.

Compost Plant Biofilter

The composting process is conducted within closed buildings that are maintained under negative pressure. The total exhaust from the buildings is treated in a biofilter for odour control. The open-top style, wood-based biofilter is configured in three 28 m x 28 m zones or beds (source IDs BF1 to BF3) supplied through a common plenum. Three fans route exhaust from the compost buildings to the common plenum.

Odour emission from the biofilter was measured during a compliance source test program in 2010 (Envirosolve Report No. E10004) which yielded an emission rate of 905 ou/s. An expansion of the plant in 2012 essentially doubled the capacity of the facility. Assuming that odour generated is

proportional to production rate, and that odour removal efficiency remains constant, the biofilter odour emission rate after expansion would be 905 x 2 = 1,810 ou/s. Measurements and the estimated emission rate are documented in Table E13.

Curing Windrows

Measurements of odour flux from windrow surfaces were made by Consumaj Inc. in March 2019 (winter conditions) and June 2019 (summer conditions). Fall and spring conditions were interpolated from the measured odour fluxes and used to model emissions from the windrows with seasonal variability.

During each measurement program, measurements were made on three windrows of different age: freshly built, about 1 week, and about 3 months old. Emission rate from the windrows is dependent on windrow age. For windrow ages between 1 week and 3 months, odour flux was linearly interpolated from the 1 week and 3 month measurements.

There is a 1 m separation between each windrow. The footprint of each of the 12 windrows including the 1 m separation between them was combined and used as the modelled area for the assessment (source ID CURING).

The measurements, calculations and the estimated emission rate are documented in Table E14.

Leaf and Yard Waste Odour

Leaf and yard waste is received and stored in stockpiles on the leaf and yard waste storage pad, sometimes for extended periods. There are low levels of odour emitted from undisturbed surfaces of the piles, and higher levels emitted from freshly disturbed surfaces as material is removed from the stockpile.

Measurements of odour flux from pile surfaces were made by Consumaj Inc. in March 2019 (winter conditions) and June 2019 (summer conditions). During each measurement program, measurements were made on undisturbed material, and freshly exposed face. Fall and spring conditions were interpolated from the measured odour fluxes and used to model emissions from the stockpiles with seasonal variability.

There is a 9 m separation between each stockpile. Each footprint of each of the six stockpiles were used in the assessment (source IDs LFYD_1 to LFYD_6).

The measurements, calculations and the estimated emission rate are documented in Table E15.

5. SOURCE SUMMARY TABLE AND SITE PLAN

The Source Summary is given in Table A2, Appendix A.

The property boundary, site layout, and source locations are found in Figures B1 and B2, Appendix B.

6. DISPERSION MODELLING

Atmospheric dispersion modelling was used to predict the concentrations of air and odour beyond the facility boundary. The modelling was conducted in accordance with the Air Dispersion Modelling Guideline for Ontario (ADMGO), Version 3, February 2017.

The US EPA's AERMOD atmospheric dispersion model (version 19191), an approved model under O.Reg. 419/05, was used to predict ground level concentrations beyond the facility boundary.

The facility has an approval for use of site-specific meteorological data under s.13(1) of O.Reg.419/05. A site-specific dataset (2015 to 2019), preprocessed with AERMET version 19191, was provided by the MECP in November 2020. This dataset was used for modelling of air and odour.

Terrain data obtained from the MECP website was incorporated into the model. Fence line receptors and a multi-tier receptor grid were applied in accordance with the ADMGO. Property line coordinates are given in Appendix D.

Locations of modelled sources are provided in Figures D1 and D2, Appendix D.

The filled landfill areas (Stages 1 to 4) are essentially hills of roughly 10 m in height, but the standard terrain data files do not reflect these filled heights. To reflect a ground-based release at the actual height of discharge, area sources located on top of the stages were assigned a base elevation 10 m above the file values for elevation, and a release height of 0 m.

The inputs to the models are summarized in Tables D1 to D5, given in Appendix D. Sources associated with roads and mobile equipment were modelled as emitting during operating hours only (7:00am to 6:00pm weekdays, and 7:00am to 5:00pm Saturday). All other sources were modelled as emitting constantly, 24 hours per day, 365 days per year.

Additional discrete receptors were placed at 81 sensitive locations (residences) close to the facility. These sensitive receptors are shown in Figure D3, Appendix D, and are consistent with the receptor locations used in previous assessments of the facility. Coordinates of the receptors are provided in Table D6, Appendix D.

The model was run for 1 hour, 24 hour, and/or annual averaging periods corresponding to the averaging period of the applicable MECP limit, or for the applicable Ontario Ambient Air Quality Criteria (AAQC). Concentrations for other averaging periods were calculated using the averaging time conversion factors given in Section 4.4 of the ADMGO.

Meteorological anomalies were eliminated following the procedure specified in Section 6.5 of the ADMGO. That is, for hourly averages, the 8 hours per year that result in the highest concentrations were discarded, and for 24 hour averages, the 1 day per year that results in the highest concentration was discarded.

For odour, the model was run for a 1 hour averaging period. Concentrations for a 10-minute averaging period were calculated using the averaging time conversion factor (1.65) given in Section 4.4 of the ADMGO. The factor was incorporated into the model so that all off-property odour

concentrations in this report have been presented as 10-minute average values. The model was also configured to provide the 99.5th percentile odour concentration.

For all model runs, the maximum daily emission rates were modelled as occurring every day of the year. That is, any 24-hour average result reflects the maximum daily emission rate over a day with the worst weather condition, and any annual result reflects the maximum daily emission rate maintained over a whole year. As a result, no additional model runs were needed to address the Daily Assessment Values (DAV) or Annual Assessment Values (AAV) for annual limits, as per MECP Technical Bulletin "Using assessment values for contaminants with annual air standards", and no comparison to the assessment values was needed.

Model outputs are also included in Appendix D.

AAQC and CAAQS Modelling

Ambient air quality can be compared to Ontario's Ambient Air Quality Criteria (AAQC), or to the Canadian Ambient Air Quality Standards (CAAQS), which are objectives developed by the Canadian Council of Ministers of the Environment (CCME). These limits are appropriate for assessment of cumulative ambient contaminant concentrations that result from facility impacts, other local sources, and background concentrations (e.g., long-range transport).

This ESDM report does not include an assessment of ambient air background concentration, so results should not be compared directly to the AAQC or CAAQS. However, several of these limits have different statistical forms or averaging periods than typical MECP air standards. To support future comparison to the AAQC and CAAQS, facility impacts were extracted from the model in these statistical forms. For example, the additional statistical forms and averaging periods include:

Contaminant	Limit and Period	Statistical Form
Particulate Matter – Fine ($PM_{2.5}$)	AAQC, CAAQS 24-hour	3-year average of the annual 98th percentile of the daily 24-hour average concentrations
	AAQC, CAAQS Annual	3-year average of the annual average of the daily 24-hour concentrations
Particulate Matter – Inhalable (PM_{10})	AAQC 24-hour	Maximum 24-hour average concentration
Nitrogen Dioxide (NO_2)	CAAQS 1-hour	3-year average of the annual 98th percentile of the daily-maximum 1-hour average concentrations.
	CAAQS Annual	Arithmetic average over a single calendar year of all 1-hour average concentrations.
Sulphur Dioxide (SO_2)	AAQC 10-minute	Maximum 10-minute average concentration
	CAAQS 1-hour	3-year average of the annual 99th percentile of the daily-maximum 1-hour average concentrations.

7. EMISSION SUMMARY TABLE AND CONCLUSIONS

For each contaminant, the maximum off-property concentrations predicted by the dispersion modelling are compared to MECP limits in Table A3, "Emission Summary Table", given in Appendix A. In addition, the highest concentration that occurs at a sensitive receptor (i.e., residence) is also presented and compared to the limits.

The maximum concentrations were compared to the standards, guidelines, and screening levels given in the MECP's Air Contaminants Benchmarks (ACB) list, Version 2, dated April 2018. For those contaminants without an ACB, concentrations were compared to the de minimus concentration, below which they can be deemed insignificant as per Table B-2A of the ESDM guidance document.

Multiple reduced sulphur compounds are emitted from the facility, so emissions were compared to the limit for Total Reduced Sulphur (TRS) and not to the limits for individual reduced sulphur compounds, in accordance with O.Reg. 419/05.

The table also provides the facility impact in the statistical forms required for comparison to AAQC and CAAQS. To support future comparison to the AAQC and CAAQS, facility impacts were extracted from the model in these statistical forms, but the concentrations presented in Table A3 do not include background concentration, and should not be directly compared to the AAQC and CAAQS.

Table A3 indicates that, at sensitive receptors, concentrations of all contaminants are well below the applicable limits, screening levels, or de minimus concentrations. The contaminant with the highest relative impact at a sensitive receptor, suspended particulate matter or SPM, reaches as high as 52% of the air standard.

However, at the Point of Impingement (POI), the concentration of suspended particulate matter (SPM) exceeds the applicable air standard, with a maximum 24-hour concentration that is 257% of the limit. The high concentrations occur on the western property line, adjacent to the paved haul road. Dust from the adjacent haul road is the major contributor to the SPM concentration at this location. The concentration falls off with distance from the property line, as can be seen in the graphical model output given in Appendix D. At sensitive receptors, SPM concentration does not exceed 55% of the limit. The sensitive receptor exposed to the highest SPM concentration is located east of the facility, along Highway 138.

1,1,2,2-tetrachloroethane, which is a constituent of LFG, exceeds a screening level on the western property line. 3,6-dimethyloctane, which is also a constituent of LFG, has no ACB limit, but exceeds the de minimus concentration on the western property line. Concentration of these compounds fall off quickly with distance from the property line, and these levels are not exceeded at any sensitive receptor. The sensitive receptor exposed to the highest concentration of these CoCs is located to the west of the facility along Route 700E. Exceeding a screening level or the de minimus concentration does not necessarily indicate that a health risk threshold has been exceeded. Under normal circumstances any application for an Environmental Compliance Approval would include a maximum ground level concentration acceptability request for these contaminants, which would trigger evaluation of the risk associated with the modelled concentrations.

Contaminants with odour-effects based limits do not exceed any of those limits, as indicated in Table A3. For such contaminants, the MECP's Technical Bulletin "Methodology for Modeling Assessments of Contaminants with 10 Minute Average Standards and Guidelines under O. Reg. 419/05" applies. This Bulletin states "For a facility that emits a contaminant with a 10-minute odour-based standard or guideline, and for assessment purposes only, it is considered acceptable if the modelling shows that at a location of a human receptor the standard or guideline is exceeded less than 0.5% of the time, which corresponds to approximately 44 hours per year." As a result, concentration for comparison to

these limits was reported at sensitive receptors only. However, the peak concentration rather than the 99.5th percentile is reported, which is conservative.

Odour, quantified in odour units per cubic meter (ou/m^3) is compared to a guideline of 1 ou/m^3 that is often applied in Ontario. Similar to contaminants with 10-minute average standards, odour is evaluated on a 10-minute average, and the 99.5th percentile concentration at a sensitive receptor is compared to the limit. This concentration reaches 1.47 ou/m^3 or 147% of the limit at a sensitive receptor. The sensitive receptor exposed to the highest odour concentration is located southeast of the facility, along Norman Drive. The odour concentration is predicted to exceed a level of 1 ou/m^3 at a sensitive receptor about 336 times in the five year modelling period or 0.8% of the time.

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APPENDIX A:
TABLES

Table A1. Sources and Contaminants Identification Table

Source Information			Expected Contaminants	Significant (Yes or No?)	Modelled (Yes or No)?	Rationale For Source/Contaminant Insignificance
Source ID	**Source Description or Title**	**General Location**				
STG1 to STG4	Landfill surface, Stages 1 to 4	Landfill	LFG	Yes	Yes	
			Odour	Yes	Yes	
Paved_Road	Truck traffic on paved roads on site	Landfill	Products of Combustion	Yes	Yes	
			Dust	Yes	Yes	
Unpaved_Road	Truck traffic on unpaved roads on site	Landfill	Products of Combustion	Yes	Yes	
			Dust	Yes	Yes	
Working Face	Landfill working face activities and nearby construction activities	Landfill	Products of Combustion	Yes	Yes	
			Dust	Yes	Yes	
Compost_NRoad	Mobile Equipment at Compost Facility	Compost Facility	Products of Combustion	Yes	Yes	
			Dust	No	No	Negligible compared to aggregate emissions
Leachate	Leachate treatment systems - treatment facility and holding ponds	Landfill	Odour	No	No	Negligible compared to aggregate emissions
GEN1 to GEN4	Reciprocating Engines – LFG Fueled	LFG Utilization Facility	Products of Combustion	Yes	Yes	
			Siloxanes	Yes	Yes	
			uncombusted LFG	No	No	< 5% of aggregate emissions
Flare 1	Enclosed LFG Flare 1	LFG Utilization Facility	Products of Combustion	Yes	Yes	
			Siloxanes	Yes	Yes	
			uncombusted LFG	Yes	Yes	
Flare 2	Enclosed LFG Flare 2	LFG Utilization Facility	Products of Combustion	Yes	Yes	
			Siloxanes	Yes	Yes	
			uncombusted LFG	Yes	Yes	
Siloxane Flare	Enclosed Siloxane/LFG Flare	LFG Utilization Facility	Products of Combustion	No	No	<5% of aggregate emissions
			Siloxanes	Yes	Yes	
			uncombusted LFG	No	No	<5% of aggregate emissions
BF1 to BF3	Biofilter - Exhaust from composting facility (Cells 1 to 3)	Compost Facility	Odour	Yes	Yes	
Finished Compost	Finished compost screening, stockiling, and packaging	Compost Facility	Odour	No	No	Negligible odour levels
Curing	Compost Curing Windrows (Windrows 1 to 12)	Compost Facility	Odour	Yes	Yes	
LFYD_1 to LFYD_6	Leaf & Yard Waste Stockpiles (Stockpiles 1 to 6)	Compost Facility	Odour	Yes	Yes	
Farm	Sod Farm	Agriculture area	Products of Combustion	No	No	Negligible compared to aggregate emissions
			Dust	Yes	Yes	
Welding	Maintenance Welding Station	Maintenance	Welding Fume	No	No	Table B-3B of MECP Document[1].
Heating	Comfort Heating	Offices and other small buildings	Products of Combustion	No	No	Table B-3B of MECP Document[1].

LFG - Landfill Gas

[1] MECP, "Procedure for Preparing an Emission Summary and Dispersion Modelling Report", Version 4.1, dated March 2018.

Table A2. Source Summary Table

Source ID	Source Description	Source Data (per each unit)					Contaminant	CAS Number	Emission Rate [g/s] (or ou/s for Odour)	Avg. Period [hr]	Emis. Est. Tech.[1]	Data Qual.[2]	% of Overall Emissions [%]
		Flow Rate [m^3/s]	Exit Gas Temp. [°C]	Inner Dia. [m]	Height Above Grade [m]	Height Above Roof [m]							
GEN1 to GEN4	Reciprocating Engines – LFG Fueled - Aggregate emissions of all 4 engines	1.4 (each)	509	0.25	5.6	3.0	Nitrogen Oxides	10102-44-0	1.28E+00	1 & 24 hr	EF	ADQ	61%
							Suspended particulate matter	N/A	2.46E-01	24 hr	EF	ADQ	2.4%
							Particulate matter (< 10 µm dia.)	N/A	2.46E-01	24 hr	EF	ADQ	8%
							Particulate matter (< 2.5 µm dia.)	N/A	2.46E-01	24 hr	EF	ADQ	22%
							Carbon Monoxide	630-08-0	2.40E+00	1/2 hr	EF	ADQ	19%
							Sulfur Dioxide	2025884	6.83E-02	1 & 24 hr	MB	ADQ	35%
							Hydrogen Chloride	7647-01-0	6.59E-02	24 hr	MB	ADQ	35%
Flare 1	Enclosed LFG Flare 1	82.8	871	3.05	12.2	-	Nitrogen Oxides	10102-44-0	1.38E-01	1 & 24 hr	EF	ADQ	7%
							Suspended particulate matter	N/A	5.75E-02	24 hr	EF	ADQ	0.6%
							Particulate matter (< 10 µm dia.)	N/A	5.75E-02	24 hr	EF	ADQ	2%
							Particulate matter (< 2.5 µm dia.)	N/A	5.75E-02	24 hr	EF	ADQ	5%
							Carbon Monoxide	630-08-0	2.56E+00	1/2 hr	EF	ADQ	20%
							Sulfur Dioxide	2025884	4.55E-02	1 & 24 hr	MB	ADQ	23%
							Hydrogen Chloride	7647-01-0	4.39E-02	24 hr	MB	ADQ	23%
							1,1,2,2-Tetrachloroethane	79-34-5	3.13E-05	24 hr	EF	MDQ	1%
							1,1,2-Trichloroethane	79-00-5	7.34E-06	24 hr	EF	MDQ	1%
							1,2-Dichloroethane (Ethylene dichloride)	107-06-2	5.48E-06	24 hr	EF	ADQ	1%
							1,2-Dichloroethene	540-59-0	3.85E-04	24 hr	EF	MDQ	1%
							1,3-Butadiene (Vinyl ethylene)	106-99-0	3.13E-06	Annual	EF	MDQ	1%
							2-Ethyltoluene	611-14-3	1.35E-05	24 hr	EF	MDQ	1%
							Acetaldehyde	75-07-0	1.19E-06	24 hr, 1/2 hr	EF	MDQ	1%
							Benzene	71-43-2	6.53E-05	Annual	EF	ADQ	1%
							Benzyl chloride	100-44-7	7.98E-07	24 hr	EF	ADQ	1%
							cis-2-Pentene	627-20-3	1.17E-06	24 hr	EF	MDQ	1%
							Dibromochloromethane	124-48-1	1.10E-06	24 hr	EF	MDQ	1%
							Dimethyl sulfide	75-18-3	1.23E-04	10 min	EF	ADQ	1%
							Formaldehyde	50-00-0	1.22E-07	24 hr	EF	MDQ	1%
							Hydrogen sulfide	7783-06-4	3.80E-04	24 hr, 10 min	EF	ADQ	1%
							Isoprene (2-Methyl-1,3-butadiene)	78-79-5	3.92E-07	24 hr	EF	MDQ	1%
							Naphthalene	91-20-3	4.78E-06	24 hr, 10 min	EF	MDQ	1%
							p-Cymene (1-Methyl-4-Isopropylbenzene)	99-87-6	1.67E-04	24 hr	EF	MDQ	1%
							Trichloroethylene (Trichloroethene)	79-01-6	3.79E-05	24 hr	EF	ADQ	1%
							Trichloromethane (Chloroform)	67-66-3	2.94E-06	24 hr	EF	ADQ	1%
							Vinyl chloride (Chloroethene)	75-01-4	3.09E-05	24 hr	EF	ADQ	1%
							Total Reduced Sulphur Compounds	NA	5.77E-04	24 hr, 10 min	MB	MDQ	1%
							1-Methylcyclohexene	591-49-1	7.61E-07	24 hr	EF	MDQ	1%
							1-Propanethiol (n-Propyl mercaptan)	107-03-9	3.32E-06	24 hr	EF	MDQ	1%
							2,4-Dimethylhexane	589-43-5	8.84E-06	24 hr	EF	MDQ	1%
							2,5-Dimethylhexane	592-13-2	6.61E-06	24 hr	EF	MDQ	1%
							2-Ethyl-1-butene	760-21-4	5.19E-07	24 hr	EF	MDQ	1%
							2-Methyl-1-propanethiol (Isobutyl mercaptan)	513-44-0	5.34E-06	24 hr	EF	MDQ	1%
							2-Methyl-2-propanethiol (tert- Butylmercaptan)	513-35-9	1.02E-05	24 hr	EF	MDQ	1%
							3,6-Dimethyloctane	15869-94-0	3.89E-05	24 hr	EF	MDQ	1%
							cis-1,4-Dimethylcyclohexane	624-29-3	9.70E-06	24 hr	EF	MDQ	1%
							cis-1,4-Dimethylcyclohexane/trans1,3-Dimethylcyclohe	2207036	9.70E-06	24 hr	EF	MDQ	1%
							cis-2-Heptene	6443-92-1	8.38E-07	24 hr	EF	MDQ	1%
							cis-2-Octene	2097322	8.60E-06	24 hr	EF	MDQ	1%
							cis-3-Methyl-2-pentene	922-62-3	5.25E-07	24 hr	EF	MDQ	1%
							Ethyl mercaptan (Ethanediol)	75-08-01	4.29E-06	24 hr	EF	ADQ	1%
							Isopropyl mercaptan	75-33-2	4.64E-06	24 hr	EF	ADQ	1%
							Methanethiol (Methyl mercaptan)	74-93-1	2.30E-05	24 hr	EF	ADQ	1%
							trans-1,2-Dimethylcyclohexane	6876-23-9	1.58E-05	24 hr	EF	MDQ	1%
							trans-1,4-Dimethylcyclohexane	2207047	8.01E-06	24 hr	EF	MDQ	1%
							trans-2-Octene	13389-42-9	9.42E-06	24 hr	EF	MDQ	1%
							trans-3-Methyl-2-pentene	616-12-6	4.55E-07	24 hr	EF	MDQ	1%

Table A2. Source Summary Table

Source ID	Source Description	Source Data (per each unit)					Contaminant	CAS Number	Emission Rate [g/s] (or ou/s for Odour)	Avg. Period [hr]	Emis. Est. Tech.[1]	Data Qual.[2]	% of Overall Emissions [%]
		Flow Rate [m^3/s]	Exit Gas Temp. [°C]	Inner Dia. [m]	Height Above Grade [m]	Height Above Roof [m]							
							Trichlorofluoromethane (Freon 11)	91315-61-6	1.19E-05	24 hr	EF	MDQ	1%
							Trimethylsilanol	1066-40-6	4.49E-03	24 hr	EF	ADQ	17%
							Trimethylsilyl Fluoride	420-56-4	2.33E-04	24 hr	EF	ADQ	17%
							Methoxytrimethylsilane	1825-61-2	1.50E-04	24 hr	EF	ADQ	17%
							Ethoxytrimethylsilane	1825-62-3	8.67E-05	24 hr	EF	ADQ	17%
							Propoxytrimethylsilane	1825-63-4	6.75E-05	24 hr	EF	ADQ	17%
							Isopropoxytrimethylsilane	1825-64-5	7.73E-05	24 hr	EF	ADQ	17%
							Butoxytrimethylsilane	1825-65-6	3.84E-05	24 hr	EF	ADQ	17%
							1-methylbutoxytrimethylsilane	1825-67-8	8.20E-05	24 hr	EF	ADQ	17%
Flare 2	Enclosed LFG Flare 2	140	871	3.66	15.2	-	Nitrogen Oxides	10102-44-0	2.49E-01	1 & 24 hr	EF	ADQ	12%
							Suspended particulate matter	N/A	1.04E-01	24 hr	EF	ADQ	1%
							Particulate matter (< 10 µm dia.)	N/A	1.04E-01	24 hr	EF	ADQ	3%
							Particulate matter (< 2.5 µm dia.)	N/A	1.04E-01	24 hr	EF	ADQ	9%
							Carbon Monoxide	630-08-0	4.60E+00	1/2 hr	EF	ADQ	36%
							Sulfur Dioxide	2025884	8.18E-02	1 & 24 hr	MB	ADQ	42%
							Hydrogen Chloride	7647-01-0	7.8938E-02	24 hr	MB	ADQ	42%
							1,1,2,2-Tetrachloroethane	79-34-5	5.63E-05	24 hr	EF	MDQ	2%
							1,1,2-Trichloroethane	79-00-5	1.32E-05	24 hr	EF	MDQ	2%
							1,2-Dichloroethane (Ethylene dichloride)	107-06-2	9.87E-06	24 hr	EF	ADQ	2%
							1,2-Dichloroethene	540-59-0	6.93E-04	24 hr	EF	MDQ	2%
							1,3-Butadiene (Vinyl ethylene)	106-99-0	5.63E-06	Annual	EF	MDQ	2%
							2-Ethyltoluene	611-14-3	2.43E-05	24 hr	EF	MDQ	2%
							Acetaldehyde	75-07-0	2.14E-06	24 hr, 1/2 hr	EF	MDQ	2%
							Benzene	71-43-2	1.18E-04	Annual	EF	ADQ	2%
							Benzyl chloride	100-44-7	1.44E-06	24 hr	EF	ADQ	2%
							cis-2-Pentene	627-20-3	2.11E-06	24 hr	EF	MDQ	2%
							Dibromochloromethane	124-48-1	1.97E-06	24 hr	EF	MDQ	2%
							Dimethyl sulfide	75-18-3	2.21E-04	10 min	EF	ADQ	2%
							Formaldehyde	50-00-0	2.20E-07	24 hr	EF	MDQ	2%
							Hydrogen sulfide	7783-06-4	6.84E-04	24 hr, 10 min	EF	ADQ	2%
							Isoprene (2-Methyl-1,3-butadiene)	78-79-5	7.05E-07	24 hr	EF	MDQ	2%
							Naphthalene	91-20-3	8.60E-06	24 hr, 10 min	EF	MDQ	2%
							p-Cymene (1-Methyl-4-lsopropylbenzene)	99-87-6	3.01E-04	24 hr	EF	MDQ	2%
							Trichloroethylene (Trichloroethene)	79-01-6	6.82E-05	24 hr	EF	ADQ	2%
							Trichloromethane (Chloroform)	67-66-3	5.30E-06	24 hr	EF	ADQ	2%
							Vinyl chloride (Chloroethene)	75-01-4	5.57E-05	24 hr	EF	ADQ	2%
							Total Reduced Sulphur Compounds	NA	1.04E-03	24 hr, 10 min	MB	MDQ	2%
							1-Methylcyclohexene	591-49-1	1.37E-06	24 hr	EF	MDQ	2%
							1-Propanethiol (n-Propyl mercaptan)	107-03-9	5.97E-06	24 hr	EF	MDQ	2%
							2,4-Dimethylhexane	589-43-5	1.59E-05	24 hr	EF	MDQ	2%
							2,5-Dimethylhexane	592-13-2	1.19E-05	24 hr	EF	MDQ	2%
							2-Ethyl-1-butene	760-21-4	9.34E-07	24 hr	EF	MDQ	2%
							2-Methyl-1-propanethiol (Isobutyl mercaptan)	513-44-0	9.62E-06	24 hr	EF	MDQ	2%
							2-Methyl-2-propanethiol (tert- Butylmercaptan)	513-35-9	1.84E-05	24 hr	EF	MDQ	2%
							3,6-Dimethyloctane	15869-94-0	7.00E-05	24 hr	EF	MDQ	2%
							cis-1,4-Dimethylcyclohexane	624-29-3	1.75E-05	24 hr	EF	MDQ	2%
							cis-1,4-Dimethylcyclohexane/trans1,3-Dimethylcyclohe	2207036	1.75E-05	24 hr	EF	MDQ	2%
							cis-2-Heptene	6443-92-1	1.51E-06	24 hr	EF	MDQ	2%
							cis-2-Octene	2097322	1.55E-05	24 hr	EF	MDQ	2%
							cis-3-Methyl-2-pentene	922-62-3	9.45E-07	24 hr	EF	MDQ	2%
							Ethyl mercaptan (Ethanediol)	75-08-01	7.72E-06	24 hr	EF	ADQ	2%
							Isopropyl mercaptan	75-33-2	8.36E-06	24 hr	EF	ADQ	2%
							Methanethiol (Methyl mercaptan)	74-93-1	4.13E-05	24 hr	EF	ADQ	2%
							trans-1,2-Dimethylcyclohexane	6876-23-9	2.84E-05	24 hr	EF	MDQ	2%
							trans-1,4-Dimethylcyclohexane	2207047	1.44E-05	24 hr	EF	MDQ	2%

Table A2. Source Summary Table

Source ID	Source Description	Source Data (per each unit)					Contaminant	CAS Number	Emission Rate [g/s] (or ou/s for Odour)	Avg. Period [hr]	Emis. Est. Tech.[1]	Data Qual.[2]	% of Overall Emissions [%]
		Flow Rate [m^3/s]	Exit Gas Temp. [°C]	Inner Dia. [m]	Height Above Grade [m]	Height Above Roof [m]							
							trans-2-Octene	13389-42-9	1.70E-05	24 hr	EF	MDQ	2%
							trans-3-Methyl-2-pentene	616-12-6	8.18E-07	24 hr	EF	MDQ	2%
							Trichlorofluoromethane (Freon 11)	91315-61-6	2.14E-05	24 hr	EF	MDQ	2%
							Trimethylsilanol	1066-40-6	8.09E-03	24 hr	EF	ADQ	31%
							Trimethylsilyl Fluoride	420-56-4	4.20E-04	24 hr	EF	ADQ	31%
							Methoxytrimethylsilane	1825-61-2	2.70E-04	24 hr	EF	ADQ	31%
							Ethoxytrimethylsilane	1825-62-3	1.56E-04	24 hr	EF	ADQ	31%
							Propoxytrimethylsilane	1825-63-4	1.21E-04	24 hr	EF	ADQ	31%
							Isopropoxytrimethylsilane	1825-64-5	1.39E-04	24 hr	EF	ADQ	31%
							Butoxytrimethylsilane	1825-65-6	6.92E-05	24 hr	EF	ADQ	31%
							1-methylbutoxytrimethylsilane	1825-67-8	1.48E-04	24 hr	EF	ADQ	31%
Siloxane Flare	Enclosed Siloxane/LFG Flare	1.23	871	0.77	9.17	-	Trimethylsilanol	1066-40-6	7.04E-03	24 hr	EF	ADQ	27%
							Trimethylsilyl Fluoride	420-56-4	3.65E-04	24 hr	EF	ADQ	27%
							Methoxytrimethylsilane	1825-61-2	2.35E-04	24 hr	EF	ADQ	27%
							Ethoxytrimethylsilane	1825-62-3	1.36E-04	24 hr	EF	ADQ	27%
							Propoxytrimethylsilane	1825-63-4	1.06E-04	24 hr	EF	ADQ	27%
							Isopropoxytrimethylsilane	1825-64-5	1.21E-04	24 hr	EF	ADQ	27%
							Butoxytrimethylsilane	1825-65-6	6.02E-05	24 hr	EF	ADQ	27%
							1-methylbutoxytrimethylsilane	1825-67-8	1.28E-04	24 hr	EF	ADQ	27%
BF1 to BF3	Biofilter - Exhaust from composting facility (Cells 1 to 3)	N/A	N/A	N/A	N/A	N/A	odour	N/A	9.05E+02	10 min	EC	MDQ	1%
Curing	Compost Curing Windrows (Windrows 1 to 12)	N/A	N/A	N/A	N/A	N/A	odour	N/A	3.99E+04 (Max season)	10 min	EC	MDQ	48%
LFYD_1 to LFYD_6	Leaf & Yard Waste Stockpiles (Stockpiles 1 to 6)	N/A	N/A	N/A	N/A	N/A	odour	N/A	1.36E+04 (Max season)	10 min	EC	MDQ	16%

Table A2. Source Summary Table

Source ID	Source Description	Source Data (per each unit)					Contaminant	CAS Number	Emission Rate [g/s] (or ou/s for Odour)	Avg. Period [hr]	Emis. Est. Tech.[1]	Data Qual.[2]	% of Overall Emissions [%]
		Flow Rate [m^3/s]	Exit Gas Temp. [°C]	Inner Dia. [m]	Height Above Grade [m]	Height Above Roof [m]							
STG1 to STG4	Landfill surface - Stages 1 to 4 - Aggregate fugitive emissions from all four stages	N/A	N/A	N/A	N/A	N/A	Carbon Monoxide	630-08-0	1.73E-02	1/2 hr	EF	MDQ	0%
							1,1,2,2-Tetrachloroethane	79-34-5	2.28E-03	24 hr	EF	MDQ	96%
							1,1,2-Trichloroethane	79-00-5	5.35E-04	24 hr	EF	MDQ	96%
							1,2-Dichloroethane (Ethylene dichloride)	107-06-2	3.99E-04	24 hr	EF	ADQ	96%
							1,2-Dichloroethene	540-59-0	2.80E-02	24 hr	EF	MDQ	96%
							1,3-Butadiene (Vinyl ethylene)	106-99-0	2.28E-04	Annual	EF	MDQ	96%
							2-Ethyltoluene	611-14-3	9.85E-04	24 hr	EF	MDQ	96%
							Acetaldehyde	75-07-0	8.65E-05	24 hr, 1/2 hr	EF	MDQ	96%
							Benzene	71-43-2	4.75E-03	Annual	EF	ADQ	96%
							Benzyl chloride	100-44-7	5.81E-05	24 hr	EF	ADQ	96%
							cis-2-Pentene	627-20-3	8.52E-05	24 hr	EF	MDQ	96%
							Dibromochloromethane	124-48-1	7.98E-05	24 hr	EF	MDQ	96%
							Dimethyl sulfide	75-18-3	8.92E-03	10 min	EF	ADQ	96%
							Formaldehyde	50-00-0	8.91E-06	24 hr	EF	MDQ	96%
							Hydrogen sulfide	7783-06-4	2.77E-02	24 hr, 10 min	EF	ADQ	96%
							Isoprene (2-Methyl-1,3-butadiene)	78-79-5	2.85E-05	24 hr	EF	MDQ	96%
							Naphthalene	91-20-3	3.48E-04	24 hr, 10 min	EF	MDQ	96%
							p-Cymene (1-Methyl-4-lsopropylbenzene)	99-87-6	1.22E-02	24 hr	EF	MDQ	96%
							Trichloroethylene (Trichloroethene)	79-01-6	2.76E-03	24 hr	EF	ADQ	96%
							Trichloromethane (Chloroform)	67-66-3	2.14E-04	24 hr	EF	ADQ	96%
							Vinyl chloride (Chloroethene)	75-01-4	2.25E-03	24 hr	EF	ADQ	96%
							Total Reduced Sulphur Compounds	NA	4.20E-02	24 hr, 10 min	MB	MDQ	96%
							1-Methylcyclohexene	591-49-1	5.54E-05	24 hr	EF	MDQ	96%
							1-Propanethiol (n-Propyl mercaptan)	107-03-9	2.41E-04	24 hr	EF	MDQ	96%
							2,4-Dimethylhexane	589-43-5	6.43E-04	24 hr	EF	MDQ	96%
							2,5-Dimethylhexane	592-13-2	4.81E-04	24 hr	EF	MDQ	96%
							2-Ethyl-1-butene	760-21-4	3.78E-05	24 hr	EF	MDQ	96%
							2-Methyl-1-propanethiol (Isobutyl mercaptan)	513-44-0	3.89E-04	24 hr	EF	MDQ	96%
							2-Methyl-2-propanethiol (tert- Butylmercaptan)	513-35-9	7.43E-04	24 hr	EF	MDQ	96%
							3,6-Dimethyloctane	15869-94-0	2.83E-03	24 hr	EF	MDQ	96%
							cis-1,4-Dimethylcyclohexane	624-29-3	7.06E-04	24 hr	EF	MDQ	96%
							cis-1,4-Dimethylcyclohexane/trans1,3-Dimethylcyclohe	2207036	7.06E-04	24 hr	EF	MDQ	96%
							cis-2-Heptene	6443-92-1	6.10E-05	24 hr	EF	MDQ	96%
							cis-2-Octene	2097322	6.26E-04	24 hr	EF	MDQ	96%
							cis-3-Methyl-2-pentene	922-62-3	3.82E-05	24 hr	EF	MDQ	96%
							Ethyl mercaptan (Ethanediol)	75-08-01	3.12E-04	24 hr	EF	ADQ	96%
							Isopropyl mercaptan	75-33-2	3.38E-04	24 hr	EF	ADQ	96%
							Methanethiol (Methyl mercaptan)	74-93-1	1.67E-03	24 hr	EF	ADQ	96%
							trans-1,2-Dimethylcyclohexane	6876-23-9	1.15E-03	24 hr	EF	MDQ	96%
							trans-1,4-Dimethylcyclohexane	2207047	5.83E-04	24 hr	EF	MDQ	96%
							trans-2-Octene	13389-42-9	6.86E-04	24 hr	EF	MDQ	96%
							trans-3-Methyl-2-pentene	616-12-6	3.31E-05	24 hr	EF	MDQ	96%
							Trichlorofluoromethane (Freon 11)	91315-61-6	8.64E-04	24 hr	EF	MDQ	96%
							Trimethylsilanol	1066-40-6	6.53E-03	24 hr	EF	ADQ	25%
							Trimethylsilyl Fluoride	420-56-4	3.39E-04	24 hr	EF	ADQ	25%
							Methoxytrimethylsilane	1825-61-2	2.18E-04	24 hr	EF	ADQ	25%
							Ethoxytrimethylsilane	1825-62-3	1.26E-04	24 hr	EF	ADQ	25%
							Propoxytrimethylsilane	1825-63-4	9.80E-05	24 hr	EF	ADQ	25%
							Isopropoxytrimethylsilane	1825-64-5	1.12E-04	24 hr	EF	ADQ	25%
							Butoxytrimethylsilane	1825-65-6	5.59E-05	24 hr	EF	ADQ	25%
							1-methylbutoxytrimethylsilane	1825-67-8	1.19E-04	24 hr	EF	ADQ	25%
							odour	N/A	6.21E+03	10 min	EC	MDQ	7%

Table A2. Source Summary Table

Source ID	Source Description	Source Data (per each unit)					Contaminant	CAS Number	Emission Rate [g/s] (or ou/s for Odour)	Avg. Period [hr]	Emis. Est. Tech.[1]	Data Qual.[2]	% of Overall Emissions [%]
		Flow Rate [m^3/s]	Exit Gas Temp. [°C]	Inner Dia. [m]	Height Above Grade [m]	Height Above Roof [m]							
Paved_Road	Truck traffic on paved roads on site	N/A	N/A	N/A	N/A	N/A	Nitrogen Oxides	10102-44-0	5.24E-02	1 hr	EF	ADQ	2.5%
							Suspended particulate matter	N/A	3.80E+00	1 hr	EF	ADQ	37.14%
							Particulate matter (< 10 µm dia.)	N/A	7.64E-01	1 hr	EF	ADQ	23.49%
							Particulate matter (< 2.5 µm dia.)	N/A	1.89E-01	1 hr	EF	ADQ	16.65%
							Carbon Monoxide	630-08-0	1.64E-02	1/2 hr	EF	ADQ	0.1%
Unpaved_Road	Truck traffic on unpaved roads on site	N/A	N/A	N/A	N/A	N/A	Nitrogen Oxides	10102-44-0	4.60E-03	1 hr	EF	ADQ	0.2%
							Suspended particulate matter	N/A	1.06E+00	1 hr	EF	ADQ	10%
							Particulate matter (< 10 µm dia.)	N/A	2.71E-01	1 hr	EF	ADQ	8%
							Particulate matter (< 2.5 µm dia.)	N/A	2.73E-02	1 hr	EF	ADQ	2%
							Carbon Monoxide	630-08-0	1.44E-03	1/2 hr	EF	ADQ	0.0%
Working Face	Landfill working face activities and nearby construction activities	N/A	N/A	N/A	N/A	N/A	Nitrogen Oxides	10102-44-0	1.54E-01	1 hr	EF	ADQ	7%
							Suspended particulate matter	N/A	1.43E+00	1 hr	EF	ADQ	14.0%
							Particulate matter (< 10 µm dia.)	N/A	1.06E+00	1 hr	EF	ADQ	32.6%
							Particulate matter (< 2.5 µm dia.)	N/A	1.51E-01	1 hr	EF	ADQ	13.4%
							Carbon Monoxide	630-08-0	1.35E+00	1/2 hr	EF	ADQ	10.6%
							odour	N/A	2.25E+04	10 min	EC	MDQ	27%
Compost_NRoad	Mobile Equipment at Compost Facility	N/A	N/A	N/A	N/A	N/A	Nitrogen Oxides	10102-44-0	2.06E-01	1 hr	EF	ADQ	9.9%
							Suspended particulate matter	N/A	1.03E-02	1 hr	EF	ADQ	0.1%
							Particulate matter (< 10 µm dia.)	N/A	1.03E-02	1 hr	EF	ADQ	0.3%
							Particulate matter (< 2.5 µm dia.)	N/A	5.00E-03	1 hr	EF	ADQ	0.4%
							Carbon Monoxide	630-08-0	1.79E+00	1/2 hr	EF	ADQ	14%
Farm	Sod Farm	N/A	N/A	N/A	N/A	N/A	Suspended particulate matter	N/A	3.53E+00	24 hr	EF	ADQ	34%
							Particulate matter (< 10 µm dia.)	N/A	7.41E-01	24 hr	EF	ADQ	23%
							Particulate matter (< 2.5 µm dia.)	N/A	3.53E-01	24 hr	EF	ADQ	31%

Note:

[1]Emission Estimating Technique: "V-ST" - Validated Source Test, "ST" - Source Test, "EF" - Emission Factor, "MB" - Mass Balance, "EC" - Engineering Calculation

[2]Emissions Data Quality: "HDQ" - Highest; "AADQ" - Above Average; "ADQ" - Average; and "MDQ" - Marginal

[3]Landfill Gas profiles were obtained from AP 42. The amount of total reduced sulfur was calculated per procedure described in O. Reg. 516/07.

