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Landfill Expansion Emission Summary and Dispersion Modelling Report

St. Marys Future Solid Waste Disposal Needs Environmental Assessment

Town of St. Marys

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Record of Revisions

Revision	Date	Description
0	October 2015	Initial Submission by Burnside to Town of St. Marys
1	July 2019	More detailed odour modelling
2	April 2020	Typographical corrections and expanded descriptions
3	June 2020	Reduce annual background PM, correct roadway emissions, add fugitive odour emission.
4	August 2020	Typographical corrections and updated tables.

R.J. Burnside & Associates Limited

LICENSED PROFESSIONAL ENGINEER
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August 10, 2020
PROVINCE OF ONTARIO

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Definitions

St. Marys	Town of St. Marys
Site	1221 Water St. South, St. Marys, Ontario
AAQC	Ontario's Ambient Air Quality Criteria
ACB List	"Air Contaminants Benchmarks (ACB) List: Standards, guidelines and screening levels for assessing point of impingement concentrations of air contaminants" downloaded from https://www.ontario.ca/page/air-contaminants-benchmarks-list-standards-guidelines-and-screening-levels-assessing-point on April 27, 2018.
BPIP	Building Profile Input Program – Part of the AERMOD air dispersion model
BMPP	Best Management Practice Plan
The ADMGO	"Air Dispersion Modelling Guideline for Ontario", PIBS: 5165e
CA	Composting Area
CAS#	Chemical Abstract Society reference number
CO	Carbon Monoxide
EC	Engineering Calculation
EF	Emission Factor
ESDM	Emissions Summary and Dispersion Model
g	Gram
h	Hour
Insignificant	Negligible
List of MECP POI Limits	Ontario AAQCs or the ACB List
kg	Metric kilograms
km	Metric kilometre
lb	US pound
LFG	Landfill Gas
LST	Leachate Storage Tank
m	Metric metre
m^2	Metric square metre
m^3	Metric cubic metre
MB	Mass Balance
MECP	Ontario Ministry of the Environment, Conservation and Parks
mol	Moles
NAD83	North American Datum of 1983 used for UTM coordinates
NOx	Nitrogen Oxides
OU	Odour Unit – 1 OU = concentration at which

	50 % of the population can detect an odour
PM	Particulate Matter
PM10	Particulate Matter with an aerodynamic diameter of 10 µm or less
PM2.5	Particulate Matter with an aerodynamic diameter of 2.5 µm or less
ppm	Parts per million
ppmv	Parts per million by volume
POI	Point of Impingement (Contaminant)
Products of Combustion	Contaminants emitted as a result of burning natural gas
s	Second
Significant	Non-negligible
Source ID	The alphanumeric string assigned to a discharge point otherwise known as a “source reference number” in the “Acme Example” PIBS: 5987e.pdf.
ST	Stockpile
ton	US ton = 2200 pounds
tonne	Metric tonne = 1000 kg
TSP	Total Suspended Particulate
UTM	Universal Transverse Mercator
VMT	Vehicle Mile Travelled
VKT	Vehicle Kilometre Travelled
VOC	Volatile Organic Compound
WF	Working Face
WS	Perth Road 123/Water Street

Executive Summary

Town of St. Marys (St. Marys) operates a landfill, composting and public drop-off facility at 1221 Water St. South, St. Marys, Ontario (the “Site”). The Site is owned by the Town of St. Marys. The Site is located in an area zoned for extractive industrial and environmental constraint. The main processes are waste transfer, landfilling and composting.

This Emission Summary and Dispersion Modelling (“ESDM”) report was prepared to assess the existing emissions from the Site and how those emissions will be different under the various Alternative Methods for the expansion of the landfill. St. Marys has compared all their emissions modelling results against Ontario’s Ambient Air Quality Criteria (AAQCs) and the Air Contaminants Benchmarks (ACB) List as appropriate.

The Site is expected to emit vehicle products of combustion, odour, and particulate matter (PM).

The maximum Point of Impingement (POI) concentrations were calculated based on the operating conditions where all significant sources are operating simultaneously at their individual maximum rates of production.

An estimated POI concentration for each significant contaminant emitted from the Site is based on the calculated emission rates and the output from the Air Dispersion Model; the results are presented in the Emissions Summary Tables (4-E, 4-2, 4-3, and 4-4).

The POI concentrations listed in the Emissions Summary Table were compared against the AAQCs or the ACB List.

Of the contaminants listed in Table 5a, all the predicted POI concentrations are below the corresponding limits. For example, the 24-hour POI concentration for particulate matter (PM) is 89.15 $\mu g/m^3$ at 74.3 % of the AAQC of 120 $\mu g/m^3$. Note that the current compactor is Tier 3 (not Tier 4) compliant. The facility will meet the 1-h nitrogen oxide CAAQS in 2025.

When the cumulative impacts are considered, as shown in Table 5c, all the predicted POI concentrations are below the corresponding limits except for PM_{10}, and Total Particulate Matter. These two contaminants show compliance at all sensitive receptors and only exceed close to the property boundary. Therefore, they comply with the AAQC at all sensitive receptors and will also comply with the ECA requirements anywhere off-property.

Odour impacts are at levels generally considered acceptable. The model indicates that the receptors generally do not exceed 6 OU which is the level at which odour complaints are received. The frequency of exceedance of this level is generally less than 0.5 % at all receptors. The preferred alternative, Alternative Method 3, shows the highest impact but the impact is still at acceptable levels.

1.0 Introduction and Site Description

This Emission Summary and Dispersion Modelling (ESDM) report was prepared to assess the impact of the existing operation and five Alternative Methods proposed for landfill expansion.

For ease of review and to promote clarity, this ESDM report is structured to correspond to each of the items listed in the MECP's ESDM Report Checklist.

1.1 Purpose and Scope of the ESDM Report

This ESDM report was prepared to assess the impact of the current operation and five Alternative Methods proposed options for landfill expansion.

Town of St. Marys (St. Marys) operates a landfill, composting and public drop-off facility at 1221 Water St. South, St. Marys, Ontario

The Site is located in an area zoned for extractive industrial and environmental constraint.

The location of the Site is presented in Figure 1 – Site Location Plan and the land use designation of the Site and surrounding area is presented in Figure 2 – Land Use Zoning Designation Plan. The location of the discharges from each of the sources is presented in Figure 3_E through 3_4; the location of each source is labelled with the Source ID.

1.2 Description of Processes and NAICS Code

St. Marys operates a solid waste management facility at the site. The main processes are waste transfer, landfilling and composting. Many of these activities are performed continuously at the Site but some may be intermittent. The frequency of intermittent activities depends on necessity. See also Section 1.5.

The NAICS codes that apply to this facility are 562210 Waste treatment and disposal and 325314 Mixed fertilizer manufacturing. The NAICS industry group 5622 is listed in Schedule 5 and in the Schedule of O.Reg.1/17 so this facility is not eligible for EASR registration.

1.3 Description of Products and Raw Materials

Segregated waste is accepted at the site and directed to the appropriate disposal area (i.e., public drop-off depot, to the composting area, or for landfilling).

The main sources of contaminant emissions are dust from roads and landfill operations, products of combustion from diesel engines, and odour from garbage, compost, and the closed portions of the landfill.

Product usages and process information are provided in greater detail in Appendix A – Supporting Calculations. Refer to Table 1 – Sources and Contaminants Identification Table, which tabulates the individual sources of emissions at the Site. Note that Table 1 lists all the source for all the scenarios as the only difference between scenarios is the location of each element.

1.4 Process Flow Diagram

Since landfill operations are well known, process flow diagrams were not produced.

1.5 Operating Schedule

The landfill currently operates Tuesday, Wednesday, Friday and Saturday between the hours of 8:00 A.M. and 4:30 P.M.

Since odours and landfill gas are emitted continuously, the modelling assumes that the Site operates 24 hours a day, 7 days a week, all year.

1.6 Changes Since Last Revision

Changes since the last revision, March 2015, include:

- Reduction of on-site vehicle road emissions.
- Correct typographical errors.
- Revise tables to use 24-hour 90th percentile background values for comparison against 1 hour or 10-minute impacts where corresponding 90th percentile values not available.
- Revise tables to use annual average background for comparison against annual impacts where corresponding 90th percentile values are not available.

2.0 Initial Identification of Sources and Contaminants

This section provides an initial identification of all the sources and the contaminants emitted from the Site as required by sub paragraphs 2 to 4 of s.26 (1) of O. Reg. 419.

The contaminant list includes contaminants normally considered for landfills.

2.1 Sources and Contaminants Identification Table

Table 1 – Sources and Contaminants Identification Table tabulates all the emission sources at the Site, for example, EA-09 – Working face is identified as a source.

Table 1 (E through 4) provides the details about all the sources.

The expected contaminants emitted from each source are also identified in Table 1; for example, the expected contaminants emitted from EA-09 – Working face are identified as Particulate, Landfill Gas (LFG), and Odour. Each of the identified sources has been assigned a Source ID, for example the Working Face source has been identified as "WF".

The location of each discharge point is presented in Figure 3 (E through 4); the discharge point is labelled with its Source ID.

3.0 Assessment of the Significance of Contaminants and Sources

This section provides an explanation for each source and contaminant identified in Table 1 – Sources and Contaminants Identification Table (E through 4). Of the processes listed on Table 1 all have been identified as significant. For example, EA-09 – Working Face is considered a significant process. These significant processes are included in the dispersion modelling for the Site.

3.1 Identification of Negligible Contaminants and Sources

Emission rate calculations and dispersion modelling have not been performed for emissions from negligible sources or for the emission of negligible contaminants from significant sources.

Of the sources listed on Table 1 (E through 4), one emission point have been identified as negligible. Each negligible emission point is identified in the table, for example, Leachate Storage Tank (LST) has been labelled as insignificant. Working Face (WF) has been labelled as significant. The significant sources will be included in the dispersion modelling for the Site. The emissions from many exhaust points are covered under the processes listed above. If this is the case, then the “Rate / Rational” column will indicate the process that exhausts through this point. Typically, the only emissions listed here are related to gas-fired equipment and cooling towers, none of which are present at this Site.

All significant contaminants are listed in Table 4a (E through 4).

3.2 Contaminant Screening

Since the sources of most contaminants are all from the same processes, only the most significant contaminants need be assessed. For instance, if 1 m^3 of diesel combustion products were to contain 1 % of the NO_2 limit but only 0.014 % of the CO limit, then only NO_2 needs to be modelled because if that contaminant doesn’t exceed its criterion then CO will also not exceed its criterion.

Contaminant screening is described in more detail in Appendix A Section 3.5. The calculations are shown in Table EA-05 in Appendix A.

4.0 Operating Conditions, Emissions Estimating and Data Quality Emissions

This section provides a description of the operating conditions used in the calculation of the emission estimates and an assessment of the data quality of the emission estimates for each significant contaminant from the Site.

4.1 Description of Operating Conditions

As noted in Section 1.2, The NAICS codes that apply to this facility are 562210 Waste treatment and disposal and 325314 Mixed fertilizer manufacturing.

Section 10 of O. Reg. 419 states “A scenario that assumes operating conditions for the Facility that would result, for the relevant contaminant, in the highest concentration of the contaminant at a point of impingement that the Facility is capable of.” The operating condition described in this ESDM Report meets this requirement.

The averaging time for the operating condition is 10-minute, 1-hour, 8-hour, 24-hours and annual as appropriate. The operating condition used for this Site that results in the maximum concentration at a POI is the scenario where all significant sources are operating simultaneously at their individual maximum rates of production. The individual maximum rates of production for each significant source of emissions correspond to the maximum emission rate during any 24-hour period. The individual maximum rates of production for each significant source of emissions are explicitly described in Appendix A – Supporting Calculations.

The assessment of all operating conditions included transient, start-up, shut-down and continuous operation modes. Continuous operation is expected to provide the largest POI concentration estimate so that method is used as the basis of calculations in this assessment.

4.2 Explanation of the Method Used to Calculate Emission Rates

The maximum emission rates for each significant contaminant emitted from the significant sources were calculated.

The emission rate for each significant contaminant emitted from a significant source was estimated and the methodology for the calculation is documented in Table 2-1 and 2-2 Source Summary Table (E through 4). For example, the emission of Nitrogen Oxides was calculated using an emission factor (EF) technique.

4.3 Sample Calculations

The technical rationale, including sample calculations, required to substantiate the emission rates presented in Table 2-1 & 2-2 – Source Summary Table (E through 4) is documented in Appendix A – Supporting Calculations.

4.4 Assessment of Data Quality

This section provides a description of the assessment of the data quality of the emission estimates for each significant contaminant from the Site.

The assessment of data quality of the emission rate estimates for each significant contaminant emitted from significant sources was performed. For example, the EF technique used to calculate the emissions from WF is based on the USEPA Tier 4 specification for Non-Road diesel engines. The data quality of that emission factor is "A" which is equivalent to the MECP data Quality of "Above-Average".

Therefore, the emission rate estimate is not likely to be an underestimate of the actual emission rate and use of these emission rates will result in a calculated concentration at a POI greater than the actual concentrations. This source was documented as having a Data Quality of "Above-Average".

For each contaminant, the emission rate was estimated, and the data quality of the estimate is documented in Table 2-1 & 2-2 – Source Summary Table (E through 4). The assessment of data quality for each type of source listed in Table 2-1 & 2-2 (E through 4) is documented in Appendix A – Supporting Calculations.

All the emission rates listed in Table 2-1 & 2-2 (E through 4) are documented as having between Above Average and Marginal Data Quality and correspond to the operating scenario where all significant sources are operating simultaneously at their individual maximum rates averaged over the appropriate averaging time for that contaminant. Therefore, the emission rate estimates listed in Table 2-1 & 2-2 (E through 4) are not likely to be an underestimate of the actual emission rates and use of those emission rates will result in a calculated POI concentration greater than the actual concentrations.

4.5 Background Concentrations

The background concentrations are also discussed in Section 8. Background data values are shown in Table 5b.

90th percentile value for particulate matter and nitrogen dioxide were calculated from the MECP values recorded at London Station #15026. Data collected in 2009 through 2013 was used to correspond to the site-specific meteorological data provided by the MECP for modelling at the Site.

Note that carbon monoxide 90th Percentile value of 0.3 ppm was taken from “Air Quality in Ontario Report & Appendix (2010)”, Table A6, page A-11 (58 of 90). For CO, $[CO]_{\mu g/m3} = [CO]_{ppm} * (36,200/30)$.

90th percentile value for vinyl chloride and chlorobenzene were calculated from the NAPS values downloaded from http://maps-cartes.ec.gc.ca/rnspa-naps/data.aspx. Data collected in 2009 through 2013 was used to correspond to the site-specific meteorological data provided by the MECP for modelling at the Site.

All 90th Percentile values and averages are shown in Table 5b: Average and 90th Percentile Values Used (London Station #15026 or NAPS Station S60903) (2020).

5.0 Source Summary Table and Site Plan

5.1 Source Summary Table

The emission rate estimates for each source of significant contaminants are documented in Table 2-1 & 2-2 (E through 4).

For each source of significant contaminants, the following parameters are referenced:

- Contaminant name.
- Chemical Abstract Society (CAS) reference number.
- Source ID.
- Source description.
- Stack parameters (flow rate, exhaust temperature, diameter, height above grade, height above roof).
- Location referenced to a Cartesian coordinate system presented on Figure 3 – Site Plan and Roof Diagram.
- Averaging period.
- Emission estimating technique.
- Estimation of data quality.
- Emission rate.
- Percentage of overall emission.

5.2 Site Plan

The locations of the emission sources listed in Table 2-1 & 2-2 (E through 4) are presented in Figure 3 (E through 4) – Site Plan; the location of each of the sources is specified with the Source ID. The location of the property line is indicated on Figure 3 (E through 4). The coordinates of each node along the property line is shown in Appendix C in Table C-1.

The location of each source is referenced to this Cartesian coordinate system under a column in Table 2-1 & 2-2 (E through 4).

6.0 Dispersion Modelling

This section provides a description of how the dispersion modelling was conducted at the Site to calculate the maximum concentration at a POI.

Dispersion modelling was completed in accordance with the MECP's "Air Dispersion Modelling Guideline for Ontario" PIBS 5165e (ADMGO). A general description of the input data used in the dispersion model is provided below and summarized in Table 3.

Since the AAQC, and Schedule 3 standards of O. Reg. 419/05 have been used, the modelled impact of contaminant emissions are assessed as 10-minute, one-hour, 24-hour, and annual maximum POI concentrations. The appropriate model to assess the maximum POI impact is the USEPA AERMOD model. The following dispersion model and pre-processors were used in the assessment:

- AERMOD dispersion model (v. AERMOD_MPI_Lakes_16216r).
- AERMAP surface pre-processor (v. AERMAP_EPA_16216).
- BPIP building downwash pre-processor (v. 0474).

MECP provided site specific meteorological data based on AERMOD v16216 was used for this assessment.

There is no childcare facility, senior's residence, health care facility, long-term care facility, or educational facility located at the Site and no other tenant at the Site. As such, same structure contamination was not considered.

6.1 Meteorology and Land Use Data

A land use zoning plan is provided on Figure E2 – Land Use Zoning Designation Plan. Figure 2 also illustrates the extent of the Site property boundary and provides the zoning of adjacent land uses. The Site is located in an area partially zoned for Extractive Industrial and partially for Environmental Constraint. The area north and east of the site is zoned for Extractive Industrial. The area west of the site is zoned as agricultural. The area south of the site is zoned as Mineral Aggregate Resources.

The MECP provided site specific meteorological datasets for use with dispersion modelling using AERMOD. The meteorological data covers the dates from January 1, 2009 to December 31, 2013. The hourly data includes many factors which affect the dispersion of air contaminants including wind speed, wind direction, temperature, ceiling height, and atmospheric stability. Based on the provided data, an average wind speed at the station is 3.98 m/s. The dominant wind direction is west. Wind rose depicting the relative frequency of wind directions including wind speeds is provided in Figure 4 - Wind Rose.

6.2 Coordinate System

The Universal Transverse Mercator (UTM) coordinate system, as per Section 5.2.2 of the ADGMO, was used to specify model object sources, buildings, and receptors. All coordinates were defined in the North American Datum of 1983 (NAD83).

All source, building, and property line coordinates are shown in Figure 3 with exact property coordinates in Table C-1 (see Appendix C).

6.3 Terrain

Section 16 of O. Reg. 419/05 sets out when terrain must be considered. In this assessment, terrain elevation contour data was downloaded from Ontario Digital Elevation Model Data set and processed using the AERMOD terrain processor AERMAP. AERMAP determines base terrain elevation using the DEM data for all sources, receptors and buildings, and provides the user with a suitable input file for use with AERMOD.

6.4 Dispersion Modelling Input Summary Table

A description of the way in which the approved dispersion model was performed is included in Table 3 – Dispersion Modelling Input Summary Table. This table follows the format provided in the ESDM Procedure Document.

The Site was modelled as area and line-volume sources, with the release height based on the equipment heights and the location of those sources. A summary of the AERMOD source input parameters is provided in Table 2-1 and 2-2 (E through 4). Property Boundary locations are listed in Table C-1 found in Appendix C. The location of all emission points is shown in Figure 3 (E through 4). The location of the property line in relation to the dispersion modelling sources is also presented in those figures.

The emission rates used are at least as high as the maximum emission rate that the source of contaminant is reasonably capable of for the relevant contaminant. These emission rates are further described in Appendix A – Supporting Calculations. A summary of the modelled emission rates for each point source is provided in Tables 2-1 & 2-2 (E through 4).

6.5 Building Downwash

The only buildings on site are small. They do not significantly impact dispersion so the USEPA Building Profile Input Program (BPIP) was not used.

6.6 Deposition

AERMOD has the capability to account for wet and dry deposition of substances that would reduce airborne concentrations.

The deposition algorithm in the AERMOD model was not used for this assessment and therefore the predicted modelled POI concentrations are considered to be conservative.

6.7 Averaging Time and Conversions

The shortest time scale that AERMOD predicts is a 1-hour average value. AAQCs and Schedule 3 standards of O.Reg. 419/05 are being applied to this Site. Many of these standards are based on 1-hour and 24-hour averaging times, which are averaging times that are easily provided by AERMOD. In cases where a standard has an averaging period of less than 1-hour (e.g. 10 minutes for odour), a conversion to the appropriate averaging period was completed using the MECP recommended conversion factors, as documented in the ADMGO.

6.8 Area of Modelling Coverage

Receptors were chosen based on recommendations provided in Section 7.1 of the ADGMO, which is in accordance with s.14 of O. Reg. 419/05. Specifically, a nested receptor grid, generally centred on the major sources, was placed as follows:

A bounding box was created that encompasses all the sources at the Site.

- 20 m spacing within 200 m of the edge of the bounding box.
- 50 m spacing from 200 m to 500 m.
- 100 m spacing from 500 m to 1000 m.
- 200 m spacing from 1000 m to 2000 m.
- 500 m spacing from 2000 m to 5000 m.

In addition to using the nested grid, receptors were placed every 10 m along the property boundary. No receptors were placed inside the Site's property line.

Closest sensitive receptors were identified from aerial photographs and are summarized in table below:

Type	Name & Address	Direction
Residence	1025 Water Street South	North/West
Residence	1774 Water Street South	West
Residence	1827 Water Street South	West
Residence	4461 3 Line	West
Residence	1646 Perth Road 123	South/West
Residence	1579 Perth Road 123	South/West

All residences directly north, east and south of the Site are more than 1 km from the property boundary.

7.0 Modelling Results

7.1 Emissions Summary Table

A POI concentration for each significant contaminant emitted from the Site was calculated based on the emission rates listed in Table E2-1 and 2-2 (E through 4) – Source Summary Table and the output from the approved dispersion model. The results are presented in Table 4a (E through 4) – Emissions Summary Table. For each source of significant contaminants, the following parameters are referenced:

- Contaminant name.
- Chemical Abstract Society (CAS) reference number.
- Total Site emission rate.
- Approved dispersion model used.
- Max POI concentration.
- Averaging period for the dispersion modelling.
- MECP POI limit.
- Indication of the limiting effect.
- Schedule in O. Reg. 419/05.
- The percentage of standard or indication of the likelihood of an adverse effect.

The POI concentrations listed in Table E4a (E through 4) – Emission Summary Table are the highest concentrations calculated by the model with meteorological anomalies removed from consideration where noted. The POI concentrations listed in the Emissions Summary Table were compared against the List of MECP POI Limits.

All the contaminants listed in Tables 4a (E through 4) have limits in the List of Ministry POI Limits. All the predicted POI concentrations are below the corresponding limits. For example, the 24-hour POI concentration for particulate matter (PM) is 89.15 µg/m^3 at 74.3 % of the AAQC of 120 µg/m^3 in the existing (E) scenario (Table 4a: Emissions Summary Table (2020_E), 2nd last row).

7.2 Comparison of Alternative Methods

	Method	**Description**
1	Vertical Expansion of the Existing Landfill	This Method involves an expansion in the vertical direction within the existing footprint of the landfill.
2	Horizontal Expansion of the Existing Landfill	This involves an expansion outside of the existing landfill footprint to the east of the current footprint.
3	A Combination of Vertical and Horizontal Expansion	This Method would involve partial vertical expansion along with some horizontal expansion of the landfill footprint, basically a mixture of Methods 1 and 2.
4	Development of a new landfill footprint at the site	This Method involves closure of the existing footprint and development of a new landfill footprint north east of the Existing footprint.
5	Vertical Expansion plus a new footprint	This option involves a combination of Methods 1 and 4.

The existing situation and 5 Alternative Methods of landfill expansion are assessed in this report. In each case, the worst-case impact was selected for investigation. The choice means that there are substantial periods of time when the activity will be substantially less than modelled and/or that activity will be further from the receptors than modelled so the impacts will be less than predicted.

The Alternative Method 1, Alternative Method 3, and Alternative Method 5 have the same worst-case scenario, so the modelling and results indicated as “Alternative Method 3” are representative of all three scenarios (1, 3, and 5).

“Alternative Method 5” has a portion of the expansion that matches “Alternative Method 4” but all the impacts for “Alternative Method 3” are higher than “Alternative Method 4” so no further assessment is required of “Alternative Method 5”.

The figures showing all 5 alternative method scenarios are shown in Appendix D.

There are 4 categories of contaminants being emitted by the facility: nitrogen oxides, particulate matter, volatile organics, and odour.

Nitrogen oxides (NOx) are created as by-products of combustion. They are created by the diesel engines of the vehicles on site. As expected, the largest source of those emissions is the vehicles that work at the facility.

Particulate matter is generated as by-products of combustion and road dust. The roads are the source of most of the emissions. The site has a Best Management Practice Plan (BMPP) to ensure that the road dust is kept to acceptable levels. The BMPP is expected to achieve an emission reduction of 90%. An application of 1.5 L/m^2 every hour will provide more water than can evaporate under even the highest evaporation conditions and is expected to achieve up to 95 % reduction in emissions. This assessment assumes 90% reduction[1].

Landfills emit small amounts of a wide variety of volatile contaminants. The modelling indicates that the impact of these contaminants is below their various criteria. The contaminant with the largest off-property concentration is vinyl chloride at 54.0 % of the 24-hour AAQC of 1.0 µg/m^3 under Alternative Method 4.

The most obvious emission from landfills is odour. Since odour is only an issue where people are there to smell it, the values along Perth Road 123 are the values of significance. The highest modelled off-property concentration of odour is 99.56 OU (Alternative Method 4); however, the highest modelled concentration of odour at a sensitive receptor is 15.46 OU at (487080, 4787240) (Alternative Method 4) along Perth Road 123. There is no published criterion for odour in general.

A goal of the ministry is that the odour level be below 1 OU. In general, odour complaints from this landfill is expected to occur at levels over 6 OU.

7.3 Nitrogen Oxides

The emission rates are for NOx rather than NO_2 despite the criterion being for NO_2. As a result, the modelled impact is higher than it would have been if NO2 were modelled resulting in a conservative treatment.

7.4 Odour

Odour emission rates were multiplied by $(60/10)^{0.28}$ so that the 1 h results display in Odour Units (OU) on a 10-minute average basis.

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[1] Air and Waste Management Association, Dust, Odour, Noise Nuisance Technical Conference, June 21, 2017, RWDI Presentation on Dust BMPP, page 14 and 15. https://static1.squarespace.com/static/50ba2be5e4b012760add2bd3/t/5970ede2ff7c50cf13b28e66/1500573158428/13_Fugitive+Dust+Best+Management+Practices+%28RWDI%29.pdf

8.0 Individual Contaminants

To assess the combined impact of the contributions from both the local road, Perth Road 123, and the closest MECP monitoring station, London. Since the emissions are very conservative, the modelling is conservative, and the 90th Percentile values from the other local sources are all conservative values. The presented impact is much greater than that would be expected in reality. The background values used are shown in Section 4.5 above.

Tables 4a (E through 4) show the maximum off-property impact of each contaminant. The table contains the following columns:

- CAS# – CAS# of contaminant. If there is no universally accepted CAS#, then a synthetic CAS# will be assigned as a place holder (0-02-2 for PM_{10}, 0-03-3 for $PM_{2.5}$).
- Contaminant – Name of contaminant.
- Total Emission Rate (g/s) – Total site-wide emission rate. Sum of all sources regardless of location.
- Dispersion Model Used – AERMOD-m indicates that the Lakes MultiChem was used to calculate the impact.
- Max POI Value (µg/m^3) – Maximum off property values predicted by Dispersion Model Used. If outliers were removed, a note will be provided to the right of the “Percentage of Criteria or Likelihood of adverse effect” column.
- Location of Maximum POI – UTM X and Y of the receptor showing the “Max POI Value”.
- Averaging Period Modelled (h) – Averaging period in hours in the Air Dispersion Model. 720 indicates monthly. 8760 indicates annual. This is the averaging period that the “Air Dispersion Model” uses to calculate the “Max POI Value” so, since AERMOD cannot model a 10 minute averaging period, this column will usually show “1” when calculating odour-based impacts (see exception in “Max POI Value Converted to Criterion Period” below).
- Averaging Period of Criterion (h) – Averaging period of the criterion in hours. 0.1667 indicates 10 minutes. 720 indicates monthly. 8760 indicates annual. This value is the MECP averaging period published in the ACB List.
- Max POI Value Converted to Criterion Period (µg/m^3) – Value of “Max POI Value” converted from the “Averaging Period Modelled” to the “Averaging Period of Criterion”. The formula is the one described in the ESDM Procedure guide for adjusting off property POI concentrations namely $C_{converted} = C_{predicted} * (t_{converted}/t_{predicted})^{0.28}$. This formula only results in a change for odour-based criteria where the Air Dispersion model calculated on a 1-hour basis, but the criterion is a 10-minute averaging period. If the “Averaging Period Modelled” shows 0.1667, then the emission rate was multiplied by the same factor (~1.65) so that the contour plot shows odour-unit-based contour lines.
- Criteria (µg/m^3) – the value in the List of MECP POI Limits for the corresponding averaging period.

- Limiting Effect – Text from the List of MECP POI Limits for the Limiting Effect.
- Regulation Schedule # – Source of the criterion.
- Percentage of Criteria or Likelihood of adverse effect (%) – “Max POI Value. Converted to Criterion Period” / “Criteria”.

Table 4b (E through 4) show the 90th percentile and average background value & percent of criterion from Table 5b, the POI values from the corresponding Table 4a, and the resulting combined impact.

Table 5a compares the modelling results. The Alternative Method with the highest modelled impact is highlighted. The Alternative Method 4 gives the highest impacts for ten (10) contaminant/averaging periods each with Alternative Method 3 showing the highest impact for six (6) contaminant/averaging periods.

Table 5b shows the background concentrations recorded by the MECP London monitoring station.

Table 5c compares the modelling results including background from Tables 4b (E through 4). The Alternative Method with the highest modelled impact is highlighted. The Alternative Method 4 gives the highest impacts for ten (10) contaminant/averaging periods each with Alternative Method 3 showing the highest impact for six (6) contaminant/averaging periods.

Tables 6 (E through 4) show the Receptor location (X & Y), Total number of binned results (always 43824), and the number of results in each bin (0-1 OU, 1-6 OU and > 6 OU). The last column is the % of value in the “> 6 OU” column.

Table 7 summarizes the results shown in Tables 6 (E through 4) by showing the % of results in each bin for each receptor and the maximum % at any receptor.

8.1 PM_{10}

The maximum off-property PM_{10} concentration is shown in Table 4a (E through 4). The maximum concentration occurs in the 2020_E version at 48.3 % of the 24-h criterion of 50 µg/m^3.

Figures 5 (E through 4) show the contour plots of the 24-h PM_{10} models.

Note that most of the PM impact is caused by the entry roadway parallel to Perth Road 123.

8.2 $PM_{2.5}$

The maximum off-property $PM_{2.5}$ concentration is shown in Table 4a (E through 4). The maximum concentration occurs in the 2020_E version at 9.4 % of the 24-h criterion of 27 µg/m^3 and 4.4 % of the annual criterion of 8.8 µg/m^3.

8.3 Methane

The maximum off-property methane concentration is shown in Table 4a (E through 4). The maximum concentration occurs in the 2020_4 version at 25.4 % of the 24-h criterion of 27 µg/m^3.

8.4 Vinyl Chloride

The maximum off-property vinyl chloride concentration is shown in Table 4a (E through 4). The maximum concentration occurs in the 2020_4 version at 54.0 % of the 1-h criterion of 1 µg/m^3 and at 29.8 % of the annual criterion of 0.2 µg/m^3.

8.5 Dimethyl Sulphide

The maximum off-property dimethyl sulphide concentration is shown in Table 4a (E through 4). The maximum concentration occurs in the 2020_4 version at 13.3 % of the 10-minute criterion of 30 µg/m^3.

8.6 Dichlorofluoromethane

The maximum off-property dichlorofluoromethane concentration is shown in Table 4a (E through 4). The maximum concentration occurs in the 2020_4 version at 0.1 % of the 24-h criterion of 500 µg/m^3.

8.7 Chlorobenzene

The maximum off-property chlorobenzene concentration is shown in Table 4a (E through 4). The maximum concentration occurs in the 2020_4 version at 0.0 % of the 10-minute criterion of 4500 µg/m^3 and 0.0 % of the 1-h criterion of 3500 µg/m^3.

8.8 Carbon Dioxide

The maximum off-property carbon dioxide concentration is shown in Table 4a (E through 4). The maximum concentration occurs in the 2020_4 version at 10.2 % of the 24-h criterion of 255,800 µg/m^3.

8.9 Carbon Monoxide

The maximum off-property carbon monoxide concentration is shown in Table 4a (E through 4). The maximum concentration occurs in the 2020_3 version at 0.7 % of the 1-h criterion of 36,200 µg/m^3 and 0.9 % of the 8-h criterion of 15,700 µg/m^3.

8.10 Hydrogen Sulphide

The maximum off-property hydrogen sulphide concentration is shown in Table 4a (E through 4). The maximum concentration occurs in the 2020_4 version at 77.8 % of the 10-minute criterion of 13 µg/m^3 and 20.7 % of the 24-h criterion of 7 µg/m^3. Note that the

10-minute values are at the property line, not where a sensitive receptor would experience it.

8.11 Nitrogen oxides

The maximum off-property nitrogen oxides concentration is shown in Table 4a (E through 4). The maximum 1-hour concentration occurs in the 2020_3 version at 8.0 % of the 1-h criterion of 400 µg/m^3. The same impact when compared to the 2025 CAAQS of 78.96 µg/m^3 is 40.6% of criterion. The maximum 24-hour and annual concentrations occurs in the 2020_3 version at 4.6 % of the 24-h criterion of 200 µg/m^3 and 3.4% of the annual criterion adopted in 2025 of 22.56 µg/m^3.

Note that the facility is modelled as having a Tier 4 compliant compactor in 2025 when the 2025 NO_2 1-h value of 42 ppb takes effect. The current equipment is from the model year 2006 which is Tier 3 compliant. This equipment was purchased in 2016. It is reasonable to expect that Tier 4 compliant equipment will be on Site by 2025 as Tier 4 standards were required for all equipment starting in 2014. Tier 3 compliant equipment shows off-property impacts meeting all criteria except the 2025 NO_2 CAAQS.

Figures 7 (E through 4) show the contour plots of the 1-h NOx models.

Note that by 2025, the working face will be farther from the road than modelled and so may show compliance without using Tier 4 emissions.

8.12 Total particulate matter

The maximum off-property particulate matter concentration is shown in Table 4a (E through 4). The maximum concentration occurs in the 2020_E version at 74.3% of the 24-h criterion of 120 µg/m^3 and occurs in the 2020_2 version at 23.4% of the annual criterion of 60 µg/m^3.

Figures 6 (E through 4) show the contour plots of the 24-h PM models.

8.13 General Odour

Odour is typically the most contentious issue for residents surrounding landfills, so more detail has been provided on this topic than the others. Figure 8_3 shows the impact under the worst-case Alternative Method 3. As mentioned previously, the modelled scenario is the worst case which corresponds to the landfill filling the section closest to Perth Road 123/Water St. S.

As expected, the contours show that the highest impact occurs near the working face.

Given the accuracy of the odour model, discussed below, all the Alternative Methods appear to have the same impact as the current situation (see Table 6 (E through 4) and 7).

Since odour impacts are only important at sensitive receptors, 25 representative receptors were selected from the overall grid of receptors. These locations are the closest receptors to houses.

All 5 years of hourly impacts were binned to determine the number of impacts in each odour range. Since the odour level at which complaints tend to occur is 3-4 OU. The results are shown in Table 6 (E through 4) for percent below 1 OU, percent between 1 OU and 6 OU, and % over 6 OU. A few sensitive receptors show 0.5 % or more impacts over 6 OU. Because of the conservative way in which it was modelled and the fact that outliers were not removed this impact is considered acceptable compared to the recommended level of 0.5%[2].

The complaints received at the facility since 2013 are:

- 2013 – 1 complaint from a resident on Line 3, odour.
- 2014 – 2 complaints from residents on Perth Road 123, odour.
- 2015 – 6 complaints from 2 residents on Perth Road 123 (5 directly from residents, 1via MECP) – all odour related.
- 2016 – 2 complaints from residents on Perth Road 123, odour.
- 2017 – No formal complaints reported.
- 2018 – 5 complaints from 2 residents on Perth Road 123, all odour related.

This list suggests that the odour impacts recently have been relatively consistent and within the level considered acceptable by the MECP. The modelling shows that a level of 6 OU is approximately similar to that level of complaints, so the model is reasonable. During this time, the working face has been as close as possible to the sensitive receptors because the landfill was at the end of its previous capacity.

The working face was modelled at the closest point to the sensitive receptors in each Alternative Method. Over the life of the landfill, the working face will progress over the entire area in which waste will be deposited; therefore, the worst case was modelled and, for the majority of the landfill life, the working face will be further from the sensitive receptors and so odour impacts will be less than modelled.

Because the modelled impact exceeded 1 OU, the frequency of impacts was assessed. The results from each scenario were binned to determine the number of results in each section. Since 6 OU corresponds to the same complaint frequency, the results were sorted into the number of values less than 1 OU, the number of values between 1 OU and 6 OU, and the number of results exceeding 6 OU. The entire five (5) years of data was considered together.

Tables 6_E through 6_4 show the frequency of results for each Alternative Method. The Percent of each is summarized in Table 7.

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[2] “Modelling Contaminants With 10-Minute Average POIs”, PIBS 6700e.

8.14 Landfill Monitoring

The results above show that the landfill emissions are not expected to have a significant off property impact, so monitoring is not recommended.

9.0 Combined Impacts

The 90th percentile value recorded from measurements at the MECP monitoring station in London, ON. Since the measured MECP concentration is the traditional value, it has been shown combined in Tables 4b (Existing through Alternative Method 4).

As an alternative, the emission of NOx and PM were modelled along Perth Road 123 using standard emission rates calculated on Table EA-01: Off-Site Vehicle Emissions. The 90th percentile 1-h NOx concentration predicted using this method was 21.65 µg/m^3. The 90th percentile 24-h PM concentration predicted using this method was of 10.56 µg/m^3. These values are lower than the 90th percentile values used in the traditional/measured method, so the values were not considered further.

Tables 4b (E through 4) show the modelled impact from Table 4a (E through 4) plus the background from Table 5b.

Table 5c compares the modelling results from Table 4b (E through 4). The Alternative Method with the highest modelled impact is highlighted. The Alternative Method 4 gives the highest impacts for ten (10) contaminant/averaging periods each with Alternative Method 3 showing the highest impact for six (6) contaminant/averaging periods.

9.1 VOCs and Hydrogen Sulphide

There are no measured or modelled background values for the VOCs or Hydrogen Sulphide other than chlorobenzene and vinyl chloride, so the combined impact is the same as discussed in Section 8 above.

9.2 Vinyl Chloride

The 90th Percentile background vinyl chloride concentration is 0.00438 µg/m^3 which is 0.4 % of the 24-h criterion (see Table 5b: 90th Percentile Values Used (London Station #15026)). Note that this value was calculated from data collected at NAPS Station S60903 instead of MECP London Station #15026.

Adding the 90th Percentile background value to the highest modelled impact (see Section 8) gives 0.544 µg/m^3 which is 54.4% of the 1-h criterion which continues to show compliance (see Table 5c: Combined Summary Comparison from All Alternative Methods).

Adding the average background value to the highest modelled impact (see Section 8) gives 0.05 µg/m^3 which is 25.8 % of the annual criterion which continues to show compliance (see Table 5c: Combined Summary Comparison from All Alternative Methods).

9.3 Chlorobenzene

The 90th Percentile background chlorobenzene concentration is 0.0100 µg/m^3 which is 0.0 % of the 24-h criterion (see Table 5b: 90th Percentile Values Used (London Station #15026)). Note that this value was calculated from data collected at NAPS Station S60903 instead of MECP London Station #15026.

Adding the 90th Percentile background value to the highest modelled impact (see Section 8) gives 0.24 µg/m^3 which is 0.0 % of the 24-h criterion which continues to show compliance (see Table 5c: Combined Summary Comparison from All Alternative Methods).

Measurements of chlorobenzene are only reported on a daily basis, so it is not possible to calculate a 1-h 90th percentile value; however, using the 24-h 90th percentile value, the background would be 0.0 % of the annual criterion of 500 µg/m^3. Adding that 0.0 % to 0.1 % gives 0.1 %.

9.4 Carbon Monoxide

The 90th Percentile background carbon monoxide concentration is 362 µg/m^3 which is 1 % of the 8-h criterion (see Table 5b: 90th Percentile Values Used (London Station #15026)).

Adding the 90th Percentile background value to the highest modelled impact (see Section 8) gives 630 µg/m^3 which is 1.7 % of the 1-h criterion which continues to show compliance (see Table 5c: Combined Summary Comparison from All Alternative Methods).

Adding the 90th Percentile background value to the highest modelled impact (see Section 8) gives 503 µg/m^3 which is 3.2 % of the 8-h criterion which continues to show compliance (see Table 5c: Combined Summary Comparison from All Alternative Methods).

9.5 Nitrogen Oxides

The 90th Percentile background nitrogen oxides concentration is 39.48 µg/m^3 which is 9.9 % of the 1-h criterion (see Table 5b: 90th Percentile Values Used (London Station #15026)) and 36.58 µg/m^3 which is 18.3 % of the 24-h criterion. This 90th percentile value of 39.48 µg/m^3 is also 50.0 % of the 1-h CAAQS 2025 criterion.

Adding the 90th Percentile background value to the highest modelled 1-h impact (see Section 8) gives 71.96 µg/m^3 which is 17.9 % of the 1-h criterion. When compared to the 2025 CAAQS of 78.95 µg/m^3, the maximum off-property impact is 91.1% of that criterion at the property line. In Figures 7 (E through 4), the 40 µg/m^3 contour line shows that none of the sensitive receptors experience a modelled exceedance.

Adding the 90th Percentile background value to the highest modelled 24-h impact (see Section 8) gives 45.84 µg/m^3 which is 22.8% of the 24-h criterion.

Adding the average background value to the highest modelled impact (see Section 8) gives 17.26 µg/m^3 which is 76.4% of the annual criterion which continues to show compliance (see Table 5c: Combined Summary Comparison from All Alternative Methods).

All impacts including background continue to show compliance (see Table 5c: Combined Summary Comparison from All Alternative Methods) except the annual impact which either shows compliance or not depending on whether the background shows compliance or not.

Note that measured NOx concentrations have dropped consistently over the last ten (10) years[3] so the expectation is that the model results are over predicting the impact.

9.6 PM10

The 90th Percentile background PM_{10} concentration is 27.78 µg/m^3 which is 55.6 % of the 24-h criterion (see Table 5b: 90th Percentile Values Used (London Station #15026)).

Adding the 90th Percentile background value to the highest modelled impact (see Section 8) gives 51.95 µg/m^3 which is 103.9% of the 24-h criterion (see Table 5c: Combined Summary Comparison from All Alternative Methods).

While the Maximum off-property concentration exceeds after adding background, the contour plot of the PM_{10} emission from the Existing situation shows that all sensitive receptors are outside the 20 µg/m^3 contour so no sensitive receptors are exposed to impacts above criterion (see Figures 5 (E through 4)).

9.7 PM2.5

The 90th Percentile background $PM_{2.5}$ concentration is 15 µg/m^3 which is 50.0 % of the 24-h criterion (see Table 5b: 90th Percentile Values Used (London Station #15026)).

Adding the 90th Percentile background value to the highest modelled 24-h impact (see Section 8) gives 17.53 µg/m^3 which is 64.9% of the 24-h criterion.

Adding the average annual background value of 7.5 to the highest modelled impact (see Section 8) gives 7.88 µg/m^3 which is 89.6% (see Table 5c: Combined Summary Comparison from All Alternative Methods) which continues to show compliance.

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[3] "Air Quality in Ontario Report & Appendix (2013)", Figure 9, page 13 (15 of 80).

9.8 Total Particulate Matter

The 90th Percentile background PM concentration is 50 µg/m^3 which is 41.7 % of the 24-h criterion (see Table 5b: 90th Percentile Values Used (London Station #15026)). The average annual background is 25 µg/m^3 (see Table 5b: 90th Percentile Values Used (London Station #15026)).

Adding the 90th Percentile background value to the highest modelled impact (see Section 8) gives 139.15 µg/m^3 which is 116.0% of the 24-h criterion (see Table 5c: Combined Summary Comparison from All Alternative Methods).

While the maximum off-property concentration exceeds after adding background, the contour plots of the PM emission show that all sensitive receptors are outside the 50 µg/m^3 contour so no sensitive receptors are exposed to impacts above criterion (see Figures 6 (E through 4)).

24-h impacts including background exceed criteria (see Table 5c: Combined Summary Comparison from All Alternative Methods) because the background contribution is over 40% of the criterion by itself.

Adding the average annual background value to the highest modelled impact (see Section 8) gives 39.02 µg/m^3 which is 65.0% of the annual criterion (see Table 5c: Combined Summary Comparison from All Alternative Methods). (see Figures 6 (Ea through 4a)).

10.0 Conservative Assumptions

The purpose of this Environmental Assessment is to determine the environmental impact of the proposed alternatives over the next 40 years in which the landfill could operate. In each case, the worst possible off-property impact was selected to ensure that the operation will meet criteria throughout its life. Many of the impacts appear to be close to the limit but the reader is encouraged to remember that the modelling was done in a very conservative manner. These conservative choices are:

- In general, the worst-case hour is assumed to occur every hour of the day for contaminants with a 1-hour averaging period.
- Contaminants generated by on-site equipment are assumed to operate at the worst-case hour for the entire workday.
- The operations are located at the closest point to Perth Road 123 that they will ever be in the 40 years the landfill operates. The working face was the closest to the receptors in 2018 and will move east in future until capacity is reached at which point the working face will be at the farthest point east.
- The composting area is assumed to have emissions equal to the emission from the garbage; however, the Site only composts leaf and yard wastes so this assumption is very conservative. Expected odours are likely to be less than those from the landfill[4].
- The results reported from the model are the worst values in five (5) years of modelled data.
- The results reported from the model are at the point where they are highest which is usually on the property boundary of the landfill property. The roadway (Perth Road 123) east of the landfill sees substantially lower concentrations than the property boundary 20 m away or more.
- The background values provided for comparison are the 90th percentile values which mean that the actual values are lower 9 times out of 10.
- The landfill gas (LFG) estimate is generated by the LandGem model which assumes 100% municipal solid waste (MSW). The St. Marys landfill typically receives approximately one third MSW and two thirds industrial waste so the LFG volume estimate is likely substantially overstated.
- The odour from LFG was assigned the value of 10,000 OU/m^3 from the obsolete guidance written in 1992. The fraction of odour producing materials in MSW in Ontario has been steadily dropping for the past 30 years and is expected to continue to drop as more compostable material is redirected from the landfill stream further reducing the expected odour emission.

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[4] Ziyang Lou, Mingchao Wang, Youcai Zhao & Renhua Huang (2015) The contribution of biowaste disposal to odor emission from landfills, Journal of the Air & Waste Management Association, 65:4, 479-484, DOI: 10.1080/10962247.2014.1002870 (copy in Appendix E)

11.0 Conclusions

The emission rate estimates for each source of significant contaminants are documented in Tables EA-01 through EA-07. All the emission rates listed correspond to the operating scenario where all sources are operating simultaneously at their individual maximum rates of production. Therefore, these emission rate estimates are not likely to be an underestimate of the actual emission rates.

A POI concentration for each contaminant emitted from the Site was calculated based on the calculated emission rates and the output from the model; the results are presented in Tables 4a (E through 4) for each Alternative Method (summarized in Table 5a). Cumulative Impact results are presented in Tables 4b (E through 4) for each Alternative Method (summarized in Table 5c).

The POI concentrations listed in the Emissions Summary Table were compared against the List of MECP POI Limits.

The various alternatives are all similar to the Existing situation. Given that the Alternative Methods all show the worst case in 40 years, the public can be assured that the expanded landfill will be no worse than the current operation and each alternative result in a similar off-property impact.

Since landfill gas was modelled for the worst case (closure) and the results show low impacts, landfill gas monitoring is not warranted.

Tables

The Corporation of the Town of St. Marys
St. Marys, Ontario

Project No.: 032339

Table 1:
Sources and Contaminants Identification Table Existing
(2020_E)

Source Information			Expected Contaminants	Significant	
Process ID	**Unit Name**	**Stack IDs**	**Contaminants**	**Yes or No?**	**Rate / Rationale**
EA-01	Water St. Municipal Road	WS	NOx, CO, Particulate	No	Separate Model
EA-02	AB - On-site road to scale	TRKAB	NOx, CO, Particulate	Yes	8.617 E-02 g/s
EA-03	BC -On-site road to truck dump place	TRKBC	NOx, CO, Particulate	Yes	4.490 E-03 g/s
EA-04	BD - On-site road to drop off area	TRKBD	NOx, CO, Particulate	Yes	2.919 E-02 g/s
EA-05	DE - On-site road Drop off to stock pile	TRKDE	NOx, CO, Particulate	Yes	1.867 E-03 g/s
EA-06	EF - On-site road to stock pile	TRKEF	NOx, CO, Particulate	Yes	2.466 E-03 g/s
EA-07	EH - On-stie road to composting area	TRKEH	NOx, CO, Particulate	Yes	9.189 E-03 g/s
EA-08	Stockpile	ST	Particulate	Yes	7.841 E-08 g/s-m2
EA-09	Working face	WF	Particulate, Odour	Yes	1.817 E00 OU/s-m2
EA-10	Composting area	CA	Particulate, Odour	Yes	1.817 E00 OU/s-m2
EA-11	Landfill Gas	ACL	LFG	Yes	7.368 E-04 g/s-m2
EA-12	Working Face Engines	CMPTR	NOx, CO, Particulate	Yes	6.490 E-03 g/s

Source ID	Source Description	General Location	Contaminants	Yes or No?	Rate / Rationale
ACL	Active Covered Landfill Area	South Centre	LFG	Yes	See EA-11
CA	Composting area	East side		Yes	
CMPTR	Compactor 1986 CAT 816D	West side	CO, NOx, Particulate	Yes	See EA-12
ECL	Exhausted Covered Landfill Area	Cntre		No	No Emissions
LDR	Loader 2013 CAT 938K	West side		No	CMPTR more conservative
LST	Leachate storage tank			No	Not used anymore
ST	Stockpile	Centre		Yes	
TRKAB	AB - On-site road to scale	West side	CO, NOx, Particulate	Yes	See EA-02
TRKBC	BC -On-site road to truck dump place	North side	CO, NOx, Particulate	Yes	See EA-03
TRKBD	BD - On-site road to drop off area	North west side	CO, NOx, Particulate	Yes	See EA-04
TRKDE	DE - On-site road Drop off to stock pile	North side	CO, NOx, Particulate	Yes	See EA-05
TRKEF	EF - On-site road to stock pile	North & east sides	CO, NOx, Particulate	Yes	See EA-06
TRKEH	EH - On-stie road to composting area	North & east sides	CO, NOx, Particulate	Yes	See EA-07
WF	Working face	West side	Odour, Particulate	Yes	See EA-09
WS	Water St	West of site	CO, NOx, Particulate	Yes	See EA-01

MSDS	Supplier	Product	Contaminants	Yes or No?	Rate / Rationale
1	None	Unit with no Emission		Yes	
2	Vehicles	Nitrogen oxides		Yes	
3	Vehicles	Carbon Monoxide		Yes	
4	Vehicles / Dust	TSP		Yes	
5	Vehicles / Dust	PM10		Yes	
6	Vehicles / Dust	PM2.5		Yes	
7	Landfill Gas	Methane		Yes	
8	Landfill Gas	Carbon Dioxide		Yes	
9	Landfill Gas	Vinyl Chloride		Yes	
10	Landfill Gas	Odour		Yes	
11	Landfill Gas	Chlorobenzene - HAP/VOC		Yes	
12	Landfill Gas	Dichlorofluoromethane - VOC		Yes	
13	Landfill Gas	Dimethyl sulfide (methyl sulfide) - VOC		Yes	
14	Landfill Gas	Hydrogen Sulphide		Yes	

The Corporation of the Town of St. Marys
St. Marys, Ontario

Project No.: 032339

Table 1:
Sources and Contaminants Identification Table Alternative 2
(2020_2)

Source Information			Expected Contaminants	Significant	
Process ID	**Unit Name**	**Stack IDs**	**Contaminants**	**Yes or No?**	**Rate / Rationale**
EA-01	Water St. Municipal Road	WS	NOx, CO, Particulate	No	Separate Model
EA-02	AB - On-site road to scale	TRKAB	NOx, CO, Particulate	Yes	8.617 E-02 g/s
EA-03	BC -On-site road to truck dump place	TRKBC	NOx, CO, Particulate	Yes	1.203 E-02 g/s
EA-04	BD - On-site road to drop off area	TRKBD	NOx, CO, Particulate	Yes	6.362 E-02 g/s
EA-05	DE - On-site road Drop off to stock pile	TRKDE	NOx, CO, Particulate	Yes	5.282 E-03 g/s
EA-06	EF - On-site road to stock pile	TRKEF	NOx, CO, Particulate	Yes	4.811 E-03 g/s
EA-07	EH - On-stie road to composting area	TRKEH	NOx, CO, Particulate	Yes	6.967 E-03 g/s
EA-08	Stockpile	ST	Particulate	Yes	7.841 E-08 g/s-m2
EA-09	Working face	WF	Particulate, Odour	Yes	1.817 E00 OU/s-m2
EA-10	Composting area	CA	Particulate, Odour	Yes	1.817 E00 OU/s-m2
EA-11	Landfill Gas	ACL	LFG	Yes	1.328 E-03 g/s-m2
EA-12	Working Face Engines	CMPTR	NOx, CO, Particulate	Yes	5.679 E-02 g/s

Source ID	Source Description	General Location	Contaminants	Yes or No?	Rate / Rationale
ACL	Active Covered Landfill Area	South Centre	LFG	Yes	See EA-11
CA	Composting area	East side		Yes	
CMPTR	Compactor 1986 CAT 816D	West side	CO, NOx, Particulate	Yes	See EA-12
ECL	Exhausted Covered Landfill Area	Cntre		No	No Emissions
LDR	Loader 2013 CAT 938K	West side		No	CMPTR more conservative
LST	Leachate storage tank			No	Not used anymore
ST	Stockpile	Centre		Yes	
TRKAB	AB - On-site road to scale	West side	CO, NOx, Particulate	Yes	See EA-02
TRKBC	BC -On-site road to truck dump place	North side	CO, NOx, Particulate	Yes	See EA-03
TRKBD	BD - On-site road to drop off area	North west side	CO, NOx, Particulate	Yes	See EA-04
TRKDE	DE - On-site road Drop off to stock pile	North side	CO, NOx, Particulate	Yes	See EA-05
TRKEF	EF - On-site road to stock pile	North & east sides	CO, NOx, Particulate	Yes	See EA-06
TRKEH	EH - On-stie road to composting area	North & east sides	CO, NOx, Particulate	Yes	See EA-07
WF	Working face	West side	Odour, Particulate	Yes	See EA-09
WS	Water St	West of site	CO, NOx, Particulate	Yes	See EA-01

MSDS	Supplier	Product	Contaminants	Yes or No?	Rate / Rationale
1	None	Unit with no Emission		Yes	
2	Vehicles	Nitrogen oxides		Yes	
3	Vehicles	Carbon Monoxide		Yes	
4	Vehicles / Dust	TSP		Yes	
5	Vehicles / Dust	PM10		Yes	
6	Vehicles / Dust	PM2.5		Yes	
7	Landfill Gas	Methane		Yes	
8	Landfill Gas	Carbon Dioxide		Yes	
9	Landfill Gas	Vinyl Chloride		Yes	
10	Landfill Gas	Odour		Yes	
11	Landfill Gas	Chlorobenzene - HAP/VOC		Yes	
12	Landfill Gas	Dichlorofluoromethane - VOC		Yes	
13	Landfill Gas	Dimethyl sulfide (methyl sulfide) - VOC		Yes	
14	Landfill Gas	Hydrogen Sulphide		Yes	

The Corporation of the Town of St. Marys
St. Marys, Ontario

Project No.: 032339

Table 1:
Sources and Contaminants Identification Table Alternative 3
(2020_3)

Source Information			Expected Contaminants	Significant	
Process ID	**Unit Name**	**Stack IDs**	**Contaminants**	**Yes or No?**	**Rate / Rationale**
EA-01	Water St. Municipal Road	WS	NOx, CO, Particulate	No	Separate Model
EA-02	AB - On-site road to scale	TRKAB	NOx, CO, Particulate	Yes	8.617 E-02 g/s
EA-03	BC -On-site road to truck dump place	TRKBC	NOx, CO, Particulate	Yes	3.570 E-03 g/s
EA-04	BD - On-site road to drop off area	TRKBD	NOx, CO, Particulate	Yes	1.935 E-02 g/s
EA-05	DE - On-site road Drop off to stock pile	TRKDE	NOx, CO, Particulate	Yes	3.627 E-03 g/s
EA-06	EF - On-site road to stock pile	TRKEF	NOx, CO, Particulate	Yes	6.691 E-03 g/s
EA-07	EH - On-stie road to composting area	TRKEH	NOx, CO, Particulate	Yes	5.615 E-03 g/s
EA-08	Stockpile	ST	Particulate	Yes	7.841 E-08 g/s-m2
EA-09	Working face	WF	Particulate, Odour	Yes	1.817 E00 OU/s-m2
EA-10	Composting area	CA	Particulate, Odour	Yes	1.817 E00 OU/s-m2
EA-11	Landfill Gas	ACL	LFG	Yes	1.328 E-03 g/s-m2
EA-12	Working Face Engines	CMPTR	NOx, CO, Particulate	Yes	6.490 E-03 g/s

Source ID	Source Description	General Location	Contaminants	Yes or No?	Rate / Rationale
ACL	Active Covered Landfill Area	South Centre	LFG	Yes	See EA-11
CA	Composting area	East side		Yes	
CMPTR	Compactor 1986 CAT 816D	West side	CO, NOx, Particulate	Yes	See EA-12
ECL	Exhausted Covered Landfill Area	Cntre		No	No Emissions
LDR	Loader 2013 CAT 938K	West side		No	CMPTR more conservative
LST	Leachate storage tank			No	Not used anymore
ST	Stockpile	Centre		Yes	
TRKAB	AB - On-site road to scale	West side	CO, NOx, Particulate	Yes	See EA-02
TRKBC	BC -On-site road to truck dump place	North side	CO, NOx, Particulate	Yes	See EA-03
TRKBD	BD - On-site road to drop off area	North west side	CO, NOx, Particulate	Yes	See EA-04
TRKDE	DE - On-site road Drop off to stock pile	North side	CO, NOx, Particulate	Yes	See EA-05
TRKEF	EF - On-site road to stock pile	North & east sides	CO, NOx, Particulate	Yes	See EA-06
TRKEH	EH - On-stie road to composting area	North & east sides	CO, NOx, Particulate	Yes	See EA-07
WF	Working face	West side	Odour, Particulate	Yes	See EA-09
WS	Water St	West of site	CO, NOx, Particulate	Yes	See EA-01

MSDS	Supplier	Product	Contaminants	Yes or No?	Rate / Rationale
1	None	Unit with no Emission		Yes	
2	Vehicles	Nitrogen oxides		Yes	
3	Vehicles	Carbon Monoxide		Yes	
4	Vehicles / Dust	TSP		Yes	
5	Vehicles / Dust	PM10		Yes	
6	Vehicles / Dust	PM2.5		Yes	
7	Landfill Gas	Methane		Yes	
8	Landfill Gas	Carbon Dioxide		Yes	
9	Landfill Gas	Vinyl Chloride		Yes	
10	Landfill Gas	Odour		Yes	
11	Landfill Gas	Chlorobenzene - HAP/VOC		Yes	
12	Landfill Gas	Dichlorofluoromethane - VOC		Yes	
13	Landfill Gas	Dimethyl sulfide (methyl sulfide) - VOC		Yes	

The Corporation of the Town of St. Marys
St. Marys, Ontario

Project No.: 032339

Table 1:
Sources and Contaminants Identification Table Alternative 4
(2020_4)

Source Information			Expected Contaminants	Significant	
Process ID	**Unit Name**	**Stack IDs**	**Contaminants**	**Yes or No?**	**Rate / Rationale**
EA-01	Water St. Municipal Road	WS	NOx, CO, Particulate	No	Separate Model
EA-02	AB - On-site road to scale	TRKAB	NOx, CO, Particulate	Yes	8.617 E-02 g/s
EA-03	BC -On-site road to truck dump place	TRKBC	NOx, CO, Particulate	Yes	2.446 E-03 g/s
EA-04	BD - On-site road to drop off area	TRKBD	NOx, CO, Particulate	Yes	3.168 E-02 g/s
EA-05	DE - On-site road Drop off to stock pile	TRKDE	NOx, CO, Particulate	Yes	6.482 E-03 g/s
EA-06	EF - On-site road to stock pile	TRKEF	NOx, CO, Particulate	Yes	4.754 E-03 g/s
EA-07	EH - On-stie road to composting area	TRKEH	NOx, CO, Particulate	Yes	5.667 E-03 g/s
EA-08	Stockpile	ST	Particulate	Yes	7.841 E-08 g/s-m2
EA-09	Working face	WF	Particulate, Odour	Yes	1.817 E00 OU/s-m2
EA-10	Composting area	CA	Particulate, Odour	Yes	1.817 E00 OU/s-m2
EA-11	Landfill Gas	ACL	LFG	Yes	1.328 E-03 g/s-m2
EA-12	Working Face Engines	CMPTR	NOx, CO, Particulate	Yes	6.490 E-03 g/s

Source ID	Source Description	General Location	Contaminants	Yes or No?	Rate / Rationale
ACL	Active Covered Landfill Area	South Centre	LFG	Yes	See EA-11
CA	Composting area	East side		Yes	
CMPTR	Compactor 1986 CAT 816D	West side	CO, NOx, Particulate	Yes	See EA-12
ECL	Exhausted Covered Landfill Area	Cntre		No	No Emissions
LDR	Loader 2013 CAT 938K	West side		No	CMPTR more conservative
LST	Leachate storage tank			No	Not used anymore
ST	Stockpile	Centre		Yes	
TRKAB	AB - On-site road to scale	West side	CO, NOx, Particulate	Yes	See EA-02
TRKBC	BC -On-site road to truck dump place	North side	CO, NOx, Particulate	Yes	See EA-03
TRKBD	BD - On-site road to drop off area	North west side	CO, NOx, Particulate	Yes	See EA-04
TRKDE	DE - On-site road Drop off to stock pile	North side	CO, NOx, Particulate	Yes	See EA-05
TRKEF	EF - On-site road to stock pile	North & east sides	CO, NOx, Particulate	Yes	See EA-06
TRKEH	EH - On-stie road to composting area	North & east sides	CO, NOx, Particulate	Yes	See EA-07
WF	Working face	West side	Odour, Particulate	Yes	See EA-09
WS	Water St	West of site	CO, NOx, Particulate	Yes	See EA-01

MSDS	Supplier	Product	Contaminants	Yes or No?	Rate / Rationale
1	None	Unit with no Emission		Yes	
2	Vehicles	Nitrogen oxides		Yes	
3	Vehicles	Carbon Monoxide		Yes	
4	Vehicles / Dust	TSP		Yes	
5	Vehicles / Dust	PM10		Yes	
6	Vehicles / Dust	PM2.5		Yes	
7	Landfill Gas	Methane		Yes	
8	Landfill Gas	Carbon Dioxide		Yes	
9	Landfill Gas	Vinyl Chloride		Yes	
10	Landfill Gas	Odour		Yes	
11	Landfill Gas	Chlorobenzene - HAP/VOC		Yes	
12	Landfill Gas	Dichlorofluoromethane - VOC		Yes	
13	Landfill Gas	Dimethyl sulfide (methyl sulfide) - VOC		Yes	

Table 2-1:
Source Summary Table - Stack ID
(2020_E)

Source ID	Description	Volumetric Emission Rate (m^3/s)	Emission Temperature (°C)	Stack Dimensions (dia. or X by Y) (m)	Emission Height above Grade (m)	Stack Location X	Stack Location Y	CAS	Contaminant Name	Averaging Period (h)	Estimation Method	Accuracy	Emission Rate (g/s)	Percent of total Emission (%)	Footnote
ACL	Active Covered Landfill Area	0.00047195	20	244.34 x 158.43	1	487301.43	4786958.14	74-82-8	Methane	24	EC	Marginal	10.39536	100.00%	b
								75-01-4	Vinyl chloride	24	EC	Marginal	0.0005914	100.00%	b
								75-18-3	dimethyl sulphide	0.1667	EC	Marginal	0.0006281	100.00%	b
								75-43-4	Dichlorofluoromethane	24	EC	Marginal	0.0003468	100.00%	b
								108-90-7	Chlorobenzene	0.1667	EC	Marginal	3.647E-05	100.00%	b
								124-38-9	Carbon Dioxide	24	EC	Marginal	28.522431	100.00%	b
								7783-06-4	Hydrogen sulphide	0.1667	EC	Marginal	0.0015903	100.00%	b
CA	Composting area	0.00047195	20	12 x 20	1	487745.062	4787018.8	0-02-2	PM10	24	EF	Marginal	4.402E-08	0.00%	
								0-03-3	PM2.5	24	EF	Marginal	6.666E-09	0.00%	
								0-04-4	Odour	0.1667	EF	Marginal	1.8165641	50.00%	a
								PM	Total particulate matter	24	EF	Marginal	9.308E-08	0.00%	
CMPTR	Compactor 1986 CAT 816D	0.00047195	20	30 x 40	1	487295.829	4787085.96	0-02-2	PM10	24	EF	Average	0.0001364	0.38%	
								0-03-3	PM2.5	24	EF	Average	0.0001364	3.60%	
								630-08-0	Carbon monoxide	1	EF	Average	0.0567906	91.40%	
								10102-44-0	Nitrogen oxides	1	EF	Average	0.0064904	60.14%	
								PM	Total particulate matter	24	EF	Average	0.0001364	0.10%	
ST	Stockpile	0.00047195	20	17.7 x 17.7	1	487412.63	4786999.02	0-02-2	PM10	24	EF	Average	3.709E-08	0.00%	b
								0-03-3	PM2.5	24	EF	Average	5.616E-09	0.00%	b
								PM	Total particulate matter	24	EF	Average	7.841E-08	0.00%	b
TRKAB	AB - On-site road to scale	0.00047195	20	356	1	487190.03	4786890.06	0-02-2	PM10	24	EF	Average	0.0232842	64.35%	
								0-03-3	PM2.5	24	EF	Average	0.0023534	62.12%	
								630-08-0	Carbon monoxide	1	EF	Average	0.0030426	4.90%	
								10102-44-0	Nitrogen oxides	1	EF	Average	0.0014976	13.88%	
								PM	Total particulate matter	24	EF	Average	0.0861673	64.54%	
TRKBC	BC -On-site road to truck dump place	0.00047195	20	85.9	1	487221.018	4787130.06	0-02-2	PM10	24	EF	Average	0.0012143	3.36%	
								0-03-3	PM2.5	24	EF	Average	0.0001239	3.27%	
								630-08-0	Carbon monoxide	1	EF	Average	0.0001055	0.17%	
								10102-44-0	Nitrogen oxides	1	EF	Average	0.00029	2.69%	
								PM	Total particulate matter	24	EF	Average	0.00449	3.36%	
TRKBD	BD - On-site road to drop off area	0.00047195	20	182.5	1	487222.349	4787123.14	0-02-2	PM10	24	EF	Average	0.0078879	21.80%	
								0-03-3	PM2.5	24	EF	Average	0.0007981	21.07%	
								630-08-0	Carbon monoxide	1	EF	Average	0.0015598	2.51%	
								10102-44-0	Nitrogen oxides	1	EF	Average	0.0007677	7.11%	
								PM	Total particulate matter	24	EF	Average	0.0291878	21.86%	
TRKDE	DE - On-site road Drop off to stock pil	0.00047195	20	71.4	1	487409.272	4787155.86	0-02-2	PM10	24	EF	Average	0.0005055	1.40%	
								0-03-3	PM2.5	24	EF	Average	5.227E-05	1.38%	
								630-08-0	Carbon monoxide	1	EF	Average	8.772E-05	0.14%	
								10102-44-0	Nitrogen oxides	1	EF	Average	0.000241	2.23%	
								PM	Total particulate matter	24	EF	Average	0.0018669	1.40%	
TRKEF	EF - On-site road to stock pile	0.00047195	20	94.3	1	487463.903	4787104.88	0-02-2	PM10	24	EF	Average	0.0006677	1.85%	
								0-03-3	PM2.5	24	EF	Average	6.904E-05	1.82%	
								630-08-0	Carbon monoxide	1	EF	Average	0.0001159	0.19%	
								10102-44-0	Nitrogen oxides	1	EF	Average	0.0003183	2.95%	
								PM	Total particulate matter	24	EF	Average	0.0024657	1.85%	
TRKEH	EH - On-stie road to composting area	0.00047195	20	351.5	1	487474.524	4787101.69	0-02-2	PM10	24	EF	Average	0.0024866	6.87%	
								0-03-3	PM2.5	24	EF	Average	0.0002554	6.74%	
								630-08-0	Carbon monoxide	1	EF	Average	0.0004318	0.70%	
								10102-44-0	Nitrogen oxides	1	EF	Average	0.0011865	11.00%	
								PM	Total particulate matter	24	EF	Average	0.0091886	6.88%	
WF	Working face	0.00047195	20	30 x 40	1	487281.371	4787070.06	0-02-2	PM10	24	EF	Average	8.69E-08	0.00%	b
								0-03-3	PM2.5	24	EF	Average	1.316E-08	0.00%	b
								0-04-4	Odour	0.1667	EF	Average	1.8165641	50.00%	a
								PM	Total particulate matter	24	EF	Average	1.837E-07	0.00%	b

a - Odour emission rate is in OU/s m^2
b - Emission rate units is in g/s m^2

Table 2-1:
Source Summary Table - Stack ID
(2020_2)

Source ID	Description	Volumetric Emission Rate (m^3/s)	Emission Temperature (°C)	Stack Dimensions (dia. or X by Y) (m)	Emission Height above Grade (m)	Height above or below Building Roof (m)	Stack Location X	Stack Location Y	CAS	Contaminant Name	Averaging Period (h)	Estimation Method	Accuracy	Emission Rate (g/s)	Percent of total Emission (%)	Footnote
ACL	Active Covered Landfill Area	0.00047195	20	244.34 x 158.43	2	1	487395.691	4787189.36	74-82-8	Methane	24	EC	Marginal	18.742834	100.00%	b
									75-01-4	Vinyl chloride	24	EC	Marginal	0.0010663	100.00%	b
									75-18-3	dimethyl sulphide	0.1667	EC	Marginal	0.0011325	100.00%	b
									75-43-4	Dichlorofluoromethane	24	EC	Marginal	0.0006254	100.00%	b
									108-90-7	Chlorobenzene	0.1667	EC	Marginal	6.576E-05	100.00%	b
									124-38-9	Carbon Dioxide	24	EC	Marginal	51.425944	100.00%	b
									7783-06-4	Hydrogen sulphide	0.1667	EC	Marginal	0.0028672	100.00%	b
CA	Composting area	0.00047195	20	12 x 20	2	1	487694.458	4787286.47	0-02-2	PM10	24	EF	Marginal	4.402E-08	0.00%	
									0-03-3	PM2.5	24	EF	Marginal	6.666E-09	0.00%	
									0-04-4	Odour	0.1667	EF	Marginal	1.8165641	50.00%	a
									PM	Total particulate matter	24	EF	Marginal	9.308E-08	0.00%	
CMPTR	Compactor 1986 CAT 816D	0.00047195	20	30 x 40	2	1	487368.62	4787330.95	0-02-2	PM10	24	EF	Average	0.0001364	0.28%	
									0-03-3	PM2.5	24	EF	Average	0.0001364	2.71%	
									630-08-0	Carbon monoxide	1	EF	Average	0.0567906	88.30%	
									10102-44-0	Nitrogen oxides	1	EF	Average	0.0064904	51.34%	
									PM	Total particulate matter	24	EF	Average	0.0001364	0.08%	
ST	Stockpile	0.00047195	20	17.7 x 17.7	2	1	487509.844	4787142.84	0-02-2	PM10	24	EF	Average	3.709E-08	0.00%	b
									0-03-3	PM2.5	24	EF	Average	5.616E-09	0.00%	b
									PM	Total particulate matter	24	EF	Average	7.841E-08	0.00%	b
TRKAB	AB - On-site road to scale	0.00047195	20	356	2	1	487190.03	4786890.06	0-02-2	PM10	24	EF	Average	0.0232842	48.02%	
									0-03-3	PM2.5	24	EF	Average	0.0023534	46.72%	
									630-08-0	Carbon monoxide	1	EF	Average	0.0030426	4.73%	
									10102-44-0	Nitrogen oxides	1	EF	Average	0.0014976	11.85%	
									PM	Total particulate matter	24	EF	Average	0.0861673	48.13%	
TRKBC	BC -On-site road to truck dump place	0.00047195	20	85.9	2	1	487218.54	4787121.58	0-02-2	PM10	24	EF	Average	0.0032528	6.71%	
									0-03-3	PM2.5	24	EF	Average	0.0003319	6.59%	
									630-08-0	Carbon monoxide	1	EF	Average	0.0002827	0.44%	
									10102-44-0	Nitrogen oxides	1	EF	Average	0.0007767	6.14%	
									PM	Total particulate matter	24	EF	Average	0.0120275	6.72%	
TRKBD	BD - On-site road to drop off area	0.00047195	20	182.5	2	1	487221.36	4787141.4	0-02-2	PM10	24	EF	Average	0.0171936	35.46%	
									0-03-3	PM2.5	24	EF	Average	0.0017396	34.53%	
									630-08-0	Carbon monoxide	1	EF	Average	0.0033999	5.29%	
									10102-44-0	Nitrogen oxides	1	EF	Average	0.0016734	13.24%	
									PM	Total particulate matter	24	EF	Average	0.0636215	35.54%	
TRKDE	DE - On-site road Drop off to stock pil	0.00047195	20	71.4	2	1	487296.95	4787321.69	0-02-2	PM10	24	EF	Average	0.0014302	2.95%	
									0-03-3	PM2.5	24	EF	Average	0.0001479	2.94%	
									630-08-0	Carbon monoxide	1	EF	Average	0.0002482	0.39%	
									10102-44-0	Nitrogen oxides	1	EF	Average	0.0006819	5.39%	
									PM	Total particulate matter	24	EF	Average	0.0052817	2.95%	
TRKEF	EF - On-site road to stock pile	0.00047195	20	94.3	2	1	487503.44	4787336.93	0-02-2	PM10	24	EF	Average	0.0013027	2.69%	
									0-03-3	PM2.5	24	EF	Average	0.0001347	2.67%	
									630-08-0	Carbon monoxide	1	EF	Average	0.0002261	0.35%	
									10102-44-0	Nitrogen oxides	1	EF	Average	0.0006211	4.91%	
									PM	Total particulate matter	24	EF	Average	0.0048111	2.69%	
TRKEH	EH - On-stie road to composting area	0.00047195	20	351.5	2	1	487492.75	4787356.16	0-02-2	PM10	24	EF	Average	0.0018853	3.89%	
									0-03-3	PM2.5	24	EF	Average	0.0001937	3.84%	
									630-08-0	Carbon monoxide	1	EF	Average	0.0003274	0.51%	
									10102-44-0	Nitrogen oxides	1	EF	Average	0.0008996	7.12%	
									PM	Total particulate matter	24	EF	Average	0.0069666	3.89%	
WF	Working face	0.00047195	20	30 x 40	2	1	487356.46	4787307.67	0-02-2	PM10	24	EF	Average	8.69E-08	0.00%	b
									0-03-3	PM2.5	24	EF	Average	1.316E-08	0.00%	b
									0-04-4	Odour	0.1667	EF	Average	1.8165641	50.00%	a
									PM	Total particulate matter	24	EF	Average	1.837E-07	0.00%	b

a - Odour emission rate is in OU/m3
b - Emission rate units is in g/s m^2

Table 2-1:
Source Summary Table - Stack ID (2020_3)

Source ID	Description	Volumetric Emission Rate (m^3/s)	Emission Temperature (°C)	Stack Dimensions (dia. or X by Y) (m)	Emission Height above Grade (m)	Height above or below Building Roof (m)	Stack Location X	Stack Location Y	CAS	Contaminant Name	Averaging Period (h)	Estimation Method	Accuracy	Emission Rate (g/s)	Percent of total Emission (%)	Footnote
ACL	Active Covered Landfill Area	0.00047195	20	244.34 x 158.43	2	1	487248.45	4787129.58	74-82-8	Methane	24	EC	Marginal	18.742834	100.00%	b
									75-01-4	Vinyl chloride	24	EC	Marginal	0.0010663	100.00%	b
									75-18-3	dimethyl sulphide	0.1667	EC	Marginal	0.0011325	100.00%	b
									75-43-4	Dichlorofluoromethane	24	EC	Marginal	0.0006254	100.00%	b
									108-90-7	Chlorobenzene	0.1667	EC	Marginal	6.576E-05	100.00%	b
									124-38-9	Carbon Dioxide	24	EC	Marginal	51.425944	100.00%	b
									7783-06-4	Hydrogen sulphide	0.1667	EC	Marginal	0.0028672	100.00%	b
CA	Composting area	0.00047195	20	12 x 20	2	1	487565.084	4787315.88	0-02-2	PM10	24	EF	Marginal	4.402E-08	0.00%	
									0-03-3	PM2.5	24	EF	Marginal	6.666E-09	0.00%	
									0-04-4	Odour	0.1667	EF	Marginal	1.8165641	50.00%	a
									PM	Total particulate matter	24	EF	Marginal	9.308E-08	0.00%	
CMPTR	Compactor 1986 CAT 816D	0.00047195	20	30 x 40	2	1	487238	4787245.5	0-02-2	PM10	24	EF	Average	0.0001364	0.40%	
									0-03-3	PM2.5	24	EF	Average	0.0001364	3.83%	
									630-08-0	Carbon monoxide	1	EF	Average	0.0567906	92.04%	
									10102-44-0	Nitrogen oxides	1	EF	Average	0.0064904	60.18%	
									PM	Total particulate matter	24	EF	Average	0.0001364	0.11%	
ST	Stockpile	0.00047195	20	17.7 x 17.7	2	1	487389.538	4787047.13	0-02-2	PM10	24	EF	Average	3.709E-08	0.00%	b
									0-03-3	PM2.5	24	EF	Average	5.616E-09	0.00%	b
									PM	Total particulate matter	24	EF	Average	7.841E-08	0.00%	b
TRKAB	AB - On-site road to scale	0.00047195	20	356	2	1	487190.03	4786890.06	0-02-2	PM10	24	EF	Average	0.0232842	68.63%	
									0-03-3	PM2.5	24	EF	Average	0.0023534	66.06%	
									630-08-0	Carbon monoxide	1	EF	Average	0.0030426	4.93%	
									10102-44-0	Nitrogen oxides	1	EF	Average	0.0014976	13.89%	
									PM	Total particulate matter	24	EF	Average	0.0861673	68.85%	
TRKBC	BC -On-site road to truck dump place	0.00047195	20	85.9	2	1	487205.27	4787149.39	0-02-2	PM10	24	EF	Average	0.0009655	2.85%	
									0-03-3	PM2.5	24	EF	Average	9.853E-05	2.77%	
									630-08-0	Carbon monoxide	1	EF	Average	8.391E-05	0.14%	
									10102-44-0	Nitrogen oxides	1	EF	Average	0.0002306	2.14%	
									PM	Total particulate matter	24	EF	Average	0.0035701	2.85%	
TRKBD	BD - On-site road to drop off area	0.00047195	20	182.5	2	1	487200.34	4787183.63	0-02-2	PM10	24	EF	Average	0.0052298	15.41%	
									0-03-3	PM2.5	24	EF	Average	0.0005292	14.85%	
									630-08-0	Carbon monoxide	1	EF	Average	0.0010341	1.68%	
									10102-44-0	Nitrogen oxides	1	EF	Average	0.000509	4.72%	
									PM	Total particulate matter	24	EF	Average	0.0193519	15.46%	
TRKDE	DE - On-site road Drop off to stock pil	0.00047195	20	71.4	2	1	487223.59	4787297.06	0-02-2	PM10	24	EF	Average	0.000982	2.89%	
									0-03-3	PM2.5	24	EF	Average	0.0001015	2.85%	
									630-08-0	Carbon monoxide	1	EF	Average	0.0001704	0.28%	
									10102-44-0	Nitrogen oxides	1	EF	Average	0.0004682	4.34%	
									PM	Total particulate matter	24	EF	Average	0.0036266	2.90%	
TRKEF	EF - On-site road to stock pile	0.00047195	20	94.3	2	1	487359.17	4787306.01	0-02-2	PM10	24	EF	Average	0.0018118	5.34%	
									0-03-3	PM2.5	24	EF	Average	0.0001874	5.26%	
									630-08-0	Carbon monoxide	1	EF	Average	0.0003144	0.51%	
									10102-44-0	Nitrogen oxides	1	EF	Average	0.0008638	8.01%	
									PM	Total particulate matter	24	EF	Average	0.006691	5.35%	
TRKEH	EH - On-stie road to composting area	0.00047195	20	351.5	2	1	487368.4	4787309.13	0-02-2	PM10	24	EF	Average	0.0015195	4.48%	
									0-03-3	PM2.5	24	EF	Average	0.0001561	4.38%	
									630-08-0	Carbon monoxide	1	EF	Average	0.0002639	0.43%	
									10102-44-0	Nitrogen oxides	1	EF	Average	0.0007251	6.72%	
									PM	Total particulate matter	24	EF	Average	0.0056151	4.49%	
WF	Working face	0.00047195	20	30 x 40	2	1	487238	4787245.5	0-02-2	PM10	24	EF	Average	8.69E-08	0.00%	b
									0-03-3	PM2.5	24	EF	Average	1.316E-08	0.00%	b
									0-04-4	Odour	0.1667	EF	Average	1.8165641	50.00%	a
									PM	Total particulate matter	24	EF	Average	1.837E-07	0.00%	b

a - Odour emission rate is in OU/m3
b - Emission rate units is in g/s m^2

Table 2-1:
Source Summary Table - Stack ID (2020_4)

Source ID	Description	Volumetric Emission Rate (m^3/s)	Emission Temperature (°C)	Stack Dimensions (dia. or X by Y) (m)	Emission Height above Grade (m)	Height above or below Building Roof (m)	Stack Location X	Stack Location Y	CAS	Contaminant Name	Averaging Period (h)	Estimation Method	Accuracy	Emission Rate (g/s)	Percent of total Emission (%)	Footnote
ACL	Active Covered Landfill Area	0.00047195	20	244.34 x 158.43	2	1	487376.904	4787405.15	74-82-8	Methane	24	EC	Marginal	18.742834	100.00%	b
									75-01-4	Vinyl chloride	24	EC	Marginal	0.0010663	100.00%	b
									75-18-3	dimethyl sulphide	0.1667	EC	Marginal	0.0011325	100.00%	b
									75-43-4	Dichlorofluoromethane	24	EC	Marginal	0.0006254	100.00%	b
									108-90-7	Chlorobenzene	0.1667	EC	Marginal	6.576E-05	100.00%	b
									124-38-9	Carbon Dioxide	24	EC	Marginal	51.425944	100.00%	b
									7783-06-4	Hydrogen sulphide	0.1667	EC	Marginal	0.0028672	100.00%	b
CA	Composting area	0.00047195	20	12 x 20	2	1	487686.991	4787179.93	0-02-2	PM10	24	EF	Marginal	4.402E-08	0.00%	
									0-03-3	PM2.5	24	EF	Marginal	6.666E-09	0.00%	
									0-04-4	Odour	0.1667	EF	Marginal	1.8165641	50.00%	a
									PM	Total particulate matter	24	EF	Marginal	9.308E-08	0.00%	
CMPTR	Compactor 1986 CAT 816D	0.00047195	20	30 x 40	2	1	487402.17	4787397.81	0-02-2	PM10	24	EF	Average	0.0001364	0.37%	
									0-03-3	PM2.5	24	EF	Average	0.0001364	3.50%	
									630-08-0	Carbon monoxide	1	EF	Average	0.0567906	91.04%	
									10102-44-0	Nitrogen oxides	1	EF	Average	0.0064904	58.15%	
									PM	Total particulate matter	24	EF	Average	0.0001364	0.10%	
ST	Stockpile	0.00047195	20	17.7 x 17.7	2	1	487370.916	4787000.66	0-02-2	PM10	24	EF	Average	3.709E-08	0.00%	b
									0-03-3	PM2.5	24	EF	Average	5.616E-09	0.00%	b
									PM	Total particulate matter	24	EF	Average	7.841E-08	0.00%	b
TRKAB	AB - On-site road to scale	0.00047195	20	356	2	1	487190.03	4786890.06	0-02-2	PM10	24	EF	Average	0.0232842	62.56%	
									0-03-3	PM2.5	24	EF	Average	0.0023534	60.41%	
									630-08-0	Carbon monoxide	1	EF	Average	0.0030426	4.88%	
									10102-44-0	Nitrogen oxides	1	EF	Average	0.0014976	13.42%	
									PM	Total particulate matter	24	EF	Average	0.0861673	62.74%	
TRKBC	BC -On-site road to truck dump place	0.00047195	20	85.9	2	1	487202.32	4787152.63	0-02-2	PM10	24	EF	Average	0.0006616	1.78%	
									0-03-3	PM2.5	24	EF	Average	6.751E-05	1.73%	
									630-08-0	Carbon monoxide	1	EF	Average	5.75E-05	0.09%	
									10102-44-0	Nitrogen oxides	1	EF	Average	0.000158	1.42%	
									PM	Total particulate matter	24	EF	Average	0.0024463	1.78%	
TRKBD	BD - On-site road to drop off area	0.00047195	20	182.5	2	1	487200.8	4787169.29	0-02-2	PM10	24	EF	Average	0.0085622	23.00%	
									0-03-3	PM2.5	24	EF	Average	0.0008663	22.24%	
									630-08-0	Carbon monoxide	1	EF	Average	0.0016931	2.71%	
									10102-44-0	Nitrogen oxides	1	EF	Average	0.0008333	7.47%	
									PM	Total particulate matter	24	EF	Average	0.0316828	23.07%	
TRKDE	DE - On-site road Drop off to stock pil	0.00047195	20	71.4	2	1	487258.58	4787337.81	0-02-2	PM10	24	EF	Average	0.0017551	4.72%	
									0-03-3	PM2.5	24	EF	Average	0.0001815	4.66%	
									630-08-0	Carbon monoxide	1	EF	Average	0.0003046	0.49%	
									10102-44-0	Nitrogen oxides	1	EF	Average	0.0008368	7.50%	
									PM	Total particulate matter	24	EF	Average	0.0064819	4.72%	
TRKEF	EF - On-site road to stock pile	0.00047195	20	94.3	2	1	487426.19	4787184.16	0-02-2	PM10	24	EF	Average	0.0012872	3.46%	
									0-03-3	PM2.5	24	EF	Average	0.0001331	3.42%	
									630-08-0	Carbon monoxide	1	EF	Average	0.0002234	0.36%	
									10102-44-0	Nitrogen oxides	1	EF	Average	0.0006137	5.50%	
									PM	Total particulate matter	24	EF	Average	0.0047535	3.46%	
TRKEH	EH - On-stie road to composting area	0.00047195	20	351.5	2	1	487446.43	4787185.79	0-02-2	PM10	24	EF	Average	0.0015337	4.12%	
									0-03-3	PM2.5	24	EF	Average	0.0001576	4.04%	
									630-08-0	Carbon monoxide	1	EF	Average	0.0002664	0.43%	
									10102-44-0	Nitrogen oxides	1	EF	Average	0.0007318	6.56%	
									PM	Total particulate matter	24	EF	Average	0.0056674	4.13%	
WF	Working face	0.00047195	20	30 x 40	2	1	487396.886	4787378.71	0-02-2	PM10	24	EF	Average	8.69E-08	0.00%	b
									0-03-3	PM2.5	24	EF	Average	1.316E-08	0.00%	b
									0-04-4	Odour	0.1667	EF	Average	1.8165641	50.00%	a
									PM	Total particulate matter	24	EF	Average	1.837E-07	0.00%	b

a - Odour emission rate is in OU/m3
b - Emission rate units is in g/s m^2

Table 2-2:
Source Summary Table - Contaminant
(2020_E)

CAS	Contaminant Name	Averaging Period (h)	Source ID	Description	Volumetric Emission Rate (m3/s)	Emission Temperature (°C)	Stack Dimensions (dia. or X by Y) (m)	Emission Height above Grade (m)	Stack Location X	Stack Location Y	Estimation Method	Accuracy	Emission Rate (g/s)	Percent of total Emission (%)	Footnote
0-02-2	PM10	24	CA	Composting area	0.00047195	20	12 x 20	1	487745.062	4787018.8	EF	Marginal	4.402E-08	0.00%	
			CMPTR	Compactor 1986 CAT 816D	0.00047195	20	30 x 40	1	487295.829	4787085.96	EF	Average	0.0001364	0.38%	
			ST	Stockpile	0.00047195	20	17.7 x 17.7	1	487412.63	4786999.02	EF	Average	3.709E-08	0.00%	b
			TRKAB	AB - On-site road to scale	0.00047195	20	356	1	487190.03	4786890.06	EF	Average	0.0232842	64.35%	
			TRKBC	BC -On-site road to truck dump place	0.00047195	20	85.9	1	487221.018	4787130.06	EF	Average	0.0012143	3.36%	
			TRKBD	BD - On-site road to drop off area	0.00047195	20	182.5	1	487222.349	4787123.14	EF	Average	0.0078879	21.80%	
			TRKDE	DE - On-site road Drop off to stock pil	0.00047195	20	71.4	1	487409.272	4787155.86	EF	Average	0.0005055	1.40%	
			TRKEF	EF - On-site road to stock pile	0.00047195	20	94.3	1	487463.903	4787104.88	EF	Average	0.0006677	1.85%	
			TRKEH	EH - On-stie road to composting area	0.00047195	20	351.5	1	487474.524	4787101.69	EF	Average	0.0024866	6.87%	
			WF	Working face	0.00047195	20	30 x 40	1	487281.371	4787070.06	EF	Average	8.69E-08	0.00%	b
0-03-3	PM2.5	24	CA	Composting area	0.00047195	20	12 x 20	1	487745.062	4787018.8	EF	Marginal	6.666E-09	0.00%	
			CMPTR	Compactor 1986 CAT 816D	0.00047195	20	30 x 40	1	487295.829	4787085.96	EF	Average	0.0001364	3.60%	
			ST	Stockpile	0.00047195	20	17.7 x 17.7	1	487412.63	4786999.02	EF	Average	5.616E-09	0.00%	b
			TRKAB	AB - On-site road to scale	0.00047195	20	356	1	487190.03	4786890.06	EF	Average	0.0023534	62.12%	
			TRKBC	BC -On-site road to truck dump place	0.00047195	20	85.9	1	487221.018	4787130.06	EF	Average	0.0001239	3.27%	
			TRKBD	BD - On-site road to drop off area	0.00047195	20	182.5	1	487222.349	4787123.14	EF	Average	0.0007981	21.07%	
			TRKDE	DE - On-site road Drop off to stock pil	0.00047195	20	71.4	1	487409.272	4787155.86	EF	Average	5.227E-05	1.38%	
			TRKEF	EF - On-site road to stock pile	0.00047195	20	94.3	1	487463.903	4787104.88	EF	Average	6.904E-05	1.82%	
			TRKEH	EH - On-stie road to composting area	0.00047195	20	351.5	1	487474.524	4787101.69	EF	Average	0.0002554	6.74%	
			WF	Working face	0.00047195	20	30 x 40	1	487281.371	4787070.06	EF	Average	1.316E-08	0.00%	b
0-04-4	Odour	0.1667	CA	Composting area	0.00047195	20	12 x 20	1	487745.062	4787018.8	EF	Marginal	1.8165641	50.00%	a
			WF	Working face	0.00047195	20	30 x 40	1	487281.371	4787070.06	EF	Average	1.8165641	50.00%	a
74-82-8	Methane	24	ACL	Active Covered Landfill Area	0.00047195	20	244.34 x 158.43	1	487301.43	4786958.14	EC	Marginal	10.39536	100.00%	b
75-01-4	Vinyl chloride	24	ACL	Active Covered Landfill Area	0.00047195	20	244.34 x 158.43	1	487301.43	4786958.14	EC	Marginal	0.0005914	100.00%	b
75-18-3	dimethyl sulphide	0.1667	ACL	Active Covered Landfill Area	0.00047195	20	244.34 x 158.43	1	487301.43	4786958.14	EC	Marginal	0.0006281	100.00%	b
75-43-4	Dichlorofluoromethane	24	ACL	Active Covered Landfill Area	0.00047195	20	244.34 x 158.43	1	487301.43	4786958.14	EC	Marginal	0.0003468	100.00%	b
108-90-7	Chlorobenzene	0.1667	ACL	Active Covered Landfill Area	0.00047195	20	244.34 x 158.43	1	487301.43	4786958.14	EC	Marginal	3.647E-05	100.00%	b
124-38-9	Carbon Dioxide	24	ACL	Active Covered Landfill Area	0.00047195	20	244.34 x 158.43	1	487301.43	4786958.14	EC	Marginal	28.522431	100.00%	b
630-08-0	Carbon monoxide	1	CMPTR	Compactor 1986 CAT 816D	0.00047195	20	30 x 40	1	487295.829	4787085.96	EF	Average	0.0567906	91.40%	
			TRKAB	AB - On-site road to scale	0.00047195	20	356	1	487190.03	4786890.06	EF	Average	0.0030426	4.90%	
			TRKBC	BC -On-site road to truck dump place	0.00047195	20	85.9	1	487221.018	4787130.06	EF	Average	0.0001055	0.17%	
			TRKBD	BD - On-site road to drop off area	0.00047195	20	182.5	1	487222.349	4787123.14	EF	Average	0.0015598	2.51%	
			TRKDE	DE - On-site road Drop off to stock pil	0.00047195	20	71.4	1	487409.272	4787155.86	EF	Average	8.772E-05	0.14%	
			TRKEF	EF - On-site road to stock pile	0.00047195	20	94.3	1	487463.903	4787104.88	EF	Average	0.0001159	0.19%	
			TRKEH	EH - On-stie road to composting area	0.00047195	20	351.5	1	487474.524	4787101.69	EF	Average	0.0004318	0.70%	
7783-06-4	Hydrogen sulphide	0.1667	ACL	Active Covered Landfill Area	0.00047195	20	244.34 x 158.43	1	487301.43	4786958.14	EC	Marginal	0.0015903	100.00%	b
10102-44-0	Nitrogen oxides	1	CMPTR	Compactor 1986 CAT 816D	0.00047195	20	30 x 40	1	487295.829	4787085.96	EF	Average	0.0064904	60.14%	
			TRKAB	AB - On-site road to scale	0.00047195	20	356	1	487190.03	4786890.06	EF	Average	0.0014976	13.88%	
			TRKBC	BC -On-site road to truck dump place	0.00047195	20	85.9	1	487221.018	4787130.06	EF	Average	0.00029	2.69%	
			TRKBD	BD - On-site road to drop off area	0.00047195	20	182.5	1	487222.349	4787123.14	EF	Average	0.0007677	7.11%	
			TRKDE	DE - On-site road Drop off to stock pil	0.00047195	20	71.4	1	487409.272	4787155.86	EF	Average	0.000241	2.23%	
			TRKEF	EF - On-site road to stock pile	0.00047195	20	94.3	1	487463.903	4787104.88	EF	Average	0.0003183	2.95%	
			TRKEH	EH - On-stie road to composting area	0.00047195	20	351.5	1	487474.524	4787101.69	EF	Average	0.0011865	11.00%	
PM	Total particulate matter	24	CA	Composting area	0.00047195	20	12 x 20	1	487745.062	4787018.8	EF	Marginal	9.308E-08	0.00%	
			CMPTR	Compactor 1986 CAT 816D	0.00047195	20	30 x 40	1	487295.829	4787085.96	EF	Average	0.0001364	0.10%	
			ST	Stockpile	0.00047195	20	17.7 x 17.7	1	487412.63	4786999.02	EF	Average	7.841E-08	0.00%	b
			TRKAB	AB - On-site road to scale	0.00047195	20	356	1	487190.03	4786890.06	EF	Average	0.0861673	64.54%	
			TRKBC	BC -On-site road to truck dump place	0.00047195	20	85.9	1	487221.018	4787130.06	EF	Average	0.00449	3.36%	
			TRKBD	BD - On-site road to drop off area	0.00047195	20	182.5	1	487222.349	4787123.14	EF	Average	0.0291878	21.86%	
			TRKDE	DE - On-site road Drop off to stock pil	0.00047195	20	71.4	1	487409.272	4787155.86	EF	Average	0.0018669	1.40%	
			TRKEF	EF - On-site road to stock pile	0.00047195	20	94.3	1	487463.903	4787104.88	EF	Average	0.0024657	1.85%	
			TRKEH	EH - On-stie road to composting area	0.00047195	20	351.5	1	487474.524	4787101.69	EF	Average	0.0091886	6.88%	
			WF	Working face	0.00047195	20	30 x 40	1	487281.371	4787070.06	EF	Average	1.837E-07	0.00%	b

a - Odour emission rate is in OU/m3

b - Emission rate units is in g/s m^2

Table 2-2:
Source Summary Table - Contaminant
(2020_2)

CAS	Contaminant Name	Averaging Period (h)	Source ID	Description	Volumetric Emission Rate (m3/s)	Emission Temperature (°C)	Stack Dimensions (dia. or X by Y) (m)	Emission Height above Grade (m)	Height above or below Building Roof (m)	Stack Location X	Stack Location Y	Estimation Method	Accuracy	Emission Rate (g/s)	Percent of total Emission (%)	Footnote
0-02-2	PM10	24	CA	Composting area	0.00047195	20	12 x 20	2	1	487694.458	4787286.47	EF	Marginal	4.402E-08	0.00%	
			CMPTR	Compactor 1986 CAT 816D	0.00047195	20	30 x 40	2	1	487368.62	4787330.95	EF	Average	0.0001364	0.28%	
			ST	Stockpile	0.00047195	20	17.7 x 17.7	2	1	487509.844	4787142.84	EF	Average	3.709E-08	0.00%	b
			TRKAB	AB - On-site road to scale	0.00047195	20	356	2	1	487190.03	4786890.06	EF	Average	0.0232842	48.02%	
			TRKBC	BC -On-site road to truck dump place	0.00047195	20	85.9	2	1	487218.54	4787121.58	EF	Average	0.0032528	6.71%	
			TRKBD	BD - On-site road to drop off area	0.00047195	20	182.5	2	1	487221.36	4787141.4	EF	Average	0.0171936	35.46%	
			TRKDE	DE - On-site road Drop off to stock pil	0.00047195	20	71.4	2	1	487296.95	4787321.69	EF	Average	0.0014302	2.95%	
			TRKEF	EF - On-site road to stock pile	0.00047195	20	94.3	2	1	487503.44	4787336.93	EF	Average	0.0013027	2.69%	
			TRKEH	EH - On-stie road to composting area	0.00047195	20	351.5	2	1	487492.75	4787356.16	EF	Average	0.0018853	3.89%	
			WF	Working face	0.00047195	20	30 x 40	2	1	487356.46	4787307.67	EF	Average	8.69E-08	0.00%	b
0-03-3	PM2.5	24	CA	Composting area	0.00047195	20	12 x 20	2	1	487694.458	4787286.47	EF	Marginal	6.666E-09	0.00%	
			CMPTR	Compactor 1986 CAT 816D	0.00047195	20	30 x 40	2	1	487368.62	4787330.95	EF	Average	0.0001364	2.71%	
			ST	Stockpile	0.00047195	20	17.7 x 17.7	2	1	487509.844	4787142.84	EF	Average	5.616E-09	0.00%	b
			TRKAB	AB - On-site road to scale	0.00047195	20	356	2	1	487190.03	4786890.06	EF	Average	0.0023534	46.72%	
			TRKBC	BC -On-site road to truck dump place	0.00047195	20	85.9	2	1	487218.54	4787121.58	EF	Average	0.0003319	6.59%	
			TRKBD	BD - On-site road to drop off area	0.00047195	20	182.5	2	1	487221.36	4787141.4	EF	Average	0.0017396	34.53%	
			TRKDE	DE - On-site road Drop off to stock pil	0.00047195	20	71.4	2	1	487296.95	4787321.69	EF	Average	0.0001479	2.94%	
			TRKEF	EF - On-site road to stock pile	0.00047195	20	94.3	2	1	487503.44	4787336.93	EF	Average	0.0001347	2.67%	
			TRKEH	EH - On-stie road to composting area	0.00047195	20	351.5	2	1	487492.75	4787356.16	EF	Average	0.0001937	3.84%	
			WF	Working face	0.00047195	20	30 x 40	2	1	487356.46	4787307.67	EF	Average	1.316E-08	0.00%	b
0-04-4	Odour	0.1667	CA	Composting area	0.00047195	20	12 x 20	2	1	487694.458	4787286.47	EF	Marginal	1.8165641	50.00%	a
			WF	Working face	0.00047195	20	30 x 40	2	1	487356.46	4787307.67	EF	Average	1.8165641	50.00%	a
74-82-8	Methane	24	ACL	Active Covered Landfill Area	0.00047195	20	244.34 x 158.43	2	1	487395.691	4787189.36	EC	Marginal	18.742834	100.00%	b
75-01-4	Vinyl chloride	24	ACL	Active Covered Landfill Area	0.00047195	20	244.34 x 158.43	2	1	487395.691	4787189.36	EC	Marginal	0.0010663	100.00%	b
75-18-3	dimethyl sulphide	0.1667	ACL	Active Covered Landfill Area	0.00047195	20	244.34 x 158.43	2	1	487395.691	4787189.36	EC	Marginal	0.0011325	100.00%	b
75-43-4	Dichlorofluoromethane	24	ACL	Active Covered Landfill Area	0.00047195	20	244.34 x 158.43	2	1	487395.691	4787189.36	EC	Marginal	0.0006254	100.00%	b
108-90-7	Chlorobenzene	0.1667	ACL	Active Covered Landfill Area	0.00047195	20	244.34 x 158.43	2	1	487395.691	4787189.36	EC	Marginal	6.576E-05	100.00%	b
124-38-9	Carbon Dioxide	24	ACL	Active Covered Landfill Area	0.00047195	20	244.34 x 158.43	2	1	487395.691	4787189.36	EC	Marginal	51.425944	100.00%	b
630-08-0	Carbon monoxide	1	CMPTR	Compactor 1986 CAT 816D	0.00047195	20	30 x 40	2	1	487368.62	4787330.95	EF	Average	0.0567906	88.30%	
			TRKAB	AB - On-site road to scale	0.00047195	20	356	2	1	487190.03	4786890.06	EF	Average	0.0030426	4.73%	
			TRKBC	BC -On-site road to truck dump place	0.00047195	20	85.9	2	1	487218.54	4787121.58	EF	Average	0.0002827	0.44%	
			TRKBD	BD - On-site road to drop off area	0.00047195	20	182.5	2	1	487221.36	4787141.4	EF	Average	0.0033999	5.29%	
			TRKDE	DE - On-site road Drop off to stock pil	0.00047195	20	71.4	2	1	487296.95	4787321.69	EF	Average	0.0002482	0.39%	
			TRKEF	EF - On-site road to stock pile	0.00047195	20	94.3	2	1	487503.44	4787336.93	EF	Average	0.0002261	0.35%	
			TRKEH	EH - On-stie road to composting area	0.00047195	20	351.5	2	1	487492.75	4787356.16	EF	Average	0.0003274	0.51%	
7783-06-4	Hydrogen sulphide	0.1667	ACL	Active Covered Landfill Area	0.00047195	20	244.34 x 158.43	2	1	487395.691	4787189.36	EC	Marginal	0.0028672	100.00%	b
10102-44-0	Nitrogen oxides	1	CMPTR	Compactor 1986 CAT 816D	0.00047195	20	30 x 40	2	1	487368.62	4787330.95	EF	Average	0.0064904	51.34%	
			TRKAB	AB - On-site road to scale	0.00047195	20	356	2	1	487190.03	4786890.06	EF	Average	0.0014976	11.85%	
			TRKBC	BC -On-site road to truck dump place	0.00047195	20	85.9	2	1	487218.54	4787121.58	EF	Average	0.0007767	6.14%	
			TRKBD	BD - On-site road to drop off area	0.00047195	20	182.5	2	1	487221.36	4787141.4	EF	Average	0.0016734	13.24%	
			TRKDE	DE - On-site road Drop off to stock pil	0.00047195	20	71.4	2	1	487296.95	4787321.69	EF	Average	0.0006819	5.39%	
			TRKEF	EF - On-site road to stock pile	0.00047195	20	94.3	2	1	487503.44	4787336.93	EF	Average	0.0006211	4.91%	
			TRKEH	EH - On-stie road to composting area	0.00047195	20	351.5	2	1	487492.75	4787356.16	EF	Average	0.0008996	7.12%	
PM	Total particulate matter	24	CA	Composting area	0.00047195	20	12 x 20	2	1	487694.458	4787286.47	EF	Marginal	9.308E-08	0.00%	
			CMPTR	Compactor 1986 CAT 816D	0.00047195	20	30 x 40	2	1	487368.62	4787330.95	EF	Average	0.0001364	0.08%	
			ST	Stockpile	0.00047195	20	17.7 x 17.7	2	1	487509.844	4787142.84	EF	Average	7.841E-08	0.00%	b
			TRKAB	AB - On-site road to scale	0.00047195	20	356	2	1	487190.03	4786890.06	EF	Average	0.0861673	48.13%	
			TRKBC	BC -On-site road to truck dump place	0.00047195	20	85.9	2	1	487218.54	4787121.58	EF	Average	0.0120275	6.72%	
			TRKBD	BD - On-site road to drop off area	0.00047195	20	182.5	2	1	487221.36	4787141.4	EF	Average	0.0636215	35.54%	
			TRKDE	DE - On-site road Drop off to stock pil	0.00047195	20	71.4	2	1	487296.95	4787321.69	EF	Average	0.0052817	2.95%	
			TRKEF	EF - On-site road to stock pile	0.00047195	20	94.3	2	1	487503.44	4787336.93	EF	Average	0.0048111	2.69%	
			TRKEH	EH - On-stie road to composting area	0.00047195	20	351.5	2	1	487492.75	4787356.16	EF	Average	0.0069666	3.89%	
			WF	Working face	0.00047195	20	30 x 40	2	1	487356.46	4787307.67	EF	Average	1.837E-07	0.00%	b

a - Odour emission rate is in OU/m3

Table 2-2:
Source Summary Table - Contaminant
(2020_3)

CAS	Contaminant Name	Averaging Period (h)	Source ID	Description	Volumetric Emission Rate (m3/s)	Emission Temperature (°C)	Stack Dimensions (dia. or X by Y) (m)	Emission Height above Grade (m)	Height above or below Building Roof (m)	Stack Location X	Stack Location Y	Estimation Method	Accuracy	Emission Rate (g/s)	Percent of total Emission (%)	Footnote
0-02-2	PM10	24	CA	Composting area	0.00047195	20	12 x 20	2	1	487565.084	4787315.88	EF	Marginal	4.402E-08	0.00%	
			CMPTR	Compactor 1986 CAT 816D	0.00047195	20	30 x 40	2	1	487238	4787245.5	EF	Average	0.0001364	0.40%	
			ST	Stockpile	0.00047195	20	17.7 x 17.7	2	1	487389.538	4787047.13	EF	Average	3.709E-08	0.00%	b
			TRKAB	AB - On-site road to scale	0.00047195	20	356	2	1	487190.03	4786890.06	EF	Average	0.0232842	68.63%	
			TRKBC	BC -On-site road to truck dump place	0.00047195	20	85.9	2	1	487205.27	4787149.39	EF	Average	0.0009655	2.85%	
			TRKBD	BD - On-site road to drop off area	0.00047195	20	182.5	2	1	487200.34	4787183.63	EF	Average	0.0052298	15.41%	
			TRKDE	DE - On-site road Drop off to stock pil	0.00047195	20	71.4	2	1	487223.59	4787297.06	EF	Average	0.000982	2.89%	
			TRKEF	EF - On-site road to stock pile	0.00047195	20	94.3	2	1	487359.17	4787306.01	EF	Average	0.0018118	5.34%	
			TRKEH	EH - On-stie road to composting area	0.00047195	20	351.5	2	1	487368.4	4787309.13	EF	Average	0.0015195	4.48%	
			WF	Working face	0.00047195	20	30 x 40	2	1	487238	4787245.5	EF	Average	8.69E-08	0.00%	b
0-03-3	PM2.5	24	CA	Composting area	0.00047195	20	12 x 20	2	1	487565.084	4787315.88	EF	Marginal	6.666E-09	0.00%	
			CMPTR	Compactor 1986 CAT 816D	0.00047195	20	30 x 40	2	1	487238	4787245.5	EF	Average	0.0001364	3.83%	
			ST	Stockpile	0.00047195	20	17.7 x 17.7	2	1	487389.538	4787047.13	EF	Average	5.616E-09	0.00%	b
			TRKAB	AB - On-site road to scale	0.00047195	20	356	2	1	487190.03	4786890.06	EF	Average	0.0023534	66.06%	
			TRKBC	BC -On-site road to truck dump place	0.00047195	20	85.9	2	1	487205.27	4787149.39	EF	Average	9.853E-05	2.77%	
			TRKBD	BD - On-site road to drop off area	0.00047195	20	182.5	2	1	487200.34	4787183.63	EF	Average	0.0005292	14.85%	
			TRKDE	DE - On-site road Drop off to stock pil	0.00047195	20	71.4	2	1	487223.59	4787297.06	EF	Average	0.0001015	2.85%	
			TRKEF	EF - On-site road to stock pile	0.00047195	20	94.3	2	1	487359.17	4787306.01	EF	Average	0.0001874	5.26%	
			TRKEH	EH - On-stie road to composting area	0.00047195	20	351.5	2	1	487368.4	4787309.13	EF	Average	0.0001561	4.38%	
			WF	Working face	0.00047195	20	30 x 40	2	1	487238	4787245.5	EF	Average	1.316E-08	0.00%	b
0-04-4	Odour	0.1667	CA	Composting area	0.00047195	20	12 x 20	2	1	487565.084	4787315.88	EF	Marginal	1.8165641	50.00%	a
			WF	Working face	0.00047195	20	30 x 40	2	1	487238	4787245.5	EF	Average	1.8165641	50.00%	a
74-82-8	Methane	24	ACL	Active Covered Landfill Area	0.00047195	20	244.34 x 158.43	2	1	487248.45	4787129.58	EC	Marginal	18.742834	100.00%	b
75-01-4	Vinyl chloride	24	ACL	Active Covered Landfill Area	0.00047195	20	244.34 x 158.43	2	1	487248.45	4787129.58	EC	Marginal	0.0010663	100.00%	b
75-18-3	dimethyl sulphide	0.1667	ACL	Active Covered Landfill Area	0.00047195	20	244.34 x 158.43	2	1	487248.45	4787129.58	EC	Marginal	0.0011325	100.00%	b
75-43-4	Dichlorofluoromethane	24	ACL	Active Covered Landfill Area	0.00047195	20	244.34 x 158.43	2	1	487248.45	4787129.58	EC	Marginal	0.0006254	100.00%	b
108-90-7	Chlorobenzene	0.1667	ACL	Active Covered Landfill Area	0.00047195	20	244.34 x 158.43	2	1	487248.45	4787129.58	EC	Marginal	6.576E-05	100.00%	b
124-38-9	Carbon Dioxide	24	ACL	Active Covered Landfill Area	0.00047195	20	244.34 x 158.43	2	1	487248.45	4787129.58	EC	Marginal	51.425944	100.00%	b
630-08-0	Carbon monoxide	1	CMPTR	Compactor 1986 CAT 816D	0.00047195	20	30 x 40	2	1	487238	4787245.5	EF	Average	0.0567906	92.04%	
			TRKAB	AB - On-site road to scale	0.00047195	20	356	2	1	487190.03	4786890.06	EF	Average	0.0030426	4.93%	
			TRKBC	BC -On-site road to truck dump place	0.00047195	20	85.9	2	1	487205.27	4787149.39	EF	Average	8.391E-05	0.14%	
			TRKBD	BD - On-site road to drop off area	0.00047195	20	182.5	2	1	487200.34	4787183.63	EF	Average	0.0010341	1.68%	
			TRKDE	DE - On-site road Drop off to stock pil	0.00047195	20	71.4	2	1	487223.59	4787297.06	EF	Average	0.0001704	0.28%	
			TRKEF	EF - On-site road to stock pile	0.00047195	20	94.3	2	1	487359.17	4787306.01	EF	Average	0.0003144	0.51%	
			TRKEH	EH - On-stie road to composting area	0.00047195	20	351.5	2	1	487368.4	4787309.13	EF	Average	0.0002639	0.43%	
7783-06-4	Hydrogen sulphide	0.1667	ACL	Active Covered Landfill Area	0.00047195	20	244.34 x 158.43	2	1	487248.45	4787129.58	EC	Marginal	0.0028672	100.00%	b
10102-44-0	Nitrogen oxides	1	CMPTR	Compactor 1986 CAT 816D	0.00047195	20	30 x 40	2	1	487238	4787245.5	EF	Average	0.0064904	60.18%	
			TRKAB	AB - On-site road to scale	0.00047195	20	356	2	1	487190.03	4786890.06	EF	Average	0.0014976	13.89%	
			TRKBC	BC -On-site road to truck dump place	0.00047195	20	85.9	2	1	487205.27	4787149.39	EF	Average	0.0002306	2.14%	
			TRKBD	BD - On-site road to drop off area	0.00047195	20	182.5	2	1	487200.34	4787183.63	EF	Average	0.000509	4.72%	
			TRKDE	DE - On-site road Drop off to stock pil	0.00047195	20	71.4	2	1	487223.59	4787297.06	EF	Average	0.0004682	4.34%	
			TRKEF	EF - On-site road to stock pile	0.00047195	20	94.3	2	1	487359.17	4787306.01	EF	Average	0.0008638	8.01%	
			TRKEH	EH - On-stie road to composting area	0.00047195	20	351.5	2	1	487368.4	4787309.13	EF	Average	0.0007251	6.72%	
PM	Total particulate matter	24	CA	Composting area	0.00047195	20	12 x 20	2	1	487565.084	4787315.88	EF	Marginal	9.308E-08	0.00%	
			CMPTR	Compactor 1986 CAT 816D	0.00047195	20	30 x 40	2	1	487238	4787245.5	EF	Average	0.0001364	0.11%	
			ST	Stockpile	0.00047195	20	17.7 x 17.7	2	1	487389.538	4787047.13	EF	Average	7.841E-08	0.00%	b
			TRKAB	AB - On-site road to scale	0.00047195	20	356	2	1	487190.03	4786890.06	EF	Average	0.0861673	68.85%	
			TRKBC	BC -On-site road to truck dump place	0.00047195	20	85.9	2	1	487205.27	4787149.39	EF	Average	0.0035701	2.85%	
			TRKBD	BD - On-site road to drop off area	0.00047195	20	182.5	2	1	487200.34	4787183.63	EF	Average	0.0193519	15.46%	
			TRKDE	DE - On-site road Drop off to stock pil	0.00047195	20	71.4	2	1	487223.59	4787297.06	EF	Average	0.0036266	2.90%	
			TRKEF	EF - On-site road to stock pile	0.00047195	20	94.3	2	1	487359.17	4787306.01	EF	Average	0.006691	5.35%	
			TRKEH	EH - On-stie road to composting area	0.00047195	20	351.5	2	1	487368.4	4787309.13	EF	Average	0.0056151	4.49%	
			WF	Working face	0.00047195	20	30 x 40	2	1	487238	4787245.5	EF	Average	1.837E-07	0.00%	b

a - Odour emission rate is in OU/m3

b - Emission rate units is in g/s m^2

Table 2-2:
Source Summary Table - Contaminant
(2020_4)

CAS	Contaminant Name	Averaging Period (h)	Source ID	Description	Volumetric Emission Rate (m3/s)	Emission Temperature (°C)	Stack Dimensions (dia. or X by Y) (m)	Emission Height above Grade (m)	Height above or below Building Roof (m)	Stack Location X	Stack Location Y	Estimation Method	Accuracy	Emission Rate (g/s)	Percent of total Emission (%)	Footnote
0-02-2	PM10	24	CA	Composting area	0.00047195	20	12 x 20	2	1	487686.991	4787179.93	EF	Marginal	4.402E-08	0.00%	
			CMPTR	Compactor 1986 CAT 816D	0.00047195	20	30 x 40	2	1	487402.17	4787397.81	EF	Average	0.0001364	0.37%	
			ST	Stockpile	0.00047195	20	17.7 x 17.7	2	1	487370.916	4787000.66	EF	Average	3.709E-08	0.00%	b
			TRKAB	AB - On-site road to scale	0.00047195	20	356	2	1	487190.03	4786890.06	EF	Average	0.0232842	62.56%	
			TRKBC	BC -On-site road to truck dump place	0.00047195	20	85.9	2	1	487202.32	4787152.63	EF	Average	0.0006616	1.78%	
			TRKBD	BD - On-site road to drop off area	0.00047195	20	182.5	2	1	487200.8	4787169.29	EF	Average	0.0085622	23.00%	
			TRKDE	DE - On-site road Drop off to stock pil	0.00047195	20	71.4	2	1	487258.58	4787337.81	EF	Average	0.0017551	4.72%	
			TRKEF	EF - On-site road to stock pile	0.00047195	20	94.3	2	1	487426.19	4787184.16	EF	Average	0.0012872	3.46%	
			TRKEH	EH - On-stie road to composting area	0.00047195	20	351.5	2	1	487446.43	4787185.79	EF	Average	0.0015337	4.12%	
			WF	Working face	0.00047195	20	30 x 40	2	1	487396.886	4787378.71	EF	Average	8.69E-08	0.00%	b
0-03-3	PM2.5	24	CA	Composting area	0.00047195	20	12 x 20	2	1	487686.991	4787179.93	EF	Marginal	6.666E-09	0.00%	
			CMPTR	Compactor 1986 CAT 816D	0.00047195	20	30 x 40	2	1	487402.17	4787397.81	EF	Average	0.0001364	3.50%	
			ST	Stockpile	0.00047195	20	17.7 x 17.7	2	1	487370.916	4787000.66	EF	Average	5.616E-09	0.00%	b
			TRKAB	AB - On-site road to scale	0.00047195	20	356	2	1	487190.03	4786890.06	EF	Average	0.0023534	60.41%	
			TRKBC	BC -On-site road to truck dump place	0.00047195	20	85.9	2	1	487202.32	4787152.63	EF	Average	6.751E-05	1.73%	
			TRKBD	BD - On-site road to drop off area	0.00047195	20	182.5	2	1	487200.8	4787169.29	EF	Average	0.0008663	22.24%	
			TRKDE	DE - On-site road Drop off to stock pil	0.00047195	20	71.4	2	1	487258.58	4787337.81	EF	Average	0.0001815	4.66%	
			TRKEF	EF - On-site road to stock pile	0.00047195	20	94.3	2	1	487426.19	4787184.16	EF	Average	0.0001331	3.42%	
			TRKEH	EH - On-stie road to composting area	0.00047195	20	351.5	2	1	487446.43	4787185.79	EF	Average	0.0001576	4.04%	
			WF	Working face	0.00047195	20	30 x 40	2	1	487396.886	4787378.71	EF	Average	1.316E-08	0.00%	b
0-04-4	Odour	0.1667	CA	Composting area	0.00047195	20	12 x 20	2	1	487686.991	4787179.93	EF	Marginal	1.8165641	50.00%	a
			WF	Working face	0.00047195	20	30 x 40	2	1	487396.886	4787378.71	EF	Average	1.8165641	50.00%	a
74-82-8	Methane	24	ACL	Active Covered Landfill Area	0.00047195	20	244.34 x 158.43	2	1	487376.904	4787405.15	EC	Marginal	18.742834	100.00%	b
75-01-4	Vinyl chloride	24	ACL	Active Covered Landfill Area	0.00047195	20	244.34 x 158.43	2	1	487376.904	4787405.15	EC	Marginal	0.0010663	100.00%	b
75-18-3	dimethyl sulphide	0.1667	ACL	Active Covered Landfill Area	0.00047195	20	244.34 x 158.43	2	1	487376.904	4787405.15	EC	Marginal	0.0011325	100.00%	b
75-43-4	Dichlorofluoromethane	24	ACL	Active Covered Landfill Area	0.00047195	20	244.34 x 158.43	2	1	487376.904	4787405.15	EC	Marginal	0.0006254	100.00%	b
108-90-7	Chlorobenzene	0.1667	ACL	Active Covered Landfill Area	0.00047195	20	244.34 x 158.43	2	1	487376.904	4787405.15	EC	Marginal	6.576E-05	100.00%	b
124-38-9	Carbon Dioxide	24	ACL	Active Covered Landfill Area	0.00047195	20	244.34 x 158.43	2	1	487376.904	4787405.15	EC	Marginal	51.425944	100.00%	b
630-08-0	Carbon monoxide	1	CMPTR	Compactor 1986 CAT 816D	0.00047195	20	30 x 40	2	1	487402.17	4787397.81	EF	Average	0.0567906	91.04%	
			TRKAB	AB - On-site road to scale	0.00047195	20	356	2	1	487190.03	4786890.06	EF	Average	0.0030426	4.88%	
			TRKBC	BC -On-site road to truck dump place	0.00047195	20	85.9	2	1	487202.32	4787152.63	EF	Average	5.75E-05	0.09%	
			TRKBD	BD - On-site road to drop off area	0.00047195	20	182.5	2	1	487200.8	4787169.29	EF	Average	0.0016931	2.71%	
			TRKDE	DE - On-site road Drop off to stock pil	0.00047195	20	71.4	2	1	487258.58	4787337.81	EF	Average	0.0003046	0.49%	
			TRKEF	EF - On-site road to stock pile	0.00047195	20	94.3	2	1	487426.19	4787184.16	EF	Average	0.0002234	0.36%	
			TRKEH	EH - On-stie road to composting area	0.00047195	20	351.5	2	1	487446.43	4787185.79	EF	Average	0.0002664	0.43%	
7783-06-4	Hydrogen sulphide	0.1667	ACL	Active Covered Landfill Area	0.00047195	20	244.34 x 158.43	2	1	487376.904	4787405.15	EC	Marginal	0.0028672	100.00%	b
10102-44-0	Nitrogen oxides	1	CMPTR	Compactor 1986 CAT 816D	0.00047195	20	30 x 40	2	1	487402.17	4787397.81	EF	Average	0.0064904	58.15%	
			TRKAB	AB - On-site road to scale	0.00047195	20	356	2	1	487190.03	4786890.06	EF	Average	0.0014976	13.42%	
			TRKBC	BC -On-site road to truck dump place	0.00047195	20	85.9	2	1	487202.32	4787152.63	EF	Average	0.000158	1.42%	
			TRKBD	BD - On-site road to drop off area	0.00047195	20	182.5	2	1	487200.8	4787169.29	EF	Average	0.0008333	7.47%	
			TRKDE	DE - On-site road Drop off to stock pil	0.00047195	20	71.4	2	1	487258.58	4787337.81	EF	Average	0.0008368	7.50%	
			TRKEF	EF - On-site road to stock pile	0.00047195	20	94.3	2	1	487426.19	4787184.16	EF	Average	0.0006137	5.50%	
			TRKEH	EH - On-stie road to composting area	0.00047195	20	351.5	2	1	487446.43	4787185.79	EF	Average	0.0007318	6.56%	
PM	Total particulate matter	24	CA	Composting area	0.00047195	20	12 x 20	2	1	487686.991	4787179.93	EF	Marginal	9.308E-08	0.00%	
			CMPTR	Compactor 1986 CAT 816D	0.00047195	20	30 x 40	2	1	487402.17	4787397.81	EF	Average	0.0001364	0.10%	
			ST	Stockpile	0.00047195	20	17.7 x 17.7	2	1	487370.916	4787000.66	EF	Average	7.841E-08	0.00%	b
			TRKAB	AB - On-site road to scale	0.00047195	20	356	2	1	487190.03	4786890.06	EF	Average	0.0861673	62.74%	
			TRKBC	BC -On-site road to truck dump place	0.00047195	20	85.9	2	1	487202.32	4787152.63	EF	Average	0.0024463	1.78%	
			TRKBD	BD - On-site road to drop off area	0.00047195	20	182.5	2	1	487200.8	4787169.29	EF	Average	0.0316828	23.07%	
			TRKDE	DE - On-site road Drop off to stock pil	0.00047195	20	71.4	2	1	487258.58	4787337.81	EF	Average	0.0064819	4.72%	
			TRKEF	EF - On-site road to stock pile	0.00047195	20	94.3	2	1	487426.19	4787184.16	EF	Average	0.0047535	3.46%	
			TRKEH	EH - On-stie road to composting area	0.00047195	20	351.5	2	1	487446.43	4787185.79	EF	Average	0.0056674	4.13%	
			WF	Working face	0.00047195	20	30 x 40	2	1	487396.886	4787378.71	EF	Average	1.837E-07	0.00%	b

a - Odour emission rate is in OU/m3
b - Emission rate units is in g/s m^2

Table 3:
Dispersion Modeling Input Summary Table
(2020)

Relevant Section of the Regulation	Section Title	Description of How the Approved Dispersion Model Was Used
Section 6	Air Dispersion Model(s)	Site Specific Met Data by MECP v16216r AERMET v16216 (incl. in Met Data) BPIP v. 0474 AERMAP v11103 AERMOD version v16216r
Section 8	Negligible sources	The sources deemed negligible are discussed in the application document in Section 3 and Appendix EB.
Section 9	Same Structure contamination	Not applicable.
Section 10	Operating Conditions	See Section 4 and Appendix EA of the Application
Section 11	Source of Contaminant Emission rates	See Section 3 and Appendix EA of the Application
Section 12	Combined effect of Assumptions for Operating Conditions and Emission Rates	Not applicable (no values exceed their respective criterion)
Section 13	Meteorological Conditions	The Preprocessed Meteorological Data issued by the MECP titled "TheCorporationOfTheSeparatedTownOfStMarys_StMarysLandfill_StMarys_16216" (AERMOD v16216r) was used.
Section 14	Area of Modelling Coverage	The entire grid specified by Section 14 of O.Reg.419/05 is used.
Section 15	Stack Height for Certain New Sources of Contaminant	No stack heights in this model (actual or modelled) exceed the restiction in Section 15 of O.Reg 419/05
Section 16	Terrain Data	Terrain elevation contour data used was downloaded from the MECP website https://www.ontario.ca/environment-and-energy/map-regional-meteorological-and-terrain-data-air-dispersion-modelling
Section 17	Averaging Periods	Emission rates were calculated based on averaging periods that matched the averaging period of the respective criterion. See Section 6.7, Appendix EA and Appendix EC.