Table A3. Emission Summary Table

Contaminant	CAS Number	Total Facility Emission Rate [g/s]	Dispersion Model Used	Max. POI Conc. [µg/m³]	Max. at Sensitive Receptor [µg/m³]	MECP Limit					Percent of POI Limit [%]	Percent of Limit at Receptor [%]
						Avg. Period [hr]	Limit µg/m³	Limiting Effect	ACB Source[1]	Category[2]		
Nitrogen Oxides (as NO_2)	10102-44-0	2.1	AERMOD	45	6.9	24 hr	200	Health	Standard	B1	23%	3%
				151	33.9	1 hr	400	Health	Standard	B1	38%	8%
Nitrogen Dioxide	10102-44-0	2.1	AERMOD	45	6.9	24 hr	200	Health	AAQC	n/a	23%	3%
				151	33.9	1 hr	400	Health	AAQC	n/a	38%	8%
				91.1	24.1	1-hr	113	n/a	CAAQS	n/a	81%	21%
				5.81	0.68	Annual	32	n/a	CAAQS	n/a	18%	2%
Suspended particulate matter	n/a	10.2	AERMOD	308	63	24 hr	120	Visibility	Standard	B1	257%	52%
Particulate matter (< 10 µm dia.)	n/a	3.3	AERMOD	65	20	24 hr	50	Health	AAQC	n/a	129%	41%
Particulate matter (< 2.5 µm dia.)	n/a	1.1	AERMOD	10.4	3.4	24 hr	27	Health	AAQC	n/a	39%	13%
				2.63	0.92	annual	8.8	Health	AAQC	n/a	30%	10%
Carbon Monoxide	630-08-0	12.7	AERMOD	1537	320	0.5 hr	6000	Health	Standard	B1	26%	5%
				1281	266	1 hr	36,200	Health	AAQC	n/a	4%	<1%
				715	149	8 hr	15,700	Health	AAQC	n/a	5%	<1%
Sulfur Dioxide	7446-09-5	0.2	AERMOD	7.80	2.59	10 min	178	Health	AAQC	n/a	4%	1%
				4.73	1.57	1 hr	100	Health & Veg.	Standard	B1	5%	2%
				0.295	0.030	annual	10	Health & Veg.	Standard	B1	3%	<1%
				4.63	1.35	1 hr	173	n/a	CAAQS	n/a	n/a	n/a
Hydrogen Chloride	7647-01-0	0.189	AERMOD	2.32	0.33	24 hr	20	Health	Standard	B1	12%	2%
Odour[3] (units: ou/s, or ou/m³)	n/a	83,091 (Max seasons)	AERMOD	n/a	1.47	10 min	1	---	Guideline	---	n/a	147%
LFG Contaminants												
LFG Unit Emission Run		1.0E+00	AERMOD	112.0	49.3	1 hr						
				49.9	9.69	24 hr						
				6.30	0.740	annual						
				185	81.4	10 min						
1,1,2,2-Tetrachloroethane	79-34-5	2.4E-03	AERMOD	0.118	0.023	24 hr	0.1	Health	SL-JSL	B2	118%	23%
1,1,2-Trichloroethane	79-00-5	5.6E-04	AERMOD	0.028	0.005	24 hr	0.3	Health	SL-JSL	B2	9%	2%
1,2-Dichloroethane (Ethylene dichloride)	107-06-2	4.1E-04	AERMOD	0.021	0.004	24 hr	2	Health	Standard	B1	1%	<1%
				0.003	0.000	Annual	0.4	Health	AAQC	n/a	<1%	<1%
1,2-Dichloroethene	540-59-0	2.9E-02	AERMOD	1.451	0.282	24 hr	105	Health	Guideline	B1	1%	<1%
1,3-Butadiene (Vinyl ethylene)	106-99-0	2.4E-04	AERMOD	0.001	0.0002	Annual	2	Health	Standard	B1	<1%	<1%
				0.012	0.002	24 hr	10	Health	AAQC	n/a	<1%	<1%
2-Ethyltoluene	611-14-3	1.0E-03	AERMOD	0.051	0.010	24 hr	0.5	Health	SL-JSL	B2	10%	2%
Acetaldehyde	75-07-0	9.0E-05	AERMOD	0.004	0.001	24 hr	500	Health	Standard	B1	<1%	<1%
				0.012	0.005	0.5 hr	500	Health	Standard	B1	<1%	<1%
Benzene	71-43-2	4.9E-03	AERMOD	0.031	0.004	Annual	0.45	Health	Standard	B1	7%	<1%
				0.246	0.048	24 hr	2.3	Health	AAQC	n/a	11%	2%
Benzyl chloride	100-44-7	6.0E-05	AERMOD	0.003	0.001	24 hr	0.1	Health	SL-JSL	B2	3%	<1%
cis-2-Pentene	627-20-3	8.8E-05	AERMOD	0.004	0.001	24 hr	0.5	Health	SL-JSL	B2	<1%	<1%
Dibromochloromethane	124-48-1	8.3E-05	AERMOD	0.004	0.001	24 hr	0.2	Health	SL-JSL	B2	2%	<1%
Formaldehyde	50-00-0	9.3E-06	AERMOD	0.000	0.0001	24 hr	65	Health	Standard	B1	<1%	<1%
Isoprene (2-Methyl-1,3-butadiene)	78-79-5	3.0E-05	AERMOD	0.001	0.0003	24 hr	0.1	Health	SL-JSL	B2	1%	<1%
Naphthalene	91-20-3	3.6E-04	AERMOD	0.018	0.004	24 hr	22.5	Health	Guideline	B1	<1%	<1%
					0.029	10 min	50	Odour	Guideline	B1	---	<1%
p-Cymene (1-Methyl-4-Isopropylbenzene)	99-87-6	1.3E-02	AERMOD	0.631	0.123	24 hr	50	Health	SL-JSL	B2	1%	<1%

Table A3. Emission Summary Table

Contaminant	CAS Number	Total Facility Emission Rate [g/s]	Dispersion Model Used	Max. POI Conc. [µg/m³]	Max. at Sensitive Receptor [µg/m³]	MECP Limit					Percent of POI Limit [%]	Percent of Limit at Receptor [%]
						Avg. Period [hr]	Limit µg/m³	Limiting Effect	ACB Source[1]	Category[2]		
Trichloroethylene (Trichloroethene)	79-01-6	2.9E-03	AERMOD	0.143	0.028	24 hr	12	Health	Standard	B1	1%	<1%
				0.018	0.0021	Annual	2.3	Health	AAQC	n/a	<1%	<1%
Trichloromethane (Chloroform)	67-66-3	2.2E-04	AERMOD	0.011	0.002	24 hr	1	Health	Standard	B1	1%	<1%
				0.001	0.0002	Annual	0.2	Health	AAQC	n/a	<1%	<1%
Vinyl chloride (Chloroethene)	75-01-4	2.3E-03	AERMOD	0.117	0.023	24 hr	1	Health	Standard	B1	12%	2%
				0.015	0.002	Annual	0.2	Health	AAQC	n/a	7%	<1%
Total Reduced Sulphur Compounds	NA	4.4E-02	AERMOD	2.176	0.423	24 hr	7	Health	Guideline	B1	31%	6%
					3.551	10 min	13	Odour	Guideline	B1	---	27%
1-Methylcyclohexene	591-49-1	5.7E-05	AERMOD	0.003	0.001	24 hr	0.1	de minimus	Table B-2A	n/a	3%	<1%
2,4-Dimethylhexane	589-43-5	6.7E-04	AERMOD	0.033	0.006	24 hr	0.1	de minimus	Table B-2A	n/a	33%	6%
2,5-Dimethylhexane	592-13-2	5.0E-04	AERMOD	0.025	0.005	24 hr	0.1	de minimus	Table B-2A	n/a	25%	5%
2-Ethyl-1-butene	760-21-4	3.9E-05	AERMOD	0.002	0.000	24 hr	0.1	de minimus	Table B-2A	n/a	2%	<1%
3,6-Dimethyloctane	15869-94-0	2.9E-03	AERMOD	0.147	0.029	24 hr	0.1	de minimus	Table B-2A	n/a	147%	29%
cis-1,4-Dimethylcyclohexane	624-29-3	7.3E-04	AERMOD	0.037	0.007	24 hr	0.1	de minimus	Table B-2A	n/a	37%	7%
cis-1,4-Dimethylcyclohexane/trans1,3-Dimethylcyclohexane	2207036	7.3E-04	AERMOD	0.037	0.007	24 hr	0.1	de minimus	Table B-2A	n/a	37%	7%
trans-1,4-Dimethylcyclohexane	2207047	6.1E-04	AERMOD	0.030	0.006	24 hr	0.1	de minimus	Table B-2A	n/a	30%	6%
cis-2-Heptene	6443-92-1	6.3E-05	AERMOD	0.003	0.001	24 hr	0.1	de minimus	Table B-2A	n/a	3%	<1%
cis-2-Octene	2097322	6.5E-04	AERMOD	0.032	0.006	24 hr	0.1	de minimus	Table B-2A	n/a	32%	6%
cis-3-Methyl-2-pentene	922-62-3	4.0E-05	AERMOD	0.002	0.000	24 hr	0.1	de minimus	Table B-2A	n/a	2%	<1%
Isopropyl mercaptan	75-33-2	3.5E-04	AERMOD	0.018	0.003	24 hr	0.1	de minimus	Table B-2A	n/a	18%	3%
trans-1,2-Dimethylcyclohexane	6876-23-9	1.2E-03	AERMOD	0.060	0.012	24 hr	0.1	de minimus	Table B-2A	n/a	60%	12%
trans-1,4-Dimethylcyclohexane	2207047	6.1E-04	AERMOD	0.030	0.006	24 hr	0.1	de minimus	Table B-2A	n/a	30%	6%
trans-2-Octene	13389-42-9	7.1E-04	AERMOD	0.036	0.007	24 hr	0.1	de minimus	Table B-2A	n/a	36%	7%
trans-3-Methyl-2-pentene	616-12-6	3.4E-05	AERMOD	0.002	0.000	24 hr	0.1	de minimus	Table B-2A	n/a	2%	<1%
Trichlorofluoromethane (Freon 11)	91315-61-6	9.0E-04	AERMOD	0.045	0.009	24 hr	0.1	de minimus	Table B-2A	n/a	45%	9%
Siloxanes												
Siloxanes Unit Emission Run		1.0E+00	AERMOD	13.0	2.73	24 hr						
Trimethylsilanol	1066-40-6	2.6E-02	AERMOD	0.340	0.071	24 hr	32.5	Health	SL-JSL	B2	1%	0%
Trimethylsilyl Fluoride	420-56-4	1.4E-03	AERMOD	0.018	0.004	24 hr	0.1	de minimus	Table B-2A	n/a	18%	4%
Methoxytrimethylsilane	1825-61-2	8.7E-04	AERMOD	0.011	0.002	24 hr	0.1	de minimus	Table B-2A	n/a	11%	2%
Ethoxytrimethylsilane	1825-62-3	5.0E-04	AERMOD	0.007	0.001	24 hr	0.1	de minimus	Table B-2A	n/a	7%	1%
Propoxytrimethylsilane	1825-63-4	3.9E-04	AERMOD	0.005	0.001	24 hr	0.1	de minimus	Table B-2A	n/a	5%	1%
Isopropoxytrimethylsilane	1825-64-5	4.5E-04	AERMOD	0.006	0.001	24 hr	0.1	de minimus	Table B-2A	n/a	6%	1%
Butoxytrimethylsilane	1825-65-6	2.2E-04	AERMOD	0.003	0.001	24 hr	0.1	de minimus	Table B-2A	n/a	3%	1%
1-methylbutoxytrimethylsilane	1825-67-8	4.8E-04	AERMOD	0.006	0.001	24 hr	0.1	de minimus	Table B-2A	n/a	6%	1%

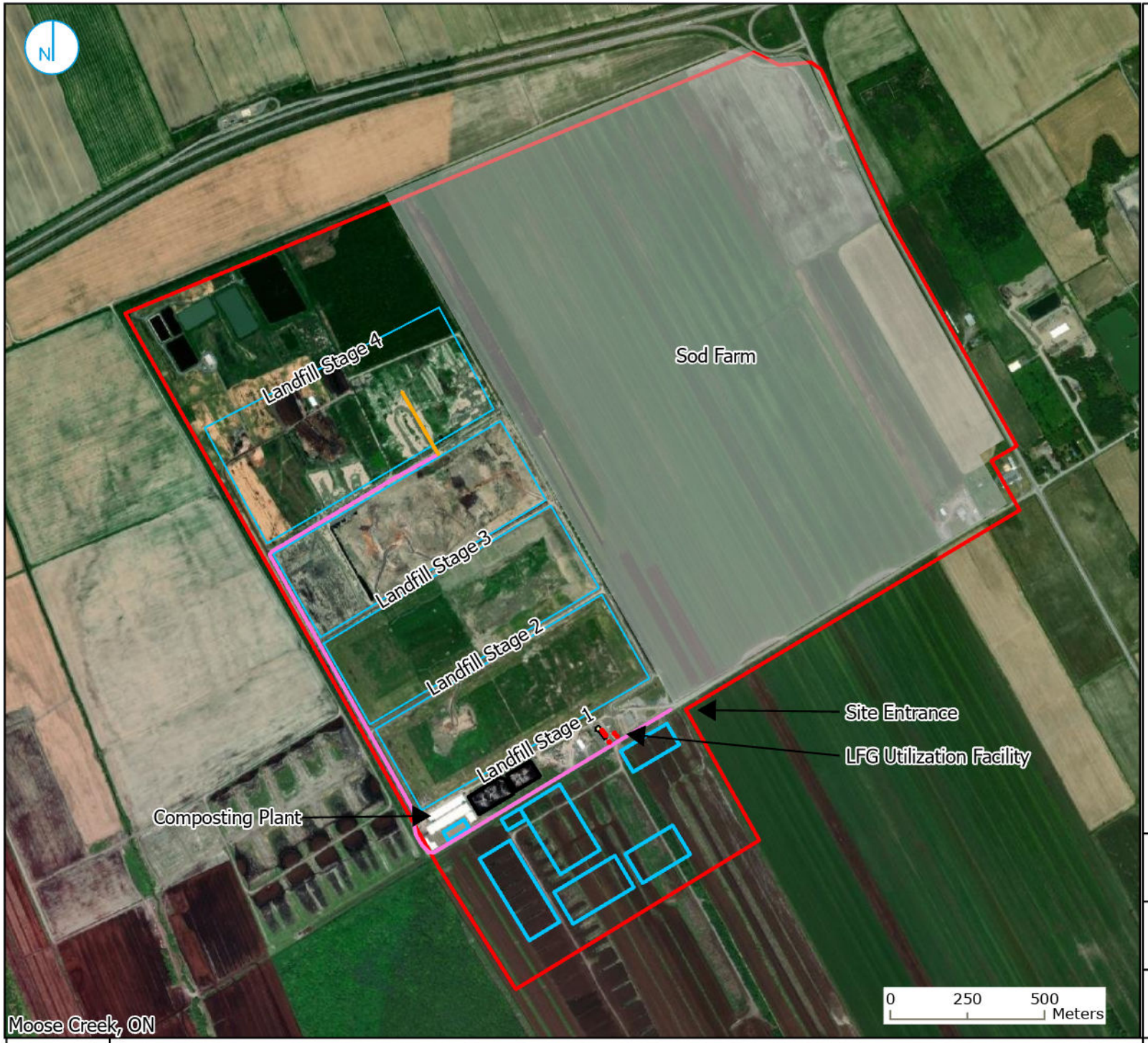
Note:

[1] ACB Source: "S" - Standard (for Section 20), "G" - Guideline (for Section 20), "SL-JSL" - Screening Level (SL) set by the MECP based on a review of toxicity information and/or other jurisdictional levels (JSL)

[2] Category: "B1" - Benchmark 1 , "B2" - Benchmark 2.

[3] The 1-hr air dispersion modelling output units were adjusted in AERMOD to reflect the expected peak 10-min average values using the MECP recommended standard conversion factor of 1.65

APPENDIX B: FIGURES



Legend

- Facility Boundary
- Designated Activity Areas

Roads

- Paved
- Unpaved

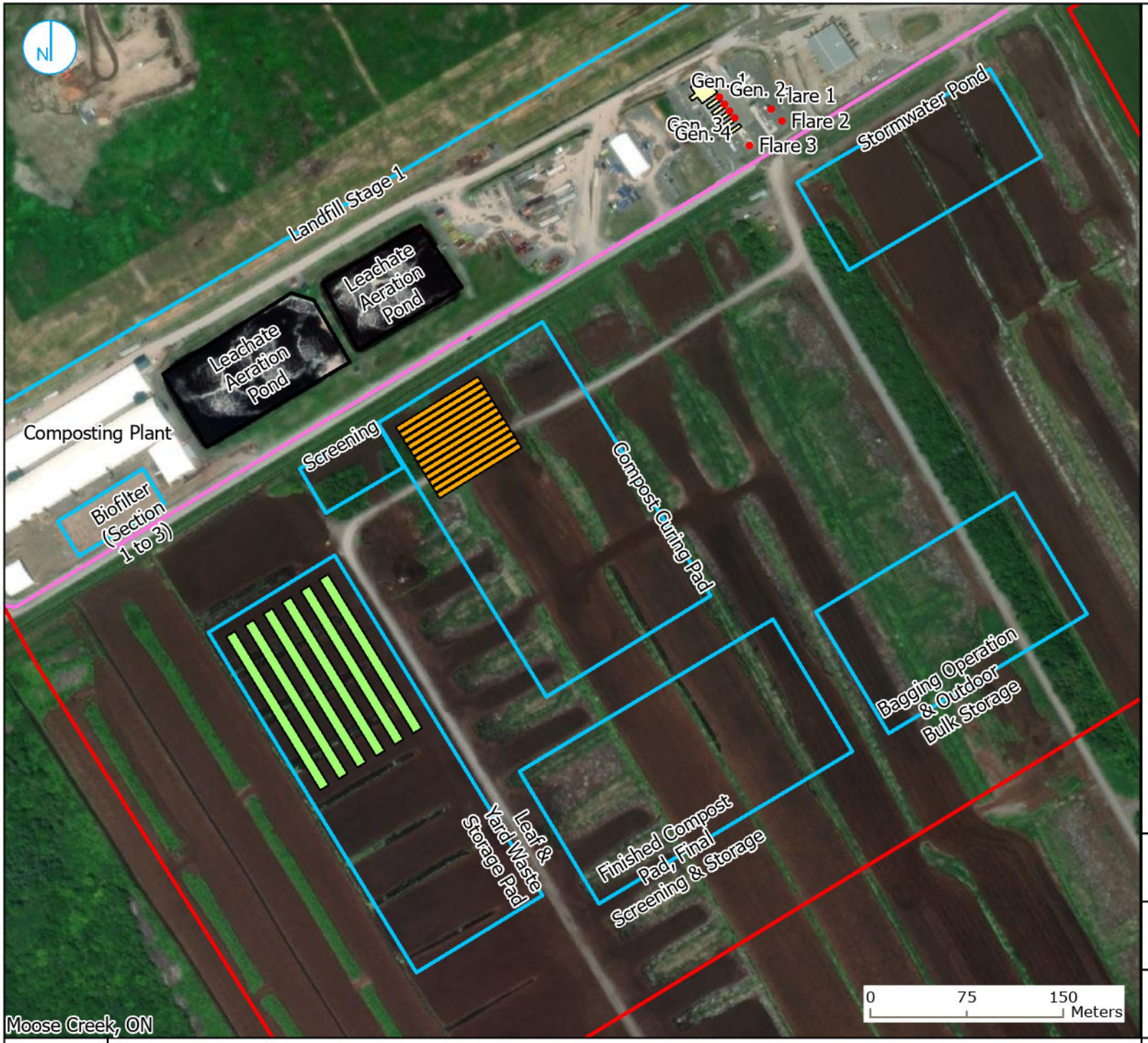
- Buildings
- Leachate Aeration Ponds
- Sod Farm

Project No.: 324000731

Map Created: 02/06/2023

RAMBOLL

Figure B1	Site Plan GFL (Moose Creek, ON Facility)	2400 Meadowpine Blvd, Suite 100 Mississauga, ON, Canada



Legend

- Facility Boundary
- Compost Curing Windrows (Windrows 1 to 12)
- Leaf & Yard Waste Stockpiles (Stockpiles 1 to 6)
- Paved Road
- Leachate Aeration Ponds
- Buildings

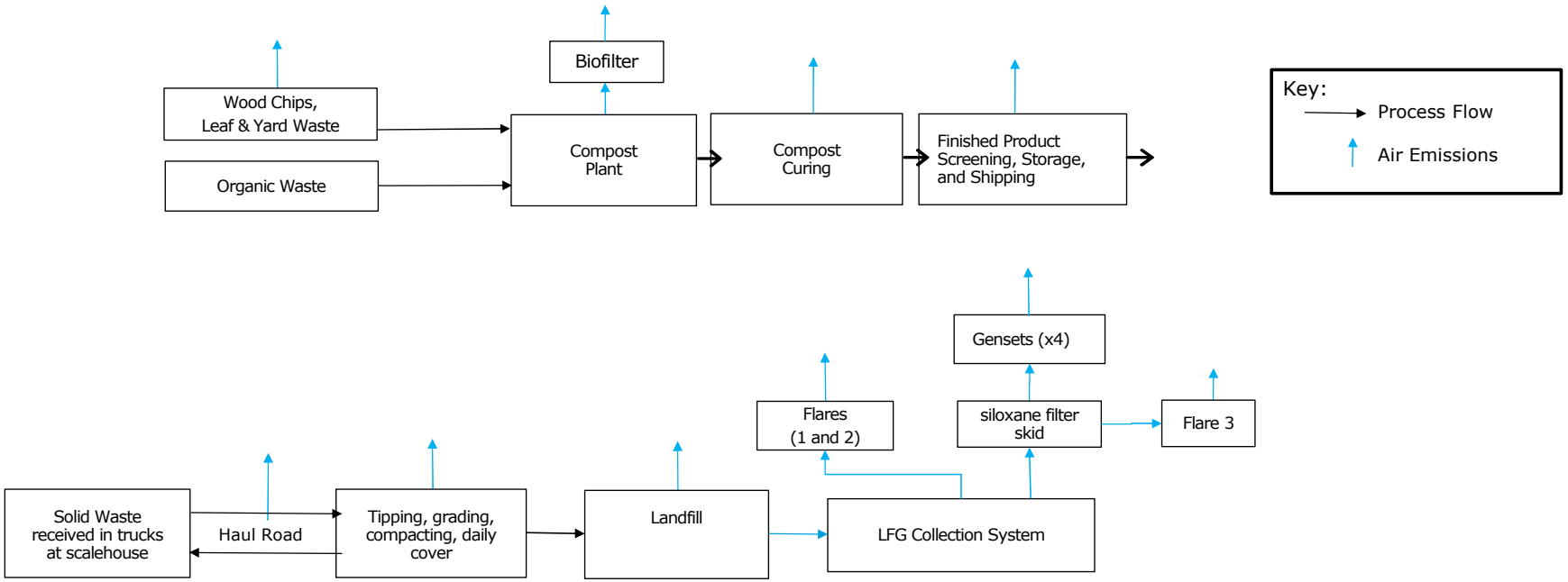
Project No.: 324000731

Map Created: 02/06/2023

RAMBOLL

Figure B2	Site Plan - South End - GFL (Moose Creek, ON Facility)	2400 Meadowpine Blvd, Suite 100 Mississauga, ON, Canada

Figure B3: Process Flow Diagram



APPENDIX C:
NEGLIGIBLE SOURCES AND CONTAMINANTS

Table C1. Insignificant Sources

Negligible Sources

Source	Contaminants	Rational
Maintenance Welding Station	Weld Fume	as per Table B-3B of MECP Procedure Document
Landfill leachate aeration ponds, treatment facility, and storage ponds	Odour, other contaminants	Negligible compared to aggregate emissions
Finished compost screening, stockpiling, and bagging	Odour	Negligible compared to aggregate emissions

Sources that are Negligible Compared to Total Emissions

Source	Contaminants	Rational
Engines (Gen1 to Gen4)	Siloxanes, LFG	<5% of aggregate emission
Siloxane flare (Flare 3)	LFG, Products of combustion	<5% of aggregate emission
Compost material handling	Particulate matter	Negligible compared to aggregate emissions
Farm Mobile Equipment	Products of Combustion	Negligible compared to aggregate emissions

Natural gas fired comfort heating equipment with a total facility-wide heat input usage of less than 20 million KJ/hr

Units	KJ/hr	number of units	Total heat input (KJ/hr)
boiler	1319000	1	1,319,000
HVAC	475000	1	475,000
		Total	**1,794,000**

Table C2. Insignificant Sources

Negligible Contaminants as per Section B-1 of MECP Procedure Document

The product of a conservative dispersion modelling factor (in micrograms per cubic metre per gram per second emission) and the aggregate facility-wide emission rate of a contaminant (using the appropriate averaging period) can be compared to the corresponding ministry POI Limit as a means to conservatively but simply assess POI concentrations as appropriate. As per section 7.2 of the document, the contaminants with less than 50% of the MECP limit were deemed negligible and excluded from the modeling.

Distance from Source (m)	Rural Dispersion Factor (µg/m³ per g/s)
250	2300

Source: Table B-1, Procedure for Preparing an ESDM Report

Averaging Period	1 hr	10 min	1/2 hr	24 hr	Annual
Rural Dispersion Factor (µg/m³ per g/s)	2300	3795	2760	920	184

a) Contaminants with MECP Limits

Contaminant	CAS. NO	Total Emission Rate (g/s)	Rural Dispersion Factor (µg/m³ / g/s)	Estimated Screening Conc. (µg/m³)	MECP Limit	Avg. Period	% of Limit	Insignificant ?
1,1,1-Trichloroethane	71556	8.33E-04	920	7.67E-01	115000	24 hr	0%	Insignificant
1,1,2,2-Tetrachloroethane	79345	2.31E-03	920	2.12E+00	0.1	24 hr	4248%	Significant
1,1,2,3,4,4-Hexachloro-1,3-butadiene (Hexachlorobutadiene)	87683	2.34E-05	920	2.15E-02	0.225	24 hr	19%	Insignificant
1,1,2-Trichloro-1,2,2-Trifluoroethane	76131	3.24E-04	920	2.98E-01	800000	24 hr	0%	Insignificant
1,1,2-Trichloroethane	79005	5.42E-04	920	4.99E-01	0.3	24 hr	332%	Significant
1,1-Dichloroethane	75343	5.29E-03	920	4.87E+00	165	24 hr	6%	Insignificant
1,1-Dichloroethene (1,1- Dichloroethylene)	75354	3.99E-04	920	3.67E-01	10	24 hr	7%	Insignificant
1,2,3-Trimethylbenzene	526738	1.11E-03	920	1.02E+00	220	24 hr	1%	Insignificant
1,2,4-Trichlorobenzene	120821	2.57E-05	920	2.36E-02	400	24 hr	0%	Insignificant
1,2,4-Trimethylbenzene	95636	4.23E-03	920	3.89E+00	220	24 hr	4%	Insignificant
1,2-Dibromoethane (Ethylene dibromide)	106934	2.32E-05	920	2.13E-02	3	24 hr	1%	Insignificant
1,2-Dichloro-1,1,2,2- tetrafluoroethane (Freon 114)	76142	4.66E-04	920	4.29E-01	700000	24 hr	0%	Insignificant
1,2-Dichloroethane (Ethylene dichloride)	107062	4.05E-04	920	3.72E-01	2	24 hr	37%	Insignificant
1,2-Dichloroethene	540590	2.84E-02	920	2.61E+01	105	24 hr	50%	Insignificant
1,2-Dichloropropane	78875	1.51E-04	920	1.39E-01	2400	24 hr	0%	Insignificant
1,2-Diethylbenzene	135013	6.87E-05	920	6.32E-02	125	24 hr	0%	Insignificant
1,3,5-Trimethylbenzene	108678	1.93E-03	920	1.77E+00	220	24 hr	2%	Insignificant
1,3-Butadiene (Vinyl ethylene)	106990	2.31E-04	184	4.25E-02	2	Annual	4%	Insignificant
1,3-Diethylbenzene	141935	2.26E-04	920	2.08E-01	125	24 hr	0%	Insignificant
1,4-Diethylbenzene	105055	9.04E-04	920	8.32E-01	125	24 hr	1%	Insignificant
1,4-Dioxane (1,4-Diethylene dioxide)	123911	1.88E-05	920	1.73E-02	3500	24 hr	0%	Insignificant
1-Butene	106989	3.35E-03	920	3.08E+00	7000	24 hr	0%	Insignificant
2-Methylbutene	513359	2.75E-03	920	2.53E+00	530	24 hr	1%	Insignificant
1-Butene	106989	3.35E-03	920	3.08E+00	7000	24 hr	0%	Insignificant
2-Methylpropene	115117	1.59E-03	920	1.46E+00	7000	24 hr	0%	Insignificant
1-Ethyl-4-methylbenzene (4-Ethyl toluene)	622968	3.06E-03	920	2.81E+00	625	24 hr	1%	Insignificant
1-Heptene	592767	1.58E-03	920	1.45E+00	120	24 hr	2%	Insignificant
1-Hexene	592416	1.92E-04	920	1.77E-01	850	24 hr	0%	Insignificant
2-Methyl-1-pentene	763291	1.92E-04	920	1.77E-01	85	24 hr	0%	Insignificant
1-Methylcyclopentene	693890	5.32E-05	920	4.90E-02	405	24 hr	0%	Insignificant
1-Pentene	109671	3.97E-04	920	3.65E-01	2050	24 hr	0%	Insignificant
2,2,3-Trimethylbutane	464062	2.37E-05	920	2.18E-02	175	24 hr	0%	Insignificant
2,2,4-Trimethylpentane	540841	1.80E-03	920	1.66E+00	1750	24 hr	0%	Insignificant
2,2,5-Trimethylhexane	3522949	5.14E-04	920	4.73E-01	175	24 hr	1%	Insignificant
2,2-Dimethylbutane	75832	3.46E-04	920	3.18E-01	1750	24 hr	0%	Insignificant
2,2-Dimethylpentane	590352	1.57E-04	920	1.44E-01	175	24 hr	0%	Insignificant
2,2-Dimethylpropane	463821	5.08E-05	920	4.68E-02	35500	24 hr	0%	Insignificant
2,3,4-Trimethylpentane	565753	9.16E-04	920	8.43E-01	175	24 hr	1%	Insignificant
2,3-Dimethylbutane	79298	3.70E-04	920	3.40E-01	1750	24 hr	0%	Insignificant
2,3-Dimethylpentane	565593	7.99E-04	920	7.35E-01	1750	24 hr	0%	Insignificant
2,4-Dimethylpentane	108087	2.58E-04	920	2.37E-01	1750	24 hr	0%	Insignificant
2,5-Dimethylthiophene	638028	1.86E-04	920	1.71E-01	5	24 hr	7%	Insignificant

Table C2. Insignificant Sources

2-Butanone (Methyl ethyl ketone)	78933	7.43E-03	920	6.84E+00	1000	24 hr	1%	Insignificant
2-Ethylthiophene	872559	1.81E-04	920	1.67E-01	5	24 hr	7%	Insignificant
2-Ethyltoluene	611143	9.98E-04	920	9.18E-01	0.5	24 hr	367%	Significant
2-Hexanone (Methyl butyl ketone)	591786	1.58E-03	920	1.45E+00	150	24 hr	2%	Insignificant
2-Methyl-1-butene	563462	3.23E-04	920	2.97E-01	300	24 hr	0%	Insignificant
2-Methyl-2-butene	513359	2.75E-03	920	2.53E+00	530	24 hr	1%	Insignificant
2-Methylbutane	78784	4.19E-03	920	3.86E+00	35500	24 hr	0%	Insignificant
2-Methylheptane	592278	2.10E-03	920	1.93E+00	175	24 hr	2%	Insignificant
2-Methylhexane	591764	2.10E-03	920	1.93E+00	1535	24 hr	0%	Insignificant
2-Methylpentane	107835	1.52E-03	920	1.40E+00	1750	24 hr	0%	Insignificant
2-Propanol (Isopropyl alcohol)	67630	2.78E-03	920	2.56E+00	7300	24 hr	0%	Insignificant
3-Ethyltoluene	620144	2.41E-03	920	2.22E+00	62.5	24 hr	7%	Insignificant
3-Methylheptane	589811	2.24E-03	920	2.06E+00	175	24 hr	2%	Insignificant
3-Methylhexane	589344	2.91E-03	920	2.68E+00	1535	24 hr	0%	Insignificant
3-Methylpentane	96140	1.64E-03	920	1.51E+00	1750	24 hr	0%	Insignificant
3-Methylthiophene	616444	2.33E-04	920	2.15E-01	5	24 hr	9%	Insignificant
4-Methyl-1-pentene	691372	5.04E-05	920	4.64E-02	85	24 hr	0%	Insignificant
4-Methyl-2-pentanone (MIBK)	108101	2.27E-03	920	2.09E+00	1200	24 hr	0%	Insignificant
4-Methylheptane	589537	7.31E-04	920	6.73E-01	175	24 hr	1%	Insignificant
Acetaldehyde	75070	8.77E-05	920	8.06E-02	500	24 hr	0%	Insignificant
Acetaldehyde	75070	8.77E-05	2,760	8.06E-02	500	1/2 hr	0%	Insignificant
Acetone	67641	1.00E-02	920	9.20E+00	11880	24 hr	0%	Insignificant
Acetonitrile	75058	5.87E-04	920	5.40E-01	70	24 hr	2%	Insignificant
Benzene	71432	4.82E-03	184	8.87E-01	0.45	Annual	394%	Significant
Benzyl chloride	100447	5.89E-05	920	5.42E-02	0.1	24 hr	108%	Significant
Bromodichloromethane	75274	3.70E-05	920	3.40E-02	350	24 hr	0%	Insignificant
Bromomethane (Methyl bromide)	74839	5.13E-05	920	4.72E-02	1350	24 hr	0%	Insignificant
Butane	106978	9.29E-03	920	8.55E+00	3600	24 hr	0%	Insignificant
Carbon disulfide	75150	2.88E-04	920	2.65E-01	330	24 hr	0%	Insignificant
Carbon monoxide	630080	1.76E-02	2,760	4.85E+01	6000	1/2 hr	2%	Insignificant
Carbon tetrachloride	56235	3.16E-05	920	2.90E-02	2.4	24 hr	2%	Insignificant
Carbon tetrafluoride (Freon 14)	75730	3.42E-04	920	3.14E-01	900	24 hr	0%	Insignificant
Carbonyl sulfide (Carbon oxysulfide)	463581	1.88E-04	920	1.73E-01	13	24 hr	3%	Insignificant
Chlorobenzene	108907	1.40E-03	2,300	3.22E+00	3500	1 hr	0%	Insignificant
Chlorobenzene	108907	1.40E-03	3,795	3.22E+00	4500	10 min	0%	Insignificant
Chlorodifluoromethane (Freon 22)	75456	1.77E-03	920	1.63E+00	350000	24 hr	0%	Insignificant
Chloroethane (Ethyl chloride)	75003	6.55E-03	920	6.03E+00	5600	24 hr	0%	Insignificant
Chloromethane (Methyl chloride)	74873	3.17E-04	920	2.91E-01	320	24 hr	0%	Insignificant
cis-1,2-Dichloroethene	156592	3.09E-03	920	2.84E+00	105	24 hr	5%	Insignificant
cis-1,2-Dimethylcyclohexane	2207014	2.34E-04	920	2.15E-01	175	24 hr	0%	Insignificant
cis-1,3-Dichloropropene	10061015	8.64E-06	920	7.95E-03	2.25	24 hr	1%	Insignificant
cis-1,3-Dimethylcyclohexane	638040	1.45E-03	920	1.33E+00	175	24 hr	2%	Insignificant
cis-2-Butene	590181	1.51E-04	920	1.39E-01	2400	24 hr	0%	Insignificant
cis-2-Hexene	7688213	3.72E-05	920	3.42E-02	85	24 hr	0%	Insignificant
cis-2-Pentene	627203	8.64E-05	920	7.95E-02	0.5	24 hr	32%	Insignificant
Cyclohexane	110827	2.19E-03	920	2.01E+00	6100	24 hr	0%	Insignificant
Cyclohexene	110838	3.89E-05	920	3.57E-02	5000	24 hr	0%	Insignificant
Cyclopentane	287923	3.98E-05	920	3.67E-02	1700	24 hr	0%	Insignificant
Cyclopentene	142290	2.12E-05	920	1.95E-02	25	24 hr	0%	Insignificant
Decane	124185	1.39E-02	920	1.28E+01	60000	24 hr	0%	Insignificant
Dibromochloromethane	124481	8.09E-05	920	7.44E-02	0.2	24 hr	74%	Significant
Dibromomethane (Methylene dibromide)	74953	3.73E-06	920	3.43E-03	66	24 hr	0%	Insignificant
Dichlorobenzene	106467	3.55E-03	920	3.27E+00	95	24 hr	7%	Insignificant
Dichlorodifluoromethane (Freon 12)	75718	3.67E-03	920	3.37E+00	500000	24 hr	0%	Insignificant
Dichloromethane (Methylene chloride)	75092	1.34E-02	920	1.24E+01	220	24 hr	11%	Insignificant
Diethyl sulfide	352932	2.00E-04	920	1.84E-01	7	24 hr	5%	Insignificant
Dimethyl disulfide	624920	3.32E-04	3,795	1.26E+00	56	10 min	4%	Insignificant
Dimethyl sulfide	75183	9.04E-03	3,795	3.43E+01	30	10 min	229%	Significant
Dodecane (n-Dodecane)	112403	9.68E-04	920	8.90E-01	175	24 hr	1%	Insignificant
Ethane	74840	7.00E-03	920	6.44E+00	14500	24 hr	0%	Insignificant
Ethanol	64175	2.72E-04	920	2.51E-01	19000	24 hr	0%	Insignificant
Ethyl acetate	141786	4.26E-03	920	3.92E+00	19000	24 hr	0%	Insignificant
Ethyl methyl sulfide	624895	7.19E-05	920	6.61E-02	7	24 hr	2%	Insignificant
Ethylbenzene	100414	1.33E-02	3,795	5.03E+01	19000	10 min	1%	Insignificant
Formaldehyde	50000	9.03E-06	920	8.31E-03	65	24 hr	0%	Insignificant
Heptane	142825	3.45E-03	920	3.18E+00	11000	24 hr	0%	Insignificant
Hexane	110543	6.87E-03	920	6.32E+00	7500	24 hr	0%	Insignificant
Hydrogen sulfide	7783064	2.24E-01	920	2.06E+02	7	24 hr	5878%	Significant

Table C2. Insignificant Sources

Hydrogen sulfide	7783064	2.17E-01	3,795	2.06E+02	13	10 min	3165%	Significant
Indane (2,3-Dihydroindene)	496117	5.84E-05	920	5.37E-02	24	24 hr	0%	Insignificant
Isobutane (2-Methylpropane)	75285	1.22E-02	920	1.12E+01	3600	24 hr	1%	Insignificant
Isobutylbenzene	538932	1.40E-04	920	1.29E-01	62.5	24 hr	0%	Insignificant
Isoprene (2-Methyl-1,3-butadiene)	78795	2.89E-05	920	2.66E-02	0.1	24 hr	53%	Significant
Isopropylbenzene (Cumene)	98828	1.33E-03	920	1.22E+00	400	24 hr	1%	Insignificant
Mercury (total)	7439976	1.05E-06	920	9.63E-04	0.5	24 hr	0%	Insignificant
Mercury (elemental)	7439976	1.05E-06	920	9.63E-04	0.5	24 hr	0%	Insignificant
Methyl tert-butyl ether (MTBE)	1634044	2.67E-04	920	2.46E-01	7000	24 hr	0%	Insignificant
Methylcyclohexane	108872	3.26E-03	920	3.00E+00	8050	24 hr	0%	Insignificant
Methylcyclopentane	96377	1.41E-03	920	1.29E+00	3500	24 hr	0%	Insignificant
Naphthalene	91203	3.53E-04	920	3.24E-01	22.5	24 hr	3%	Insignificant
Naphthalene	91203	3.53E-04	3,795	3.24E-01	50	10 min	1%	Insignificant
n-Butylbenzene	104518	2.35E-04	920	2.16E-01	150	24 hr	0%	Insignificant
Nonane	111842	7.82E-03	920	7.19E+00	5250	24 hr	0%	Insignificant
n-Propylbenzene (Propylbenzene)	103651	1.28E-03	920	1.17E+00	1250	24 hr	0%	Insignificant
Octane	111659	3.17E-03	3,795	1.20E+01	61800	10 min	0%	Insignificant
p-Cymene (1-Methyl-4-lsopropylbenzene)	99876	1.24E-02	920	1.14E+01	50	24 hr	45%	Insignificant
Pentane	109660	8.27E-03	920	7.61E+00	35500	24 hr	0%	Insignificant
Propane	74986	1.76E-02	920	1.62E+01	215000	24 hr	0%	Insignificant
Propene	115071	3.59E-03	920	3.30E+00	4000	24 hr	0%	Insignificant
Propyne	74997	3.91E-05	920	3.60E-02	8200	24 hr	0%	Insignificant
sec-Butylbenzene	135988	2.33E-04	920	2.14E-01	3	24 hr	14%	Insignificant
Styrene (Vinylbenzene)	100425	1.10E-03	920	1.01E+00	400	24 hr	1%	Insignificant
Tetrachloroethylene (Perchloroethylene)	127184	8.66E-03	920	7.96E+00	360	24 hr	4%	Insignificant
Tetrahydrofuran (Diethylene oxide)	109999	1.80E-03	920	1.65E+00	93000	24 hr	0%	Insignificant
Thiophene	110021	7.55E-04	920	6.95E-01	5	24 hr	28%	Insignificant
Toluene (Methyl benzene)	108883	6.99E-02	920	6.43E+01	2000	24 hr	6%	Insignificant
trans-1,2-Dichloroethene	156605	7.15E-05	920	6.58E-02	105	24 hr	0%	Insignificant
trans-1,3-Dichloropropene	10061026	2.69E-05	920	2.48E-02	2.25	24 hr	2%	Insignificant
trans-2-Butene	624646	1.50E-04	920	1.38E-01	2400	24 hr	0%	Insignificant
trans-2-Hexene	4050457	4.46E-05	920	4.10E-02	85	24 hr	0%	Insignificant
trans-2-Pentene	646048	6.26E-05	920	5.76E-02	300	24 hr	0%	Insignificant
Tribromomethane (Bromoform)	75252	8.06E-05	920	7.41E-02	55	24 hr	0%	Insignificant
Trichloroethylene (Trichloroethene)	79016	2.80E-03	920	2.57E+00	12	24 hr	43%	Insignificant
Undecane	1120214	6.71E-03	920	6.17E+00	175	24 hr	7%	Insignificant
Trichloromethane (Chloroform)	67663	2.17E-04	920	2.00E-01	1	24 hr	40%	Insignificant
Vinyl acetate	108054	0.00E+00	920	0.00E+00	1000	24 hr	0%	Insignificant
Vinyl chloride (Chloroethene)	75,014	2.28E-03	920	2.10E+00	1	24 hr	420%	Significant
Xylenes (o-, m-, p-, mixtures)	1330207	2.52E-02	920	2.32E+01	730	24 hr	6%	Insignificant
Xylenes (o-, m-, p-, mixtures)	1330207	2.52E-02	3,795	9.56E+01	3000	10 min	6%	Insignificant
Total Reduced Sulphur Compounds	N/A	0.00E+00	920	0.00E+00	7	24 hr	0%	Insignificant
Total Reduced Sulphur Compounds	N/A	0.00E+00	3,795	0.00E+00	13	10 min	0%	Insignificant
Tetramethylsilane	75763	6.21E-07	920	5.71E-04	650	24 hr	0%	Insignificant
Hexamethyldisiloxane	107460	1.31E-03	920	1.21E+00	1200	24 hr	0%	Insignificant
Octamethyltrisiloxane	107517	1.37E-04	920	1.26E-01	204	24 hr	0%	Insignificant
Decamethyltetrasiloxane	141628	1.68E-05	920	1.54E-02	0.5	24 hr	6%	Insignificant
Dodecamethylpentasiloxane	141639	1.80E-05	920	1.66E-02	0.75	24 hr	4%	Insignificant
Dodecamethylcyclohexasiloxane	540976	1.80E-05	920	1.66E-02	500	24 hr	0%	Insignificant
Decamethylcyclopentasiloxane	541026	2.65E-03	920	2.43E+00	500	24 hr	1%	Insignificant
Hexamethyltricyclosiloxane	541059	3.28E-04	920	3.01E-01	25	24 hr	2%	Insignificant
Octamethylcyclotetrasiloxane	556672	5.42E-03	920	4.99E+00	500	24 hr	2%	Insignificant
Trimethylsilanol	1066406	6.53E-03	920	6.01E+00	32.5	24 hr	37%	Insignificant

Table C2. Insignificant Sources

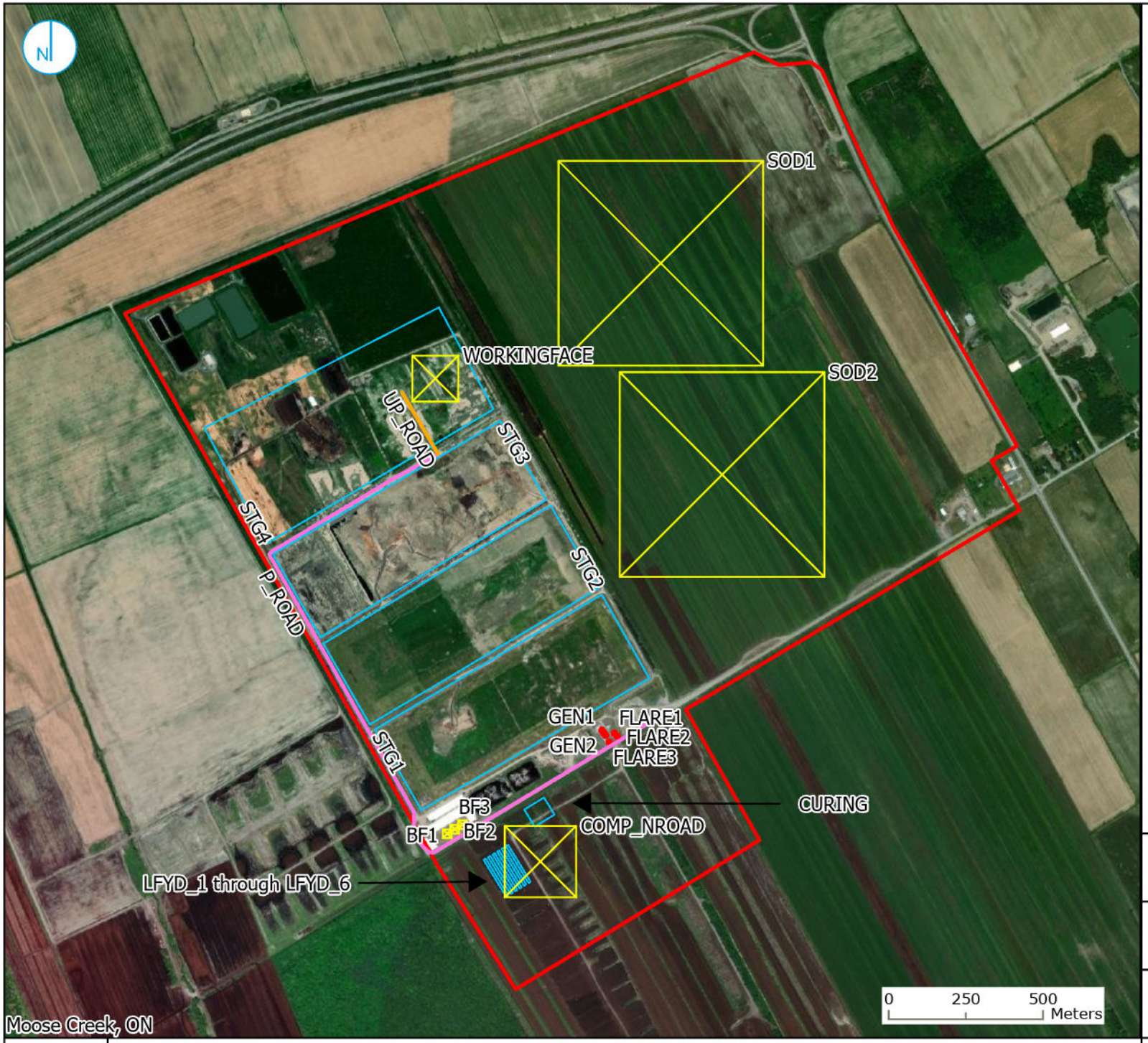
b) Contaminants without MECP limits

Screening concentrations compared to limits as per Table B-2A: De minimus Concentrations for Contaminants Not Listed in the ministry ACB List that Can Be Considered Insignificant in a Specific Situation

If substance **NOT** on ACB List **AND NOT** on Table B-2B List of Contaminants Excluded from de minimus level:
If < 0.1 µg/m³ (24-hour average) or < 0.3 µg/m³ (1/2-hr average), then impacts can be considered insignificant

Contaminant	CAS. NO	Total Emission Rate (g/s)	Rural Dispersion Factor (µg/m³ per g/s)	Estimated Screening Conc. (µg/m³)	De minimus Conc. (µg/m³)	Avg. Period	% of the De minimus Conc.	Insignificant ?
1-Methylcyclohexene	591491	5.61E-05	920	0.1	0.1	24 hr	103%	Significant
1-Propanethiol (n-Propyl mercaptan)	107039	2.45E-04	920	0.2	0.1	24 hr	450%	Significant
2,4-Dimethylhexane	589435	6.52E-04	920	0.6	0.1	24 hr	1200%	Significant
2,5-Dimethylhexane	592132	4.88E-04	920	0.4	0.1	24 hr	897%	Significant
2-Ethyl-1-butene	760214	3.83E-05	920	0.0	0.1	24 hr	70%	Insignificant
2-Methyl-1-propanethiol (Isobutyl mercaptan)	513440	3.94E-04	920	0.4	0.1	24 hr	725%	Significant
2-Methyl-2-propanethiol (tert-Butylmercaptan)	75661	7.54E-04	920	0.7	0.1	24 hr	1387%	Significant
3,6-Dimethyloctane	15869940	2.87E-03	920	2.6	0.1	24 hr	5284%	Significant
3-Methyl-1-pentene	760203	1.51E-05	920	0.0	0.1	24 hr	28%	Insignificant
cis-1,4-Dimethylcyclohexane	624293	7.15E-04	920	0.7	0.1	24 hr	1316%	Significant
cis-1,4-Dimethylcyclohexane/trans1,3-Dimethylcyclohexane	2207036	7.15E-04	920	0.7	0.1	24 hr	1316%	Significant
cis-2-Heptene	6443921	6.19E-05	920	0.1	0.1	24 hr	114%	Significant
cis-2-Octene	7642048	6.35E-04	920	0.6	0.1	24 hr	1168%	Significant
cis-3-Methyl-2-pentene	922623	3.87E-05	920	0.0	0.1	24 hr	71%	Insignificant
Ethyl mercaptan (Ethanediol)	75081	3.16E-04	920	0.3	0.1	24 hr	582%	Significant
Isopropyl mercaptan	75332	3.43E-04	920	0.3	0.1	24 hr	631%	Significant
Mercury (monomethyl)	51176126	0.00E+00	920	0.0	0.1	24 hr	0%	Insignificant
Mercury (dimethyl)	627441	0.00E+00	920	0.0	0.1	24 hr	0%	Insignificant
Methanethiol (Methyl mercaptan)	74931	1.69E-03	920	1.6	0.1	24 hr	3118%	Significant
trans-1,2-Dimethylcyclohexane	6876239	1.17E-03	920	1.1	0.1	24 hr	2145%	Significant
trans-1,4-Dimethylcyclohexane	2207047	5.91E-04	920	0.5	0.1	24 hr	1088%	Significant
trans-2-Heptene	14686136	6.31E-06	920	0.0	0.1	24 hr	12%	Insignificant
trans-2-Octene	13389429	6.95E-04	920	0.6	0.1	24 hr	1279%	Significant
trans-3-Methyl-2-pentene	616126	3.35E-05	920	0.0	0.1	24 hr	62%	Insignificant
Trichlorofluoromethane (Freon 11)	91315616	8.76E-04	920	0.8	0.1	24 hr	1612%	Significant
Trimethylsilyl Fluoride	420564	3.39E-04	920	0.3	0.1	24 hr	623%	Significant
Methoxytrimethylsilane	1825612	2.18E-04	920	0.2	0.1	24 hr	401%	Significant
Ethoxytrimethylsilane	1825623	1.26E-04	920	0.1	0.1	24 hr	232%	Significant
Propoxytrimethylsilane	1825634	9.80E-05	920	0.1	0.1	24 hr	180%	Significant
Isopropoxytrimethylsilane	1825645	1.12E-04	920	0.1	0.1	24 hr	207%	Significant
Butoxytrimethylsilane	1825656	5.59E-05	920	0.1	0.1	24 hr	103%	Significant
1-methylbutoxytrimethylsilane	1825678	1.19E-04	920	0.1	0.1	24 hr	219%	Significant

APPENDIX D:
DISPERSION MODELLING



Legend

- Facility Boundary

Area Sources

- Area Sources
- Volume Sources

Line Volume Sources

- P_ROAD
- UP_ROAD

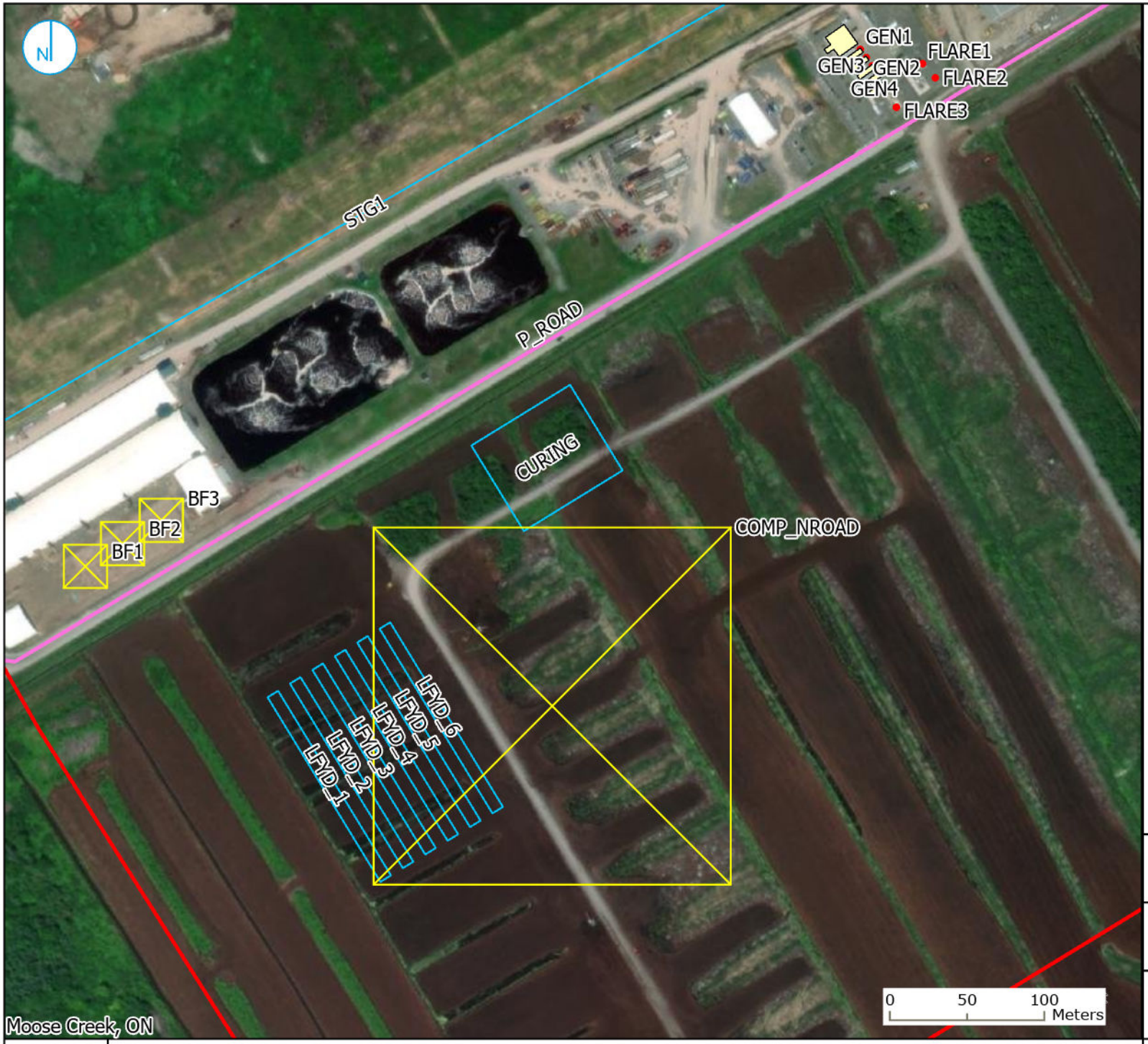
- Point Sources

Project No.: 324000731

Map Created: 02/06/2023

RAMBOLL

Figure D1	Dispersion Model Sources - GFL (Moose Creek,ON Facility)	2400 Meadowpine Blvd, Suite 100 Mississauga, ON, Canada



Legend

- Facility Boundary
- Area Sources
- Volume Sources

Line Volume Sources

- P_ROAD
- UP_ROAD
- Point Sources
- Buildings

Project No.: 324000731

Map Created: 02/06/2023

RAMBOLL

Figure D2	Dispersion Model Sources (South End) - GFL (Moose Creek,ON Facility)	2400 Meadowpine Blvd, Suite 100 Mississauga, ON, Canada

Legend

- Facility Boundary
- Sensitive Receptors

Project No.: 324000731

Map Created: 02/06/2023

RAMBOLL

Figure D3

Dispersion Model Sensitive Receptors - GFL (Moose Creek,ON Facility)

2400 Meadowpine Blvd, Suite 100
Mississauga, ON, Canada

Table D1. Dispersion Modelling Input Summary Table

Relevant Section of the Regulation	Section Title	Description of How the Approved Dispersion Model was Used
Section 8	Negligible Sources	See Section 3 of this ESDM Report.
Section 9	Same Structure Contamination	Not Applicable
Section 10	Operating Conditions	See Section 4.1 of this ESDM Report.
Section 11	Source of Contaminant Emission Rates	See Section 4.2 of this ESDM Report.
Section 12	Combined Effect of Assumptions for Operating Conditions and Emission Rates	Not Applicable
Section 13	Meteorological Conditions	Site specific meteorological data provided by MECP
Section 14	Area of Modelling Coverage	Property Boundary Receptors and Multi Tier Receptor Grid in Accordance with ADMGO, over 13km x 13km domain.
Section 15	Stack Height for Certain New Sources of Contaminant	Not Applicable
Section 16	Terrain Data	Terrain files from MECP Website
Section 17	Averaging Periods	AERMOD set for 1 hour, 24 hour and annual averaging periods. Conversion to other periods as per ADMGO.

Table D2. Point Source Parameters

Modelled Emission Rates

Model ID	Source	Emission Rates								
		LFG (base run)	Siloxane (base run)	CO	SO2	HCL	NOx	PM	PM10	PM2.5
		(g/s)	(g/s)	(g/s)	(g/s)	(g/s)	(g/s)	(g/s)	(g/s)	(g/s)
GEN1	Reciprocating Engines	-	-	0.600	0.0171	0.0165	0.320	0.0616	0.0616	0.0616
GEN2		-	-	0.600	0.0171	0.0165	0.320	0.0616	0.0616	0.0616
GEN3		-	-	0.600	0.0171	0.0165	0.320	0.0616	0.0616	0.0616
GEN4		-	-	0.600	0.0171	0.0165	0.320	0.0616	0.0616	0.0616
Flare1	LFG Flare 1	0.013	0.172	2.556	0.0455	0.0439	0.138	0.058	0.058	0.058
Flare2	LFG Flare 2	0.024	0.309	4.601	0.082	0.079	0.249	0.104	0.104	0.104
Flare3	Enclosed Siloxane Flare	-	0.269	-	-	-	-	-	-	-

Modelled Discharge Parameters

Model ID	Source	UTM Coordinates*		Height Above Grade	Exit Temp.	Stack Diameter	Exit Velocity	Release Type
		X (m)	Y (m)	(m)	[K]	(m)	[m/s]	
GEN1	Reciprocating Engines	500582	5016784	5.6	782	0.25	28.5	Vertical
GEN2		500586	5016778	5.6	782	0.25	28.5	Vertical
GEN3		500590	5016773	5.6	782	0.25	28.5	Vertical
GEN4		500594	5016768	5.6	782	0.25	28.5	Vertical
Flare1	LFG Flare 1	500623	5016774	12.2	1144	3.05	11.3	Vertical
Flare2	LFG Flare 2	500631	5016765	12.2	1144	3.66	13.3	Vertical
Flare3	Enclosed Siloxane	500606	5016746	9.2	1144	0.77	2.7	Vertical

*UTM Zone 18

Table D3. Area Source Parameters

Modelled Emission Rates

Source	Model ID	Emission Rate				Area	Emission Flux		
		Season	LFG (base run) (g/s)	Siloxane (base run) (g/s)	Odour (ou/s)	(m²)	LFG (base run) (g/s/m²)	Siloxane (base run) (g/s/m²)	Odour (ou/s/m²)
Landfill (Stages 1 to Stage 4)	STG1	-	0.219	0.0567	1,410	244,000	8.9663E-07	2.3246E-07	0.00578
	STG2	-	0.219	0.0567	1,410	244,000	8.9663E-07	2.3246E-07	0.00578
	STG3	-	0.219	0.0567	1,410	244,000	8.9663E-07	2.3246E-07	0.00578
	STG4	-	0.307	0.0795	1,976	342,000	8.9663E-07	2.3246E-07	0.00578
Compost Curing Windrows (Windrows 1 to 12)	CURING	Winter	-	-	1,715	4,875	-	-	0.3518
		Spring	-	-	20,794		-	-	4.2655
		Summer	-	-	39,874		-	-	8.1792
		Fall	-	-	20,794		-	-	4.2655
Leaf & Yard Waste Stockpile 1	LFYD_1	Winter	-	-	1,213	1,120	-	-	1.0828
		Spring	-	-	1,739		-	-	1.5527
		Summer	-	-	2,265		-	-	2.0226
		Fall	-	-	1,739		-	-	1.5527
Leaf & Yard Waste Stockpile 2	LFYD_2	Winter	-	-	1,213	1,120	-	-	1.0828
		Spring	-	-	1,739		-	-	1.5527
		Summer	-	-	2,265		-	-	2.0226
		Fall	-	-	1,739		-	-	1.5527
Leaf & Yard Waste Stockpile 3	LFYD_3	Winter	-	-	1,213	1,120	-	-	1.0828
		Spring	-	-	1,739		-	-	1.5527
		Summer	-	-	2,265		-	-	2.0226
		Fall	-	-	1,739		-	-	1.5527
Leaf & Yard Waste Stockpile 4	LFYD_4	Winter	-	-	1,213	1,120	-	-	1.0828
		Spring	-	-	1,739		-	-	1.5527
		Summer	-	-	2,265		-	-	2.0226
		Fall	-	-	1,739		-	-	1.5527
Leaf & Yard Waste Stockpile 5	LFYD_5	Winter	-	-	1,213	1,120	-	-	1.0828
		Spring	-	-	1,739		-	-	1.5527
		Summer	-	-	2,265		-	-	2.0226
		Fall	-	-	1,739		-	-	1.5527
Leaf & Yard Waste Stockpile 6	LFYD_5	Winter	-	-	1,213	1,120	-	-	1.0828
		Spring	-	-	1,739		-	-	1.5527
		Summer	-	-	2,265		-	-	2.0226
		Fall	-	-	1,739		-	-	1.5527

Modelled Discharge Parameters

Source	Model ID	Release Height (m)	Sigma Z (m)	UTM Coordinates* X (m)	UTM Coordinates* Y (m)	Length X (m)	Length Y (m)	Rotation Angle (deg)
Landfill (Stages 1 to Stage 4)	STG1	0	0	500000	5016531	847.2	288.0	-30
	STG2	0	0	499670	5017100	847.2	288.0	-30
	STG3	0	0	499832	5016813	847.2	288.0	-30
	STG4	0	0	499501	5017389	847.2	403.7	-30
Compost Curing Windrows (Windrows 1 to 12)	CURING	1.00	0.93	500330	5016527	65.0	75.0	58.41
Leaf & Yard Waste Stockpile 1	LFYD_1	2.00	1.86	500199	5016364	140.0	8.0	58.56
Leaf & Yard Waste Stockpile 2	LFYD_2	2.00	1.86	500213	5016373	140.0	8.0	58.56
Leaf & Yard Waste Stockpile 3	LFYD_3	2.00	1.86	500228	5016382	140.0	8.0	58.56
Leaf & Yard Waste Stockpile 4	LFYD_4	2.00	1.86	500242	5016391	140.0	8.0	58.56
Leaf & Yard Waste Stockpile 5	LFYD_5	2.00	1.86	500257	5016400	140.0	8.0	58.56
Leaf & Yard Waste Stockpile 6	LFYD_6	2.00	1.86	500271	5016409	140.0	8.0	58.56

*UTM Zone 18

Note: For Stage 1 to Stage 4, an additional 10 m height was added to base elevation estimated by AERMAP.