The Corporation of the Town of St. Marys
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Table 4a:
Emissions Summary Table
(2020_E)

Project No.: 032339

CAS#	Contaminant	Total Emission Rate (g/s)	Dispersion Model Used	Max POI Value (µg/m^3)	Location of		Averaging Period Modelled (h)	Averaging Period of Criterion (h)	Max POI Value Converted to Criterion Period (µg/m^3)	Criteria (µg/m^3)	Limiting Effect	Regulation Schedule #	Percentage of Criteria or Likelihood of adverse effect (%)
					X (m)	Y (m)							
0-02-2	PM10	0.03618	AERMOD-m	24.17	487158	4787151	24	24	24.17	50	Health	AAQC	48.3%
0-03-3	PM2.5	0.003789	AERMOD-m	2.525	487160	4787141	24	24	2.525	27	Health	CAAQS 2020	9.4%
0-03-3	PM2.5	0.003789	AERMOD-m	0.3836	487240	4786894	8760	8760	0.3836	8.8	Health	CAAQS 2020	4.4%
0-04-4	Odour	3.633	AERMOD-0-04-4	99.36	487760	4786974	0.1667	0.1667	99.36	N/A	0	0	
74-82-8	Methane	10.4	AERMOD-m	4249	487447	4786926	24	24	4249	37,330	Health	SL-PA	11.4%
75-01-4	Vinyl chloride	0.0005914	AERMOD-m	0.2417	487447	4786926	24	24	0.2417	1	Health	AAQC	24.2%
75-01-4	Vinyl chloride	0.0005914	AERMOD-m	0.02541	487477	4786931	8760	8760	0.02541	0.2	Health	AAQC	12.7%
75-18-3	dimethyl sulphide	0.0006281	AERMOD-m	0.7385	487157	4787160	1	0.1667	1.22	30	Health	AAQC	4.1%
75-43-4	Dichlorofluoromethane	0.0003468	AERMOD-m	0.1418	487447	4786926	24	24	0.1418	500	Health	SL-JSL	0.0%
108-90-7	Chlorobenzene	0.00003647	AERMOD-m	0.04288	487157	4787160	1	0.1667	0.07082	4,500	Health	AAQC	0.0%
108-90-7	Chlorobenzene	0.00003647	AERMOD-m	0.04288	487157	4787160	1	1	0.04288	3,500	Health	AAQC	0.0%
124-38-9	Carbon Dioxide	28.52	AERMOD-m	11660	487447	4786926	24	24	11660	255,800	Health	B2	4.6%
630-08-0	Carbon monoxide	0.06213	AERMOD-m	201.2	487166	4787102	1	1	201.2	36,200	Health	AAQC	0.6%
630-08-0	Carbon monoxide	0.06213	AERMOD-m	98.5	487163	4787122	8	8	98.5	15,700	Health	AAQC	0.6%
7783-06-4	Hydrogen sulphide	0.00159	AERMOD-m	1.87	487157	4787160	1	0.1667	3.088	13	Odour	AAQC	23.8%
7783-06-4	Hydrogen sulphide	0.00159	AERMOD-m	0.6499	487447	4786926	24	24	0.6499	7	Health	AAQC	9.3%
10102-44-0	Nitrogen oxides	0.01079	AERMOD-m	26.17	487166	4787102	1	1	26.17	400	Health	AAQC	6.5%
10102-44-0	Nitrogen oxides	0.01079	AERMOD-m	26.17	487166	4787102	1	1	26.17	79	Health	CAAQS 2025	33.1%
10102-44-0	Nitrogen oxides	0.01079	AERMOD-m	7.101	487163	4787122	24	24	7.101	200	Health	AAQC	3.6%
10102-44-0	Nitrogen oxides	0.01079	AERMOD-m	0.6471	487166	4787102	8760	8760	0.6471	22.56	Health	CAAQS 2025	2.9%
PM	Total particulate matter	0.1335	AERMOD-m	89.15	487158	4787151	24	24	89.15	120	Health	AAQC	74.3%
PM	Total particulate matter	0.1335	AERMOD-m	13.97	487240	4786894	8760	8760	13.97	60	Health	AAQC	23.3%

The Corporation of the Town of St. Marys
St. Marys, Ontario

Project No.: 032339

Table 4a:
Emissions Summary Table
(2020_2)

CAS#	Contaminant	Total Emission Rate (g/s)	Dispersion Model Used	Max POI Value (µg/m^3)	Location of		Averaging Period Modelled (h)	Averaging Period of Criterion (h)	Max POI Value Converted to Criterion Period (µg/m^3)	Criteria (µg/m^3)	Limiting Effect	Regulation Schedule #	Percentage of Criteria or Likelihood of adverse effect (%)
					X (m)	Y (m)							
0-02-2	PM10	0.04849	AERMOD-m	23.26	487240	4786894	24	24	23.26	50	Health	AAQC	46.5%
0-03-3	PM2.5	0.005038	AERMOD-m	2.351	487240	4786894	24	24	2.351	27	Health	CAAQS 2020	8.7%
0-03-3	PM2.5	0.005038	AERMOD-m	0.3833	487240	4786894	8760	8760	0.3833	8.8	Health	CAAQS 2020	4.4%
0-04-4	Odour	3.633	AERMOD-0-04-4	86.56	487731	4787390	0.1667	0.1667	86.56	N/A	0	0	
74-82-8	Methane	18.74	AERMOD-m	7550	487608	4787453	24	24	7550	37,330	Health	SL-PA	20.2%
75-01-4	Vinyl chloride	0.001066	AERMOD-m	0.4295	487608	4787453	24	24	0.4295	1	Health	AAQC	43.0%
75-01-4	Vinyl chloride	0.001066	AERMOD-m	0.03343	487608	4787453	8760	8760	0.03343	0.2	Health	AAQC	16.7%
75-18-3	dimethyl sulphide	0.001133	AERMOD-m	1.727	487608	4787453	1	0.1667	2.853	30	Health	AAQC	9.5%
75-43-4	Dichlorofluoromethane	0.0006254	AERMOD-m	0.2519	487608	4787453	24	24	0.2519	500	Health	SL-JSL	0.1%
108-90-7	Chlorobenzene	0.00006576	AERMOD-m	0.1003	487608	4787453	1	0.1667	0.1656	4,500	Health	AAQC	0.0%
108-90-7	Chlorobenzene	0.00006576	AERMOD-m	0.1003	487608	4787453	1	1	0.1003	3,500	Health	AAQC	0.0%
124-38-9	Carbon Dioxide	51.43	AERMOD-m	20720	487608	4787453	24	24	20720	255,800	Health	B2	8.1%
630-08-0	Carbon monoxide	0.06432	AERMOD-m	166.6	487264	4787438	1	1	166.6	36,200	Health	AAQC	0.5%
630-08-0	Carbon monoxide	0.06432	AERMOD-m	77.1	487224	4787375	8	8	77.1	15,700	Health	AAQC	0.5%
7783-06-4	Hydrogen sulphide	0.002867	AERMOD-m	4.373	487608	4787453	1	0.1667	7.222	13	Odour	AAQC	55.6%
7783-06-4	Hydrogen sulphide	0.002867	AERMOD-m	1.155	487608	4787453	24	24	1.155	7	Health	AAQC	16.5%
10102-44-0	Nitrogen oxides	0.01264	AERMOD-m	21.19	487234	4787391	1	1	21.19	400	Health	AAQC	5.3%
10102-44-0	Nitrogen oxides	0.01264	AERMOD-m	21.19	487234	4787391	1	1	21.19	79	Health	CAAQS 2025	26.8%
10102-44-0	Nitrogen oxides	0.01264	AERMOD-m	5.59	487224	4787375	24	24	5.59	200	Health	AAQC	2.8%
10102-44-0	Nitrogen oxides	0.01264	AERMOD-m	0.4113	487219	4787367	8760	8760	0.4113	22.56	Health	CAAQS	1.8%
PM	Total particulate matter	0.179	AERMOD-m	86.08	487240	4786894	24	24	86.08	120	Health	AAQC	71.7%
PM	Total particulate matter	0.179	AERMOD-m	14.02	487240	4786894	8760	8760	14.02	60	Health	AAQC	23.4%

The Corporation of the Town of St. Marys
St. Marys, Ontario

Table 4a:
Emissions Summary Table
(2020_3)

Project No.: 032339

CAS#	Contaminant	Total Emission Rate (g/s)	Dispersion Model Used	Max POI Value (µg/m³)	Location of		Averaging Period Modelled (h)	Averaging Period of Criterion (h)	Max POI Value Converted to Criterion Period (µg/m³)	Criteria (µg/m³)	Limiting Effect	Regulation Schedule #	Percentage of Criteria or Likelihood of adverse effect (%)
					X (m)	Y (m)							
0-02-2	PM10	0.03393	AERMOD-m	23.37	487240	4786894	24	24	23.37	50	Health	AAQC	46.7%
0-03-3	PM2.5	0.003563	AERMOD-m	2.368	487240	4786894	24	24	2.368	27	Health	CAAQS 2020	8.8%
0-03-3	PM2.5	0.003563	AERMOD-m	0.3772	487240	4786894	8760	8760	0.3772	8.8	Health	CAAQS 2020	4.3%
0-04-4	Odour	3.633	AERMOD-0-04-4	86.62	487731	4787390	0.1667	0.1667	86.62	N/A	0	0	
74-82-8	Methane	18.74	AERMOD-m	8057	487141	4787268	24	24	8057	37,330	Health	SL-PA	21.6%
75-01-4	Vinyl chloride	0.001066	AERMOD-m	0.4584	487141	4787268	24	24	0.4584	1	Health	AAQC	45.8%
75-01-4	Vinyl chloride	0.001066	AERMOD-m	0.03445	487145	4787229	8760	8760	0.03445	0.2	Health	AAQC	17.2%
75-18-3	dimethyl sulphide	0.001133	AERMOD-m	1.588	487142	4787317	1	0.1667	2.623	30	Health	AAQC	8.7%
75-43-4	Dichlorofluoromethane	0.0006254	AERMOD-m	0.2688	487141	4787268	24	24	0.2688	500	Health	SL-JSL	0.1%
108-90-7	Chlorobenzene	0.00006576	AERMOD-m	0.09223	487142	4787317	1	0.1667	0.1523	4,500	Health	AAQC	0.0%
108-90-7	Chlorobenzene	0.00006576	AERMOD-m	0.09223	487142	4787317	1	1	0.09223	3,500	Health	AAQC	0.0%
124-38-9	Carbon Dioxide	51.43	AERMOD-m	22110	487141	4787268	24	24	22110	255,800	Health	B2	8.6%
630-08-0	Carbon monoxide	0.0617	AERMOD-m	268.1	487198	4787336	1	1	268.1	36,200	Health	AAQC	0.7%
630-08-0	Carbon monoxide	0.0617	AERMOD-m	140.8	487141	4787268	8	8	140.8	15,700	Health	AAQC	0.9%
7783-06-4	Hydrogen sulphide	0.002867	AERMOD-m	4.021	487142	4787317	1	0.1667	6.641	13	Odour	AAQC	51.1%
7783-06-4	Hydrogen sulphide	0.002867	AERMOD-m	1.233	487141	4787268	24	24	1.233	7	Health	AAQC	17.6%
10102-44-0	Nitrogen oxides	0.01078	AERMOD-m	32.09	487141	4787258	1	1	32.09	400	Health	AAQC	8.0%
10102-44-0	Nitrogen oxides	0.01078	AERMOD-m	32.09	487141	4787258	1	1	32.09	79	Health	CAAQS 2025	40.6%
10102-44-0	Nitrogen oxides	0.01078	AERMOD-m	9.101	487141	4787268	24	24	9.101	200	Health	AAQC	4.6%
10102-44-0	Nitrogen oxides	0.01078	AERMOD-m	0.7771	487144	4787238	8760	8760	0.7771	22.56	Health	CAAQS	3.4%
PM	Total particulate matter	0.1252	AERMOD-m	86.45	487240	4786894	24	24	86.45	120	Health	AAQC	72.0%
PM	Total particulate matter	0.1252	AERMOD-m	13.77	487240	4786894	8760	8760	13.77	60	Health	AAQC	22.9%

The Corporation of the Town of St. Marys
St. Marys, Ontario

Project No.: 032339

Table 4a:
Emissions Summary Table
(2019_4)

CAS#	Contaminant	Total Emission Rate (g/s)	Dispersion Model Used	Max POI Value (μg/m^3)	Location of		Averaging Period Modelled (h)	Averaging Period of Criterion (h)	Max POI Value Converted to Criterion Period (μg/m^3)	Criteria (μg/m^3)	Limiting Effect	Regulation Schedule #	Percentage of Criteria or Likelihood of adverse effect (%)
					X (m)	Y (m)							
0-02-2	PM10	0.03722	AERMOD-m	23.54	487240	4786894	24	24	23.54	50	Health	AAQC	47.1%
0-03-3	PM2.5	0.003896	AERMOD-m	2.379	487240	4786894	24	24	2.379	27	Health	CAAQS 2020	8.8%
0-03-3	PM2.5	0.003896	AERMOD-m	0.3788	487240	4786894	8760	8760	0.3788	8.8	Health	CAAQS 2020	4.3%
0-04-4	Odour	3.633	AERMOD-0-04-4	99.56	487760	4786974	0.1667	0.1667	99.56	N/A	0	0	
74-82-8	Methane	18.74	AERMOD-m	9488	487511	4787503	24	24	9488	37,330	Health	SL-PA	25.4%
75-01-4	Vinyl chloride	0.001066	AERMOD-m	0.5398	487511	4787503	24	24	0.5398	1	Health	AAQC	54.0%
75-01-4	Vinyl chloride	0.001066	AERMOD-m	0.05952	487537	4787490	8760	8760	0.05952	0.2	Health	AAQC	29.8%
75-18-3	dimethyl sulphide	0.001133	AERMOD-m	2.42	487519	4787499	1	0.1667	3.997	30	Health	AAQC	13.3%
75-43-4	Dichlorofluoromethane	0.0006254	AERMOD-m	0.3166	487511	4787503	24	24	0.3166	500	Health	SL-JSL	0.1%
108-90-7	Chlorobenzene	0.00006576	AERMOD-m	0.1405	487519	4787499	1	0.1667	0.2321	4,500	Health	AAQC	0.0%
108-90-7	Chlorobenzene	0.00006576	AERMOD-m	0.1405	487519	4787499	1	1	0.1405	3,500	Health	AAQC	0.0%
124-38-9	Carbon Dioxide	51.43	AERMOD-m	26030	487511	4787503	24	24	26030	255,800	Health	B2	10.2%
630-08-0	Carbon monoxide	0.06238	AERMOD-m	184.1	487274	4787454	1	1	184.1	36,200	Health	AAQC	0.5%
630-08-0	Carbon monoxide	0.06238	AERMOD-m	89.07	487264	4787438	8	8	89.07	15,700	Health	AAQC	0.6%
7783-06-4	Hydrogen sulphide	0.002867	AERMOD-m	6.127	487519	4787499	1	0.1667	10.12	13	Odour	AAQC	77.8%
7783-06-4	Hydrogen sulphide	0.002867	AERMOD-m	1.451	487511	4787503	24	24	1.451	7	Health	AAQC	20.7%
10102-44-0	Nitrogen oxides	0.01116	AERMOD-m	21.12	487274	4787454	1	1	21.12	400	Health	AAQC	5.3%
10102-44-0	Nitrogen oxides	0.01116	AERMOD-m	21.12	487274	4787454	1	1	21.12	79	Health	CAAQS 2025	26.7%
10102-44-0	Nitrogen oxides	0.01116	AERMOD-m	5.319	487264	4787438	24	24	5.319	200	Health	AAQC	2.7%
10102-44-0	Nitrogen oxides	0.01116	AERMOD-m	0.3714	487259	4787430	8760	8760	0.3714	22.56	Health	CAAQS	1.6%
PM	Total particulate matter	0.1373	AERMOD-m	87.1	487240	4786894	24	24	87.1	120	Health	AAQC	72.6%
PM	Total particulate matter	0.1373	AERMOD-m	13.85	487240	4786894	8760	8760	13.85	60	Health	AAQC	23.1%

Table 4b:
Combined Impact Summary Table (Existing)
(2020_E)

CAS#	Contaminant	Bkgrnd (µg/m^3)	Bkgrnd % of Criterion (%)	Max POI Value (µg/m^3)	Averaging Period of Criterion (h)	Max POI Value + Bkgrnd (µg/m^3)	Criteria (µg/m^3)	Limiting Effect	Regulation Schedule #	Percentage of Criteria or Likelihood of adverse effect (%)
0-02-2	PM10	27.78	55.6%	24.2	24	51.9	50	Health	AAQC	103.9%
0-03-3	PM2.5	15	55.6%	2.5	24	17.5	27	Health	CAAQS 2020	64.9%
0-03-3	PM2.5	7.50	85.2%	0.4	8760	7.9	8.8	Health	CAAQS 2020	89.6%
0-04-4	Odour			99.4	0.1667	99.4	N/A	0	0	
74-82-8	Methane			4249.0	24	4249.0	37330	Health	SL-PA	11.4%
75-01-4	Vinyl chloride	0.00438	0.4%	0.2	24	0.2	1	Health	AAQC	24.6%
75-01-4	Vinyl chloride	0.0015	0.8%	0.03	8760	0.03	0.2	Health	AAQC	13.5%
75-18-3	dimethyl sulphide			1.2	0.1667	1.2	30	Health	AAQC	4.1%
75-43-4	Dichlorofluoromethane			0.1	24	0.1	500	Health	SL-JSL	0.0%
108-90-7	Chlorobenzene	0.01	0.0%	0.1	0.1667	0.1	4500	Health	AAQC	0.0%
108-90-7	Chlorobenzene	0.01	0.0%	0.0	1	0.1	3500	Health	AAQC	0.0%
124-38-9	Carbon Dioxide			11660.0	24	11660.0	255800	Health	B2	4.6%
630-08-0	Carbon monoxide	362	1.0%	201.2	1	563.2	36200	Health	AAQC	1.6%
630-08-0	Carbon monoxide	362	2.3%	98.5	8	460.5	15700	Health	AAQC	2.9%
7783-06-4	Hydrogen sulphide			3.1	0.1667	3.1	13	Odour	AAQC	23.8%
7783-06-4	Hydrogen sulphide			0.6	24	0.6	7	Health	AAQC	9.3%
10102-44-0	Nitrogen oxides	39.48	9.9%	26.2	1	65.7	400	Health	AAQC	16.4%
10102-44-0	Nitrogen oxides	39.48	50.0%	26.2	1	65.7	78.96	Health	CAAQS 2025	83.1%
10102-44-0	Nitrogen oxides	36.58	18.3%	7.1	24	43.7	200	Health	AAQC	21.8%
10102-44-0	Nitrogen oxides	16.45	72.9%	0.6	8760	17.1	22.56	Health	CAAQS 2025	75.8%
PM	Total particulate matter	50	41.7%	89.2	24	139.2	120	Health	AAQC	116.0%
PM	Total particulate matter	25	41.7%	14.0	8760	39.0	60	Health	AAQC	65.0%

Table 4b:
Combined Impact Summary Table (Alternative Method 2)
(2020_2)

CAS#	Contaminant	Bkgrnd (µg/m^3)	Bkgrnd % of Criterion (%)	Max POI Value (µg/m^3)	Averaging Period of Criterion (h)	Max POI Value + Bkgrnd (µg/m^3)	Criteria (µg/m^3)	Limiting Effect	Regulation Schedule #	Percentage of Criteria or Likelihood of adverse effect (%)
0-02-2	PM10	27.78	55.6%	23.3	24	51.0	50	Health	AAQC	102.1%
0-03-3	PM2.5	15	55.6%	2.4	24	17.4	27	Health	CAAQS 2020	64.3%
0-03-3	PM2.5	7.50	85.2%	0.4	8760	7.9	8.8	Health	CAAQS 2020	89.6%
0-04-4	Odour			86.6	0.1667	86.6	N/A	0	0	
74-82-8	Methane			7550.0	24	7550.0	37330	Health	SL-PA	20.2%
75-01-4	Vinyl chloride	0.00438	0.4%	0.4	24	0.4	1	Health	AAQC	43.4%
75-01-4	Vinyl chloride	0.0015	0.8%	0.0	8760	0.0	0.2	Health	AAQC	17.5%
75-18-3	dimethyl sulphide			2.9	0.1667	2.9	30	Health	AAQC	9.5%
75-43-4	Dichlorofluoromethane			0.3	24	0.3	500	Health	SL-JSL	0.1%
108-90-7	Chlorobenzene	0.01	0.0%	0.2	0.1667	0.2	4500	Health	AAQC	0.0%
108-90-7	Chlorobenzene	0.01	0.0%	0.1	1	0.1	3500	Health	AAQC	0.0%
124-38-9	Carbon Dioxide			20720.0	24	20720.0	255800	Health	B2	8.1%
630-08-0	Carbon monoxide	362	1.0%	166.6	1	528.6	36200	Health	AAQC	1.5%
630-08-0	Carbon monoxide	362	2.3%	77.1	8	439.1	15700	Health	AAQC	2.8%
7783-06-4	Hydrogen sulphide			7.2	0.1667	7.2	13	Odour	AAQC	55.6%
7783-06-4	Hydrogen sulphide			1.2	24	1.2	7	Health	AAQC	16.5%
10102-44-0	Nitrogen oxides	39.48	9.9%	21.2	1	60.7	400	Health	AAQC	15.2%
10102-44-0	Nitrogen oxides	39.48	50.0%	21.2	1	60.7	78.96	Health	CAAQS 2025	76.8%
10102-44-0	Nitrogen oxides	36.58	18.3%	5.6	24	42.2	200	Health	AAQC	21.1%
10102-44-0	Nitrogen oxides	16.45	72.9%	0.4	8760	16.9	22.56	Health	CAAQS	74.7%
PM	Total particulate matter	50	41.7%	86.1	24	136.1	120	Health	AAQC	113.4%
PM	Total particulate matter	25	41.7%	14.0	8760	39.0	60	Health	AAQC	65.0%

Table 4b:
Combined Impact Summary Table (Alternative Method 3)
(2020_3)

CAS#	Contaminant	Bkgrnd (µg/m^3)	Bkgrnd % of Criterion (%)	Max POI Value (µg/m^3)	Averaging Period of Criterion (h)	Max POI Value + Bkgrnd (µg/m^3)	Criteria (µg/m^3)	Limiting Effect	Regulation Schedule #	Percentage of Criteria or Likelihood of adverse effect (%)
0-02-2	PM10	27.78	55.6%	23.4	24	51.1	50	Health	AAQC	102.3%
0-03-3	PM2.5	15	55.6%	2.4	24	17.4	27	Health	CAAQS 2020	64.3%
0-03-3	PM2.5	7.50	85.2%	0.4	8760	7.9	8.8	Health	CAAQS 2020	89.5%
0-04-4	Odour			86.6	0.1667	86.6	N/A	0	0	
74-82-8	Methane			8057.0	24	8057.0	37330	Health	SL-PA	21.6%
75-01-4	Vinyl chloride	0.00438	0.4%	0.5	24	0.5	1	Health	AAQC	46.3%
75-01-4	Vinyl chloride	0.0015	0.8%	0.0	8760	0.0	0.2	Health	AAQC	18.0%
75-18-3	dimethyl sulphide			2.6	0.1667	2.6	30	Health	AAQC	8.7%
75-43-4	Dichlorofluoromethane			0.3	24	0.3	500	Health	SL-JSL	0.1%
108-90-7	Chlorobenzene	0.01	0.0%	0.2	0.1667	0.2	4500	Health	AAQC	0.0%
108-90-7	Chlorobenzene	0.01	0.0%	0.1	1	0.1	3500	Health	AAQC	0.0%
124-38-9	Carbon Dioxide			22110.0	24	22110.0	255800	Health	B2	8.6%
630-08-0	Carbon monoxide	362	1.0%	268.1	1	630.1	36200	Health	AAQC	1.7%
630-08-0	Carbon monoxide	362	2.3%	140.8	8	502.8	15700	Health	AAQC	3.2%
7783-06-4	Hydrogen sulphide			6.6	0.1667	6.6	13	Odour	AAQC	51.1%
7783-06-4	Hydrogen sulphide			1.2	24	1.2	7	Health	AAQC	17.6%
10102-44-0	Nitrogen oxides	39.48	9.9%	32.1	1	71.6	400	Health	AAQC	17.9%
10102-44-0	Nitrogen oxides	39.48	50.0%	32.1	1	71.6	78.96	Health	CAAQS 2025	90.6%
10102-44-0	Nitrogen oxides	36.58	18.3%	9.1	24	45.7	200	Health	AAQC	22.8%
10102-44-0	Nitrogen oxides	16.45	72.9%	0.8	8760	17.2	22.56	Health	CAAQS	76.4%
PM	Total particulate matter	50	41.7%	86.5	24	136.5	120	Health	AAQC	113.7%
PM	Total particulate matter	25	41.7%	13.8	8760	38.8	60	Health	AAQC	64.6%

Table 4b:
Combined Impact Summary Table (Alternative Method 4)
(2020_4)

CAS#	Contaminant	Bkgrnd (µg/m^{3})	Bkgrnd % of Criterion (%)	Max POI Value (µg/m^{3})	Averaging Period of Criterion (h)	Max POI Value + Bkgrnd (µg/m^{3})	Criteria (µg/m^{3})	Limiting Effect	Regulation Schedule #	Percentage of Criteria or Likelihood of adverse effect (%)
0-02-2	PM10	27.78	55.6%	23.5	24	51.3	50	Health	AAQC	102.6%
0-03-3	PM2.5	15	55.6%	2.4	24	17.4	27	Health	CAAQS 2020	64.4%
0-03-3	PM2.5	7.50	85.2%	0.4	8760	7.9	8.8	Health	CAAQS 2020	89.5%
0-04-4	Odour			99.6	0.1667	99.6	N/A	0	0	
74-82-8	Methane			9488.0	24	9488.0	37330	Health	SL-PA	25.4%
75-01-4	Vinyl chloride	0.00438	0.4%	0.5	24	0.5	1	Health	AAQC	54.4%
75-01-4	Vinyl chloride	0.0015	0.8%	0.1	8760	0.1	0.2	Health	AAQC	30.5%
75-18-3	dimethyl sulphide			4.0	0.1667	4.0	30	Health	AAQC	13.3%
75-43-4	Dichlorofluoromethane			0.3	24	0.3	500	Health	SL-JSL	0.1%
108-90-7	Chlorobenzene	0.01	0.0%	0.2	0.1667	0.2	4500	Health	AAQC	0.0%
108-90-7	Chlorobenzene	0.01	0.0%	0.1	1	0.2	3500	Health	AAQC	0.0%
124-38-9	Carbon Dioxide			26030.0	24	26030.0	255800	Health	B2	10.2%
630-08-0	Carbon monoxide	362	1.0%	184.1	1	546.1	36200	Health	AAQC	1.5%
630-08-0	Carbon monoxide	362	2.3%	89.1	8	451.1	15700	Health	AAQC	2.9%
7783-06-4	Hydrogen sulphide			10.1	0.1667	10.1	13	Odour	AAQC	77.8%
7783-06-4	Hydrogen sulphide			1.5	24	1.5	7	Health	AAQC	20.7%
10102-44-0	Nitrogen oxides	39.48	9.9%	21.1	1	60.6	400	Health	AAQC	15.2%
10102-44-0	Nitrogen oxides	39.48	50.0%	21.1	1	60.6	78.96	Health	CAAQS 2025	76.7%
10102-44-0	Nitrogen oxides	36.58	18.3%	5.3	24	41.9	200	Health	AAQC	21.0%
10102-44-0	Nitrogen oxides	16.45	72.9%	0.4	8760	16.8	22.56	Health	CAAQS	74.6%
PM	Total particulate matter	50	41.7%	87.1	24	137.1	120	Health	AAQC	114.3%
PM	Total particulate matter	25	41.7%	13.9	8760	38.9	60	Health	AAQC	64.8%

Table 5a: Emissions Summary from All Alternative Methods
(2020)

CAS#	Contaminant	Dispersion Model Used	Averaging Period of Criterion (h)	Criteria (µg/m3)	Existing		Alternative Method 2		Alternative Method 3		Alternative Method 4	
					Max POI (µg/m3)	% Criterion	Max POI (µg/m3)	% Criterion	Max POI (µg/m3)	% Criterion	Max POI (µg/m3)	% Criterion
0-02-2	PM10	AERMOD-m	24	50	24.17	48.3%	23.26	46.5%	23.37	46.7%	23.54	47.1%
0-03-3	PM2.5	AERMOD-m	24	27	2.525	9.4%	2.351	8.7%	2.368	8.8%	2.379	8.8%
0-03-3	PM2.5	AERMOD-m	8760	8.8	0.3836	4.4%	0.3833	4.4%	0.3772	4.3%	0.3788	4.3%
0-04-4	Odour	AERMOD-0-04-4	0.1667	N/A	99.36		86.56		86.62		99.56	
74-82-8	Methane	AERMOD-m	24	37330	4249	11.4%	7550	20.2%	8057	21.6%	9488	25.4%
75-01-4	Vinyl chloride	AERMOD-m	24	1	0.2417	24.2%	0.4295	43.0%	0.4584	45.8%	0.5398	54.0%
75-01-4	Vinyl chloride	AERMOD-m	8760	0.2	0.02541	12.7%	0.03343	16.7%	0.03445	17.2%	0.05952	29.8%
75-18-3	dimethyl sulphide	AERMOD-m	0.1667	30	1.22	4.1%	2.853	9.5%	2.623	8.7%	3.997	13.3%
75-43-4	Dichlorofluoromethane	AERMOD-m	24	500	0.1418	0.0%	0.2519	0.1%	0.2688	0.1%	0.3166	0.1%
108-90-7	Chlorobenzene	AERMOD-m	0.1667	4500	0.07082	0.0%	0.1656	0.0%	0.1523	0.0%	0.2321	0.0%
108-90-7	Chlorobenzene	AERMOD-m	1	3500	0.04288	0.0%	0.1003	0.0%	0.09223	0.0%	0.1405	0.0%
124-38-9	Carbon Dioxide	AERMOD-m	24	255800	11660	4.6%	20720	8.1%	22110	8.6%	26030	10.2%
630-08-0	Carbon monoxide	AERMOD-m	1	36200	201.2	0.6%	166.6	0.5%	268.1	0.7%	184.1	0.5%
630-08-0	Carbon monoxide	AERMOD-m	8	15700	98.5	0.6%	77.1	0.5%	140.8	0.9%	89.07	0.6%
7783-06-4	Hydrogen sulphide	AERMOD-m	0.1667	13	3.088	23.8%	7.222	55.6%	6.641	51.1%	10.12	77.8%
7783-06-4	Hydrogen sulphide	AERMOD-m	24	7	0.6499	9.3%	1.155	16.5%	1.233	17.6%	1.451	20.7%
10102-44-0	Nitrogen oxides	AERMOD-m	1	400	26.17	6.5%	21.19	5.3%	32.09	8.0%	21.12	5.3%
10102-44-0	Nitrogen oxides	AERMOD-m	1	78.96	26.17	33.1%	21.19	26.8%	32.09	40.6%	21.12	26.7%
10102-44-0	Nitrogen oxides	AERMOD-m	24	200	7.101	3.6%	5.59	2.8%	9.101	4.6%	5.319	2.7%
10102-44-0	Nitrogen oxides	AERMOD-m	8760	22.56	0.6471	2.9%	0.4113	1.8%	0.7771	3.4%	0.3714	1.6%
PM	Total particulate matter	AERMOD-m	24	120	89.15	74.3%	86.08	71.7%	86.45	72.0%	87.1	72.6%
PM	Total particulate matter	AERMOD-m	8760	60	13.97	23.3%	14.02	23.4%	13.77	22.9%	13.85	23.1%

▨ Highest Scenario

Table 5b:
Average and 90th Percentile Values Used
(London Station #15026 or NAPS Station S60903)
(2020)

Contaminant	Date Range	Avg Per (h)	Average or 90th Percentile (µg/m3)[1]	Criterion (µg/m^3)	Source	% Criterion
Carbon Monoxide	2006-2010	1	362	36,200	AAQC	1.0%
Carbon Monoxide	2006-2010	8	362	15,700	AAQC	2.3%
Chlorobenzene*	2009-2013	0.1667	0.0100	4,500	AAQC	0.0%
Chlorobenzene*	2009-2013	24	0.0100	3,500	AAQC	0.0%
Vinyl chloride*	2009-2013	24	0.00438	1.0	AAQC	0.4%
Vinyl chloride*	2009-2013	8760	0.0015	0.2	AAQC	0.8%
Nitrogen Oxides	2009-2013	1	39.48	400	AAQC	9.9%
Nitrogen Oxides	2009-2013	1	39.48	78.96	CAAQS 2025	50.0%
Nitrogen Oxides	2009-2013	24	36.58	200	AAQC	18.3%
Nitrogen Oxides	2009-2013	8760	16.45	22.6	CAAQS	72.8%
Particulate Matter <2.5 µm	2009-2013	24	15	27	AAQC	55.6%
Particulate Matter <2.5 µm	2009-2013	8760	7.50	8.8	CAAQS	85.2%
Particulate Matter <10 µm	2009-2013	24	27.78	50	AAQC	55.6%
Particulate Matter <44 µm	2009-2013	24	50	120	AAQC	41.7%
Particulate Matter <44 µm	2009-2013	8760	25	60	AAQC	41.7%

* NAPS Station S60903 instead of MECP London Station #15026

1 Annual Values show the Average. All other values show 90th Percentile

Table 5c: Combined Summary Comparison from All Alternative Methods
(2020)

CAS#	Contaminant	Dispersion Model Used	Averaging Period of Criterion (h)	Criteria (µg/m3)	Bkgrnd (µg/m3)	Bkgrnd % of Criterion (%)	Existing		Alternative Method 2		Alternative Method 3		Alternative Method 4	
							Max POI (µg/m3)	% Criterion	Max POI (µg/m3)	% Criterion	Max POI (µg/m3)	% Criterion	Max POI (µg/m3)	% Criterion
0-02-2	PM10	AERMOD-m	24	50	27.78	55.6%	51.95	103.9%	51.04	102.1%	51.15	102.3%	51.32	102.6%
0-03-3	PM2.5	AERMOD-m	24	27	15	55.6%	17.53	64.9%	17.35	64.3%	17.37	64.3%	17.38	64.4%
0-03-3	PM2.5	AERMOD-m	8760	8.8	7.5	85.2%	7.88	89.6%	7.88	89.6%	7.88	89.5%	7.88	89.5%
0-04-4	Odour	AERMOD-0-04-4	0.1667	N/A			99.36		86.56		86.62		99.56	
74-82-8	Methane	AERMOD-m	24	37330			4249.00	11.4%	7550.00	20.2%	8057.00	21.6%	9488.00	25.4%
75-01-4	Vinyl chloride	AERMOD-m	24	1	0.0044	0.4%	0.25	24.6%	0.43	43.4%	0.46	46.3%	0.54	54.4%
75-01-4	Vinyl chloride	AERMOD-m	8760	0.2	0.0015	0.8%	0.03	13.5%	0.03	17.5%	0.04	18.0%	0.06	30.5%
75-18-3	dimethyl sulphide	AERMOD-m	0.1667	30			1.22	4.1%	2.85	9.5%	2.62	8.7%	4.00	13.3%
75-43-4	Dichlorofluoromethane	AERMOD-m	24	500			0.14	0.0%	0.25	0.1%	0.27	0.1%	0.32	0.1%
108-90-7	Chlorobenzene	AERMOD-m	0.1667	4500	0.01	0.0%	0.08	0.0%	0.18	0.0%	0.16	0.0%	0.24	0.0%
108-90-7	Chlorobenzene	AERMOD-m	1	3500			0.05	0.0%	0.11	0.0%	0.10	0.0%	0.15	0.0%
124-38-9	Carbon Dioxide	AERMOD-m	24	255800			11660.00	4.6%	20720.00	8.1%	22110.00	8.6%	26030.00	10.2%
630-08-0	Carbon monoxide	AERMOD-m	1	36200	362	1.0%	563.20	1.6%	528.60	1.5%	630.10	1.7%	546.10	1.5%
630-08-0	Carbon monoxide	AERMOD-m	8	15700	362	2.3%	460.50	2.9%	439.10	2.8%	502.80	3.2%	451.07	2.9%
7783-06-4	Hydrogen sulphide	AERMOD-m	0.1667	13			3.09	23.8%	7.22	55.6%	6.64	51.1%	10.12	77.8%
7783-06-4	Hydrogen sulphide	AERMOD-m	24	7			0.65	9.3%	1.16	16.5%	1.23	17.6%	1.45	20.7%
10102-44-0	Nitrogen oxides	AERMOD-m	1	400	39.48	9.9%	65.65	16.4%	60.67	15.2%	71.57	17.9%	60.60	15.2%
10102-44-0	Nitrogen oxides	AERMOD-m	1	78.96	39.48	50.0%	65.65	83.1%	60.67	76.8%	71.57	90.6%	60.60	76.7%
10102-44-0	Nitrogen oxides	AERMOD-m	24	200	36.58	18.3%	43.68	21.8%	42.17	21.1%	45.68	22.8%	41.90	21.0%
10102-44-0	Nitrogen oxides	AERMOD-m	8760	22.56	16.45	72.9%	17.10	75.8%	16.86	74.7%	17.23	76.4%	16.82	74.6%
PM	Total particulate matter	AERMOD-m	24	120	50	41.7%	139.15	116.0%	136.08	113.4%	136.45	113.7%	137.10	114.3%
PM	Total particulate matter	AERMOD-m	8760	60	25	41.7%	38.97	65.0%	39.02	65.0%	38.77	64.6%	38.85	64.8%

Highest Scenario

Table 6:
Odour Frequency (2020_E)

Receptor Location		**Lower Limit (OU):**	**0**	**1**	**6**	
		Upper Limit (OU):	**1**	**6**	**17**	
X	**Y**	**Total**				% over 6 OU
487080	4786920	43824	42782	1042		
487080	4786940	43824	42738	1086		
487080	4787060	43824	42491	1128	205	0.47%
487080	4787080	43824	42500	1096	228	0.52%
487080	4787100	43824	42593	998	233	0.53%
487080	4787120	43824	42650	976	198	0.45%
487080	4787240	43824	42874	932	18	0.04%
487080	4787260	43824	42885	935	4	0.01%
487080	4787280	43824	42961	863		
487080	4787300	43824	43010	814		
487080	4787320	43824	43050	774		
487080	4787400	43824	43200	624		
487080	4787420	43824	43231	593		
487100	4787060	43824	42369	1203	252	0.58%
487100	4787080	43824	42382	1137	305	0.70%
487100	4787100	43824	42460	1063	301	0.69%
487100	4787120	43824	42551	1020	253	0.58%
487100	4787400	43824	43191	633		
487100	4787420	43824	43232	592		
487120	4786780	43824	43237	587		
487120	4786800	43824	43176	648		
487120	4786940	43824	42661	1163		
487140	4786780	43824	43217	607		
487140	4786800	43824	43173	651		
487140	4786940	43824	42657	1167		

Table 6:
Odour Frequency (2020_2)

Receptor Location		Lower Limit (OU):	0	1	5	
		Upper Limit (OU):	1	5	17	
X	Y	Total				% over 5 OU
487080	4786920	43824	43323	501		
487080	4786940	43824	43302	522		
487080	4787060	43824	43146	671	7	0.02%
487080	4787080	43824	43143	651	30	0.07%
487080	4787100	43824	43136	618	70	0.16%
487080	4787120	43824	43087	641	96	0.22%
487080	4787240	43824	42825	816	183	0.42%
487080	4787260	43824	42823	811	190	0.43%
487080	4787280	43824	42807	847	170	0.39%
487080	4787300	43824	42797	855	172	0.39%
487080	4787320	43824	42795	885	144	0.33%
487080	4787400	43824	42850	939	35	0.08%
487080	4787420	43824	42890	908	26	0.06%
487100	4787060	43824	43117	700	7	0.02%
487100	4787080	43824	43092	701	31	0.07%
487100	4787100	43824	43086	667	71	0.16%
487100	4787120	43824	43052	669	103	0.24%
487100	4787400	43824	42803	972	49	0.11%
487100	4787420	43824	42858	926	40	0.09%
487120	4786780	43824	43487	337		
487120	4786800	43824	43471	353		
487120	4786940	43824	43278	546		
487140	4786780	43824	43468	356		
487140	4786800	43824	43460	364		
487140	4786940	43824	43259	565		

Table 6:
Odour Frequency (2020_3)

Receptor Location		Lower Limit (OU):	0	1	6	
		Upper Limit (OU):	1	6	17	
X	Y	Total				% over 6 OU
487080	4786920	43824	43249	575		
487080	4786940	43824	43203	621		
487080	4787060	43824	42919	905		
487080	4787080	43824	42897	927		
487080	4787100	43824	42845	879	100	0.23%
487080	4787120	43824	42753	912	159	0.36%
487080	4787240	43824	42194	1286	344	0.78%
487080	4787260	43824	42238	1351	235	0.54%
487080	4787280	43824	42302	1332	190	0.43%
487080	4787300	43824	42374	1288	162	0.37%
487080	4787320	43824	42464	1248	112	0.26%
487080	4787400	43824	42855	937	32	0.07%
487080	4787420	43824	42914	892	18	0.04%
487100	4787060	43824	42868	956		
487100	4787080	43824	42843	981		
487100	4787100	43824	42792	952	80	0.18%
487100	4787120	43824	42702	928	194	0.44%
487100	4787400	43824	42827	955	42	0.10%
487100	4787420	43824	42895	900	29	0.07%
487120	4786780	43824	43456	368		
487120	4786800	43824	43436	388		
487120	4786940	43824	43215	609		
487140	4786780	43824	43434	390		
487140	4786800	43824	43414	410		
487140	4786940	43824	43177	647		

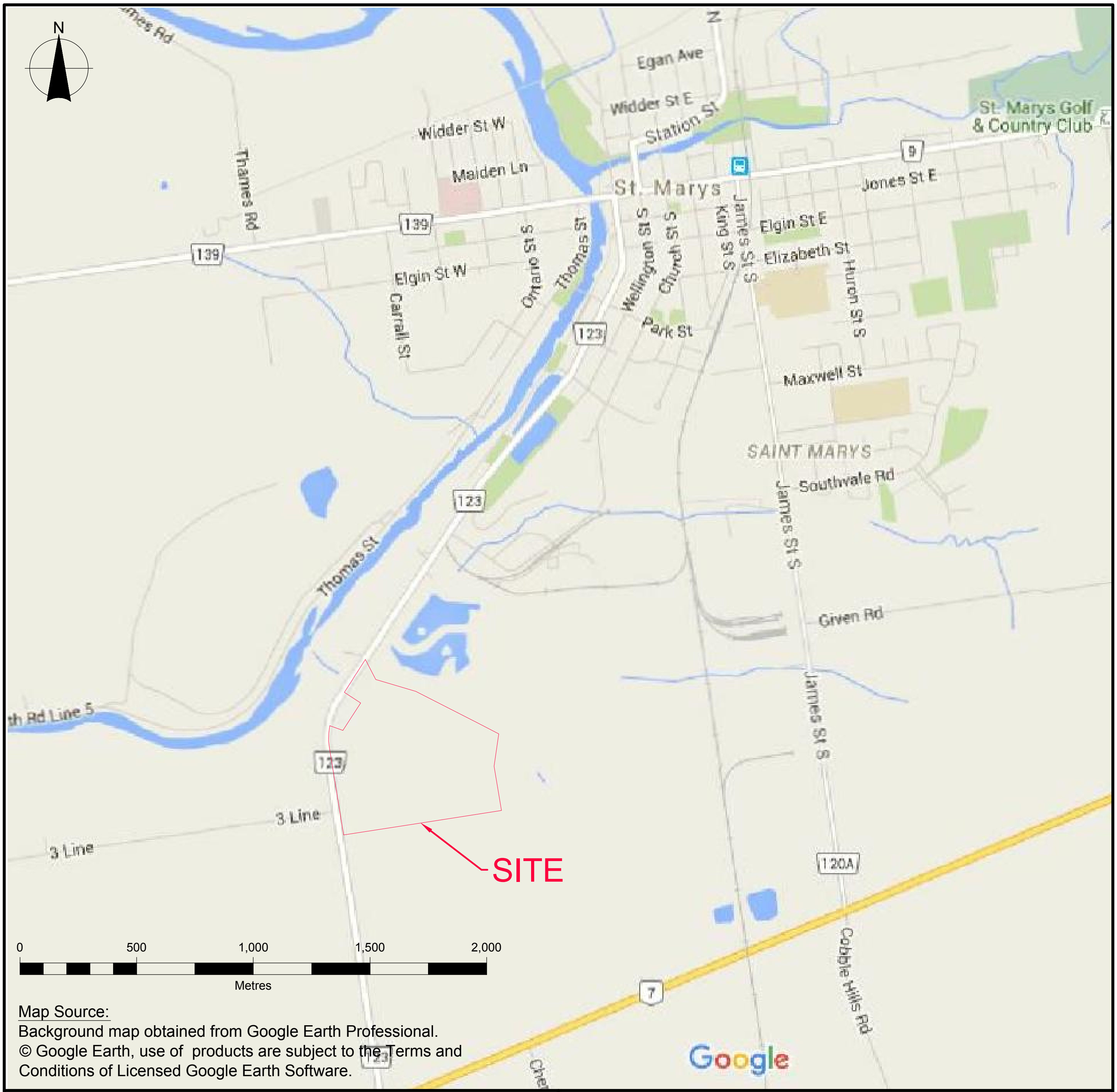
Table 6:
Odour Frequency (2020_4)

Receptor Location		**Lower Limit (OU):**	**0**	**1**	**6**	
		Upper Limit (OU):	**1**	**6**	**17**	
X	**Y**	**Total**				% over 6 OU
487080	4786920	43824	43041	783		
487080	4786940	43824	43008	816		
487080	4787060	43824	42655	1169		
487080	4787080	43824	42565	1237	22	0.05%
487080	4787100	43824	42434	1316	74	0.17%
487080	4787120	43824	42298	1393	133	0.30%
487080	4787240	43824	42526	982	316	0.72%
487080	4787260	43824	42704	841	279	0.64%
487080	4787280	43824	42815	774	235	0.54%
487080	4787300	43824	42874	765	185	0.42%
487080	4787320	43824	42906	778	140	0.32%
487080	4787400	43824	43019	792	13	0.03%
487080	4787420	43824	43058	762	4	0.01%
487100	4787060	43824	42646	1178		
487100	4787080	43824	42529	1269	26	0.06%
487100	4787100	43824	42415	1312	97	0.22%
487100	4787120	43824	42198	1474	152	0.35%
487100	4787400	43824	43004	792	28	0.06%
487100	4787420	43824	43052	764	8	0.02%
487120	4786780	43824	43337	487		
487120	4786800	43824	43287	537		
487120	4786940	43824	42964	860		
487140	4786780	43824	43306	518		
487140	4786800	43824	43277	547		
487140	4786940	43824	42919	905		

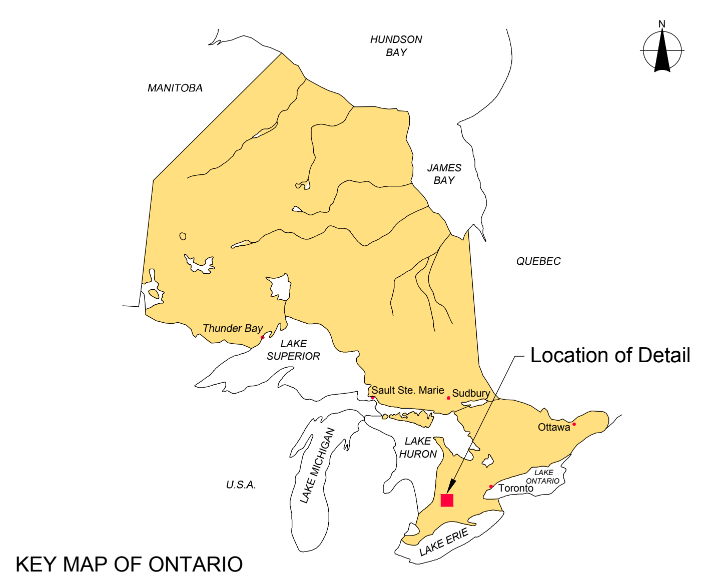
Table 7:
Percent of Odour Impacts in Range by Alternative

		Existing			Alternative Method 2			Alternative Method 3			Alternative Method 4		
Location (X)	**Location (Y)**	**< 1 OU (%)**	**1 to 6 OU (%)**	**> 6 OU (%)**	**< 1 OU (%)**	**1 to 6 OU (%)**	**> 6 OU (%)**	**< 1 OU (%)**	**1 to 6 OU (%)**	**> 6 OU (%)**	**< 1 OU (%)**	**1 to 6 OU (%)**	**> 6 OU (%)**
487080	4786920	97.62%	2.38%		98.86%	1.14%		98.69%	1.31%		98.21%	1.79%	
487080	4786940	97.52%	2.48%		98.81%	1.19%		98.58%	1.42%		98.14%	1.86%	
487080	4787060	96.96%	2.57%	0.47%	98.45%	1.53%	0.02%	97.93%	2.07%		97.33%	2.67%	
487080	4787080	96.98%	2.50%	0.52%	98.45%	1.49%	0.07%	97.88%	2.12%		97.13%	2.82%	0.05%
487080	4787100	97.19%	2.28%	0.53%	98.43%	1.41%	0.16%	97.77%	2.01%	0.23%	96.83%	3.00%	0.17%
487080	4787120	97.32%	2.23%	0.45%	98.32%	1.46%	0.22%	97.56%	2.08%	0.36%	96.52%	3.18%	0.30%
487080	4787240	97.83%	2.13%	0.04%	97.72%	1.86%	0.42%	96.28%	2.93%	0.78%	97.04%	2.24%	0.72%
487080	4787260	97.86%	2.13%	0.01%	97.72%	1.85%	0.43%	96.38%	3.08%	0.54%	97.44%	1.92%	0.64%
487080	4787280	98.03%	1.97%		97.68%	1.93%	0.39%	96.53%	3.04%	0.43%	97.70%	1.77%	0.54%
487080	4787300	98.14%	1.86%		97.66%	1.95%	0.39%	96.69%	2.94%	0.37%	97.83%	1.75%	0.42%
487080	4787320	98.23%	1.77%		97.65%	2.02%	0.33%	96.90%	2.85%	0.26%	97.91%	1.78%	0.32%
487080	4787400	98.58%	1.42%		97.78%	2.14%	0.08%	97.79%	2.14%	0.07%	98.16%	1.81%	0.03%
487080	4787420	98.65%	1.35%		97.87%	2.07%	0.06%	97.92%	2.04%	0.04%	98.25%	1.74%	0.01%
487100	4787060	96.68%	2.75%	0.58%	98.39%	1.60%	0.02%	97.82%	2.18%		97.31%	2.69%	
487100	4787080	96.71%	2.59%	0.70%	98.33%	1.60%	0.07%	97.76%	2.24%		97.04%	2.90%	0.06%
487100	4787100	96.89%	2.43%	0.69%	98.32%	1.52%	0.16%	97.65%	2.17%	0.18%	96.78%	2.99%	0.22%
487100	4787120	97.10%	2.33%	0.58%	98.24%	1.53%	0.24%	97.44%	2.12%	0.44%	96.29%	3.36%	0.35%
487100	4787400	98.56%	1.44%		97.67%	2.22%	0.11%	97.72%	2.18%	0.10%	98.13%	1.81%	0.06%
487100	4787420	98.65%	1.35%		97.80%	2.11%	0.09%	97.88%	2.05%	0.07%	98.24%	1.74%	0.02%
487120	4786780	98.66%	1.34%		99.23%	0.77%		99.16%	0.84%		98.89%	1.11%	
487120	4786800	98.52%	1.48%		99.19%	0.81%		99.11%	0.89%		98.77%	1.23%	
487120	4786940	97.35%	2.65%		98.75%	1.25%		98.61%	1.39%		98.04%	1.96%	
487140	4786780	98.61%	1.39%		99.19%	0.81%		99.11%	0.89%		98.82%	1.18%	
487140	4786800	98.51%	1.49%		99.17%	0.83%		99.06%	0.94%		98.75%	1.25%	
487140	4786940	97.34%	2.66%		98.71%	1.29%		98.52%	1.48%		97.93%	2.07%	

Figures



Map Source:
Background map obtained from Google Earth Professional.
© Google Earth, use of products are subject to the Terms and Conditions of Licensed Google Earth Software.