Table D4. Volume Source Parameters

Modelled Emission Rates

Model ID	Source	Emission Rate					
		PM (g/s)	PM10 (g/s)	PM2.5 (g/s)	NOx (g/s)	CO (g/s)	Odour (ou/s)
BF1	Biofilter	-	-	-	-	-	603
BF2		-	-	-	-	-	603
BF3		-	-	-	-	-	603
WORKINGFACE	working face/construction	1.43	1.06	0.15	0.15	1.35	22,514
SOD1	Farm	1.76	0.37	0.18	-	-	-
SOD2		1.76	0.37	0.18	-	-	-
COMP_NROAD	Compost Mobile Equipment	0.01	0.01	0.01	0.21	1.79	-
P_ROAD	Paved Roads	3.80	0.76	0.19	0.05	0.02	-
UP_ROAD	Unpaved Roads	1.06	0.27	0.03	0.00	0.00	-

Modelled Discharge Parameters - Volume Sources

Model ID	Source	UTM Coordinates*		Release Height (m)	Inititial Lateral Dim. (m)	Initial Vertical Dim. (m)	Side Length (m)
		X (m)	Y (m)				
BF1	Biofilter	500081	5016449	9	7	7	28
BF2		500105	5016464	9	7	7	28
BF3		500130	5016479	9	7	7	28
WORKINGFACE	working face/construction	500042	5017924	0	35	1	149
SOD1	Farm	500773	5018298	0	154	1	663
SOD2		500972	5017613	0	154	1	663
COMP_NROAD	Compost Mobile Equipment	500383	5016359	0	54	1	231

Modelled Discharge Parameters - Line Volume Sources

Model ID	Source	Node Coordinates*		Release Height (m)	Plume Height (m)	Plume Width (m)	Config.
		X m	Y m				
P_ROAD	Paved Roads	500805	5016851	2.55	5.1	13	Adjacent
		500057	5016401				
		500035	5016387				
		500021	5016389				
		500014	5016396				
		499999	5016410				
		499986	5016433				
		499978	5016447				
		499975	5016464				
		499973	5016479				
		499973	5016505				
		499975	5016513				
		499971	5016521				
		499972	5016521				
		499503	5017354				
		499513	5017364				
		499911	5017603				
UP_ROAD	Unpaved Roads	500051	5017679	2.55	5.1	13	Adjacent
		499934	5017880				

*UTM Zone 18

Table D5. Facility Boundary and Buildings

Facility Boundary Coordinates

Point No.	UTM Coordinates*	
	X (m)	Y (m)
Point 1	498995	5018155
Point 2	501035	5019002
Point 3	501116	5018960
Point 4	501215	5018969
Point 5	501222	5018968
Point 6	501253	5018946
Point 7	501363	5018712
Point 8	501485	5018439

Point No.	UTM Coordinates*	
	X (m)	Y (m)
Point 9	501888	5017726
Point 10	501806	5017678
Point 11	501897	5017518
Point 12	500814	5016872
Point 13	501052	5016448
Point 14	500262	5015965
Point 15	500010	5016364

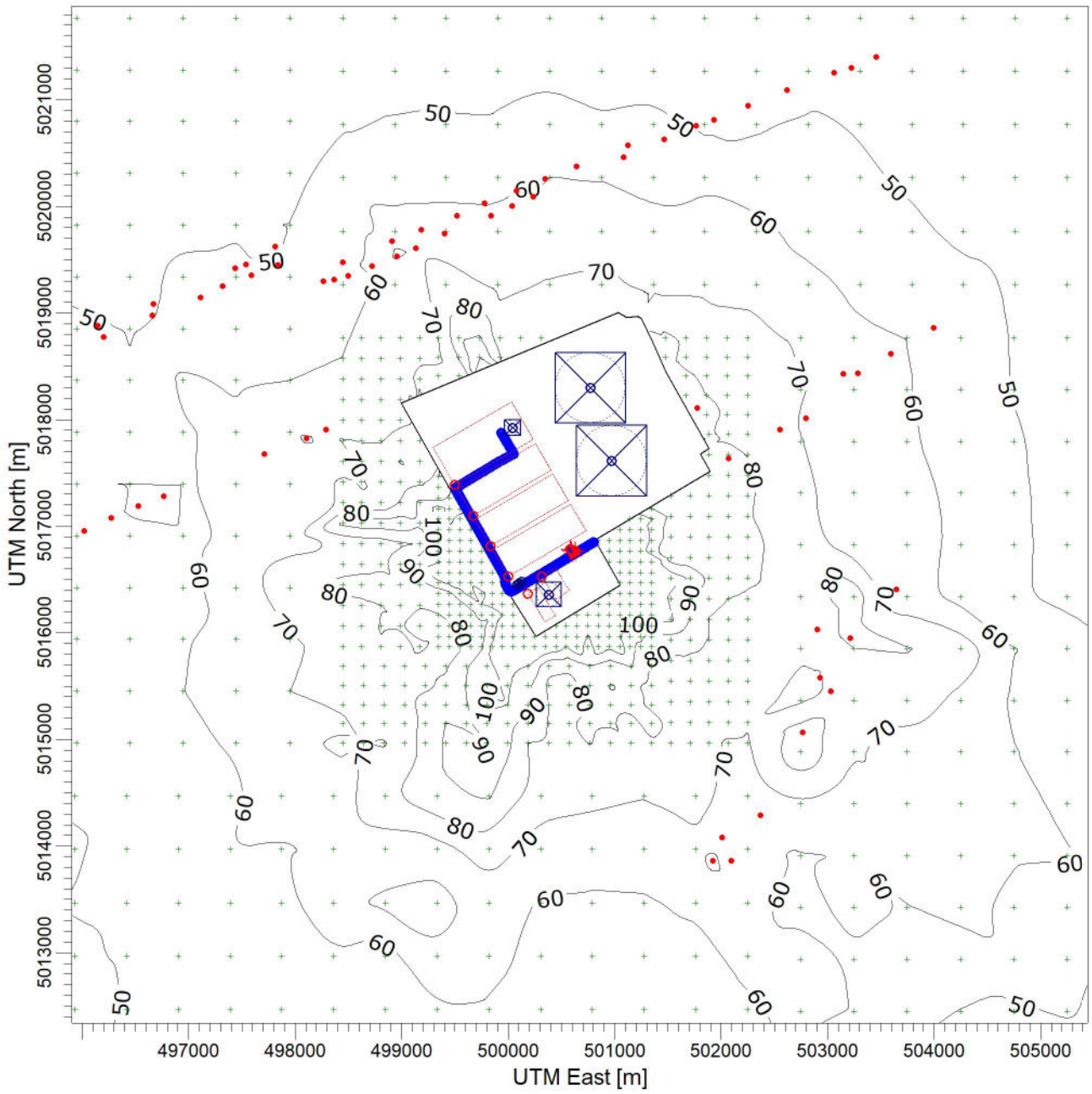
Building Parameters

Building ID	No. of Points	No. of Tiers	Height (m)	UTM Coordinates*	
				X (m)	Y (m)
BLD_1	8	1	4.57	500559	5016784
				500563	5016787
				500560	5016791
				500572	5016800
				500581	5016787
				500569	5016779
				500565	5016784
				500561	5016781
BLD_2	4	1	2	500572	5016777
				500582	5016785
				500584	5016782
				500574	5016775
BLD_3	4	1	2	500576	5016772
				500586	5016779
				500588	5016777
				500578	5016769
BLD_4	4	1	2	500580	5016767
				500590	5016774
				500592	5016771
				500582	5016764
BLD_5	4	1	2	500584	5016762
				500594	5016769
				500596	5016766
				500586	5016759
BLD_6	4	1	2	500588	5016756
				500598	5016763
				500599	5016761
				500590	5016754

*UTM Zone 18

PROJECT TITLE:

GFL Moosecreek Effects Assessment - Existing Conditions
Nitrogen Oxides (NOx) Peak 1 Hour Average Concentration Contours

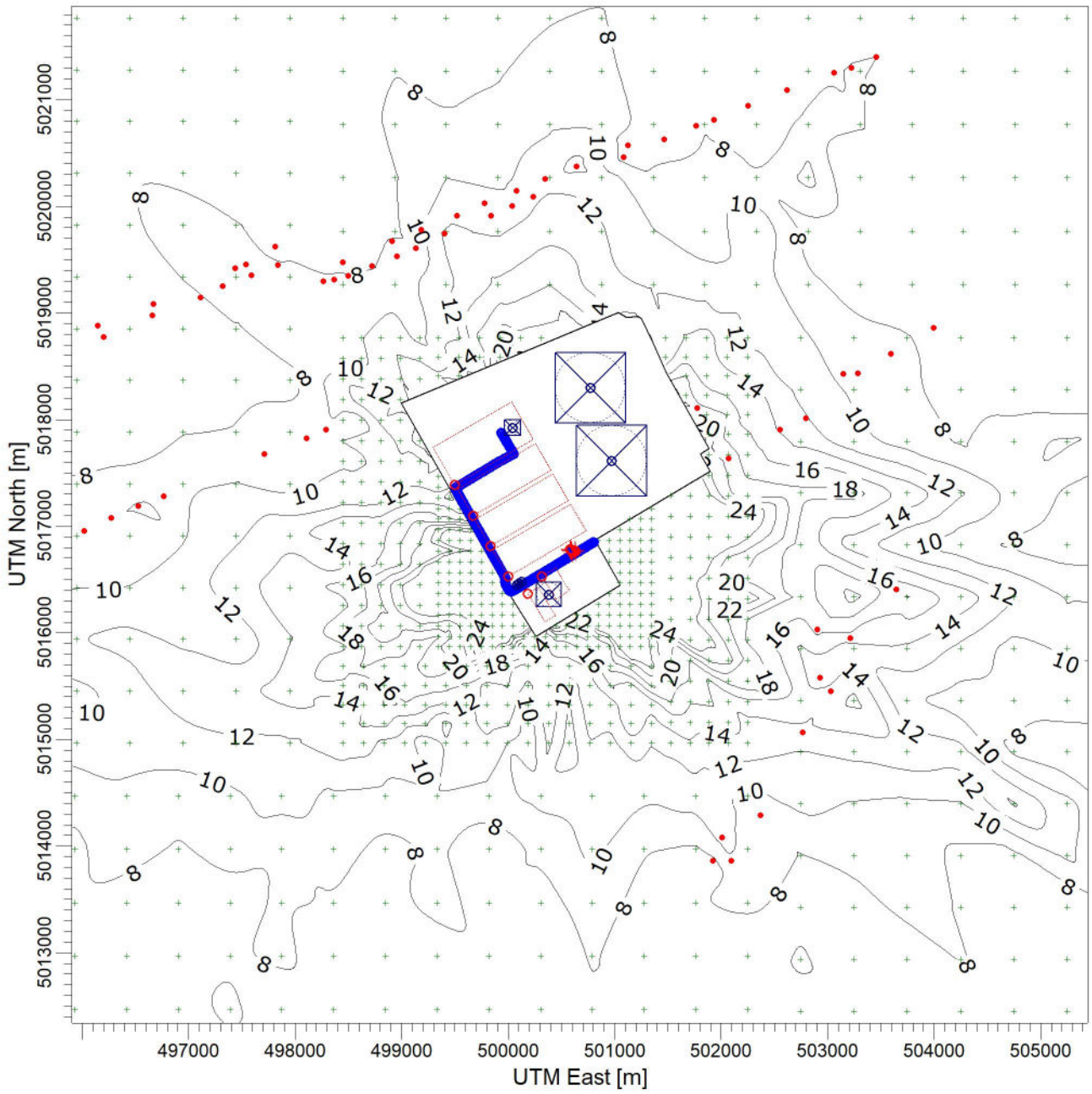


COMMENTS:	**SOURCES:** 22	**COMPANY NAME:** Ramboll Canada Inc.	
	RECEPTORS: 1922	**MODELER:** EM	RAMBOLL
	OUTPUT TYPE: Concentration	**SCALE:** 1:60,000 (0 — 2 km)	
	MAX: 264 ug/m^3	**DATE:** 2022-06-22	**PROJECT NO.:** 324000731

AERMOD View - Lakes Environmental Software

PROJECT TITLE:

GFL Moosecreek Effects Assessment - Existing Conditions
Nitrogen Oxides (NOx) Peak 24 Hour Average Concentration Contours

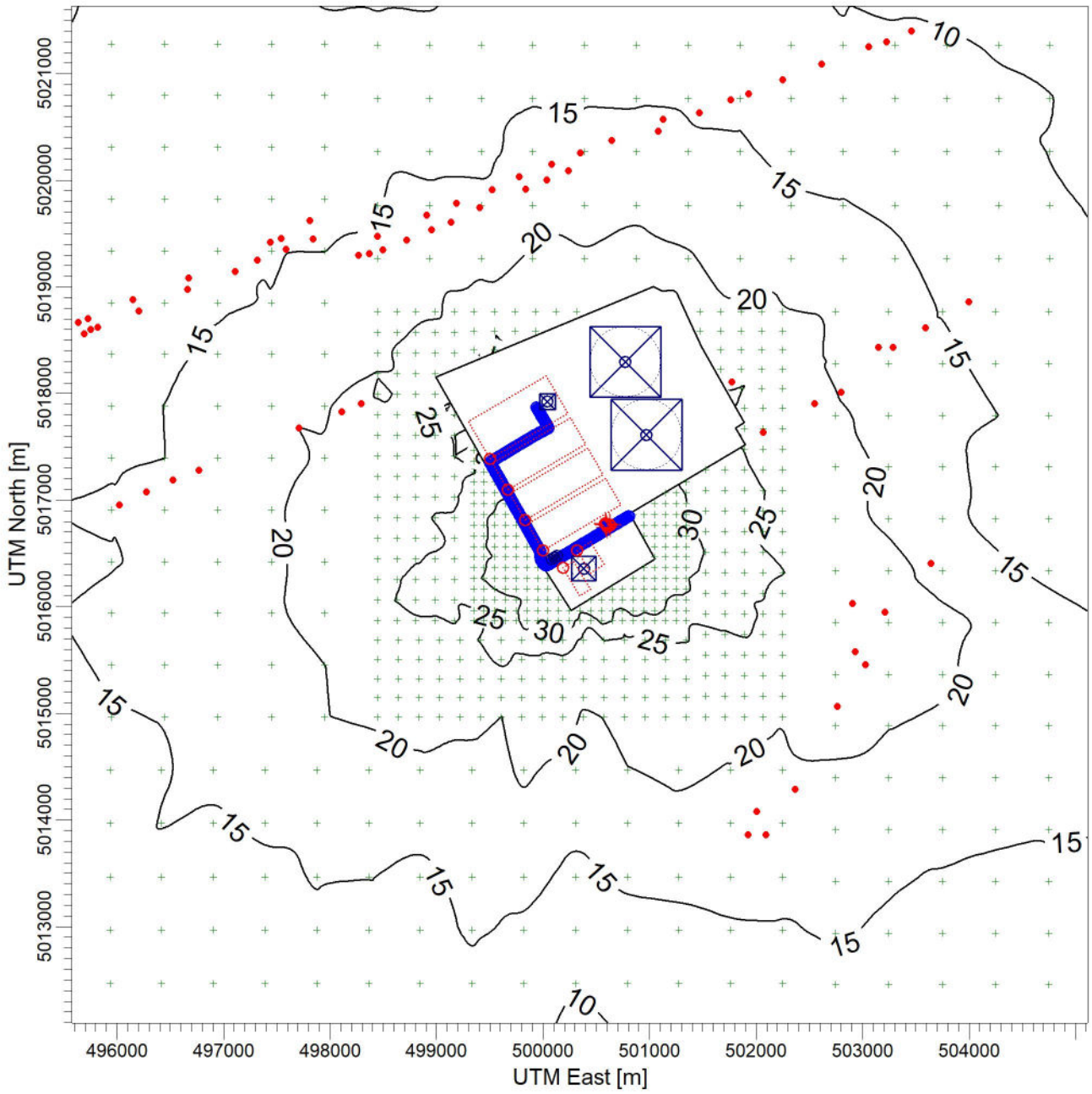


COMMENTS:	**SOURCES:** 22	**COMPANY NAME:** Ramboll Canada Inc.	
	RECEPTORS: 1922	**MODELER:** EM	
	OUTPUT TYPE: Concentration	**SCALE:** 1:60,000 (0 — 2 km)	
	MAX: 178 ug/m^3	**DATE:** 2022-06-22	**PROJECT NO.:** 324000731

AERMOD View - Lakes Environmental Software

PROJECT TITLE:

GFL Moosecreek Effects Assessment - Existing Conditions
Nitrogen Dioxide - Multi year average of 98th percentile of daily maximum 1-hr concentration

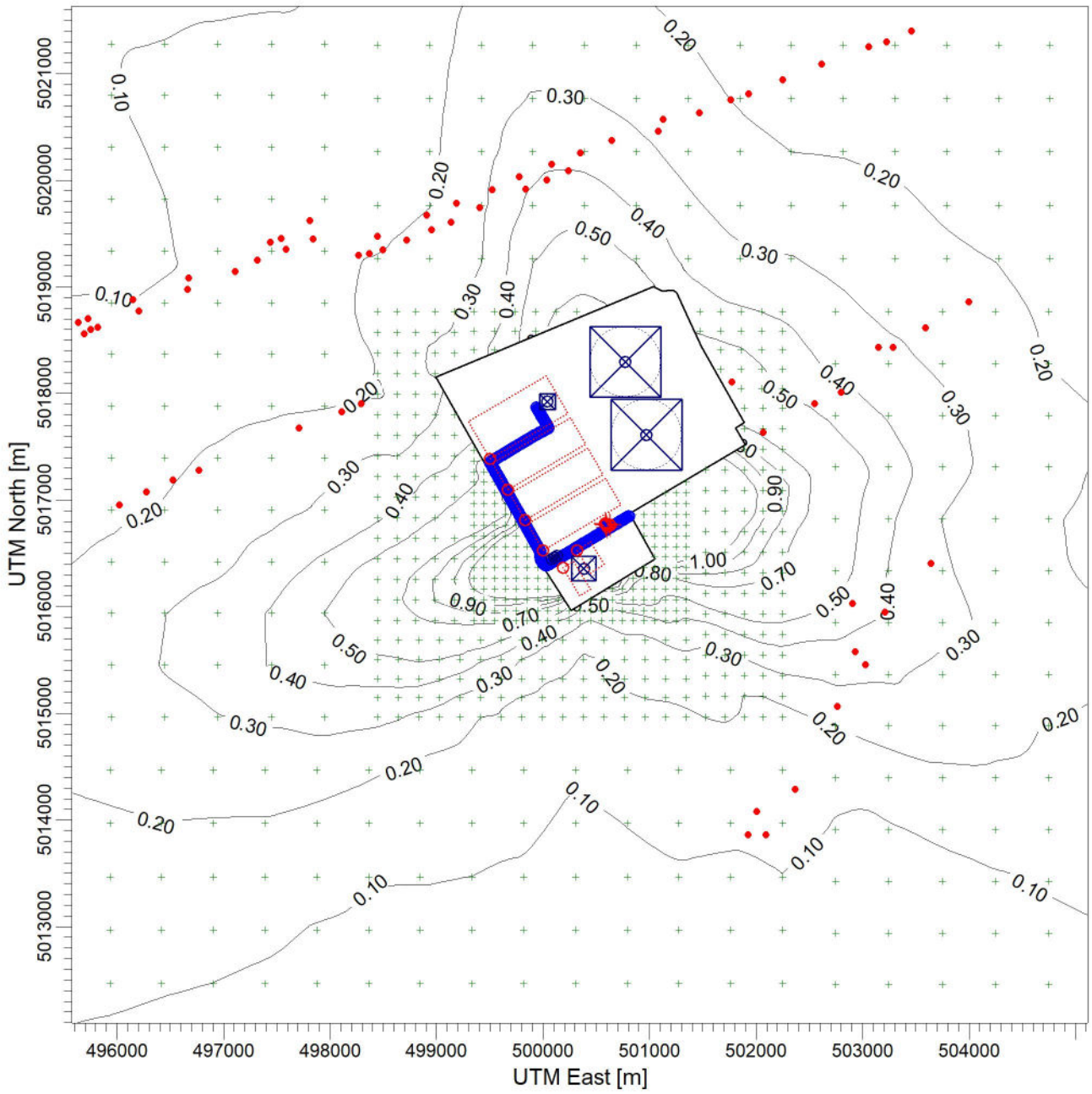


COMMENTS:	**SOURCES:** 22	**COMPANY NAME:** Ramboll Canada Inc.	
	RECEPTORS: 1922	**MODELER:** EM	
	OUTPUT TYPE: Concentration	**SCALE:** 1:60,000 (0 — 2 km)	RAMBOLL
	MAX: 91.1 ug/m^3	**DATE:** 2022-06-21	**PROJECT NO.:** 324000731

AERMOD View - Lakes Environmental Software

PROJECT TITLE:

GFL Moosecreek Effects Assessment - Existing Conditions
Nitrogen Dioxide - Annual concentration, highest year (Year 3)

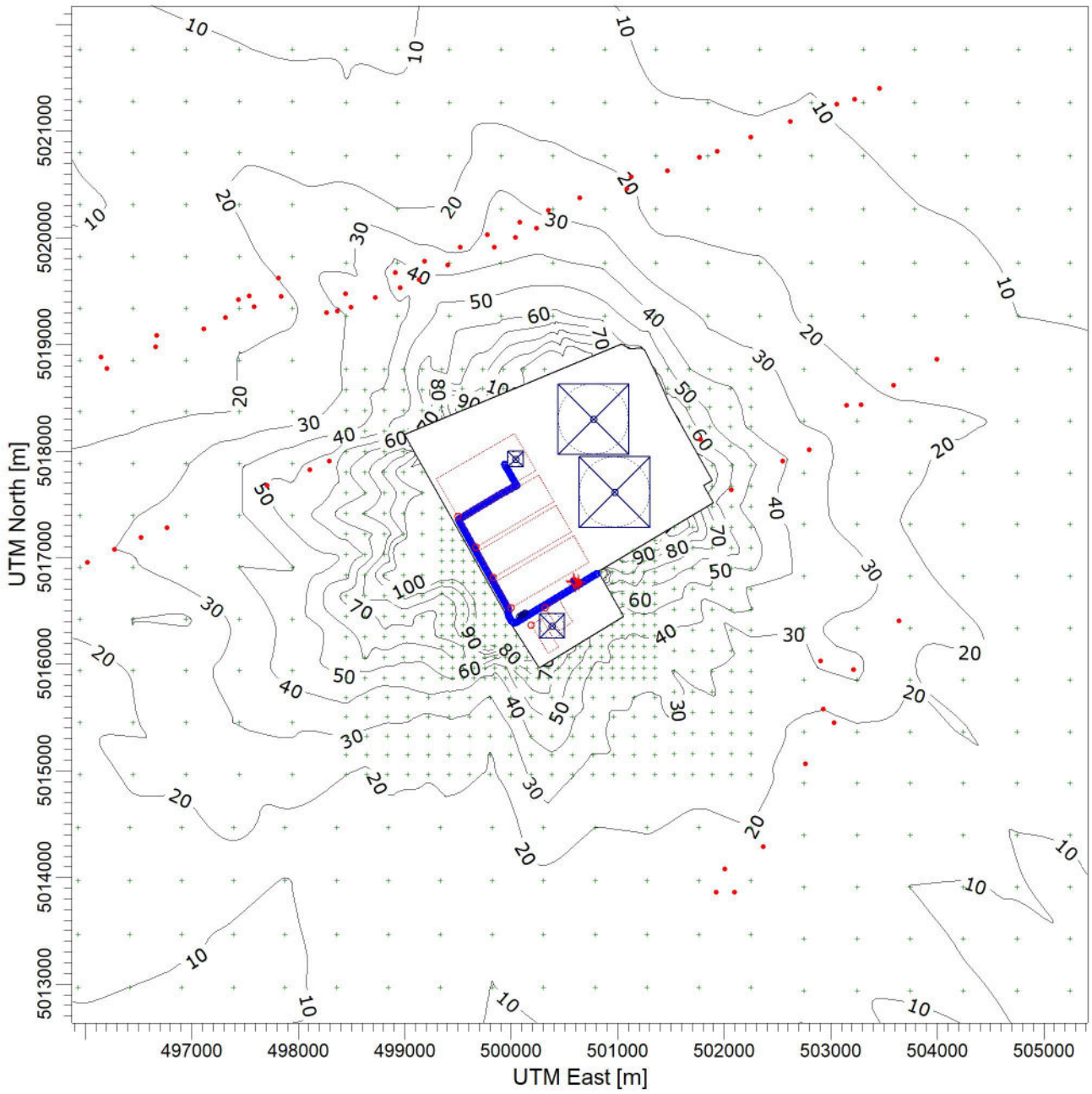


COMMENTS:	**SOURCES:** 22	**COMPANY NAME:** Ramboll Canada Inc.	
	RECEPTORS: 1922	**MODELER:** EM	RAMBOLL
	OUTPUT TYPE: Concentration	**SCALE:** 1:60,000 0 2 km	
	MAX: 5.81 ug/m^3	**DATE:** 2022-06-21	**PROJECT NO.:** 324000731

AERMOD View - Lakes Environmental Software

PROJECT TITLE:

GFL Moosecreek Effects Assessment - Existing Conditions
Particulate Matter (PM) Peak 24 Hour Average Concentration Contours

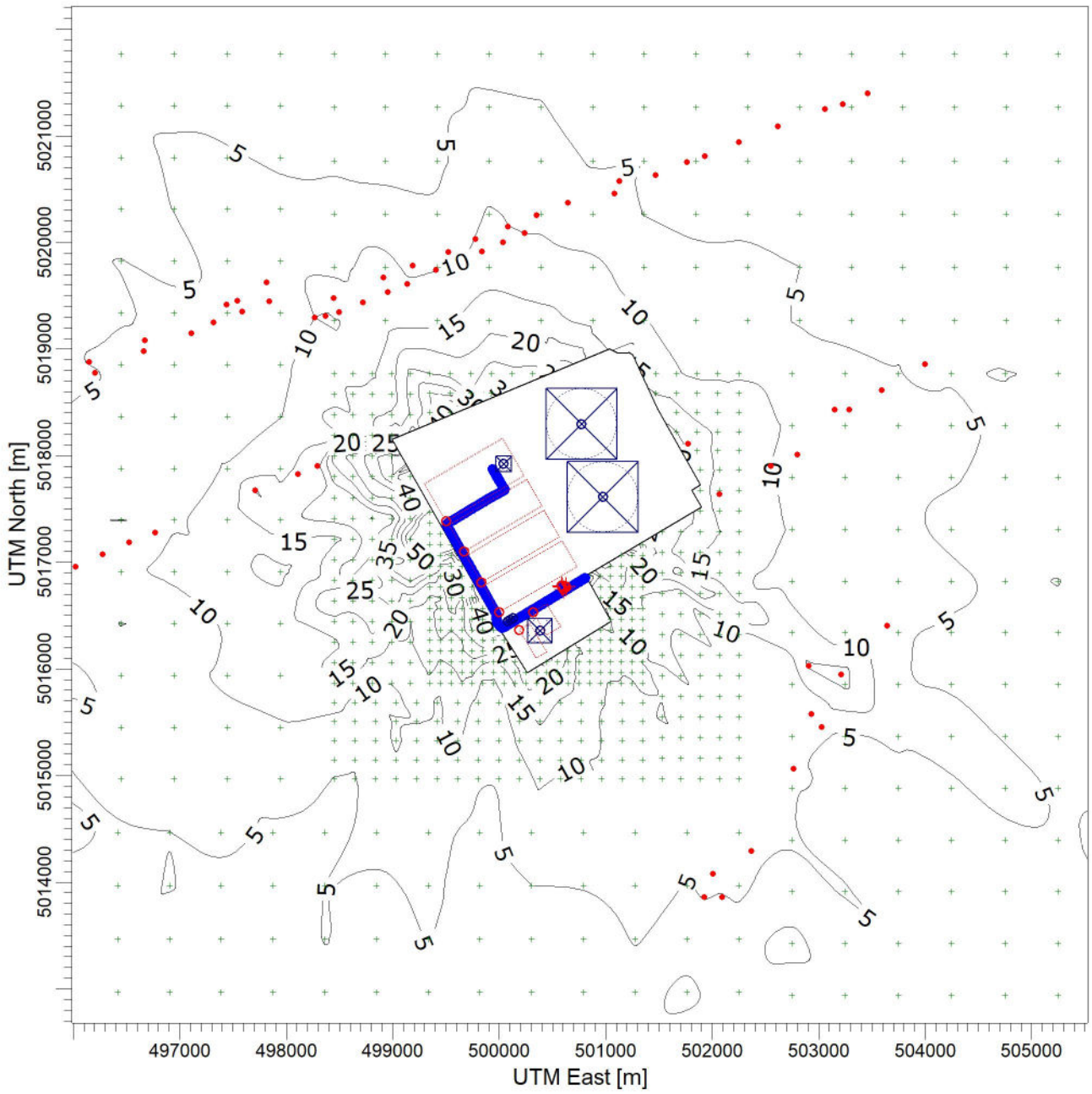


COMMENTS:	**SOURCES:** 22	**COMPANY NAME:** Ramboll Canada Inc.	
	RECEPTORS: 1922	**MODELER:** EM	
	OUTPUT TYPE: Concentration	**SCALE:** 1:60,000 (0 — 2 km)	
	MAX: 458.3 ug/m^3	**DATE:** 2022-06-21	**PROJECT NO.:** 324000731

AERMOD View - Lakes Environmental Software

PROJECT TITLE:

GFL Moosecreek Effects Assessment - Existing Conditions
PM10 Peak 24 Hour Average Concentration Contours

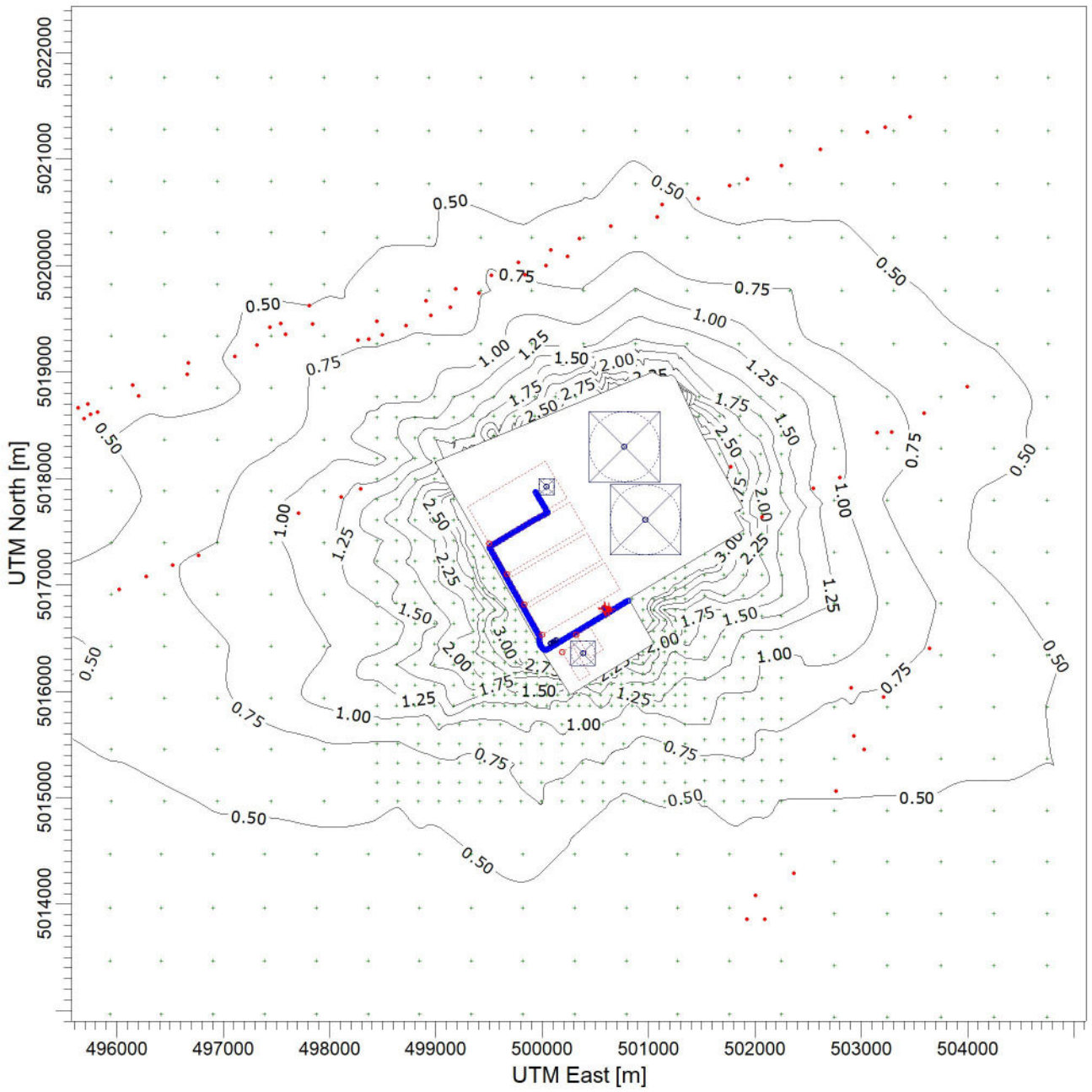


COMMENTS:	**SOURCES:** 22	**COMPANY NAME:** Ramboll Canada Inc.	
	RECEPTORS: 1922	**MODELER:** EM	
	OUTPUT TYPE: Concentration	**SCALE:** 1:60,000 — 0 — 2 km	
	MAX: 114 ug/m^3	**DATE:** 2022-06-21	**PROJECT NO.:** 324000731

AERMOD View - Lakes Environmental Software

PROJECT TITLE:

GFL Moosecreek Effects Assessment - Existing Conditions
PM2.5 Peak 24 Hour Average Concentration Contours - 98th Percentile - Year 1 (2015)

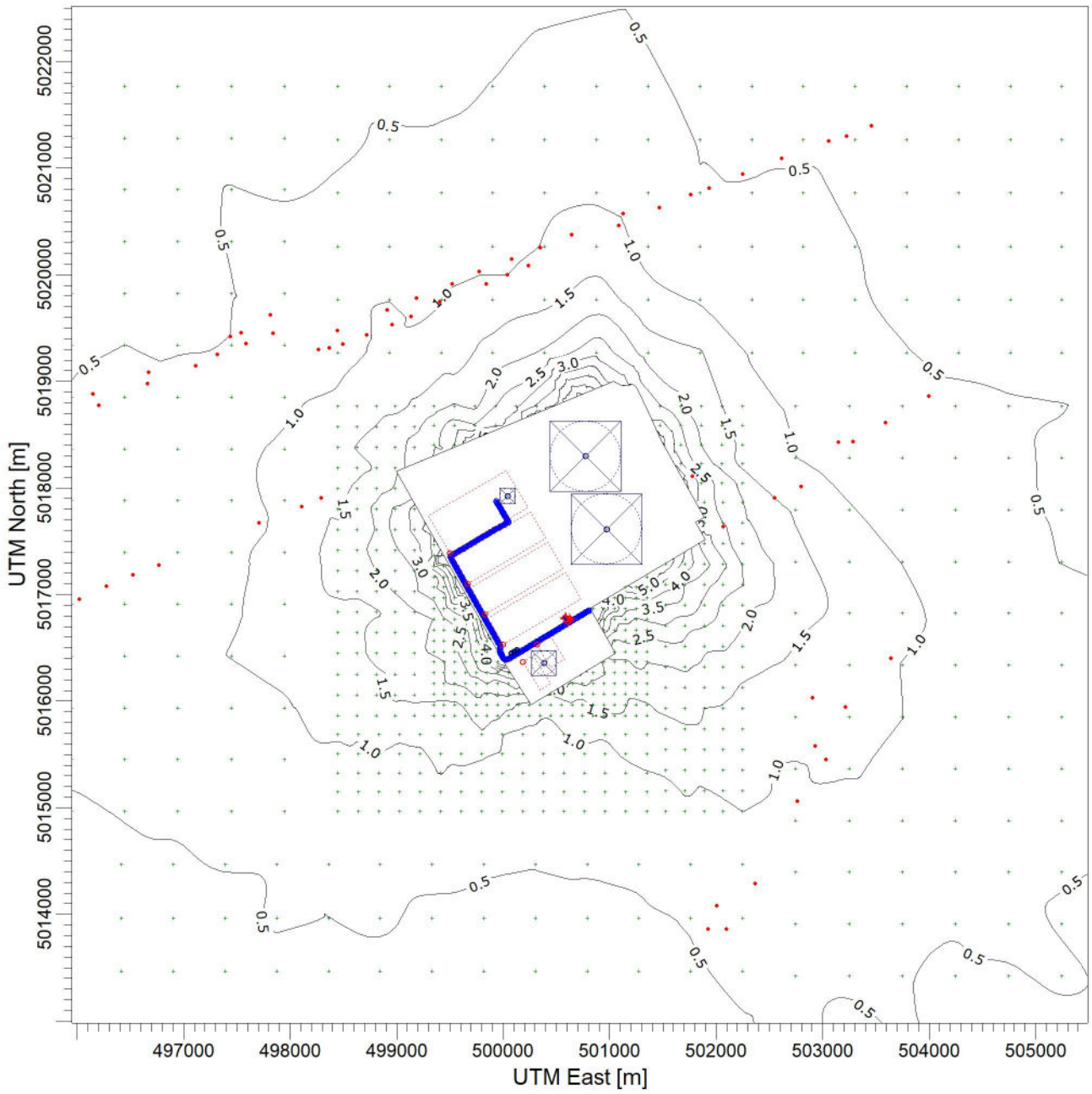


COMMENTS:	**SOURCES:** 22	**COMPANY NAME:** Ramboll Canada Inc.	
	RECEPTORS: 1922	**MODELER:** EM	RAMBOLL
	OUTPUT TYPE: Concentration	**SCALE:** 1:60,000 — 0 — 2 km	
	MAX: 8.57 ug/m^3	**DATE:** 2022-06-21	**PROJECT NO.:** 324000731