KEY MAP OF ONTARIO

BURNSIDE

Client

CORPORATION OF THE
TOWN OF ST. MARYS

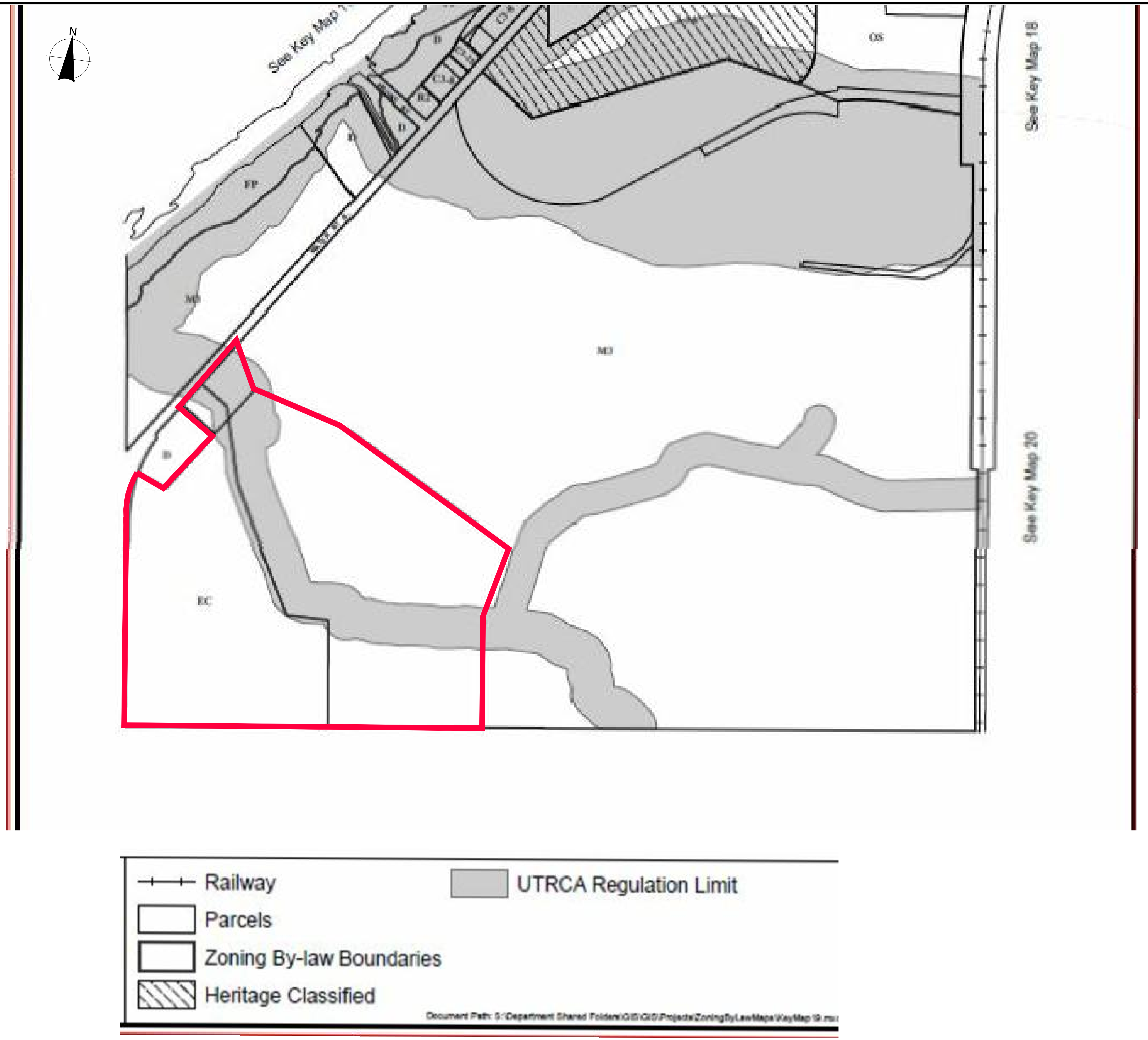
Figure Title

ENVIRONMENTAL ASSESSMENT

SITE LOCATION MAP

Drawn	Checked	Date	Figure No.
C.S.	H.W.	MARCH 2016	**1**
Scale		Project No.	
1:25,000		300032339	

File: \\MONTY\Shared\AirGroup_Projects\St Marys EA 300032339.0000\Drawing Set\032339 Environmental Assessment Drawing Set.dwg Date Plotted: April 14, 2016 - 11:58 AM



LEGEND

APPROXIMATE SITE BOUNDARY

Zone	Zone Symbol
Agricultural Zone One	A1
Agricultural Zone Two	A2
Residential Zone One	R1
Residential Zone Two	R2
Residential Zone Three	R3
Residential Zone Four	R4
Residential Zone Five	R5
Residential Zone Six	R6
Residential Zone Seven	R7
Central Commercial Zone	C1
Limited Commercial Zone	C2
Highway Commercial Zone	C3
Special Commercial Zone	C4
Light Industrial Zone	M1
General Industrial Zone	M2
Extractive Industrial Zone	M3
Environmental Constraint Zone	EC
Institutional Zone	I
Open Space Zone	OS
Flood Plain Zone	FP
Special Policy Area Constraint Zone	-SPA
Holding Zone	-H
Development Zone	D or RD

0 100 200 400 600
Metres

Zoning Map Source:
Background zoning map obtained from the Corporation of the Town of St. Marys website. Zoning Map 19 from Zoning By-Law Z1-1997 consolidated through to January 15, 2015.

BURNSIDE

Client
CORPORATION OF THE TOWN OF ST. MARYS

Figure Title
ENVIRONMENTAL ASSESSMENT

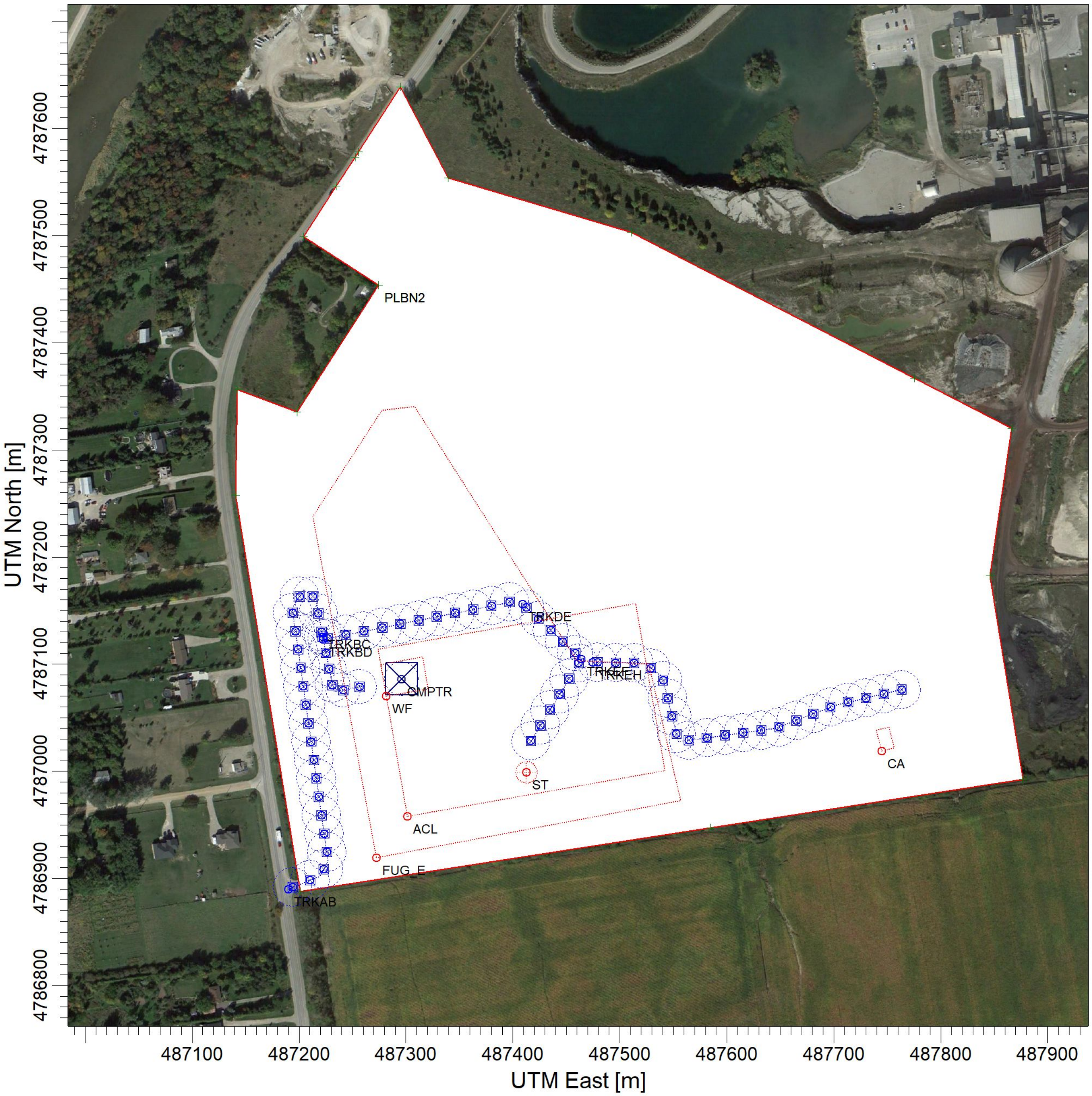
ZONING LAND USE PLAN

Drawn C.S.
Checked H.W.
Date MARCH 2016
Figure No. 2
Scale 1:7,500
Project No. 300032339

File: \\MONTY\Shared\AirGroup_Projects\St Marys EA 300032339\300032339.0000\Drawing Set\032339 Environmental Assessment Drawing Set.dwg Date Plotted: April 14, 2016 - 11:58 AM

PROJECT TITLE:

Figure 3_E:□
Site Plan Existing Conditions



COMMENTS:

SOURCES:
12

COMPANY NAME:
R.J. Burnside & Associates Limited

RECEPTORS:
4483

MODELER:
H. Watson

SCALE: 1:6,000

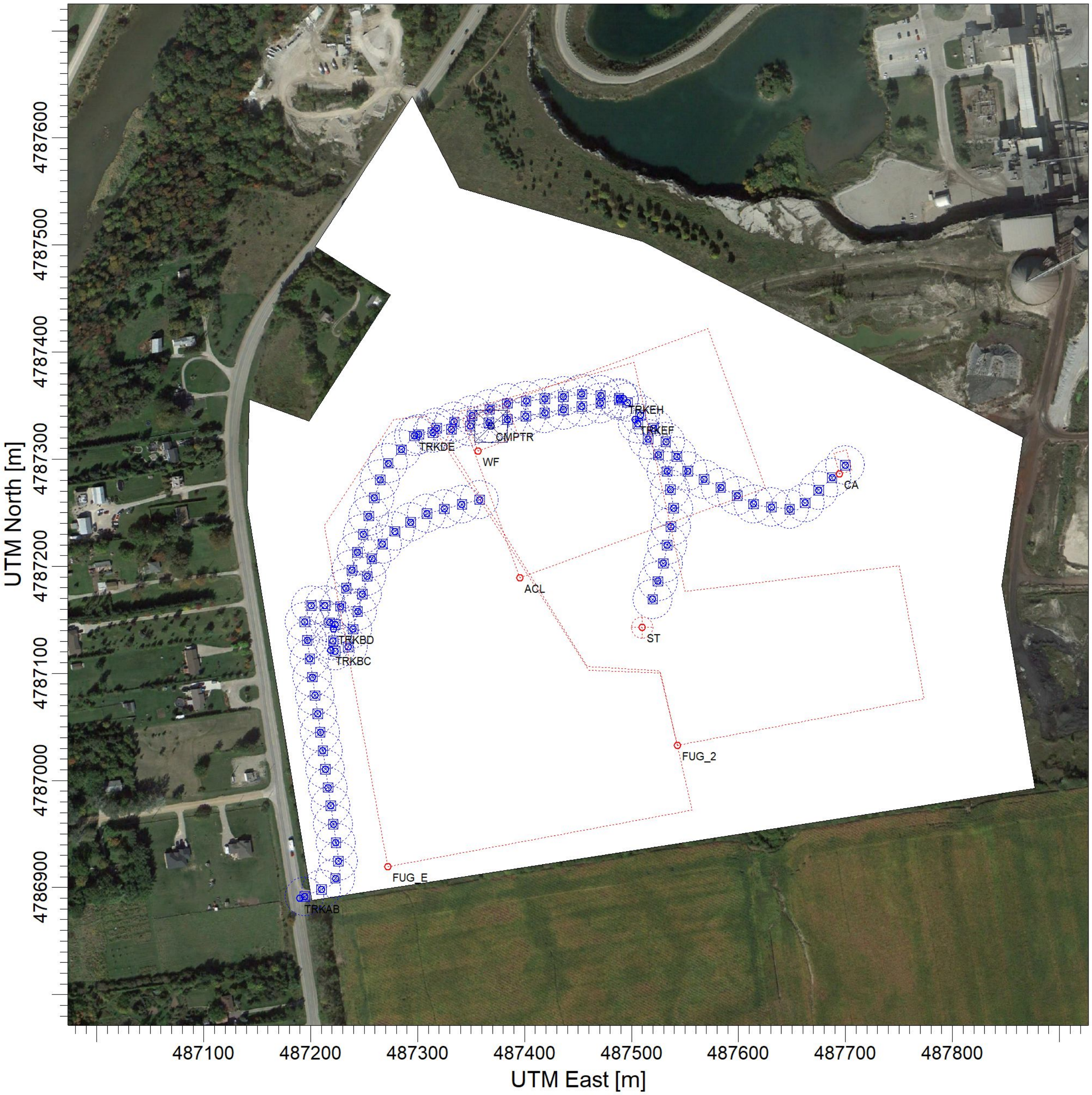
0 ▬▬ 0.2 km

DATE:
6/26/2020

PROJECT NO.:

PROJECT TITLE:

Figure 3_2:
Site Plan Alternative Method 2



COMMENTS:

SOURCES:

13

COMPANY NAME:

R.J. Burnside & Associates Limited

RECEPTORS:

4483

MODELER:

H. Watson

SCALE:

1:6,000

0 0.2 km

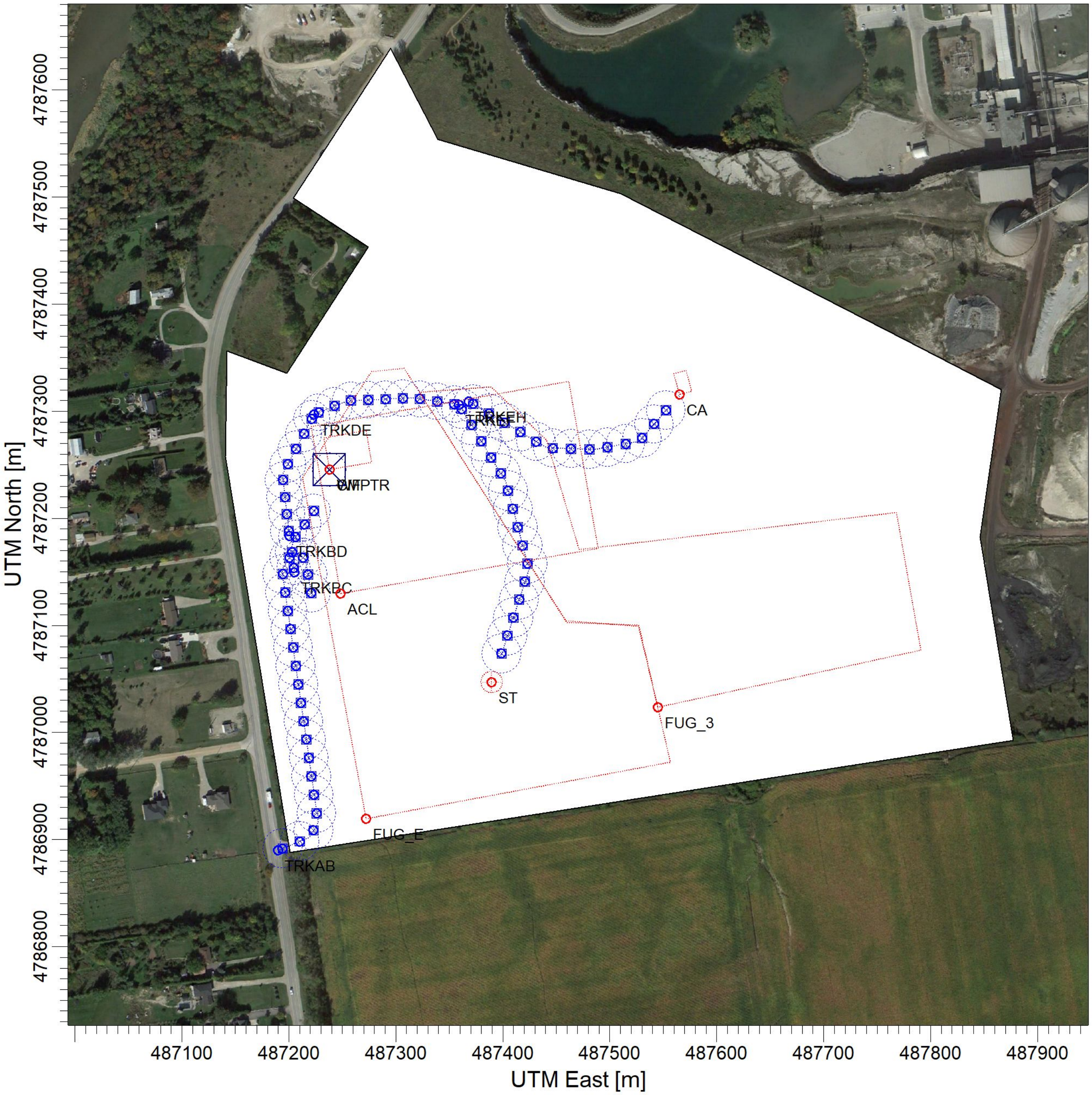
DATE:

6/26/2020

PROJECT NO.:

PROJECT TITLE:

Figure 3_3:
Site Plan Alternative Method 3



COMMENTS:

SOURCES:

13

COMPANY NAME:

R.J. Burnside & Associates Limited

RECEPTORS:

4483

MODELER:

H. Watson

SCALE:

1:6,000

0 0.2 km

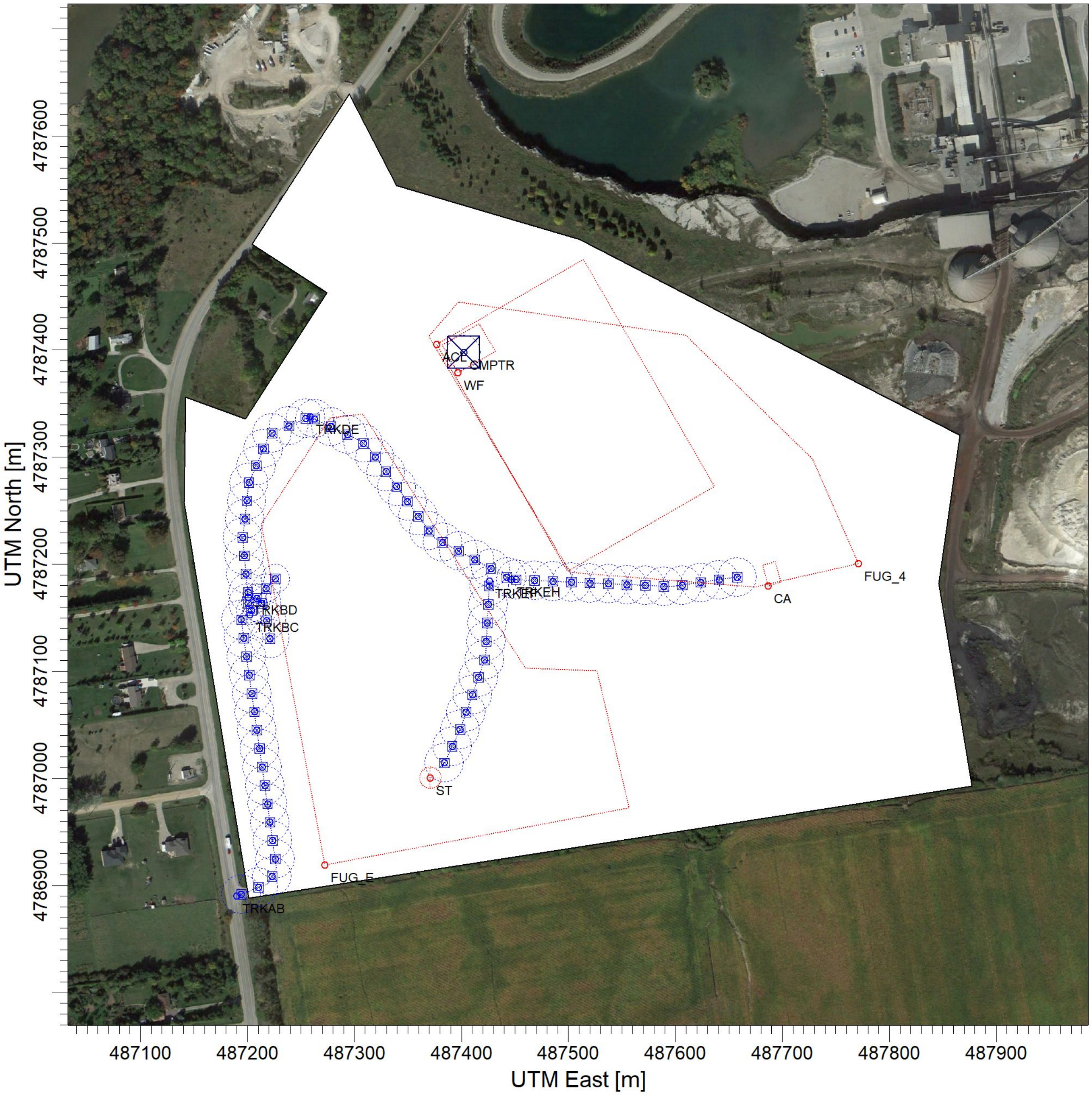
DATE:

6/26/2020

PROJECT NO.:

PROJECT TITLE:

Figure 3_4:
Site Plan Alternative Method 4



COMMENTS:

SOURCES:

13

COMPANY NAME:

R.J. Burnside & Associates Limited

RECEPTORS:

4483

MODELER:

H. Watson

SCALE: 1:6,000

0 0.2 km

DATE:

6/26/2020

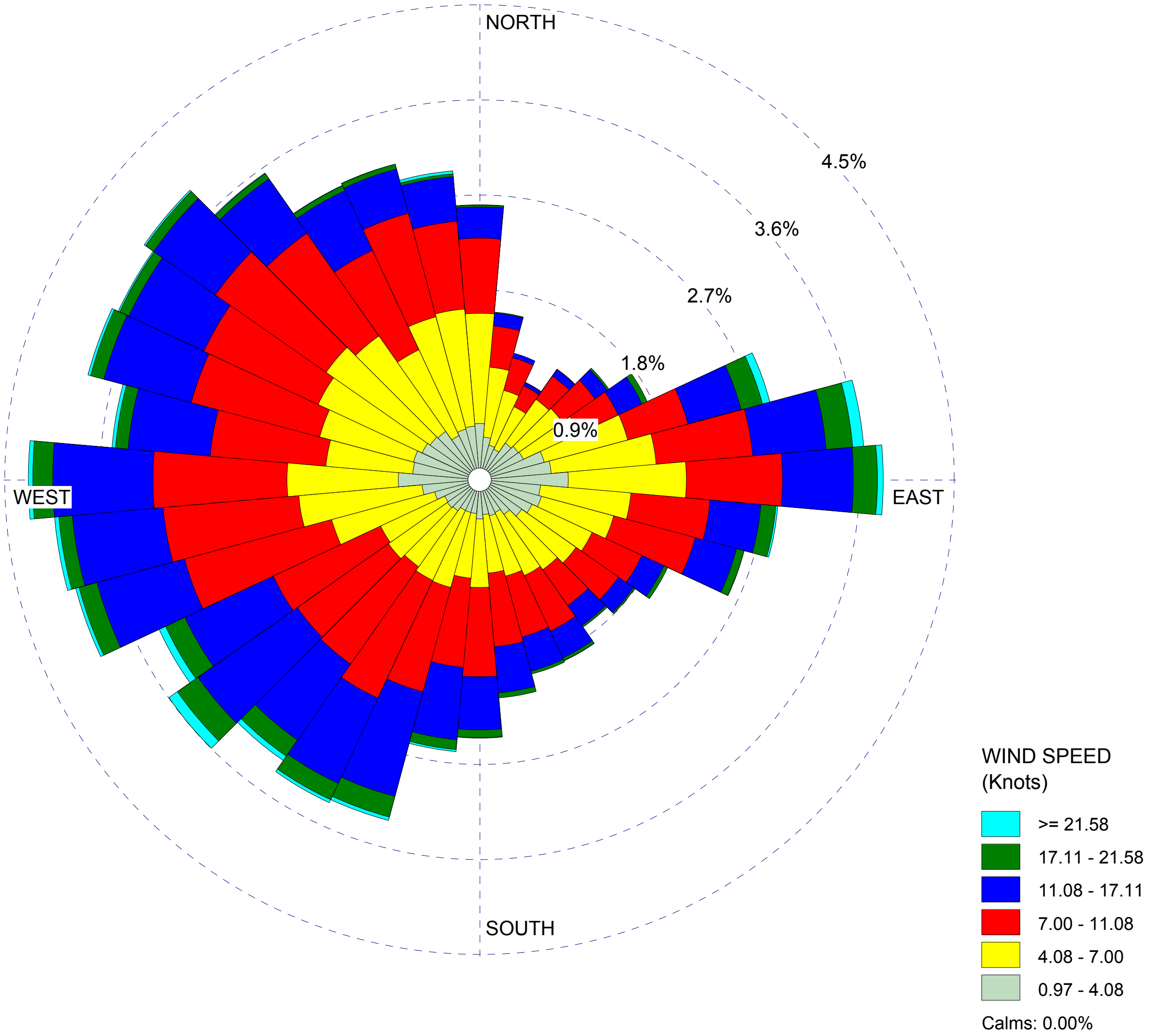
PROJECT NO.:

WIND ROSE PLOT:

St Marys Landfill
Wind Rose (2009 - 2013)

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:

DATA PERIOD:

Start Date: 1/1/2009 - 00:00
End Date: 12/31/2013 - 23:00

COMPANY NAME:

R.J. Burnside & Associates Limited

MODELER:

H. Watson

CALM WINDS:

0.00%

TOTAL COUNT:

43734 hrs.

AVG. WIND SPEED:

7.73 Knots

DATE:

3/16/2016

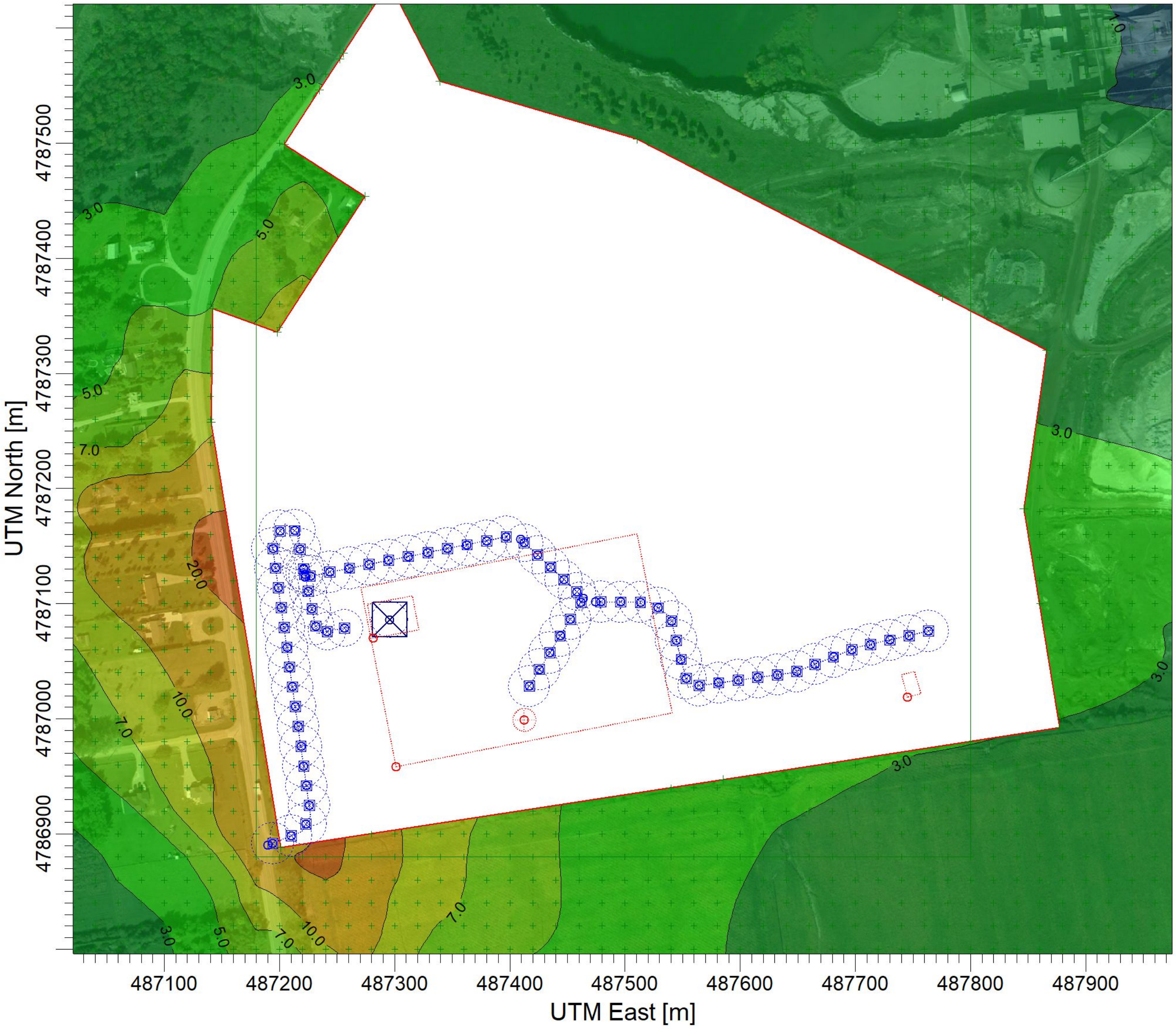
PROJECT NO.:

300032239.0000

WRPLOT View - Lakes Environmental Software

PROJECT TITLE:

Figure 5_E:
PM10 24-h Contour Plot Existing



PLOT FILE OF HIGH 1ST HIGH 24-HR VALUES FOR SOURCE GROUP: ALL

ug/m^3

Max: 30.3 [ug/m^3] at (487158.15, 4787150.73)

0.3 0.5 0.7 1.0 3.0 5.0 7.0 10.0 20.0 30.3

COMMENTS:

SOURCES:
11

COMPANY NAME:
R.J. Burnside & Associates Limited

RECEPTORS:
4483

MODELER:
H.Watson

OUTPUT TYPE:
Concentration

SCALE: 1:6,000
0 0.2 km

MAX:
30.3 ug/m^3

DATE:
7/2/2019

PROJECT NO.:
300032339.0000

PROJECT TITLE:

Figure 5_2:
PM10 24-h Contour Plot Alternative Method 2

PLOT FILE OF HIGH 1ST HIGH 24-HR VALUES FOR SOURCE GROUP: ALL

ug/m^3

Max: 29.0 [ug/m^3] at (487240.49, 4786894.15)

0.3 0.5 0.6 1.0 2.0 5.0 6.0 10.0 20.0 29.0

COMMENTS:

SOURCES:
11

COMPANY NAME:
R.J. Burnside & Associates Limited

RECEPTORS:
4483

MODELER:
H.Watson

OUTPUT TYPE:
Concentration

SCALE: 1:6,000

0 0.2 km

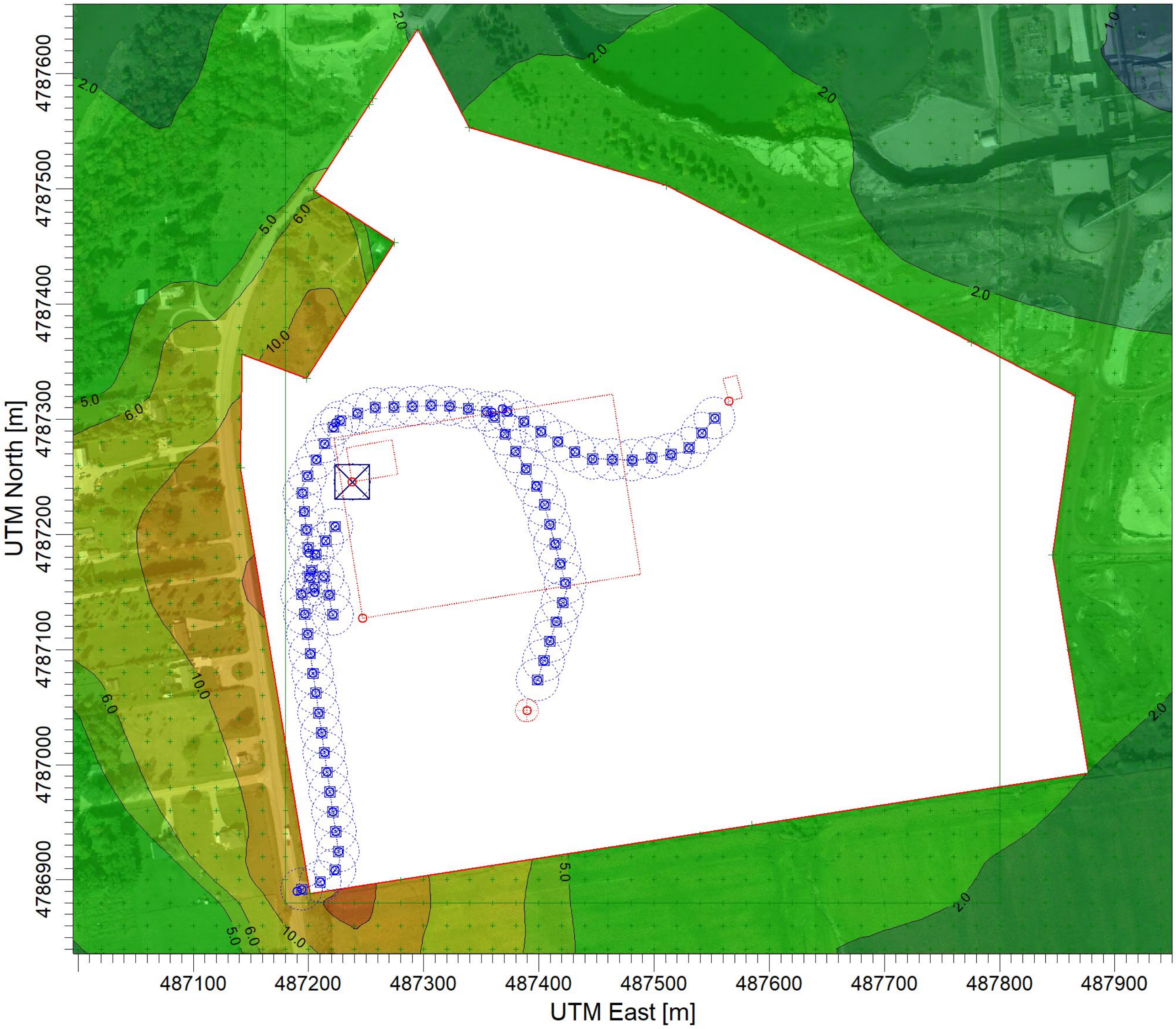
MAX:
29.0 ug/m^3

DATE:
7/2/2019

PROJECT NO.:

PROJECT TITLE:

Figure 5_3:
PM10 24-h Contour Plot Alternative Method 3



PLOT FILE OF HIGH 1ST HIGH 24-HR VALUES FOR SOURCE GROUP: ALL

ug/m^3

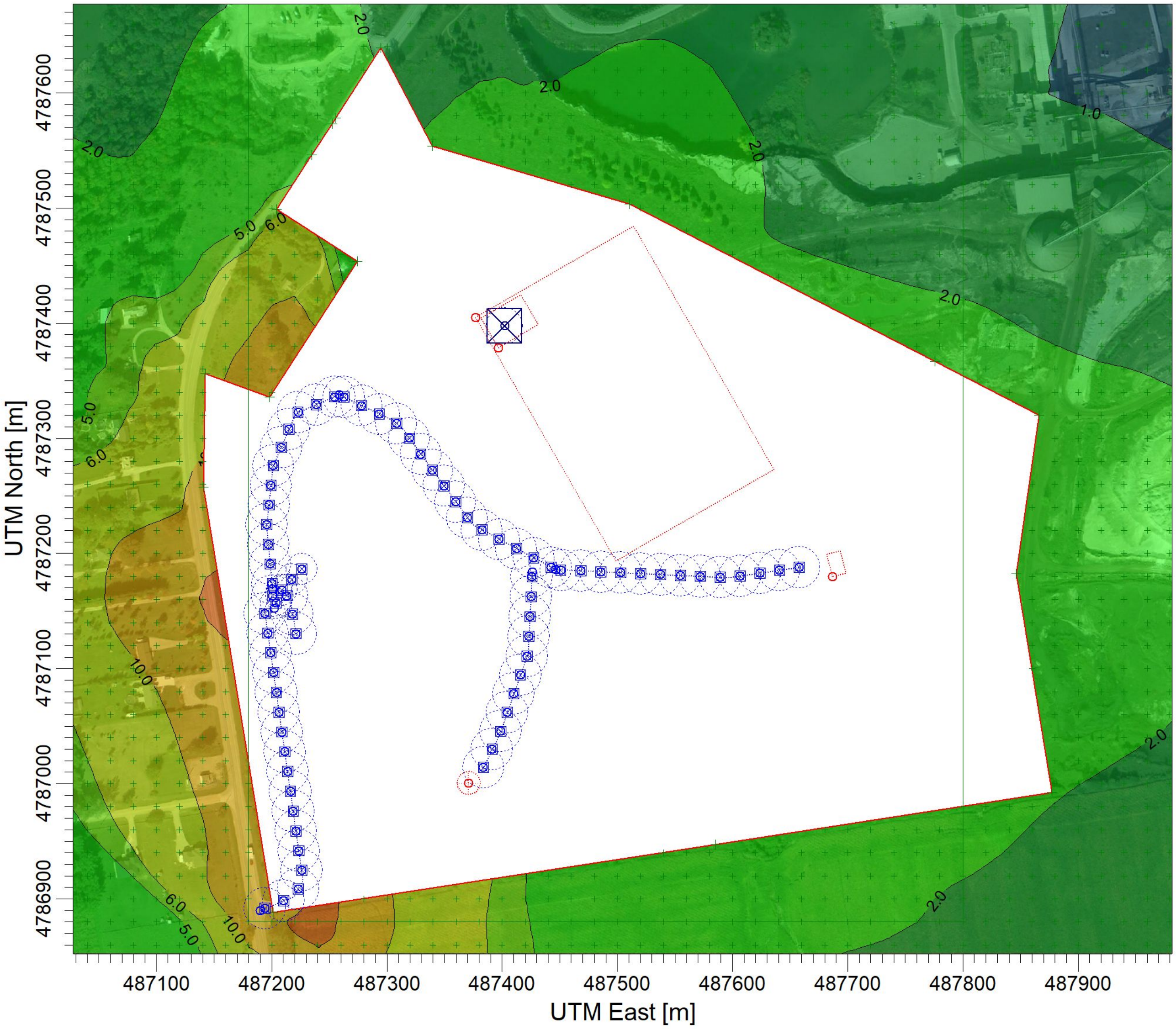
Max: 30.0 [ug/m^3] at (487240.49, 4786894.15)

🟪	🟪	🟦	🟩	🟩	🟩	🟨	🟨	🟧	🟥
0.3	0.5	0.6	1.0	2.0	5.0	6.0	10.0	20.0	30.0

COMMENTS:	SOURCES: **11**	COMPANY NAME: **R.J. Burnside & Associates Limited**	
	RECEPTORS: **4483**	MODELER: **H.Watson**	
	OUTPUT TYPE: **Concentration**	SCALE: 1:6,000 0 ▬▬ 0.2 km	
	MAX: **30.0 ug/m^3**	DATE: **7/2/2019**	PROJECT NO.:

PROJECT TITLE:

Figure 5_4:
PM10 24-h Contour Plot Alternative Method 4



PLOT FILE OF HIGH 1ST HIGH 24-HR VALUES FOR SOURCE GROUP: ALL

ug/m^3

Max: 29.8 [ug/m^3] at (487240.49, 4786894.15)

0.3 0.5 0.6 1.0 2.0 5.0 6.0 10.0 20.0 29.8

COMMENTS:

SOURCES:

11

COMPANY NAME:

R.J. Burnside & Associates Limited

RECEPTORS:

4483

MODELER:

H.Watson

OUTPUT TYPE:

Concentration

SCALE:

1:6,000

0 0.2 km

MAX:

29.8 ug/m^3

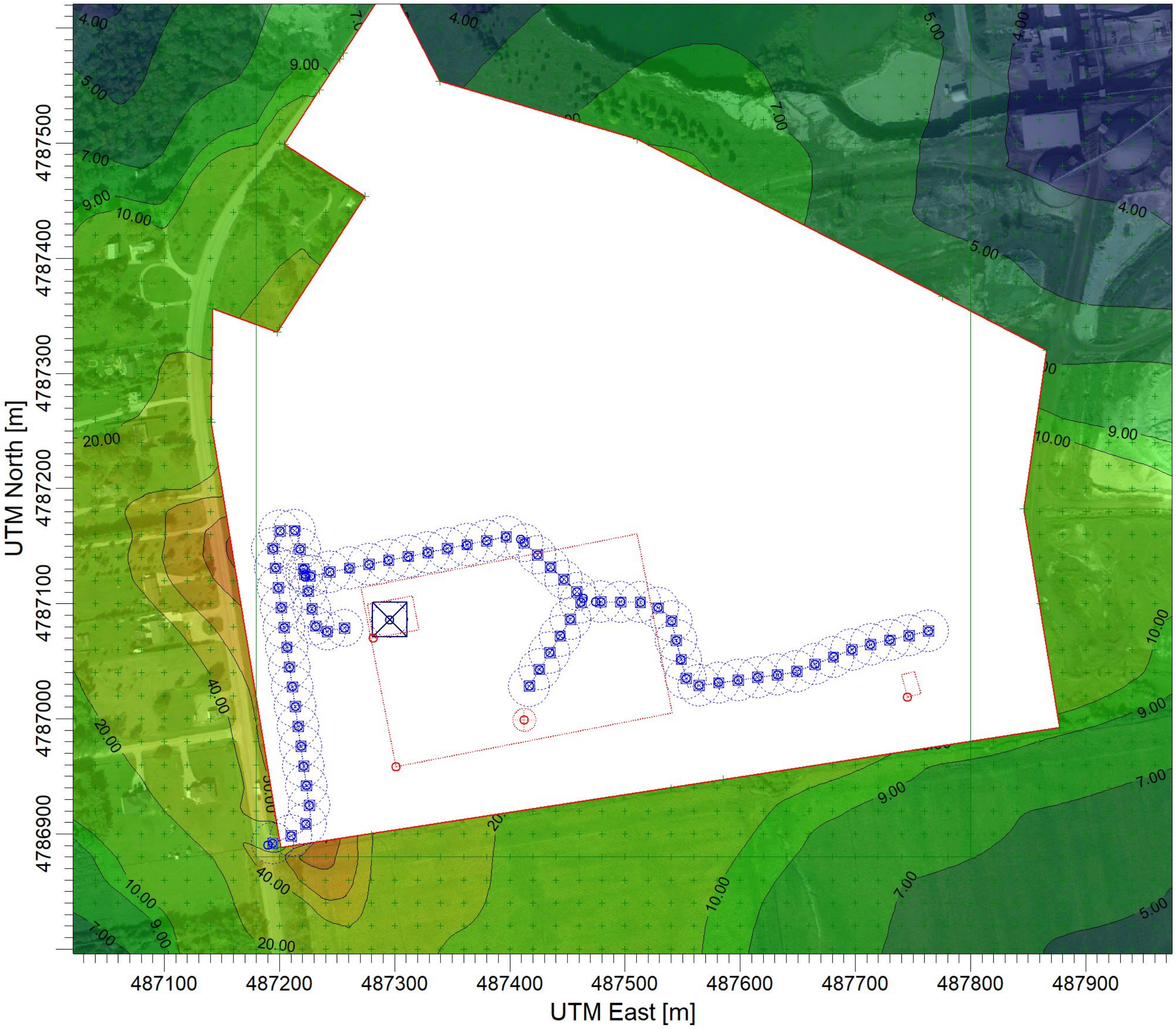
DATE:

7/2/2019

PROJECT NO.:

PROJECT TITLE:

Figure 6_E:
PM 24-h Contour Plot Existing



PLOT FILE OF HIGH 1ST HIGH 24-HR VALUES FOR SOURCE GROUP: ALL

ug/m^3

Max: 95.29 [ug/m^3] at (487158.15, 4787150.73)

0.95	1.00	2.00	4.00	5.00	7.00	9.00	10.00	20.00	40.00	50.00	70.00	90.00	95.29

COMMENTS:

SOURCES:
11

COMPANY NAME:
R.J. Burnside & Associates Limited

RECEPTORS:
4483

MODELER:
H.Watson

OUTPUT TYPE:
Concentration

SCALE: 1:6,000

0 0.2 km

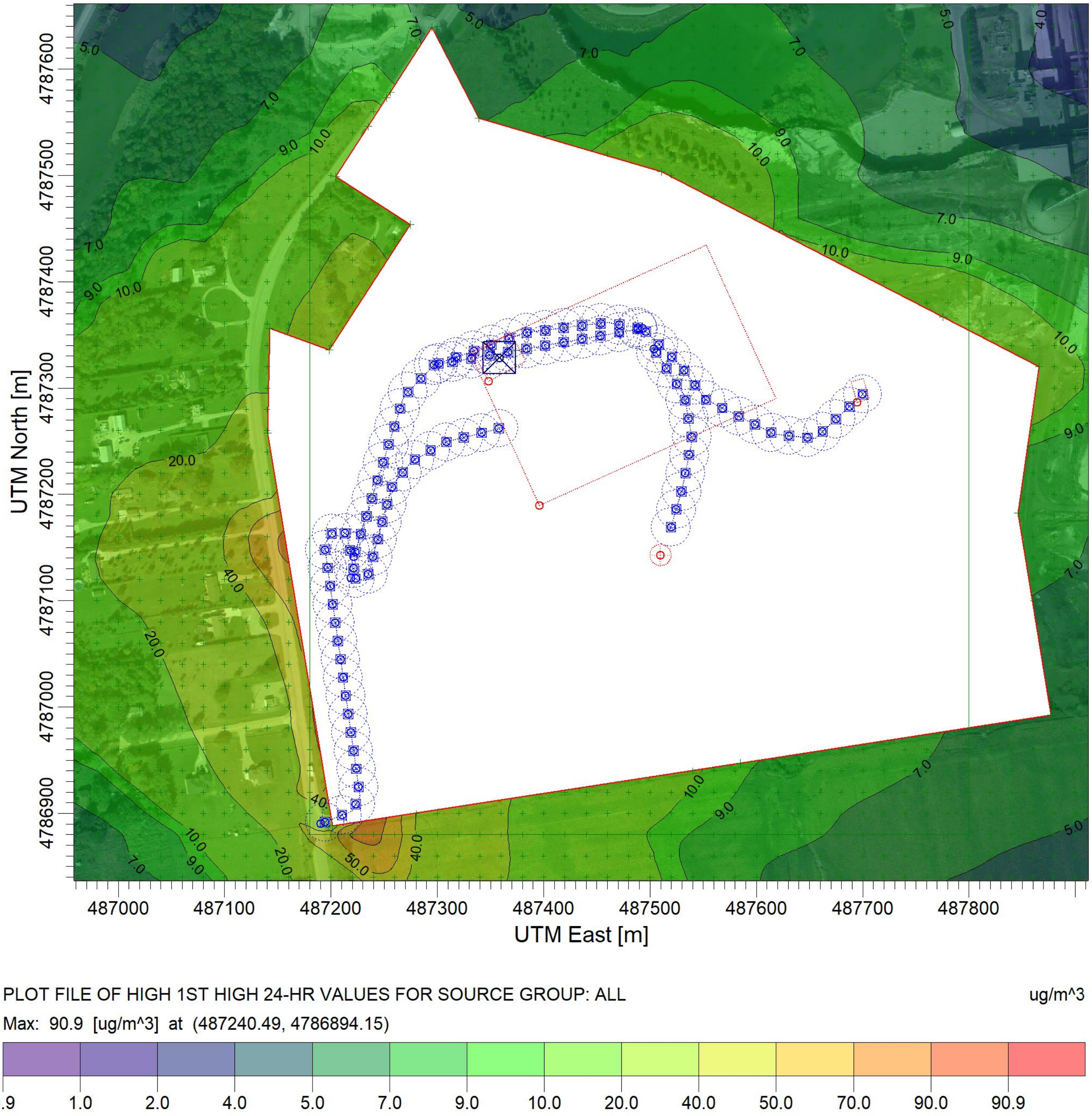
MAX:
95.29 ug/m^3

DATE:
7/2/2019

PROJECT NO.:
300032339.0000

PROJECT TITLE:

Figure 6_2:
PM 24-h Contour Plot Alternative Method 2



PLOT FILE OF HIGH 1ST HIGH 24-HR VALUES FOR SOURCE GROUP: ALL

ug/m^3

Max: 90.9 [ug/m^3] at (487240.49, 4786894.15)

COMMENTS:

SOURCES:
11

COMPANY NAME:
R.J. Burnside & Associates Limited

RECEPTORS:
4483

MODELER:
H.Watson

OUTPUT TYPE:
Concentration

SCALE:
1:6,000
0 0.2 km

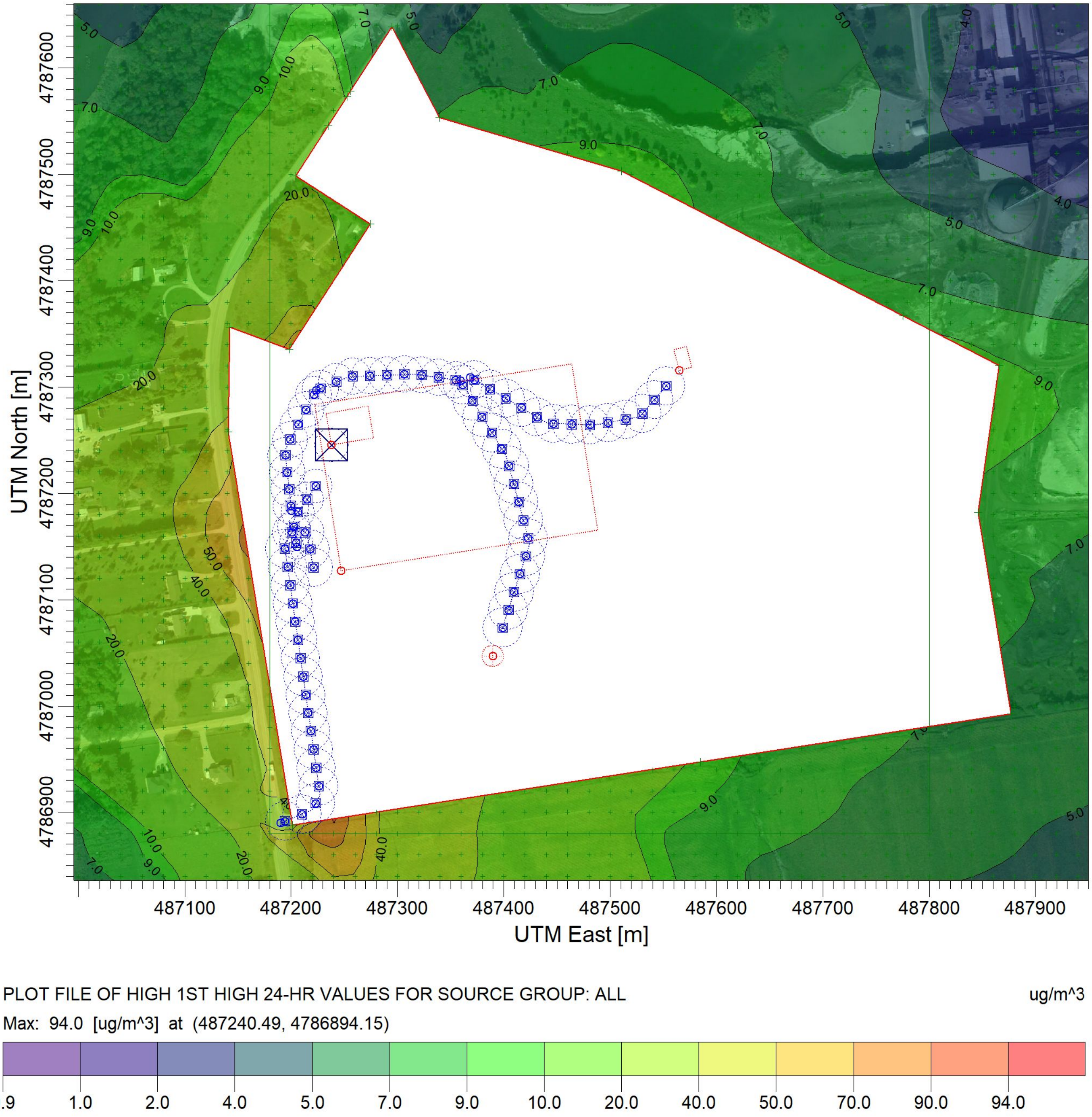
MAX:
90.9 ug/m^3

DATE:
7/2/2019

PROJECT NO.:

PROJECT TITLE:

Figure 6_3:
PM 24-h Contour Plot Alternative Method 3



PLOT FILE OF HIGH 1ST HIGH 24-HR VALUES FOR SOURCE GROUP: ALL

Max: 94.0 [ug/m^3] at (487240.49, 4786894.15)

COMMENTS:

SOURCES:

11

COMPANY NAME:

R.J. Burnside & Associates Limited

RECEPTORS:

4483

MODELER:

H.Watson

OUTPUT TYPE:

Concentration

SCALE: 1:6,000

0 0.2 km

MAX:

94.0 ug/m^3

DATE:

7/2/2019

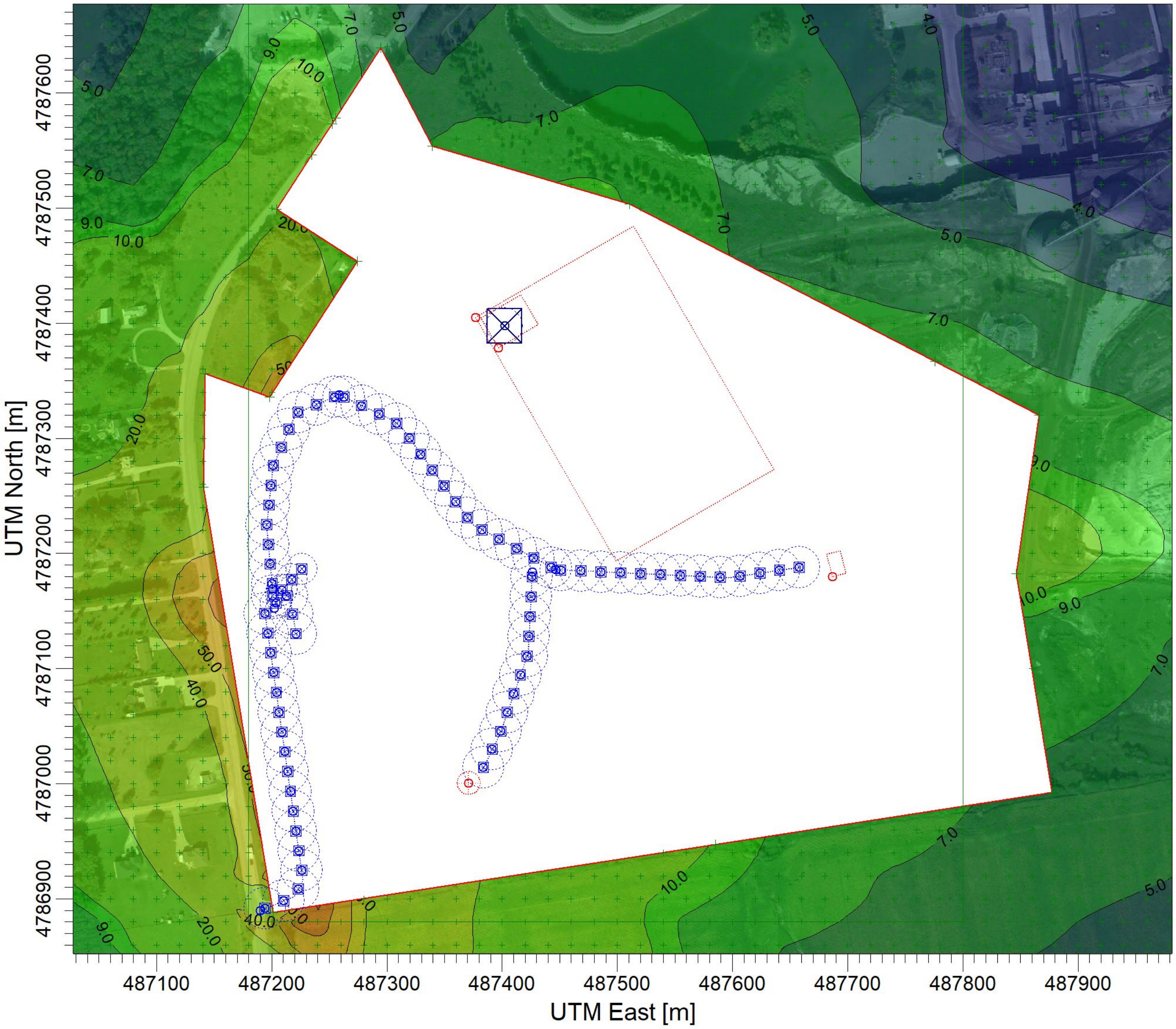
PROJECT NO.:

AERMOD View - Lakes Environmental Software

C:\AERMOD\St. Marys\032339\2019_3\MultiChem\St Mays.isc

PROJECT TITLE:

Figure 6_4:
PM 24-h Contour Plot Alternative Method 4



PLOT FILE OF HIGH 1ST HIGH 24-HR VALUES FOR SOURCE GROUP: ALL

ug/m^3

Max: 93.3 [ug/m^3] at (487240.49, 4786894.15)

🟪	🟪	🟦	🟦	🟩	🟩	🟩	🟩	🟩	🟨	🟨	🟧	🟧	🟥
0.9	1.0	2.0	4.0	5.0	7.0	9.0	10.0	20.0	40.0	50.0	70.0	90.0	93.3

COMMENTS:

SOURCES:

11

COMPANY NAME:

R.J. Burnside & Associates Limited

RECEPTORS:

4483

MODELER:

H.Watson

OUTPUT TYPE:

Concentration

SCALE:

1:6,000

0 0.2 km

MAX:

93.3 ug/m^3

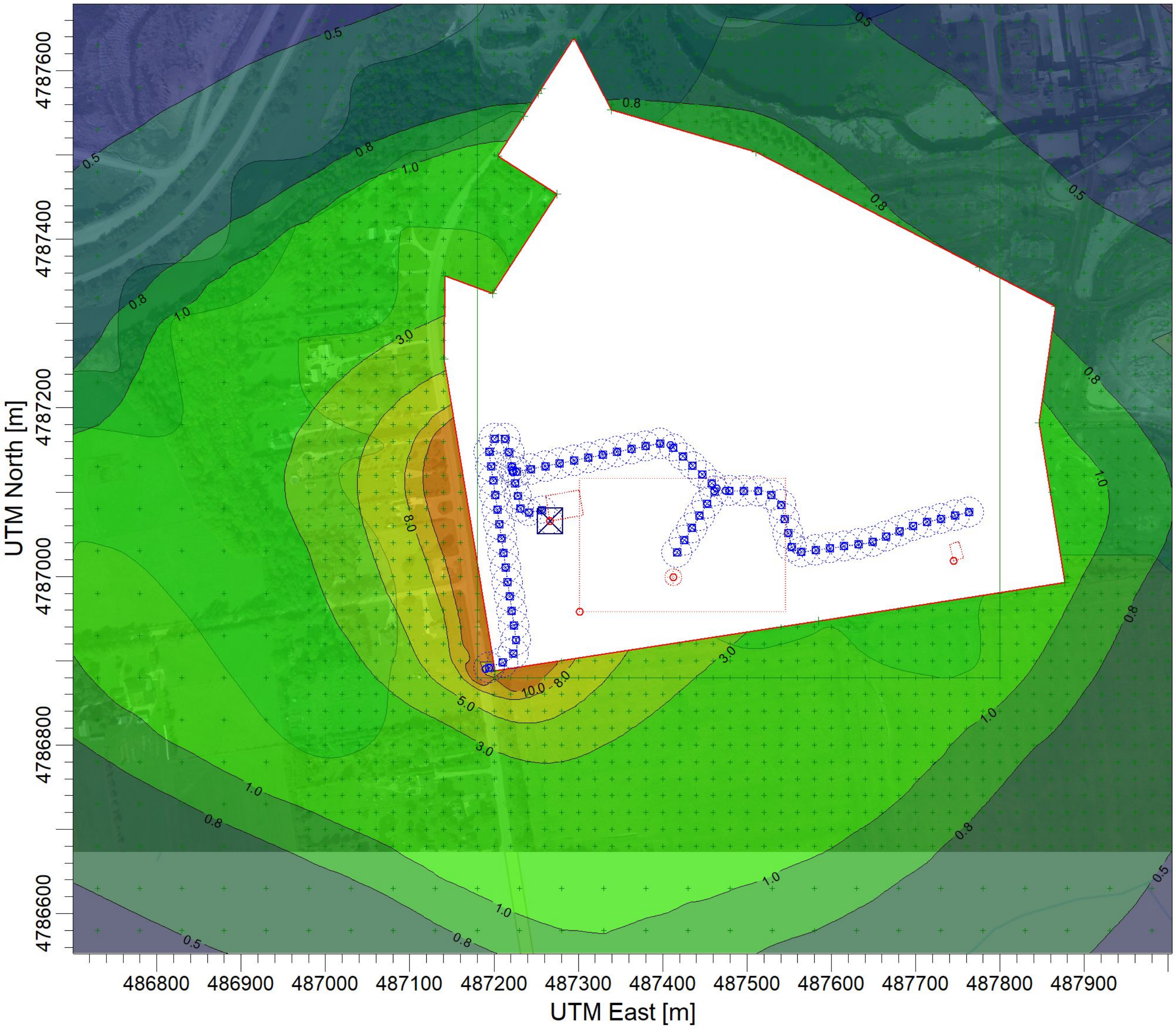
DATE:

7/2/2019

PROJECT NO.:

PROJECT TITLE:

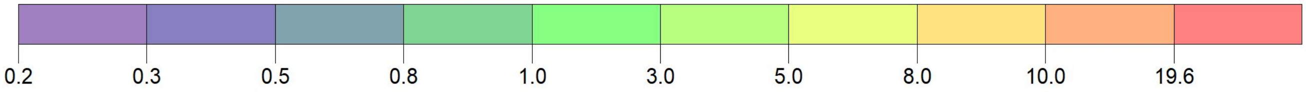
Figure 6_Ea
PM Annual Contour Plot Exisiting



PLOT FILE OF ANNUAL VALUES FOR SOURCE GROUP: ALL

ug/m^3

Max: 19.6 [ug/m^3] at (487164.52, 4787111.82)



COMMENTS:

SOURCES:
11

COMPANY NAME:
R. J. Burnside & Associates Limited

RECEPTORS:
4483

MODELER:
KS

OUTPUT TYPE:
Concentration

SCALE:
1:8,196
0 0.3 km

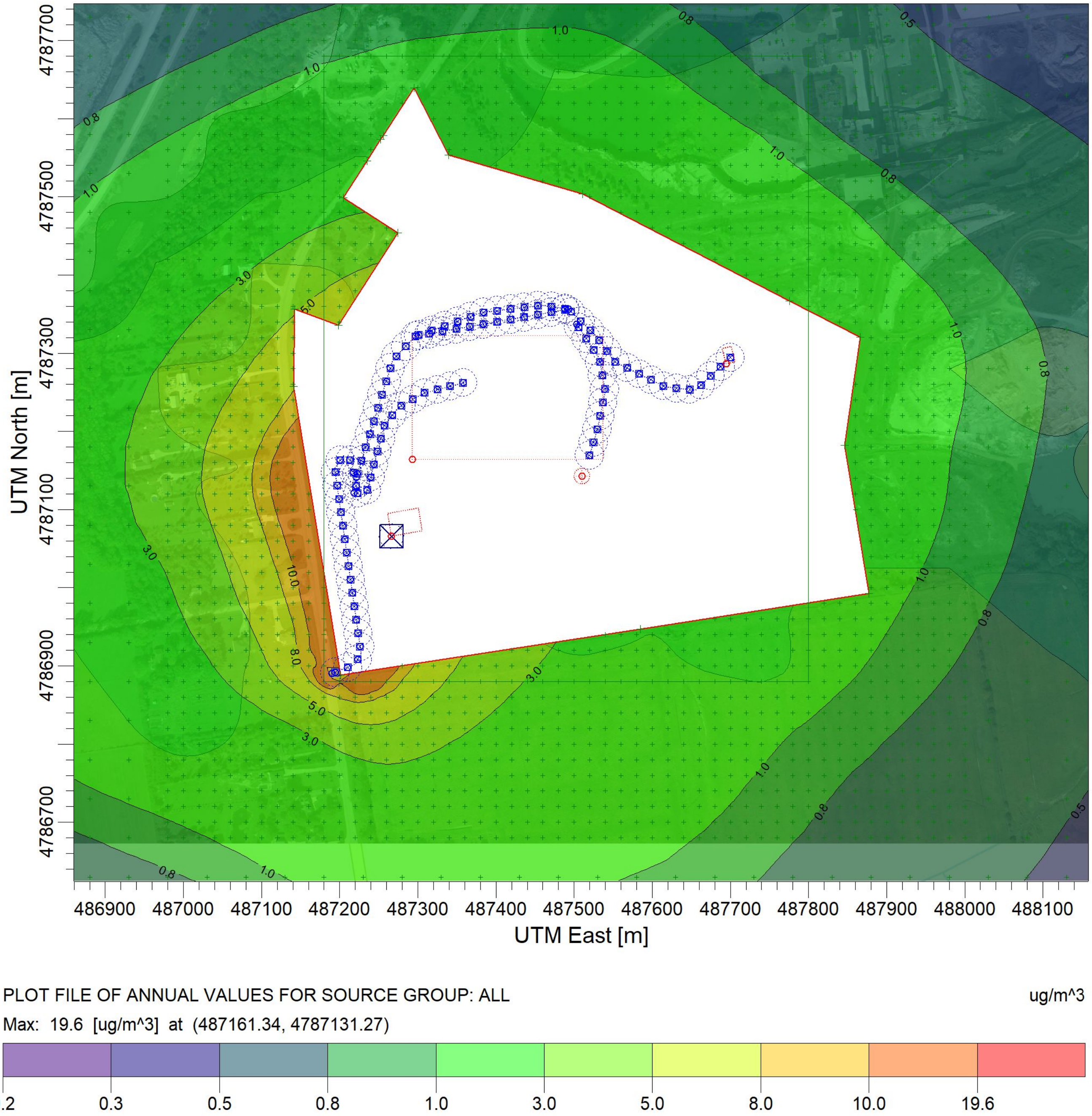
MAX:
19.6 ug/m^3

DATE:
4/24/2020

PROJECT NO.:
300032339.0000

PROJECT TITLE:

Figure 6_2a
PM Annual Contour Plot Alternative Method 2



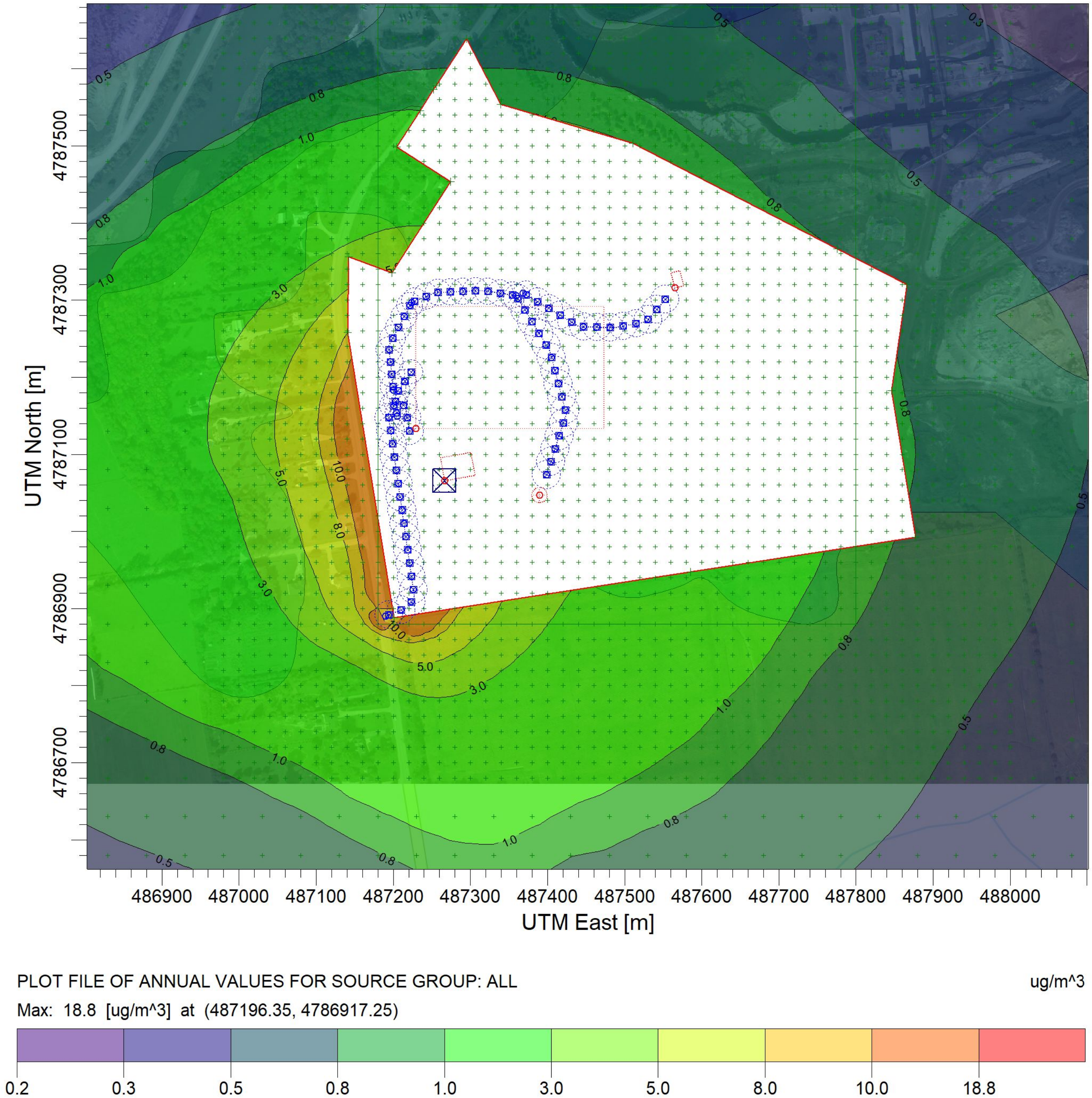
PLOT FILE OF ANNUAL VALUES FOR SOURCE GROUP: ALL

Max: 19.6 [ug/m^3] at (487161.34, 4787131.27)

COMMENTS:	SOURCES: **11**	COMPANY NAME: **R. J. Burnside & Associates Limited**	
	RECEPTORS: **4483**	MODELER: **KS**	
	OUTPUT TYPE: **Concentration**	SCALE: 1:8,166 0 0.3 km	
	MAX: **19.6 ug/m^3**	DATE: **4/24/2020**	PROJECT NO.: **300032339.0000**

PROJECT TITLE:

Figure 6_3a
PM Annual Contour Plot Alternative Method 3



PLOT FILE OF ANNUAL VALUES FOR SOURCE GROUP: ALL

Max: 18.8 [ug/m^3] at (487196.35, 4786917.25)

COMMENTS:

SOURCES:
11

COMPANY NAME:
R. J. Burnside & Associates Limited

RECEPTORS:
5393

MODELER:
KS

OUTPUT TYPE:
Concentration

SCALE: 1:8,166

0 0.3 km

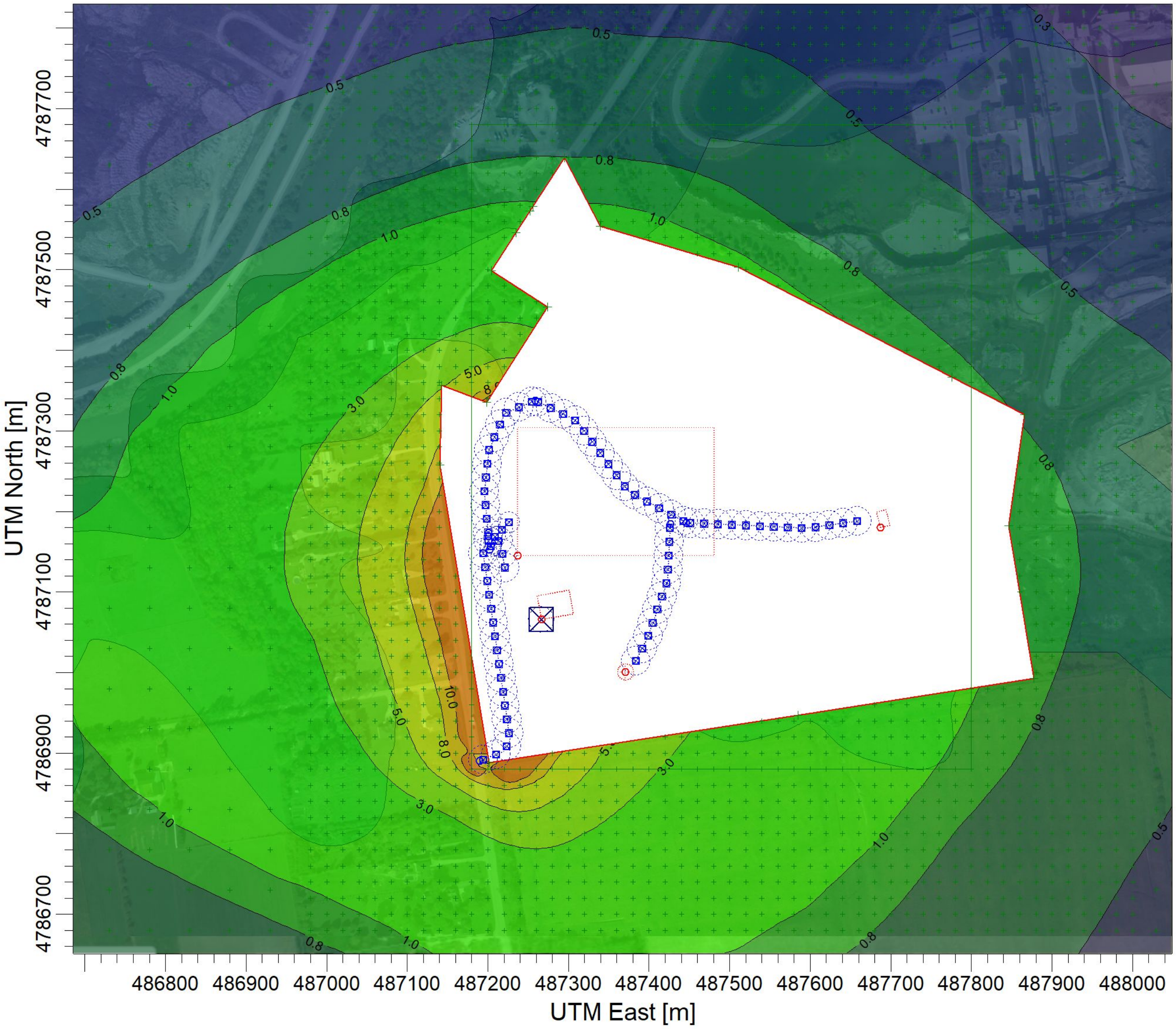
MAX:
18.8 ug/m^3

DATE:
4/24/2020

PROJECT NO.:
300032339.0000

PROJECT TITLE:

Figure 6_4a
PM Annual Contour Plot Alternative Method 4



PLOT FILE OF ANNUAL VALUES FOR SOURCE GROUP: ALL

ug/m^3

Max: 18.9 [ug/m^3] at (487196.35, 4786917.25)

🟪	🟪	▨	🟩	🟩	🟩	🟨	🟧	🟧	🟥
0.2	0.3	0.5	0.8	1.0	3.0	5.0	8.0	10.0	18.9

COMMENTS:

SOURCES:

11

COMPANY NAME:

R. J. Burnside & Associates Limited

RECEPTORS:

4483

MODELER:

KS

OUTPUT TYPE:

Concentration

SCALE:

1:8,576

0 0.3 km

MAX:

18.9 ug/m^3

DATE:

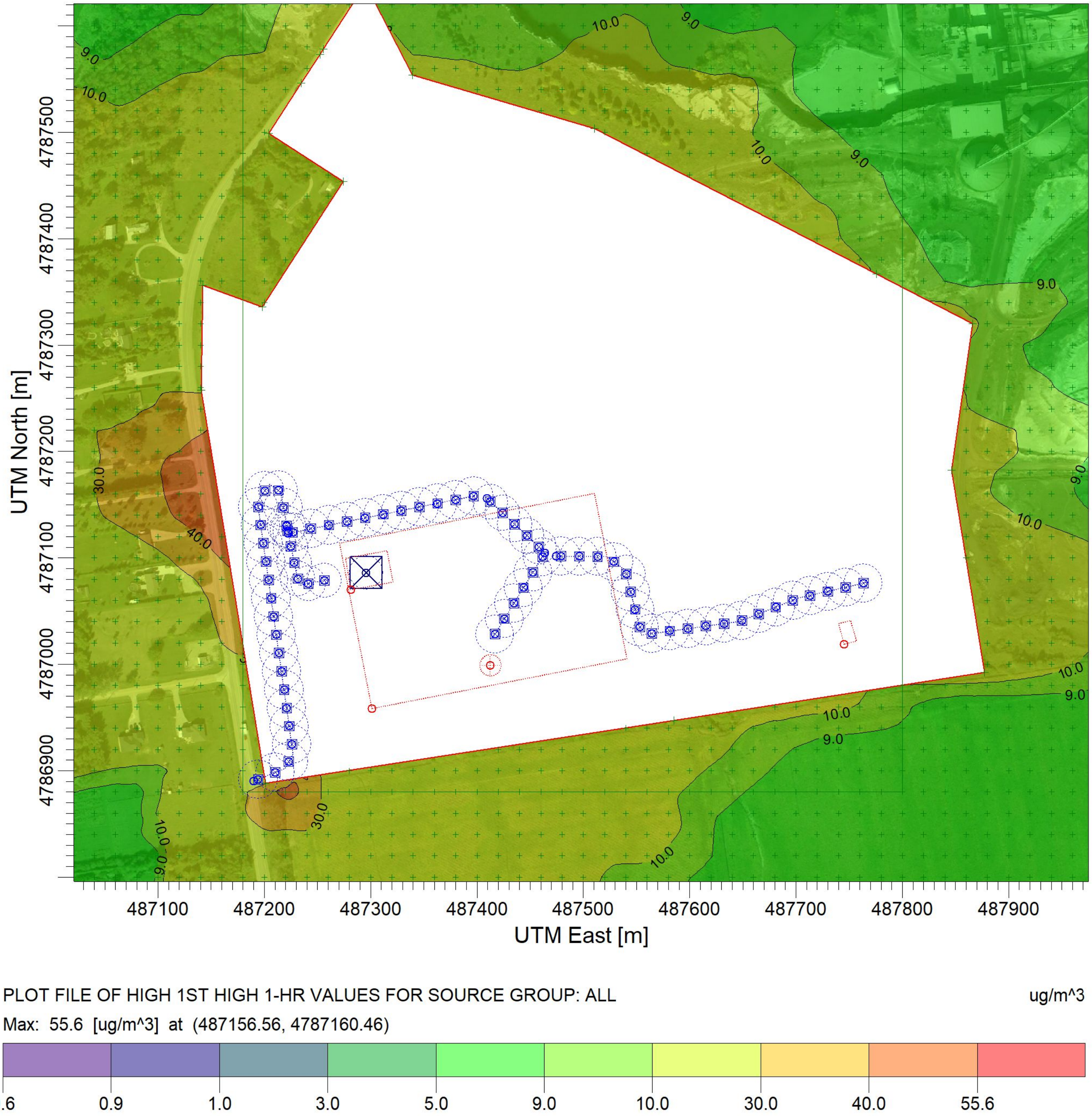
4/24/2020

PROJECT NO.:

300032339.0000

PROJECT TITLE:

Figure 7_E:
NOx 1-h Contour Plot Existing



PLOT FILE OF HIGH 1ST HIGH 1-HR VALUES FOR SOURCE GROUP: ALL

ug/m^3

Max: 55.6 [ug/m^3] at (487156.56, 4787160.46)

COMMENTS:

SOURCES:
11

COMPANY NAME:
R.J. Burnside & Associates Limited

RECEPTORS:
4483

MODELER:
H.Watson

OUTPUT TYPE:
Concentration

SCALE: 1:6,000

0 0.2 km

MAX:
55.6 ug/m^3

DATE:
7/2/2019

PROJECT NO.:
300032339.0000

PROJECT TITLE:

Figure 7_2:
NOx 1-h Contour Plot Alternative Method 2

PLOT FILE OF HIGH 1ST HIGH 1-HR VALUES FOR SOURCE GROUP: ALL

ug/m^3

Max: 42.1 [ug/m^3] at (487220.00, 4786880.00)

0.4 0.5 0.6 0.8 1.0 2.0 4.0 5.0 6.0 8.0 10.0 20.0 40.0 42.1

COMMENTS:

SOURCES:

11

COMPANY NAME:

R.J. Burnside & Associates Limited

RECEPTORS:

4483

MODELER:

H.Watson

OUTPUT TYPE:

Concentration

SCALE: 1:6,000

0 0.2 km

MAX:

42.1 ug/m^3

DATE:

7/2/2019

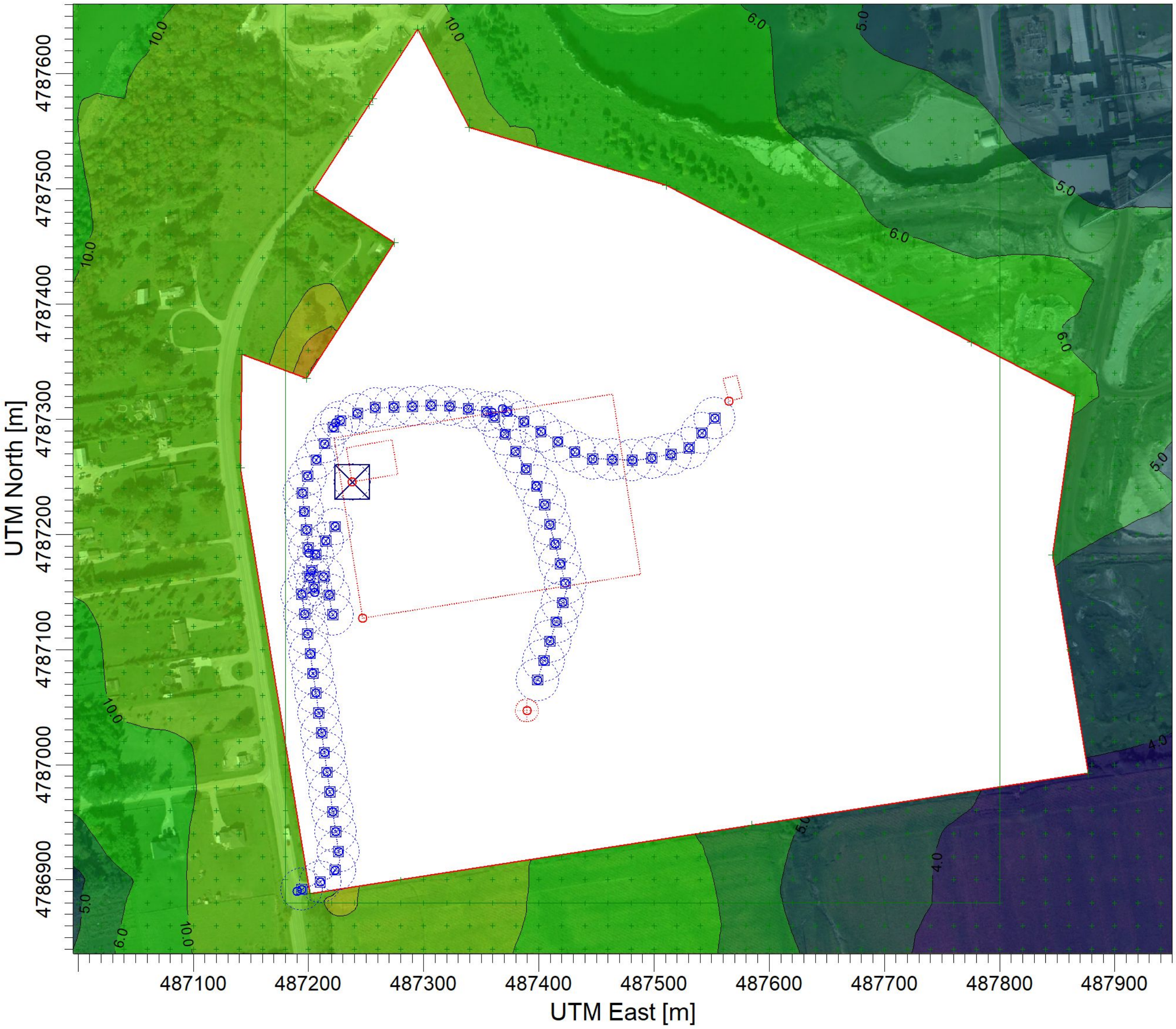
PROJECT NO.:

AERMOD View - Lakes Environmental Software

C:\AERMOD\St. Marys\032339\2019_2\MultiChem\St Mays.isc

PROJECT TITLE:

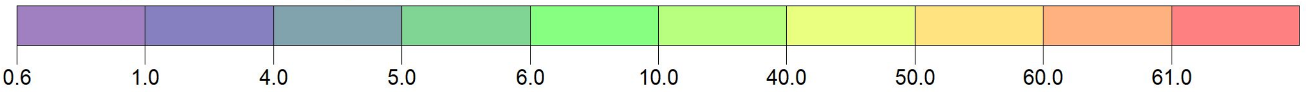
Figure 7_3:
NOx 1-h Contour Plot Alternative Method 3



PLOT FILE OF HIGH 1ST HIGH 1-HR VALUES FOR SOURCE GROUP: ALL

ug/m^3

Max: 61.0 [ug/m^3] at (487203.30, 4787343.51)



COMMENTS:

SOURCES:

11

COMPANY NAME:

R.J. Burnside & Associates Limited

RECEPTORS:

4483

MODELER:

H.Watson

OUTPUT TYPE:

Concentration

SCALE:

1:6,000

0 0.2 km

MAX:

61.0 ug/m^3

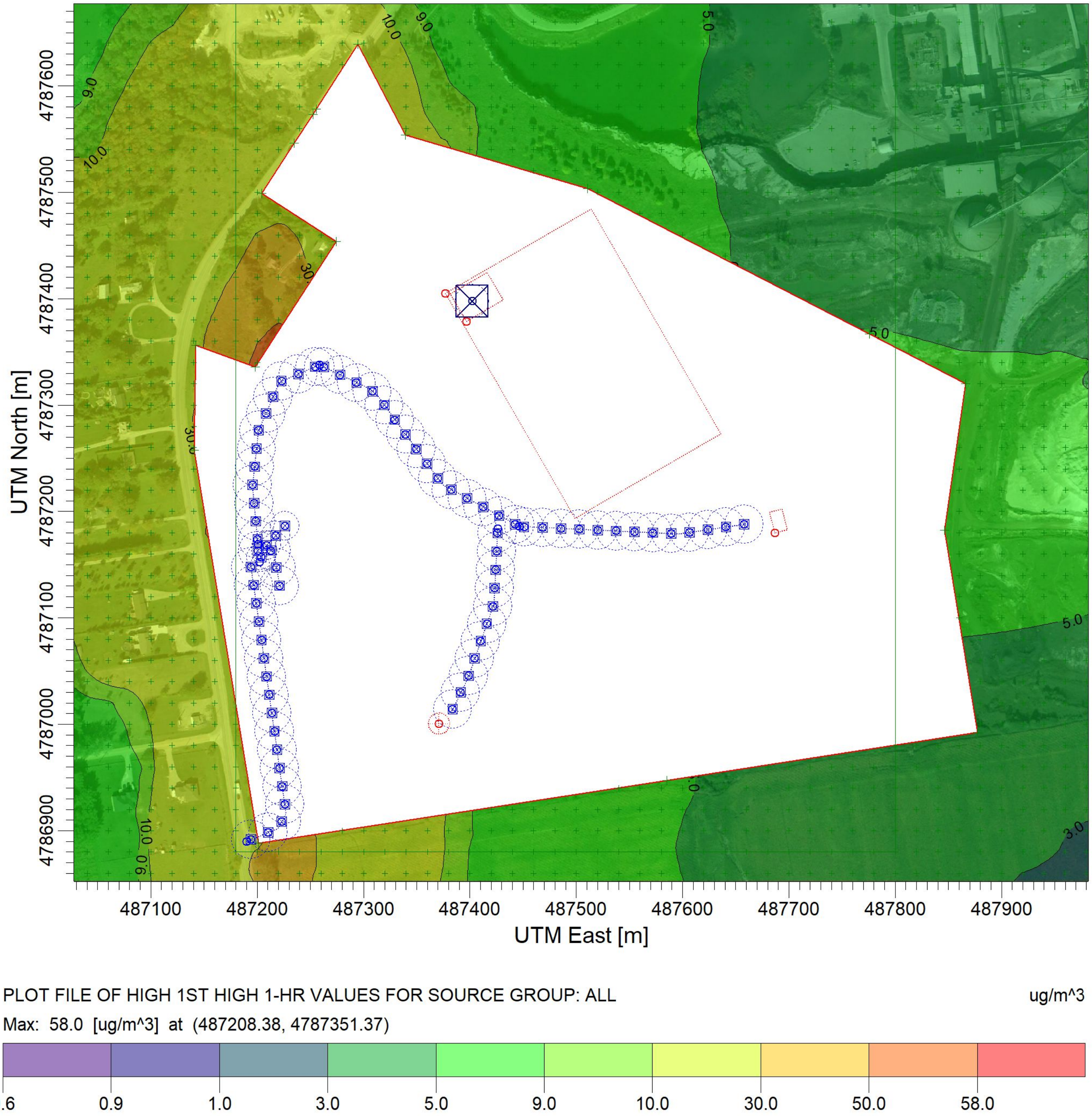
DATE:

7/2/2019

PROJECT NO.:

PROJECT TITLE:

Figure 7_4:
NOx 1-h Contour Plot Alternative Method 4



PLOT FILE OF HIGH 1ST HIGH 1-HR VALUES FOR SOURCE GROUP: ALL

ug/m^3

Max: 58.0 [ug/m^3] at (487208.38, 4787351.37)

COMMENTS:	SOURCES: **11**	COMPANY NAME: **R.J. Burnside & Associates Limited**
	RECEPTORS: **4483**	MODELER: **H.Watson**
	OUTPUT TYPE: **Concentration**	SCALE: 1:6,000 0 ▬▬ 0.2 km
	MAX: **58.0 ug/m^3**	DATE: **7/2/2019**
		PROJECT NO.:

AERMOD View - Lakes Environmental Software

C:\AERMOD\St. Marys\032339\2019_4\MultiChem\St Mays.isc

PROJECT TITLE:

Figure 8_3:
Worst Case Odour Contour Plot Alternative Method 3

PLOT FILE OF HIGH 1ST HIGH 1-HR VALUES FOR SOURCE GROUP: ALL OU/M**3

Max: 10.3 [OU/M**3] at (487198.22, 4787335.65)

1.0 3.0 4.0 5.0 6.0 7.0 8.0 10.0 10.3

COMMENTS:

SOURCES:
2

COMPANY NAME:
R.J. Burnside & Associates Limited

RECEPTORS:
4483

MODELER:
H.Watson

OUTPUT TYPE:
Concentration

SCALE: 1:6,000
0 0.2 km

MAX:
10.3 OU/M3**

DATE:
7/2/2019

PROJECT NO.:

Appendix A

Supporting Calculations

Appendix A
Supporting Calculations

1.0 Usage Rates

Please see Table 1 for maximum usage rates and list of combustion equipment corresponding to the operating conditions that would result in the maximum emission rate in accordance with s.10 and s.11 of O. Reg. 419/05.

2.0 Combustion Equipment:

Combustion equipment on Site is restricted to the compactor and loader. Scale house heat is provided by electric heaters.

3.0 Equipment Emissions

Emission Rates are calculated to match the averaging period of the contaminant so particulate emission rates are averaged over 24 hours while NOx and CO are averaged over 1 hour. As a result, the 24-hour NOx impact is based on 24 hours of operation at the 1-hour maximum rate and is a vast overestimate of the actual impact.

3.1 Perth Road 123/Water Street South, WS

Perth Road 123 runs north-south on the west side of the landfill. Water Street South begins at the point where the road bends to the east. The speed limit for Perth Road 123 is 80 km/h. The speed limit drops to 50 km/h on Water Street South.

Road emissions, considering only Perth Road 123 due to its higher speed limit, are Nitrogen Oxides (NOx), particulate matter (PM, PM10, and PM2.5), and carbon monoxide (CO).

All contaminant emission rates were calculated using the US EPA's MOVES emission model.

The emission Calculations are shown in Table EA-01: Off-Site Vehicle Emissions.

Methodology: Emission Factor ("EF")

The Annual Average Daily Traffic (AADT) for 2012 Perth Road 123/Water Street South was obtained from Perth County and is shown in the section of Table EA-01 titled "Traffic on Perth Road 123 (Weekday) – AADT" along with their vehicle weights.

The distance travelled is the length of the road in the Air Dispersion Model. The number of vehicles per day is calculated by multiplying the Total (AADT) by the % of vehicles of that type. The number of vehicles per hour is calculated by dividing the vehicles per day by 5 (assume that the worst-case hour sees 20 % of the daily total. Values are rounded to the nearest whole number. Note that the rule of thumb allocation is 10 % of the AADT in the peak hour so the method used doubles the normally expected peak hour traffic.

A summary of the MECP measurement data for NOx and PM$_{2.5}$ is shown under the heading "Measured Data (MECP Stn 15026 – London ON)". The values presented are the minimum, 10th percentile, 50th percentile (median), 90th percentile, and maximum.

The 90th Percentile value is used as part of the background.

MOVES was used to provide the emission factors for NOx, CO, PM$_{2.5}$, PM$_{10}$, and TSP (PM). The inputs to MOVES are listed below:

Time Span Year 2015
    Month January
    Days Weekdays
    Hours 00:00-23:59
On Road Vehicles Equipment
    Diesel Fuel Single Unit Short-haul Truck
    Gasoline - Passenger Car
    Gasoline - Passenger Truck
Road Type Rural Unrestricted
Pollutants CO Running Exhaust only
    NOx Running Exhaust only
    PM2.5 Running Exhaust only
    PM10 Running Exhaust only
Vehicle Speed
    80 km/h

The output from MOVES is shown in the section of Table EA-01 titled “MOVES Emission Rates (g/VMT)”.

Road dust entrained by passing vehicles is calculated using the methodology described in “"USEPA TTN CHIEF, AP-42, Fifth Edition, Volume I, Chapter 13, Section 13.2.1, Draft Section - June 10, 2010”.

Note that MOVES continues to predict lower emission rates in later years so the expected impact is lower than modelled.

Sample Calculation:

The “Distance travelled” in metres is the length of the road segment in the air dispersion model = 2394.3 m.

The “Distance travelled” in miles is the “Distance travelled” in m / 1609 = 2394.3 m/ 1609 = 1.488 miles.

The “Number of pick-up trucks” (per Day) is the Total * “% Pick-up Trucks” = 2189 * 2 % = 44 vehicles per day. The “Number of pick-up trucks” (per hour) is the “Number of pick- up trucks” (per Day) / 5 = 44 / 5 = 9 vehicles per hour. The “Total vehicles” is the sum of the three types of vehicles. The Total VKT is the “Total vehicles” * “Distance travelled (m)” / 1000 m/km = 2394.3 m * 438 / 1000 m/km = 1048 km.

The values in the table “Emission (g/time)” are calculated for NOx and CO by multiplying the number of vehicles per hour by the MOVES Emission Rates (g/VMT) for the appropriate vehicle type * “Distance travelled”. For NOx, 0.591 g/VMT * 9 vehicles/h *1.488 miles/vehicle = 7.698 g/h. The “Total (g/time)” is the sum of the three vehicle emissions = 7.698 + 263.287 + 161.549 = 432.534 g/h. The “Max (g/s) – 1h” = “Total (g/time)” / 3600 s/h = 432.534 g/h / 3600 g/s = 0.1201 g/s.

The values in the table “Emission (g/time)” are calculated for PM2.5, PM10, and TSP by multiplying the number of vehicles per day by the MOVES Emission Rates (g/VMT) for the appropriate vehicle type * “Distance travelled”. For PM2.5, 0.013 g/VMT * 44 vehicles/h * 1.488 miles/vehicle = 0.851 g/h. The “Total (g/time)” is the sum of the three vehicle emissions = 0.851 + 50.344 + 33.687 = 84.881 g/day. The “Average (g/s) - 24h” = “Total (g/time)” / 3600s/h = 84.881 g/h / (3600*24) g/s = 0.000982 g/s.

Particulate matter entrained by passing vehicles is calculated as described in the US EPA TTN CHIEF section of AP-42.

sL = 0.2 g/m2 is typical loading for paved roads

W = 2.25 * 2 % + 30 * 12 % + 1.75 * 86 % = 5.2 tons (fraction of each vehicle type times the weight of those vehicles)

S = 80 km/h / 1.609 km/mile = 49.7 miles per hour

P = 117.7 is the number of days with at least 0.245 mm (0.01 inches) of rain at the Stratford WWTP. Data at the London Airport was also examined but the number of days was larger at London Airport and the airport is farther from the site, so the Stratford data was used[5].

N = 365 for annual

The calculation of the values in the Road Dust Emission Rates table is described at the bottom of Table EA-01.

The “Total Average (g/s) – 24h” is the sum of “Average (g/s) - 24h” and “Rate (g/s)”. For PM2.5, Total Average (g/s) – 24h = 0.000982 + 0.0425 = 0.04348.

The bold values are used as the emission rates from the WS – Perth Road 123/Water Street source to determine the local background particulate, NOx and CO concentrations.

Data Quality: Above Average

Data quality for this calculation is best characterized by the following paragraph from Section 8.3.2 of the ESDM Procedure Document titled “Above-Average Data Quality” Emission Estimating Techniques:

> *Emission Factors: Emission rate estimates that are developed from tests on a moderate to large number of sources where the source category population is sufficiently specific to minimize variability (e.g., US EPA, AP-42, emission factor quality rating of A or B) are anticipated to provide above-average quality of emission rate estimates.*

Operating Condition, Individual Maximum Rates of Production:

3.2 On-Site Road Dust, TRKAB, TRKBC, TRKBD, TRKDE, TRKEF, and TRKEH

Vehicles traveling on gravel roads cause dust to be transported into the air. Particulate emissions, NOx and CO are also emitted by those vehicles as they consume fuel. This section calculates the amount of each contaminant from each source.

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[5] “Climate Normals for London 1981 to 2010 - normals-6148105-1981-2010.csv” and “Climate Normals for Stratford 1981 to 2010 -6148105-1981-2010.csv” downloaded from “http://climate.weather.gc.ca/climate_normals/index_e.html”.

The emission calculations for this source are shown on Table EA-02: On-Site Road Emissions.

Methodology: Emission Factor ("EF")

Based on the traffic study, the number of each kind of vehicle for weekdays and Saturdays was calculated. Because there are many more vehicles on Saturday but most of those vehicles are cars, it was not clear which day would result in the highest emission rate so both cases were examined for road dust. Upon finding that the maximum occurred during weekdays, the NOx, CO and particulate from vehicles were calculated for that same time period.

The road dust emission is calculated as recommended in AP-42 for industrial unpaved roads. The surface silt content is estimated at 6.4 % based on the median value provided in the AP-42 document for Municipal Solid Waste Landfills[6]. The other variables are taken from the same guidance documents[7].

The engine emissions are taken from the MOVES program output above except that the vehicle speed is 20 km/h.

Sample Calculation:

On weekdays, the peak number of vehicles per hour is 10 (8 leaving north, 1 leaving south, 1 entering landfill)[8]. The daily traffic is assumed to be 10 times the maximum hourly traffic during the week and 5 times the maximum hourly traffic on Saturday multiplied by 2 as all the vehicles will be entering and leaving the Site the same day. These estimates are very conservative because the landfill is open 8 hours per day on the weekdays (but permitted for 12), and 4 hours on Saturdays. The values above assume that the maximum hourly vehicles occur every hour the landfill is open.

In the section titled "Weekdays:" each road segment is listed in Table EA-02: On-Site Road Emissions. The length of each segment is shown in the next column. Paths are also shown in Figures 3 (E through 4). The number of trips per day is dependent on where various vehicles are expected to go. Every vehicle enters and leaves the site so the "# Trips per day" for segment AB is the total for the day. That total number of trips is split between the three vehicle types based on the % Med. Trucks, % Heavy Trucks and % Cars shown at the top of the page. For A-B, Cars = Trips * % cars = 200 * 91 % = 182.

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[6] https://www3.epa.gov/ttnchi1/ap42/ch13/final/c13s0202.pdf, Table 13.2.2-1 (p. 3 of 20)
[7] https://www3.epa.gov/ttnchi1/ap42/ch13/final/c13s0202.pdf, Table 13.2.2-2 (p. 5 of 20)
[8] 032339_TIS_Report.pdf Figure A4.

The value in “W: Mean vehicle weight (ton)” is the value assigned to the variable “W” in the emission equation. The value is calculated as the Average Vehicle Weight above times the “Number of Trips” for each type of vehicle divided by the total number of vehicles. For segment A-B, 0 * 2.25 ton + 18 * 30 ton + 182 * 1.75 ton = 4.3 ton.

The Vehicle km Travelled (VKT) = Segment Length * # Trips per day = 356 m * 200 vehicles/day /1000 m/km = 71.2 km.

The Vehicle Miles Travelled (VMT) = VKT / 1.609 = 71.2 / 1.609 = 44 miles.

The “E: Emission Rates (lb/VMT)” for PM2.5 = k(s/12)a*(W/3)b = 0.15 * (6.4 /12)0.9 * (4.3/3)0.45 = 0.1001 lb/VMT.

The “"Emission Rates (g/s) (24 h day)" =(44 VMT*0.1001)/ 2.2 lb/kg * 1000 g/kg / (3600 s/h * 24 h/day) = 0.0233 g/s.

The same process was used to assess the Saturday emissions which showed that the weekday emissions were much larger.

On the second page of Table EA-02, the data retrieved from MOVES is shown. The values in the table “Engine non-Particulate Emissions” are calculated in the same way as the same values on the first page except that the maximum number of vehicles per hour is used instead of total vehicles per day and The “Hourly E-Rate (g/h)” is calculated as the Emission Rate (g/mile)(from MOVES) * VMT.

For instance for NOx, “Hourly E-Rate (g/h)”= ((2 * 2.5 * 9.776581) + (9 * 2.5 * 0.528953)) / 11 trips = 5.39 g/h.

“Emission Rates (g/s) (1-h Max)” = “Hourly E-Rate (g/h)” /3600 s/h = 5.39 g/h / 3600 s/h= 0.0015 g/s.

“Engine Particulate Emissions:” is calculated the same way except that the total for the day is calculated and average over the day. Also, BMPP reduction of 90% was assumed for road dust.

“Total Particulate Emissions:” is the total of the various particulate emissions. For instance for PM2.5, “Emission Rates (g/s) (24-h Average)” = “Emission Rates (g/s) (24 h day)” from weekdays + “Emission Rates (g/s) (24 h day)” from “Engine Particulate Emissions:” = 0.02325 g/s * (1 - 0.9) + 0.000028 g/s = 0.0024 g/s.

The last page of this table scales the emissions for each segment based on the new length under the appropriate Alternative Method. There is one version for each scenario with the only difference the segment length for the appropriate scenario.

Data Quality: Above Average

Data quality for this calculation is best characterized by the following paragraph from Section 8.3.2 of the ESDM Procedure Document titled “Above-Average Data Quality” Emission Estimating Techniques states:

> *Emission Factors: Emission rate estimates that are developed from tests on a moderate to large number of sources where the source category population is sufficiently specific to minimize variability (e.g., US EPA, AP-42, emission factor quality rating of A or B) are anticipated to provide above-average quality of emission rate estimates.*

The US EPA data quality is listed as “B”.

Operating Condition, Individual Maximum Rates of Production:

The emission rate calculations for these sources are based on the maximum number of vehicles per hour for every hour of operation.

3.3 On-Site Non-Road Dust, ST, WF, and CA

Dust can be emitted when soil is disturbed by equipment moving the soil. This section calculates the emissions from the Stockpile (ST), Working Face (WF), and Composting Area (CA).

The emission calculations for this source are shown on Table EA-03: On-Site Non-Road Dust.

Methodology: Emission Factor (“EF”)

The emissions from these sources is calculated from the "USEPA TTN CHIEF, AP-42, Fifth Edition, Volume I, Chapter 13, Equation 13.2.4.(1). The table of “Particle size” and “k” is taken from the same document.

The wind speed “U” is taken from the meteorological data provided by the MECP.

The Stockpile holds soil used to cover the waste after it has been compacted. The waste is covered every operating day at the end of the day, including Saturdays. Under ideal operating conditions, if St. Marys was doing everything possible to extend the life of the landfill, they could also remove approximately half of the cover the next morning before adding new waste.

Because the cover material is stored for an extended period of time, the moisture content is estimated to be 5 %. The material is clay/dirt and 1 transfer location. The cover is estimated to be up to 2 tons per day so recovery the next morning would be 1 ton for a total of 3 ton. The area of the source is 314 m^2.

The AP-42 methodology is used to estimate the total particulate emission in each size fraction and then divided by the area to give an emission rate/m^2 for use in AERMOD.

The estimate for the working face is calculated in the same way except that some of the inputs are different. Municipal solid waste is estimated to be approximately 20 % moisture so 15 % was used to be conservative. The waste is closer to sand than dirt although this parameter is not used in the calculation. The facility can receive up to 62.5 tonnes/day of waste although it will rarely exceed half that amount and the working face is estimated to be 1200 m^2.

The estimate for the Composting Area is calculated in the same way except that some of the inputs are different. Compost is quite wet, with moisture content between 40 % and 60 %. 40 % was used to be conservative. The waste is a clay/dirt mix although this parameter is not used in the calculation. The facility can receive up to 25 tonnes/day of compostable material although it will rarely exceed half that amount and the active area of the composting pad is estimated to be 240 m^2.

The calculations are described in detail on the bottom of the page.

Sample Calculation:

The “Emission Factor” for $PM_{2.5}$ = k x 0.0016 x $(U/2.2)^{1.3}$ / $(M/2)^{1.4}$ = 0.053 * 0.0016* $((3.98/2.2)^{1.3})$ / $((5/2)^{1.4})$ = 0.00005081 kg /MG.

Emission Rates (kg/day) = Transfer points * Daily Turnover (T/0) * Emission Factor = 0.00005081 * 3 * 1 = 0.0001524 kg/day

Emission Rates (g/s) = Emission Rates (kg/day) *1000 g/kg / (24 h/day * 3600 s/h) =0.0001524 kg/day * 1000 g/kg /(24*3600) = 1.764E-06 g/s

Emission Rates (g/s/m^2) = Emission Rates (g/s)/area = 1.764E-06 g/s / 314.16 m^2 = 5.616E-09 g/s m^2.

Data Quality: Average

Data quality for this calculation is best characterized by the following paragraph from Section 8.3.3 of the ESDM Procedure Document titled “Average Data Quality” Emission Estimating Techniques states:

> *Emission Factors: Emission rate estimates that are developed from tests on a reasonable number of facilities where the source category population is sufficiently specific to minimize variability (e.g., US EPA, AP-42, emission factor quality rating of C) are anticipated to provide average quality emission rate estimates.*

Operating Condition, Individual Maximum Rates of Production:

The emission rate calculations for these sources are based on the largest amount of material passing through each group in 1 day.

3.4 On-Site Vehicle Emissions, CMPTR

There are two vehicles that work at the site, the loader and the compactor. It is possible for both vehicles to be on site at the same time but unlikely working. It is estimated that the total time spend in both vehicles is less than 20 minutes an hour. To be conservative, the compactor (higher emission rate) was assumed to be that vehicle for 20 minutes.

The emission calculations for this source are shown on Table EA-04: On-Site Vehicle Emissions.

Methodology: Emission Factor (“EF”)

The engines are expected to meet US EPA Tier 4 emission standards.

Sample Calculation:

The vehicle power rating is shown in hp and kW. There is 1 unit of each. For the NOx and CO (1-hour averaging) the largest machine is assumed to operate for 20 minutes of the hour. Over the working day, each machine will not exceed 2 hours of operation.

The Emission Factor is retrieved from the “Tier 4 Lookup” table at the bottom of the page. This table is constructed from the information at https://www.ecfr.gov/cgi-bin/text-idx?SID=5bd49186c6de428e7d6446a56baab96c&mc=true&node=pt40.36.1039&rgn=div5.

The Hourly Emission for NOx for the compactor = 175.2 kW * 1 unit * 33% * 1 h * 0.4 g/kW-h = 23.365 g/h.

The Emission Rate for NOx = 23.365 g/h / 3600 s/h = 0.006490 g/s.

Since the model uses an emission rate in g/s m^2, the total emission is divided by the area. NOx (g/s m^2) = NOx (g/s) / area = 0.006490 g/s / 1200 m^2 = 5.4086 * 10-6 g/s m^2.

The calculation for particulate is the same as NOx except the factors are different, and the emission is averaged over the 24-hour day because the particulate averaging period is 24 hours.

Data Quality: Above Average

Data quality for this calculation is best characterized by the following paragraph from Section 8.3.2 of the ESDM Procedure Document titled “Above-Average Data Quality” Emission Estimating Techniques states:

> *Engineering Calculations/Judgement: Emission rate estimates derived from fundamental scientific and engineering principles; and/or relevant empirical data can be considered above-average quality estimates if it is clear (e.g., the approach is recommended through MECP documentation) that the estimating technique will result in relatively conservative predictions.*

The emissions are the maximum emission allowed under the standard so they will exceed actual emissions.

3.5 Contaminant Screening

Table EA-05: Contaminant Screening assesses the relative impact of the contaminants to predict which contaminants should be investigated. The Table EA-05 is divided into 2 sections: top and bottom. The top section assesses products of combustion while the bottom assesses Landfill Gas (LFG). In each case, the emission rate (or concentration) is divided by the criterion for that contaminant for each averaging period which produces a Ratio. The Ratios in each averaging period are ranked with the highest value assigned 1. From each section, the highest ranked contaminants will show the highest fraction of their criterion when modelled. Therefore, modelling the highest ranked contaminants will ensure that the lower ranked contaminants meet criteria if the higher ranked contaminants meet criteria.

For instance, in the top section, the emission factor for nitrogen oxides from the loader and compactor is 0.4 g/kW-h. The maximum Emission Factor for CO is 5 g/kW-h and particulate matter is 0.02 g/kW-h. The standard limits Sulphur to 500 ppm in the source fuel so the Sulphur dioxide will be much less than 0.02 g/kW-h. For the 1-hour averaging period, the criteria are 400 µg/m^3 for NOx, 36,200 µg/m^3 for CO and 690 µg/m^3 for Sulphur dioxide. Dividing the first value by the second gives respectively (as shown in “Ratio - Emission Factor/Criterion” for “1hr”) 1.0E-03 for NOx, 1.4E-04 for CO, and 2.9E-06 for SOx. Therefore, NOx is ranked 1, CO is Ranked 2 and SOx is ranked 3. The top ranked contaminant is selected for modelling (highlighted green in Table). In some cases, the second ranked contaminant is also included (and highlighted).

CO has been added because it is typically a contaminant of concern in similar assessments. PM (total, PM_{10} and $PM_{2.5}$) has been added because there are sources that emit only particulate, so this methodology won't work for the particulate emissions.

Sulphur dioxide is not included despite typically being a contaminant of concern in similar assessments because the CO assessment will prove that the impact of CO is less than NOx so SOx will also be less than NOx.

The bottom portion of the table shows the emission rate of all landfill gas constituents (calculated on Table EA-06). The process is the same as described above.

The 1-hour ranking shows chlorobenzene as the highest ranked contaminant because the negligible limit was assigned to this contaminant because there is no published limit for this contaminant. As a result, vinyl chloride was added to the 1 hour because it has a published limit and it is generally a contaminant of concern from landfills. Only the highest ranked contaminants were selected for the remainder.

3.6 Landfill Gas, ACL

Table EA-06: Landfill Gas calculates the emission rate of landfill gas (LFG) components from the landfill. Table EA-06_E calculates the emission from the Existing landfill. Table EA-06_2-4 calculates the emission from the Alternative Methods. By using the LandGEM calculated emission rate and US EPA emission Factors.

Methodology: Engineering Calculation ("EC")

The United States Environmental Protection Agency's (USEPA's) LandGEM program was used to determine landfill gas (LFG) emissions. It was assumed that the waste types and quantity generated in the Town of St. Marys would remain the same regardless of the Alternative selected for disposal, and that the standard LandGEM modelling parameters would be applicable to the St. Marys landfill. For the modelling we built a table of waste tonnage placed during each year of the site's operation, beginning when it opened in 1984. The table also projected disposal tonnages during the EA planning period. This is what was meant when we indicated the modelling included the current waste.

From this data, LandGEM (v.3.02) determined:

- The waste in place as of December 2017 generated approximately 1,000,000 m3 of LFG.
- The peak LFG emission rate will reach 1,800,000 m3 one year after the site stops accepting waste (year 2057).

The amount of gas times the US EPA emission factor will give the emission rate.

No concentration was provided for Total landfill gas, Methane, or Carbon dioxide. Obviously, the Total Landfill Gas will be 100 % of the total landfill gas. Methane and carbon dioxide are also substantial fractions but since the concentration wasn't supplied, the LFG was assumed to be 50 % (500,000 ppm)[9] for both of these contaminants. This is a reasonable assumption.

The contaminants selected on Table EA-05 are highlighted in green for easy reference as are the emission rates in Table EA-06.

Sample Calculation:

The first three columns in the table are Compound Name, Concentration (ppmv), and Molecular Weight (g/mol). The Total Moles in 1 m^3 is n=PV/RT = 101.325 kPA * 1 L/(8.314 kPa L/ g-mol K * 298.15 K) = 40.88 mol.

For NMOC, the Moles of Contaminant (mol/m^3) = concentration / 1,000,000 * Total Moles in 1 m^3 = 4,000 / 1,000,000 * 40.88 mol = 0.1635 mol/m^3.

The Mass of Contaminant (g/m^3) = Moles of Contaminant (mol/m^3) * Molecular Weight (g/mol) = 0.1635 mol/m^3 * 86.18 g/mol = 14.09 g/m^3.

Flow Rate (m^3/s) = Total LFG emission converted to m^3/s = 1,800,000 m^3/yr / 365 days/yr / 24 h/day / 3600 s/h = 0.05717 m^3/s.

Mass Emission Rate (g/s) = Mass of Contaminant (g/m3) * Flow Rate (m^3/s) = 14.09 g/m^3 * 0.05717 m^3/s = 0.8056 g/s.

Mass Emission Rate (g/s/m^2) = Mass Emission Rate (g/s/) / Landfill Area = 0.0008056 g/s / (244.340*158.430) m^2 = 2.0811E-05 g/s/m^2.

Data Quality: Marginal

Data quality for this calculation is best characterized by the following paragraph from Section 8.3.4 of the ESDM Procedure Document titled "Marginal" or "Uncertain Data Quality" Emission Estimating Techniques states:

> *Calculations/Judgement: Emission rate estimates derived from calculations where the scientific/technical integrity of the approach is uncertain are considered to have uncertain data quality. In many cases, the use of emission rate estimating methodologies that are classified as*

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[9] https://www3.epa.gov/lmop/faq/landfill-gas.html

> *Marginal or Uncertain Data Quality may be the only available method. Where the maximum POI concentration is not approaching the MECP POI Limit (i.e., the POI concentration is less than 10% of the respective limit), emission rate estimates of*

This source information for this calculation is data from another location. Conservative assumptions have been used to account for the uncertainty.

Operating Condition, Individual Maximum Rates of Production:

The emission rate calculations for these sources are based on the samples of LFG from another Ontario Landfill.

3.7 Odour, WF, CA, Fug (_E - _4)

Table EA-07: Odour shows the parameters related to the odour emissions at the Site. The Odour emission rate at the working face is taken from another Ontario Landfill, “Ridge Landfill Environmental Screening [BFI Canada Inc.], Appendix F - Site Vicinity Air (Dust and Odour) Impact Assessment”, Table 9 (p. 34 of 43) (copy in Appendix F).

The fugitive odour related to landfill gas was estimated using 10,000 OU/m^3 as provided in the obsolete guide “Interim Guide to Estimate and Assess Landfill Air Impacts”, MECP, 1992.

Methodology: Engineering Calculation (EC)

Emission rates from the Ridge Landfill (1.1 OU/m^2) area assumed to be emitted from the working face. To be conservative, the emission rate from the compost area is assumed to be (1.1 OU/m^2). These values were adjusted prior to use in AERMOD to show the 10-minute average values instead of the 1-hour averages for comparison to the odour criteria.

In the Existing case, the entire amount emitted from the LandGem model for 2017 (67.49 cfm) was given an emission of 10,000 OU/m^3. For the alternative methods, the emission from the 2057 year (115.1 cfm) was averaged over the entire area (new and old). Note that this treatment overestimates the emissions from the Existing landfill as the future emissions in that area will be much lower than the average at the end of the landfill’s life.

Note that the landfill receives a significant fraction of industrial waste so the LandGem model, which assumes all municipal solid waste, is likely a substantial overestimate.

Sample Calculation:

The working face modelled emission rate = 1-hour emission * conversion factor = 1.1 OU/s m^2 * 1.65 = 1.817 OU/s m^2.

Similarly, the composting area modelled emission rate = 1-hour emission * conversion factor = 1.1 OU/s m^2 * 1.65 = 1.817 OU/s m^2.

Fugitive emission from Alternative Method 2 is calculated:

LFG e-rate (cfm) is the maximum LFG emission from the LandGem model = 115.1 cfm in 2057.

LFG e-rate (m^3/s) = LFG e-rate (cfm) * 0.00047194745 cfm / m^3/s = 0.05434 m^3/s

Concentration (OU/m^3): 10,000 OU/m^3

Odour emission (OU/s) = LFG e-rate (m^3/s) * Concentration (OU/m^3) = 0.05434 m^3/s * 10,000 OU/m^3 = 543.4 OU/s

Landfill Area (m^2) = 151,017 m^2

Landfill Area Flux (OU/s m^2) = Odour emission (OU/s) / Landfill Area (m^2) = 543.4 OU/s / 151,017 m^2 = 0.003598 OU/s m^2

Model Adjustment Factor (h:10min) = 1.65

Modelled Flux Rate (OU/s m^2) = Landfill Area Flux (OU/s m^2) * Model Adjustment Factor (h:10min) = 0.003598 OU/s m^2 * 1.65 = 0.005943 OU/s m^2

Data Quality: Marginal

Data quality for this calculation is best characterized by the following paragraph from Section 8.3.4 of the ESDM Procedure Document titled “Marginal” or “Uncertain Data Quality” Emission Estimating Techniques states:

> *Calculations/Judgement: Emission rate estimates derived from calculations where the scientific/technical integrity of the approach is uncertain are considered to have uncertain data quality.*
>
> *In many cases, the use of emission rate estimating methodologies that are classified as Marginal or Uncertain Data Quality may be the only available method. Where the maximum POI concentration is not approaching the MECP POI Limit (i.e., the POI concentration is less than 10% of the respective limit), emission rate estimates of*

This source information for this calculation is data from another location. Conservative assumptions have been used to account for the uncertainty.

Operating Condition, Individual Maximum Rates of Production:

The emission rate calculations for these sources are based on the samples of LFG from another Ontario Landfill.