AERMOD View - Lakes Environmental Software

PROJECT TITLE:

GFL Moosecreek Effects Assessment - Existing Conditions
PM2.5 Peak 24 Hour Average Concentration Contours - 98th Percentile - Year 2 (2016)

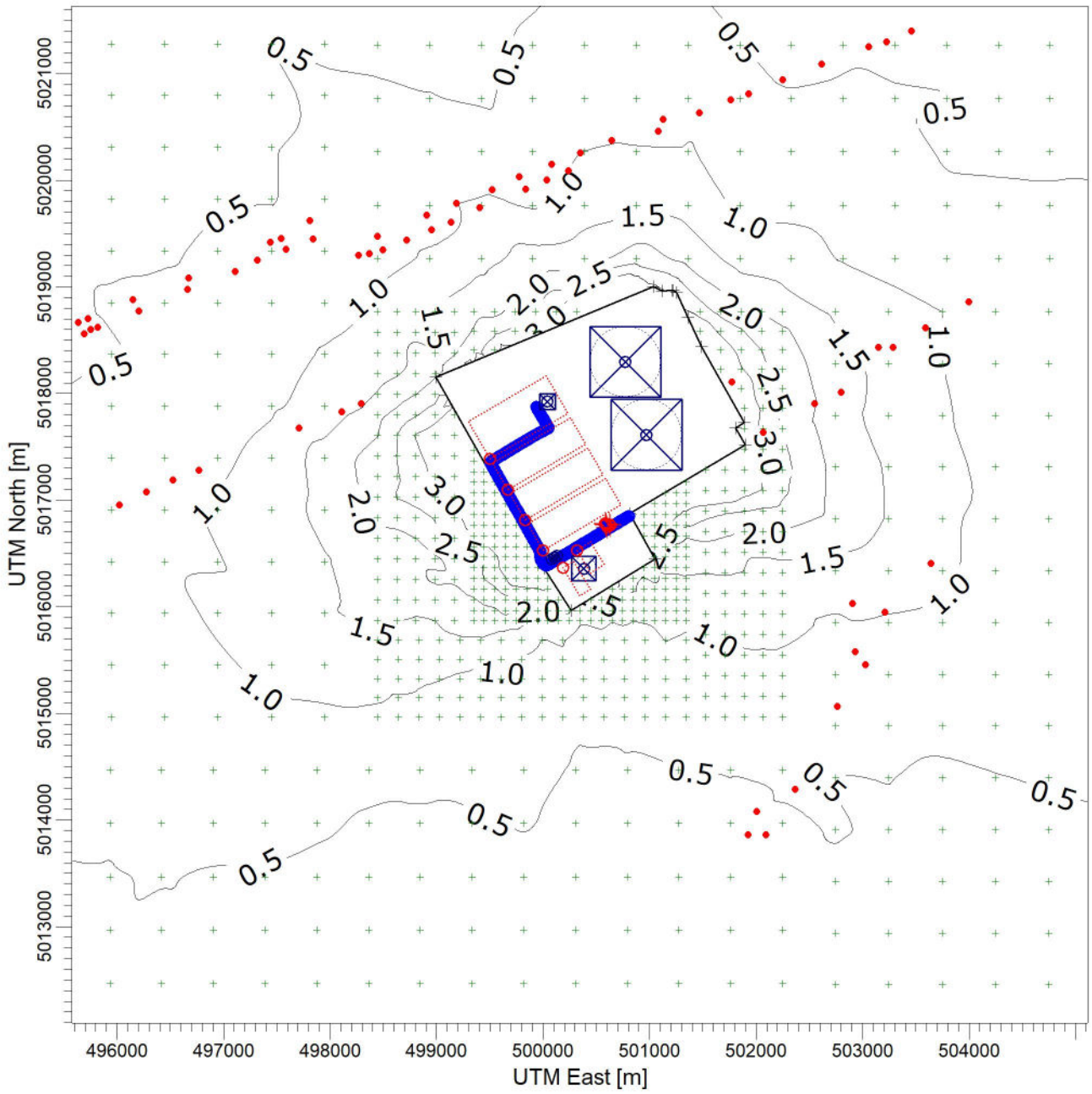


COMMENTS:	**SOURCES:** 22	**COMPANY NAME:** Ramboll Canada Inc.	
	RECEPTORS: 1922	**MODELER:** EM	RAMBOLL
	OUTPUT TYPE: Concentration	**SCALE:** 1:60,000 (0 — 2 km)	
	MAX: 9.2 ug/m^3	**DATE:** 2022-06-21	**PROJECT NO.:** 324000731

AERMOD View - Lakes Environmental Software

PROJECT TITLE:

GFL Moosecreek Effects Assessment - Existing Conditions
PM2.5 Peak 24 Hour Average Concentration Contours - 98th Percentile - Year 3 (2017)

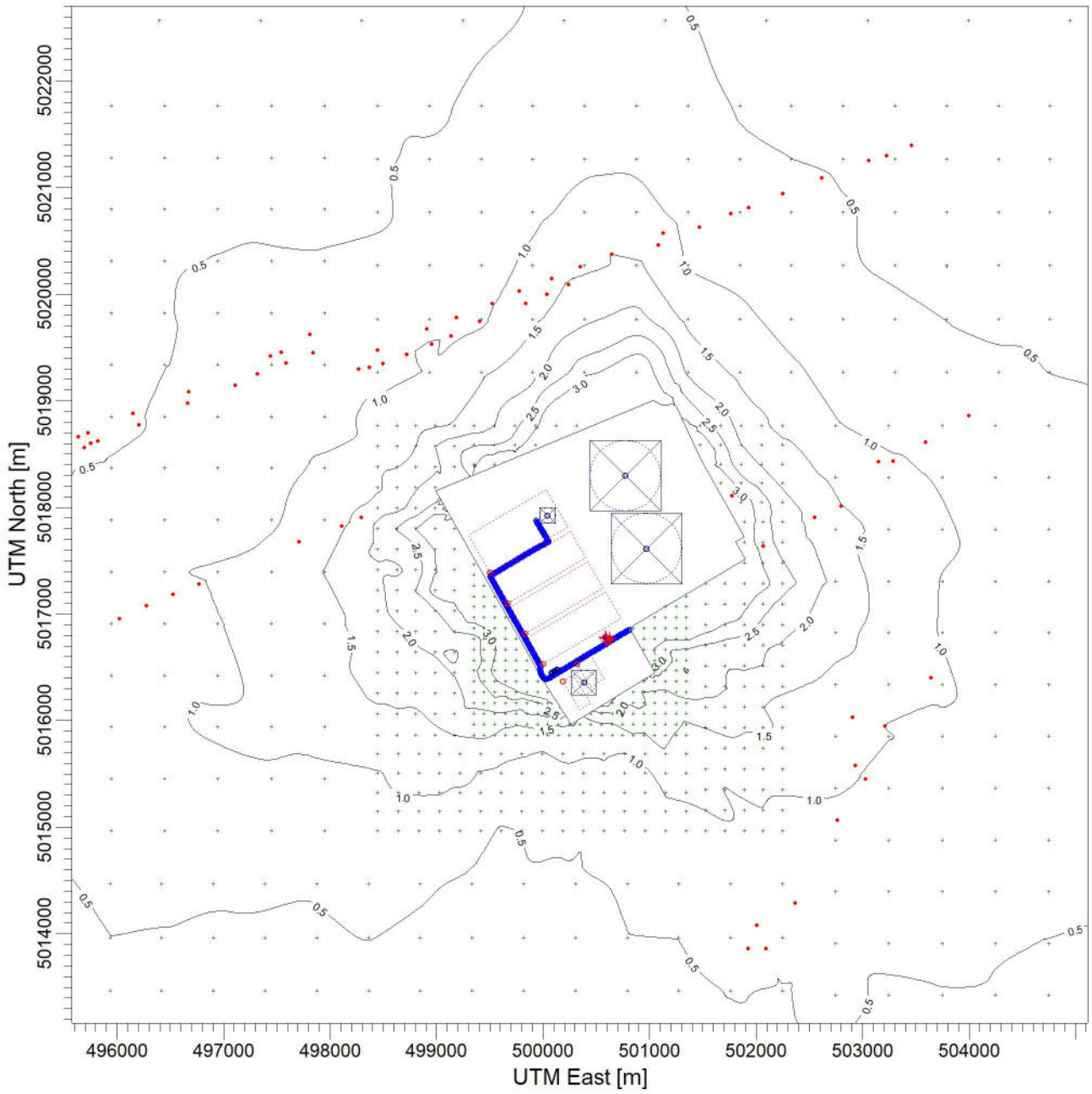


COMMENTS:	**SOURCES:** 22	**COMPANY NAME:** Ramboll Canada Inc.	
	RECEPTORS: 1922	**MODELER:** EM	RAMBOLL
	OUTPUT TYPE: Concentration	**SCALE:** 1:60,000 0 2 km	
	MAX: 11.1 ug/m^3	**DATE:** 2022-06-21	**PROJECT NO.:** 324000731

AERMOD View - Lakes Environmental Software

PROJECT TITLE:

GFL Moosecreek Effects Assessment - Existing Conditions
PM2.5 Peak 24 Hour Average Concentration Contours - 98th Percentile - Year 4 (2018)

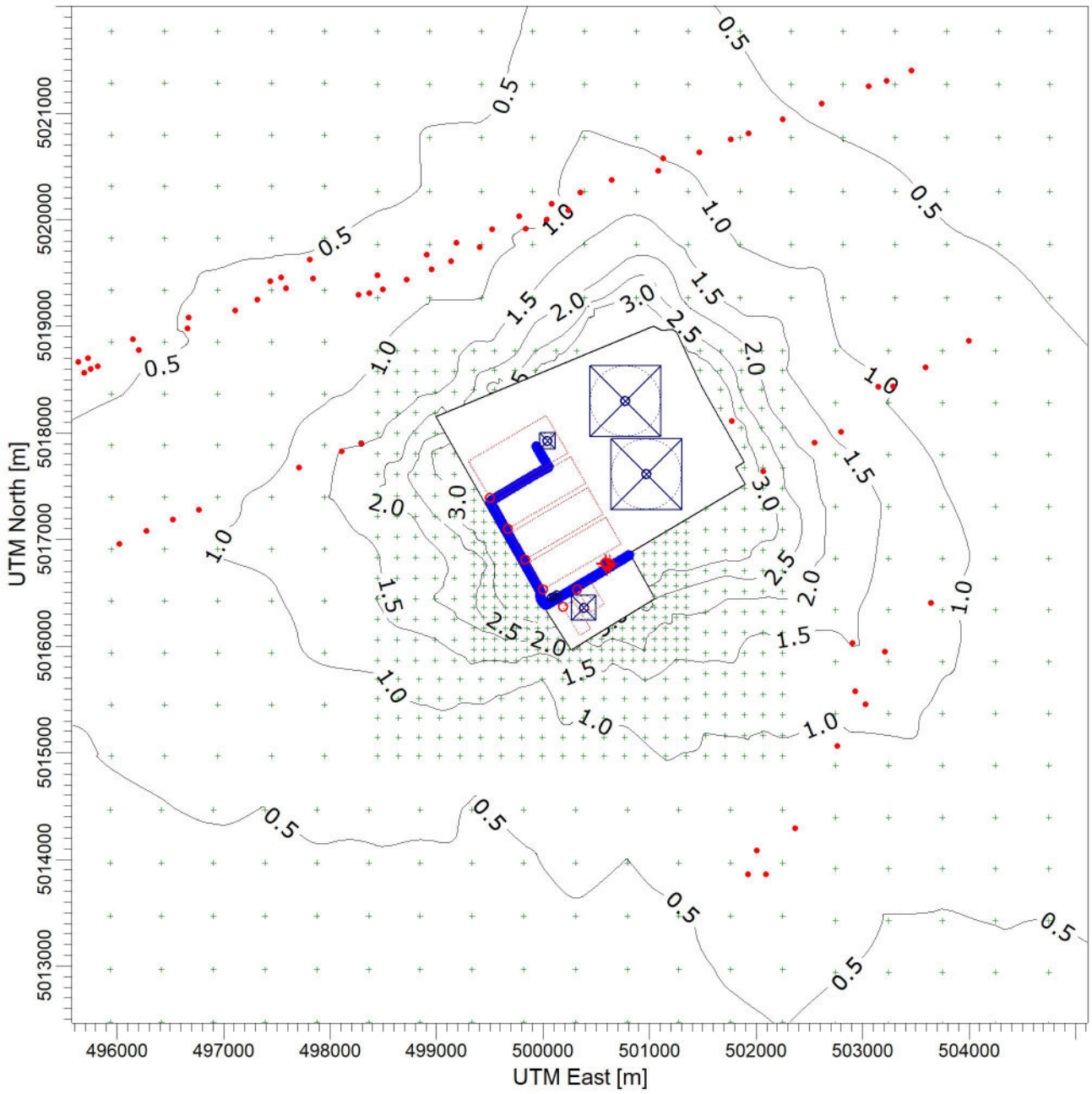


COMMENTS:	**SOURCES:** 22	**COMPANY NAME:** Ramboll Canada Inc.	
	RECEPTORS: 1922	**MODELER:** EM	
	OUTPUT TYPE: Concentration	**SCALE:** 1:60,000 (0 — 2 km)	
	MAX: 10.8 ug/m^3	**DATE:** 2022-06-21	**PROJECT NO.:** 324000731

AERMOD View - Lakes Environmental Software

PROJECT TITLE:

GFL Moosecreek Effects Assessment - Existing Conditions
PM2.5 Peak 24 Hour Average Concentration Contours - 98th Percentile - Year 5 (2019)

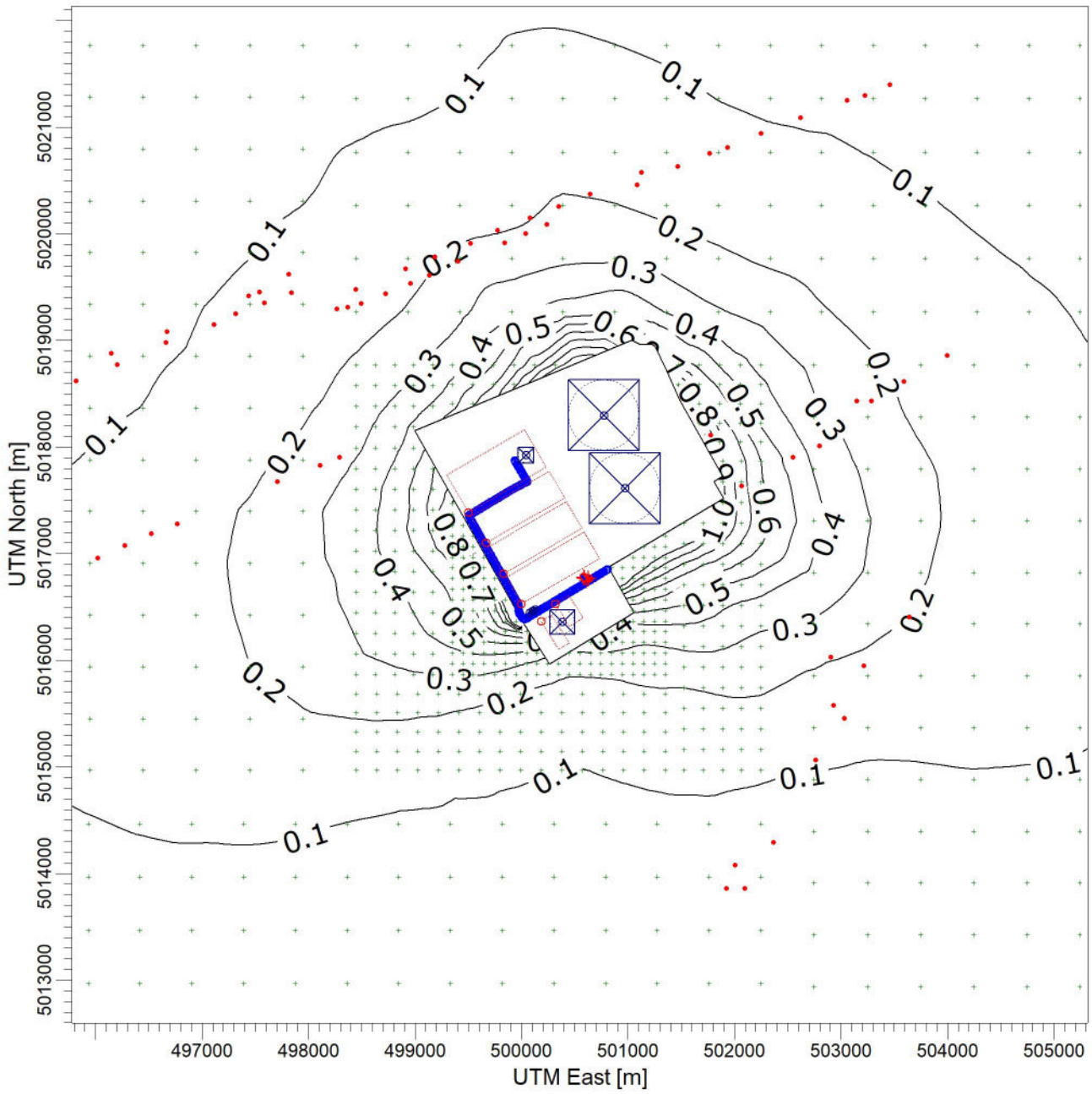


COMMENTS:	**SOURCES:** 22	**COMPANY NAME:** Ramboll Canada Inc.	
	RECEPTORS: 1922	**MODELER:** EM	RAMBOLL
	OUTPUT TYPE: Concentration	**SCALE:** 1:60,000 0 2 km	
	MAX: 9.4 ug/m^3	**DATE:** 2022-06-21	**PROJECT NO.:** 324000731

AERMOD View - Lakes Environmental Software

PROJECT TITLE:

GFL Moosecreek Effects Assessment - Existing Conditions
PM2.5 Peak Annual Average Concentration Contours

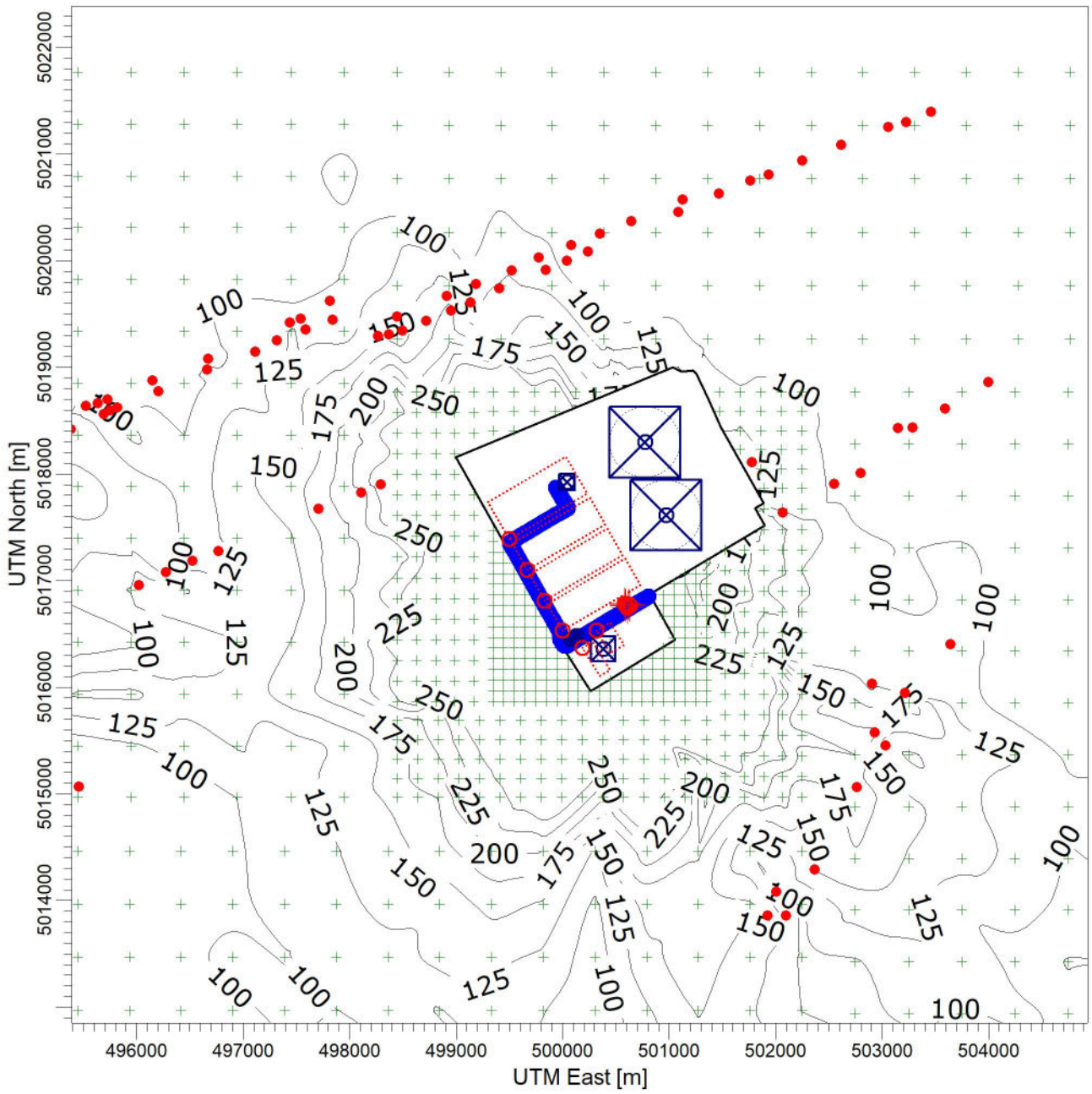


COMMENTS:	**SOURCES:** 22	**COMPANY NAME:** Ramboll Canada Inc.	
	RECEPTORS: 1922	**MODELER:** EM	
	OUTPUT TYPE: Concentration	**SCALE:** 1:60,000 (0 — 2 km)	
	MAX: 2.64 ug/m^3	**DATE:** 2022-06-21	**PROJECT NO.:** 324000731

AERMOD View - Lakes Environmental Software

PROJECT TITLE:

GFL Moosecreek Effects Assessment - Existing Conditions
Carbon Monoxide Peak 1 Hour Average Concentration Contours

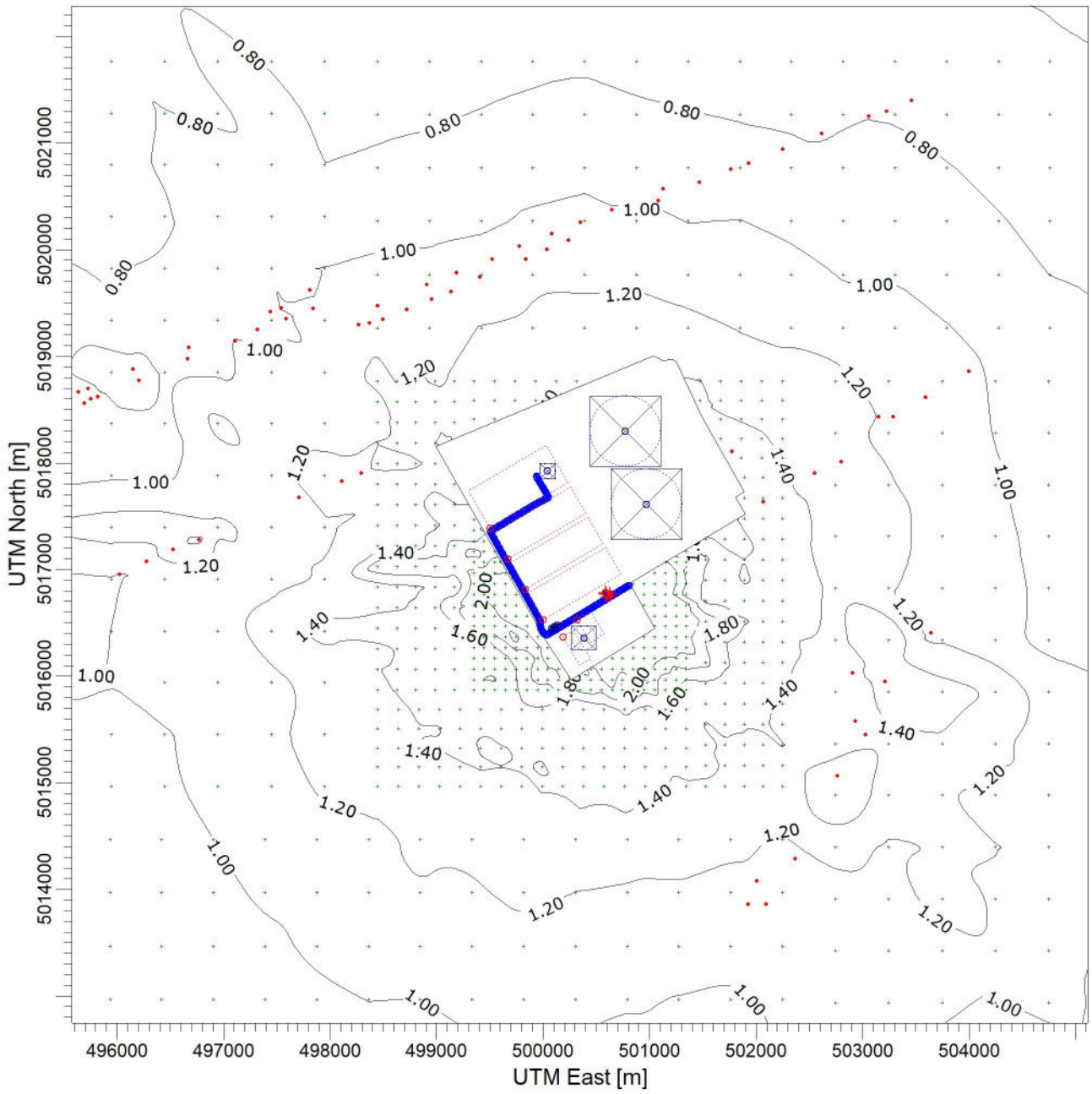


COMMENTS:	**SOURCES:** 22	**COMPANY NAME:** Ramboll Canada Inc.	
	RECEPTORS: 1922	**MODELER:** EM	
	OUTPUT TYPE: Concentration	**SCALE:** 1:60,000 (0 — 2 km)	
	MAX: 1413 ug/m^3	**DATE:** 2022-06-21	**PROJECT NO.:** 324000731

AERMOD View - Lakes Environmental Software

PROJECT TITLE:

GFL Moosecreek Effects Assessment - Existing Conditions
Sulphur Dioxide Peak 1 Hour Concentration Contours

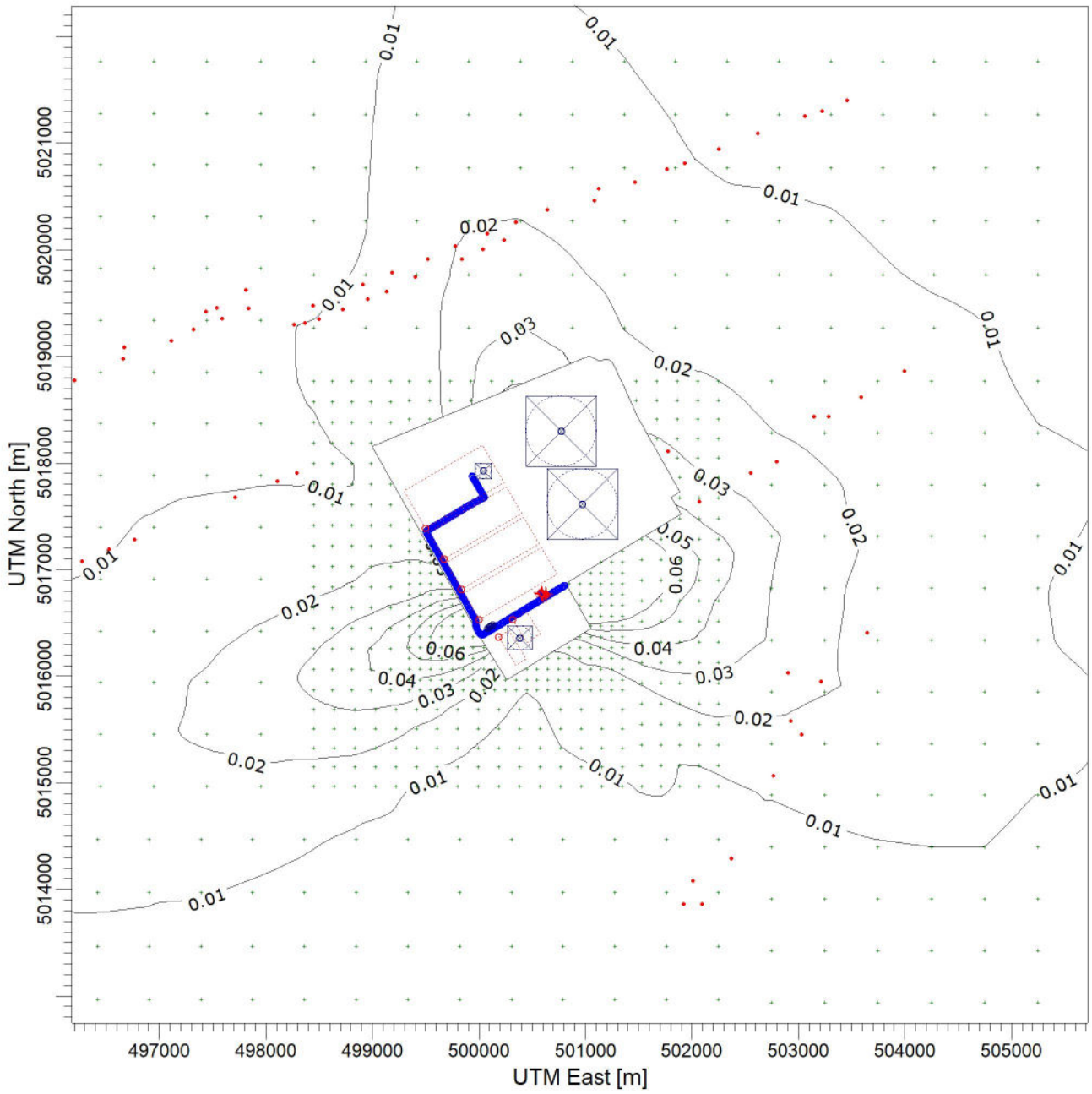


COMMENTS:	**SOURCES:** 22	**COMPANY NAME:** Ramboll Canada Inc.	
	RECEPTORS: 1922	**MODELER:** EM	RAMBOLL
	OUTPUT TYPE: Concentration	**SCALE:** 1:60,000 — 0 — 2 km	
	MAX: 4.85 ug/m^3	**DATE:** 2022-06-21	**PROJECT NO.:** 32400731

AERMOD View - Lakes Environmental Software

PROJECT TITLE:

GFL Moosecreek Effects Assessment - Existing Conditions
Sulphur Dioxide Peak Annual Concentration Contours, Highest Year (Year 3)



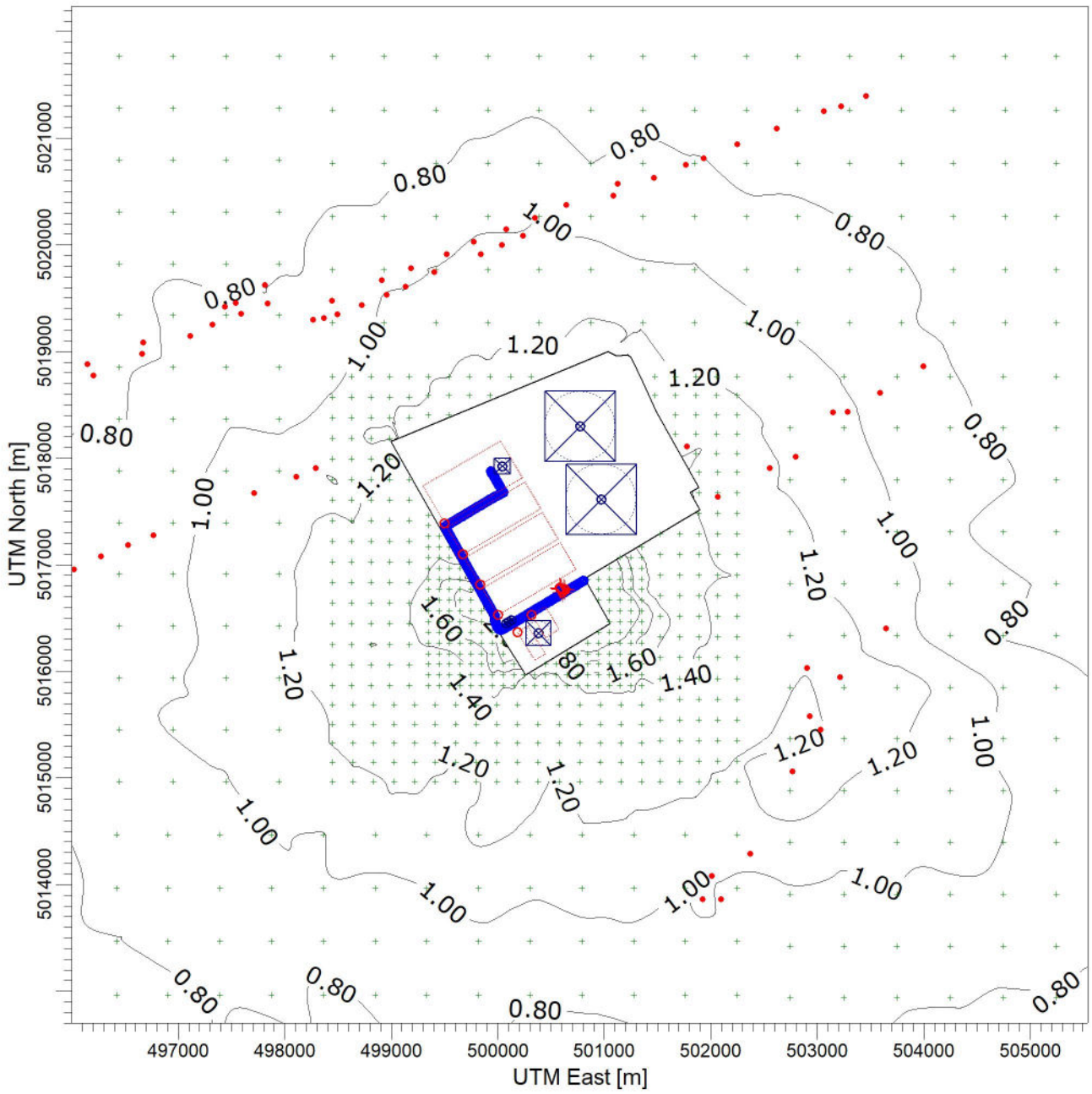
COMMENTS:	**SOURCES:** 22	**COMPANY NAME:** Ramboll Canada Inc.	
	RECEPTORS: 1922	**MODELER:** EM	RAMBOLL
	OUTPUT TYPE: Concentration	**SCALE:** 1:60,000 — 0 — 2 km	
	MAX: 0.295 ug/m^3	**DATE:** 2022-06-21	**PROJECT NO.:** 32400731

AERMOD View - Lakes Environmental Software

PROJECT TITLE:

GFL Moosecreek Effects Assessment - Existing Conditions

Sulphur Dioxide, 1 Hour CAAQS - Multi year average of the 99th percentile daily maximum 1-hour concentration

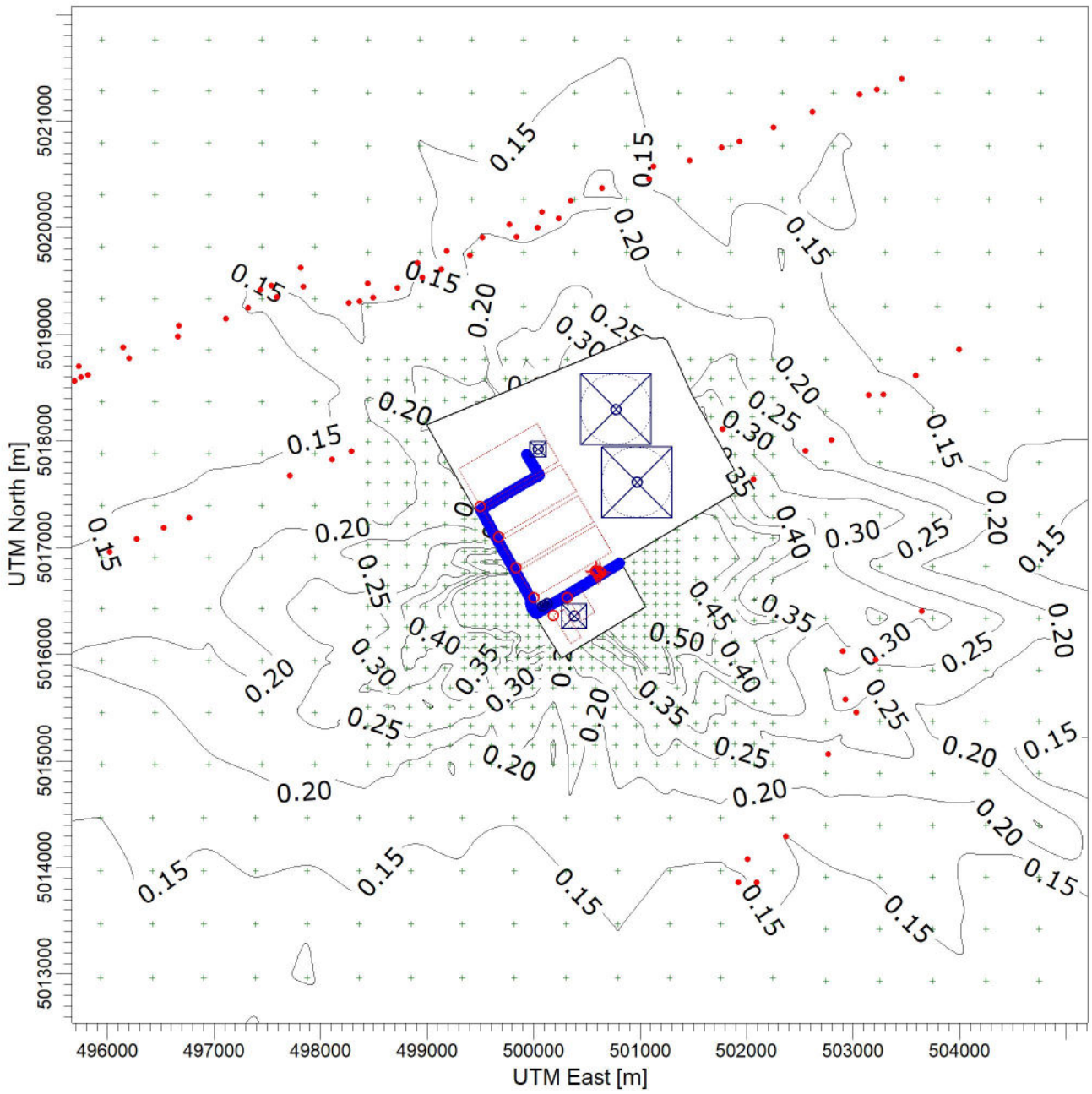


COMMENTS:	**SOURCES:** 22	**COMPANY NAME:** Ramboll Canada Inc.	
	RECEPTORS: 1922	**MODELER:** EM	RAMBOLL
	OUTPUT TYPE: Concentration	**SCALE:** 1:60,000 0 2 km	
	MAX: 4.63 ug/m^3	**DATE:** 2022-06-22	**PROJECT NO.:** 324000731

AERMOD View - Lakes Environmental Software

PROJECT TITLE:

GFL Moosecreek Effects Assessment - Existing Conditions
Hydrogen Chloride Peak 24 Hour Average Concentration Contours

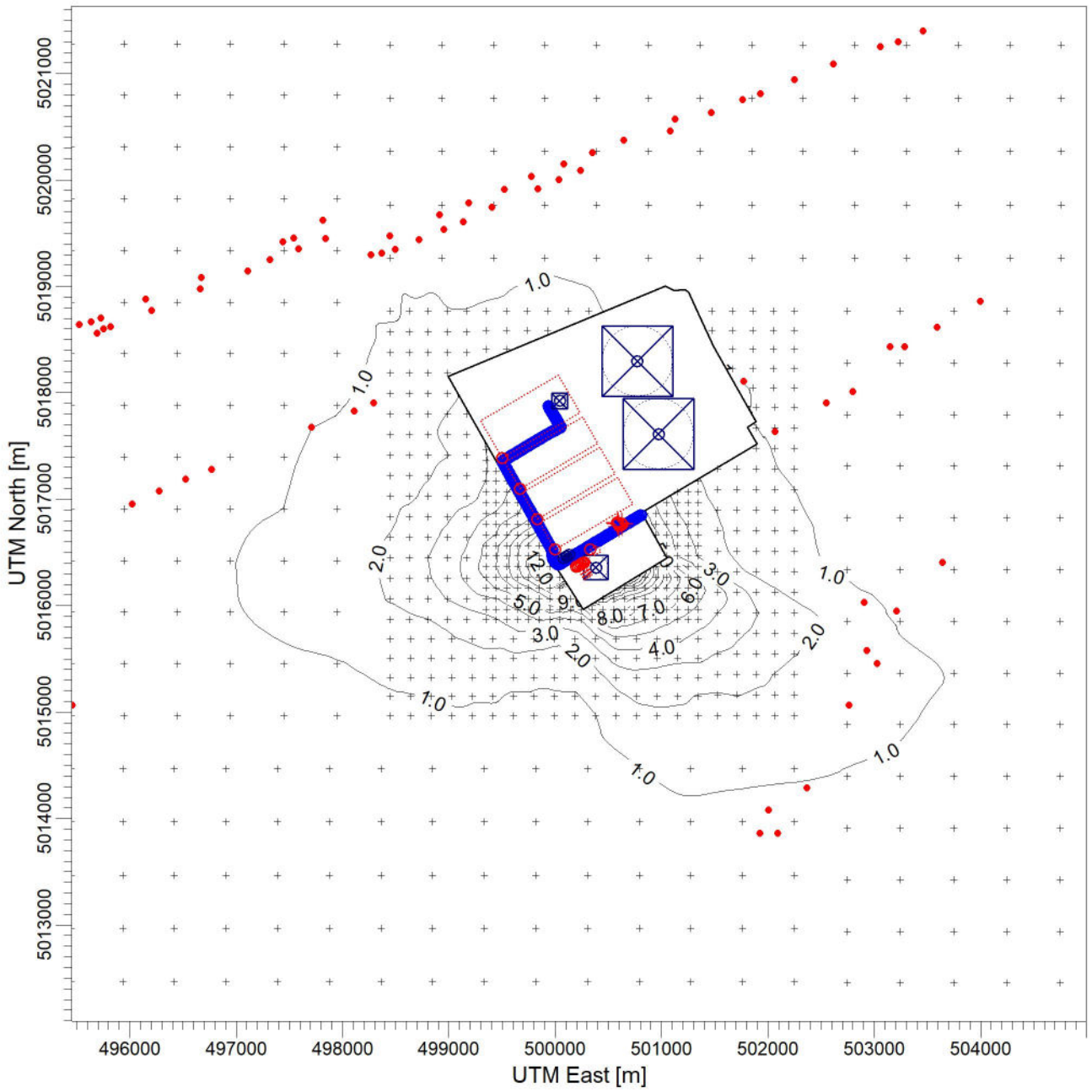


COMMENTS:	**SOURCES:** 22	**COMPANY NAME:** Ramboll Canada Inc.	
	RECEPTORS: 1922	**MODELER:** EM	
	OUTPUT TYPE: Concentration	**SCALE:** 1:60,000 (0 — 2 km)	
	MAX: 3.164 ug/m^3	**DATE:** 2022-06-22	**PROJECT NO.:** 324000731

AERMOD View - Lakes Environmental Software

PROJECT TITLE:

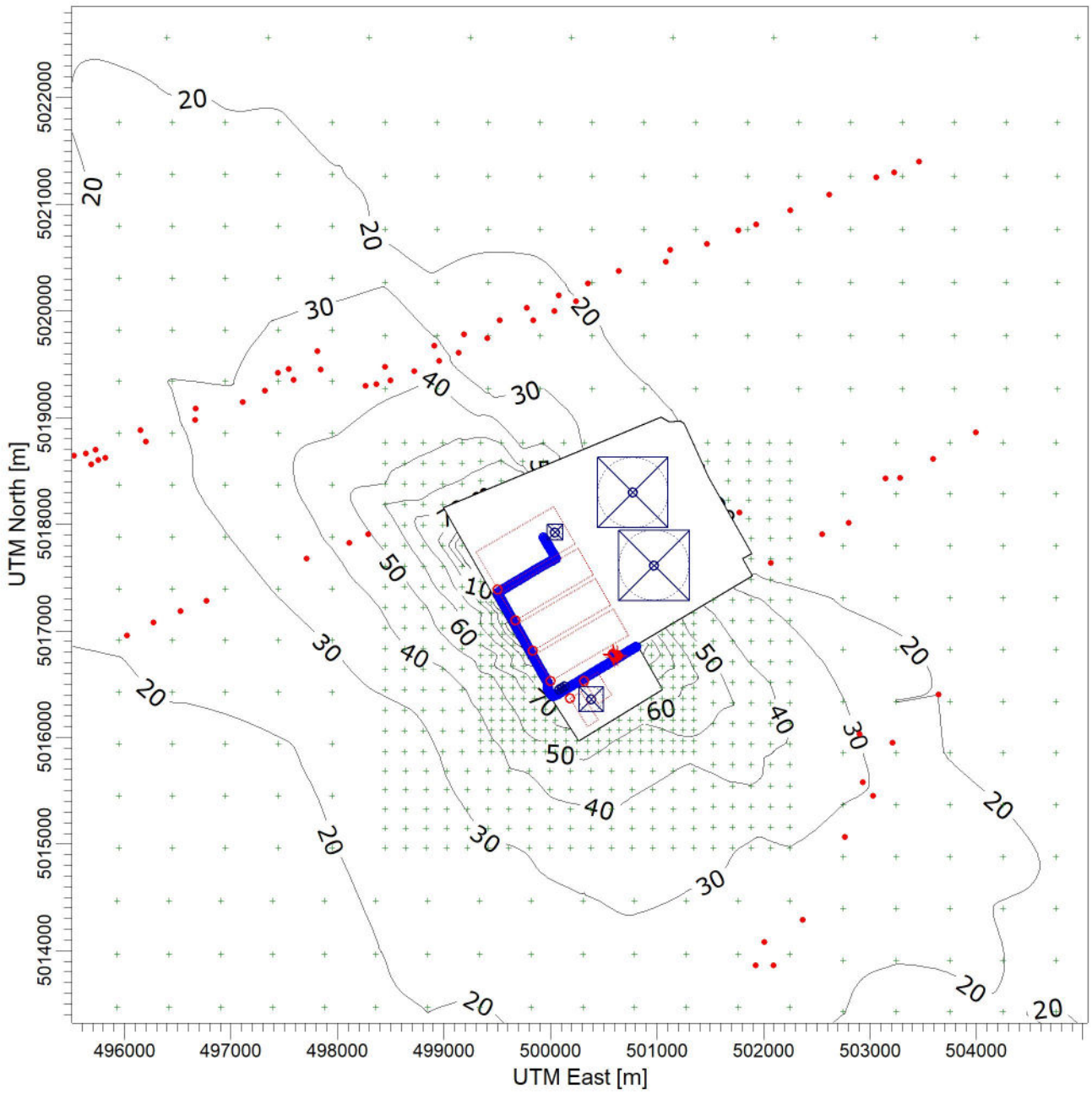
GFL Moosecreek Effects Assessment - Existing Conditions
Odour 10 Minute Average Peak Concentration Contours (99.5th Percentile)



COMMENTS: The 1-hr air dispersion modelling output units were adjusted in AERMOD to reflect the expected peak 10-min average values using the MECP recommended standard conversion factor of 1.65.	SOURCES: **27**	COMPANY NAME: **Ramboll Canada Inc.**	
	RECEPTORS: **1922**		RAMBOLL
	OUTPUT TYPE: **Concentration**	SCALE: 1:60,000 0 2 km	
	MAX: **17.7 OU/M³**	DATE: **2023-05-30**	PROJECT NO.: **324000731**

PROJECT TITLE:

GFL Moosecreek Effects Assessment - Existing Conditions
Landfill Gas (LFG) Base Run (1 g/s) Peak 1 Hour Average Concentration Contours

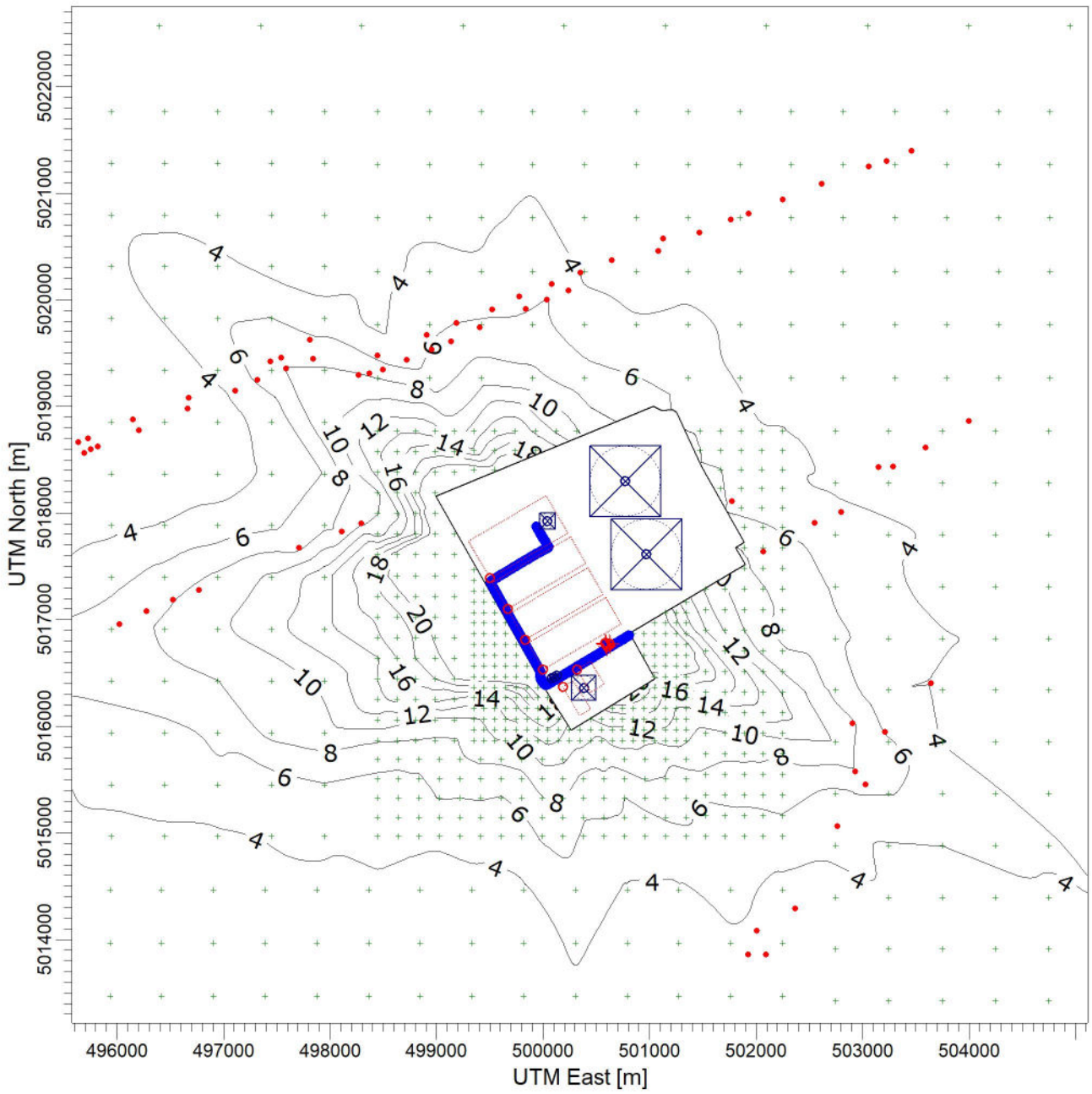


COMMENTS:	**SOURCES:** 22	**COMPANY NAME:** Ramboll Canada Inc.	
	RECEPTORS: 1922	**MODELER:** EM	RAMBOLL
	OUTPUT TYPE: Concentration	**SCALE:** 1:60,000 — 0 — 2 km	
	MAX: 123.3 ug/m^3	**DATE:** 2022-06-22	**PROJECT NO.:** 324000731

AERMOD View - Lakes Environmental Software

PROJECT TITLE:

GFL Moosecreek Effects Assessment - Existing Conditions
Landfill Gas (LFG) Base Run (1 g/s) Peak 24 Hour Average Concentration Contours

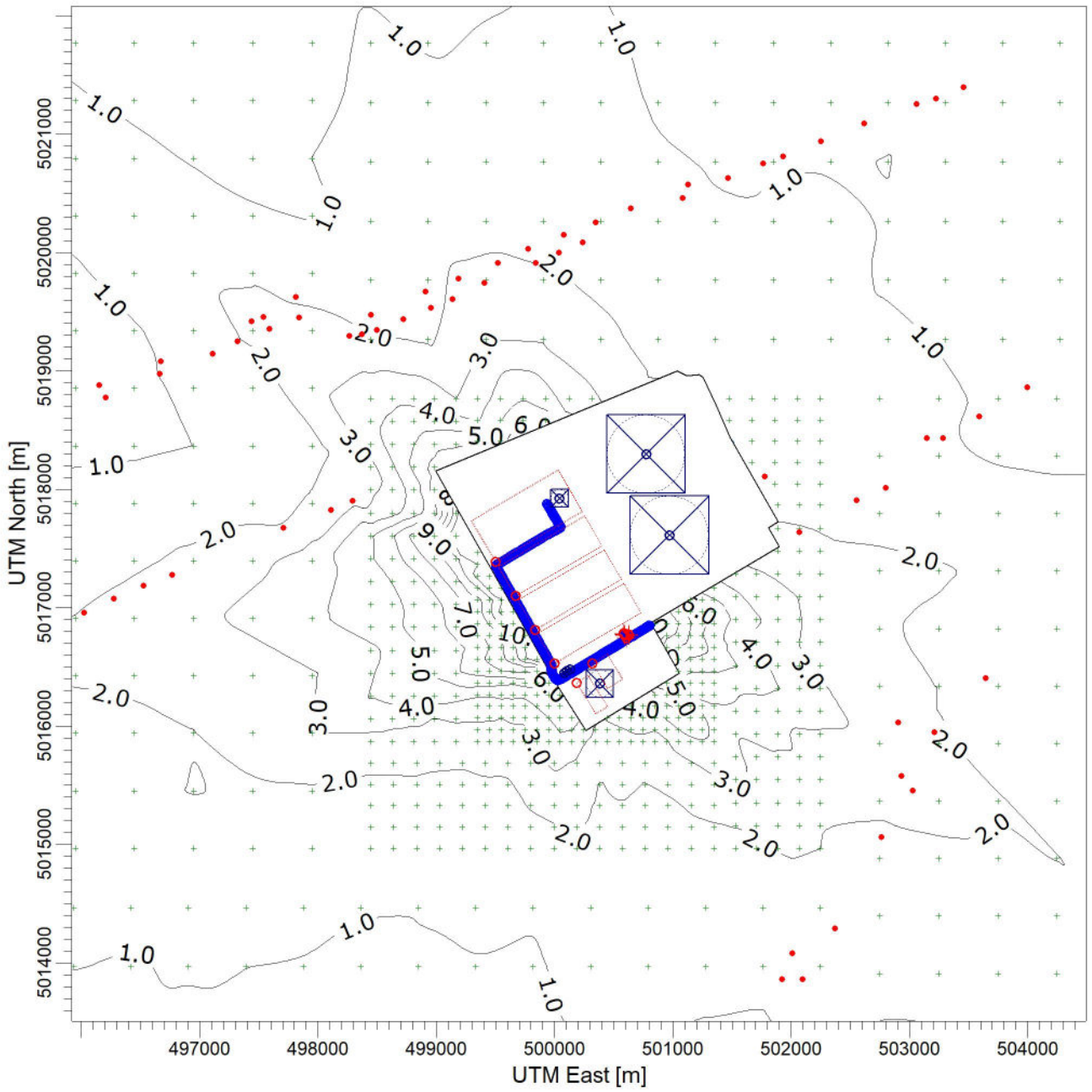


COMMENTS:	**SOURCES:** 22	**COMPANY NAME:** Ramboll Canada Inc.	
	RECEPTORS: 1922	**MODELER:** EM	RAMBOLL
	OUTPUT TYPE: Concentration	**SCALE:** 1:60,000 — 0 — 2 km	
	MAX: 57 ug/m^3	**DATE:** 2022-06-22	**PROJECT NO.:** 324000731

AERMOD View - Lakes Environmental Software

PROJECT TITLE:

GFL Moosecreek Effects Assessment - Existing Conditions
Siloxane Base Run (1 g/s) Peak 24 Hour Average Concentration Contours



COMMENTS:	**SOURCES:** 22	**COMPANY NAME:** Ramboll Canada Inc.	
	RECEPTORS: 1922	**MODELER:** EM	RAMBOLL
	OUTPUT TYPE: Concentration	**SCALE:** 1:53,937 (0 — 2 km)	
	MAX: 15.0 ug/m^3	**DATE:** 2022-06-22	**PROJECT NO.:** 324000731

AERMOD View - Lakes Environmental Software

APPENDIX E:
EMISSION ESTIMATES

Calculation Sheet
LFG Emissions from Gensets and Flares

The maximum quantity of LFG was estimated by using LandGEM Landfill Gas Emissions Model version 3.02, USEPA :

Max Quantity of LFG= 7.83E+07 m^3/year

It was assumed that the LFG collection system has a capture capacity of 75%. As such:

25% of LFG is emitted into the atmosphere as fugitive emissions:

=25% x 7.83e7 1.96E+07 m^3/year

75% of LFG is captured by LFG collection system and will be directed into the flares and generators.

=75% x 7.83e7 5.87E+07 m^3/year

The majority of collected LFG from collection system is directed into flare#1, and flare#2 (new flare). The remaining LFG will be directed into generators.

The LFG required to be filtered from siloxane compounds prior to combustion in generators in order to protect generators engines.
The purge gas from siloxane filter will be sent to flare 3 (siloxane filter) and will be combusted.

The amount of LFG combusted in flare #1 and #2 was estimated based on the following assumptions:

1. LFG quantity combusted in generators and siloxane flare was estimated based on actual quantity reported in 2019.
Approximately, 20,100,962 Sm3 and 891,340 Sm3 of total captured LFG was combusted in generators and siloxane flare, respectively.
2. The quantity of LFG combusted in generators and siloxane filter was subtract from total captured LFG to estimate the remaining quantity of LFG.
Quantity of remaining LFG =5.87e7 (m3/year) - 20,100,962 (m3/year) - 891,340 (m3/year)= 3.77E+07 m^3/year
3. The remaining quantity of LFG was splited between flare 1 and flare 2 based on their design capacity obtained from manufacturers.

Units	Design Capacity (cfm)	LFG Quantity
Flare 1	2500	1.35E+07
Flare 2	4500	2.42E+07

Source ID	LFG quantity[1,2]			No. of units	LFG quantity per unit	
	LFG Quantity (Sm^3/year)	hours/year	m^3/hr		m^3/hr	m^3/s
LFG Fugitive	19,570,000	8,760	2,234	-	2234	0.62
Engines	20,100,962	8,760	2,295	4	574	0.16
Flare 1	13,470,606	8,760	1,538	1	1538	0.43
Flare 2	24,247,092	8,760	2,768	1	2768	0.77
Flare 3	891,340	8,760	102	1	102	0.03

1. LFG quantities combusted in generator engines and siloxane flare were provided by GFL and are based on 2019 calender year.
2. LFG quantities combusted in flare 1 and flare 2 were estimated based on design capacities obtained from manufacturers.

Control Efficiency (%) from Table 2.4-3, AP-42

LFG Emission Sources	LFG Quantity (Sm^3/year)	Capture Efficiency	LFG Emission Rate (m^3/yr)	LFG Emissions	Significant? (Yes or No)[1]
Fugitives	19,570,000	0.00%	19,570,000	93%	Yes
Engines	20,100,962	97.20%	562,827	3%	No
Flare 1	13,470,606	97.70%	309,824	1%	No
Flare 2	24,247,092	97.70%	557,683	3%	No
Flare 3 (Siloxane Flare)	891,340	97.70%	20,501	0%	No
		Total	21,020,835	100%	

1. Sources that are Insignificant Relative to Total Emissions per section 7.2.2 of ESDM guidance document.

Table E1. LFG Generation and Distribution

Landfill Gas (LFG) is generated by decomposition of organic materials within the landfill. The quantity of LFG generated per year was estimated using the US EPA LandGEM Landfill Gas Emissions Model version 3.02.

Model Inputs:

Inputs to the model were based on:

- 2019 and earlier - records of quantity of waste accepted annually (tonnes/year)
- 2020 to 2025 - assumed 755,000 tonnes/year of waste accepted
- Closure at end of 2025

Model Results

The LandGEM model estimates:

Maximum LFG generation rate: 78,280,000 m³/year after 2025 (in 2026)

LFG is assumed to be generated relatively uniformly through the year, so this equates to peak generation rate of:

78280000 (m³/year) / 365 (days/year) / 24 (hours/day) / 3600 (seconds/hour)

LFG Generation Rate = 2.5 m³/s

Distribution

The landfill has an LFG Collection System to capture LFG and route it to the LFG Utilization Facility. LFG that is not captured by the system is emitted to atmosphere through the landfill surface.

LFG Capture System Efficiency: 75%

LFG captured and combusted at the LFG Utilization facility:	2.5 (m³/s) x 75% =	1.86	m³/s
LFG not captured, and emitted from surface (e.g. fugitive):	2.5 (m³/s) x (1-75%) =	0.62	m³/s

At the LFG Utilization facility, LFG is used to fuel engines driving electrical generators (Gen1 to Gen4). Siloxanes are filtered from the engine fuel, and purge gas from the filter is mixed with LFG and combusted in an enclosed flare (Flare3). Excess LFG not used in Gen1 to Gen4 or Flare3 is combusted in two enclosed flares (Flare1 and Flare2). For the puroses of this analysis, LFG is assumed to be distributed between Flares1 and 2 proportional to their rated capacity.

Source	**LFG Combusted (m³/s)**	
Engines (Gen1 to Gen 4)	0.64	m³/s, at rated power (2019)
Siloxane Flare (Flare3)	0.029	m³/s, at rated engine power (2019)
Flare 1	0.43	m³/s (rated capacity 1.18 m³/s)
Flare 2	0.77	m³/s (rated capacity 2.12 m³/s)
Total Combusted	1.86	m³/s

Table E2. Fugitive Emissions Of LFG

LFG that is not captured by the LFG Collection System is emitted from the surface of the landfill as fugitive. The landfill is divided into four stages (STG1 to STG4). Fugitive LFG was assumed to to be emitted uniformly over the area of the four stages.

Concentrations of constituents of LFG are based on US EPA, AP-42, Table 2.4-1.

Total Fugitive LFG Emission Rate: 0.62 m^3/s (see Table E1 for calculation)

Emission Sources	Surface Area (m^2)
STG1 - Stage 1	244,000
STG2 - Stage 2	244,000
STG3 - Stage 3	244,000
STG4 - Stage 4	342,000
Total Surface Area	**1,074,000**

Sample Calculation (1,1,1-Trichloroethane)

Total emission rate = LFG Emission rate (m^3/s) x Concentration in LFG (mg/m^3) /1000 (mg/g)
= 0.99 (m^3/s) x 1.32 (mg/m^3) / 1000 (mg/g)
= 0.00082

Emission flux = Total emission rate (g/s) / Total surface area (m^2)
= 0.00082 / 1,074,000 (m^2)
= 7.66E-10

Aggregate Fugitive Emissions from Stages 1 to 4 (STG1 to STG4)

Constituent	CAS No.	MW	Concentration in LFG		Total Emission Rate	Total Emission Flux	Emission Factor Rating
		(g/mole)	(ppmv)	(mg/m^3)	(g/s)	($g/s/m^2$)	
1,1,1-Trichloroethane	71556	133	2.43E-01	1.3	8.22E-04	7.66E-10	A
1,1,2,2-Tetrachloroethane	79345	168	5.35E-01	3.7	2.28E-03	2.12E-09	E
1,1,2,3,4,4-Hexachloro-1,3-butadiene (Hexachlorobutadiene)	87683	261	3.49E-03	0.0	2.31E-05	2.15E-11	D
1,1,2-Trichloro-1,2,2-Trifluoroethane	76131	187	6.72E-02	0.5	3.19E-04	2.97E-10	C
1,1,2-Trichloroethane	79005	133	1.58E-01	0.9	5.35E-04	4.98E-10	D
1,1-Dichloroethane	75343	99	2.08E+00	8.4	5.22E-03	4.86E-09	A
1,1-Dichloroethene (1,1- Dichloroethylene)	75354	97	1.60E-01	0.6	3.93E-04	3.66E-10	A
1,2,3-Trimethylbenzene	526738	120	3.59E-01	1.8	1.09E-03	1.02E-09	D
1,2,4-Trichlorobenzene	120821	181	5.51E-03	0.0	2.54E-05	2.36E-11	C
1,2,4-Trimethylbenzene	95636	120	1.37E+00	6.7	4.18E-03	3.89E-09	B
1,2-Dibromoethane (Ethylene dibromide)	106934	188	4.80E-03	0.0	2.29E-05	2.13E-11	B
1,2-Dichloro-1,1,2,2- tetrafluoroethane (Freon 114)	76142	171	1.06E-01	0.7	4.60E-04	4.28E-10	B
1,2-Dichloroethane (Ethylene dichloride)	107062	99	1.59E-01	0.6	3.99E-04	3.72E-10	A
1,2-Dichloroethene	540590	97	1.14E+01	45.2	2.80E-02	2.61E-08	E
1,2-Dichloropropane	78875	113	5.20E-02	0.2	1.49E-04	1.39E-10	D
1,2-Diethylbenzene	135013	134	1.99E-02	0.1	6.77E-05	6.31E-11	D
1,3,5-Trimethylbenzene	108678	120	6.23E-01	3.1	1.90E-03	1.77E-09	C
1,3-Butadiene (Vinyl ethylene)	106990	54	1.66E-01	0.4	2.28E-04	2.12E-10	C
1,3-Diethylbenzene	141935	134	6.55E-02	0.4	2.23E-04	2.08E-10	D
1,4-Diethylbenzene	105055	134	2.62E-01	1.4	8.92E-04	8.30E-10	D
1,4-Dioxane (1,4-Diethylene dioxide)	123911	88	8.29E-03	0.0	1.85E-05	1.72E-11	D
1-Butene	106989	56	1.22E+00	2.8	1.74E-03	1.62E-09	D
2-Methylbutene	513359	70	1.22E+00	3.5	2.17E-03	2.02E-09	D
1-Butene	106989	56	1.10E+00	2.5	1.57E-03	1.46E-09	E
2-Methylpropene	115117	56	1.10E+00	2.5	1.57E-03	1.46E-09	E
1-Ethyl-4-methylbenzene (4-Ethyl toluene)	622968	120	9.89E-01	4.9	3.01E-03	2.81E-09	C
1-Heptene	592767	98	6.25E-01	2.5	1.56E-03	1.45E-09	E
1-Hexene	592416	84	8.88E-02	0.3	1.90E-04	1.76E-10	D
2-Methyl-1-pentene	763291	84	8.88E-02	0.3	1.90E-04	1.76E-10	D
1-Methylcyclohexene	591491	96	2.27E-02	0.1	5.54E-05	5.16E-11	D
1-Methylcyclopentene	693890	82	2.52E-02	0.1	5.25E-05	4.89E-11	D
1-Pentene	109671	70	2.20E-01	0.6	3.91E-04	3.64E-10	D
1-Propanethiol (n-Propyl mercaptan)	107039	76	1.25E-01	0.4	2.41E-04	2.25E-10	D
2,2,3-Trimethylbutane	464062	100	9.19E-03	0.0	2.34E-05	2.17E-11	D
2,2,4-Trimethylpentane	540841	114	6.14E-01	2.9	1.78E-03	1.66E-09	A
2,2,5-Trimethylhexane	3522949	128	1.56E-01	0.8	5.07E-04	4.72E-10	D
2,2-Dimethylbutane	75832	86	1.56E-01	0.5	3.41E-04	3.17E-10	D
2,2-Dimethylpentane	590352	100	6.08E-02	0.2	1.55E-04	1.44E-10	D
2,2-Dimethylpropane	463821	72	2.74E-02	0.1	5.01E-05	4.67E-11	D
2,3,4-Trimethylpentane	565753	114	3.12E-01	1.5	9.04E-04	8.42E-10	D
2,3-Dimethylbutane	79298	86	1.67E-01	0.6	3.65E-04	3.40E-10	E
2,3-Dimethylpentane	565593	100	3.10E-01	1.3	7.88E-04	7.34E-10	D
2,4-Dimethylhexane	589435	114	2.22E-01	1.0	6.43E-04	5.99E-10	D
2,4-Dimethylpentane	108087	100	1.00E-01	0.4	2.54E-04	2.37E-10	D