Table EA-01:
Off-Site Vehicle Emissions
(June 2019)

Water St Emissions (background)
Traffic on Perth Road 123 (Weekday) - AADT

AADT	Total	% Pick-up Trucks	% Heavys	% Cars
2015	2189	2%	12%	86%
Average weights (tons)		2.25	30	1.75

Measured Data (MOECC Stn 15026 - London ON)

	NOx		PM2.5	
Min	0	ppb	0	µg/m3
10%	3	ppb	1	µg/m3
50%	8	ppb	5	µg/m3
90%	21	ppb	15	µg/m3
Max	208	ppb	74	µg/m3

Road description:	Paved Road	
Distance travelled:	987.9	m
Distance travelled:	0.614	miles

	per Hour	per Day
Number of pick-up trucks:	9	44
Number of trucks:	53	263
Number of cars:	377	1883
Total vehicles:	438	2189
Total VKT	433	2163

MOVES Emission Rates (g/VMT)

Vehicle	NOx	CO	PM2.5	PM10	TSP
Pick-up	0.591	2.688	0.013	0.015	0.015
Short Haul Truck	3.368	1.362	0.129	0.140	0.140
Car	0.288	1.568	0.012	0.014	0.014

Emission (g/time):

Pick-up	3.176	14.451	0.351	0.397	0.397
Short Haul Truck	108.634	43.945	20.772	22.578	22.578
Car	66.656	362.460	13.899	15.712	15.712
Total (g/time):	178.466	420.857	35.022	38.688	38.688
Max (g/s) -1h:	**0.0496**	**0.1169**			
Average (g/s) - 24h:			0.000405	0.000448	0.000448

Road Dust Emissions

sL = 0.2 g/m2 (road surface silt loading)
W = 5.2 tons (mean vehicle weight)
S = 49.7 average speed (mph) of the vehicles traveling the road
P = 117.7 Number of days with at least 0.245 mm (0.01 in.) of precipitaion per year
N = 365 number of days in the averaging period (e.g., 365 for annual, 91 for seasonal, 30 for monthly)

Road Dust Emission Rates:	PM2.5	PM10	PM30
k (g/VKT):	1.05	4.22	21.96
Factor (g/VKT) See Eqn 2:	0.1	0.6	3.1
Rate (g/s):	0.0037	0.0147	0.0764
Total Average (g/s) - 24h:	**0.00406**	**0.01513**	**0.07684**

Source:
Emissions calculated using "USEPA TTN CHIEF, AP-42, Fifth Edition, Volume I, Chapter 13, Section 13.2.1, Draft Section - June 10, 2010
Equation (2): E = [k x (sL/2)^0.98 x (W/3)^0.53 x (S/30)^0.16] x (1-P/(4xN))
1) Equation (2) accounts for precipitation on a daily basis
3) Use p = 150 (Buffalo, NY) as default value in the absence of site-specific information
4) TPM is assumed to be PM-30, as particles larger that 30 microns are assumed to fall back within property boundaries.
E = particulate emission factor in g/VKT
k = particle size multiplier in g/VKT

Quality rating:
PM10 and TPM: A
PM2.5 D

If using site specific silt loading and
Silt Loading: 0.03 - 400 g/m2
MV Weight 2.0 - 42 tons
MV Speed 1 - 55 mph

If using silt loading value from Table 13.2.1-2, quality rating reduced by 2 levels.

Recommended dafault silt loading (g/m2) values for public paved roads

Table 13.2.1-2					
ADT category	<500	500-5,000	5,000-10,000	>10,000	
Ubiquitous Baseline g/m2	0.6	0.2	0.06	0.03 0.015	limited access
Ubiquitous Winter Baseline	X4	X3	X2	X1	
Initial peak additive contribution	2	2	2	2	
Days to return to baseline conditions	7	3	1	0.5	

The winter baseline is represented as a multiple of the non-winter baseline, depending on the ADT value for the road in question.
As shown, a multiplier of 4 is applied for low volume roads (< 500 ADT) to obtain a wintertime baseline silt loading of 4 X 0.6 = 2.4 g/m2.

Table EA-02:
On-Site Road Emissions
(Jun 2020_E)

Max Hourly Vehicles:

	2015 Vehicles	Trips	% Med. Trucks	% Heavys	% Cars
Weekday	10	10	0%	9%	91%
Saturday	26	26	8%	0%	92%

Daily On-site traffic:

	2015	Trips	% Med.	% Heavys	% Cars	
Weekday	100	200	0%	9%	91%	*Obtained by multiplying a.m. OR p.m. peak hour (whichever is higher) volumes by 1*
Saturday	130	260	8%	0%	92%	*Obtained by multiplying a.m. peak hour volumes by 5*
Average Vehicle Weight			2.25	30	1.75	tons

Road description: Unpaved - Gravel

$E=k(s/12)^{a}*(W/3)^{b}$

S: Surface material silt content: 6.4 % https://www3.epa.gov/ttnchie1/ap42/ch13/final/c13s0202.pdf, Table 13.2.2-1

Constant	PM2.5	PM10	PM-30
k (lb/VMT)	0.15	1.5	4.9
a	0.9	0.9	0.7
b	0.45	0.45	0.45
Quality Rating	B	B	B

https://www3.epa.gov/ttnchie1/ap42/ch13/final/c13s0202.pdf, Table 13.2.2-2

Weekdays:

Road Segment	Segment Length (m)	# of Trips per Day	Number of Trips			W: Mean Vehicle Weight (ton)	VKT (km)	VMT (mi)	E: Emission Rates (lb/VMT)			Emission Rates (g/s) (24 h day)		
			Med Trucks	Heavy Trucks	Cars				PM2.5	PM10	TPM	PM2.5	PM10	TPM
A-B	356	200	0	18	182	4.3	71.2	44	0.1001	1.0009	3.7077	0.0233	0.2325	0.8614
B-C	85.9	18		18		30.0	1.5	1	0.2401	2.4010	8.8940	0.0012	0.0121	0.0449
B-D	182.5	184	0	2	182	2.1	33.6	21	0.0719	0.7189	2.6629	0.0079	0.0788	0.2918
D-E	71.4	9		9		30.0	0.6	0	0.2401	2.4010	8.8940	0.0005	0.0050	0.0186
E-F	94.3	9		9		30.0	0.8	1	0.2401	2.4010	8.8940	0.0007	0.0066	0.0246
E-H	351.5	9		9		30.0	3.2	2	0.2401	2.4010	8.8940	0.0025	0.0248	0.0918

Saturdays:

Emission Rates

Road Segment	Segment Length (m)	# of Trips per Day	Number of Trips			W: Mean Vehicle Weight (ton)	VKT (km)	VMT (mi)	Emission Rates (lb/VMT)			Emission Rates (g/s) (24 h day)		
			Med Trucks	Heavy Trucks	Cars				PM2.5	PM10	TPM	PM2.5	PM10	TPM
A-B	356	260	21	0	239	1.8	92.6	58	0.0675	0.6753	2.5014	0.0204	0.2039	0.7554
B-C	85.9	0		0		0.0	-	-	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
B-D	182.5	260	21	0	239	1.8	47.5	29	0.0675	0.6753	2.5014	0.0105	0.1045	0.3873
D-E	71.4	0		0		0.0	-	-	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
E-F	94.3	0		0		0.0	-	-	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
E-H	351.5	0		0		0.0	-	-	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

VKT - Vehicle Kilometres Travelled
VMT - Vehicle Miles Travelled

Source:
Emissions calculated using "USEPA TTN CHIEF, AP-42, Fifth Edition, Volume I, Chapter 13, 13.2.2, Draft Section - March 22, 2006
Equation 1a: E = [k x (s/12)^a x (W/3)^b]
Table 13.2.2-1 contains values for typical silt content

Table EA-02:
On-Site Road Emissions
(Jun 2020_E)

Emission Rate (g/mile) (from MOVES)

	NOx	CO	PM2.5	PM10	TSP
Car	0.379021	3.637447917	0.02349	0.026553	0.026553
Pick-up	0.678885	5.67886	0.022779	0.02575	0.02575
Truck	9.776581	3.55821	0.376363	0.409092	0.409092
Ave. Passe	0.528953	4.658153958	0.023134	0.026152	0.026152

Engine non-Particulate Emissions:

Road Segment	Segment Length (m)	# of Trips per Hour	Max Number of Vehicles/h			Mean Vehicle Weight, ton	VKT (km)	VMT (mi)	Hourly E-Rate (g/h)		Emission Rates (g/s) (1-h Max)	
			Med Trucks	Heavy Trucks	Cars				NOx	CO	NOx	CO
A-B	356	11	0	2	9	6.8	4.0	2.5	5.39	10.95	0.0015	0.0030
B-C	85.9	2		2		30.0	0.2	0.1	1.04	0.38	0.0003	0.0001
B-D	182.5	11	0	2	9	6.8	2.0	1.3	2.76	5.62	0.0008	0.0016
D-E	71.4	2		2		30.0	0.1	0.1	0.87	0.32	0.0002	0.0001
E-F	94.3	2		2		30.0	0.2	0.1	1.15	0.42	0.0003	0.0001
E-H	351.5	2		2		30.0	0.7	0.4	4.27	1.55	0.0012	0.0004

Engine Particulate Emissions:

Road Segment	Segment Length (m)	# of Trips per Day	Number of			Mean Vehicle Weight, ton	VKT (km)	VMT (mi)	Daily Emission Rate (g/day)			Emission Rates (g/s) (24-h Average)		
			Med Trucks	Heavy Trucks	Cars				PM2.5	PM10	TSP	PM2.5	PM10	TSP
A-B	356	200	0	18	182	4.3	71.2	44	2.43	2.68	2.68	0.000028	0.000031	0.000031
B-C	85.9	12		12		30.0	1.0	1	0.24	0.26	0.26	0.000003	0.000003	0.000003
B-D	182.5	192	0	10	182	3.2	35.0	22	0.90	1.00	1.00	0.000010	0.000012	0.000012
D-E	71.4	10		10		30.0	0.7	0	0.17	0.18	0.18	0.000002	0.000002	0.000002
E-F	94.3	10		10		30.0	0.9	1	0.22	0.24	0.24	0.000003	0.000003	0.000003
E-H	351.5	8		8		30.0	2.8	2	0.66	0.71	0.71	0.000008	0.000008	0.000008

Total Particulate Emissions:

Road Segment	Segment Length (m)	# of Trips per Day	Number of			Mean Vehicle Weight, ton	VKT (km)	VMT (mi)	BMPP Reduction			Emission Rates (g/s) (24-h Average)		
			Med Trucks	Heavy Trucks	Cars				PM2.5	PM10	TSP	PM2.5	PM10	TSP
A-B	356	200	0	18	182	4.3	71.2	44	0.90	0.90	0.90	0.0024	0.0233	0.0862
B-C	85.9	24		24		30.0	2.1	1	0.90	0.90	0.90	0.0001	0.0012	0.0045
B-D	182.5	190	0	8	182	2.9	34.7	22	0.90	0.90	0.90	0.0008	0.0079	0.0292
D-E	71.4	9		9		30.0	0.6	0	0.90	0.90	0.90	0.0001	0.0005	0.0019
E-F	94.3	9		9		30.0	0.8	1	0.90	0.90	0.90	0.0001	0.0007	0.0025
E-H	351.5	9		9		30.0	3.2	2	0.90	0.90	0.90	0.0003	0.0025	0.0092

Table EA-02:
On-Site Road Emissions
(Jun 2020_2)

Max Hourly Vehicles:

	2015 Vehicles	Trips	% Med. Trucks	% Heavys	% Cars
Weekday	10	10	0%	9%	91%
Saturday	26	26	8%	0%	92%

Daily On-site traffic:

	2015	Trips	% Med.	% Heavys	% Cars	
Weekday	100	200	0%	9%	91%	*Obtained by multiplying a.m. OR p.m. peak hour (whichever is higher) volumes by 1*
Saturday	130	260	8%	0%	92%	*Obtained by multiplying a.m. peak hour volumes by 5*
Average Vehicle Weight			2.25	30	1.75	tons

Road description: Unpaved - Gravel

$E=k(s/12)^{a}*(W/3)^{b}$

S: Surface material silt content: 6.4 % https://www3.epa.gov/ttnchie1/ap42/ch13/final/c13s0202.pdf, Table 13.2.2-1

Constant	PM2.5	PM10	PM-30
k (lb/VMT)	0.15	1.5	4.9
a	0.9	0.9	0.7
b	0.45	0.45	0.45
Quality Rating	B	B	B

https://www3.epa.gov/ttnchie1/ap42/ch13/final/c13s0202.pdf, Table 13.2.2-2

Weekdays:

Road Segment	Segment Length (m)	# of Trips per Day	Number of Trips			W: Mean Vehicle Weight (ton)	VKT (km)	VMT (mi)	E: Emission Rates (lb/VMT)			Emission Rates (g/s) (24 h day)		
			Med Trucks	Heavy Trucks	Cars				PM2.5	PM10	TPM	PM2.5	PM10	TPM
A-B	356	200	0	18	182	4.3	71.2	44	0.1001	1.0009	3.7077	0.0233	0.2325	0.8614
B-C	230.1	18		18		30.0	4.1	3	0.2401	2.4010	8.8940	0.0032	0.0324	0.1202
B-D	397.8	184	0	2	182	2.1	73.2	45	0.0719	0.7189	2.6629	0.0172	0.1717	0.6360
D-E	202	9		9		30.0	1.8	1	0.2401	2.4010	8.8940	0.0014	0.0142	0.0528
E-F	184	9		9		30.0	1.7	1	0.2401	2.4010	8.8940	0.0013	0.0130	0.0481
E-H	266.5	9		9		30.0	2.4	1	0.2401	2.4010	8.8940	0.0019	0.0188	0.0696

Saturdays:

Emission Rates

Road Segment	Segment Length (m)	# of Trips per Day	Number of Trips			W: Mean Vehicle Weight (ton)	VKT (km)	VMT (mi)	Emission Rates (lb/VMT)			Emission Rates (g/s) (24 h day)		
			Med Trucks	Heavy Trucks	Cars				PM2.5	PM10	TPM	PM2.5	PM10	TPM
A-B	356	260	21	0	239	1.8	92.6	58	0.0675	0.6753	2.5014	0.0204	0.2039	0.7554
B-C	230.1	0		0		0.0	-	-	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
B-D	397.8	260	21	0	239	1.8	103.4	64	0.0675	0.6753	2.5014	0.0228	0.2279	0.8441
D-E	202	0		0		0.0	-	-	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
E-F	184	0		0		0.0	-	-	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
E-H	266.5	0		0		0.0	-	-	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

VKT - Vehicle Kilometres Travelled
VMT - Vehicle Miles Travelled

Source:
Emissions calculated using "USEPA TTN CHIEF, AP-42, Fifth Edition, Volume I, Chapter 13, 13.2.2, Draft Section - March 22, 2006
Equation 1a: E = [k x (s/12)^a x (W/3)^b]
Table 13.2.2-1 contains values for typical silt content

Table EA-02:
On-Site Road Emissions
(Jun 2020_2)

Emission Rate (g/mile) (from MOVES)

	NOx	CO	PM2.5	PM10	TSP
Car	0.379021	3.637447917	0.02349	0.026553	0.026553
Pick-up	0.678885	5.67886	0.022779	0.02575	0.02575
Truck	9.776581	3.55821	0.376363	0.409092	0.409092
Ave. Passe	0.528953	4.658153958	0.023134	0.026152	0.026152

Engine non-Particulate Emissions:

Road Segment	Segment Length (m)	# of Trips per Hour	Max Number of Vehicles/h			Mean Vehicle Weight, ton	VKT (km)	VMT (mi)	Hourly E-Rate (g/h)		Emission Rates (g/s) (1-h Max)	
			Med Trucks	Heavy Trucks	Cars				NOx	CO	NOx	CO
A-B	356	11	0	2	9	6.8	4.0	2.5	5.39	10.95	0.0015	0.0030
B-C	230.1	2		2		30.0	0.5	0.3	2.80	1.02	0.0008	0.0003
B-D	397.8	11	0	2	9	6.8	4.4	2.7	6.02	12.24	0.0017	0.0034
D-E	202	2		2		30.0	0.4	0.3	2.45	0.89	0.0007	0.0002
E-F	184	2		2		30.0	0.4	0.2	2.24	0.81	0.0006	0.0002
E-H	266.5	2		2		30.0	0.5	0.3	3.24	1.18	0.0009	0.0003

Engine Particulate Emissions:

Road Segment	Segment Length (m)	# of Trips per Day	Number of			Mean Vehicle Weight, ton	VKT (km)	VMT (mi)	Daily Emission Rate (g/day)			Emission Rates (g/s) (24-h Average)		
			Med Trucks	Heavy Trucks	Cars				PM2.5	PM10	TSP	PM2.5	PM10	TSP
A-B	356	200	0	18	182	4.3	71.2	44	2.43	2.68	2.68	0.000028	0.000031	0.000031
B-C	230.1	12		12		30.0	2.8	2	0.65	0.70	0.70	0.000007	0.000008	0.000008
B-D	397.8	192	0	10	182	3.2	76.4	47	1.97	2.19	2.19	0.000023	0.000025	0.000025
D-E	202	10		10		30.0	2.0	1	0.47	0.51	0.51	0.000005	0.000006	0.000006
E-F	184	10		10		30.0	1.8	1	0.43	0.47	0.47	0.000005	0.000005	0.000005
E-H	266.5	8		8		30.0	2.1	1	0.50	0.54	0.54	0.000006	0.000006	0.000006

Total Particulate Emissions:

Road Segment	Segment Length (m)	# of Trips per Day	Number of			Mean Vehicle Weight, ton	VKT (km)	VMT (mi)	BMPP Reduction			Emission Rates (g/s) (24-h Average)		
			Med Trucks	Heavy Trucks	Cars				PM2.5	PM10	TSP	PM2.5	PM10	TSP
A-B	356	200	0	18	182	4.3	71.2	44	0.90	0.90	0.90	0.0024	0.0233	0.0862
B-C	230.1	24		24		30.0	5.5	3	0.90	0.90	0.90	0.0003	0.0033	0.0120
B-D	397.8	190	0	8	182	2.9	75.6	47	0.90	0.90	0.90	0.0017	0.0172	0.0636
D-E	202	9		9		30.0	1.8	1	0.90	0.90	0.90	0.0001	0.0014	0.0053
E-F	184	9		9		30.0	1.7	1	0.90	0.90	0.90	0.0001	0.0013	0.0048
E-H	266.5	9		9		30.0	2.4	1	0.90	0.90	0.90	0.0002	0.0019	0.0070

Table EA-02:
On-Site Road Emissions
(Jun 2020_3)

Max Hourly Vehicles:

	2015 Vehicles	Trips	% Med. Trucks	% Heavys	% Cars
Weekday	10	10	0%	9%	91%
Saturday	26	26	8%	0%	92%

Daily On-site traffic:

	2015	Trips	% Med.	% Heavys	% Cars	
Weekday	100	200	0%	9%	91%	*Obtained by multiplying a.m. OR p.m. peak hour (whichever is higher) volumes by 1*
Saturday	130	260	8%	0%	92%	*Obtained by multiplying a.m. peak hour volumes by 5*
Average Vehicle Weight			2.25	30	1.75	tons

Road description: Unpaved - Gravel

$E=k(s/12)^{a}*(W/3)^{b}$

S: Surface material silt content: 6.4 % https://www3.epa.gov/ttnchie1/ap42/ch13/final/c13s0202.pdf, Table 13.2.2-1

Constant	PM2.5	PM10	PM-30
k (lb/VMT)	0.15	1.5	4.9
a	0.9	0.9	0.7
b	0.45	0.45	0.45
Quality Rating	B	B	B

https://www3.epa.gov/ttnchie1/ap42/ch13/final/c13s0202.pdf, Table 13.2.2-2

Weekdays:

Road Segment	Segment Length (m)	# of Trips per Day	Number of Trips			W: Mean Vehicle Weight (ton)	VKT (km)	VMT (mi)	E: Emission Rates (lb/VMT)			Emission Rates (g/s) (24 h day)		
			Med Trucks	Heavy Trucks	Cars				PM2.5	PM10	TPM	PM2.5	PM10	TPM
A-B	356	200	0	18	182	4.3	71.2	44	0.1001	1.0009	3.7077	0.0233	0.2325	0.8614
B-C	68.3	18		18		30.0	1.2	1	0.2401	2.4010	8.8940	0.0010	0.0096	0.0357
B-D	121	184	0	2	182	2.1	22.3	14	0.0719	0.7189	2.6629	0.0052	0.0522	0.1934
D-E	138.7	9		9		30.0	1.2	1	0.2401	2.4010	8.8940	0.0010	0.0098	0.0362
E-F	255.9	9		9		30.0	2.3	1	0.2401	2.4010	8.8940	0.0018	0.0180	0.0668
E-H	214.8	9		9		30.0	1.9	1	0.2401	2.4010	8.8940	0.0015	0.0151	0.0561

Saturdays:

Emission Rates

Road Segment	Segment Length (m)	# of Trips per Day	Number of Trips			W: Mean Vehicle Weight (ton)	VKT (km)	VMT (mi)	Emission Rates (lb/VMT)			Emission Rates (g/s) (24 h day)		
			Med Trucks	Heavy Trucks	Cars				PM2.5	PM10	TPM	PM2.5	PM10	TPM
A-B	356	260	21	0	239	1.8	92.6	58	0.0675	0.6753	2.5014	0.0204	0.2039	0.7554
B-C	68.3	0		0		0.0	-	-	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
B-D	121	260	21	0	239	1.8	31.5	20	0.0675	0.6753	2.5014	0.0069	0.0693	0.2568
D-E	138.7	0		0		0.0	-	-	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
E-F	255.9	0		0		0.0	-	-	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
E-H	214.8	0		0		0.0	-	-	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

VKT - Vehicle Kilometres Travelled
VMT - Vehicle Miles Travelled

Source:
Emissions calculated using "USEPA TTN CHIEF, AP-42, Fifth Edition, Volume I, Chapter 13, 13.2.2, Draft Section - March 22, 2006
Equation 1a: E = [k x (s/12)^a x (W/3)^b]
Table 13.2.2-1 contains values for typical silt content

The Corporation of the Town of St. Marys
St. Marys, Ontario

Project No.: 032339

Table EA-02:
On-Site Road Emissions
(Jun 2020_3)

Emission Rate (g/mile) (from MOVES)

	NOx	CO	PM2.5	PM10	TSP
Car	0.379021	3.637447917	0.02349	0.026553	0.026553
Pick-up	0.678885	5.67886	0.022779	0.02575	0.02575
Truck	9.776581	3.55821	0.376363	0.409092	0.409092
Ave. Passe	0.528953	4.658153958	0.023134	0.026152	0.026152

Engine non-Particulate Emissions:

Road Segment	Segment Length (m)	# of Trips per Hour	Max Number of Vehicles/h			Mean Vehicle Weight, ton	VKT (km)	VMT (mi)	Hourly E-Rate (g/h)		Emission Rates (g/s) (1-h Max)	
			Med Trucks	Heavy Trucks	Cars				NOx	CO	NOx	CO
A-B	356	11	0	2	9	6.8	4.0	2.5	5.39	10.95	**0.0015**	**0.0030**
B-C	68.3	2		2		30.0	0.1	0.1	0.83	0.30	**0.0002**	**0.0001**
B-D	121	11	0	2	9	6.8	1.3	0.8	1.83	3.72	**0.0005**	**0.0010**
D-E	138.7	2		2		30.0	0.3	0.2	1.69	0.61	**0.0005**	**0.0002**
E-F	255.9	2		2		30.0	0.5	0.3	3.11	1.13	**0.0009**	**0.0003**
E-H	214.8	2		2		30.0	0.4	0.3	2.61	0.95	**0.0007**	**0.0003**

Engine Particulate Emissions:

Road Segment	Segment Length (m)	# of Trips per Day	Number of			Mean Vehicle Weight, ton	VKT (km)	VMT (mi)	Daily Emission Rate (g/day)			Emission Rates (g/s) (24-h Average)		
			Med Trucks	Heavy Trucks	Cars				PM2.5	PM10	TSP	PM2.5	PM10	TSP
A-B	356	200	0	18	182	4.3	71.2	44	2.43	2.68	2.68	0.0000	0.0000	0.0000
B-C	68.3	12		12		30.0	0.8	1	0.19	0.21	0.21	0.0000	0.0000	0.0000
B-D	121	192	0	10	182	3.2	23.2	14	0.60	0.67	0.67	0.0000	0.0000	0.0000
D-E	138.7	10		10		30.0	1.4	1	0.32	0.35	0.35	0.0000	0.0000	0.0000
E-F	255.9	10		10		30.0	2.6	2	0.60	0.65	0.65	0.0000	0.0000	0.0000
E-H	214.8	8		8		30.0	1.7	1	0.40	0.44	0.44	0.0000	0.0000	0.0000

Total Particulate Emissions:

Road Segment	Segment Length (m)	# of Trips per Day	Number of			Mean Vehicle Weight, ton	VKT (km)	VMT (mi)	BMPP Reduction			Emission Rates (g/s) (24-h Average)		
			Med Trucks	Heavy Trucks	Cars				PM2.5	PM10	TSP	PM2.5	PM10	TSP
A-B	356	200	0	18	182	4.3	71.2	44	0.90	0.90	0.90	**0.0024**	**0.0233**	**0.0862**
B-C	68.3	24		24		30.0	1.6	1	0.90	0.90	0.90	**0.0001**	**0.0010**	**0.0036**
B-D	121	190	0	8	182	2.9	23.0	14	0.90	0.90	0.90	**0.0005**	**0.0052**	**0.0194**
D-E	138.7	9		9		30.0	1.2	1	0.90	0.90	0.90	**0.0001**	**0.0010**	**0.0036**
E-F	255.9	9		9		30.0	2.3	1	0.90	0.90	0.90	**0.0002**	**0.0018**	**0.0067**
E-H	214.8	9		9		30.0	1.9	1	0.90	0.90	0.90	**0.0002**	**0.0015**	**0.0056**

Table EA-02:
On-Site Road Emissions
(Jun 2020_4)

Max Hourly Vehicles:

	2015 Vehicles	Trips	% Med. Trucks	% Heavys	% Cars
Weekday	10	10	0%	9%	91%
Saturday	26	26	8%	0%	92%

Daily On-site traffic:

	2015	Trips	% Med.	% Heavys	% Cars	
Weekday	100	200	0%	9%	91%	*Obtained by multiplying a.m. OR p.m. peak hour (whichever is higher) volumes by 1*
Saturday	130	260	8%	0%	92%	*Obtained by multiplying a.m. peak hour volumes by 5*
Average Vehicle Weight			2.25	30	1.75	tons

Road description: Unpaved - Gravel

$E=k(s/12)^{a}*(W/3)^{b}$

S: Surface material silt content: 6.4 % https://www3.epa.gov/ttnchie1/ap42/ch13/final/c13s0202.pdf, Table 13.2.2-1

Constant	PM2.5	PM10	PM-30
k (lb/VMT)	0.15	1.5	4.9
a	0.9	0.9	0.7
b	0.45	0.45	0.45
Quality Rating	B	B	B

https://www3.epa.gov/ttnchie1/ap42/ch13/final/c13s0202.pdf, Table 13.2.2-2

Weekdays:

Road Segment	Segment Length (m)	# of Trips per Day	Number of Trips			W: Mean Vehicle Weight (ton)	VKT (km)	VMT (mi)	E: Emission Rates (lb/VMT)			Emission Rates (g/s) (24 h day)		
			Med Trucks	Heavy Trucks	Cars				PM2.5	PM10	TPM	PM2.5	PM10	TPM
A-B	356	200	0	18	182	4.3	71.2	44	0.1001	1.0009	3.7077	0.0233	0.2325	0.8614
B-C	46.8	18		18		30.0	0.8	1	0.2401	2.4010	8.8940	0.0007	0.0066	0.0244
B-D	198.1	184	0	2	182	2.1	36.5	23	0.0719	0.7189	2.6629	0.0085	0.0855	0.3167
D-E	247.9	9		9		30.0	2.2	1	0.2401	2.4010	8.8940	0.0017	0.0175	0.0647
E-F	181.8	9		9		30.0	1.6	1	0.2401	2.4010	8.8940	0.0013	0.0128	0.0475
E-H	216.8	9		9		30.0	2.0	1	0.2401	2.4010	8.8940	0.0015	0.0153	0.0566

Saturdays:

Emission Rates

Road Segment	Segment Length (m)	# of Trips per Day	Number of Trips			W: Mean Vehicle Weight (ton)	VKT (km)	VMT (mi)	Emission Rates (lb/VMT)			Emission Rates (g/s) (24 h day)		
			Med Trucks	Heavy Trucks	Cars				PM2.5	PM10	TPM	PM2.5	PM10	TPM
A-B	356	260	21	0	239	1.8	92.6	58	0.0675	0.6753	2.5014	0.0204	0.2039	0.7554
B-C	46.8	0		0		0.0	-	-	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
B-D	198.1	260	21	0	239	1.8	51.5	32	0.0675	0.6753	2.5014	0.0113	0.1135	0.4204
D-E	247.9	0		0		0.0	-	-	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
E-F	181.8	0		0		0.0	-	-	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
E-H	216.8	0		0		0.0	-	-	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

VKT - Vehicle Kilometres Travelled
VMT - Vehicle Miles Travelled

Source:
Emissions calculated using "USEPA TTN CHIEF, AP-42, Fifth Edition, Volume I, Chapter 13, 13.2.2, Draft Section - March 22, 2006
Equation 1a: E = [k x (s/12)^a x (W/3)^b]
Table 13.2.2-1 contains values for typical silt content

Table EA-02:
On-Site Road Emissions
(Jun 2020_4)

Emission Rate (g/mile) (from MOVES)

	NOx	CO	PM2.5	PM10	TSP
Car	0.379021	3.637447917	0.02349	0.026553	0.026553
Pick-up	0.678885	5.67886	0.022779	0.02575	0.02575
Truck	9.776581	3.55821	0.376363	0.409092	0.409092
Ave. Passe	0.528953	4.658153958	0.023134	0.026152	0.026152

Engine non-Particulate Emissions:

Road Segment	Segment Length (m)	# of Trips per Hour	Max Number of Vehicles/h			Mean Vehicle Weight, ton	VKT (km)	VMT (mi)	Hourly E-Rate (g/h)		Emission Rates (g/s) (1-h Max)	
			Med Trucks	Heavy Trucks	Cars				NOx	CO	NOx	CO
A-B	356	11	0	2	9	6.8	4.0	2.5	5.39	10.95	**0.0015**	**0.0030**
B-C	46.8	2		2		30.0	0.1	0.1	0.57	0.21	**0.0002**	**0.0001**
B-D	198.1	11	0	2	9	6.8	2.2	1.4	3.00	6.10	**0.0008**	**0.0017**
D-E	247.9	2		2		30.0	0.5	0.3	3.01	1.10	**0.0008**	**0.0003**
E-F	181.8	2		2		30.0	0.4	0.2	2.21	0.80	**0.0006**	**0.0002**
E-H	216.8	2		2		30.0	0.4	0.3	2.63	0.96	**0.0007**	**0.0003**

Engine Particulate Emissions:

Road Segment	Segment Length (m)	# of Trips per Day	Number of			Mean Vehicle Weight, ton	VKT (km)	VMT (mi)	Daily Emission Rate (g/day)			Emission Rates (g/s) (24-h Average)		
			Med Trucks	Heavy Trucks	Cars				PM2.5	PM10	TSP	PM2.5	PM10	TSP
A-B	356	200	0	18	182	4.3	71.2	44	2.43	2.68	2.68	0.0000	0.0000	0.0000
B-C	46.8	12		12		30.0	0.6	0	0.13	0.14	0.14	0.0000	0.0000	0.0000
B-D	198.1	192	0	10	182	3.2	38.0	24	0.98	1.09	1.09	0.0000	0.0000	0.0000
D-E	247.9	10		10		30.0	2.5	2	0.58	0.63	0.63	0.0000	0.0000	0.0000
E-F	181.8	10		10		30.0	1.8	1	0.43	0.46	0.46	0.0000	0.0000	0.0000
E-H	216.8	8		8		30.0	1.7	1	0.41	0.44	0.44	0.0000	0.0000	0.0000

Total Particulate Emissions:

Road Segment	Segment Length (m)	# of Trips per Day	Number of			Mean Vehicle Weight, ton	VKT (km)	VMT (mi)	BMPP Reduction			Emission Rates (g/s) (24-h Average)		
			Med Trucks	Heavy Trucks	Cars				PM2.5	PM10	TSP	PM2.5	PM10	TSP
A-B	356	200	0	18	182	4.3	71.2	44	0.90	0.90	0.90	**0.0024**	**0.0233**	**0.0862**
B-C	46.8	24		24		30.0	1.1	1	0.90	0.90	0.90	**0.0001**	**0.0007**	**0.0024**
B-D	198.1	190	0	8	182	2.9	37.6	23	0.90	0.90	0.90	**0.0009**	**0.0086**	**0.0317**
D-E	247.9	9		9		30.0	2.2	1	0.90	0.90	0.90	**0.0002**	**0.0018**	**0.0065**
E-F	181.8	9		9		30.0	1.6	1	0.90	0.90	0.90	**0.0001**	**0.0013**	**0.0048**
E-H	216.8	9		9		30.0	2.0	1	0.90	0.90	0.90	**0.0002**	**0.0015**	**0.0057**

The Corporation of the Town of St. Marys
St. Marys, Ontario

Table EA-03: On-Site Non-Road Dust

(June 2019)

Project No.: 032339

Particulate Emissions from Stockpile

Particle size	k
< 30 um	0.74
< 15 um	0.48
< 10 um	0.35
< 5 um	0.2
< 2.5 um	0.053

Particle Size Multiplier (dimensionless)

U = 3.98 Mean wind speed (m/s)
M = 5 Material moisture content (%)

Type of pile:	**Clay/dirt mix**
Transfer points:	1.00
Daily Turnover (T/0):	3.0 tonnes/day
Area:	314.159265 m2

Emission factor:

	kg PM / Mg of Material
PM2.5	5.081E-05
PM10	3.356E-04
TPM	7.095E-04

Emission Rates:

	kg PM/day	g/s	g/s/m2
PM2.5	1.5E-04	**1.764E-06**	**5.6E-09**
PM10	1.0E-03	**1.165E-05**	**3.7E-08**
TPM	2.1E-03	**2.463E-05**	**7.8E-08**

Particulate Emissions from Working Face Operations

based on storage pile approach

M = 15 Material moisture content (%)

Type of pile:	**Sand**
Transfer points:	2.00
Daily Turnover (T/0):	62.5 tonnes/day
Area:	1200 m2

Emission factor:

	kg PM / Mg of Material
PM2.5	1.1E-05
PM10	7.2E-05
TPM	1.5E-04

Emission Rates:

	kg PM/day	g/s	g/s/m2
PM2.5	1.4E-03	**1.6E-05**	**1.3E-08**
PM10	9.0E-03	**1.0E-04**	**8.7E-08**
TPM	1.9E-02	**2.2E-04**	**1.8E-07**

Particulate Emissions from Compost

based on storage pile approach

M = 40 Material moisture content (%)

Type of pile:	**Clay/dirt mix**
Transfer points:	2.00
Daily Turnover (T/0):	25.0 tonnes/day
Area:	240 m2

Emission factor:

	kg PM / Mg of Material
PM2.5	2.8E-06
PM10	1.8E-05
TPM	3.9E-05

Emission Rates:

	kg PM/day	g/s	g/s/m2
PM2.5	1.4E-04	**1.6E-06**	**6.7E-09**
PM10	9.1E-04	**1.1E-05**	**4.4E-08**
TPM	1.9E-03	**2.2E-05**	**9.3E-08**

Table 1: Range of Source Conditions

Silt Content %	**Moisture Content %**	**Wind Speed**	
		m/s	**mph**
0.44 - 19	0.25 - 4.8	0.6 - 6.7	1.3 - 15

Source:
Emissions calculated using "USEPA TTN CHIEF, AP-42, Fifth Edition, Volume I, Chapter 13, Equation 13.2.4.(1)
Emission Factor (Equation 1a): E = k x 0.0016 x (U/2.2)^1.3 / (M/2)^1.4
If no site-specific data are available, use default values from Table 13.2.4-1 for silt content (%) and moisture content (%)
E (kg PM/day) = EF (kg PM/Mg Material) x T/O (Mg Material/day)
E (g/s) = E (kg/day) x 1000 g/kg / 8 hr/day / 3600 s/hr
E (kg/year) = EF (kg PM/Mg Material) x AU (Mg Material/year)

Quality rating - A, but:
(1) Quality rating reduced by 1 letter if using mean from Table 13.2.4-1
(2) Quality rating reduced by 1 letter if any source condition falls outside the values listed in Table 1 above

Total dust emissions from aggregate storage piles result from several distinct source activities within the storage cycle:
1. Loading of aggregate onto storage piles (batch or continuous drop operations).
2. Equipment traffic in storage area.
3. Wind erosion of pile surfaces and ground areas around piles.
4. Loadout of aggregate for shipment or for return to the process stream (batch or continuous drop operations

The Corporation of the Town of St. Marys
St. Marys, Ontario

Project No.: 032339

Table EA-04:
On-Site Vehicle Emissions
(June 2019)

Off-Road Vehicle Emissions

						Emission Factor		Hourly Emission		Average Emission	
Vehicle Type	Gross Power Rating (hp)	Gross Power Rating (kW)	# units	Hourly Load Factor	Hours of Operation	NOx (g/kW-h)	CO (g/kw-h)	NOx (g/h)	CO (g/h)	NOx (g/s)	CO (g/s)
Loader	160	119.312	1	0%	1	0.40	5	0	0	0	0
Compactor	235	175.2395	1	33%	1	0.40	3.5	23.36526	204.446048	0.006490351	0.056791

***Assume Equipment meets Tier 4 emission standards (2014)**

Working Face Area: 1200 m2

									Daily Emission			Daily Average Emission		
Vehicle Type	Gross Power Rating (hp)	Gross Power Rating (kW)	# units	Daily Load Factor	Hours of Operation	PM2.5 (g/kW-h)	PM10 (g/kW-h)	TSP (g/kW-h)	PM2.5 (g/day)	PM10 (g/day)	TSP (g/day)	PM2.5 (g/s)	PM10 (g/s)	TSP (g/s)
Loader	160	119.312	1	25%	8	0.02	0.02	0.02	4.77247918	4.772479181	4.772479	**5.5237E-05**	**5.5237E-05**	**5.5237E-05**
Compactor	235	175.2395	1	25%	8	0.02	0.02	0.02	7.0095788	7.009578797	7.009579	**8.11294E-05**	**8.1129E-05**	**8.1129E-05**

https://www.ecfr.gov/cgi-bin/text-idx?SID=5bd49186c6de428e7d6446a56baab96c&mc=true&node=pt40.36.1039&rgn=div5

Tier 4 Lookup

Engine Power Lower Range	Engine Power Upper Range	Year	CO	HC	NMHC + NOx	NOx	PM
0	19	2014	6.6		7.5		0.40
19	56	2014	5.0		4.7		0.03
56	130	2014	5.0	0.19		0.40	0.02
130	560	2014	3.5	0.19		0.40	0.02
560	1000000	2014	3.5	0.19		3.50	0.04
Generators		2014	3.5	0.19		0.67	0.03

The Corporation of the Town of St. Marys
St. Marys, Ontario

Table EA-05: Contaminant Screening
(June 2020)

Project No.: 032339

Contaminant	CAS	Emission factor (g/kW-h)	Source	Criterion (µg/m3)					Source	Limiting Effect	Ratio - Emission Factor/Criterion					Ranking				
				10 min	1hr	8hr	24hr	annual			10 min	1hr	8hr	24hr	annual	10 min	1hr	8hr	24hr	annual
Nitrogen Oxides	10102-44-0	0.40	(6)		400		200	60	(2)	Health		0.001		2.0E-03	6.7E-03		1		1	1
Carbon Monoxide	630-08-0	5.00	(6)		36,200	15,700			(2)	Health		1.4E-04	3.2E-04				2	1		
Sulphur Dioxide	7446-09-5	0.00			690		275	55	(2)	Health & Vegetation		2.9E-06		7.3E-06	3.6E-05		3		3	3
Particulate Matter	-	0.02	(6)				120.00	60.00	(2)	Visibility				1.7E-04	3.3E-04				2	2

Contaminant	CAS	Emission Rate (g/s)	Source	Criterion (µg/m3)					Source	Limiting Effect	Ratio - Emission Factor/Criterion					Ranking				
				10 min	1hr	8hr	24hr	annual			10 min	1hr	8hr	24hr	annual	10 min	1hr	8hr	24hr	annual
1,1,1-Trichloroethane (methyl chloroform) - H	71-55-6	2.14419E-09	(1)				115,000		(2)	Health				1.9E-14					41	
1,1,2,2-Tetrachloroethane - HAP/VOC	79-34-5	6.18226E-09	(1)				40		(4)					1.5E-10					11	
1,1-Dichloroethane (ethylidene dichloride) - H	75-34-3	7.95331E-09	(1)				165		(2)	Health				4.8E-11					20	
1,1-Dichloroethene (vinylidene chloride) - HA	75-35-4	6.49182E-10	(1)				10		(2)	Health				6.5E-11					15	
1,2-Dichloroethane (ethylene dichloride) - HA	107-06-2	1.35855E-09	(1)				2	0.4	(2)	Health				6.8E-10	3.4E-09				7	
1,2-Dichloropropane (propylene dichloride) -	78-87-5	6.80998E-10	(1)				2,400		(2)	Odour				2.8E-13					37	
2-Propanol (isopropyl alcohol) - VOC	67-63-0	1.00635E-07	(1)				7,300		(2)	Health				1.4E-11					24	
Acetone	67-64-1	1.36131E-08	(1)				11,800		(2)	Health				1.2E-12					34	
Acrylonitrile - HAP/VOC	107-13-1		(1)				0.6	0.12	(2)	Health				0.0E+00	0.0E+00				43	2
Benzene - Co-disposal - HAP/VOC	71-43-2	2.87695E-08	(1)				2.3	0.45	(2)	Health				1.3E-08	6.4E-08				4	
Bromodichloromethane - VOC	75-27-4	1.70055E-08	(1)				350		(3)					4.9E-11					19	
Butane - VOC	106-97-8	9.73036E-09	(1)				3600		(3)					2.7E-12					32	
Carbon disulfide - HAP/VOC	75-15-0	1.47849E-09	(1)				330		(2)	Odour				4.5E-12					30	
Carbon monoxide	630-08-0	1.31303E-07	(1)		36,200	15,700			(2)	Health		3.6E-12	8.4E-12				1	1		
Carbon tetrachloride - HAP/VOC	56-23-5	2.06045E-11	(1)				2.4		(2)	Health				8.6E-12					26	
Carbonyl sulfide - HAP/VOC	463-58-1	9.85569E-10	(1)				13		(3)					7.6E-11					14	
Chlorobenzene - HAP/VOC	108-90-7	9.42231E-10	(1)	4,500	3,500				(2)	Health (1 hr)/	2.1E-13	2.7E-13				5	2			
Chlorodifluoromethane	75-45-6	3.76393E-09	(1)				350,000		(2)	Health				1.1E-14					42	
Chloroethane (ethyl chloride) - HAP/VOC	75-00-3	2.80848E-09	(1)				5,600		(2)	Health				5.0E-13					36	
Chloroform - HAP/VOC	67-66-3	1.19928E-10	(1)				1	0.2	(2)	Health				1.2E-10	6.0E-10				12	
Chloromethane - VOC	74-87-3	2.02871E-09	(1)				320		(2)	Health				6.3E-12					28	
Dichlorobenzene - (HAP for para isomer/VO	106-46-7	1.03364E-09	(1)				95		(2)	Health				1.1E-11					25	
Dichlorodifluoromethane	75-71-8	6.47762E-08	(1)				500,000		(2)	Health				1.3E-13					39	
Dichlorofluoromethane - VOC	75-43-4	8.95996E-09	(1)				500		(3)					1.8E-11					21	
Dichloromethane (methylene chloride) - HAP	75-09-2	3.98175E-08	(1)				220	44	(2)	Health				1.8E-10	9.0E-10				10	
Dimethyl sulfide (methyl sulfide) - VOC	75-18-3	1.62267E-08	(1)	30					(2)	Odour	5.4E-10					2				
Ethane	74-84-0	8.961E-07	(1)				14500		(3)					6.2E-11					16	
Ethanol - VOC	622-08-2	4.16591E-08	(1)				100		(3)					4.2E-10					8	
Ethyl mercaptan (ethanethiol) - VOC	75-08-1	4.78478E-09	(1)				0.1		(5)					4.8E-08						
Ethylbenzene - HAP/VOC	100-41-4	1.63513E-08	(1)	1,900			1,000		(2)	Odour/Health	8.6E-12			1.6E-11		4			23	
Ethylene dibromide - HAP/VOC	106-93-4	6.29091E-12	(1)				3		(2)	Health				2.1E-12					33	
Fluorotrichloromethane - VOC	75-69-4	3.49599E-09	(1)				6000		(2)	Health				5.8E-13					35	
Hexane - HAP/VOC	110-54-3	1.90451E-08	(1)				2,500		(2)	Health				7.6E-12					27	
Hydrogen sulfide	7783-06-4	4.10805E-08	(1)	13			7		(3)		3.2E-09			5.9E-09		1			5	
Mercury (total) - HAP	7439-97-6	1.94798E-12	(1)				0.5		(2)	Health				3.9E-12					31	
Methyl ethyl ketone - HAP/VOC	78-93-3	1.7143E-08	(1)				1000		(2)	Health				1.7E-11					22	
Methyl isobutyl ketone - HAP/VOC	108-10-1	6.37208E-09	(1)				1,200		(2)	Odour				5.3E-12					29	
Methyl mercaptan - VOC	74-93-1	4.02725E-09	(1)				0.1		(5)					4.0E-08						
Pentane - VOC	109-66-0	7.9723E-09	(1)				35500		(3)					2.2E-13					38	
Perchloroethylene (tetrachloroethylene) - HA	127-18-4	2.05446E-08	(1)				360		(2)	Health				5.7E-11					18	
Propane - VOC	74-98-6	1.62392E-08	(1)				215000		(3)					7.6E-14					40	
t-1,2-Dichloroethene - VOC	156-60-5	9.08854E-09	(1)				105		(2)	Health				8.7E-11					13	
Toluene - No or Unknown Co-disposal - HAF	108-88-3	5.24425E-07	(1)				2,000		(2)	Odour				2.6E-10					9	
Trichloroethylene (trichloroethene) - HAP/VC	79-01-6	1.23193E-08	(1)				12	2.3	(2)	Health				1.0E-09	5.4E-09				6	3
Vinyl chloride - HAP/VOC	75-01-4	1.52769E-08	(1)				1	0.2	(2)	Health				1.5E-08	7.6E-08				3	1
Xylenes - HAP/VOC	1330207	4.26555E-08	(1)	3,000			730		(2)	Health/Odour	1.4E-11			5.8E-11		3			17	

Sources
1. AP-42 Emission Factors, Table 2.4-1. DEFAULT CONCENTRATIONS FOR LFG CONSTITUENTS, https://www3.epa.gov/ttnchie1/ap42/ch02/final/c02s04.pdf
2. Ministry of the Environment, Conservation and Parks (MECP). Ontario’s Ambient Air Quality Criteria (PIBS#6570e01). Standards Development Branch, Updated June 5, 2019 (https://www.ontario.ca/page/ontarios-ambient-air-quality-criteri
3. Ministry of the Environment, Conservation and Parks (MECP). ACB List, https://www.ontario.ca/page/air-contaminants-benchmarks-list-standards-guidelines-and-screening-levels-assessing-point
4. Ministry of the Environment (MOE) 2008. Jurisdictional Screening Level (JSL) List, a Screening Tool for Ontario Regulation 419/05: Air Pollution – Local Air Quality (PIBS#6547e). Standards Development Branch, February.
5. Contaminant did not have assigned limit. Negligable limit of 0.1 was assigned and not consider in ranking

Table EA-06:
Landfill Gas - Exiting
(2020)

Gas / Pollutant Default Parameters:

LFG Emission Rate: 1.00E+06 m3/yr
Landfill Active Area: 38,711 m2

Compound Name	**Concentration (*ppmv*)**	**Molecular Weight (g/mol)**	**Total Moles in 1m3**	**Moles of Contaminan t (mol/m3)**	**Mass of Contaminan t (g/m3)**	**Flow Rate (m3/s)**	**Mass Emission Rate (g/s)**	**Mass Emission Rate (g/s/m2)**
Total landfill gas	1,000,000	30.03	40.8763189	40.8763189	1227.51586	0.03170979	38.9242725	0.001005515
Methane	500,000	16.04	40.8763189	20.4381594	327.828077	0.03170979	10.3953601	**0.000268539**
Carbon dioxide	500,000	44.01	40.8763189	20.4381594	899.483397	0.03170979	28.5224314	**0.000736808**
NMOC	4,000	86.18	40.8763189	0.16350528	14.0908846	0.03170979	0.44681902	1.15425E-05
1,1,1-Trichloroethane (methyl chloroform) - HAP	0.48	133.41	40.8763189	1.9621E-05	0.00261759	0.03170979	8.3003E-05	2.14419E-09
1,1,2,2-Tetrachloroethane - HAP/VOC	1.1	167.85	40.8763189	4.4964E-05	0.0075472	0.03170979	0.00023932	6.18226E-09
1,1-Dichloroethane (ethylidene dichloride) - HAP/VOC	2.4	98.97	40.8763189	9.8103E-05	0.00970927	0.03170979	0.00030788	7.95331E-09
1,1-Dichloroethene (vinylidene chloride) - HAP/VOC	0.20	96.94	40.8763189	8.1753E-06	0.00079251	0.03170979	2.513E-05	6.49182E-10
1,2-Dichloroethane (ethylene dichloride) - HAP/VOC	0.41	98.96	40.8763189	1.6759E-05	0.0016585	0.03170979	5.2591E-05	1.35855E-09
1,2-Dichloropropane (propylene dichloride) - HAP/VOC	0.18	112.99	40.8763189	7.3577E-06	0.00083135	0.03170979	2.6362E-05	6.80998E-10
2-Propanol (isopropyl alcohol) - VOC	50	60.11	40.8763189	0.00204382	0.12285378	0.03170979	0.00389567	1.00635E-07
Acetone	7.0	58.08	40.8763189	0.00028613	0.01661868	0.03170979	0.00052697	1.36131E-08
Benzene - No or Unknown Co-disposal - HAP/VOC	1.9	78.11	40.8763189	7.7665E-05	0.00606641	0.03170979	0.00019236	4.96928E-09
Benzene - Co-disposal - HAP/VOC	11	78.11	40.8763189	0.00044964	0.03512134	0.03170979	0.00111369	2.87695E-08
Bromodichloromethane - VOC	3.1	163.83	40.8763189	0.00012672	0.02075998	0.03170979	0.00065829	1.70055E-08
Butane - VOC	5.0	58.12	40.8763189	0.00020438	0.01187866	0.03170979	0.00037667	9.73036E-09
Carbon disulfide - HAP/VOC	0.58	76.13	40.8763189	2.3708E-05	0.00180491	0.03170979	5.7233E-05	1.47849E-09
Carbon monoxide	140	28.01	40.8763189	0.00572268	0.1602924	0.03170979	0.00508284	**1.31303E-07**
Carbon tetrachloride - HAP/VOC	4.0E-03	153.84	40.8763189	1.6351E-07	2.5154E-05	0.03170979	7.9762E-07	2.06045E-11
Carbonyl sulfide - HAP/VOC	0.49	60.07	40.8763189	2.0029E-05	0.00120317	0.03170979	3.8152E-05	9.85569E-10
Chlorobenzene - HAP/VOC	0.25	112.56	40.8763189	1.0219E-05	0.00115026	0.03170979	3.6474E-05	**9.42231E-10**
Chlorodifluoromethane	1.3	86.47	40.8763189	5.3139E-05	0.00459495	0.03170979	0.0001457	3.76393E-09
Chloroethane (ethyl chloride) - HAP/VOC	1.3	64.52	40.8763189	5.3139E-05	0.00342854	0.03170979	0.00010872	2.80848E-09
Chloroform - HAP/VOC	0.03	119.39	40.8763189	1.2263E-06	0.00014641	0.03170979	4.6425E-06	1.19928E-10
Chloromethane - VOC	1.2	50.49	40.8763189	4.9052E-05	0.00247661	0.03170979	7.8533E-05	2.02871E-09
Dichlorobenzene - (HAP for para isomer/VOC)	0.21	147	40.8763189	8.584E-06	0.00126185	0.03170979	4.0013E-05	1.03364E-09
Dichlorodifluoromethane	16	120.91	40.8763189	0.00065402	0.07907769	0.03170979	0.00250754	6.47762E-08
Dichlorofluoromethane - VOC	2.6	102.92	40.8763189	0.00010628	0.01093818	0.03170979	0.00034685	**8.95996E-09**
Dichloromethane (methylene chloride) - HAP	14	84.94	40.8763189	0.00057227	0.04860848	0.03170979	0.00154136	3.98175E-08
Dimethyl sulfide (methyl sulfide) - VOC	7.8	62.13	40.8763189	0.00031884	0.01980924	0.03170979	0.00062815	**1.62267E-08**
Ethane	890	30.07	40.8763189	0.03637992	1.09394431	0.03170979	0.03468875	8.961E-07
Ethanol - VOC	27	46.08	40.8763189	0.00110366	0.05085668	0.03170979	0.00161265	4.16591E-08
Ethyl mercaptan (ethanethiol) - VOC	2.3	62.13	40.8763189	9.4016E-05	0.00584119	0.03170979	0.00018522	4.78478E-09
Ethylbenzene - HAP/VOC	4.6	106.16	40.8763189	0.00018803	0.01996138	0.03170979	0.00063297	1.63513E-08
Ethylene dibromide - HAP/VOC	1.0E-03	187.88	40.8763189	4.0876E-08	7.6798E-06	0.03170979	2.4353E-07	6.29091E-12
Fluorotrichloromethane - VOC	0.76	137.38	40.8763189	3.1066E-05	0.00426785	0.03170979	0.00013533	3.49599E-09
Hexane - HAP/VOC	6.6	86.18	40.8763189	0.00026978	0.02324996	0.03170979	0.00073725	1.90451E-08
Hydrogen sulfide	36	34.08	40.8763189	0.00147155	0.05015034	0.03170979	0.00159026	**4.10805E-08**
Mercury (total) - HAP	2.9E-04	200.61	40.8763189	1.1854E-08	2.3781E-06	0.03170979	7.5408E-08	1.94798E-12
Methyl ethyl ketone - HAP/VOC	7.1	72.11	40.8763189	0.00029022	0.0209279	0.03170979	0.00066362	1.7143E-08
Methyl isobutyl ketone - HAP/VOC	1.9	100.16	40.8763189	7.7665E-05	0.00777893	0.03170979	0.00024667	6.37208E-09
Methyl mercaptan - VOC	2.5	48.11	40.8763189	0.00010219	0.0049164	0.03170979	0.0001559	4.02725E-09
Pentane - VOC	3.3	72.15	40.8763189	0.00013489	0.00973245	0.03170979	0.00030861	7.9723E-09
Perchloroethylene (tetrachloroethylene) - HAP	3.7	165.83	40.8763189	0.00015124	0.02508052	0.03170979	0.0007953	2.05446E-08
Propane - VOC	11	44.09	40.8763189	0.00044964	0.01982461	0.03170979	0.00062863	1.62392E-08
t-1,2-Dichloroethene - VOC	2.8	96.94	40.8763189	0.00011445	0.01109514	0.03170979	0.00035182	9.08854E-09
Toluene - No or Unknown Co-disposal - HAP/VOC	39	92.13	40.8763189	0.00159418	0.14687148	0.03170979	0.00465726	1.20309E-07
Toluene - Co-disposal - HAP/VOC	170	92.13	40.8763189	0.00694897	0.64020899	0.03170979	0.02030089	5.24425E-07
Trichloroethylene (trichloroethene) - HAP/VOC	2.8	131.40	40.8763189	0.00011445	0.01503922	0.03170979	0.00047689	1.23193E-08
Vinyl chloride - HAP/VOC	7.3	62.50	40.8763189	0.0002984	0.01864982	0.03170979	0.00059138	**1.52769E-08**
Xylenes - HAP/VOC	12	106.16	40.8763189	0.00049052	0.05207316	0.03170979	0.00165123	4.26555E-08

The Corporation of the Town of St. Marys
St. Marys, Ontario

Table EA-07:
Odour
(June 2020)

Project No.: 032339

Source	Quantity	Area (m2)	Emission Flux Rate (OU/s m2)	Emission Flux Rate (OU/s m2)	Emission Rate (OU/s)
Working Face	1	1200	1.1	**1.817**	2179.877
Composting Facility	1	240	1.1	**1.817**	435.9754

Working Face Emission Flux Rate from Ridge Landfill Environmental Screening [BFI Canada Inc.], Appendix E - Site Vicinity Air (Dust and Odour) Impact Assessment, Table 9 (p. 34 of 43)

Fugitive Landfill Gas Emission from LandGem model

Year	**2017**	**2057**	**2057**	**2057**
Alternative Method	**E**	**2**	**3**	**4**
LFG e-rate (cfm)	67.49139	115.1466	115.146568	115.146568
LFG e-rate (m3/s)	0.031852	0.054343	0.05434313	0.05434313
Concentration (OU/m3):	10,000	10000	10000	10000
Odour emission (OU/s)	318.5239	543.4313	543.43129	543.43129
Landfill Area (m2)	81176	151017	134614	146706
Landfill Area Flux (OU/s m2)	0.003924	0.003598	0.00403696	0.00370422
Model Adjustment Factor (h:10min)	1.65	1.65	1.65	1.65
Modelled Flux Rate (OU/s m2)	0.00648	0.005943	0.00666672	0.00611723
Source IDs	Fug_E	Fug_E	Fug_E	Fug_E
		Fug_2	Fug_3	Fug_4

Appendix B

Supporting Information for Assessment of Negligibility

Appendix B
Supporting Information for Assessment of Negligibility

Sources were screened for negligibility using the following screening protocols listed in the ESDM Procedure Document.

The results of the screening are discussed in greater detail in the following text.

1.0 Fugitive Dust Emissions

Fugitive dust emissions from on-site roadways and storage piles (ESDM Procedure Document Section 7.4):

The Site is not listed in Table 7-2 but is listed on Table 7-3 of Section 7.4 of the ESDM Procedure Document, NAICS 562210 and 325314 - Waste treatment and disposal and 325314 Mixed fertilizer manufacturing. Emissions from on-site roadways and storage piles are included in this assessment.

The site is assuming that the Best Management Practise Plan (BMPP) will achieve 90% reduction in emissions.

2.0 Combustion of Natural Gas and Propane

Combustion of natural gas and propane (ESDM Procedure Document Section 7.1.1):

The Site does not have any natural gas or propane fired equipment.

Appendix C

Plant Boundary Coordinates

Appendix C

Appendix C
Dispersion Modelling

The property boundary point coordinates are listed in Table EC-1. The emission rates for the current case organized by emission point are found in Table 2-1. The emission rates for the current case organized by contaminant are found in Table 2-2.

1.0 Odour

The 1-hour odour simulations were performed separately for all scenarios because the odour impact is in OU instead of $\mu g/m^3$. The different units require a separate simulation. Odour is the only contaminant modelled in OU. All other simulations were calculated in the Multi Contaminant Run.

2.0 Multi Contaminant Run

The other contaminant simulations were done using Lakes' "Multi-Chemical Run…" option. This simulation uses the entire site and all emission points are simulated as point sources, area sources or volume sources. The first highest predicted values are reported in Table 4a (E through 4).

3.0 Site-Specific Meteorological Data

Because this assessment is an environmental assessment and one of the contaminants is odour, the MECP was requested to provide and provided Site-Specific Meteorological Data which was used throughout all simulations.

The Corporation of the Town of St. Marys
St. Marys, Ontario

Project No.: 032339

Table C-1:
Plant Boundary Coordinates
(June 2019)

	Local Coordinates	
Property Coordinates	**X (m)**	**Y (m)**
Plant Boundary Coordinate	487274.39	4787453.54
Plant Boundary Coordinate	487198.22	4787335.65
Plant Boundary Coordinate	487142.35	4787356.14
Plant Boundary Coordinate	487140.65	4787257.74
Plant Boundary Coordinate	487201.12	4786888.07
Plant Boundary Coordinate	487585.03	4786947.35
Plant Boundary Coordinate	487877.13	4786992.55
Plant Boundary Coordinate	487846.16	4787182.35
Plant Boundary Coordinate	487865.99	4787320.24
Plant Boundary Coordinate	487775.49	4787366.86
Plant Boundary Coordinate	487510.67	4787503.28
Plant Boundary Coordinate	487339.24	4787553.73
Plant Boundary Coordinate	487294.84	4787638.91
Plant Boundary Coordinate	487255.68	4787578.32
Plant Boundary Coordinate	487252.38	4787573.22
Plant Boundary Coordinate	487234.77	4787545.97
Plant Boundary Coordinate	487204.24	4787498.86

BURNSIDE

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Appendix D

Alternative Method Figures

Appendix D

LEGEND

●	OBSERVATION WELL (ANNUAL MONITORING REPORT)
●	OBSERVATION WELL
■	TEST PIT

OBTAINED CAPACITY - 577,000 m³

N

0 50 100 150 200
Metres

BURNSIDE

Figure Title

SOLID WASTE CAPACITY DEVELOPMENT

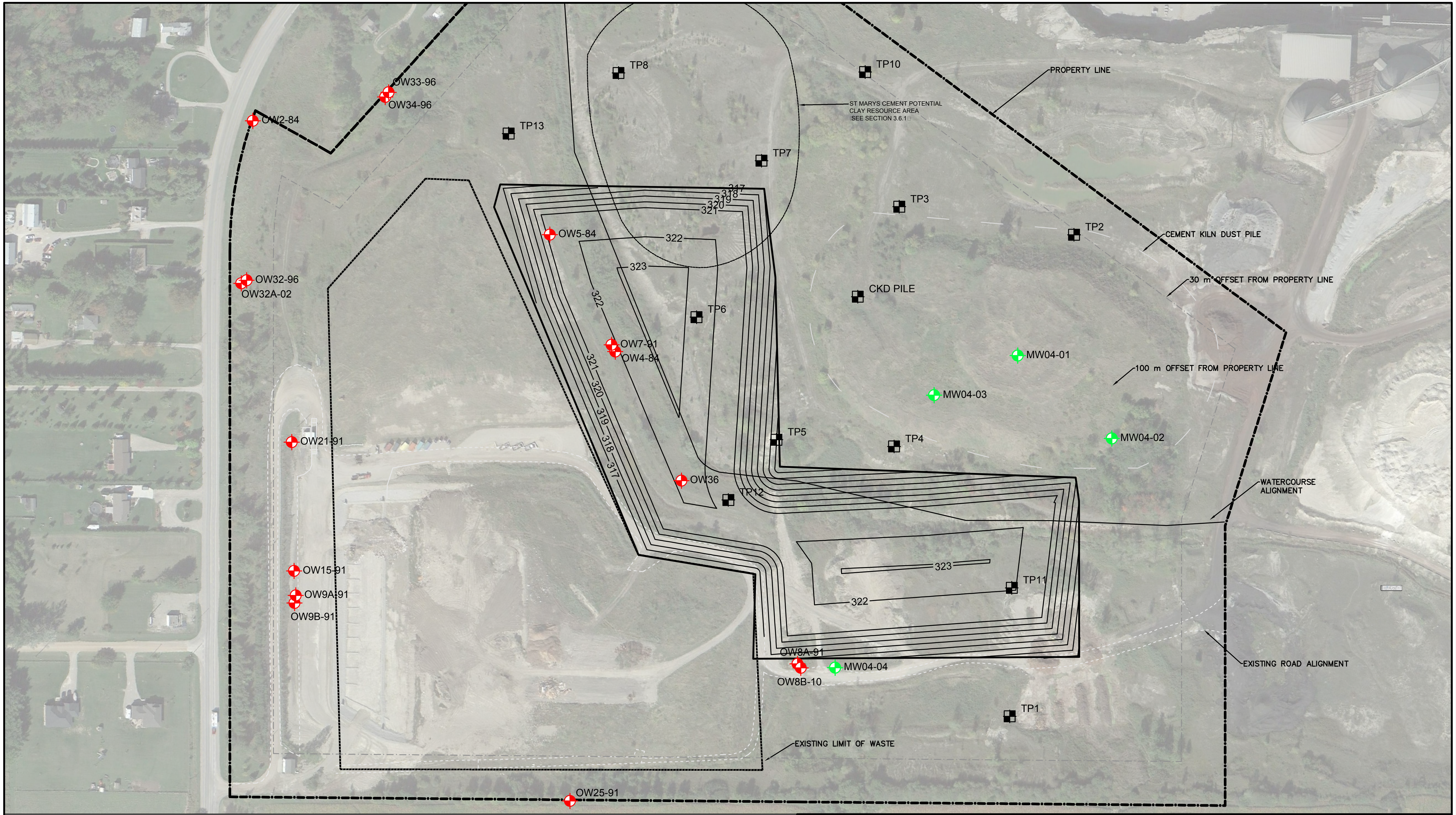
ALTERNATIVE METHOD 1 - VERTICAL EXPANSION

Client

TOWN OF ST. MARYS

Drawn	Checked	Date	Figure No.
AE	JRH	APRIL 2016	1
Scale		Project No.	
1:2500		300032339	

File: U:\032339 - St. Marys Waste\CIVIL\02_ProductionDwg\EA Figures Appendix G\Alternative Method 1.dwg Date Plotted: April 20, 2017 - 12:43 PM



LEGEND

OBSERVATION WELL
(ANNUAL MONITORING REPORT)

OBSERVATION WELL

TEST PIT

0 50 100 150 200
Metres

N

OBTAINED CAPACITY -	733,000 m³
ABOVE GRADE -	403,000 m³
BELOW GRADE-	330,000 m³

EXPANSION VOLUME IS ATTAINED FROM A 4:1 SIDESLOPE FROM THE EDGE OF WASTE TO m ELEVLATION 321 m. FOLLOWED BY A 20:1 GRADE TO THE PEAK AT 323m. COMBINED WITH A 5 m VERTICAL EXCAVATION (CKD PILE EXCLUDED).

MINIMUM MOECC SETBACK FROM PROPERTY BOUNDARY = 30 m
GUIDELINE SETBACK = 100 m

BURNSIDE

Figure Title
SOLID WASTE CAPACITY DEVELOPMENT

METHOD 2 - HORIZONTAL EXPANSION OF THE EXISTING LANDFILL

Client
TOWN OF ST. MARYS

Drawn	Checked	Date	Figure No.
AE	JRH	APRIL 2016	2
Scale		Project No.	
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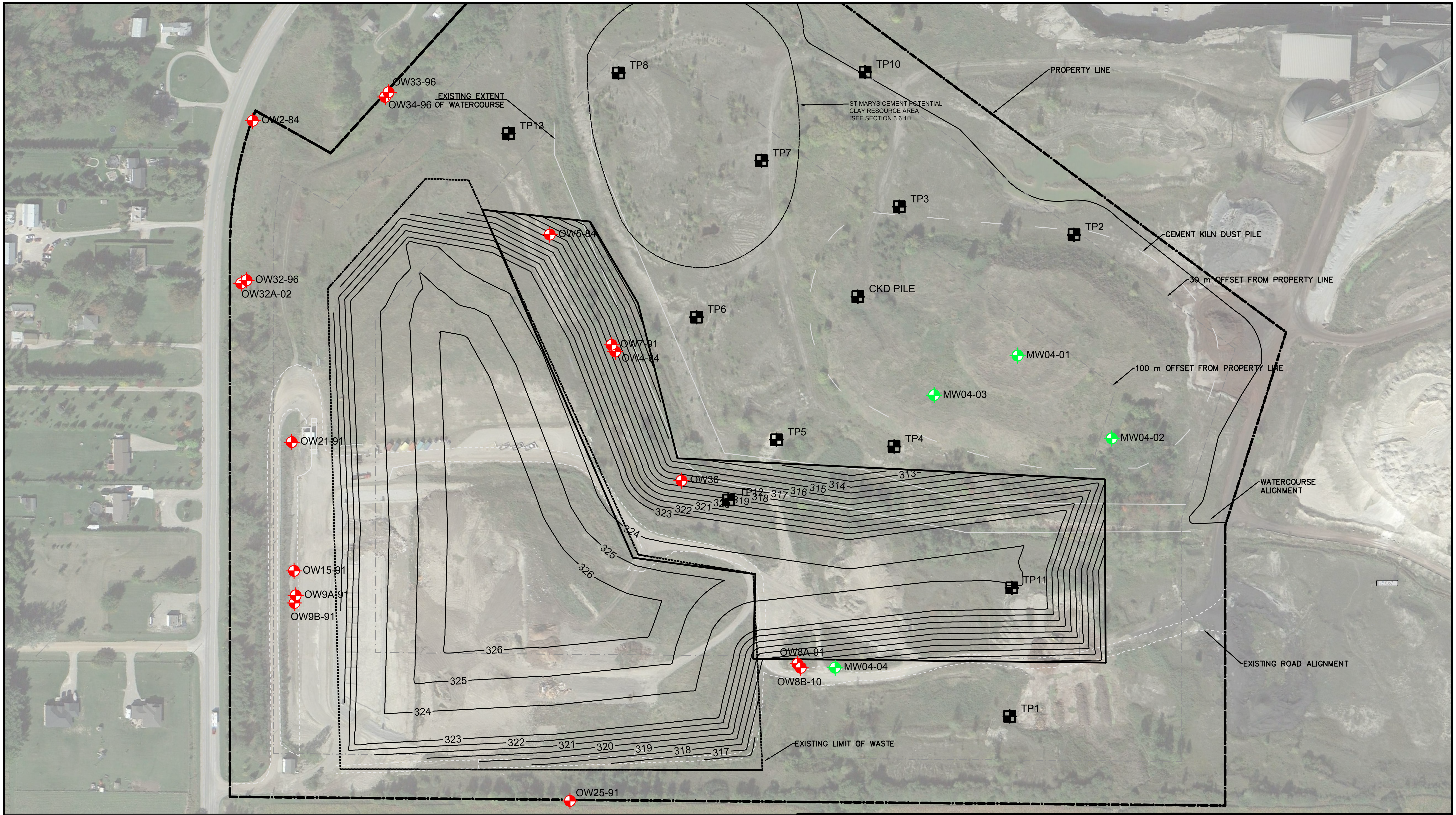
File: U:\032339 - St. Marys Waste\CIVIL\02_ProductionDwg\EA Figures Appendix G\Alternative Method 2.dwg Date Plotted: April 20, 2017 - 12:44 PM



LEGEND

OBSERVATION WELL (ANNUAL MONITORING REPORT)

OBSERVATION WELL

TEST PIT

0 50 100 150 200

Metres

N

OBTAINED CAPACITY -	756,000 m³
ABOVE GRADE -	506,000 m³
BELOW GRADE-	250,000 m³

EXPANSION VOLUME IS ATTAINED FROM A 4:1 SIDESLOPE FROM THE EDGE OF THE WASTE TO ELEVATION OF 323m, FOLLOWED BY A 20:1 SLOPE ON THE PEAK. COMBINED WITH A 5m VERTICAL EXCAVATION (CKD PILE EXCLUDED)

MINIMUM MOECC SETBACK FROM PROPERTY BOUNDARY = 30 m
GUIDELINE SETBACK = 100 m

BURNSIDE

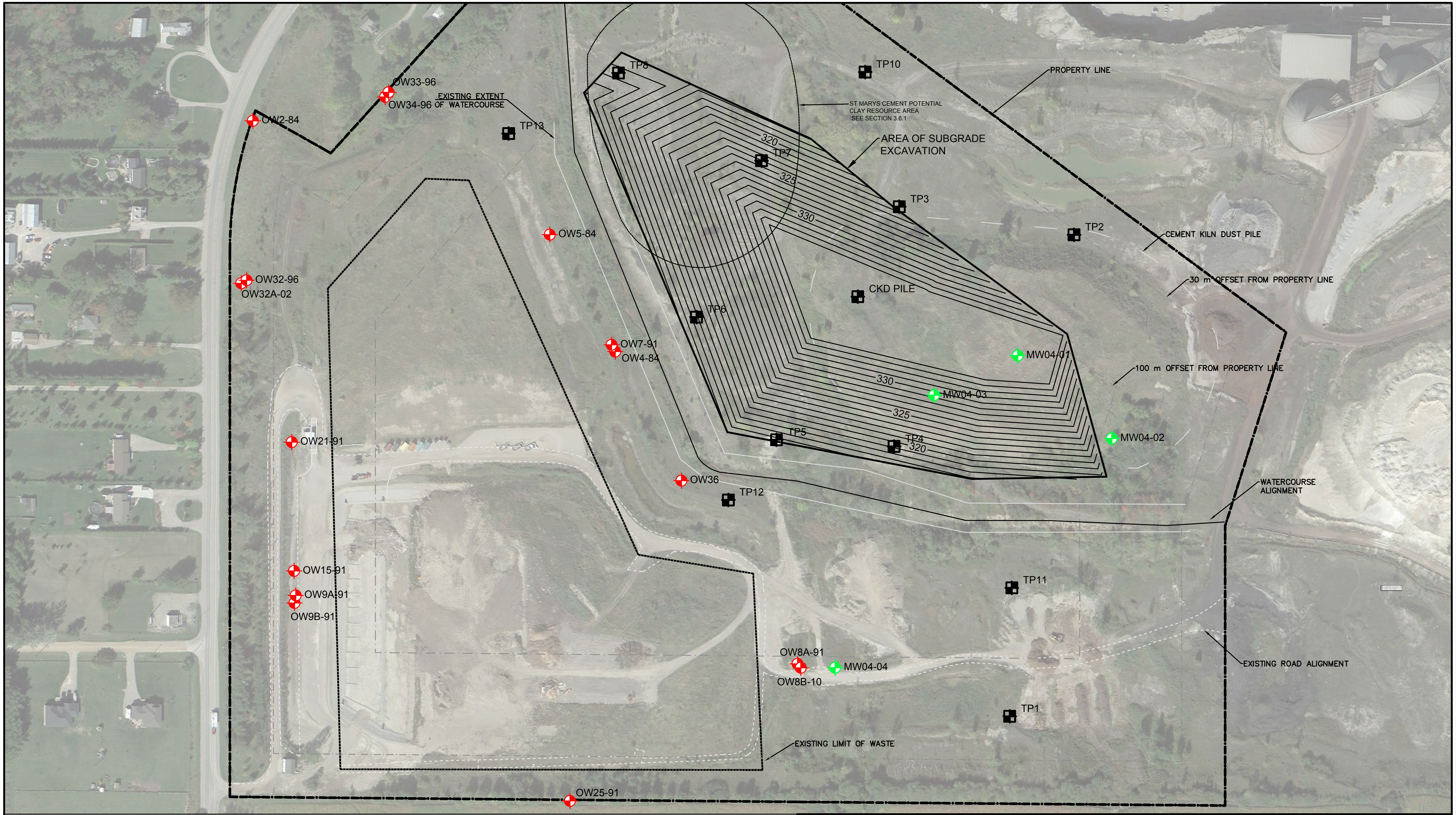
Client
TOWN OF ST. MARYS

Figure Title
SOLID WASTE CAPACITY DEVELOPMENT

METHOD 3 - COMBINATION OF VERTICAL AND HORIZONTAL EXPANSION

Drawn AE
Checked JRH
Date APRIL 2016
Scale 1:2500
Project No. 300032339
Figure No. 3

File: U:\032339 - St. Marys Waste\CIVIL\02_ProductionDwg\EA Figures Appendix G\Alternative Method 3.dwg Date Plotted: May 17, 2017 - 3:19 PM



LEGEND

🟥	OBSERVATION WELL (ANNUAL MONITORING REPORT)
🟩	OBSERVATION WELL
▣	TEST PIT

0 50 100 150 200
Metres

N

OBTAINED CAPACITY -	397,000 m³
ABOVE GRADE -	252,000 m³
BELOW GRADE-	145,000 m³

EXPANSION VOLUME IS ATTAINED FROM A 4:1 SIDESLOPE FROM THE EDGE OF THE WATERCOURSE BANK TO THE ELEVATION OF THE EXISTING TOPOGRAPHY. COMBINED WITH A 5 m VERTICAL EXCAVATION (CKD PILE EXCLUDED)

BURNSIDE

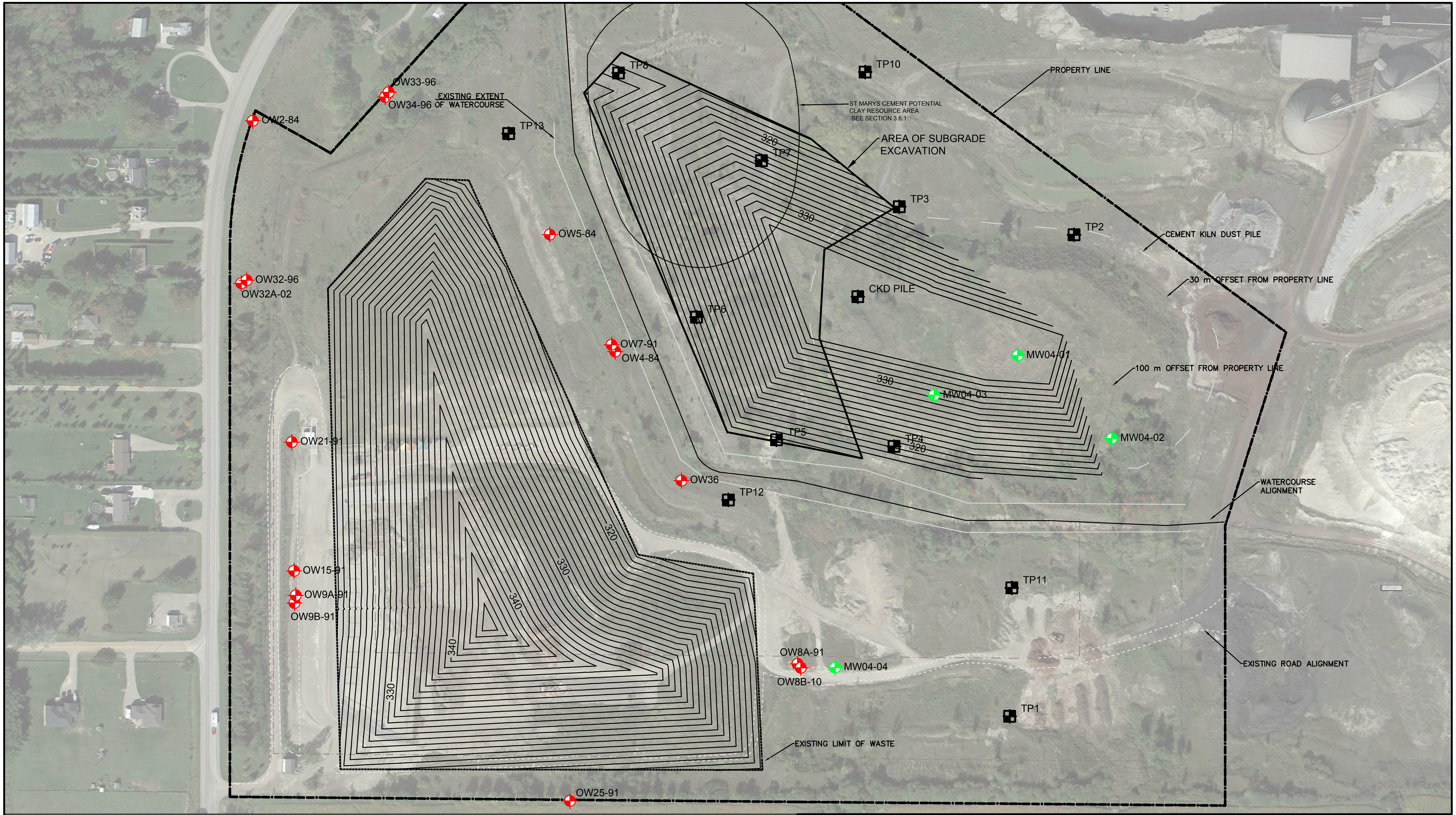
Client
TOWN OF ST. MARYS

Figure Title
SOLID WASTE CAPACITY DEVELOPMENT

ALTERNATIVE METHOD 4 -
NEW LANDFILL FOOTPRINT

Drawn	Checked	Date	Figure No.
AE	JRH	APRIL 2016	4
Scale		Project No.	
1:2500		300032339	

File: U:\032339 - St. Marys Waste\CIVIL\02_ProductionDwg\EA Concepts\Alternative Method 4.dwg Date Plotted: April 20, 2017 - 12:29 PM



LEGEND

🟥	OBSERVATION WELL (ANNUAL MONITORING REPORT)
🟩	OBSERVATION WELL
■	TEST PIT

0 50 100 150 200
Metres

N

OBTAINED CAPACITY -	974,000 m³
ABOVE GRADE -	827,000 m³
BELOW GRADE-	145,000 m³

EXPANSION VOLUME IS ATTAINED FROM A 4:1 SIDESLOPE FROM THE EDGE OF THE WATERCOURSE BANK TO THE ELEVATION OF THE EXISTING TOPOGRAPHY. COMBINED WITH A 5 m VERTICAL EXCAVATION (CKD PILE EXCLUDED). ADDITIONALLY WASTES WILL BE PLACED OVERTOP OF THE EXISTING PHASES.

MINIMUM MOECC SETBACK FROM PROPERTY BOUNDARY = 30 m
GUIDELINE SETBACK = 100 m

BURNSIDE

Client
TOWN OF ST. MARYS

Figure Title
SOLID WASTE CAPACITY DEVELOPMENT
METHOD 5 - COMBINATION OF VERTICAL EXPANSION AND SEPARATE DEVELOPMENT OF A NEW LANDFILL FOOTPRINT

Drawn	Checked	Date	Figure No.
AE	JRH	APRIL 2016	5
Scale		Project No.	
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File: U:\032339 - St. Marys Waste\CIVIL\02_ProductionDwg\EA Figures Appendix G\Alternative Method 5.dwg Date Plotted: April 20, 2017 - 12:40 PM

BURNSIDE
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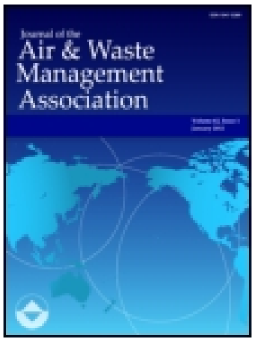
Appendix E

The contribution of biowaste disposal to odor emission from landfills



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The contribution of biowaste disposal to odor emission from landfills

Ziyang Lou, Mingchao Wang, Youcai Zhao & Renhua Huang

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TECHNICAL PAPER

The contribution of biowaste disposal to odor emission from landfills

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The biowaste fractions in municipal solid waste (MSW) are the main odor sources in landfill and cause widespread complaints from residents. The ammonia (NH_3) and hydrogen sulfide (H_2S) generation processes were simulated and compared between four typical biowaste fractions individually and combined in the mixed MSW. Food waste was found to be the main contributor to odor emission in mixed MSW, with H_2S generation potential of 48.4 μg kg^{-1} and NH_3 generation potential of 4742 μg kg^{-1}. Fruit waste was another source for NH_3 generation, with 3933 μg kg^{-1} NH_3 generation potential. Meanwhile, nitrogen (N) was released in a faster way than sulfur (S) in waste, since 31% and 46% of total NH_3 and H_2S were generated in the first 90 days after disposal, with 1811 and 72 μg kg^{-1}, and more emphasis should be placed in this initial period.

Implications: Monitoring of odor generation from biowastes in MSW on a laboratory scale showed that food waste is the main source for NH_3 and H_2S generation, whereas waste fruit is another main contributor for NH_3 released. Generally, N was released in a faster way than S from mixed-waste landfilling.

Introduction

Landfills are the predominated method for municipal solid waste (MSW) disposal. In China, around 78% of MSW was landfilling, with 95.9 Mt MSW in 2010 (National Bureau of Statistics of China, 2011). Odors are considered to be the greatest nuisance associated with landfills and cause considerable annoyance and impact both on the environment and amenities in proximity (Chiriac et al., 2011; Orzi et al., 2010; Karak et al., 2013).

Odor emission from MSW is influenced by the waste compositions, the operating conditions, and the weather conditions greatly. Around 47–200 trace components (with less than 1 vol. % of typical landfill gas) have been reported in landfill gas, including hydrocarbons, aromatics, halogenated, etc., which exerts a disproportionate environmental burden (Zou et al., 2003; Dincer et al., 2006; Scheutz et al., 2008; Chiriac et al., 2011; Orzi et al., 2010). Furthermore, Duan et al. (2014) reported that oxygenated compounds were the most abundant compounds among the measurement factors in landfill, i.e., sulfur compounds, oxygenated compounds, aromatics, hydrocarbons, halogenated compounds, and terpenes. Isobutane, ethyl alcohol, limonene, butane, toluene, and trichlorofluoromethane were recognized as the main compounds on the landfill working surface. Yue et al. (2014) claimed that dimethyl disulfide dominated in the sulfide compounds, accounting for up to 73.6% of the total detected sulfide, and H_2S was one of the main biogas components from the landfill operation areas (Yue et al., 2014). Field results showed that ammonia was the dominant compound at Laogang Refuse Landfill, with the value of 1800–70,000 ppb (Fang et al., 2012). Although amounts of volatile organic compounds, reduced sulfur compounds, carbonyls, nitrogenous compounds, and fatty acids were measured and reported, NH_3 and H_2S were regarded as the two notable odor components released from landfill due to the high contents in landfill gas (Chiriac et al., 2011; Ding et al., 2012; Fang et al., 2012). Meanwhile, a positive association between ambient H_2S concentrations and neighbors' ratings of landfill malodor was established using conditional fixed-effects regression models, when the wind was blowing in the direction of the community. H_2S was one of the landfill gases, which can trigger irritant and physical symptoms (Heaney et al., 2011). Thus, both of them were chosen as the target odor components.

Odor generated through the MSW decomposition under the prevailing anaerobic condition has been investigated in some studies (Komilis et al., 2004; Staley et al., 2006; Orzi et al., 2010; Zhang et al., 2012a, 2012b). Zhang et al. (2012a, 2012b) found that lipids and proteins were the main sources for the nonmethane organic compound (NMOC) generation, and the effect of lipids on NMOC quantity lasted longer than that of proteins. NMOCs from refuse, paper, yard waste, and food waste were around 151, 16, 38, and 221 mg C kg^{-1} dried matter in 320 running days, respectively (Staley et al., 2006). Odor emission depends fundamentally on both the quantity and the characteristics of waste compositions, especially for the readily biodegradation fractions, such as food waste, yard waste, etc.

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(Staley et al., 2006; Ko et al., 2007; Orzi et al., 2010). Nonsource separation collection of waste was operated in most of developing countries (Lou et al., 2009), and the different fractions in the mixed MSW without source separation would influence the degradation process of MSW greatly. In order to establish the correlation between the specific groups of odor emissions and the individual MSW fraction, it's important to identify the contributions of these biowaste fractions to odor emission in the actual landfill, especially in East Asia, where food waste occupies more than half of the total mixed MSW (Lou et al., 2009).

The main objective of this study was to evaluate the relationship between the individual MSW fraction and the potential odorant emission, and the typical odors, i.e., NH_3 and H_2S, from these typical biowaste fractions were measured. The degradation processes of these biofractions were identified and compared in terms of N and S, and the contribution process of the individual biowaste fractions for the NH_3 and H_2S generation was qualified.

Materials and Methods

Landfill lysimeters

Odor emissions from landfill were simulated in landfill lysimeters with a diameter and height of 300 by 500 mm. Wastes were disposed in the lysimeter of 300 mm height and run under anaerobic condition with a cap sealed in the top column. The gas generation was pumped out by a gas pumping daily and then absorbed by sulfuric acid (H_2SO_4) and cadmium hydroxide ($Ca(OH)_2$) successively. The gas emitted was collected from a gas sampling port with 0.4 m height on the sidewall in the reactor. Mixed MSW tested was collected from a waste container in the transfer station; mixed MSW consisted of kitchen waste (including food waste and fruit waste, with the ratio of 9:1), stone, paper, glass, wood, plastic, cloth, metals, and residues, with the percentages of 50%, 4%, 12%, 8%, 2%, 15%, 7%, 1%, and 1% (wet basis), respectively.

The biological components in MSW were the main odor sources, and the typical fractions, i.e., food waste (from the canteen in a campus), yard waste (street waste and cleansing waste in a campus, including leaves, branches, weeds, and dusts), paper (including newspaper, cardboard, bathroom tissues), and fruit waste (from the waste bin in a fruit market), were collected and applied in landfill lysimeters, with the corresponding weights of 2.2, 3.9, 2.0, 2.3, and 2.4 kg (wet basis), respectively. The wastes were disposed in landfill lysmeters and kept running at a constant temperature of 37 ± 2 °C after stripped with the protection gas of N_2 to guarantee an anaerobic condition.

Analysis methods

The generation rate and cumulative amounts of typical odorants, i.e., H_2S and NH_3, were measured using Nessler's reagent colorimetric method (GB/T 14668-1993; Ministry of Environmental Protection, People's Republic of China) and methylene blue spectrophotometry, respectively (Ministry of Environmental Protection of the People's Republic of China, Editorial Board of Air and Emission Monitoring and Analysis Methods, 2003). "Olfacomat" dynamic dilution olfactometer (XP-329-III odor level indicator; New Cosmos Electric Co., Ltd., Japan) was used to determine the odor concentration.

Gas chromatography instrument (Agilent 3000 Micro GC, HP5890 II; Agilent Technologies, Wilmington, DE, USA), equipped with CPWAX 30 × 0.32 mm column, was used for volatile fatty acid (VFA) analysis using an external standard. N_2 was used as the carrier gas, with flow rate at 2 mL min^{-1}. The oven temperature was initially set at 110 °C for 5 min and then increased to 220 °C for 2 min with the predetermined rate of 10 °C min^{-1}. The duration times of the typical VFAs, i.e., acetate, propionate, isobutyrate, butyrate, isovalerate, and valerate, were at 4.4, 5.3, 5.6, 6.3, 6.8, and 7.5 min, respectively.

Waste samples were dried at 105 °C in the furnace until a stable weight was obtained and were then crushed and grinded to pass through the screen with a 200 mesh sieve (0.074 mm). The samples were quartered until a sample size of about 100 g remained. Triple samples were applied and measured with CHNS model using element analyzer (Vario EL III; Elementar Analysen System GmbH, Hanau, Germany).

Results

General characteristics of biowaste fractions

The main biowaste fractions in the mixed MSW could be classified as food waste, fruit waste, yard waste, and paper, and the general characteristics of these wastes are shown in Table 1.

Table 1. Characteristics of MSW in the landfill lysimeters

Category		Mixed MSW	Food Waste	Yard Waste	Fruits Waste	Paper
Organic matter (%)		55.3 ± 5.7	95.5 ± 3.5	88.9 ± 3.4	79.1 ± 2.1	97.7 ± 1.6
pH		7.35 ± 0.01	4.42 ± 0.00	5.76 ± 0.01	5.69 ± 0.01	7.79 ± 0.00
Bulky density (kg m^{-3})		214.9 ± 13.7	492.1 ± 11.5	84.5 ± 4.5	34.7 ± 2.3	12.5 ± 0.8
Soil particle density (kg m^{-3})		1595 ± 57	1315 ± 27	1194 ± 34	1571 ± 42	785 ± 23
Moisture content (%)		78.1 ± 4.2	69.1 ± 7.8	37.9 ± 2.2	75.5 ± 6.4	9.2 ± 0.4
Element analysis (%)	C	40.3 ± 1.3	40.4 ± 1.2	47.1 ± 0.9	35.2 ± 0.7	38.8 ± 0.8
	H	7.1 ± 0.3	7.1 ± 0.1	10.1 ± 0.2	6.3 ± 0.1	11.1 ± 0.4
	O	39.5 ± 0.9	37.6 ± 0.7	45.3 ± 1.0	36.0 ± 0.3	44.0 ± 0.6
	N	2.4 ± 0.0	3.8 ± 0.1	2.6 ± 0.0	2.0 ± 0.1	2.3 ± 0.0
	S	1.6 ± 0.0	0.7 ± 0.0	0.4 ± 0.0	0.4 ± 0.0	0.4 ± 0.0
	Ash	9.3 ± 0.2	10.5 ± 0.2	18.3 ± 0.4	19.9 ± 0.3	3.4 ± 0.1

A neutral pH of 7.4 was obtained in the mixed MSW, whereas that in food waste, fruit waste, and paper was 4.4, 5.7, and 7.8, respectively, meaning that food waste and fruit waste were the readily biodegradable matters, and both were present in the acidification phase after several hours' stay at the generation points. The bulky density of food waste was at the highest value of 492 kg m^{-3}, compared with the other biowaste fractions. Moisture contents in the mixed MSW, food waste, and fruits waste were very high, and those in yard waste and paper were low, which resulted in a slow degradation process.

C, H, O, N, and S were the main contents in these wastes according to the element analysis results, and other elements were omitted due to the low contents. C/N ratio in the food waste was 10.5, and the introduction of the food waste decreased the C/N ratio in the mixed MSW. The higher N content in these biowastes might result in a higher NH_3 concentration released, compared with S and H_2S contents. Fruit waste and yard waste presented a high ash content of 19.9% and 18.3%, respectively.

Molecular formula could be used to predict the theoretical odor emission, and an apparent molecular formula was simulated based on the element analysis results. The apparent molecular weight of waste could be assigned as $C_aH_bO_cN_dS_e$, and S was chosen as the standard element for the molecular formula simulation here. It was found that the corresponding typical molecular formulas of biowaste fractions were $C_{68}H_{143}O_{50}N_3S$ of mixed waste, $C_{161}H_{337}O_{112}N_{13}S$ of food waste, $C_{295}H_{1015}O_{252}N_{15}S$ of paper, $C_{322}H_{826}O_{232}N_{15}S$ of yard waste, and $C_{234}H_{504}O_{180}N_{12}S$ of fruit waste. The apparent molecular formula of these five wastes varied greatly; thus, the corresponding NH_3 and H_2S emission potentials were different.

Odor emissions from MSW landfilling

The generation rates and cumulative volumes of H_2S and NH_3 from five biowaste fractions under the test periods are shown in Figure 1.

NH_3 generation rates from food waste and fruit waste were 4 and 2 times, respectively, higher than that from mixed MSW (with food waste of 45%). The maximum generation rates were observed during the period between 4 and 10 days after landfilling, generation rates then reached a low value after 45 days of reaction. The NH_3 generation processes of these four wastes were also different, and those in fruit waste and food waste were faster, with the highest values of 3915 and 1946 μg kg^{-1} on the 6th day, whereas the maximum NH_3 generation rates of 106 μg kg^{-1} (5th day) and 154 μg kg^{-1} (14th day) were present in paper and yard waste, meaning that fruit waste and food waste were more readily degradable materials, especially for the N removal. The cumulative NH_3 amount increased from 5.9 to 3964 μg kg^{-1} and 15.8 to 2610 μg kg^{-1} in the first 14 days in food waste and fruit waste reactors, respectively. The generation rate increased after 20 days in the paper and yard waste fractions, whereas that in mixed MSW increased after 30 days, meaning that NH_3 released in a more rapid rate from the food waste and fruit waste reactions.

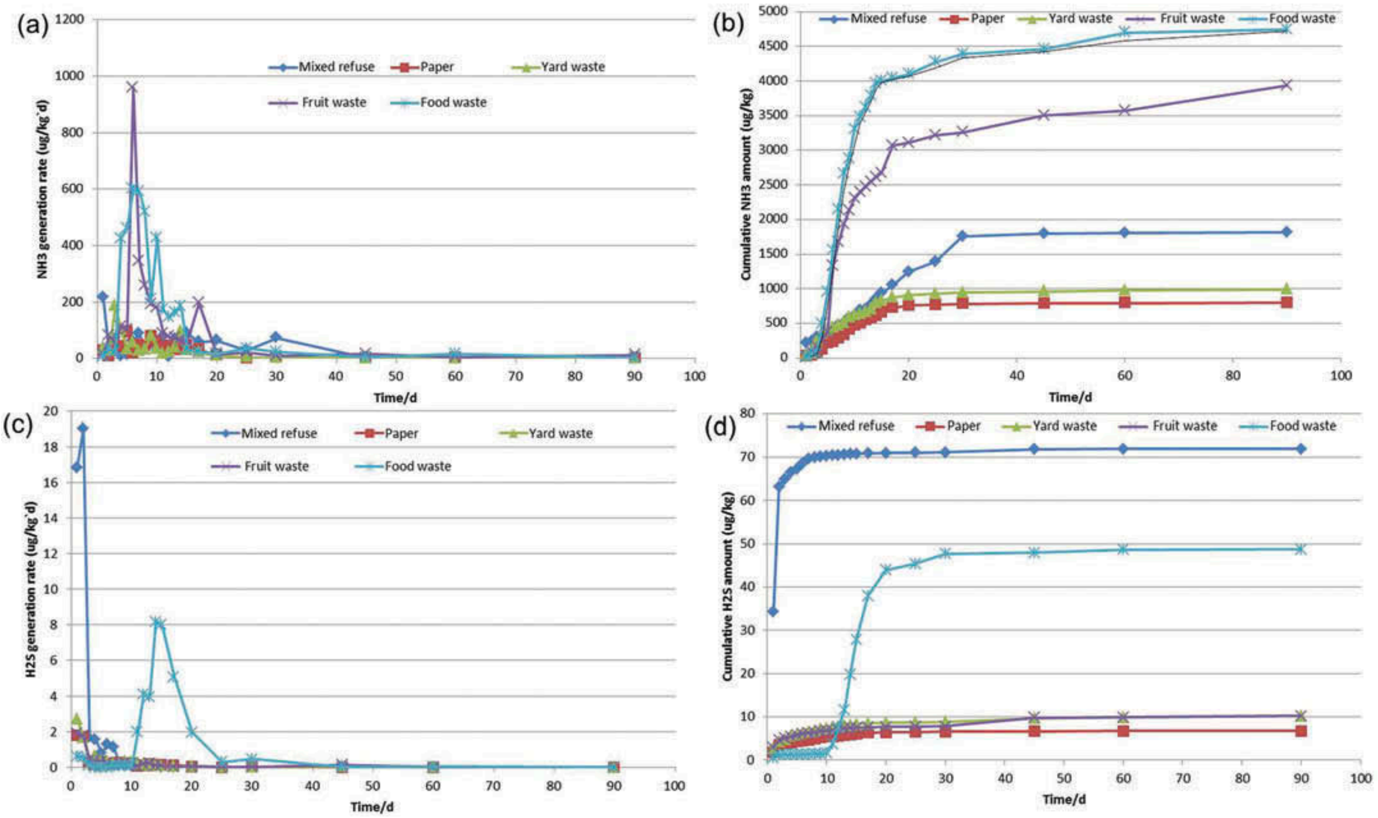

Figure 1. The generation rates and the cumulative amounts of NH_3 and H_2S from landfill lysimeters.

A great variation of H_2S generation was observed in the test period, and a maximum generation rate was obtained immediately after landfilling. The cumulative H_2S generation reached a stable value after 9 days in mixed MSW, 10 days in paper, 12 days in yard waste, and 9 days in fruit waste, respectively. For food waste, H_2S emission increased from 1.6 to 43.9 μg kg^{-1} in the period of 10–20 days, and the inhibition of high content of salt in food waste might relieve after the natural cultivation. Maximum H_2S amount was obtained in mixed MSW, with the value of 71.9 μg kg^{-1} (wet waste), followed by 48.8 μg kg^{-1} (wet waste) in food waste. It could be predicted that food waste and other non-bio-MSW, such as the waste gypsum in the construction and demolition waste, might be the main contributors for H_2S generation from landfill. It should be pointed out that pH in these lysimeters were also different. pH in leachate from mixed waste, food waste, fruit waste, and yard waste were 7.7, 3.99, 4.29, and 5.72, whereas pH in paper was undetectable due to the less of leachate, as shown in Table 2. The lower pH value might be also helpful for the formation of H_2S that escaped from the lysimeters.

The odor concentration from these waste fractions was also characterized by olfactometery, as shown in Figure 2. It could be that odor from food waste was more intense, compared with fruit waste, mixed waste, yard waste, and papers.

Table 2. VFA concentration from individual waste components

Waste component	Mixed MSW	Food Waste	Fruits Waste	Yard Waste	Paper
Acetate	19.9	124	20.3	1.1	0.6
Propionic acid	5.8	164	4.0	0.3	0.1
Isobutyrate	1.6	29.1	—	—	—
Butyrate	2.8	253.1	4.3	0.9	0.5
Isovalerate	3.4	49.4	1.1	—	—
n-Valeric acid	4.4	6.6	6.6	—	—
Leachate volume (mL)	350	485	410	90	0
pH	7.7	3.99	4.29	5.72	—
COD	17760	56000	6720	1520	—
NH_4^+	646	732	265	23.5	—
TN	1267	1595	430	25.3	—

Notes: —, below the determination limit.

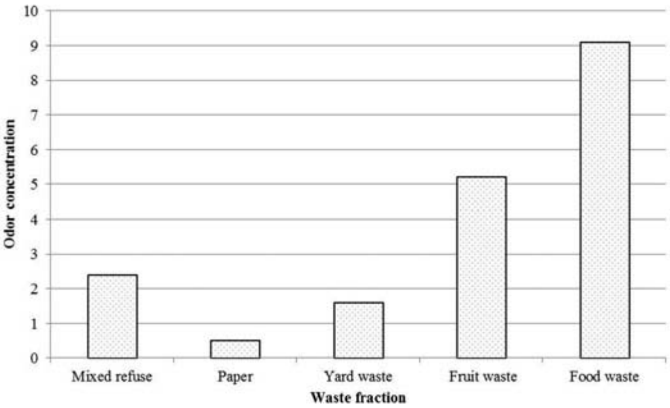

Figure 2. Olfactometery values from landfill lysimeters with the individual MSW fractions.

VFA concentration and leachate properties from landfill lysimeters

VFAs were expected upon decomposition of organic matter containing carbohydrates and proteins and thus could be regarded as one of the promising odor indicators (Qamaruz-Zaman and Milke, 2012). VFAs in leachate are shown in Table 2. All the six typical VFAs could be found in the food waste and mixed MSW, and the total concentration in food waste was higher than all the other biowastes. Both propionic acid and butyrate concentrations were in the high level in the food waste fraction, meaning that this lysimeter was in the acid accumulative phase, with a pH of 4.4.

Leachate amount could also be referred as the indictor for the waste degradation phase. Leachate of 90 and 0 mL with low VFA concentration was generated in the landfill lysimeters of yard waste and paper, respectively, indicating that both degraded in a slower way. Chemical oxygen demand (COD) in leachate from food waste and mixed MSW was 56,000 and 17,760 mg L^{-1}, respectively, which would also contribute to the odor emission in landfill.

Discussion

The generation and distribution process of NH_3 and H_2S from waste landfilling

N/S ratios of the mixed waste, food waste, yard waste, fruit waste, and paper were 1.5, 5.7, 6.7, 5.1, and 6.6, respectively, according to the element analysis results, whereas the corresponding N/S ratios of NH_3 and H_2S emissions were 22, 85, 85, 338, and 104 (M M^{-1}), respectively. N in waste was easier to be decomposed and converted into NH_3, compared with S under the test conditions, even pH values in these systems were in acid or neutral range. N in fruit waste might release in a faster way, compared with the other biowaste fractions, since N/S ratio from fruit waste was 66 times higher than that in the mixed MSW, whereas those in other fractions were 12.7–15.8 times higher. These results were also tested in Fang's field measurement of Laogang Refuse Landfill, where ammonia was the dominant compound in landfill (Fang et al., 2012), and nitrogen in waste can easily be converted to ammonia (Archer et al., 2005).

Total nitrogen (TN) was present at 1267 and 1295 mg L^{-1} in leachate from mixed MSW and food waste, respectively, whereas that in fruit waste was 430 mg L^{-1}. Therefore, around 446, 788, 184, 3.9, and 1.5 mg N (including N in leachate and landfill gas) were generated from mixed waste, food waste, fruit waste, yard waste, and paper in the test period, which occupied around 0.8%, 0.5%, 0.4%, <0.01%, and <0.01% of total N contents in the respective raw wastes, and most of N in those biowastes was still present in the residual wastes after 90 days of decomposition. The ratios of N in the leachate/landfill gas were 133, 50, and 22 in the mixed MSW, food waste, and fruit waste, respectively, indicating that N released preferred to be present in the liquid phase due to the acidification phase in the landfill lysimeters. The other fractions in mixed MSW might also influence N distribution process greatly, which resulted in more N generated in leachate, compared with the other biowaste fractions (Lou et al., 2009).

Landfill gas generation process could be roughly modeled using the theoretical first-order kinetic model, such as Scholl Canyon model (Thompson and Tanapat, 2005). As two of the landfill biogas components, H_2S and NH_3 generation was supported to follow the first-order kinetic model. The maximum cumulative generation of NH_3 and H_2S could reach around 5852 and 158 μg kg^{-1} (wet basis), respectively, in the mixed MSW in Shanghai, China, whereas 1811 and 72 μg kg^{-1} of NH_3 and H_2S were generated in the test period, which were about 31% and 46% of the maximum cumulative generation, respectively. More emphasis should be placed in the landfill in the initial period (i.e., the first 3 months) after waste disposal, to reduce the NH_3 and H_2S emissions. Particularly, the odor emissions varied as the MSW landfilling ages extended, and the concentrations of oxygenated compounds increased, whereas those of sulfur compounds decreased significantly. Closure operation in landfill was useful and efficient in reduction of the malodorous gas (Solan et al., 2010).

The contribution of individual biowastes to the odor emission

According to the Ding's report based on the filed measurement of Tianziling landfill site, Hangzhou, China, H_2S (56.58–579.84 μg m^{-3}) and NH_3 (520–4460 μg m^{-3}) were the notable odor components, contributing 4.47–10.92% and 83.91–93.94% of total odor concentrations, respectively, and both of them varied with different locations in the landfill site, which were significantly affected by environmental factors, including temperature, air pressure, and wind direction. Thus, understanding NH_3 and H_2S generation processes will benefit the development of potential odor control process.

Food waste, fruit waste, paper, and yard waste (including wood and the residues) occupied around 45%, 6%, 12%, and 3% of the mixed MSW according to the practical experiences in Shanghai. These four biowaste fractions were the main readily biodegradation fractions in the mixed MSW and contributed to the odor emission greatly. The generation rates of NH_3 and H_2S were around 798, 990, 3933, and 4742 μg kg^{-1} and 6.7, 10.2, 10.2, and 48.8 μg kg^{-1} in the paper, yard waste, fruit waste, and food waste (wet basis) after 90 days, respectively.

Total amounts of NH_3 and H_2S could be around 2476 and 23.8 μg kg^{-1} based on the individual contribution of these four biowastes in mixed MSW, whereas around 1811 μg kg^{-1} NH_3 and 71.9 μg kg^{-1} H_2S were generated from the actual mixed MSW tested. The four biowaste fractions contributed 136% and 33% of NH_3 and H_2S generation from the mixed MSW, and food waste individually contributed around 118% and 31% of the total NH_3 and H_2S emissions from landfill. Therefore, biowastes predominated in NH_3 emission in landfill gas, and food waste was the main source for NH_3 and H_2S, and some of the H_2S in mixed MSW might be generated from the other S content components. Moreover, the mixture of other substances in mixed MSW might influence the NH_3 generation rate and N distribution ratios between landfill gas and leachate greatly. Some components in the mixed MSW, such as heavy metals and salt, might inhibit the NH_3 generation rate and thus delay NH_3 release from waste in the initial period (Östman et al., 2006). It was also found that around 199.2, 75.6, 1.9, and 0.7 mg kg^{-1} N (including NH_3 in landfill gas and TN in leachate) were released from food waste, fruit waste, yard waste, and paper in the test period, with a total N of 94.4 mg kg^{-1} released based on the actual MSW compositions. The total N generated from mixed MSW was 1994 mg kg^{-1}, and around 47.3% of total N was released from those four biowaste fractions. More N was released in terms of leachate from mixed MSW due to the influence of the other fractions.

It should be pointed out the odor compositions will be different if the operation conditions changed. Komilis et al. (2004) identified and quantified volatile and semivolatile organic compounds (VOCs) produced during composting of the organic fraction of MSW under the controlled aerobic conditions. It was found that paper primarily produced alkylated benzenes, alcohols, and alkanes. Yard wastes primarily produced terpenes, alkylated benzenes, ketones, and alkanes, whereas food wastes primarily produced sulfides, acids, and alcohols. Approximately 6.5, 0.83, and 0.33 mg dry kg^{-1} of 13 volatile and semivolatile aromatic organic compounds combined generated from the mixed paper, yard wastes, and food wastes. All VOCs were emitted early during the composting process, and their production rates decreased with time at thermophilic temperatures. Therefore, the VOCs in waste should also be considered in the future.

Conclusions

The apparent molecular formula of those five wastes was modeled based on the element analysis, and the theoretic NH_3 and H_2S amounts generated could be estimated through the assumption that most of S and N will converse into H_2S and NH_3 under the anaerobic digestion process. Biowastes were the main contributors for the odor emission. Food waste and fruit waste have the higher NH_3 generation potential, and food waste was also the main contributor for H_2S released, compared with the other biowastes in mixed MSW. Around 31% and 46% of the total theoretic NH_3 and H_2S amounts were released in the test period, and more emphasis should be considered for odor abatement after waste landfilling, especially in the first 30 days. For the typical odor sources, the degradation rate of N was faster than that of S in the mixed MSW, and N preferred to be present in the liquid phase, such as leachate. The prohibition of food waste and fruit waste into the landfill will reduce odor emission from landfill greatly, just as the European Union (EU) has done in Council Directive 99/31/EC.

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Appendix F

Ridge Landfill Appendix F - Site and Vicinity Noise Assessment Report

APPENDIX E
SITE VICINITY AIR (DUST AND ODOUR) IMPACT ASSESSMENT

July 2011

RIDGE LANDFILL FILL RATE MODIFICATION
ENVIRONMENTAL SCREENING PROCESS

Ridge Landfill Environmental Screening
BFI Canada Inc.
Appendix E: Landfill Site Air Quality Impact Assessment

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1.0 INTRODUCTION

BFI is proposing a modification to the daily/annual rate of fill at the Ridge Landfill as a business opportunity to fully utilize the Ridge Landfill facility and to provide operational flexibility. With the proposed changes to increase the daily/annual fill rate, no changes to the landfill infrastructure are proposed or required, i.e. the currently approved landfill capacity (volume), footprint and final contours (profile) would not change. The landfill would continue to operate as it largely does today.

This air quality impact study has been prepared in support of the Environmental Screening for BFI's Ridge Landfill, for the proposed increase in fill rate. This study includes assessment of particulate matter and odour impacts associated with activities and operations at the landfill site, as they pertain to the proposed increase in fill rate.

1.1 Background

Particulate Matter (PM)

The term 'particulate matter' describes all airborne solid and liquid particles of microscopic size, with the exception of pure water. The suspended portion of particulate matter generally consists of particles less than 40 to 50 microns (µm) in diameter. These particles can include a broad range of chemical species, such as elemental and organic carbon compounds, sulphates, nitrates and trace metals. Particle diameter (and shape) is reflective of the origin of particulate matter; larger suspended particles often originate from crustal material and smaller particles are largely derived from combustion processes. For the purposes of this report, 'Particulate Matter' is in reference to airborne or suspended particulate matter.

Particulate matter is classified based on the size of particles, as size is directly linked to their potential to have an impact on human health (U.S. EPA, 2010). The most commonly used particle size classifications are, Total Suspended Particulate (TSP), which includes all particulates with aerodynamic diameter of up to 44 microns (44 µm); PM_{10}, which includes all particulates with aerodynamic diameter of up to 10 microns (10 µm); and, $PM_{2.5}$, which includes all particulates with aerodynamic diameter of up to 2.5 microns (2.5 µm). The finer particulate fractions of PM_{10} and $PM_{2.5}$ are also referred to as inhalable and respirable fractions, respectively. The impact of particulate matter on human health increases with decrease in particulate size, with $PM_{2.5}$ considered the key fraction that has the potential to impact human health. The courser size fractions or dust tend to have more of a nuisance impact due to soiling on the exterior of dwellings as well as infiltration of dust through open doors and windows. In extreme cases, dust emissions can also interfere with visibility.

Wind contributes to levels of particulate matter in three ways: (1) if sufficiently strong, wind can re-suspend dust; (2) wind disperses any particulate matter suspended in the air; and, (3) wind enhances evaporation, leading to surface drying and a subsequent increase in the potential for the release of dust particles. Precipitation also affects levels of suspended particulate matter. Most rainfall events are of limited duration, but their impact on suppressing dust emission is considerably longer lasting. Precipitation also helps with settling of suspended particulate matter out of the air as it falls. The levels of particulate matter in the air tend to be highest when the meteorological conditions are either conducive to raising dust (i.e., dry and windy) or non-conducive to dispersing dust (calm and dry).

Dust emissions at landfills are of fugitive nature and primarily consist of inert particulate matter from soils which are mainly of courser size fraction (i.e., TSP). The dust is emitted on an intermittent basis from truck travel on on-site haul routes, operation of earth moving equipment such as, bulldozers, excavator and articulated trucks, material handling activities such as, loading/unloading of cover material and overburden, as well as wind erosion.

Odour

The potential to cause an odour impact depends on few key factors, including, the nature of the odourous gases (i.e., offensiveness of the odour) and their emission rates, the setback from emission sources, the duration of exposure and the frequency of occurrence.

The odour emissions from the landfill site are associated with biogas / landfill gas (LFG) releases to the atmosphere, which primarily occur from leachate manholes vents, leachate pumping stations and leachate pumping facilities. LFG contains constituents such as hydrogen sulphide and alkyl mercaptan that tend to be odourous. Odour is also emitted from “fresh” waste that is brought to the landfill. Therefore, the working faces are also considered as sources of odour emission. Typical mitigation measures for landfill odour involve the capture and treatment of odorous LFG, which translates to changes (i.e. reductions) in the rate of odourous emissions.

1.2 Study Area

The potential impact of the dust and odour emissions from the landfill was assessed at the residences and businesses (receptors) that are located in the vicinity of the landfill site. These are in total 31 sensitive receptors: 28 residences and 3 businesses. These receptors are listed below in **Table 1** and their locations are presented in **Figure 1.** Also shown in Figure 1 is the landfill site layout.

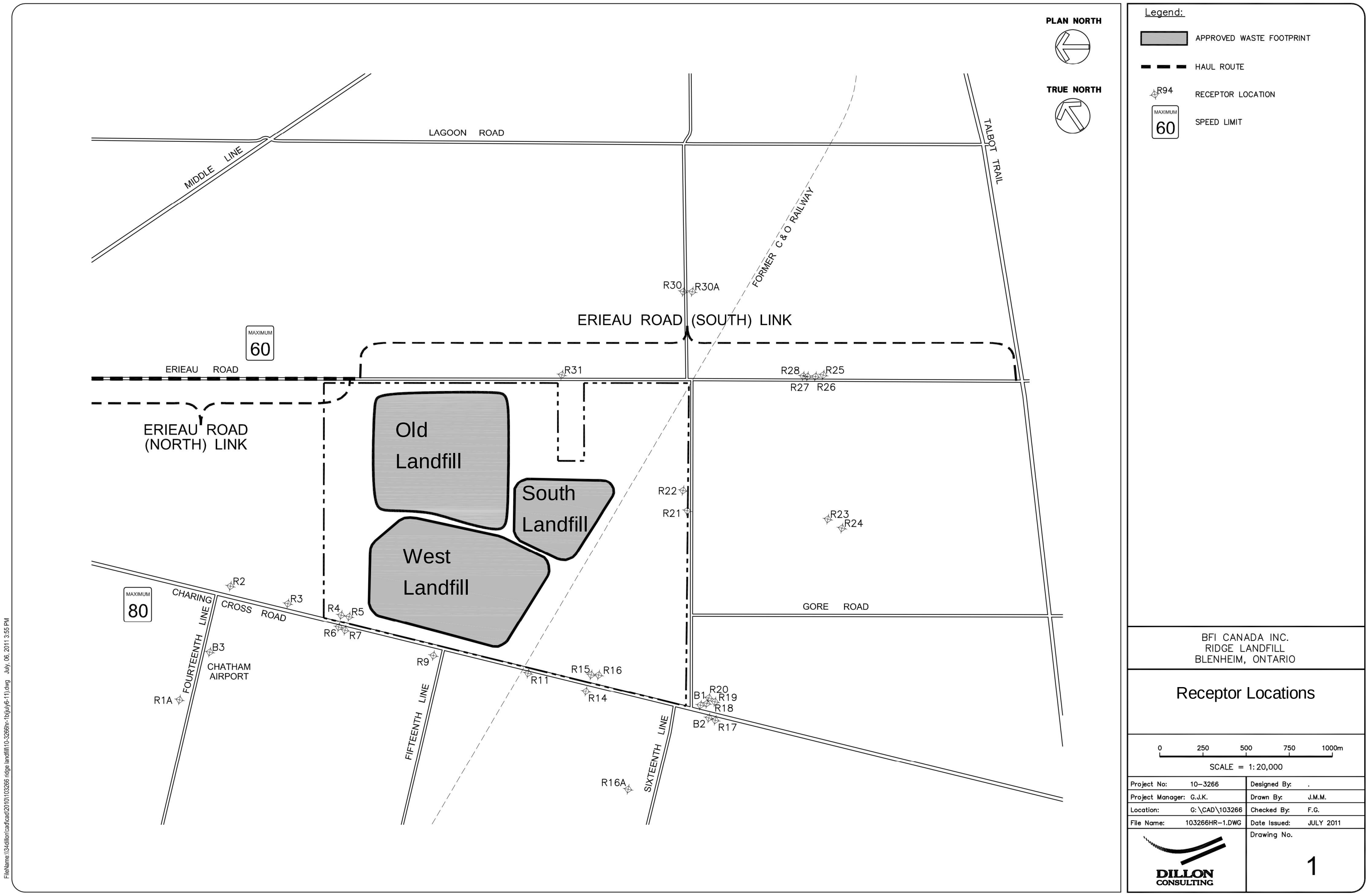
The receptors in the study area are generally located in the vicinity of Charing Cross Road (former County Road 10), Erieau Road and Allison Line. Other residences or businesses located beyond this area are expected to experience negligible PM and odour impacts associated with the landfill site (see **Figure 1**).

Table 1 - Receptor ID and UTM Coordinates

Receptor ID	UTM		Receptor ID	UTM	
	Easting (m)	Northing (m)		Easting (m)	Northing (m)
B1	413413	4682971	R17	413436	4682852
B2	413412	4682883	R18	413449	4682959
B3	411229	4684815	R19	413493	4682941
R1A	410931	4684890	R20	413476	4682978
R2	411542	4685065	R21	413980	4683948
R3	411761	4684795	R22	414024	4684058
R4	411980	4684567	R23	414627	4683453
R5	412013	4684534	R24	414666	4683364
R6	411929	4684517	R25	415071	4684159
R7	411948	4684481	R26	415029	4684176
R9	412292	4684074	R27	414991	4684203
R11	412689	4683684	R28	414972	4684218
R14	412909	4683410	R30	414669	4685012
R15	412986	4683472	R30A	414712	4684982
R16	413022	4683446	R31	413817	4685006
R16A	412811	4682817			

Note: UTM: Universal Transverse Mercator coordinate system (NAD83).

Figure 1 - Receptor Locations in Vicinity of Ridge Landfill



1.3 Dispersion Modelling

The dispersion modelling for the landfill was completed in accordance with the Ministry Publication "*Air Dispersion Modelling Guideline for Ontario*" (MOE, 2009b). To assess the dust and odour impact of the landfill, the short-range atmospheric dispersion capability of the area was examined for dust and odour emissions. To assess this and determine maximum dust and odour impacts, computer modelling, simulating dispersion pathways from sources to receptors was utilized. For the purposes of this assessment, the MOE recommended air dispersion model, AERMOD was utilized. The following paragraphs provide a brief description of the model and how it was configured for this assessment.

In order to predict the ground-level concentrations of the contaminants of concern associated with the landfill, the short-range atmospheric dispersion of these contaminants from the facility was modelled using the U.S. EPA AERMOD atmospheric dispersion modelling system (U.S. EPA, 2004).

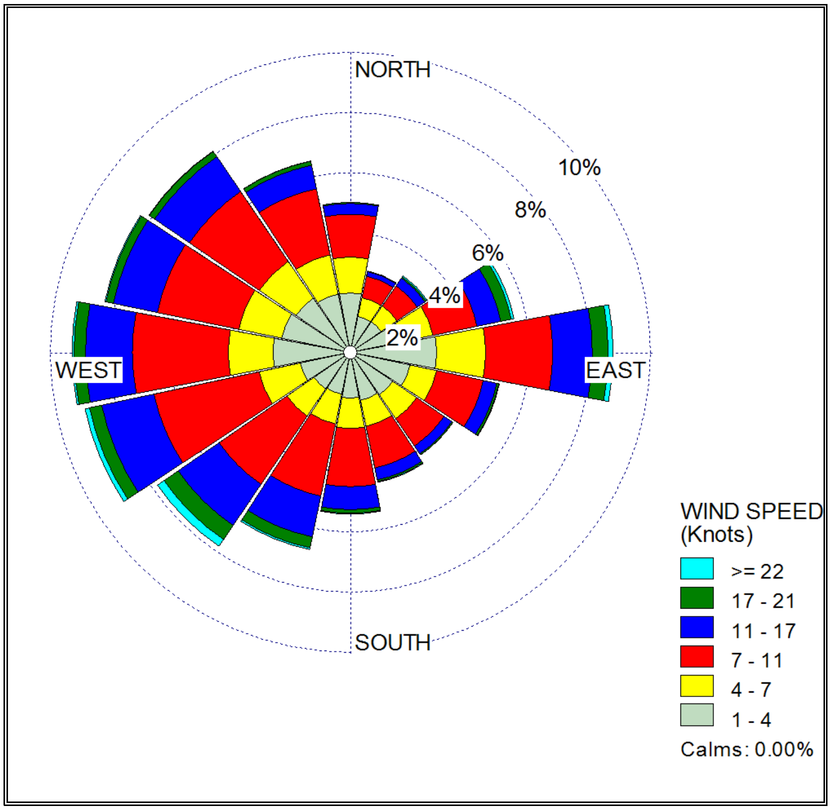
The AERMOD dispersion model was developed by the American Meteorological Society (AMS)/EPA Regulatory Model Improvement Committee (AERMIC) in an effort to improve upon the previously used regulatory Industrial Source Complex (ISC) dispersion model. AERMOD is a steady-state Gaussian plume dispersion model, used to predict ground-level concentrations of airborne contaminants. AERMOD relies on similarity theory to model the transport and dispersion of scalars in the planetary boundary layer and incorporates concepts of turbulent flows over and around buildings and hilly terrain to handle dispersion under such complex turbulent flow regimes. The Schulman et al. (2000) Building Profile Input Program with Plume Rise Model Enhancements (BPIP PRIME) methodology was used to estimate the impact of building wake effects on plume development and dispersion. The turbulent wake downwind of buildings or obstructions enhances plume dispersion coefficients and reduces plume rise due to the downward directed streamlines of the flow to the lee of a building (US EPA, 2004).