Constituent	CAS No.	MW	Concentration in LFG		Total Emission Rate	Total Emission Flux	Emission Factor Rating
		(g/mole)	(ppmv)	(mg/m³)	(g/s)	(g/s/m²)	
2,5-Dimethylhexane	592132	114	1.66E-01	0.8	4.81E-04	4.48E-10	D
2,5-Dimethylthiophene	638028	112	6.44E-02	0.3	1.83E-04	1.71E-10	D
2-Butanone (Methyl ethyl ketone)	78933	72	4.01E+00	11.8	7.33E-03	6.83E-09	D
2-Ethyl-1-butene	760214	84	1.77E-02	0.1	3.78E-05	3.52E-11	E
2-Ethylthiophene	872559	112	6.29E-02	0.3	1.79E-04	1.67E-10	C
2-Ethyltoluene	611143	120	3.23E-01	1.6	9.85E-04	9.17E-10	D
2-Hexanone (Methyl butyl ketone)	591786	100	6.13E-01	2.5	1.56E-03	1.45E-09	E
2-Methyl-1-butene	563462	70	1.79E-01	0.5	3.18E-04	2.96E-10	D
2-Methyl-1-propanethiol (Isobutyl mercaptan)	513440	90	1.70E-01	0.6	3.89E-04	3.62E-10	E
2-Methyl-2-butene	513359	70	3.03E-01	0.9	5.39E-04	5.02E-10	D
2-Methyl-2-propanethiol (tert- Butylmercaptan)	75661	90	3.25E-01	1.2	7.43E-04	6.92E-10	E
2-Methylbutane	78784	72	2.26E+00	6.7	4.14E-03	3.85E-09	D
2-Methylheptane	592278	114	7.16E-01	3.3	2.07E-03	1.93E-09	D
2-Methylhexane	591764	100	8.16E-01	3.3	2.07E-03	1.93E-09	D
2-Methylpentane	107835	86	6.88E-01	2.4	1.50E-03	1.40E-09	D
2-Propanol (Isopropyl alcohol)	67630	60	1.80E+00	4.4	2.74E-03	2.55E-09	D
3,6-Dimethyloctane	15869940	142	7.85E-01	4.6	2.83E-03	2.64E-09	D
3-Ethyltoluene	620144	120	7.80E-01	3.8	2.38E-03	2.21E-09	D
3-Methyl-1-pentene	760203	84	6.99E-03	0.0	1.49E-05	1.39E-11	D
3-Methylheptane	589811	114	7.63E-01	3.6	2.21E-03	2.06E-09	D
3-Methylhexane	589344	100	1.13E+00	4.6	2.87E-03	2.67E-09	D
3-Methylpentane	96140	86	7.40E-01	2.6	1.62E-03	1.51E-09	D
3-Methylthiophene	616444	98	9.25E-02	0.4	2.30E-04	2.14E-10	E
4-Methyl-1-pentene	691372	84	2.33E-02	0.1	4.97E-05	4.63E-11	E
4-Methyl-2-pentanone (MIBK)	108101	100	8.83E-01	3.6	2.24E-03	2.09E-09	C
4-Methylheptane	589537	114	2.49E-01	1.2	7.21E-04	6.72E-10	D
Acetaldehyde	75070	44	7.74E-02	0.1	8.65E-05	8.05E-11	D
Acetone	67641	58	6.70E+00	15.9	9.87E-03	9.19E-09	C
Acetonitrile	75058	41	5.56E-01	0.9	5.79E-04	5.39E-10	A
Benzene	71432	78	2.40E+00	7.7	4.75E-03	4.43E-09	A
Benzyl chloride	100447	127	1.81E-02	0.1	5.81E-05	5.41E-11	A
Bromodichloromethane	75274	164	8.78E-03	0.1	3.65E-05	3.40E-11	E
Bromomethane (Methyl bromide)	74839	95	2.10E-02	0.1	5.06E-05	4.71E-11	C
Butane	106978	58	6.22E+00	14.8	9.17E-03	8.54E-09	C
Carbon disulfide	75150	76	1.47E-01	0.5	2.84E-04	2.64E-10	A
Carbon monoxide	630080	28	2.44E+01	27.9	1.73E-02	1.61E-08	C
Carbon tetrachloride	56235	154	7.98E-03	0.1	3.11E-05	2.90E-11	A
Carbon tetrafluoride (Freon 14)	75730	88	1.51E-01	0.5	3.37E-04	3.14E-10	E
Carbonyl sulfide (Carbon oxysulfide)	463581	60	1.22E-01	0.3	1.86E-04	1.73E-10	A
Chlorobenzene	108907	113	4.84E-01	2.2	1.38E-03	1.29E-09	A
Chlorodifluoromethane (Freon 22)	75456	86	7.96E-01	2.8	1.75E-03	1.63E-09	D
Chloroethane (Ethyl chloride)	75003	65	3.95E+00	10.4	6.46E-03	6.02E-09	B
Chloromethane (Methyl chloride)	74873	50	2.44E-01	0.5	3.12E-04	2.91E-10	B
cis-1,2-Dichloroethene	156592	97	1.24E+00	4.9	3.05E-03	2.84E-09	B
cis-1,2-Dimethylcyclohexane	2207014	112	8.10E-02	0.4	2.31E-04	2.15E-10	D
cis-1,3-Dichloropropene	10061015	111	3.03E-03	0.0	8.53E-06	7.94E-12	D
cis-1,3-Dimethylcyclohexane	638040	112	5.01E-01	2.3	1.43E-03	1.33E-09	D
cis-1,4-Dimethylcyclohexane	624293	112	2.48E-01	1.1	7.06E-04	6.57E-10	D
cis-1,4-Dimethylcyclohexane/trans1,3-Dimethylcyclohexane	2207036	112	2.48E-01	1.1	7.06E-04	6.57E-10	D
cis-2-Butene	590181	56	1.05E-01	0.2	1.49E-04	1.39E-10	D
cis-2-Heptene	6443921	98	2.45E-02	0.1	6.10E-05	5.68E-11	E
cis-2-Hexene	7688213	84	1.72E-02	0.1	3.67E-05	3.42E-11	D
cis-2-Octene	7642048	112	2.20E-01	1.0	6.26E-04	5.83E-10	D
cis-2-Pentene	627203	70	4.79E-02	0.1	8.52E-05	7.93E-11	D
cis-3-Methyl-2-pentene	922623	84	1.79E-02	0.1	3.82E-05	3.56E-11	D
Cyclohexane	110827	84	1.01E+00	3.5	2.16E-03	2.01E-09	B
Cyclohexene	110838	82	1.84E-02	0.1	3.83E-05	3.57E-11	D
Cyclopentane	287923	70	2.21E-02	0.1	3.93E-05	3.66E-11	D
Cyclopentene	142290	68	1.21E-02	0.0	2.09E-05	1.95E-11	D
Decane	124185	142	3.80E+00	22.1	1.37E-02	1.28E-08	D
Dibromochloromethane	124481	208	1.51E-02	0.1	7.98E-05	7.43E-11	D
Dibromomethane (Methylene dibromide)	74953	174	8.35E-04	0.0	3.68E-06	3.43E-12	E
Dichlorobenzene	106467	147	9.40E-01	5.6	3.50E-03	3.26E-09	A
Dichlorodifluoromethane (Freon 12)	75718	121	1.18E+00	5.8	3.62E-03	3.37E-09	B
Dichloromethane (Methylene chloride)	75092	85	6.15E+00	21.3	1.32E-02	1.23E-08	A
Diethyl sulfide	352932	90	8.62E-02	0.3	1.97E-04	1.84E-10	E
Dimethyl disulfide	624920	94	1.37E-01	0.5	3.27E-04	3.05E-10	A
Dimethyl sulfide	75183	62	5.66E+00	14.4	8.92E-03	8.31E-09	A
Dodecane (n-Dodecane)	112403	170	2.21E-01	1.5	9.55E-04	8.89E-10	D
Ethane	74840	30	9.05E+00	11.1	6.90E-03	6.43E-09	D

Constituent	CAS No.	MW	Concentration in LFG		Total Emission Rate	Total Emission Flux	Emission Factor Rating
		(g/mole)	(ppmv)	(mg/m³)	(g/s)	(g/s/m²)	
Ethanol	64175	46	2.30E-01	0.4	2.69E-04	2.50E-10	D
Ethyl acetate	141786	88	1.88E+00	6.8	4.20E-03	3.91E-09	C
Ethyl mercaptan (Ethanediol)	75081	62	1.98E-01	0.5	3.12E-04	2.91E-10	A
Ethyl methyl sulfide	624895	76	3.67E-02	0.1	7.09E-05	6.60E-11	E
Ethylbenzene	100414	106	4.86E+00	21.1	1.31E-02	1.22E-08	B
Formaldehyde	50000	30	1.17E-02	0.0	8.91E-06	8.30E-12	D
Heptane	142825	100	1.34E+00	5.5	3.41E-03	3.17E-09	B
Hexane	110543	86	3.10E+00	10.9	6.78E-03	6.31E-09	B
Hydrogen sulfide	7783064	34	3.20E+01	44.6	2.77E-02	2.58E-08	A
Indane (2,3-Dihydroindene)	496117	34	6.66E-02	0.1	5.76E-05	5.36E-11	D
Isobutane (2-Methylpropane)	75285	58	8.16E+00	19.4	1.20E-02	1.12E-08	D
Isobutylbenzene	538932	134	4.07E-02	0.2	1.39E-04	1.29E-10	D
Isoprene (2-Methyl-1,3-butadiene)	78795	68	1.65E-02	0.0	2.85E-05	2.65E-11	D
Isopropyl mercaptan	75332	76	1.75E-01	0.5	3.38E-04	3.15E-10	A
Isopropylbenzene (Cumene)	98828	120	4.30E-01	2.1	1.31E-03	1.22E-09	D
Mercury (total)	7439976	201	1.22E-04	0.0	6.21E-07	5.78E-13	B
Methanethiol (Methyl mercaptan)	74931	48	1.37E+00	2.7	1.67E-03	1.56E-09	A
Methyl tert-butyl ether (MTBE)	1634044	88	1.18E-01	0.4	2.64E-04	2.46E-10	D
Methylcyclohexane	108872	98	1.29E+00	5.2	3.21E-03	2.99E-09	D
Methylcyclopentane	96377	84	6.50E-01	2.2	1.39E-03	1.29E-09	D
Naphthalene	91203	128	1.07E-01	0.6	3.48E-04	3.24E-10	D
n-Butylbenzene	104518	134	6.80E-02	0.4	2.31E-04	2.16E-10	D
Nonane	111842	128	2.37E+00	12.4	7.71E-03	7.18E-09	D
n-Propylbenzene (Propylbenzene)	103651	120	4.13E-01	2.0	1.26E-03	1.17E-09	D
Octane	111659	114	1.08E+00	5.0	3.13E-03	2.91E-09	D
p-Cymene (1-Methyl-4-Isopropylbenzene)	99876	134	3.58E+00	19.6	1.22E-02	1.13E-08	D
Pentane	109660	72	4.46E+00	13.2	8.16E-03	7.60E-09	C
Propane	74986	44	1.55E+01	27.9	1.73E-02	1.61E-08	C
Propene	115071	42	3.32E+00	5.7	3.54E-03	3.30E-09	D
Propyne	74997	40	3.80E-02	0.1	3.86E-05	3.59E-11	E
sec-Butylbenzene	135988	134	6.75E-02	0.4	2.30E-04	2.14E-10	D
Styrene (Vinylbenzene)	100425	104	4.11E-01	1.7	1.09E-03	1.01E-09	B
Tetrachloroethylene (Perchloroethylene)	127184	166	2.03E+00	13.8	8.54E-03	7.95E-09	A
Tetrahydrofuran (Diethylene oxide)	109999	72	9.69E-01	2.9	1.77E-03	1.65E-09	C
Thiophene	110021	84	3.49E-01	1.2	7.45E-04	6.93E-10	E
Toluene (Methyl benzene)	108883	92	2.95E+01	111.1	6.89E-02	6.42E-08	A
trans-1,2-Dichloroethene	156605	97	2.87E-02	0.1	7.06E-05	6.57E-11	C
trans-1,2-Dimethylcyclohexane	6876239	112	4.04E-01	1.9	1.15E-03	1.07E-09	D
trans-1,3-Dichloropropene	10061026	111	9.43E-03	0.0	2.65E-05	2.47E-11	D
trans-1,4-Dimethylcyclohexane	2207047	112	2.05E-01	0.9	5.83E-04	5.43E-10	D
trans-2-Butene	624646	56	1.04E-01	0.2	1.48E-04	1.38E-10	D
trans-2-Heptene	14686136	98	2.50E-03	0.0	6.23E-06	5.80E-12	E
trans-2-Hexene	4050457	84	2.06E-02	0.1	4.40E-05	4.09E-11	D
trans-2-Octene	13389429	112	2.41E-01	1.1	6.86E-04	6.39E-10	D
trans-2-Pentene	646048	70	3.47E-02	0.1	6.17E-05	5.75E-11	D
trans-3-Methyl-2-pentene	616126	84	1.55E-02	0.1	3.31E-05	3.08E-11	D
Tribromomethane (Bromoform)	75252	253	1.24E-02	0.1	7.95E-05	7.40E-11	D
Trichloroethylene (Trichloroethene)	79016	131	8.28E-01	4.4	2.76E-03	2.57E-09	A
Trichlorofluoromethane (Freon 11)	91315616	137	2.48E-01	1.4	8.64E-04	8.05E-10	B
Trichloromethane (Chloroform)	67663	119	7.08E-02	0.3	2.14E-04	2.00E-10	A
Undecane	1120214	156	1.67E+00	10.7	6.62E-03	6.16E-09	D
Vinyl acetate	85306269	86	2.48E-01	0.9	5.41E-04	5.04E-10	C
Vinyl chloride (Chloroethene)	75014	63	1.42E+00	3.6	2.25E-03	2.10E-09	A
Xylenes (o-, m-, p-, mixtures)	1330207	106	9.23E+00	40.1	2.49E-02	2.31E-08	A
Total Reduced Sulphur Compounds	n/a	-	-	67.7	4.20E-02	3.91E-08	-

Table E3. Flares 1 and 2 - LFG Emissions

Combustible constituents of LFG will be combusted in the enclosed Flares 1 and 2 with a control efficiency of 98%. Residual LFG will be emitted.

Mercury and siloxanes are not combustible, so a control efficiency of 0% is assumed for these compounds.

Enclosed Flares	Quantity of LFG Combusted* m^3/s	Control Efficiency %
Flare 1	0.43	98%
Flare 2	0.77	98%

* See Table E1 for calculation of quantity combusted.

The concentrations of constituents in LFG are based on AP-42, Table 2.4-1, AP-42, 2.4 Municipal Solid Waste Landfills, Draft Section - October 2008

Sample Calculation (1,1,1-Trichloroethane)

Concentration in LFG = Molecular Weight (g/mole) x Concentration (ppmv) / 24.45
= 133.4 (g/mole) x 0.243 (ppmv) / 24.45
= 1.33E+00 mg/m^3

Emission Rate (Flare 1) = Quantity LFG Combusted (m^3/s) x Concentration in LFG (mg/m^3) x (1 - Control Efficiency) / 1000 (mg/g)
= 0.43 (m^3/s) x 1.33 (mg/m^3) x (1-0.98) /1000 (mg/g)
= 1.13E-05 g/s

Constituent	CAS No.	MW	Concentration in LFG		Control Efficiency	Emission Rate (g/s)		Emission Factor Rating
		(g/mole)	(ppmv)	(mg/m^3)	(%)	Flare 1	Flare 2	
1,1,1-Trichloroethane	71556	133.4	0.243	1.33	98%	1.1E-05	2.0E-05	A
1,1,2,2-Tetrachloroethane	79345	167.85	0.535	3.67	98%	3.1E-05	5.6E-05	E
1,1,2,3,4,4-Hexachloro-1,3-butadiene (Hexachlorobutadiene)	87683	260.76	0.00349	0.04	98%	3.2E-07	5.7E-07	D
1,1,2-Trichloro-1,2,2-Trifluoroethane	76131	187.37	0.0672	0.51	98%	4.4E-06	7.9E-06	C
1,1,2-Trichloroethane	79005	133.4	0.158	0.86	98%	7.3E-06	1.3E-05	D
1,1-Dichloroethane	75343	98.96	2.08	8.42	98%	7.2E-05	1.3E-04	A
1,1-Dichloroethene (1,1- Dichloroethylene)	75354	96.94	0.16	0.63	98%	5.4E-06	9.7E-06	A
1,2,3-Trimethylbenzene	526738	120.19	0.359	1.76	98%	1.5E-05	2.7E-05	D
1,2,4-Trichlorobenzene	120821	181.45	0.00551	0.04	98%	3.5E-07	6.3E-07	C
1,2,4-Trimethylbenzene	95636	120.19	1.37	6.73	98%	5.7E-05	1.0E-04	B
1,2-Dibromoethane (Ethylene dibromide)	106934	187.86	0.0048	0.04	98%	3.1E-07	5.7E-07	B
1,2-Dichloro-1,1,2,2- tetrafluoroethane (Freon 114)	76142	170.92	0.106	0.74	98%	6.3E-06	1.1E-05	B
1,2-Dichloroethane (Ethylene dichloride)	107062	98.96	0.159	0.64	98%	5.5E-06	9.9E-06	A
1,2-Dichloroethene	540590	96.94	11.4	45.20	98%	3.9E-04	6.9E-04	E
1,2-Dichloropropane	78875	112.99	0.052	0.24	98%	2.0E-06	3.7E-06	D
1,2-Diethylbenzene	135013	134.22	0.0199	0.11	98%	9.3E-07	1.7E-06	D
1,3,5-Trimethylbenzene	108678	120.19	0.623	3.06	98%	2.6E-05	4.7E-05	C
1,3-Butadiene (Vinyl ethylene)	106990	54.09	0.166	0.37	98%	3.1E-06	5.6E-06	C
1,3-Diethylbenzene	141935	134.22	0.0655	0.36	98%	3.1E-06	5.5E-06	D
1,4-Diethylbenzene	105055	134.22	0.262	1.44	98%	1.2E-05	2.2E-05	D
1,4-Dioxane (1,4-Diethylene dioxide)	123911	88.11	0.00829	0.03	98%	2.5E-07	4.6E-07	D
1-Butene	106989	56.11	1.22	2.80	98%	2.4E-05	4.3E-05	D
2-Methylbutene	513359	70.13	1.22	3.50	98%	3.0E-05	5.4E-05	D
1-Butene	106989	56.11	1.1	2.52	98%	2.2E-05	3.9E-05	E
2-Methylpropene	115117	56.11	1.1	2.52	98%	2.2E-05	3.9E-05	E
1-Ethyl-4-methylbenzene (4-Ethyl toluene)	622968	120.19	0.989	4.86	98%	4.1E-05	7.5E-05	C
1-Heptene	592767	98.19	0.625	2.51	98%	2.1E-05	3.8E-05	E
1-Hexene	592416	84.16	0.0888	0.31	98%	2.6E-06	4.7E-06	D
2-Methyl-1-pentene	763291	84.16	0.0888	0.31	98%	2.6E-06	4.7E-06	D
1-Methylcyclohexene	591491	96.17	0.0227	0.09	98%	7.6E-07	1.4E-06	D
1-Methylcyclopentene	693890	82.14	0.0252	0.08	98%	7.2E-07	1.3E-06	D
1-Pentene	109671	70.13	0.22	0.63	98%	5.4E-06	9.7E-06	D
1-Propanethiol (n-Propyl mercaptan)	107039	76.16	0.125	0.39	98%	3.3E-06	6.0E-06	D
2,2,3-Trimethylbutane	464062	100.2	0.00919	0.04	98%	3.2E-07	5.8E-07	D
2,2,4-Trimethylpentane	540841	114.23	0.614	2.87	98%	2.4E-05	4.4E-05	A
2,2,5-Trimethylhexane	3522949	128.26	0.156	0.82	98%	7.0E-06	1.3E-05	D
2,2-Dimethylbutane	75832	86.18	0.156	0.55	98%	4.7E-06	8.4E-06	D
2,2-Dimethylpentane	590352	100.2	0.0608	0.25	98%	2.1E-06	3.8E-06	D
2,2-Dimethylpropane	463821	72.15	0.0274	0.08	98%	6.9E-07	1.2E-06	D
2,3,4-Trimethylpentane	565753	114.23	0.312	1.46	98%	1.2E-05	2.2E-05	D
2,3-Dimethylbutane	79298	86.18	0.167	0.59	98%	5.0E-06	9.0E-06	E
2,3-Dimethylpentane	565593	100.2	0.31	1.27	98%	1.1E-05	1.9E-05	D
2,4-Dimethylhexane	589435	114.23	0.222	1.04	98%	8.8E-06	1.6E-05	D
2,4-Dimethylpentane	108087	100.2	0.1	0.41	98%	3.5E-06	6.3E-06	D
2,5-Dimethylhexane	592132	114.23	0.166	0.78	98%	6.6E-06	1.2E-05	D
2,5-Dimethylthiophene	638028	112.19	0.0644	0.30	98%	2.5E-06	4.5E-06	D
2-Butanone (Methyl ethyl ketone)	78933	72.11	4.01	11.83	98%	1.0E-04	1.8E-04	D
2-Ethyl-1-butene	760214	84.16	0.0177	0.06	98%	5.2E-07	9.3E-07	E
2-Ethylthiophene	872559	112.19	0.0629	0.29	98%	2.5E-06	4.4E-06	C

Constituent	CAS No.	MW	Concentration in LFG		Control Efficiency	Emission Rate (g/s)		Emission Factor Rating
		(g/mole)	(ppmv)	(mg/m³)	(%)	Flare 1	Flare 2	
2-Ethyltoluene	611143	120.19	0.323	1.59	98%	1.4E-05	2.4E-05	D
2-Hexanone (Methyl butyl ketone)	591786	100.16	0.613	2.51	98%	2.1E-05	3.9E-05	E
2-Methyl-1-butene	563462	70.13	0.179	0.51	98%	4.4E-06	7.9E-06	D
2-Methyl-1-propanethiol (Isobutyl mercaptan)	513440	90.19	0.17	0.63	98%	5.3E-06	9.6E-06	E
2-Methyl-2-butene	513359	70.13	0.303	0.87	98%	7.4E-06	1.3E-05	D
2-Methyl-2-propanethiol (tert- Butylmercaptan)	75661	90.19	0.325	1.20	98%	1.0E-05	1.8E-05	E
2-Methylbutane	78784	72.15	2.26	6.67	98%	5.7E-05	1.0E-04	D
2-Methylheptane	592278	114.23	0.716	3.35	98%	2.8E-05	5.1E-05	D
2-Methylhexane	591764	100.2	0.816	3.34	98%	2.8E-05	5.1E-05	D
2-Methylpentane	107835	86.18	0.688	2.43	98%	2.1E-05	3.7E-05	D
2-Propanol (Isopropyl alcohol)	67630	60.1	1.8	4.42	98%	3.8E-05	6.8E-05	D
3,6-Dimethyloctane	15869940	142.28	0.785	4.57	98%	3.9E-05	7.0E-05	D
3-Ethyltoluene	620144	120.19	0.78	3.83	98%	3.3E-05	5.9E-05	D
3-Methyl-1-pentene	760203	84.16	0.00699	0.02	98%	2.0E-07	3.7E-07	D
3-Methylheptane	589811	114.23	0.763	3.56	98%	3.0E-05	5.5E-05	D
3-Methylhexane	589344	100.2	1.13	4.63	98%	3.9E-05	7.1E-05	D
3-Methylpentane	96140	86.18	0.74	2.61	98%	2.2E-05	4.0E-05	D
3-Methylthiophene	616444	98.17	0.0925	0.37	98%	3.2E-06	5.7E-06	E
4-Methyl-1-pentene	691372	84.16	0.0233	0.08	98%	6.8E-07	1.2E-06	E
4-Methyl-2-pentanone (MIBK)	108101	100.16	0.883	3.62	98%	3.1E-05	5.5E-05	C
4-Methylheptane	589537	114.23	0.249	1.16	98%	9.9E-06	1.8E-05	D
Acetaldehyde	75070	44.05	0.0774	0.14	98%	1.2E-06	2.1E-06	D
Acetone	67641	58.08	6.7	15.92	98%	1.4E-04	2.4E-04	C
Acetonitrile	75058	41.05	0.556	0.93	98%	8.0E-06	1.4E-05	A
Benzene	71432	78.11	2.4	7.67	98%	6.5E-05	1.2E-04	A
Benzyl chloride	100447	126.58	0.0181	0.09	98%	8.0E-07	1.4E-06	A
Bromodichloromethane	75274	163.83	0.00878	0.06	98%	5.0E-07	9.0E-07	E
Bromomethane (Methyl bromide)	74839	94.94	0.021	0.08	98%	6.9E-07	1.3E-06	C
Butane	106978	58.12	6.22	14.79	98%	1.3E-04	2.3E-04	C
Carbon disulfide	75150	76.14	0.147	0.46	98%	3.9E-06	7.0E-06	A
Carbon monoxide	630080	28.01	24.4	27.95	98%	2.4E-04	4.3E-04	C
Carbon tetrachloride	56235	153.82	0.00798	0.05	98%	4.3E-07	7.7E-07	A
Carbon tetrafluoride (Freon 14)	75730	88	0.151	0.54	98%	4.6E-06	8.3E-06	E
Carbonyl sulfide (Carbon oxysulfide)	463581	60.08	0.122	0.30	98%	2.6E-06	4.6E-06	A
Chlorobenzene	108907	112.56	0.484	2.23	98%	1.9E-05	3.4E-05	A
Chlorodifluoromethane (Freon 22)	75456	86.47	0.796	2.82	98%	2.4E-05	4.3E-05	D
Chloroethane (Ethyl chloride)	75003	64.51	3.95	10.42	98%	8.9E-05	1.6E-04	B
Chloromethane (Methyl chloride)	74873	50.49	0.244	0.50	98%	4.3E-06	7.7E-06	B
cis-1,2-Dichloroethene	156592	96.94	1.24	4.92	98%	4.2E-05	7.5E-05	B
cis-1,2-Dimethylcyclohexane	2207014	112.21	0.081	0.37	98%	3.2E-06	5.7E-06	D
cis-1,3-Dichloropropene	10061015	110.97	0.00303	0.01	98%	1.2E-07	2.1E-07	D
cis-1,3-Dimethylcyclohexane	638040	112.21	0.501	2.30	98%	2.0E-05	3.5E-05	D
cis-1,4-Dimethylcyclohexane	624293	112.21	0.248	1.14	98%	9.7E-06	1.7E-05	D
cis-1,4-Dimethylcyclohexane/trans1,3-Dimethylcyclohexane	2207036	112.21	0.248	1.14	98%	9.7E-06	1.7E-05	D
cis-2-Butene	590181	56.11	0.105	0.24	98%	2.1E-06	3.7E-06	D
cis-2-Heptene	6443921	98.19	0.0245	0.10	98%	8.4E-07	1.5E-06	E
cis-2-Hexene	7688213	84.16	0.0172	0.06	98%	5.0E-07	9.1E-07	D
cis-2-Octene	7642048	112.21	0.22	1.01	98%	8.6E-06	1.5E-05	D
cis-2-Pentene	627203	70.13	0.0479	0.14	98%	1.2E-06	2.1E-06	D
cis-3-Methyl-2-pentene	922623	84.16	0.0179	0.06	98%	5.2E-07	9.4E-07	D
Cyclohexane	110827	84.16	1.01	3.48	98%	3.0E-05	5.3E-05	B
Cyclohexene	110838	82.14	0.0184	0.06	98%	5.3E-07	9.5E-07	D
Cyclopentane	287923	70.13	0.0221	0.06	98%	5.4E-07	9.7E-07	D
Cyclopentene	142290	68.12	0.0121	0.03	98%	2.9E-07	5.2E-07	D
Decane	124185	142.28	3.8	22.11	98%	1.9E-04	3.4E-04	D
Dibromochloromethane	124481	208.28	0.0151	0.13	98%	1.1E-06	2.0E-06	D
Dibromomethane (Methylene dibromide)	74953	173.84	0.000835	0.01	98%	5.1E-08	9.1E-08	E
Dichlorobenzene	106467	147	0.94	5.65	98%	4.8E-05	8.7E-05	A
Dichlorodifluoromethane (Freon 12)	75718	120.91	1.18	5.84	98%	5.0E-05	8.9E-05	B
Dichloromethane (Methylene chloride)	75092	84.93	6.15	21.36	98%	1.8E-04	3.3E-04	A
Diethyl sulfide	352932	90.19	0.0862	0.32	98%	2.7E-06	4.9E-06	E
Dimethyl disulfide	624920	94.2	0.137	0.53	98%	4.5E-06	8.1E-06	A
Dimethyl sulfide	75183	62.14	5.66	14.38	98%	1.2E-04	2.2E-04	A
Dodecane (n-Dodecane)	112403	170.33	0.221	1.54	98%	1.3E-05	2.4E-05	D
Ethane	74840	30.07	9.05	11.13	98%	9.5E-05	1.7E-04	D
Ethanol	64175	46.07	0.23	0.43	98%	3.7E-06	6.6E-06	D
Ethyl acetate	141786	88.11	1.88	6.77	98%	5.8E-05	1.0E-04	C
Ethyl mercaptan (Ethanediol)	75081	62.14	0.198	0.50	98%	4.3E-06	7.7E-06	A
Ethyl methyl sulfide	624895	76.16	0.0367	0.11	98%	9.7E-07	1.8E-06	E
Ethylbenzene	100414	106.17	4.86	21.10	98%	1.8E-04	3.2E-04	B
Formaldehyde	50000	30.03	0.0117	0.01	98%	1.2E-07	2.2E-07	D
Heptane	142825	100.2	1.34	5.49	98%	4.7E-05	8.4E-05	B
Hexane	110543	86.18	3.1	10.93	98%	9.3E-05	1.7E-04	B
Hydrogen sulfide	7783064	34.08	32	44.60	98%	3.8E-04	6.8E-04	A
Indane (2,3-Dihydroindene)	496117	34.08	0.0666	0.09	98%	7.9E-07	1.4E-06	D

Constituent	CAS No.	MW	Concentration in LFG		Control Efficiency	Emission Rate (g/s)		Emission Factor Rating
		(g/mole)	(ppmv)	(mg/m³)	(%)	Flare 1	Flare 2	
Isobutane (2-Methylpropane)	75285	58.12	8.16	19.40	98%	1.7E-04	3.0E-04	D
Isobutylbenzene	538932	134.22	0.0407	0.22	98%	1.9E-06	3.4E-06	D
Isoprene (2-Methyl-1,3-butadiene)	78795	68.12	0.0165	0.05	98%	3.9E-07	7.0E-07	D
Isopropyl mercaptan	75332	76.16	0.175	0.55	98%	4.6E-06	8.4E-06	A
Isopropylbenzene (Cumene)	98828	120.19	0.43	2.11	98%	1.8E-05	3.2E-05	D
Mercury (total)	7439976	200.59	1.22E-04	1.00E-03	0%	4.3E-07	7.7E-07	B
Methanethiol (Methyl mercaptan)	74931	48.11	1.37	2.70	98%	2.3E-05	4.1E-05	A
Methyl tert-butyl ether (MTBE)	1634044	88.15	0.118	0.43	98%	3.6E-06	6.5E-06	D
Methylcyclohexane	108872	98.19	1.29	5.18	98%	4.4E-05	7.9E-05	D
Methylcyclopentane	96377	84.16	0.65	2.24	98%	1.9E-05	3.4E-05	D
Naphthalene	91203	128.17	0.107	0.56	98%	4.8E-06	8.6E-06	D
n-Butylbenzene	104518	134.22	0.068	0.37	98%	3.2E-06	5.7E-06	D
Nonane	111842	128.26	2.37	12.43	98%	1.1E-04	1.9E-04	D
n-Propylbenzene (Propylbenzene)	103651	120.19	0.413	2.03	98%	1.7E-05	3.1E-05	D
Octane	111659	114.23	1.08	5.05	98%	4.3E-05	7.7E-05	D
p-Cymene (1-Methyl-4-Isopropylbenzene)	99876	134.22	3.58	19.65	98%	1.7E-04	3.0E-04	D
Pentane	109660	72.15	4.46	13.16	98%	1.1E-04	2.0E-04	C
Propane	74986	44.1	15.5	27.96	98%	2.4E-04	4.3E-04	C
Propene	115071	42.08	3.32	5.71	98%	4.9E-05	8.8E-05	D
Propyne	74997	40.06	0.038	0.06	98%	5.3E-07	9.5E-07	E
sec-Butylbenzene	135988	134.22	0.0675	0.37	98%	3.2E-06	5.7E-06	D
Styrene (Vinylbenzene)	100425	104.15	0.411	1.75	98%	1.5E-05	2.7E-05	B
Tetrachloroethylene (Perchloroethylene)	127184	165.83	2.03	13.77	98%	1.2E-04	2.1E-04	A
Tetrahydrofuran (Diethylene oxide)	109999	72.11	0.969	2.86	98%	2.4E-05	4.4E-05	C
Thiophene	110021	84.14	0.349	1.20	98%	1.0E-05	1.8E-05	E
Toluene (Methyl benzene)	108883	92.14	29.5	111.17	98%	9.5E-04	1.7E-03	A
trans-1,2-Dichloroethene	156605	96.94	0.0287	0.11	98%	9.7E-07	1.7E-06	C
trans-1,2-Dimethylcyclohexane	6876239	112.21	0.404	1.85	98%	1.6E-05	2.8E-05	D
trans-1,3-Dichloropropene	10061026	110.97	0.00943	0.04	98%	3.6E-07	6.6E-07	D
trans-1,4-Dimethylcyclohexane	2207047	112.21	0.205	0.94	98%	8.0E-06	1.4E-05	D
trans-2-Butene	624646	56.11	0.104	0.24	98%	2.0E-06	3.7E-06	D
trans-2-Heptene	14686136	98.19	0.0025	0.01	98%	8.6E-08	1.5E-07	E
trans-2-Hexene	4050457	84.16	0.0206	0.07	98%	6.0E-07	1.1E-06	D
trans-2-Octene	13389429	112.21	0.241	1.11	98%	9.4E-06	1.7E-05	D
trans-2-Pentene	646048	70.13	0.0347	0.10	98%	8.5E-07	1.5E-06	D
trans-3-Methyl-2-pentene	616126	84.16	0.0155	0.05	98%	4.5E-07	8.2E-07	D
Tribromomethane (Bromoform)	75252	252.73	0.0124	0.13	98%	1.1E-06	2.0E-06	D
Trichloroethylene (Trichloroethene)	79016	131.39	0.828	4.45	98%	3.8E-05	6.8E-05	A
Trichlorofluoromethane (Freon 11)	91315616	137.37	0.248	1.39	98%	1.2E-05	2.1E-05	B
Trichloromethane (Chloroform)	67663	119.38	0.0708	0.35	98%	2.9E-06	5.3E-06	A
Undecane	1120214	156.31	1.67	10.68	98%	9.1E-05	1.6E-04	D
Vinyl acetate	85306269	86.09	0.248	0.87	98%	7.4E-06	1.3E-05	C
Vinyl chloride (Chloroethene)	75014	62.5	1.42	3.63	98%	3.1E-05	5.6E-05	A
Xylenes (o-, m-, p-, mixtures)	1330207	106.17	9.23	40.08	98%	3.4E-04	6.1E-04	A
Total Reduced Sulphur Compounds	n/a	-	-	67.7	98%	5.8E-04	1.0E-03	-

Table E4. Flares and Engines - Products of Combustion

Emissions of products of combustion were estimated based on emission factors given in Table 2.4-4, US EPA AP-42, 2.4 Municipal Solid Waste Landfills, 11/98, and the assumption that LFG is 50% methane (CH4).

Emissions of combustion gases from the siloxane flare (Flare 3) were deemed negligible because it represents less than 5% of combustion capacity.

Emissions of sulphur dioxide and hydrogen chloride were based on mass balance and the assumption that all sulphur and chlorine in LFG are converted to these compounds.

LFG Combustion Rate

Combustion Sources	LFG Combusted[1] (m^3/s)	CH4 Fraction in LFG	CH4 Combusted (m^3/s)	Percent of Total	Significant? (Yes or No)[2]
Engines (Gen1 to Gen 4) - Total	0.64	50%	0.32	34%	Yes
Flare 1	0.43	50%	0.21	23%	Yes
Flare 2	0.77	50%	0.38	41%	Yes
Flare 3 (Siloxane Flare)	0.029	50%	0.015	2%	No
Total	1.86		0.93		

1 See Table E1 for calculation of quantity combusted.

2. Sources that are Insignificant Relative to Total Emissions per section 7.2.2 of ESDM guidance document.

Emission Factors - US EPA AP-42, Table 2.4-4

Contaminant	CAS No.	IC Engines		Flares		Emission Factor Rating
		$kg/10^6$ dscm of CH_4	g/m^3 of CH4	$kg/10^6$ dscm of CH_4	g/m^3 of CH4	
Nitrogen Dioxide	10102-44-0	4000	4	650	0.65	C
Particulate Matter	N/A	770	0.77	270	0.27	D
Carbon Monoxide	630-08-0	7500	7.5	12000	12.00	C

No data on PM size distribution is provided in AP-42, Table 2.4-4; however, based on other gas-fired combustion sources, it is expected that most of the particulate matter is less than 2.5 microns. As such, it was assumed that PM=PM10=PM2.5

Emission rates - US EPA AP-42, Table 2.4-4

Contaminant	CAS No.	Emission Rate (g/s)		
		Engines	Flare 1	Flare 2
Nitrogen Dioxide	10102-44-0	1.28	0.138	0.249
Particulate Matter	N/A	0.246	0.06	0.10
Particulate Matter (PM10)	N/A	0.246	0.06	0.10
Particulate Matter (PM2.5)	N/A	0.246	0.06	0.10
Carbon Monoxide	630-08-0	2.40	2.56	4.60

Sample Calculation: (Particulate Matter, Engines)

PM Emission Rate = CH4 Combusted in Engines (m^3/s) * Emission Factor for IC Engines (g/m^3 of CH4)
= 0.32 (m^3/s) x 0.232 (g/m^3 of CH4)
= 0.2464 (g/s)

Sulphur Dioxide Emission Factor (assumes all sulphur in LFG converts to sulphur dioxide)

Molecular Weight (MW) of Sulphur (S) = 32.1 g/mole

MW of Sulphur Dioxide (SO2) = 64.1 g/mole

Sulphur Concentration in LFG

Contaminant	CAS No.	MW of Contaminant	Conc. Of Contaminant in LFG (mg/m^3)	No. of S per molecule	Conc. of S in LFG (mg/m^3)
1-Propanethiol (n-Propyl mercaptan)	107-03-9	76.16	3.89E-01	1	0.16
2-Methyl-1-propanethiol (Isobutyl mercaptan)	513440	90.19	6.27E-01	1	0.22
2-Methyl-2-propanethiol (tert- Butylmercaptan)	75661	90.19	1.20E+00	1	0.43
Carbon disulfide	75150	76.14	4.57E-01	2	0.38
Carbonyl sulfide (Carbon oxysulfide)	463581	60.08	3.00E-01	1	0.16
Diethyl sulfide	352932	90.19	3.18E-01	1	0.11
Dimethyl disulfide	624920	94.2	5.27E-01	2	0.36
Dimethyl sulfide	75183	62.14	1.44E+01	1	7.40
Ethyl mercaptan (Ethanediol)	75081	62.14	5.03E-01	1	0.26
Ethyl methyl sulfide	624895	76.16	1.14E-01	1	0.05
Hydrogen sulfide	7783064	34.08	4.46E+01	1	41.85
Isopropyl mercaptan	75332	76.16	5.45E-01	1	0.23
Methanethiol (Methyl mercaptan)	74931	48.11	2.69E+00	1	1.79
			Total Sulphur Concentration in LFG		**53**

If all S is converted to SO2, the quantity of SO2 generated is:

SO2 Emission Factor = S concentration (mg/m^3 of LFG combusted) x MW of SO2 / MW (g/mole) of S (g/mole)

= 53.4 (mg/m^3 of LFG combusted) x 64.1 (g/mole) / 32.1 (g/mole)

= 106.7 mg/m^3 of LFG combusted

Hydrogen Chloride Emission Factor (assumes all sulphur in LFG converts to sulphur dioxide)

Molecular Weight (MW) of chlorine (Cl) = 35.5 g/mole

MW of hydrogen chloride (HCl) = 36.5 g/mole

Chlorine Concentration in LFG

Contaminant	CAS No.	MW of Contaminant	Conc. Of Contaminant in LFG (mg/m^3)	No of Cl	Cl content (mg/m^3)
1,1,1-Trichloroethane	71556	133.4	1.32E+00	3	1.06
1,1,2,2-Tetrachloroethane	79345	167.85	3.67E+00	4	3.10
1,1,2,3,4,4-Hexachloro-1,3-butadiene (Hexachlorobutadiene)	87683	260.76	3.72E-02	6	0.03
1,1,2-Trichloro-1,2,2-Trifluoroethane	76131	187.37	5.15E-01	3	0.29
1,1,2-Trichloroethane	79005	133.4	8.61E-01	3	0.69
1,1-Dichloroethane	75343	98.96	8.41E+00	2	6.03
1,1-Dichloroethene (1,1- Dichloroethylene)	75354	96.94	6.34E-01	2	0.46
1,2,4-Trichlorobenzene	120821	181.45	4.09E-02	3	0.02
1,2-Dichloro-1,1,2,2- tetrafluoroethane (Freon 114)	76142	170.92	7.40E-01	2	0.31
1,2-Dichloroethane (Ethylene dichloride)	107062	98.96	6.43E-01	2	0.46
1,2-Dichloroethene	540590	96.94	4.52E+01	2	33.04
1,2-Dichloropropane	78875	112.99	2.40E-01	2	0.15
Bromodichloromethane	75274	163.83	5.88E-02	1	0.01
Chlorobenzene	108907	112.56	2.23E+00	1	0.70
Chlorodifluoromethane (Freon 22)	75456	86.47	2.81E+00	1	1.15
Chloroethane (Ethyl chloride)	75003	64.51	1.04E+01	1	5.72
Chloromethane (Methyl chloride)	74873	50.49	5.04E-01	1	0.35
cis-1,2-Dichloroethene	156592	96.94	4.91E+00	2	3.59
cis-1,3-Dichloropropene	10061015	110.97	1.37E-02	2	0.01
Dibromochloromethane	124481	208.28	1.29E-01	2	0.04
Dichlorobenzene	106467	147	5.65E+00	2	2.72
Dichlorodifluoromethane (Freon 12)	75718	120.91	5.83E+00	2	3.42
Dichloromethane (Methylene chloride)	75092	84.93	2.13E+01	2	17.82
Tetrachloroethylene (Perchloroethylene)	127184	165.83	1.38E+01	4	11.77
trans-1,2-Dichloroethene	156605	96.94	1.14E-01	2	0.08
trans-1,3-Dichloropropene	10061026	110.97	4.28E-02	2	0.03
Trichloroethylene (Trichloroethene)	79016	131.39	4.45E+00	3	3.60
Trichlorofluoromethane (Freon 11)	91315616	137.37	1.39E+00	3	1.08
Trichloromethane (Chloroform)	67-66-3	119.38	3.45E-01	3	0.31
Vinyl chloride (Chloroethene)	75014	62.5	3.63E+00	1	2.06
				Total chlorine concentration in LFG	**100**

If all Cl is converted to HCl, the quantity of HCL generated is:

HCL Emission Factor = Cl concentration (mg/m^3 of LFG combusted) x MW of HCl / MW (g/mole) of Cl (g/mole)

= 100.1 (mg/m^3 of LFG combusted) x 36.2 (g/mole) / 35.5 (g/mole)

= 103.0 mg/m^3 of LFG combusted

Emission Rates - SO2, HCl

Contaminant	CAS No.	Emission Factor (mg/m^3 of LFG)	Emission Rate (g/s)		
			Engines	Flare 1	Flare 2
Sulfur Dioxide	7446-09-05	106.7	6.83E-02	4.55E-02	8.18E-02
Hydogen Chloride	7647-01-0	103.0	6.59E-02	4.39E-02	7.89E-02

Sample Calculation: (Sulphur dioxide, Engines)

SO2 Emission Rate = LFG combusted in Engines (m^3/s) * SO2 Emission Factor (mg/m^3 of LFG) / 1000 (mg/g)

= 0.64 (m^3/s) x 106.7 (mg/m^3 of LFG) / 1000 (mg/g)

= 0.0683 (g/s)

Table E5. Siloxanes

Siloxanes are trace constituents in LFG that are essentially non-combustable, and are not controlled through combustion in flares. Siloxanes have the potential to damage engines, and are removed from the LFG fuel stream to the the engines and purged to the siloxane flare (Flare 3). Thus, all silozanes in LGF are emitted uncontrolled, through Flares 1 to 3, or as fugitive emissions from the landfill surface.

Siloxane Emission Sources	**LFG Release or Use Rate (m^3/s)**
Stg1 to Stg4 (fugitive)	0.62
Flare 1	0.43
Flare 2	0.77
Flare 3 (Siloxane Flare) - includes engines	0.67
Total	2.5

* See Table E1 for calculation of quantity combusted.

Contaminant	**CAS No.**	**Conc. in LFG mg/m^3**	**Emission Rate (g/s)**			
			Stg 1 to 4 (fugitive)	**Flare 1**	**Flare 2**	**Flare 3**
Tetramethylsilane	75-76-3	0.001	6.2E-07	4.3E-07	7.7E-07	6.7E-07
Hexamethyldisiloxane	107-46-0	2.114	1.3E-03	9.0E-04	1.6E-03	1.4E-03
Octamethyltrisiloxane	107-51-7	0.22	1.4E-04	9.4E-05	1.7E-04	1.5E-04
Decamethyltetrasiloxane	141-62-8	0.027	1.7E-05	1.2E-05	2.1E-05	1.8E-05
Dodecamethylpentasiloxane	141-63-9	0.029	1.8E-05	1.2E-05	2.2E-05	1.9E-05
Trimethylsilyl Fluoride	420-56-4	0.546	3.4E-04	2.3E-04	4.2E-04	3.7E-04
Dodecamethylcyclohexasiloxane	540-97-6	0.029	1.8E-05	1.2E-05	2.2E-05	1.9E-05
Decamethylcyclopentasiloxane	541-02-6	4.264	2.6E-03	1.8E-03	3.3E-03	2.9E-03
Hexamethyltricyclosiloxane	541-05-9	0.528	3.3E-04	2.3E-04	4.1E-04	3.5E-04
Octamethylcyclotetrasiloxane	556-67-2	8.739	5.4E-03	3.7E-03	6.7E-03	5.8E-03
Trimethylsilanol	1066-40-6	10.521	6.5E-03	4.5E-03	8.1E-03	7.0E-03
Methoxytrimethylsilane	1825-61-2	0.351	2.2E-04	1.5E-04	2.7E-04	2.3E-04
Ethoxytrimethylsilane	1825-62-3	0.203	1.3E-04	8.7E-05	1.6E-04	1.4E-04
Propoxytrimethylsilane	1825-63-4	0.158	9.8E-05	6.7E-05	1.2E-04	1.1E-04
Isopropoxytrimethylsilane	1825-64-5	0.181	1.1E-04	7.7E-05	1.4E-04	1.2E-04
Butoxytrimethylsilane	1825-65-6	0.09	5.6E-05	3.8E-05	6.9E-05	6.0E-05
1-methylbutoxytrimethylsilane	1825-67-8	0.192	1.2E-04	8.2E-05	1.5E-04	1.3E-04

Sample Calculation: (Tetramethylsilane, Flare 1)

PM Emission Rate = LFG Use in Flare 1 (m^3/s) * Concentration in LFG (mg/m^3 of LFG) / 1000 (mg/g)
= 0.43 (m^3/s) x 0.001 (mg/m^3 of LFG) / 1000 (mg/g)
= 4.27E-07 (g/s)

Note:
1. Siloxane concentrations were measured by OBS Labs, 2011.

Table E6. Tailpipe Emissions from Non-Road Mobile Equipment

Tailpipe emissions from non-road mobile equipment were based on US EPA Tier 1 to 4 Nonroad Diesel Engine Standards and load factors from the US EPA NONROAD model. Speciation of VOC and NMHC was estimated based on Speciation Profiles and Toxic Emission Factors for Nonroad Diesel Engines (MOVES2014b document). All PM (TSP) was assumed to be entirely PM10. PM2.5 was assumed to be same fraction of PM10 as calculated from On-Road mobile emissions (Table E8).

Emission Rate (g/s) = Power × LF × EF x 1hr/3600 s

where: Power = Rated Power (hp)
LF = Load Factor (dimensionless) from NONROAD model.
EF = Emission Factor (g/hp-hr) from nonroad diesel emission standards

Source ID : LFG_NROAD (Equipment mainly associated with landfilling activities)

Equipment[1]	Tier [2]	Fuel Rate (gal/day)	Engine HP	Cycle Load Factors[2]	Emission Factors (g/hp-hr)[3]			Emission Rates (g/s)- 1hr avg				
					CO	NOx	PM	CO	NOx	PM	PM10	PM2.5
JD Excavator	4	33	140	0.53	3.7	0.3	0.015	0.08	0.01	0.0003	0.0003	0.0001
JD 844K Loader	4	55	380	0.48	2.6	0.3	0.015	0.13	0.02	0.0008	0.0008	0.0004
JD 644K Loader	4	44	232	0.48	2.6	0.3	0.015	0.08	0.01	0.0005	0.0005	0.0002
JD 250D rock truck	4	44	265	0.59	2.6	0.3	0.015	0.11	0.01	0.0007	0.0007	0.0003
JD 1050K Bulldozer	4	88	350	0.59	2.6	0.3	0.015	0.15	0.02	0.0009	0.0009	0.0004
Aljon 600 compactor	4	220	600	0.59	2.6	0.3	0.015	0.26	0.03	0.0015	0.0015	0.0007
Aljon 960 compactor	4	154	500	0.59	2.6	0.3	0.015	0.21	0.02	0.0012	0.0012	0.0006
Volvo A25D rock truck	4	44	310	0.59	2.6	0.3	0.015	0.13	0.02	0.0008	0.0008	0.0004
Caterpillar D6N Bulldozer	4	33	150	0.59	2.6	0.3	0.015	0.06	0.01	0.0004	0.0004	0.0002
Cat 725 rock truck	4	44	325	0.59	2.6	0.3	0.015	0.14	0.02	0.0008	0.0008	0.0004
							Total	**1.35**	**0.15**	**0.008**	**0.008**	**0.004**

Source ID : COMPOST_NROAD (Equipment mainly associated with raw material and compost handling)

Equipment[1]	Tier [2]	Fuel Rate (gal/day)	Engine HP	Cycle Load Factors[2]	Emission Factors (g/hp-hr)[3]			Emission Rates (g/s)- 1hr avg				
					CO	NOx	PM	CO	NOx	PM	PM10	PM2.5
Vermeer 6000 grinder	4	141	600	0.59	2.6	0.3	0.015	0.26	0.030	0.0015	0.0015	0.0007
Komptech top turn	4	94	400	0.59	2.6	0.3	0.015	0.17	0.020	0.0010	0.0010	0.0005
John Deer 544k loader	4	42	180	0.48	2.6	0.3	0.015	0.06	0.007	0.0004	0.0004	0.0002
John Deer 544k loader	4	42	180	0.48	2.6	0.3	0.015	0.06	0.007	0.0004	0.0004	0.0002
John Deer 444k loader	4	33	140	0.48	2.6	0.3	0.015	0.05	0.006	0.0003	0.0003	0.0001
Cat 938 loader	4	47	200	0.48	2.6	0.3	0.015	0.07	0.008	0.0004	0.0004	0.0002
Freightliner dump truck	4	94	400	0.59	2.6	0.3	0.015	0.17	0.020	0.0010	0.0010	0.0005
Mack dump truck	4	106	450	0.59	2.6	0.3	0.015	0.19	0.022	0.0011	0.0011	0.0005
International dump truck	4	118	500	0.59	2.6	0.3	0.015	0.21	0.025	0.0012	0.0012	0.0006
International dump truck	4	112	475	0.59	2.6	0.3	0.015	0.20	0.023	0.0012	0.0012	0.0006
Western Star tractor	4	94	400	0.59	2.6	0.3	0.015	0.17	0.020	0.0010	0.0010	0.0005
Western Star dump truck	4	94	400	0.59	2.6	0.3	0.015	0.17	0.020	0.0010	0.0010	0.0005
							Total	**1.79**	**0.21**	**0.010**	**0.010**	**0.005**

Note:

[1] The information regarding type of equipment, model year, engine size, operating hour, and fuel rate was provided by GFL, by email dated January 5,

[2] The cycle load factors were obtained from the EPA document, Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling (NR-005d)

[3] Tier standard number and emission factors for NMHC, nitrogen oxide, and particulate matter were obtained from United States: Nonroad Diesel Engines, available at: https://dieselnet.com/standards/us/nonroad.php

[4] Emission factor for Non-Methane Hydrocarbons (NMHC), nitrogen oxide, and particulate matter were obtained from Tier 4 emission standards—Engines up to 560 kW, available at: https://dieselnet.com/standards/us/nonroad.php

Table E7. Emissions from On-site Truck Traffic - Road Dust

Emissions of road dust from on-site truck traffic were estimated based emisison factors obtained from US EPA AP-42, Section 13.2.1 Paved Roads and Section 13.2.2 Unpaved Roads. The detailed calculations are shown below.

Trucking occurs over a 12 hour operating period each day. Dust is controlled through watering and sweeping of paved roads, watering and other dust suppression on unpaved roads, and use of coarse gravel on haul roads.

Emission factors based on US EPA AP-42, Section 13.2.1 Paved Roads and Section 13.2.2 Unpaved Roads

Number of Trucks	200	trucks/day	
Mean Vehicle Weight	25.0	tonnes/truck	data received from GFL in 2020

GFL has indicated that the site entrance and main onsite road network is paved.

Road Segment Traffic:

Source ID	Length (m)	No. Trucks	Condition
Unpaved_Road	466	200	Unpaved
Paved_Road	5311.2	200	Paved

Emission Factors:

For vehicles traveling on unpaved surfaces at industrial sites, emissions are estimated from the following equation

$E = k\ (s/12)^a \times (W/3)^b$ Industrial Roads (Equation 1a)

size-specific emission factor (E)		lb/VMT (multiply by 281.9 to convert to g/VKT)	
surface material silt content (s)	4.8	%	Table 13.2.2-1, Avg. silt content for Sand and Gravel Processing
mean vehicle weight (W)	27.5	short ton	
surface material moisture content (M)	6.5	%	Table 13.2.2-3, midpoint of range of source conditions
constants (k, a, b)	see below		

For vehicles traveling on paved surfaces, emissions are estimated from the following equation

$E = k \times (sL)^{0.91} \times (W)^{1.02}$

Road surface silt loading (sL)	8.2	g/m^2	Table 13.2.1-3, AP-42
Particle size multiplier (k)	see below		

Unpaved - Industrial Roads - AP-42, 13.2.2			
Constant	**PM**	**PM_{10}**	**$PM_{2.5}$**
k (lb/VMT)	4.9	1.5	0.15
a	0.7	0.9	0.9
b	0.45	0.45	0.45

Paved Roads (Equation 1a) - AP-42, 13.2.1			
	PM	**PM_{10}**	**$PM_{2.5}$**
k (lb/VMT)	0.011	0.0022	0.00054

Emission Factors (E) converted to g/VKT

Emission Source	Road Type	EF Ref.	PM	PM_{10}	$PM_{2.5}$	Units	Controls	Control Efficiency (%)
Unpaved_Road	Unpaved Road	AP-42, 13.2.2	1971	502	50	g/VKT	controlled	75
Paved_Road	Paved Road	AP-42, 13.2.1	618	124	30	g/VKT	controlled	75

* VKT = Vehicle Kilometers Traveled

Emission Rates

Source ID	Road Length (km)	Trucks per Hour	Emission Rates (g/s, 1-hour average)		
			PM	PM_{10}	$PM_{2.5}$
Unpaved_Road	0.5	17	1.1	0.27	0.027
Paved_Road	5.3	17	3.80	0.760	0.187
Total			4.9	1.03	0.214

Table E8. Emissions from On-site Truck Traffic - Tail Pipe

Tailpipe emissions from highway truck traffic on on-site roads were estimated based on emission factors from the US EPA MOVES2014b model. Speciation profiles of on road diesel exhaust from MOVES Onroad Technical Reports document were used to estimate the emission rates of individual pollutants. Daily traffic and activities occur over the 11 hour period 7:00am to 6:00pm. The detailed calculations are shown below.

Highway Truck Traffic

Number of Trucks	200	trucks/day	this will occur over 11 hours
Total travel distance on-site (km)	6	km	

Road Segment Traffic:

Source ID	Length (m)	Trucks / day	Paved or Unpaved?
Unpaved_Road	466	200	Unpaved
Paved_Road	5311.2	200	Paved

Emission Factors:

The Emission Factors for VOC, PM and NOx were obtained from MOVES2014b model, inventory run for nation region, aggregated all road types and 2021 calendar year. All PM (TSP) was assumed to be PM10.

Emission Factors (E) converted to g/VKT

Emission Source	EF Ref.	PM	PM_{10}	$PM_{2.5}$	NOx	CO	Units
Unpaved_Road	MOVES 2014b Master	1.52E-01	1.52E-01	7.40E-02	1.95E+00	6.12E-01	g/VKT
Paved_Road	MOVES 2014b Master	1.52E-01	1.52E-01	7.40E-02	1.95E+00	6.12E-01	g/VKT

* VKT = Vehicle Kilometers Traveled

Emission Rates

Source ID	Road Length (km)	Trucks per Hour	Emission Rates (g/s, 1-hour average)				
			PM	PM_{10}	$PM_{2.5}$	NOx	CO
Unpaved_Road	0.5	18	0.0004	0.0004	0.0002	0.0046	0.0014
Paved_Road	5.3	18	0.0041	0.0041	0.0020	0.0524	0.0164
		Total	**0.0044**	**0.0044**	**0.0022**	**0.057**	**0.018**

Table E9. Emissions from Working and Construction - Dust

Dust is generated during dumping and handling of waste and cover at the working face, and dumping and handling of construction materials on cells under construction. Dust emissions were estimated from US EPA AP-42, Chapters 13.2.4, Aggregate Handling and Storage Piles, and 11.9 Western Surface Coal Mining.

Quantity of materials Handled

Misc. Fill (Waste materials)			
Unloading rate	3,100	Mg/day	
Operating hours	12	hr/day	
Waste Unloading rate (Misc. Fill)	**0.07**	Mg/s	
Cover:			
Cover rate	310	Mg/day	assuming a 10:1 ratio for waste:cover
Cover Application hours	1	hr/day	
Cover materials- movement rate:	**0.09**	Mg/s	
Clay (Construction materials):			
soil density	1700	kg/m3	
Bucket size	1	m3	
Bucket load	1700	kg	
lifts/min	2	lifts/min	
operating hours	8	hr/day	
Clay movement rate	1632	Mg/day	
Clay movement rate	**0.06**	Mg/s	assumes 30 s/lift; 8 hr/day of continuous work

a) Emissions from material drop (unloading) activities:

E = emission factor (kg/tonnes)

k = particle size multiplier (dimensionless) < 30 µm =	0.74	AP-42 13.2.4
k = particle size multiplier (dimensionless) < 10 µm =	0.35	AP-42 13.2.4
k = particle size multiplier (dimensionless) < 2.5 µm =	0.05	AP-42 13.2.4
U = mean wind speed, meters per second (m/s) =	5	regional wind speed
M = material moisture content (%)		

$$E = k\,(0.0016) \times \frac{(\frac{U}{2.2})^{1.3}}{(M * 0.5)^{1.4}}$$

Typical moisture contents were obtained from Table 13.2.4-1, Municipal solid waste landfill industries, AP-42, Chapter 13.2.4 Aggregate Handling And Storage Piles. Misc. Fill materials and Clay/Dirt Mix were selected to represent landfill waste materials and construction materials,

Unloading Material		**Moisture Content %**	**EF (kg/Mg)**			**Rating**	**Reference**
			PM	**PM 10**	**PM 2.5**		
			k= 0.74	**k= 0.35**	**k= 0.053**		
Waste (Misc. Fill materials)	Working Face	11.00	3.16E-04	1.50E-04	2.27E-05	A	AP-42 13.2.4
Cover	Working Face	12.00	2.80E-04	1.33E-04	2.01E-05	A	AP-42 13.2.4
Construction Material (Clay/Dirt Mix)	Construction	14.00	2.26E-04	1.07E-04	1.62E-05	A	AP-42 13.2.4

* source: AP-42, Chapter 13.2.4 Aggregate Handling And Storage Piles . Available at: https://www3.epa.gov/ttn/chief/ap42/ch13/final/c13s0204.pdf

Source Description		**Material Movement Rate (Mg/s)**	**Emission Rate (g/s)- 1 hour average**		
			PM	**PM 10**	**PM 2.5**
Unloading Waste materials (Misc. Fill)	Working Face	0.07	0.023	0.011	0.002
Unloading Cover materials (Cover)	Working Face	0.09	0.024	0.011	0.002
Unloading Construction materials (Clay/D	Construction	0.06	0.013	0.006	0.001
	Total		0.060	0.028	0.004

b) Emissions from Bulldozing,Compacting and Construction

Emission factors for bulldozing/compacting and construction activities are estimated using Table 11.9-2 of AP 42, bulldozing of overburden.

		reference:
EF= emission factor of TSP (kg/hr/vehicle)		AP 42 11.9
M = material moisture content (%)		AP-42 13.2.4
S = silt content (%)		AP-42 13.2.4
Scaling factor for PM10	0.75	AP 42 11.9
Scaling factor for PM2.5	0.105	AP 42 11.9

$$EF_{TSP} = 2.6 \times S^{1.2}/M^{1.3}$$

Source Description	Silt Content %	Moisture Content %	EF (kg/hr) PM	EF (kg/hr) PM10	EF (kg/hr) PM2.5	Rating	Reference
Bulldozing/Compacting of Waste (Misc. Fi	12	11.00	2.27	1.70	0.24	B,D,D	AP 42 11.9
Bulldozing/Compacting of Cover	9	12.00	1.44	1.08	0.15	B,D,D	AP 42 11.9
Construction of Clay/Dirt Mix	9.2	14.00	1.21	0.90	0.13	B,D,D	AP 42 11.9

* source : AP 42 11.9 Western Surface Coal Mining (epa.gov)

Source Description		Emission Rate (g/s) PM	PM10	PM2.5
Bulldozing/Compacting of Waste (Misc. Fi	Working Face	0.631	0.473	0.066
Bulldozing/Compacting of Cover	Working Face	0.399	0.299	0.042
Construction of Clay/Dirt Mix	Construction	0.335	0.251	0.035
Total		1.365	1.024	0.143

c) Total Emissions from Material Handling (a + b)

Source ID	Source Description		PM Emission Rate (g/s) PM	PM10	PM2.5
Working Face	Waste Materials	Working Face	0.653	0.484	0.068
	Cover	Working Face	0.423	0.311	0.044
	Construction Materials (clay)	Construction	0.348	0.257	0.036
		Total	**1.424**	**1.052**	**0.148**

AP42 13.2.4 Aggregate Handling And Storage Piles (epa.gov)
AP 42 11.9 Western Surface Coal Mining (epa.gov)

Table E11. Agriculture - Particulate Matter

The eastern portion of the study area is currently operated as a sod farm. The total area of the sod farm is approximately 230 hectares. Sod is harvested and tilled for re-seeding in narrow strips. Typically, a maximum of less than 10 hectares is tilled in one day.

Tilling of soil prior to seeding can be a significant source of particulate matter (dust) emissions. Harvesting of sod is not a significant dust source.

Emission of particulate matter were estimated based on methodology described in US EPA report "Emission Factor Documentation for AP-42 Section 9,1 Tilling Operations, Draft Report, July 1995". The document defines emission factors as follows:

Emission Factors

$EF = k(5.38)(s)^{0.6}$ (kg/hectare)

where

EF = emission factor (kg/hectare)
k = partical size multiplier (dimensionless)
s = silt content (%)

Particle size multiplier varies with partical size:

	Total (TSP)	PM10	PM2.5
k	1	0.21	0.1

Where site specific silt content is unknown, a default value of 18% is recommended.

Particulate Matter Emission Rate

	TSP	**PM10**	**PM2.5**
Particle size multiplier k	1	0.21	0.1
Silt content s (%)	18	18	18
Emission Factor (kg/hectare)	30.5	6.40	3.05
Area tilled (hectares/day)	10	10	10
Emission Rate (g/s, 24-hour average)	**3.53**	**0.74**	**0.35**
Data Quality	B	C	C

Sample Calculation (TSP)

Emission Factor = $k \times 5.38 \times s^{0.6}$
= $1.0 \times 5.38 \times 18^{0.6}$
= 30.5 kg/hectare

Emission Rate = Emission Factor (kg/hectare) x Area Tilled (hectares/day) x 1000 (g/kg) / 86,400 (s/day)
= 30.5 (kg/hectare) x 10 (hectares/day) x 1000 (g/kg) / 86,400 (s/day)
= 3.53 g/s, 24-hour average

Table E12. Landfill - Odour

Odour results from handling and placement of fresh waste, and from fugitive emissions of LFG

Odour from LFG
Fugitive, uncontrolled emissions of LFG contribute to odour. Odour emissions due to LFG are estimated based on the Interim Guide to Estimate and Assess Landfill Air Impacts (MOE 1992) default odour emission factor of 10,000 ou/m³ of landfill gas.

Fugitive LFG Emission Rate 0.62 m³/s, See Table E1 for calculation
Odour Emission Factor 10,000 ou/m³ of LFG

Source	Odour Emission Rate (ou/s)
Landfill (Stg1 to Stg4)	**6,206**

Sample Calculation: (LFG)
Emission Rate = LFG Emission Rate (m³/s) x Emission Factor (ou/m³ of LFG)
= 1.05 m³/s x 10,000 (ou/m³)
= 6,206 (ou/s)

Odour from Working Face
Tipping, spreading and compaction of fresh waste contributes to odour emissions. On any given day, the area of exposed fresh waste is relatively small, and estimated at about 3,200m². Estimates of odour emissions from the working face were based on measurements of odour flux from the literature with respect to municipal landfills.

Source	Subject of Measurements	Odour Flux ou/s/m²
Sironi et al. (2005)	freshly tipped waste	59
Longhurst, P. (2007)	freshly tipped refuse	2
Environmental Alliances Pty (2015)	active tipping area	35.6
Card, T.R. et al. (2015)	active face	0.58
	Geometric mean	7.0

* Longhurst reported a range of 1 to 4 ou/s/m²

Near final completion of the landfill (~2025), the working face will be on Cells 7 and 8 of Stage 4 of the landfill.

Emission Source	Approx. Working Area m²	Odour Flux ou/s/m²	Odour Emission Rate ou/s
Working Face	**3,200**	**7.0**	**22,514**

Sample Calculation: (Working Face)
Emission Rate = Exposed Working Area (m²) x Odour Flux (ou/s/m²)
= 3,200 (m²) x 7.0 (ou/s/m²)
= 22,514 (ou/s)

Table E13. Composting Process - Biofilter

Composting of organics generates significant odour emissions. Composting at the facility is done entirely within the compost plant, a closed building maintained under negative pressure. All exhaust from the building is treated in a biofilter for odour control.

Odour emission rate from the biofilter was measured during a compliance source test program in 2010 (Envirosolve Report No. E10004).

An expansion of the plant in 2012 essentially doubled the capacity of the facility. Assuming that odour generated is proportional to production rate, and that odour removal efficiency remains constant, odour emission rate should also double.

Emission Source		Gas Flow Rate[1]	Measured Odour Emission Rate[2] (2010)	Estimated Odour Emission Rate (post 2012)
Source	Cell or Bed			
		m^3/s	ou/s	ou/s
Biofilter	BF1	17.5	302	603
	BF2	17.5	302	603
	BF3	17.5	302	603
	Total	52.4	905	1,810

References:
1. Rated flow rates provided by GFL via email on 2019-06-17.
2. Odour concentrations from measurements (Envirosolve Reort No. E10004, 2010).

Table E14. Compost Curing - Odour

Compost is cured in windrows on the the compost curing pad. Odour emissions are highest when compost is fresh, and falls off as the compost is cured. Emissions are also affected by seasonal temperature. Measurments of odour flux were made on three windrows by Consumage in March (winter) and June (summer), 2019. For the modelling assessment, odour fluxes for spring and fall were interpolated using the measured data.

Odour Flux

	Seasonal Odour Flux (ou/s/m³)			
Data source	Measurements	Interpolation	Measurements	Interpolation
Season	Winter	Spring	Summer	Fall
Months	Dec, Jan, Feb	Mar, Apr, May	Jun, July, Aug	Sept, Oct, Nov
Compost age				
Fresh	0.98	15.74	30.49	15.74
1 week old	0.28	4.71	9.15	4.71
3 months old	0.24	0.83	1.42	0.83

Storage piles (typical):	Number of windrows:	12	
	Windrow length:	75	m
	Windrow width:	4.5	m
	Windrow height:	2	m
	Effective surface area of each windrow:	450	m²
	Total effective surface area of all windro	5,399	m²

Curing Odour Emission Rate: Winter

Windrow	Age	Odour Flux	Interpolated Odour Flux	Windrow Surface Area	Emission Rate
	weeks	ou/s/m²	ou/s/m²	m²	ou/s
1	0 (fresh)	0.98		450	441
2	1	0.28		450	124
3	2		0.27	450	122
4	3		0.27	450	121
5	4		0.26	450	119
6	5		0.26	450	117
7	6		0.26	450	116
8	7		0.25	450	114
9	8		0.25	450	113
10	9		0.25	450	111
11	10		0.24	450	110
12	11	0.24		450	108
			Total Winter Emission Rate from Curing		**1,715**

Curing Odour Emission Rate: Spring

Windrow	Age	Odour Flux	Interpolated Odour Flux	Windrow Surface Area	Emission Rate
	weeks	ou/s/m²	ou/s/m²	m²	ou/s
1	0 (fresh)	15.74		450	7,079
2	1	4.71		450	2,121
3	2		4.33	450	1,946
4	3		3.94	450	1,771
5	4		3.55	450	1,597
6	5		3.16	450	1,422
7	6		2.77	450	1,247
8	7		2.38	450	1,072
9	8		1.99	450	897
10	9		1.61	450	722
11	10		1.22	450	548
12	11	0.83		450	373
				Total Spring Emission Rate from Curing	**20,794**

Curing Odour Emission Rate: Summer

Windrow	Age	Odour Flux	Interpolated Odour Flux	Windrow Surface Area	Emission Rate
	weeks	ou/s/m²	ou/s/m²	m²	ou/s
1	0 (fresh)	30.49		450	13,717
2	1	9.15		450	4,118
3	2		8.38	450	3,770
4	3		7.61	450	3,422
5	4		6.83	450	3,074
6	5		6.06	450	2,726
7	6		5.29	450	2,378
8	7		4.51	450	2,030
9	8		3.74	450	1,682
10	9		2.96	450	1,334
11	10		2.19	450	986
12	11	1.42		450	637
				Total Summer Emission Rate from Curing	**39,874**

Curing Odour Emission Rate: Fall

Windrow	Age	Odour Flux	Interpolated Odour Flux	Windrow Surface Area	Emission Rate
	weeks	ou/s/m²	ou/s/m²	m²	ou/s
1	0 (fresh)	15.74		450	7,079
2	1	4.71		450	2,121
3	2		4.33	450	1,946
4	3		3.94	450	1,771
5	4		3.55	450	1,597
6	5		3.16	450	1,422
7	6		2.77	450	1,247
8	7		2.38	450	1,072
9	8		1.99	450	897
10	9		1.61	450	722
11	10		1.22	450	548
12	11	0.83		450	373
				Total Fall Emission Rate from Curing	**20,794**

Table E15. Leaf & Yard Waste Stockpiles - Odour

Leaf & yard waste is used as a bulking agent in compost, and is stockpiled outdoors until needed. With age, the stockpiles of organic materials can produce odour. Odour from undisturbed surfaces is low, but odour from freshly disturbed surfaces can be higher. Odour can also be affected by seasonal temperature. Odour flux from undisturbed and freshly disturbed surfaces of the stockpiles was measured by Consumage in March (winter) and June (summer), 2019. For the modelling assessment, odour fluxes for spring and fall were interpolated using the measured data.

Odour Flux

	Seasonal Odour Flux (ou/s/m³)			
Data source	Measurements	Interpolation	Measurements	Interpolation
Season	Winter	Spring	Summer	Fall
Months	Dec, Jan, Feb	Mar, Apr, May	Jun, July, Aug	Sept, Oct, Nov
Stockpile surface				
Undisturbed surface	0.52	0.45	0.37	0.45
Freshly disturbed surface	1.31	21.18	41.0	21.18

At time of measurement, there were six stockpiles, each 140m x 8m x 4m high. Of the total surface area, only a small area of fresh surface would be exposed.

Stockpiles piles (typical):	Number of piles:	6
	Pile length:	140 m
	Pile width:	8 m
	Pile height:	4 m
	Effective surface area per pile:	2,240 m²
	Total surface area of all piles:	13,440 m²
	Total freshly opened surface area:	210 m²

Odour Emission Rate: Winter

Source	**Surface Area of Piles** m²	**Odour Flux** ou/s/m²	**Total Odour Emission Rate** ou/s	**Individual Pile Odour Emission Rate** ou/s
Undisturbed surface	13,440	0.52	7,002	1,167
Freshly disturbed surface	210	1.31	274	46
Total Winter Emission Rate from Stockpiles			**7,277**	**1,213**

Odour Emission Rate: Spring

Source	**Surface Area of Piles** m²	**Odour Flux** ou/s/m²	**Total Odour Emission Rate** ou/s	**Individual Pile Odour Emission Rate** ou/s
Undisturbed surface	13,440	0.45	5,988	998
Freshly disturbed surface	210	21.18	4,447	741
Total Spring Emission Rate from Stockpiles			**10,434**	**1,739**

Odour Emission Rate: Summer

Source	Surface Area of Piles m²	Odour Flux ou/s/m²	Total Odour Emission Rate ou/s	Individual Pile Odour Emission Rate ou/s
Undisturbed surface	13,440	0.37	4,973	829
Freshly disturbed surface	210	41.04	8,619	1,437
Total Summer Emission Rate from Stockpiles			**13,592**	**2,265**

Odour Emission Rate: Fall

Source	Surface Area of Piles m²	Odour Flux ou/s/m²	Total Odour Emission Rate ou/s	Individual Pile Odour Emission Rate ou/s
Undisturbed surface	13,440	0.45	5,988	998
Freshly disturbed surface	210	21.18	4,447	741
Total Fall Emission Rate from Stockpiles			**10,434**	**1,739**