The AERMOD modelling suite is made up of two pre-processor modules, AERMET and AERMAP. The AERMIC Meteorological pre-processor, AERMET, provides AERMOD with the detailed hourly meteorological data needed to characterize the planetary boundary layer (PBL) and estimate PBL and micrometeorological parameters. The AERMIC terrain pre-processor, AERMAP, uses gridded terrain data to calculate a representative terrain-influence height (i.e., terrain height scale) which is uniquely defined for each receptor location. The gridded data needed by AERMAP is selected from Digital Elevation Model (DEM) data. AERMAP is also used to create receptor grids. The elevation for each specified receptor is automatically assigned through AERMAP. The following sub-sections describe the AERMET and AERMAP pre-processing of the input data for this study (US EPA, 2004).

1.3.1 AERMET Meteorological Data Processing

The Ridge Landfill is located in a rural landscape. The MOE-approved 5-year (1996 – 2000, inclusive) hourly surface (London, Ontario) and upper air (White Lake, Michigan) meteorological data sets (MOE, 2011a) for the region were used in the modelling exercise. The surface and upper air data were then processed by the Lakes Environmental AERMET View 06341 version of the US EPA AERMET meteorological pre-processor, for use in AERMOD. A windrose for the surface wind data (wind speed and wind direction) is presented in **Figure 2**. As can be seen, the predominant winds are westerly and easterly.

Figure 2 - Surface Windrose - London (1996-2000)



1.3.2 AERMAP Terrain Data Processing

Digital elevation data provided by the MOE for air dispersion modelling (MOE, 2011b) were used for this study. DEM Tiles 0683_2, 0683_2, 0683_3, 0683_4, 0684_2, 0684_3, 0684_4, 0685_2, 0685_3 and 0685_3 in the Universal Transverse Mercator (UTM) zone 17 were used to define the modelling domain. They were processed by the AERMAP terrain module for a realistic representation of terrain features and elevation. These DEM grid data have a 7.5′ resolution and are based on the North American Datum 1983 (NAD83) horizontal reference datum. The US EPA AERMET version 09040 meteorological pre-processor was used. The terrain data used for the dispersion modelling covered an approximate 20 km by 20 km area centred on the landfill. In addition to the nearby receptors (included as discrete receptors), a multi-tiered receptor grid was included in the modelling. The multi-tiered grid and its resolutions were set as per the requirements of s.14 of the MOE’s O.Reg. 419/05.

1.4 This Assessment

The dust and odour impact assessments were conducted through emission estimation and dispersion modelling of relevant emission sources at the landfill site. The assessments were completed considering emission sources and rates that pertained to the proposed increase in fill rate. The predicted maximum ground level concentrations averaged over 24-hour and 10-minute periods for dust and odour, respectively, were compared against their respective Ambient Air Quality Criteria (AAQC) as defined by the Ontario Ministry of the Environment (MOE).

It should be noted that the proposed increase in fill rate will not change most of the existing sources of odour and dust emissions, including odour sources such as, leachate manholes and pumping stations/facilities as well as dust sources such as, stockpile and working face. The only additional sources of emission include a second working face and a relatively short travel route that leads to it. For the purposes of this assessment, in order to determine a worst-case emission scenario for the site, in addition to all the existing sources, new sources that result from the proposed increase in fill rate have also been incorporated. For the existing sources, the associated changes in the emission rates (e.g., higher emission rate from onsite routes due to higher truck traffic) have also been incorporated.

2.0 DUST IMPACT ASSESSMENT

2.1 Scope of Assessment

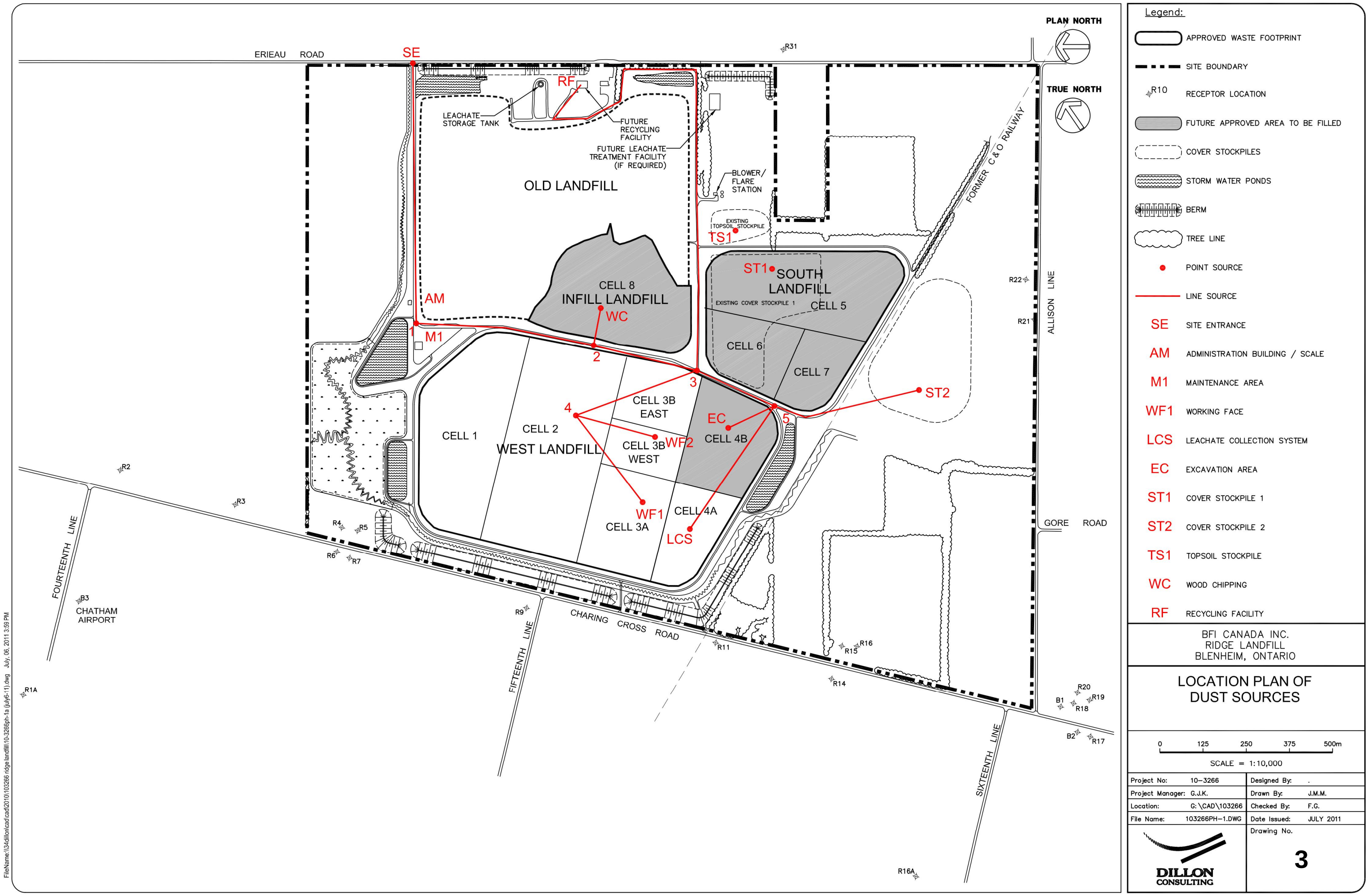
The assessment consisted of PM emission rate estimations for various sources at the Site and predicting ambient PM concentrations at the nearby receptors through dispersion modelling. The dominant sources of PM emissions at the landfill site consist of the following:

- Re-suspension of road dust due to travel of vehicles along the onsite haul routes (both paved and unpaved routes);
- PM emissions due to mechanical disturbance during material handling processes (e.g., loading / unloading); and,
- Wind erosion of active stockpiles and working faces.

The locations of the onsite haul routes, stockpiles and working faces (WFs) are presented in **Figure 3**. The prediction of potential PM impacts around the BFI Ridge Landfill consisted of the following steps:

- Determination of maximum PM emission rates for all the onsite emission sources;
- Atmospheric dispersion modelling of the onsite sources to determine maximum Point of Impingement (POI) concentrations and maximum concentrations at the identified sensitive receptor locations in the vicinity of the site;
- Calculation of the frequency of exceedance events based on number of event per annum that the provincial criteria at each receptor is exceeded; and,
- Where required, devise series of mitigation measures that can reduce emissions and thus minimize impact.

Figure 3 - Sources of Particulate Matter Emissions at Ridge Landfill Site - Increased Fill Rate Scenario



2.2 Methods of Assessment

2.2.1 Assessment Criteria

The Ontario Ministry of Environment (MOE) has published Ambient Air Quality Criteria (AAQC) levels for numerous air contaminants (MOE, 2008) including those considered in this assessment. The AAQC are effect-based contaminant concentrations in ambient air with variable averaging times (e.g., 10-minute, 1-hour, 24-hour, etc.) based on the effects that they are intended to protect against. The AAQC are the "desirable" levels of contaminants in the ambient air, based on their effects on health, odour, vegetation, soiling, visibility, corrosion and other effects (MOE, 2008). The AAQC are typically used in environmental assessments, ambient air monitoring studies, and the assessment of the general air quality in a community and are therefore used in assessing the potential for adverse effects (MOE, 2008). The AAQC are hence applicable for the assessment of the potential air quality impacts on nearby sensitive receptors as a result of the proposed increase in the fill rate. **Table 2** presents the MOE AAQC for the particulate matter of various size fractions assessed in this study.

Table 2 - Ontario's Ambient Air Quality Criteria (AAQC) for TSP, PM_{10} and $PM_{2.5}$

Pollutant	Averaging Period	Air Quality Standard/Criteria	Limiting Effect
TSP	24-hour	120 µg/m^3	Visibility
PM_{10}	24-hour	50 µg/m^3	Interim
$PM_{2.5}$	24-hour	30 µg/m^3	Health

Note: The 24-hour primary $PM_{2.5}$ of 30 µg/m^3 is the Canada Wide Standard (CWS) target for ambient air.
The MOE's guideline value for contribution from any single facility to an airshed is at 25 µg/m^3 (MOE, 2008).

All three (3) AAQC for PM are expressed in units of micrograms of particulate per cubic metre of air (µg/m^3) over a 24-hour averaging period.

2.2.2 Determination of Emission Rates

Dust emissions from vehicle traffic and landfill equipment depend on a variety of factors including, moisture content, particle characteristics of the soil, types of vehicles and equipment operating at the site, vehicle travel speed along haul routes, and material (waste / cover) handling rates. A reasonable general estimate of emission rates in dry conditions can be obtained from methodologies published by the U.S. EPA AP-42 Chapter 13.2 for fugitive dust emissions. Methodologies cover emissions from aggregate handling, storage piles / stockpiles, and travel on paved and unpaved industrial roads. Conservatively, worst-case emissions under dry conditions (i.e., no reduction due to precipitation) for each of these sources-types were considered in calculating the emission rates.

The methodologies used to estimate PM emission rates required several input parameters. Some of these parameters are shown in **Table 3**. Site-specific parameters related to waste hauling trucks and onsite equipment such as, type, weight, capacity, travel speed and vehicular traffic for onsite routes (forecasted for the proposed increase in fill rate) were gathered from existing operations at the site and/or from the transportation report prepared by Dillon for the Ridge landfill as a part of this screening EA (Dillon, 2010). Some if this information is presented in **Table 4**. The moisture content of the surface was obtained from on-site soil analyses conducted by M. M. Dillon Ltd. (M.M. Dillon, 1996).

Table 3 - Summary of Particulate Emission Calculation Parameters

Parameter	Values Used	Reference
Silt loading of paved internal roads (g/m^2)	7.4	U.S. EPA AP-42, Ch 13.2.4-1
Silt loading of internal unpaved roads (%)	6.4	U.S. EPA AP-42, p 13.2.2-1
Moisture content of till (%)	14	Site-specific data (Dillon, 1996)
K factor for paved roads TSP (g/VKT)	3.23	U.S. EPA AP-42, Ch 13.2.1-1
K factor for paved roads PM_{10} (g/VKT)	0.62	U.S. EPA AP-42, Ch 13.2.1-1
K factor for paved roads $PM_{2.5}$ (g/VKT)	0.15	U.S. EPA AP-42, Ch 13.2.1-1
K factor for unpaved roads TSP (lb/VMT)	4.9	U.S. EPA AP-42, Ch 13.2.2-2
K factor for unpaved roads PM_{10} (lb/VMT)	1.5	U.S. EPA AP-42, Ch 13.2.2-2
K factor for unpaved roads $PM_{2.5}$ (lb/VMT)	0.15	U.S. EPA AP-42, Ch 13.2.2-2
K factor for material transfer TSP	0.74	U.S. EPA AP-42, Ch 13.2.4
K factor for material transfer PM_{10}	0.35	U.S. EPA AP-42, Ch 13.2.4
K factor for material transfer $PM_{2.5}$	0.053	U.S. EPA AP-42, Ch 13.2.4
Mean wind speed (m/s)	3.7	Hourly MOE surface meteorological data for dispersion modelling 1996-2000.

2.2.3 Scenario Modelled

In terms of sources of dust emission, the proposed increased fill rate scenario is similar to the existing conditions except for the additional working face and the truck route that leads to it, which is required to accommodate the increased fill rate. The rest of the onsite haul routes will experience a slightly higher truck traffic associated with the proposed increase in fill rate, however, other relevant parameters such as, location and length of the routes, route surface materials and travel speed remain unchanged (i.e., same as existing conditions). The details of landfill operations based on the increased fill rate are discussed below. The dust sources at the landfill site, including the haul routes are illustrated in **Figure 3.**

2.2.4 Landfilling Operations

- A maximum annual waste tonnage of 1.3 million tonnes, which defines peak on-site traffic volumes was used in the assessment.

- The sources of dust considered in this assessment were located as close as possible to the receptor locations to ensure a worst-case dust impact is modelled. For example, the facility will use cover materials from Stockpile 1 (ST1) as well as Stockpile 2 (ST2). For the purposes of this assessment, it was assumed that all cover materials are taken from ST2, which is closer to the property boundary and nearby receptors (see **Figure 2**).

- The permanent internal haul roads are hard-surfaced; the main onsite haul route from the entrance to maintenance area is paved; semi-permanent internal roads are constructed with course gravel and/or other relatively stable road base materials (e.g., recycled asphalt or concrete); and travel routes close to the working face and stockpiles are constructed of native soil. 100% of the traffic on onsite routes were considered to be heavy trucks.

- The articulated truck activity occurs at the excavation area, adjacent to the working face, as well as at the Stockpile 2 (ST2). The articulated truck travels between the excavation area and the stockpile area on a course gravel and/or alternative road bed materials (e.g., recycled asphalt / concrete) route.

- Incoming waste trucks travel on paved route, then upaved gravel (or other relatively stable surface) access roads to within 65 m of the working face, thereafter they travel on compacted native soil.

- Alternative Daily Cover (ADC) is delivered to the working face area and is spread at the end of each operating day over the working face by a bulldozer.

- The inactive / undisturbed areas of exposed earth are well compacted.

- Construction activities for a new landfill cell (i.e., Cell 4B) are included in the assessment. The installation of a leachate collection system for this cell includes use of clear stone / gravel which is brought into the site with dump trucks. The maximum hourly counts of clear stone trucks have been included in this assessment.

In **Figure 3**, alphabetic and alphanumeric symbols are used to identify the site features and operations that were modelled, including working faces (WF), the end points of road segments (e.g., 2, 3, etc.) stockpiles (ST2), and the site entrance (SE). The selected scenario is considered to be worst-case in terms of maximum dust emissions and alignment of sources with respect to residences surrounding the landfill. **Table 4** summarizes the onsite trucks and equipment counts and the relevant activities for each of the dust source locations (note, the first column of this table identified ‘from-to’ haul routes as well as source IDs, according to those presented and defined in **Figure 3**, above).

Table 4 - Site Haul Routes Vehicular Traffic

Location	Equipment		
	Description	Quantity per hour	Activity
SE-1	Tri-Axle truck	96	Waste and ADC
	Tri-Axle truck	2	Recyclables
	Tri-Axle truck	5	Clear stone trucks
	CAT 430 backhoe or equivalent	1	Site maintenance
	CAT 735 articulated truck or equivalent	1	Site maintenance

Location	Equipment		
	Description	Quantity per hour	Activity
1-2	Tri-Axle truck	96	Waste and ADC
	Tri-Axle truck	2	Recyclables
	Tri-Axle truck	5	Clear stone trucks
	CAT 430 backhoe or equivalent	1	Site maintenance
	CAT 735 articulated truck or equivalent	1	Site maintenance
2-3	Tri-Axle truck	96	Waste and ADC
	Tri-Axle truck	2	Recyclables
	Tri-Axle truck	5	Clear stone trucks
	CAT 735 articulated truck or equivalent	1	Site maintenance
3-4	Tri-Axle truck	96	Waste and ADC
3-5	Tri-Axle truck	5	Clear stone trucks
5-LCS	Tri-Axle truck	5	Clear stone trucks
EC-ST2	CAT 735 articulated truck or equivalent [3]	6	Hauling Soil
	CAT 345 Excavator or equivalent	1	Loading the articulated truck
3-RF	Tri-Axle truck	2	Recyclables
4-WF1	Tri-Axle truck	48	Waste and ADC
	CAT D8 Dozer or equivalent	1	Working face operation at WF1
	CAT 836 Compactor or equivalent	1	Working face operation at WF1
4-WF2	Tri-Axle truck	48	Waste and ADC
	CAT D8 Dozer or equivalent	1	Working face operation at WF2
	CAT 836 Compactor or equivalent	1	Working face operation at WF2

Note:
ADC: Alternative Daily Cover.
The onsite routes are identified by their end points (‘from-to’) as per those shown in Figure 2.
Operation of onsite equipment such as dozer or compactor are specific to a location onsite, such as working faces.

2.2.5 Modelling of Dust Sources

PM sources were modelled either as line or volume sources depending on the nature of the source. Roads segments SE-S1, S1-S2, S2-S3, S3-RF, S3-S5, S5-LCS, and EC-ST2 were modelled as line sources (see **Figure 3**, above). Road segment SE-S1 is paved and all other road segments are unpaved (with course gravel surface). Stockpile 2 was modelled as a volume source that encompasses the entire stockpile. It should be noted that a third of the road segment EC-ST2 falls within the Stockpile 2 volume source.

A second volume source (West Landfill) was used to model the combined sources of the two working faces and the haul route to these working faces. Road segments included in the volume source were: S3-S4, S4-WF1, and S4-WF2. It should be noted that these road segments are not permanent and change on regular basis. Therefore, they were incorporated into a volume source, while considering the maximum length of each segment in calculating the emission rates. The Dust emissions from the working faces WF1 and WF2 were calculated considering material handling and wind erosion for the maximum quantity of cover material that can be applied per operating day. Cover material is transported from ST2 and dumped at the working face area in a relatively small stockpile and at the end of each working it is spread onto the “fresh” waste at the working face.

2.3 Existing Environment

Dust within the existing environment is generated by a number of sources including activities at the existing BFI Ridge Landfill, local traffic and agricultural operations in the area. Long range transport of PM from distant sources will also contribute to local ambient levels. This assessment accounts for dust emissions from the existing landfill, under the proposed increased fill rate scenario, and does not include external PM sources such as, agricultural-related emissions, long range transports and other roadways in the area.

A review of complaint records contained in the latest annual report regarding complaints associated with the existing BFI Ridge Landfill operations found that there were no dust complaints from the nearby receptors.

Where available, monitored PM concentrations in the area were also considered in the assessment as background levels. The MOE only monitors the ambient levels of $PM_{2.5}$ as ambient levels of TSP and PM_{10} are no longer of significant concern (see Section 1.1). The background $PM_{2.5}$ level of 21.9 µg/m^3 was obtained from the nearest MOE air quality monitoring station (Chatham, ID # 13001). The value is the 98th percentile of the 24-hour concentrations measured in 2008 (latest available data from the MOE) and is considered to represent contributions from all PM sources in the area, including the existing Ridge landfill. As mentioned above (footnote to Table 3), the MOE’s guideline value for $PM_{2.5}$ contribution from a single facility is at 25 µg/m^3, which is set in order to achieve the target ambient air concentration of 30 µg/m^3. This value is a Canada Wide Standard (CWS) which has been adopted by several provinces including Ontario.

2.4 Existing Dust Mitigation Measures – Particulate Matter

If not mitigated, the landfill operations including, construction and earth moving can have the potential to produce significant dust emissions. The landfill has implemented series of dust mitigation measures at the site based on previous air quality studies that were completed for the site, including one completed in 1996. These mitigation measures are itemized below.

- The onsite haul route from the entrance to the landfill up to 750m inside the landfill site is paved in order to reduce dust emissions and minimize tracking of soil onto off-site roadways.

- A dust suppression program for the paved and unpaved traffic areas is implemented at the site:

    - The *paved portion* of the onsite haul route is maintained through a program of regular cleaning (e.g., flushing with water, wet sweeping). The required frequency of cleaning to minimize visible dust will depend on a number of factors, such as weather conditions and the number of vehicles using the road, and may be as high as once-per-hour during busy periods, particularly where a hard-surfaced (paved) road meets the gravel road.

    - The *unpaved portion* of the onsite haul route is maintained through application of dust suppressants (including calcium chloride) during the warm and dry season as well as regular watering on as needed basis. Watering at a rate up to 10,000 litres/hr (i.e., once-per-hour with a typical 10,000 litre water truck) may be needed during mid-day in dry weather and peak operations to optimize dust suppression. A course gravel surface is also maintained on unpaved routes, which can consist of gravel or recycled asphalt / concrete. This will significantly reduce re-suspension of road dust from unpaved routes and minimize the tracking of soil onto the paved portion of onsite route.

- Dust suppression through water spray / compaction is expected to be needed to minimize wind erosion in areas of exposed and un-compacted earth, such as disturbed areas of onsite stockpiles.
- Travel on areas of undisturbed soil should be minimized, where possible, and exposed soil areas seeded as quickly as possible.

- The speed limit should be enforced for all onsite routes.

The above existing mitigation measures are expected to significantly reduced PM emissions from onsite sources. Based on information provided on control measures in relevant chapters of the U.S. EPA AP-42, Dillon's experience as well as measurements conducted by Chow et al (1990) and Cowherd et al (1988), the above mitigation measure can readily achieve a 90% reduction in PM emissions from paved and unpaved haul routes at the site. Similarly, a 50% control was assigned to PM emissions from material handling and wind erosion.

In order to understand the impact of the dust emissions due to wind erosion from the exposed areas at the Ridge Landfill facility, the extreme wind erosion events which occur under high wind conditions when the erodible materials are available (AP-42, Section 13.2.5), were examined. Using the threshold friction velocity of 1.33 m/s for Scoria (roadbed material) as described in Table 13.2.5-2 of AP-42 Section 13.2.5, which is representative to the site conditions, the corresponding threshold fastest mile of wind at a reference anemometer height of 10 m was calculated to be 25.1 m/s, based on Equation (4) of AP-42 Section 13.2.5. In Canada, the fastest mile of wind is not routinely recorded by Environment Canada (EC). Accordingly, a factor of 1.5 was applied to the hourly wind speed recorded at London Airport Station to derive the fastest mile of wind. Therefore, the minimum wind speed which could result in extreme dust emissions by wind erosion was estimated to be above 16.7 m/s.

After analyzing the wind speed distribution at the London Airport Station for the modelling years (1996 - 2000), it was determined that the wind speeds of above the established 16.7 m/s only occurred for three hours in the 5-year period. The maximum TSP concentrations were predicted through modelling for these three hours. The results are presented in **Table 5**.

As shown in **Table 5**, the maximum 24-hour Point of Impingement concentration of TSP is almost negligible. This is because the wind speeds are typically high during wind erosion episodes with result in better dispersion of PM and thus lower concentrations in ambient air. This analysis clearly illustrates that the impact of PM emissions from the landfill during extreme wind erosion events is negligible.

Table 5 - Maximum 24-hour TSP Concentrations for Wind Erosion Events

Wind Erosion Event*	Wind Speed** (m/s)	TSP Emission Rate (wind erosion only) (g/s)	Maximum 24-hour TSP Concentration (µg/m^3)
1	19	0.4	0.02
2	18.5	0.292	0.01
3	18.5	0.292	<0.01

Note:
* Only three (3) hours in 5-year modelling period had wind speeds that exceeded the friction velocity. The three hours are referred to as events.
** Wind speeds shown are at anemometer height of 10m above ground.

2.5 Potential Net Effects – Particulate Matter

The results of the PM impact assessment are summarized and discussed in this section. As discussed in previous sections, numerous conservative assumptions were incorporated in emission estimation and modelling of PM from the landfill site to ensure that the worst-case PM impact is assessed. The peak dust emissions from the landfill site will occur during periods of concurrent PM generating activities including, peak waste disposal and material handling (i.e., transport / loading and unloading of cover and clear stone) at the site, coupled with meteorological conditions that are either conducive to raising dust (i.e., dry and windy) or non-conducive to dispersing dust (calm and dry).

For the purposes of this assessment worst-case PM emissions from the site were modelled using 5 years of representative meteorological data (MOE regional meteorological data). The MOE's regional meteorological data set includes 5 years (43,800 hours) of data and thus it is highly likely that every possible combination of wind speed, atmospheric stability and direction will have occurred at least once in those data sets (MOE, 2008). In modelling applications using regional or local meteorological data sets, certain extreme, rare and transient metrological conditions may be present in the data sets that are considered to be outliers. Therefore, for assessments of the 24-hour average concentrations of PM, the highest 24-hour average predicted concentration in each single meteorological year can be discarded (MOE, 2009). For the purposes of this assessment, with the exception of $PM_{2.5}$, the highest concentration after elimination of the highest 24-hour average concentrations per annum (over 5-year modelling period) was considered (note: The predicted $PM_{2.5}$ concentrations were below the applicable criterion and thus elimination of meteorological anomalies was not required).

The maximum PM concentrations for the three size fractions of TSP, PM_{10} and $PM_{2.5}$ were predicted for all nearby sensitive receptors (i.e., residences and businesses in the vicinity of the landfill) as well as for maximum Point of Impingement (POI) at or beyond the property boundary of the site. The modelling results for TSP, PM_{10} and $PM_{2.5}$ concentrations are summarized in **Tables 6**, **7** and **8**, respectively. Also shown in these tables are the maximum number of days over a 5-year period that the 24-hour criterion for each of the PM size fractions (TSP: 120 $\mu g/m^3$, PM_{10}: 50 $\mu g/m^3$, $PM_{2.5}$: 25 $\mu g/m^3$) would be exceeded.

TSP

For TSP, the maximum ground level concentration beyond the site boundary was predicted at approximately 190 $\mu g/m^3$, with the concentrations at this POI location exceeding the 120 $\mu g/m^3$ criterion ten (10) days in a 5-year period, or 0.02% of the time. The location of this maximum concentration occurs along the western boundary of the landfill property where there are no sensitive receptors. The predicted concentrations at the nearby sensitive receptors, including those located inside the property boundary of the site, did not exceed the criterion (see **Table 6**).

These results are based on worst-case emission scenario from the site, and include numerous conservative assumptions (previously mentioned) that were considered in the emission estimation and dispersion modelling. Therefore the actual number of days in a typical year that exceedances will occur are expected to be less than the values predicted in this assessment. Also, TSP tends to have nuisance impact at sensitive receptors and the maximum POI location that exceeds the criterion is not at a sensitive receptor. Therefore the TSP impact on nearby receptors is considered to be negligible.

Table 6 - Maximum Predicted TSP Concentrations and Frequency of Exceedance

Receptor ID	UTM Coordinates		Maximum Predicted 24-Hour TSP Concentration (ug/m^3)	Frequency of Exceedance (over a 5-year period)	24-Hour TSP Criteria (µg/m^3)
	Easting	Northing			
B1	413413	4682971	27.3	-	120
B2	413412	4682883	25.1	-	
B3	411229	4684815	30.7	-	
R1A	410931	4684890	24.7	-	
R2	411542	4685065	40.9	-	
R3	411761	4684795	47.8	-	
R4	411980	4684567	64.6	-	
R5	412013	4684534	66.3	-	
R6	411929	4684517	59.6	-	
R7	411948	4684481	60.8	-	
R9	412292	4684074	79.2	-	
R11	412689	4683684	70.8	-	120
R14	412909	4683410	61.6	-	
R15	412986	4683472	79.4	-	
R16	413022	4683446	78.5	-	
R16A	412811	4682817	29.9	-	
R17	413436	4682852	23.8	-	
R18	413449	4682959	27.6	-	
R19	413493	4682941	27.8	-	
R20	413476	4682978	28.7	-	
R21	413980	4683948	34.9	-	
R22	414024	4684058	43.8	-	
R23	414627	4683453	17.5	-	
R24	414666	4683364	17.7	-	
R25	415071	4684159	19.3	-	
R26	415029	4684176	20.1	-	
R27	414991	4684203	21.0	-	

Receptor ID	UTM Coordinates		Maximum Predicted 24-Hour TSP Concentration (ug/m^3)	Frequency of Exceedance (over a 5-year period)	24-Hour TSP Criteria (µg/m^3)
	Easting	Northing			
R28	414972	4684218	21.4	-	120
R30	414669	4685012	22.0	-	
R30A	414712	4684982	23.4	-	
R31	413817	4685006	33.2	-	
Maximum POI	**412910**	**4685590**	**190.0**	**10**	

Note:

Frequency of exceedance is in reference to the number of days that the 24-hour TSP criterion is exceeded over a 5-year period.

The predicted TSP concentrations that exceed the 24-hour criterion are presented in **Bold**.

Maximum Point of Impingement (POI) is in reference to a location outside of the property boundary of the site where the maximum TSP concentration was predicted. The predicted maximum POI does not occur at a sensitive receptor.

PM$_{10}$

For PM$_{10}$, the maximum ground level concentration beyond the site boundary was predicted at approximately 98 µg/m^3, with concentrations exceeding the 50 µg/m^3 criterion nine (9) days in a 5-year period, or 0.02% of the time. Similar to TSP, the location of the maximum concentration does not occur at a sensitive receptor location. From the 31 sensitive receptors near the site, eight (8) receptors, R4, R5, R7, R9, R11, R14, R15, and R16 exceed the criterion. From these receptors, those that are inside the property boundary (i.e., R4, R5, R15 and R16, with R15 and R16) where predicted to have the highest 24-hour PM$_{10}$ concentrations (see **Table 7**). For these receptors, typical number of exceedance over the five-year modelling period was on the order of one day per year.

These results are based on worst-case emission scenario from the site, and include numerous conservative assumptions (previously mentioned) that were considered in the emission estimation and dispersion modelling. It also did not account for the mitigating effect of precipitation on PM emissions. Therefore the actual number of days in a typical year that exceedances will occur are expected to be less than the values predicted in this assessment. Therefore the net PM$_{10}$ impact at these receptors is considered to be minor.

Table 7 - Maximum Predicted PM$_{10}$ Concentrations and Frequency of Exceedance

Receptor ID	UTM Coordinates	Maximum Predicted 24-Hour PM$_{10}$ Concentration (ug/m^3)	Frequency of Exceedance (over a 5-year period)	24-Hour PM$_{10}$ Guideline (ug/m^3)

	Northing	Easting			
B1	413413	4682971	24.6	-	50
B2	413412	4682883	24.4	-	
B3	411229	4684815	30.2	-	
R1A	410931	4684890	24.4	-	
R2	411542	4685065	37.2	-	
R3	411761	4684795	46.2	-	
R4	411980	4684567	**50.3**	1	
R5	412013	4684534	**51.0**	2	
R6	411929	4684517	48.2	-	
R7	411948	4684481	**50.6**	1	
R9	412292	4684074	**60.1**	3	
R11	412689	4683684	**67.7**	6	
R14	412909	4683410	**58.5**	3	
R15	412986	4683472	**74.5**	3	50
R16	413022	4683446	**73.8**	1	
R16A	412811	4682817	29.6	-	
R17	413436	4682852	22.6	-	
R18	413449	4682959	24.6	-	
R19	413493	4682941	27.5	-	
R20	413476	4682978	28.4	-	
R21	413980	4683948	30.7	-	
R22	414024	4684058	38.2	-	
R23	414627	4683453	15.7	-	
R24	414666	4683364	15.7	-	
R25	415071	4684159	16.8	-	
R26	415029	4684176	17.5	-	
R27	414991	4684203	18.4	-	
R28	414972	4684218	18.9	-	
R30	414669	4685012	19.3	-	
R30A	414712	4684982	20.6	-	
R31	413817	4685006	32.1	-	

Receptor ID	UTM Coordinates		Maximum Predicted 24-Hour PM_{10} Concentration (µg/m^3)	Frequency of Exceedance (over a 5-year period)	24-Hour PM_{10} Guideline (µg/m^3)
	Northing	Easting			
Maximum POI	**412257**	**4685158**	**98.0**	**9**	50

Note:

Frequency of exceedance is in reference to the number of days that the 24-hour PM_{10} criterion is exceeded over a 5-year period.

The predicted PM_{10} concentrations that exceed the 24-hour criterion are presented in **Bold**.

Maximum Point of Impingement (POI) is in reference to a location outside of the property boundary of the site where the maximum PM_{10} concentration was predicted. The predicted maximum POI does not occur at a sensitive receptor.

$PM_{2.5}$

For $PM_{2.5}$, the maximum ground level concentration beyond the site boundary was predicted at approximately 18 µg/m^3, which is approximately 28% lower than the guideline value of 25 µg/m^3 (contribution from a single facility, as per MOE, 2008) and 40% lower than the Canada Wide Standard (CWS) for ambient air of 30 µg/m^3 (see **Table 8**). The predicted concentrations at the nearby sensitive receptors, including those located inside the property boundary of the site, did not exceed the health base criterion for $PM_{2.5}$, despite the conservative assumptions that were incorporated in this assessment.

As mentioned earlier, due to potential to impact human health, ambient air concentrations of $PM_{2.5}$ has gained significant attention from regulatory agencies, including MOE. In fact $PM_{2.5}$ is the only particulate size fraction that the MOE currently monitors in the area. The results of this conservative assessment clearly indicate that the maximum concentrations are well below the applicable criterion. This and the inert nature of particulates emitted from the site lead to the conclusion that the $PM_{2.5}$ impact associated from the operations at the landfill are insignificant.

Table 8 - Maximum Predicted $PM_{2.5}$ Concentrations

Receptor ID	UTM Coordinates		Maximum Predicted 24-Hour $PM_{2.5}$ Concentration (µg/m^3)	24-Hour $PM_{2.5}$ Guideline (µg/m^3)	Background $PM_{2.5}$ Concentration (µg/m^3)
	Northing	Easting			
B1	413413	4682971	3.7	25	21.9
B2	413412	4682883	3.8		
B3	411229	4684815	4.7		
R1A	410931	4684890	4.1		

Receptor ID	UTM Coordinates		Maximum Predicted 24-Hour $PM_{2.5}$ Concentration (µg/m^3)	24-Hour $PM_{2.5}$ Guideline (µg/m^3)	Background $PM_{2.5}$ Concentration (µg/m^3)
	Northing	Easting			
R2	411542	4685065	5.2	25	21.9
R3	411761	4684795	6.4		
R4	411980	4684567	8.5		
R5	412013	4684534	8.4		
R6	411929	4684517	8.1		
R7	411948	4684481	8.1		
R9	412292	4684074	10.2		
R11	412689	4683684	9.1		
R14	412909	4683410	8.4		
R15	412986	4683472	10.4		
R16	413022	4683446	10.3		
R16A	412811	4682817	4.2		
R17	413436	4682852	3.5		
R18	413449	4682959	3.8		
R19	413493	4682941	4.3		
R20	413476	4682978	4.4		
R21	413980	4683948	4.3		
R22	414024	4684058	5.0		
R23	414627	4683453	2.4		
R24	414666	4683364	2.6		
R25	415071	4684159	2.6		
R26	415029	4684176	2.7		
R27	414991	4684203	2.8		
R28	414972	4684218	2.9		
R30	414669	4685012	3.1		
R30A	414712	4684982	3.2		
R31	413817	4685006	5.3		
Maximum POI	**412380**	**4685341**	**17.8**		

Note:

The background $PM_{2.5}$ concentration is from MOE monitoring station in Chatham (Station ID# 13001). The value is the 98th percentile of 24-hour values for 2008.

Receptor ID	UTM Coordinates		Maximum Predicted 24-Hour $PM_{2.5}$ Concentration ($\mu g/m^3$)	24-Hour $PM_{2.5}$ Guideline ($\mu g/m^3$)	Background $PM_{2.5}$ Concentration ($\mu g/m^3$)
	Northing	Easting			

The 24-hour primary $PM_{2.5}$ guideline value of 25 $\mu g/m^3$ is the target defined by the MOE for contribution from a single facility to an airshed. This value is based on aiming to achieve the Canada Wide Standard (CWS) target of 30 $\mu g/m^3$ for $PM_{2.5}$ in ambient air (MOE, 2008).

3.0 ODOUR IMPACT ASSESSMENT

3.1 Scope of Assessment

The odour assessment has been completed in accordance with applicable guidelines of the Ontario Ministry of the Environment (MOE). The assessment is based on a series of conservative assumptions and considerations in order to ensure that the worst-case odour impact is captured in the analysis. These assumptions and considerations are further discussed in the following sections.

The odour assessment involved the following tasks:

- Predict odour levels at the nearby receptors using regulatory approved dispersion modelling methodology;
- Determine the impact of the odour emissions on the surrounding environment by comparing the predicted results to Ontario's regulatory criterion;
- If applicable, determine the frequency of odour exceedance events and compare with the MOE's allowable annual number of exceedances; and,
- Provide recommendations, if required, to mitigate any adverse odour impacts.

3.2 Methodology

The odour assessment, including the dispersion modelling was completed in accordance with the MOE Technical Bulletin: "*Methodology for Modelling Assessments of Contaminants with 10-Minute Average Standards and Guidelines under O. Reg. 419/05*", dated April 2008. Odour impacts were assessed by identifying odour sources, estimating the odour emission rate from each source and predicting the odour concentrations at the neighbouring receptors using dispersion modelling (predictive) methodology. The analysis conducted for these steps is discussed below.

Assessment Criteria

The Ontario Ministry of the Environment (MOE) has set a 10-minute odour criterion of 1 odour-unit per cubic metre (1 OU/m^3), which is not to be exceeded more than 0.5% of the time (annually) at a receptor location. An odour unit is defined as the quantity of odourous substances that, when dispersed in 1 m^3 of odour-free air, becomes just detectable by a "normal" human observer whose sensitivity to the odorant represents the mean of the population. In other words, 1 OU/m^3 is the average threshold for odour detection.

Landfill Odour Sources

The majority of odour emissions from the landfill are associated with biogas that is released through manholes and the leachate collection system. As mentioned above, odour is also emitted from "Fresh" waste that is brought to the landfill daily. Therefore, for the purposes of this odour assessment the following key odour sources were included:

1. Leachate collection system, consisting of thirty (30) leachate manholes, and eight (8) leachate pumping stations and facilities; and,

2. Two (2) active working faces, where the fresh waste is received daily and is covered at the end of each day.

The odour emissions from leachate manholes as well as the leachate pumping stations and facilities are passive (i.e., no active / power venting releases). The leachate manholes are slightly raised above grade and have a steel cover with vent holes. The odour escapes through the manhole vent holes by natural venting or convection. Leachate pumping stations and facilities consist of small shed-like buildings (4.2m L x 3.05m W x 3.85m H) that contain leachate pumps and are equipped with convective vents from the leachate pipe. The vents are elevated to above the shed rooftop, with the discharge point being approximate 5m above grade. It should be noted that the leachate manholes and leachate pumping stations and facilities currently exist or are proposed, and they are not going to increase in numbers as a result of the proposed increase in fill rate. Therefore, odour impact associated with these sources is not expected to change. However, in order to determine cumulative odour impact from the landfill, all the existing manholes and leachate pumping stations and facilities were included in the odour assessment. The manholes and the vents for the pumping stations and facilities were modelled as point sources.

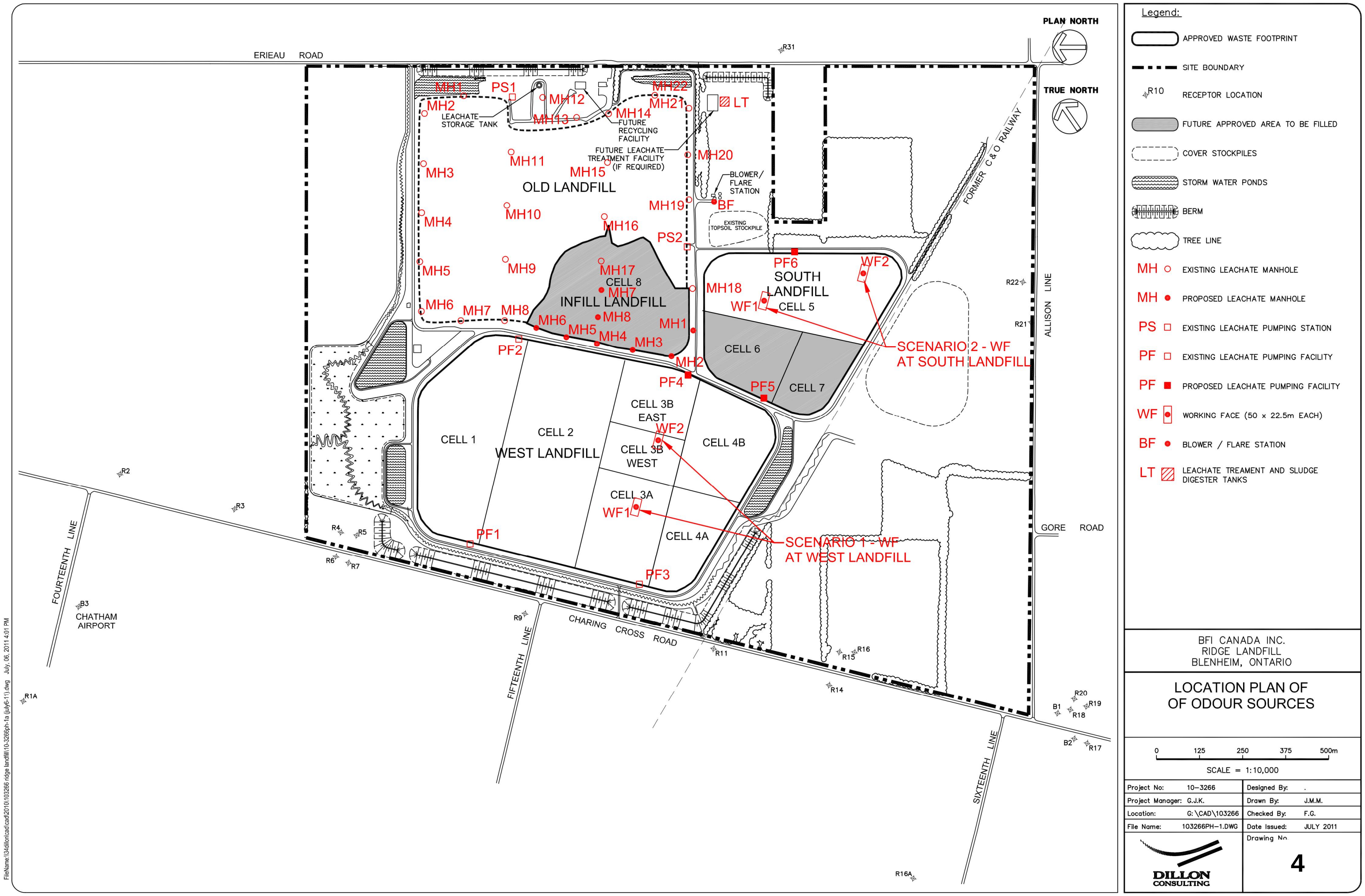
The “fresh” waste received at the site is to be deposited at the West Landfill cells initially, and at the South Landfill cells subsequently. The setback distances from the two landfill cells / working faces to the nearby receptors are different, which can influence the level of odour impact at the receptor locations. Therefore, to account for this difference, two odour scenarios were assessed, one with the working faces at the West landfill (Scenario 1) and one with the working faces at the South Landfill (Scenario 2). It should be noted that the proposed increase in fill rate results in having two (2) working faces instead of the existing one (1) working face for each of the mentioned scenarios. Although the current daily operation of the landfill includes one (1) working face, in order to assess cumulative odour impact from the landfill, both working faces were included in assessing the impact of the proposed increase in fill rate. Each working face is approximately 22.5m by 50m. The waste received is spread and compacted over this area. The working faces were modelled as area sources.

The “fresh” waste is deposited at the working faces during the daytime operating hours of the landfill and is covered with approved landfill cover material at the end of each day. Since the daily waste received at the landfill is considered to be adequately covered and compacted at the end of each working day, fugitive odour emissions during non-working hours are considered to be negligible. The analysis did not include the covered fill areas as an odour source since, (1) the odour emissions are typically negligible relative to larger sources, such as the working faces, and (2) the landfill has an operating gas collection and flaring system, which limits the odourous releases through the landfill cover.

The proposed leachate riser pipes and cleanouts in the West and South landfills will only be used for access to the leachate collection system and will not be used to vent leachate gases. The riser pipes and cleanouts can be safely sealed to prevent any fugitive odour emissions and, therefore, were excluded from the assessment.

Dry recyclable materials will be handled within an enclosed existing structure in the future. Odours associated with a recycling facility, if any, tend to be negligible and therefore, it was not considered an odour source. **Figure 4** shows the landfill site layout and the location of odour sources, including manholes, leachate pumping facilities, leachate pumping stations as well as the two working face locations for Scenario 1 – West Landfill, and Scenario 2 – South Landfill.

Figure 4 - Source of Odour Emission at Ridge Landfill - Increased Fill Rate Scenario



Emission Estimation

The odour emission rates for the above-mentioned sources were obtained from the Ridge Landfill Expansion EA that was completed by in 1996 by RWDI. The odour emission rates were estimated based on previous field testing and analytical work conducted by RWDI at several landfill sites and other facilities in Southern Ontario (CJB, 1993; RWDI, 1996). It should be noted that Dillon has also conducted several odour testings at various landfills in Ontario, and the levels (especially at the working face) were 2 to 3 times lower than those measured by RWDI and used in the1996 EA. However, as a conservative measure, the higher values from 1996 EA were used in this odour assessment. The odour emission rates for the main odour sources are listed in **Table 9.** As shown in **Table 9,** the working face has the highest odour emission rates.

Table 9 - Estimated Odour Emission Rates

Source	Quantity	Total Area (m^2)	Source Conc. (OU/m^3)	Emission Flux Rate ($OU/m^2/s$)	Emission Rate (OU/s)
Leachate Manhole	30	n/a	43,500	n/a	8.0
Leachate Pumping Station or Facility	8	n/a	840	n/a	2.0
Working Face	2	1,125	4,350	1.10	1,238

* Area and emission rate (OU/m^3) are per working face.

Scenarios Modelled

All odour sources at the landfill, except the working faces, are fixed and therefore worst-case impacts from these sources will not vary much from year to year assuming emission rates remain the same. However, due to the high odour emissions from the working faces and the transient nature of this source, worst-case odour impacts at each receptor will occur at different times during the landfill site life. For example, worst-case impacts for receptors along Charing Cross Road may occur when landfilling is occurring in the West landfill (Scenario 1 as shown in **Figure 4**). Worst-case impacts at receptors to the south and east of the landfill may occur when landfilling is occurring at the South landfill (Scenario 2 as shown in **Figure 4**).

Potential impacts of odour emissions were evaluated for two scenarios. The first was based on two working faces located in the West Landfill near R9 and R11. The second scenario was based on two working faces located along the South landfill near R21 and R22 (see **Figure 4**).

3.3 Existing Environment

Odours within the existing environment will be generated predominantly by the existing BFI Ridge Landfill including the active working face and the leachate collection system. The BFI Ridge Landfill is located in a rural setting and, therefore, agricultural operations will also be a source of odours.

A review of the latest annual reports supplied to the District Office of the MOE regarding complaints associated with the BFI Ridge Landfill found one odour complaint in 2009.

A visit to the site by Dillon personnel found that odours from the working face were not offensive at the time of two visits, one in January 2010 and another in June 2010, probably due to large quantities of commercial, industrial and auto fluff waste received that are known for not producing offensive odours as compared to typical residential waste. The installation and operation of the landfill gas collection and flaring system in 2009 has significantly reduced odour emissions at the site.

3.4 Existing Mitigation Measures – Odour

With the exception of the second working face, all other odour sources currently exist. As such, the odour assessment presented in this report includes the odour impact that the nearby receptors are already exposed to. Additionally, the fugitive odour emissions associated with the working faces are limited to the daily hours of operation of the landfill, as each working face is covered at the end of each day, resulting in negligible (if any) odour releases. Therefore, the odour impact at the nearby receptors, associated with the proposed increase in fill rate, is considered to be minor and cumulatively (i.e., including the existing sources) still within the MOE's allowable frequency of exceedance. Additionally, the odour emission rates used are conservative (2 to 3 times higher than Dillon's field measurements for similar sources). Furthermore, odourous emissions from the landfill are expected to be considerably lower due to the installation of a gas collection and flaring system in 2009. Therefore, on a cumulative basis, the actual odour impacts at the nearby receptors are most likely less than those predicted in this assessment. As such, additional odour mitigation measures (i.e., beyond what is in place now) is not necessary.

The key existing mitigation measures include:

- Completed landfill cells will be capped as soon as possible with a layer of soil about 1.5 m thick, which will be important in reducing landfill gas emissions to the ambient air environment;
- Daily cover will be applied to the working faces at the end of each working day to reduce odourous emissions during non-working hours;
- Landfill gas collection and flaring system in completed cells;
- Waste deposited at the working face will be covered as quickly as possible and never left exposed overnight;
- Riser pipes and cleanouts for the leachate collection system in the West and South landfills will be sealed to prevent fugitive emissions; and,
- Leachate will be collected and pumped to an off-site wastewater treatment facility.

In addition, the current and future operations at the site should include a regular inspection of covered fill areas to identify any fissures, cracks or erosion of the soil cover that would allow landfill odourous gases to escape (fissures allow more rapid and concentrated escape of gases through the cover); if fissures are found, they should be closed immediately.

3.5 Potential Net Effects – Odour

The model-predicted maximum 10-minute odour concentrations predicted at each of the nearby receptors are presented in the **Table 10.** The maximum annual frequency of occurrences of odour exceedance event at each of the receptors is summarized in **Table 11**.

A comparison of the results between the two scenarios reveals that generally there is little difference between the two scenarios in terms of overall odour impact. There are some differences in results for receptors R9, R11 and R21, which reflects the location of the working faces, but for the most part the differences in maximum odour concentrations and number of events that the maximum predicted odour concentrations are above the odour thresholds, is minor between the two scenarios. This implies that the fugitive odour emissions from the working faces have more of a localized impact on the surrounding environment. This can be attributed to the dispersive characteristics of the atmosphere. The odour impact tends to be worsened when the atmospheric conditions are least dispersive (i.e., stable, low wind speeds). A review of the meteorological data indicates that these conditions predominantly occur at night and in the early morning when the landfill is closed and the working faces are covered.

Table 10 - Maximum Predicted 10-Minute Odour Concentration

Receptor ID	UTM Coordinates		Maximum Predicted 10-minute Odour Concentration at Receptors (OU/m^3)		MOE 10-minute Odour Criterion (OU/m^3)
	Northing	Easting	Scenario 1 (Working Faces at West Landfill)	Scenario 2 (Working Faces at South Landfill)	
B1	413,413	4,682,971	1.6	1.5	1.0
B2	413,412	4,682,883	1.4	1.4	
B3	411,229	4,684,815	1.1	1.3	
R1A	410,931	4,684,890	1.0	1.1	
R2	411,542	4,685,065	1.3	1.3	
R3	411,761	4,684,795	1.6	1.8	
R4	411,980	4,684,567	2.8	2.0	
R5	412,013	4,684,534	2.9	2.3	
R6	411,929	4,684,517	2.4	2.1	
R7	411,948	4,684,481	2.5	1.9	
R9	412,292	4,684,074	6.1	1.8	
R11	412,689	4,683,684	6.3	1.8	
R14	412,909	4,683,410	3.5	1.9	
R15	412,986	4,683,472	3.7	2.2	
R16	413,022	4,683,446	3.3	2.3	
R16A	412,811	4,682,817	1.6	1.5	
R17	413,436	4,682,852	1.3	1.2	
R18	413,449	4,682,959	1.6	1.3	
R19	413,493	4,682,941	1.5	1.4	
R20	413,476	4,682,978	1.6	1.4	
R21	413,980	4,683,948	1.7	5.6	
R22	414,024	4,684,058	1.8	6.8	
R23	414,627	4,683,453	1.0	2.0	
R24	414,666	4,683,364	0.9	1.7	
R25	415,071	4,684,159	1.0	2.3	
R26	415,029	4,684,176	1.0	2.4	
R27	414,991	4,684,203	1.0	2.2	
R28	414,972	4,684,218	1.0	2.2	
R30	414,669	4,685,012	1.5	1.8	
R30A	414,712	4,684,982	1.3	1.7	
R31	413,817	4,685,006	3.1	3.4	

Table 11 - Predicted Maximum Annual Frequency of Exceedance of the 10-Minute Odour Criterion

Receptor ID	UTM Coordinates		Maximum Predicted Annual Frequency of Exceedance (hour/year)		Acceptable Annual Frequency of Exceedance (hour/year)
	Northing	Easting	Scenario 1 (Working Face at West Landfill)	Scenario 2 (Working Face at South Landfill)	
B1	413,413	4,682,971	5	3	44
B2	413,412	4,682,883	2	2	
B3	411,229	4,684,815	2	1	
R1A	410,931	4,684,890	0	1	
R2	411,542	4,685,065	3	2	
R3	411,761	4,684,795	6	3	
R4	411,980	4,684,567	8	7	
R5	412,013	4,684,534	9	8	
R6	411,929	4,684,517	12	6	
R7	411,948	4,684,481	14	7	
R9	412,292	4,684,074	24	7	
R11	412,689	4,683,684	19	11	
R14	412,909	4,683,410	13	6	
R15	412,986	4,683,472	16	7	
R16	413,022	4,683,446	15	6	
R16A	412,811	4,682,817	5	3	
R17	413,436	4,682,852	2	2	
R18	413,449	4,682,959	5	3	
R19	413,493	4,682,941	5	4	
R20	413,476	4,682,978	5	3	
R21	413,980	4,683,948	8	18	
R22	414,024	4,684,058	11	19	
R23	414,627	4,683,453	1	7	
R24	414,666	4,683,364	0	5	
R25	415,071	4,684,159	0	10	
R26	415,029	4,684,176	1	9	
R27	414,991	4,684,203	2	10	
R28	414,972	4,684,218	2	10	
R30	414,669	4,685,012	3	4	
R30A	414,712	4,684,982	2	4	
R31	413,817	4,685,006	7	8	

Note: The 44 hours of exceedance events is calculated based on MOE allowance of 0.5% of the time (annually).

Dispersion modelling results indicate that with the conservative assumptions and considerations incorporated in this odour assessment, under worst-case conditions, the MOE's 10-minute odour criterion is exceeded at all nearby receptors except R24 and R25 for Scenario 1. However, when considering all the assessed receptors, the *maximum* annual frequency of exceeding the criterion is approximately 0.28% of the time or 24 exceedance events per year, which occurs at R9. This maximum number of exceedance events per year is less than the MOE allowance of 0.5% of the time or 44 events per year. Also, given the level of conservatism incorporated in this assessment, it is expected that the actual odour impacts will be less than those predicted in this study.

4.0 CONCLUSIONS

This air quality impact study has been prepared in support of the Environmental Screening for BFI's Ridge Landfill, for the proposed increase in fill rate. In this study the particulate matter (PM) and odour impact from the landfill site were assessed. The assessments were conducted through emission estimation and dispersion modelling of relevant emission sources at the landfill site. The assessments were completed considering emission sources and rates that pertained to the proposed increase in fill rate, while incorporating the existing dust and odour mitigation measures. The predicted maximum ground level concentrations averaged over 24-hour and 10-minute periods for dust and odour, respectively, were compared against their respective Ambient Air Quality Criteria (AAQC) as defined by the Ontario Ministry of the Environment (MOE).

The proposed increase in fill rate will not change most of the existing sources of odour and dust emissions, including odour sources such as, leachate manholes and pumping stations/facilities as well as dust sources such as, stockpile and working face. The only additional sources of emission include a second working face and a relatively short travel route that leads to it. For the purposes of this assessment, in order to determine a worst-case emission scenario for the site, in addition to all the existing sources, new sources that result from the proposed increase in fill rate were incorporated. For the existing sources, the associated changes in the emission rates (e.g., higher emission rate from onsite routes due to higher truck traffic) were also incorporated.

The maximum ground level concentration of TSP beyond the site boundary was predicted at approximately 190 $\mu g/m^3$, with the concentrations at this POI location exceeding the 120 $\mu g/m^3$ criterion ten (10) days in a 5-year period, or 0.02% of the time. The maximum POI location was established to occur along the western boundary of the landfill property where there are no sensitive receptors. Therefore the net TSP impact associated with onsite operations at the landfill is considered to be negligible.

The maximum ground level concentration of PM_{10} beyond the site boundary was predicted at approximately 98 $\mu g/m^3$, with concentrations exceeding the 50 $\mu g/m^3$ criterion nine (9) days in a 5-year period, or 0.02% of the time. Similar to TSP, the location of the maximum POI was not at a sensitive receptor. From the 31 sensitive receptors (i.e., residences and businesses) near the site, eight (8) receptors exceed the criterion, with typical number of exceedance over the 5-year period being approximately at one day per year. Therefore the net PM_{10} impact resulting from the operations at the landfill site is considered to be minor.

The maximum ground level concentration of $PM_{2.5}$ beyond the site boundary was predicted at approximately 18 µg/m^3, which is approximately 28% lower than the guideline value of 25 µg/m^3 (contribution from a single facility, as per MOE, 2008) and 40% lower than the Canada Wide Standard (CWS) for ambient air of 30 µg/m^3. The predicted concentrations at the nearby sensitive receptors, including those located inside the property boundary of the site, did not exceed the health base criterion for $PM_{2.5}$, despite the conservative assumptions that were incorporated in this assessment.

As mentioned earlier, due to potential to impact human health, ambient air concentrations of $PM_{2.5}$ has gained significant attention from regulatory agencies, including MOE. In fact $PM_{2.5}$ is the only particulate size fraction that the MOE currently monitors in the area. The results of this conservative assessment clearly indicate that the maximum concentrations of $PM_{2.5}$ are well below the applicable criterion. This and the inert nature of particulates emitted from the site lead to the conclusion that the net $PM_{2.5}$ impact associated from the operations at the landfill are insignificant.

The odour assessment results indicate that under worst-case conditions, the applicable 10-minute odour criterion is exceeded at all nearby receptors except R24 and R25 for Scenario 1. However, when considering all the assessed receptors, the *maximum* annual frequency of exceedance is approximately 0.28% of the time or 24 exceedance events per year, which occurs at R9. This maximum number of exceedance events per year is less than the MOE allowance of 0.5% of the time or 44 events per year.

Given the level of conservatism incorporated in this assessment, it is expected that the actual PM and odour impacts will be less than those predicted in this study.

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